AP1603 Demo Board Design Notice

Contents

AP1603

Step-Up DC/DC Converter

■ Features

-A Guaranteed Start-Up from less than 0.9 V.
-High Efficiency.
-Low Quiescent Current.
-Less Number of External Components needed.
-Low Ripple and Low Noise.
-Space Saving **Pb-Free** Packages: SOT23-6

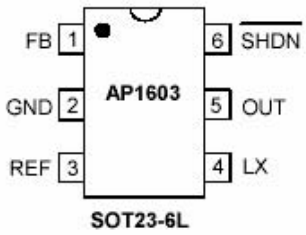
■ Applications

-Pagers.
-Cameras.
-Wireless Microphones.
-Pocket Organizers.
-Battery Backup Suppliers.
-Portable Instruments.

■ General Description

The AP1603 is a high efficiency step-up DC/DC converter for applications using 1 to 2 NiMH battery cells. Only three external components are required to deliver a fixed output voltage of 3.3V. The AP1603 starts up from less than 0.9V input with 1mA load. Pulse Frequency Modulation scheme brings optimized performance for applications with light output loading and low input voltages. The output ripple and noise are lower compared with the circuits operating in PSM mode.
The PFM control circuit operating in 150KHz (max.) switching rate results in smaller passive components. The space saving SOT23-6 packages make the AP1603 an ideal choice of DC/DC converter for space conscious applications, like pagers, electronic cameras, and wireless microphones.

■ Pin Assignments

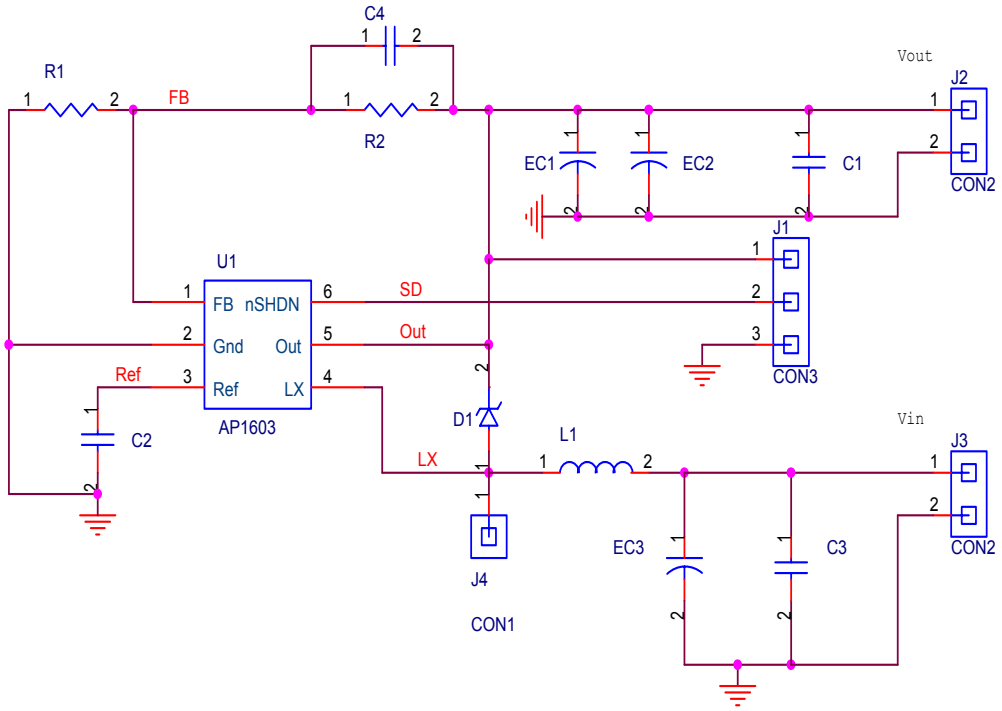


SOT23-6L

■ Pin Descriptions

Name	Description
REF	1.2V Reference Voltage. Bypass with a 0.1μF capacitor.
OUT	Power Output. OUT provides bootstrap power to the IC.
LX	N-Channel and P-Channel Power MOSFET Drain
GND	Ground
$\overline{SHDN}$	Shutdown Input. Drive high (>80% of V_{OUT}) for operating mode. Drive low (<20% of V_{OUT}) for shutdown mode. Connect to OUT for normal operation.
FB	Feedback

2.0 展示板線路


C4
R1
FB
R2
Vout
J2
CON2
EC1
EC2
C1
J1
CON3
U1
FB nSHDN
Gnd Out
Ref LX
AP1603
SD
Out
Ref
C2
D1
L1
LX
Vin
J3
CON2
EC3
C3
J4
CON1

2.1 bom list

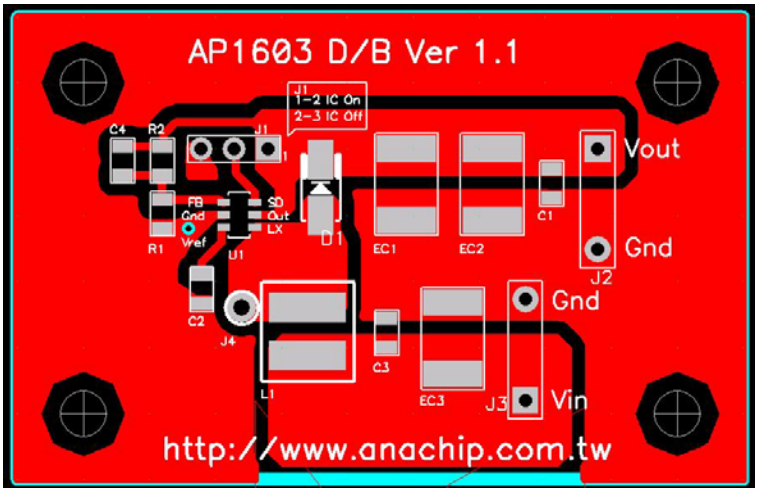
EC1	47uF/16V tantalum
EC2	47uF/16V tantalum
EC3	47uF/16V tantalum
C1	0.1uF
C2	0.1uF
C3	0.1uF
L1	22uH
U1	AP1603
D1	ASB0320

2.2 線路設計

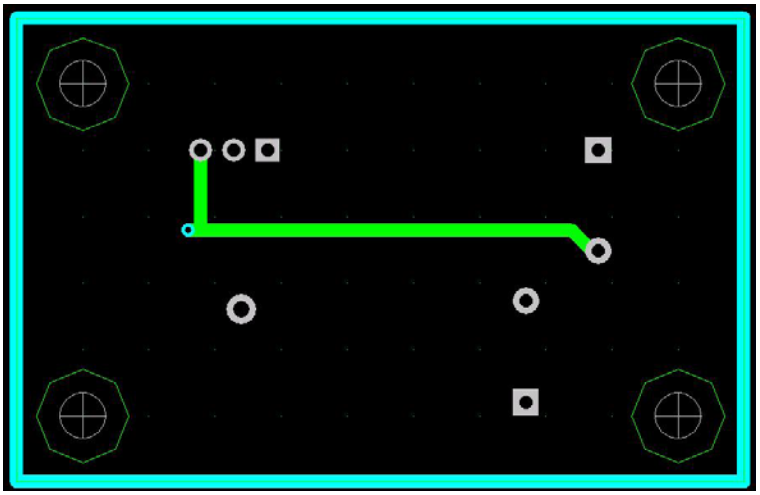
AP1601 在輸出電壓定在 5 伏特或 3.3 伏特時，因為沒有辦法作補償，所以在補償的考慮上，只限在可調的部分。當用在 1.8 伏特轉 2.4 伏特時，波形正常，並不需要加上補償電容。但是當使用在 3.3 伏特轉 4.2 伏特/200 毫安培時，IC out 會有振盪產生，經實驗後，建議可以加上 10nF~47nF 在 C4 上面。

3.0 展示板佈線

3.1 上層



3.2 下層



4.0 基本功能測試

4.1 最低起動電壓

測試環境 Iout = 5mA

	Vout 5V	Vout 3.3V	Vout 2.5V
有二極體	1V	1V	0.92V

4.2 最低工作電壓

測試環境 Iout =5mA

	Vout 5V	Vout 3.3V	Vout 2.5V
有二極體	0.966V	0.6V	0.67V

4.3 無載電流

測試環境 Iout = 0mA

	Vout 5V	Vout 3.3V	Vout 2.5V
有二極體	Vin = 1.8V Iin=98uA	Vin = 1.8V Iin = 60 uA	Vin = 1.8V Iin = 60uA

4.4 IC 最大輸入電壓

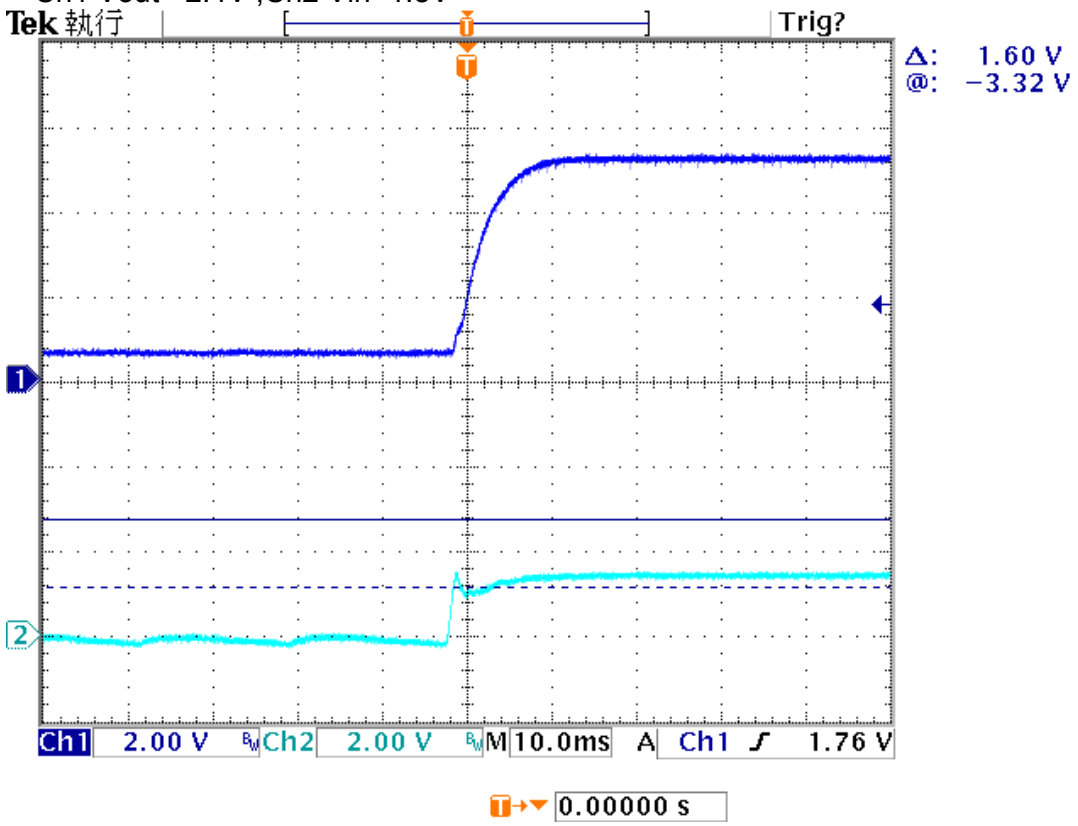
測試環境 Iout = 5mA

當 Vcc > 10V 後，ic 冒煙且 ic 表面隆起。

4.5 開關機波形

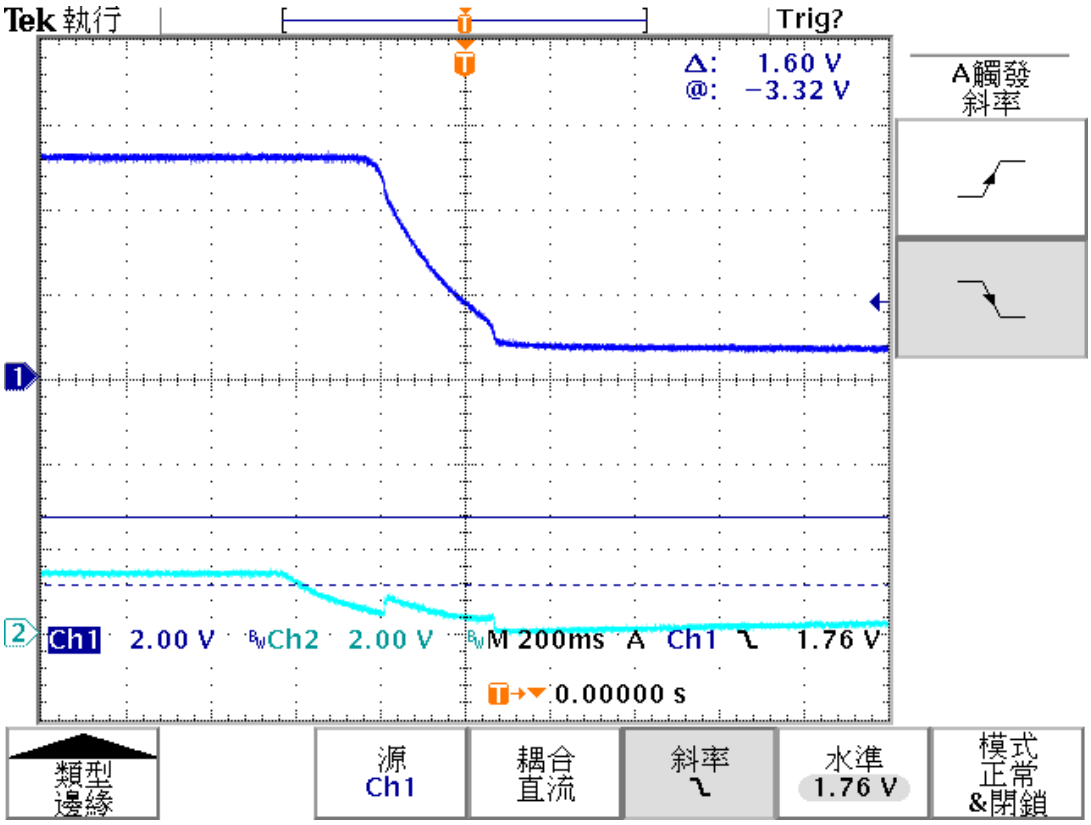
4.5.1 開機波形

Ch1 Vout =2.4V ,Ch2 Vin=1.8V



4.5.2 關機波形

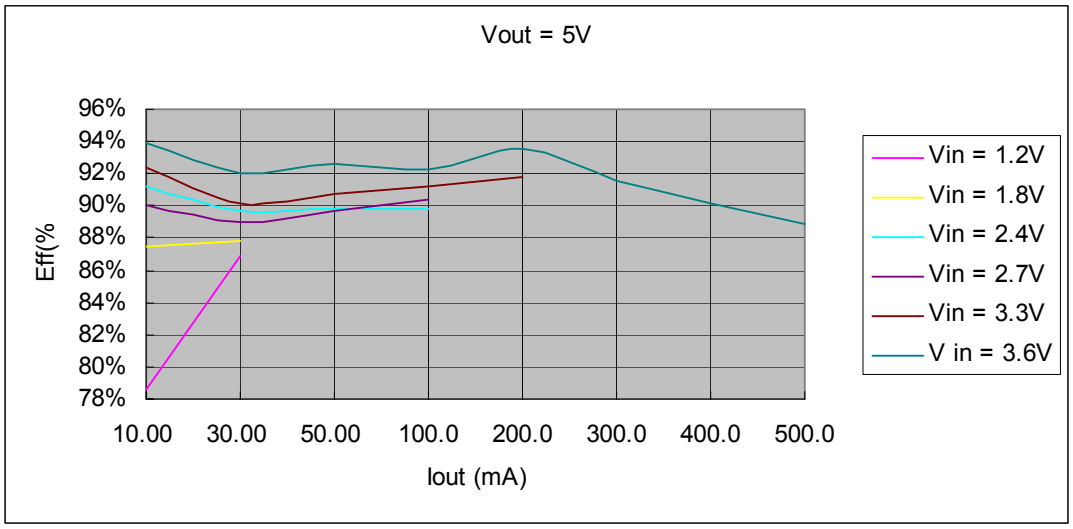
Ch1 Vout,=2.4V ,Ch2 Vin=1.8V



5.0 效率測試

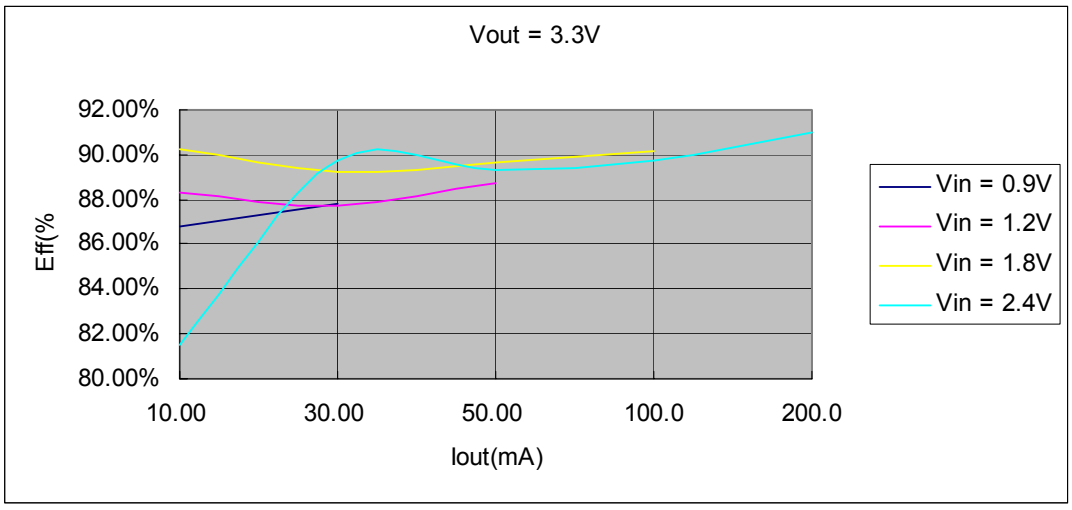
5.1 Vout = 5V

Vin	Iin	Vout	Iout	eff
0.938	64.500	4.720	10	78.02%
1.218	51.100	4.890	10	78.57%
1.256	86.000	4.690	20	86.84%
1.816	32.000	5.080	10	87.42%
1.787	92.000	4.810	30	87.77%
2.460	23.000	5.160	10	91.20%
2.437	69.000	5.030	30	89.74%
2.419	113.000	4.910	50	89.81%
2.393	178.000	4.780	80	89.77%
2.740	21.000	5.180	10	90.02%
2.722	63.000	5.090	30	89.05%
2.705	103.000	5.000	50	89.73%
2.759	195.000	4.860	100	90.33%
3.310	17.000	5.200	10	92.41%
3.300	52.000	5.160	30	90.21%
3.280	86.000	5.120	50	90.75%
3.250	169.000	5.010	100	91.22%
3.220	245.000	4.830	150	91.84%
3.690	15.000	5.200	10	93.95%
3.670	46.000	5.180	30	92.05%
3.660	76.000	5.150	50	92.57%
3.630	152.000	5.090	100	92.25%
3.580	283.000	4.740	200	93.57%
3.520	444.000	4.770	300	91.56%
3.550	589.000	4.710	400	90.10%
3.660	726.000	4.720	500	88.82%



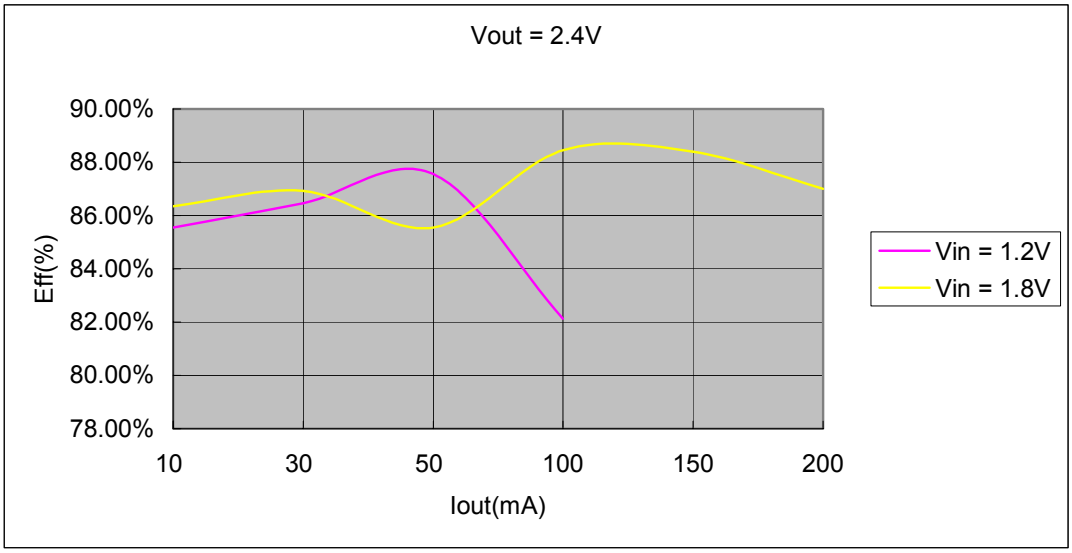
5.2 Vout = 3.3V

Vin	Iin	Vout	Iout	eff
0.900	43.000	3.360	10	86.82%
0.900	120.000	3.160	30	87.78%
1.196	32.000	3.380	10	88.32%
1.168	96.000	3.280	30	87.76%
1.176	150.000	3.130	50	88.72%
1.800	21.000	3.410	10	90.21%
1.782	63.000	3.340	30	89.25%
1.765	104.000	3.290	50	89.62%
1.720	200.000	3.100	100	90.12%
2.417	17.300	3.410	10	81.55%
2.418	47.000	3.400	30	89.75%
2.404	78.000	3.350	50	89.33%
2.374	153.000	3.260	100	89.75%
2.321	288.000	3.040	200	90.96%



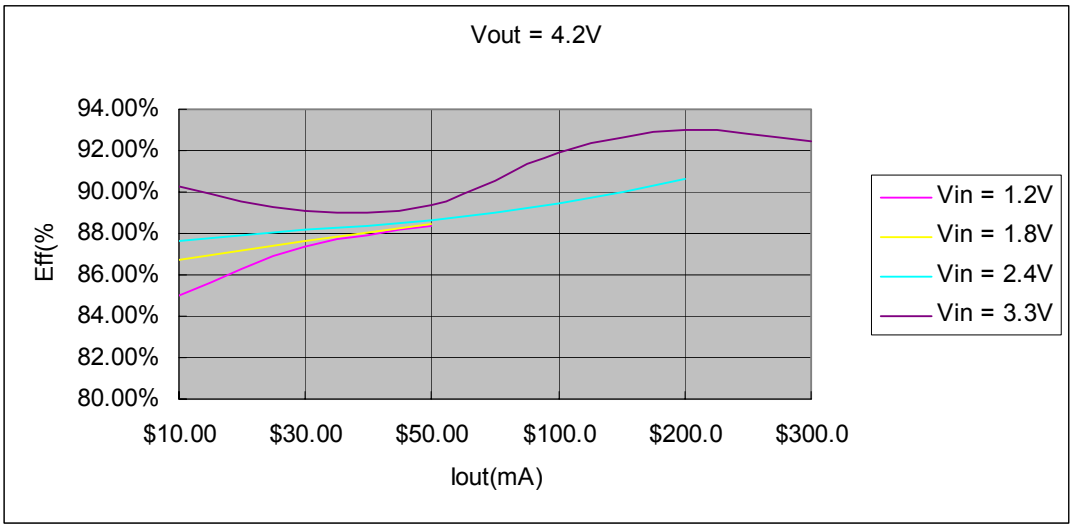
5.3 Vout = 2.4V
R1=R2=100K

Vin	Iin	Vout	Iout(mA)	Eff
0.903	32.170	2.472	10	85.10%
0.924	91.500	2.446	30	86.79%
0.912	152.800	2.394	50	85.90%
0.910	252.500	2.292	80	79.80%
1.131	25.580	2.475	10	85.55%
1.101	77.300	2.453	30	86.47%
1.118	123.200	2.412	50	87.56%
1.113	248.900	2.275	100	82.12%
1.834	15.710	2.488	10	86.35%
1.809	47.200	2.474	30	86.92%
1.804	79.600	2.457	50	85.55%
1.804	151.600	2.419	100	88.45%
1.791	223.700	2.361	150	88.39%
1.818	288.300	2.280	200	87.00%



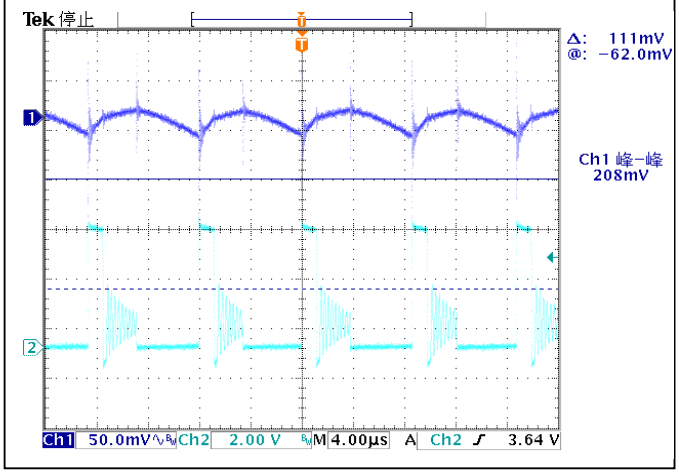
5.4 Vout = 4.2V
R1=120K R2=300K

Vin	Iin	Vout	Iout(mA)	Eff
0.907	53.700	4.140	10	85.00%
1.100	44.800	4.190	10	85.02%
1.211	112.600	3.970	30	87.34%
1.204	175.800	3.740	50	88.35%
1.826	26.950	4.270	10	86.77%
1.801	78.500	4.130	30	87.64%
1.817	124.500	4.000	50	88.41%
2.405	20.440	4.310	10	87.68%
2.400	60.100	4.240	30	88.19%
2.398	97.900	4.160	50	88.60%
2.414	183.400	3.960	100	89.45%
2.405	259.400	3.770	150	90.65%
3.370	14.240	4.330	10	90.23%
3.320	43.900	4.330	30	89.13%
3.280	73.500	4.310	50	89.39%
3.260	139.200	4.170	100	91.89%
3.300	261.400	4.010	200	92.97%
3.340	384.800	3.960	300	92.43%

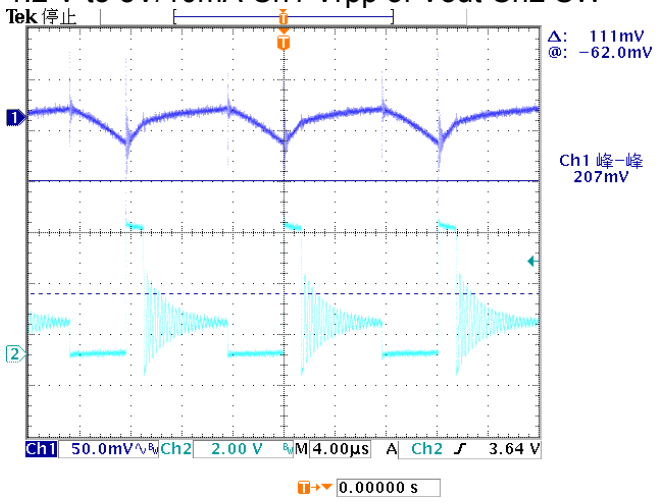


測試波形

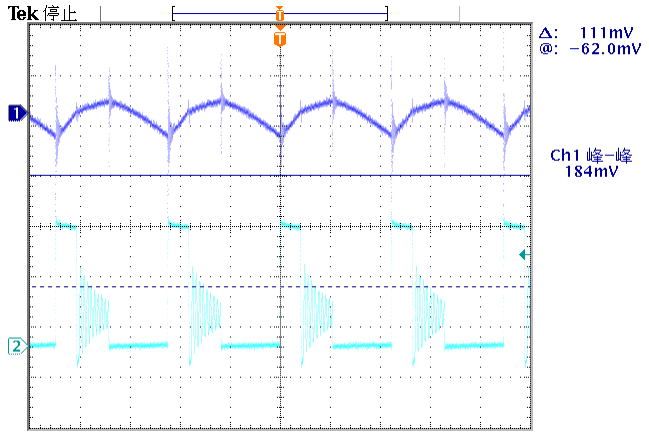
0.9V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



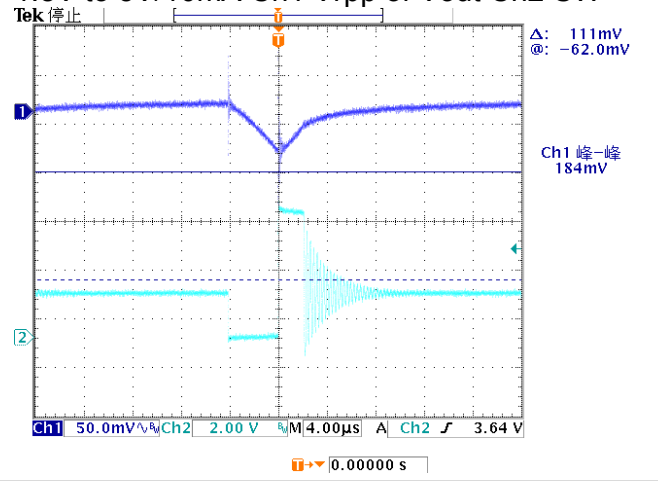
1.2 V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



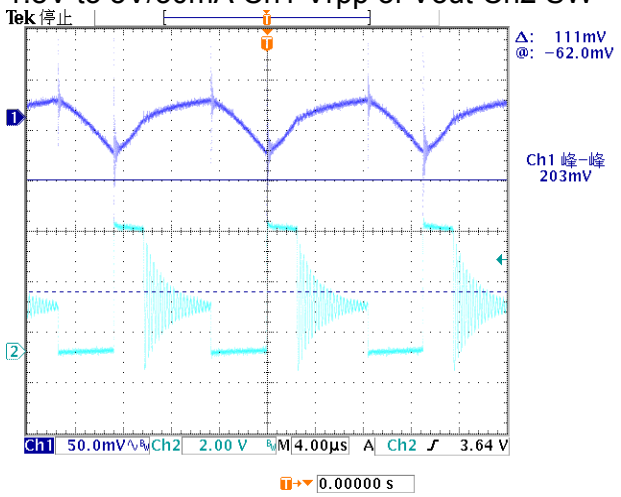
1.2V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



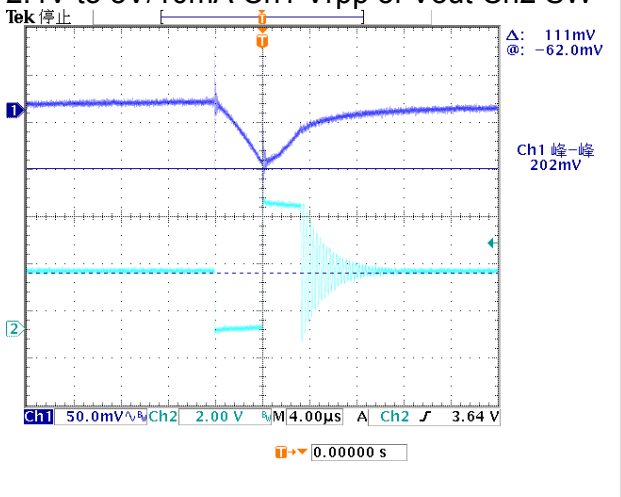
1.8V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



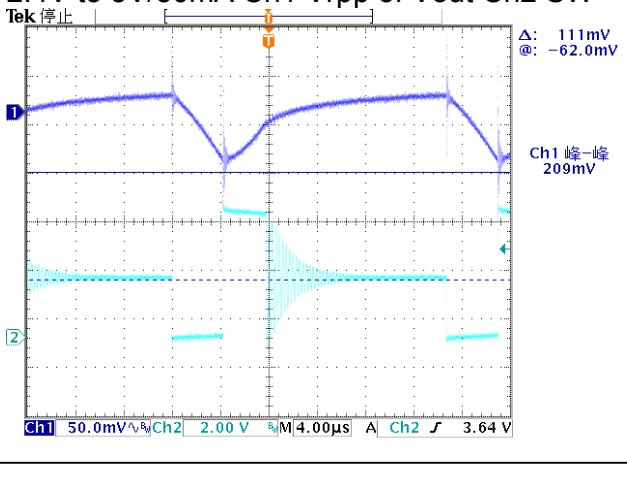
1.8V to 5V/30mA Ch1 Vrpp of Vout Ch2 SW



2.4V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



2.4V to 5V/30mA Ch1 Vrpp of Vout Ch2 SW



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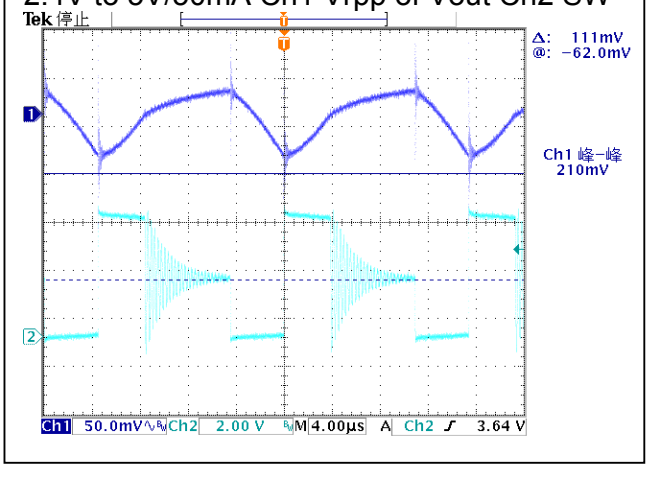

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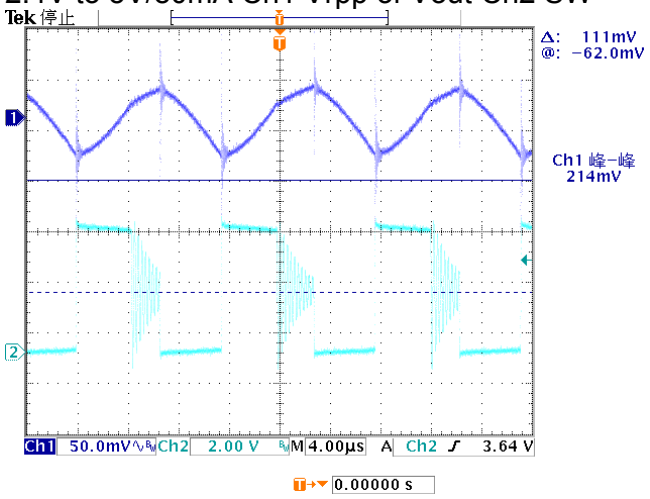

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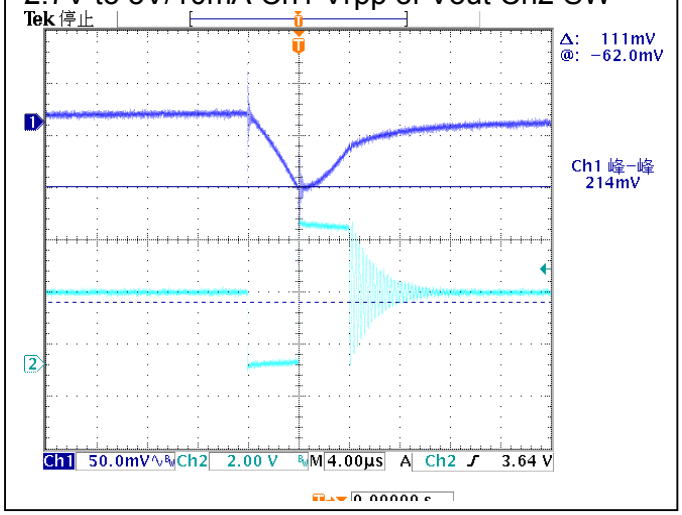

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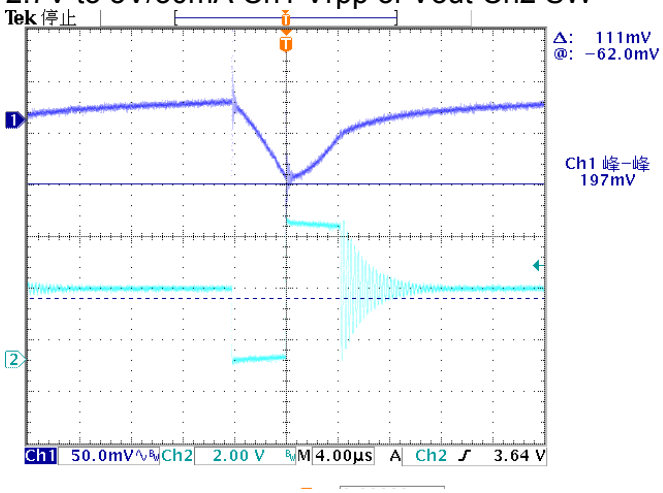

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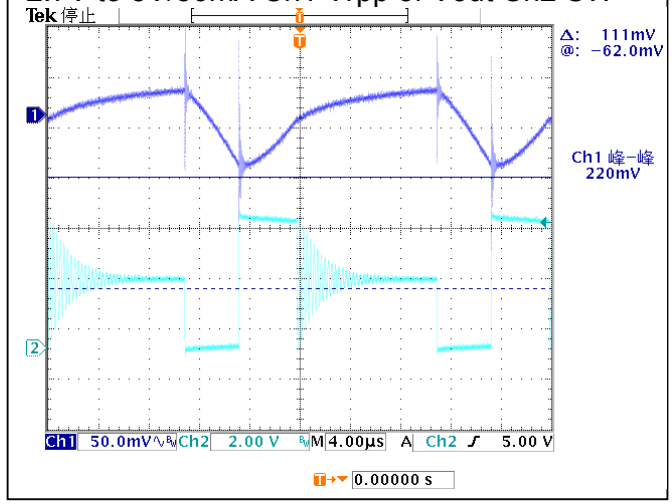

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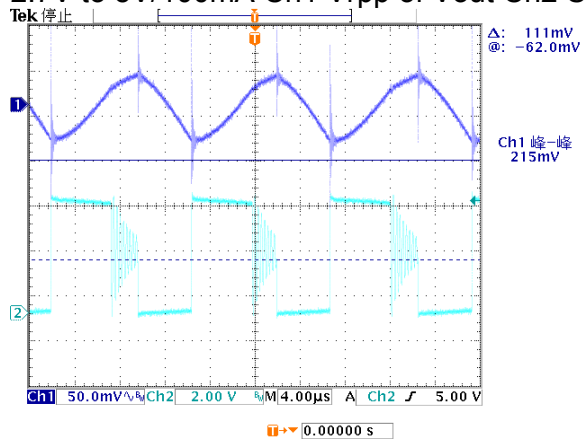
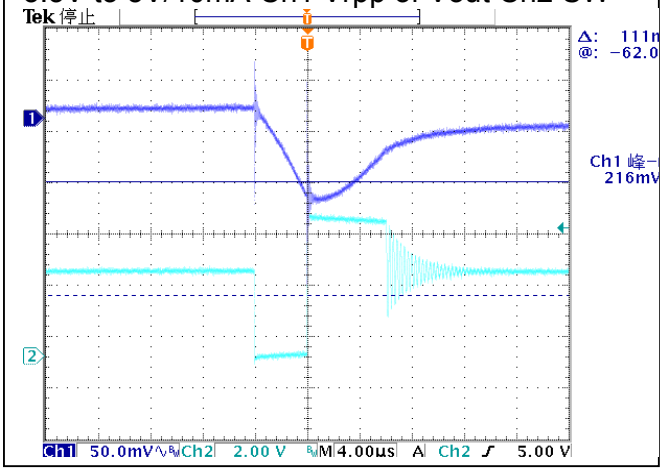
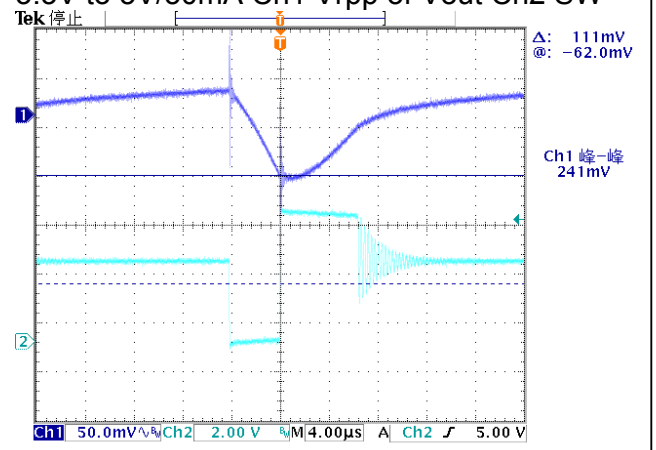


3.3V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



3.3V to 5V/50mA Ch1 Vrpp of Vout Ch2 SW



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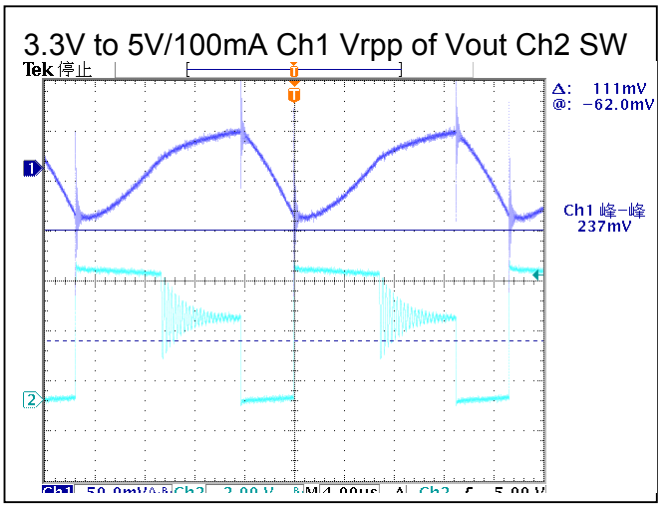

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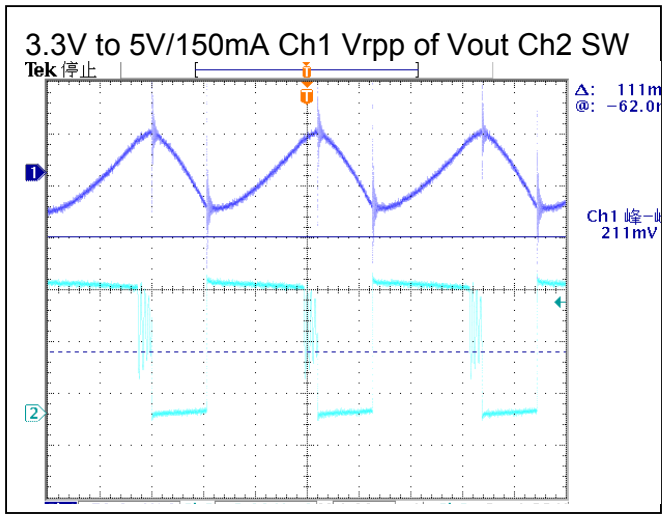
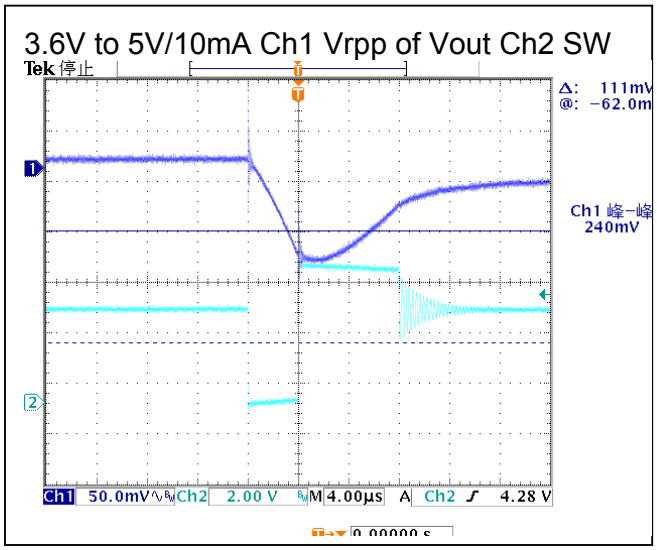
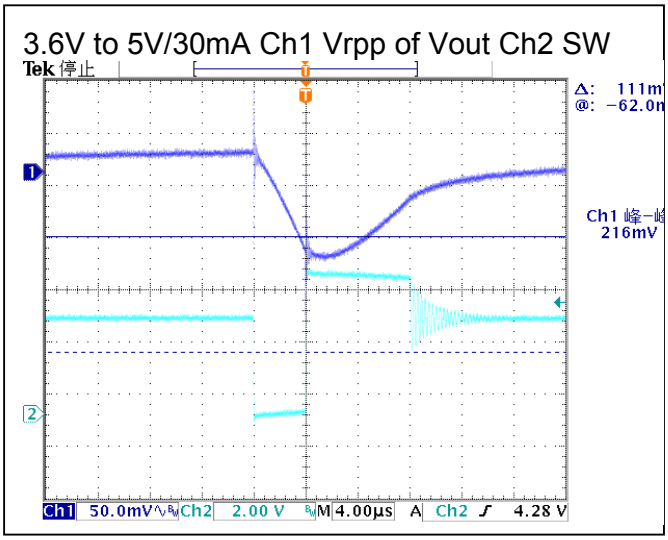


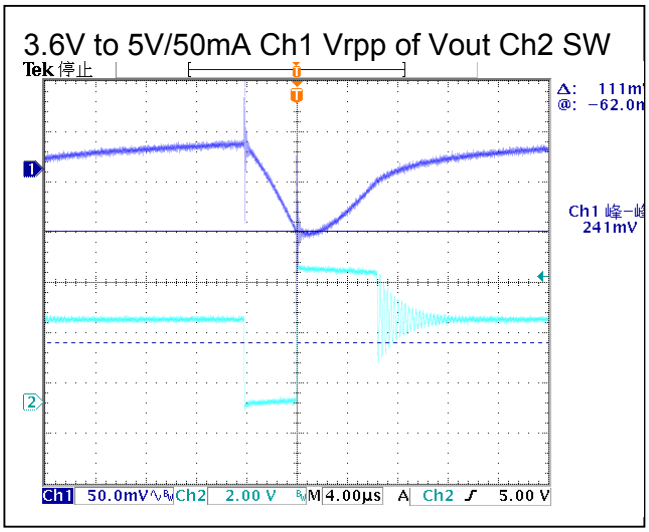
3.6V to 5V/10mA Ch1 Vrpp of Vout Ch2 SW



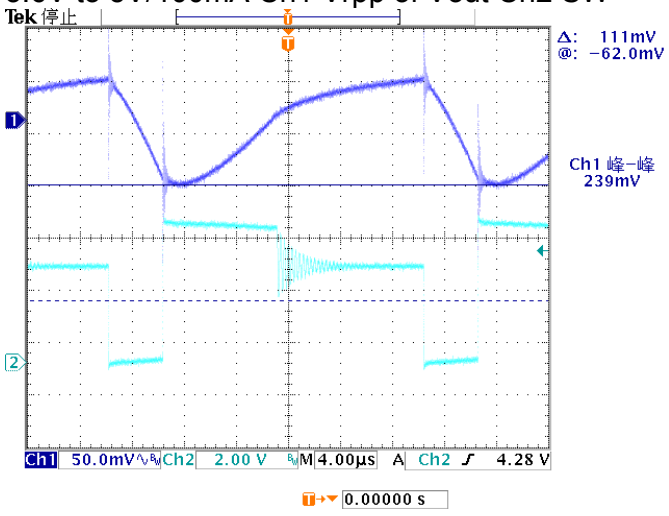
3.6V to 5V/30mA Ch1 Vrpp of Vout Ch2 SW



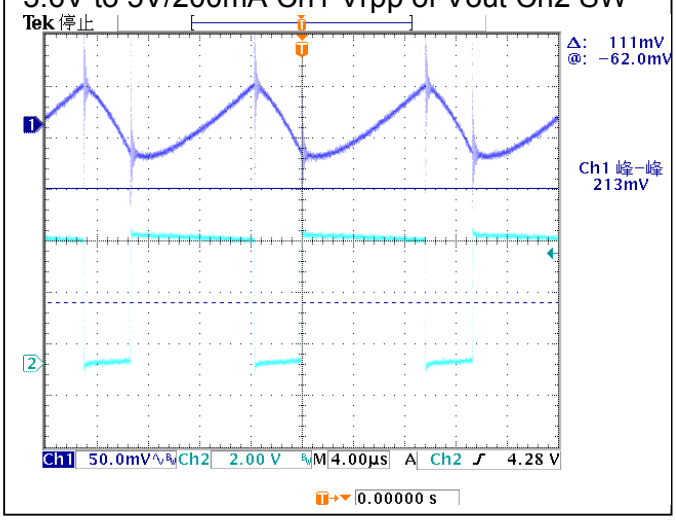
3.6V to 5V/50mA Ch1 Vrpp of Vout Ch2 SW



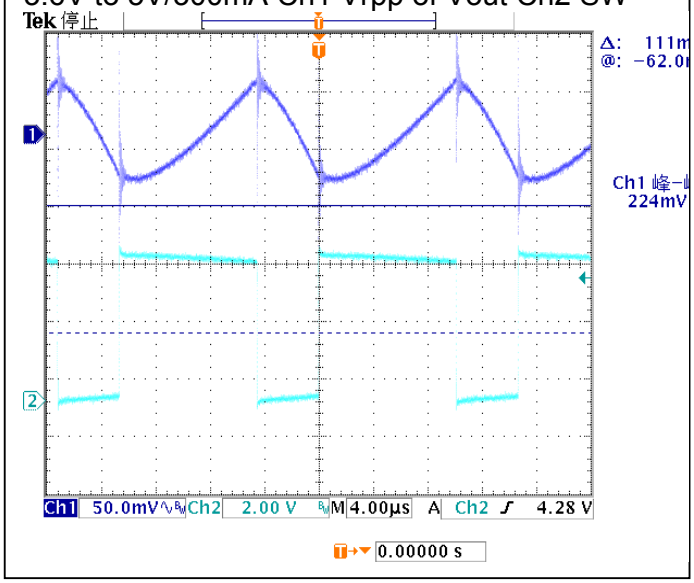
3.6V to 5V/100mA Ch1 Vrpp of Vout Ch2 SW



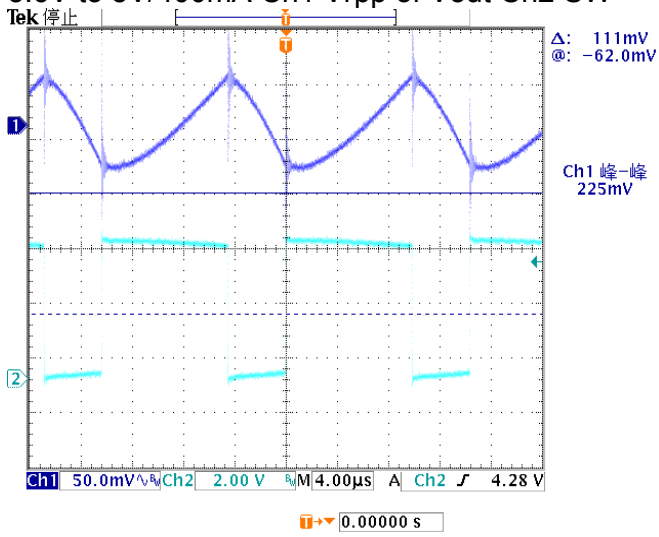
3.6V to 5V/200mA Ch1 Vrpp of Vout Ch2 SW



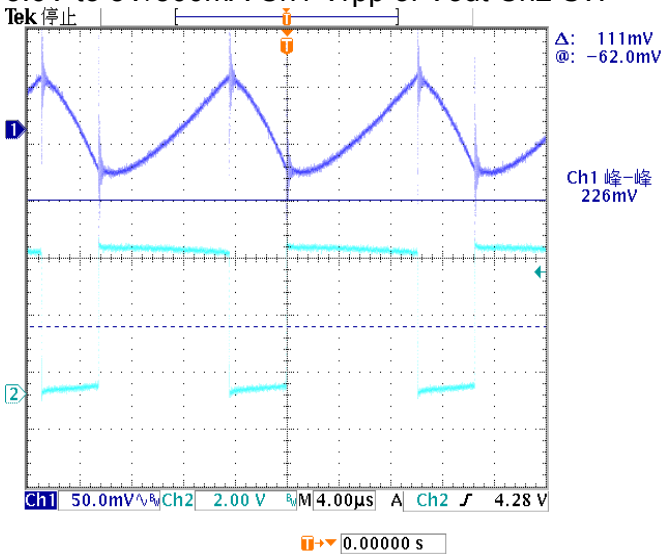
3.6V to 5V/300mA Ch1 Vrpp of Vout Ch2 SW



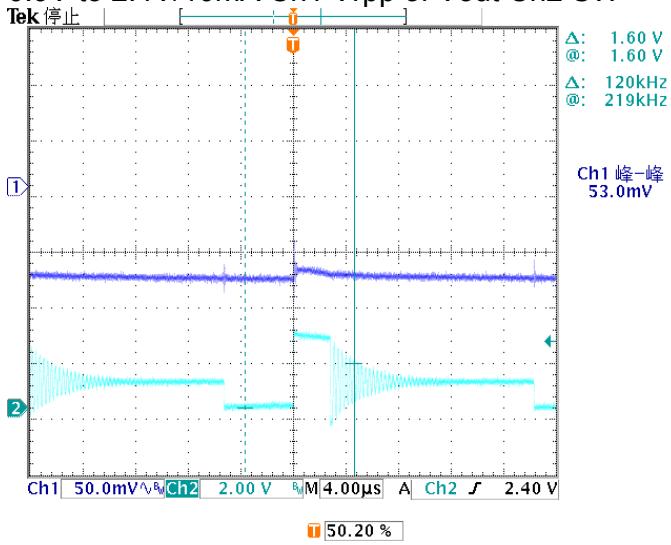
3.6V to 5V/400mA Ch1 Vrpp of Vout Ch2 SW



3.6V to 5V/500mA Ch1 Vrpp of Vout Ch2 SW



0.9V to 2.4V/10mA Ch1 Vrpp of Vout Ch2 SW



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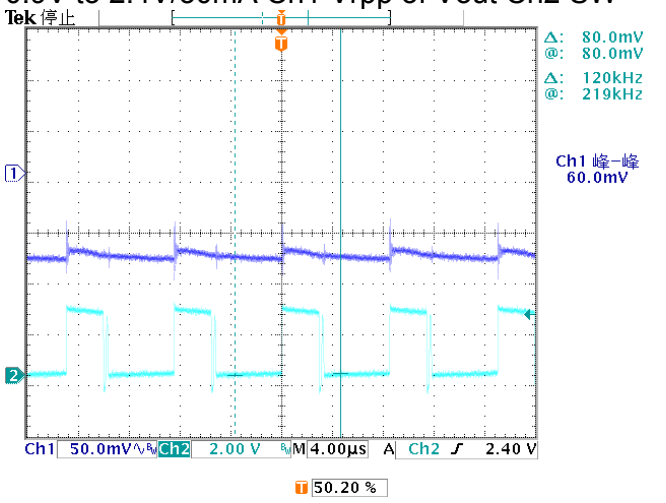

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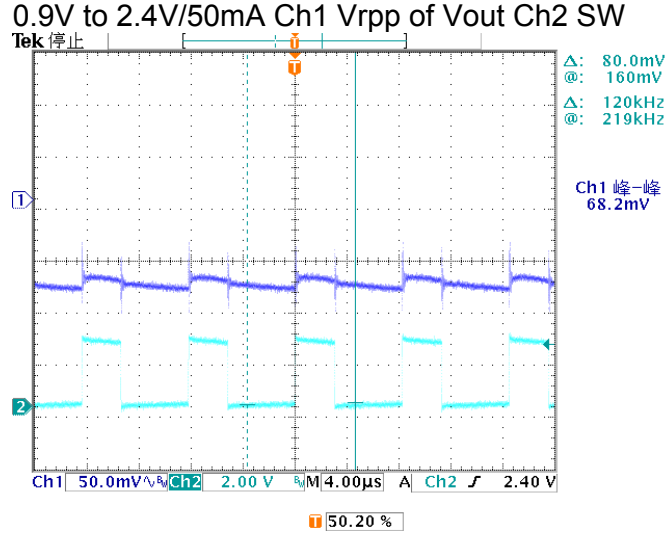

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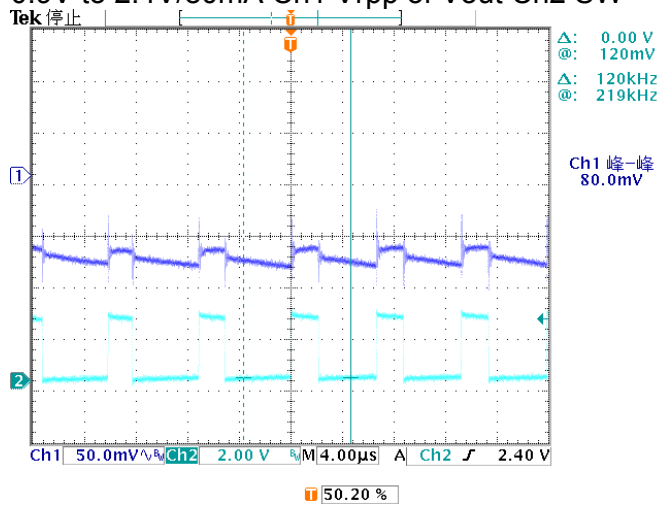

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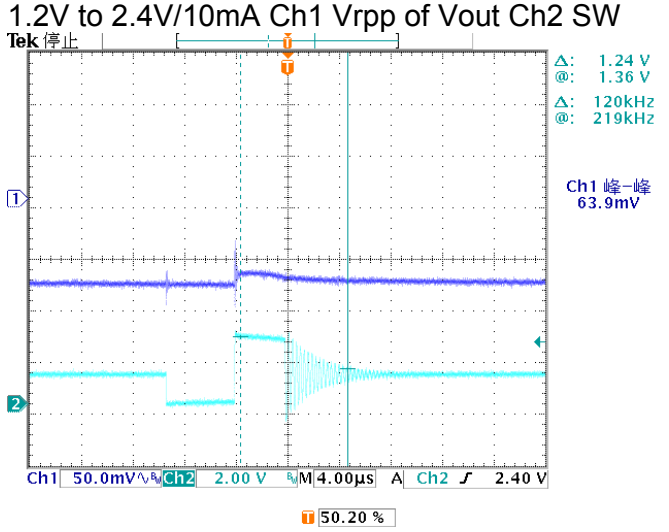

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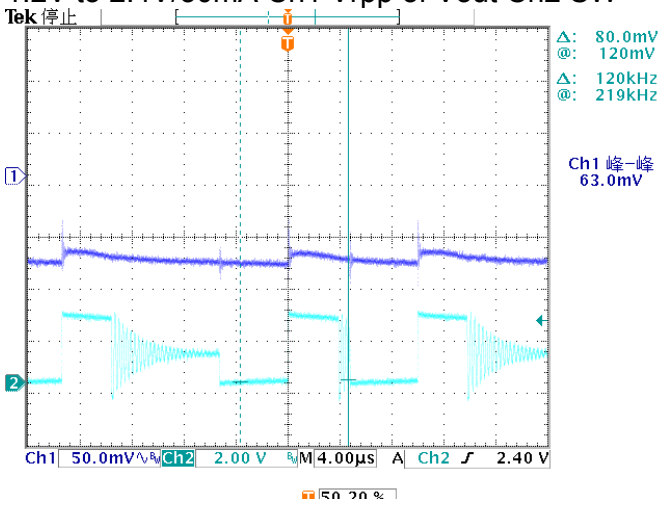

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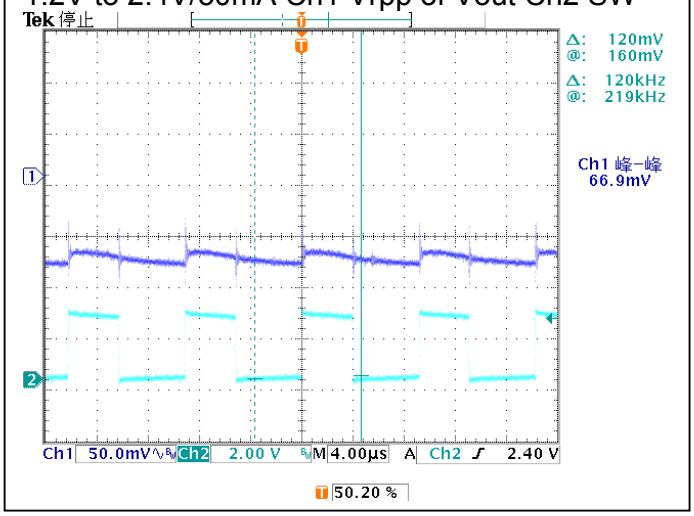

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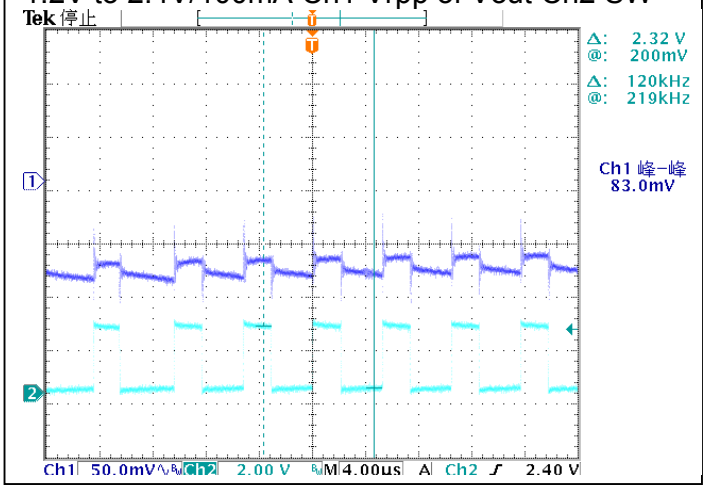

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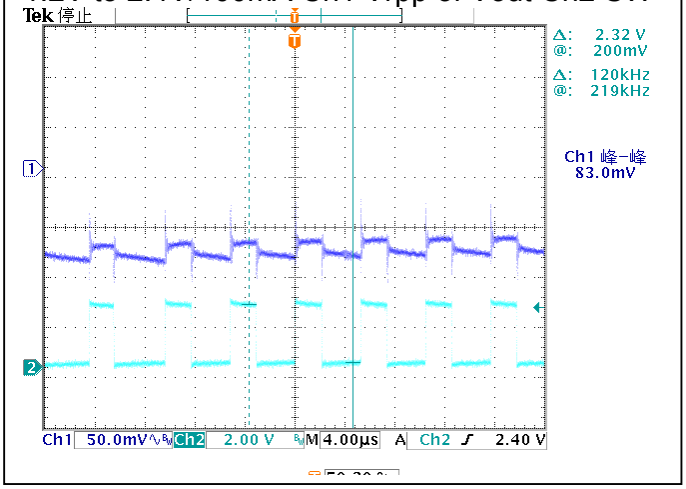

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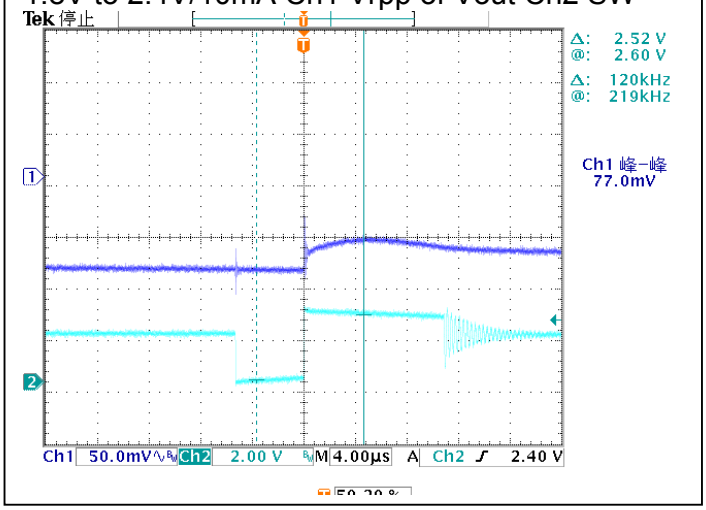

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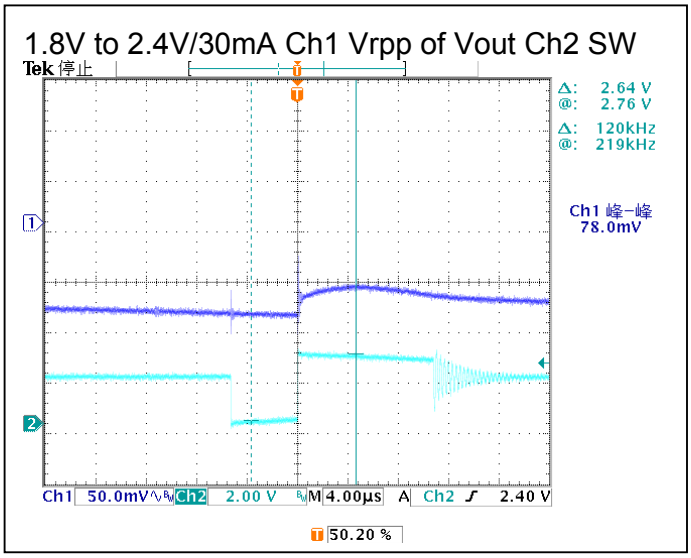

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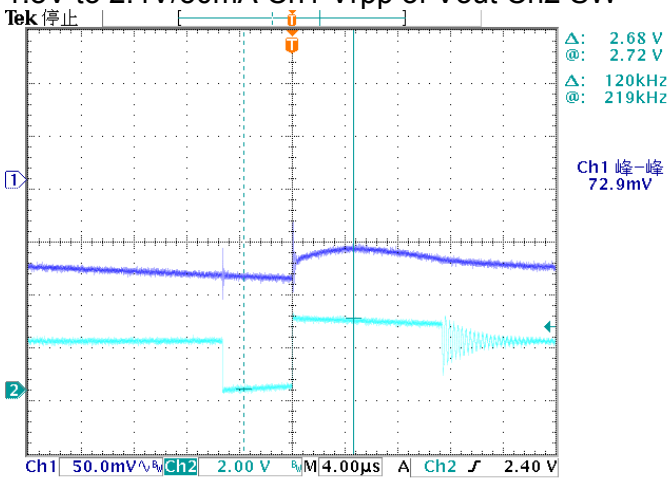

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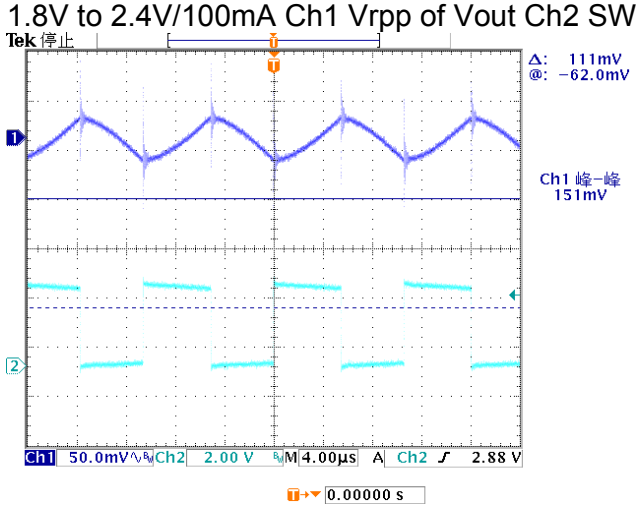

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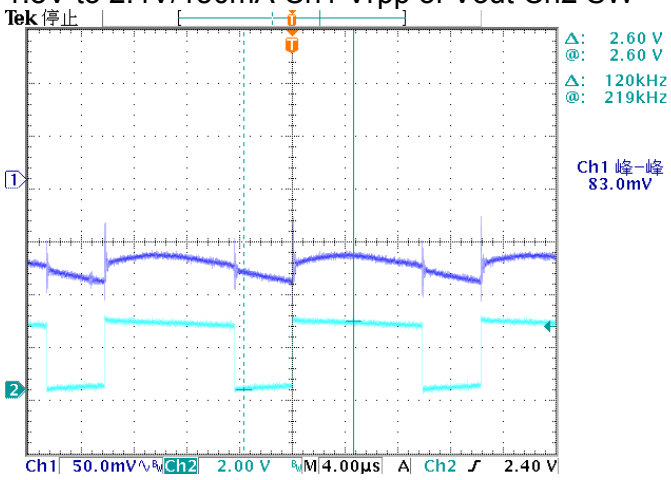

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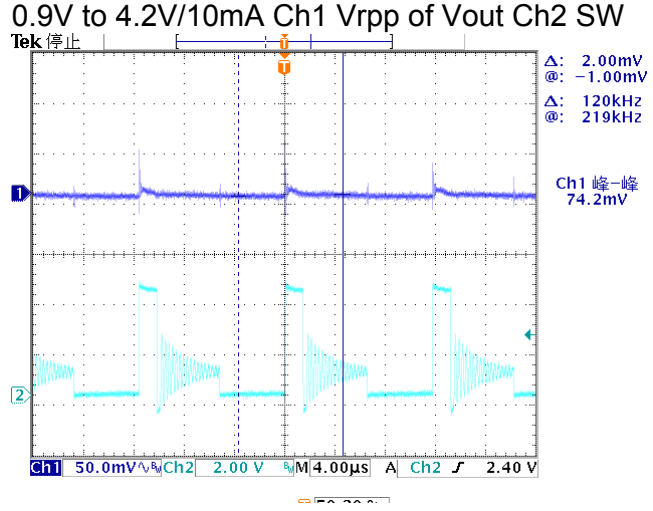

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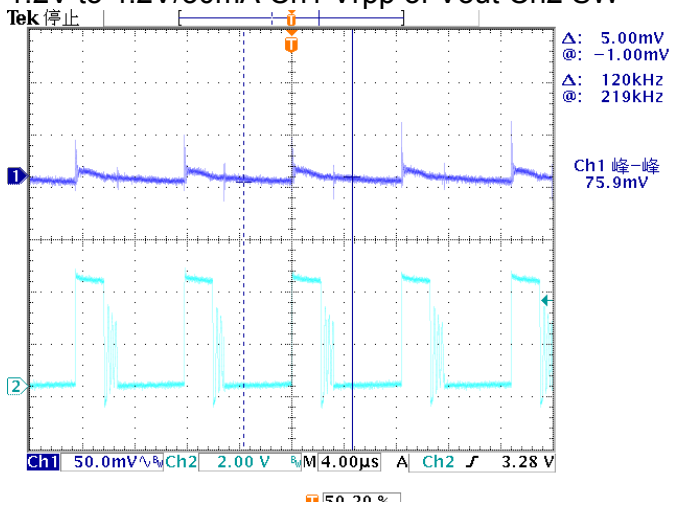

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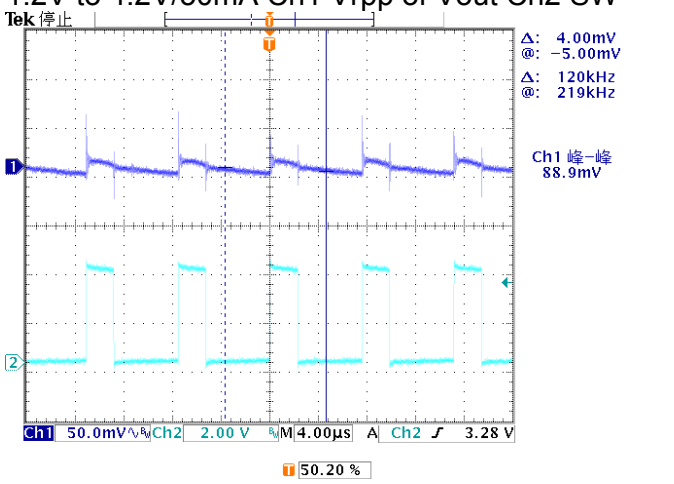

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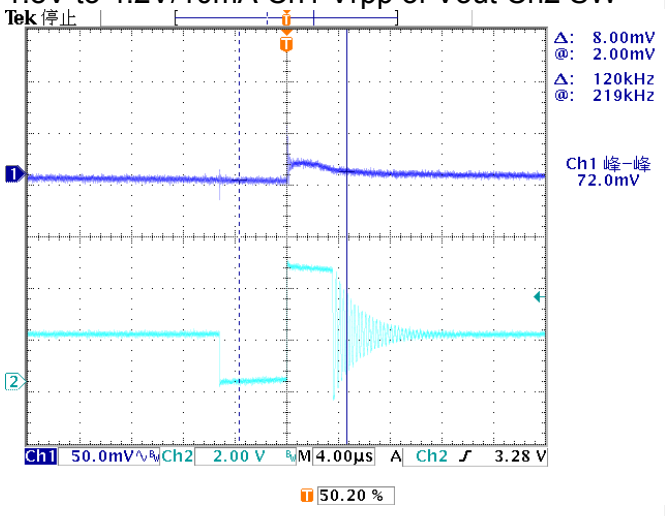

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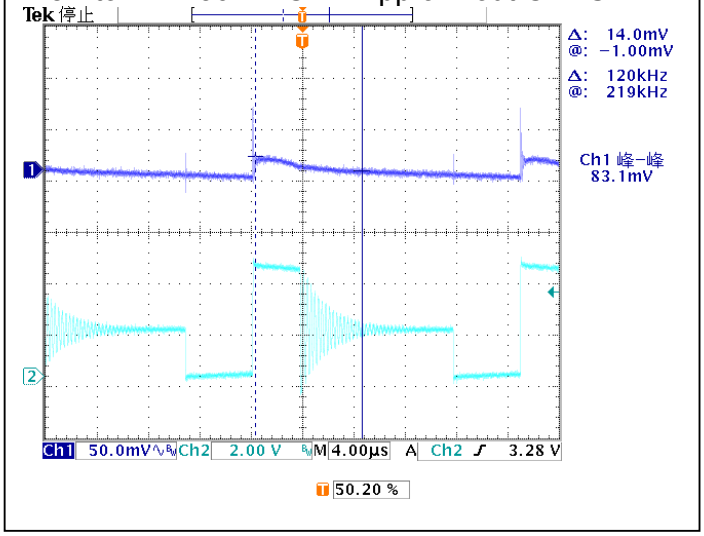

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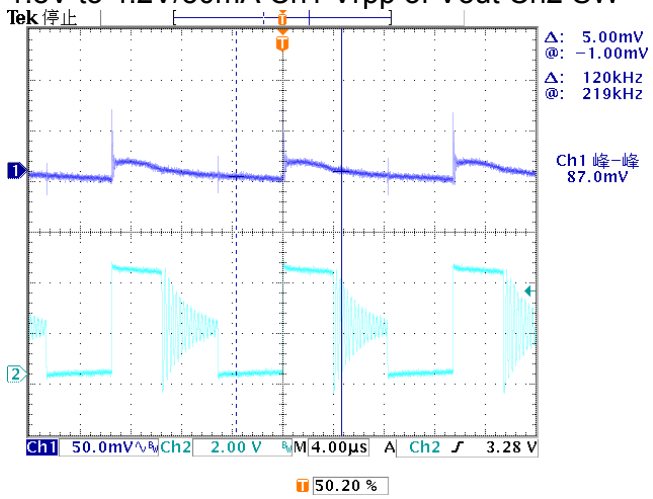

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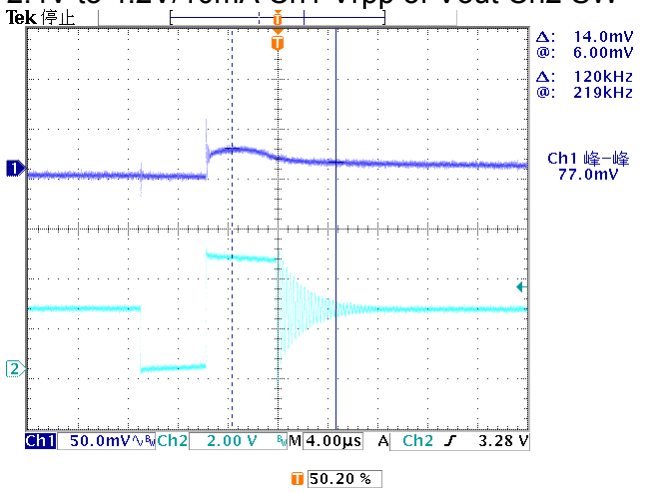

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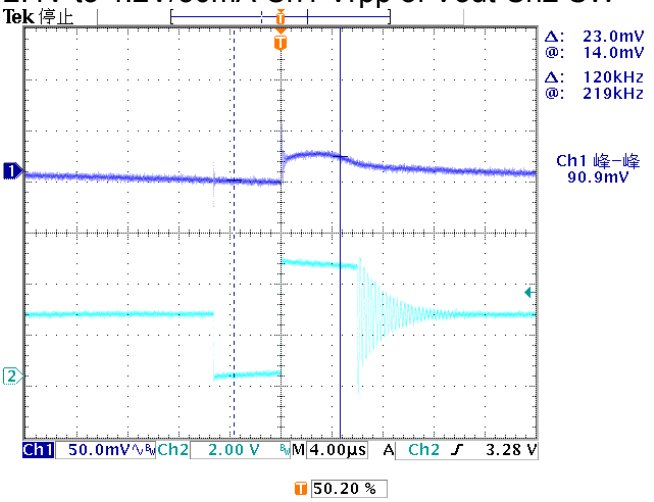

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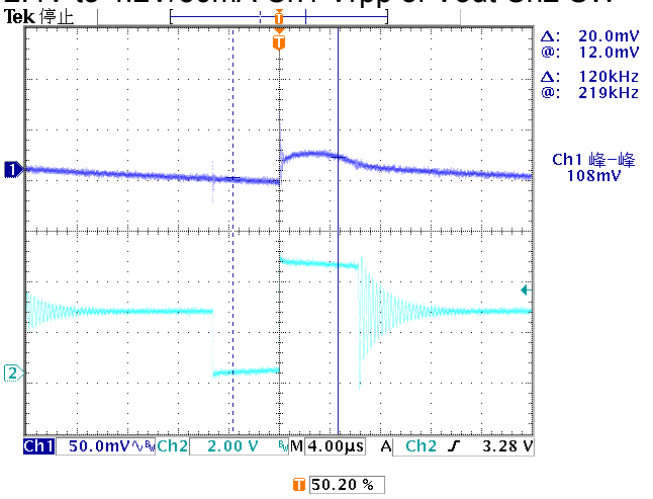

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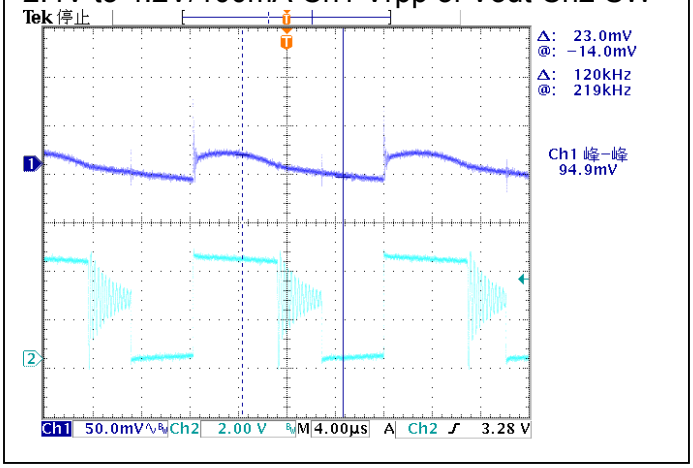

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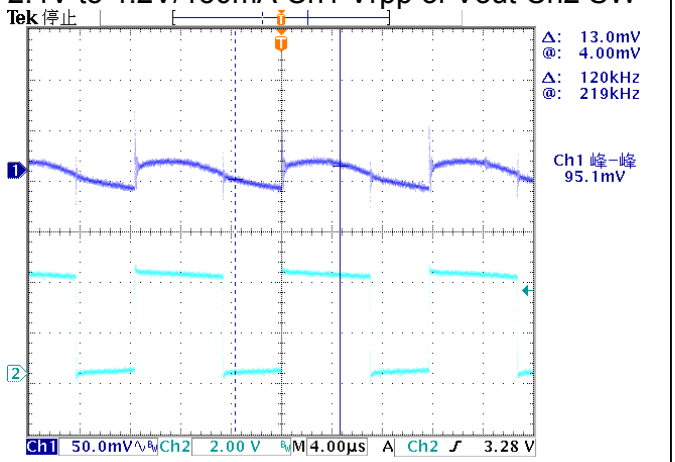

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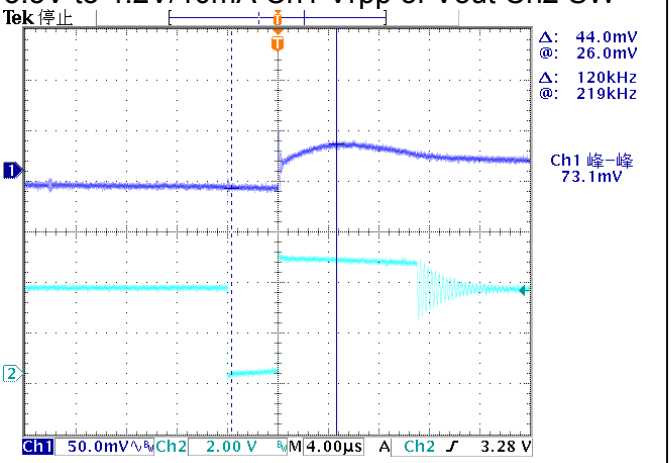

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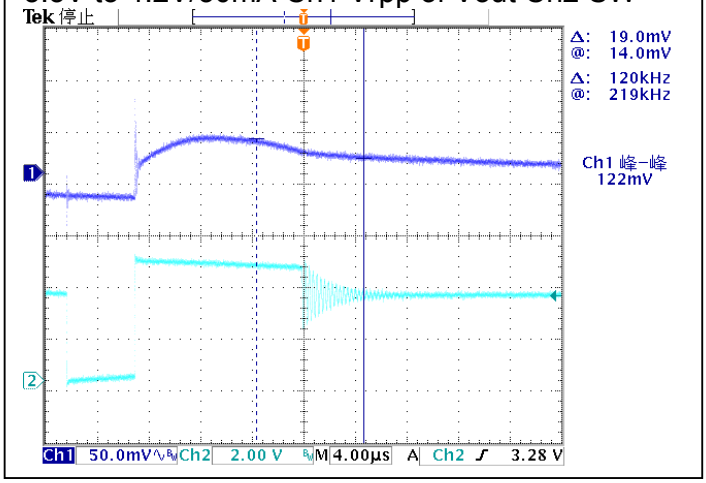

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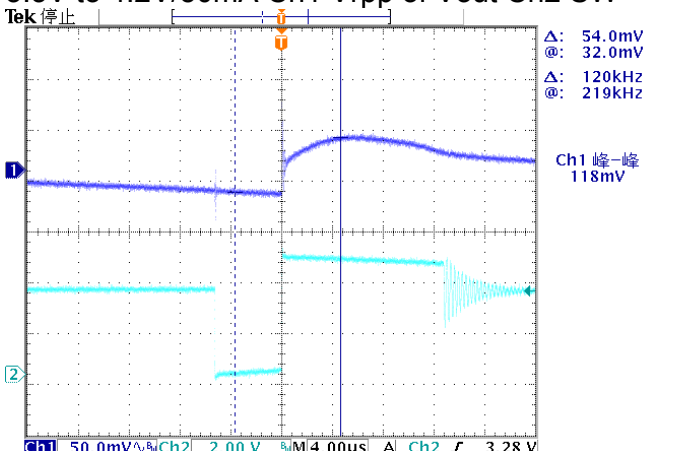

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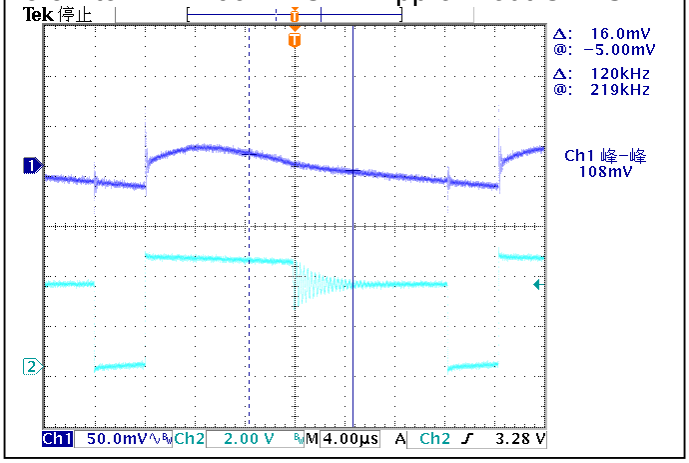

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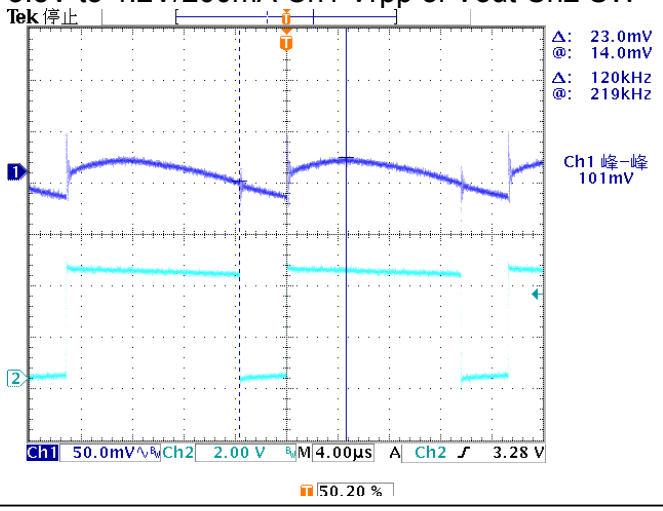

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