Test Report
For PMP10725
03/17/2016

1. Design Specifications

Vin Min	**15VDC**
Vin Max	**36VDC**
Vout1	**24VDC**
Iout1	**500mA**
Vout2	**6VDC**
Iout2	**100mA**
Vout3	**6VDC**
Iout3	**100mA**
Target Switching Frequency	**200kHz**

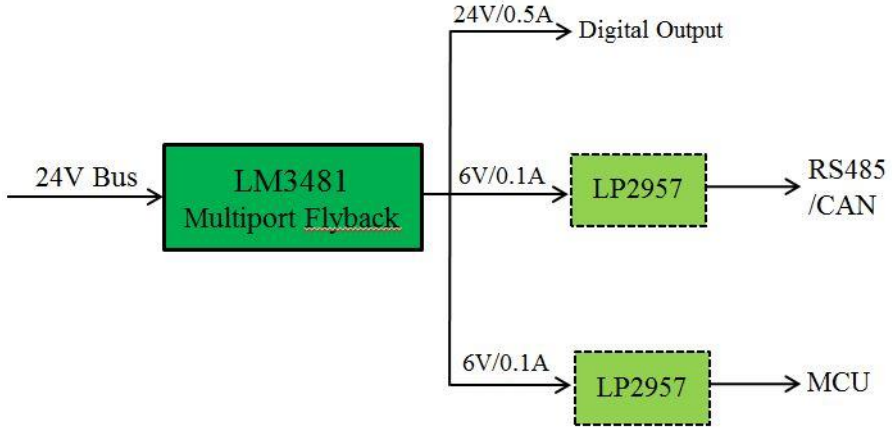
2. Circuit Description

PMP10725 is an isolated flyback solution which accepts an input voltage of 15 to 36V_{IN} and provides multiport output to the load. This reference design compares primary and secondary control solutions. With primary control, it can achieve higher efficiency with lower BOM cost, but the regulation performance is not so good. With secondary control, it can achieve great load regulation performance by controlling the 24V-rail voltage. This LM3481 flyback reference design can be used for supplying the digital output module in industrial PLC application.

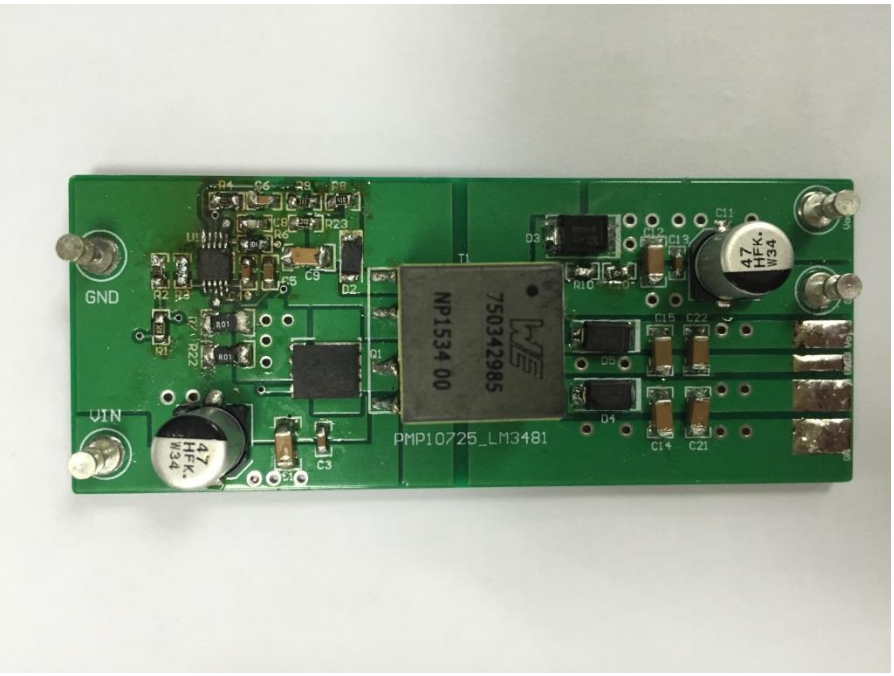
2.1 Brief Comparison Table of Primary and Secondary Control

Item	Primary Control	Secondary Control
Efficiency	**85.6%**@ 15V_{IN} 100%load **83.5%**@36V_{IN} 100%load	84.8%@ 15V_{IN} 100%load 81.3%@36V_{IN} 100%load
Regulation	-6.19%/+5.06%@15V_{IN}, 24V rail -4.47%/+3.51%@36V_{IN}, 24V rail	**-0.37%/+0.28%**@15V_{IN}, 24V rail **-0.10%/+0.05%**@36V_{IN}, 24V rail
BOM Quantity	**43**	50
Semiconductor Devices (Ignore same devices)	Primary output diode	Opto coupler(PS2811) Zener Shunt Regulator(LM431)

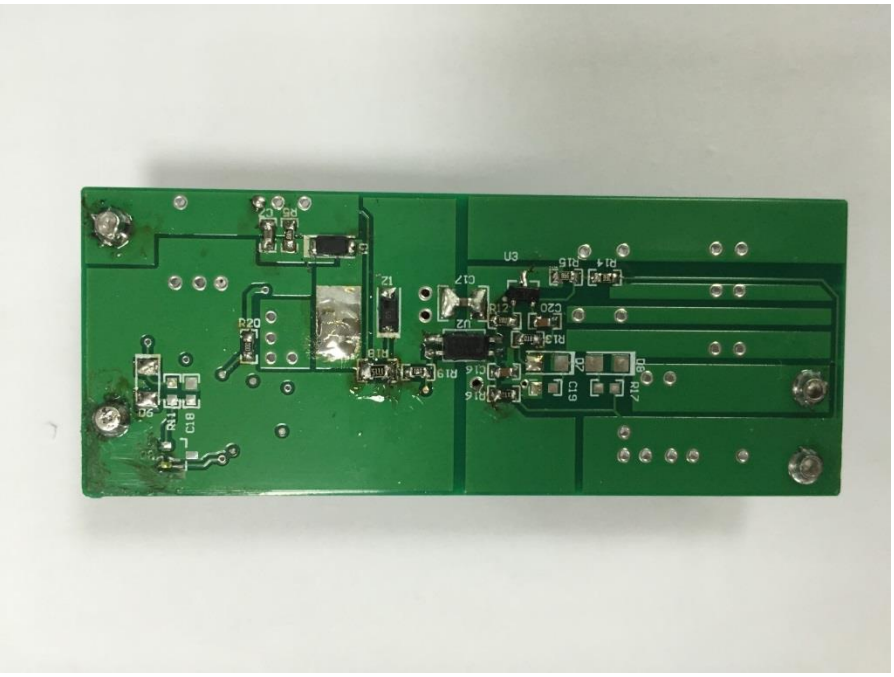
2.2 PLC Digital Output Module Power Tree



3. Board Photos

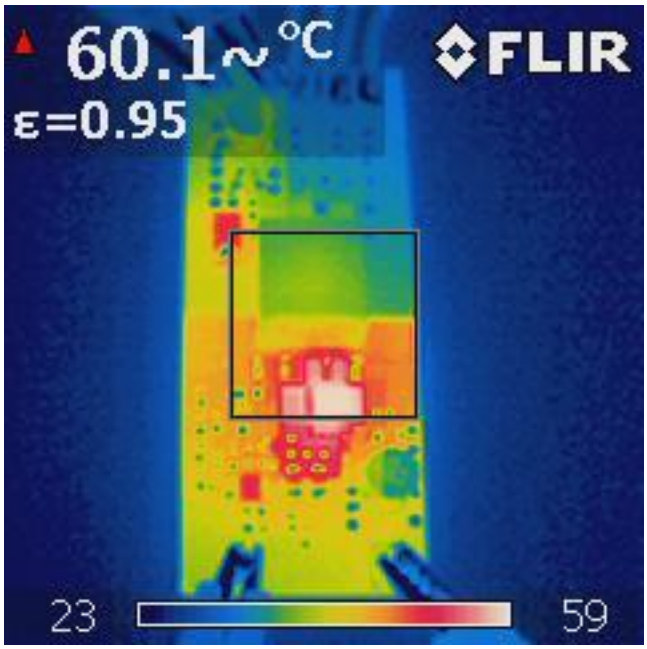


Top (66.37x22.61mm^2)

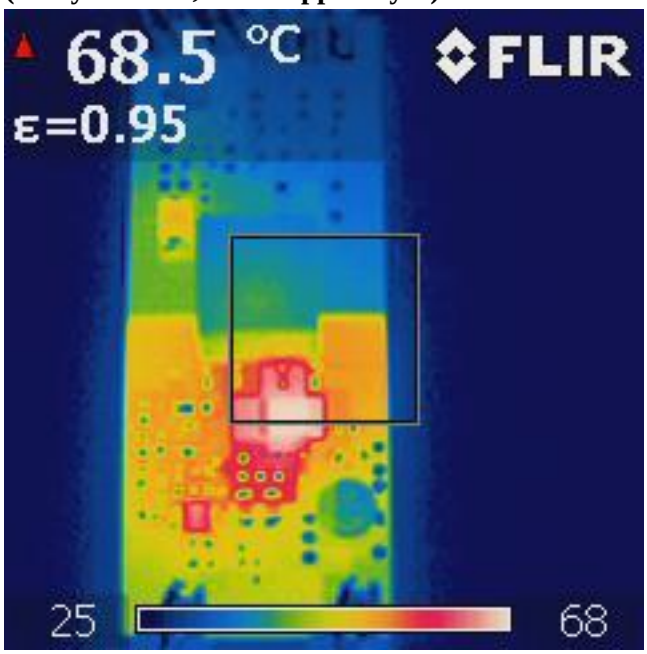


Bottom (66.37x22.61mm^2)

4. Thermal Data



IR thermal image taken at steady state at 100% load and V_{IN} = 15 V (secondary control) for two minutes with no airflow (4 Layer board, 1 Oz copper layer)

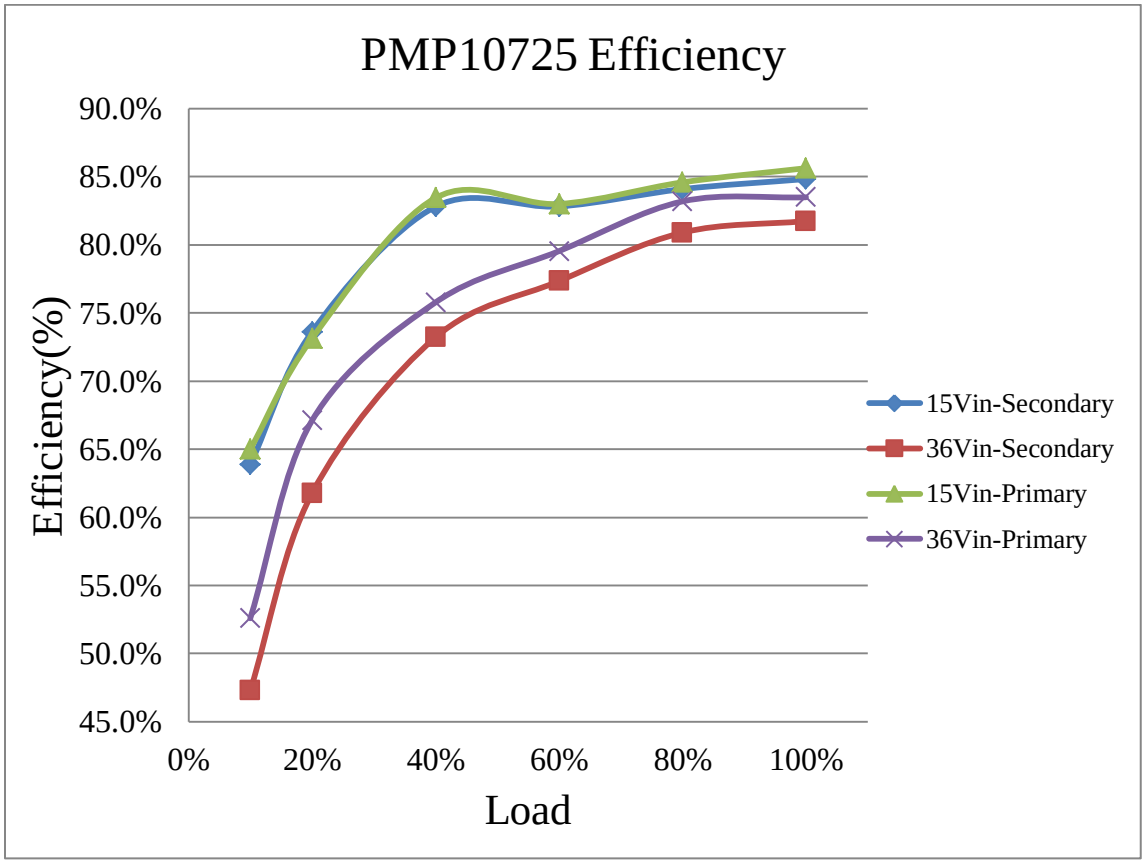


IR thermal image taken at steady state at 100% load and VIN = 36V (secondary control) for two minutes with no airflow (4 Layer board, 1 Oz copper layer)

5. Efficiency and Regulation

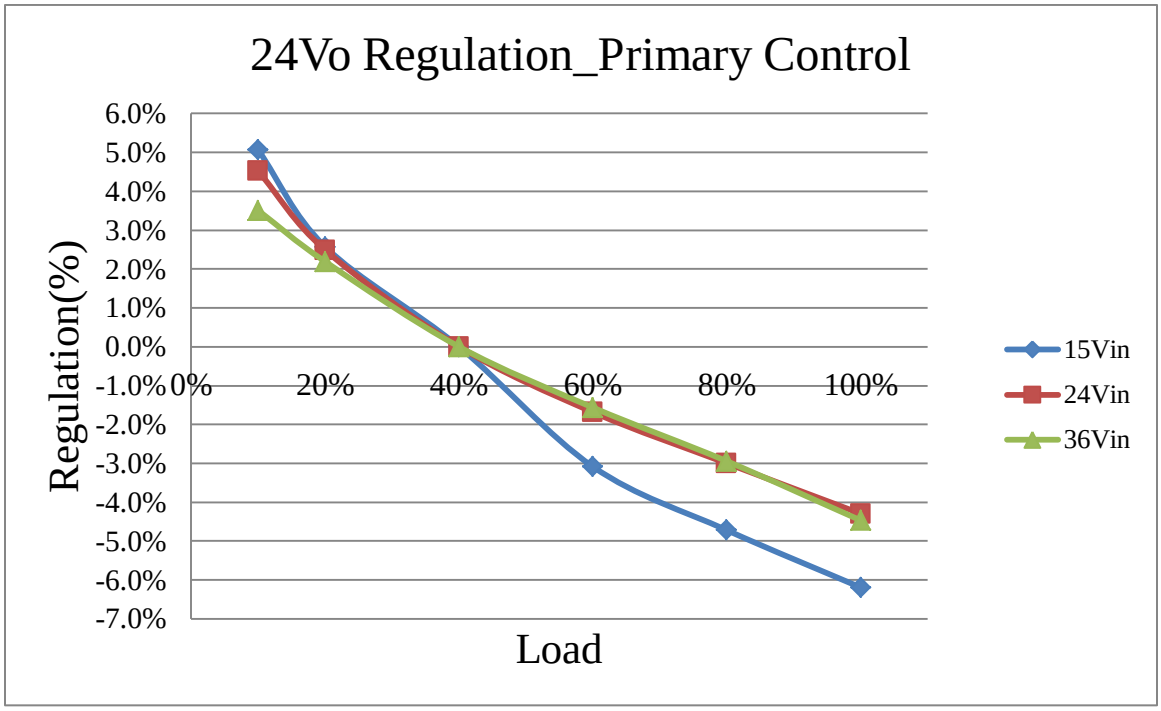
5.1 Efficiency Chart

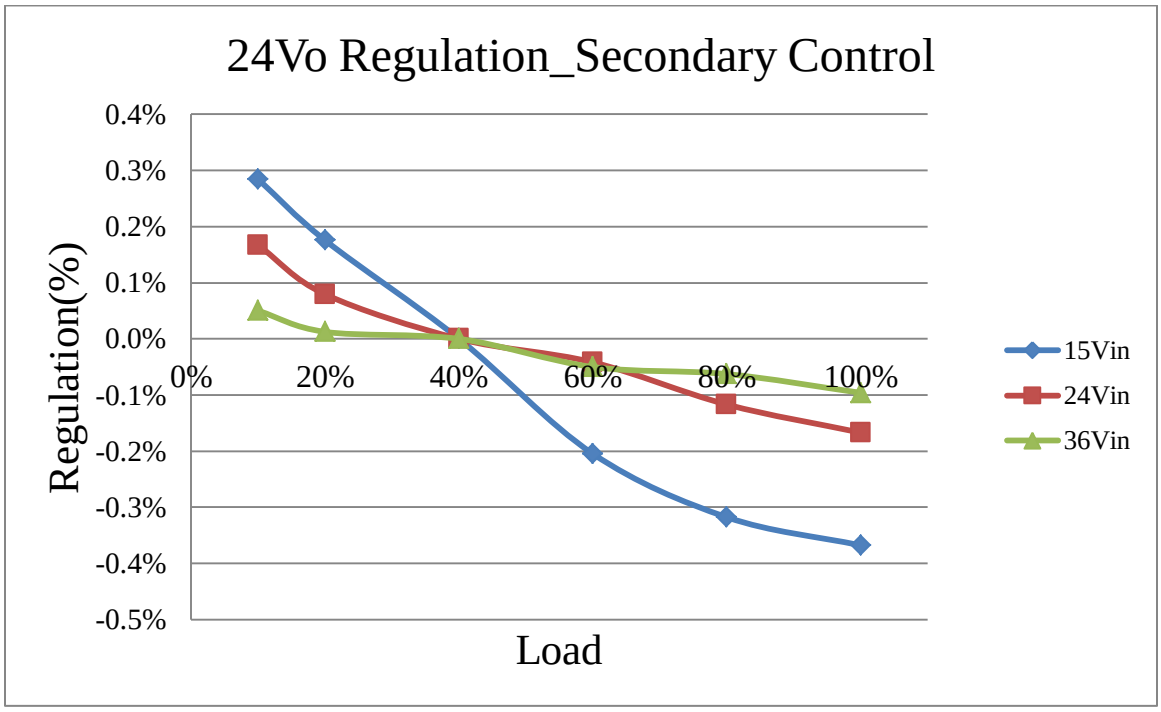
The Efficiency measurement was taken in the condition that all three outputs were loaded at the same percentage current in respect of their full load.

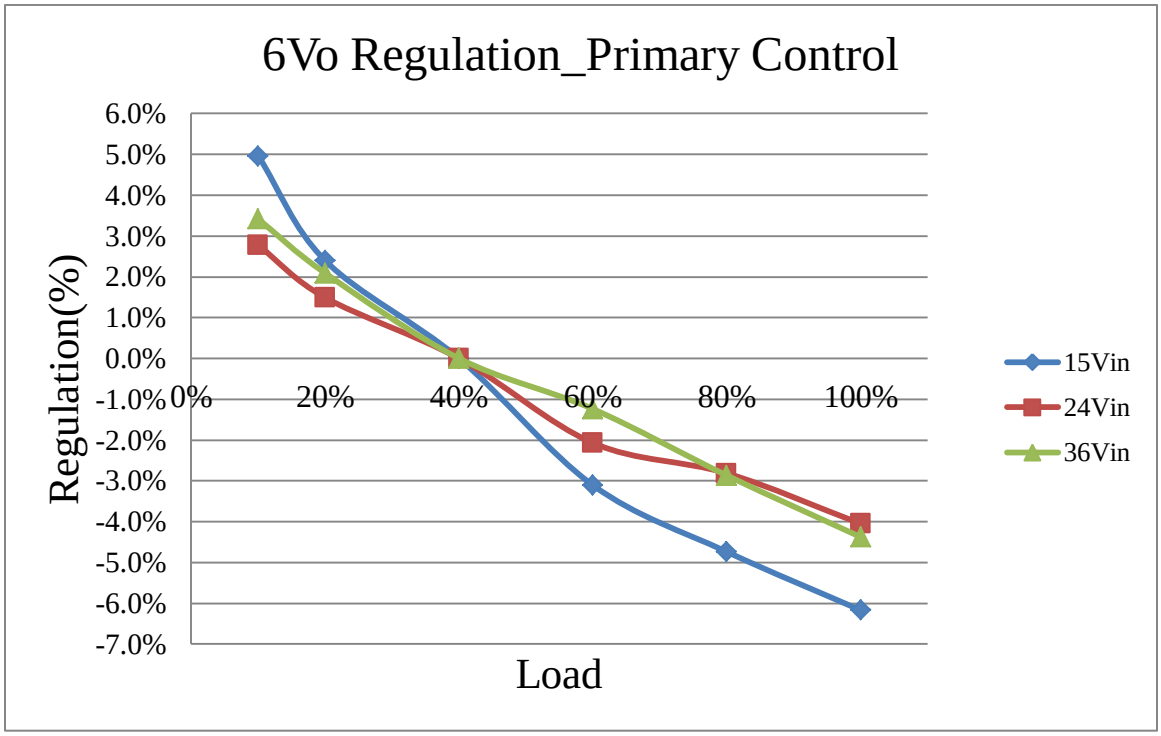


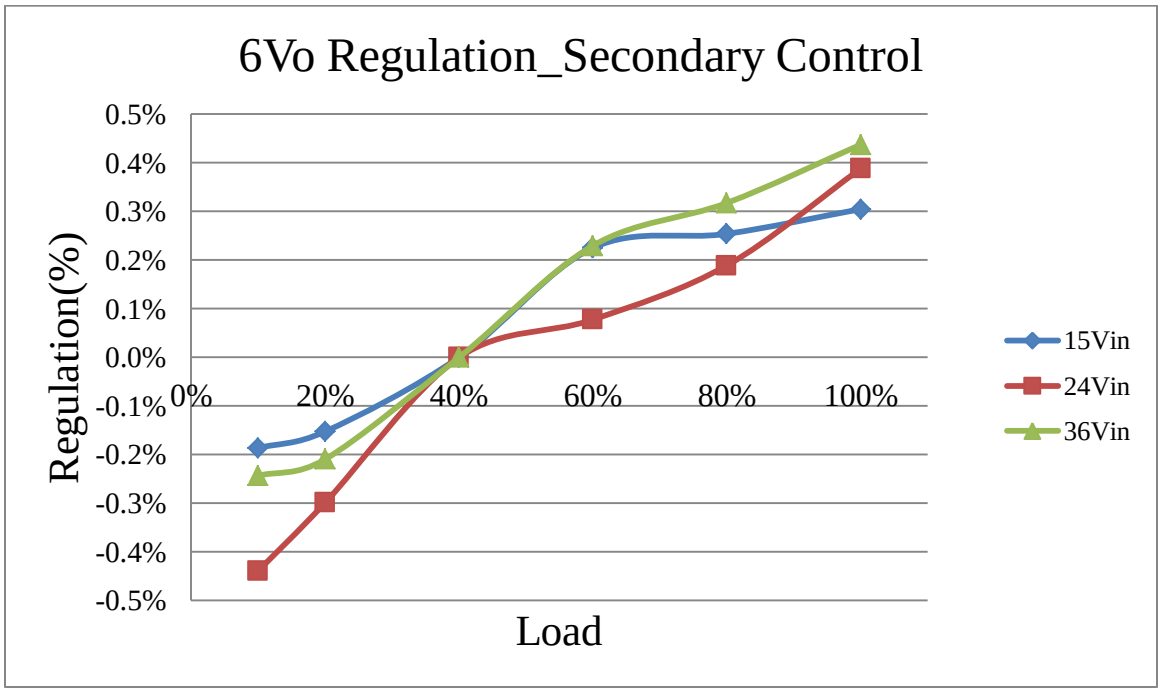
5.2 Cross Regulation Chart

The regulation under balanced load condition was tested as all three outputs were loaded with the same percentage of current in respect of their full load at different input voltage condition. Since two +6V outputs are symmetrical, only one +6V output regulation is shown.

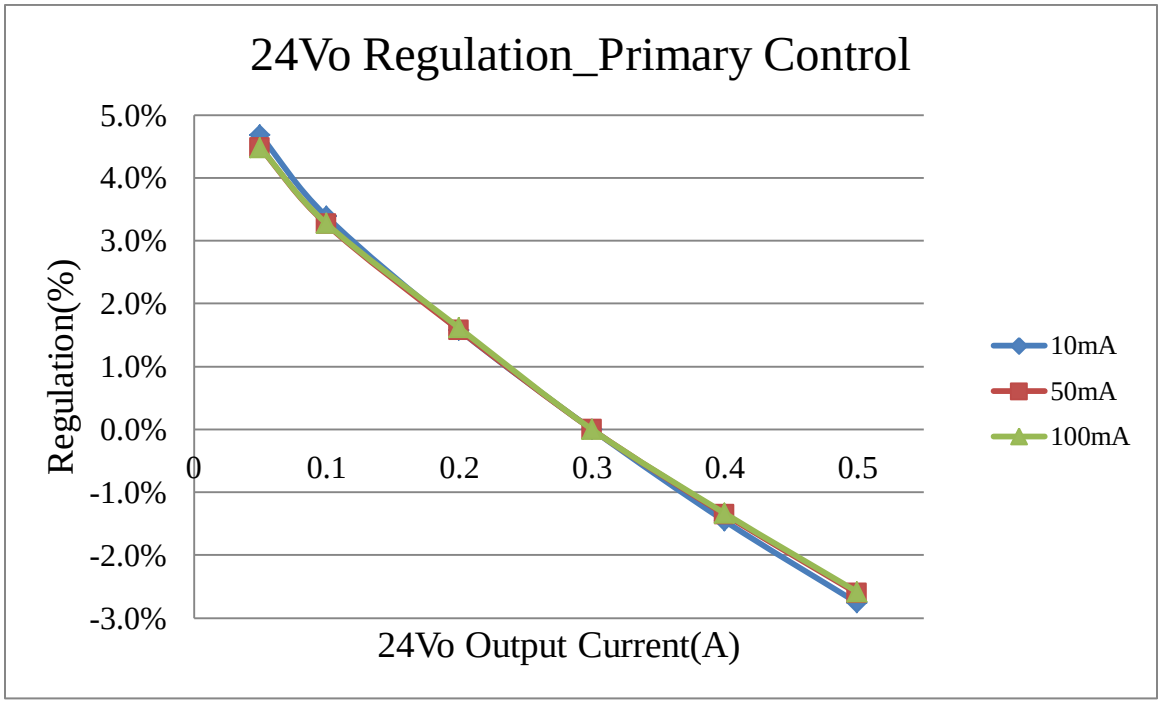

24Vo Regulation_Primary Control
Regulation(%)
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
-6.0%
-7.0%
0%
20%
40%
60%
80%
100%
Load
15Vin
24Vin
36Vin

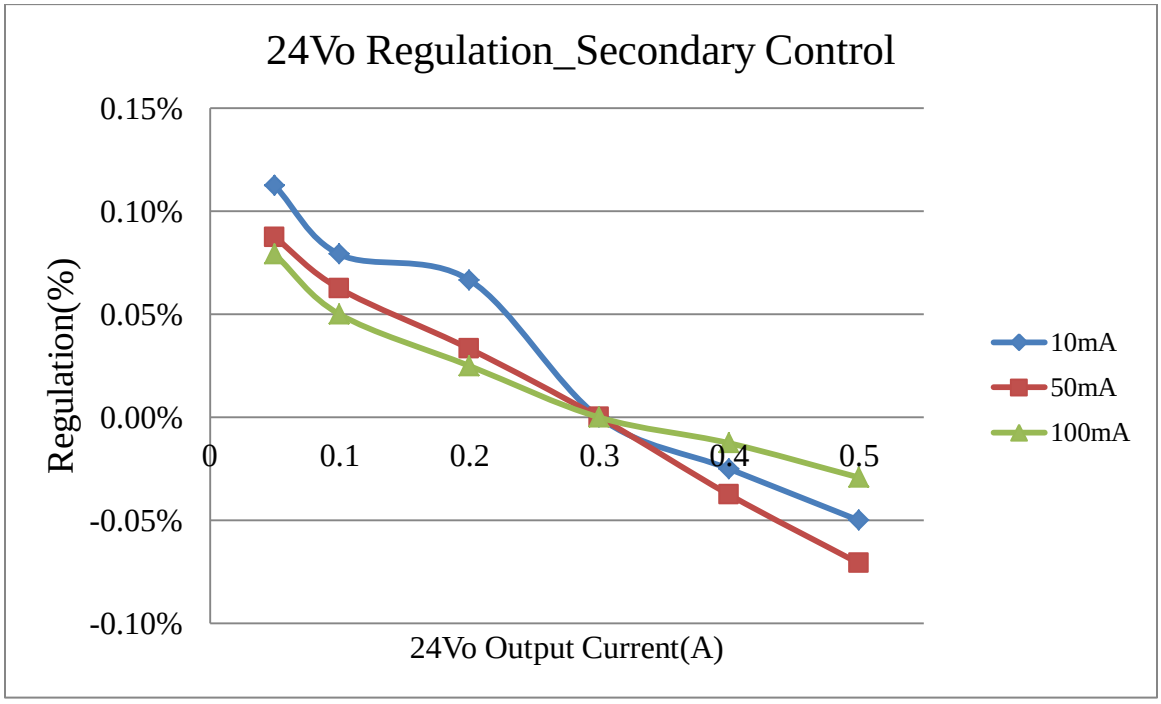

24Vo Regulation_Secondary Control
Regulation(%)
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%
-0.5%
0%
20%
40%
60%
80%
100%
Load
15Vin
24Vin
36Vin

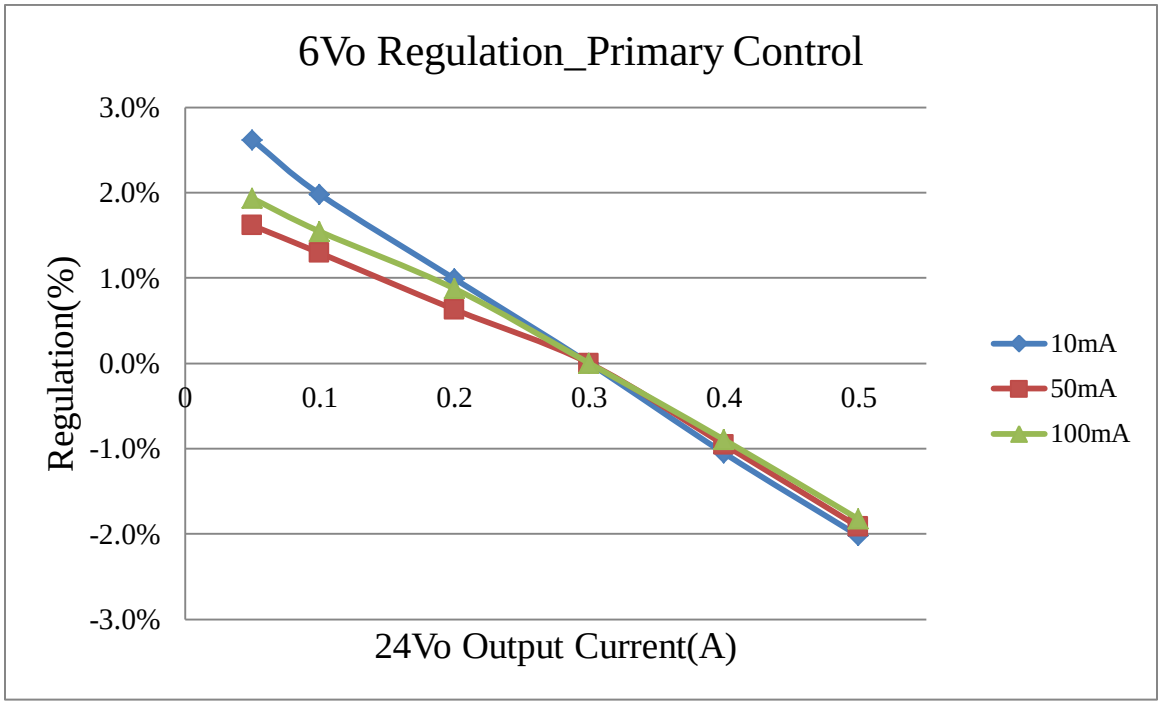


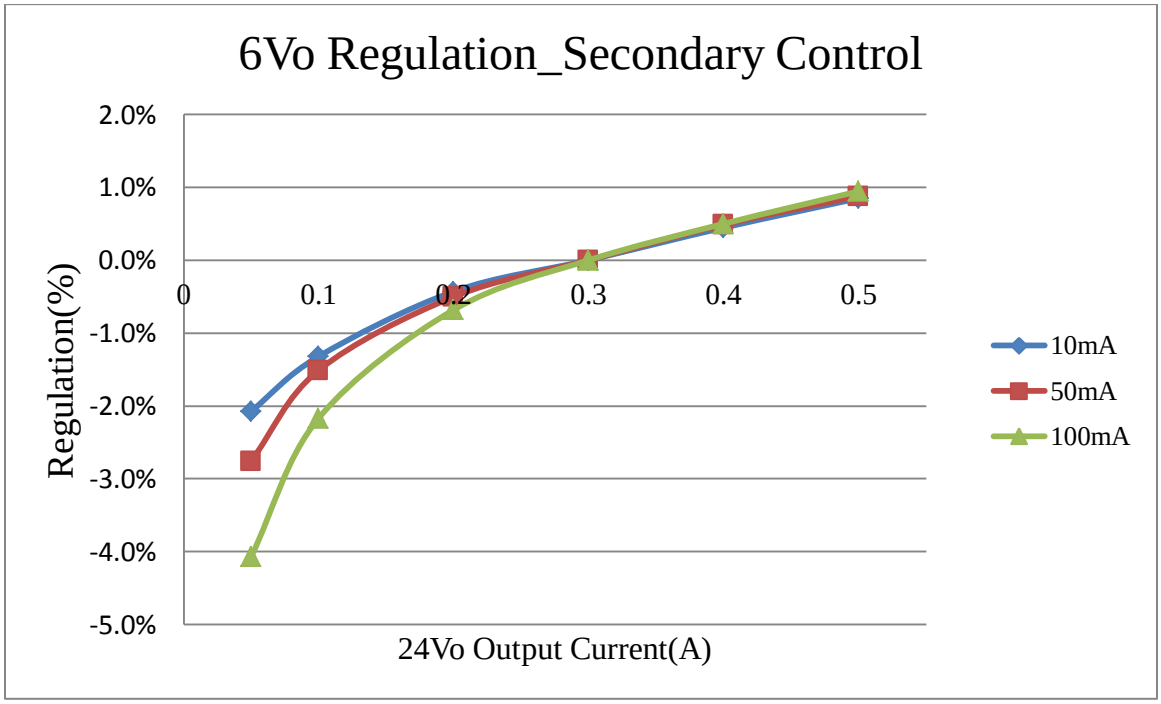


The regulation under unbalanced load was tested by sweeping different load current on the 24V output while the two +6V output were loaded with 10mA, 50mA and 100mA at 24V input. Since the two +6V outputs are symmetrical, only one rail output regulation is shown.


24Vo Regulation_Primary Control
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
Regulation(%)
0
0.1
0.2
0.3
0.4
0.5
24Vo Output Current(A)
10mA
50mA
100mA

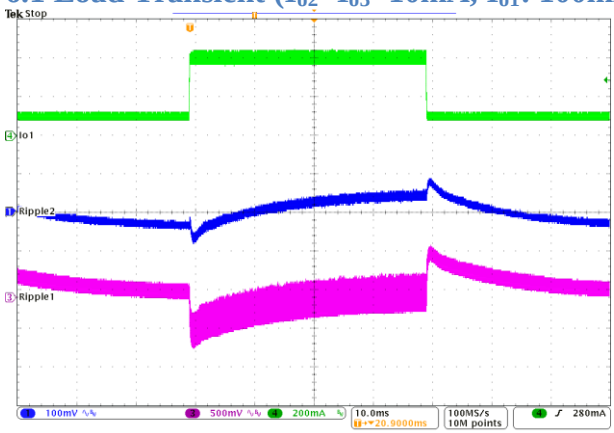

24Vo Regulation_Secondary Control
0.15%
0.10%
0.05%
0.00%
-0.05%
-0.10%
Regulation(%)
0
0.1
0.2
0.3
0.4
0.5
24Vo Output Current(A)
10mA
50mA
100mA


6Vo Regulation_Primary Control
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
Regulation(%)
0
0.1
0.2
0.3
0.4
0.5
24Vo Output Current(A)
10mA
50mA
100mA

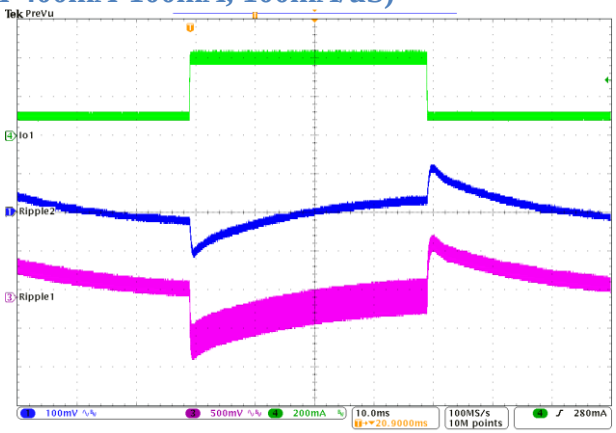

6Vo Regulation_Secondary Control
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
Regulation(%)
0
0.1
0.2
0.3
0.4
0.5
24Vo Output Current(A)
10mA
50mA
100mA

6. Waveform

6.1 Load Transient (I_{o2}=I_{o3}=10mA, I_{o1}: 100mA-400mA-100mA, 100mA/uS)

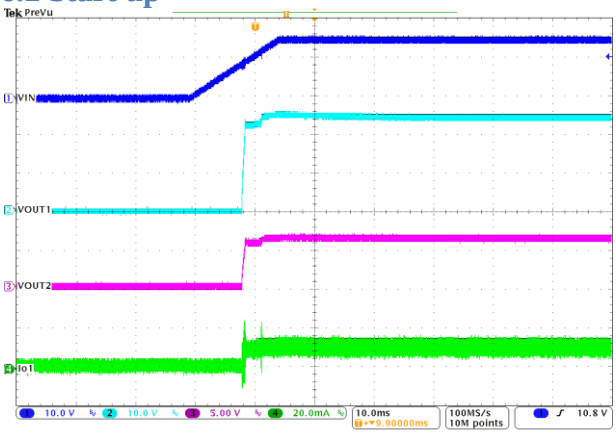


V_{IN}=15V

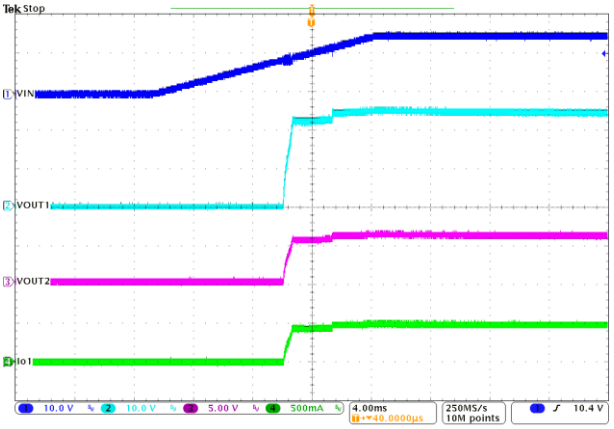


V_{IN}=36V

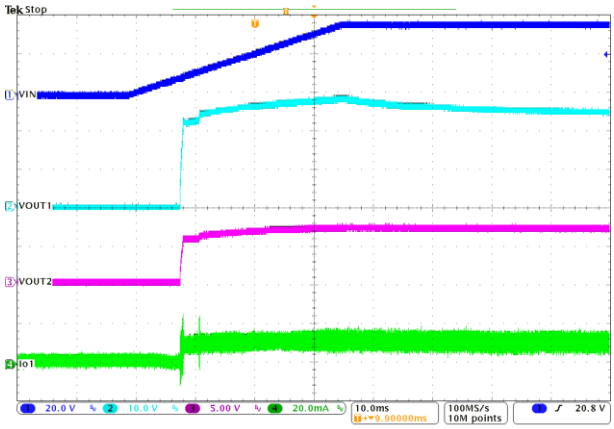
6.2 Start up



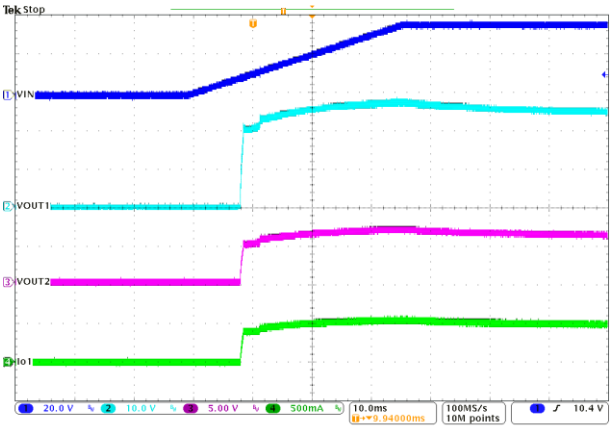
V_{IN}=15V, I_1=0; I_2=0; I_3=10mA



V_{IN}=15V, I_1=0.1A; I_2=0.1A; I_3=0.5A

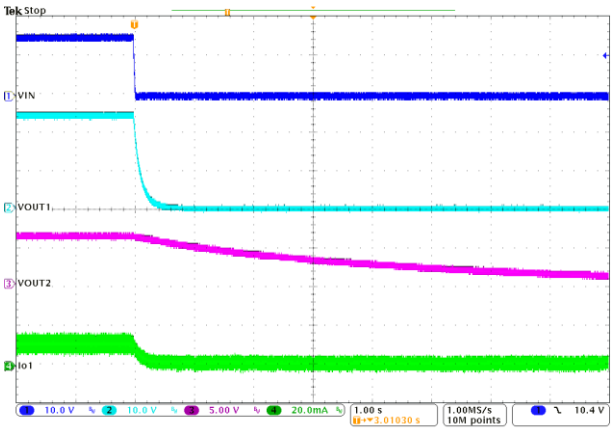


V_{IN}=36V, I_1=0; I_2=0; I_3=10mA

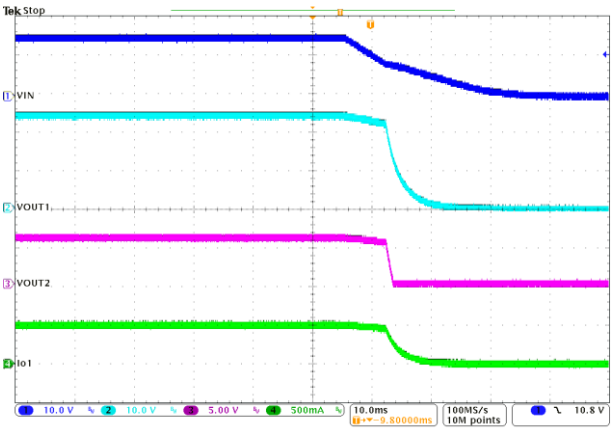


V_{IN}=36V, I_1=0.1A; I_2=0.1A; I_3=0.5A

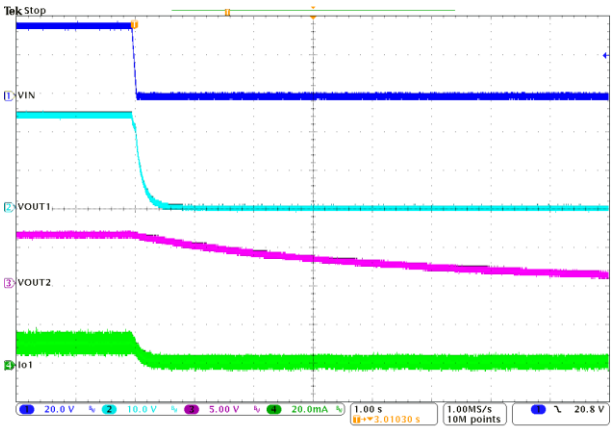
6.3 Shutdown



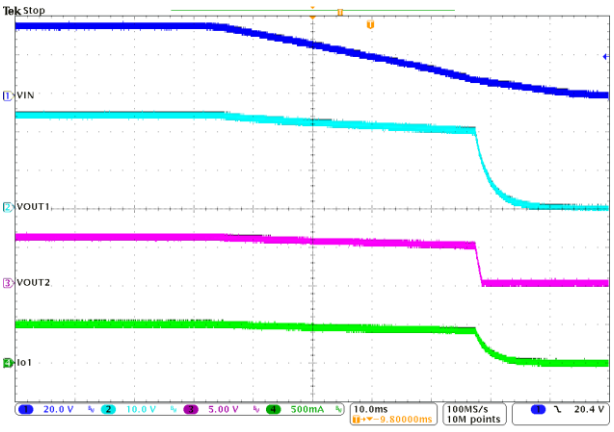
V_{IN}=15V, I_1=0; I_2=0; I_3=10mA



V_{IN}=15V, I_1=0.1A; I_2=0.1A; I_3=0.5A

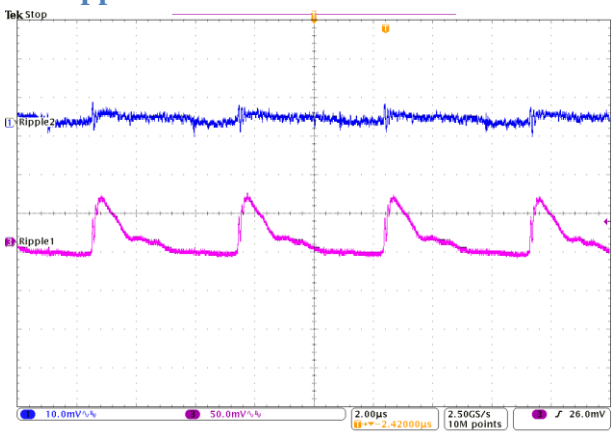


V_{IN}=36V, I_1=0; I_2=0; I_3=10mA

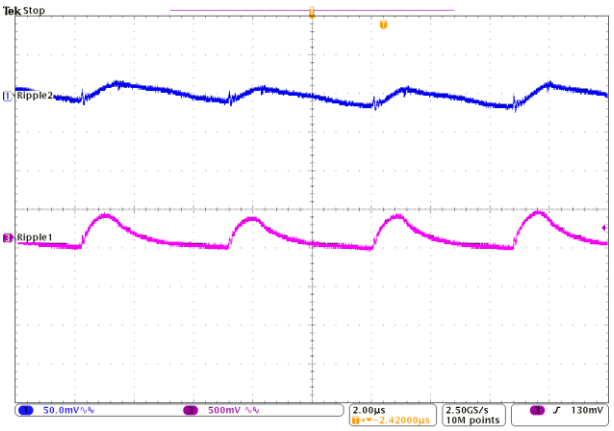


V_{IN}=36V, I_1=0.1A; I_2=0.1A; I_3=0.5A

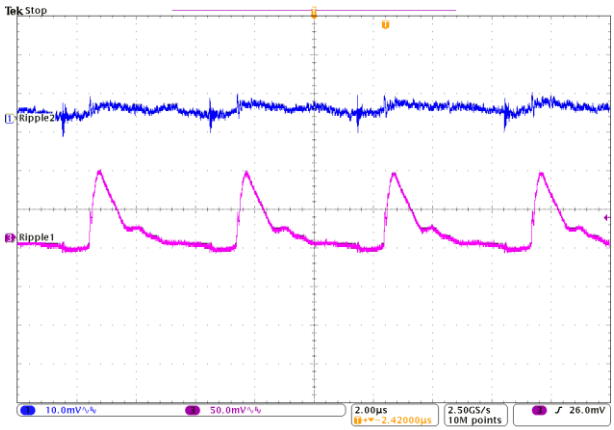
6.4 Ripple



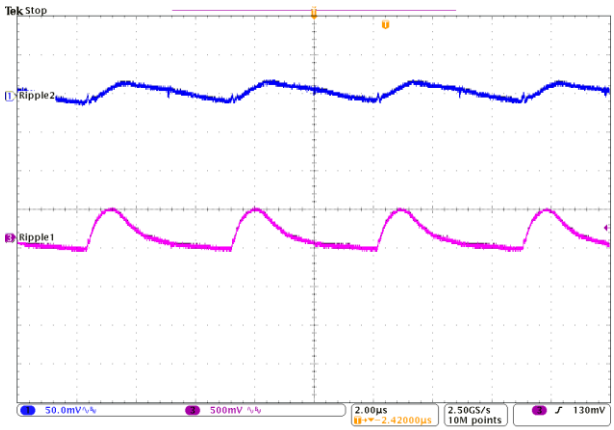
V_{IN}=15V, I_1=0; I_2=0; I_3=50mA



V_{IN}=15V, I_1=0.1A; I_2=0.1A; I_3=0.5A

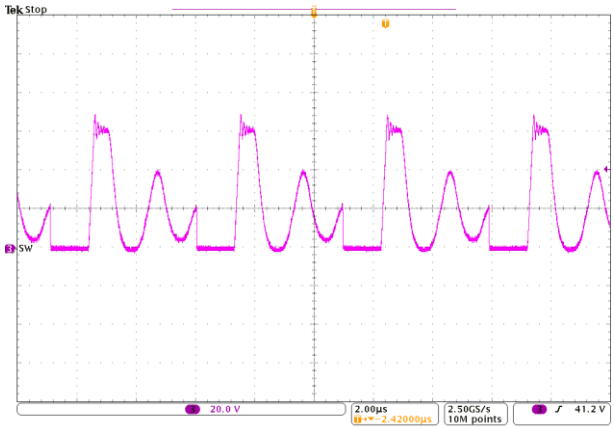


V_{IN}=36V, I_1=0; I_2=0; I_3=50mA

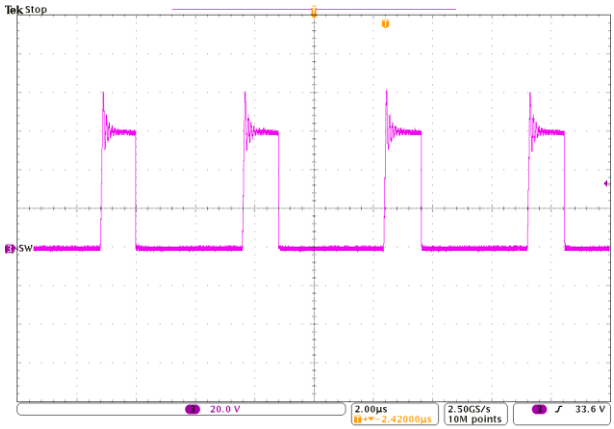


V_{IN}=36V, I_1=0.1A; I_2=0.1A; I_3=0.5A

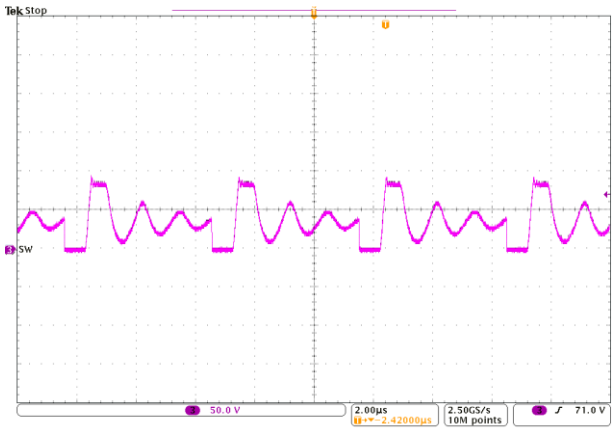
6.5 Switching



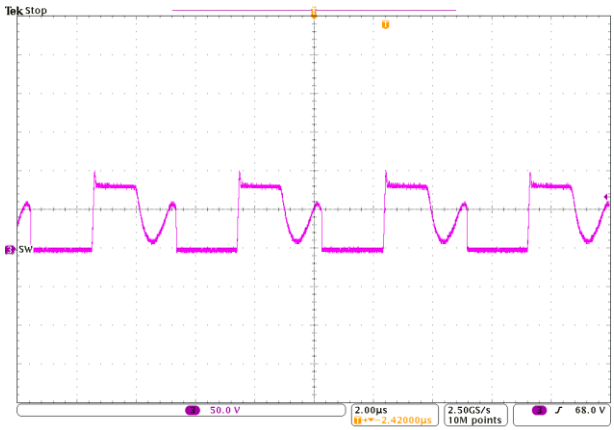
V_{IN}=15V, I_1=0; I_2=0; I_3=50mA



V_{IN}=15V, I_1=0.1A; I_2=0.1A; I_3=0.5A

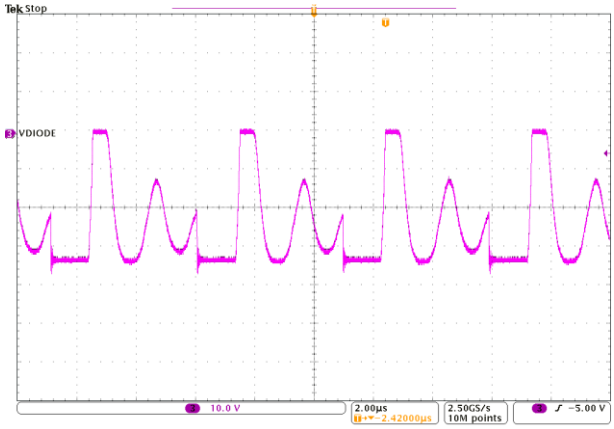


V_{IN}=36V, I_1=0; I_2=0; I_3=50mA

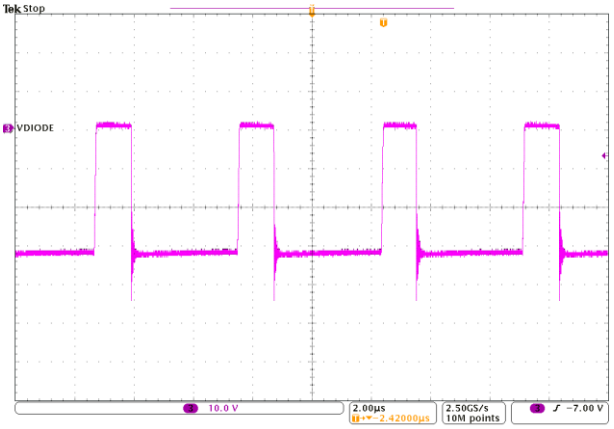


V_{IN}=36V, I_1=0.1A; I_2=0.1A; I_3=0.5A

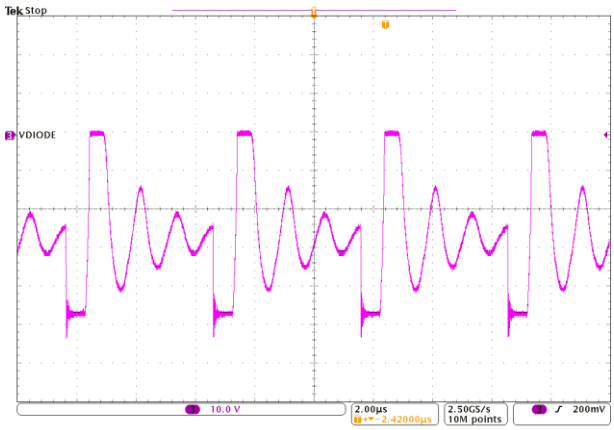
6.6 Diode Voltage



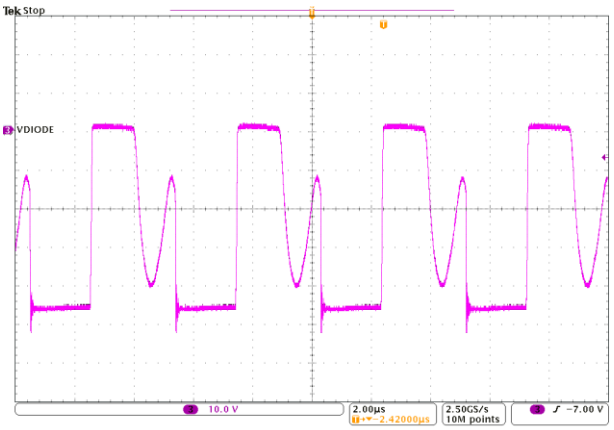
V_{IN}=15V, I_1=0; I_2=0; I_3=50mA



V_{IN}=15V, I_1=0.1A; I_2=0.1A; I_3=0.5A



V_{IN}=36V, I_1=0; I_2=0; I_3=50mA



V_{IN}=36V, I_1=0.1A; I_2=0.1A; I_3=0.5A

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