Texas Instruments

PMP4333A Test Report

China Power Reference Design

REVA

05/07/2013

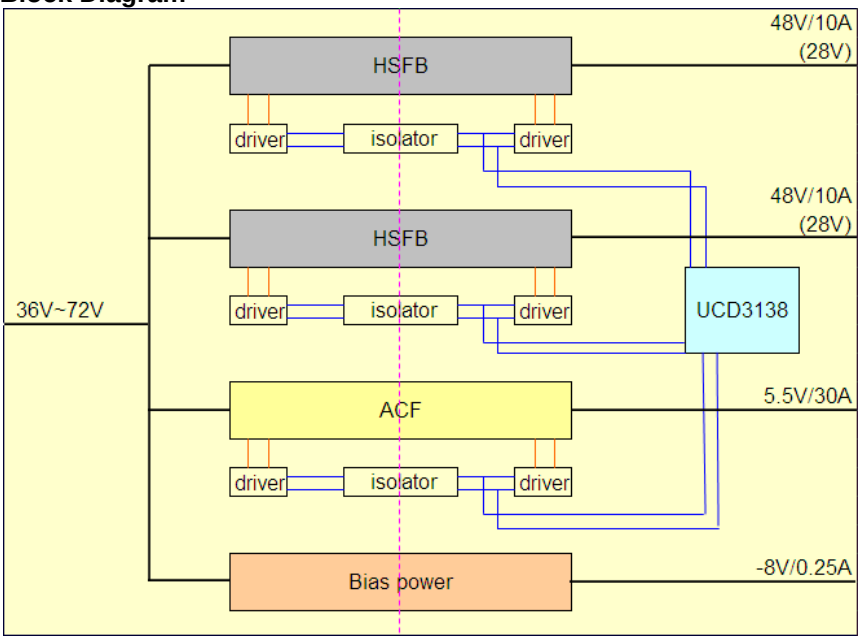
1 General

1.1 PURPOSE

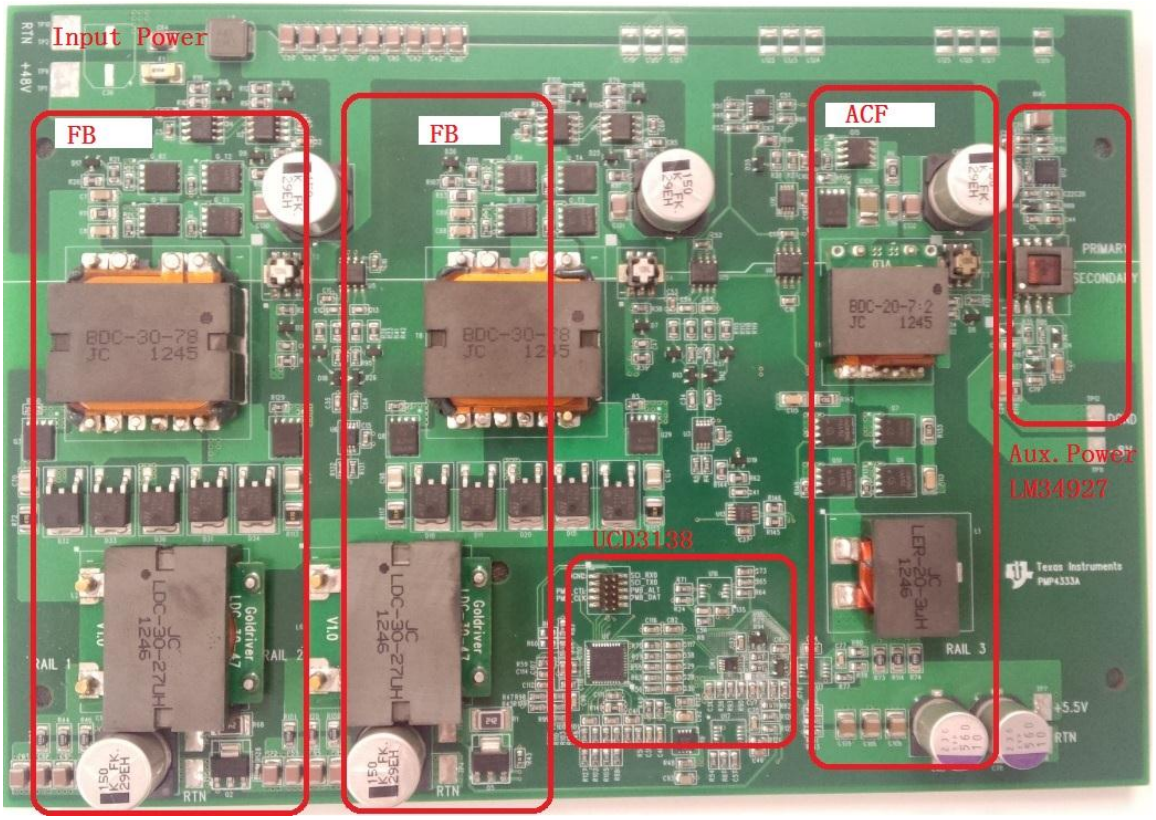
Provide the detailed data for evaluating and verifying the PMP4333.

The PMP4333 is a three outputs DC-DC converter with full digital controlling configuration (UCD3138). It delivers up to 3 outputs, 5.5V/30A, 48V/10A and 48V/10A. The converter could provide high efficiency more than 92% and good performance, which makes it an ideal choice for bus converter. For testing applications, cooling airflow is required.

Block Diagram



Board Photo



1.2 REFERENCE DOCUMENTATION

Schematic: PMP4333A Rev A_SCH.PDF
Assembly: PMP4333A Rev A_PCB.PDF
BOM

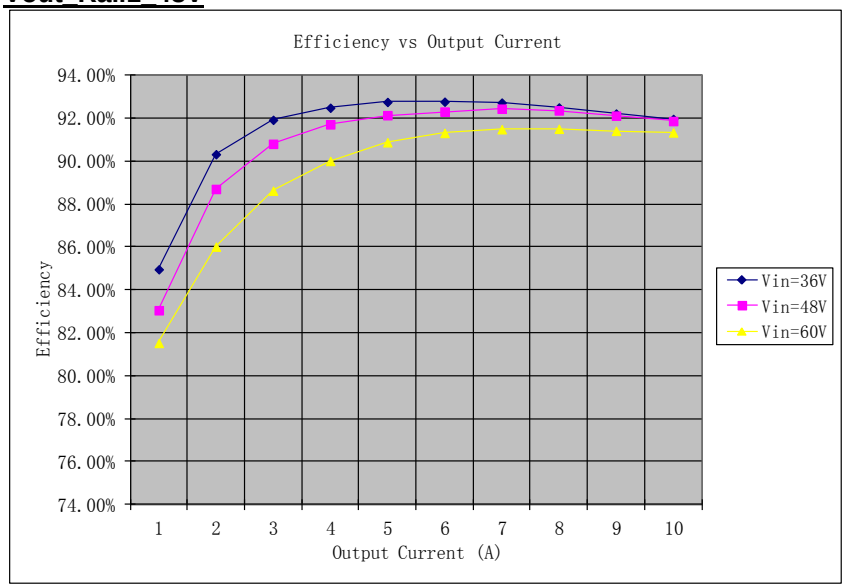
1.3 TEST EQUIPMENTS

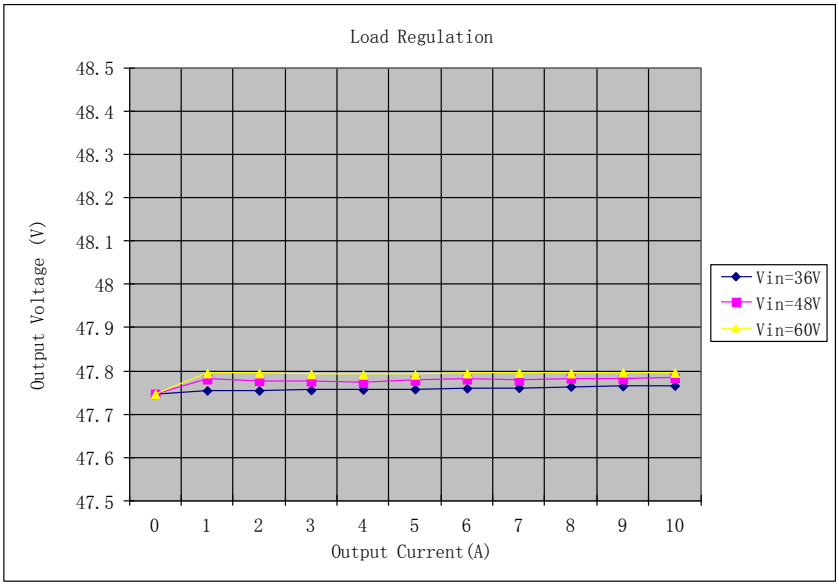
Multi-meter: Fluke 187
DC Source: TDK-Lambda GEN100-33
Power Meter: WT210
Ambient Temperature at 25DegC, with Fan cooling

2 INPUT & OUTPUT CHARACTERISTICS

2.1 Efficiency

Vout_Rail1_48V

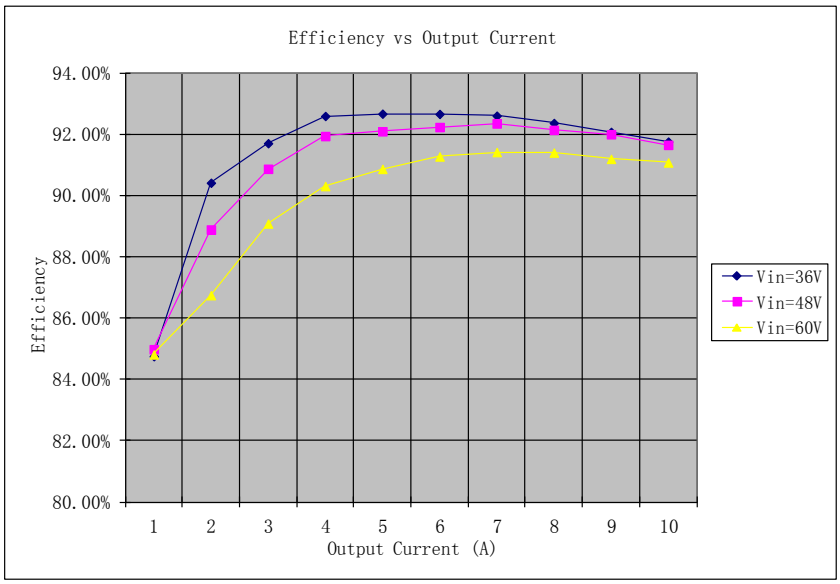


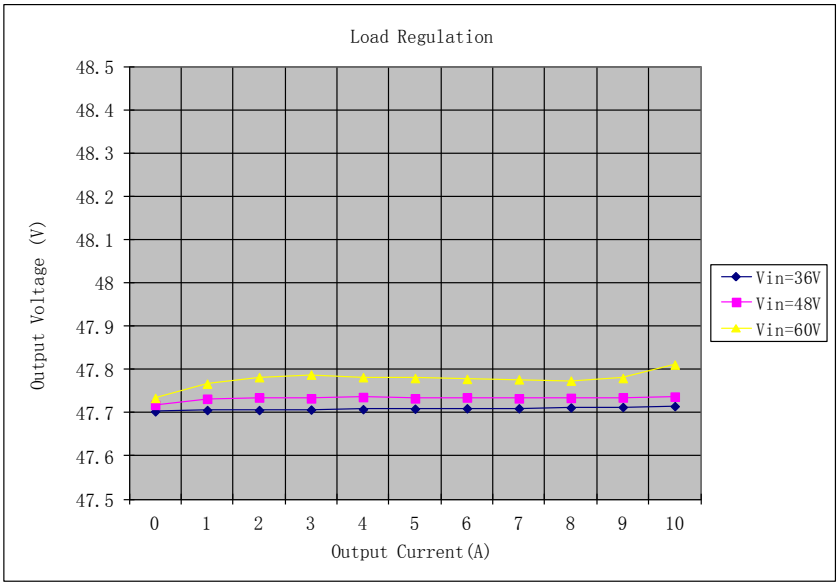


Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)

36V Input				
36.316	0.16	47.747	0	0.00%
36.266	1.55	47.755	1	84.95%
36.215	2.92	47.755	2	90.32%
36.163	4.31	47.756	3	91.92%
36.111	5.72	47.757	4	92.48%
36.057	7.14	47.758	5	92.75%
36.003	8.58	47.76	6	92.77%
35.948	10.03	47.761	7	92.72%
35.891	11.51	47.764	8	92.50%
35.833	13.01	47.765	9	92.21%
35.772	14.52	47.766	10	91.96%
48V Input				
48.386	0.14	47.747	0	0.00%
48.348	1.19	47.781	1	83.05%
48.309	2.23	47.777	2	88.70%
48.271	3.27	47.776	3	90.80%
48.232	4.32	47.773	4	91.71%
48.193	5.38	47.778	5	92.14%
48.153	6.45	47.781	6	92.30%
48.112	7.52	47.778	7	92.44%
48.07	8.61	47.783	8	92.36%
48.029	9.72	47.781	9	92.11%
47.985	10.84	47.784	10	91.86%
60V Input				
60.47	0.16	47.747	0	0.00%
60.44	0.97	47.795	1	81.52%
60.4	1.84	47.795	2	86.01%
60.37	2.68	47.793	3	88.62%
60.34	3.52	47.792	4	90.01%
60.31	4.36	47.792	5	90.88%
60.28	5.21	47.795	6	91.31%
60.25	6.07	47.796	7	91.48%
60.21	6.94	47.795	8	91.50%
60.18	7.82	47.797	9	91.41%
60.15	8.70	47.796	10	91.33%

Vout_Rail2_48V

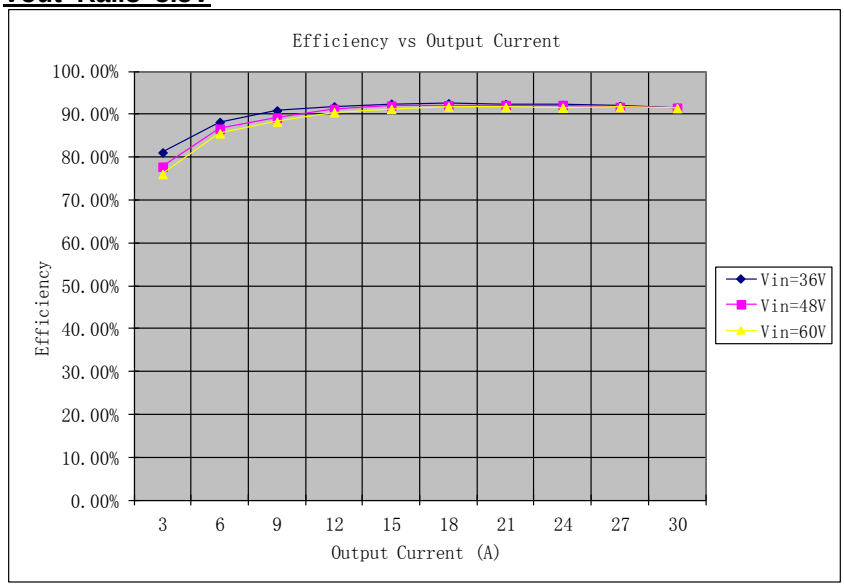


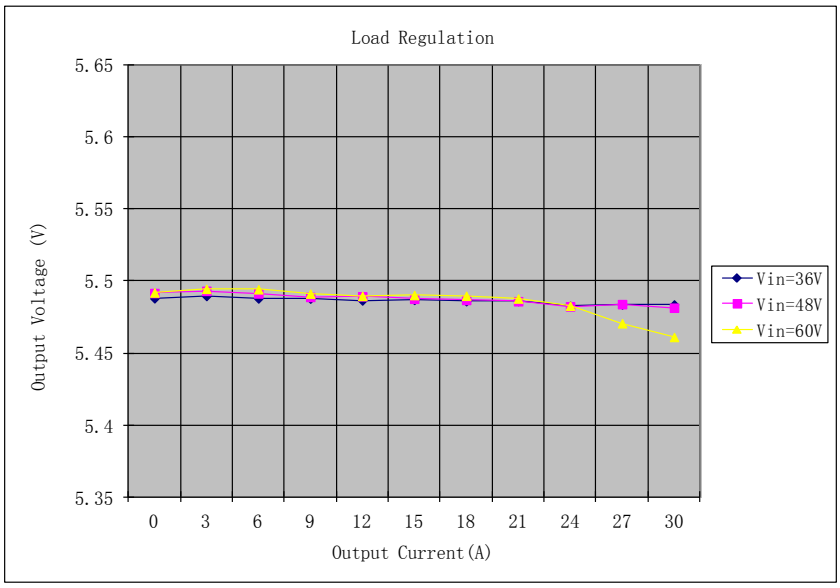


Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.366	0.15	47.703	0	0.00%
36.314	1.55	47.706	1	84.76%
36.264	2.91	47.706	2	90.41%
36.211	4.31	47.707	3	91.70%
36.158	5.70	47.708	4	92.59%
36.104	7.13	47.709	5	92.67%
36.049	8.57	47.71	6	92.66%
35.993	10.02	47.71	7	92.60%
35.935	11.50	47.712	8	92.36%
35.876	13.00	47.713	9	92.07%
35.814	14.52	47.715	10	91.76%

48V Input				
48.457	0.13	47.718	0	0.00%
48.419	1.16	47.732	1	84.98%
48.38	2.22	47.735	2	88.89%
48.34	3.26	47.733	3	90.87%
48.3	4.30	47.736	4	91.94%
48.26	5.37	47.733	5	92.09%
48.22	6.44	47.735	6	92.23%
48.178	7.51	47.733	7	92.35%
48.137	8.61	47.734	8	92.14%
48.094	9.71	47.735	9	92.00%
48.05	10.84	47.737	10	91.65%
60V Input				
60.59	0.10	47.734	0	0.00%
60.56	0.93	47.767	1	84.81%
60.53	1.82	47.782	2	86.75%
60.5	2.66	47.788	3	89.08%
60.47	3.50	47.782	4	90.31%
60.44	4.35	47.78	5	90.87%
60.4	5.20	47.778	6	91.27%
60.37	6.06	47.777	7	91.42%
60.34	6.93	47.774	8	91.40%
60.3	7.82	47.78	9	91.19%
60.27	8.71	47.811	10	91.08%

Vout_Rail3_5.5V





Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.366	0.15	47.703	0	0.00%
36.314	1.55	47.706	1	84.76%
36.264	2.91	47.706	2	90.41%
36.211	4.31	47.707	3	91.70%
36.158	5.70	47.708	4	92.59%
36.104	7.13	47.709	5	92.67%
36.049	8.57	47.71	6	92.66%
35.993	10.02	47.71	7	92.60%
35.935	11.50	47.712	8	92.36%
35.876	13.00	47.713	9	92.07%
35.814	14.52	47.715	10	91.76%
48V Input				
48.457	0.13	47.718	0	0.00%
48.419	1.16	47.732	1	84.98%
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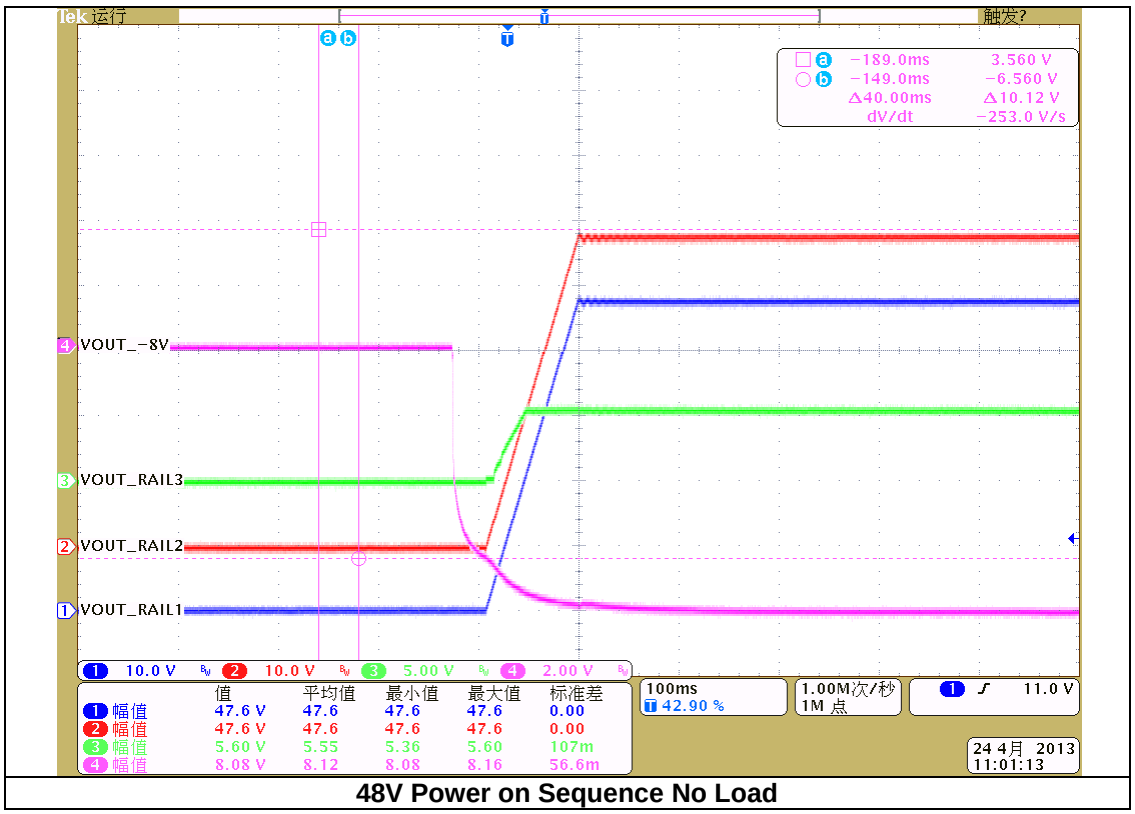
48.34	3.26	47.733	3	90.87%
48.3	4.30	47.736	4	91.94%
48.26	5.37	47.733	5	92.09%
48.22	6.44	47.735	6	92.23%
48.178	7.51	47.733	7	92.35%
48.137	8.61	47.734	8	92.14%
48.094	9.71	47.735	9	92.00%
48.05	10.84	47.737	10	91.65%

60V Input				
60.59	0.10	47.734	0	0.00%
60.56	0.93	47.767	1	84.81%
60.53	1.82	47.782	2	86.75%
60.5	2.66	47.788	3	89.08%
60.47	3.50	47.782	4	90.31%
60.44	4.35	47.78	5	90.87%
60.4	5.20	47.778	6	91.27%
60.37	6.06	47.777	7	91.42%
60.34	6.93	47.774	8	91.40%
60.3	7.82	47.78	9	91.19%
60.27	8.71	47.811	10	91.08%

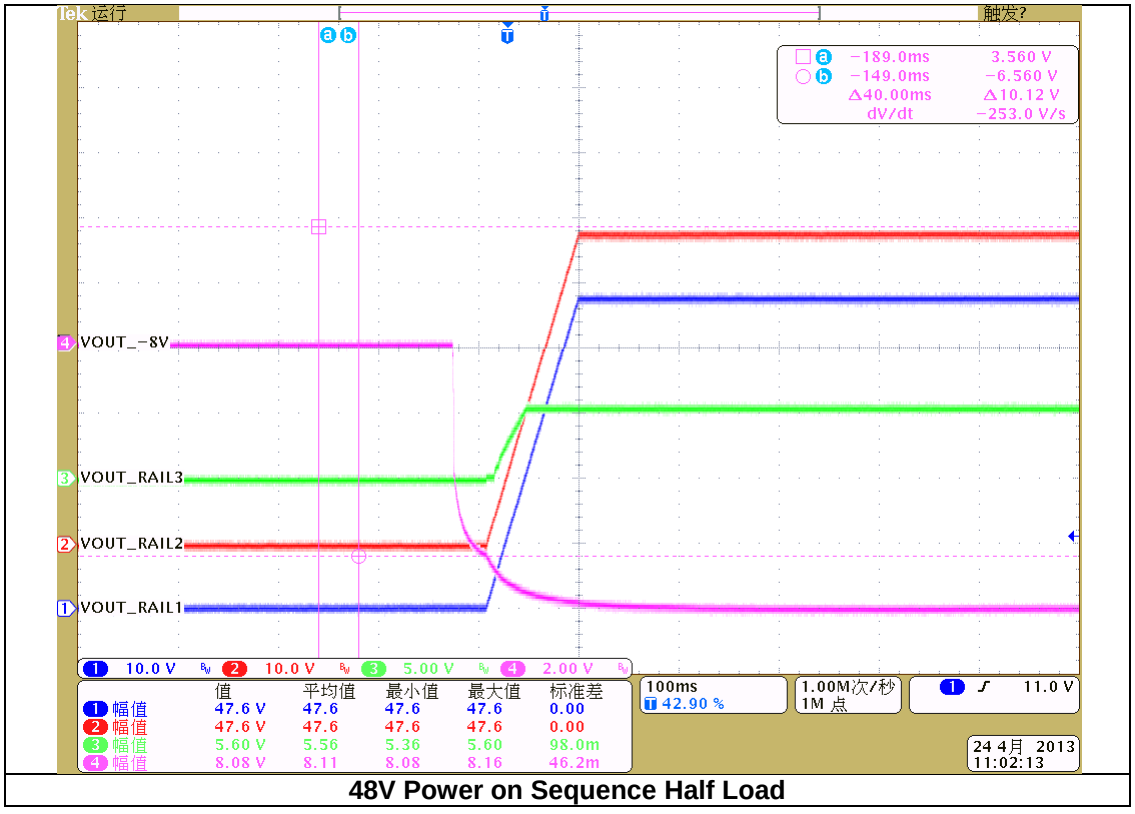
Vout_All_Efficiency

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.254	0.33	5.4732	0	0.00%
		47.709	0	
		47.745	0	
35.663	16.85	5.4946	15	93.16%
		47.725	5	
		47.76	5	
37.103	32.91	5.4825	30	91.70%
		47.75	10	
		47.776	10	
48V Input				
48.294	0.31	5.4551	0	0.00%
		47.738	0	
		47.748	0	
48.59	12.47	5.472	15	92.39%
		47.765	5	
		47.785	5	
48.11	25.38	5.468	30	91.71%
		47.782	10	
		47.795	10	
60V Input				
60.57	0.32	5.4815	0	0.00%
		47.739	0	
		47.744	0	
60.22	10.19	5.4741	15	91.29%
		47.819	5	
		47.795	5	
59.82	20.54	5.4514	30	91.14%
		47.833	10	
		47.801	10	

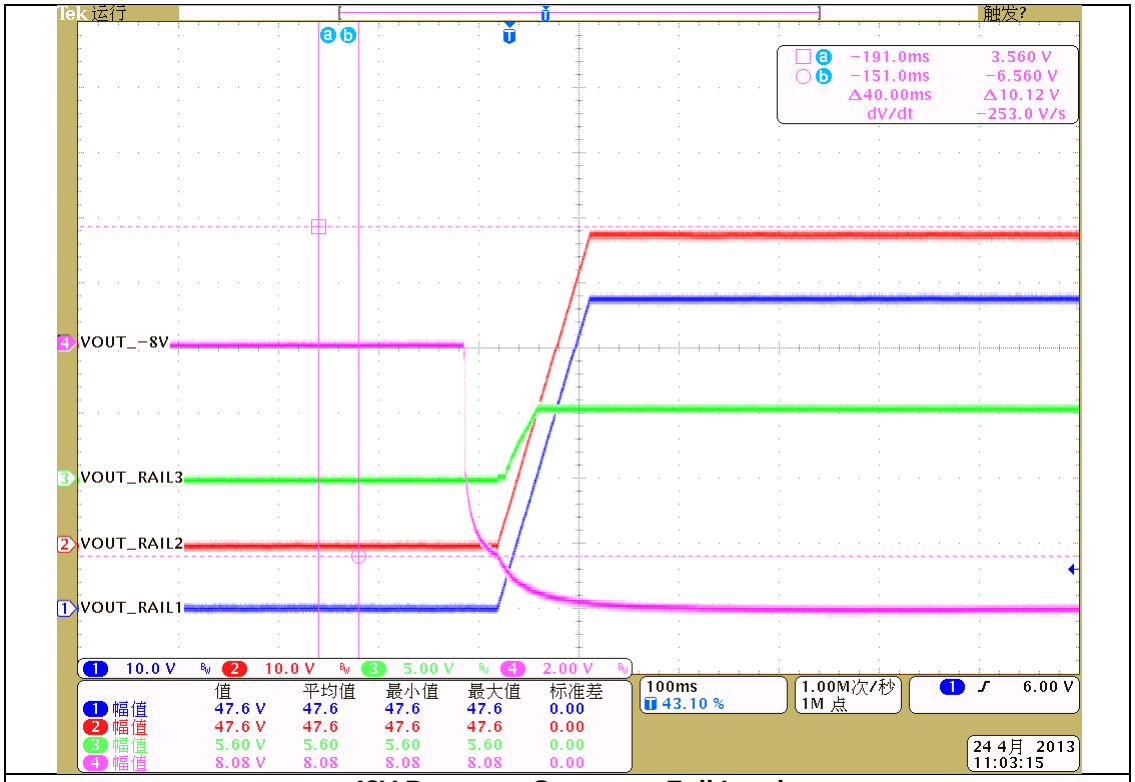
2.2 The sequence of the all output voltage



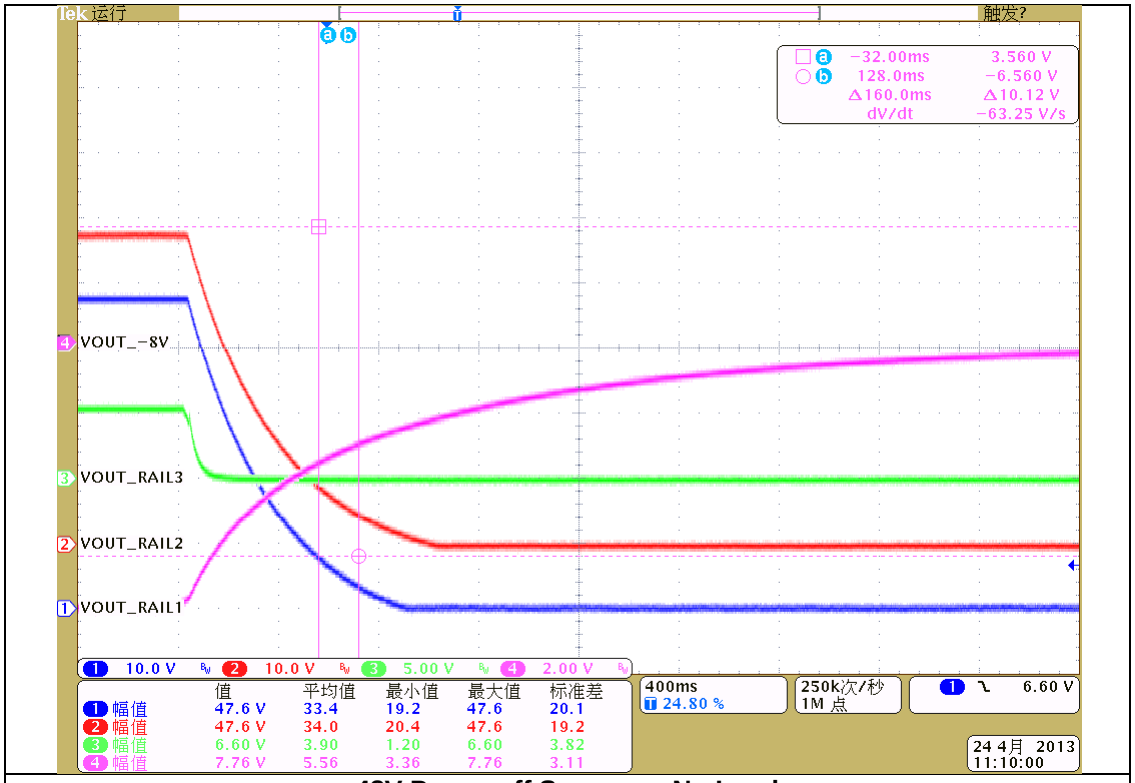
48V Power on Sequence No Load



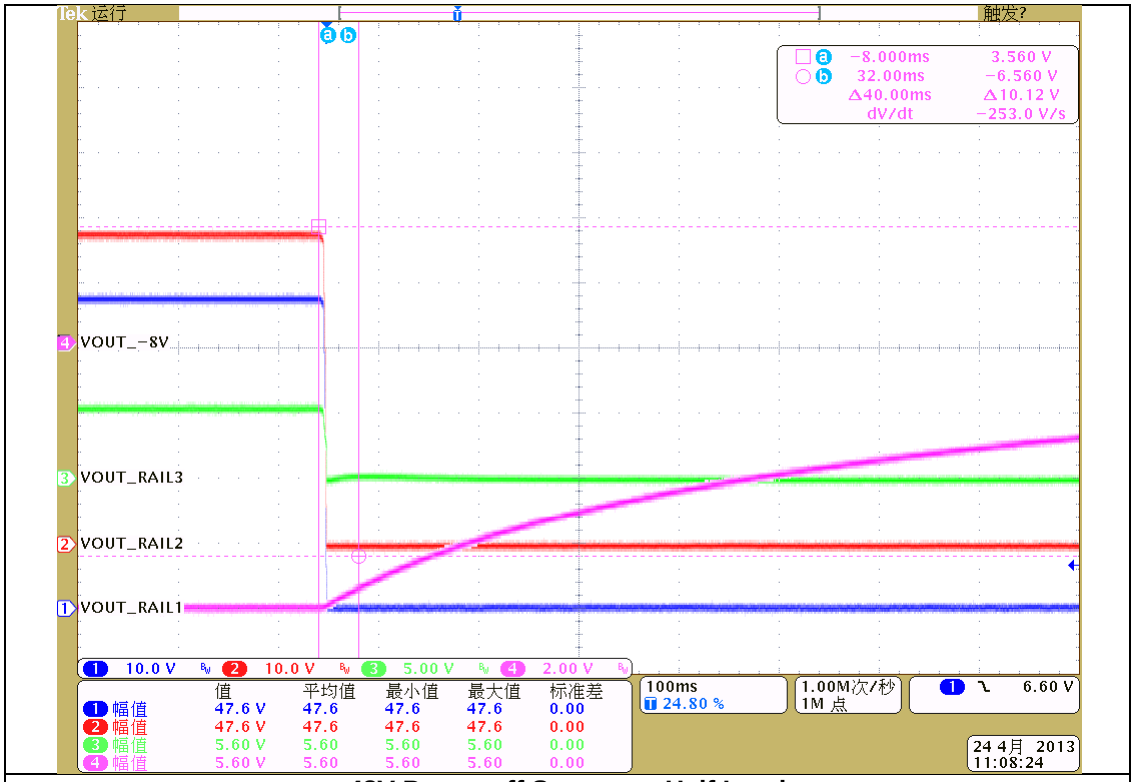
48V Power on Sequence Half Load



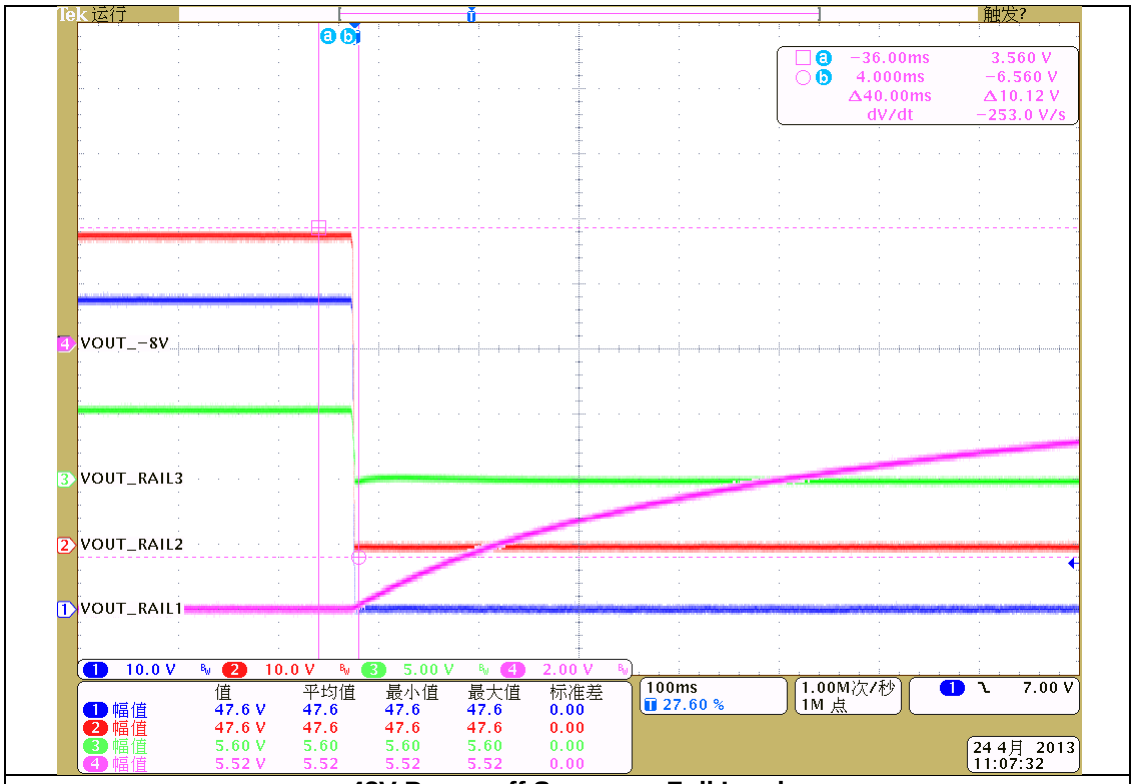
48V Power on Sequence Full Load



48V Power off Sequence No Load

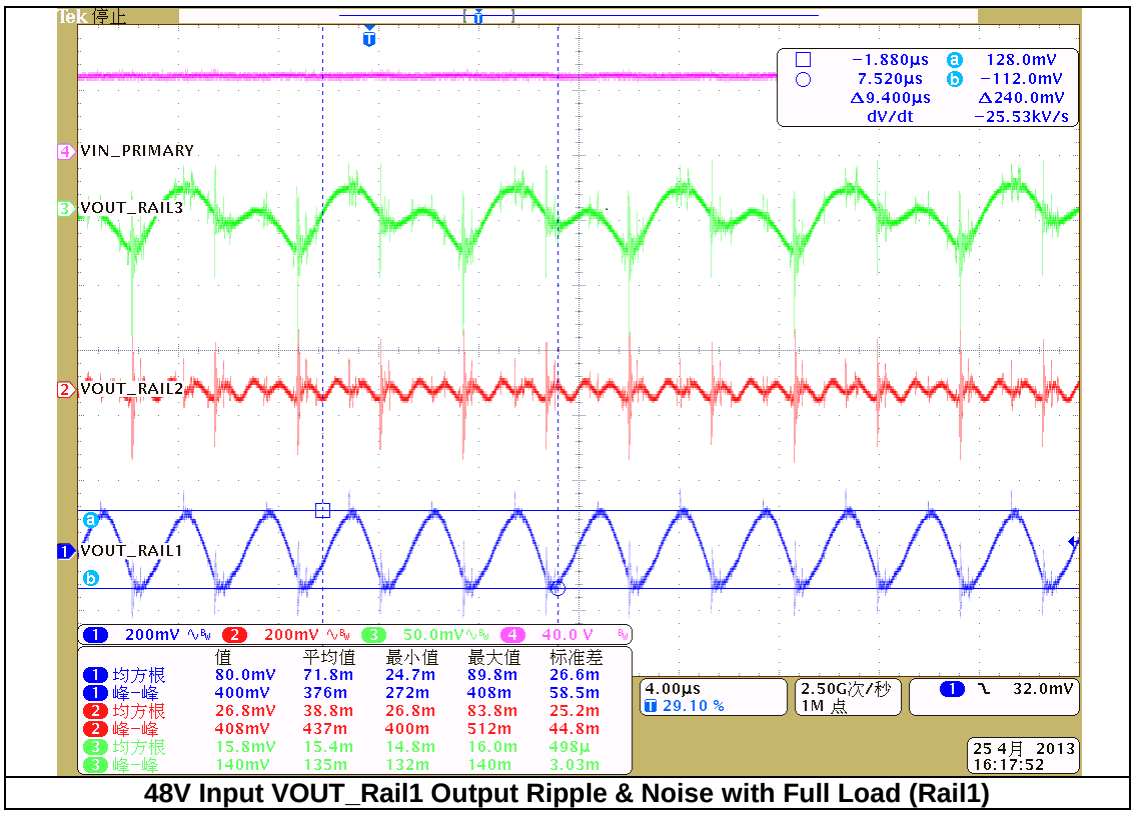


48V Power off Sequence Half Load

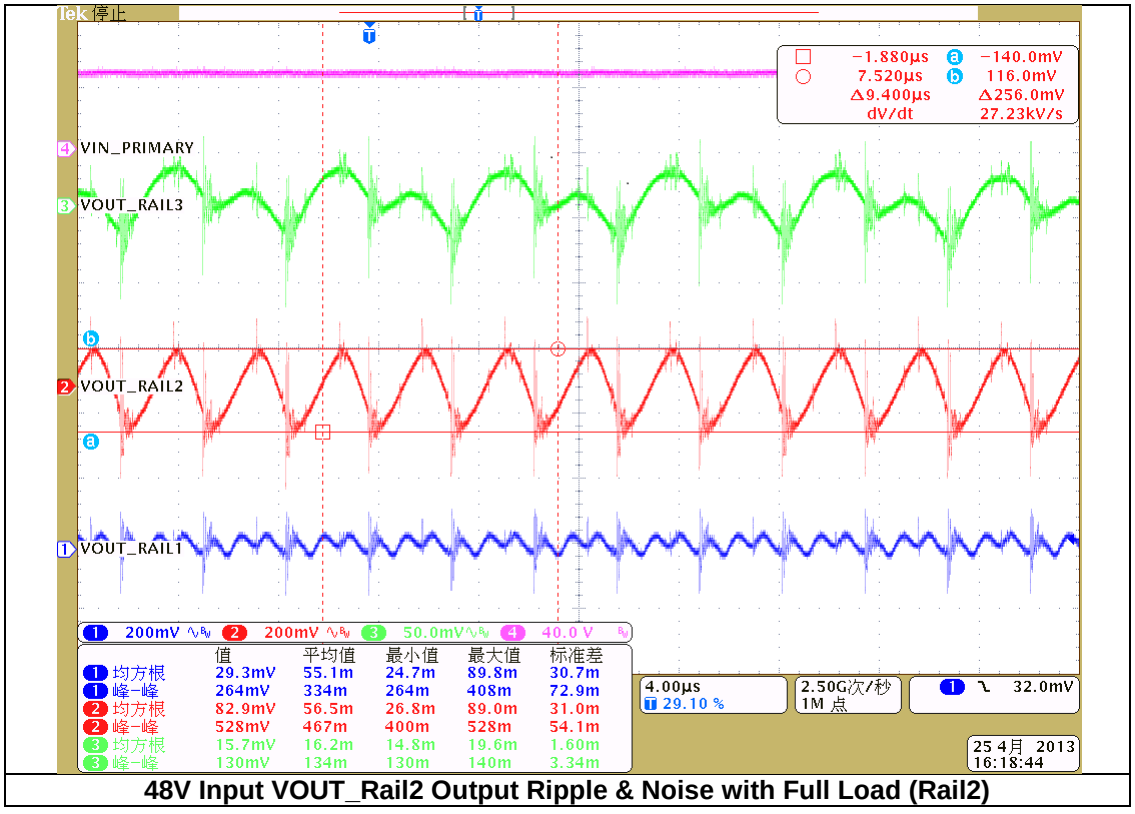


48V Power off Sequence Full Load

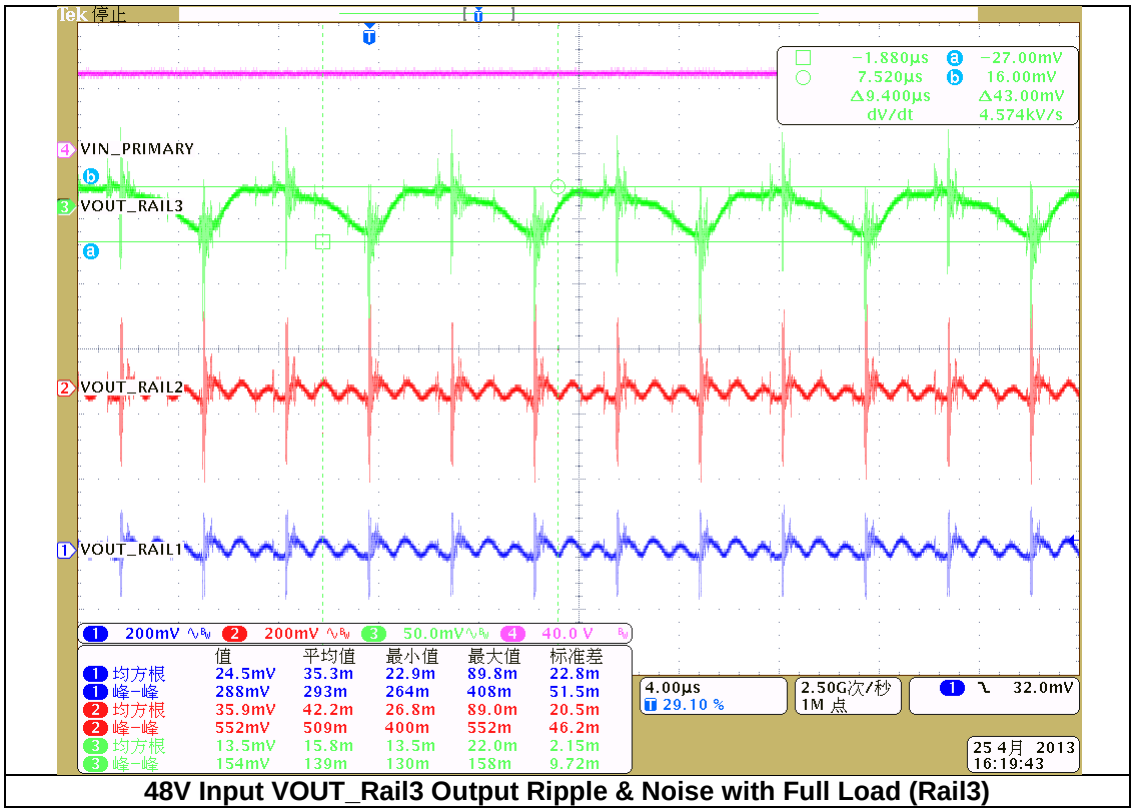
2.3 The output Ripple & Noise Waveforms



48V Input VOUT_Rail1 Output Ripple & Noise with Full Load (Rail1)

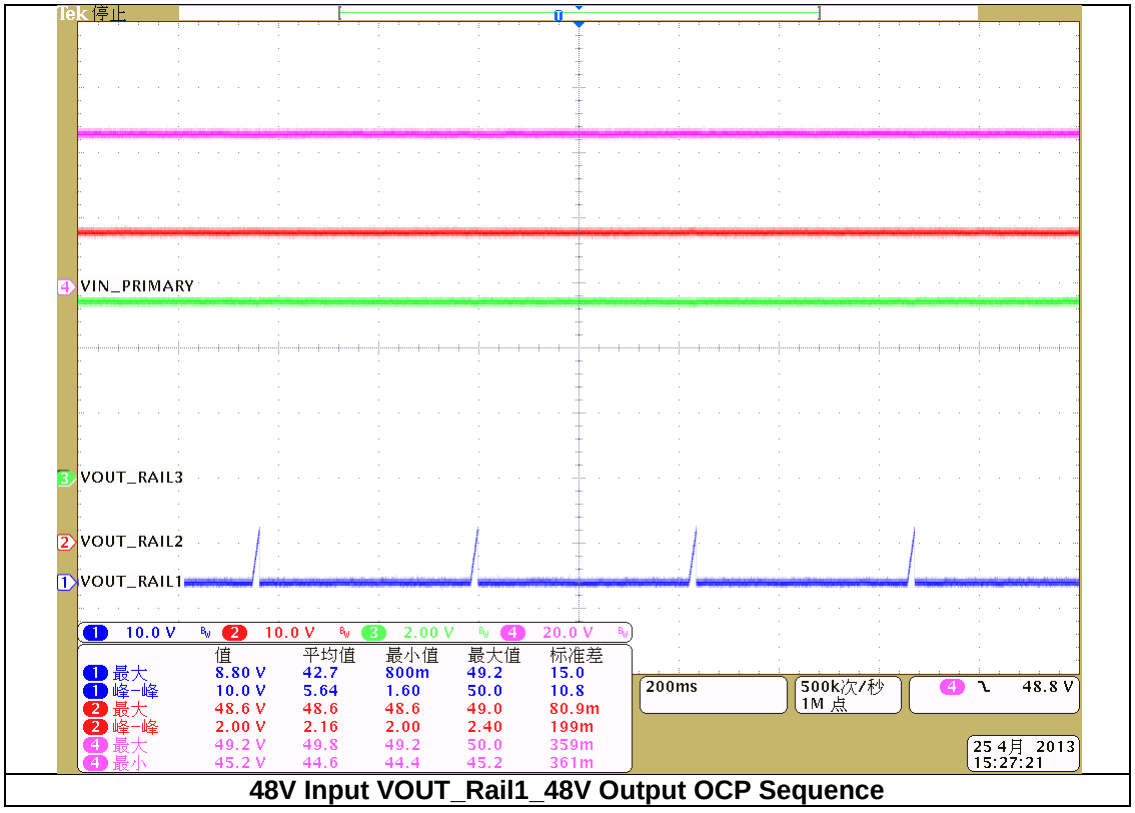


48V Input VOUT_Rail2 Output Ripple & Noise with Full Load (Rail2)



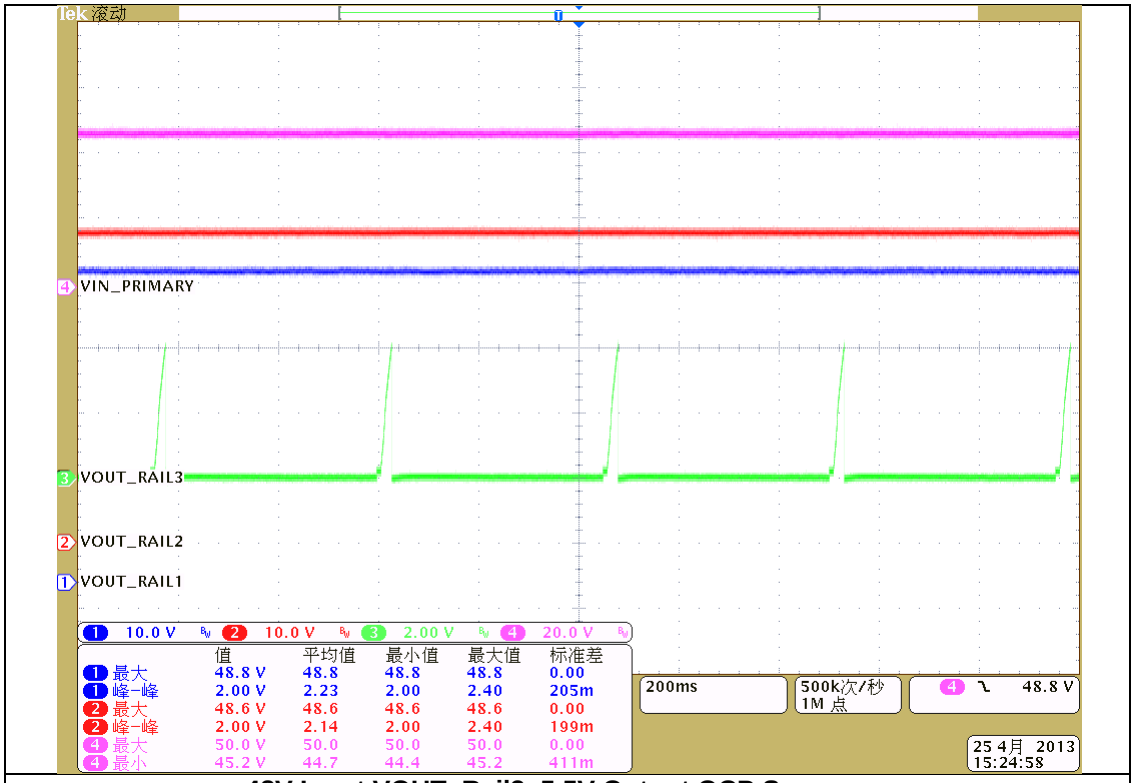
48V Input VOUT_Rail3 Output Ripple & Noise with Full Load (Rail3)

2.4 The output Over Current Protection Waveforms



48V Input VOUT_Rail1_48V Output OCP Sequence

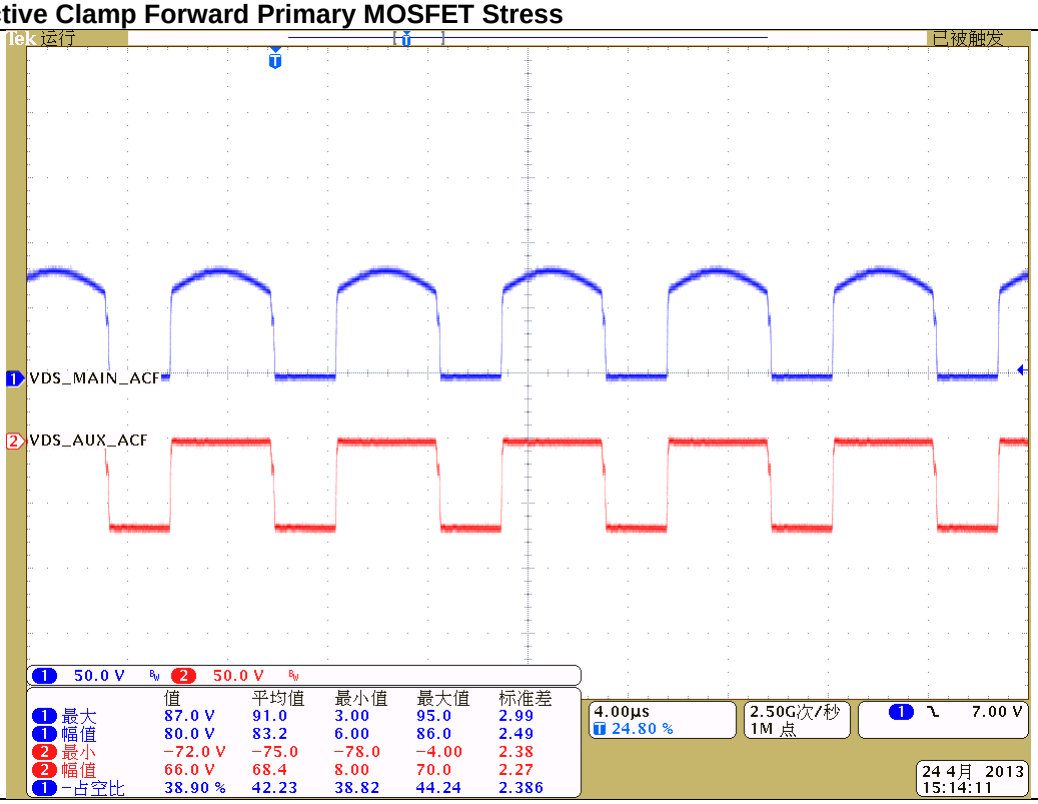
48V Input VOUT_Rail2_48V Output OCP Sequence



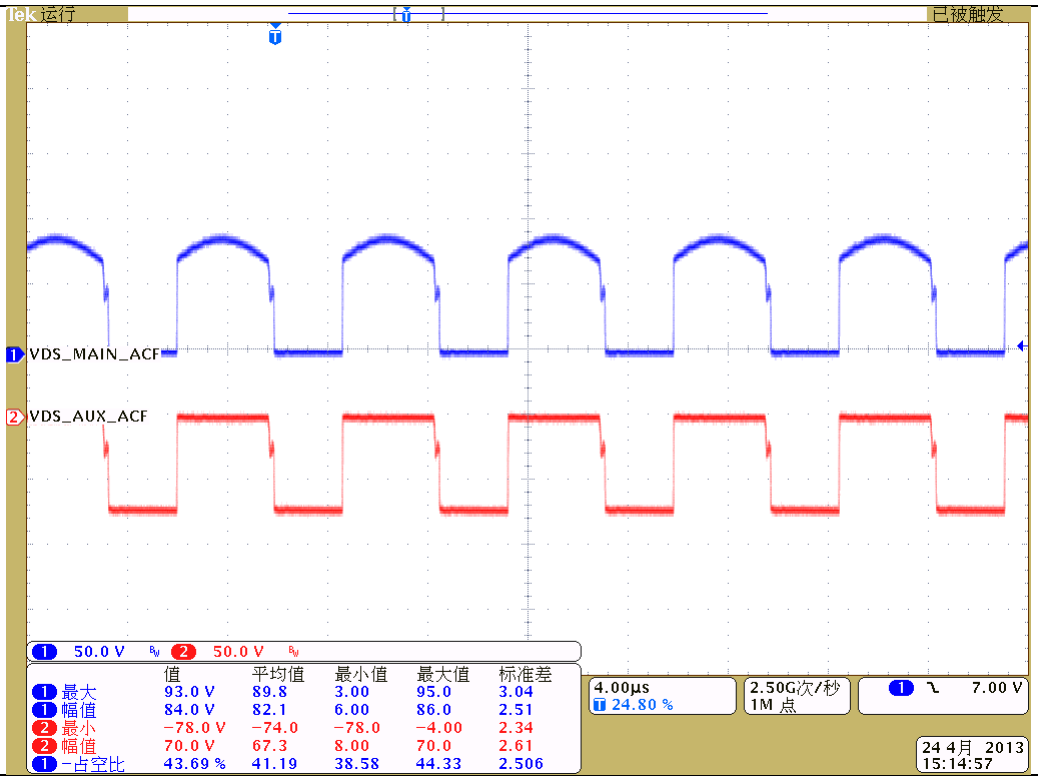
48V Input VOUT_Rail3_5.5V Output OCP Sequence

2.5 Stress of the key components

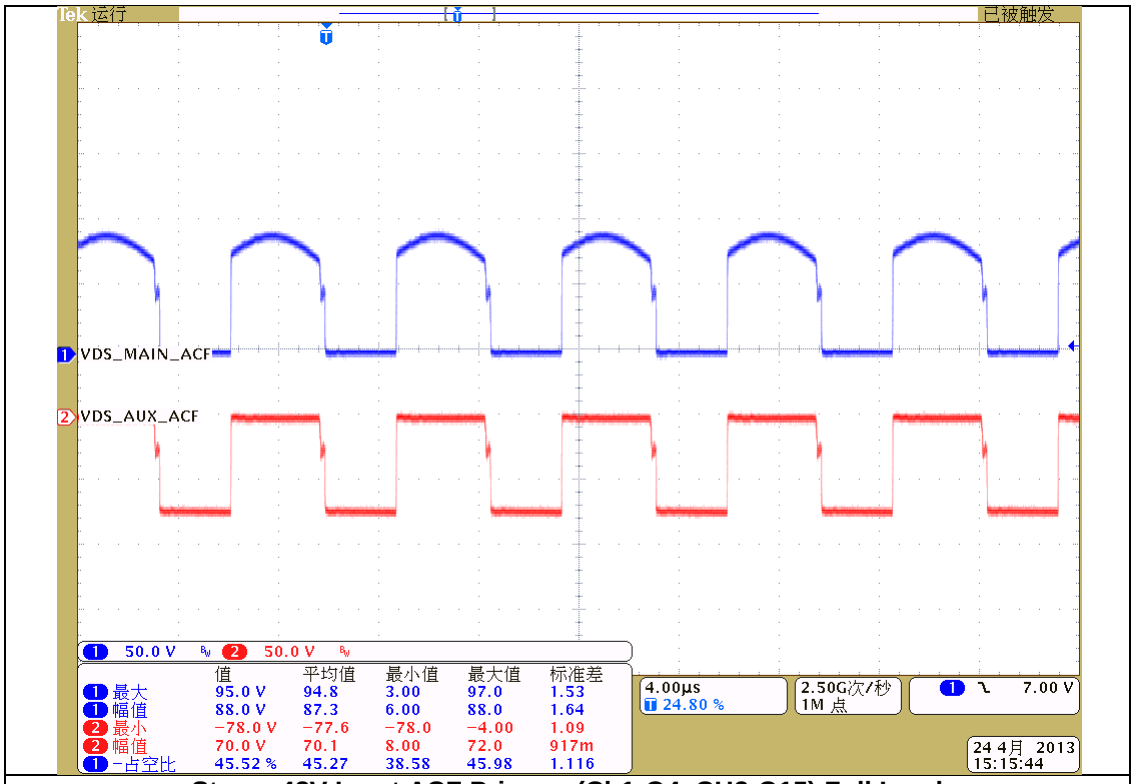
Active Clamp Forward Primary MOSFET Stress



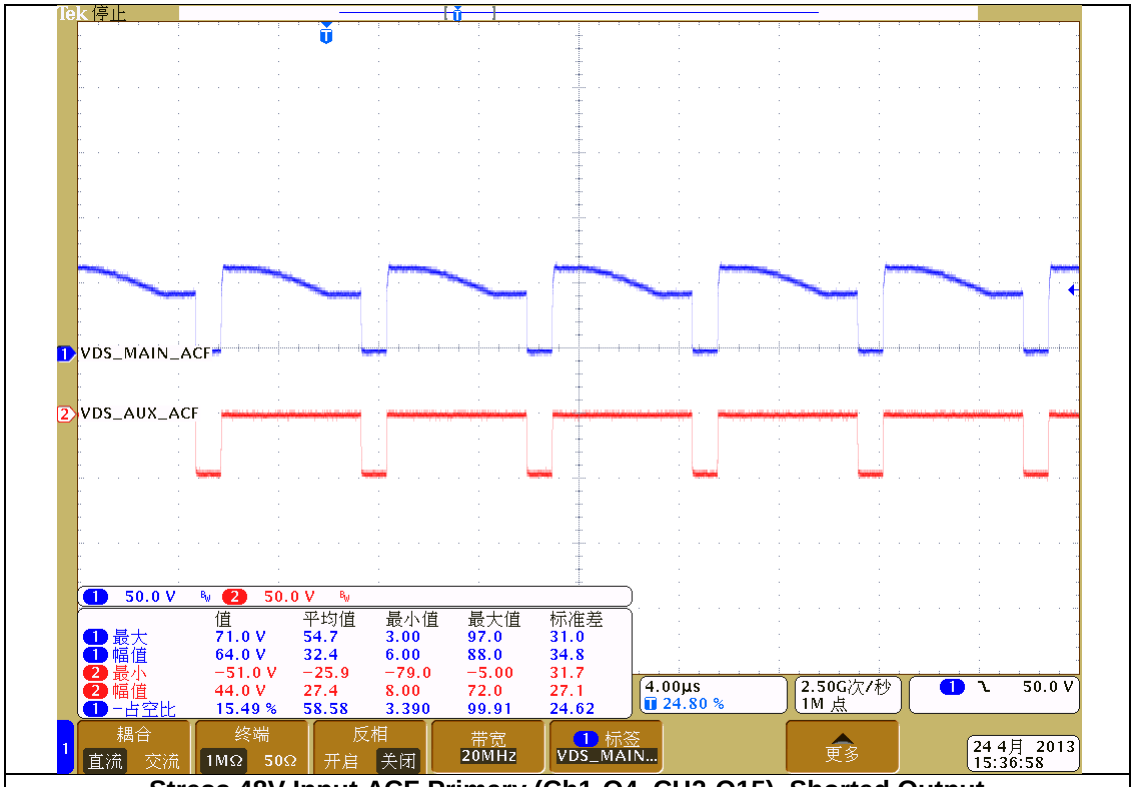
Stress 48V Input ACF Primary (Ch1-Q4, CH2-Q15) No Load



Stress 48V Input ACF Primary (Ch1-Q4, CH2-Q15) Half Load

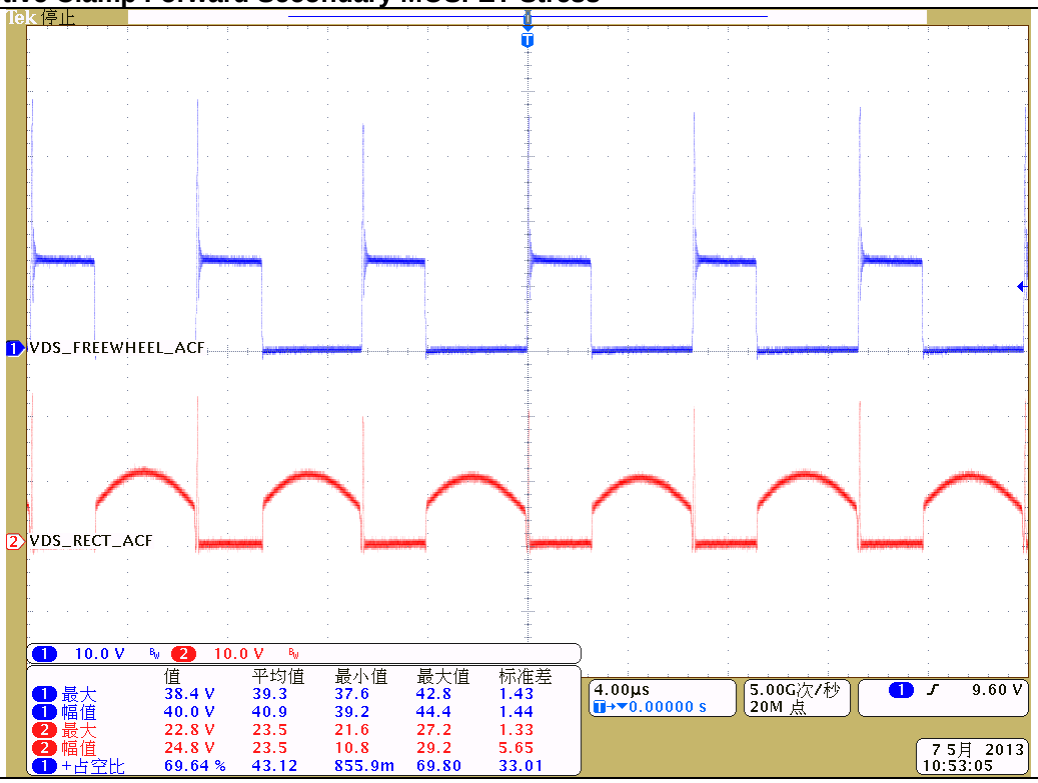


Stress 48V Input ACF Primary (Ch1-Q4, CH2-Q15) Full Load

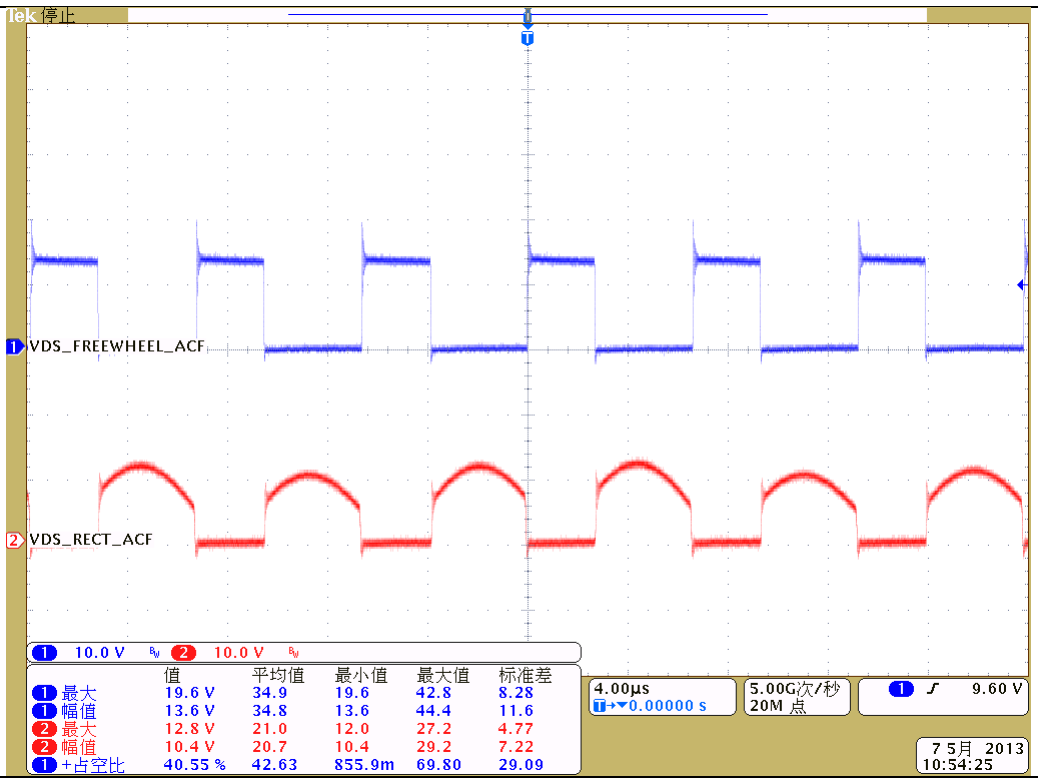


Stress 48V Input ACF Primary (Ch1-Q4, CH2-Q15) Shorted Output

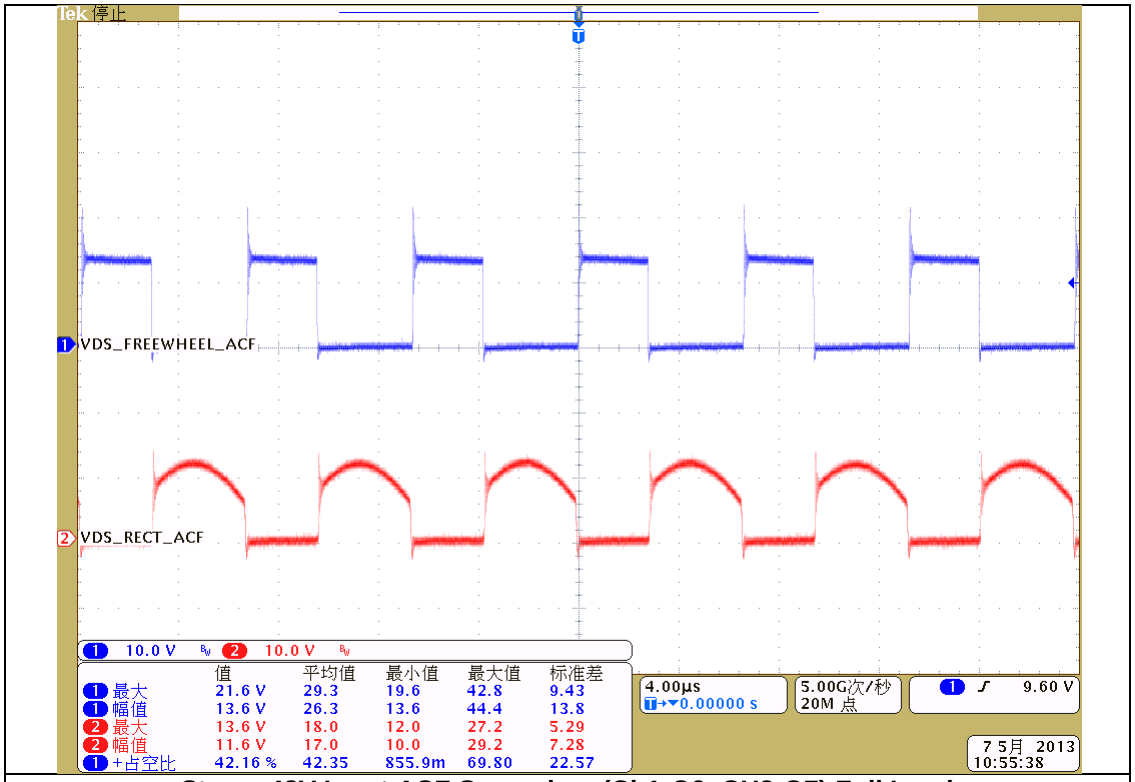
Active Clamp Forward Secondary MOSFET Stress



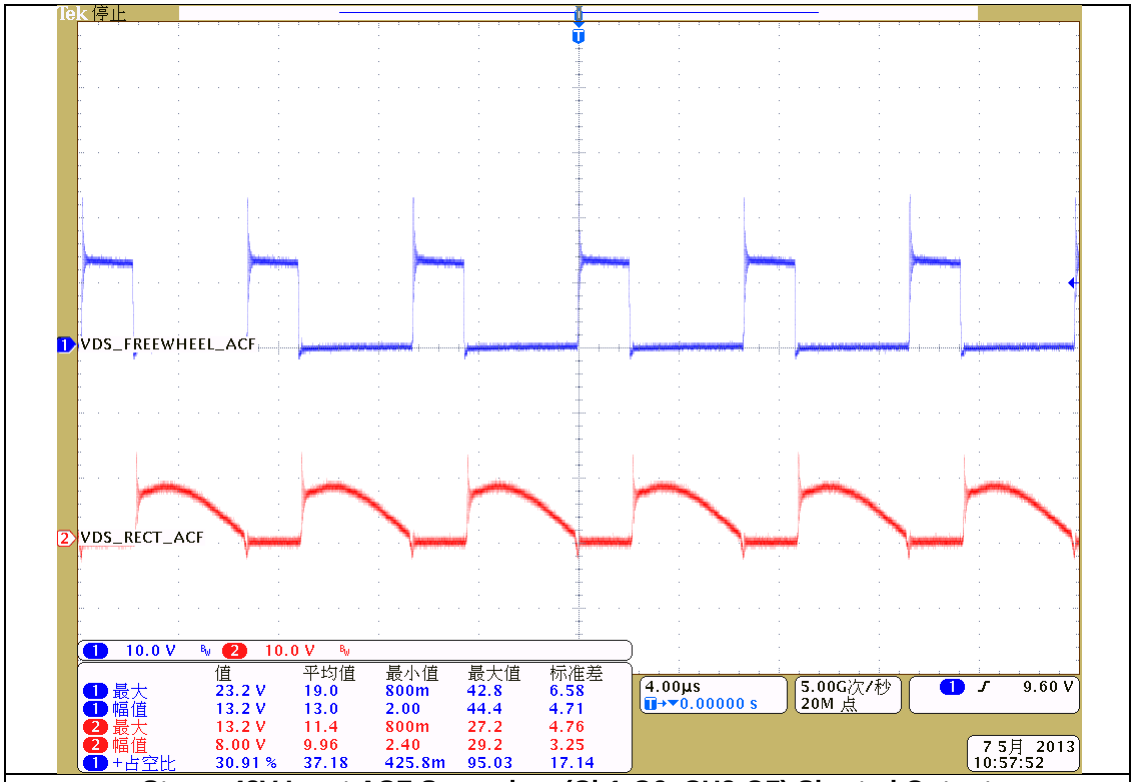
Stress 48V Input ACF Secondary (Ch1-Q9, CH2-Q7) No Load



Stress 48V Input ACF Secondary (Ch1-Q9, CH2-Q7) Half Load

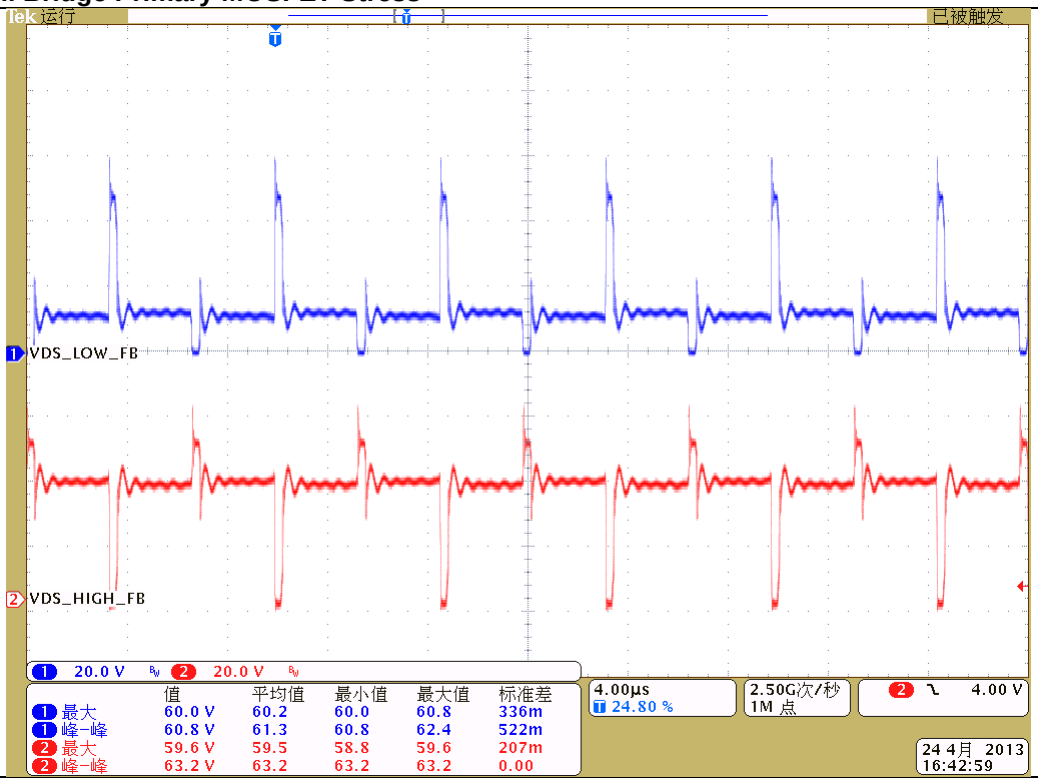


Stress 48V Input ACF Secondary (Ch1-Q9, CH2-Q7) Full Load

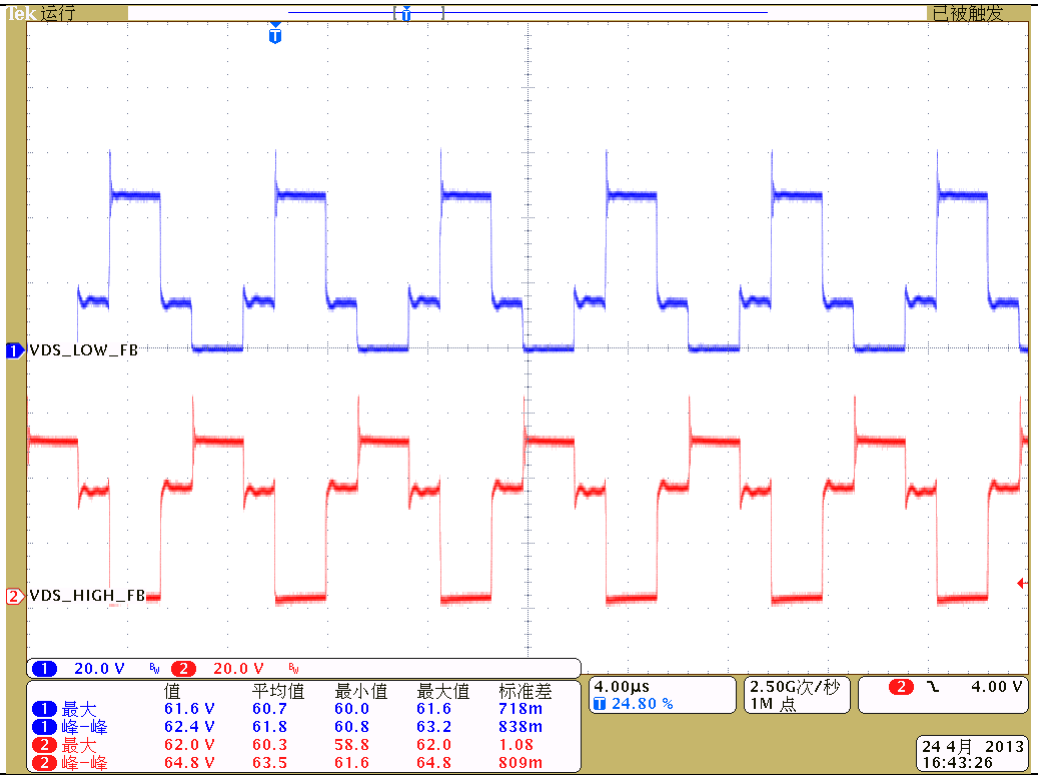


Stress 48V Input ACF Secondary (Ch1-Q9, CH2-Q7) Shorted Output

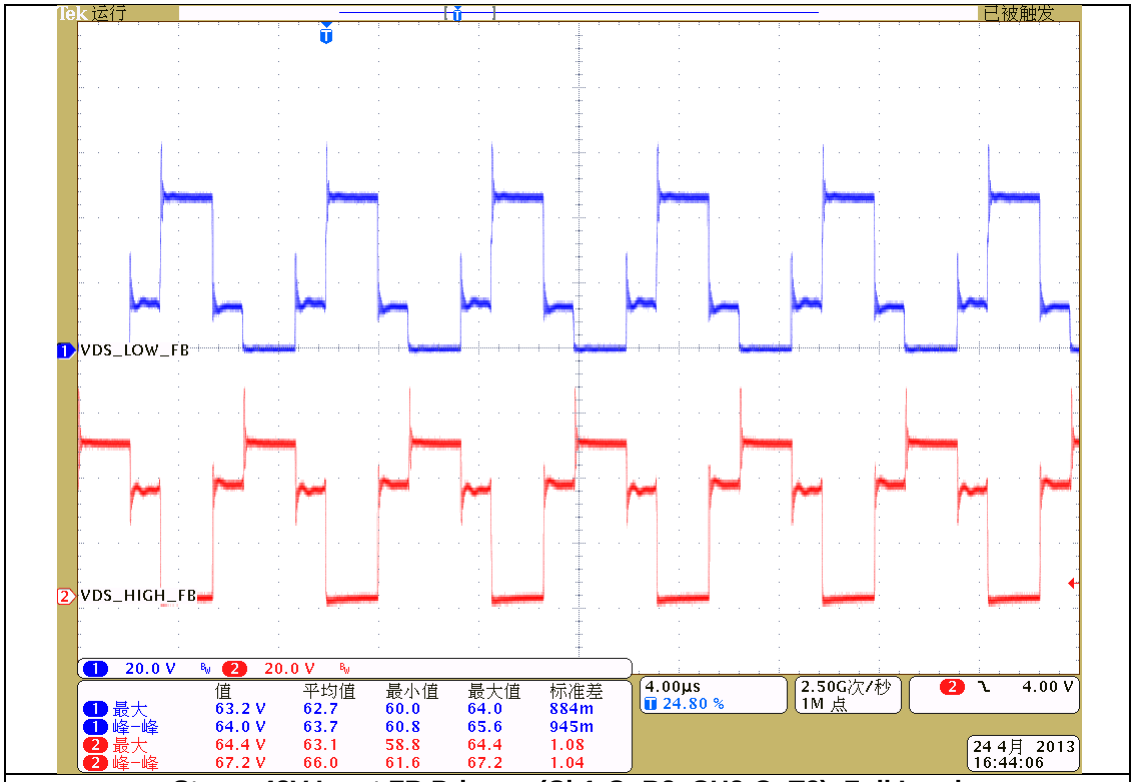
Full Bridge Primary MOSFET Stress



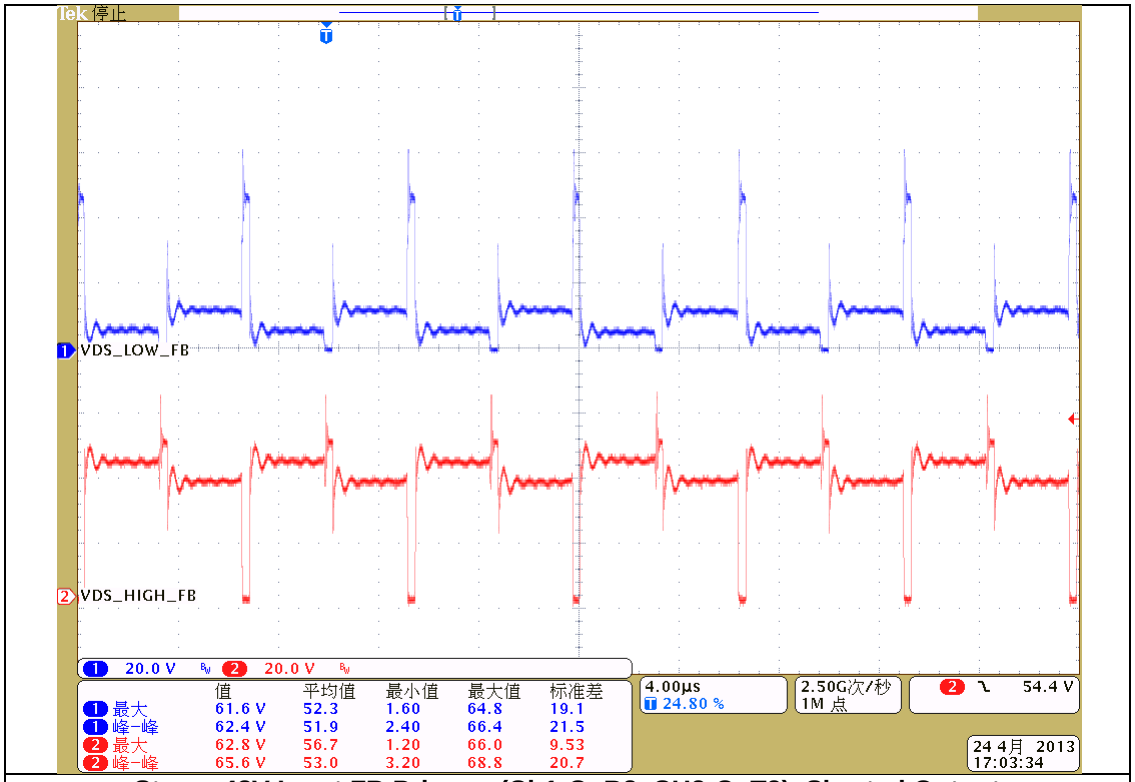
Stress 48V Input FB Primary (Ch1-Q_B2, CH2-Q_T2) No Load



Stress 48V Input FB Primary (Ch1-Q_B2, CH2-Q_T2) Half Load

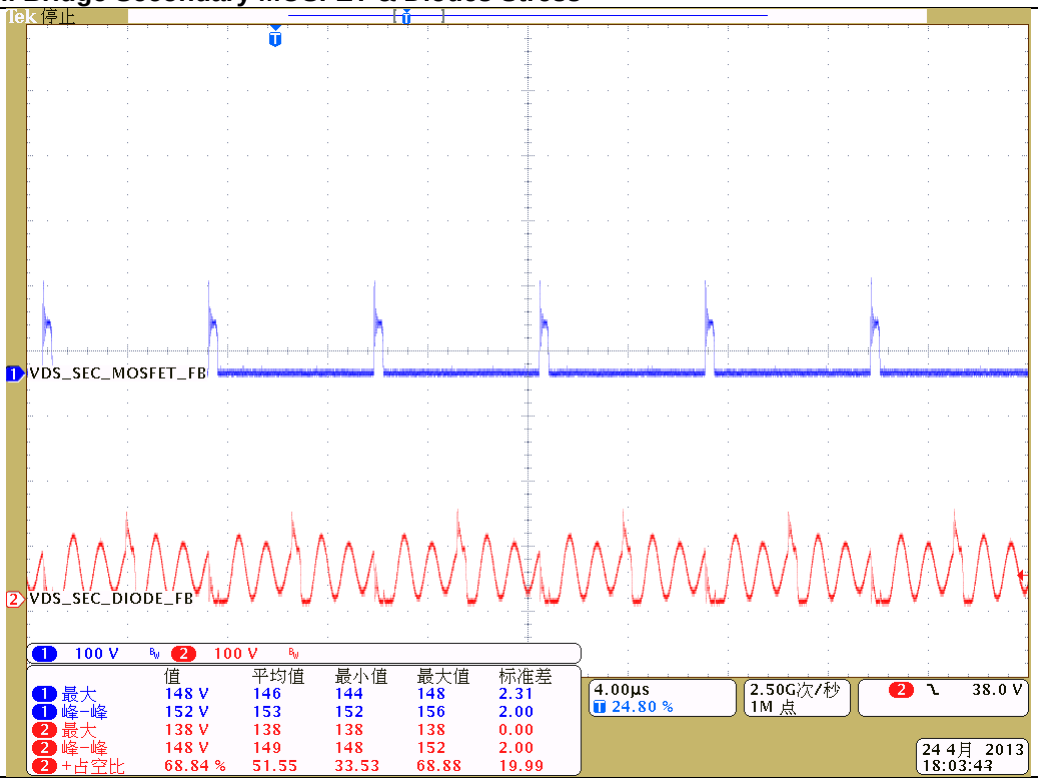


Stress 48V Input FB Primary (Ch1-Q_B2, CH2-Q_T2) Full Load

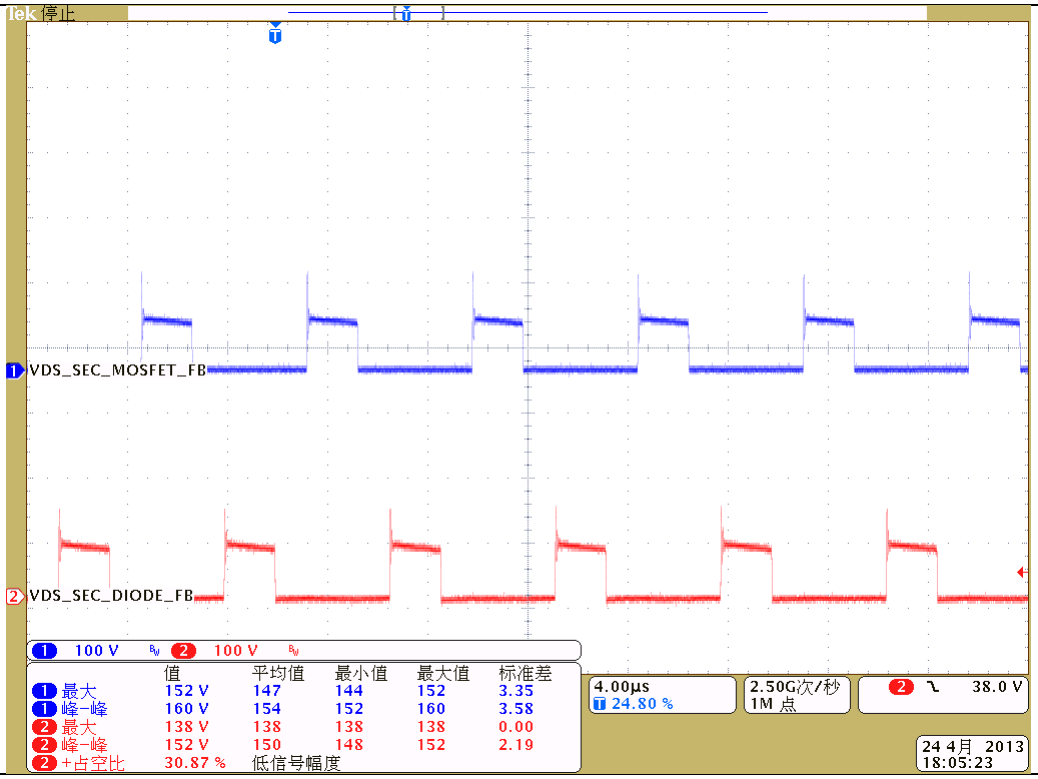


Stress 48V Input FB Primary (Ch1-Q_B2, CH2-Q_T2) Shorted Output

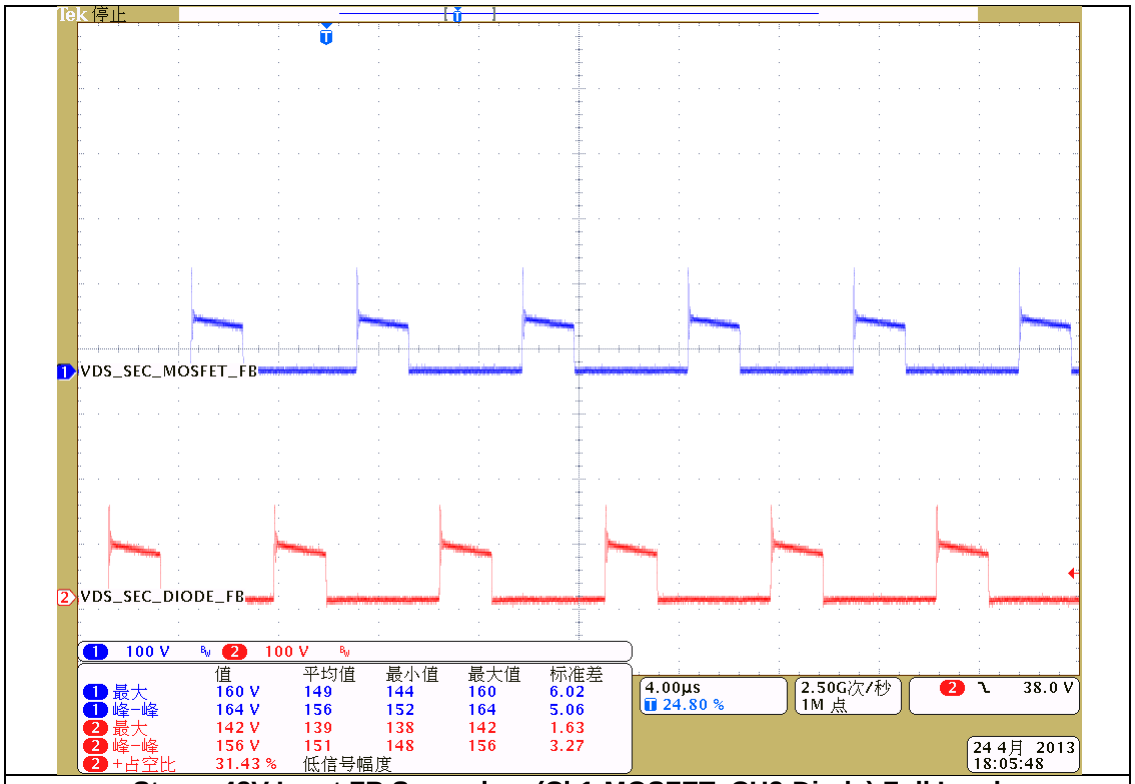
Full Bridge Secondary MOSFET & Diodes Stress



Stress 48V Input FB Secondary (Ch1-MOSFET, CH2-Diode) No Load



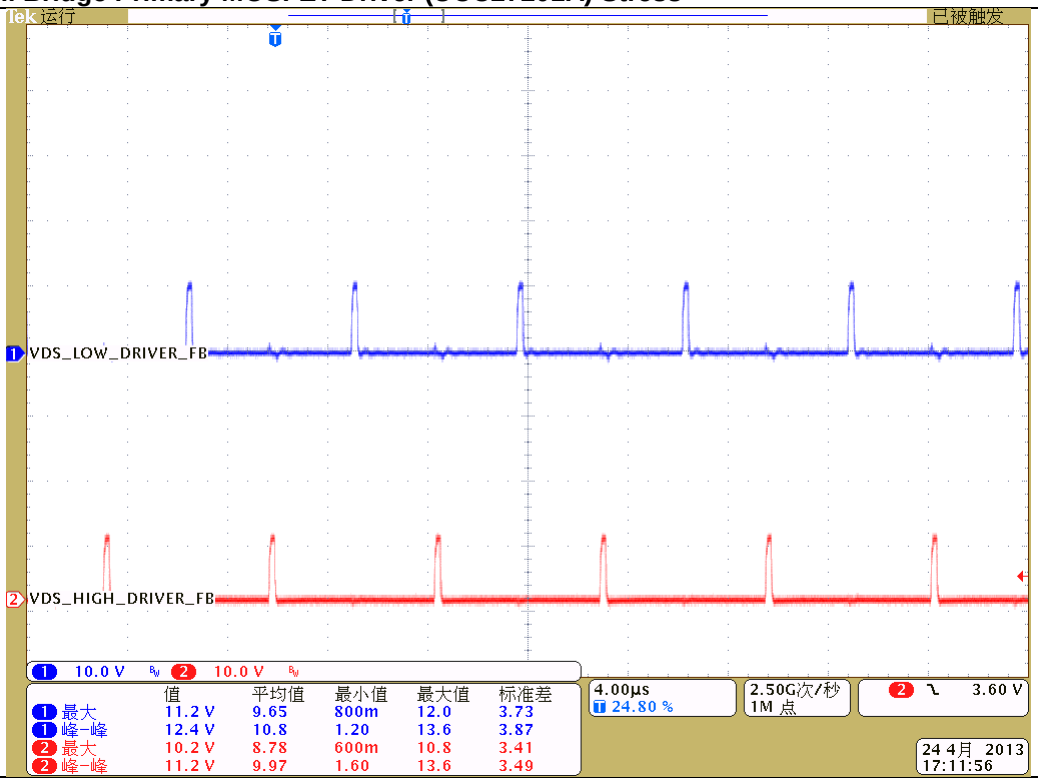
Stress 48V Input FB Secondary (Ch1-MOSFET, CH2-Diode) Half Load



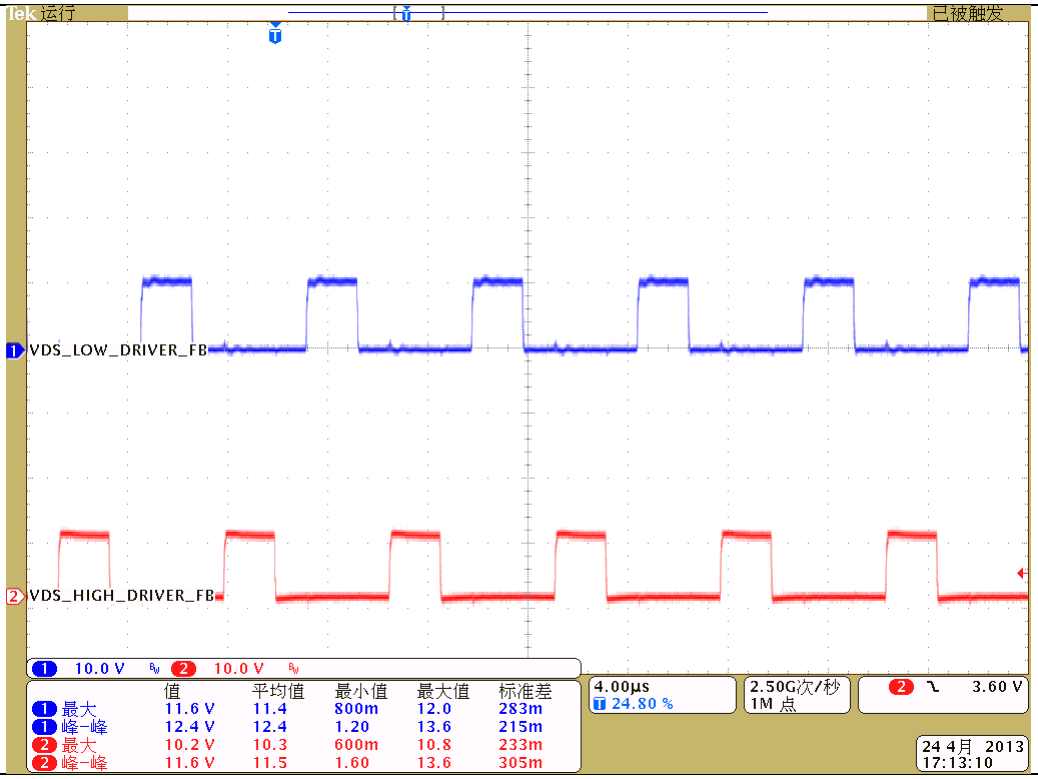
Stress 48V Input FB Secondary (Ch1-MOSFET, CH2-Diode) Full Load

Stress 48V Input ACF Secondary (Ch1-Q9, CH2-Q7) Shorted Output

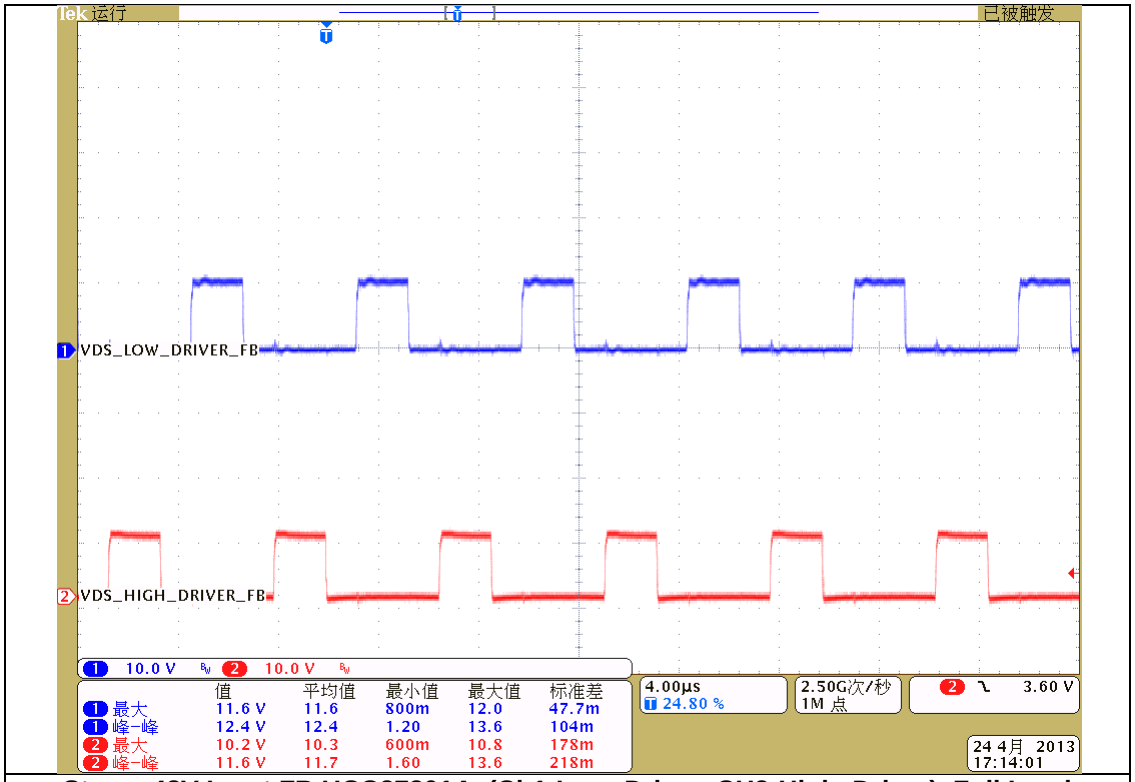
Full Bridge Primary MOSFET Driver (UCC27201A) Stress



Stress 48V Input FB UCC27201A (Ch1-Low_Driver, CH2-High_Driver) No Load



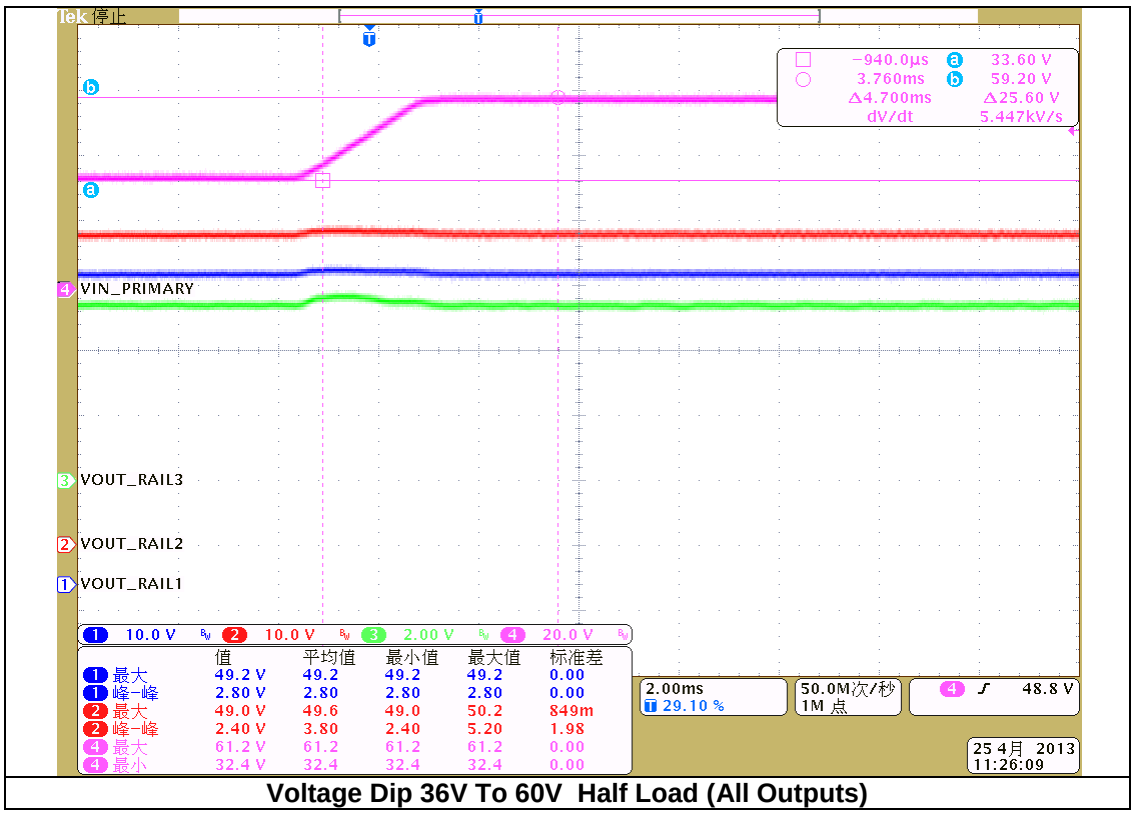
Stress 48V Input FB UCC27201A (Ch1-Low_Driver, CH2-High_Driver) Half Load



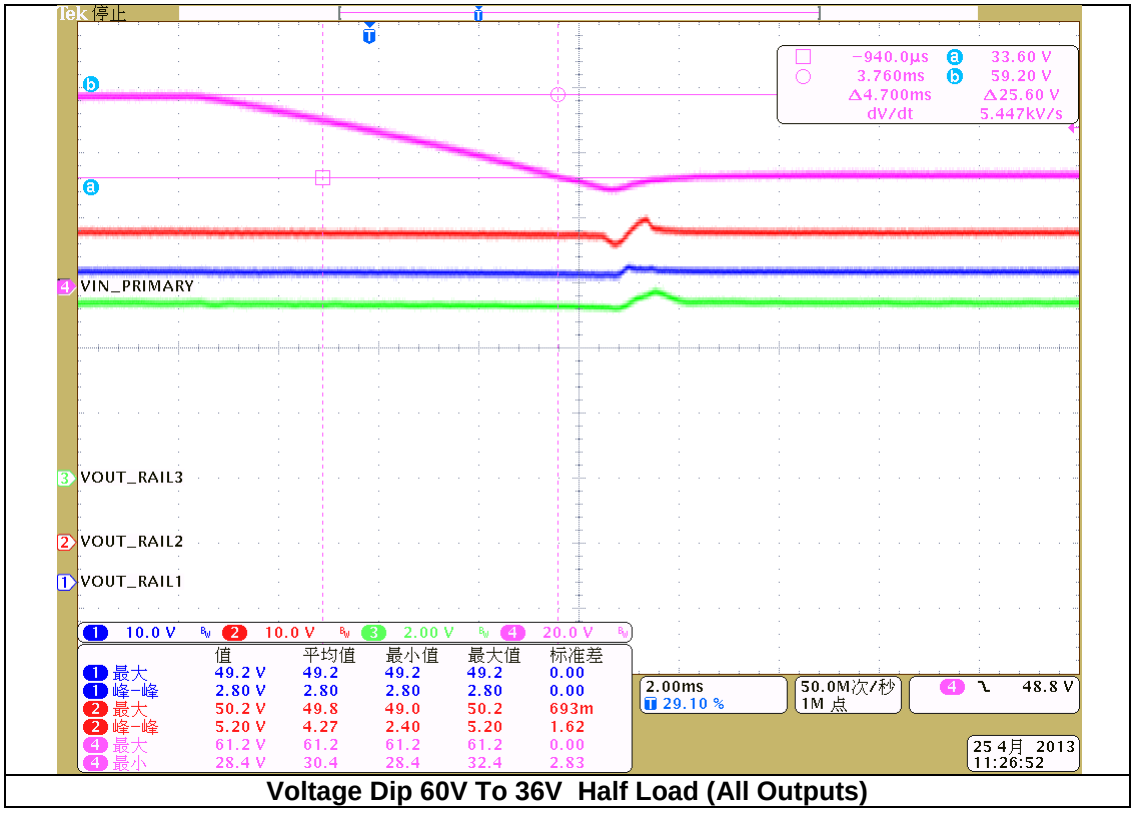
Stress 48V Input FB UCC27201A (Ch1-Low_Driver, CH2-High_Driver) Full Load

Stress 48V Input FB UCC27201A (Ch1-Low_Driver, CH2-High_Driver) Shorted Output

2.6 Input Voltage Dip Testing

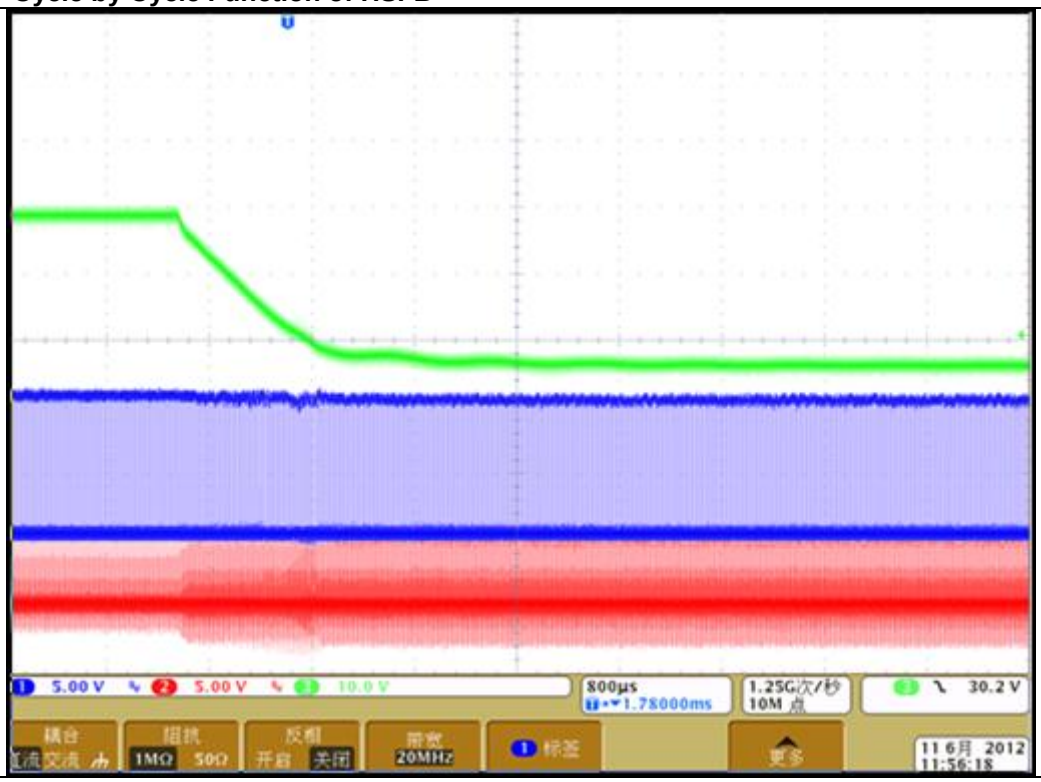


Voltage Dip 36V To 60V Half Load (All Outputs)

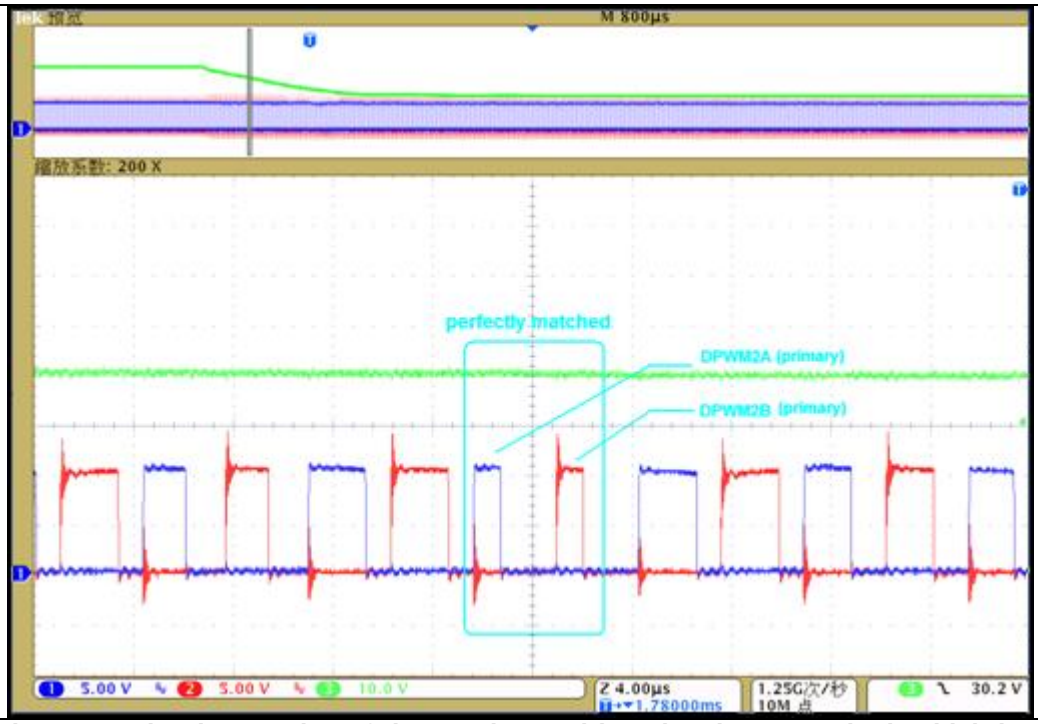


Voltage Dip 60V To 36V Half Load (All Outputs)

2.7 Cycle by Cycle Function of HSFB



- **triggers CBC but do not power off system, only used for demonstrate this function;**
- **CH1: primary driver signal (actual is DPWM2A)**
  CH2: primary driver signal (actual is DPWM2B)
  CH3: output voltage;



During CBC, the duty cycles of these primary drive signal are matched, which keeps the primary current to be balanced.

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