LM5022 Isolated Flyback Converter

TI reference design number: PMP20468

Input: 36V to 57V DC
Output: 12V @ 2A

DC – DC Test Results

Table of Contents

1 Test Specifications....3
2 Circuit Description....3
3 Board Photo....3
4 Efficiency....4
4.1 Efficiency Chart....4
4.2 Efficiency Data....4
5 Thermal....6
5.1 36V Input, 12V @ 2A Output....6
5.2 48V Input, 12V @ 2A Output....7
5.3 57V Input, 12V @ 2A Output....7
6 Startup....8
6.1 36V Input, 12V @ 2A Output....8
6.2 48V Input, 12V @ 2A Output....8
6.3 57V Input, 12V @ 2A Output....9
7 Switching and Ripple Voltage....10
7.1 36V Input, 12V @ 2A Output....10
7.2 48V Input, 12V @ 2A Output....10
7.3 57V Input, 12V @ 2A Output....11
8 Load Transient Response....12
8.1 36V Input, 12Vout, 1A-to-2A Load Step....12
8.2 48V Input, 12Vout, 1A-to-2A Load Step....12
8.3 57V Input, 12Vout, 1A-to-2A Load Step....13
9 Frequency Response....14
9.1 36V Input, 12V @ 2A Output....14
9.2 48V Input, 12V @ 2A Output....14
9.3 57V Input, 12V @ 2A Output....15

1 Test Specifications

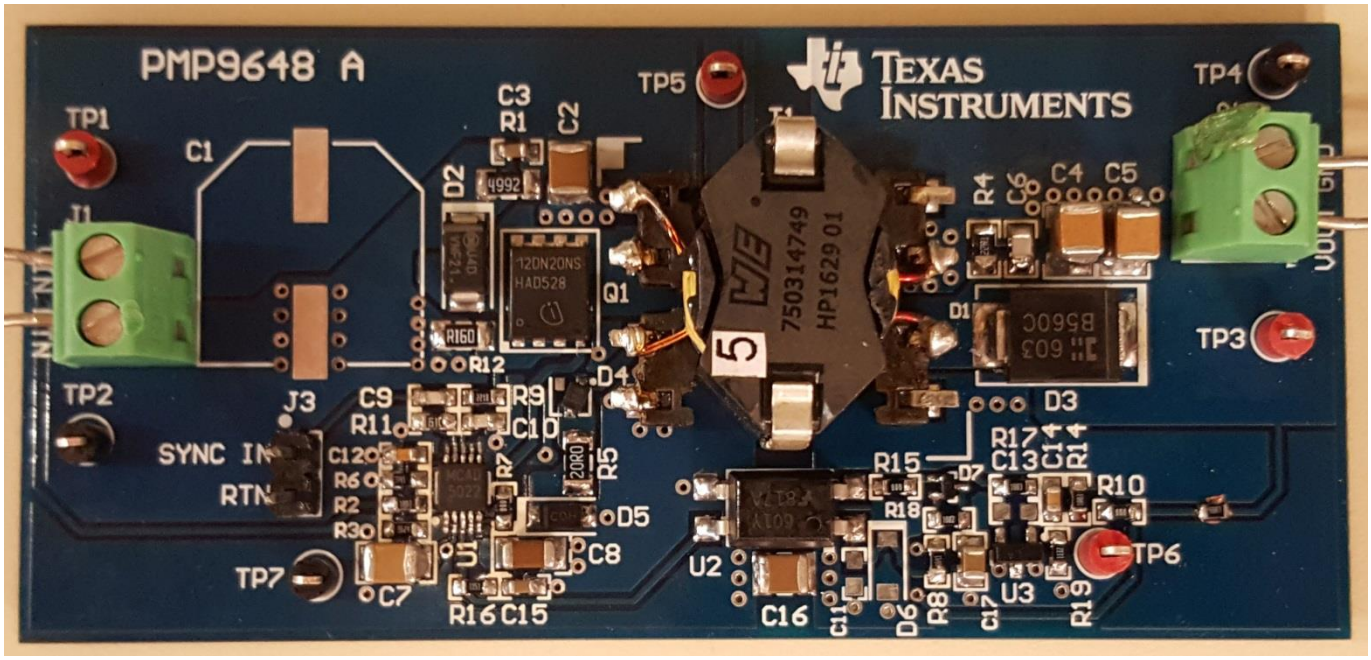
Vin Minimum	**36V**
Vin Maximum	**57V**
Output	**12V @ 2A**
Nominal Switching Frequency	**≈ 420kHz**

2 Circuit Description

PMP20468 is an isolated flyback converter utilizing the LM5022 controller for Power-over-Ethernet applications. This design has a minimum operating input voltage of 36V and a maximum input voltage of 57V. The report here is for inputs of 36V, 48V, and 57V and an output of 12V @ 2A of load current. Switching frequency is set to 420kHz. A custom Wurth transformer is used in this design.

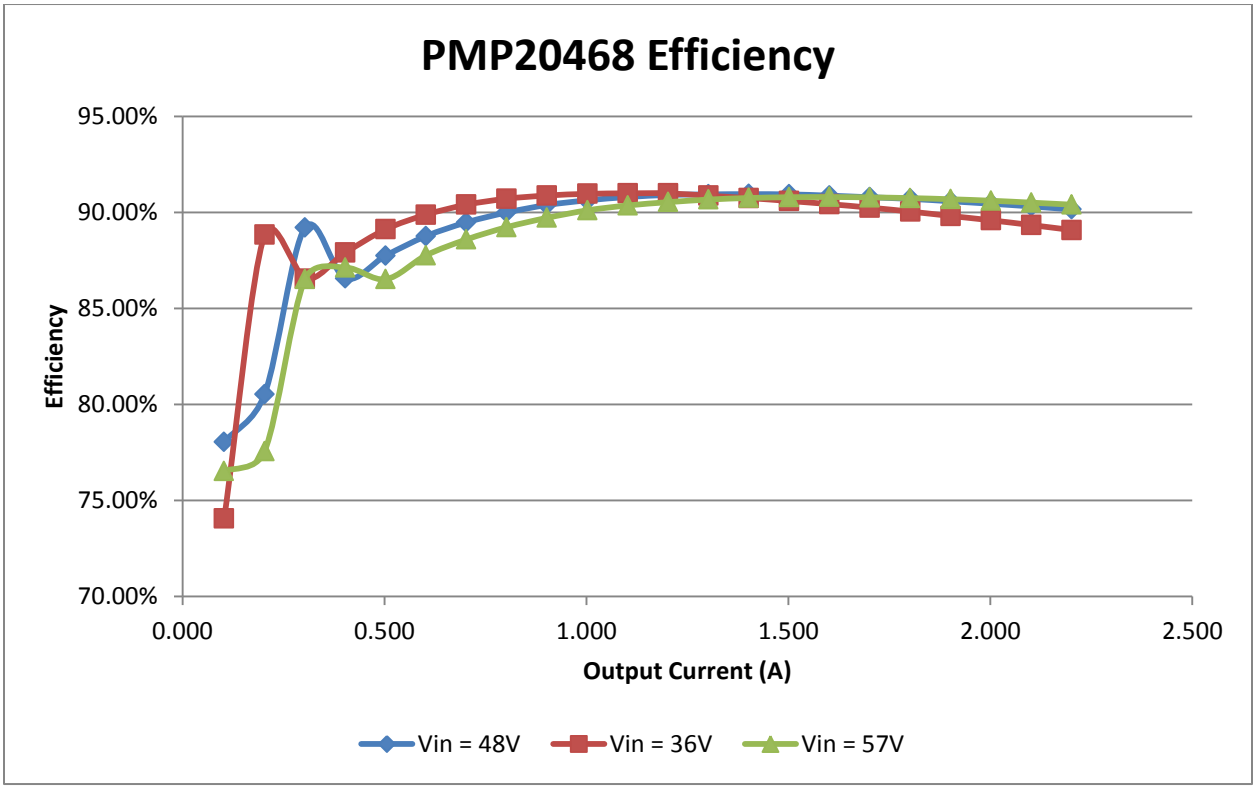
3 Board Photo

This is a 2-layer PCB with 2 oz. copper layers. The PCB dimensions are 81.3mm x 38.1mm.



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 (%)
36.010	0.047	12.118	0.103	1.685	1.248	0.437	74.063
36.010	0.077	12.118	0.203	2.769	2.460	0.309	88.833
36.009	0.118	12.115	0.303	4.242	3.671	0.571	86.539
36.009	0.154	12.114	0.403	5.553	4.881	0.672	87.901
36.009	0.190	12.114	0.503	6.835	6.091	0.744	89.117
36.009	0.226	12.113	0.603	8.120	7.298	0.822	89.876
36.008	0.261	12.112	0.703	9.413	8.509	0.904	90.398
36.008	0.298	12.111	0.803	10.716	9.721	0.996	90.710
36.008	0.334	12.110	0.902	12.027	10.929	1.097	90.877
36.007	0.371	12.110	1.002	13.344	12.139	1.206	90.965
36.007	0.407	12.109	1.102	14.669	13.348	1.322	90.991
36.007	0.444	12.108	1.202	15.998	14.556	1.441	90.991
36.006	0.482	12.107	1.302	17.351	15.766	1.585	90.863
36.006	0.520	12.106	1.402	18.709	16.977	1.732	90.743

36.005	0.557	12.106	1.502	20.073	18.184	1.889	90.591
36.004	0.596	12.105	1.602	21.444	19.392	2.053	90.428
36.003	0.634	12.104	1.702	22.826	20.599	2.227	90.245
36.003	0.673	12.103	1.802	24.219	21.807	2.412	90.041
36.002	0.712	12.102	1.902	25.626	23.015	2.611	89.812
36.001	0.751	12.101	2.002	27.041	24.225	2.816	89.587
36.000	0.791	12.100	2.102	28.465	25.431	3.035	89.339
35.999	0.831	12.099	2.201	29.901	26.635	3.265	89.079

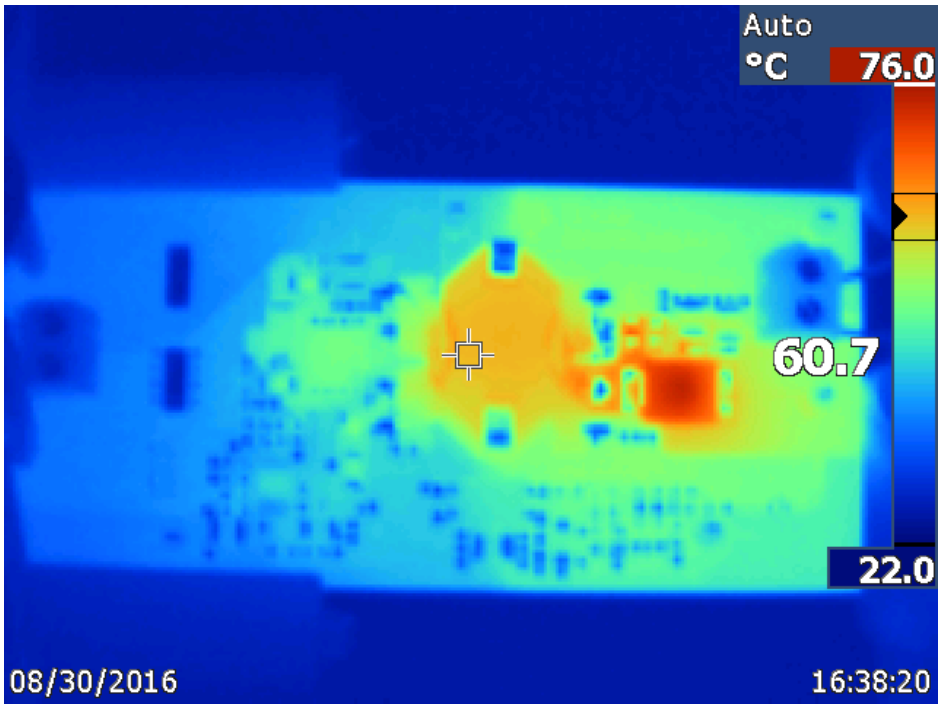
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Losses (W)	Efficiency (%)
48.016	0.033	12.116	0.103	1.599	1.248	0.351	78.052
48.016	0.064	12.114	0.203	3.054	2.459	0.595	80.528
48.016	0.086	12.114	0.303	4.115	3.671	0.444	89.200
48.016	0.117	12.111	0.403	5.637	4.880	0.757	86.564
48.015	0.144	12.111	0.503	6.938	6.088	0.850	87.745
48.015	0.171	12.110	0.603	8.220	7.296	0.924	88.759
48.015	0.198	12.109	0.703	9.507	8.507	1.000	89.476
48.015	0.225	12.108	0.803	10.799	9.718	1.081	89.994
48.014	0.252	12.108	0.902	12.090	10.927	1.163	90.382
48.014	0.279	12.107	1.002	13.391	12.136	1.255	90.626
48.013	0.306	12.106	1.102	14.697	13.344	1.352	90.798
48.013	0.333	12.105	1.202	16.008	14.552	1.456	90.906
48.012	0.361	12.105	1.302	17.332	15.762	1.571	90.937
48.012	0.389	12.104	1.402	18.662	16.973	1.689	90.949
48.011	0.416	12.103	1.502	19.992	18.180	1.812	90.936
48.010	0.444	12.102	1.602	21.336	19.388	1.948	90.871
48.010	0.472	12.102	1.702	22.685	20.595	2.090	90.786
48.009	0.501	12.101	1.802	24.038	21.803	2.235	90.702
48.008	0.529	12.100	1.902	25.406	23.012	2.394	90.577
48.007	0.558	12.099	2.002	26.778	24.221	2.558	90.448
48.006	0.587	12.098	2.102	28.156	25.427	2.729	90.309
48.005	0.615	12.098	2.201	29.542	26.633	2.910	90.151

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Losses (W)	Efficiency (%)
57.012	0.029	12.114	0.103	1.631	1.248	0.383	76.524
57.012	0.056	12.111	0.203	3.170	2.459	0.711	77.561
57.012	0.074	12.111	0.303	4.242	3.670	0.572	86.516
57.011	0.098	12.110	0.403	5.599	4.878	0.721	87.126
57.011	0.123	12.108	0.503	7.035	6.087	0.948	86.518
57.011	0.146	12.107	0.603	8.312	7.295	1.018	87.759
57.011	0.168	12.106	0.703	9.601	8.505	1.096	88.586
57.010	0.191	12.106	0.803	10.889	9.716	1.173	89.228

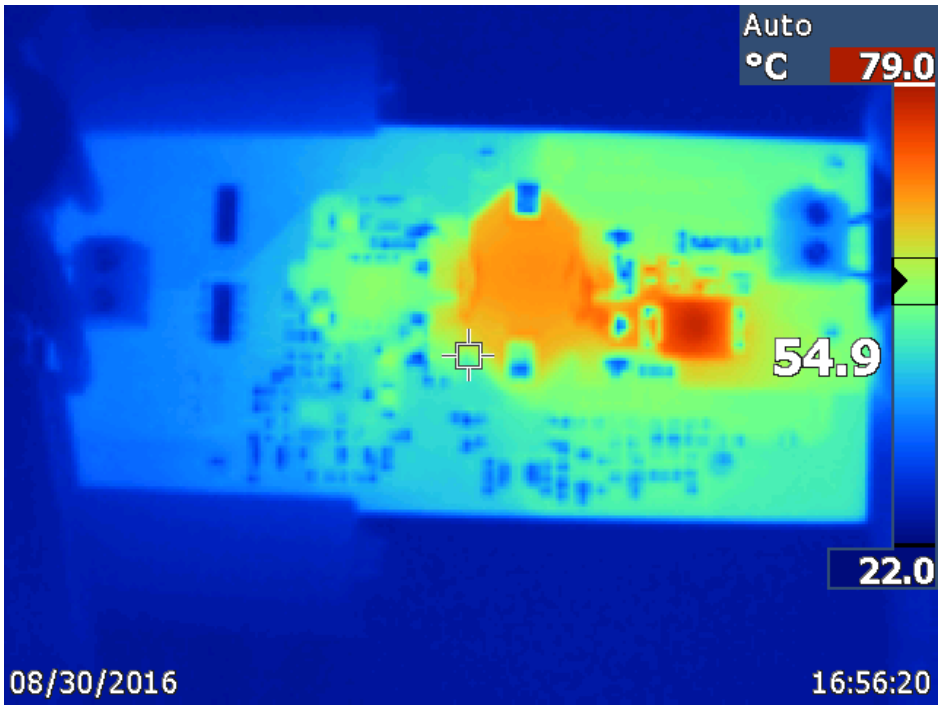
57.009	0.214	12.105	0.902	12.177	10.925	1.252	89.715
57.009	0.236	12.104	1.002	13.466	12.133	1.332	90.107
57.009	0.259	12.104	1.102	14.765	13.342	1.423	90.361
57.008	0.282	12.103	1.202	16.071	14.549	1.522	90.531
57.008	0.305	12.102	1.302	17.382	15.759	1.622	90.666
57.007	0.328	12.101	1.402	18.698	16.969	1.730	90.749
57.007	0.351	12.101	1.502	20.021	18.177	1.844	90.789
57.006	0.375	12.100	1.602	21.349	19.384	1.964	90.798
57.005	0.398	12.099	1.702	22.682	20.591	2.092	90.779
57.004	0.421	12.099	1.802	24.022	21.798	2.223	90.744
57.003	0.445	12.098	1.902	25.372	23.008	2.364	90.683
57.003	0.469	12.097	2.002	26.728	24.218	2.511	90.607
57.002	0.493	12.097	2.102	28.090	25.424	2.667	90.506
57.000	0.517	12.096	2.202	29.458	26.630	2.828	90.401

5 Thermal

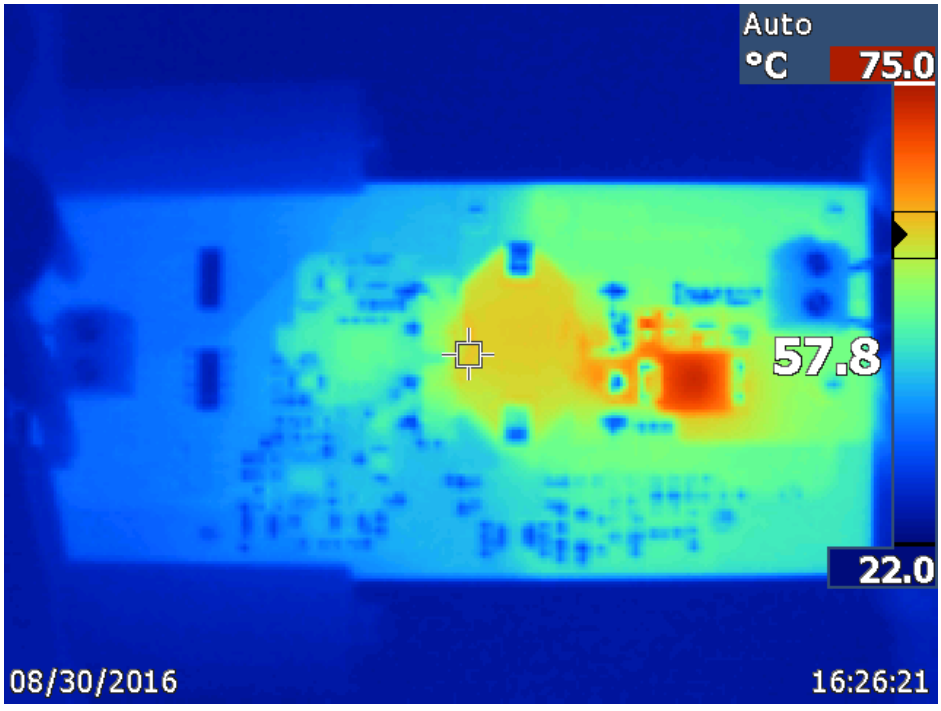
5.1 36V Input, 12V @ 2A Output



5.2 48V Input, 12V @ 2A Output

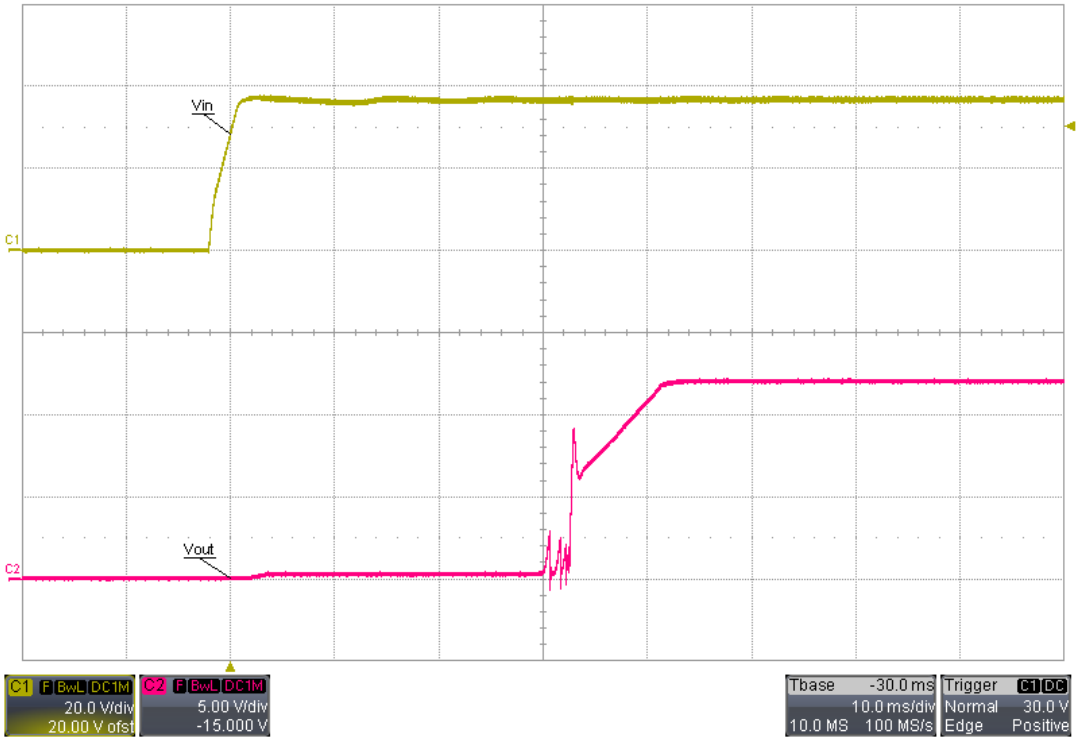


5.3 57V Input, 12V @ 2A Output

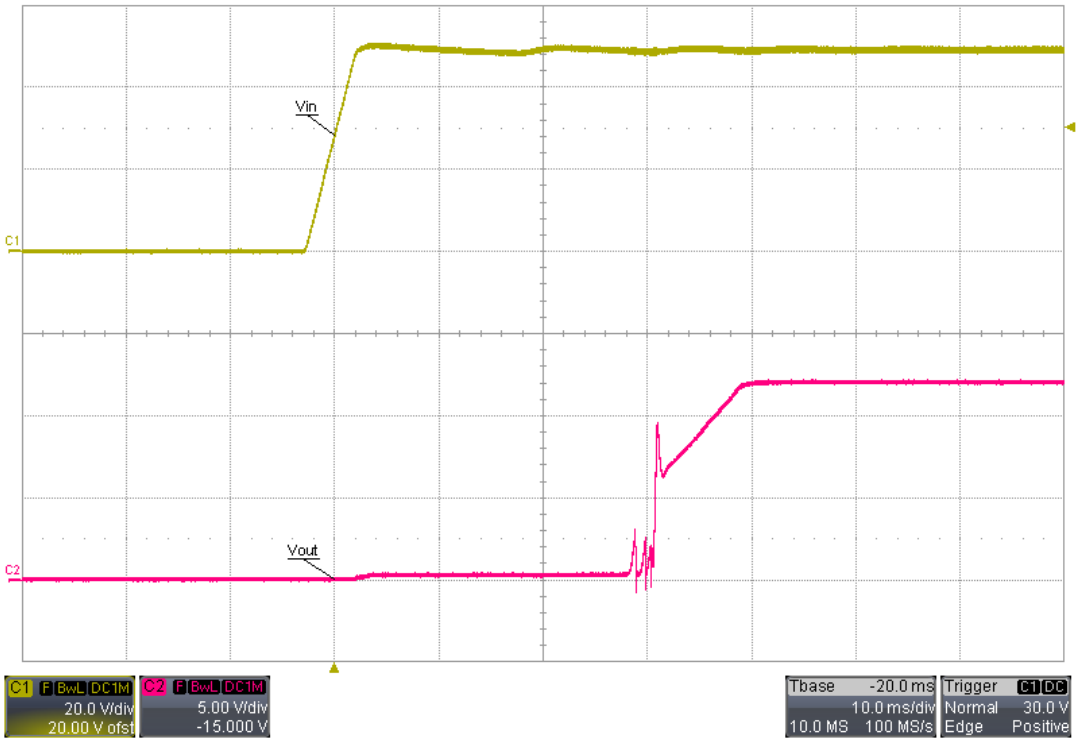


6 Startup

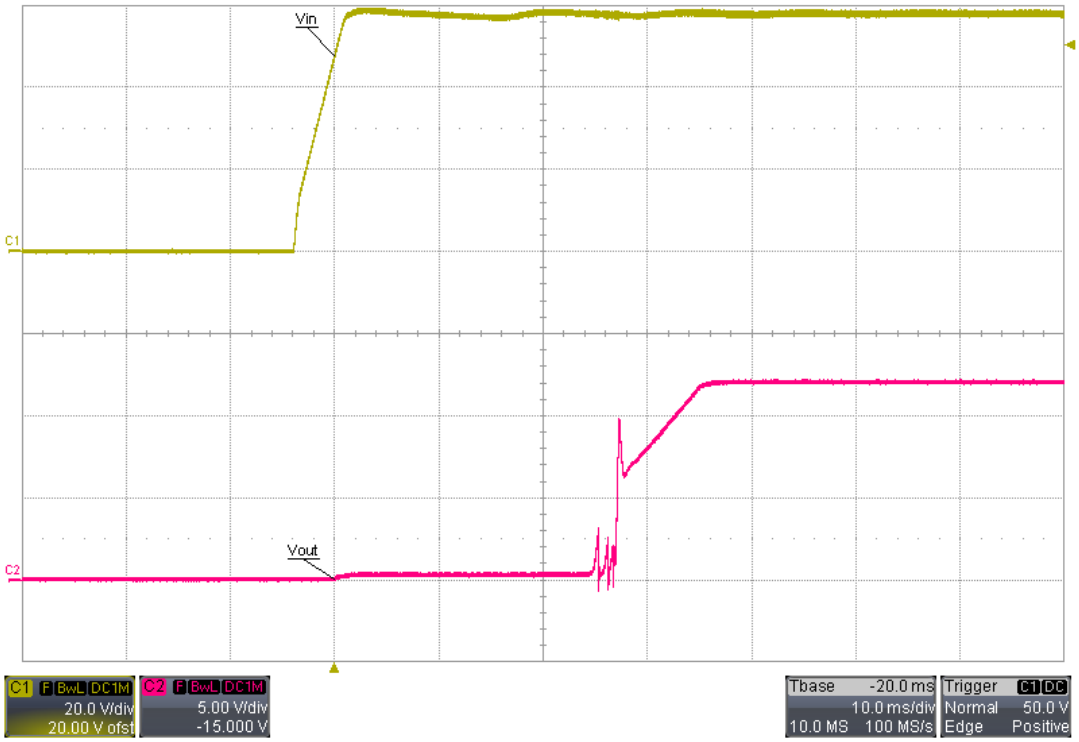
6.1 36V Input, 12V @ 2A Output



6.2 48V Input, 12V @ 2A Output

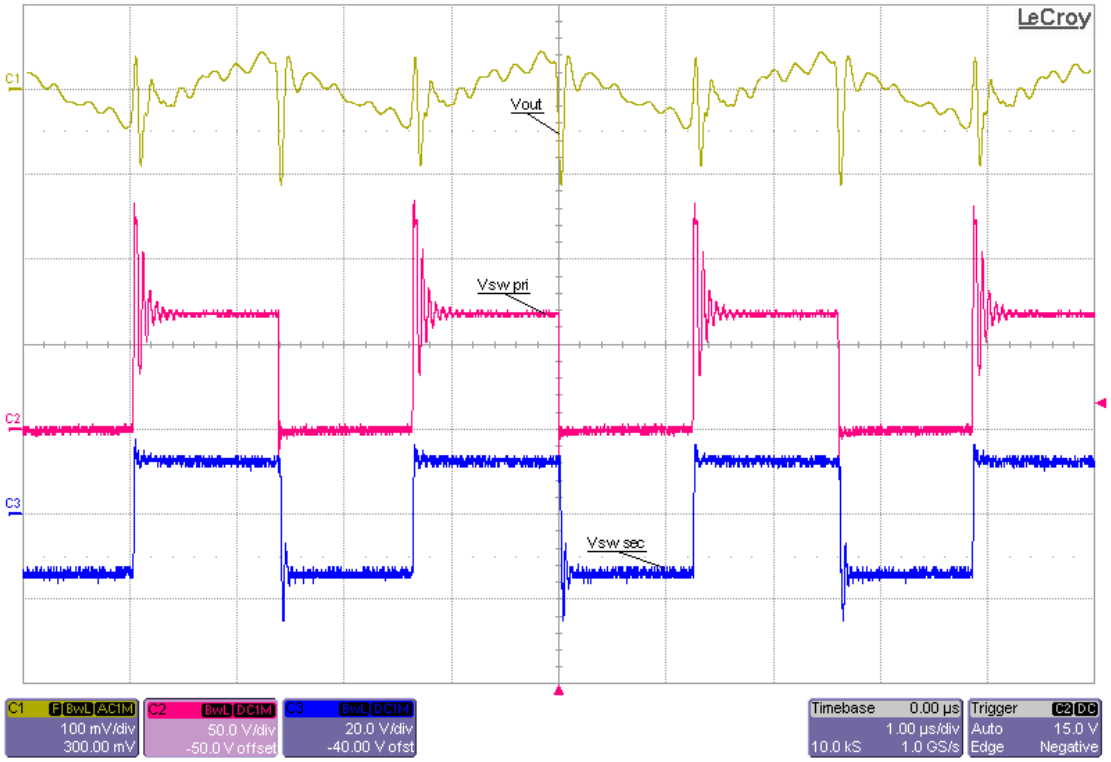


6.3 57V Input, 12V @ 2A Output

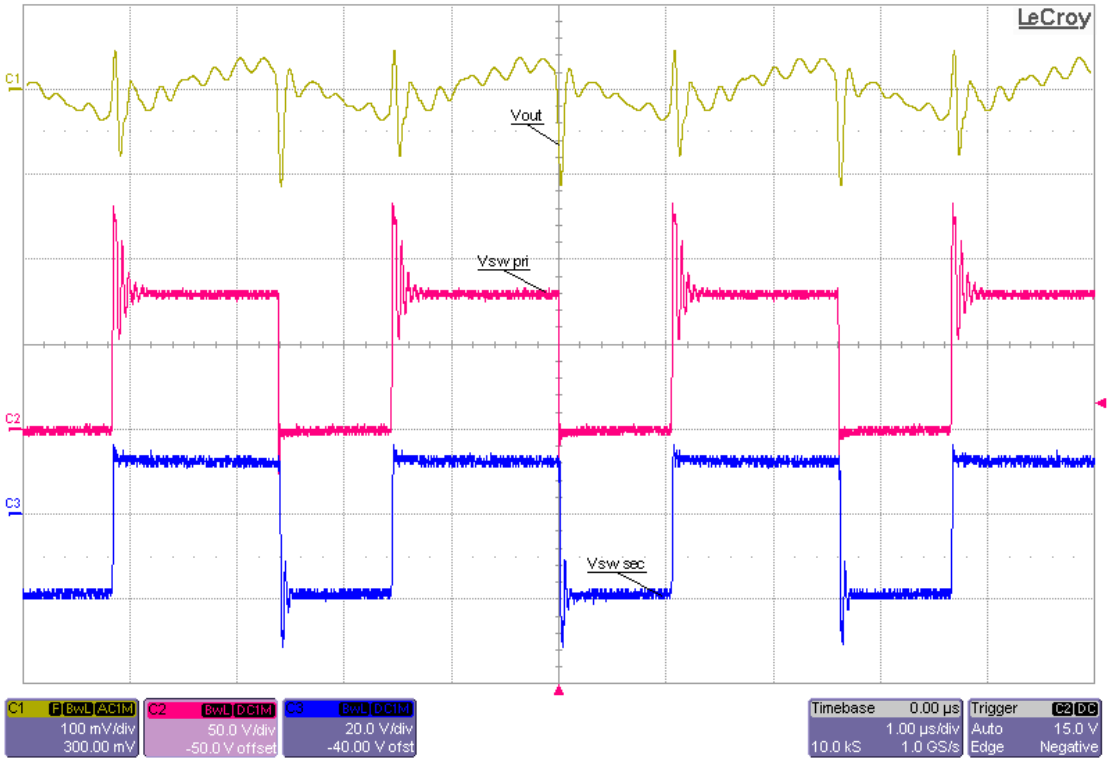


7 Switching and Ripple Voltage

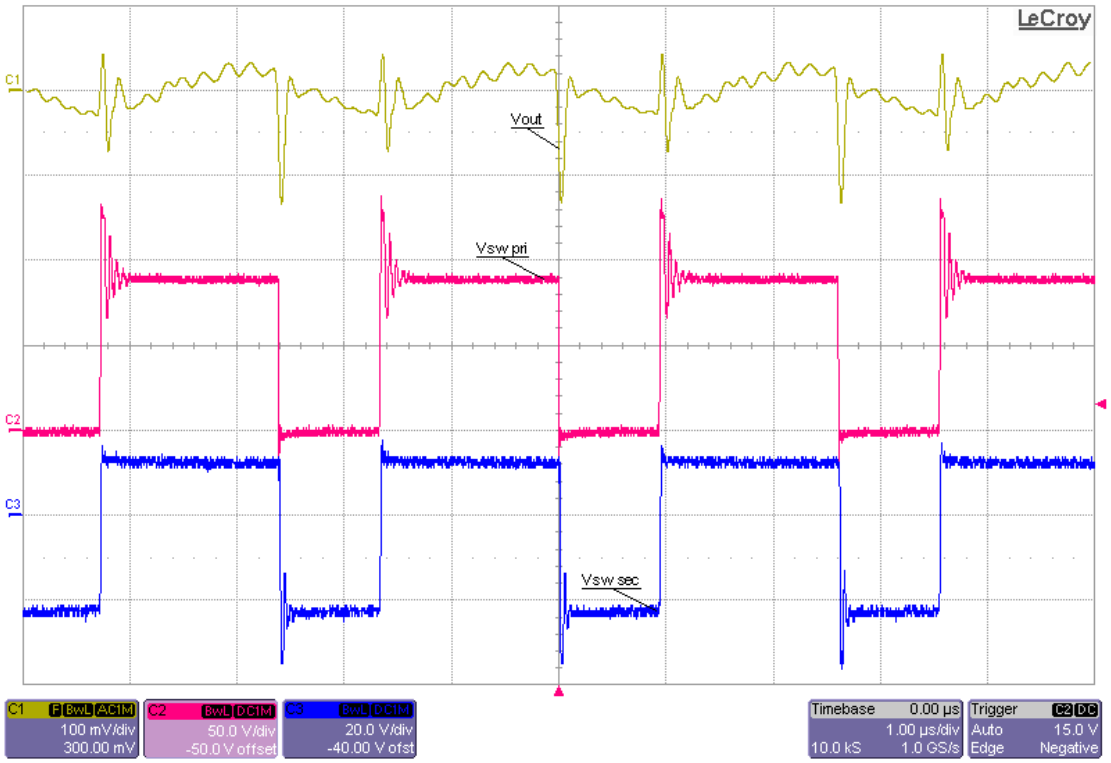
7.1 36V Input, 12V @ 2A Output



7.2 48V Input, 12V @ 2A Output

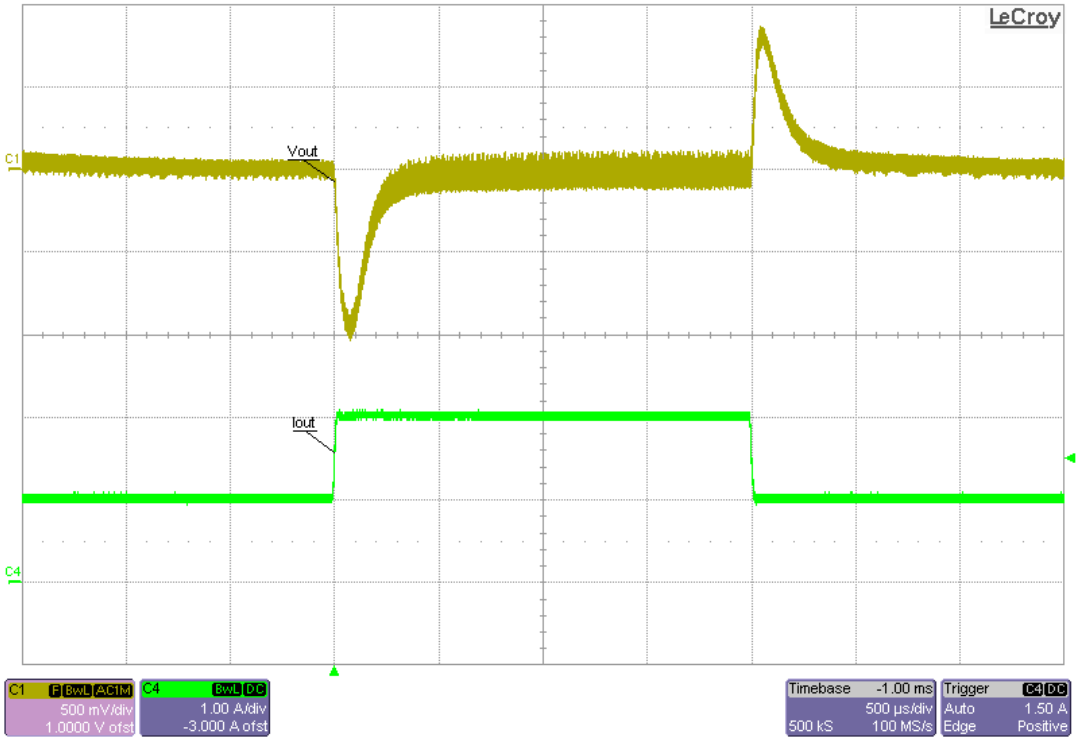


7.3 57V Input, 12V @ 2A Output

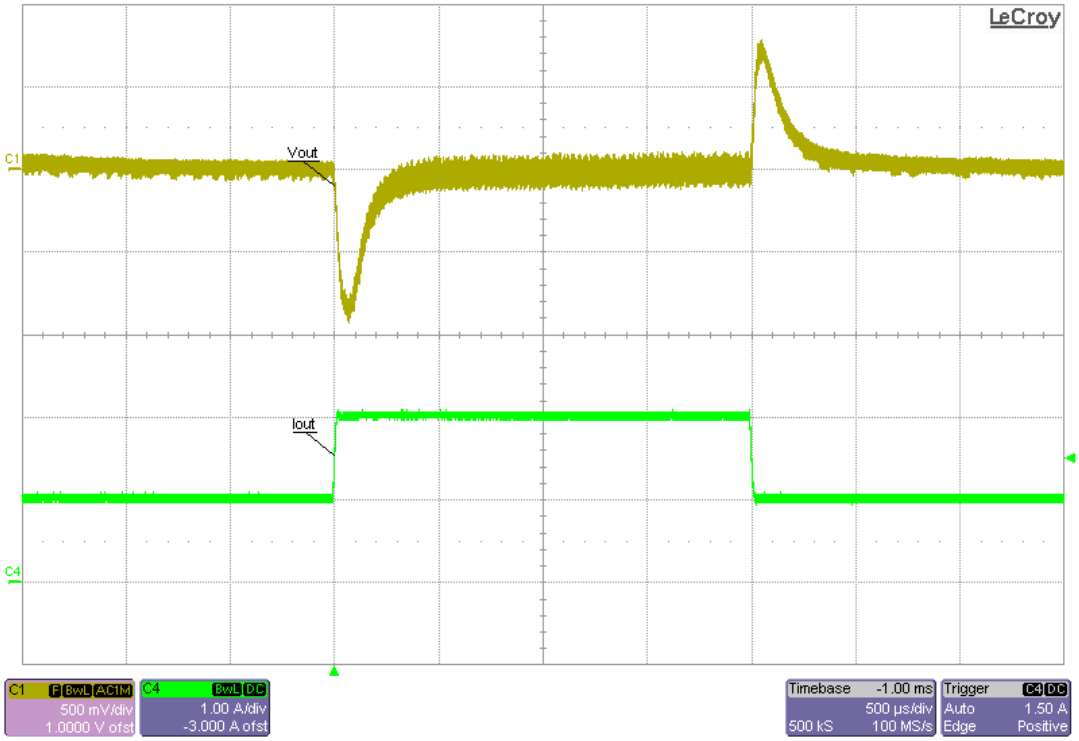


8 Load Transient Response

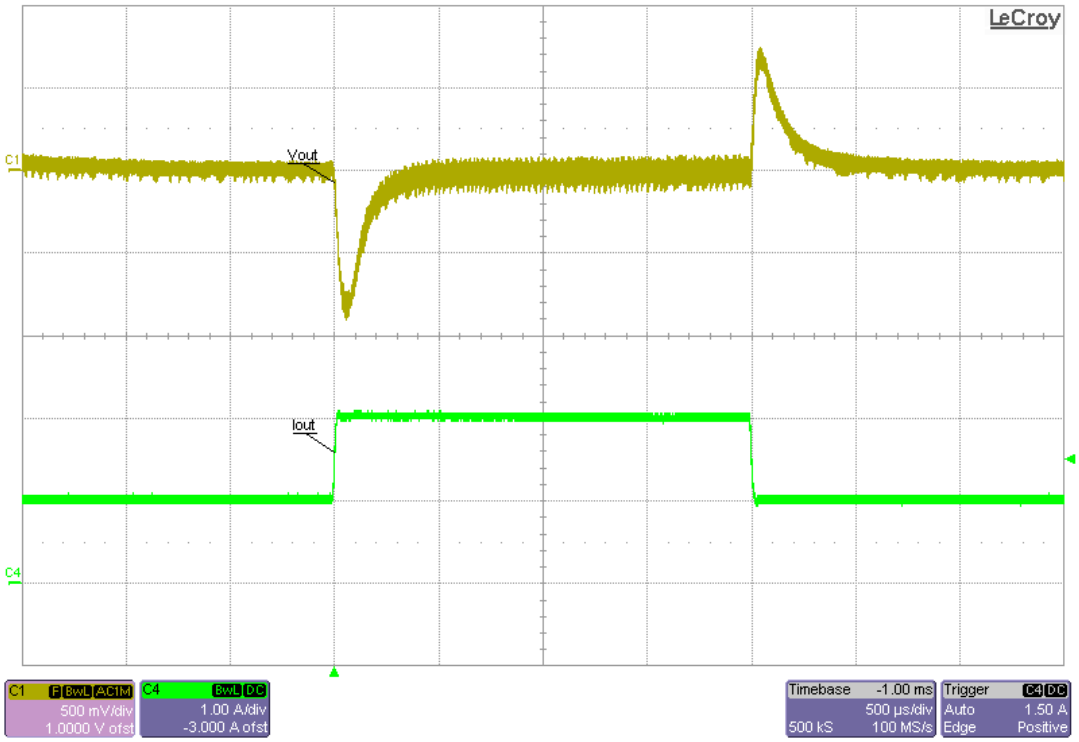
8.1 36V Input, 12Vout, 1A-to-2A Load Step



8.2 48V Input, 12Vout, 1A-to-2A Load Step

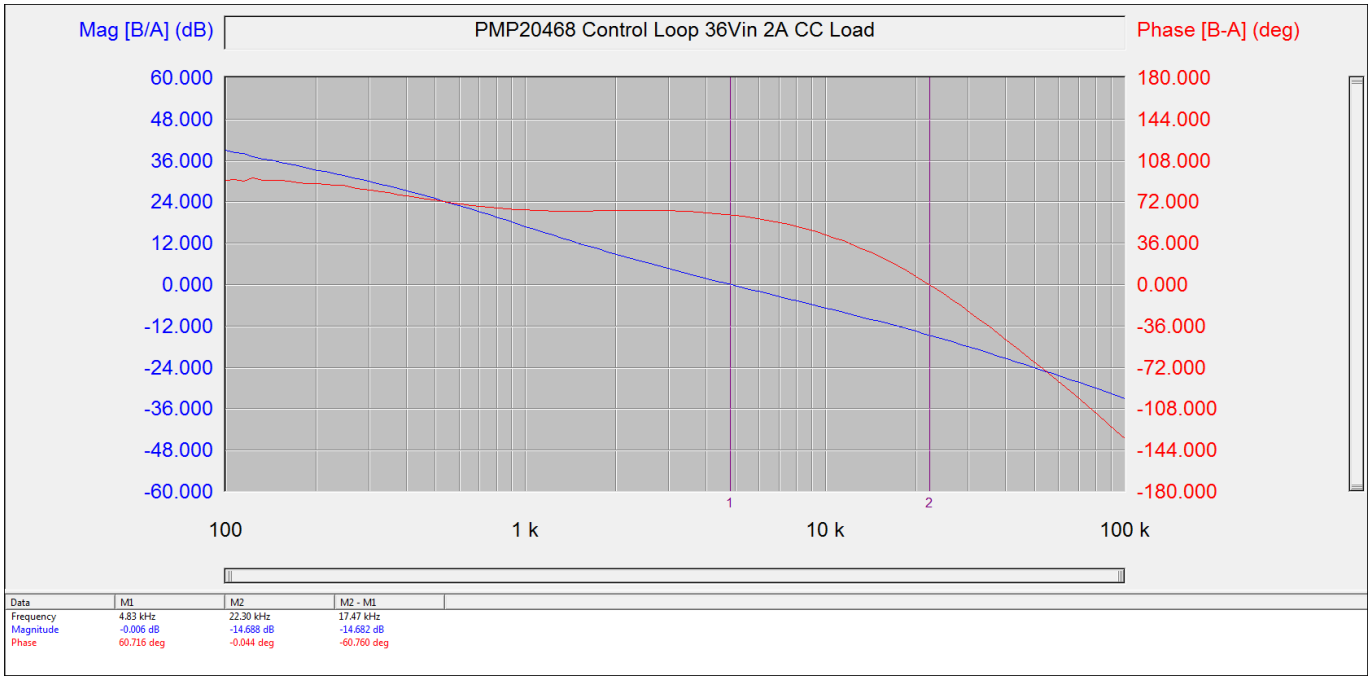


8.3 57V Input, 12Vout, 1A-to-2A Load Step



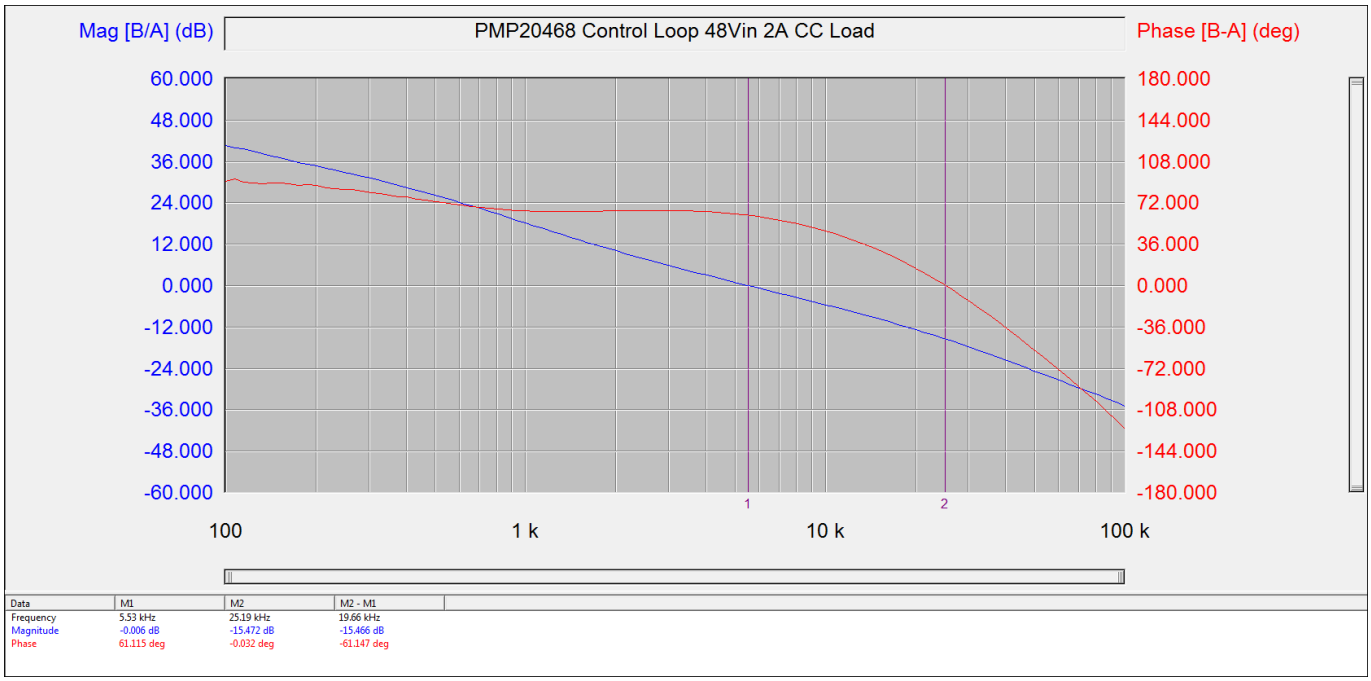
9 Frequency Response

9.1 36V Input, 12V @ 2A Output



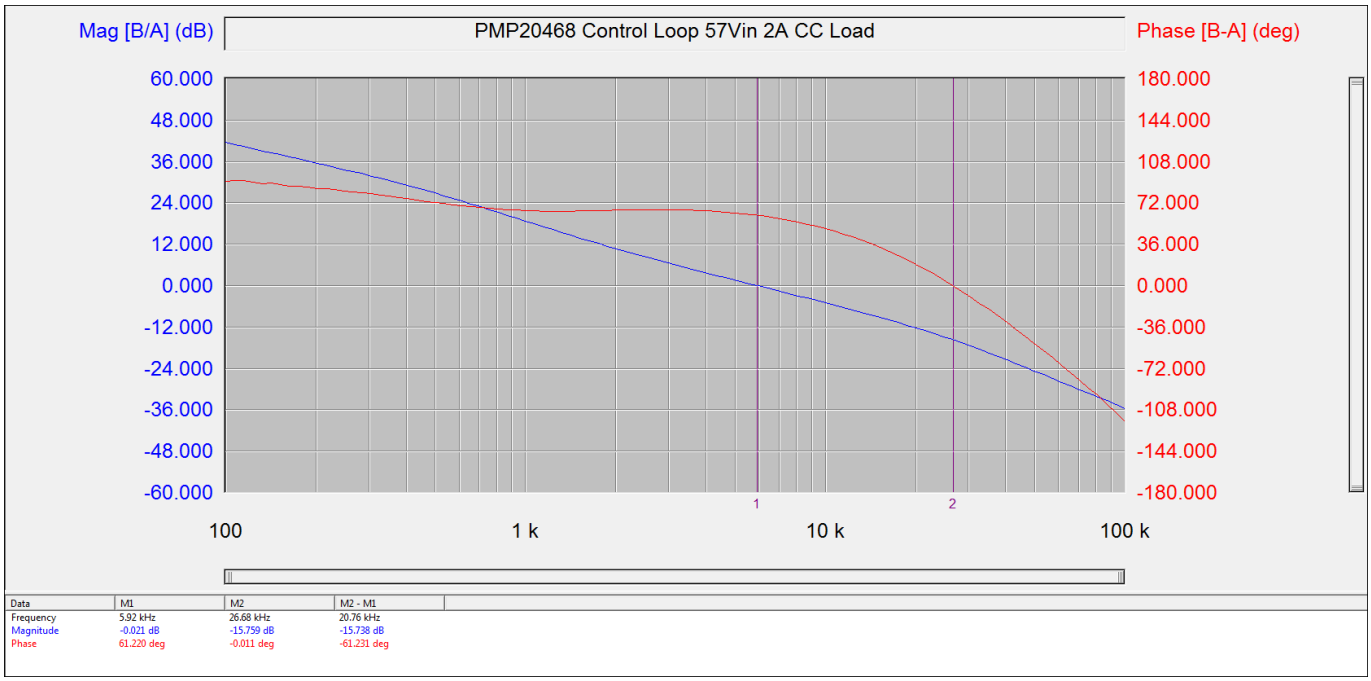
Bandwidth: 4.83kHz Phase Margin: 60.7° Gain Margin: 14.7dB

9.2 48V Input, 12V @ 2A Output



Bandwidth: 5.53kHz Phase Margin: 61.1° Gain Margin: 15.5dB

9.3 57V Input, 12V @ 2A Output



Bandwidth: 5.92kHz Phase Margin: 61.2° Gain Margin: 15.8dB

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