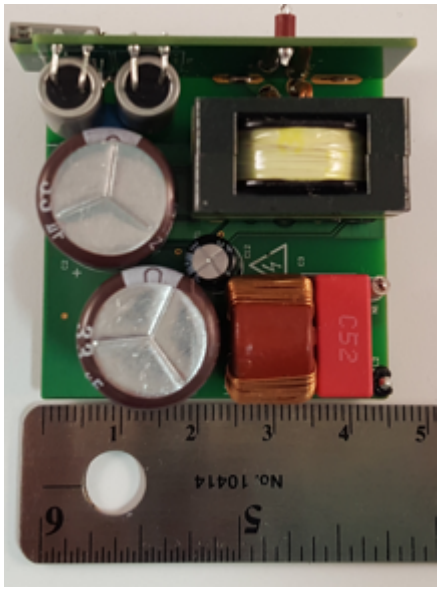
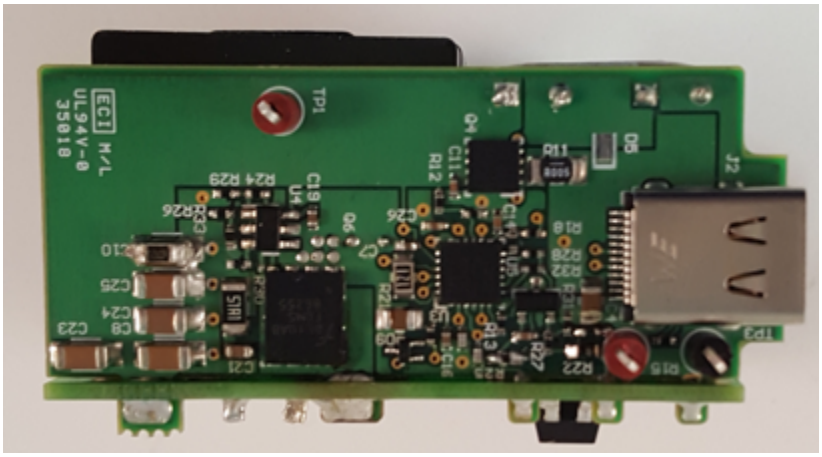
Test Report: PMP20533

USB Type-C™ DFP 15V/3A/45W Out, Universal AC Input Reference Design

Description

The PMP20533 power reference design provides up to 15 V/45 W over USB Type-C from a universal AC input range of 85 to 265 VAC for charger applications. The UCC24636 synchronous rectifier driver allows this design to provide 91% average efficiency. The TPS25740A provides the interface between the flyback power supply and the USB Type-C™ cable.





1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
V_{IN}	85 - 265 VAC
V_{OUT}	5/9/12/15 V
Nominal switching frequency	74 kHz

2 Testing and Results

2.1 Efficiency Graphs

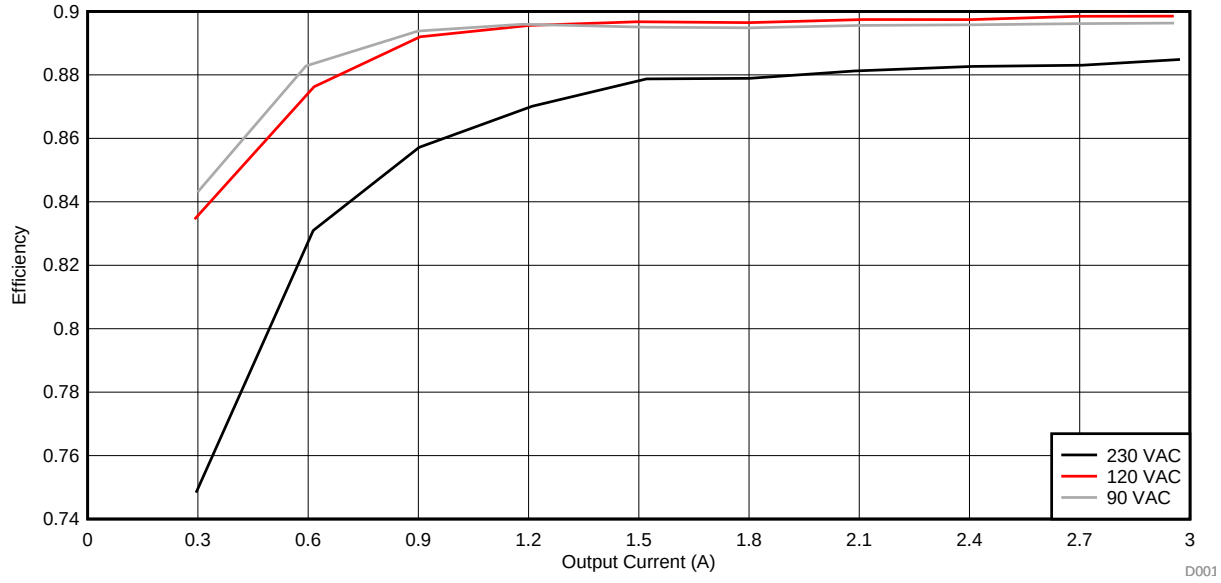


Figure 1. Efficiency with 5 V Output

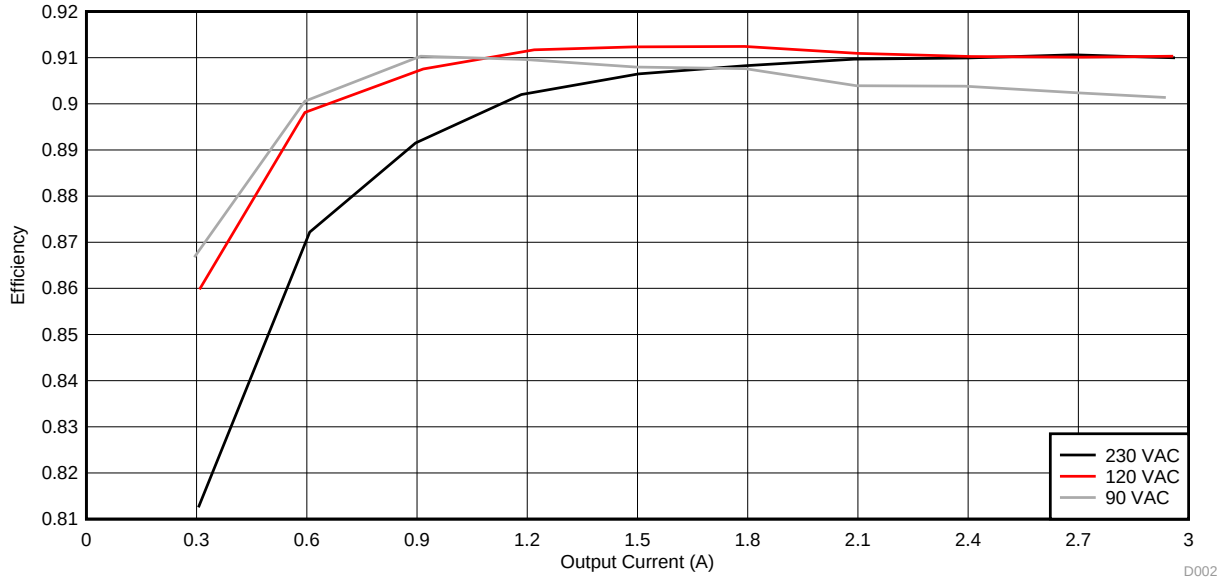


Figure 2. Efficiency with 9 V Output

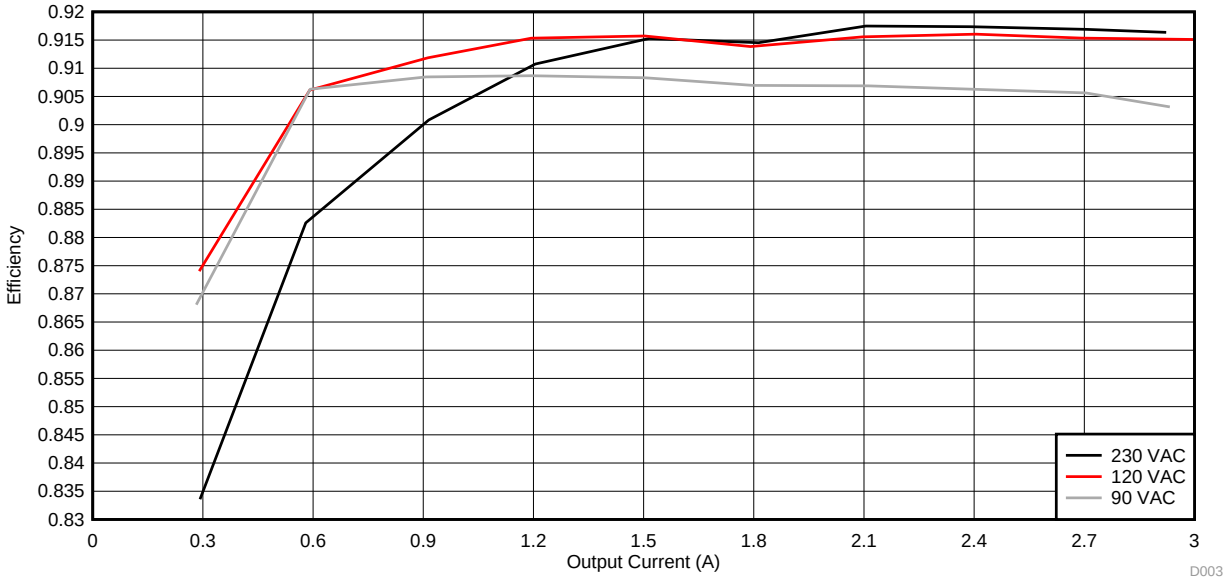


Figure 3. Efficiency with 12 V Output

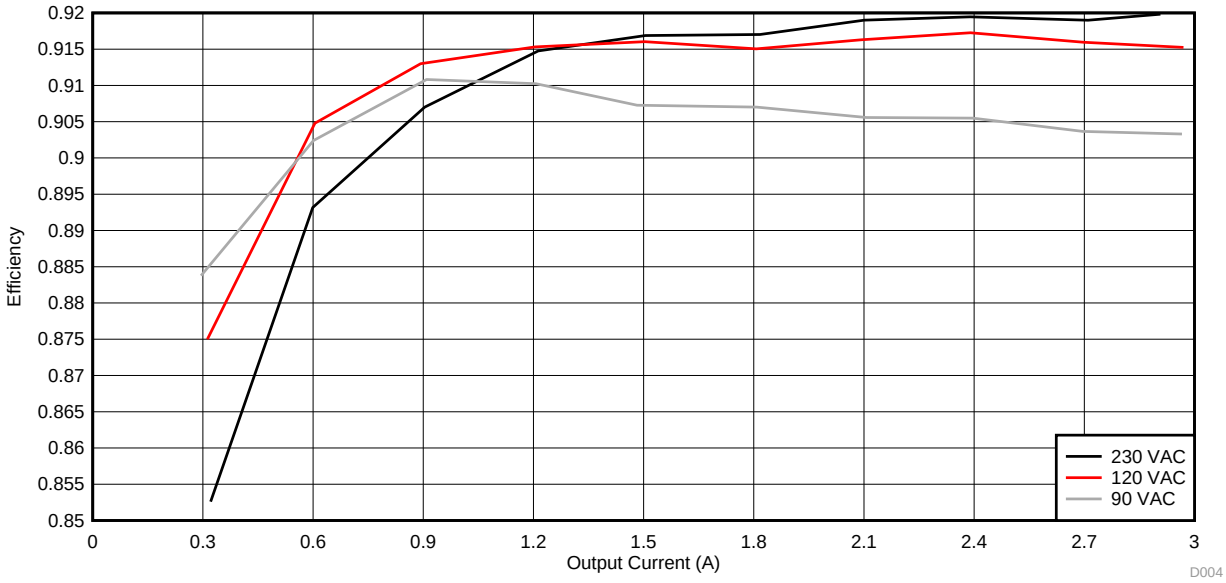


Figure 4. Efficiency with 15 V Output

2.2 Efficiency Data

Table 2. 5 V Efficiency with 90 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™ (V)
2.973	5.01	4.975	230.6	174.9	16.833	0.417	14.89473	14.790675	88.49%	87.87%
2.707	5.01	4.978	230.6	161.3	15.358	0.413	13.56207	13.475446	88.31%	87.74%
2.407	5.01	4.981	230.6	145.6	13.662	0.408	12.05907	11.989267	88.27%	87.76%
2.087	5.01	4.985	230.6	128.8	11.865	0.4	10.45587	10.403695	88.12%	87.68%
1.801	5.01	4.988	230.6	113.5	10.266	0.393	9.02301	8.983388	87.89%	87.51%
1.521	5.01	4.991	230.7	98.1	8.672	0.382	7.62021	7.591311	87.87%	87.54%
1.21	5.01	4.995	230.7	81.3	6.967	0.372	6.0621	6.04395	87.01%	86.75%
0.902	5.01	4.998	230.7	64.2	5.272	0.356	4.51902	4.508196	85.72%	85.51%
0.614	5.01	5.002	230.7	48.3	3.702	0.333	3.07614	3.071228	83.09%	82.96%
0.295	5.01	5.005	230.7	30.2	1.975	0.283	1.47795	1.476475	74.83%	74.76%
0.012	5.01	5.008	230.7	15.2	0.18	0.05	0.06012	0.060096	33.40%	33.39%

Table 3. 5 V Efficiency with 120 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™ (V)
2.956	5.01	4.975	120.14	274	16.482	0.501	14.80956	14.7061	89.85%	89.23%
2.699	5.01	4.978	120.16	252.8	15.05	0.496	13.52199	13.435622	89.85%	89.27%
2.405	5.01	4.981	120.19	228.2	13.426	0.489	12.04905	11.979305	89.74%	89.22%
2.1111	5.01	4.985	120.22	203.3	11.785	0.482	10.576611	10.5238335	89.75%	89.30%
1.801	5.01	4.988	120.25	177	10.065	0.473	9.02301	8.983388	89.65%	89.25%
1.496	5.01	4.992	120.28	150.4	8.358	0.462	7.49496	7.468032	89.67%	89.35%
1.202	5.01	4.995	120.32	124.2	6.724	0.45	6.02202	6.00399	89.56%	89.29%
0.905	5.01	4.998	120.34	97.2	5.083	0.435	4.53405	4.52319	89.20%	88.99%
0.616	5.01	5.001	120.37	70.5	3.522	0.415	3.08616	3.080616	87.63%	87.47%
0.291	5.01	5.005	120.41	38.77	1.747	0.374	1.45791	1.456455	83.45%	83.37%
0.012	5.01	5.008	120.44	10	0.133	0.112	0.06012	0.060096	45.20%	45.18%

Table 4. 5 V Efficiency with 230 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.973	5.01	4.975	230.6	174.9	16.833	0.417	14.89473	14.790675	88.49%	87.87%
2.707	5.01	4.978	230.6	161.3	15.358	0.413	13.56207	13.475446	88.31%	87.74%
2.407	5.01	4.981	230.6	145.6	13.662	0.408	12.05907	11.989267	88.27%	87.76%
2.087	5.01	4.985	230.6	128.8	11.865	0.4	10.45587	10.403695	88.12%	87.68%
1.801	5.01	4.988	230.6	113.5	10.266	0.393	9.02301	8.983388	87.89%	87.51%
1.521	5.01	4.991	230.7	98.1	8.672	0.382	7.62021	7.591311	87.87%	87.54%
1.21	5.01	4.995	230.7	81.3	6.967	0.372	6.0621	6.04395	87.01%	86.75%
0.902	5.01	4.998	230.7	64.2	5.272	0.356	4.51902	4.508196	85.72%	85.51%
0.614	5.01	5.002	230.7	48.3	3.702	0.333	3.07614	3.071228	83.09%	82.96%
0.295	5.01	5.005	230.7	30.2	1.975	0.283	1.47795	1.476475	74.83%	74.76%
0.012	5.01	5.008	230.7	15.2	0.18	0.05	0.06012	0.060096	33.40%	33.39%

Table 5. 9 V Efficiency with 90 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.938	8.94	8.9	90.19	574.6	29.14	0.562	26.26572	26.1482	90.14%	89.73%
2.707	8.94	8.9	90.24	531.9	26.82	0.559	24.20058	24.0923	90.23%	89.83%
2.391	8.94	8.91	90.32	473.4	23.65	0.553	21.37554	21.30381	90.38%	90.08%
2.096	8.94	8.91	90.37	419	20.73	0.548	18.73824	18.67536	90.39%	90.09%
1.794	8.94	8.91	90.45	361.8	17.671	0.541	16.03836	15.98454	90.76%	90.46%
1.495	8.94	8.92	90.53	306.2	14.72	0.533	13.3653	13.3354	90.80%	90.59%
1.194	8.93	8.92	90.58	248.6	11.722	0.521	10.66242	10.65048	90.96%	90.86%
0.91	8.93	8.92	90.68	196.2	8.927	0.502	8.1263	8.1172	91.03%	90.93%
0.595	8.93	8.93	90.76	135.7	5.9	0.479	5.31335	5.31335	90.06%	90.06%
0.294	8.93	8.93	90.85	75.6	3.029	0.439	2.62542	2.62542	86.68%	86.68%
0.012	8.93	8.93	90.92	10.21	0.212	0.233	0.10716	0.10716	50.55%	50.55%

Table 6. 9 V Efficiency with 120 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.958	8.94	8.9	119.62	448.1	29.05	0.542	26.44452	26.3262	91.03%	90.62%
2.71	8.94	8.9	119.72	414.7	26.62	0.536	24.2274	24.119	91.01%	90.60%
2.409	8.94	8.91	119.8	372.4	23.66	0.53	21.53646	21.46419	91.02%	90.72%
2.099	8.94	8.91	119.84	328.8	20.6	0.523	18.76506	18.70209	91.09%	90.79%
1.792	8.94	8.91	119.92	285.9	17.558	0.512	16.02048	15.96672	91.24%	90.94%
1.491	8.93	8.92	119.97	242.1	14.594	0.502	13.31463	13.29972	91.23%	91.13%
1.219	8.93	8.92	120.05	203.2	11.94	0.488	10.88567	10.87348	91.17%	91.07%
0.917	8.93	8.92	120.14	159.7	9.023	0.47	8.18881	8.17964	90.75%	90.65%
0.595	8.93	8.93	120.22	110.6	5.916	0.445	5.31335	5.31335	89.81%	89.81%
0.308	8.93	8.93	120.27	64.7	3.199	0.411	2.75044	2.75044	85.98%	85.98%
0.012	8.93	8.93	120.34	11.2	0.237	0.166	0.10716	0.10716	45.22%	45.22%

Table 7. 9 V Efficiency with 230 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.963	8.94	8.9	230.4	281.1	29.11	0.449	26.48922	26.3707	91.00%	90.59%
2.686	8.94	8.9	230.5	257.8	26.37	0.444	24.01284	23.9054	91.06%	90.65%
2.399	8.94	8.91	230.5	233.6	23.57	0.438	21.44706	21.37509	90.99%	90.69%
2.089	8.94	8.91	230.5	207.1	20.53	0.43	18.67566	18.61299	90.97%	90.66%
1.795	8.94	8.91	230.5	181.5	17.668	0.422	16.0473	15.99345	90.83%	90.52%
1.503	8.94	8.92	230.6	155.6	14.823	0.413	13.43682	13.40676	90.65%	90.45%
1.184	8.94	8.92	230.6	127.2	11.735	0.4	10.58496	10.56128	90.20%	90.00%
0.896	8.93	8.92	230.7	100.7	8.975	0.386	8.00128	7.99232	89.15%	89.05%
0.608	8.93	8.93	230.7	73.5	6.225	0.366	5.42944	5.42944	87.22%	87.22%
0.305	8.93	8.93	230.7	44.32	3.352	0.328	2.72365	2.72365	81.25%	81.25%
0.012	8.93	8.93	230.8	15.6	0.275	0.081	0.10716	0.10716	38.97%	38.97%

Table 8. 12 V Efficiency with 90 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.933	11.96	11.92	90.11	758.6	38.84	0.568	35.07868	34.96136	90.32%	90.01%
2.704	11.96	11.92	90.16	699.7	35.71	0.567	32.33984	32.23168	90.56%	90.26%
2.395	11.95	11.93	90.24	620.7	31.58	0.564	28.62025	28.57235	90.63%	90.48%
2.112	11.95	11.93	90.31	551.3	27.83	0.56	25.2384	25.19616	90.69%	90.54%
1.798	11.95	11.93	90.41	473.2	23.69	0.554	21.4861	21.45014	90.70%	90.55%
1.504	11.95	11.94	90.5	401	19.787	0.546	17.9728	17.95776	90.83%	90.76%
1.192	11.95	11.94	90.59	323.1	15.676	0.536	14.2444	14.23248	90.87%	90.79%
0.908	11.95	11.94	90.65	251.5	11.944	0.525	10.8506	10.84152	90.85%	90.77%
0.592	11.95	11.94	90.72	170	7.806	0.505	7.0744	7.06848	90.63%	90.55%
0.282	11.95	11.95	90.87	92.4	3.882	0.462	3.3699	3.3699	86.81%	86.81%
0.012	11.95	11.95	91.01	12.2	0.315	0.275	0.1434	0.1434	45.52%	45.52%

Table 9. 12 V Efficiency with 120 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.997	11.96	11.92	120.05	591.1	39.17	0.552	35.84412	35.72424	91.51%	91.20%
2.694	11.96	11.92	120.12	535.6	35.2	0.547	32.22024	32.11248	91.53%	91.23%
2.405	11.96	11.93	120.2	482.7	31.4	0.542	28.7638	28.69165	91.60%	91.37%
2.097	11.95	11.93	120.28	426	27.37	0.535	25.05915	25.01721	91.56%	91.40%
1.791	11.95	11.93	120.37	370.4	23.42	0.526	21.40245	21.36663	91.39%	91.23%
1.503	11.95	11.94	120.43	315.1	19.614	0.517	17.96085	17.94582	91.57%	91.49%
1.194	11.95	11.94	120.51	256.3	15.588	0.505	14.2683	14.25636	91.53%	91.46%
0.913	11.95	11.94	120.57	201.9	11.965	0.491	10.91035	10.90122	91.19%	91.11%
0.591	11.95	11.95	120.65	137.58	7.794	0.47	7.06245	7.06245	90.61%	90.61%
0.29	11.95	11.95	120.71	75.8	3.965	0.435	3.4655	3.4655	87.40%	87.40%
0.012	11.95	11.95	120.84	12.4	0.321	0.207	0.1434	0.1434	44.67%	44.67%

Table 10. 12 V Efficiency with 230 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.923	11.96	11.92	230	355.9	38.15	0.466	34.95908	34.84216	91.64%	91.33%
2.707	11.96	11.92	230	332.3	35.31	0.462	32.37572	32.26744	91.69%	91.38%
2.389	11.95	11.93	230.1	297.2	31.12	0.455	28.54855	28.50077	91.74%	91.58%
2.105	11.96	11.93	230.1	263.5	27.44	0.453	25.1758	25.11265	91.75%	91.52%
1.813	11.95	11.93	230.1	231.8	23.69	0.444	21.66535	21.62909	91.45%	91.30%
1.515	11.95	11.94	230.1	198.4	19.78	0.432	18.10425	18.0891	91.53%	91.45%
1.205	11.95	11.94	230.2	161.2	15.811	0.424	14.39975	14.3877	91.07%	91.00%
0.915	11.95	11.94	230.2	128.8	12.138	0.41	10.93425	10.9251	90.08%	90.01%
0.58	11.95	11.95	230.2	86.2	7.853	0.397	6.931	6.931	88.26%	88.26%
0.292	11.95	11.95	230.3	51.3	4.186	0.355	3.4894	3.4894	83.36%	83.36%
0.012	11.95	11.95	230.4	16	0.373	0.1	0.1434	0.1434	38.45%	38.45%

Table 11. 15 V Efficiency with 90 VAC input

Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.966	15.06	15.02	90.11	941.5	49.45	0.583	44.66796	44.54932	90.33%	90.09%
2.696	15.06	15.03	90.2	858.4	44.93	0.58	40.60176	40.52088	90.37%	90.19%
2.396	15.06	15.03	90.31	765.9	39.85	0.576	36.08376	36.01188	90.55%	90.37%
2.107	15.06	15.04	90.39	675.2	35.04	0.573	31.73142	31.68928	90.56%	90.44%
1.808	15.06	15.04	90.52	583.9	30.02	0.568	27.22848	27.19232	90.70%	90.58%
1.482	15.06	15.04	90.65	484.4	24.6	0.56	22.31892	22.28928	90.73%	90.61%
1.207	15.06	15.04	90.77	401	19.97	0.549	18.17742	18.15328	91.02%	90.90%
0.909	15.06	15.05	90.9	310.1	15.03	0.534	13.68954	13.68045	91.08%	91.02%
0.601	15.06	15.05	91.05	215.5	10.03	0.511	9.05106	9.04505	90.24%	90.18%
0.295	15.06	15.06	91.17	117.1	5.027	0.474	4.4427	4.4427	88.38%	88.38%
0.012	15.06	15.06	91.35	14.3	0.403	0.301	0.18072	0.18072	44.84%	44.84%

Table 12. 15 V Efficiency with 120 VAC input

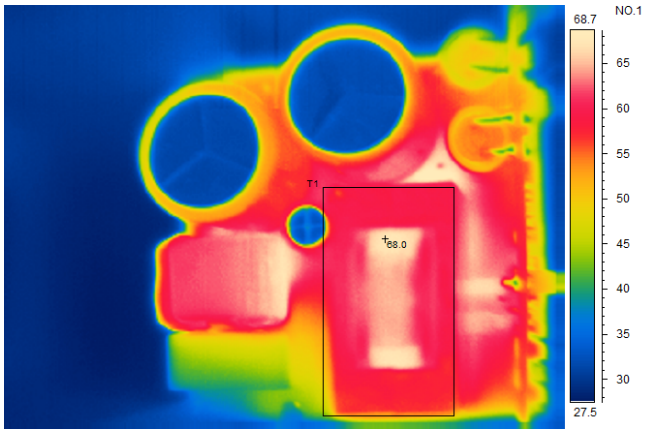
Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.97	15.06	15.03	120	727.3	48.87	0.56	44.7282	44.6391	91.52%	91.34%
2.698	15.06	15.03	120.1	664.3	44.36	0.556	40.63188	40.55094	91.60%	91.41%
2.39	15.06	15.03	120.2	593.5	39.24	0.551	35.9934	35.9217	91.73%	91.54%
2.093	15.06	15.04	120.3	525.6	34.4	0.545	31.52058	31.47872	91.63%	91.51%
1.807	15.06	15.04	120.4	459.8	29.74	0.538	27.21342	27.17728	91.50%	91.38%
1.503	15.06	15.04	120.5	388.3	24.71	0.529	22.63518	22.60512	91.60%	91.48%
1.204	15.06	15.05	120.5	317.6	19.81	0.518	18.13224	18.1202	91.53%	91.47%
0.893	15.06	15.05	120.7	244.2	14.73	0.501	13.44858	13.43965	91.30%	91.24%
0.605	15.06	15.05	120.8	174.6	10.07	0.478	9.1113	9.10525	90.48%	90.42%
0.312	15.06	15.06	120.9	100.6	5.37	0.443	4.69872	4.69872	87.50%	87.50%
0.012	15.06	15.06	121	14.3	0.412	0.25	0.18072	0.18072	43.86%	43.86%

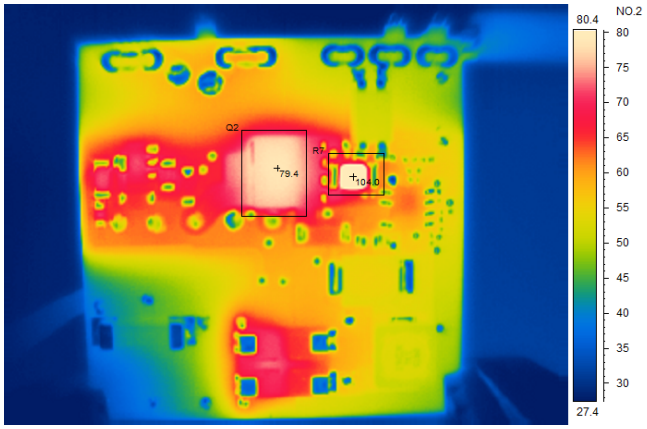
Table 13. 15 V Efficiency with 230 VAC input

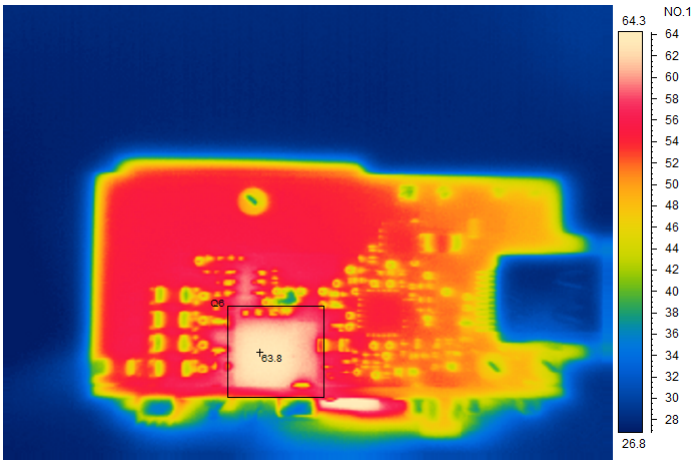
Iout (A)	Vout AC/DC (V)	Vout USB Type-C™ (V)	Vin (Vrms)	Iin (mArms)	Pin (W)	PF	Pout (W)	Pout (W)	Efficiency AC/DC	Efficiency USB Type-C™
2.937	15.06	15.03	230.1	442.7	48.08	0.472	44.23122	44.14311	92.00%	91.81%
2.71	15.06	15.03	230.1	412.1	44.41	0.468	40.8126	40.7313	91.90%	91.72%
2.389	15.06	15.03	230.1	368.5	39.13	0.462	35.97834	35.90667	91.95%	91.76%
2.101	15.06	15.04	230.2	328.3	34.43	0.455	31.64106	31.59904	91.90%	91.78%
1.817	15.06	15.04	230.2	289.4	29.84	0.448	27.36402	27.32768	91.70%	91.58%
1.505	15.06	15.04	230.3	245.1	24.72	0.438	22.6653	22.6352	91.69%	91.57%
1.213	15.06	15.04	230.3	203.3	19.97	0.427	18.26778	18.24352	91.48%	91.35%
0.904	15.06	15.05	230.4	158	15.01	0.412	13.61424	13.6052	90.70%	90.64%
0.599	15.06	15.05	230.4	111.9	10.1	0.392	9.02094	9.01495	89.32%	89.26%
0.321	15.06	15.06	230.5	68.1	5.67	0.361	4.83426	4.83426	85.26%	85.26%
0.012	15.06	15.06	230.6	16.7	0.492	0.126	0.18072	0.18072	36.73%	36.73%

2.3 Thermal Images

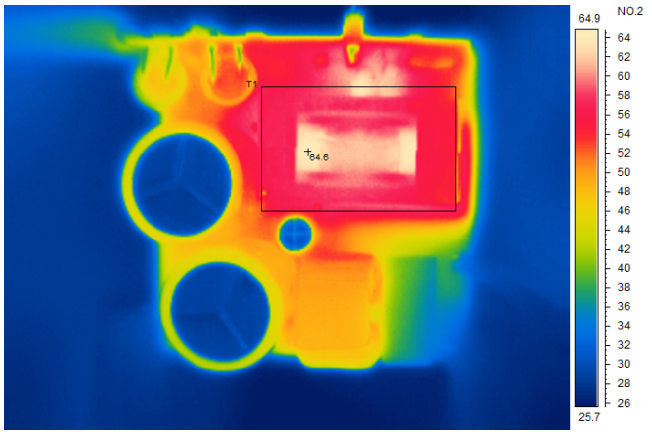
The following three thermal images were taken at 90 VAC.

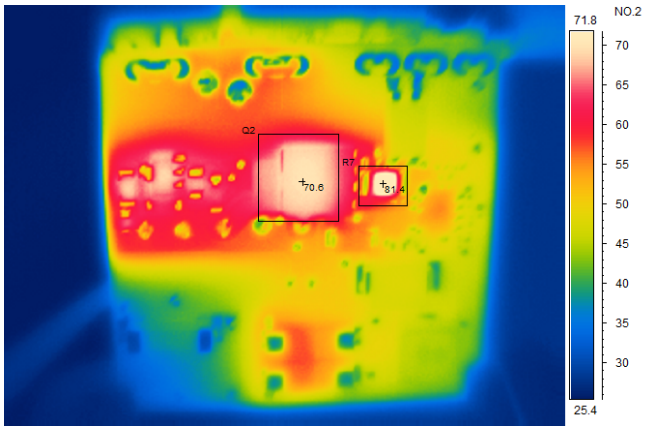


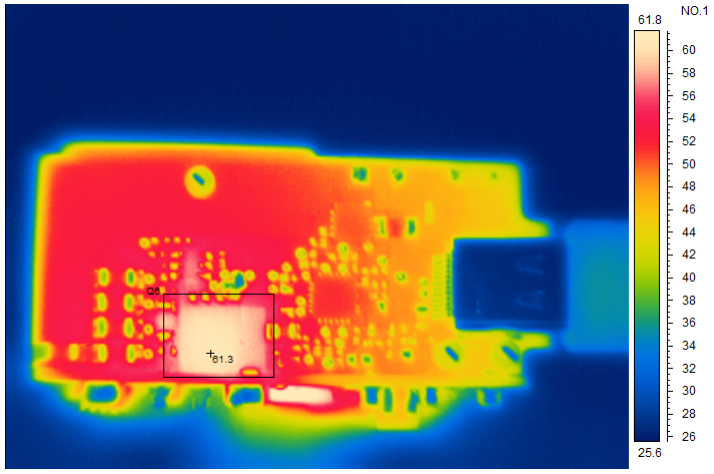




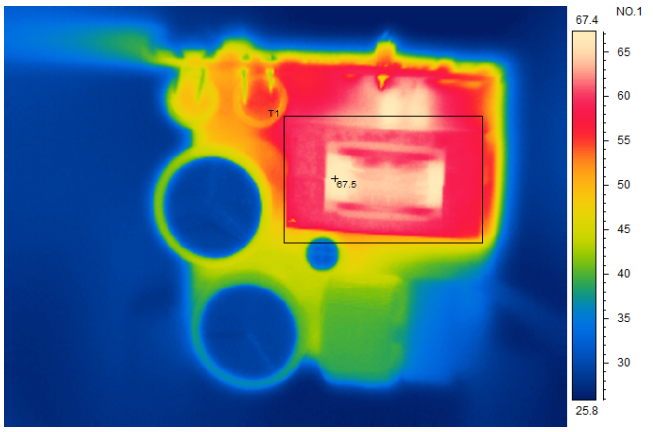
The following three thermal images were taken at 120 VAC.

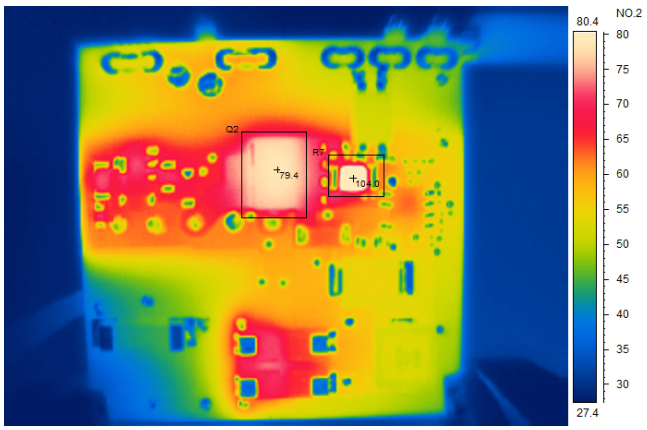


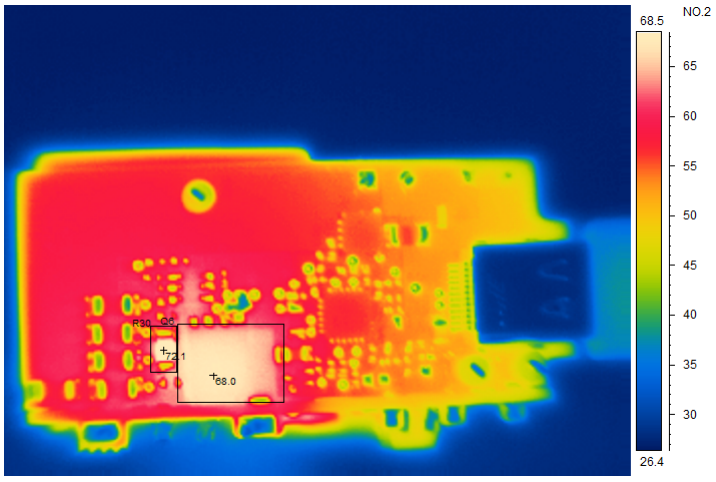




The following three thermal images were taken at 230 VAC.







3 Waveforms

3.1 Switching

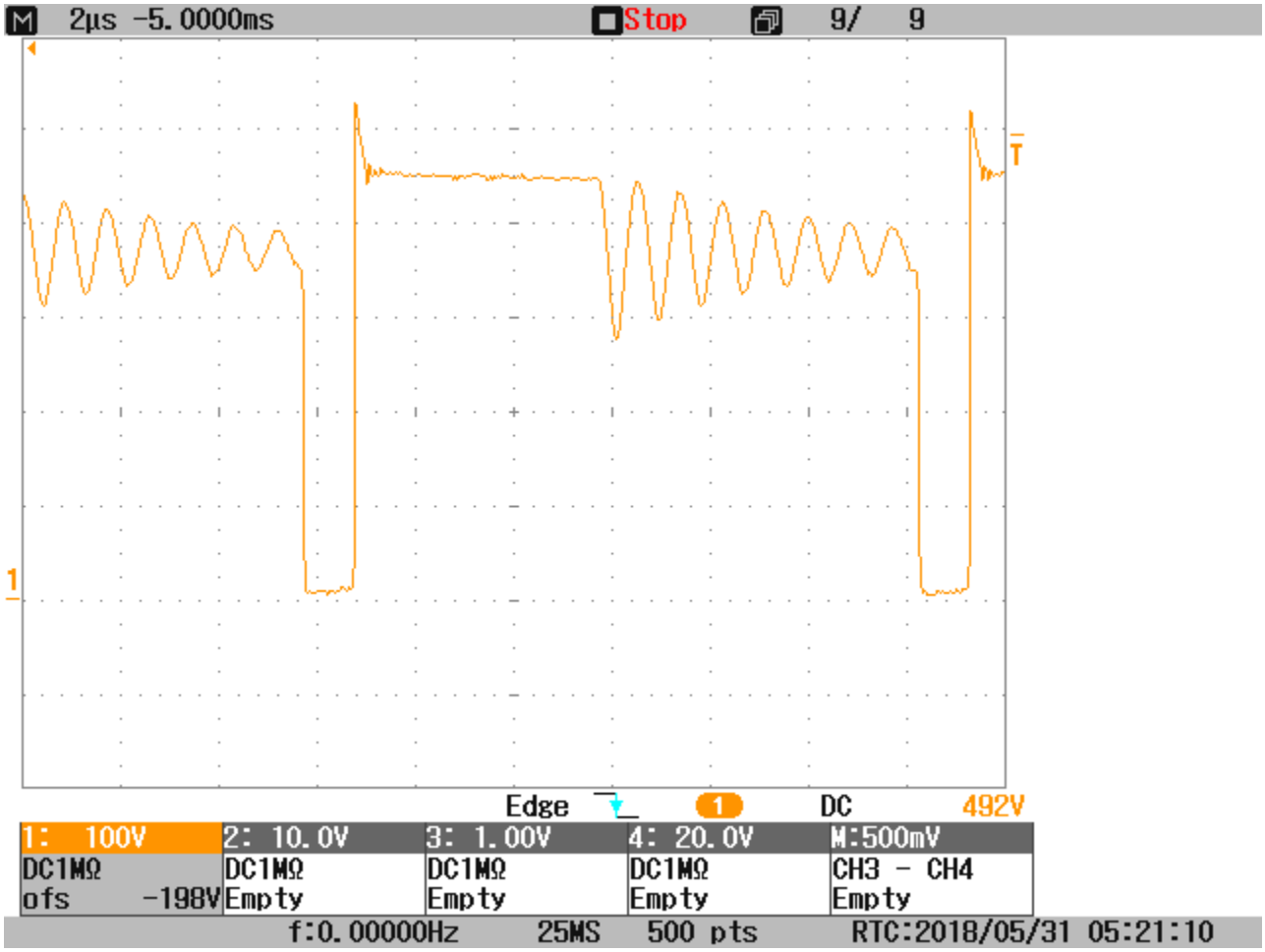


Figure 5. Switch Node Across Q2

Test was done with 265 VAC input and 15 V/3 A output.

Figure 6. Switch Node Across Q6

Test was done with 265 VAC input and 15 V/3 A output.

3.2 Output Voltage Ripple

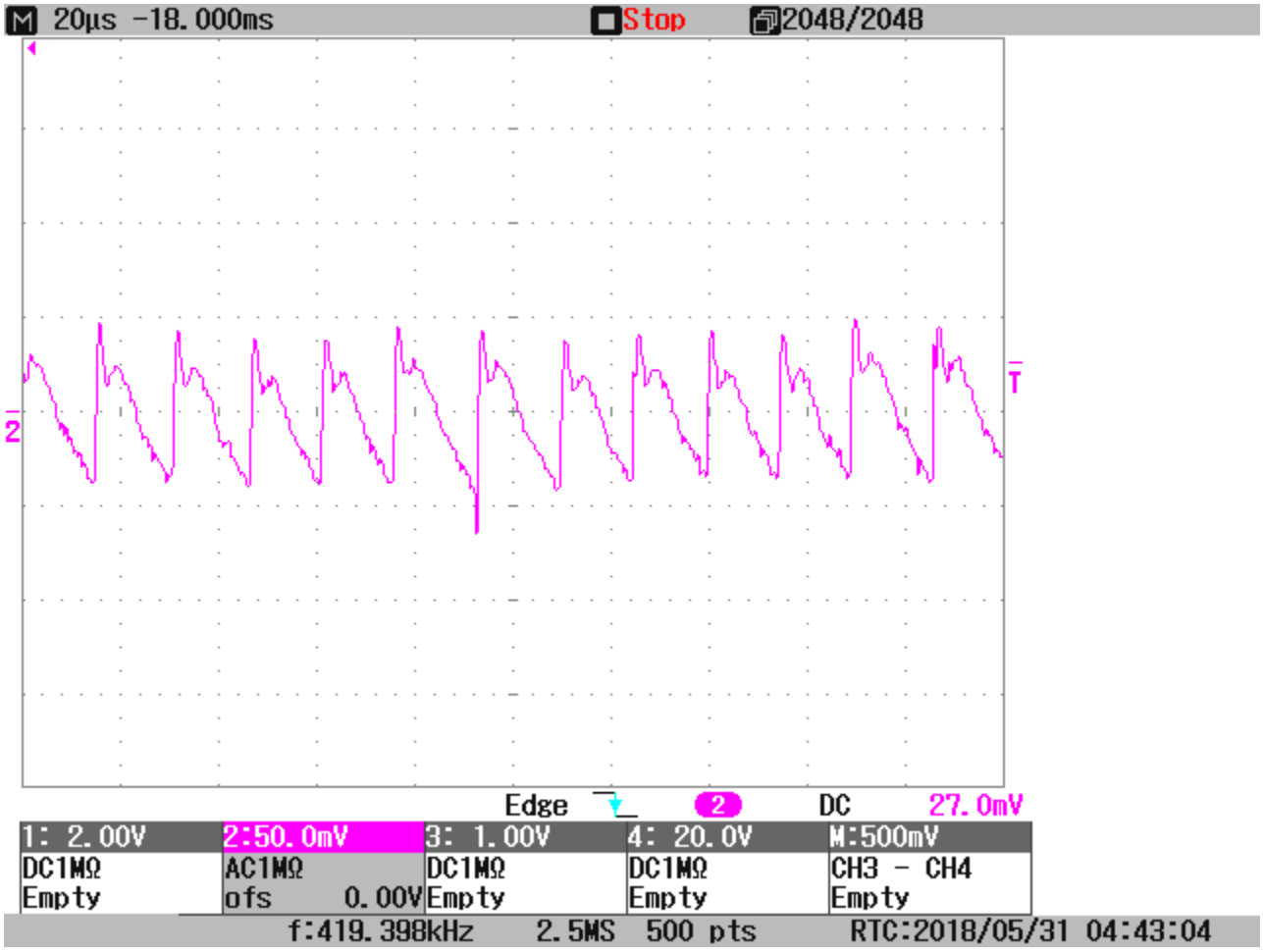


Figure 7. Output Ripple Voltage 5 V Output and 120 VAC Output

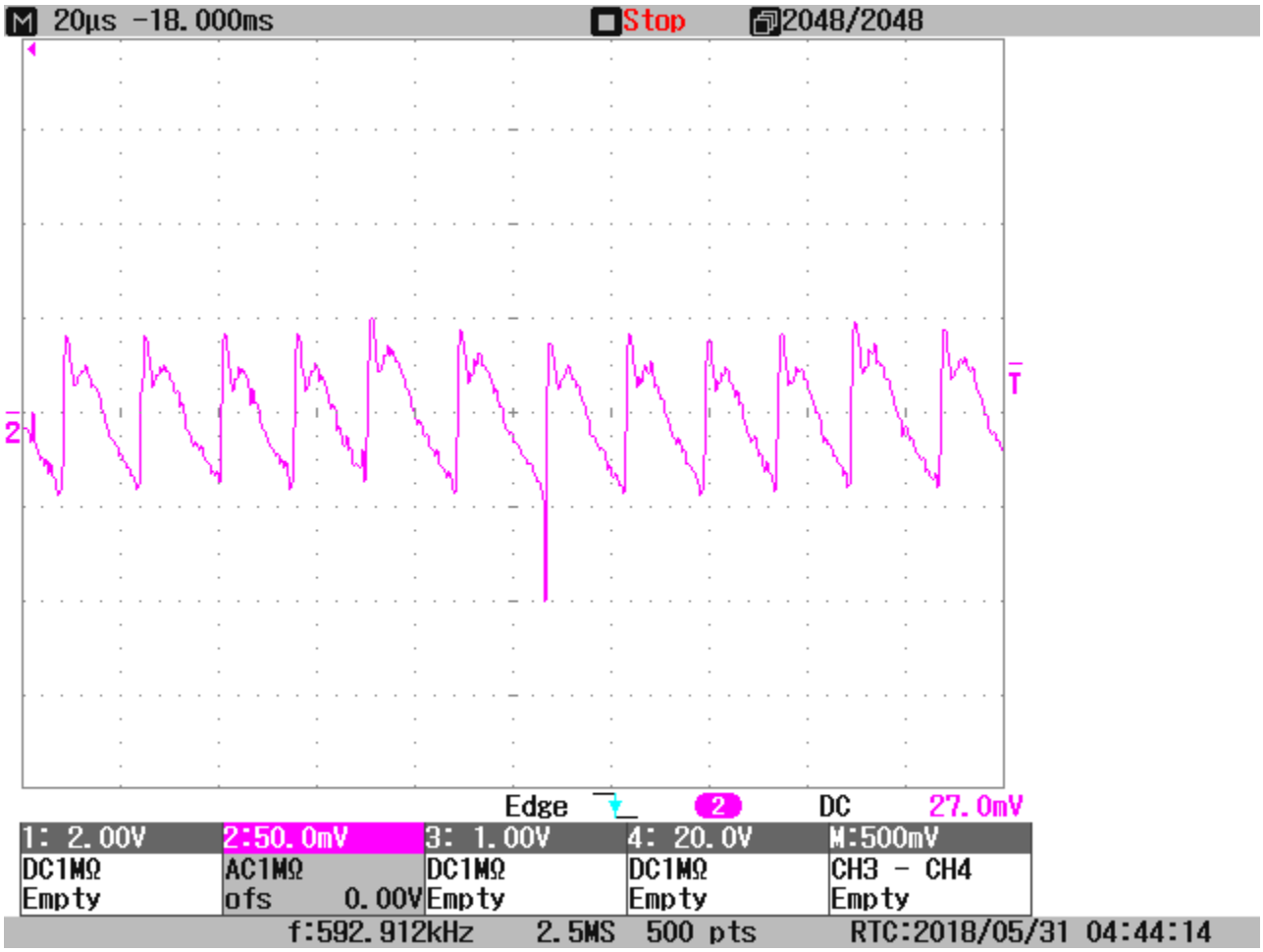


Figure 8. Output Ripple Voltage 5 V Output and 230 VAC Input

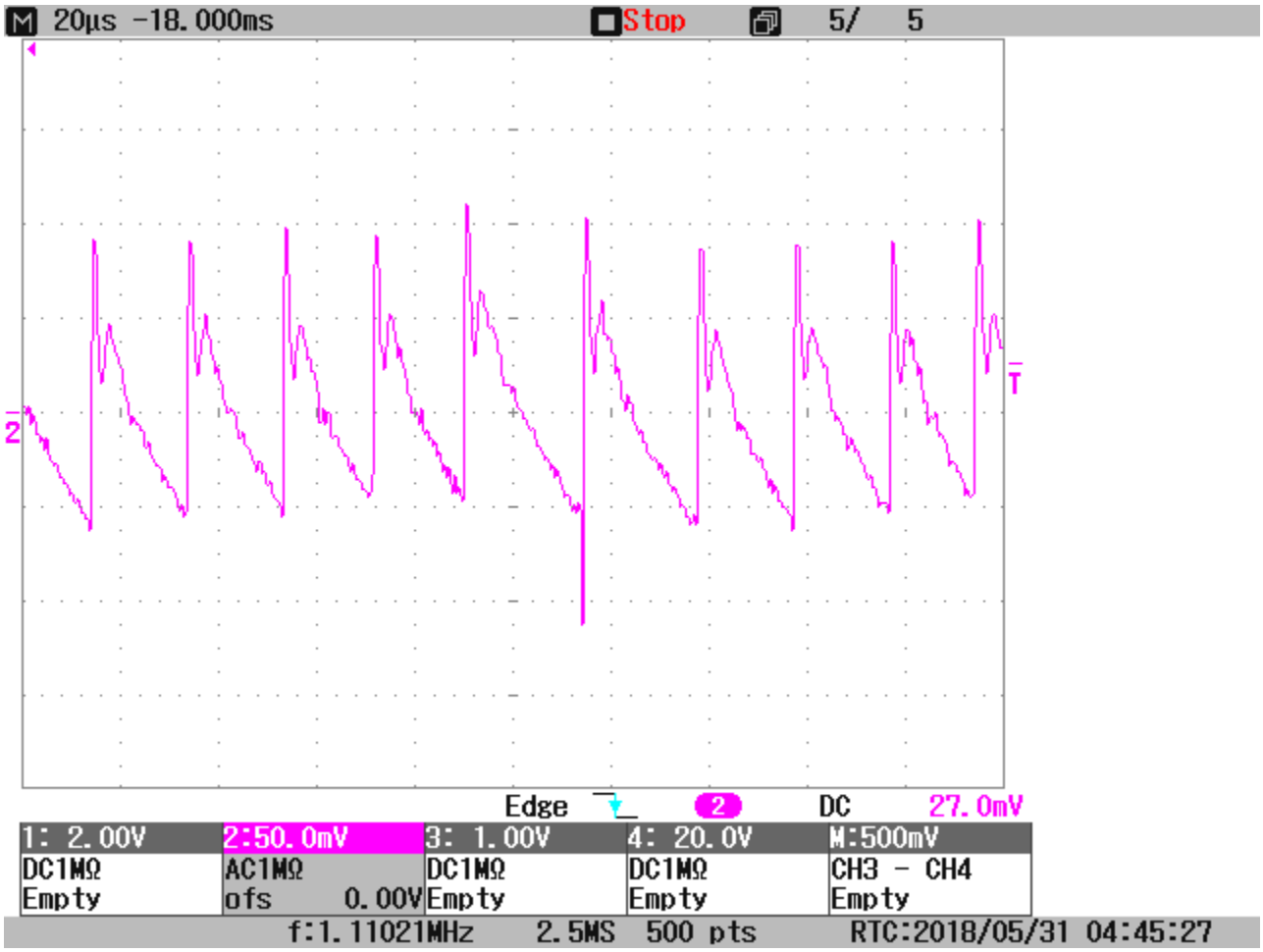


Figure 9. Output Ripple Voltage 9 V Output and 120 VAC Input

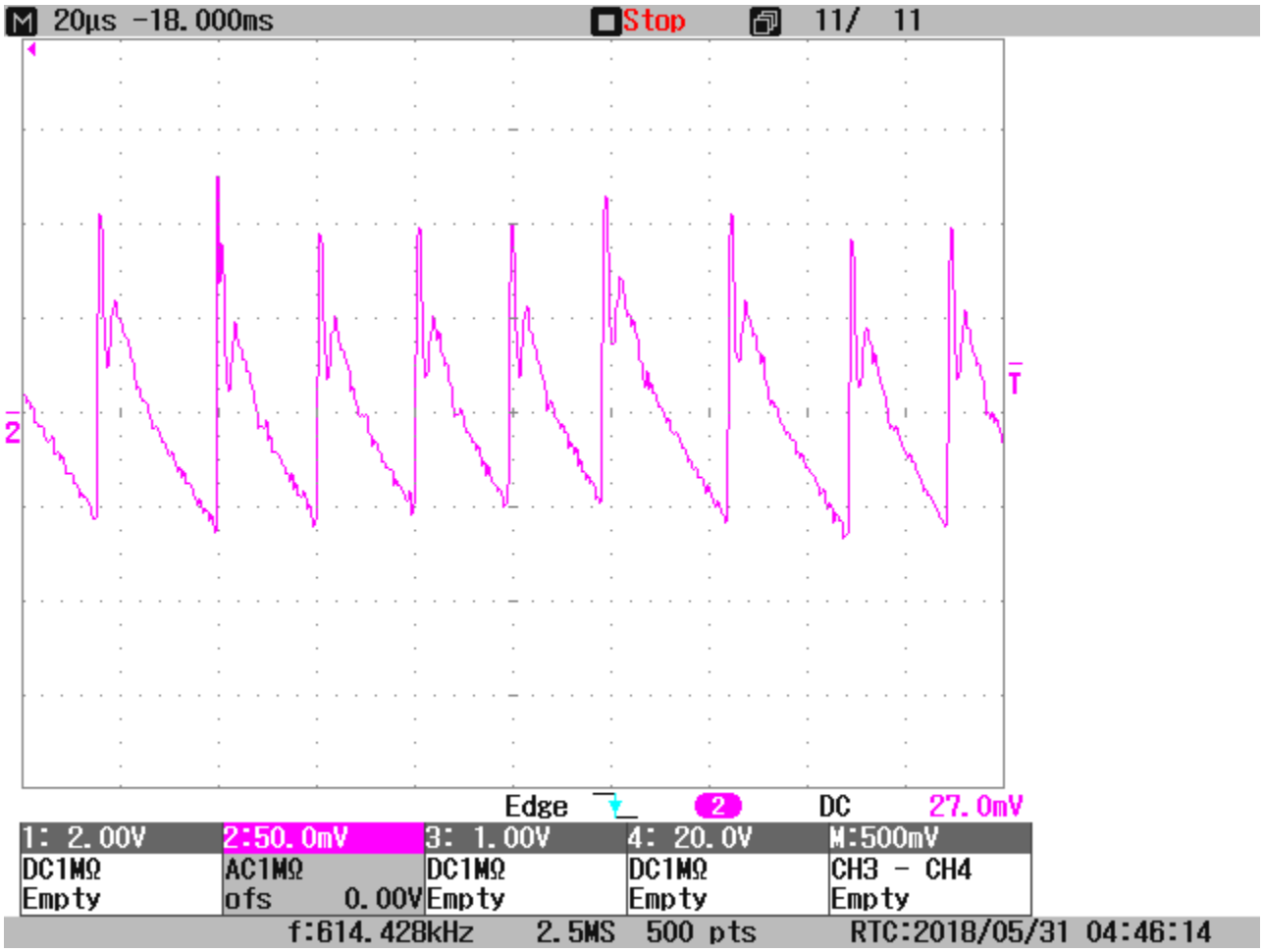


Figure 10. Output Ripple Voltage 9 V Output and 230 VAC Input

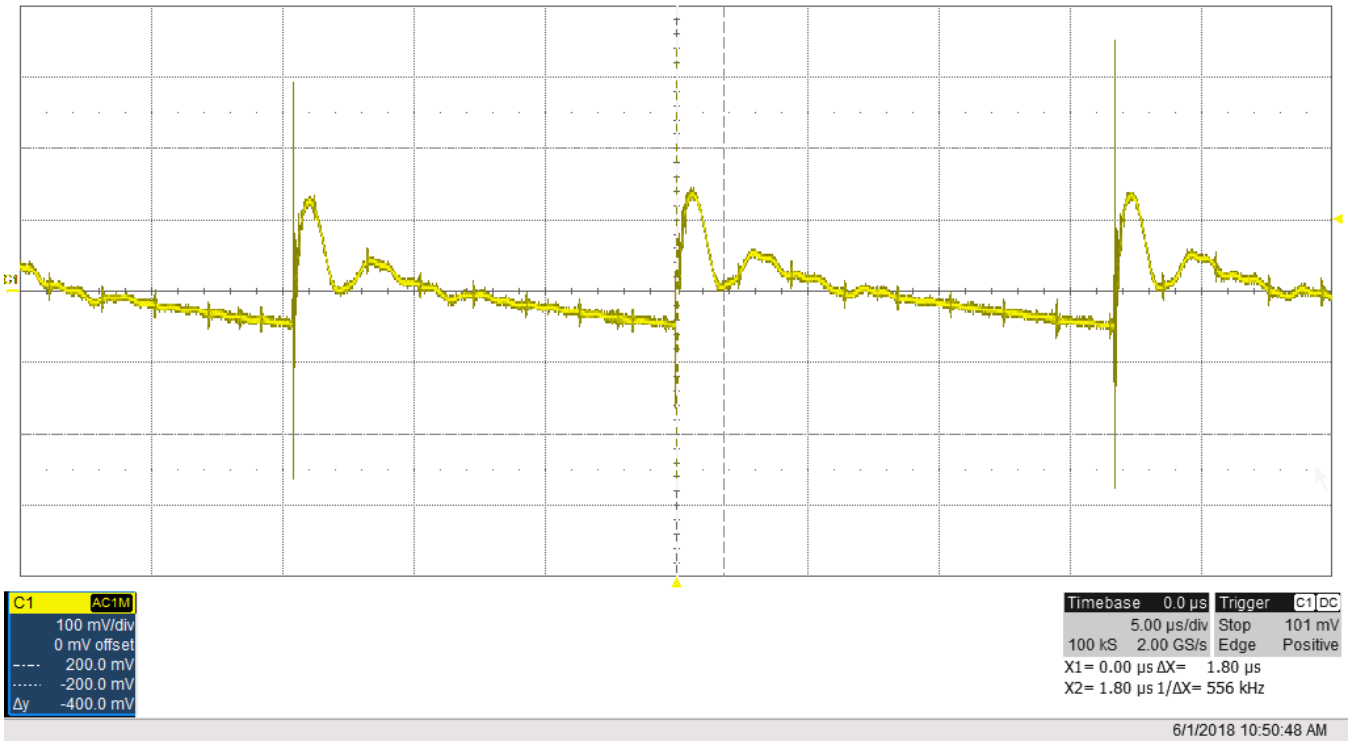


Figure 11. Output Ripple Voltage 12 V Output and 120 VAC Input

Figure 12. Output Ripple Voltage 12 V Output and 230 VAC Input

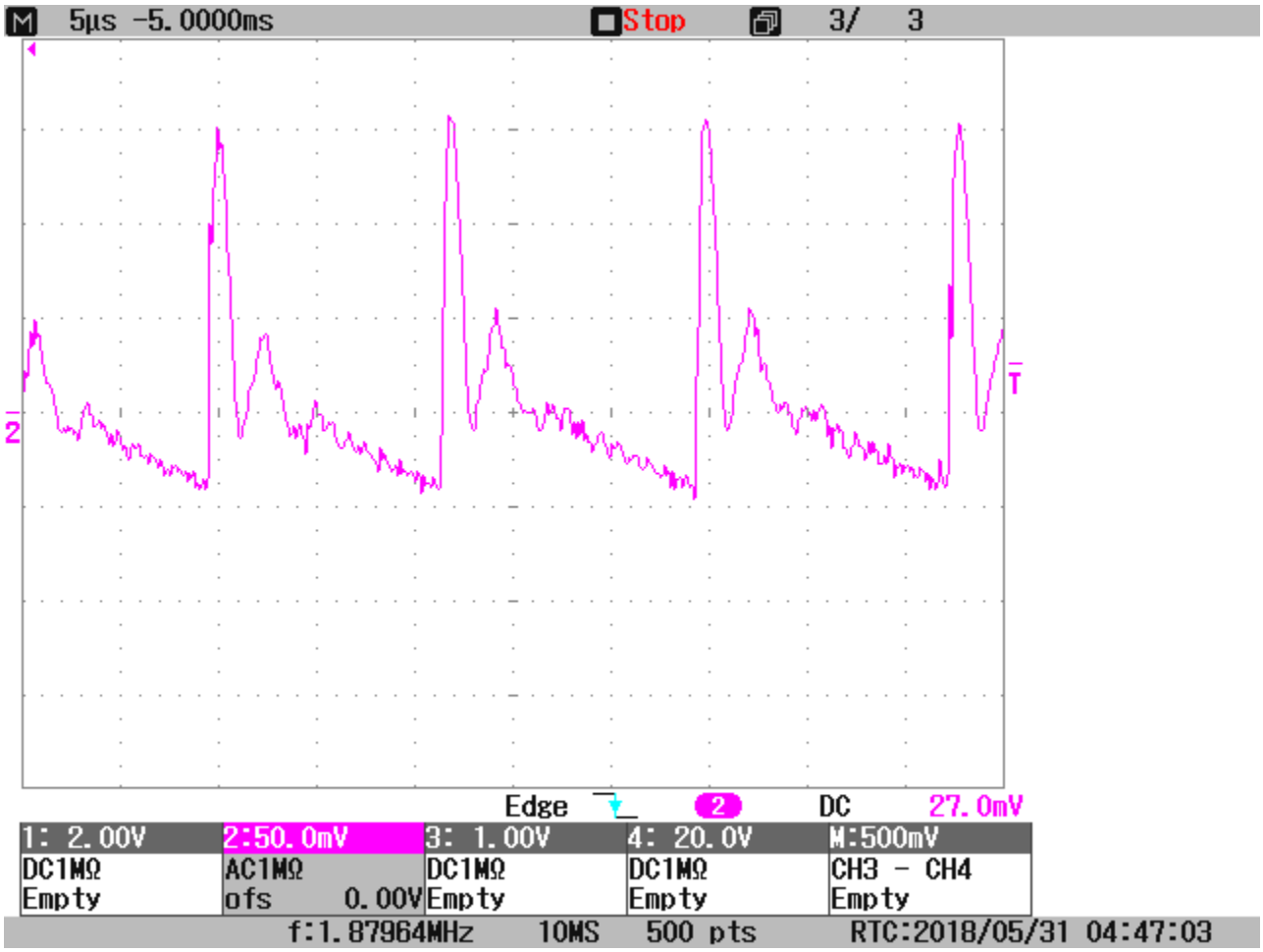


Figure 13. Output Ripple Voltage 15 V Output and 120 VAC Input

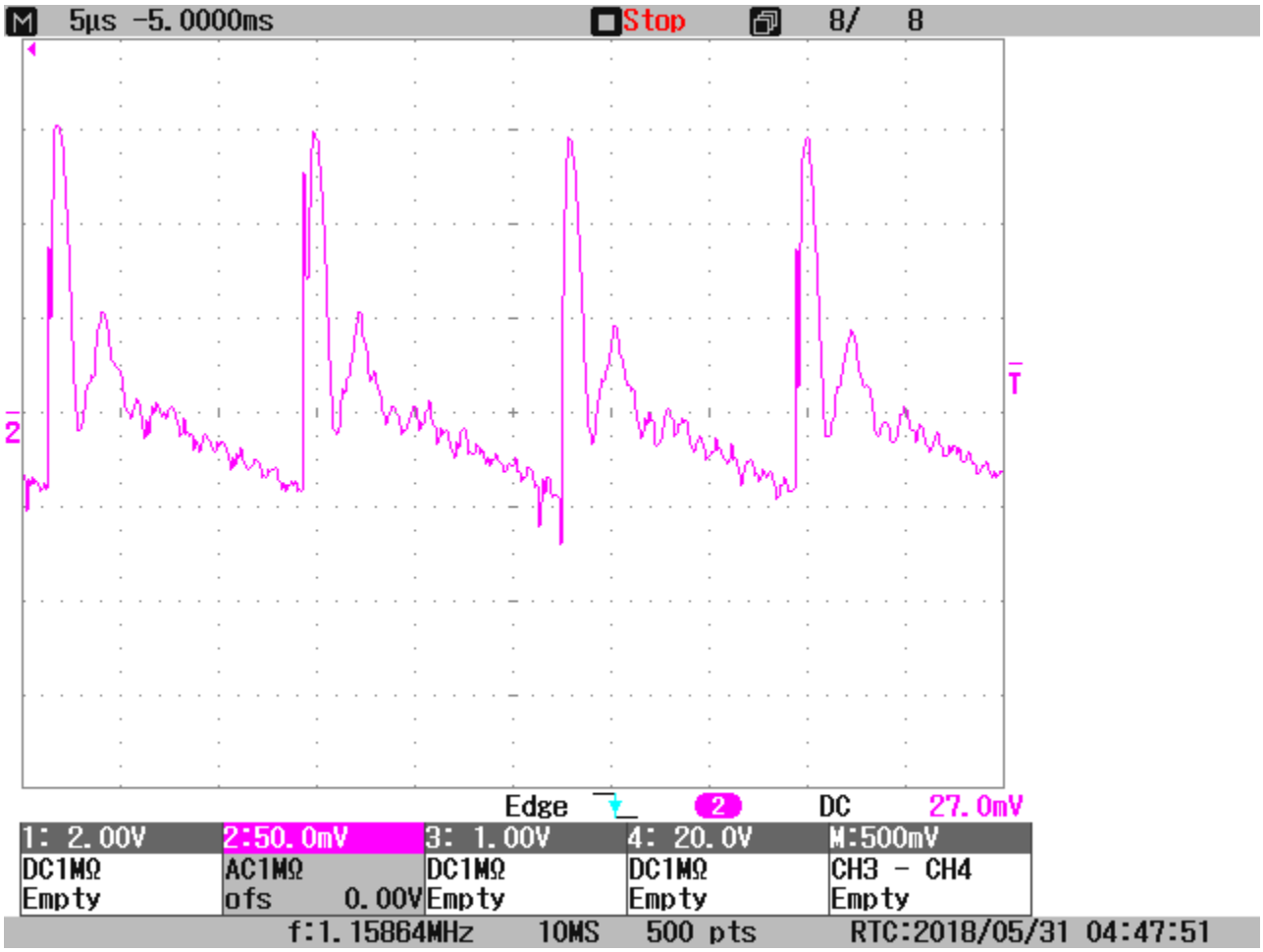


Figure 14. Output Ripple Voltage 15 V Output and 230 VAC Input

3.3 Bode Plot

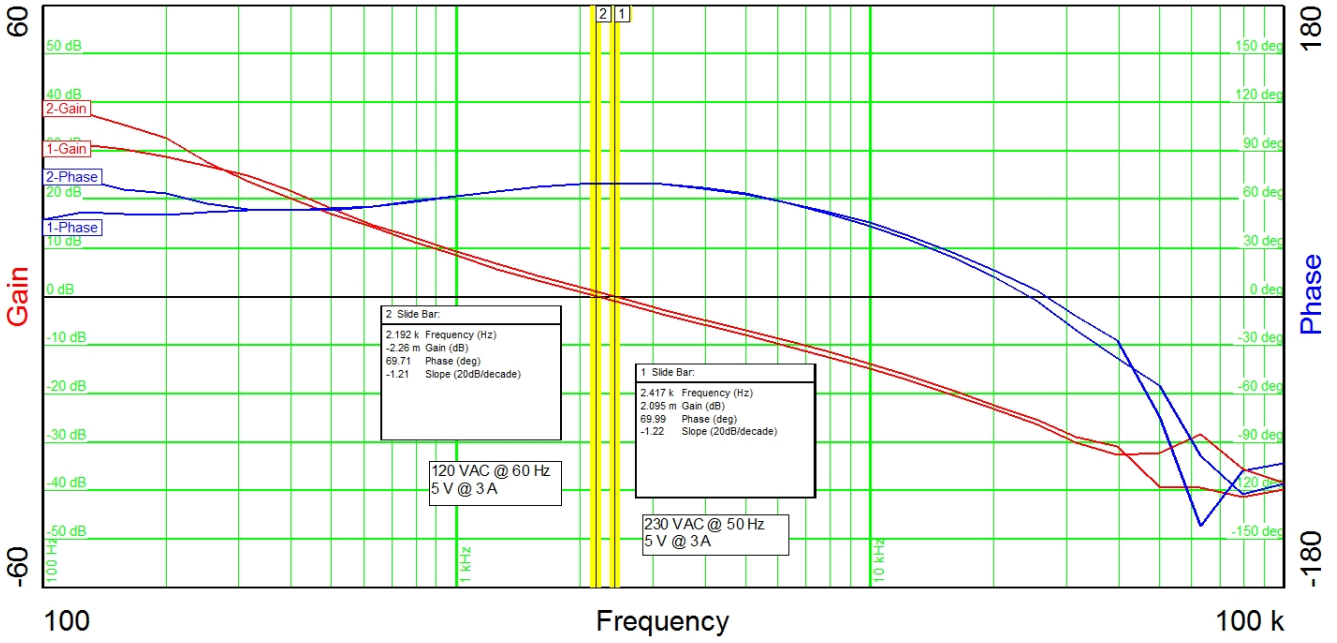


Figure 15. 5 V Output Stability Plot

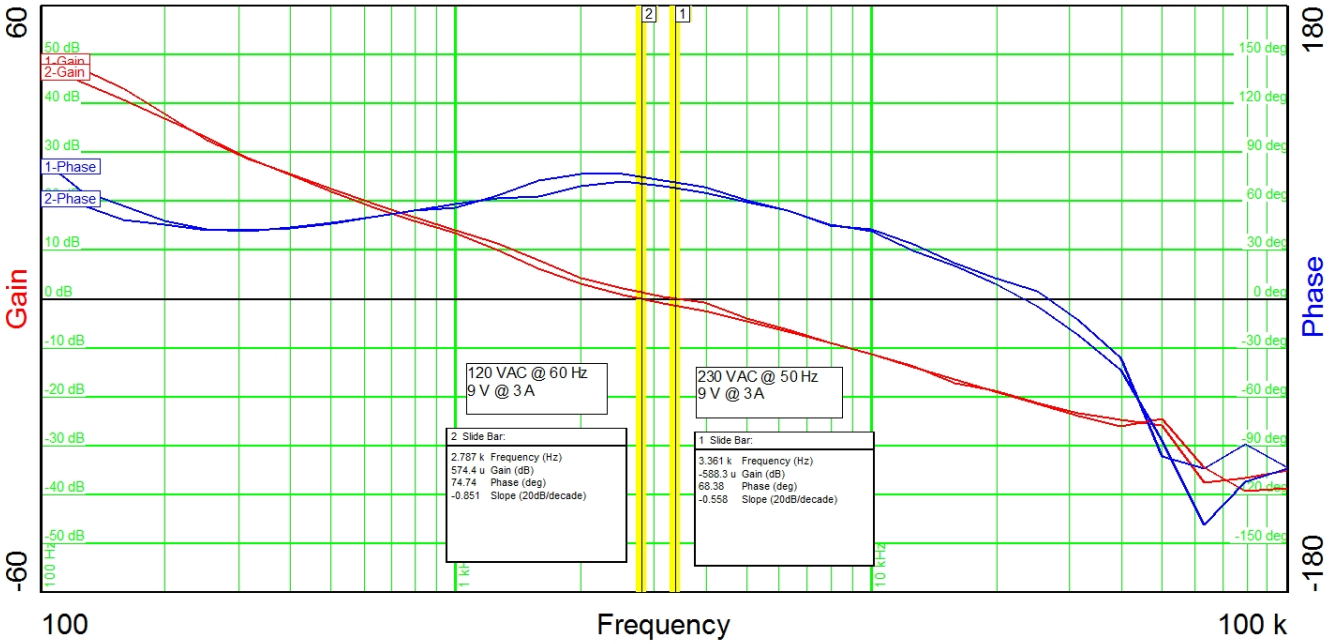


Figure 16. 9 V Output Stability Plot

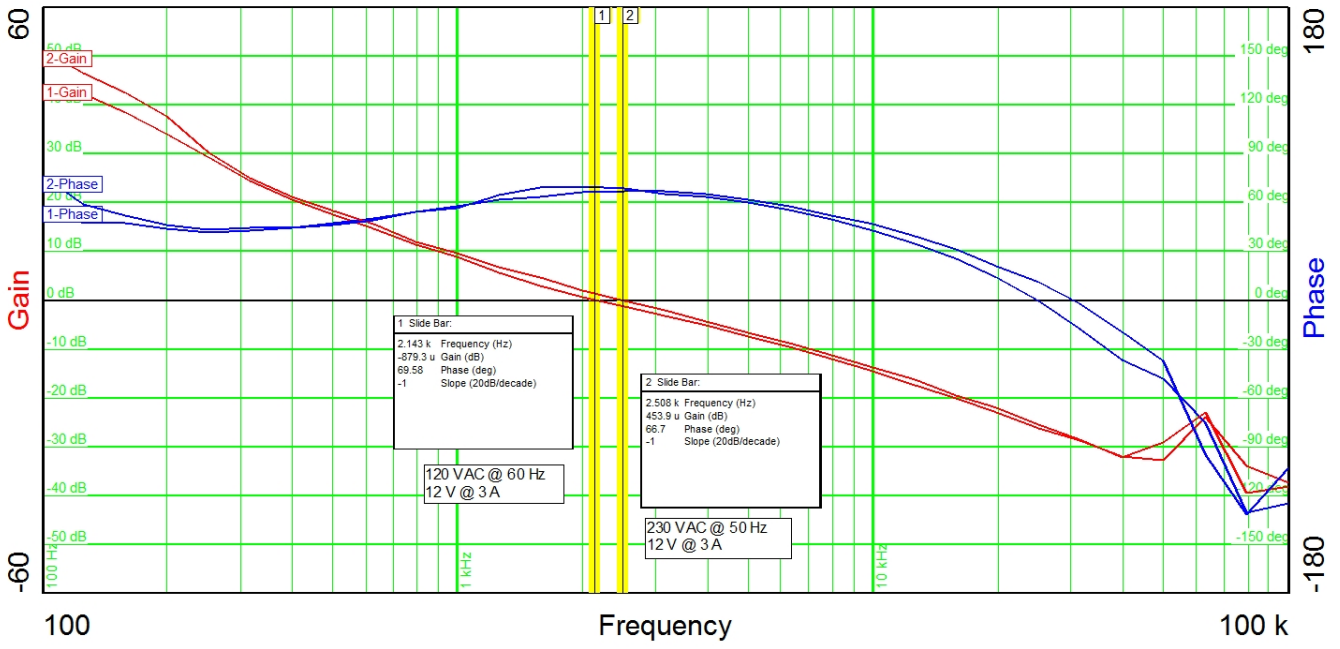


Figure 17. 12 V Output Stability Plot

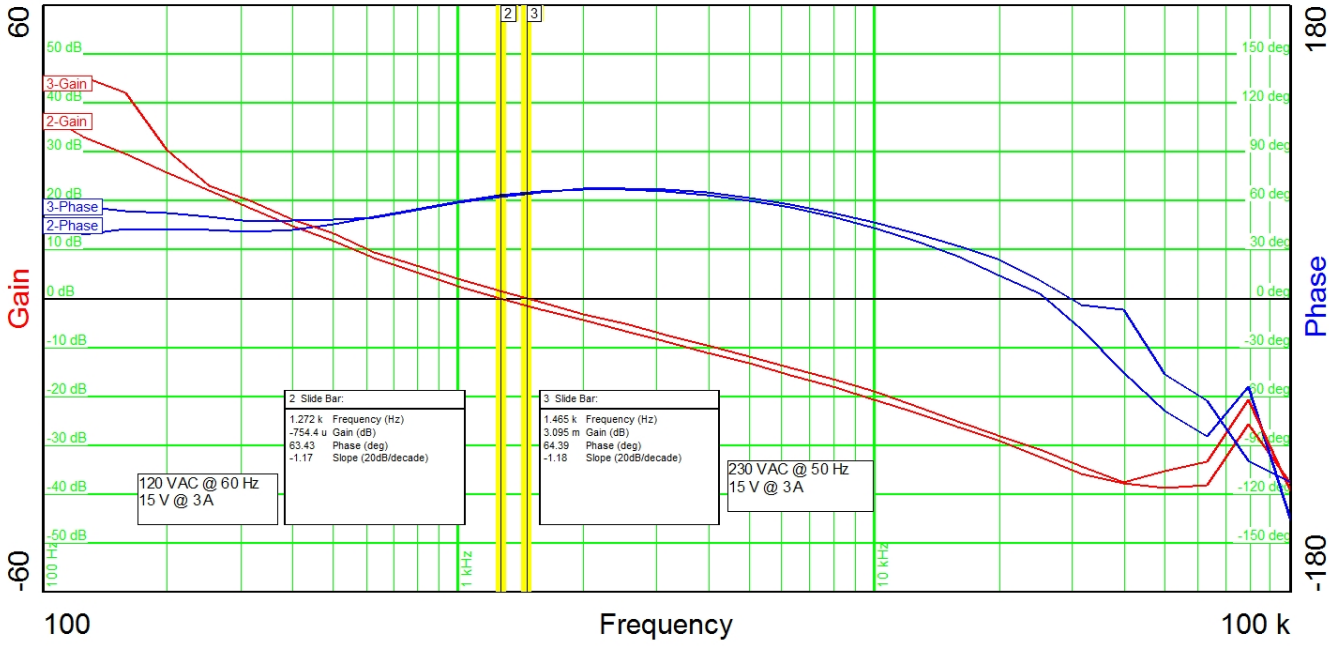


Figure 18. 15 V Output Stability Plot

3.4 Load Transients

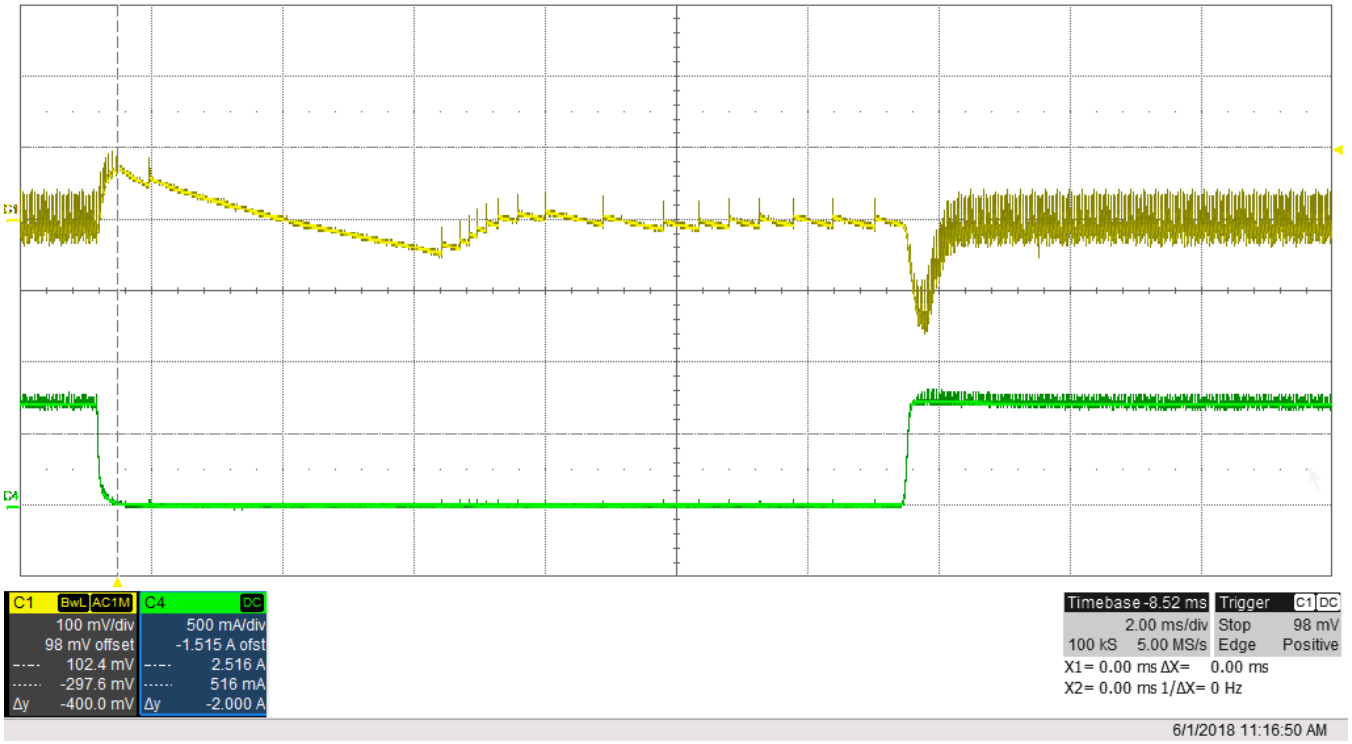


Figure 19. 5 V No Load to 25% Load Transient with 120 VAC Input

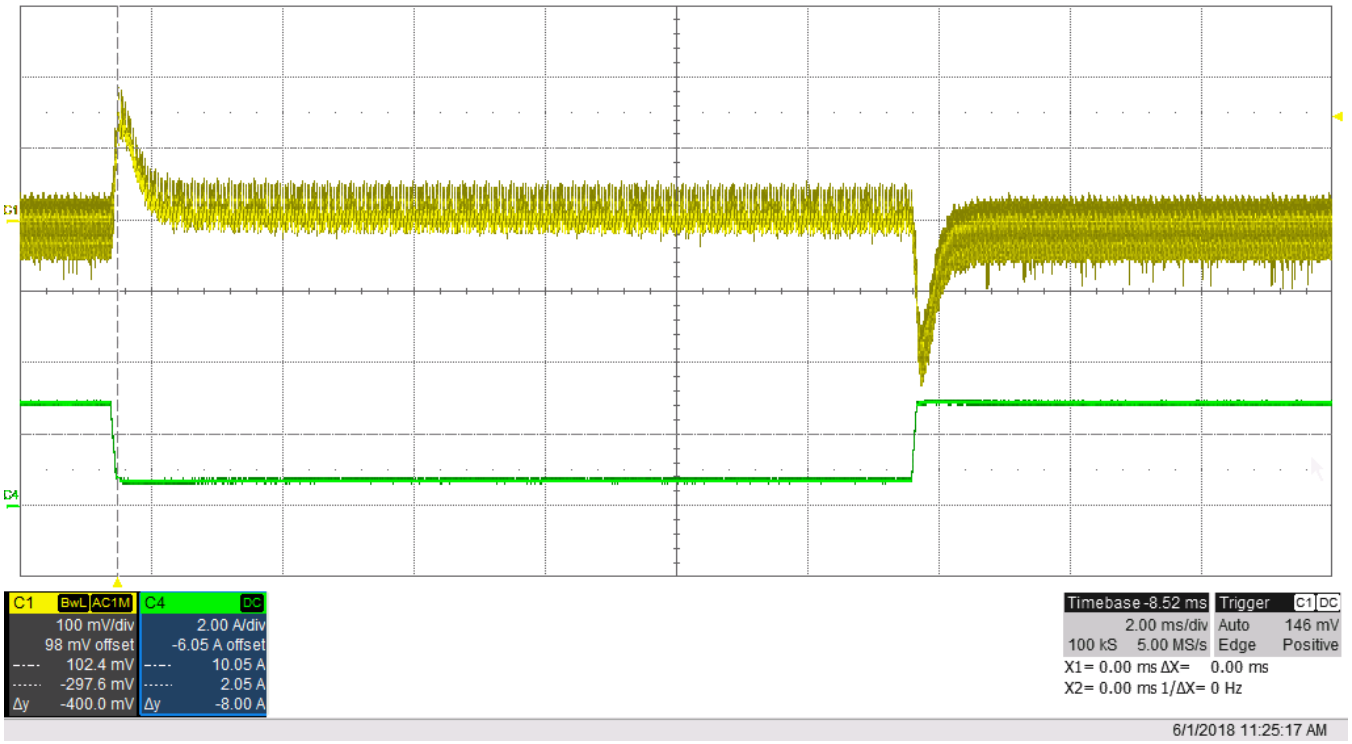


Figure 21. 5 V 25% Load to Full Load Transient with 120 VAC Input

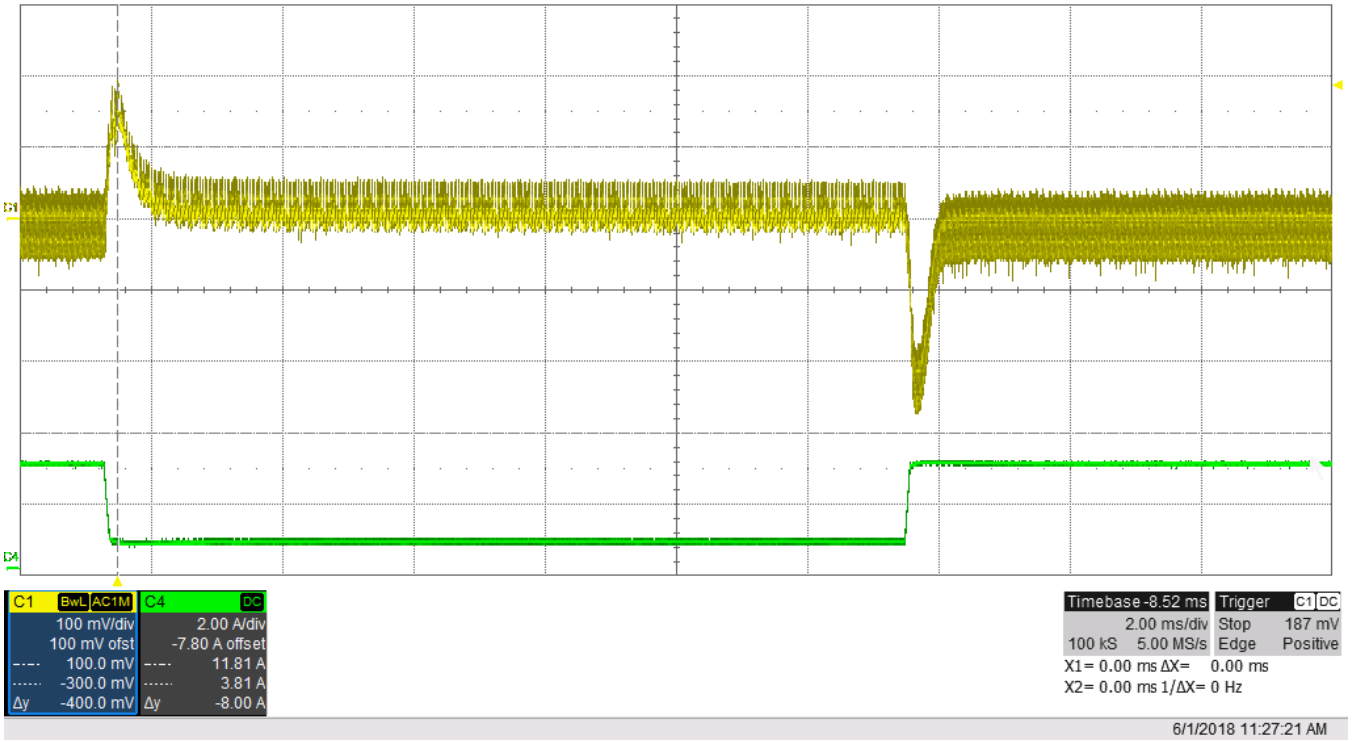


Figure 22. 5 V 25% Load to Full Load Transient with 120 VAC Input

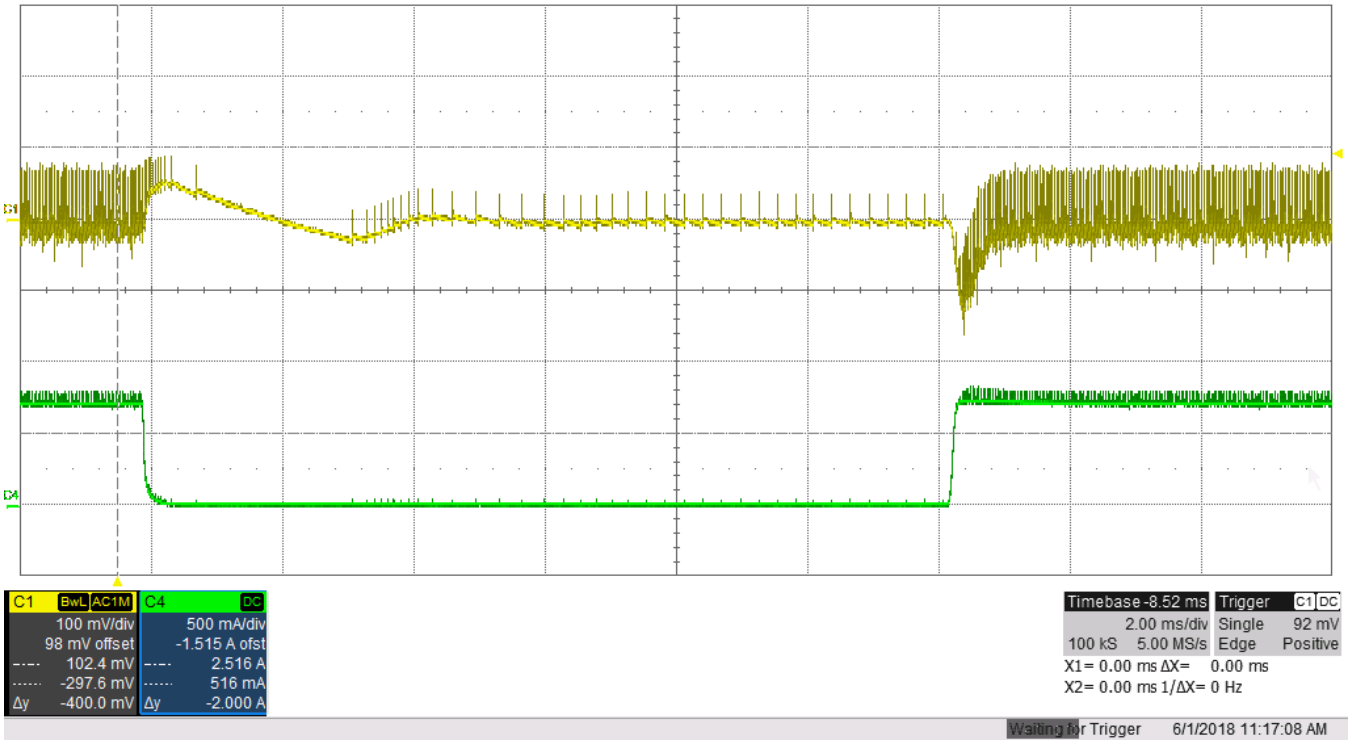


Figure 23. 9 V No Load to 25% Load Transient with 120 VAC Input

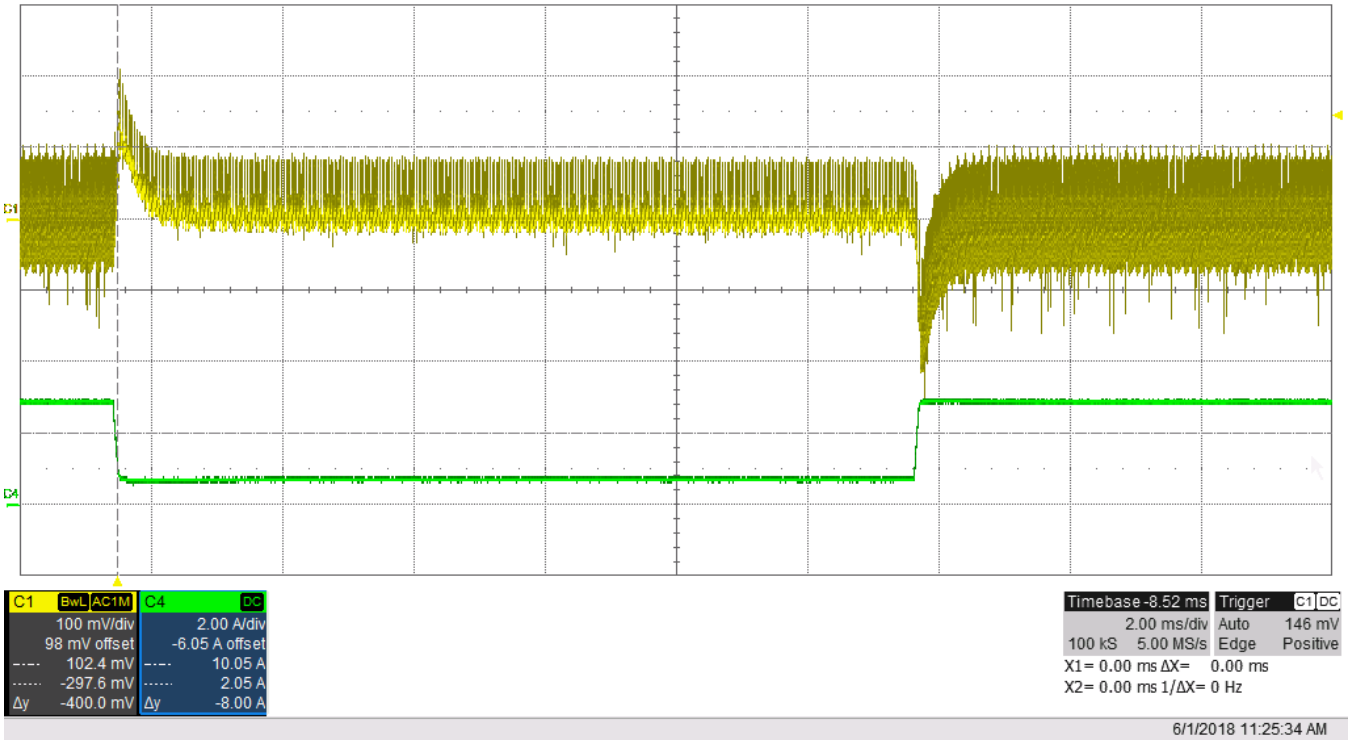


Figure 25. 9 V 25% Load to Full Load Transient with 120 VAC Input

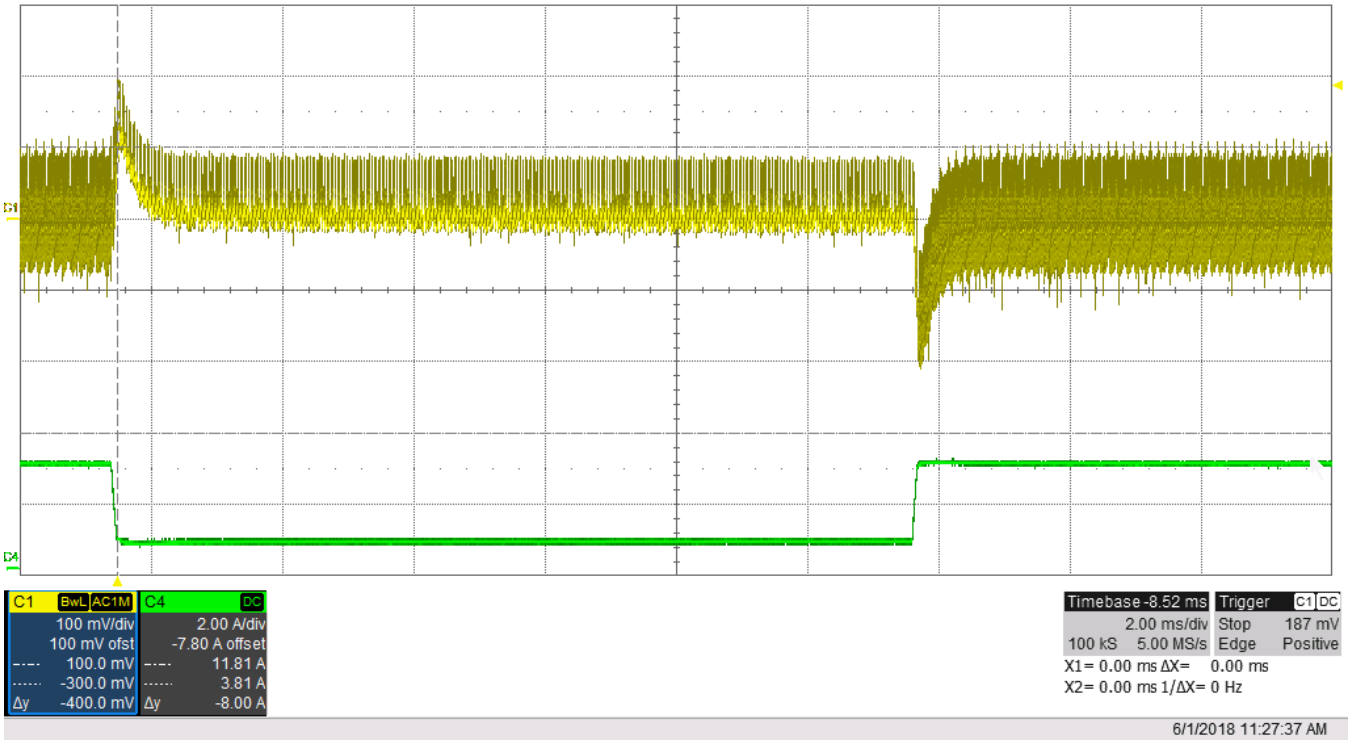


Figure 26. 9 V 25% Load to Full Load Transient with 230 VAC Input

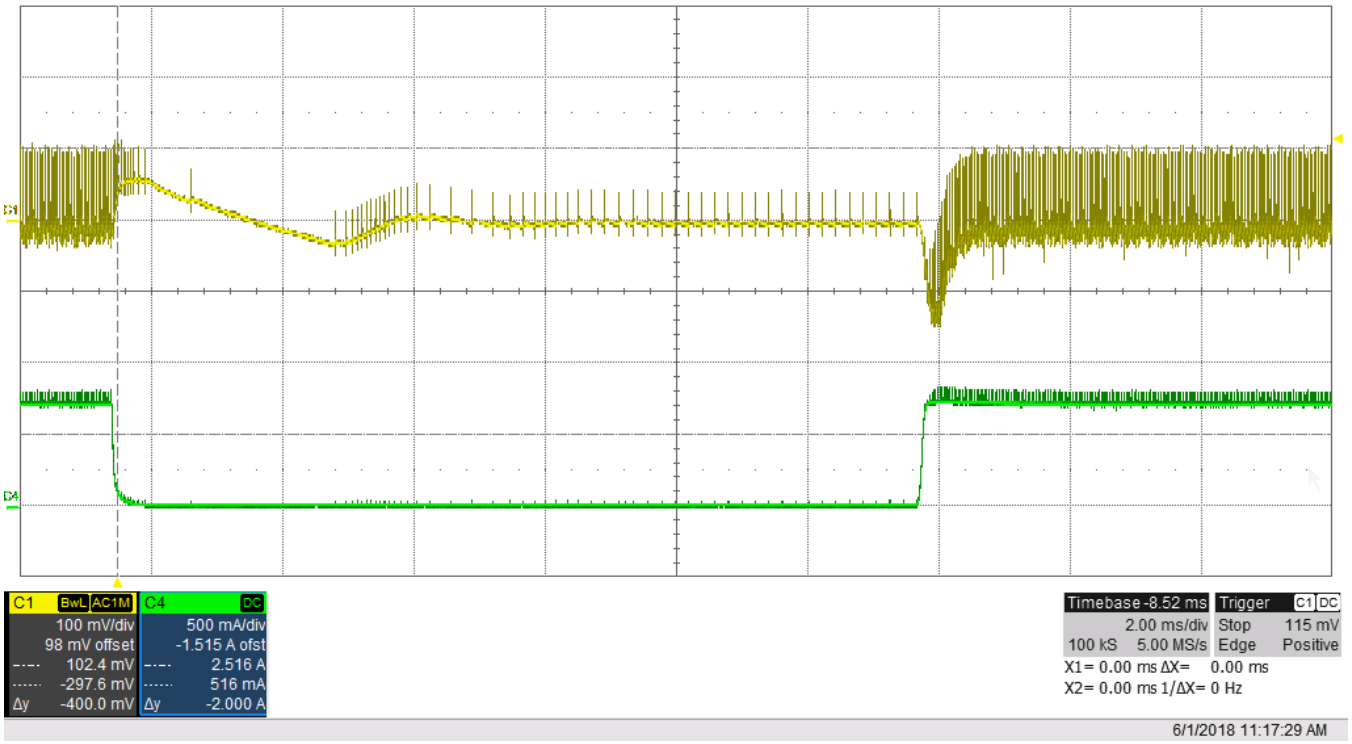


Figure 27. 12 V No Load to 25% Load Transient with 120 VAC Input

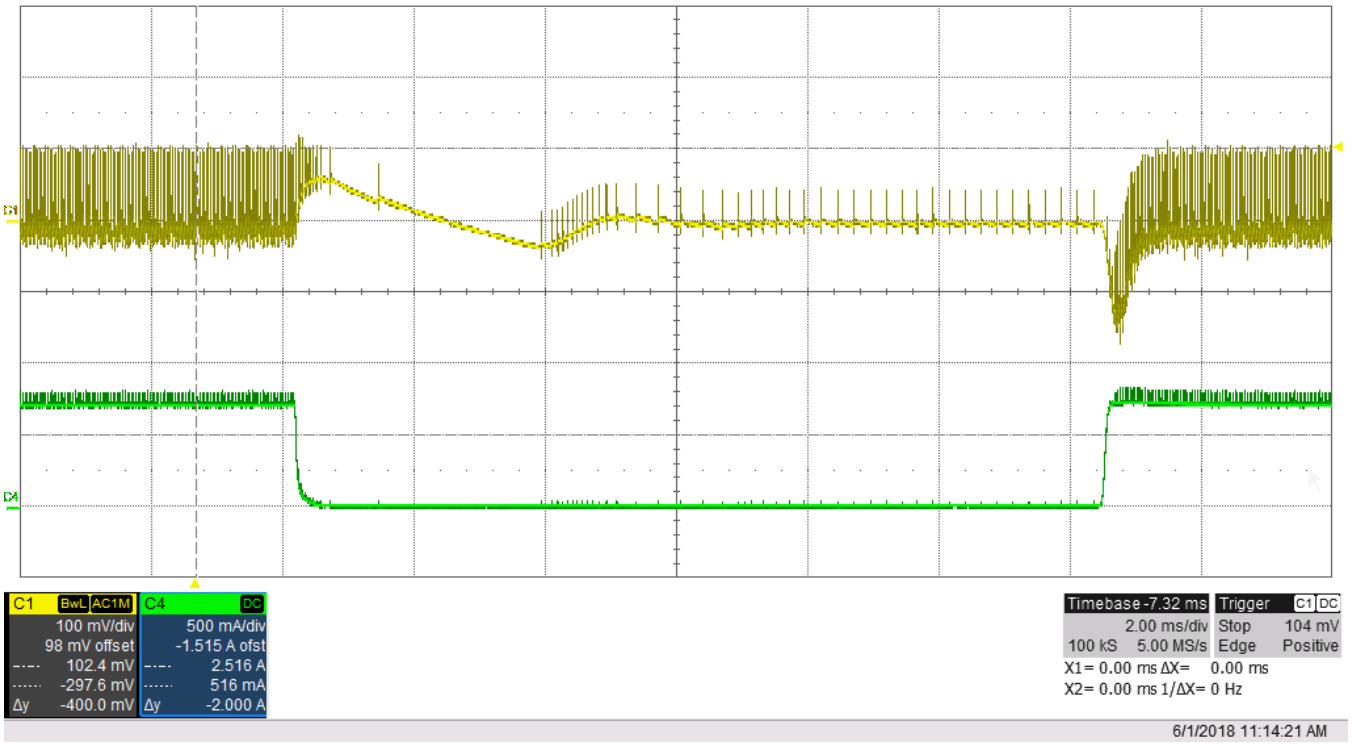


Figure 28. 12 V No Load to 25% Load Transient with 230 VAC Input

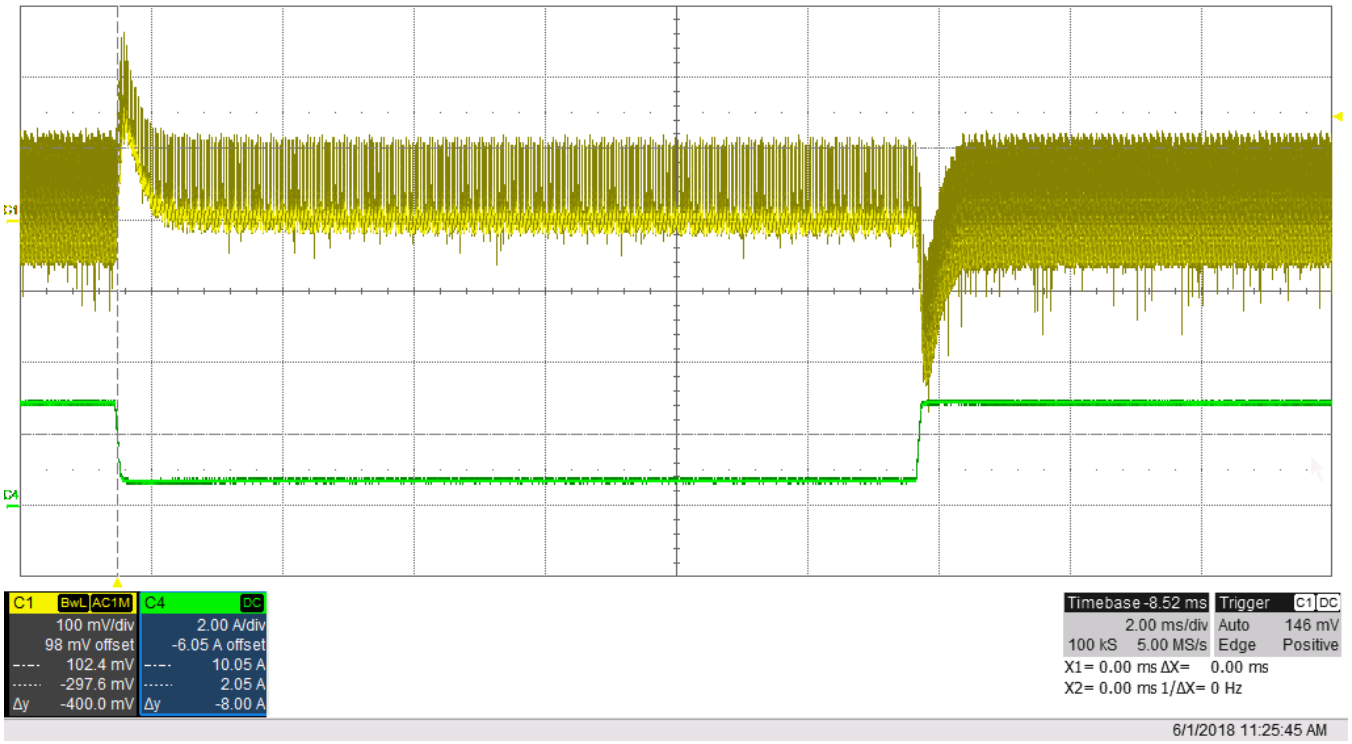


Figure 29. 12 V 25% Load to Full Load Transient with 120 VAC Input

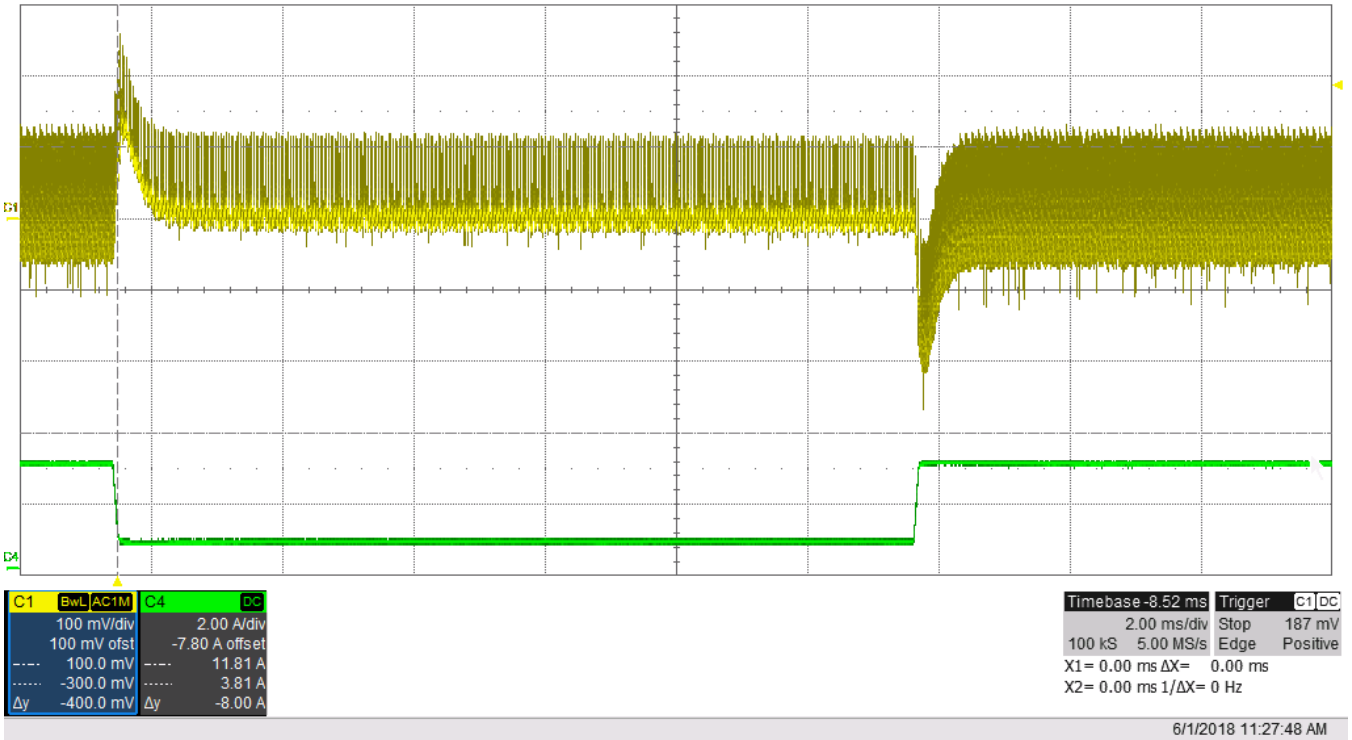


Figure 30. 12 V 25% Load to Full Load Transient with 230 VAC Input

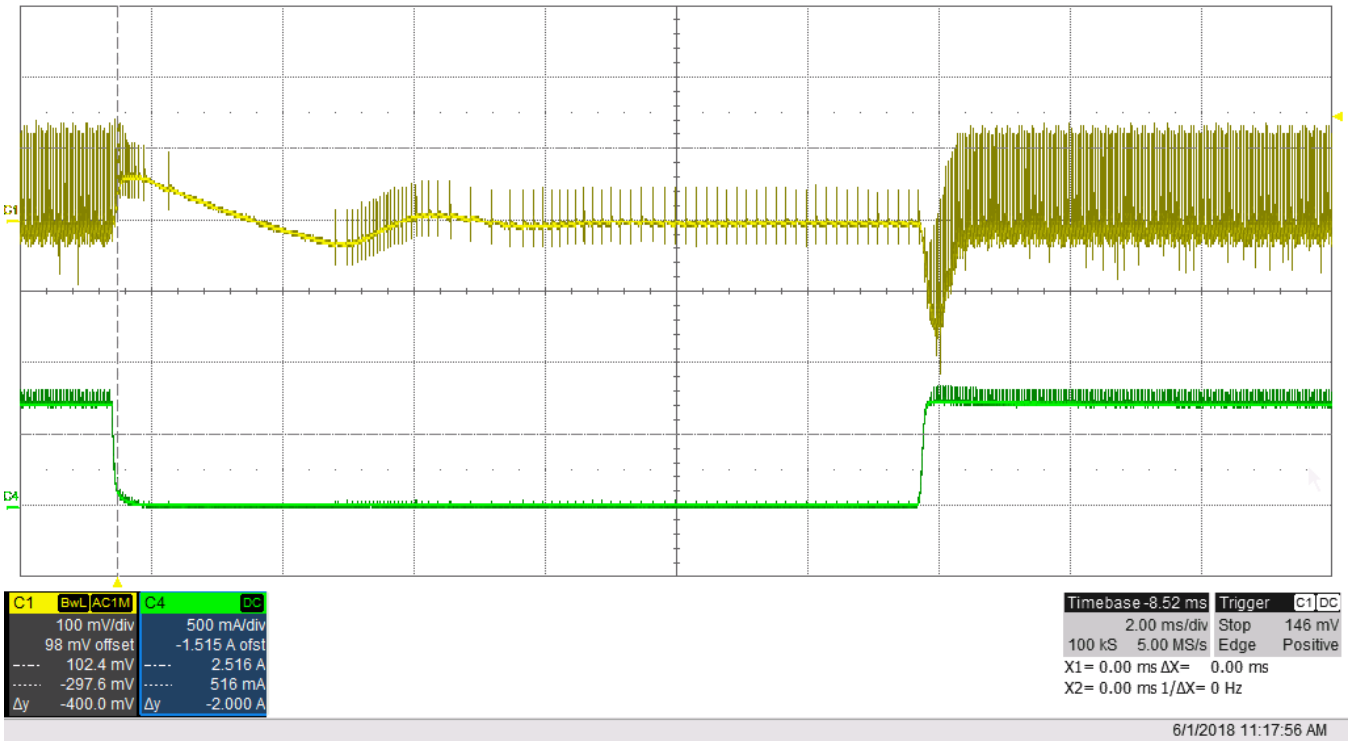


Figure 31. 15 V No Load to 25% Load Transient with 120 VAC Input

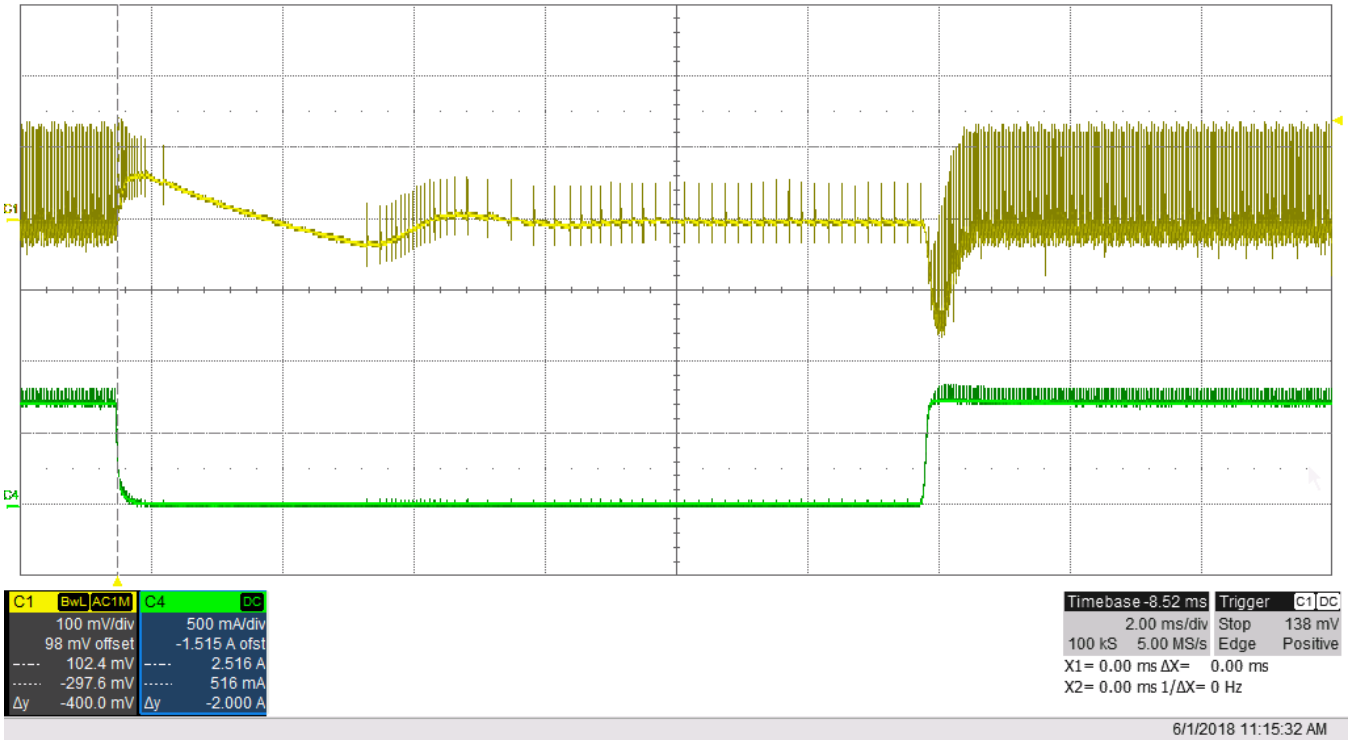


Figure 32. 15 V No Load to 25% Load Transient with 230 VAC Input

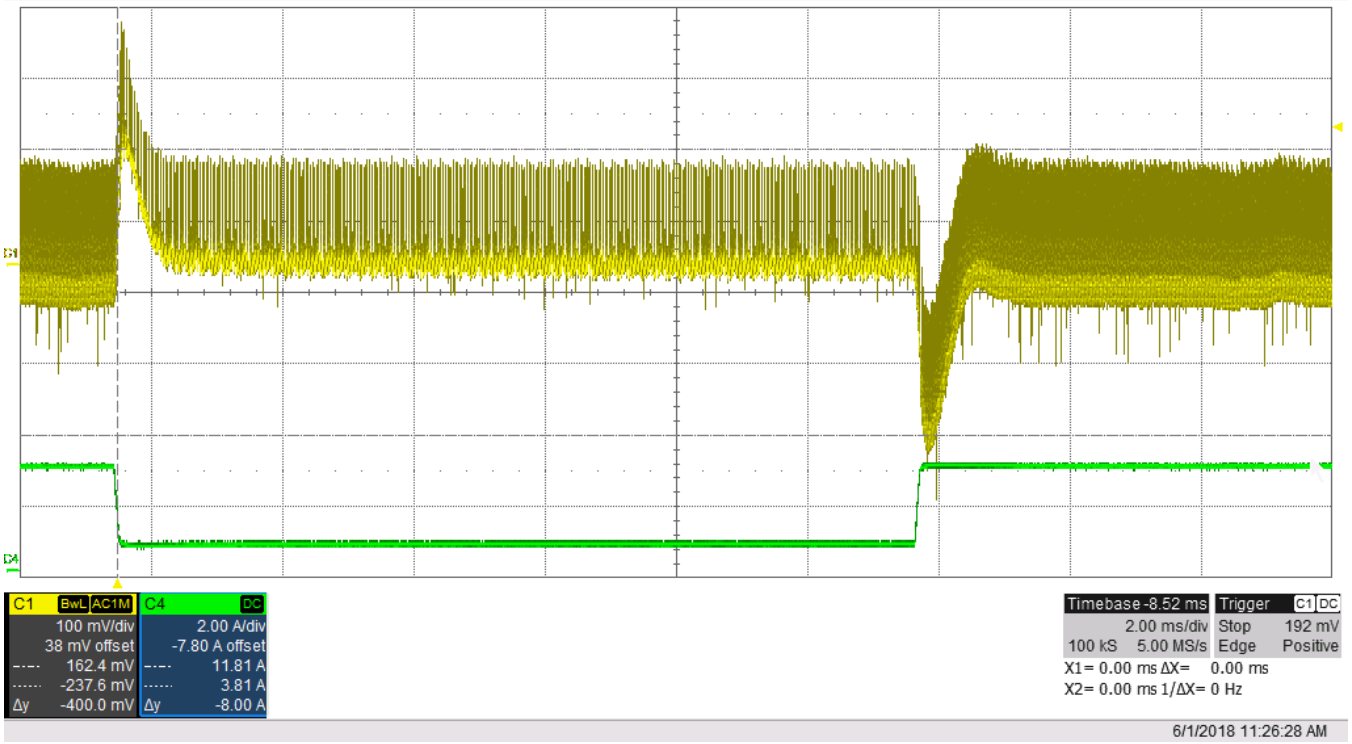


Figure 33. 15 V 25% Load to Full Load Transient with 120 VAC Input

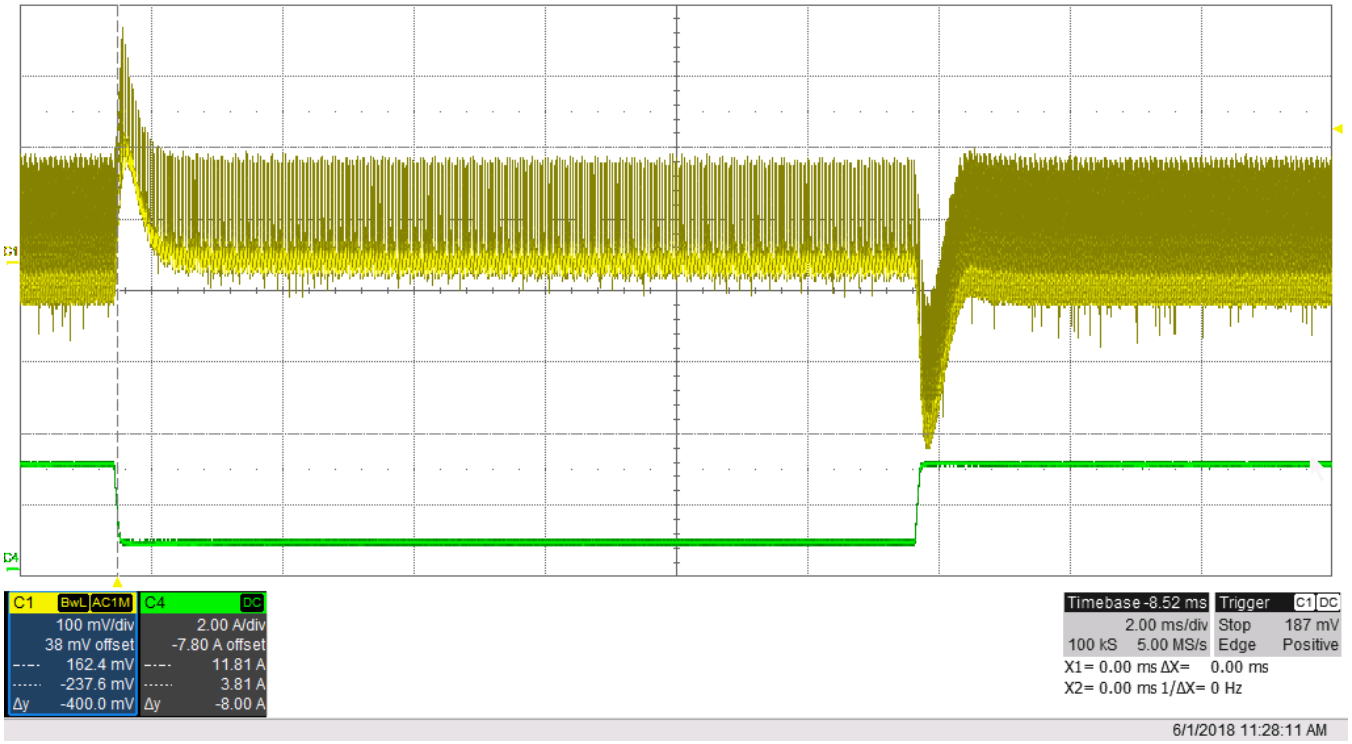


Figure 34. 15 V 25% Load to Full Load Transient with 230 VAC Input

3.5 Start-up

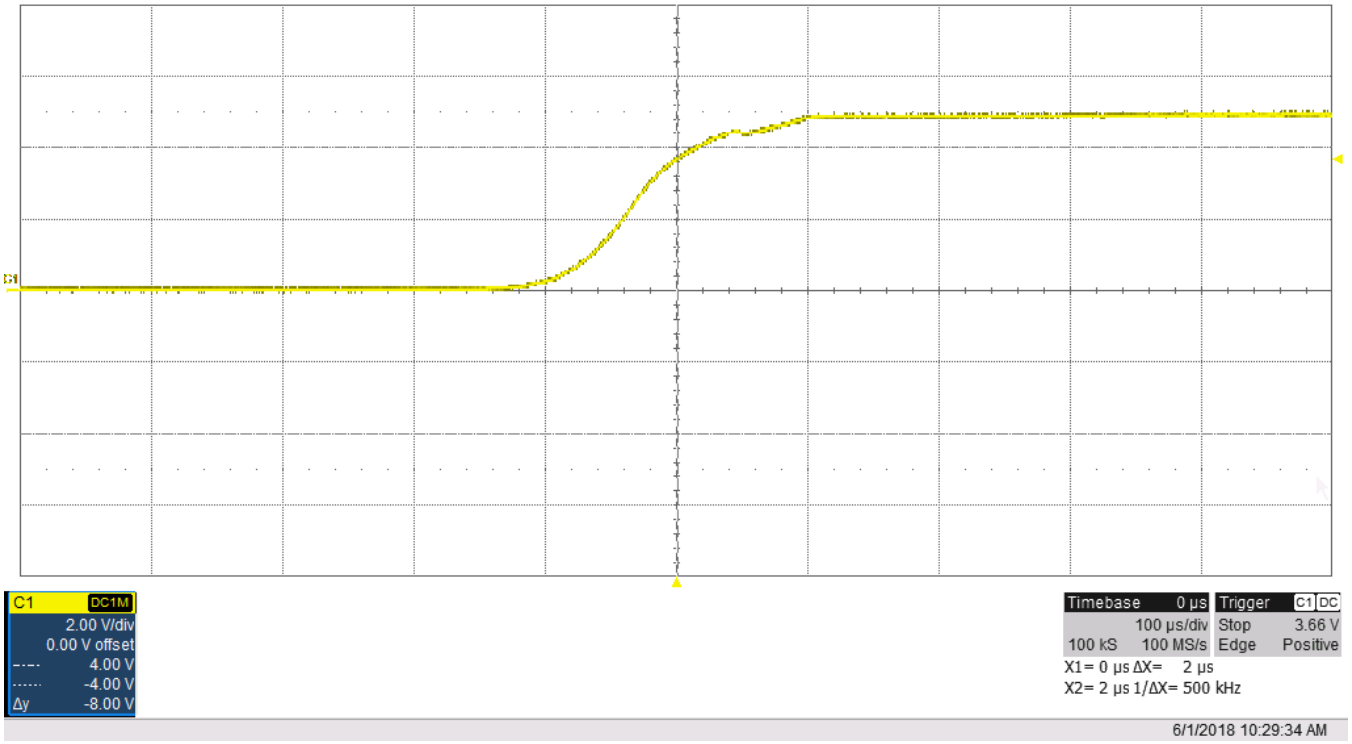


Figure 35. Start up Output Voltage

3.6 Voltage Transitions

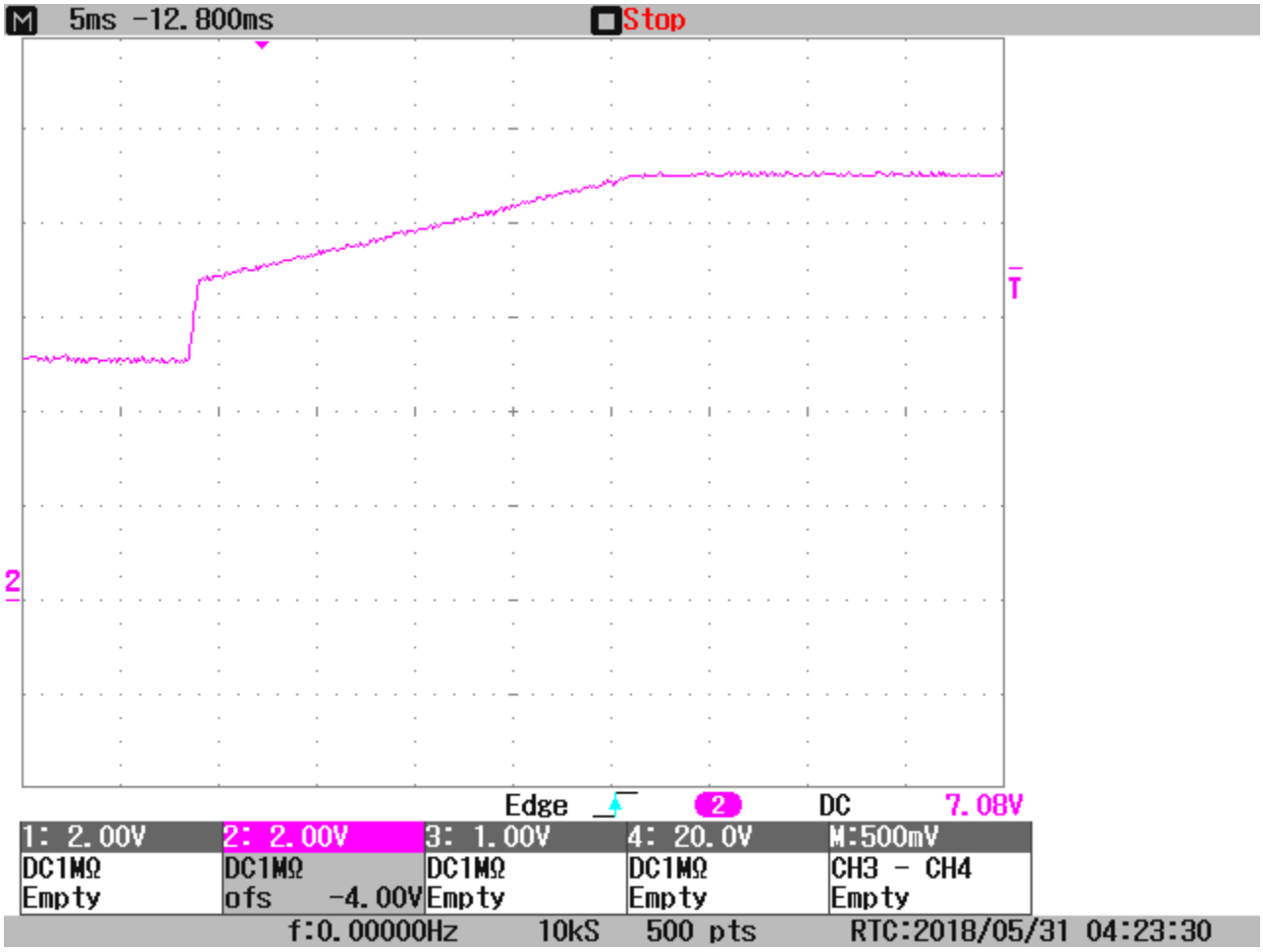


Figure 36. 5 V to 9 V Output Transition

Test was done with 230 VAC Input.

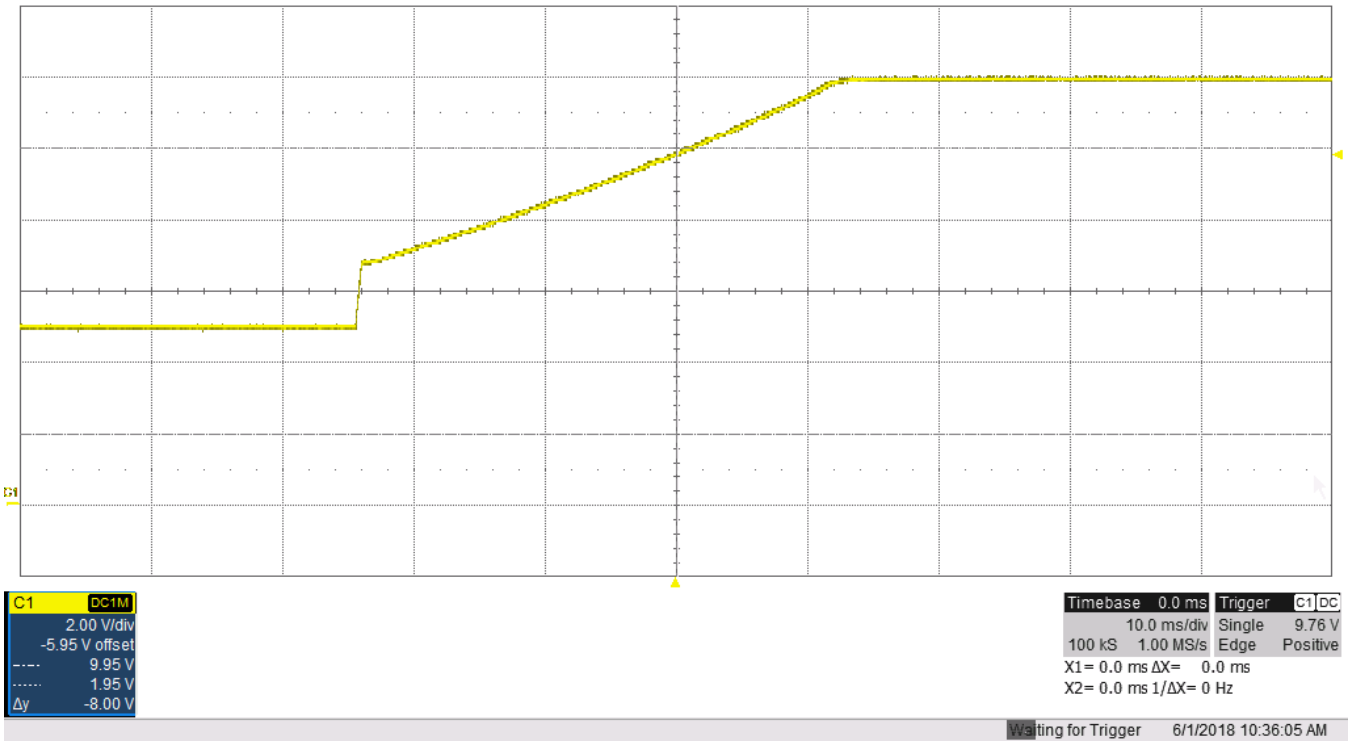


Figure 37. 5 V to 12 V Output Transition

Test was done with 230 VAC Input.

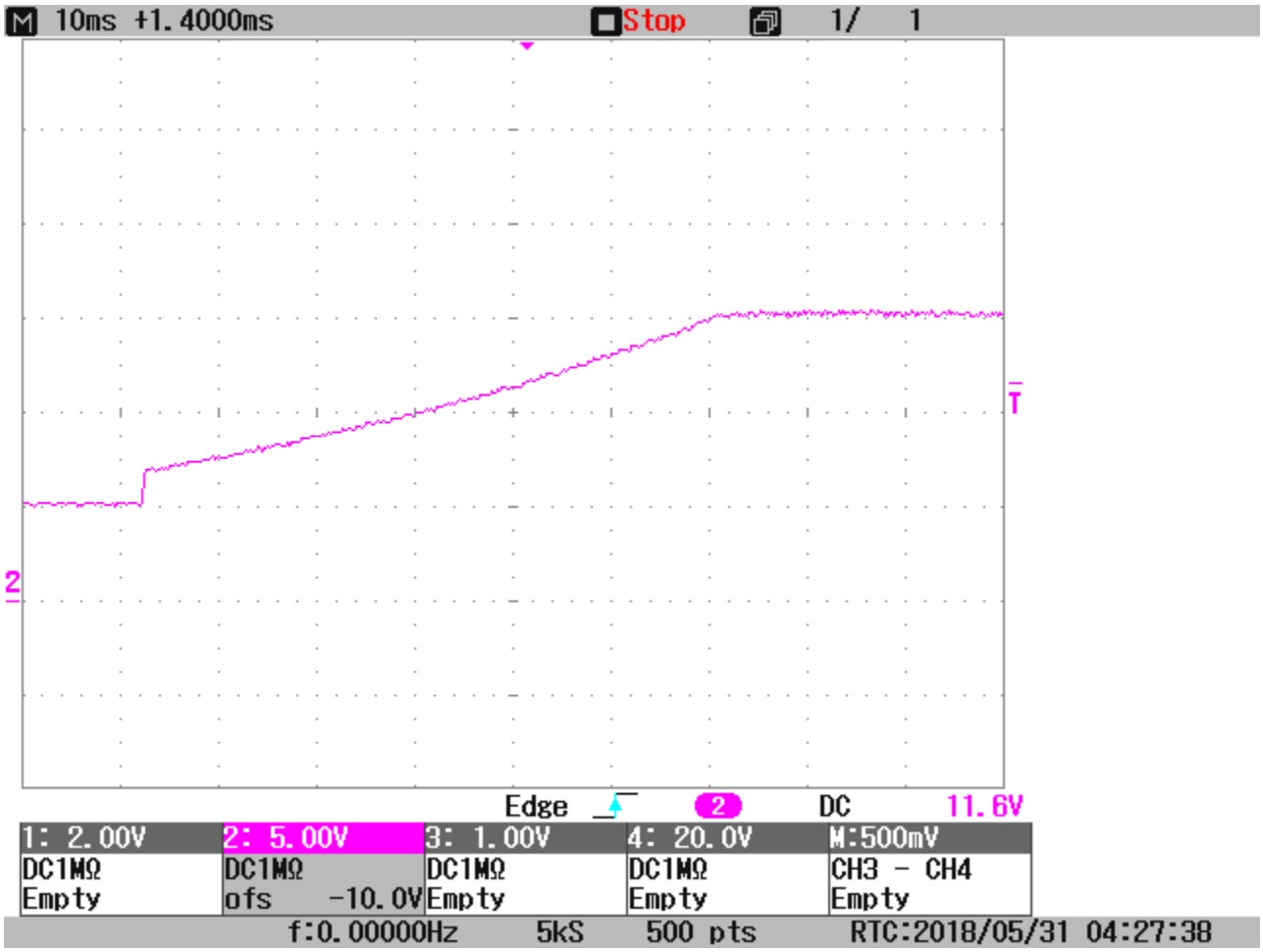


Figure 38. 5 V to 15 V Output Transition

Test was done with 230 VAC Input.

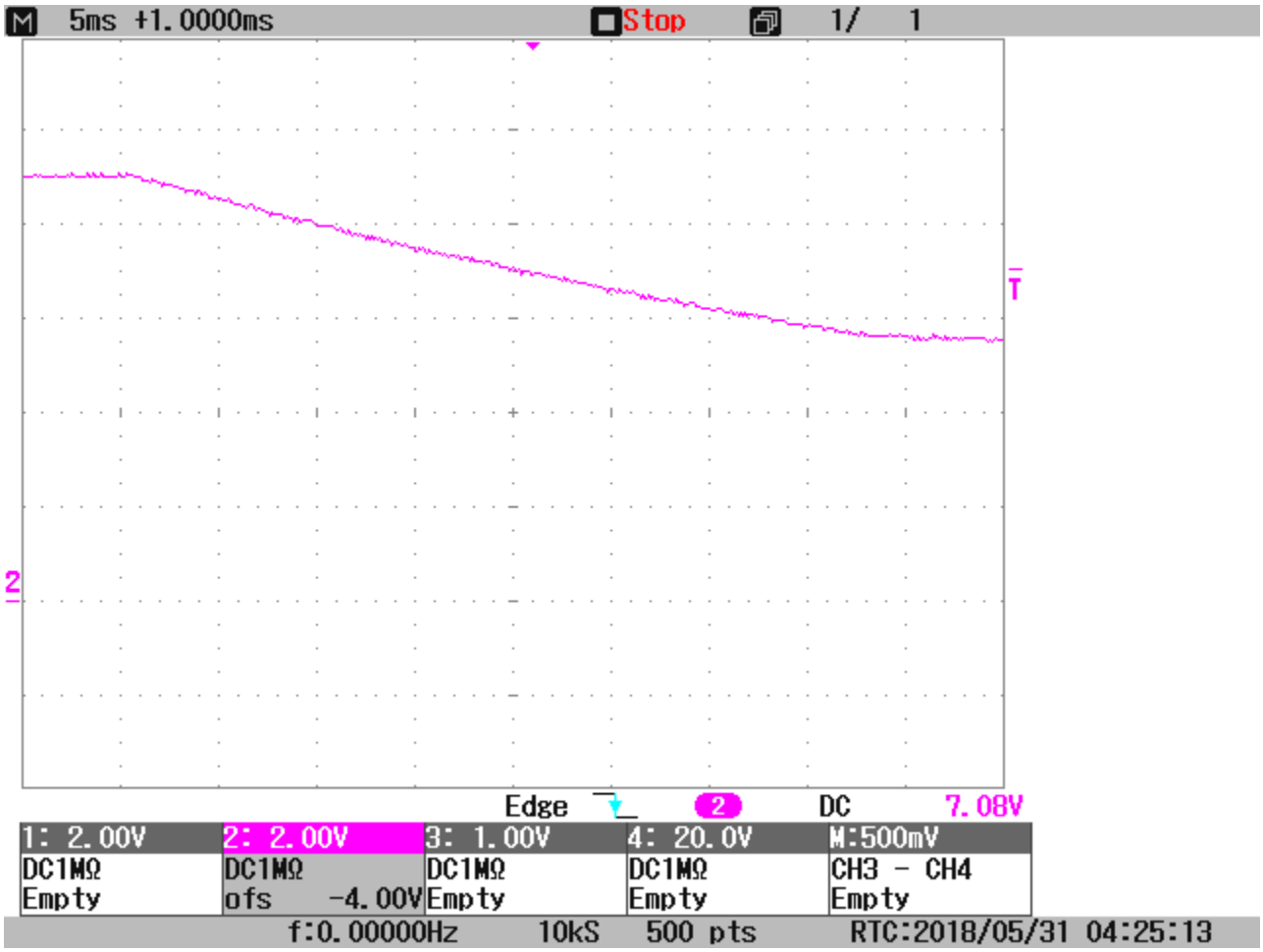


Figure 39. 9 V to 5 V Output Transition

Test was done with 230 VAC Input.

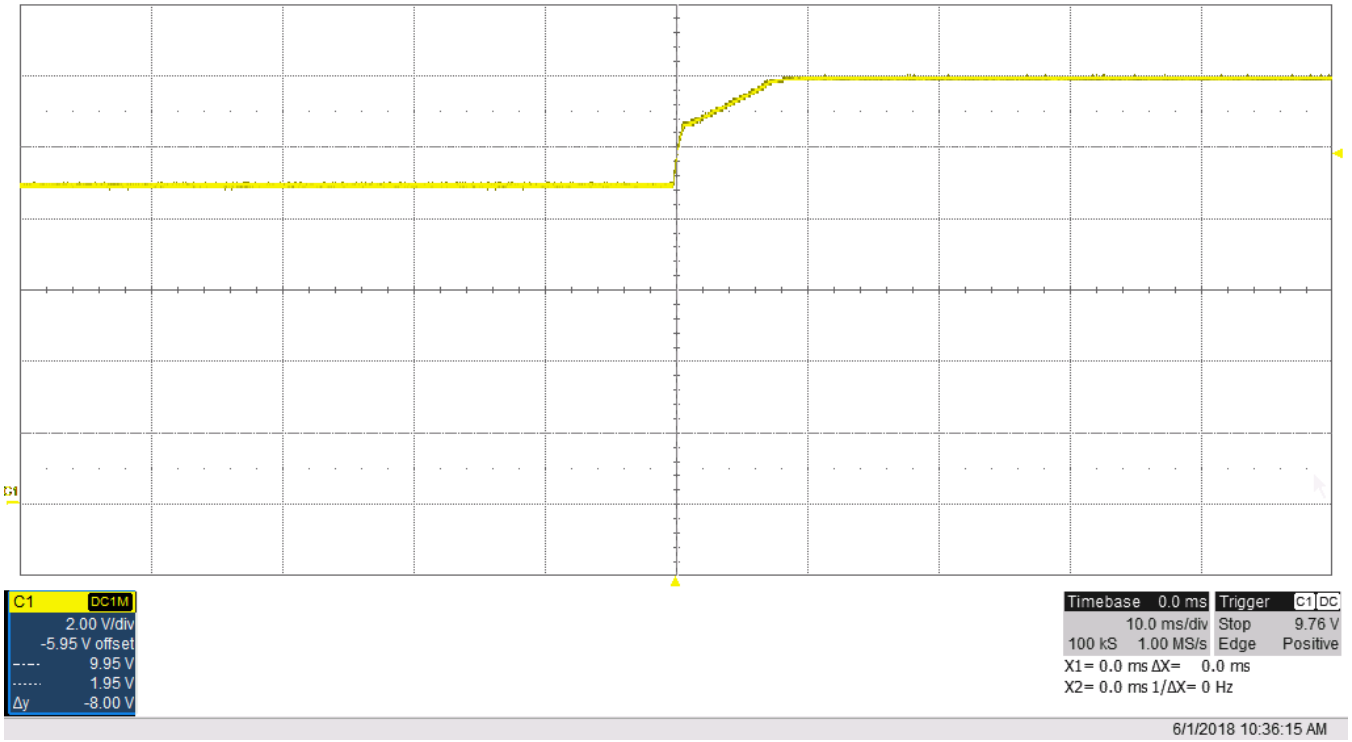


Figure 40. 9 V to 12 V Output Transition

Test was done with 230 VAC Input.

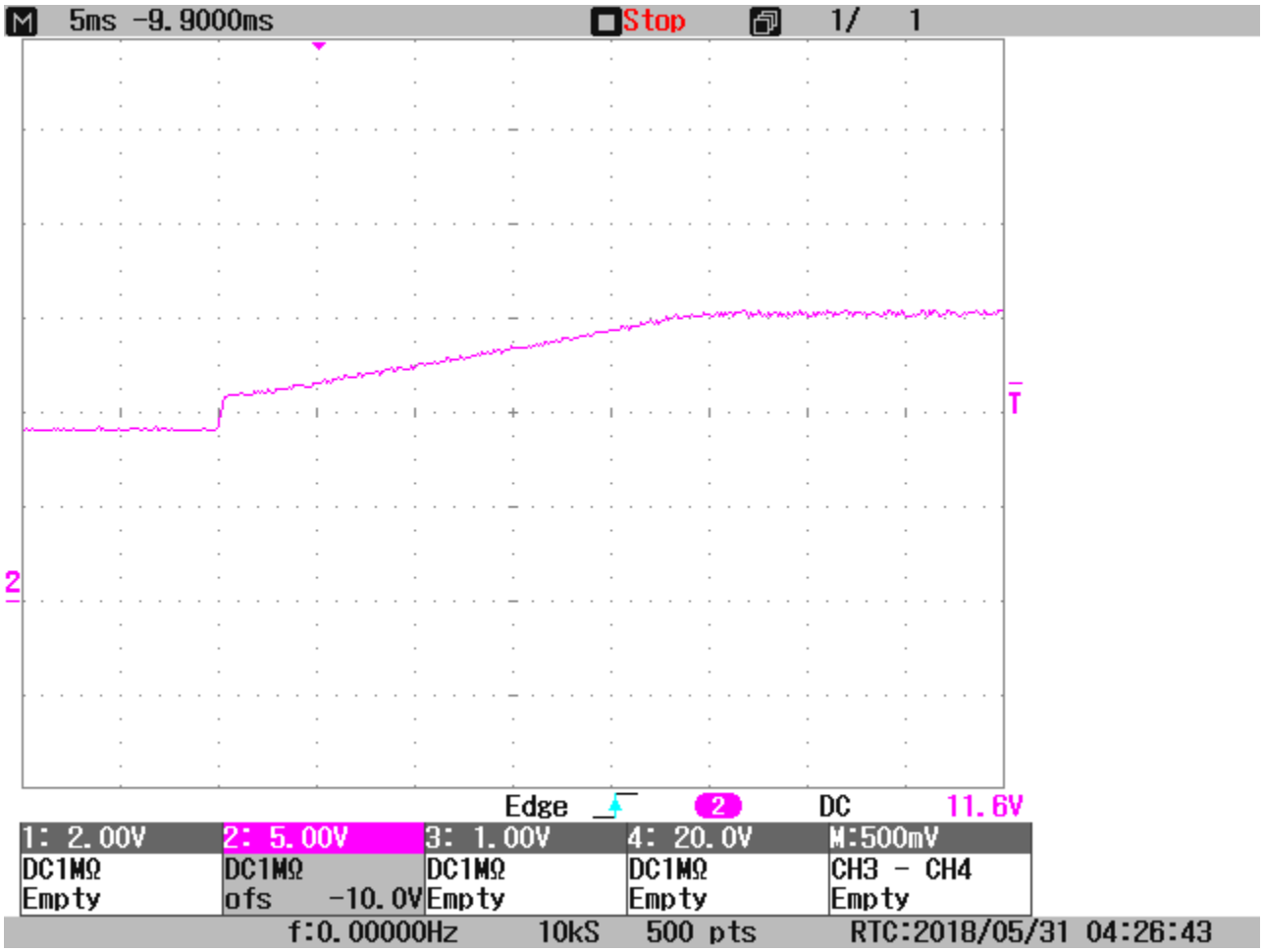


Figure 41. 9 V to 15 V Output Transition

Test was done with 230 VAC Input.

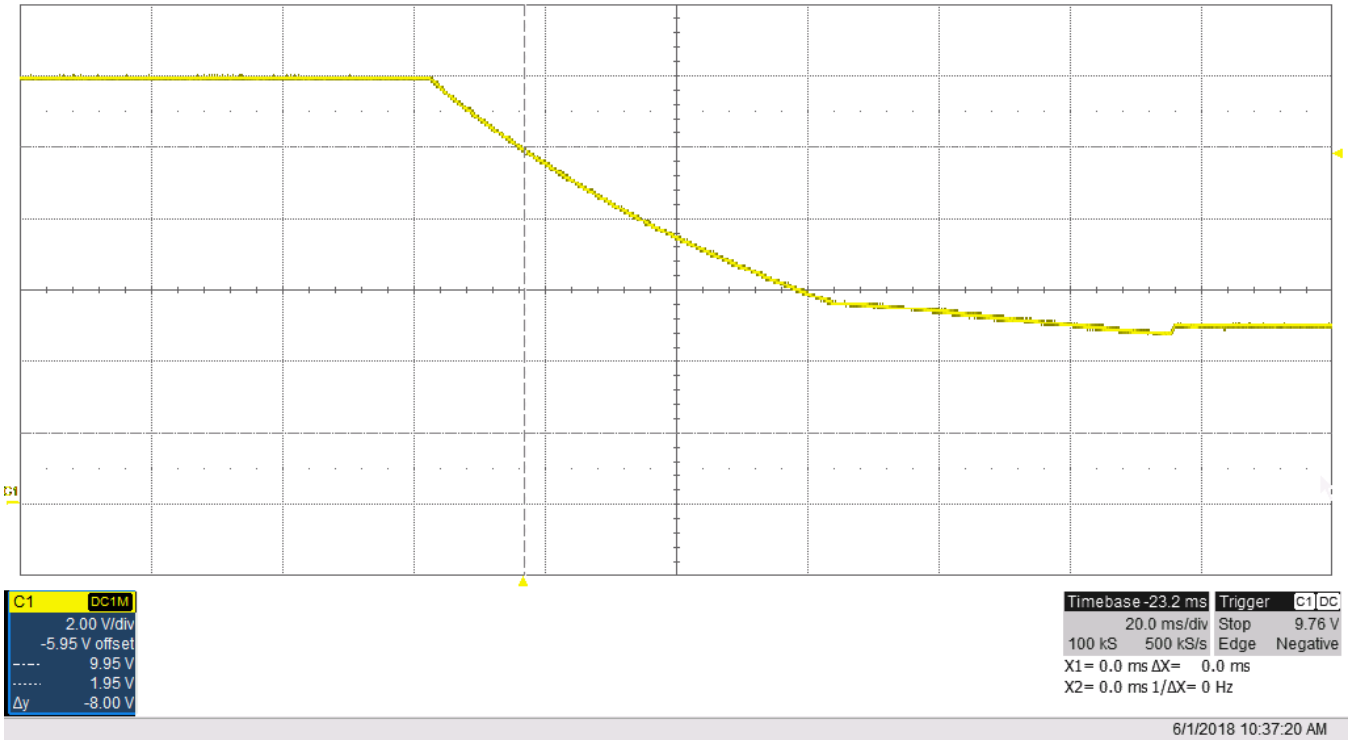


Figure 42. 12 V to 5 V Output Transition

Test was done with 230 VAC Input.

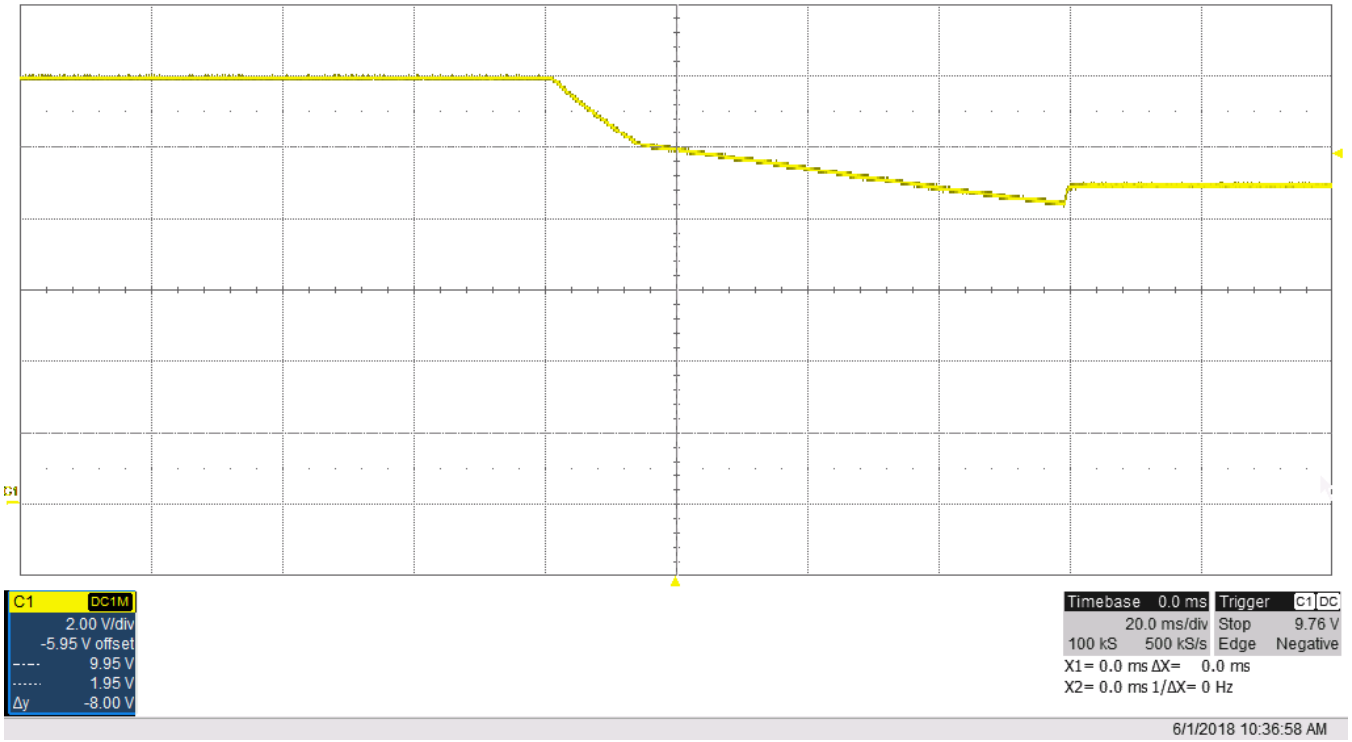


Figure 43. 12 V to 9 V Output Transition

Test was done with 230 VAC Input.

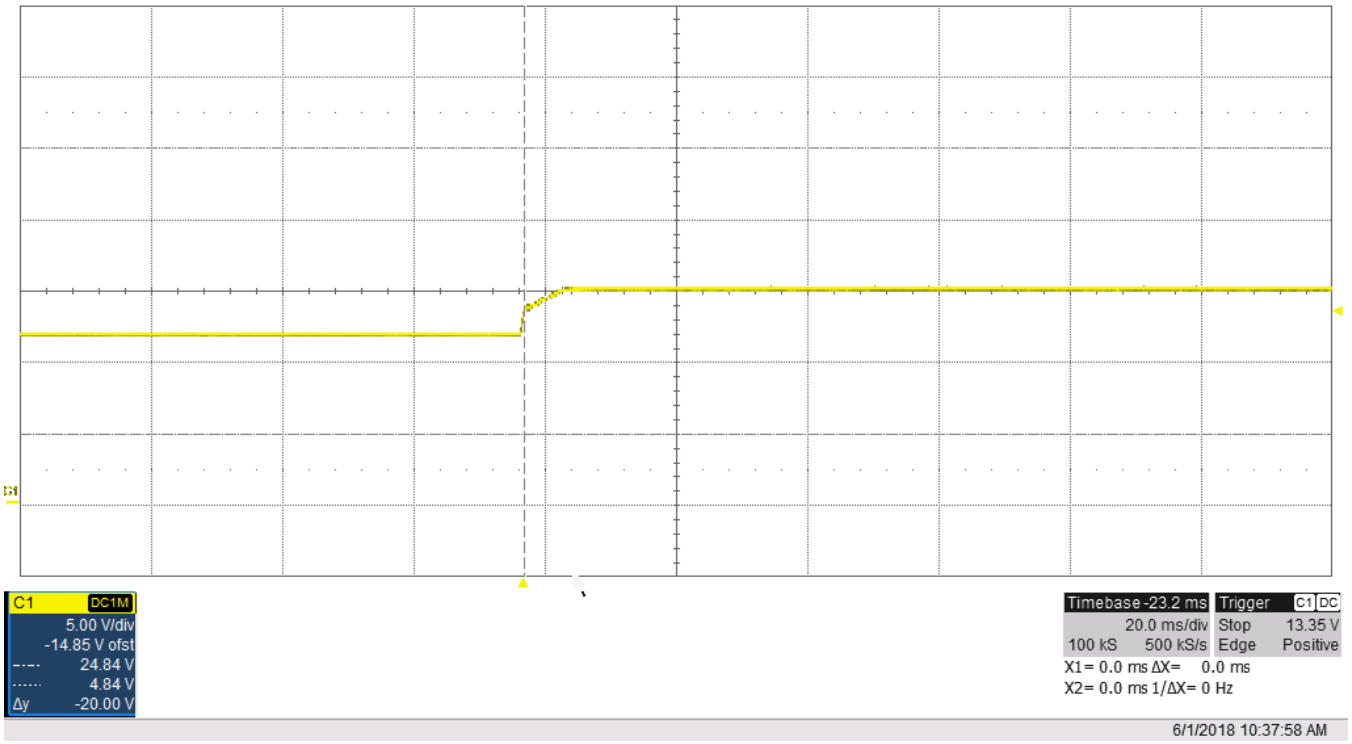


Figure 44. 12 V to 15 V Output Transition

Test was done with 230 VAC Input.

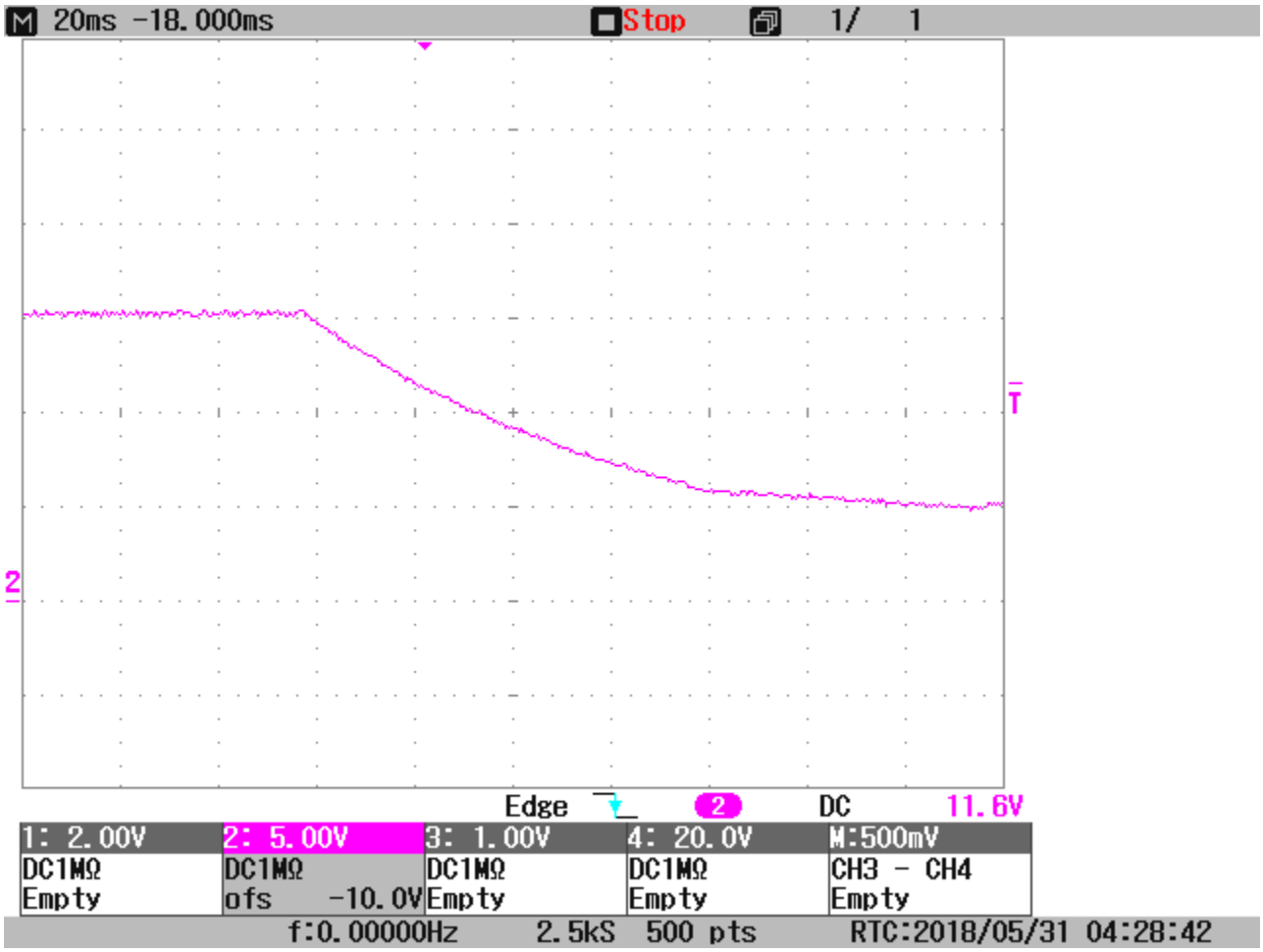


Figure 45. 15 V to 5 V Output Transition

Test was done with 230 VAC Input.

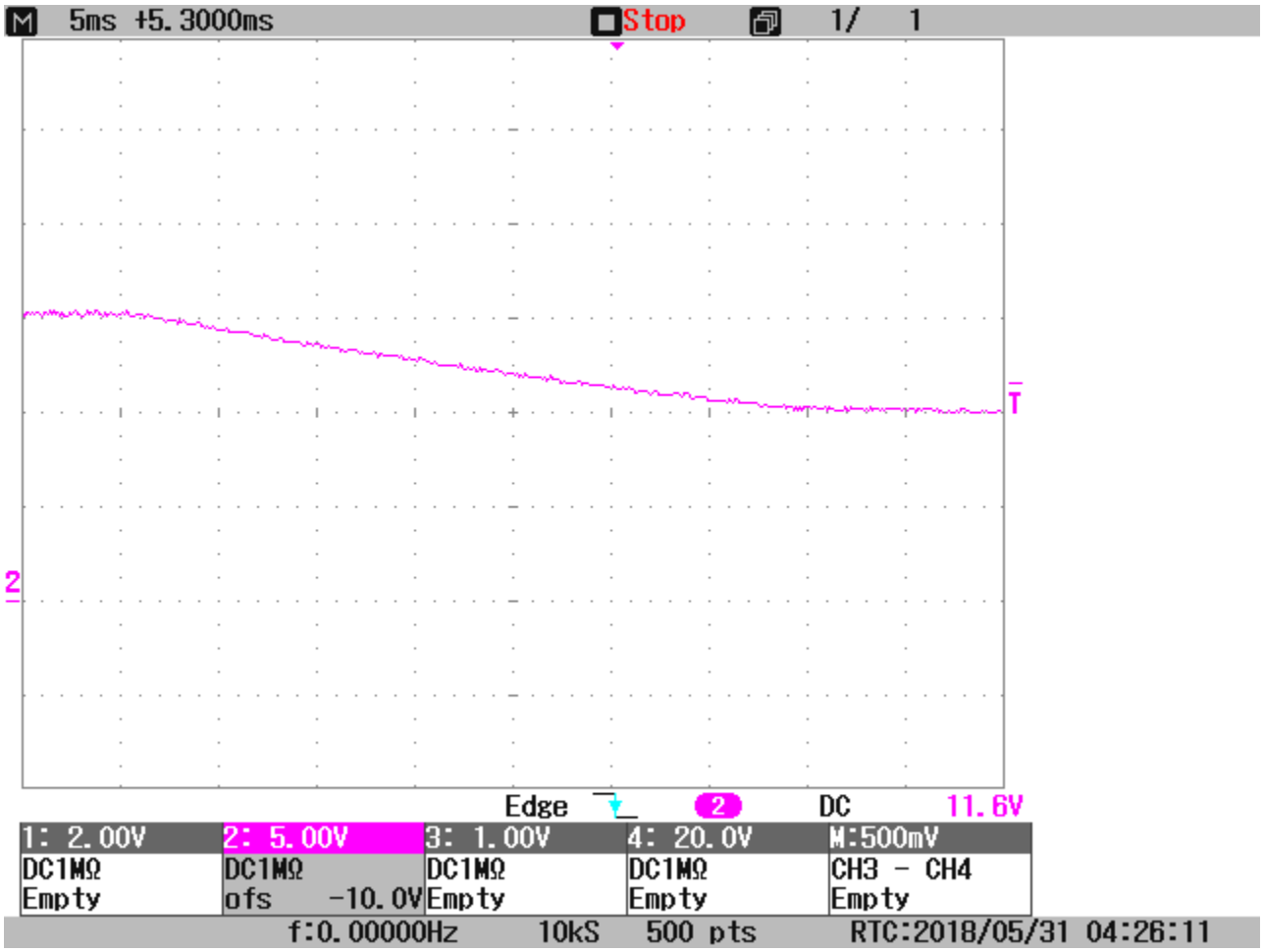


Figure 46. 15 V to 9 V Output Transition

Test was done with 230 VAC Input.

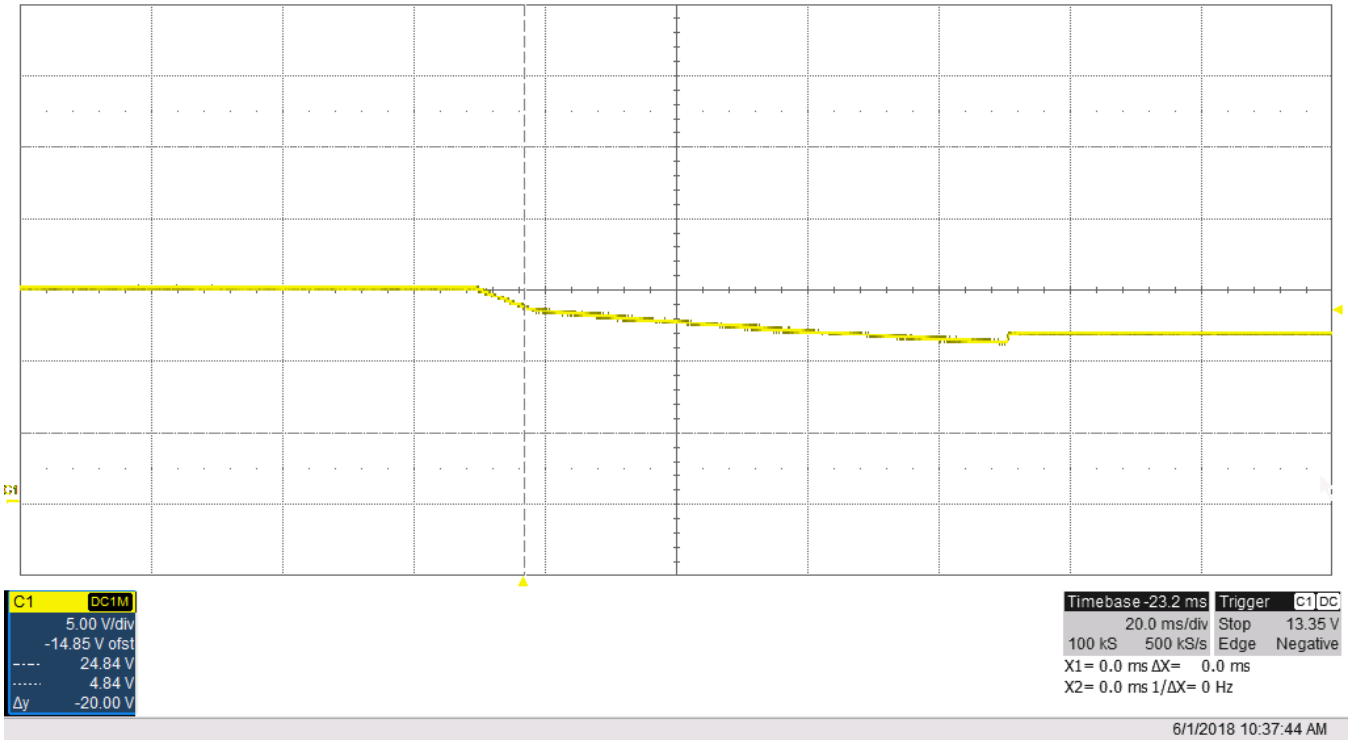


Figure 47. 15 V to 12 V Output Transition

Test was done with 230 VAC Input.

3.7 Standby Power

Table 14. Standby Power

Input Voltage	Standby Power
120 VAC/60Hz	14.416 mW
230 VAC/50 Hz	70.6 mW

3.8 Conducted Emissions

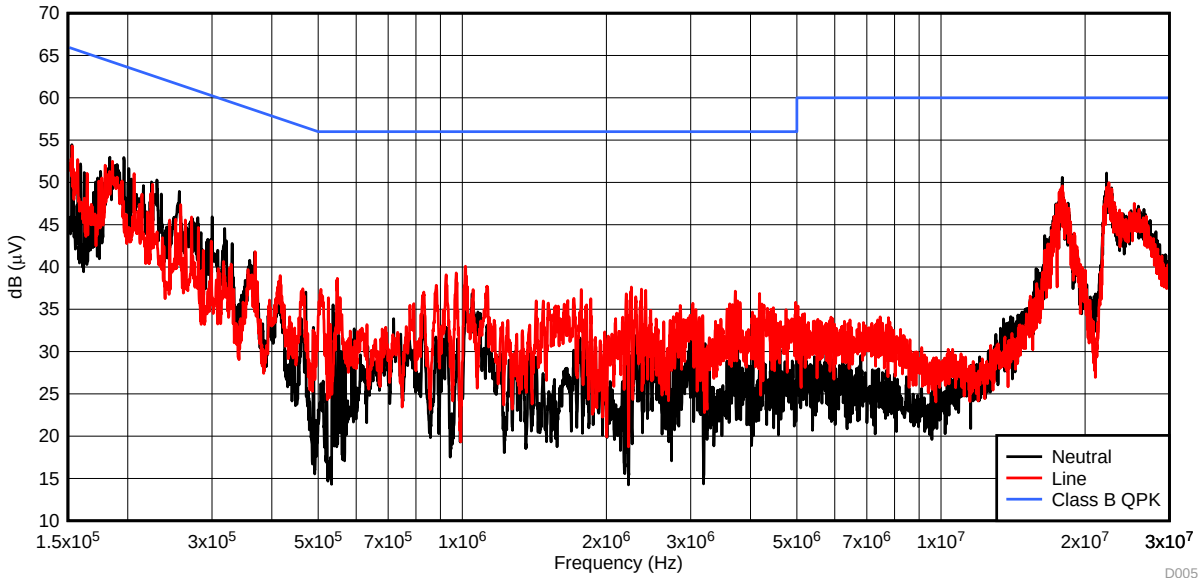


Figure 48. Conducted Emissions 5 V Output 120 VAC Input

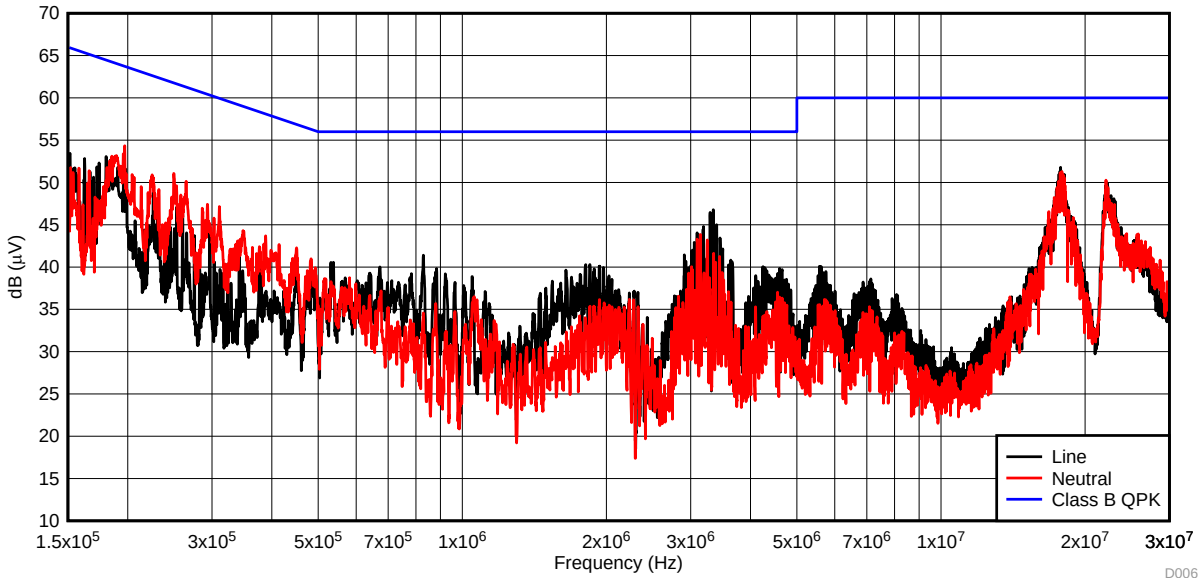


Figure 49. Conducted Emissions 5 V Output 230 VAC Input

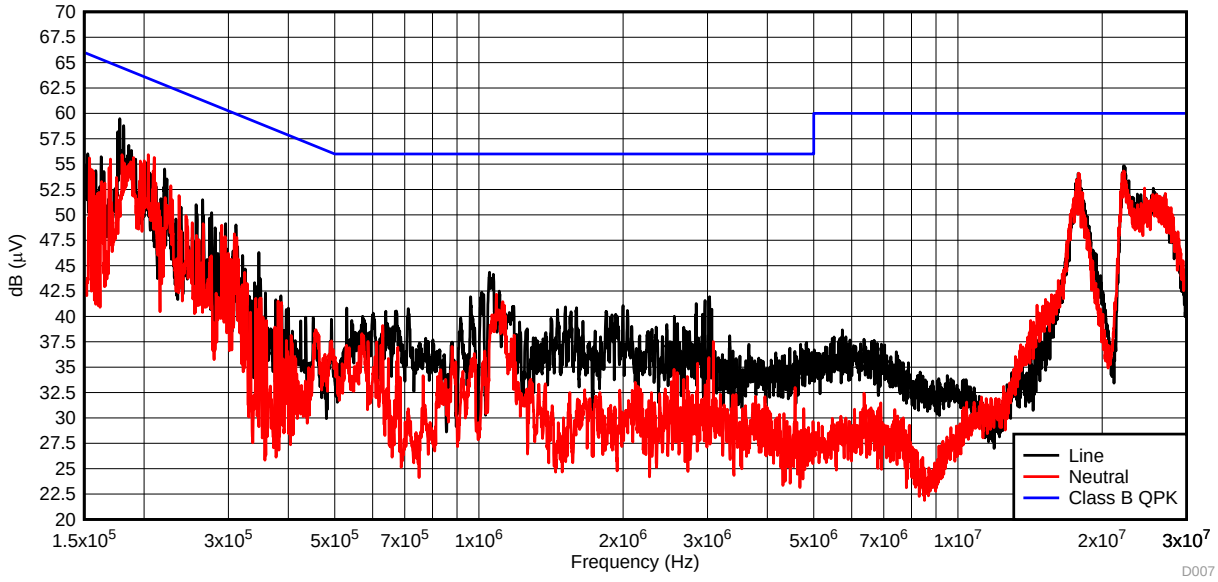


Figure 50. Conducted Emissions 9 V Output 120 VAC Input

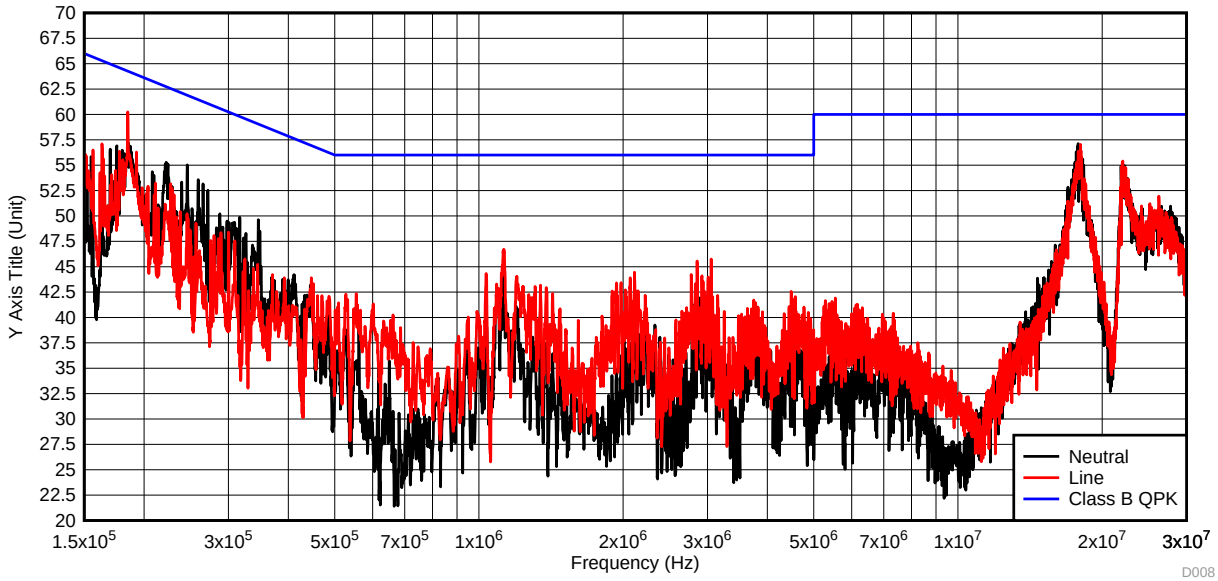


Figure 51. Conducted Emissions 9 V Output 230 VAC Input

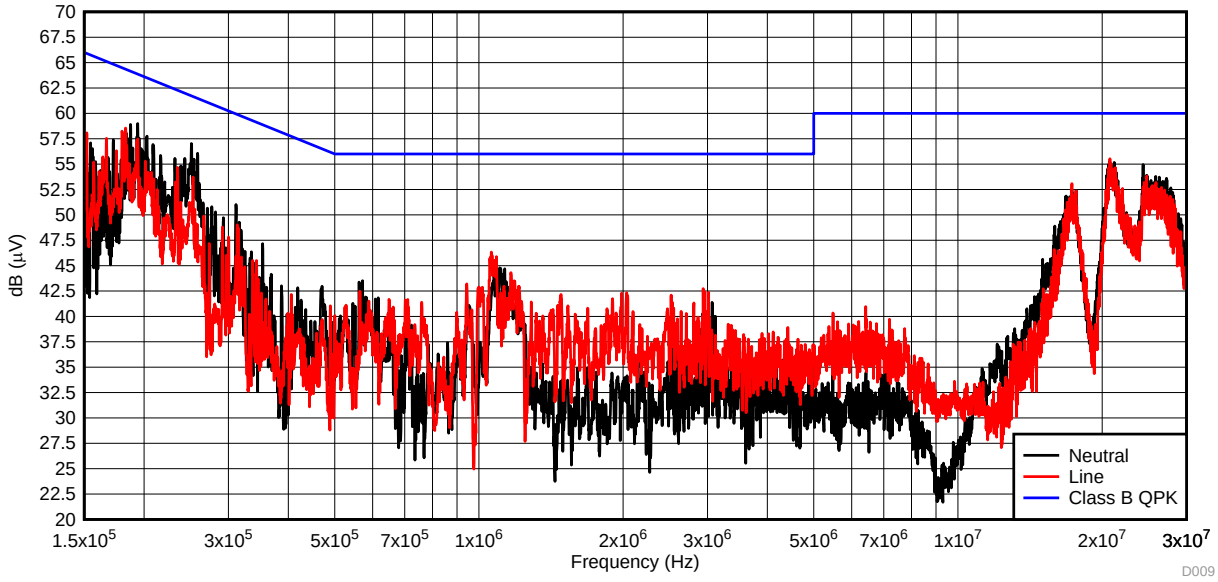


Figure 52. Conducted Emissions 12 V Output 120 VAC Input

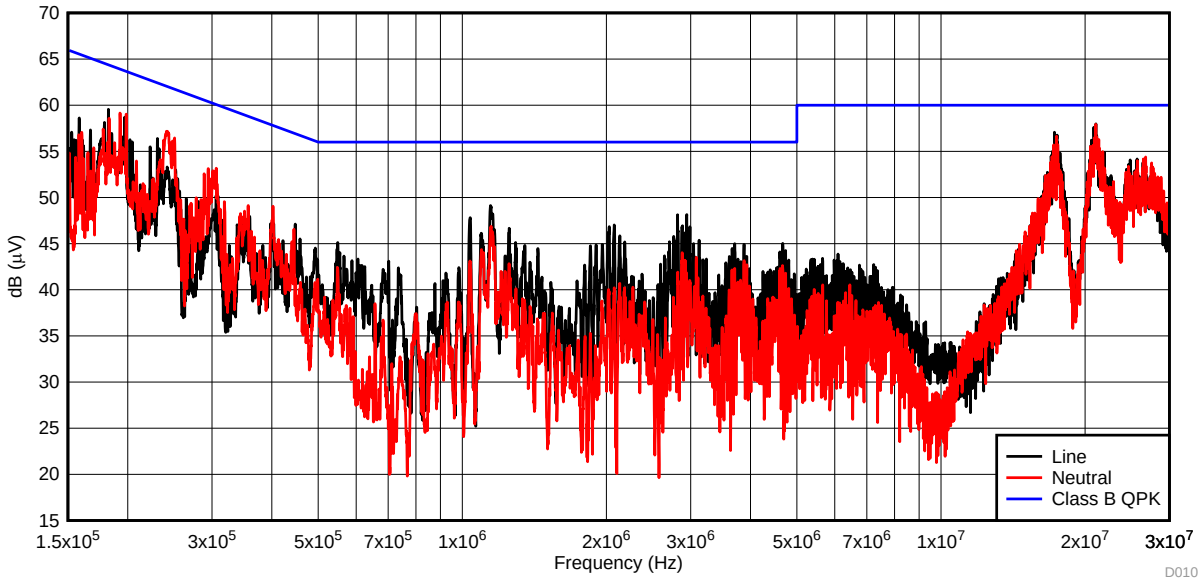


Figure 53. Conducted Emissions 12 V Output 230 VAC Input

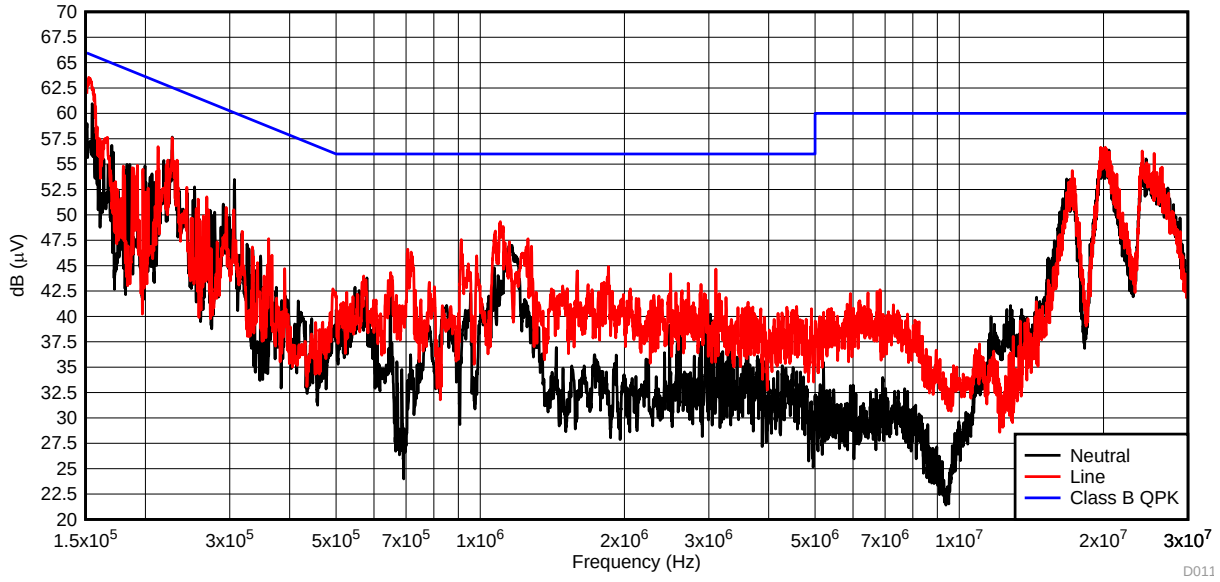


Figure 54. Conducted Emissions 15 V Output 120 VAC Input

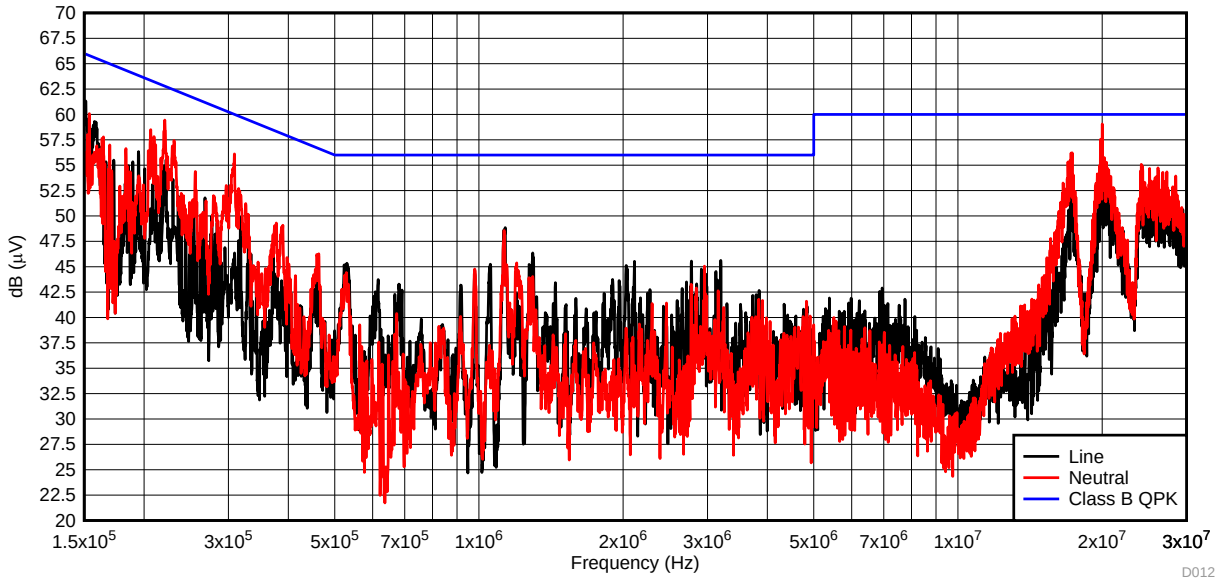


Figure 55. Conducted Emissions 15 V Output 230 VAC Input

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