

PMP20599 Rev B

45W POE to USB Type-C PD

Active Clamp Forward

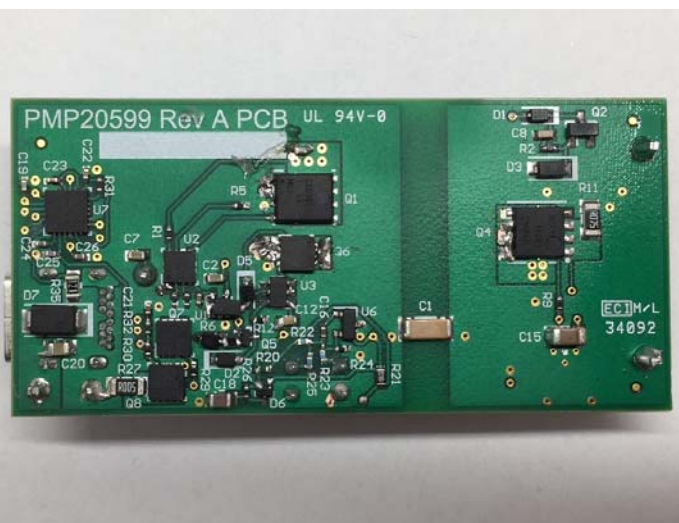
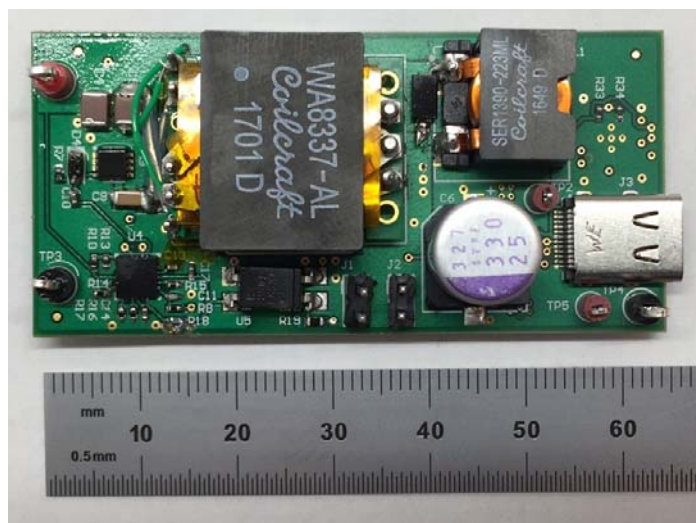
Test Results

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1 Photos

The photographs below show the PMP20599 Rev B prototype assembly. This circuit was built using a PMP20599PCB Rev A.



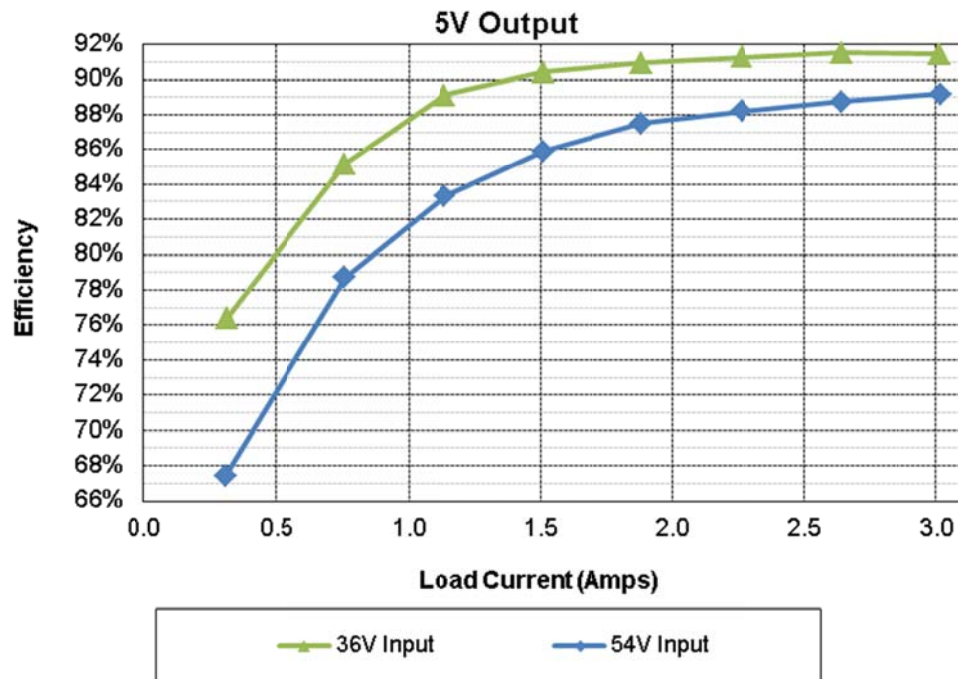
2 Standby Power (Cable Unplugged)

Input Voltage	Input Power
36 V	137 mW
54 V	173 mW

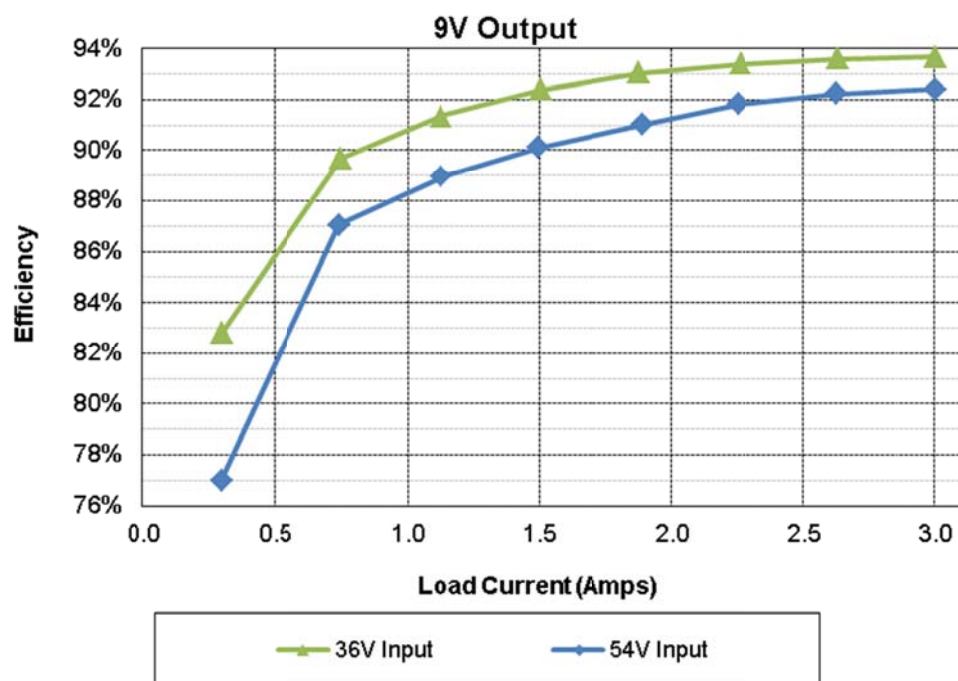
3 Efficiency

3.1 Efficiency Charts

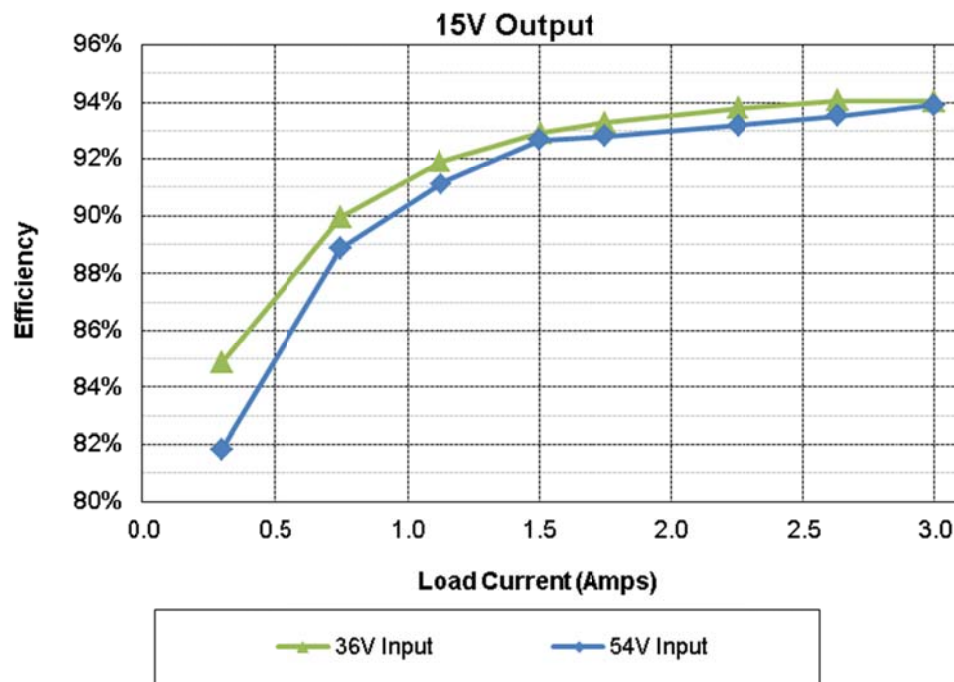
3.1.1 5V Output



3.1.2 9V Output

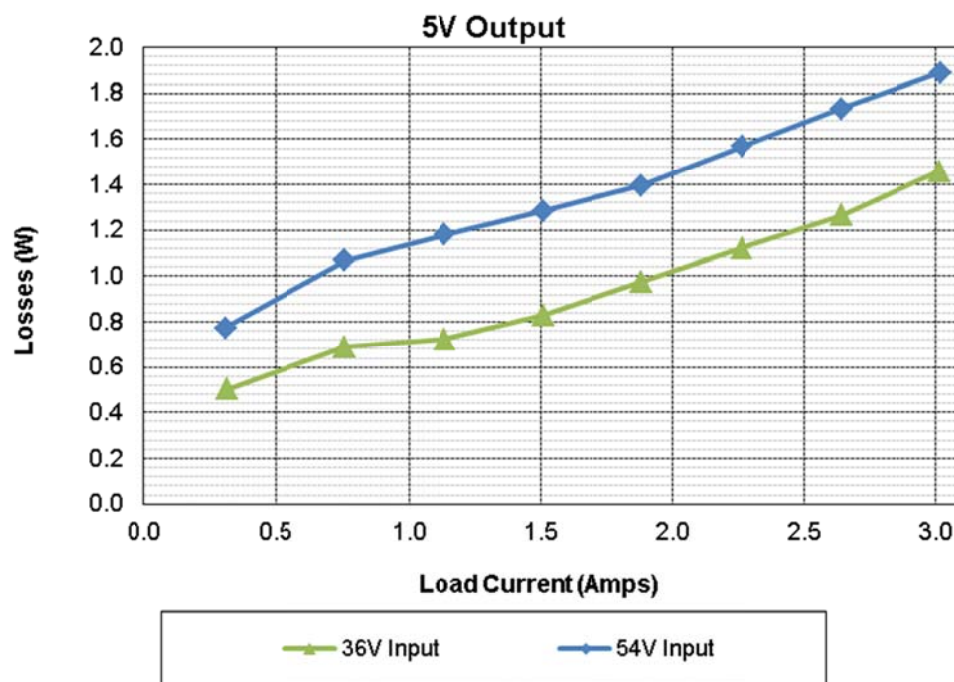


3.1.3 15V Output

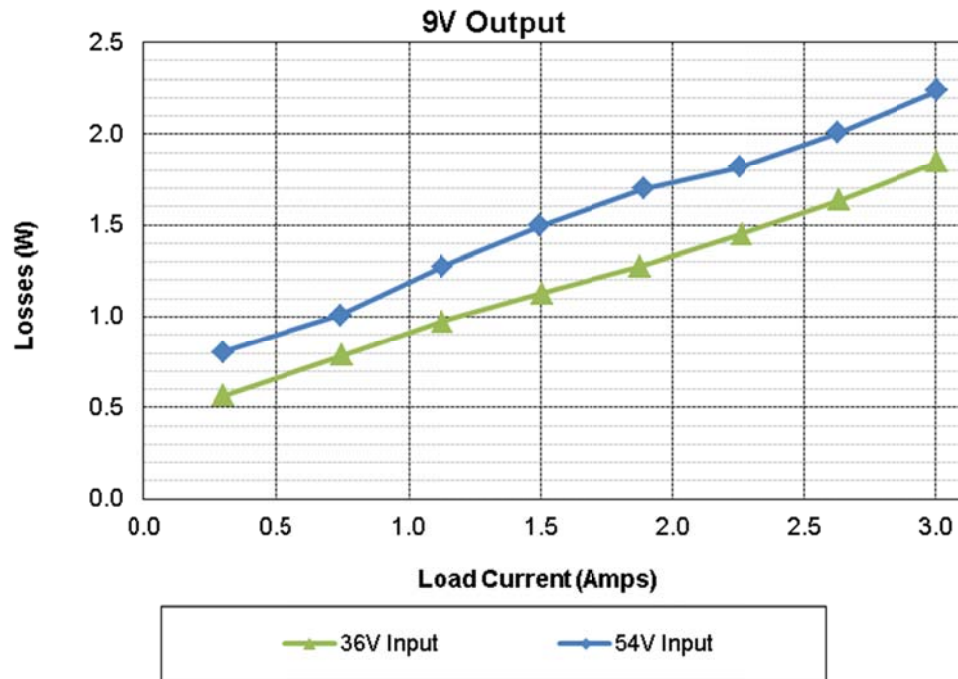


3.2 Power Loss Charts

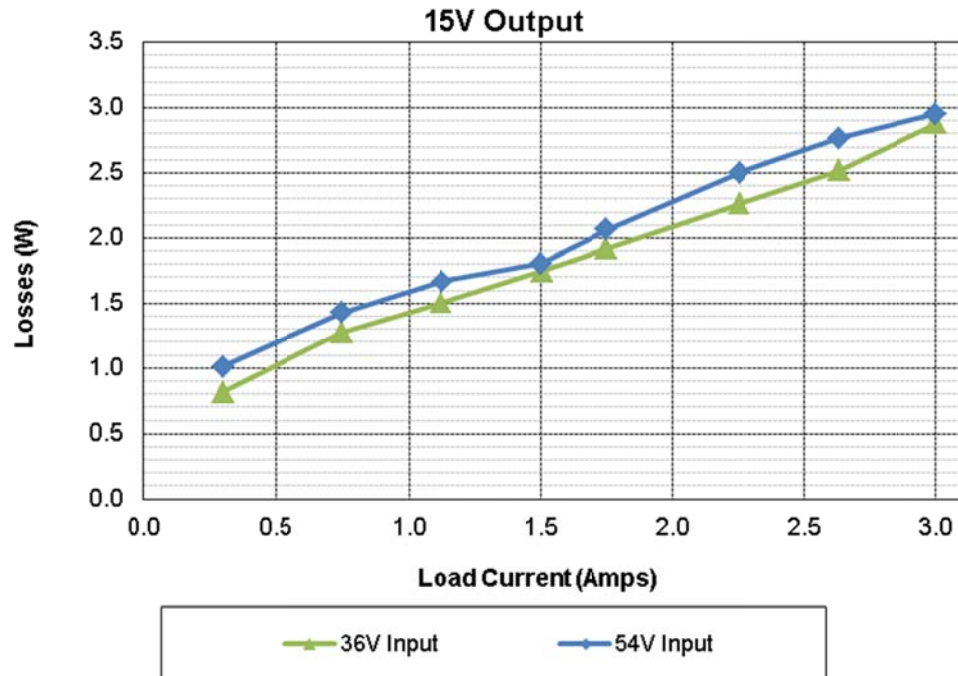
3.2.1 5V Output



3.2.2 9V Output



3.2.3 15V Output



3.3 Raw Data

3.3.1 5V Output

36V Input		5V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.011	5.201	36.00	0.007	0.252	0.06	0.19	22.7%
0.312	5.198	35.99	0.059	2.123	1.62	0.50	76.4%
0.761	5.193	35.97	0.129	4.640	3.95	0.69	85.2%
1.136	5.189	35.96	0.184	6.617	5.89	0.72	89.1%
1.511	5.185	35.95	0.241	8.664	7.83	0.83	90.4%
1.886	5.181	35.94	0.299	10.75	9.77	0.97	90.9%
2.261	5.177	35.93	0.357	12.83	11.71	1.12	91.3%
2.637	5.173	35.92	0.415	14.91	13.64	1.27	91.5%
3.011	5.169	35.91	0.474	17.02	15.56	1.46	91.4%

54V Input		5V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.011	5.201	53.99	0.006	0.324	0.06	0.27	17.7%
0.308	5.198	53.98	0.044	2.375	1.60	0.77	67.4%
0.761	5.193	53.98	0.093	5.020	3.95	1.07	78.7%
1.136	5.189	53.97	0.131	7.075	5.89	1.18	83.3%
1.511	5.185	53.96	0.169	9.119	7.83	1.28	85.9%
1.886	5.181	53.95	0.207	11.17	9.77	1.40	87.5%
2.261	5.177	53.95	0.246	13.27	11.71	1.57	88.2%
2.637	5.173	53.94	0.285	15.37	13.64	1.73	88.7%
3.015	5.169	53.93	0.324	17.47	15.58	1.89	89.2%

3.3.2 9V Output

36V Input		9V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.011	9.099	36.00	0.011	0.396	0.10	0.30	25.3%
0.298	9.096	35.98	0.091	3.274	2.71	0.56	82.8%
0.752	9.091	35.96	0.212	7.624	6.84	0.79	89.7%
1.127	9.087	35.94	0.312	11.213	10.24	0.97	91.3%
1.505	9.083	35.92	0.412	14.799	13.67	1.13	92.4%
1.880	9.079	35.90	0.511	18.34	17.07	1.28	93.0%
2.260	9.075	36.00	0.610	21.96	20.51	1.45	93.4%
2.632	9.071	35.98	0.709	25.51	23.87	1.63	93.6%
3.005	9.067	35.96	0.809	29.09	27.25	1.85	93.7%

54V Input		9V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.011	9.100	53.99	0.008	0.432	0.10	0.33	23.2%
0.297	9.097	53.98	0.065	3.509	2.70	0.81	77.0%
0.744	9.092	53.97	0.144	7.772	6.76	1.01	87.0%
1.130	9.088	53.95	0.214	11.545	10.27	1.28	88.9%
1.498	9.084	53.94	0.280	15.103	13.61	1.50	90.1%
1.892	9.079	53.93	0.350	18.88	17.18	1.70	91.0%
2.253	9.075	53.91	0.413	22.26	20.45	1.82	91.8%
2.625	9.071	53.90	0.479	25.82	23.81	2.01	92.2%
3.004	9.067	53.89	0.547	29.48	27.24	2.24	92.4%

3.3.3 15V Output

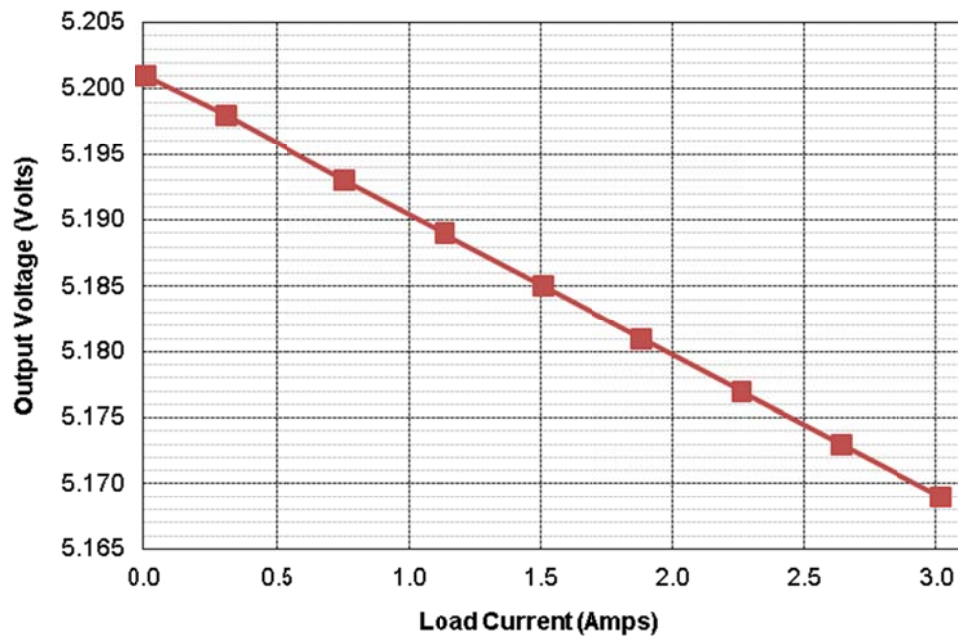
36V Input		15V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.013	15.213	35.99	0.021	0.756	0.20	0.56	26.2%
0.299	15.211	35.97	0.149	5.360	4.55	0.81	84.9%
0.750	15.206	36.02	0.352	12.679	11.40	1.27	89.9%
1.125	15.202	35.99	0.517	18.607	17.10	1.50	91.9%
1.505	15.198	35.99	0.684	24.617	22.87	1.74	92.9%
1.751	15.195	35.97	0.793	28.52	26.61	1.92	93.3%
2.251	15.190	36.02	1.012	36.45	34.19	2.26	93.8%
2.628	15.185	35.98	1.179	42.42	39.91	2.51	94.1%
3.000	15.181	35.95	1.347	48.42	45.54	2.88	94.0%

54V Input		15V Output					
I _{out}	V _{out}	V _{in}	I _{in}	P _{in}	P _{out}	Losses	Efficiency
0.013	15.213	53.99	0.015	0.810	0.20	0.61	24.4%
0.299	15.211	53.97	0.103	5.559	4.55	1.01	81.8%
0.748	15.206	54.01	0.237	12.800	11.37	1.43	88.9%
1.126	15.202	53.98	0.348	18.785	17.12	1.67	91.1%
1.502	15.198	54.02	0.456	24.633	22.83	1.81	92.7%
1.755	15.195	54.01	0.532	28.73	26.67	2.07	92.8%
2.252	15.189	53.98	0.680	36.71	34.21	2.50	93.2%
2.632	15.185	53.96	0.792	42.74	39.97	2.77	93.5%
3.000	15.180	53.94	0.899	48.49	45.54	2.95	93.9%

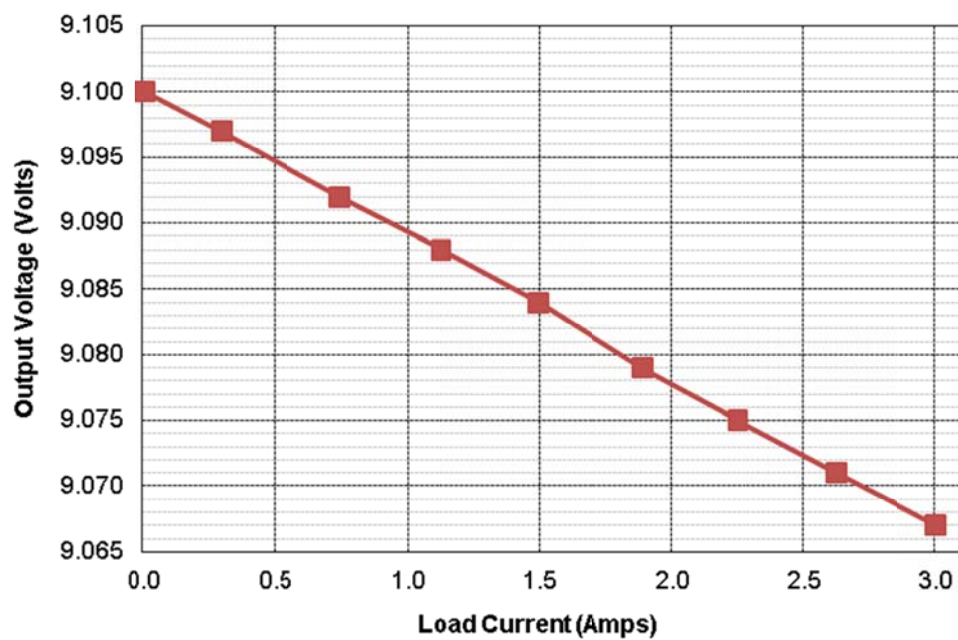
4 Regulation

Measured at TP4/TP5.

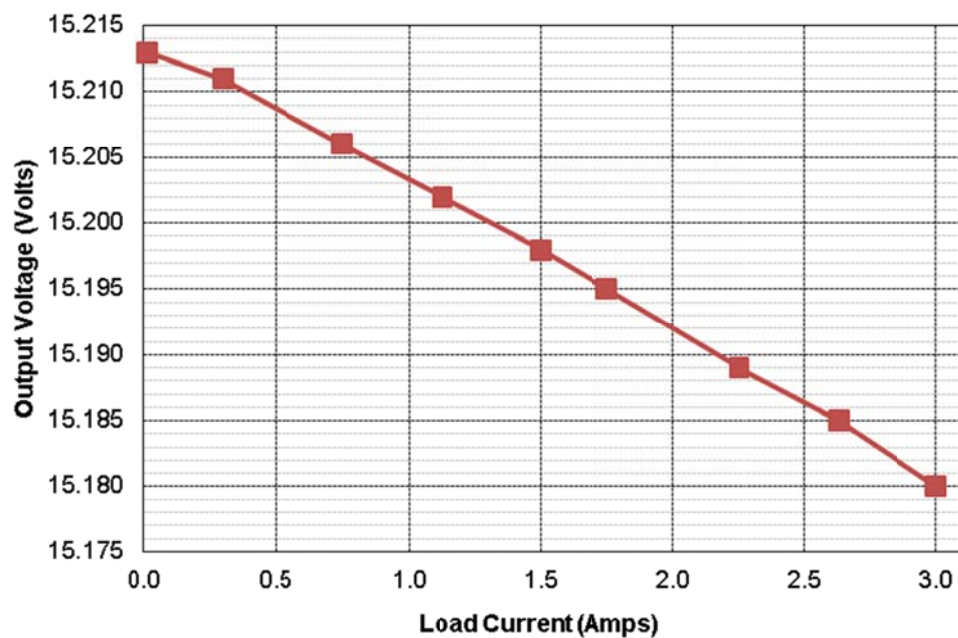
4.1 5V Output



4.2 9V Output

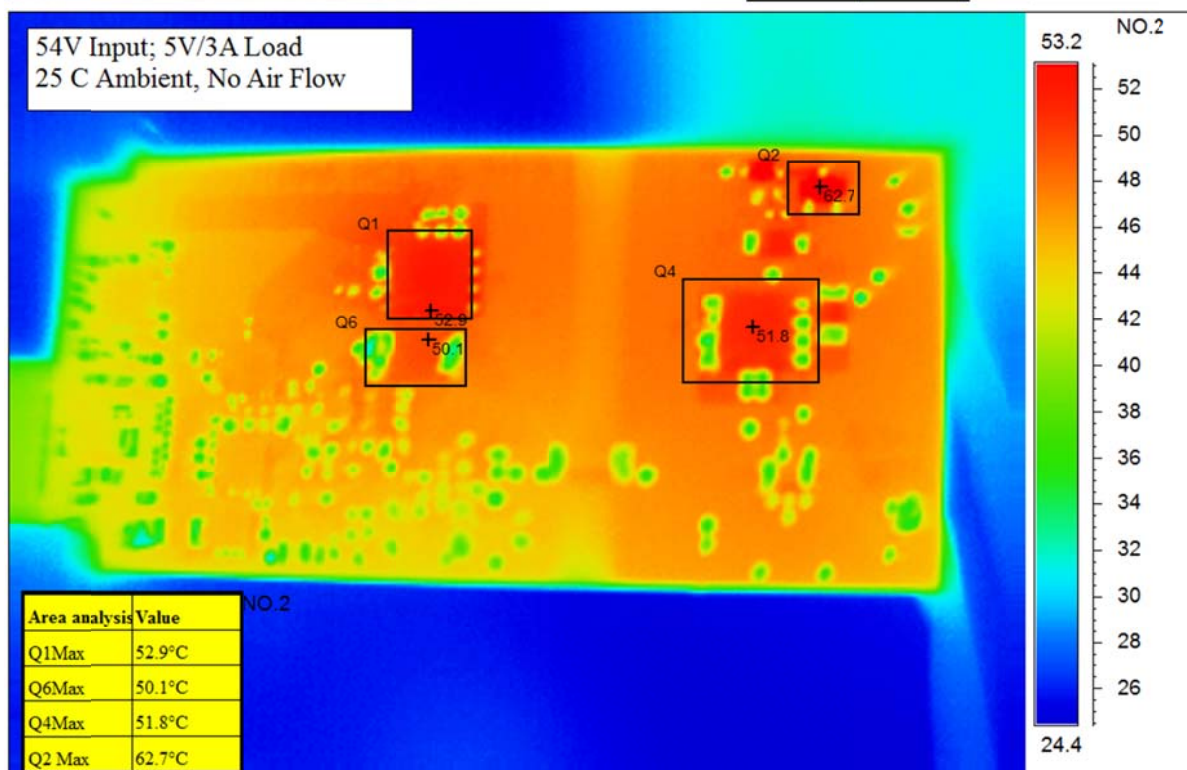
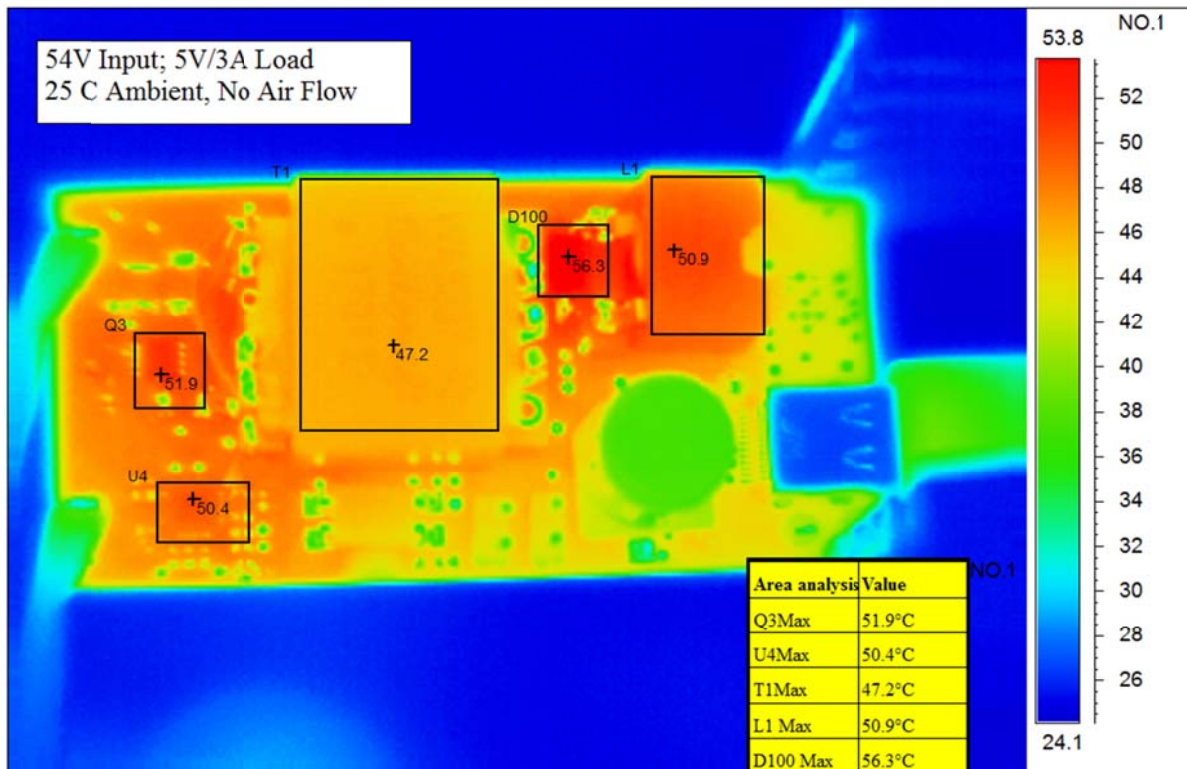


4.3 15V Output

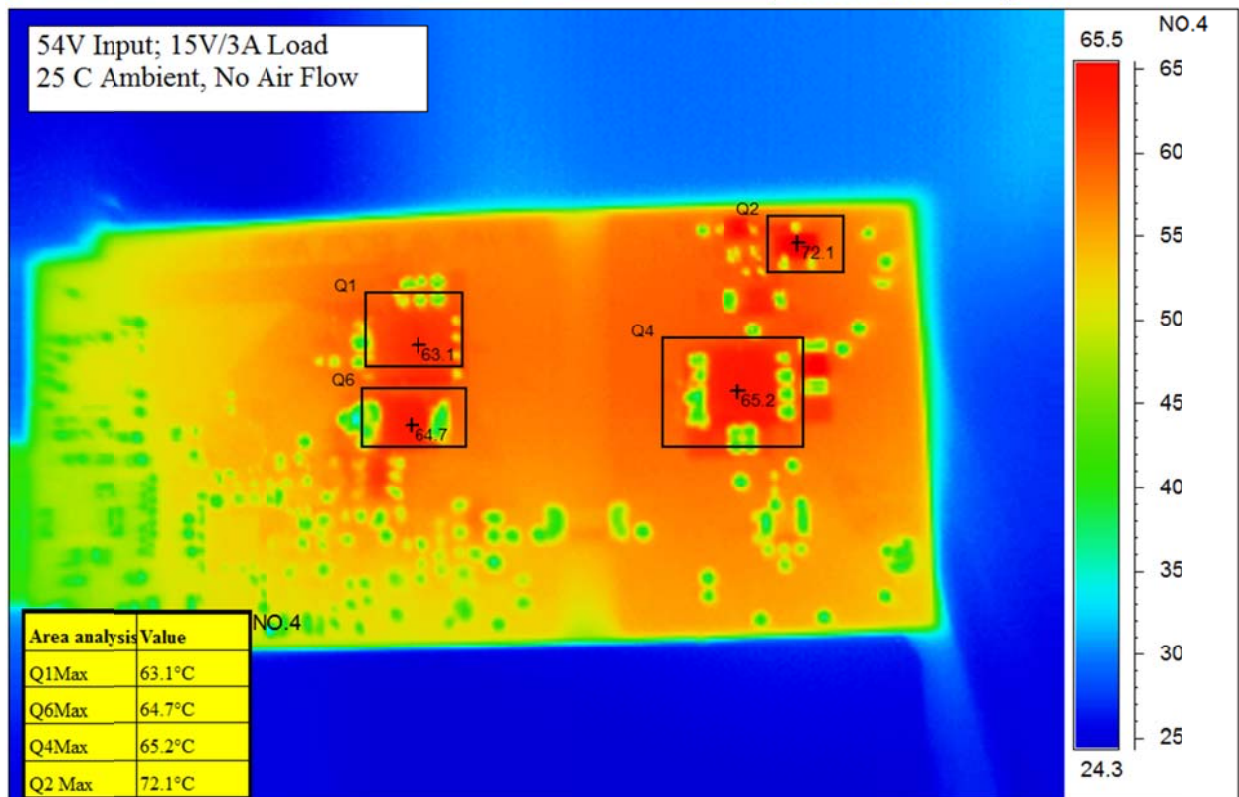
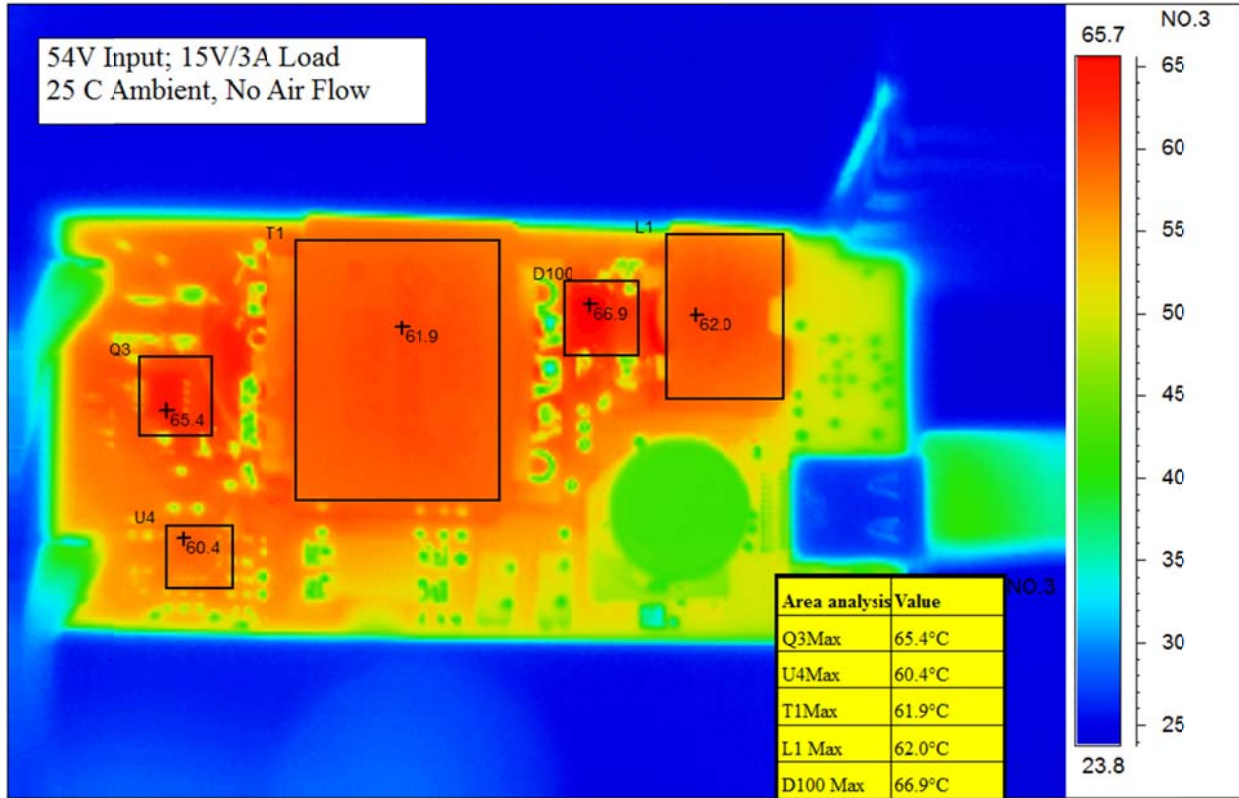


5 Thermal Images

5.1 5V Output

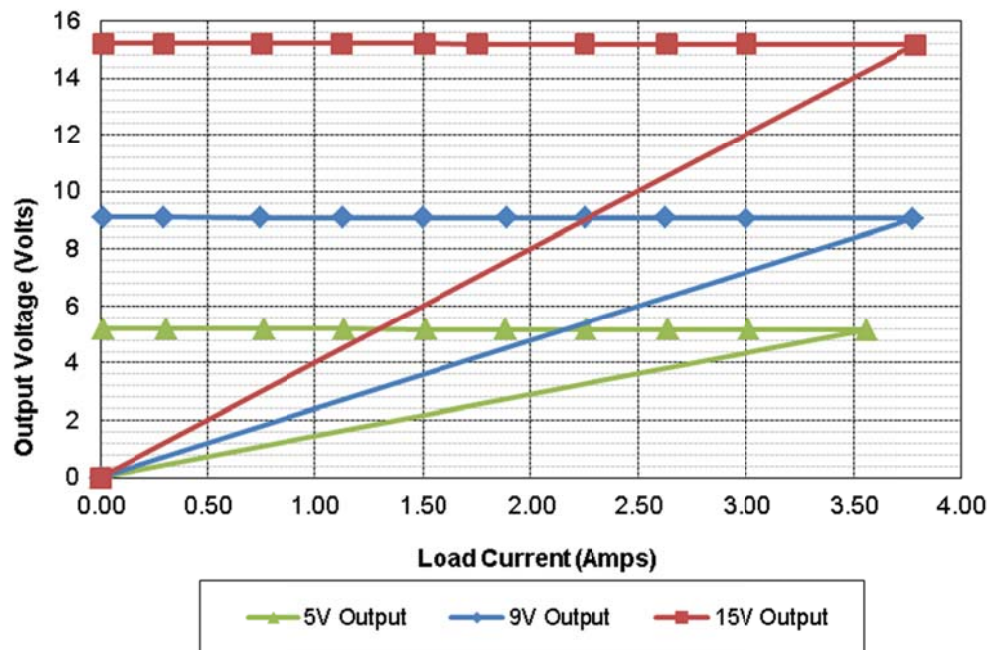


5.2 15V Output



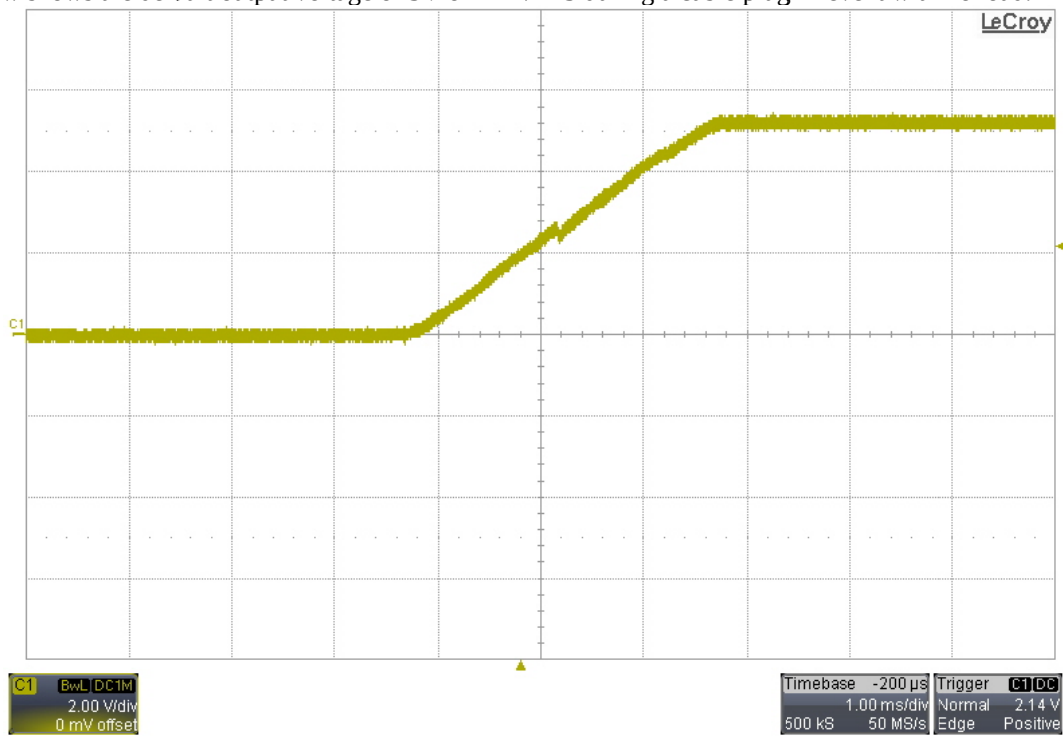
6 Current Limit

The plot below shows the output voltage on TP4/TP5 versus output current as the load is increased into current limit.



7 Startup

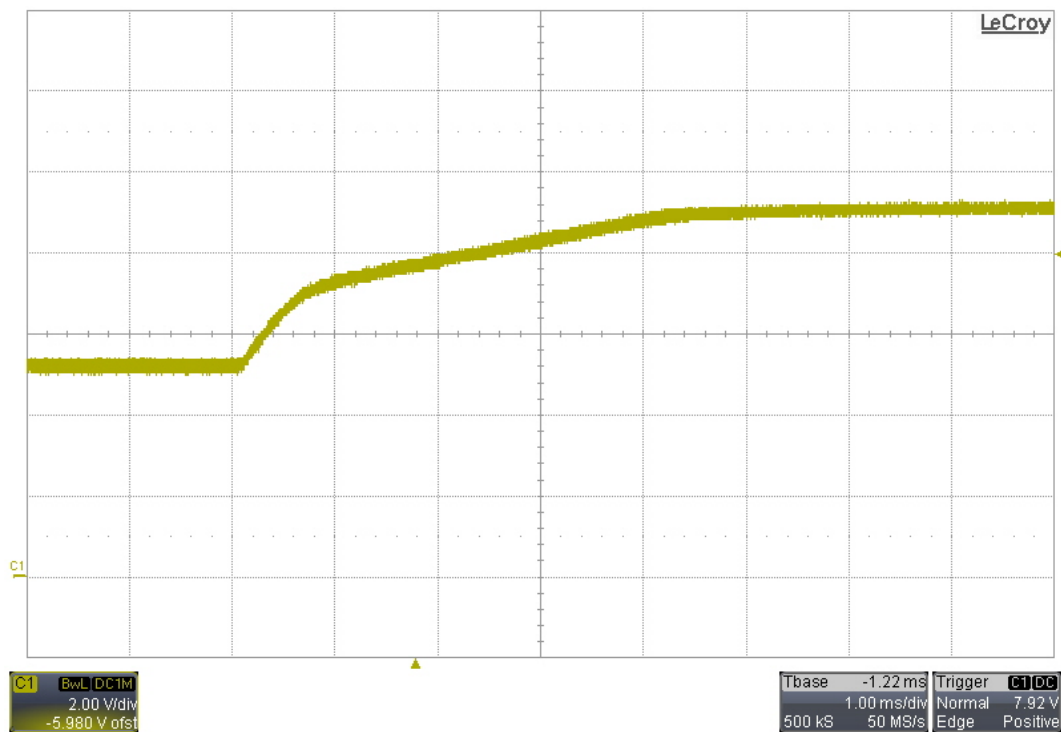
The image below shows the default output voltage of 5V on TP4/TP5 during a cable plug-in event with no load.



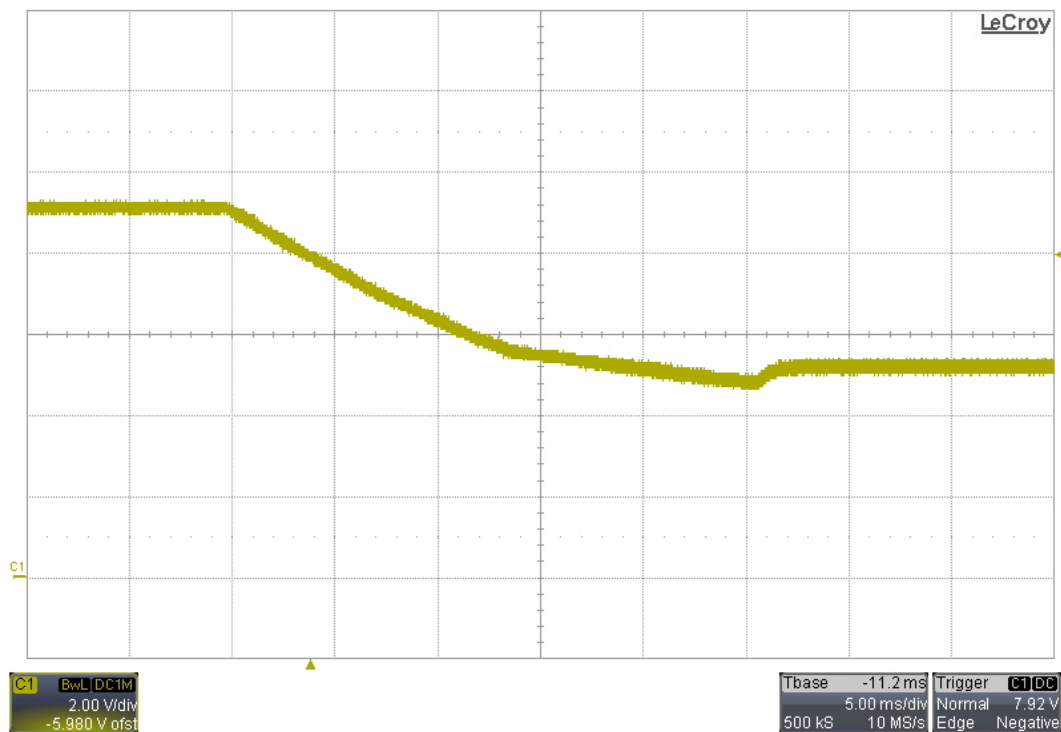
8 Output Voltage Transitions

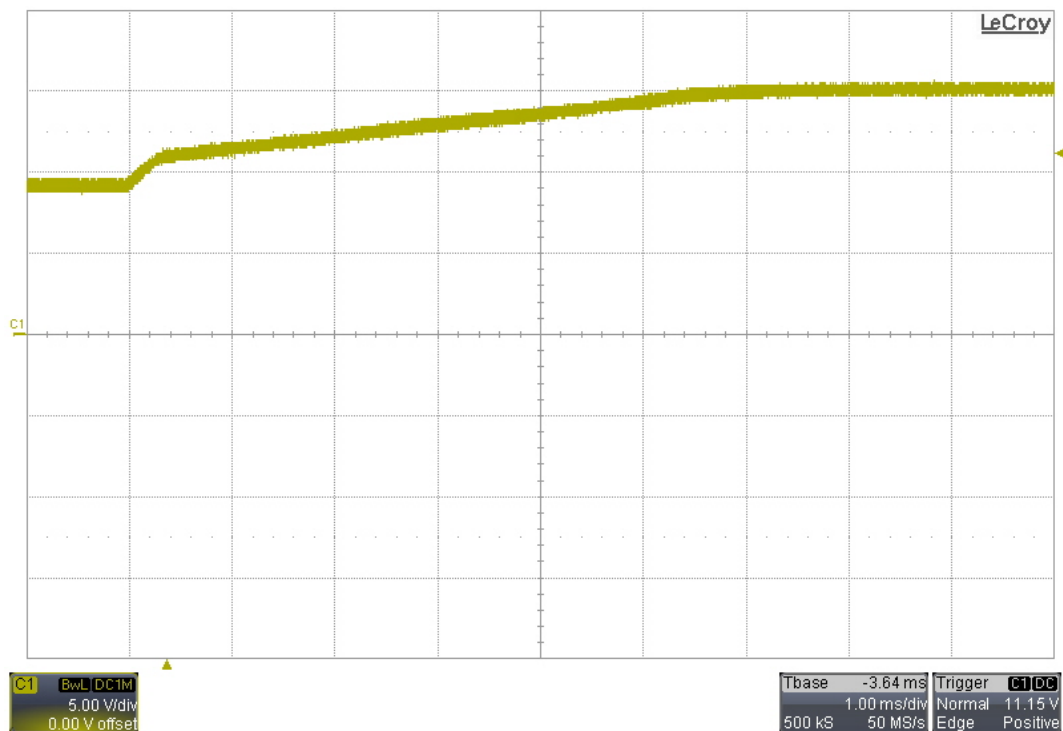
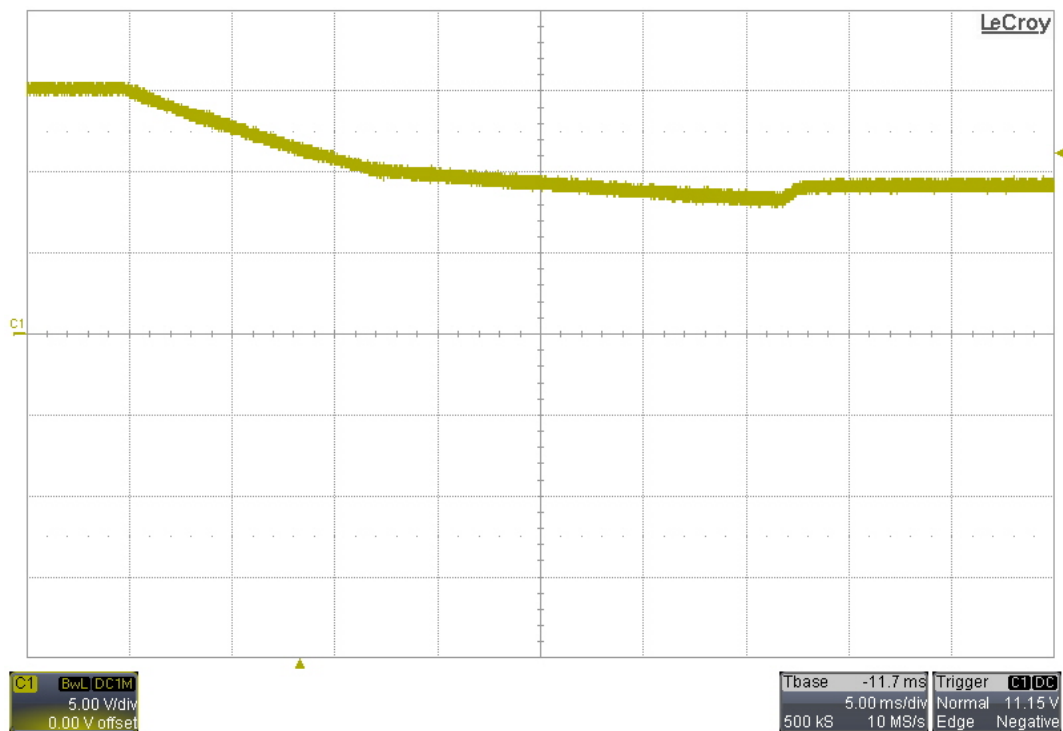
The following screenshots below demonstrate the transitions between 5V, 9V, and 15V. The input was 54V. No load is applied.

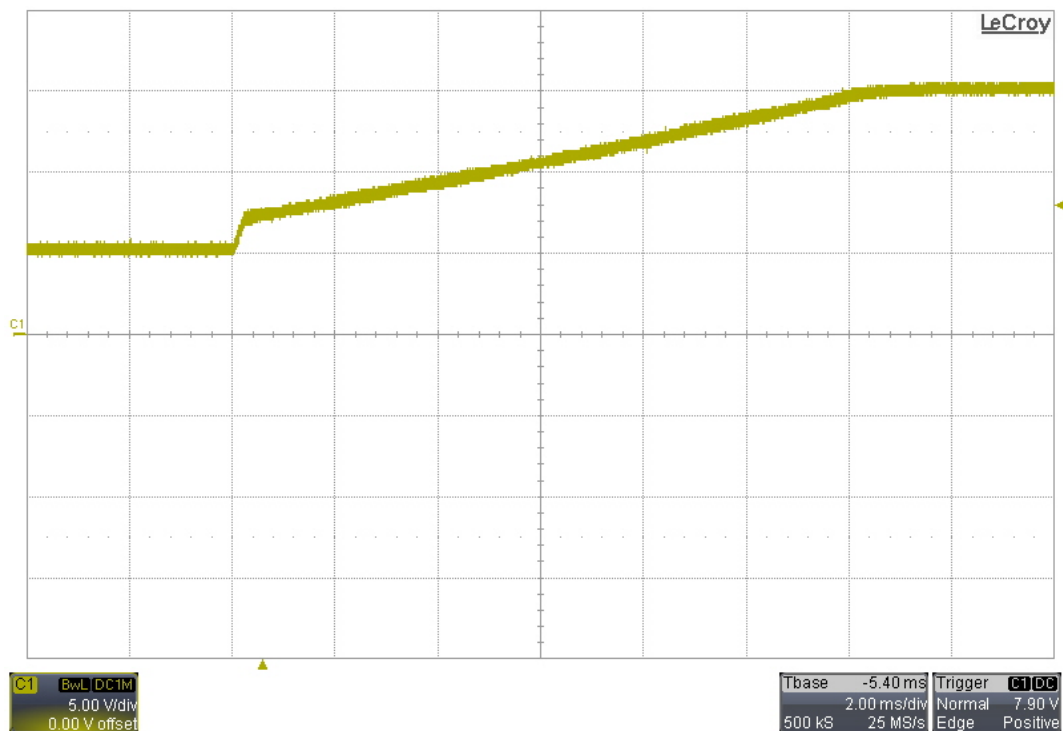
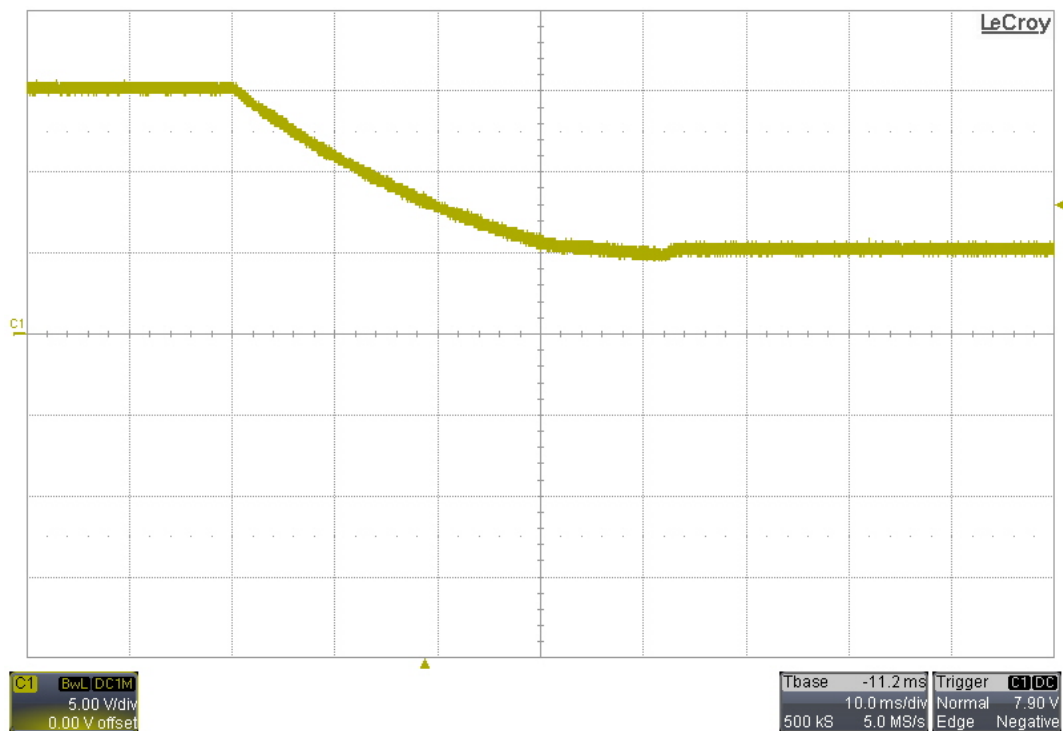
8.1 5V to 9V



8.2 9V to 5V

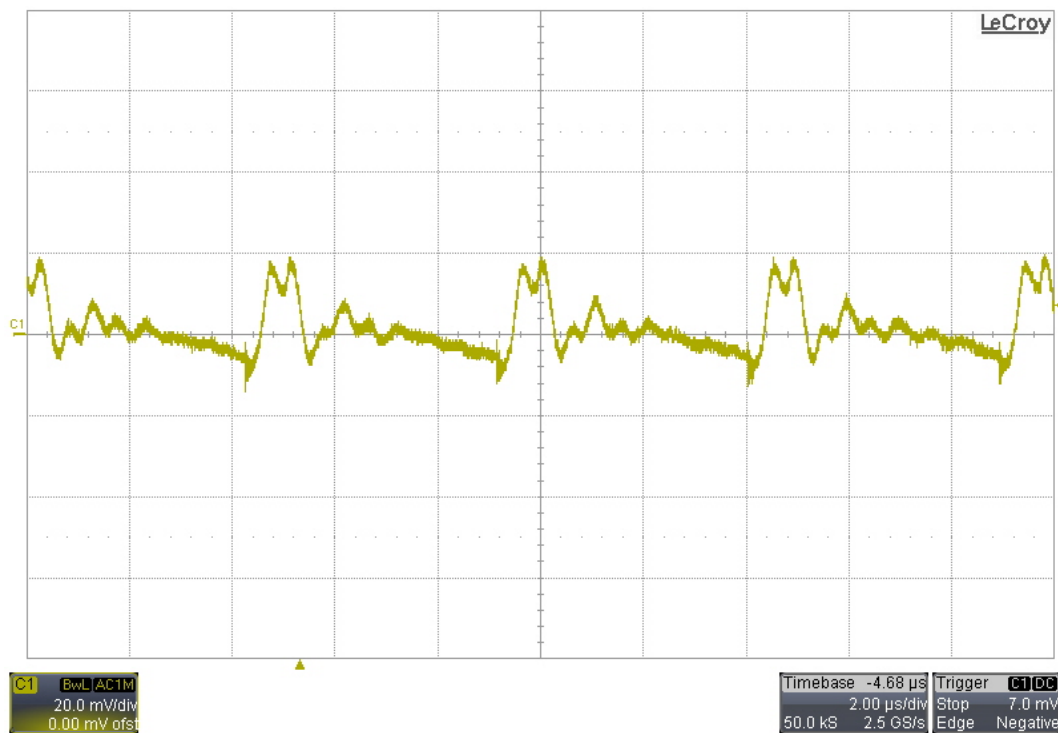


8.3 9V to 15V**8.4 15V to 9V**

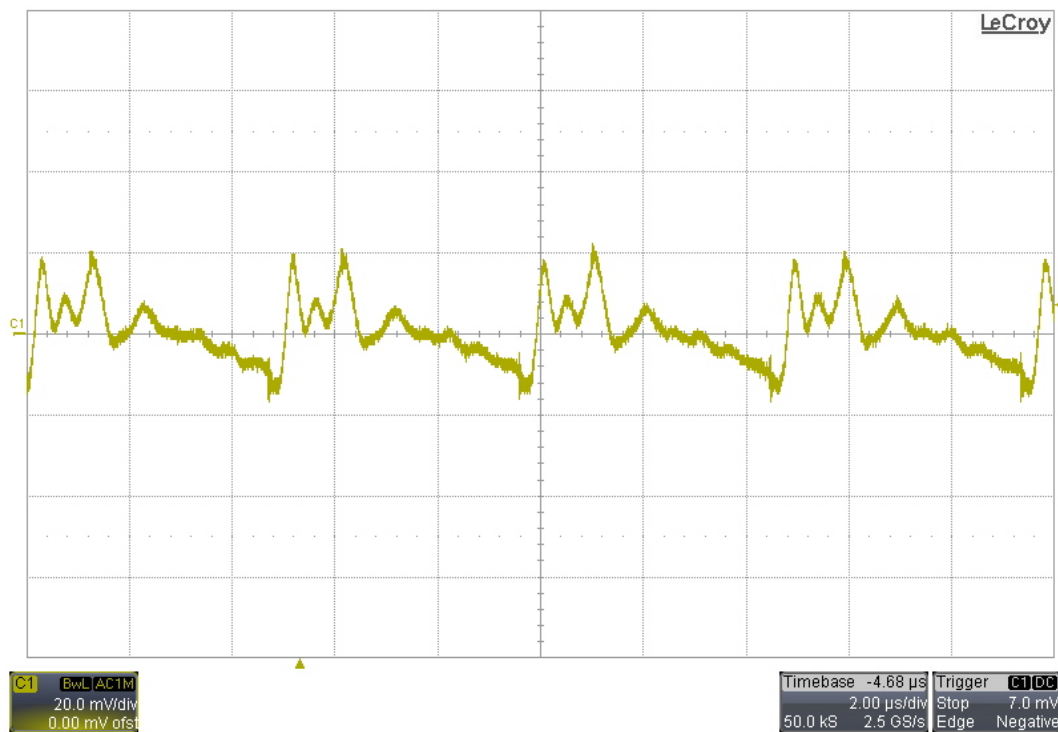
8.5 5V to 15V**8.6 15V to 5V**

9 Output Ripple Voltage

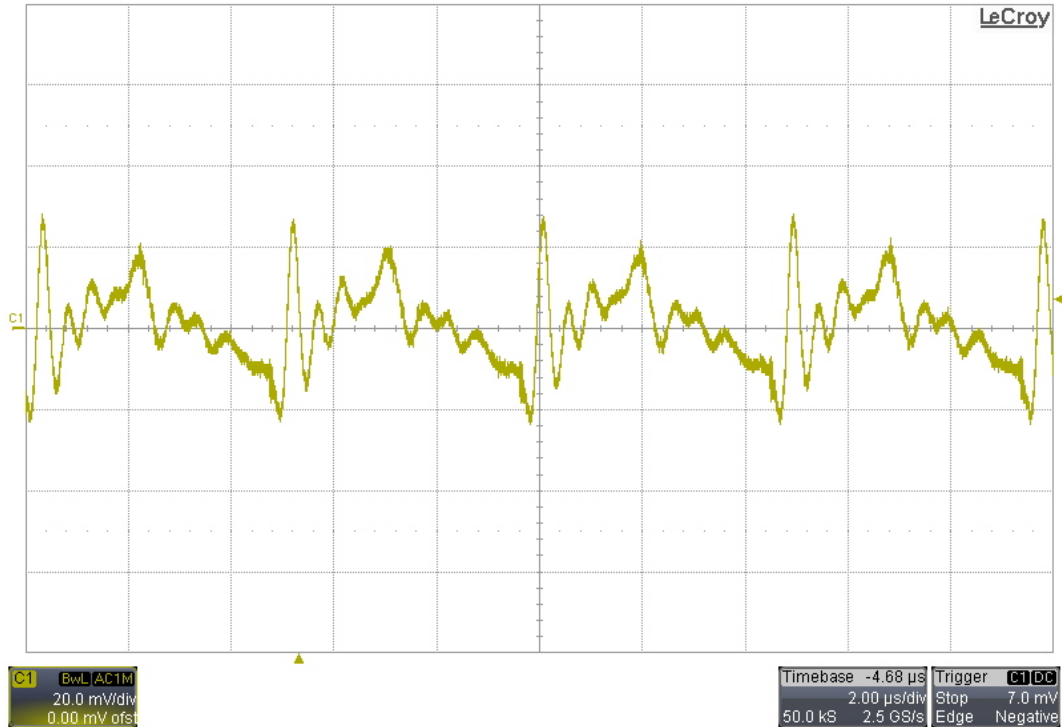
9.1 5V Output, 54V Input, 3A Load



9.2 9V Output, 54V Input, 3A Load

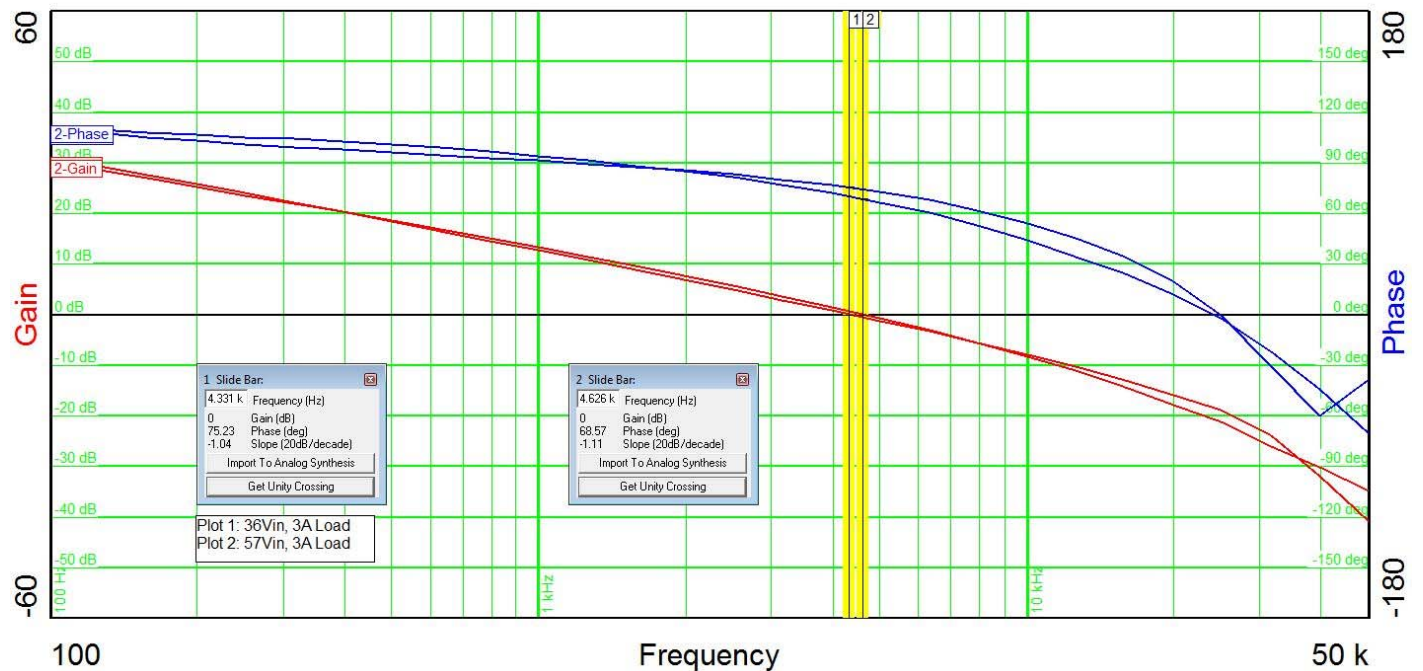


9.3 15V Output, 54V Input, 3A Load

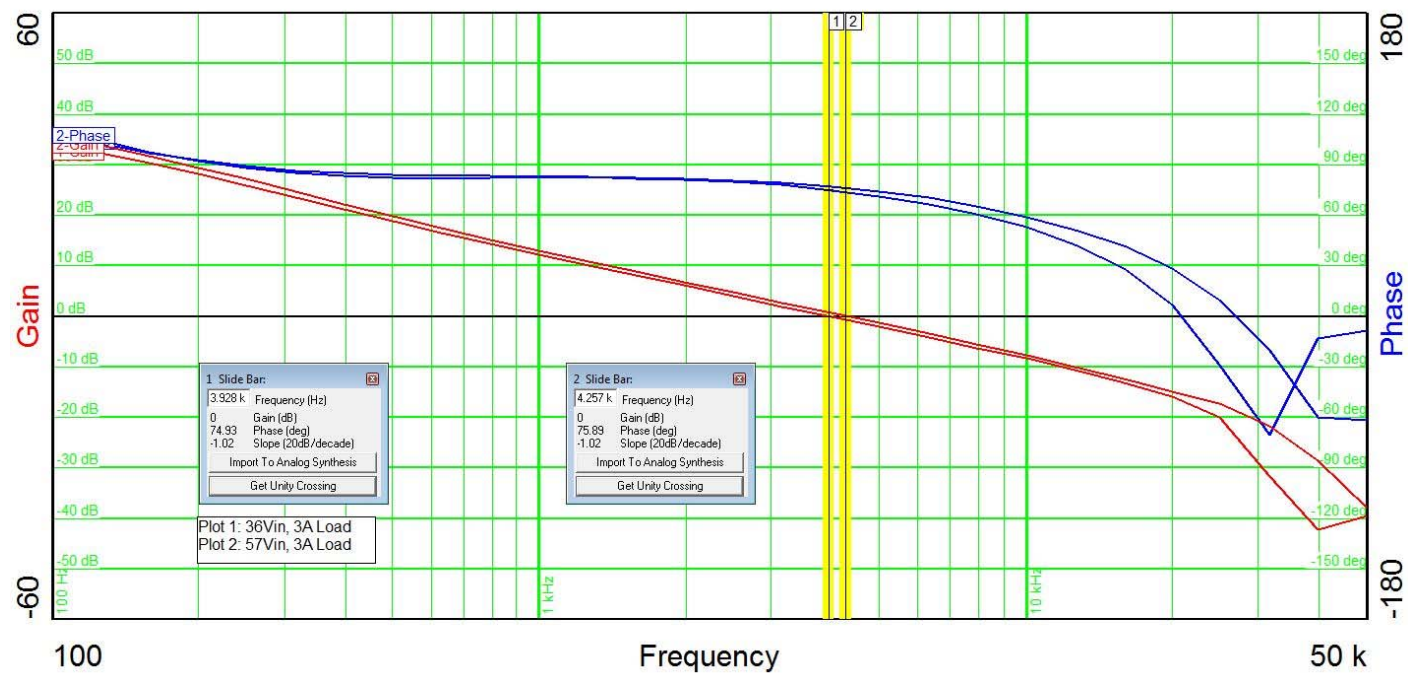


10 Loop Response

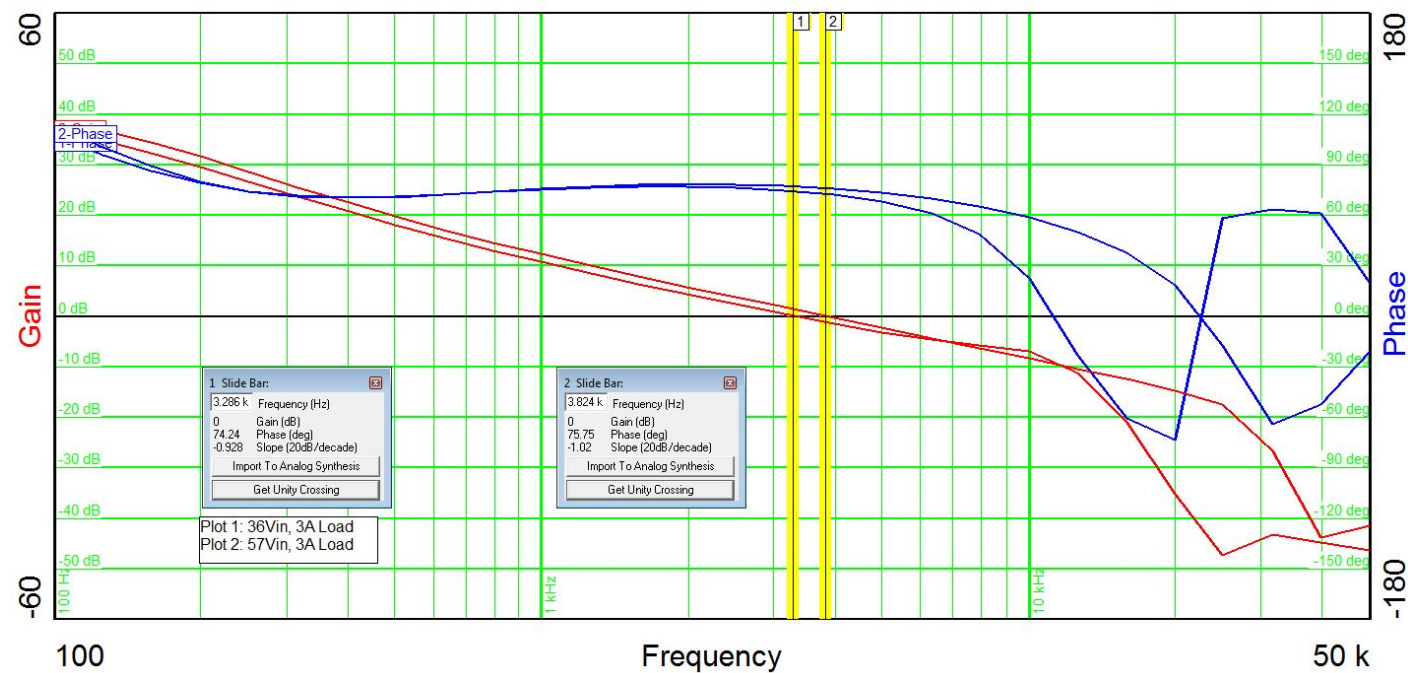
10.1 5V Output



10.2 9V Output

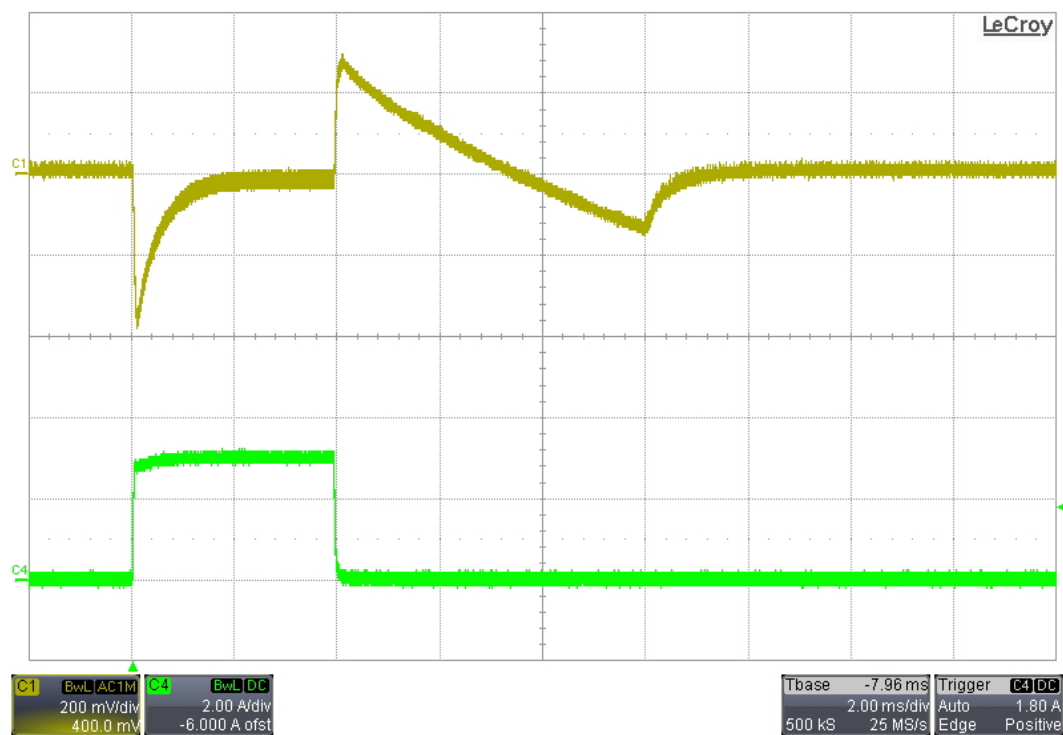


10.3 15V Output

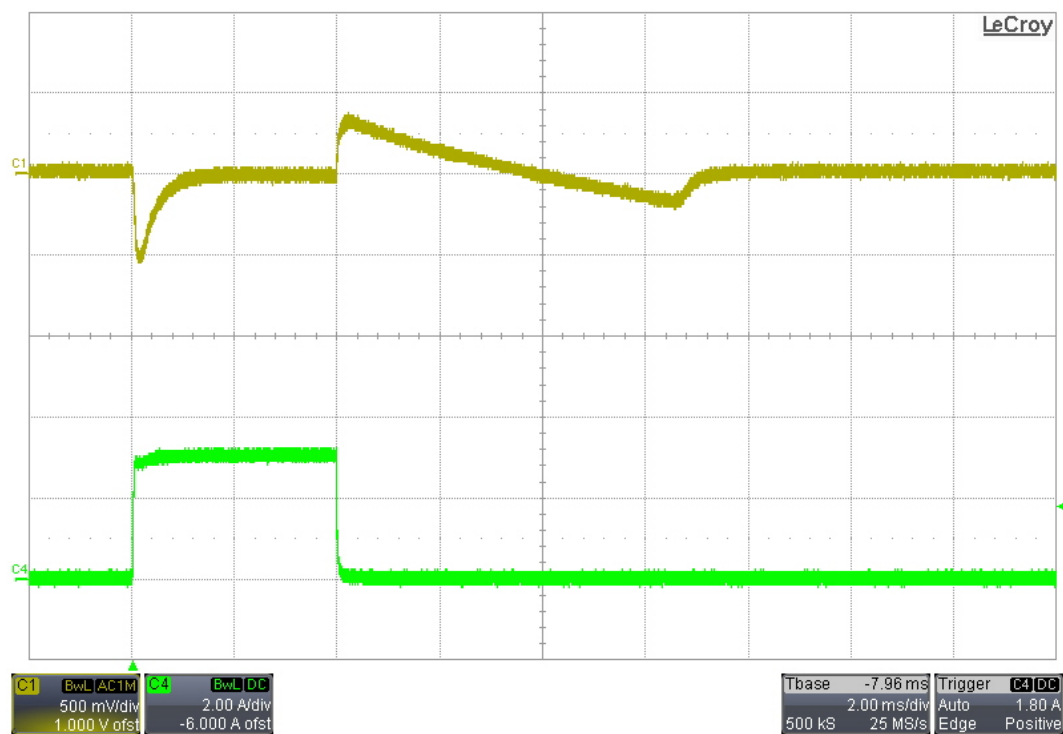


11 Load Transients

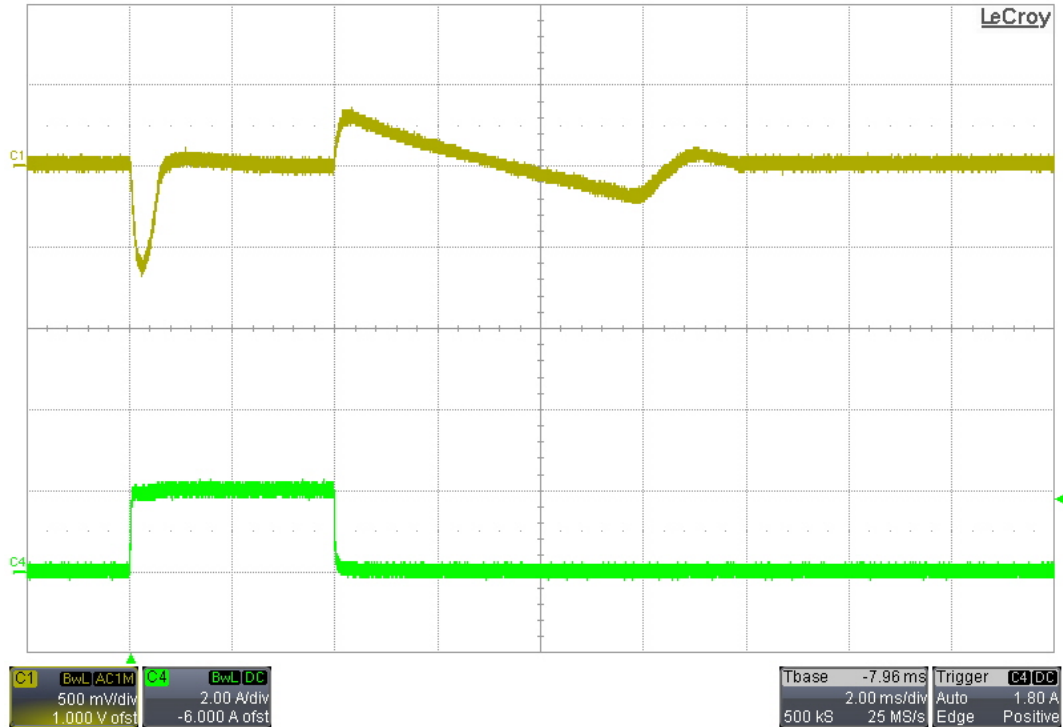
11.1 5V Output, 54V Input, 0A to 3A



11.2 9V Output, 54V Input, 0A to 3A

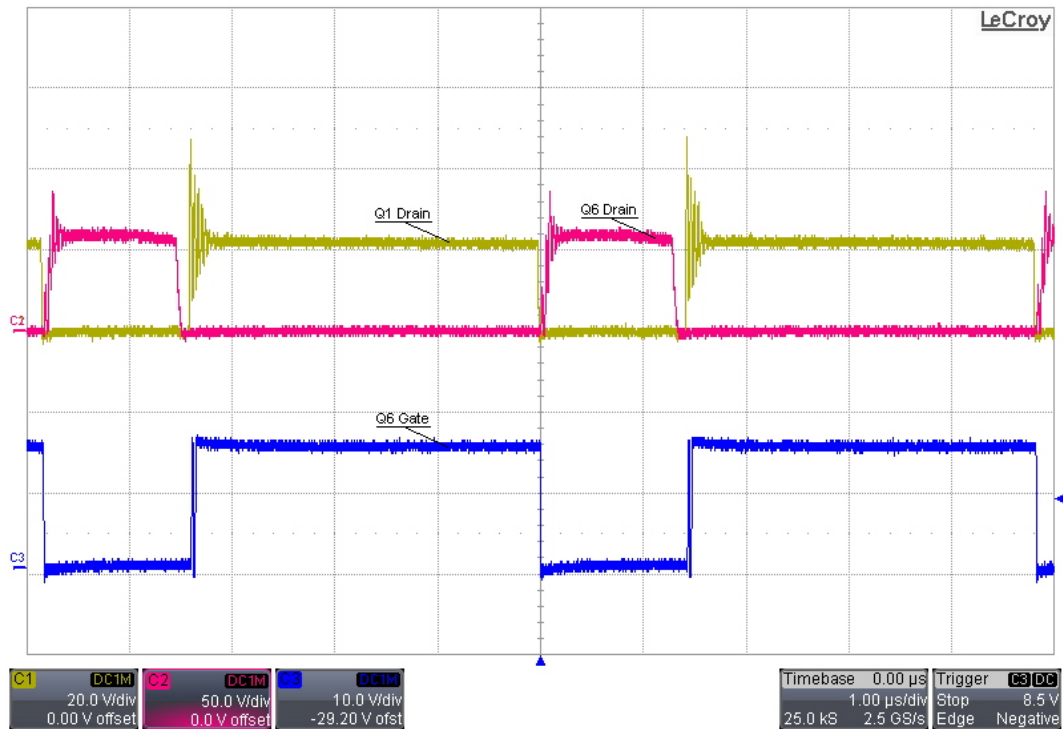


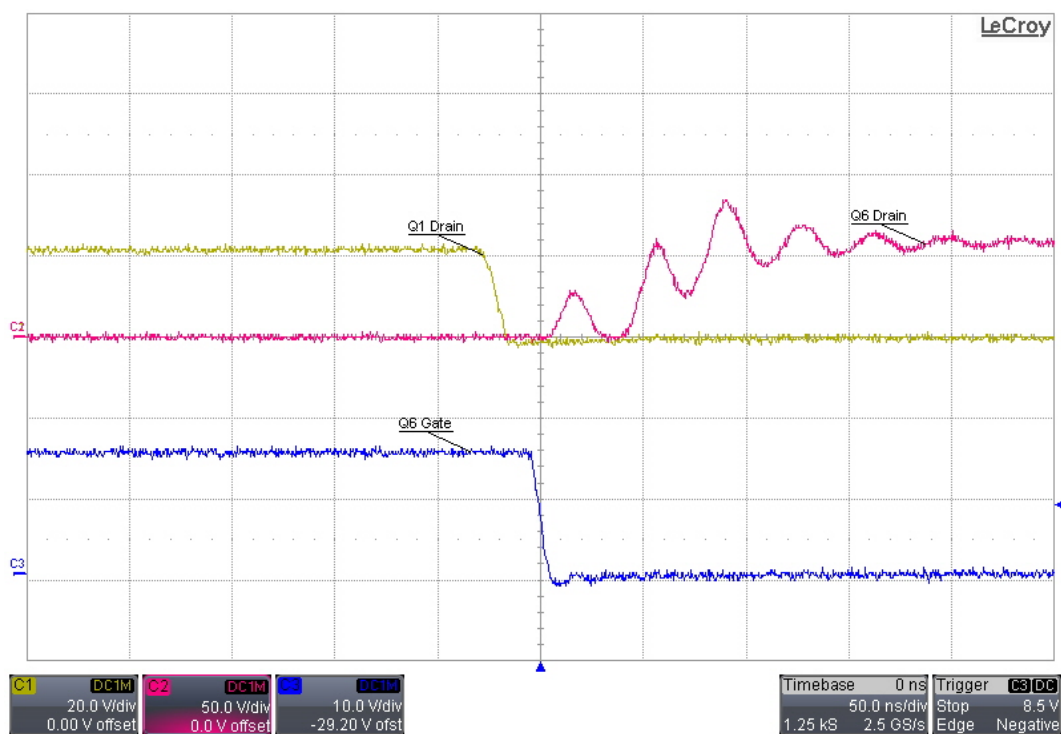
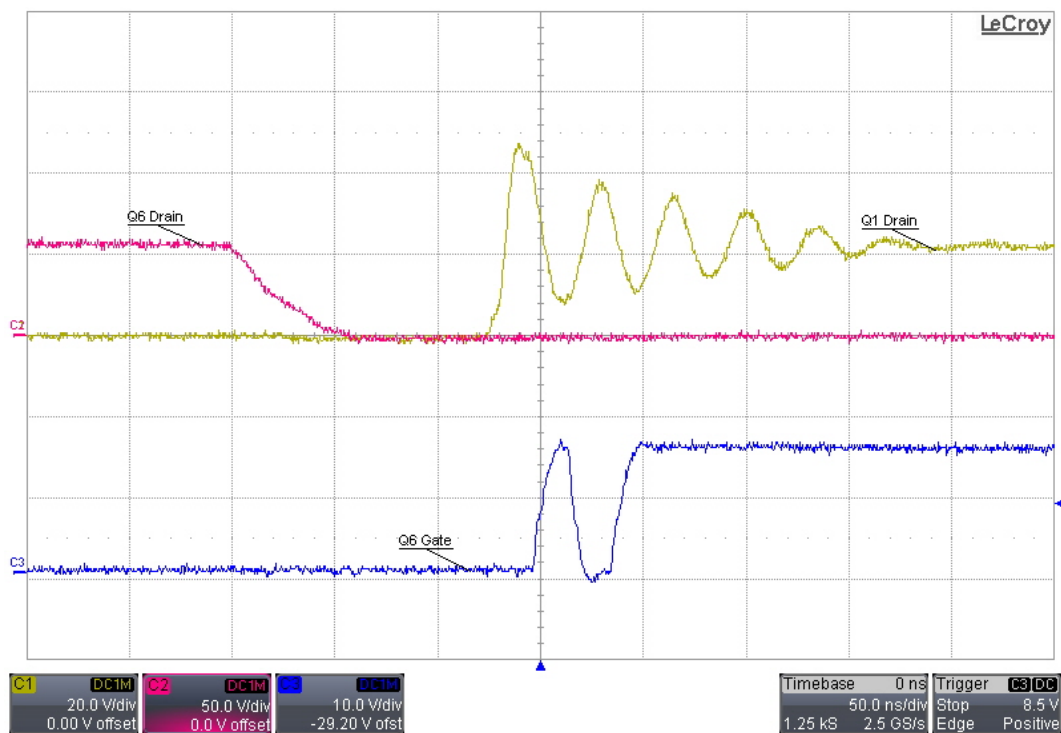
11.3 15V Output, 54V Input, 0A to 2A

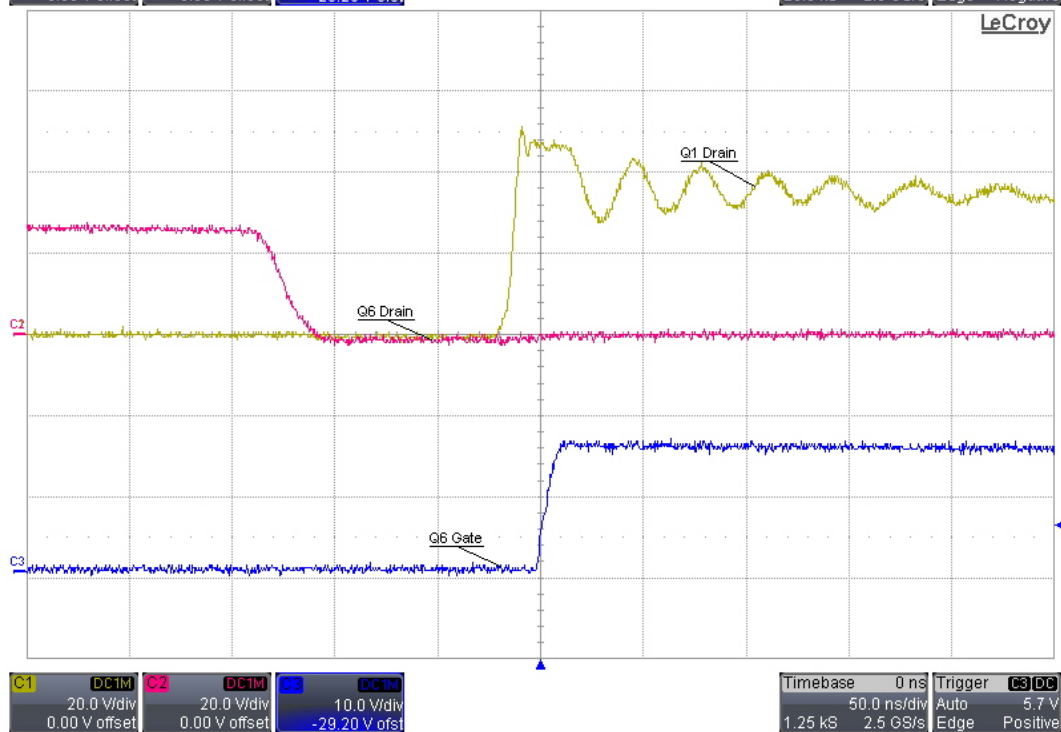
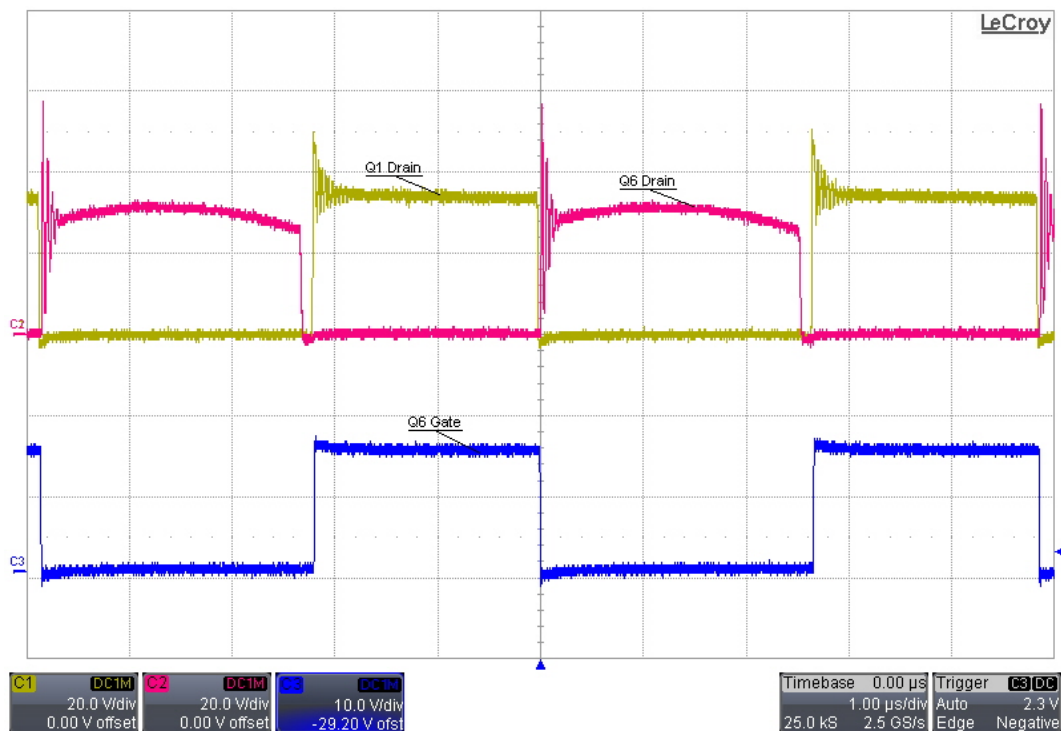


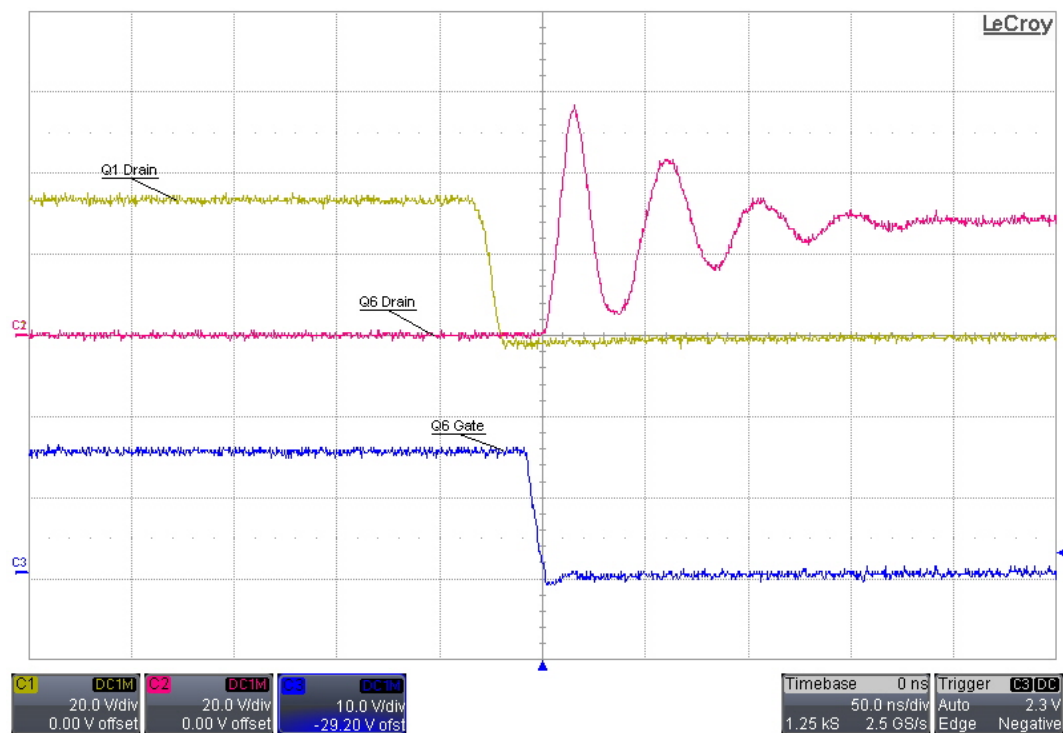
12 Switching Waveforms

12.1 Secondary – 36V Input, 15V Output, 3A Load

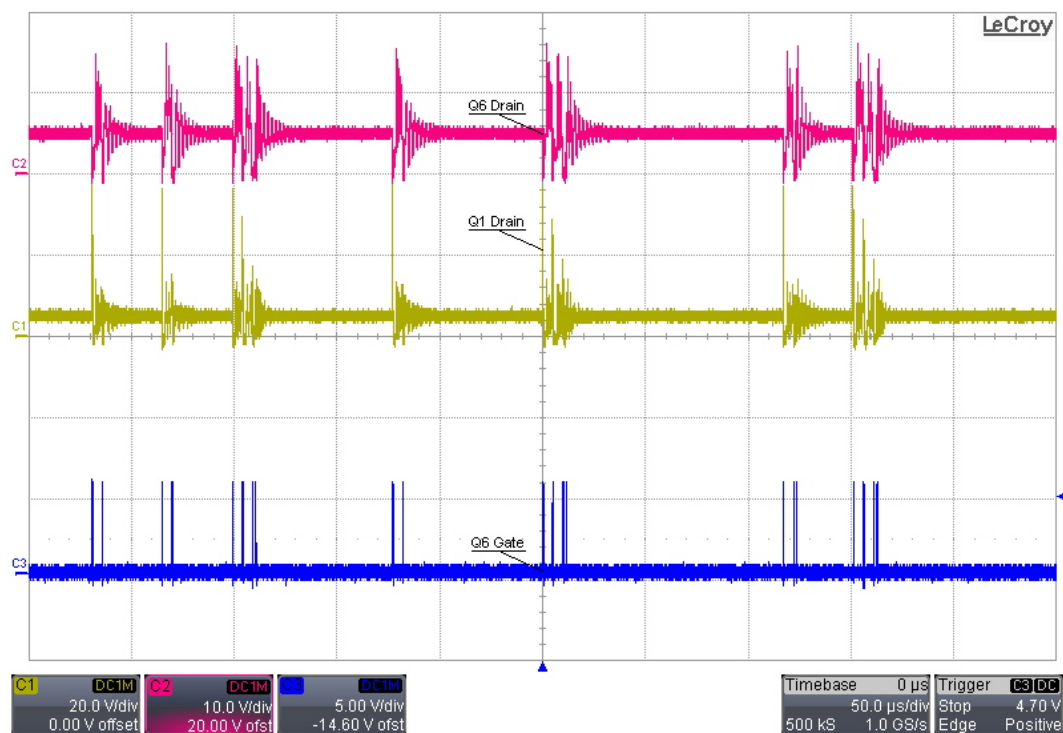




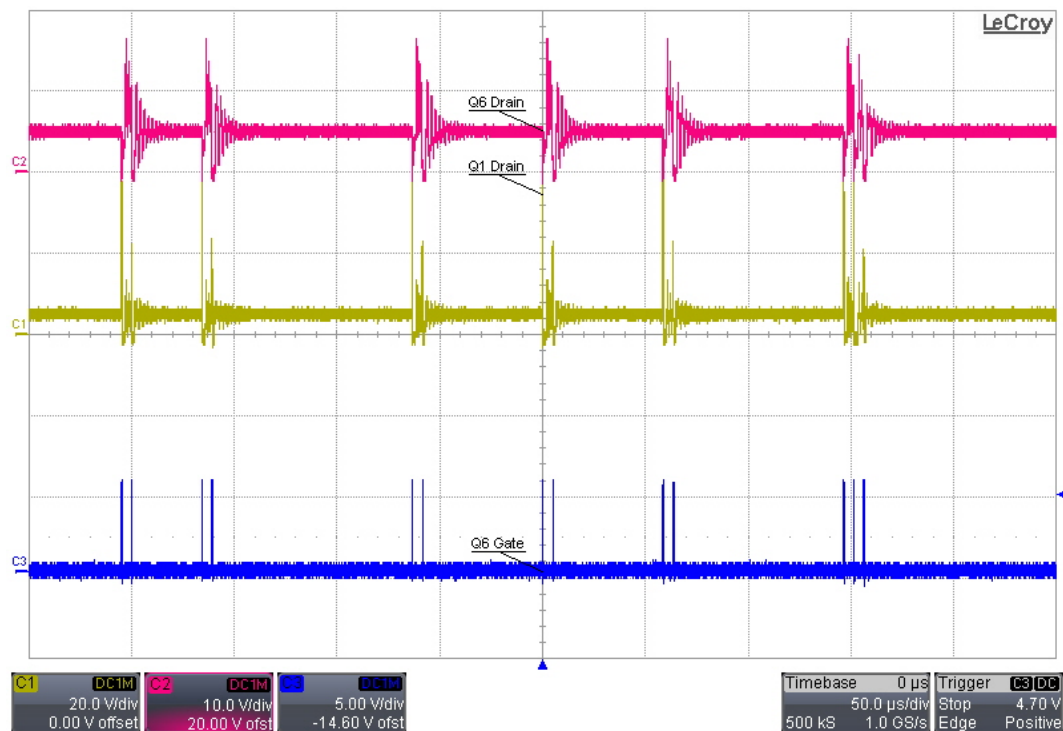
12.2 Secondary – 57V Input, 15V Output, 3A Load



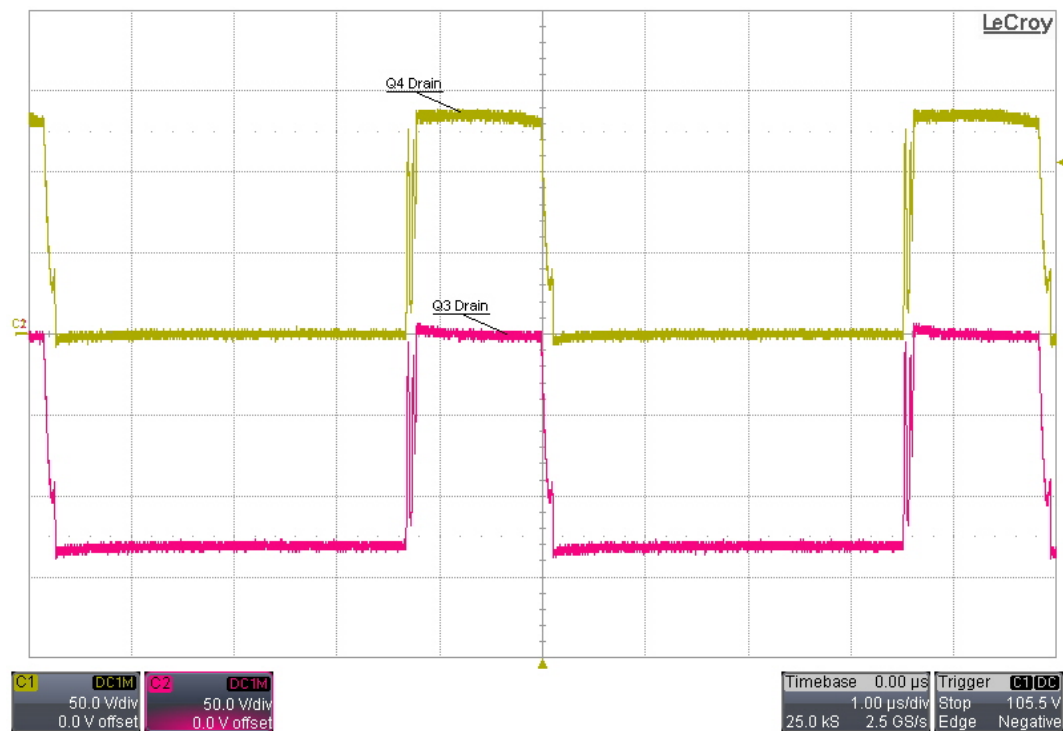
12.3 Secondary – 36V Input, Cable Unplugged



12.4 Secondary – 57V Input, Cable Unplugged



12.5 Primary – 36V Input, 15V Output, 3A Load



12.6 Primary – 57V Input, 15V Output, 3A Load