Test Data
For PMP20371
8/19/2016

Table of Contents

1. Design Specifications

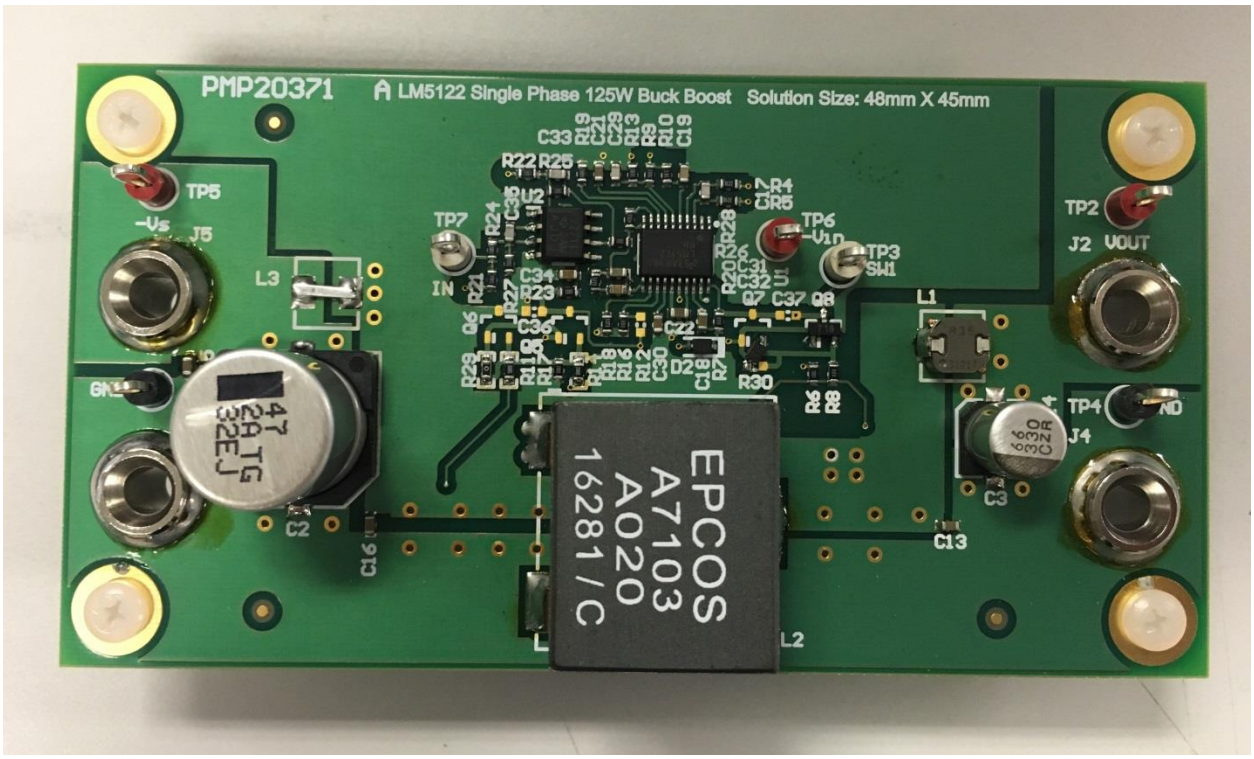
Vin Minimum	**-35VDC**
Vin Maximum	**-60VDC**
Vout	**+14.5VDC @ 8.5A**
Nominal Switching Frequency	**≈ 150KHz**

2. Circuit Description

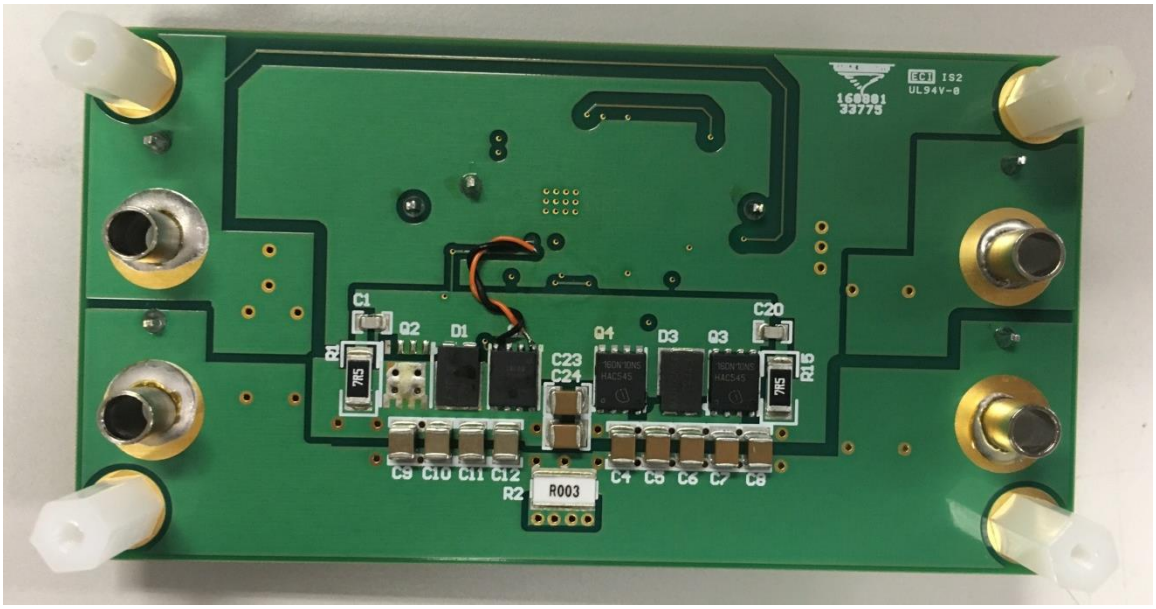
PMP20371 is a synchronous buck boost design utilizing the LM5122 for telecom applications. This design has a minimum operating input voltage of -35V and a maximum input voltage of -60V. Switching frequency is set to 150kHz. The design is built on PMP20371 PCB, 4 layer board with 2oz copper on each layer.

3. PMP20371 Board Photos

Board Dimensions: 101.3mm x 53.2mm



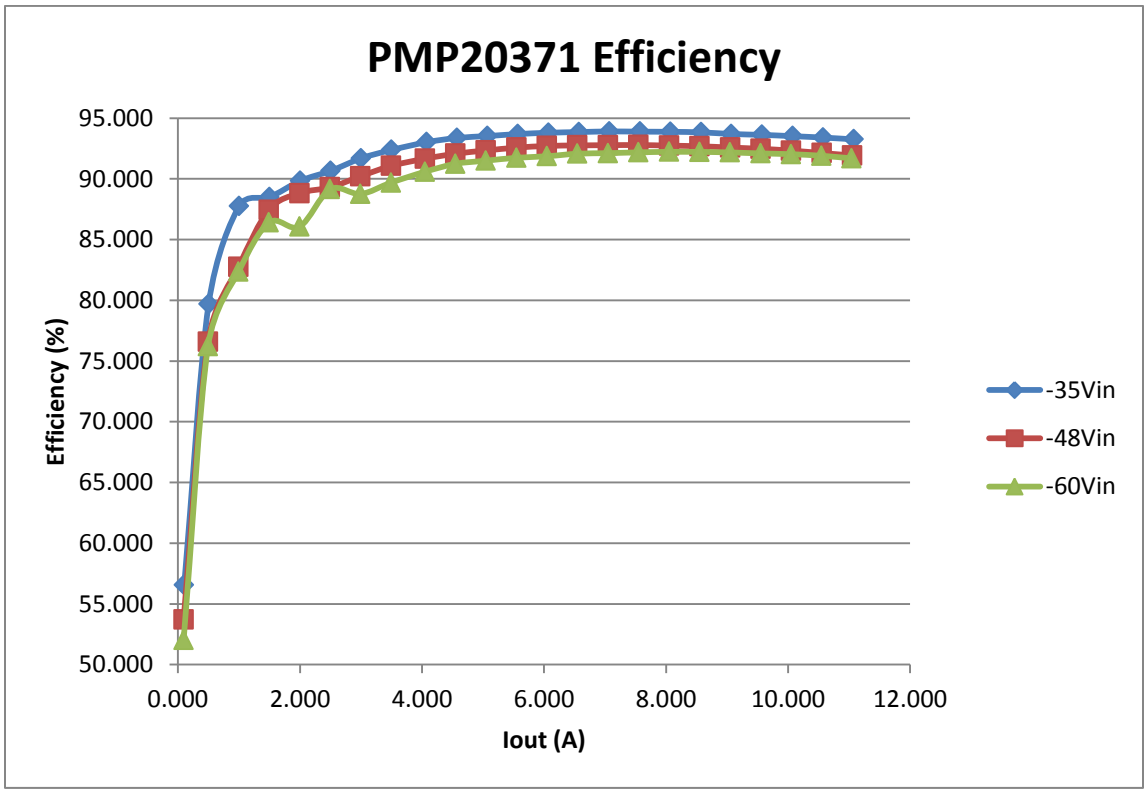
Board Photo (Top)



Board Photo (Bottom)

4. Efficiency

4.1 Efficiency Chart

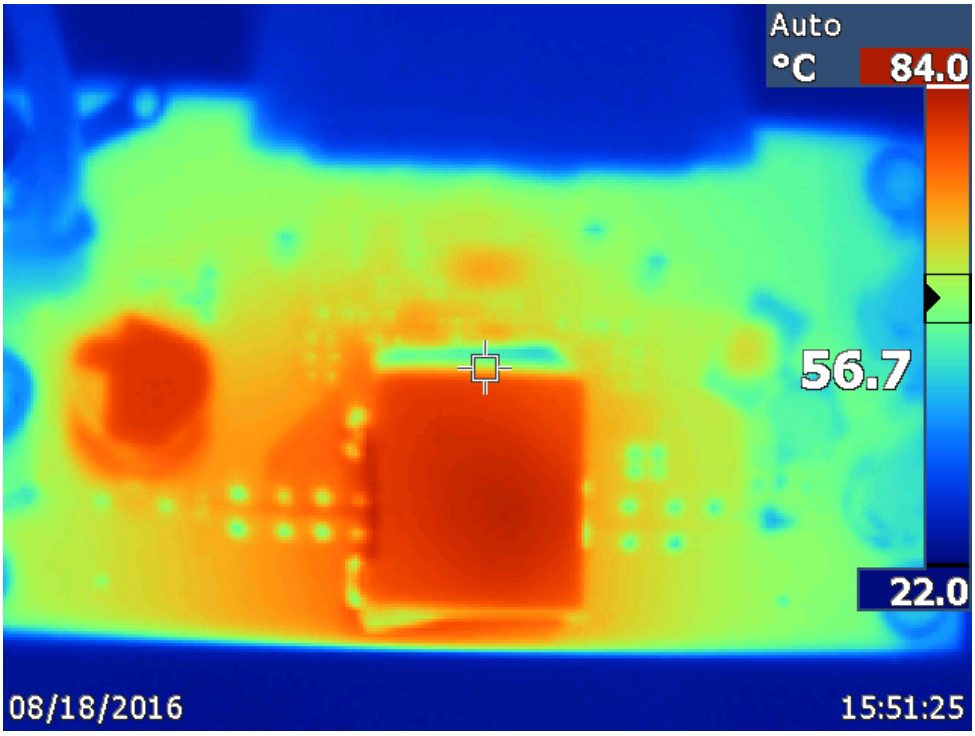


4.2 Efficiency Data

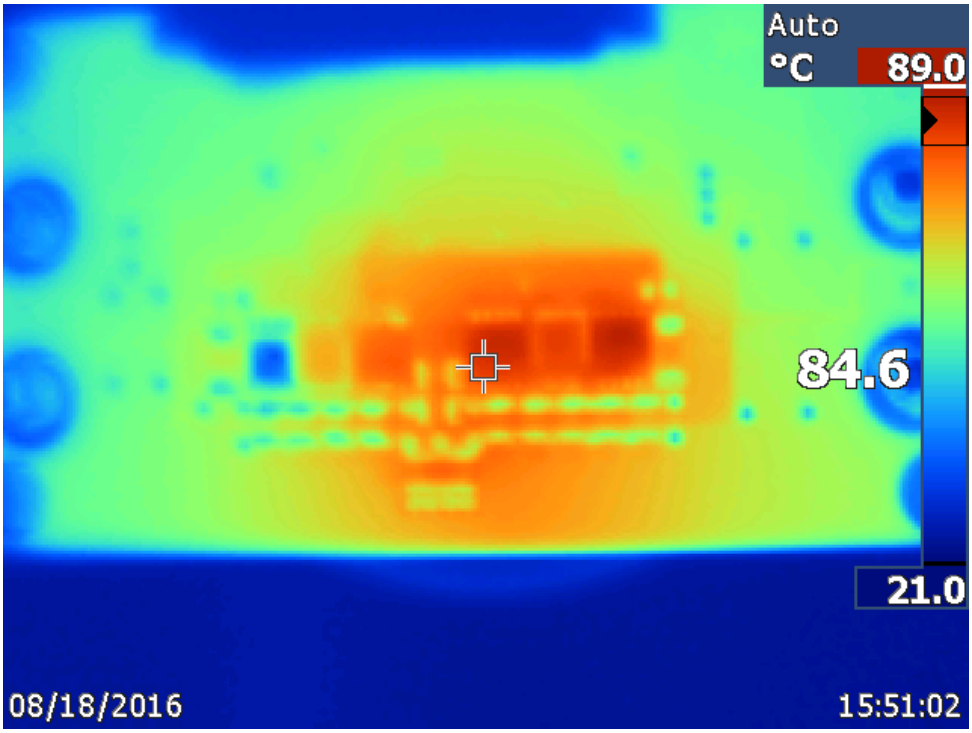
Vin(V)	Iin(A)	Vout(V)	Iout(A)	Pin(W)	Pout(W)	Losses(W)	Efficiency
35.009	0.007	14.562	0.000	0.245	0.000	0.245	0.000
35.009	0.075	14.562	0.102	2.626	1.485	1.140	56.568
35.009	0.262	14.562	0.502	9.172	7.310	1.862	79.699
35.008	0.475	14.562	1.002	16.629	14.591	2.038	87.746
35.008	0.706	14.562	1.502	24.716	21.872	2.843	88.495
35.008	0.927	14.562	2.002	32.452	29.153	3.299	89.834
35.007	1.148	14.563	2.502	40.188	36.435	3.753	90.662
35.007	1.362	14.563	3.002	47.679	43.719	3.961	91.693
35.006	1.576	14.562	3.500	55.170	50.967	4.203	92.383
35.006	1.822	14.562	4.074	63.781	59.327	4.454	93.016
35.006	2.037	14.562	4.572	71.307	66.578	4.729	93.368
35.005	2.256	14.562	5.072	78.972	73.859	5.113	93.525
35.006	2.474	14.562	5.572	86.604	81.141	5.463	93.692
35.005	2.693	14.562	6.072	94.269	88.423	5.846	93.799
35.005	2.913	14.562	6.572	101.970	95.704	6.266	93.855
35.005	3.133	14.563	7.072	109.671	102.989	6.682	93.907
35.005	3.356	14.563	7.574	117.478	110.296	7.181	93.887
35.005	3.578	14.563	8.074	125.249	117.579	7.670	93.876
35.006	3.802	14.562	8.576	133.093	124.884	8.209	93.832
35.007	4.027	14.563	9.070	140.973	132.084	8.888	93.695
35.007	4.253	14.563	9.572	148.887	139.394	9.493	93.624
35.008	4.481	14.563	10.074	156.873	146.704	10.169	93.518
35.010	4.710	14.563	10.576	164.897	154.016	10.881	93.401
35.012	4.940	14.562	11.076	172.957	161.292	11.665	93.255
48.015	0.007	14.575	0.000	0.336	0.000	0.336	0.000
48.015	0.058	14.577	0.102	2.785	1.487	1.298	53.389
48.015	0.191	14.576	0.502	9.171	7.317	1.854	79.787
48.015	0.364	14.577	1.002	17.477	14.606	2.871	83.570
48.015	0.539	14.576	1.504	25.880	21.923	3.957	84.709
48.014	0.678	14.577	2.002	32.553	29.182	3.371	89.644
48.013	0.858	14.576	2.504	41.196	36.499	4.696	88.600
48.013	1.017	14.576	3.004	48.829	43.788	5.042	89.675
48.013	1.174	14.576	3.504	56.367	51.075	5.292	90.612
48.012	1.352	14.576	4.070	64.913	59.326	5.587	91.394
48.012	1.509	14.576	4.570	72.450	66.613	5.838	91.942
48.011	1.667	14.576	5.070	80.035	73.902	6.133	92.337
48.011	1.826	14.576	5.570	87.668	81.186	6.481	92.607

48.011	1.985	14.576	6.070	95.301	88.476	6.825	92.838
48.010	2.146	14.576	6.570	103.030	95.765	7.265	92.949
48.010	2.306	14.576	7.070	110.712	103.054	7.658	93.083
48.010	2.468	14.577	7.572	118.488	110.374	8.115	93.152
48.010	2.629	14.576	8.072	126.218	117.657	8.561	93.217
48.010	2.792	14.575	8.572	134.043	124.940	9.103	93.209
48.010	2.954	14.576	9.072	141.821	132.229	9.592	93.237
48.010	3.119	14.576	9.574	149.744	139.546	10.198	93.190
48.010	3.282	14.576	10.074	157.569	146.840	10.729	93.191
48.011	3.448	14.576	10.574	165.541	154.122	11.419	93.102
48.011	3.614	14.576	11.074	173.513	161.414	12.100	93.027
60.015	0.008	14.596	0.000	0.480	0.000	0.480	0.000
60.015	0.050	14.592	0.102	3.001	1.488	1.512	49.602
60.015	0.165	14.593	0.500	9.902	7.297	2.606	73.685
60.014	0.312	14.595	1.002	18.725	14.624	4.100	78.102
60.014	0.437	14.594	1.502	26.226	21.921	4.306	83.582
60.014	0.566	14.595	2.002	33.968	29.219	4.748	86.021
60.013	0.691	14.594	2.502	41.469	36.515	4.954	88.054
60.013	0.831	14.595	3.002	49.871	43.814	6.057	87.855
60.012	0.957	14.593	3.502	57.432	51.106	6.326	88.985
60.012	1.099	14.594	4.070	65.953	59.397	6.556	90.059
60.011	1.225	14.593	4.568	73.514	66.662	6.852	90.680
60.011	1.352	14.593	5.068	81.135	73.959	7.175	91.156
60.011	1.480	14.593	5.568	88.816	81.256	7.559	91.489
60.010	1.607	14.594	6.070	96.436	88.584	7.852	91.857
60.009	1.735	14.594	6.568	104.116	95.852	8.264	92.063
60.009	1.864	14.593	7.070	111.856	103.176	8.681	92.239
60.009	1.993	14.593	7.572	119.597	110.501	9.097	92.394
60.008	2.122	14.594	8.072	127.338	117.800	9.538	92.510
60.008	2.252	14.593	8.572	135.137	125.093	10.044	92.567
60.008	2.382	14.593	9.072	142.938	132.390	10.549	92.620
60.008	2.513	14.594	9.572	150.799	139.696	11.104	92.637
60.008	2.644	14.593	10.070	158.660	146.954	11.706	92.622
60.007	2.775	14.593	10.572	166.521	154.282	12.239	92.650
60.008	2.908	14.593	11.074	174.502	161.598	12.904	92.605

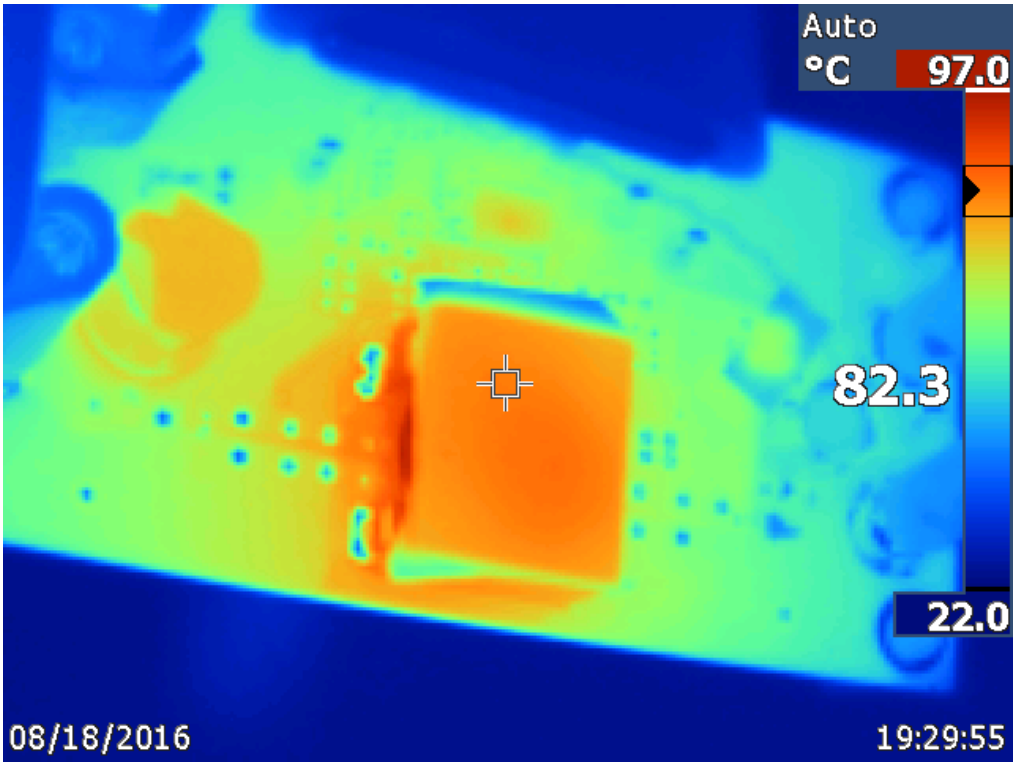
5 Thermal Images



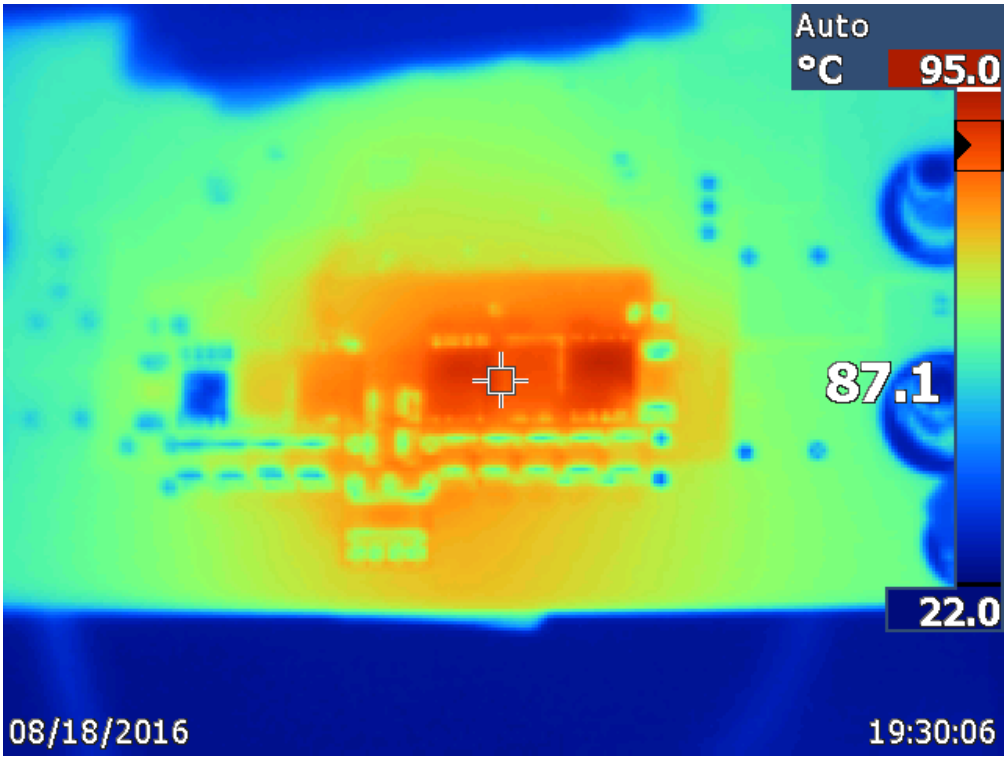
Top Thermal was taken at -35Vin, 8.5A load when the board reaches equilibrium without airflow.



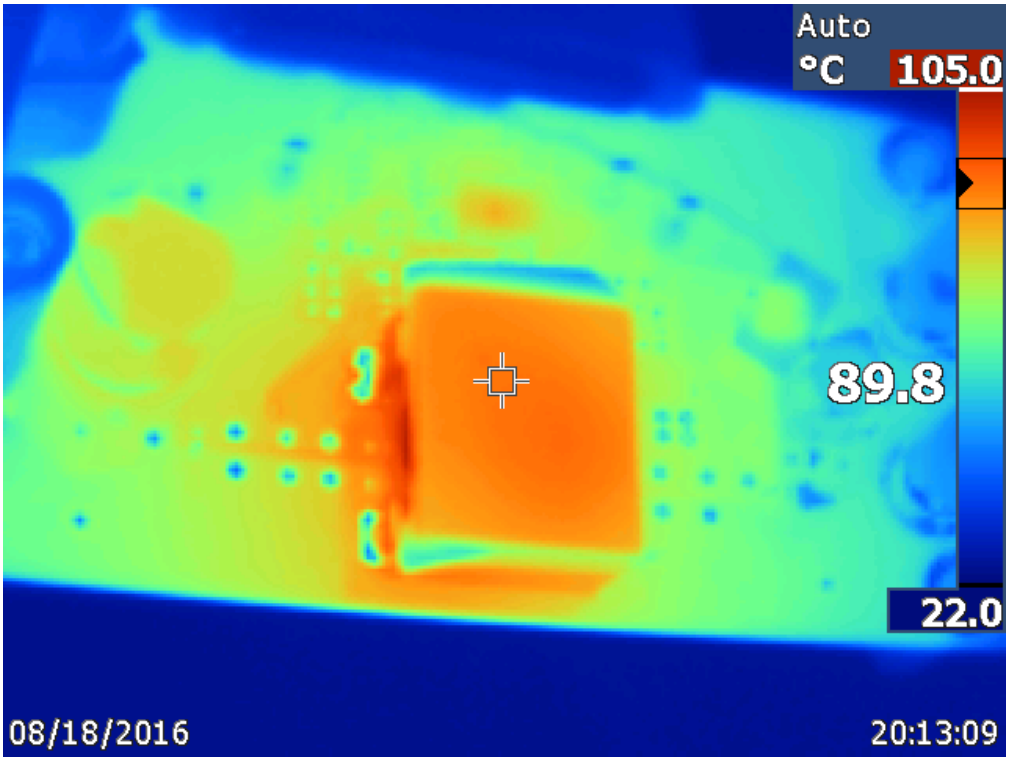
Bottom Thermal was taken at -35Vin, 8.5A load when the board reaches equilibrium without airflow.



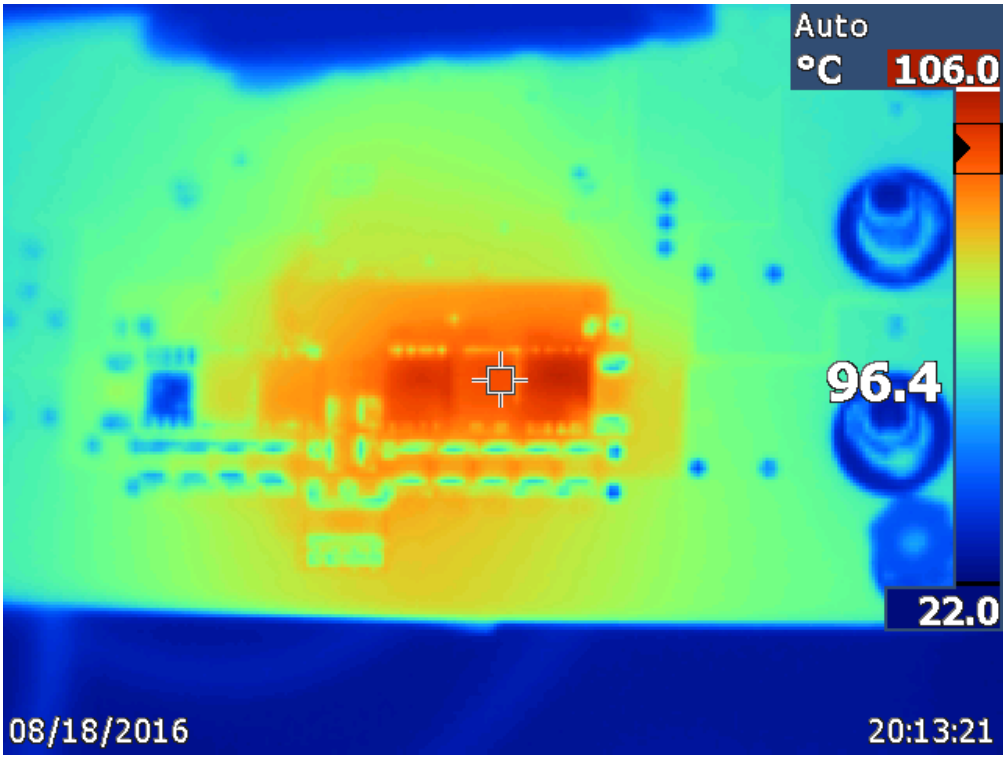
Top Thermal was taken at -48Vin, 8.5A load when the board reaches equilibrium without airflow.



Bottom Thermal was taken at -48Vin, 8.5A load when the board reaches equilibrium without airflow.



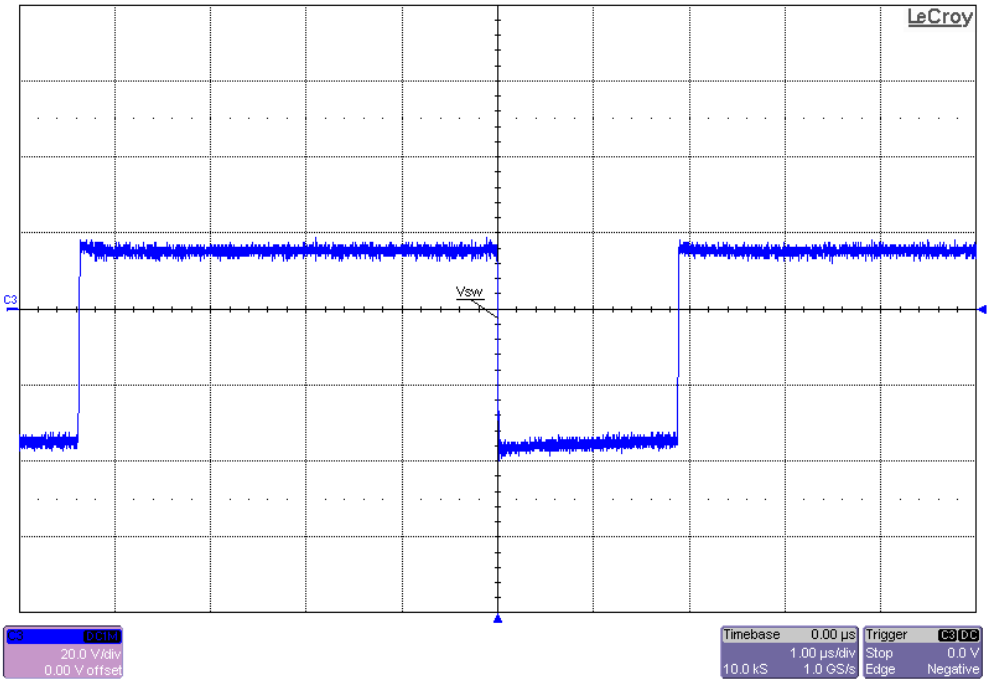
Top Thermal was taken at -60Vin, 8.5A load when the board reaches equilibrium without airflow.



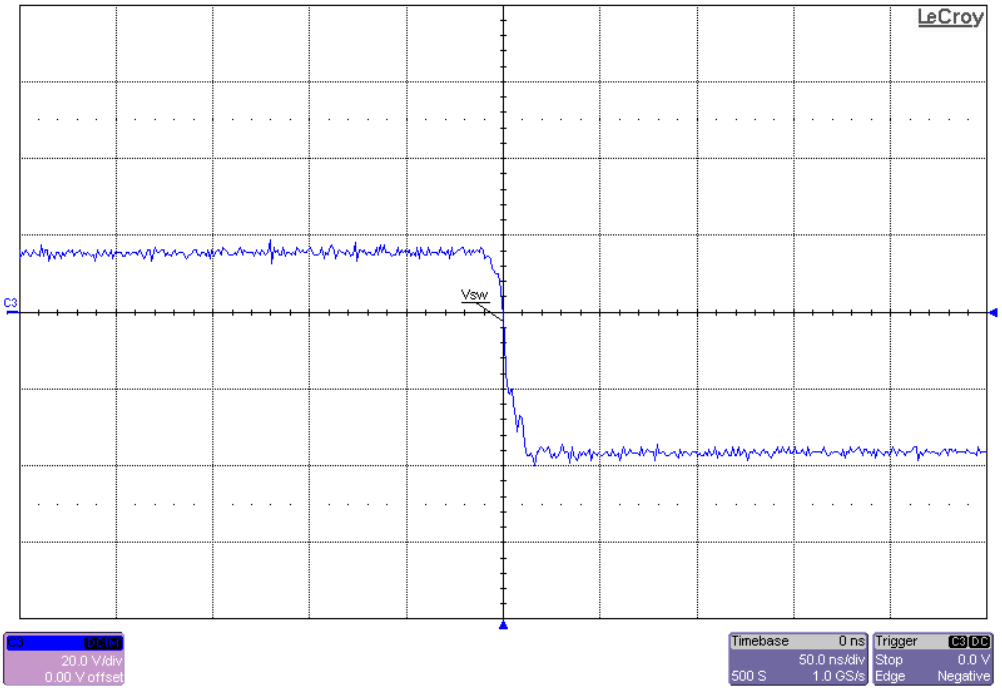
Bottom Thermal was taken at -60Vin, 8.5A load when the board reaches equilibrium without airflow.

6 Waveform

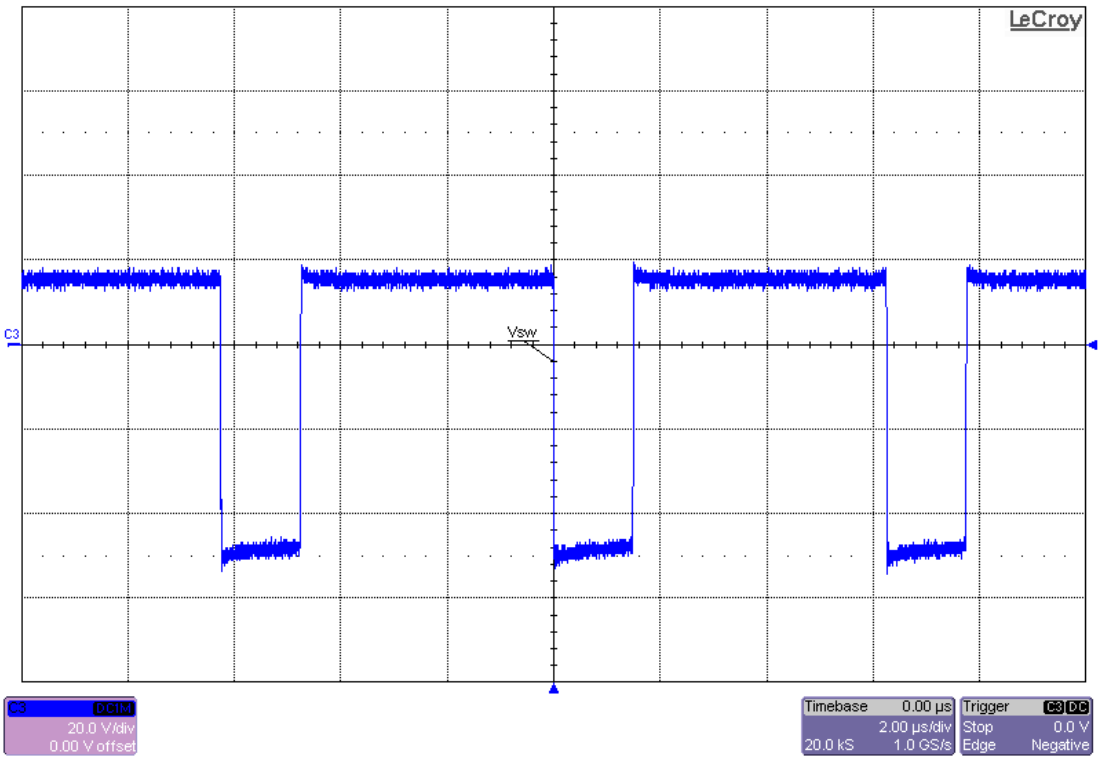
6.1 Low Side Vds Switching



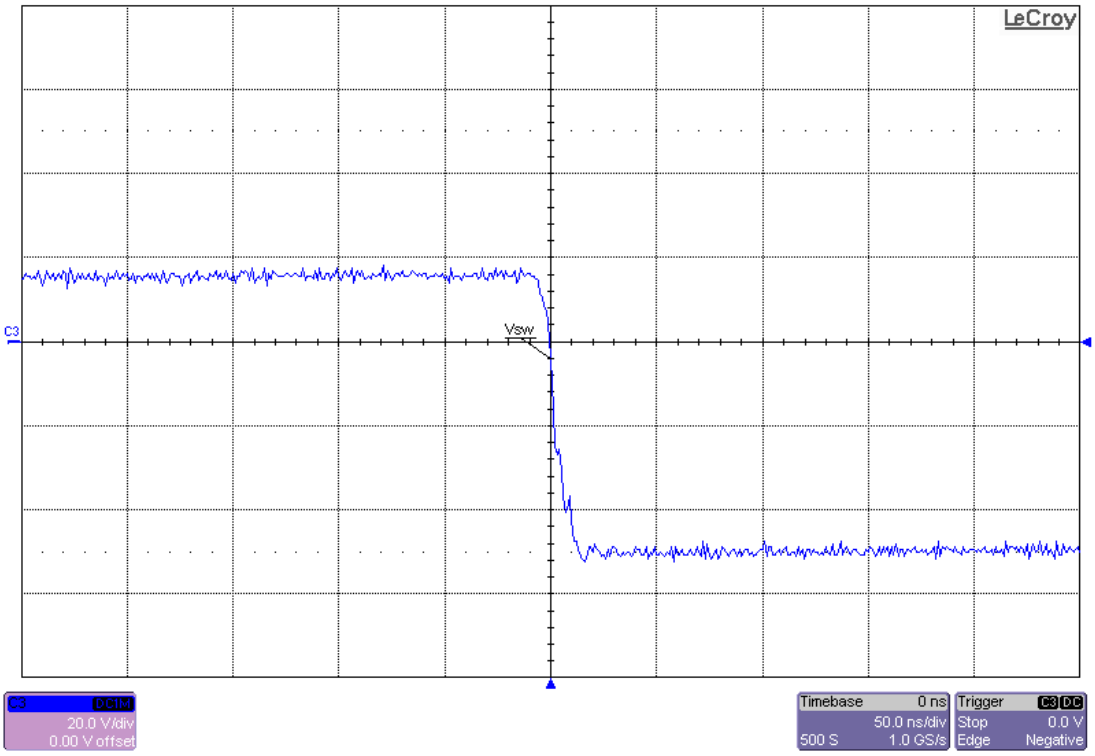
-35Vin, 8.5A load. Ch3 measures low side FET Vds.



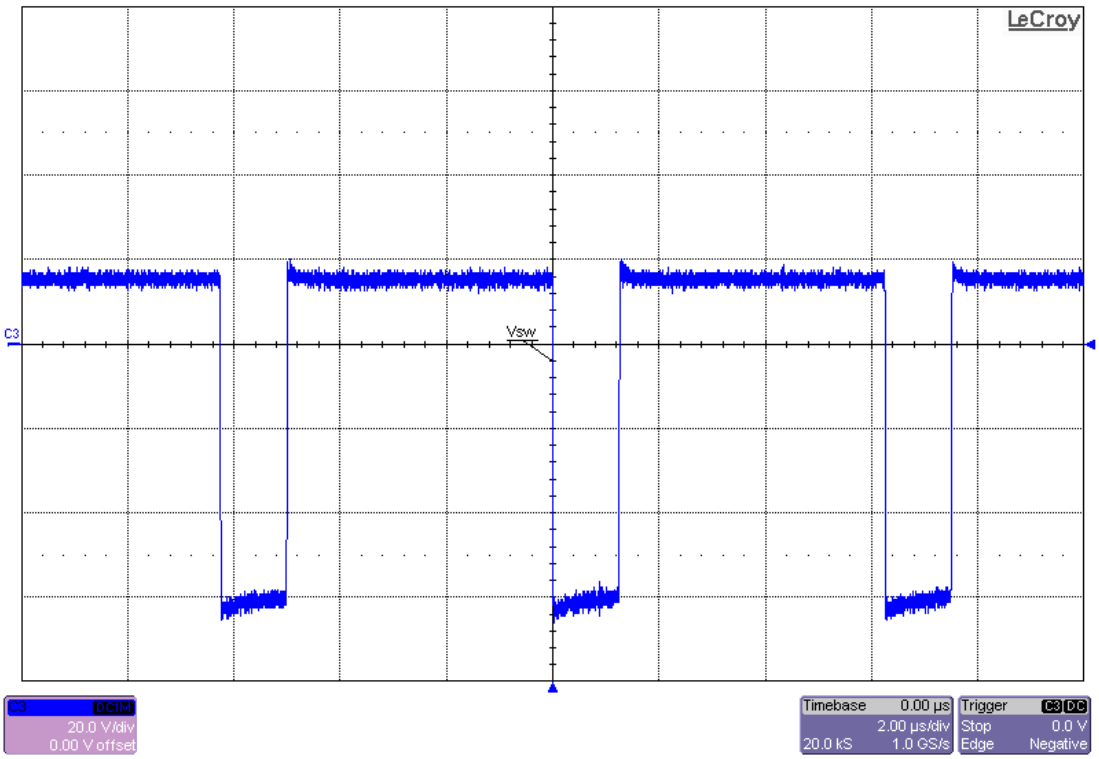
Zoomed switching edge of -35Vin, 8.5A load. Ch3 measures low side FET Vds.



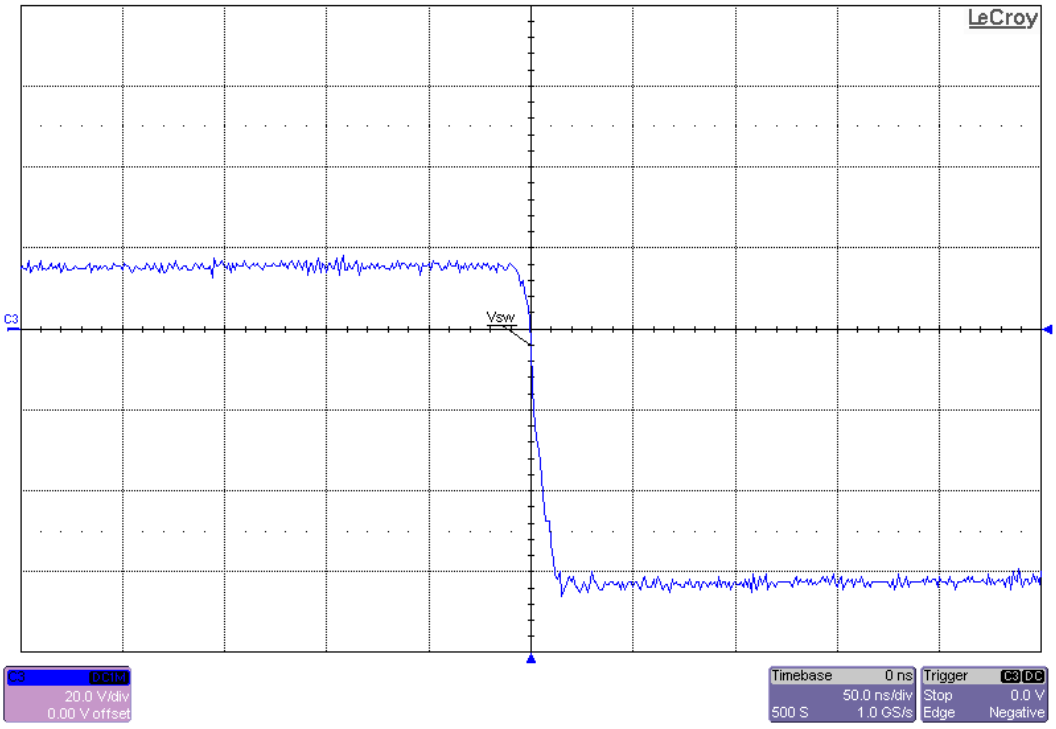
-48Vin, 8.5A load. Ch3 measures low side FET Vds.



Zoomed switching edge of -48Vin, 8.5A load. Ch3 measures low side FET Vds.

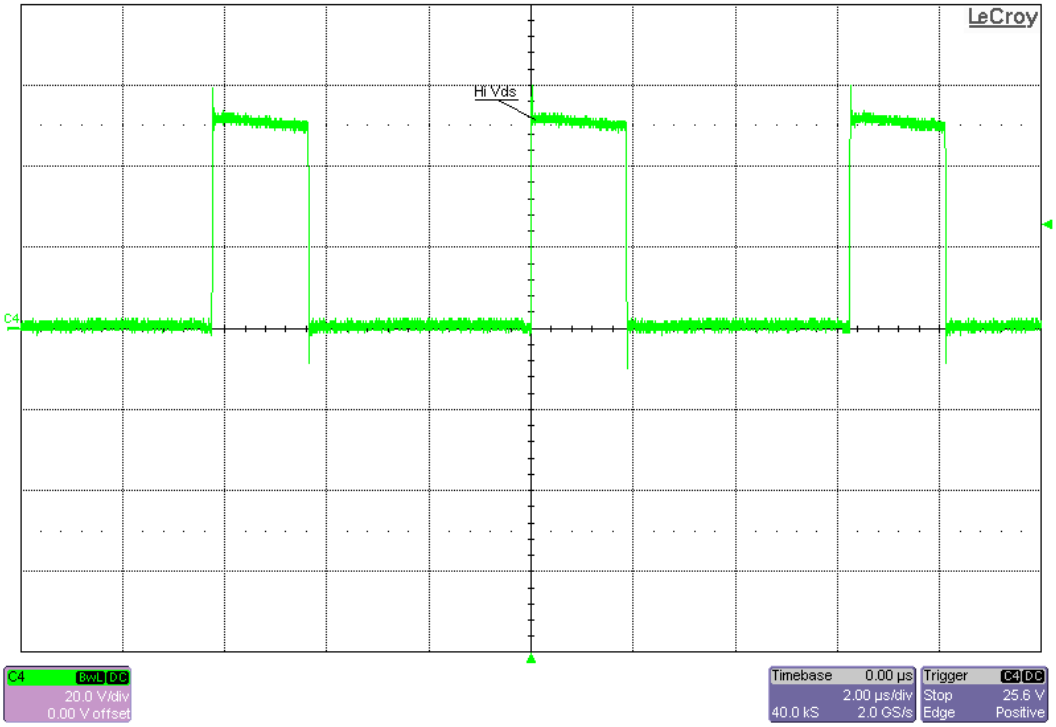


-60Vin, 8.5A load. Ch3 measures low side FET Vds.

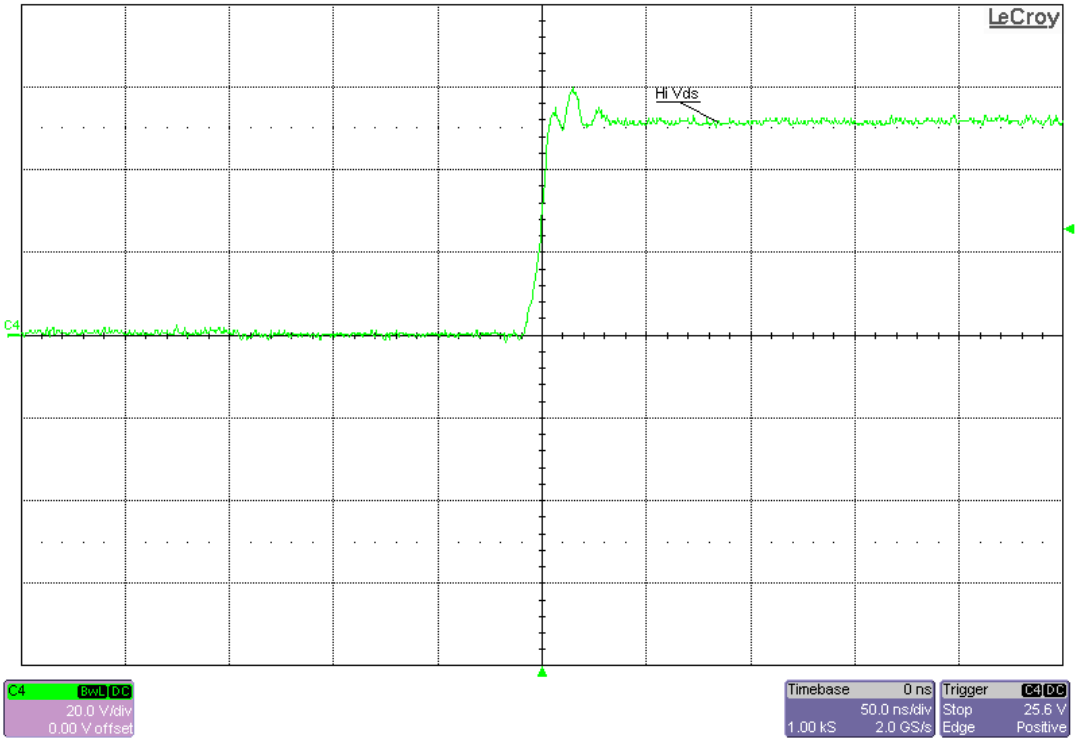


Zoomed switching edge of -60Vin, 8.5A load. Ch3 measures low side FET Vds.

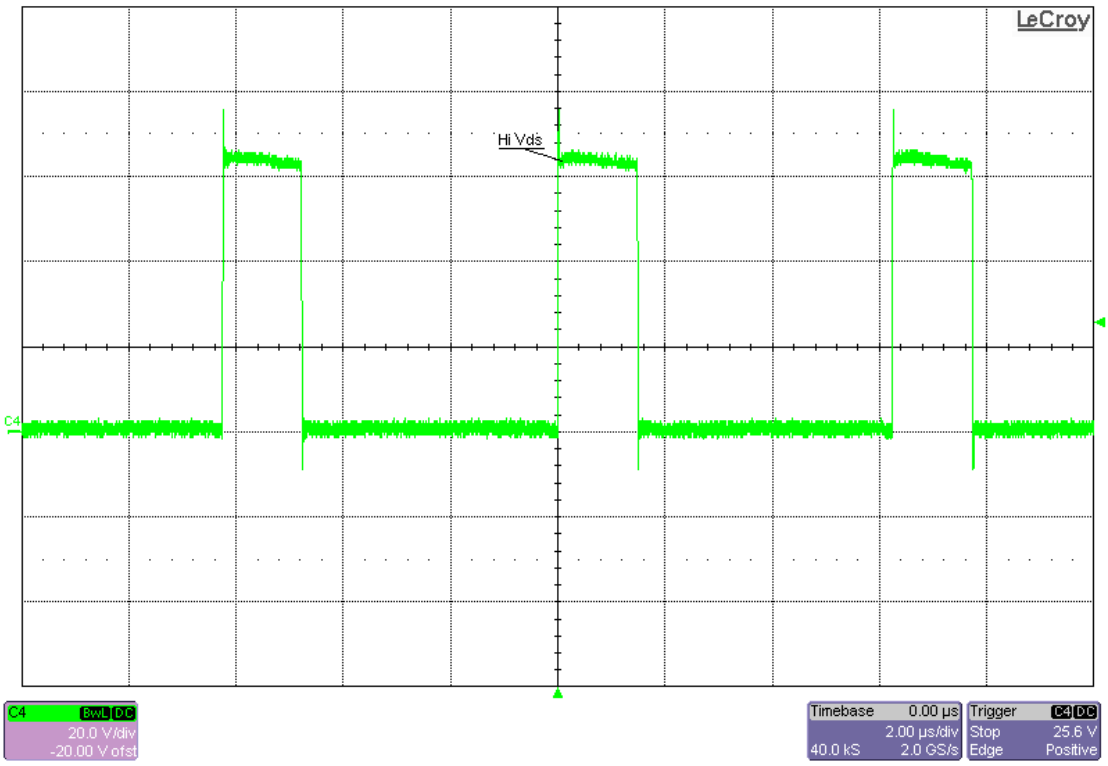
6.2 High Side Vds Switching



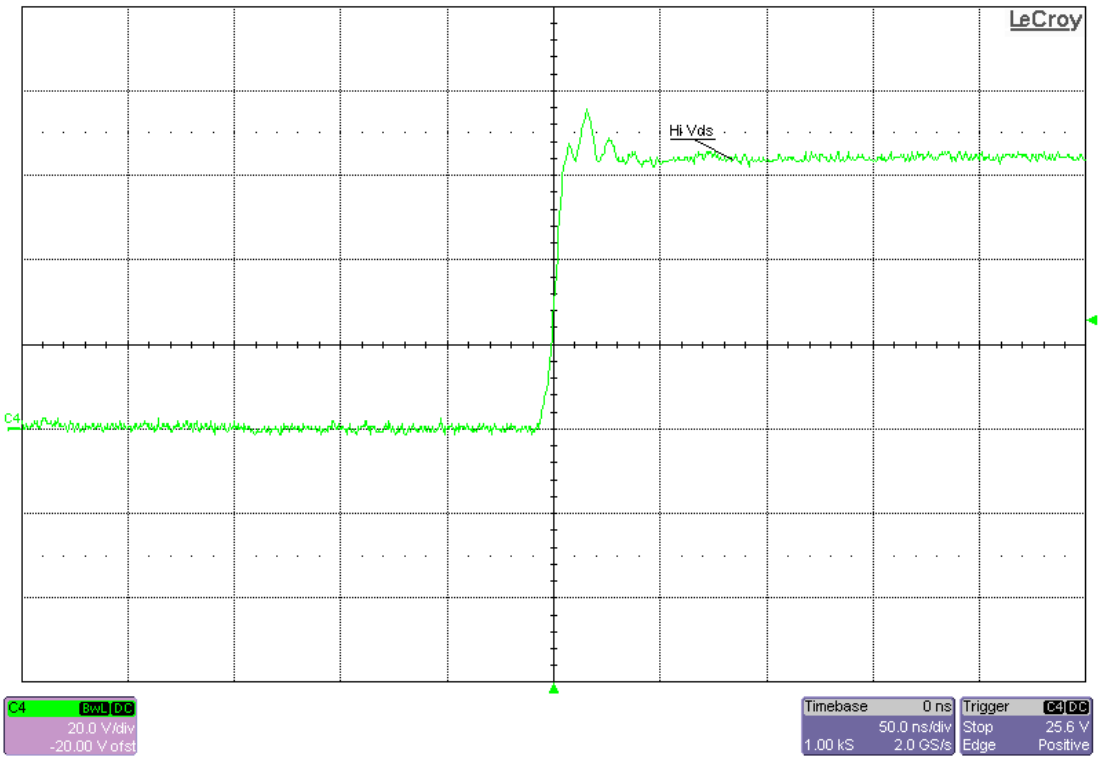
-35Vin, 8.5A load. Ch4 measures high side FET Vds.



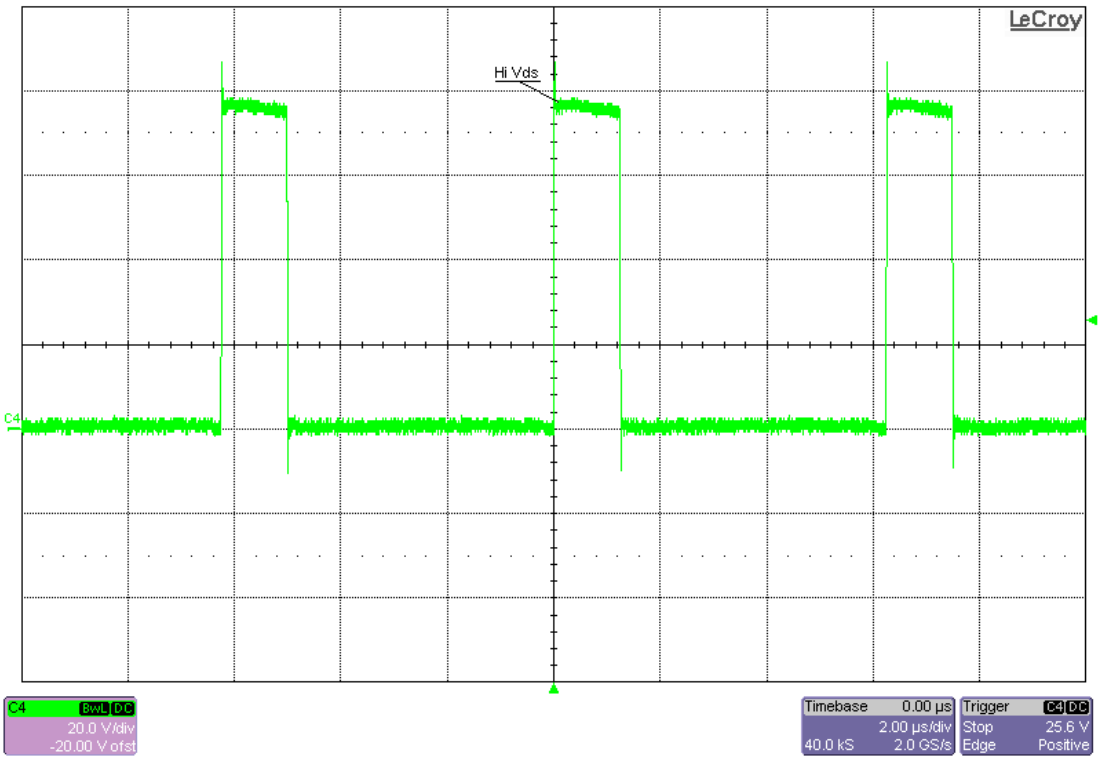
Zoomed switching edge of -35Vin, 8.5A load. Ch4 measures high side FET Vds.



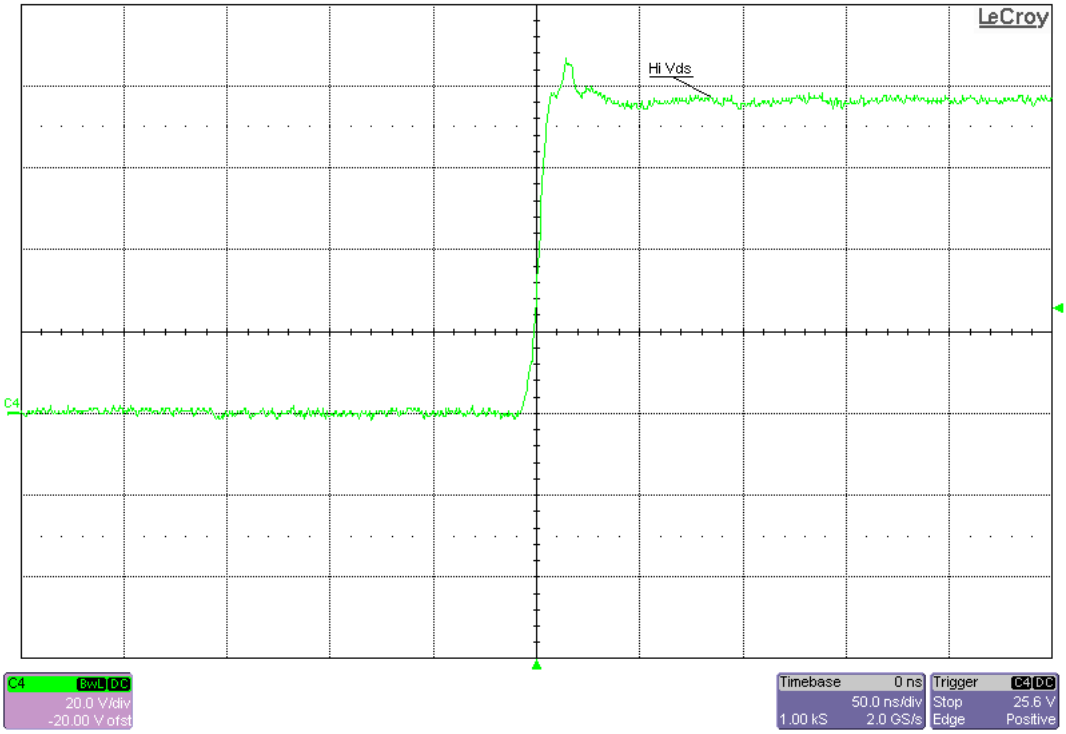
-48Vin, 8.5A load. Ch4 measures high side FET Vds.



Zoomed switching edge of -48Vin, 8.5A load. Ch4 measures high side FET Vds.

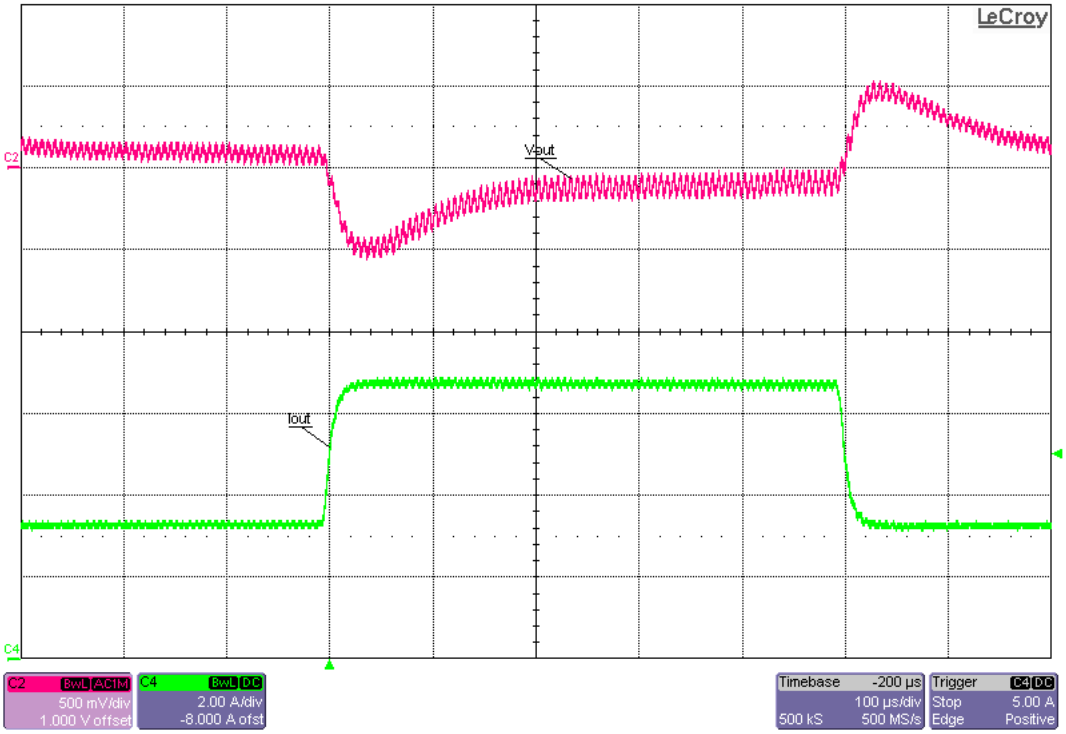


-60Vin, 8.5A load. Ch4 measures high side FET Vds.

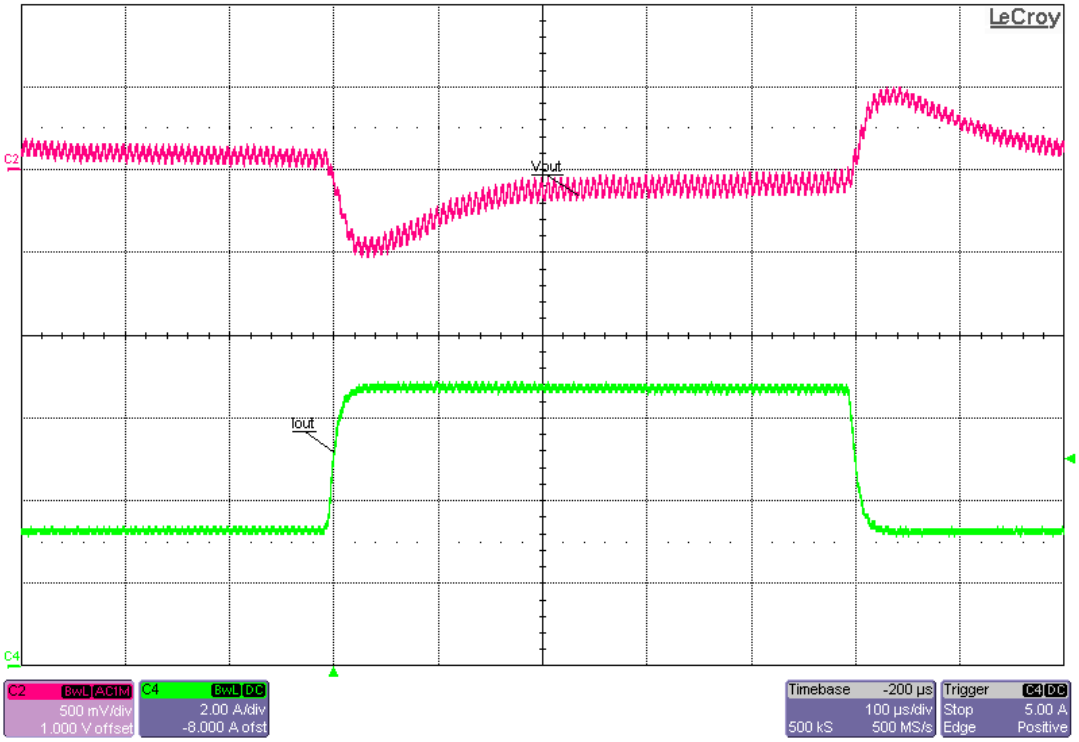


Zoomed switching edge of -60Vin, 8.5A load. Ch4 measures high side FET Vds.

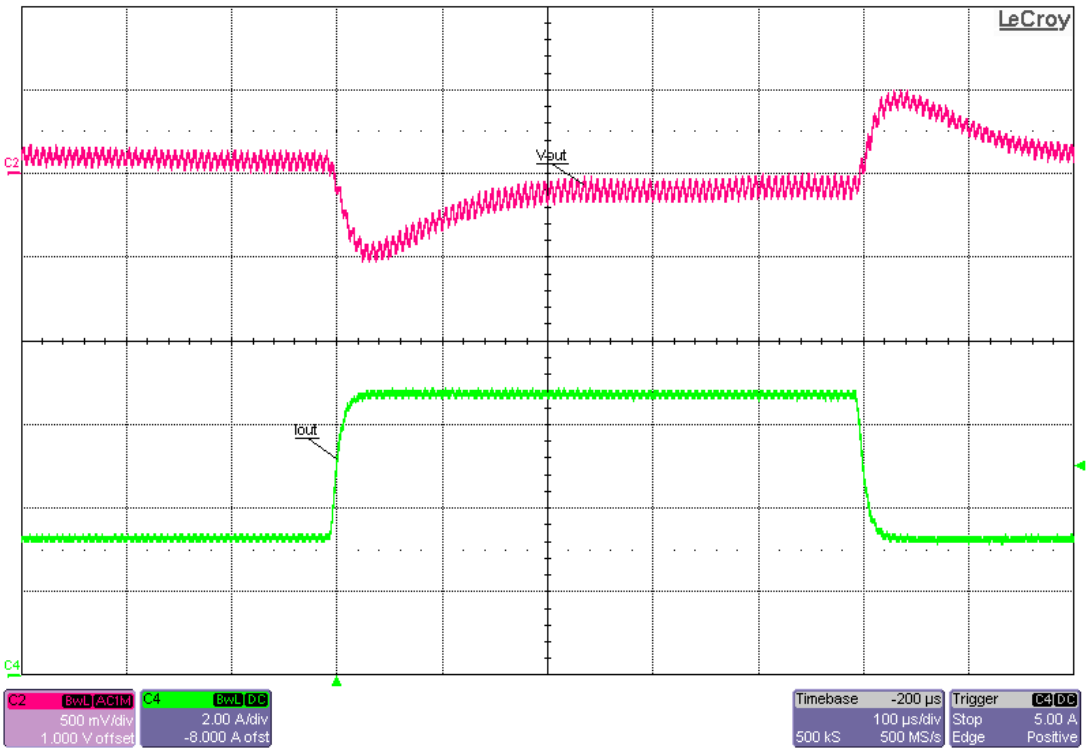
6.3 Load Transient



-35Vin, 3.4A-6.8A load step. Ch2 measures output voltage, Ch4 measures load current.

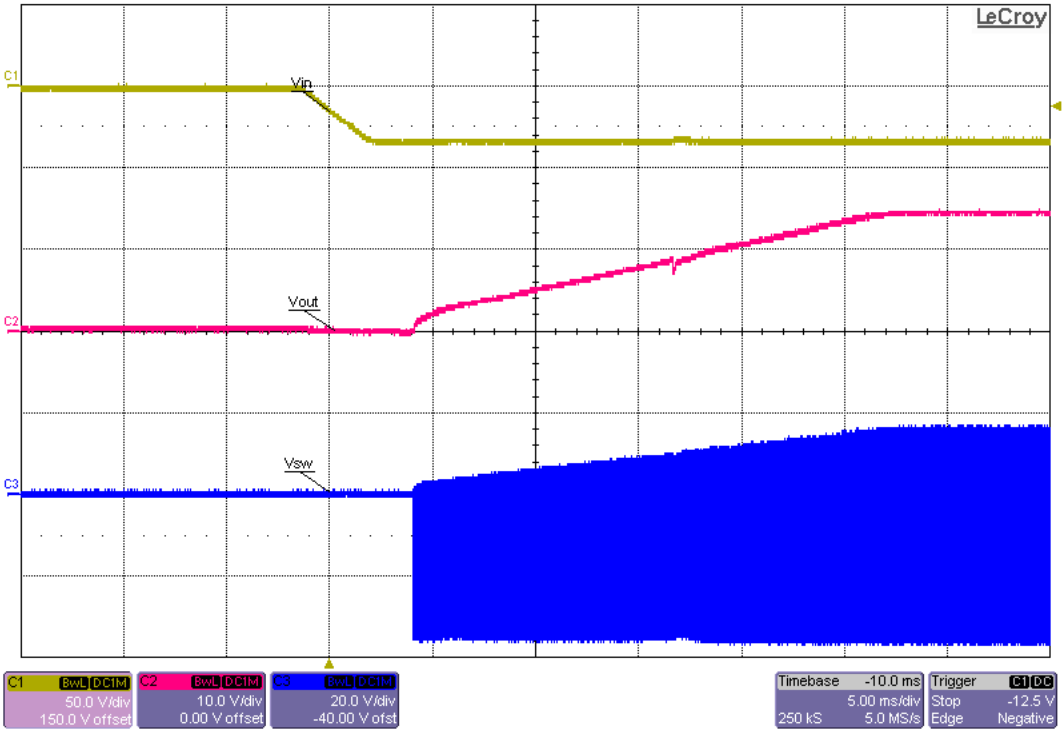


-48Vin, 3.4A-6.8A load step. Ch2 measures output voltage, Ch4 measures load current.

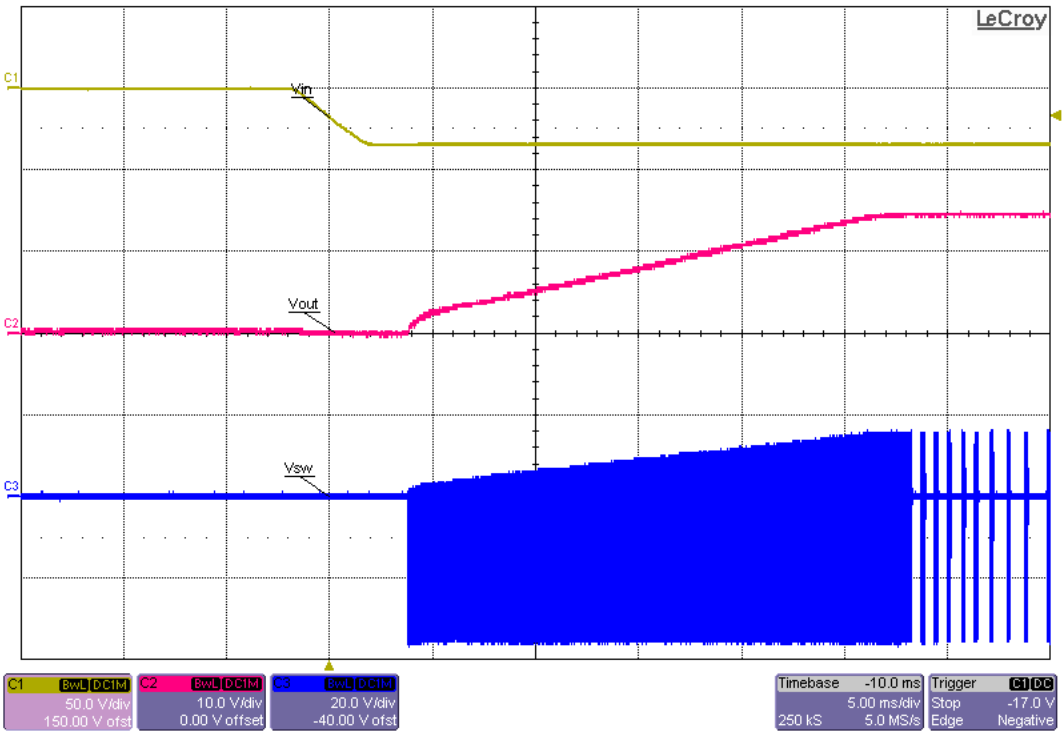


-60Vin, 3.4A-6.8A load step . Ch2 measures output voltage, Ch4 measures load current.

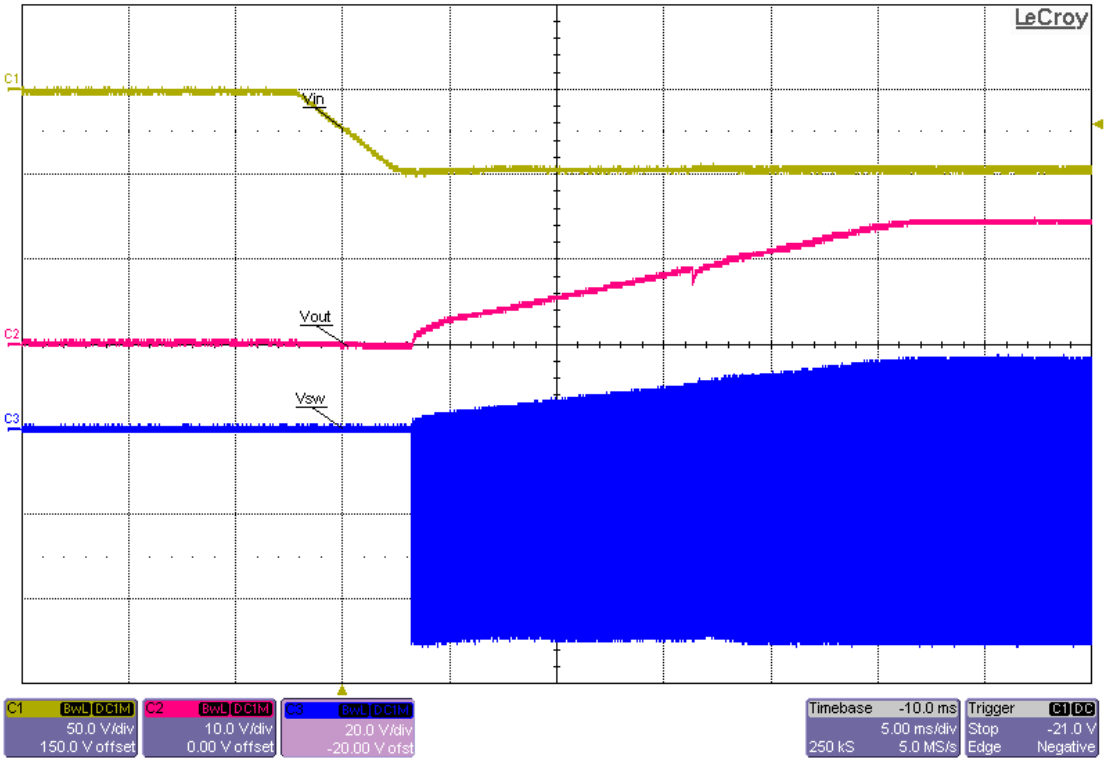
6.4 Start Up



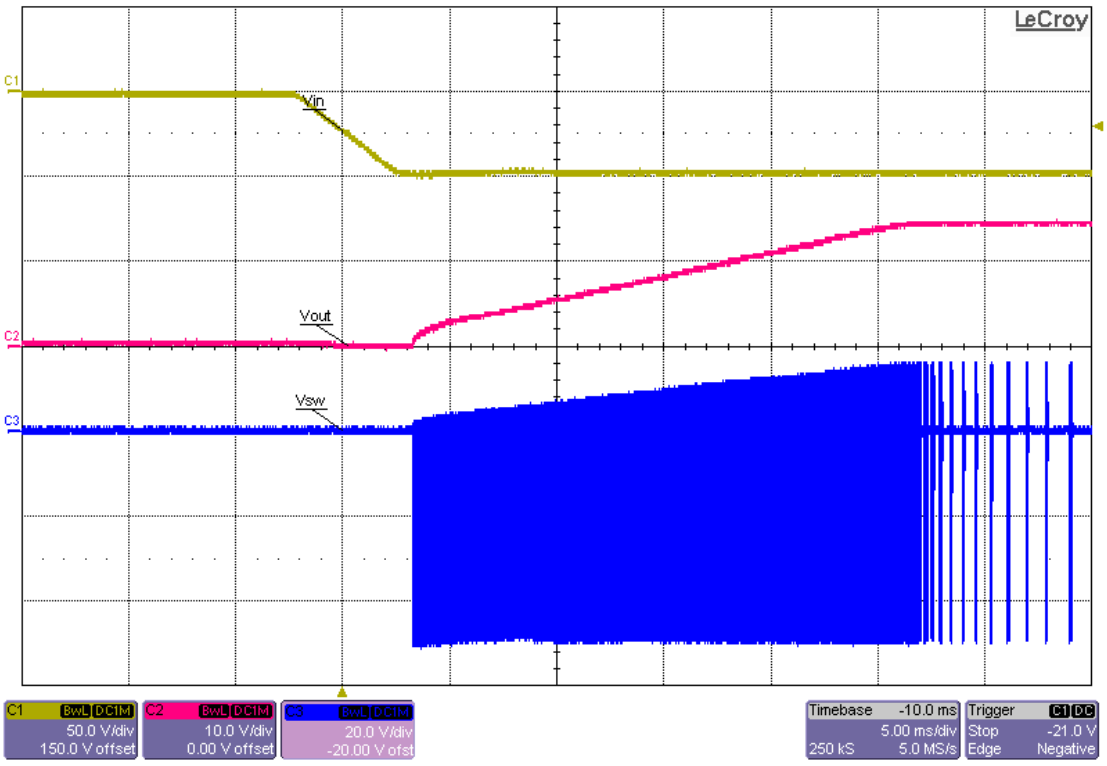
-35Vin, 8.4A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.



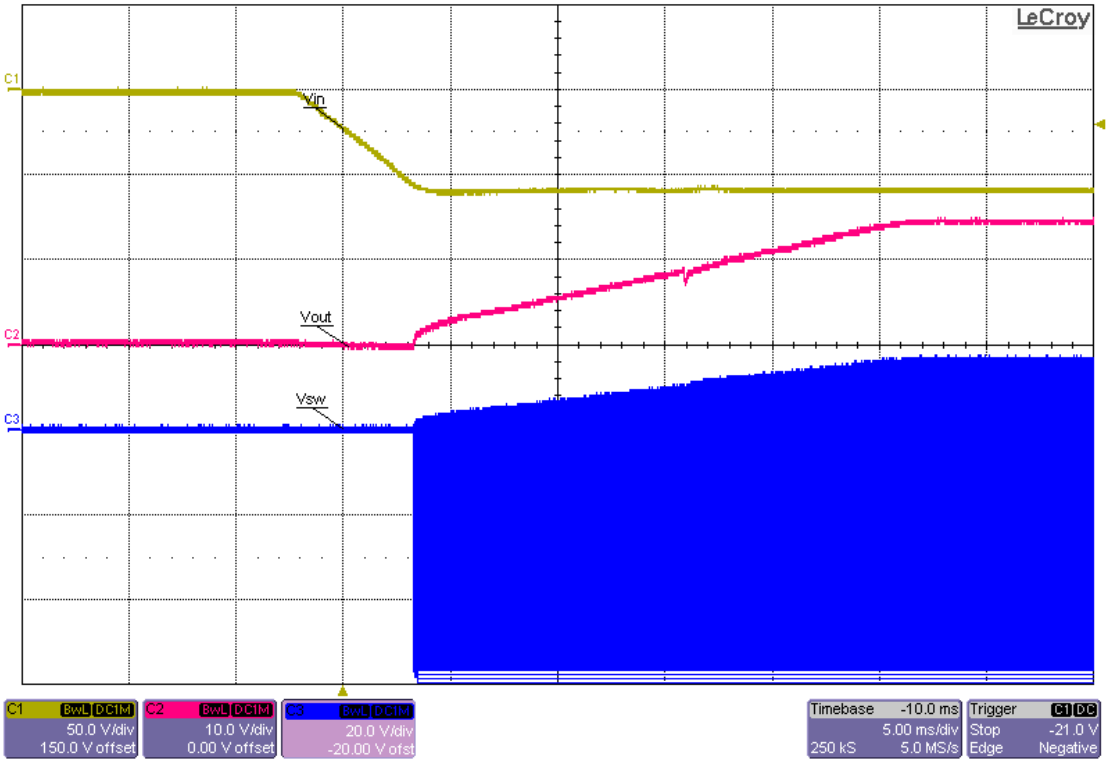
-35Vin, 0A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.



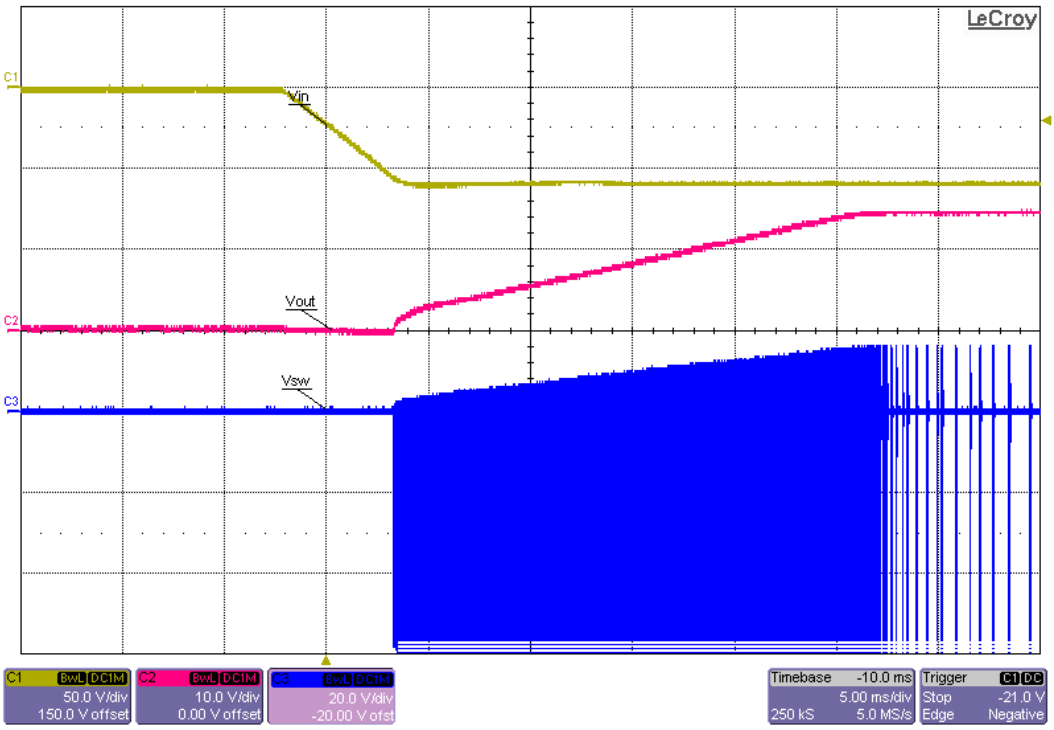
-48Vin, 8.4A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.



-48Vin, 0A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.

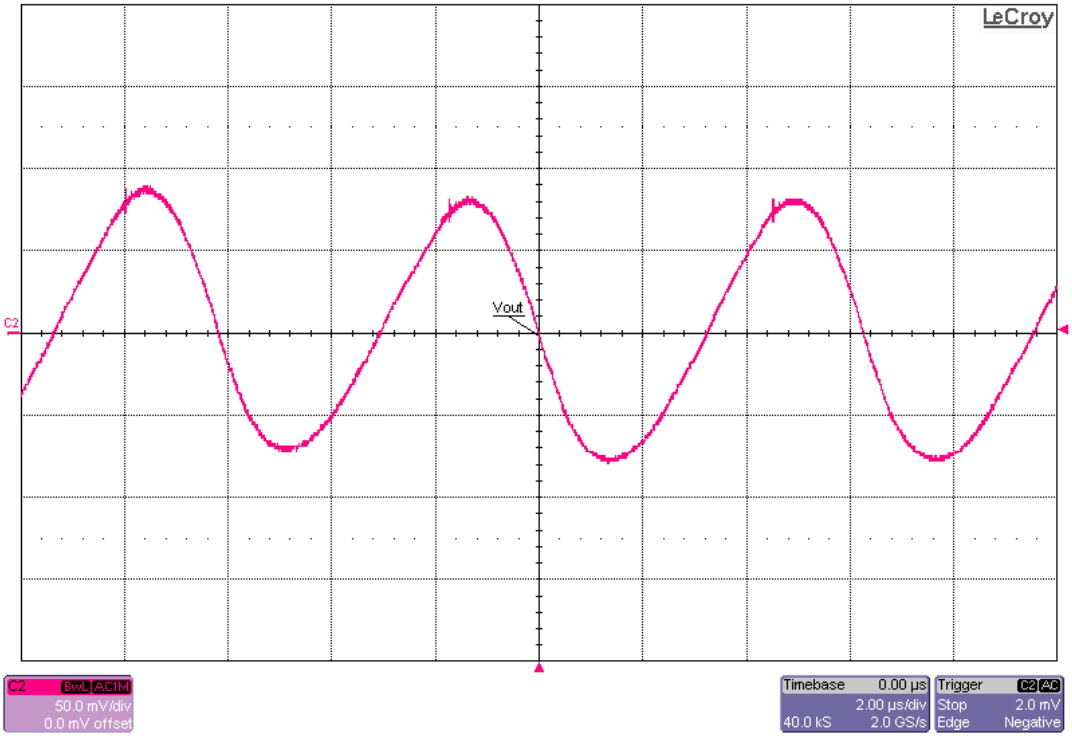


-60Vin, 8.4A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.

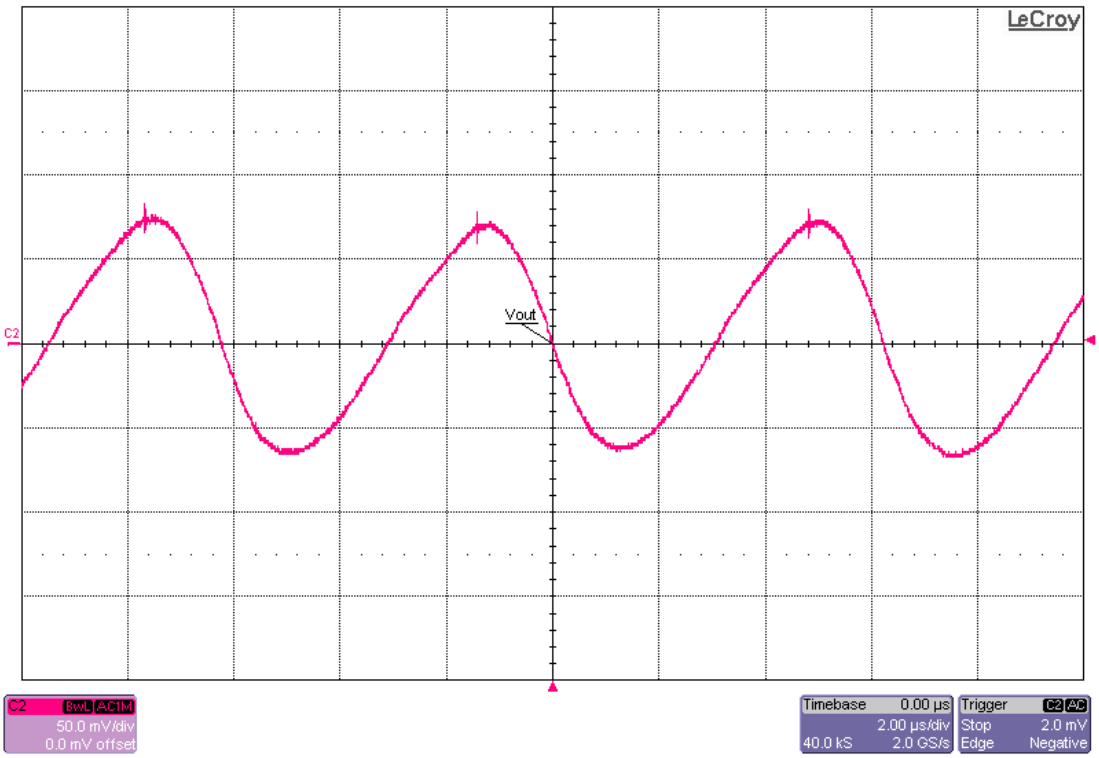


-60Vin, 0A load. Ch1 measures input voltage, Ch2 measures output voltage, Ch3 measures SW.

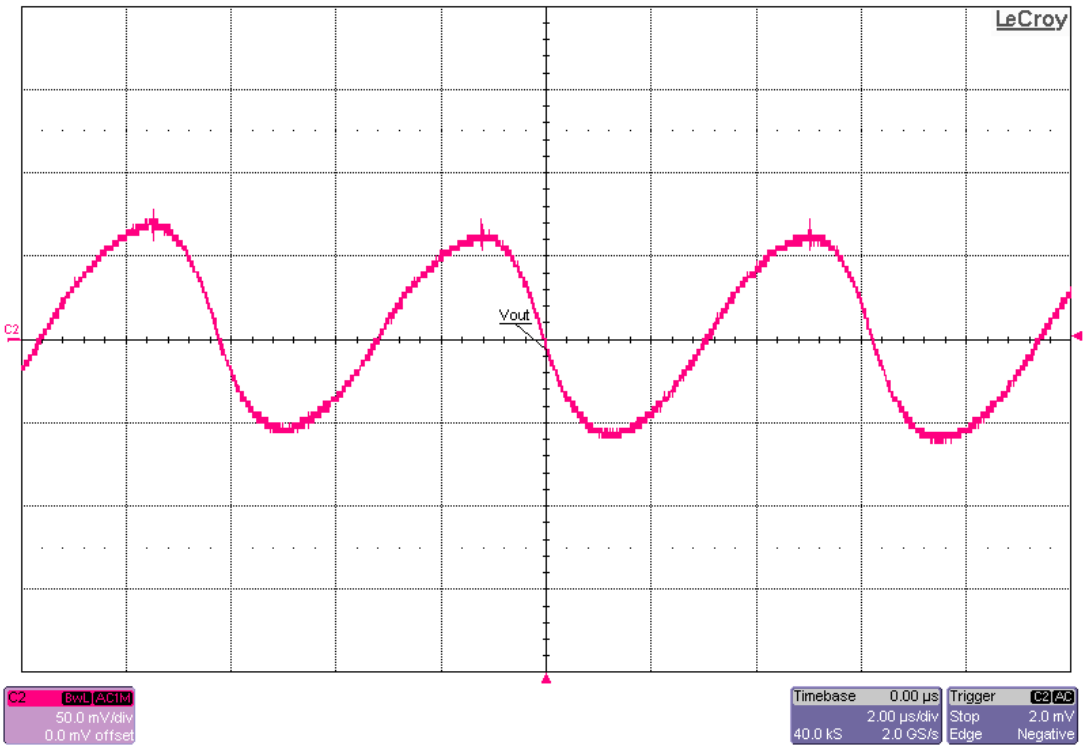
6.5 Output Switching Ripple



-35Vin, 8.4A load. Ch2 measures output voltage ripple.

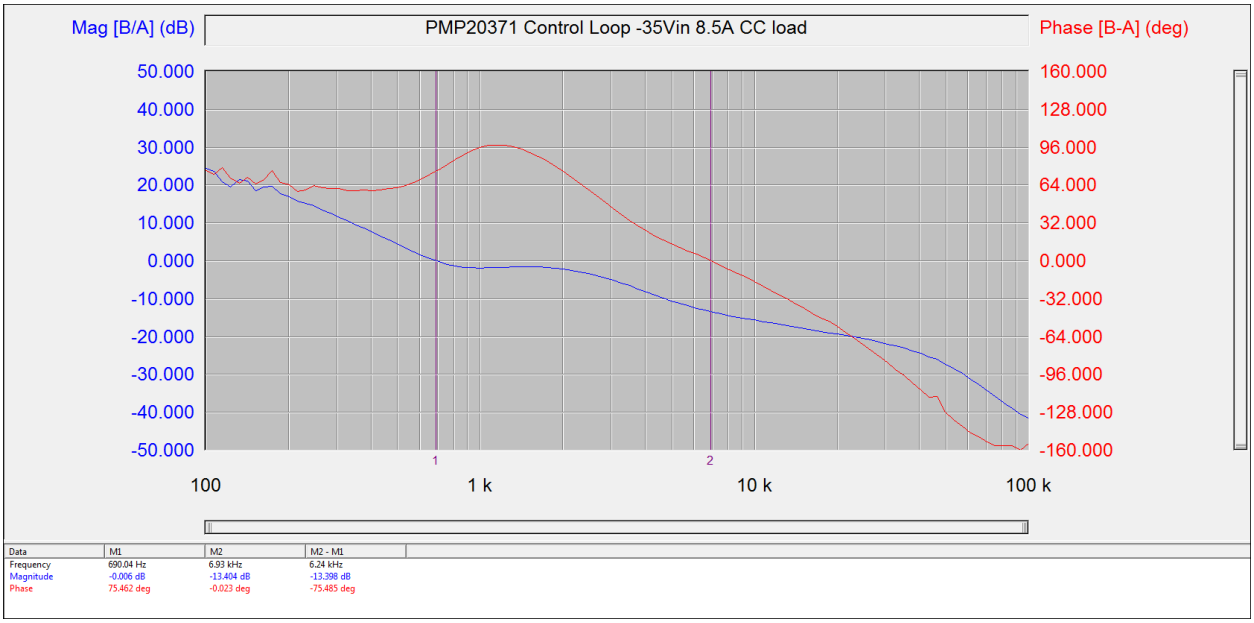


-48Vin, 8.4A load. Ch2 measures output voltage ripple.

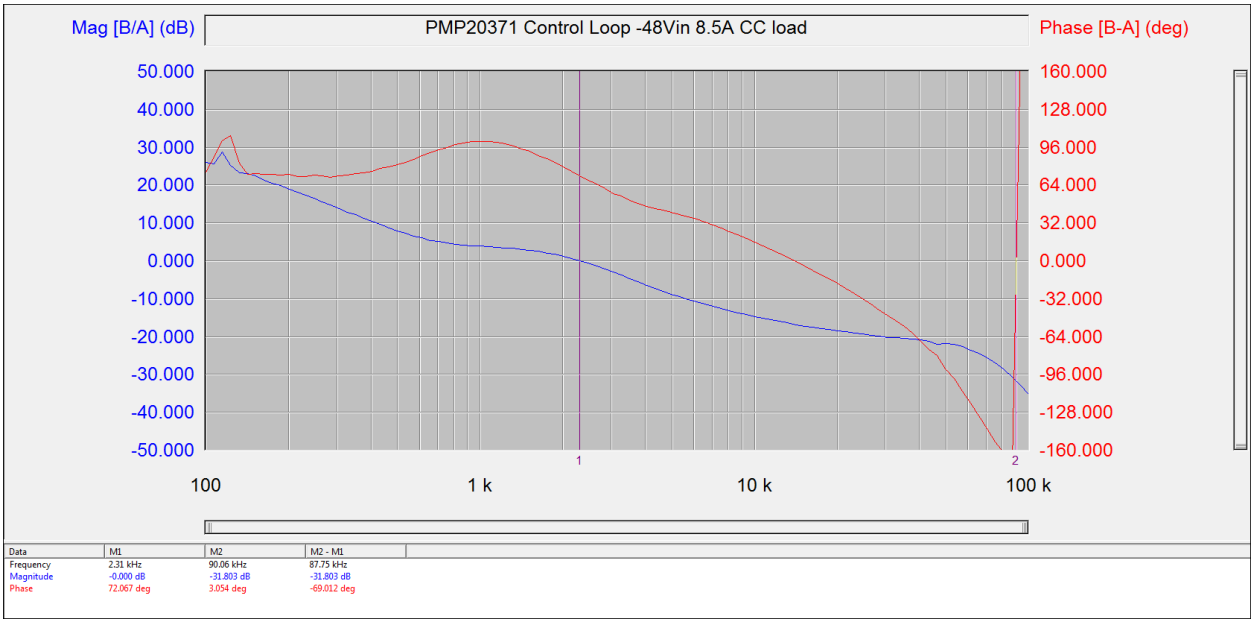


-60Vin, 8.4A load. Ch2 measures output voltage ripple.

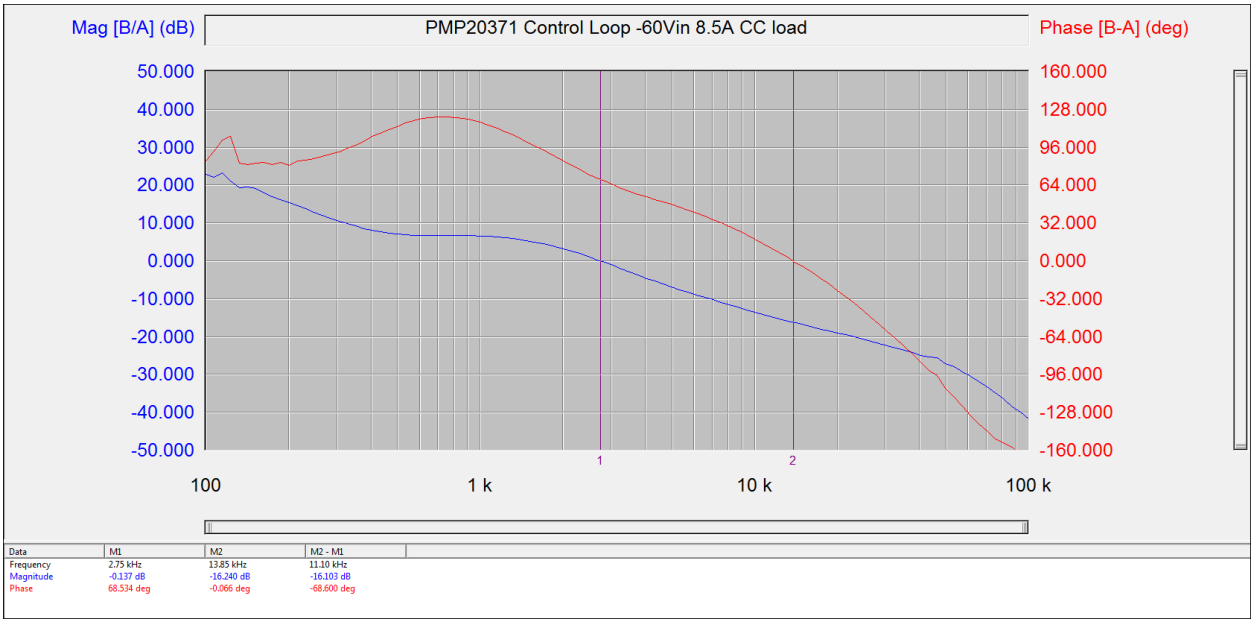
6.6 Bode Plot



-35Vin, 8.5A load bode plot, 75.5 degrees phase margin, and 13.4dB gain margin.



-48Vin, 8.5A load bode plot, 72 degrees phase margin, and 18dB gain margin.



-60Vin, 8.5A load bode plot, 68.53 degrees phase margin, and 16.24dB gain margin.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (https:www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265