PMP-9738 1V 200A / 255A(peak) 6 phases off 12Vin Test Report (TPS53661 / CSD95372B)
Texas Instruments

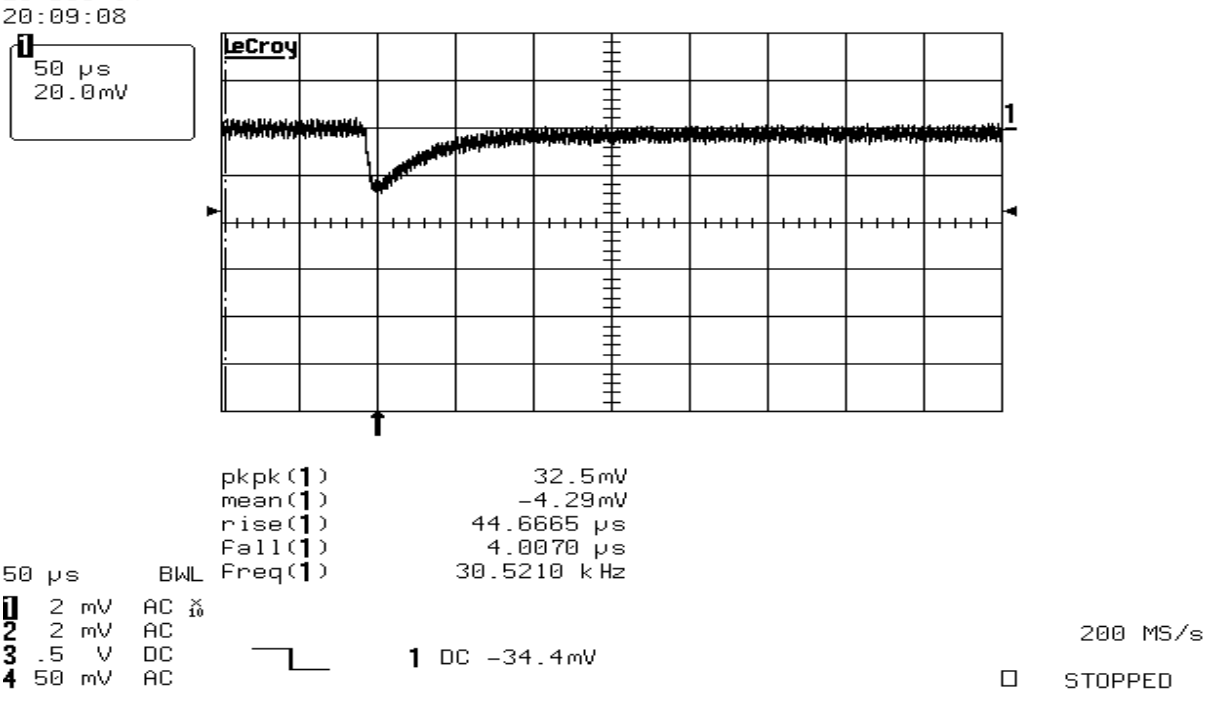
Table of Contents:

Model t11 used for the testing:
main loop Rcomp at 19.1k and C series at 1500pF and C parallel at 10 pF

Tested at up to and including 200 A load steady state and about 255 A peak for electrical performance. From the step load response plots on page 2 and the load dump responses on page 4, the steady state output ripple is less than 10 mV p-p over the full load range.

Comments about load dynamics testing:
DC static load has very little effect on dynamic response as operation is Forced Continuous Conduction Mode (FCCM). The load dump was about twice as fast (~5 usec vs. 10 usec) and 8% more in magnitude 142 A vs. 132 A. Load dump peak overshoot was 55 mV vs. 25 mV undershoot for step load. Hence, peak overshoot & undershoot are very sensitive to speed of load change.

1.0V 300kHz settings: 12.0Vin, Vout measured at C19
Step load response from no load to 132 A in 10 usec: ~25 mV peak undershoot



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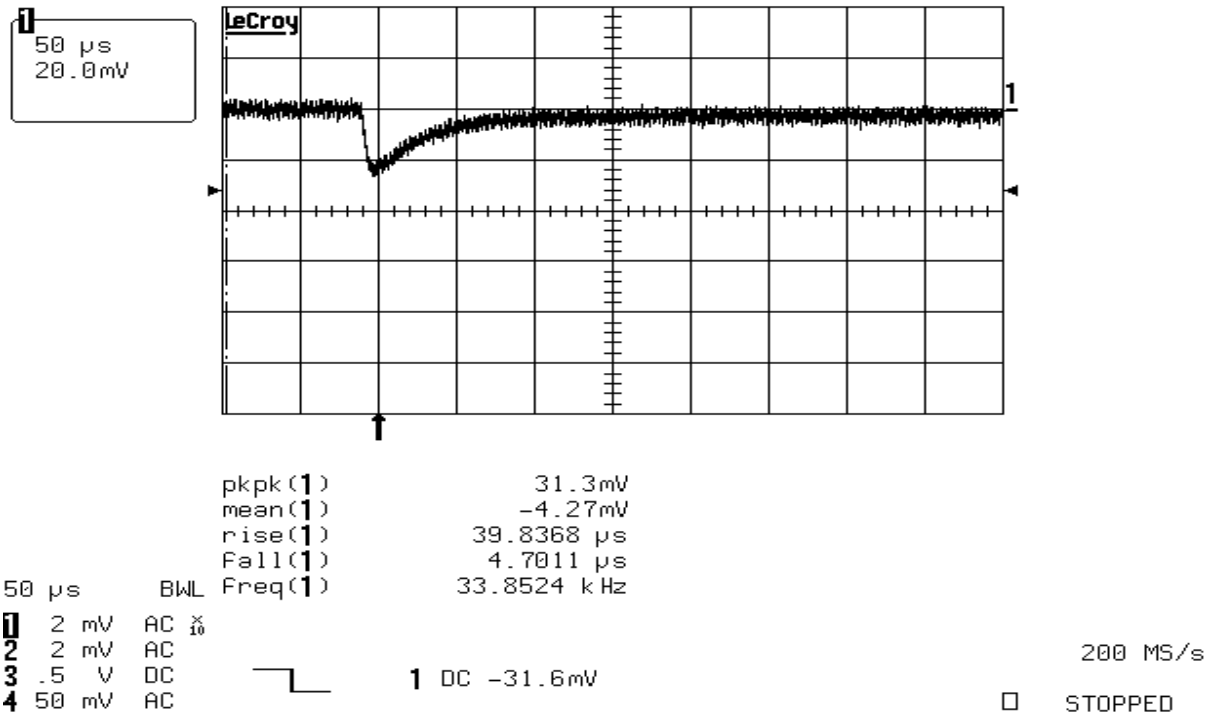
And now from 120A static load to 252A in 10 usec with undershoot also ~25mV



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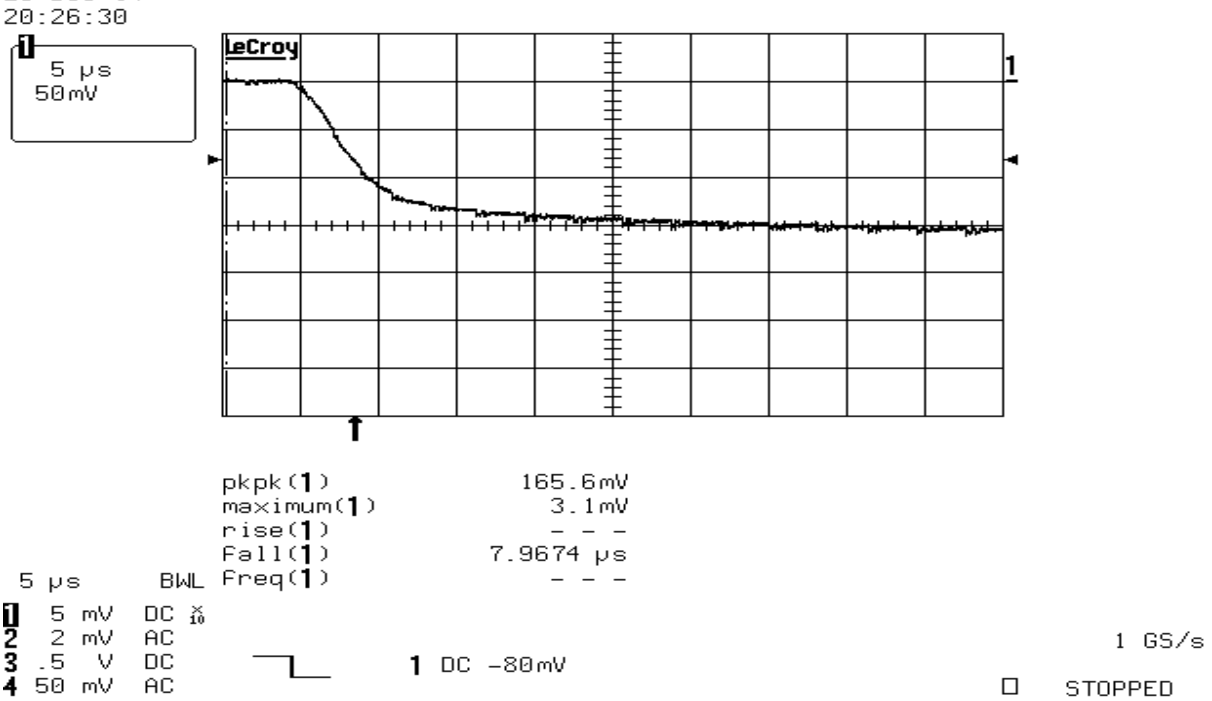
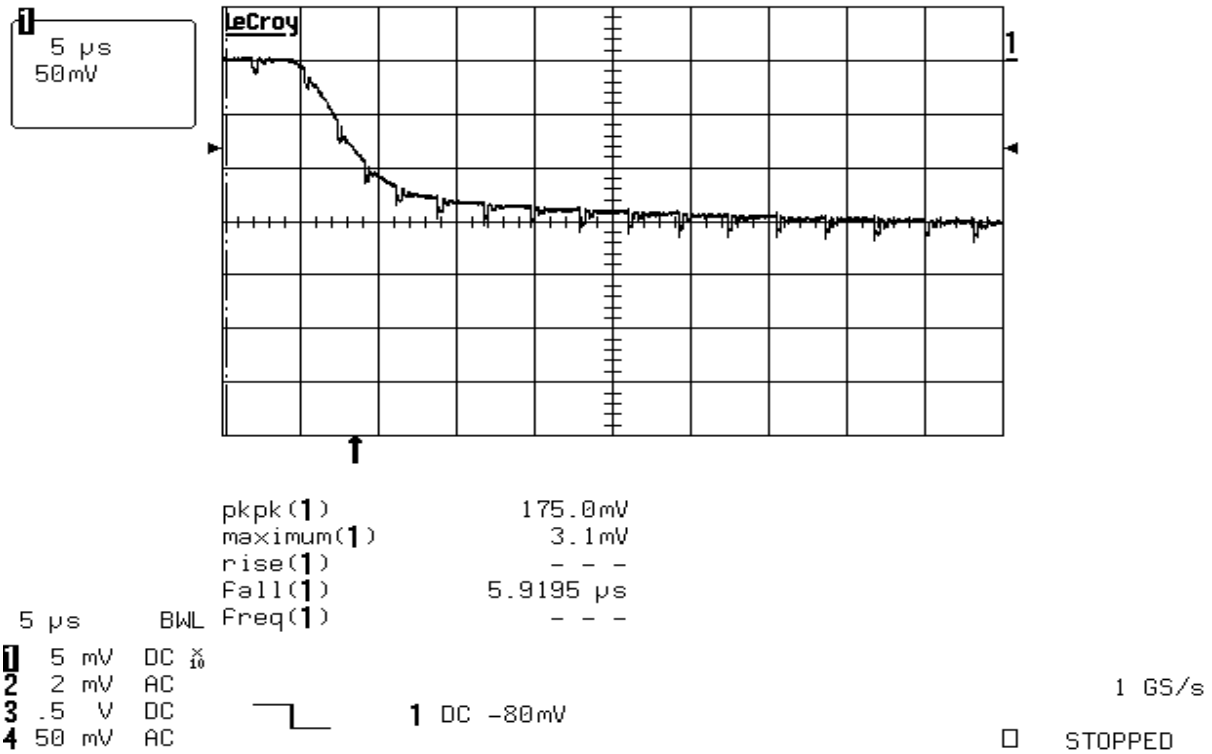
Details of step load: across R1 & R2 each 2 mOhms tied to Vout:
First R1 2mOhm: 135 mV in 10 usec or 67 A in 10 usec

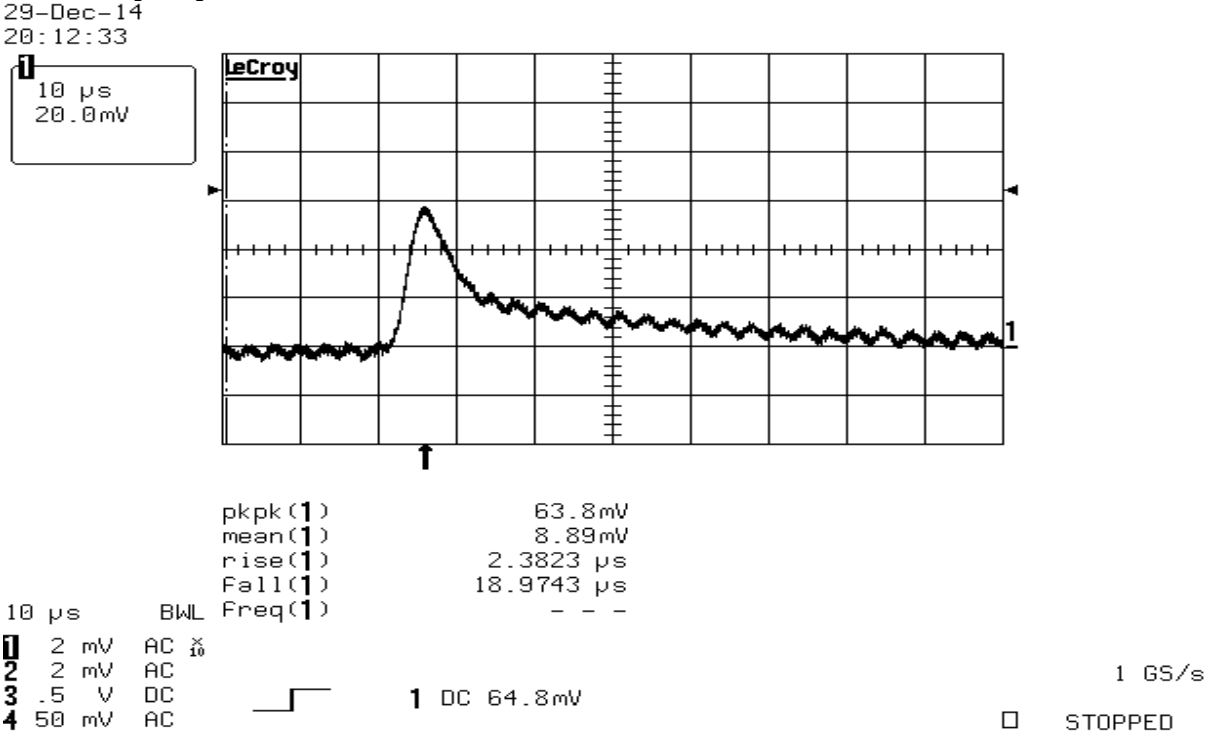


And now R2(also 2mOhm): 130 mV in 10 usec or 65 A in 10 usec



Combined: 132 A in 10 usec

1.0V 300kHz settings: 12.0Vin, Vout measured at C19
Load dump response from 142 A to no load in 5 usec: ~55 mV overshoot



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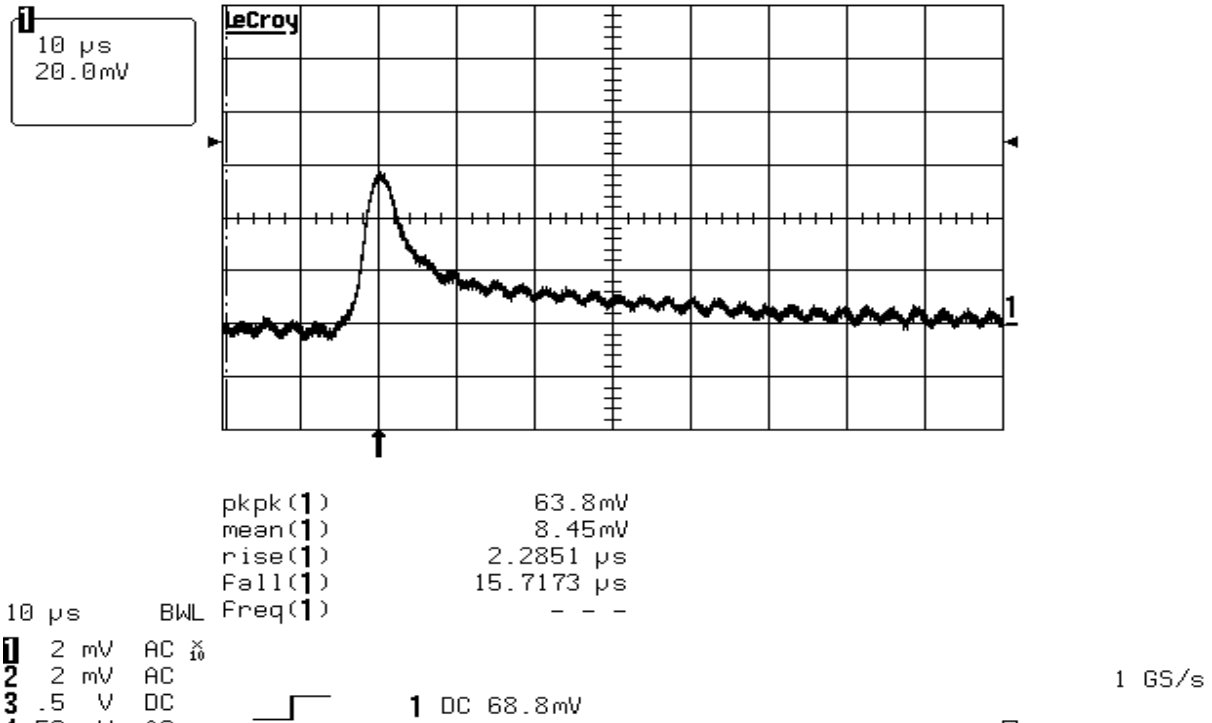
Load dump response from 262 A to 120A in 5 usec: ~55 mV overshoot



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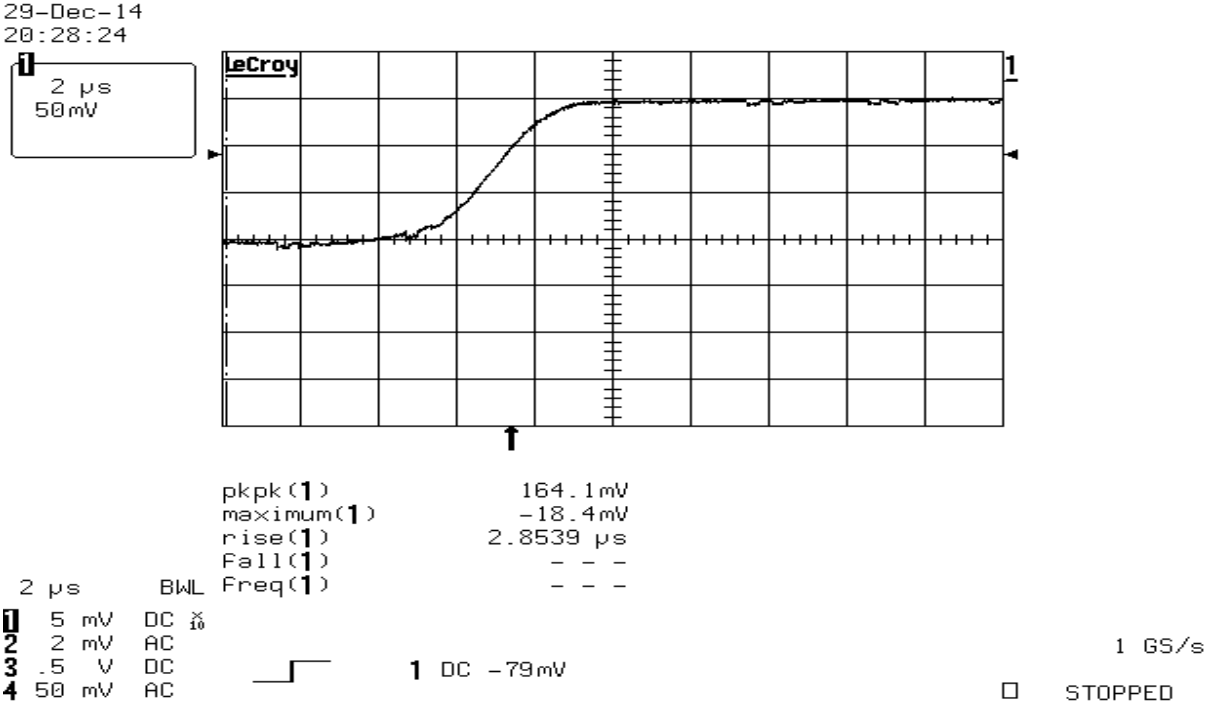
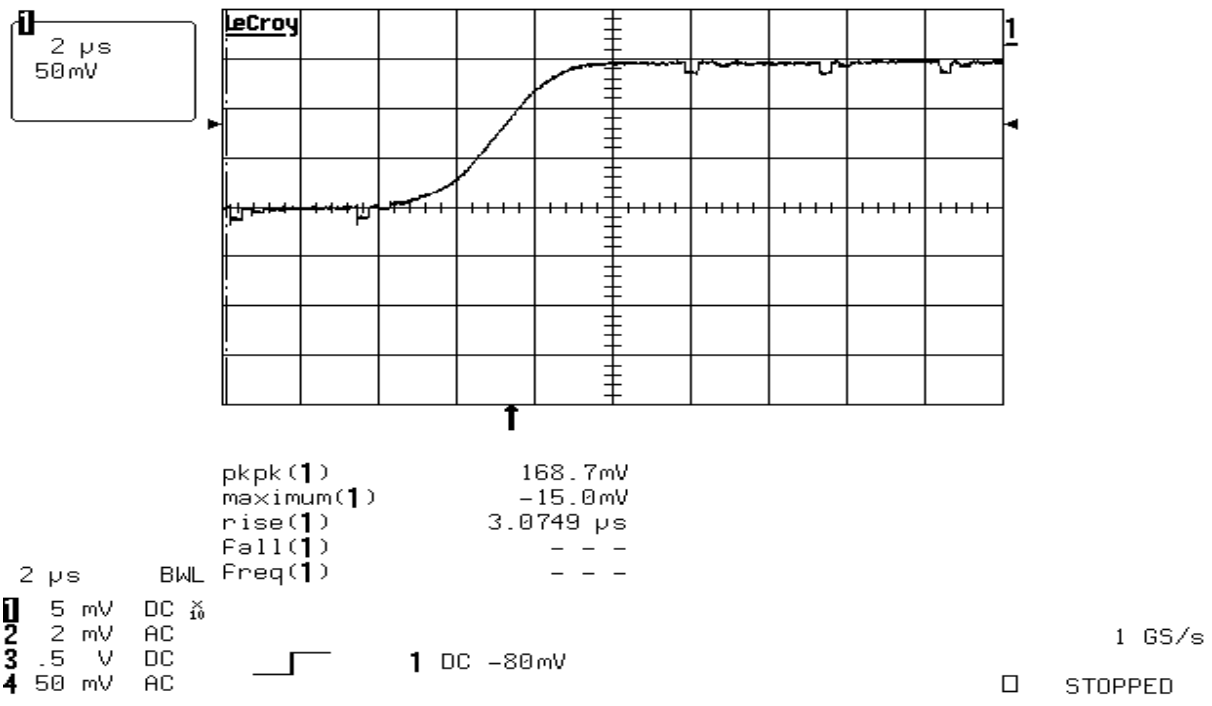
Details of load dump: across R1 & R2 each 2 mOhms tied to Vout:
First R1 2mOhm: 144 mV in 5 usec or 72 A in 5 usec

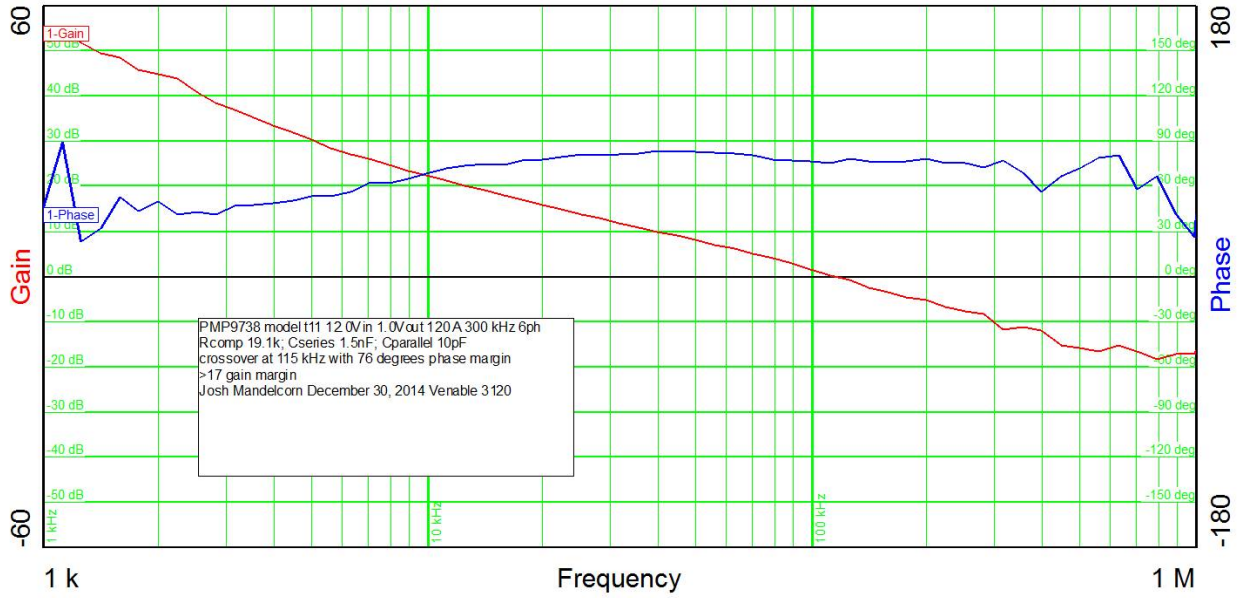


And now R2(also 2mOhm): 140 mV in 5 usec or 70 A in 5 usec

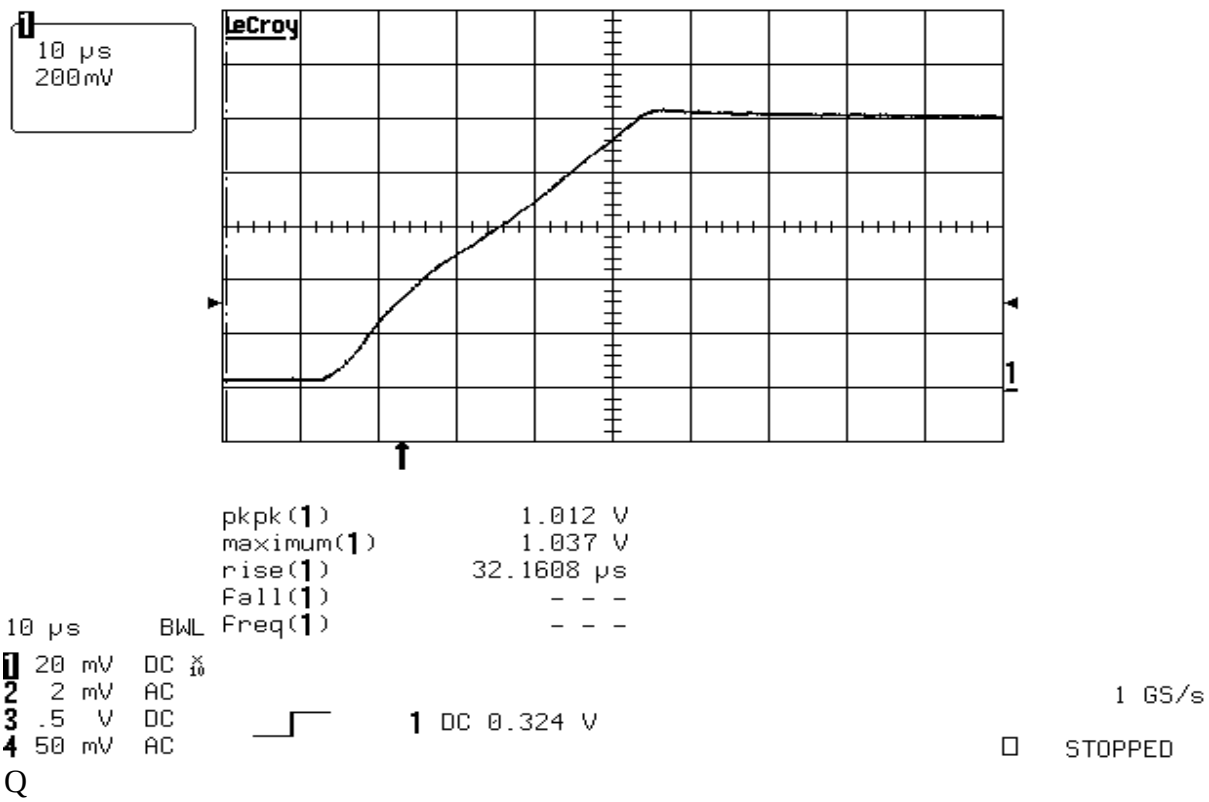


Combined: 142 A in 5 usec

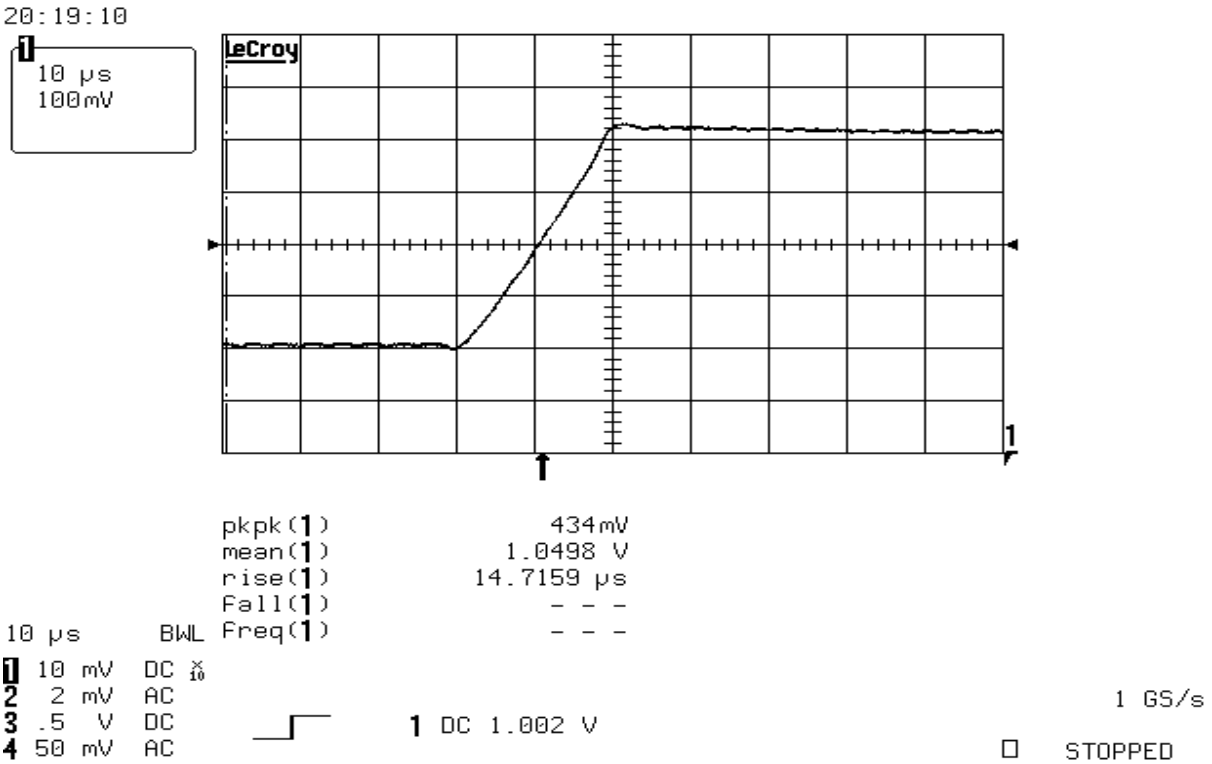
Bode Plot:



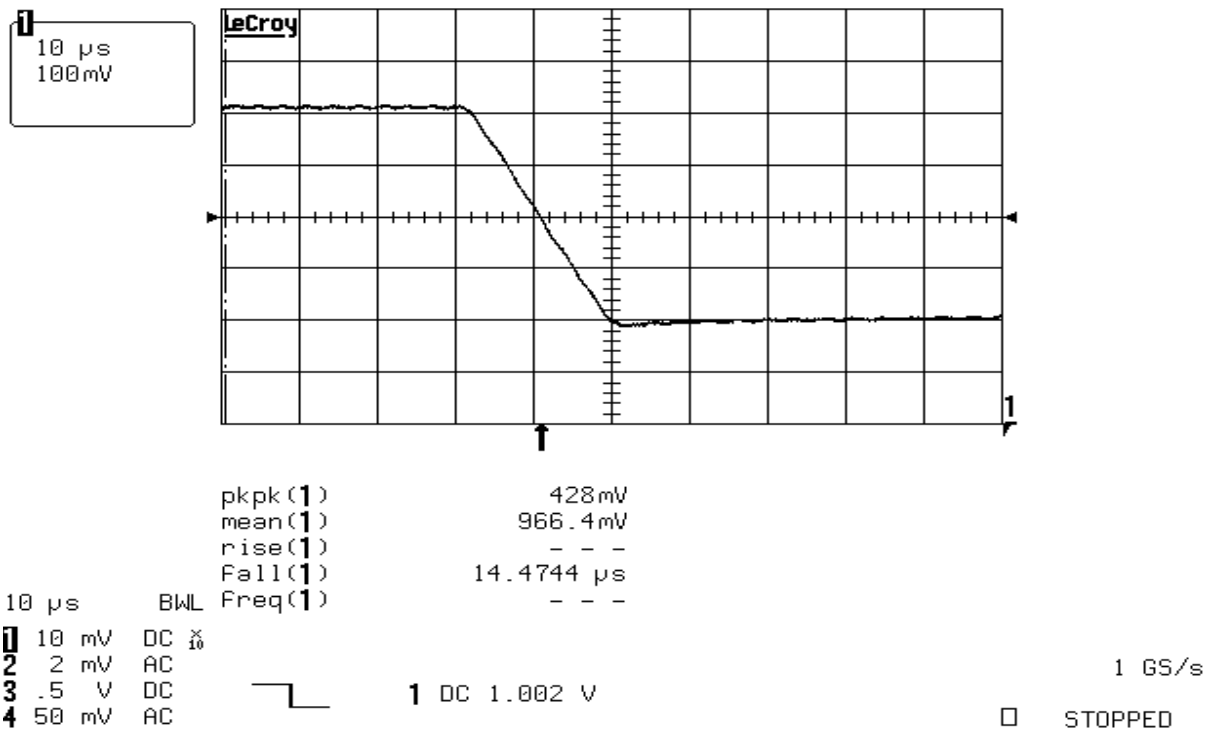
Start up at no load: 12 Vin and operation command given: 37 mV peak overshoot above 1.00 V



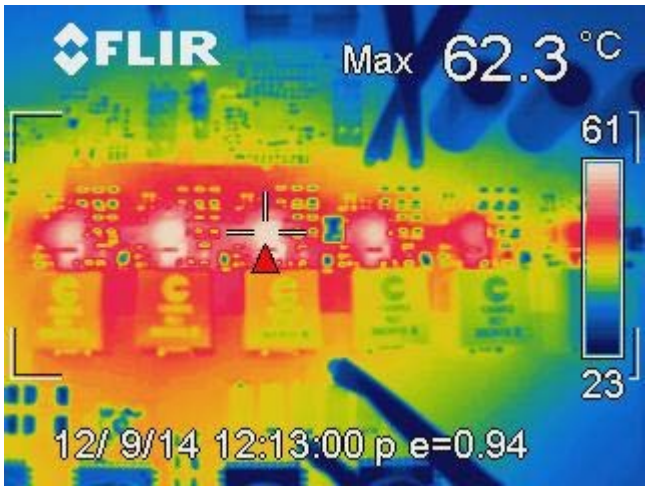
Extreme margining of 1.0 Vout from 80% to 120% of 1.0 V and then back to 80% with constant current load of 120 A: Vin 12.0 V



And now back to 800 mV output:



Thermal Image: 12.0424Vin 0.99725Vout 329kHz/phase 18.736Ain 200.61Aout 88.7% eff.
5” fan 12.0V 460mA at 5” from UUT 20+ minutes stabilized 23 deg. C ambient
IR726 and 62.3 max U301 hottest



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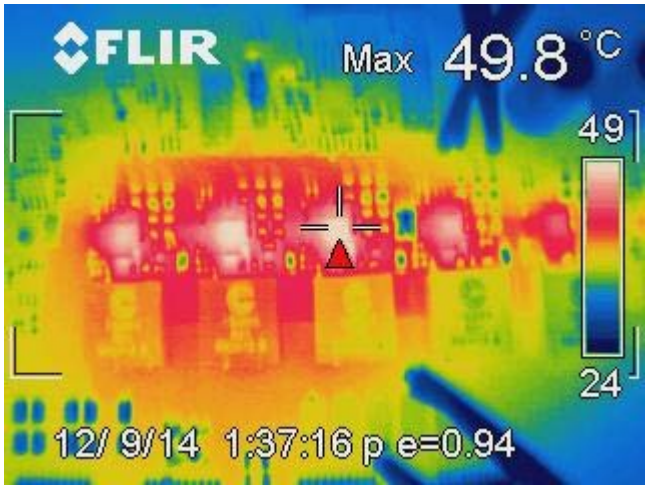
Thermal Image: 12.0163Vin 0.9977Vout 326kHz/phase 14.735ain 160.046aout 90.2%
5” fan 12.0V 460mA at 5” from UUT 30 minutes stabilized 23 deg. C ambient
IR729 and 50 max U301 hottest



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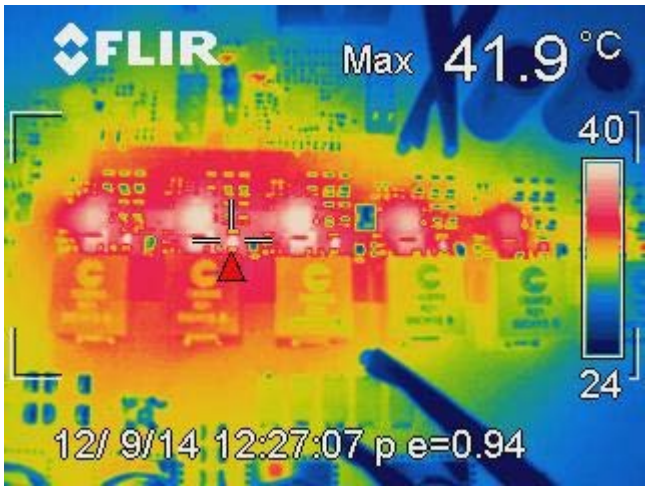
Thermal Image: 12.061Vin 0.9979Vout 323kHz/phase 10.878Ain 120.06Aout 91.3% eff.
5” fan 12.0V 460mA at 5” from UUT 10+ minutes stabilized 21-23 deg. C ambient
IR727 and 42 max U201-snubber hottest



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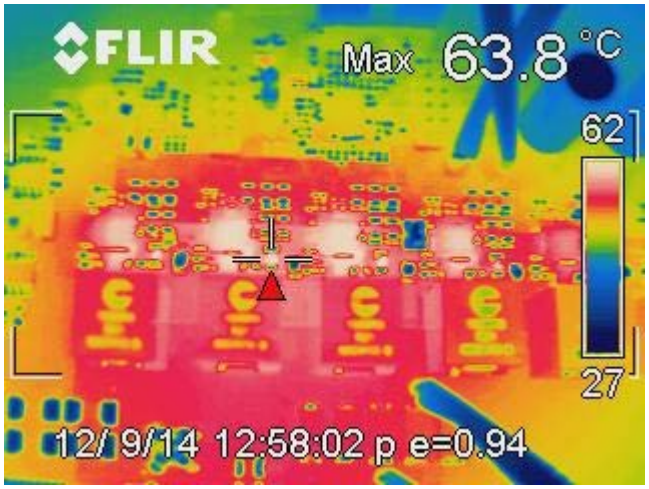
Fan off no other change at 11:18A on lab clock now 11:39
Thermal Image: 12.054Vin 0.9971Vout 325kHz/phase 10.916Ain 120.02Aout 90.9% eff.
Fan off 25 minutes stabilized 21-23 deg. C ambient
IR728 and 64 max U201-snubber hottest



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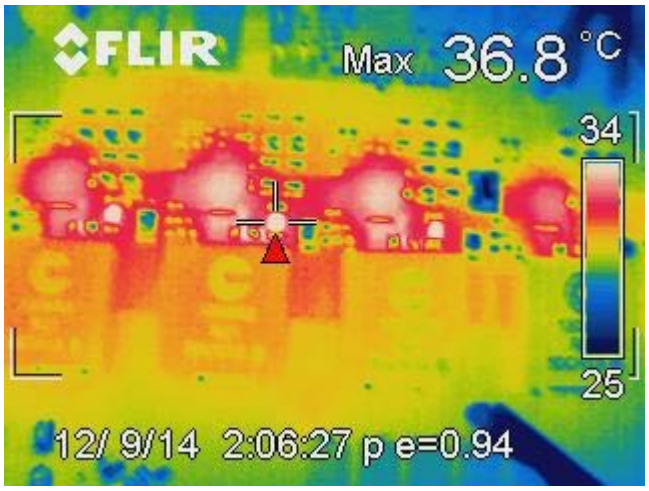
Thermal Image: 12.034Vin 0.9982Vout 321kHz/phase 7.232Ain 80.045Aout 91.8% eff.
5” fan 12.0V 460mA at 5” from UUT 20 minutes stabilized 23 deg. C ambient
IR730 and 37 max U201-snubber hottest



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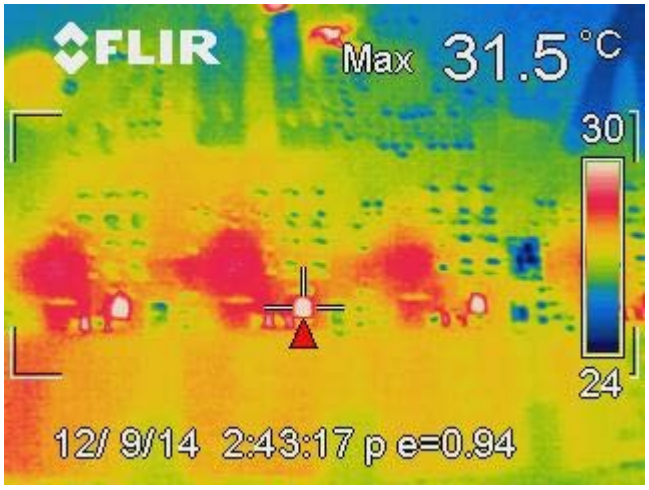
Thermal Image: 12.035Vin 0.9984Vout 318kHz/phase 3.700Ain 40.016Aout 89.7%
5” fan 12.0V 460mA at 5” from UUT 20 minutes stabilized 23 deg. C ambient
IR731 and 31.5 max U201-snubber hottest



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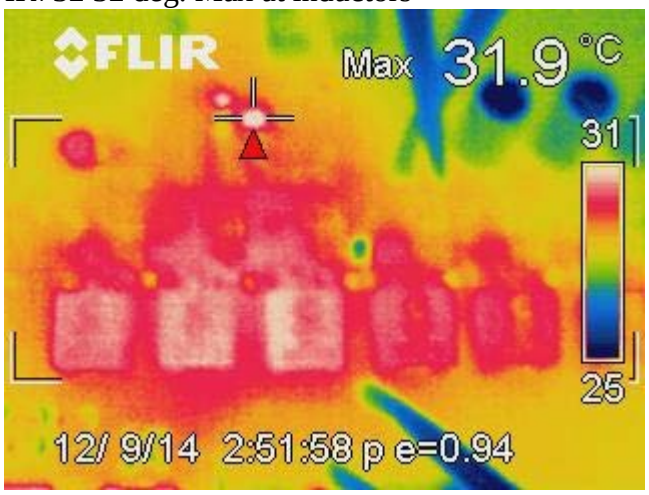
No load & no fan
12.033Vin 238mA in 0.9984vout 294kHz 2.86Watts in
IR732 32 deg. Max at inductors



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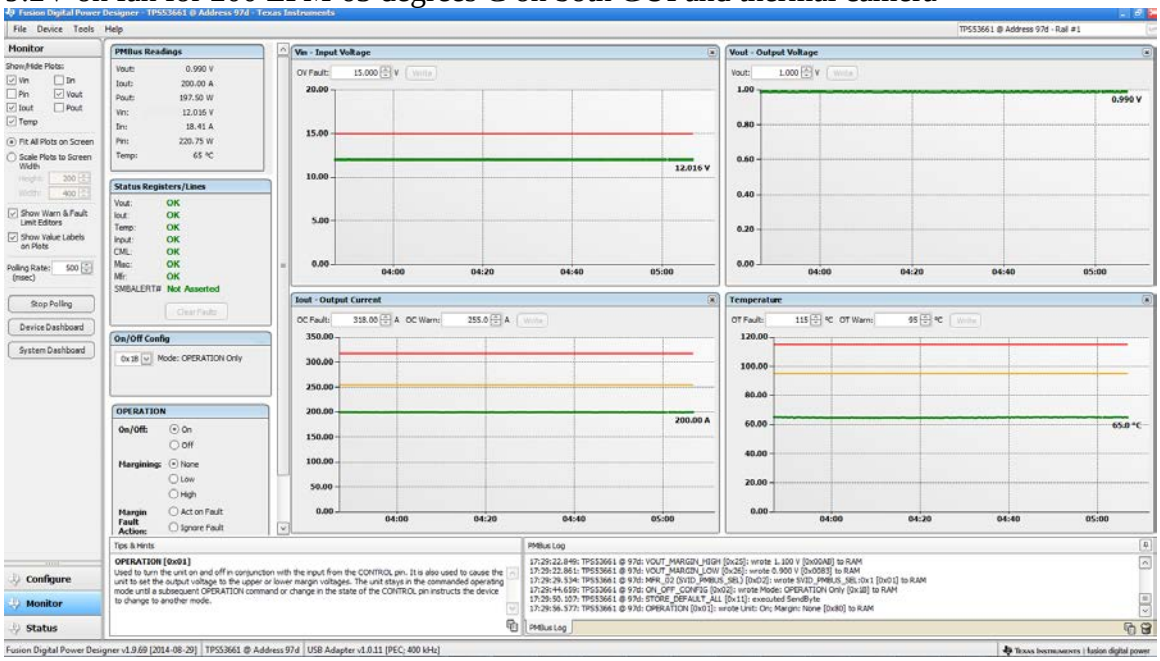
200A stabilization 200.0A 0.99724Vout 11.999Vin 18.745Ain or 88.7% eff.
9.2V on fan for 200 LFM 65 degrees C on both GUI and thermal camera



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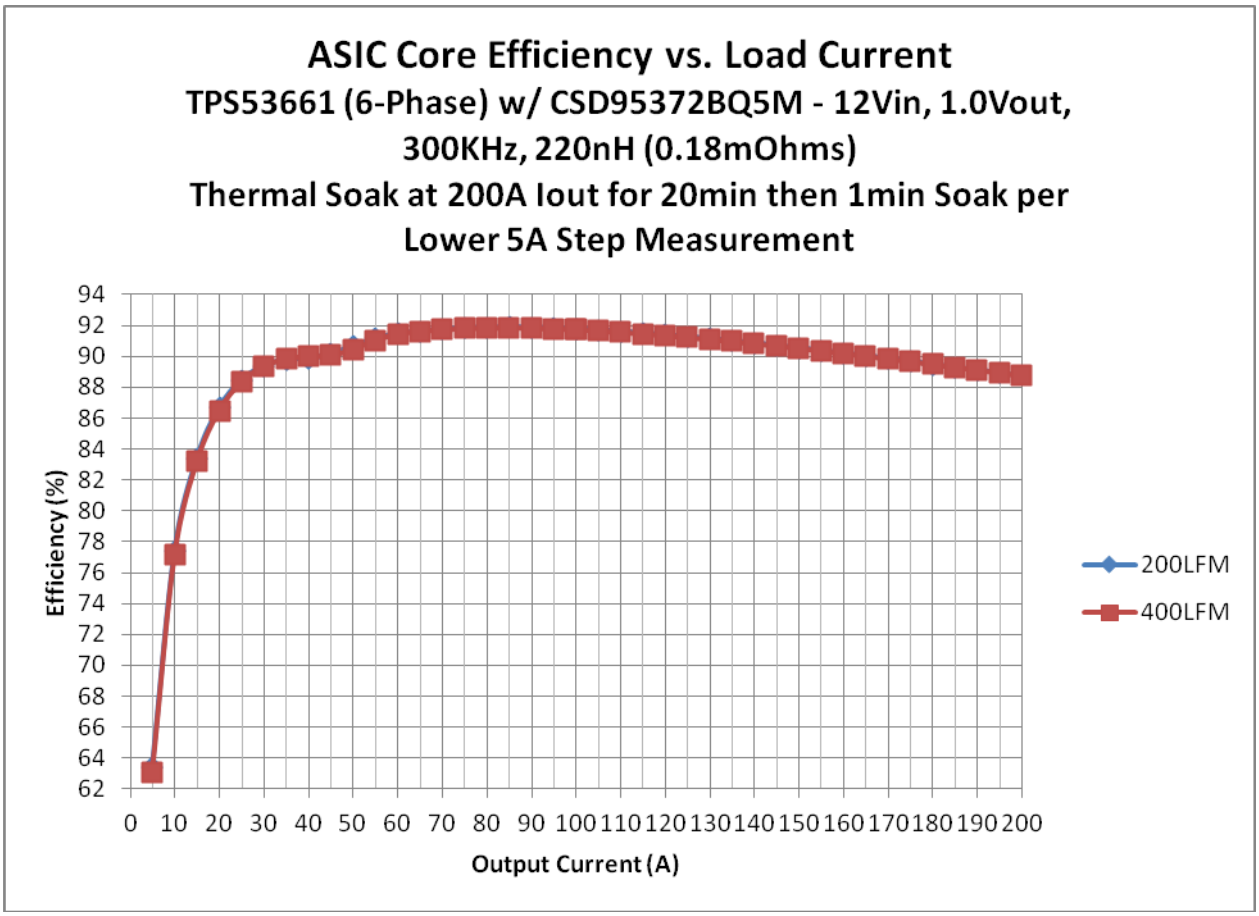
Automated Test Data: pre run 12Vin 1V 200A out for 20 minutes with fan at 9.2Vin to approximate 200 LFM and then fan at 13 Vin to approximate 400 LFM



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Efficiency / regulation data 200 LFM airflow:

Vin	Iin	Vout	total Iout	efficiency	loss in W
11.999	18.739	0.997	200.036	88.723	25.356
11.999	18.234	0.997	195.038	88.905	24.275
11.999	17.729	0.997	190.037	89.093	23.203
11.999	17.226	0.997	185.034	89.286	22.145
11.999	16.725	0.997	180.029	89.477	21.119
11.999	16.227	0.997	175.028	89.665	20.123
11.999	15.731	0.997	170.022	89.849	19.160
11.999	15.238	0.998	165.018	90.029	18.232
11.999	14.748	0.998	160.016	90.203	17.336
11.999	14.261	0.998	155.013	90.374	16.472
11.999	13.776	0.998	150.011	90.539	15.640
11.999	13.293	0.998	145.006	90.698	14.837
11.999	12.814	0.998	140.004	90.852	14.066
11.999	12.336	0.998	135.005	90.998	13.325
11.999	11.862	0.998	130.003	91.139	12.611
11.999	11.390	0.998	125.006	91.269	11.933
11.999	10.920	0.998	120.008	91.389	11.284
11.999	10.453	0.998	115.012	91.508	10.650
11.999	9.987	0.998	110.015	91.614	10.050
11.999	9.525	0.998	105.022	91.707	9.478
11.999	9.066	0.998	100.047	91.793	8.928
11.999	9.062	0.998	100.009	91.793	8.924
11.999	8.604	0.998	95.007	91.842	8.422
11.999	8.148	0.998	90.003	91.879	7.940
11.999	7.694	0.998	84.997	91.890	7.487
11.999	7.242	0.998	79.991	91.876	7.060
11.999	6.793	0.998	74.987	91.831	6.659
11.999	6.344	0.998	69.980	91.756	6.276
11.999	5.899	0.998	64.974	91.631	5.924
11.999	5.454	0.998	59.969	91.472	5.581
11.999	5.017	0.998	54.964	91.144	5.331
11.999	4.585	0.998	49.963	90.661	5.138
11.999	4.149	0.998	44.960	90.163	4.897
11.999	3.700	0.998	39.957	89.859	4.502
11.999	3.239	0.998	34.955	89.781	3.972
11.999	2.789	0.998	29.953	89.378	3.554
11.999	2.348	0.998	24.956	88.454	3.252
11.999	1.916	0.998	19.958	86.664	3.066
11.999	1.493	0.998	14.962	83.396	2.974
11.999	1.071	0.998	9.965	77.390	2.907
11.999	0.652	0.998	4.971	63.432	2.862
11.999	0.236	0.998	0.000	0.027	2.829

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Efficiency / regulation data 400 LFM airflow:

Vin	Iin	Vout	total Iout	efficiency	loss in W
11.999	18.689	0.996	199.958	88.777	25.168
11.999	18.187	0.996	194.938	88.942	24.131
11.999	17.682	0.996	189.937	89.134	23.055
11.999	17.182	0.996	184.932	89.310	22.039
11.999	16.682	0.996	179.927	89.494	21.031
11.999	16.185	0.996	174.925	89.678	20.047
11.999	15.691	0.996	169.919	89.854	19.103
11.999	15.198	0.996	164.914	90.031	18.180
11.999	14.709	0.996	159.912	90.202	17.293
11.999	14.222	0.996	154.905	90.370	16.433
11.999	13.738	0.996	149.902	90.530	15.611
11.999	13.256	0.996	144.898	90.687	14.813
11.999	12.777	0.995	139.896	90.837	14.048
11.999	12.301	0.995	134.896	90.978	13.317
11.999	11.828	0.995	129.895	91.109	12.618
11.999	11.357	0.995	124.898	91.238	11.941
11.999	10.888	0.995	119.900	91.356	11.293
11.999	10.421	0.995	114.903	91.467	10.670
11.999	9.957	0.995	109.908	91.570	10.072
11.999	9.495	0.995	104.914	91.660	9.501
11.999	9.038	0.995	99.950	91.739	8.959
11.999	9.030	0.995	99.876	91.739	8.952
11.999	8.576	0.995	94.897	91.792	8.446
11.999	8.122	0.995	89.913	91.833	7.959
11.999	7.669	0.995	84.922	91.856	7.494
11.999	7.218	0.995	79.930	91.853	7.056
11.999	6.770	0.995	74.937	91.815	6.649
11.999	6.323	0.995	69.938	91.741	6.267
11.999	5.879	0.995	64.939	91.630	5.904
11.999	5.436	0.995	59.941	91.466	5.566
11.999	5.005	0.995	54.940	91.050	5.375
11.999	4.579	0.995	49.941	90.470	5.236
11.999	4.139	0.995	44.940	90.072	4.930
11.999	3.680	0.995	39.942	90.026	4.404
11.999	3.226	0.995	34.944	89.855	3.927
11.999	2.780	0.995	29.945	89.362	3.548
11.999	2.342	0.995	24.948	88.365	3.270
11.999	1.914	0.995	19.953	86.484	3.104
11.999	1.491	0.995	14.955	83.194	3.007
11.999	1.071	0.995	9.960	77.137	2.938
11.999	0.653	0.995	4.968	63.098	2.892
11.999	0.238	0.995	0.000	0.039	2.861

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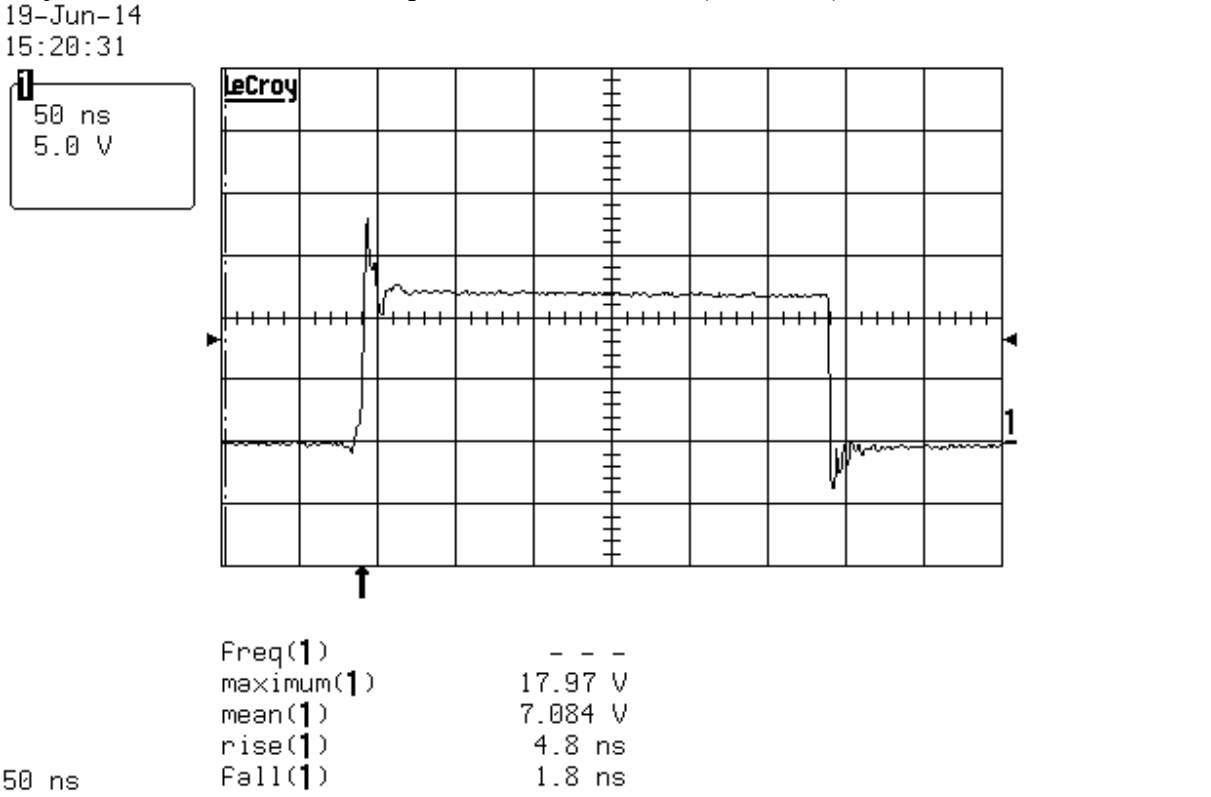
Major waveform at 50A on the phase: 12Vin 1.0Vout (channel 1)



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