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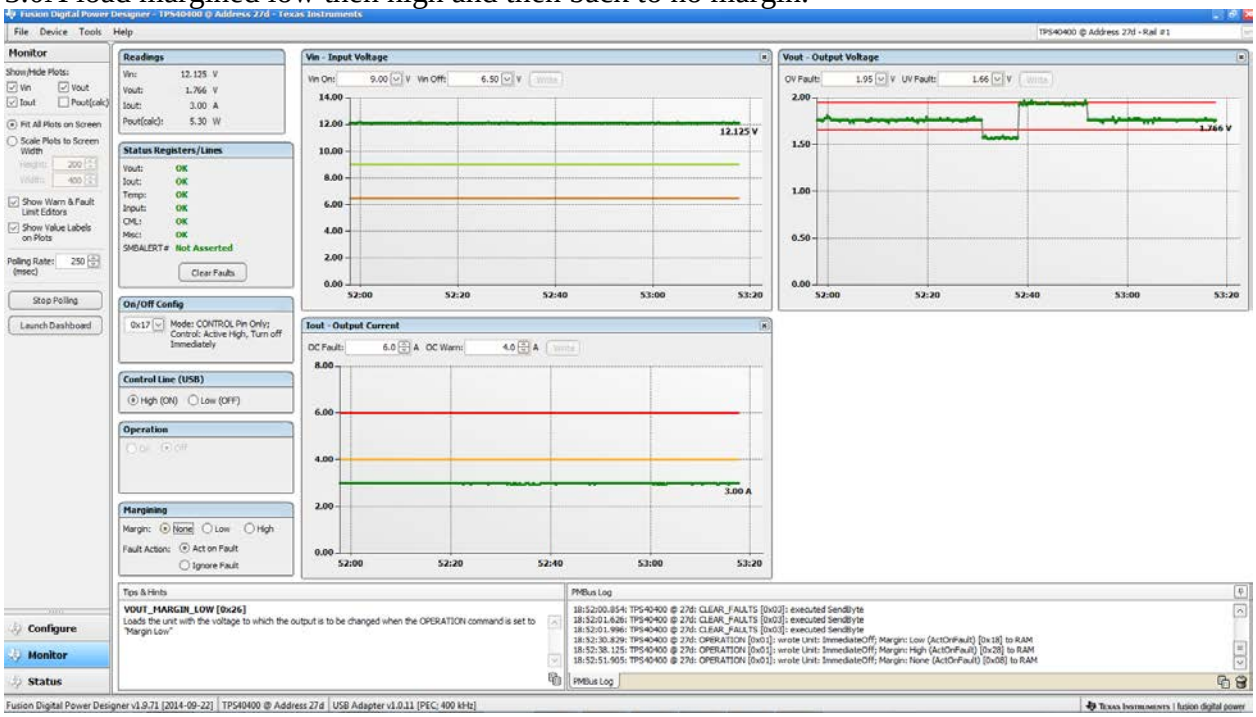
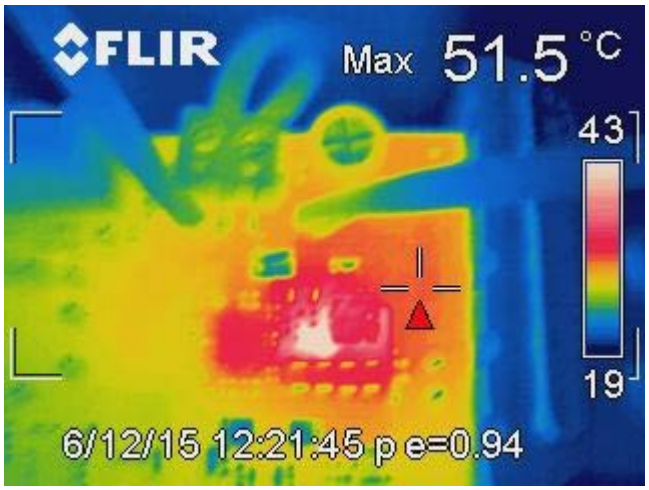
Test / bring up log:
Based upon thermal runs and inductor saturation rating of 7 A:
Targets are 40 degrees C max temperature rise at full load and inductor saturation rating of at least 1.7 full rating.
Without fan, 3A steady state / thermal max and 4 A electrical peak can be advised.
With fan, 4A steady state can also be advised.

R9/R2 ratio as built for 20 mOhms current sense setting. GUI does not allow >15.5 mOhms setting. Hence R9 was increased from 1.5k to 2.49k and with 40mOhm inductor and R2 at 1.5k, gain will now be 15 mOhms an allowed value. See GUI for model t2 with update:
3.0A load margined low then high and then back to no margin.

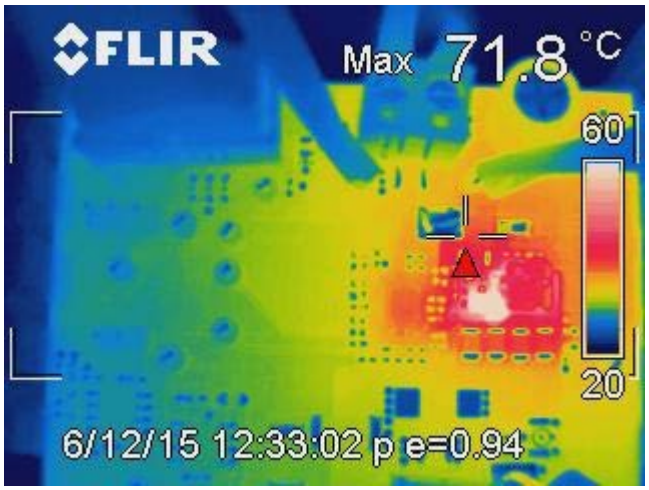


Q

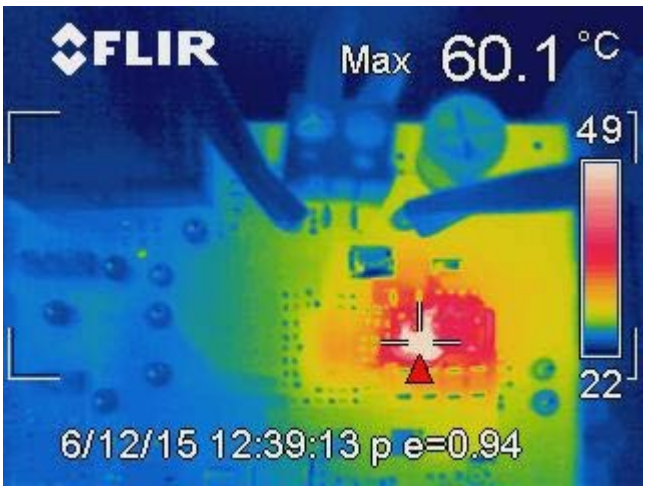
12.35Vin 530mAin 492kHz 1.8102Vout 3.01Aout IR1134 at 51.5 degrees C no fan



12.33Vin 725mA in 493kHz 1.8097Vout 4.01Aout IR1135 at 72 degrees C no fan



12.33 Vin 721mA in 491kHz 1.8088Vout 4.01Aout IR1136 at 60 deg. C ~1M/S airflow

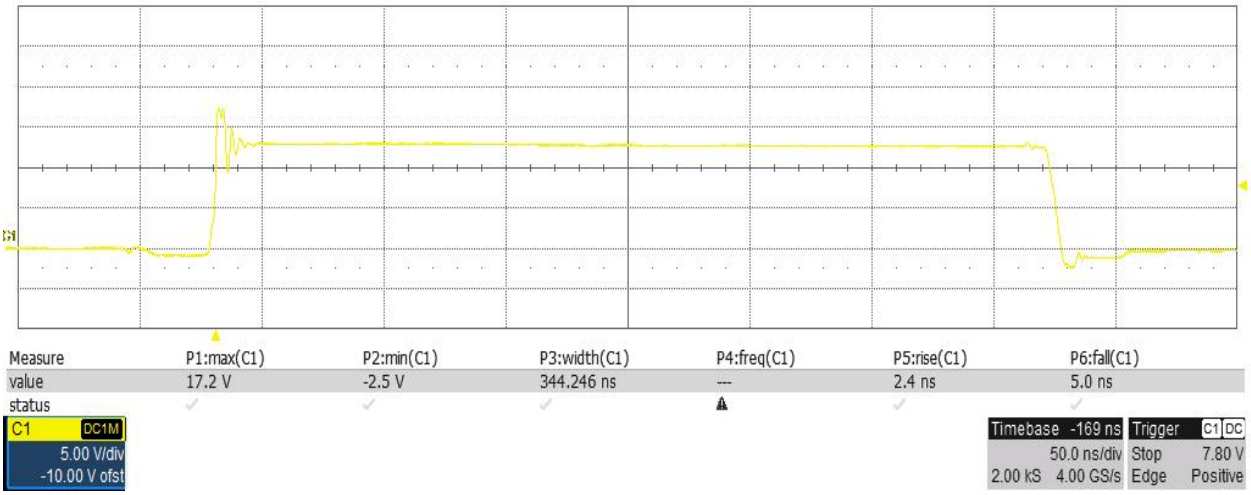


Q

Major waveform one pulse

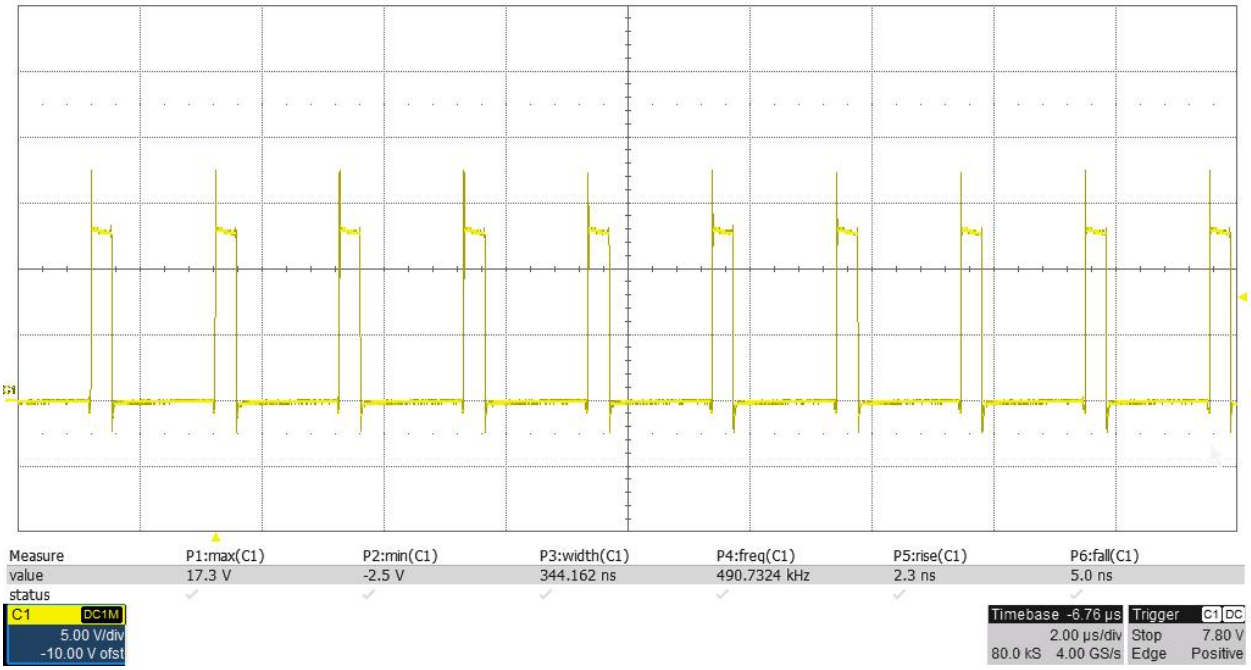
At max 4A load with fan
12.33 Vin 491kHz 721mA in 1.8088Vout 4.01A ~1M/S flow IR1136 at 60 deg. C

Full bandwidth here: (scope LeCroy WS3074 750 MHz with 500 MHz probe PP020)



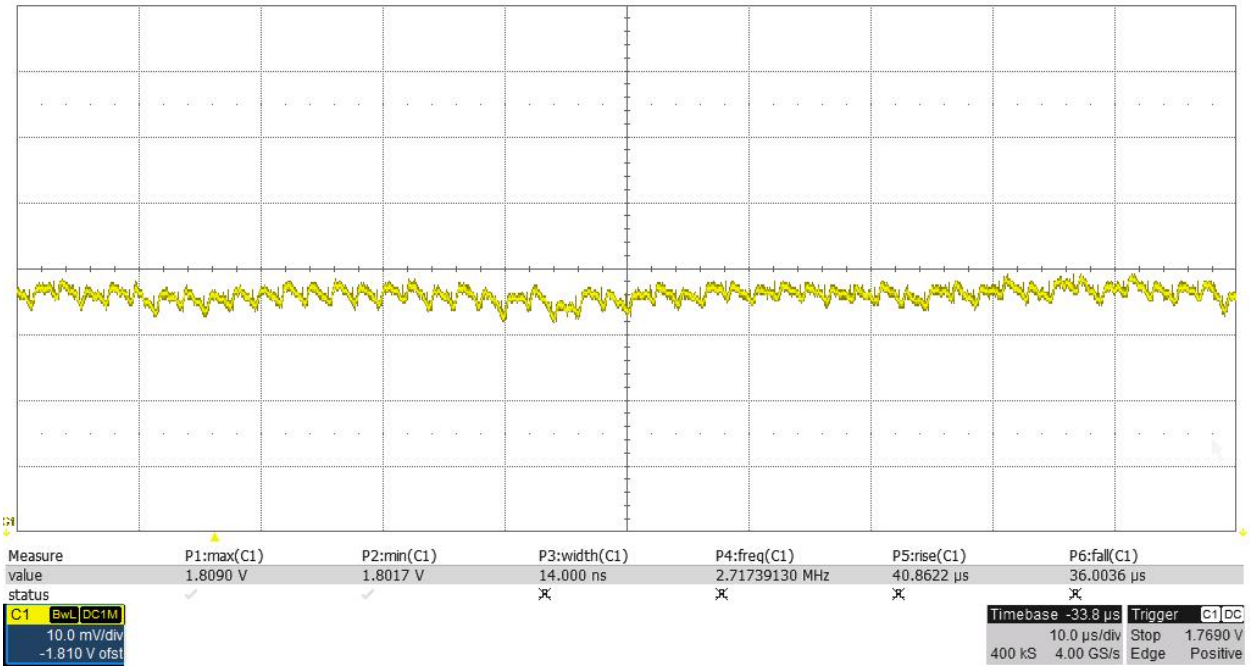
Q

Same **Major Waveform**, but **10 cycles** shown:

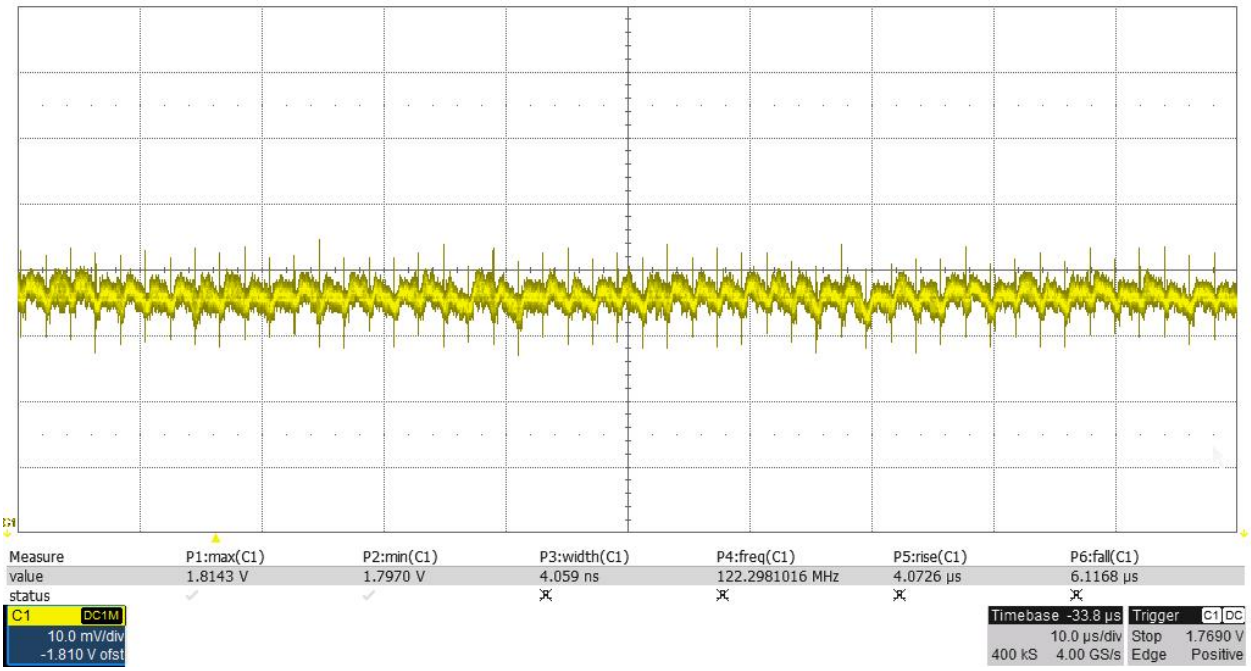


Q

Output ripple at C111 (22uF ceramic cap near load connector)
At max 4A load with fan
12.33 Vin 491kHz 721mA in 1.8088Vout 4.01A ~1M/S flow IR1136 at 60 deg. C
20MHz Bandwidth:

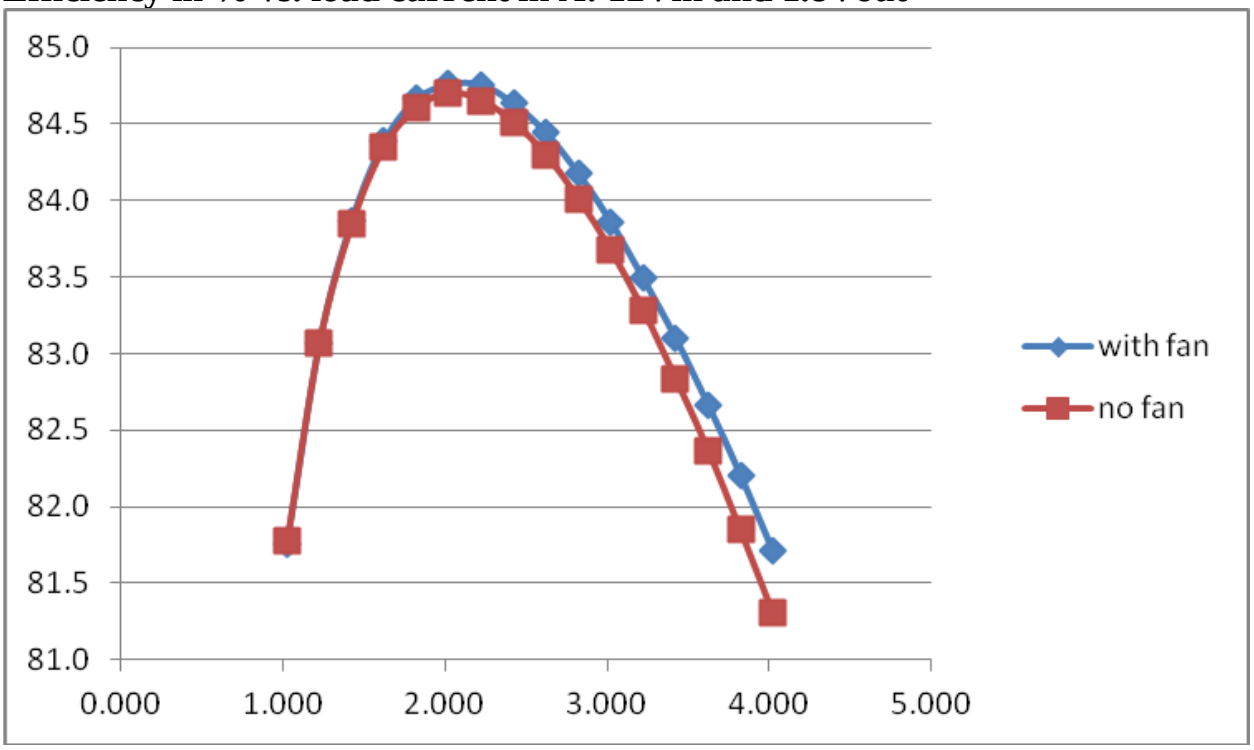


Full bandwidth here: (scope LeCroy WS3074 750 MHz with 500 MHz probe PP020)



Q

Efficiency in % vs. load current in A: 12Vin and 1.8Vout



Q

See next 2 pages for detailed data:

Efficiency / losses with fan (~1 Meter per second)

Vin V	Iin A	Vout V	Iout A	eff. %	Loss W
11.999	0.021	1.812	0.000	0.000	0.249
11.999	0.055	1.812	0.221	60.865	0.258
11.999	0.088	1.812	0.421	72.339	0.292
11.999	0.123	1.812	0.621	76.386	0.348
11.999	0.156	1.812	0.821	79.675	0.379
11.999	0.189	1.811	1.021	81.760	0.413
11.999	0.222	1.811	1.221	83.071	0.451
11.999	0.256	1.811	1.421	83.872	0.495
11.999	0.290	1.811	1.622	84.392	0.543
11.999	0.325	1.811	1.821	84.667	0.597
11.999	0.360	1.811	2.021	84.762	0.658
11.999	0.396	1.810	2.222	84.760	0.723
11.999	0.432	1.810	2.422	84.636	0.796
11.999	0.468	1.810	2.622	84.446	0.874
11.999	0.506	1.810	2.822	84.180	0.960
11.999	0.544	1.810	3.022	83.863	1.053
11.999	0.582	1.810	3.222	83.493	1.153
11.999	0.621	1.810	3.422	83.103	1.259
11.999	0.661	1.809	3.623	82.668	1.374
11.999	0.701	1.809	3.823	82.207	1.497
11.999	0.742	1.809	4.023	81.711	1.629
11.999	0.784	1.809	4.223	81.190	1.770
11.999	0.827	1.809	4.423	80.629	1.922

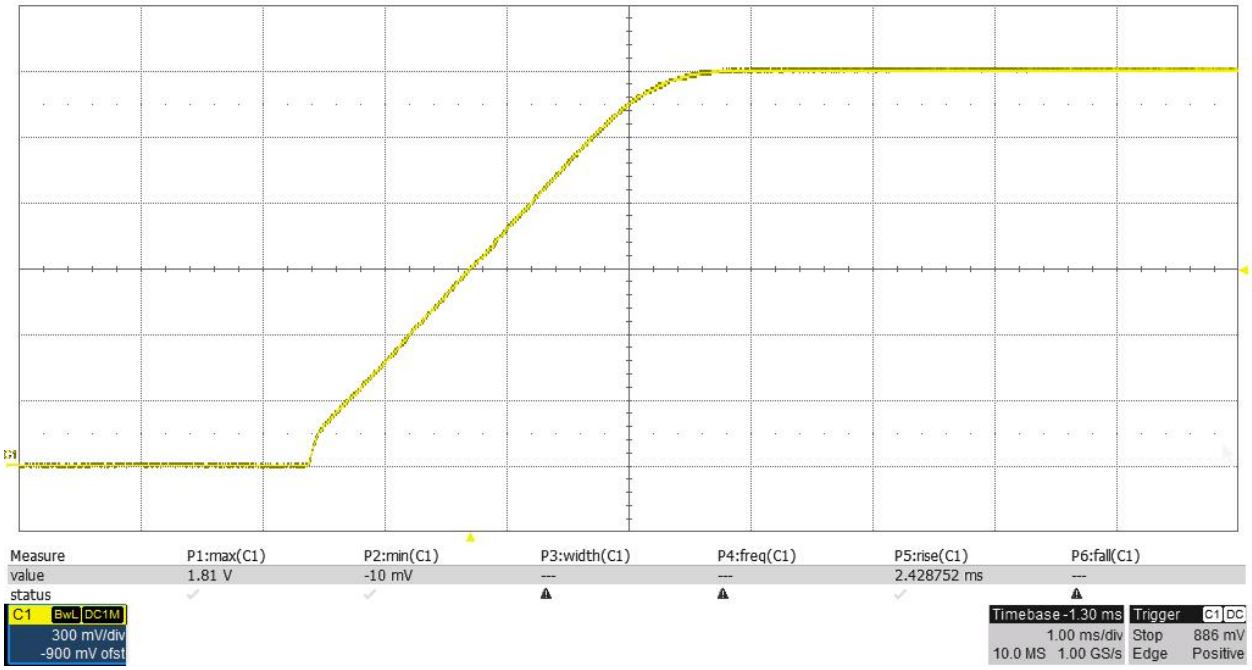
Q

Efficiency / losses with no fan

Vin V	Iin A	Vout V	Iout A	eff. %	Loss W
11.999	0.021	1.813	0.000	0.000	0.247
11.999	0.055	1.812	0.220	60.807	0.257
11.999	0.088	1.812	0.420	72.394	0.290
11.999	0.123	1.812	0.620	76.421	0.347
11.999	0.155	1.812	0.820	79.690	0.379
11.999	0.188	1.812	1.020	81.773	0.412
11.999	0.222	1.811	1.221	83.070	0.451
11.999	0.256	1.811	1.421	83.847	0.496
11.999	0.290	1.811	1.621	84.351	0.545
11.999	0.325	1.811	1.821	84.605	0.600
11.999	0.360	1.811	2.021	84.701	0.661
11.999	0.396	1.811	2.222	84.652	0.729
11.999	0.432	1.811	2.422	84.509	0.804
11.999	0.469	1.811	2.622	84.295	0.884
11.999	0.507	1.810	2.822	84.011	0.972
11.999	0.545	1.810	3.022	83.675	1.067
11.999	0.584	1.810	3.222	83.282	1.171
11.999	0.623	1.810	3.423	82.837	1.284
11.999	0.663	1.810	3.623	82.369	1.404
11.999	0.704	1.810	3.823	81.848	1.534
11.999	0.746	1.810	4.023	81.308	1.674

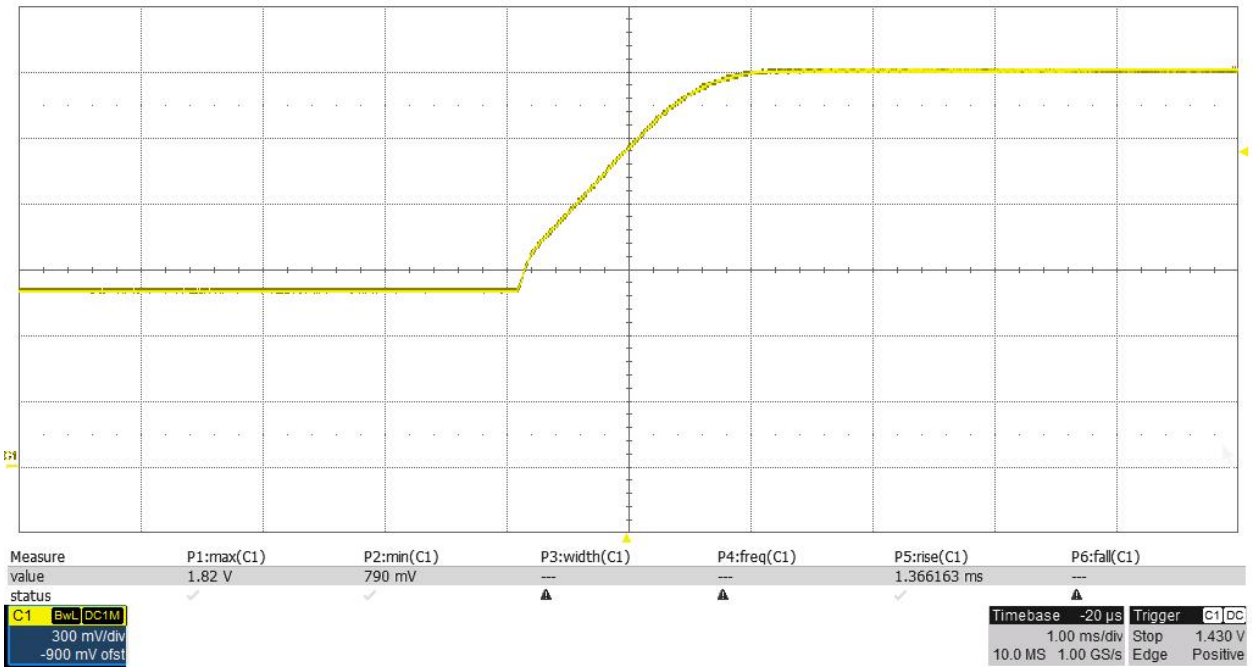
Start up:

12Vin enabled with no load and minimal pre-bias: Overshoot is < 10 mV max



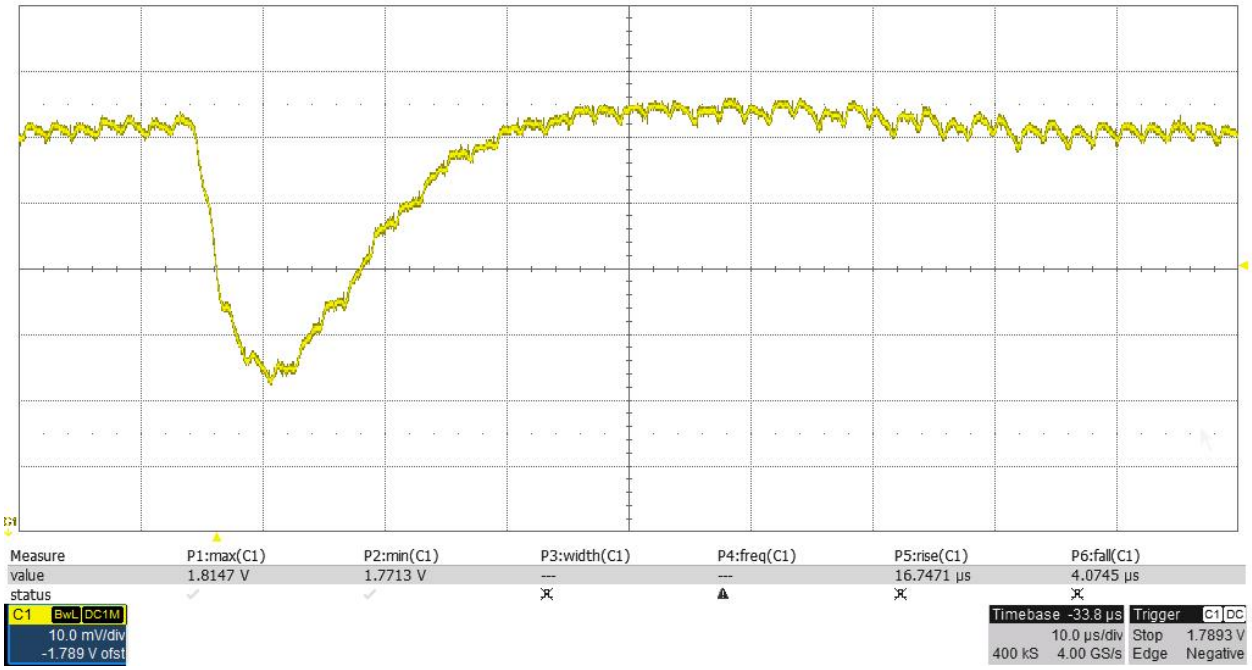
Start up with pre – bias:

Same, but with 800 mV pre-bias on output: 20 mV max overshoot, no dip when conversion started



Q

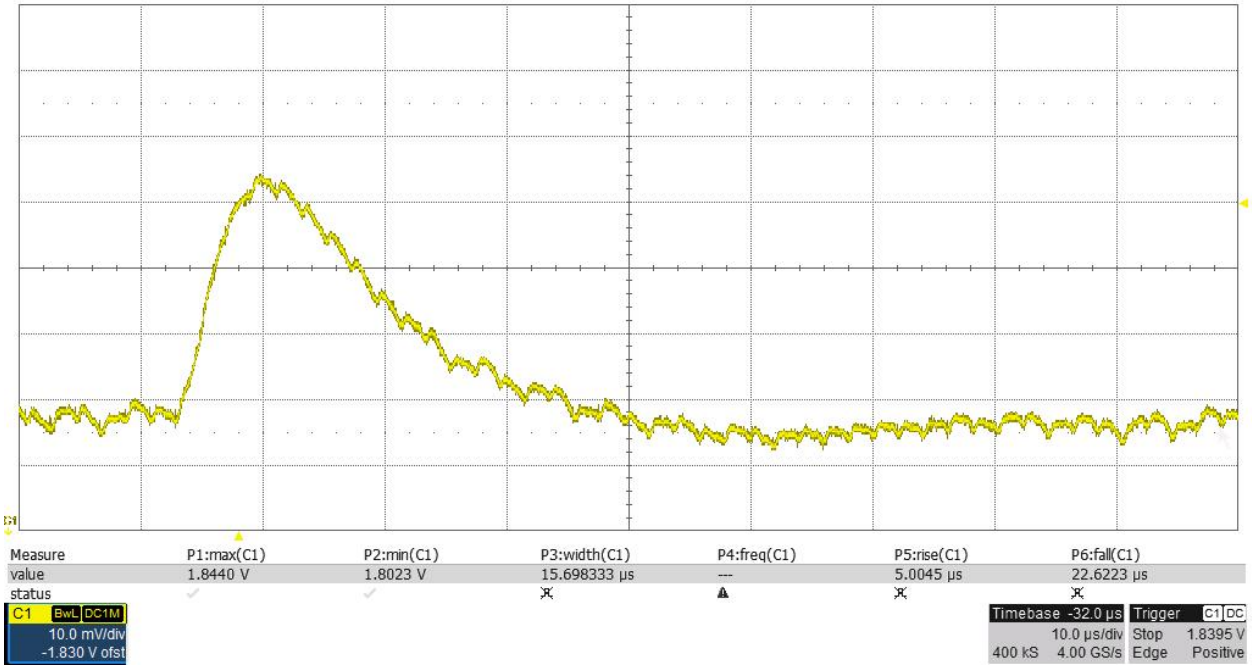
Step load response: 12Vin 1.8 Vout from 0.5A to 2.4A in 0.7 usec: 40mV peak undershoot
Vout monitored at C103:



Q

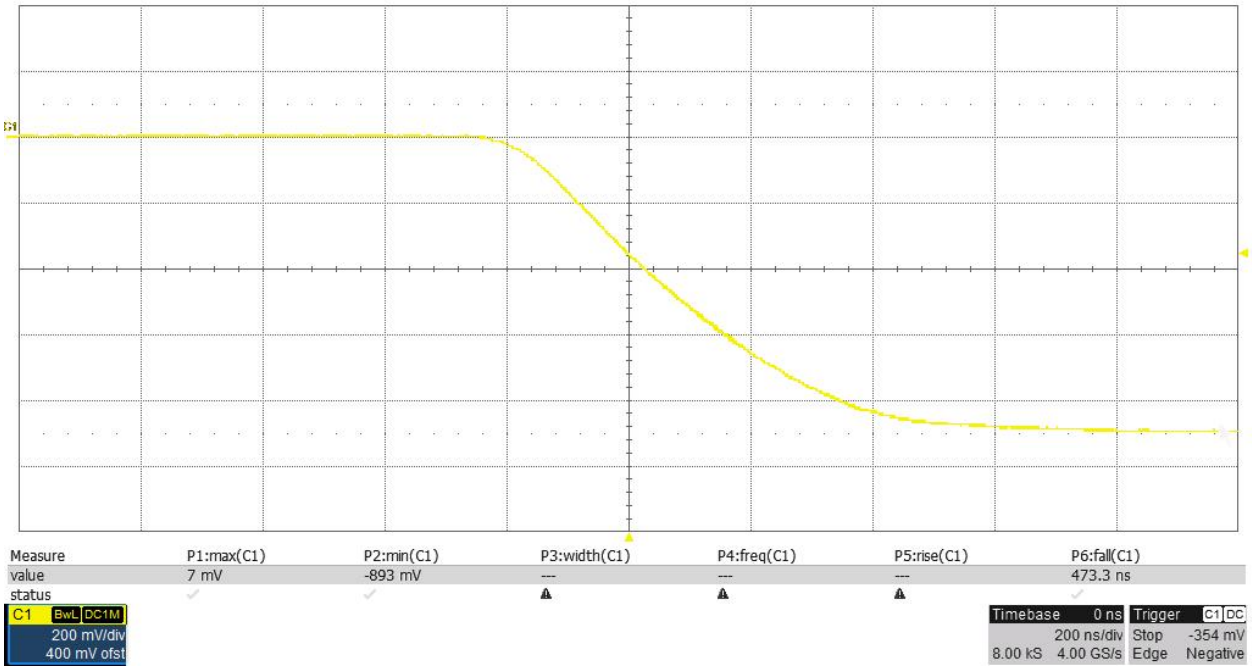
Load dump response:

And now from 2.3A back to 0.5A load in 2-3 usec: 35mV overshoot



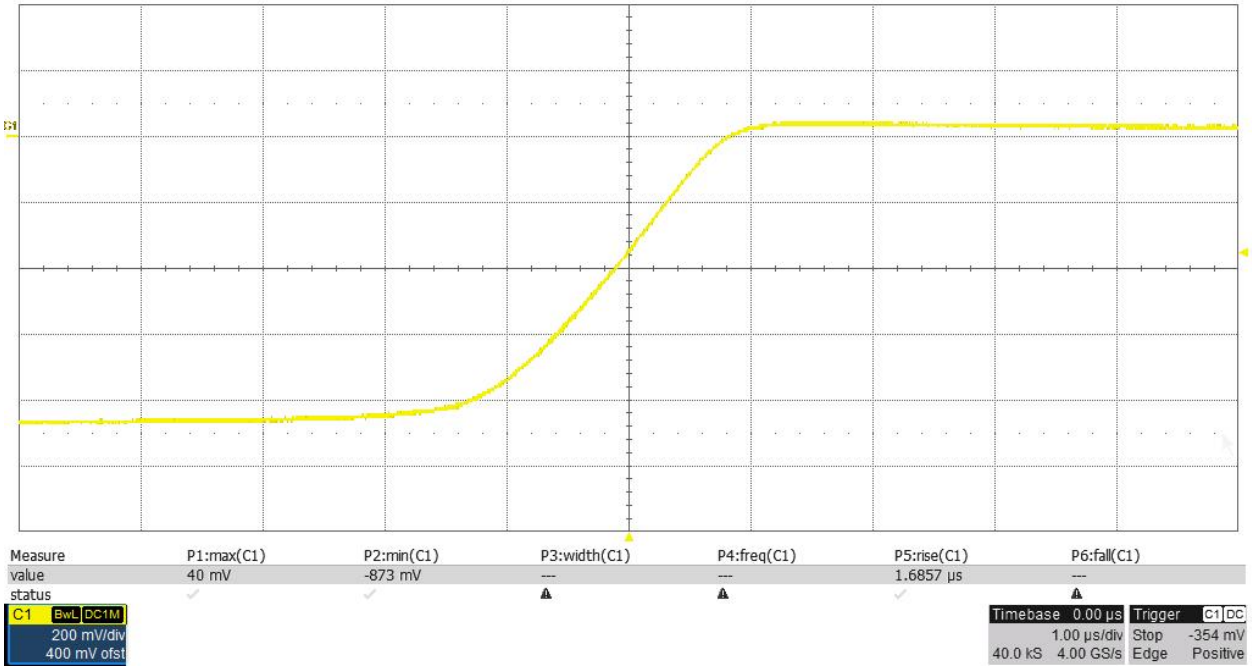
The 0.5 A static load is external to the board.

Details of step load looking at R251 470 mOhms tied to Vout and scope ground tied to Vout:
900 mV in about 0.7 usec or 900/470 = 1.9 A in 0.7 usec or 2.7 A per usec
Q250 dynamic load switch pulls R251 – R252 resistor string to ground. Hence, negative going waveform from scope ground at Vout is positive current.



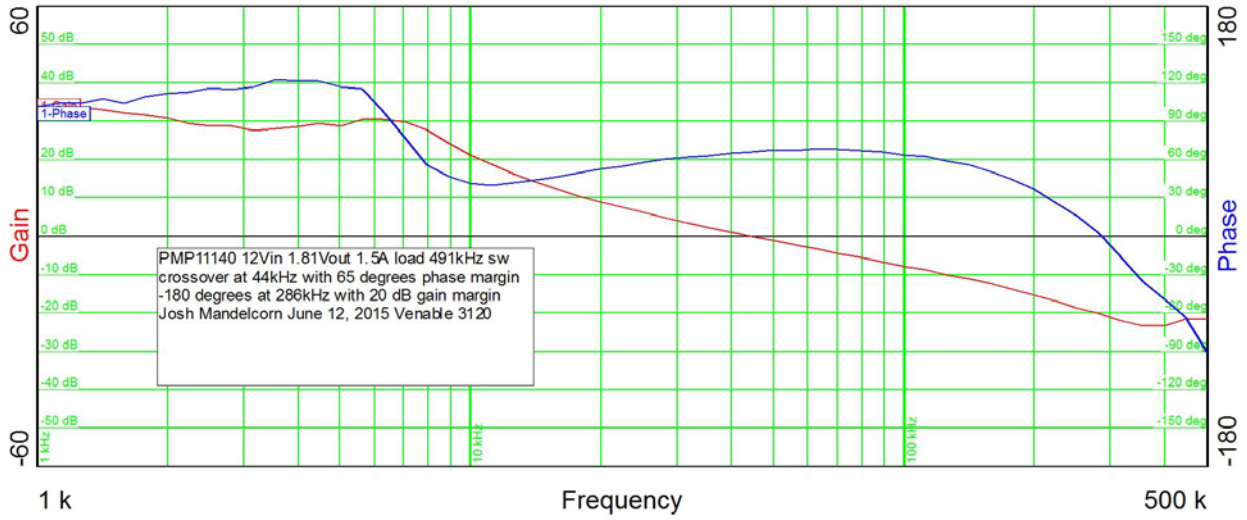
Q

And same for load dump:
840 mV removed in about 3 usec or 840/470 = 1.8 A in 3 usec or ~0.6 A per usec



Bode plot:

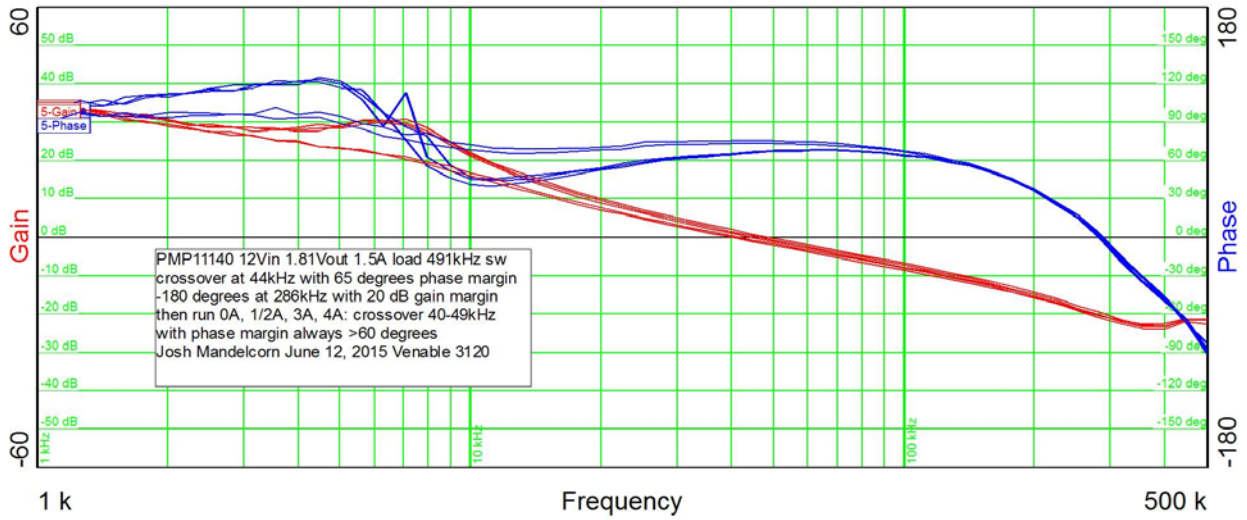
12Vin and 1.5A load:



Q

Composite Bode plots: 0A, 1/2A, 1.5A, 3A and 4A off 1.8V and 12Vin

Crossover in 40-49kHz range with > 60 degrees phase margin and gain margin always about 20 dB:



Q

Project file settings: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<Code>214</Code>
<IDAndCode>VIN_CAL_OFFSET [MFR 06,0xD6]</IDAndCode>
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<IDAndCode>VOUT_CAL_GAIN [MFR 05,0xD5]</IDAndCode>
<ValueText>0.000 %</ValueText>
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<ID>TPS40400_MFR_SPECIFIC_04</ID>
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<IDAndCode>VOUT_CAL_OFFSET [MFR 04,0xD4]</IDAndCode>
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<Code>37</Code>
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<Code>38</Code>
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