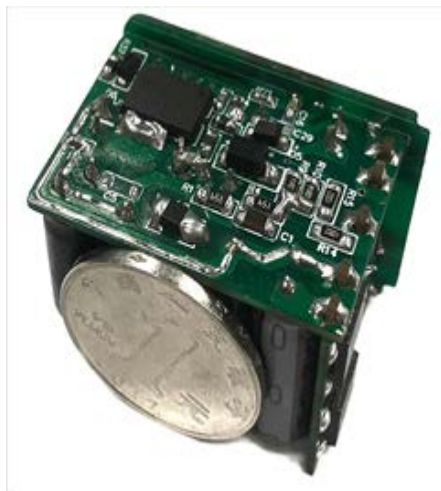


Subject
OB2736VIEP+OB2009+OB2613N
 Board Manual

Demo

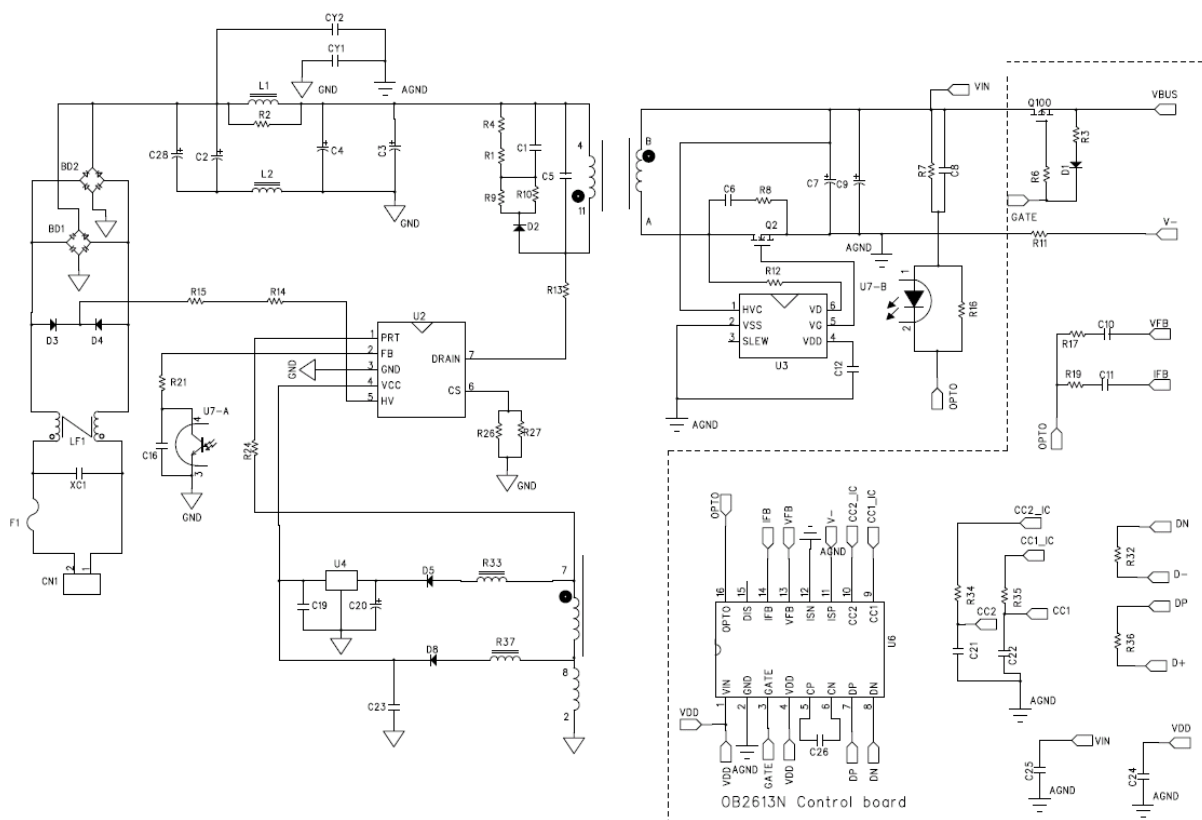
Board Model: PD20V2.25A OB2736VIEP+OB2613N
 Doc. No: OB_DOC_DBM_2736V+2613N00



Key features:

- Support Power Delivery 3.0 Protocol@ Include PPS
- Output voltage: 5V/9V/12V/15V/20V
- Output current: 3A/3A/3A/3A/2.25A
- Standby power less than 75mW
- Average efficiency meet COC V tier2
- Comprehensive protection coverage such as SCP、OCV、OLP、OVP、OTP
- High precision OCP performance
- Programmable cable drop compensation
- Meet EN55022 Class B EMI

Schematic



Performance Evaluation

Test Equipments

Item	Vender	Module
AC Source:	WEST	WEW1010
Digital Power Meter	YOKOGAWA	WT210
Electrical Load	Prodigit	3315C
Oscilloscope	LeCroy	WS424
Multimeter	VICTORY	VC9807A
Thermal	FLUKE	HS 2

1. Input Characteristics

1.1 Input current and Standby power

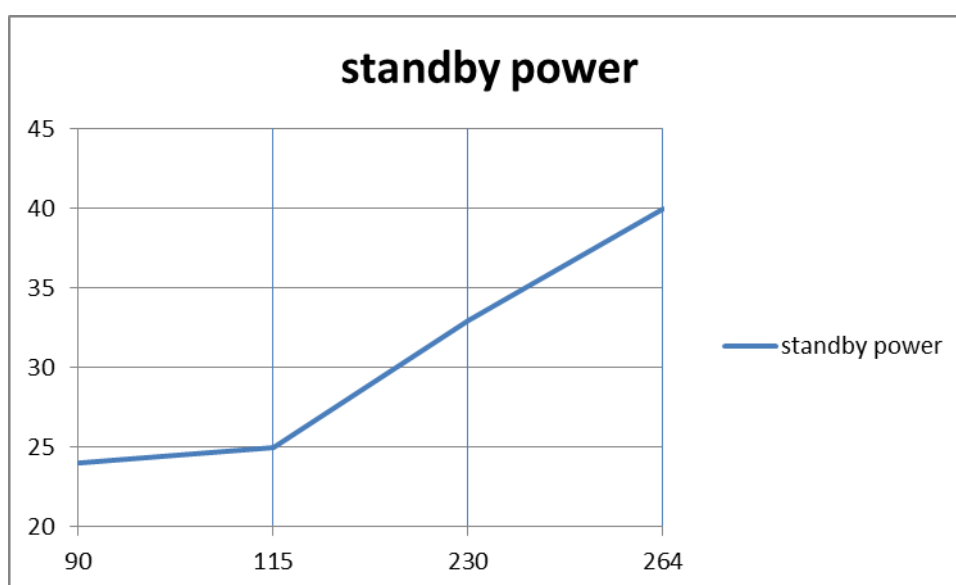
The module was tested at different input voltages (from 90Vac to 264Vac)

Table 1 Input current at full load

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
Input Current(A)	1.0	0.86	0.48	0.43

Table 2 Standby power at no load

Input voltage	Pin(mW)	Vo(V)	Specification	Test result
90Vac/60HZ	24	4.98	<75mW	Pass
115Vac/60HZ	25	4.98		
230Vac/50HZ	33	4.98		
264Vac/50HZ	40	4.98		



1.2 Efficiency

Table 3 Efficiency @PCB End

5V3A								
	100%	75%	50%	25%	AVE	CoC Req	10%	CoC Req
115Vac	90.88	91.02	90.88	90.21	90.75	81.84%	85.43	72.48%
230Vac	89.44	88.88	88.16	85.52	88.00		77.34	

9V3A								
	100%	75%	50%	25%	AVE	CoC Req	10%	CoC Req
115Vac	92.89	93.12	92.63	91.87	92.63	87.30%	89.33	77.30%
230Vac	91.64	90.96	89.66	89.80	90.52		85.30	

12V3A								
	100%	75%	50%	25%	AVE	CoC Req	10%	CoC Req
115Vac	93.05	93.35	93.06	91.46	92.73	88.30%	89.67	78.30%
230Vac	92.46	91.97	90.56	90.45	91.36		86.62	

15V3A								
	100%	75%	50%	25%	AVE	CoC Req	10%	CoC Req
115Vac	92.99	93.41	93.09	91.69	92.80	88.85%	89.74	78.85%
230Vac	93.09	92.53	91.58	91.03	92.06		87.43	

20V2.25A								
	100%	75%	50%	25%	AVE	CoC Req	10%	CoC Req
115Vac	93.08	92.99	92.35	90.14	92.14	88.85%	87.57	79%
230Vac	93.06	92.48	91.05	87.33	90.98		85.38	

2. Output Characteristics

2.1 Line Regulation & Load Regulation

All data was measurement at @100mR CABLE end

Table 4 Line Regulation & Load Regulation

Input voltage	No load	Half load	Full load	Specification	Output Voltage
90Vac/60HZ	4.985	4.950	4.926		5V
115Vac/60HZ	4.987	4.951	4.929		
230Vac/50HZ	4.986	4.950	4.925		
264Vac/50HZ	4.990	4.949	4.922		
Line Regulation	0.10%			<2%	
Load Regulation	1.38%			<5%	

Input voltage	No load	Half load	Full load	Specification	Output Voltage
90Vac/60HZ	8.964	8.933	8.928		9V
115Vac/60HZ	8.966	8.935	8.924		
230Vac/50HZ	8.961	8.948	8.917		
264Vac/50HZ	8.967	8.950	8.920		
Line Regulation	0.19%			<2%	
Load Regulation	0.53%			<5%	

Input voltage	No load	Half load	Full load	Specification	Output Voltage
90Vac/60HZ	11.959	11.858	11.782		12V
115Vac/60HZ	11.970	11.868	11.786		
230Vac/50HZ	11.965	11.864	11.791		
264Vac/50HZ	11.981	11.785	11.784		
Line Regulation	0.70%			<2%	
Load Regulation	1.67%			<5%	

Input voltage	No load	Half load	Full load	Specification	Output Voltage
90Vac/60HZ	14.950	14.856	14.787		15V
115Vac/60HZ	14.958	14.849	14.782		
230Vac/50HZ	14.968	14.867	14.781		
264Vac/50HZ	14.966	14.864	14.781		
Line Regulation	0.12%			<2%	
Load Regulation	1.27%			<5%	

Input voltage	No load	Half load	Full load	Specification	Output Voltage
90Vac/60HZ	19.967	19.890	19.851		20V
115Vac/60HZ	19.971	19.891	19.837		
230Vac/50HZ	19.949	19.858	19.865		
264Vac/50HZ	19.961	19.879	19.807		
Line Regulation	0.58%			<2%	
Load Regulation	0.78%			<5%	

2.2 Ripple & Noise

All data was measurement at @100mR CABLE end

Table 5 Ripple & Noise

Input voltage	5V R&N (mV)		Remark
	No load	Full load	
90Vac/60HZ	26.3	43.7	
264Vac/50HZ	30.6	47.0	

Input voltage	9V R&N (mV)		Remark
	No load	Full load	
90Vac/60HZ	30.1	49.0	
264Vac/50HZ	38.1	42.7	

Input voltage	12V R&N (mV)		Remark
	No load	Full load	
90Vac/60HZ	30.0	66.0	
264Vac/50HZ	33.1	52.5	

Input voltage	15V R&N (mV)		Remark
	No load	Full load	
90Vac/60HZ	35.0	89.0	
264Vac/50HZ	36.1	56.6	

Input voltage	20V R&N (mV)		Remark
	No load	Full load	
90Vac/60HZ	45.2	85.0	
264Vac/50HZ	42.2	49.7	

Note: Ripple& noise was measured at DC cord end without probe cap and ground clip. Measurement bandwidth was limited to 20MHZ.

2.3 Dynamic Test

A dynamic loading with low set at 10% full load lasting for 10mS and high set at 90% full load lasting for 10mS is added to output. The ramp is set at 0.25A/uS at transient.

All data was measurement at @100mR CABLE end.

Table 6 Output voltage under dynamic test

Input voltage	5V Output voltage (mV)	Waveform
90V/60HZ	±311	Fig.15-16
264V/50HZ	±320	

Input voltage	9V Output voltage (mV)	Waveform
90V/60HZ	±338	
264V/50HZ	±341	

Input voltage	12V Output voltage (mV)	Waveform
90V/60HZ	±328	
264V/50HZ	±332	

Input voltage	15V Output voltage (mV)	Waveform
90V/60HZ	±333	
264V/50HZ	±334	

Input voltage	20V Output voltage (mV)	Waveform
90V/60HZ	±268	Fig.17-18
264V/50HZ	±270	

Dynamic waveform

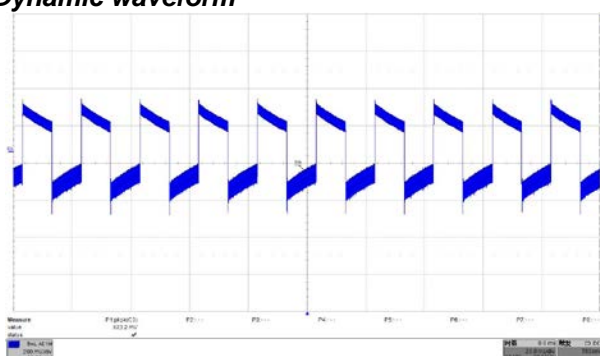


Fig. 1 Dynamic waveform @90Vac input

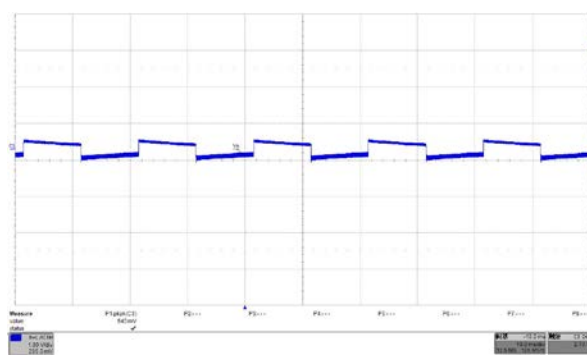


Fig. 2 Dynamic waveform @264Vac input

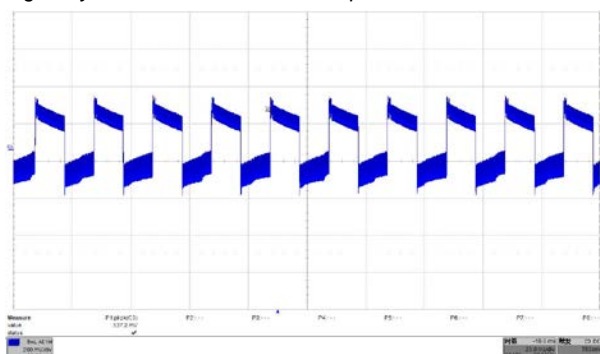


Fig. 3 Dynamic waveform @90Vac input

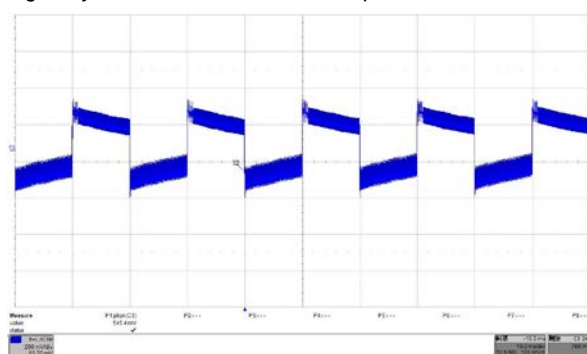
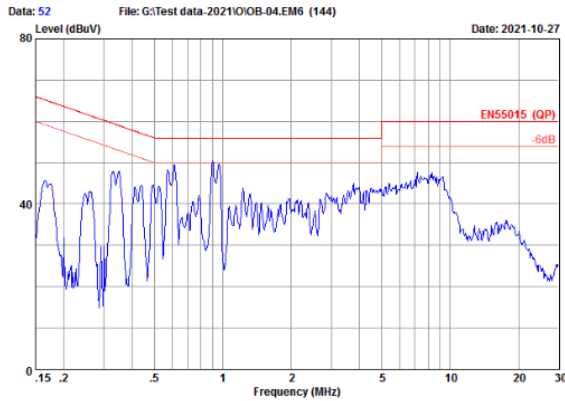


Fig. 4 Dynamic waveform @264Vac input

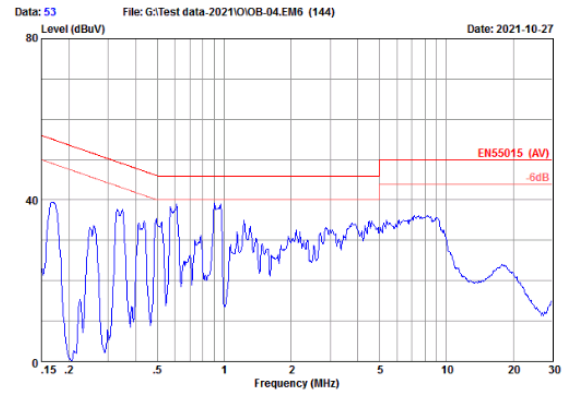
3. Output Characteristics

The Power supply passed EN55022 Class B & FCC class B EMI requirement with more than 6dB margin tested with shield.

3.1 Conducted EMI

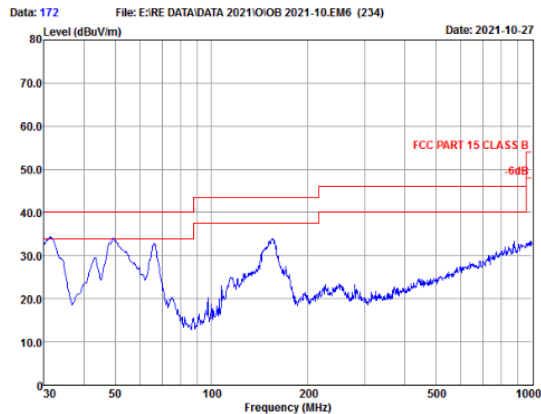


Site : Audix ACI (Conducted Emission)
 Condition : EN55015 (QP) ESH2-25-2017 NEUTRAL
 Project No. :
 Applicant :
 EUT : OB2736
 M/N : MCM 20V 2.25A
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : N
 Test Mode :
 Test Engineer : Neil
 Memo : PCB3 2009

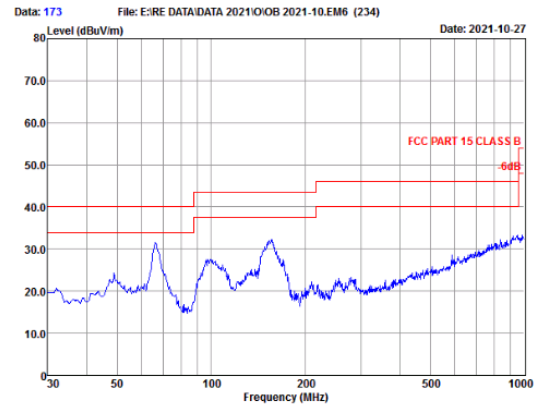


Site : Audix ACI (Conducted Emission)
 Condition : EN55015 (AV) ESH2-25-2017 NEUTRAL
 Project No. :
 Applicant :
 EUT : OB2736
 M/N : MCM 20V 2.25A
 S/N :
 Power Supply : 230V/50Hz
 Ambient : 22°C 48%RH
 Test line : N
 Test Mode :
 Test Engineer : Neil
 Memo : PCB3 2009

3.2 Radiation EMI



Site : Audix (Shanghai) Chamber3
 Condition : FCC PART 15 CLASS B VERTICAL
 Project No. :
 Applicant :
 EUT : OB2736MCM
 M/N : 20V 2.25A
 S/N :
 Power Supply : 120V/60Hz
 Ambient : 22°C 60%RH
 Test Mode :
 Test Engineer : Avalon
 Memo : PCB3 2009



Site : Audix (Shanghai) Chamber3
 Condition : FCC PART 15 CLASS B HORIZONTAL
 Project No. :
 Applicant :
 EUT : OB2736MCM
 M/N : 20V 2.25A
 S/N :
 Power Supply : 120V/60Hz
 Ambient : 22°C 60%RH
 Test Mode :
 Test Engineer : Avalon
 Memo : PCB3 2009

4. PD Specification Test

4.1 Vbus Change Test

Vbus changing test between 5V/9V/12V/15V/20V under No load/Full load conditions

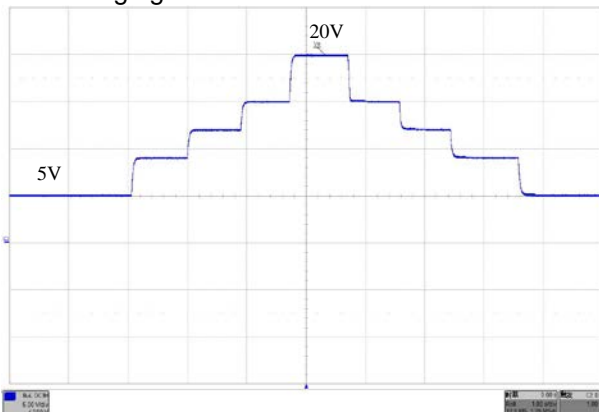


Fig. 5 Vbus Changing Test @no load

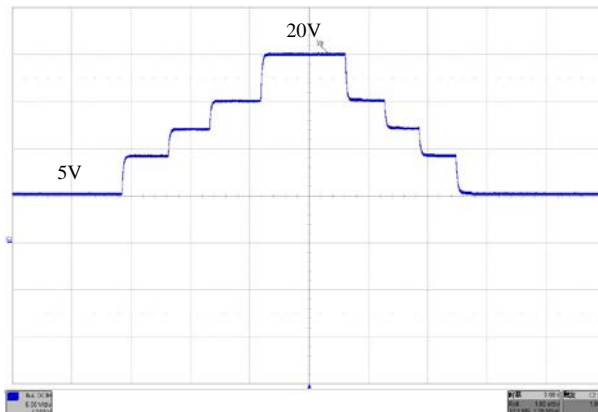


Fig. 6 Vbus Changing Test @full load

4.2 Negative Voltage Transitions

Vbus changing test from 20V to 5V @No load/Full load. The transition time is 120ms (spec: <275ms)

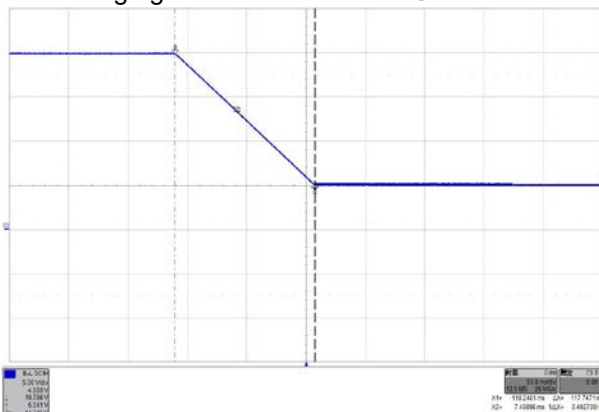


Fig. 7 Vbus Change From 20V to 5V @no load

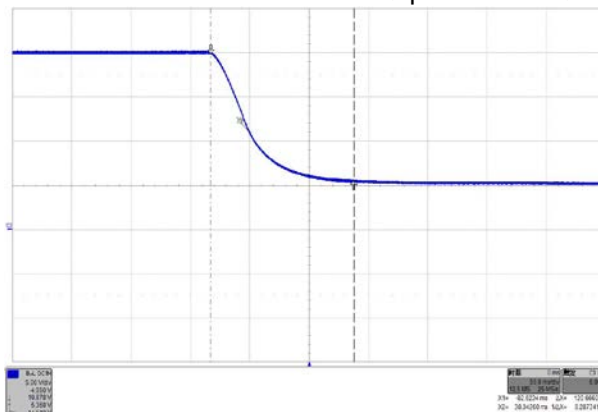


Fig. 8 Vbus Change From 20V to 5V @full load

4.3 Positive Voltage Transitions

Vbus changing test from 5V to 20V @No load/Full load. The transition time is 130ms (spec: <275ms)

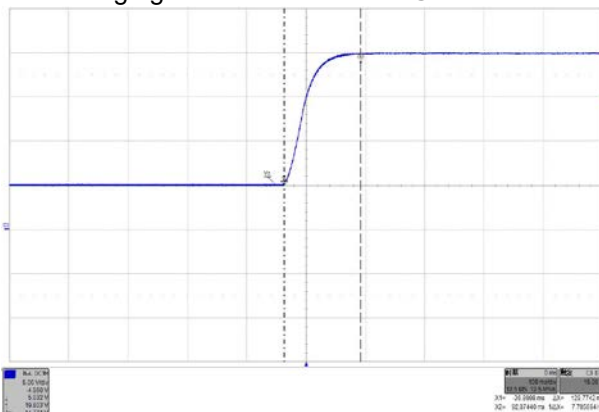


Fig. 9 Vbus Change From 5V to 20V @no load

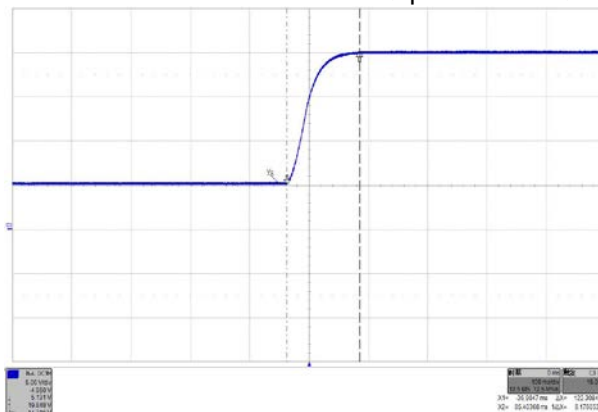


Fig. 10 Vbus Change From 5V to 20V @full load

4.4 Response to Hard Resets

When responding to hard reset, the time of t_{Safe5V} / t_{Safe0V} / $t_{SrcRecover}$ / $t_{SrcTurn}$ on are strict following PD spec.

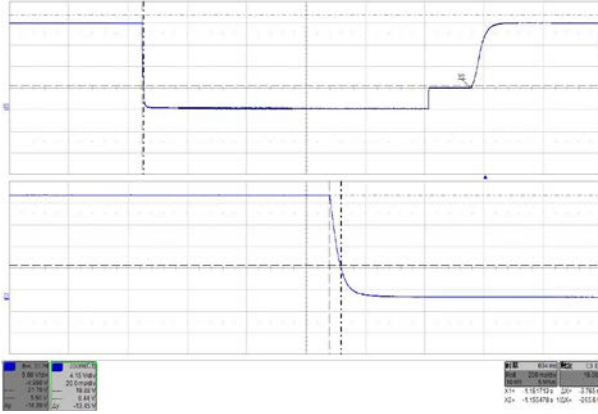


Fig. 11 Hard Reset t_0 - t_{Safe5V} (spec: <275ms)

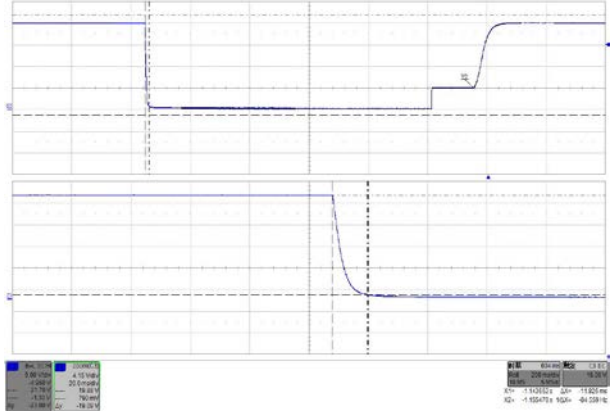


Fig. 12 Hard Reset t_0 - t_{Safe0V} (spec: <650ms)

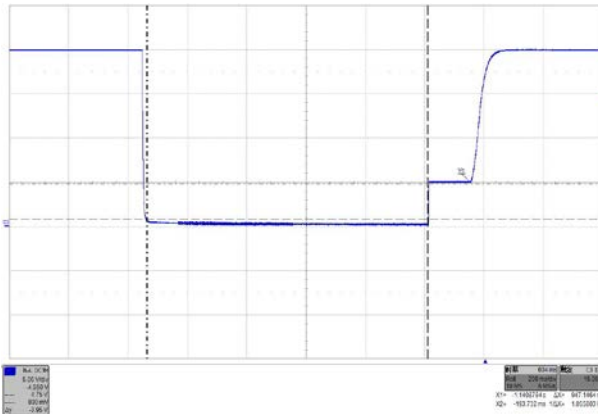


Fig. 13 Hard Reset $t_{SrcRecover}$ (947ms<spec<1s)

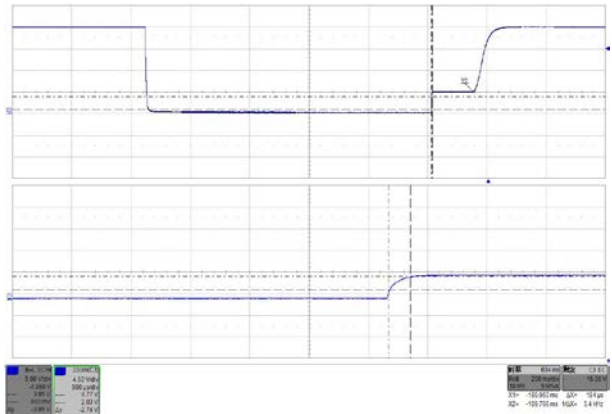


Fig. 14 Hard Reset $t_{SrcTurnon}$ (spec: <275ms)

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