

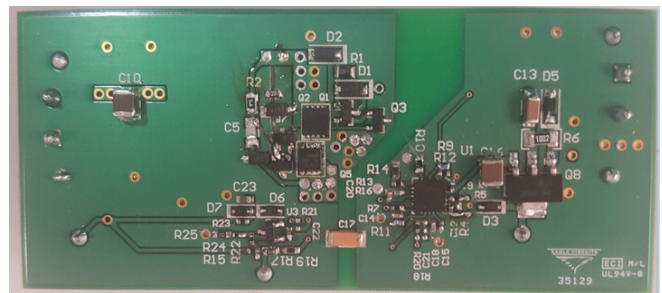
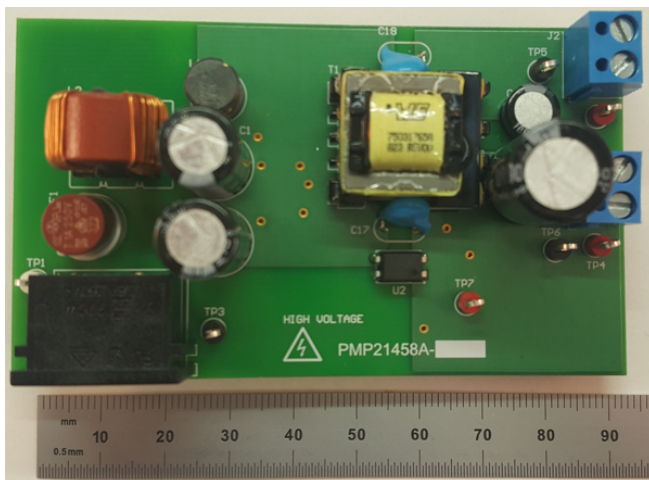
Test Report: PMP21458

6-Watt, Magnetically Resistant, Quasi-Resonant Flyback Reference Design



Description

The PMP21458 is a quasi-resonant flyback developed to be resistant to large magnetic fields near the transformer. The PMP21458 has a regulated 3.6-V output that can handle up to 1 A of current and secondary 12-V output that can handle 0.2 A of current.



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1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
V_{IN}	100-450 V_{AC}
V_{OUT}	3.6 V / 1 A , 12 V / 200 mA ; minimum current requirements of 50 mA on 3.6-V line
Nominal switching frequency	26 kHz

2 Testing and Results

2.1 Efficiency Graphs

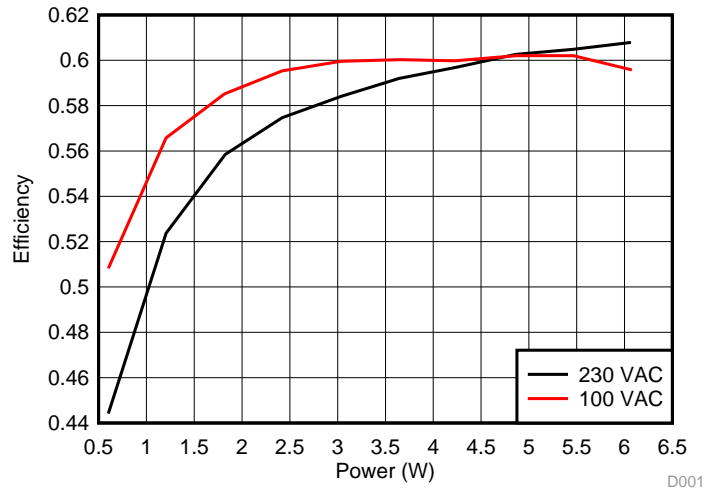


Figure 1. Efficiency of 3.6-V Line at 230 V_{AC} and 100 V_{AC}

2.2 Efficiency Data

Table 2. 230 V_{AC} Efficiency Data

V _{in}	I _{in}	WATT	PF	VA	V _{out} (3V6)	I _{out}	V _{out} (12 V)	I _{out}	P _{out}	EFFICIENCY
230.6	0.0482	3.773	0.339	11.1149 2	3.562	0.498	13.43	0.02	2.042	54.1%
230.6	0.0199	1.354	0.294	4.58894	3.564	0.1	12.25	0.02	0.601	44.4%
230.6	0.0312	2.304	0.32	7.19472	3.564	0.2	12.35	0.04	1.207	52.4%
230.6	0.0424	3.267	0.334	9.77744	3.563	0.3	12.39	0.061	1.825	55.9%
230.6	0.053	4.21	0.344	12.2218	3.562	0.4	12.43	0.08	2.419	57.5%
230.6	0.0639	5.195	0.353	14.7353 4	3.562	0.502	12.46	0.1	3.034	58.4%
230.6	0.0742	6.151	0.359	17.1105 2	3.561	0.602	12.48	0.12	3.641	59.2%
230.6	0.0844	7.106	0.365	19.4626 4	3.56	0.7	12.5	0.14	4.242	59.7%
230.6	0.0943	8.071	0.372	21.7455 8	3.56	0.8	12.52	0.161	4.864	60.3%
230.6	0.103	9.036	0.38	23.7518	3.559	0.901	12.55	0.18	5.466	60.5%
230.6	0.111	9.979	0.389	25.5966	3.558	0.999	12.56	0.2	6.066	60.8%

Table 3. 100 V_{AC} Efficiency Data

V _{in}	I _{in}	WATT	PF	VA	V _{out} (3V6)	I _{out}	V _{out} (12 V)	I _{out}	P _{out}	EFFICIENCY
99.88	0.0847	3.671	0.439	8.459836	3.562	0.503	13.39	0.02	2.059	56.1%
99.94	0.0317	1.183	0.374	3.168098	3.564	0.1	12.24	0.02	0.601	50.8%
99.92	0.0538	2.132	0.392	5.375696	3.563	0.2	12.34	0.04	1.206	56.6%
99.89	0.0737	3.104	0.422	7.361893	3.563	0.301	12.4	0.06	1.816	58.5%
99.88	0.0902	4.065	0.451	9.009176	3.562	0.4	12.44	0.08	2.420	59.5%

Table 3. 100 V_{AC} Efficiency Data (continued)

V _{in}	I _{in}	WATT	PF	VA	V _{out} (3V6)	I _{out}	V _{out} (12 V)	I _{out}	P _{out}	EFFICIENCY
99.86	0.1064	5.064	0.477	10.625104	3.562	0.502	12.48	0.1	3.036	60.0%
99.83	0.1231	6.096	0.496	12.289073	3.561	0.606	12.51	0.12	3.659	60.0%
99.81	0.138	7.044	0.51	13.77378	3.561	0.704	12.54	0.137	4.225	60.0%
99.78	0.155	8.09	0.523	15.4659	3.56	0.801	12.54	0.161	4.871	60.2%
99.77	0.1707	9.077	0.533	17.030739	3.56	0.9	12.56	0.18	5.465	60.2%
99.74	0.1885	10.2	0.542	18.80099	3.559	1	12.59	0.2	6.077	59.6%

2.3 Thermal Images

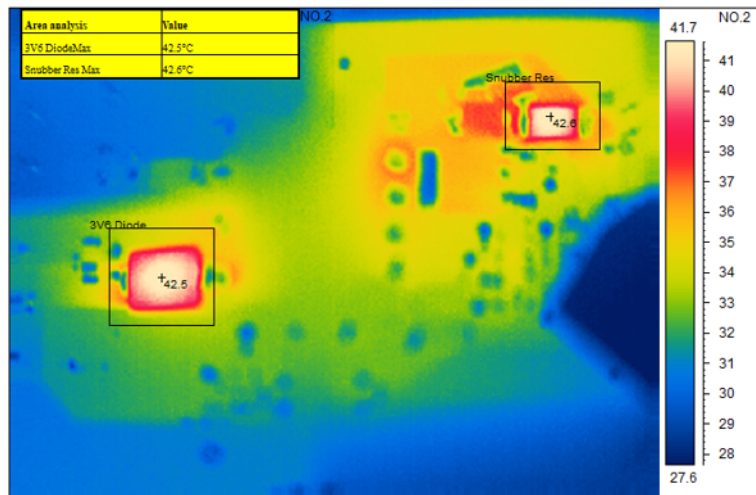


Figure 2. 100 V_{AC} 60 Hz Front Side Thermal Picture

Figure 2 shows testing done at a nominal load of 3.6 V/0.5 A and 12 V/0.02 A.

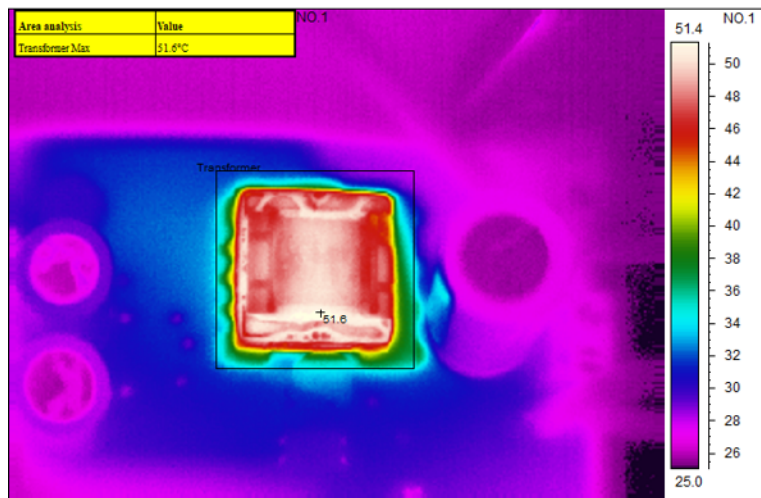


Figure 3. 100 V_{AC} 60 Hz Back Side Thermal Picture

Figure 3 shows testing done at a nominal load of 3.6 V/0.5 A and 12 V/0.02 A.

3 Waveforms

3.1 Switching

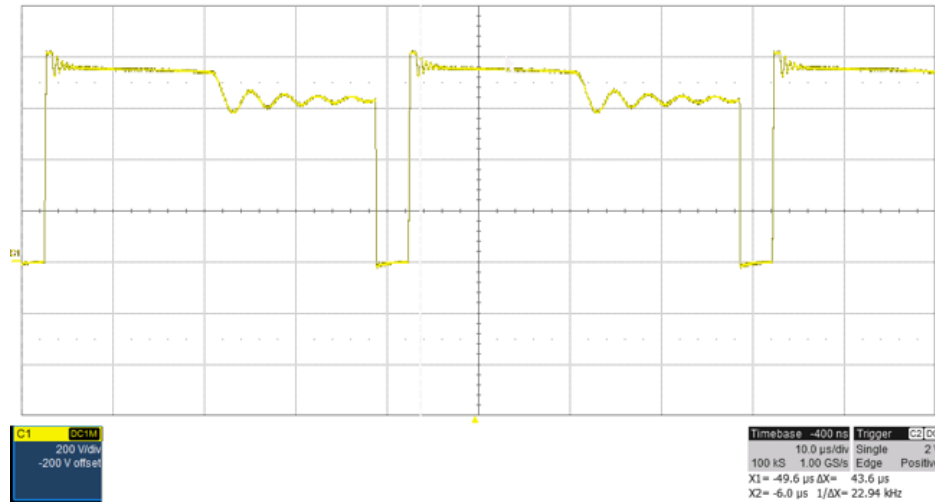


Figure 4. Switch Node Tested at 640 V_{DC}

Measurement was taken across the drain to source voltage of primary side MOSFET (Q1) in Figure 4.

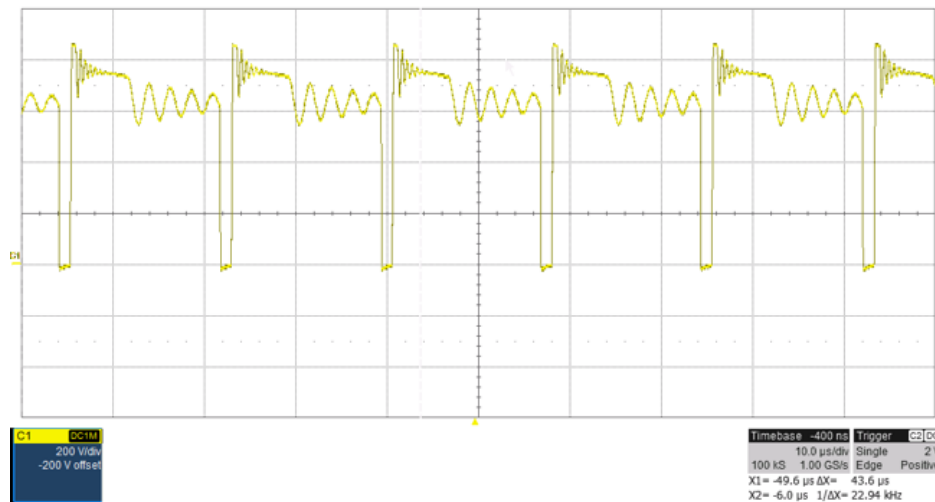


Figure 5. Switch Node Tested at 640 V_{DC} With Applied Magnetic Field

Measurement was taken across the drain to source voltage of primary side MOSFET (Q1) in Figure 5.

3.2 Diode Stress

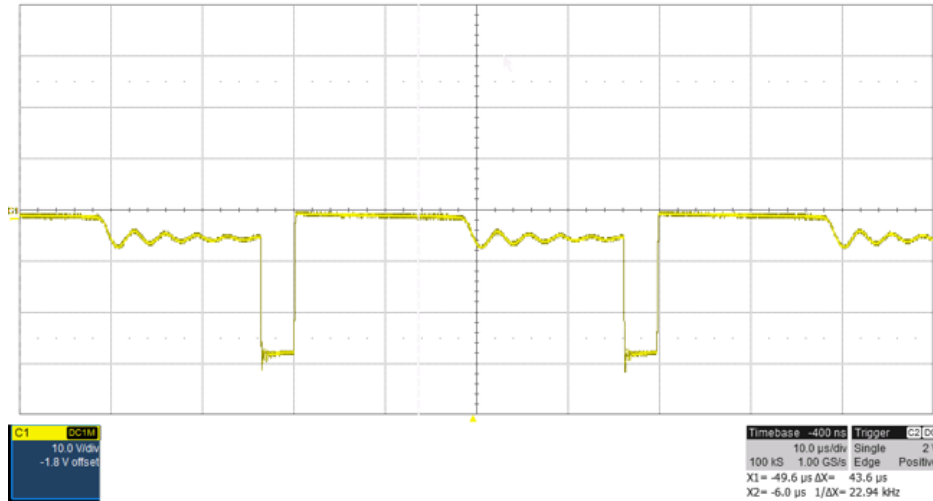


Figure 6. 3V6 Output Diode (D4) Voltage Stress

Figure 6 shows testing done at 630-V_{DC} input with fully loaded output.

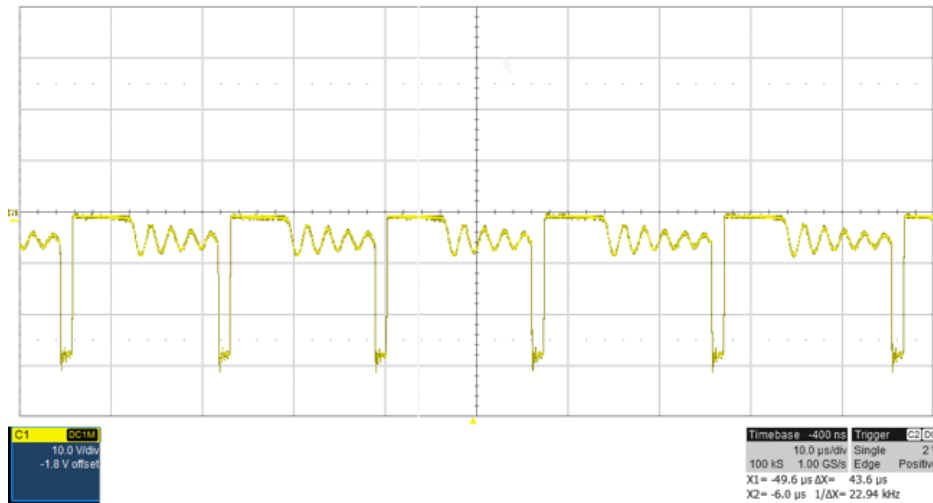


Figure 7. 3V6 Output Diode Voltage (D4) Stress With Applied Magnetic Field

Figure 7 shows testing done at 630-V_{DC} input with fully loaded output.

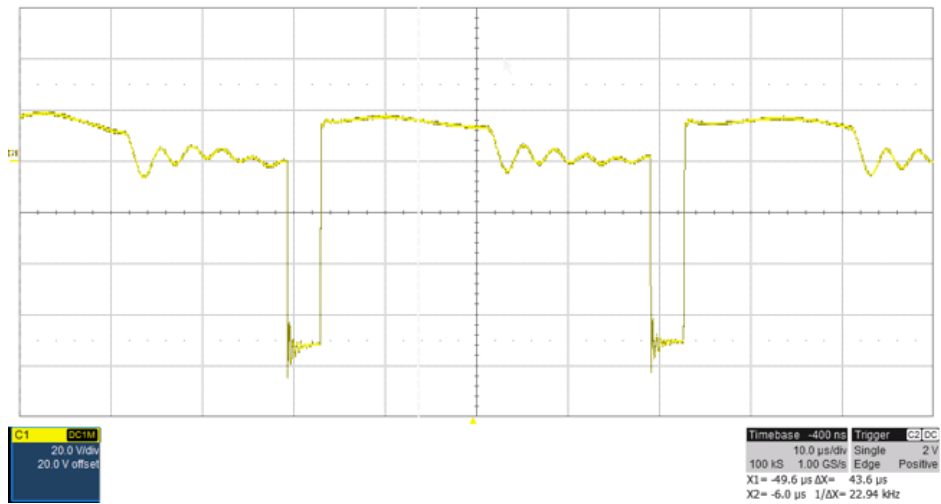


Figure 8. 12-V Output Diode (D2) Voltage Stress

Figure 8 shows testing done at 630-V_{DC} input with fully loaded output.

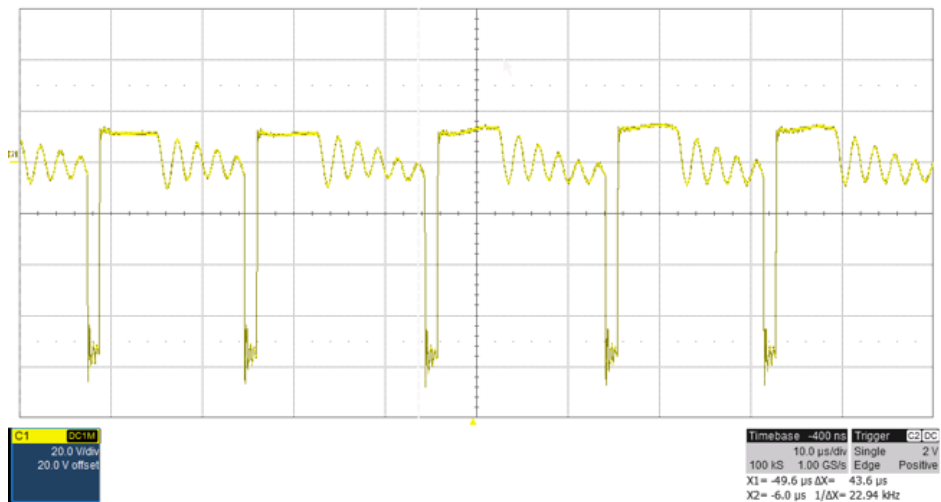


Figure 9. 12-V Output Diode (D2) Voltage Stress With Applied Magnetic Field

Figure 9 shows testing done at 630-V_{DC} input with fully loaded output.

3.3 Output Voltage Ripple

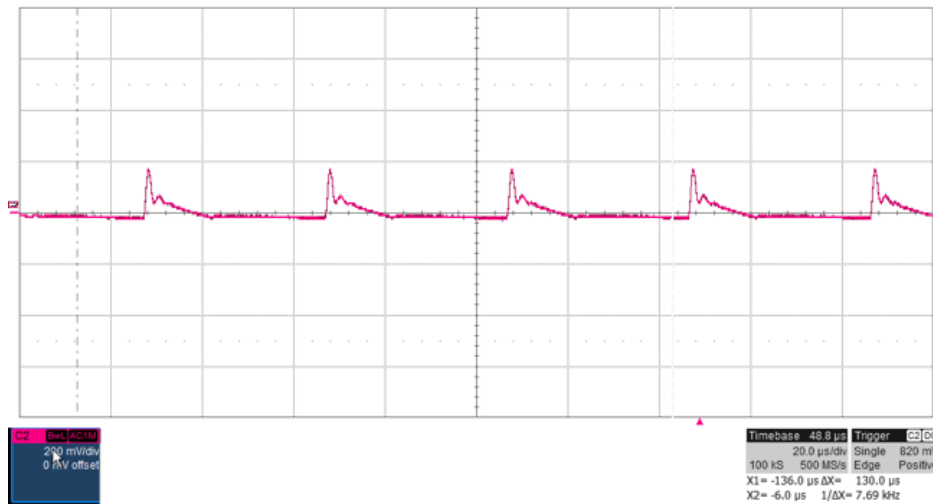


Figure 10. Ripple on 3.6-V Line

Ripple was tested at 230-V_{AC} input and fully loaded output in Figure 10.

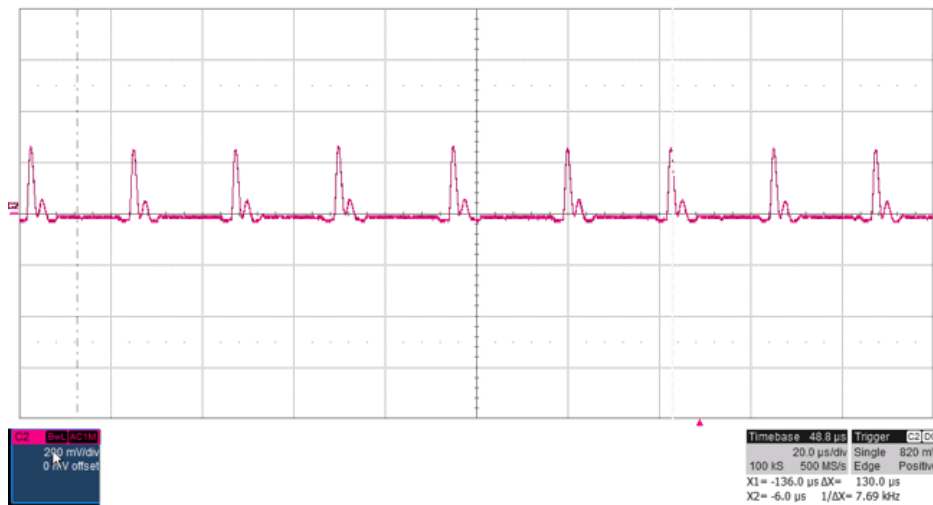


Figure 11. Ripple on 3.6-V Line With Applied Magnetic Field

Ripple was tested at 230-V_{AC} input and fully loaded output in Figure 11.

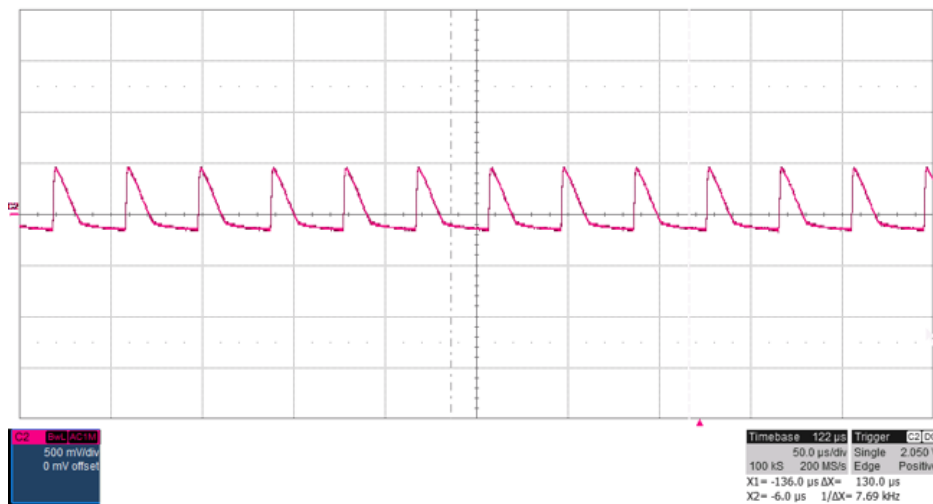


Figure 12. Ripple on 12-V Line

Ripple was tested at 230-V_{AC} input and fully loaded output in Figure 12.

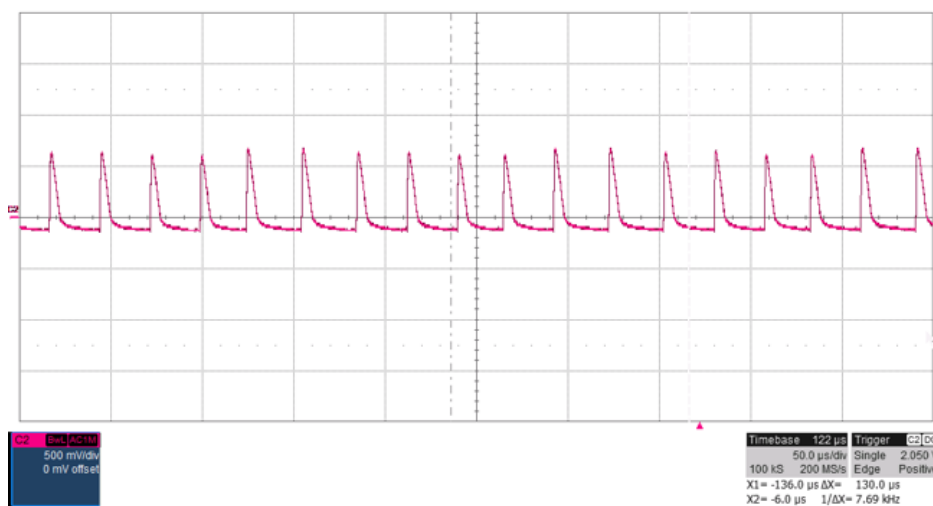


Figure 13. Ripple on 12-V Line With Applied Magnetic Field

Ripple was tested at 230-V_{AC} input and fully loaded output in Figure 13.

3.4 Bode Plot

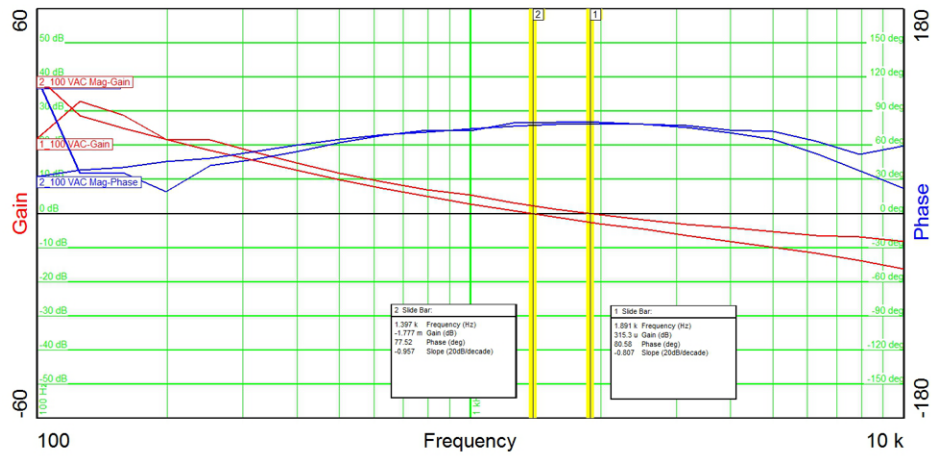


Figure 14. Bode Plot at 100 V_{AC}

Figure 14 shows testing done at 100-V_{AC} input and fully loaded output.

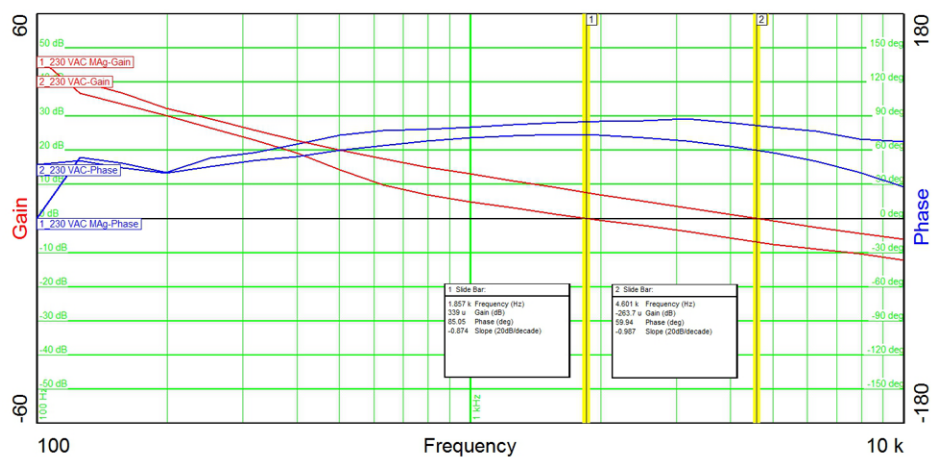


Figure 15. Bode Plot at 230 V_{AC}

Figure 15 shows testing done at 230-V_{AC} input and fully loaded output.

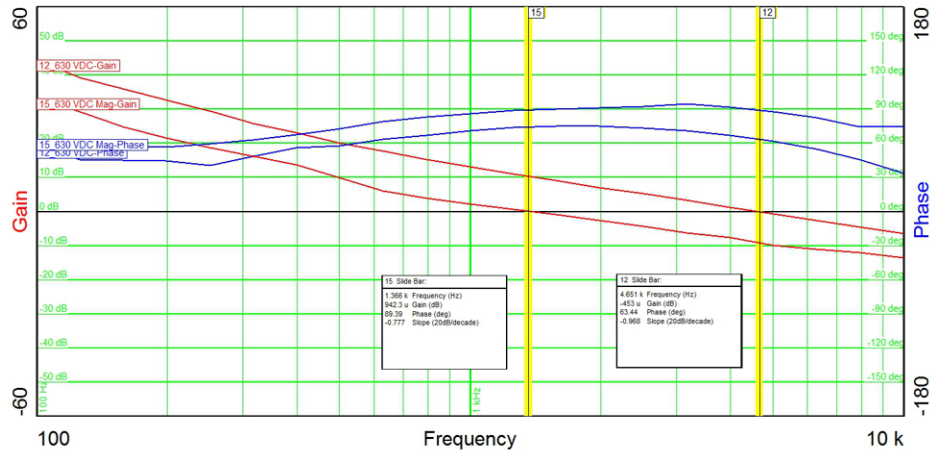


Figure 16. Bode Plot at 630 V_{DC}

Figure 16 shows testing done at 630-V_{AC} input and fully loaded output.

3.5 Load Transients

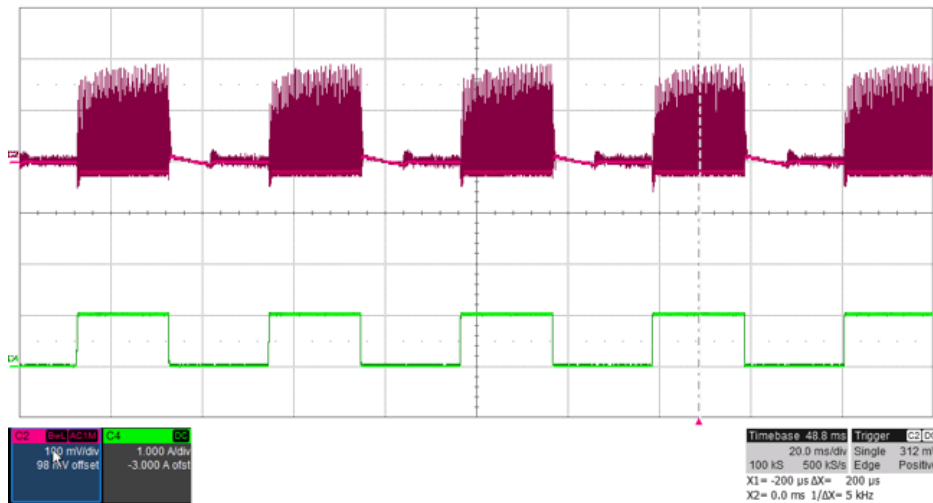


Figure 17. Load Transient on 3.6-V Line

Figure 17 shows the load transient on a 3.6-V line switching between 50 mA to 1 A.

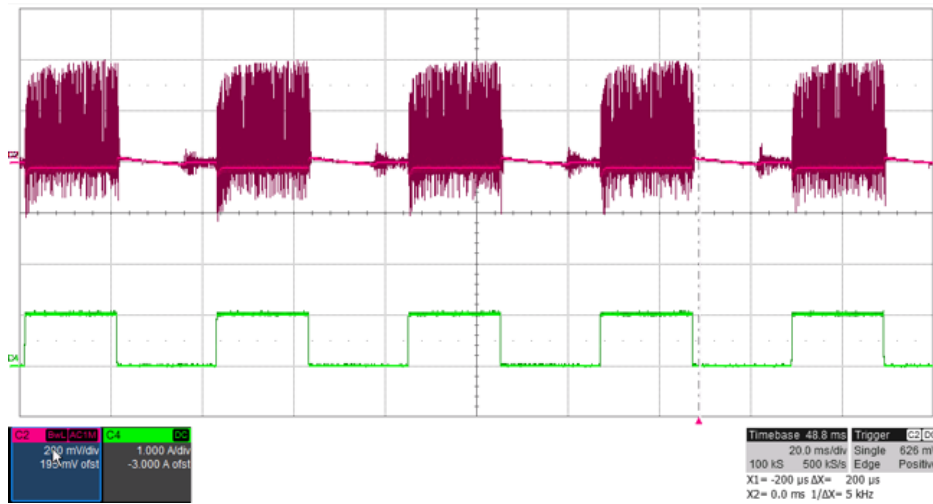


Figure 18. Load Transient on 3.6-V Line With Applied Magnetic Field

Figure 18 shows the load transient on a 3.6-V line switching between 50 mA to 1 A.

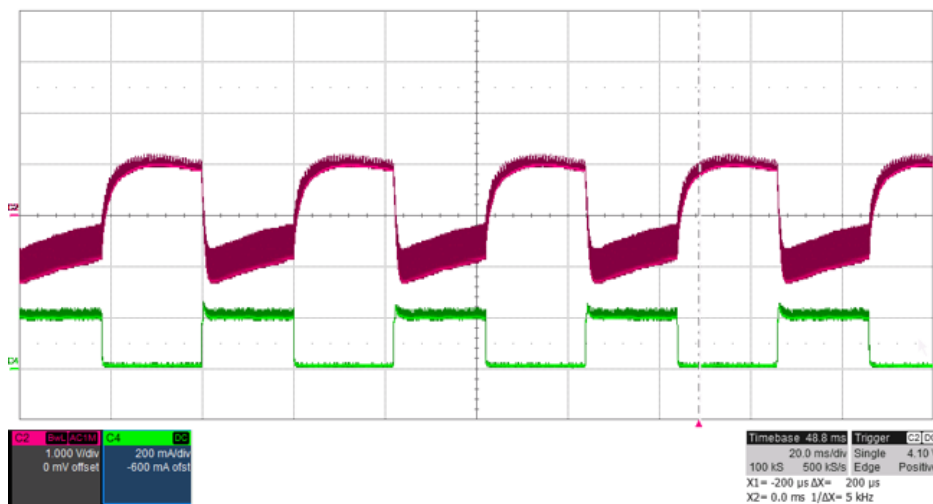


Figure 19. Load Transient on 12-V Line

Figure 19 shows the load transient on a 12-V line switching between 0 A to 200 mA.

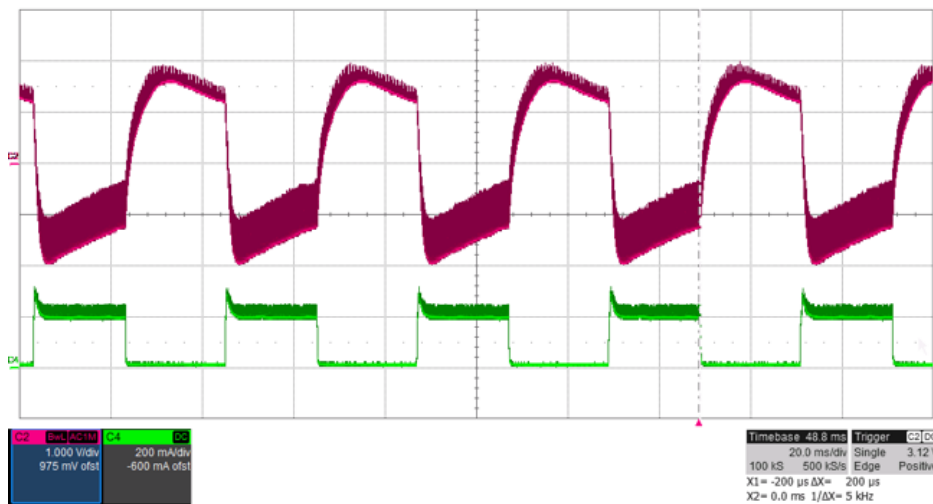


Figure 20. Load Transient on 12-V Line With Applied Magnetic Field

Figure 20 shows the load transient on a 12-V line switching between 0 A to 200 mA.

3.6 Start-up and Shutdown

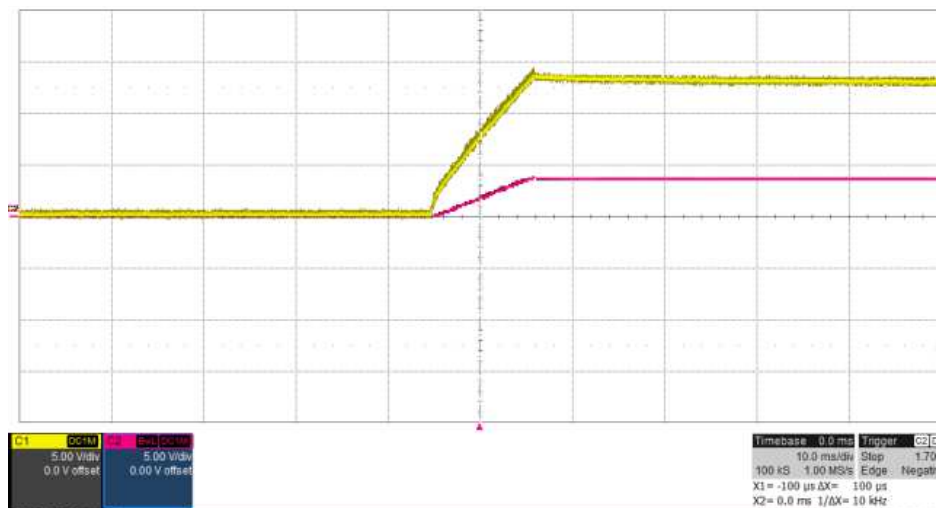


Figure 21. Start-up With Full Load

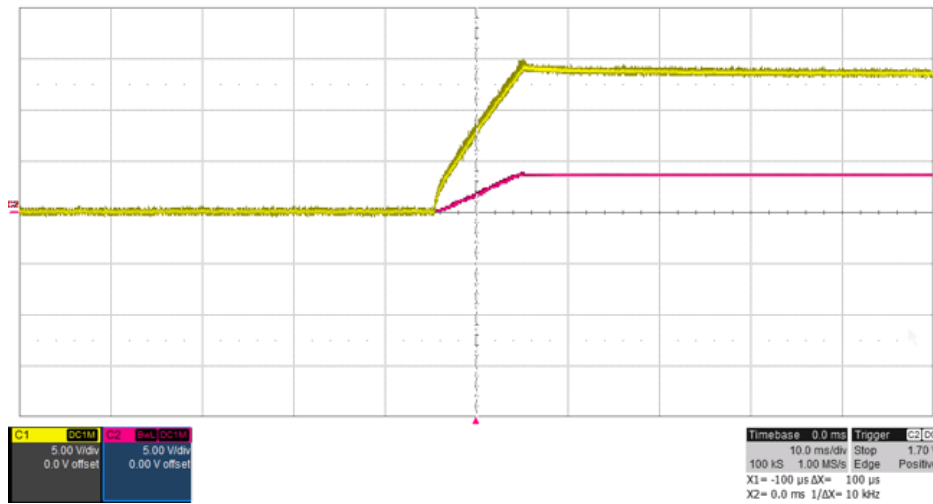


Figure 22. Start-up With Full Load With Applied Magnetic Field

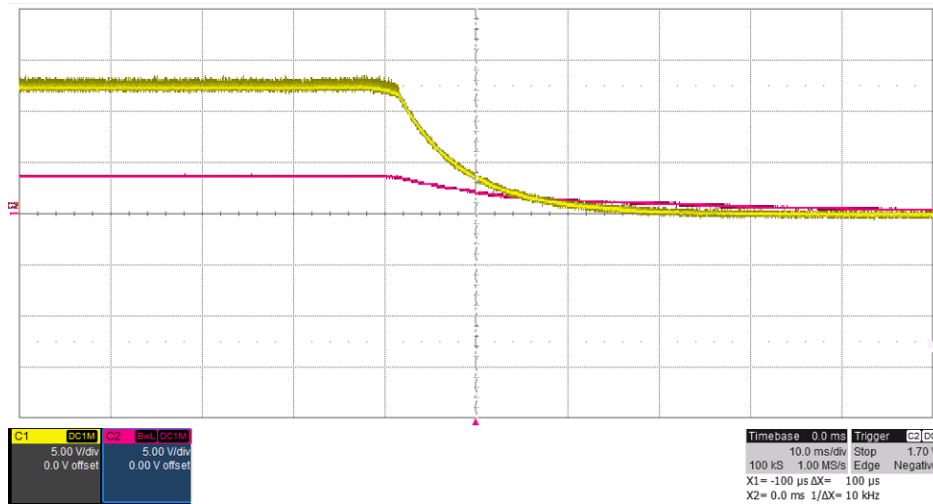


Figure 23. Shutdown With Full Load

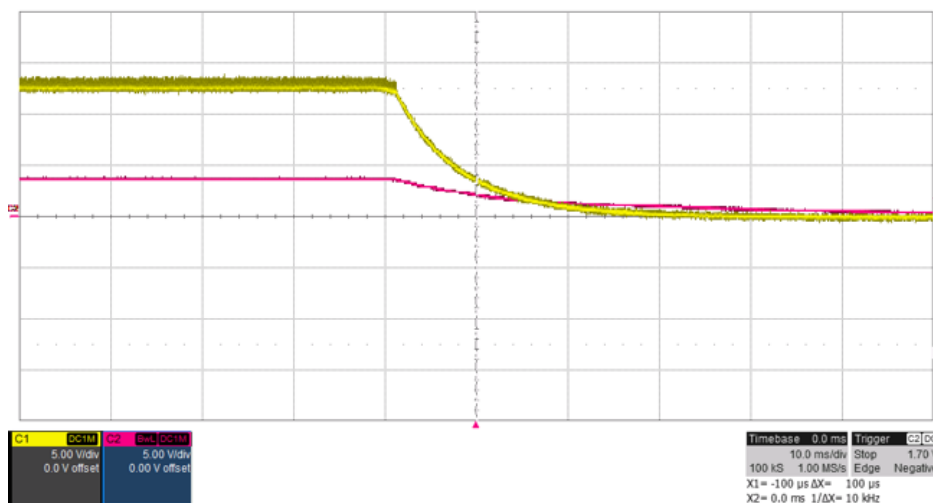


Figure 24. Shutdown With Full Load With Applied Magnetic Field

3.7 Conducted EMI

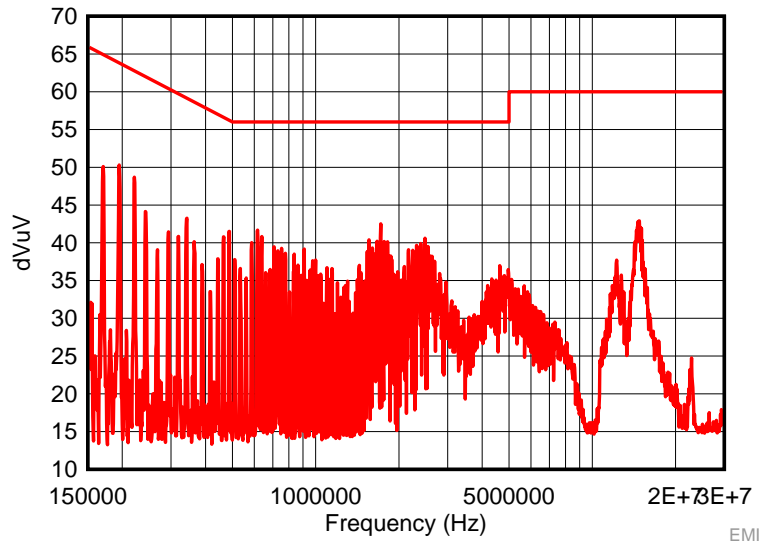


Figure 25. EMI at 230 V_{AC}

Figure 25 shows testing done at 230-V_{AC} input and fully loaded output.

3.8 Short Circuit Recovery

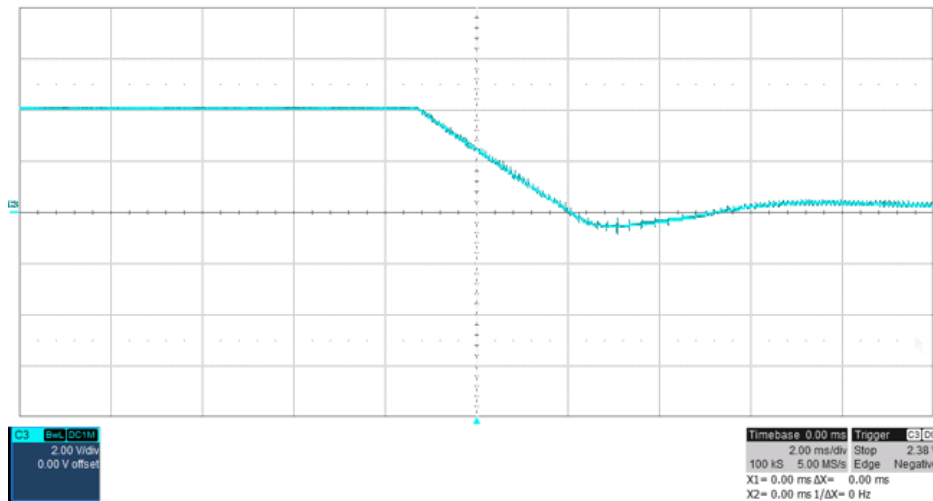


Figure 26. Short Circuit Event on 3.6-V Line

Figure 26 shows results from a test that was run at 230-V_{AC} input voltage.

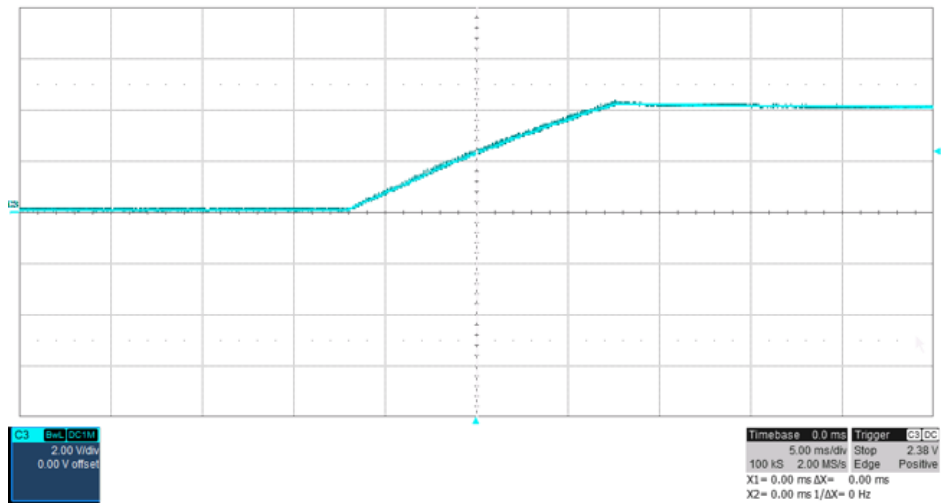


Figure 27. Recovery After Event on 3.6-V Line

Figure 27 shows results from a test that was run at 230-V_{AC} input voltage.

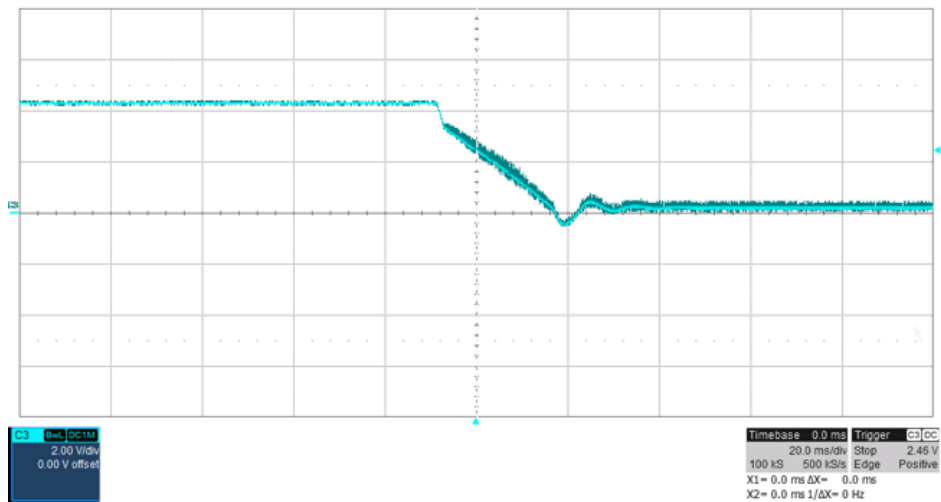


Figure 28. Short Circuit Event on 3.6-V Line With Applied Magnetic Field

Figure 28 shows results from a test that was run at 230-V_{AC} input voltage.

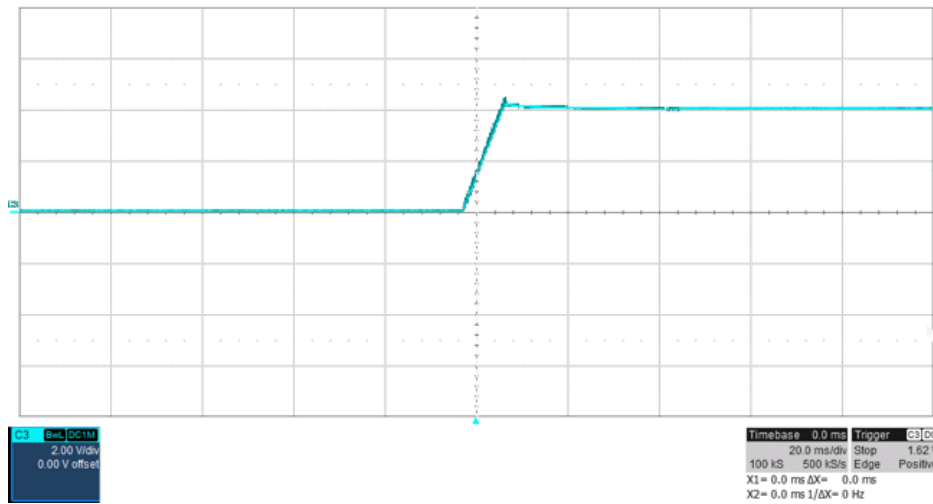


Figure 29. Recovery After Event on 3.6-V Line With Applied Magnetic Field

Figure 29 shows a test that was run at 230- V_{AC} input voltage.

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