Test Data
For PMP20660
January 10, 2017

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1. Design Specifications

Vin Minimum	**5VDC**
Vin Maximum	**13VDC**
Vout	**12VDC**
Iout	**≈ 11A Constant-Current**
Nominal Switching Frequency	**≈ 250KHz**

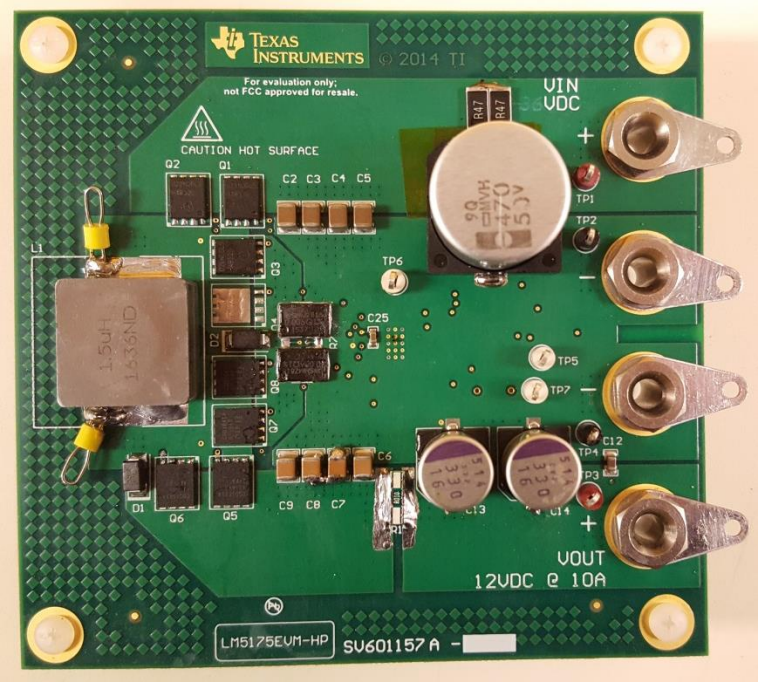
2. Circuit Description

PMP20660 is a Synchronous 4-Switch Buck-Boost Converter circuit using the LM5175 controller IC. The converter accepts an input voltage of 5Vin to 13Vin and provides a constant-voltage/constant-current output of 12Vout and approximately 11A. The design is built on the LM5175EVM-HP evaluation board which is a 6-layer FR-4 PCB, with 2 oz. Copper for each of the six layers.

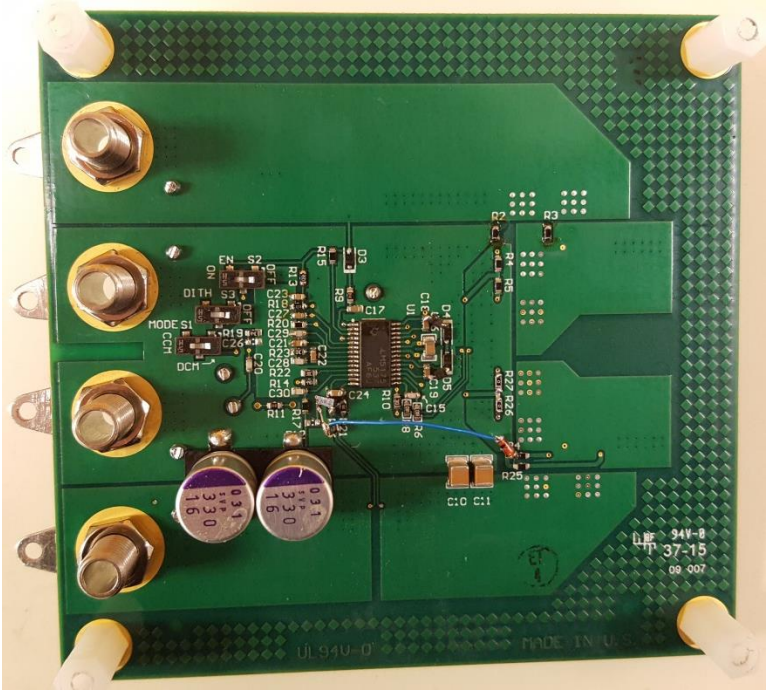
All tests were performed with switching frequency dithering (spread spectrum feature) disabled and a 10V external auxiliary supply connected to the bias pin of the LM5175. This external 10V bias supply needs to be connected and powered before the 4-switch buck-boost converter is enabled or powered up.

3. PMP20660 Board Photos

Board Dimensions: 3.85” x 3.65”

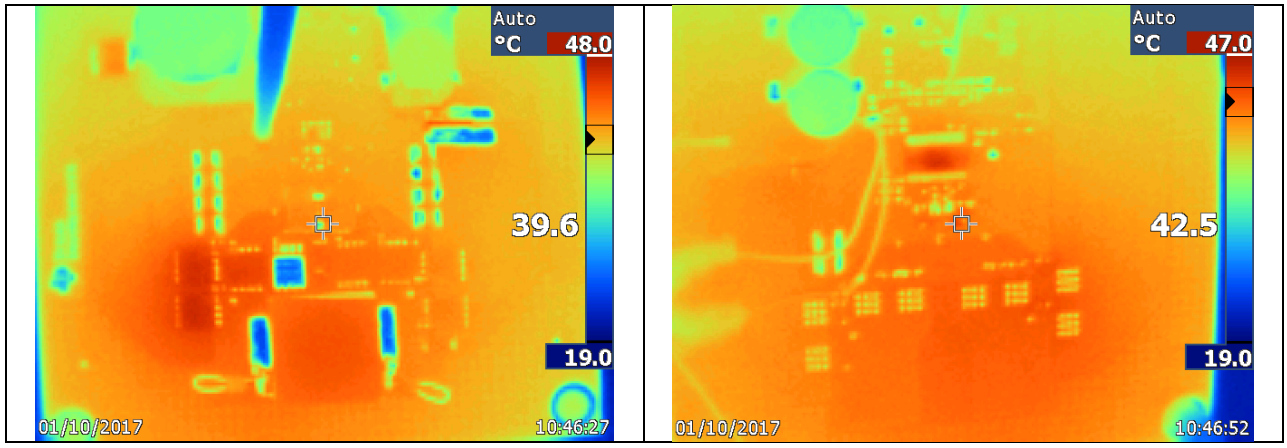


Board Photo (Top View)

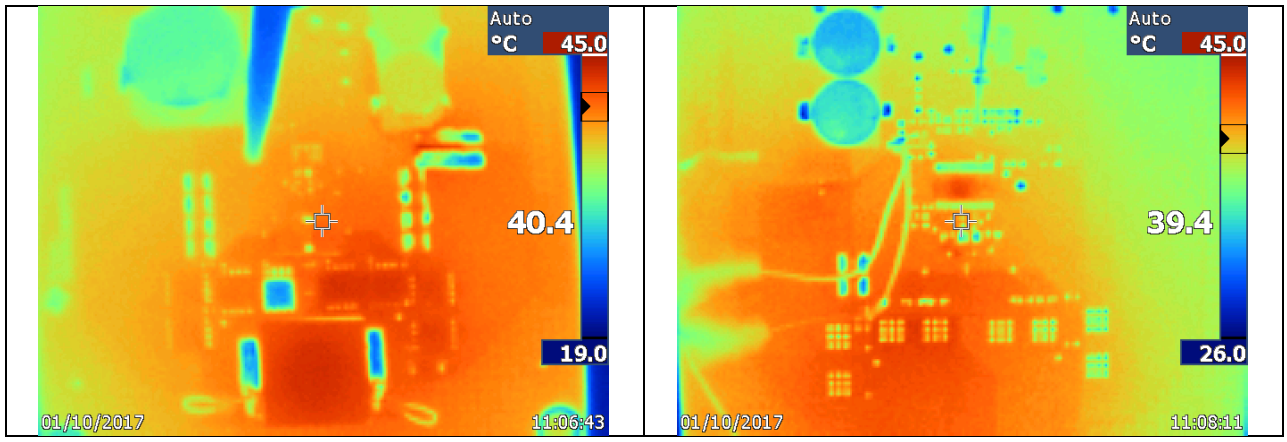


Board Photo (Bottom View)

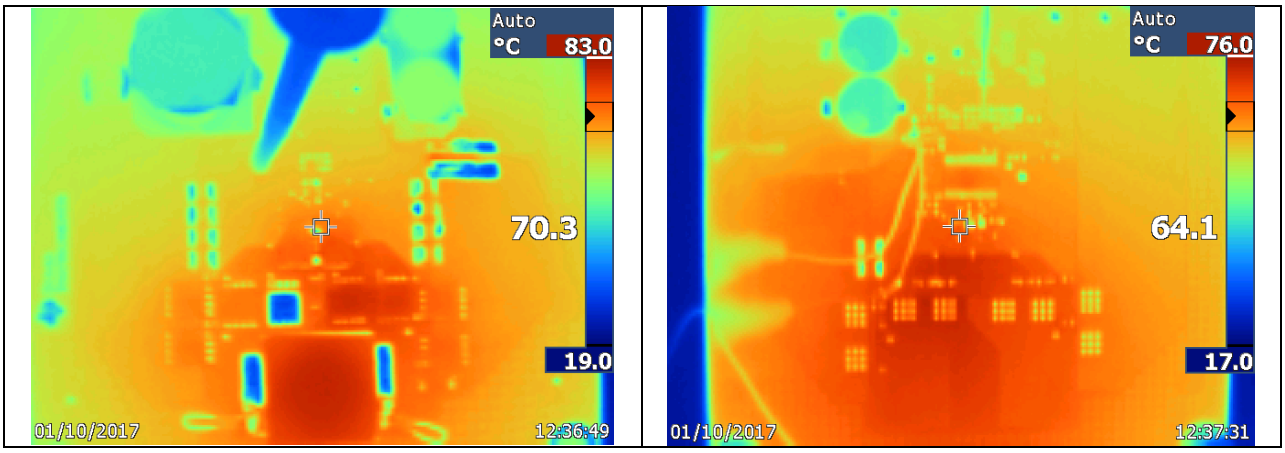
4. Thermal Data



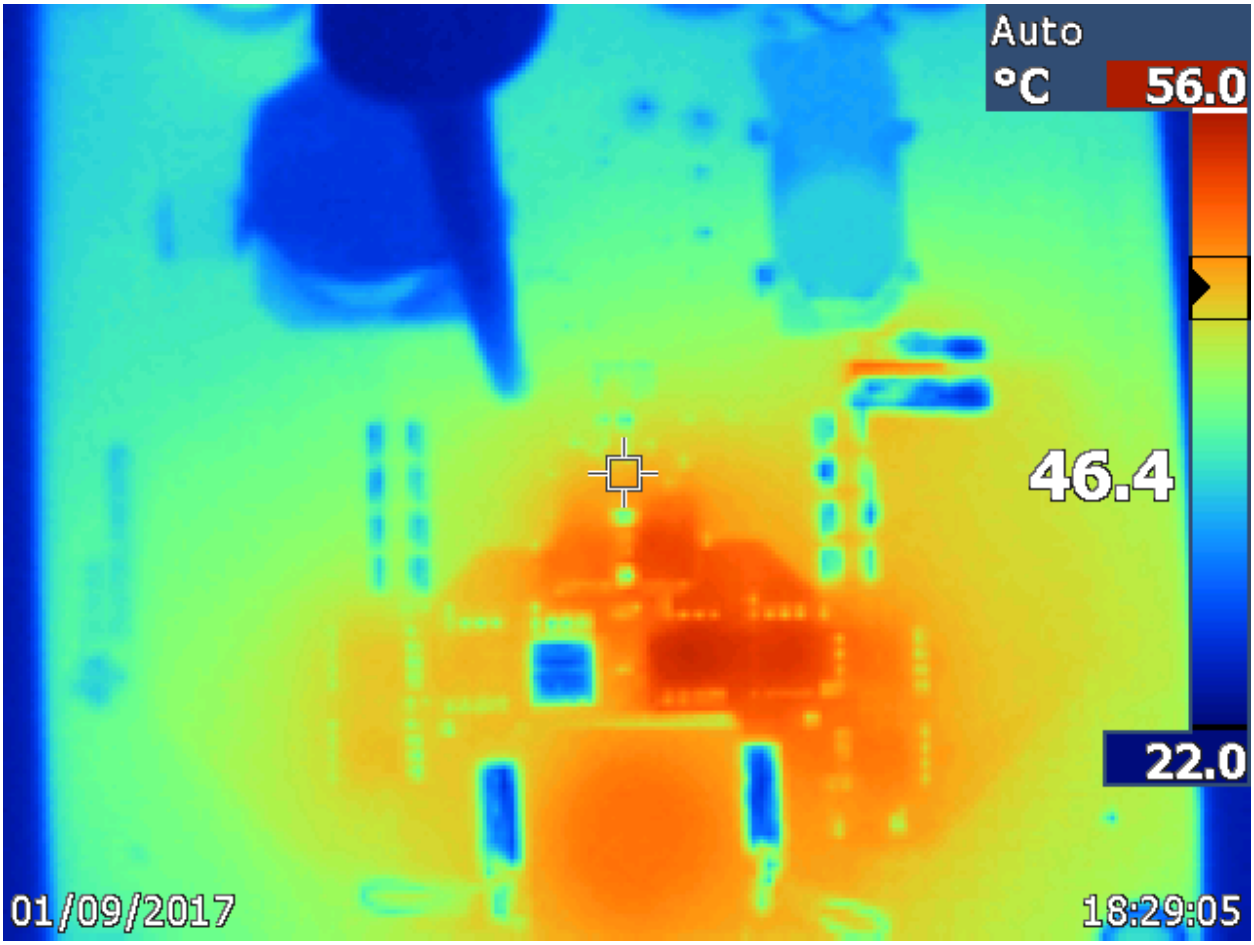
IR thermal image taken at steady state with 13Vin and 12Vout @ 11A Load (no airflow; image on left is of top side of board; image on right is of bottom side of board)



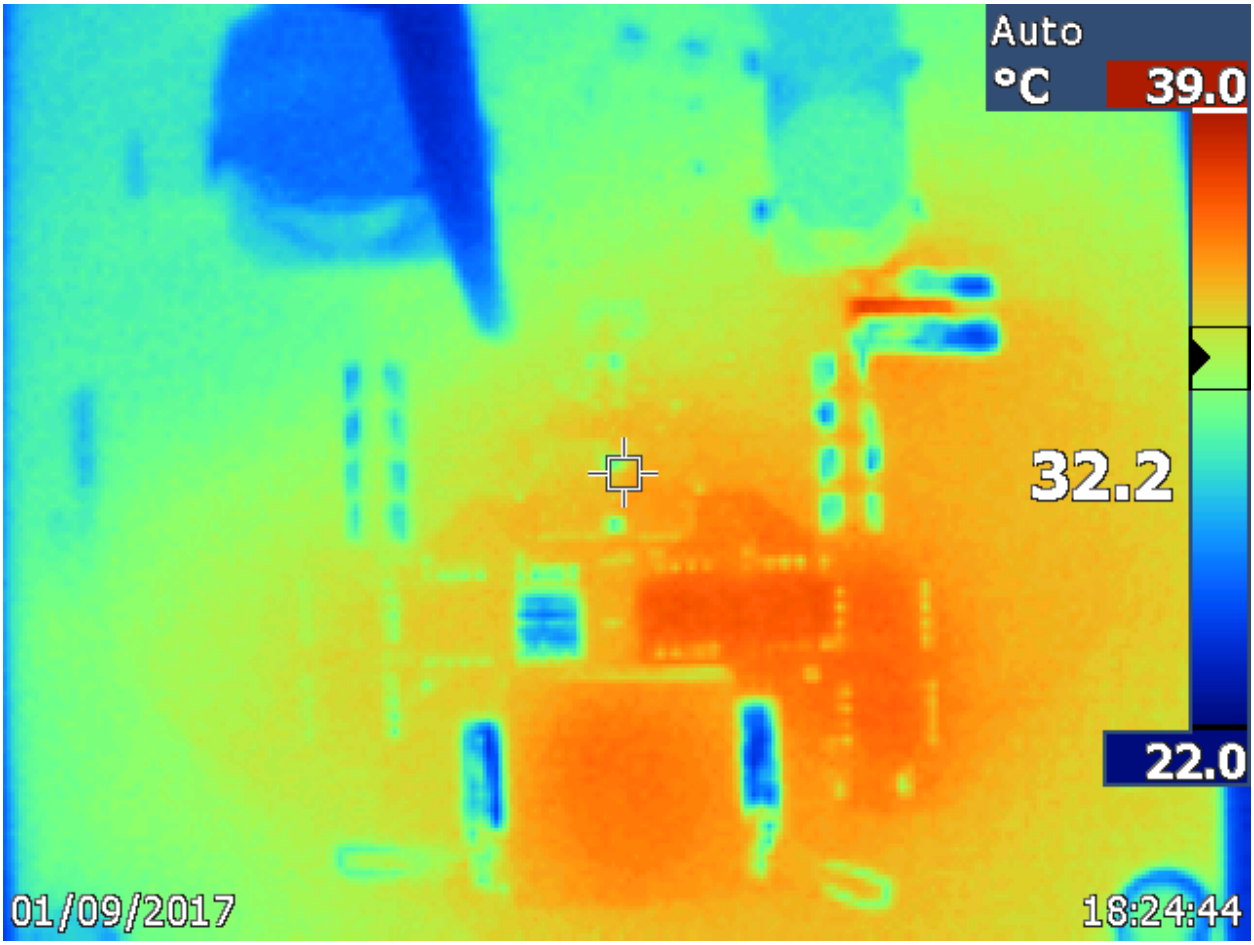
IR thermal image taken at steady state with 9Vin and 12Vout @ 11A Load (no airflow; image on left is of top side of board; image on right is of bottom side of board)



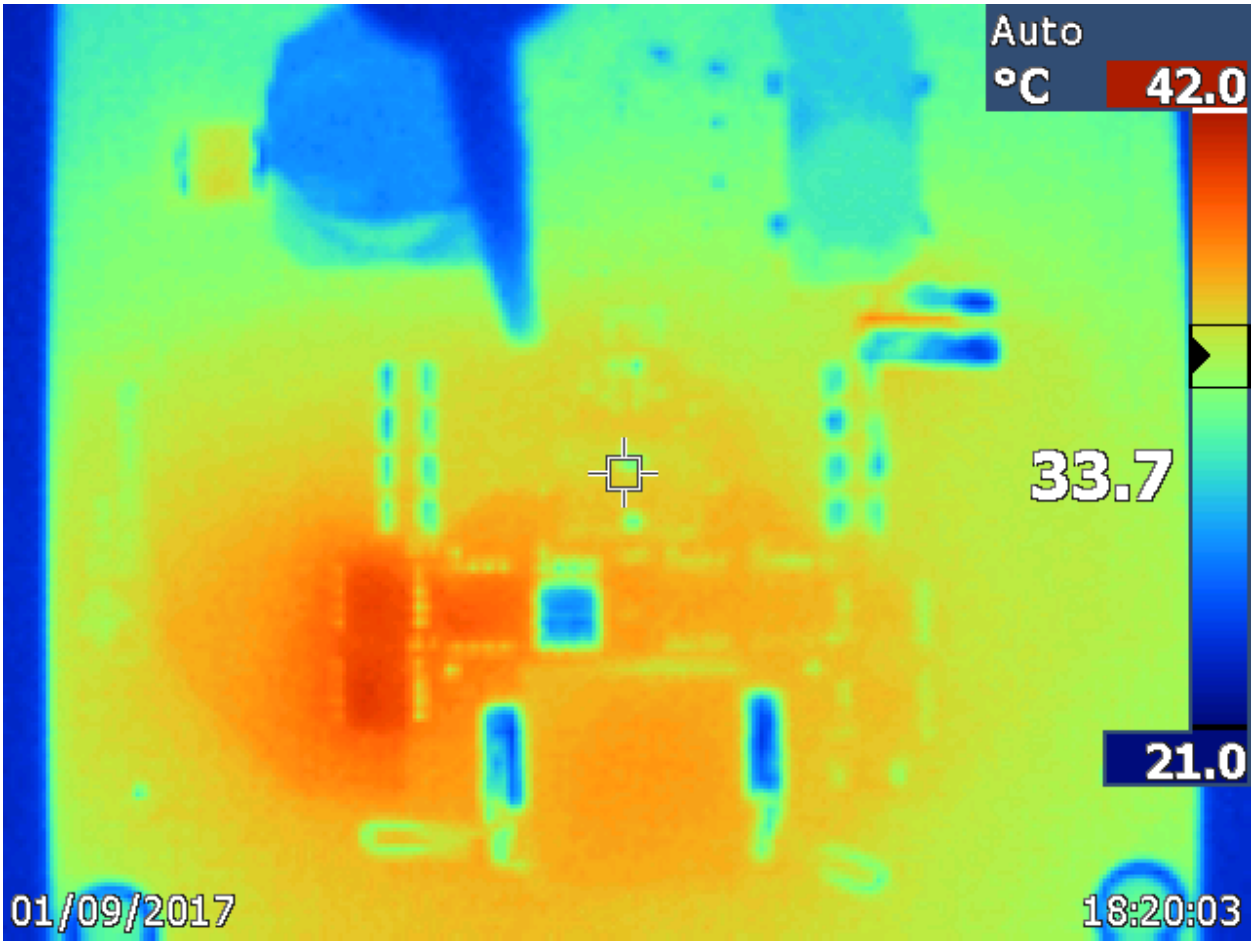
IR thermal image taken at steady state with 5Vin and 12Vout @ 11A Load (no airflow; image on left is of top side of board; image on right is of bottom side of board)



IR thermal image taken at 5Vin and: 60 seconds at 6Vout (CV Load) and 11A (i.e. Constant-Current loop engaged; Pout ≈ 66W), then 80 seconds at 12Vout and 11A (Pout ≈ 132W); no airflow; top side of board; mimics charging a 200F capacitor load (i.e. ≈ 14.4KJ)



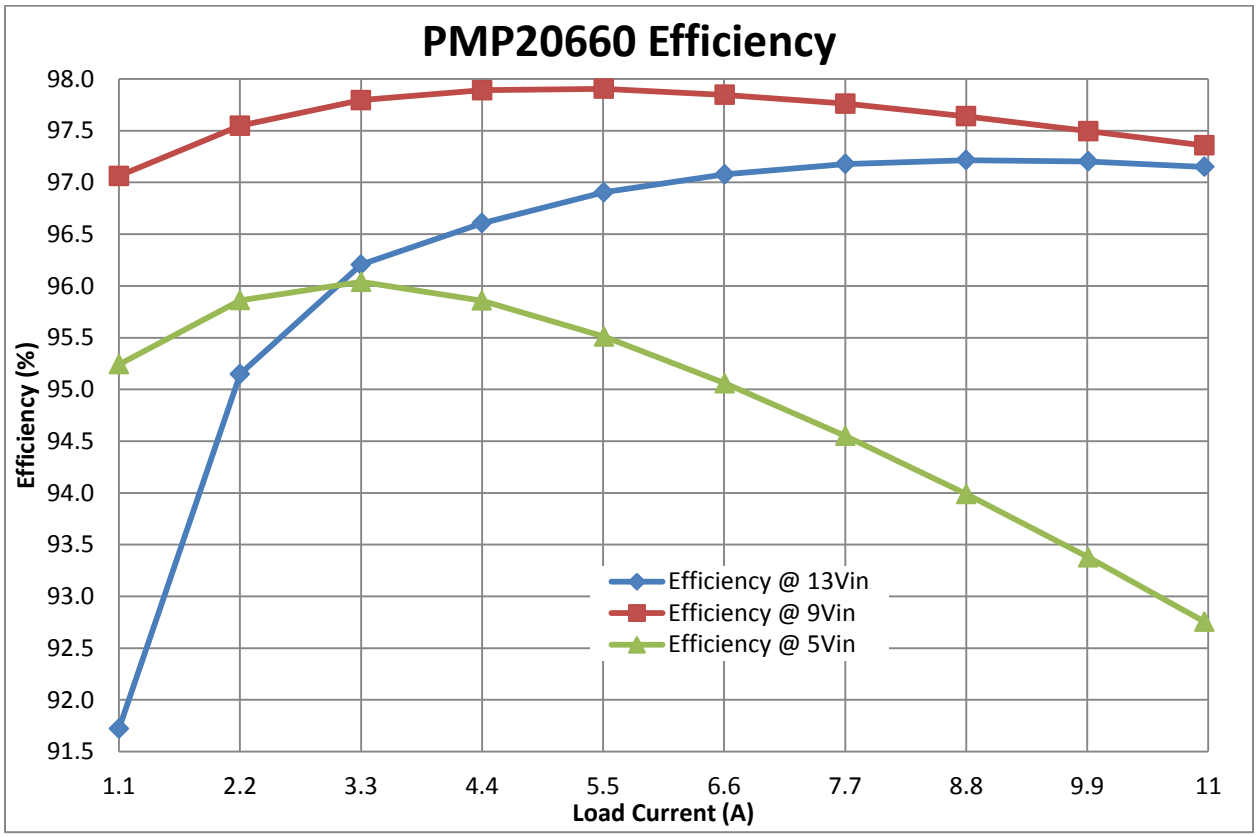
IR thermal image taken at 9Vin and: 60 seconds at 6Vout (CV Load) and 11A (i.e. Constant-Current loop engaged; Pout ≈ 66W), then 80 seconds at 12Vout and 11A (Pout ≈ 132W); no airflow; top side of board; mimics charging a 200F capacitor load (i.e. ≈ 14.4KJ)



IR thermal image taken at 13Vin and: 60 seconds at 6Vout (CV Load) and 11A (i.e. Constant-Current loop engaged; Pout ≈ 66W), then 80 seconds at 12Vout and 11A (Pout ≈ 132W); no airflow; top side of board; mimics charging a 200F capacitor load (i.e. ≈ 14.4KJ)

5. Efficiency

5.1 Efficiency Graph



5.2 Efficiency Data

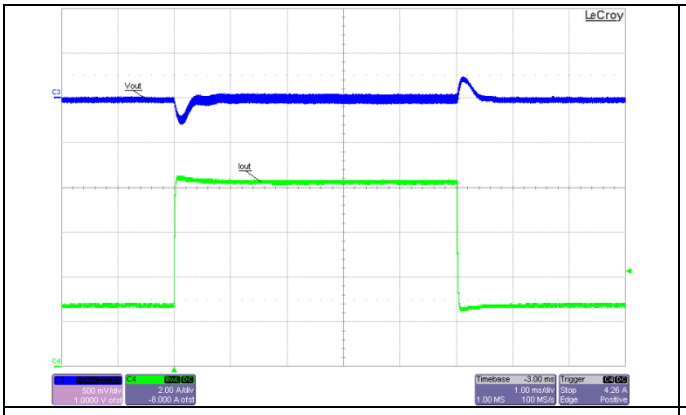
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
13	1.111	12.043	1.1	14.4430	13.2473	1.1957	91.7
13	2.143	12.045	2.2007	27.8590	26.5074	1.3516	95.1
13	3.179	12.046	3.3006	41.3270	39.7590	1.5680	96.2
13	4.221	12.048	4.4	54.8730	53.0112	1.8618	96.6
13	5.268	12.049	5.5079	68.4840	66.3647	2.1193	96.9
13	6.308	12.05	6.6065	82.0040	79.6083	2.3957	97.1
13	7.348	12.052	7.7024	95.5240	92.8293	2.6947	97.2
13	8.393	12.053	8.8004	109.1090	106.0712	3.0378	97.2
13	9.452	12.053	9.9095	122.8760	119.4392	3.4368	97.2
13	10.421	12.003	10.965	135.4730	131.6129	3.8601	97.2

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
9	1.518	12.053	1.1002	13.6620	13.2607	0.4013	97.1
9	3.022	12.053	2.2012	27.1980	26.5311	0.6669	97.5
9	4.519	12.054	3.2997	40.6710	39.7746	0.8964	97.8
9	6.021	12.054	4.4007	54.1890	53.0460	1.1430	97.9
9	7.536	12.055	5.5084	67.8240	66.4038	1.4202	97.9
9	9.046	12.057	6.607	81.4140	79.6606	1.7534	97.8
9	10.557	12.058	7.7033	95.0130	92.8864	2.1266	97.8
9	12.076	12.058	8.8007	108.6840	106.1188	2.5652	97.6
9	13.62	12.059	9.9105	122.5800	119.5107	3.0693	97.5
9	15.037	12.015	10.966	135.3330	131.7565	3.5765	97.4

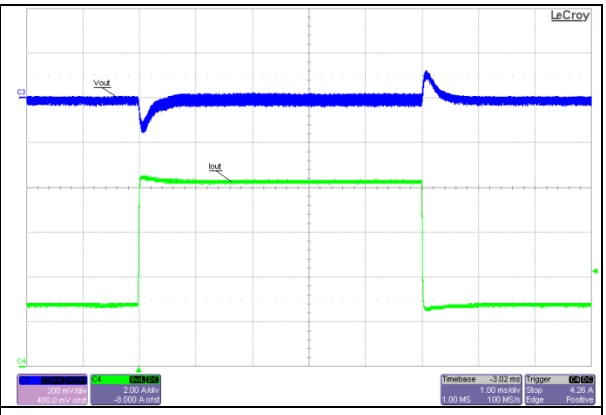
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Pin (W)	Pout (W)	Ploss (W)	Efficiency (%)
5	2.788	12.06	1.1009	13.9400	13.2769	0.6631	95.2
5	5.539	12.061	2.2012	27.6950	26.5487	1.1463	95.9
5	8.293	12.062	3.3015	41.4650	39.8227	1.6423	96.0
5	11.074	12.064	4.3996	55.3700	53.0768	2.2932	95.9
5	13.917	12.065	5.5086	69.5850	66.4613	3.1237	95.5
5	16.776	12.068	6.6072	83.8800	79.7357	4.1443	95.1
5	19.668	12.07	7.7034	98.3400	92.9800	5.3600	94.5
5	22.606	12.071	8.8009	113.0300	106.2357	6.7943	94.0
5	25.624	12.071	9.9108	128.1200	119.6333	8.4867	93.4
5	28.301	11.97	10.9651	141.5050	131.2522	10.2528	92.8

6 Waveforms

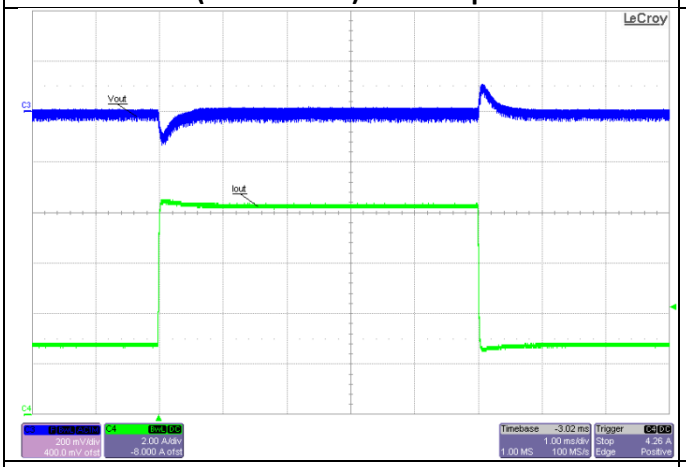
6.1 Load Transient Response



Load Transient Response at 5Vin and 2.75A-to-8.25A (25%-to-75%) Load Step

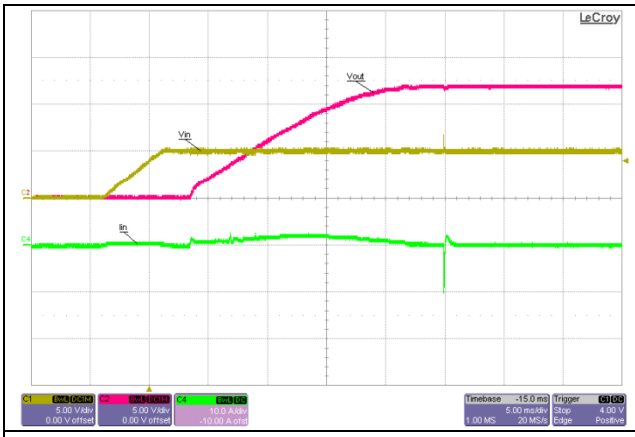


Load Transient Response at 9Vin and 2.75A-to-8.25A (25%-to-75%) Load Step

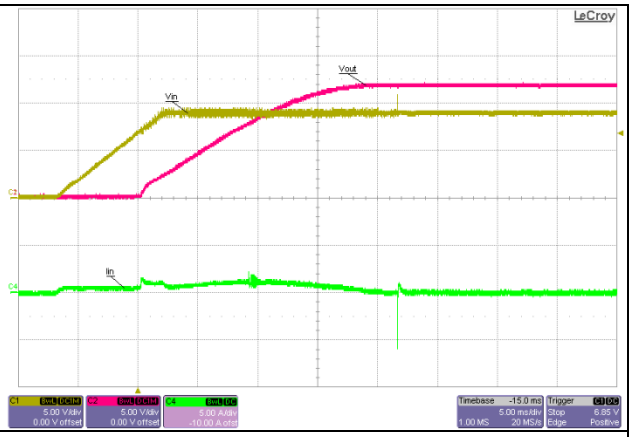


Load Transient Response at 13Vin and 2.75A-to-8.25A (25%-to-75%) Load Step

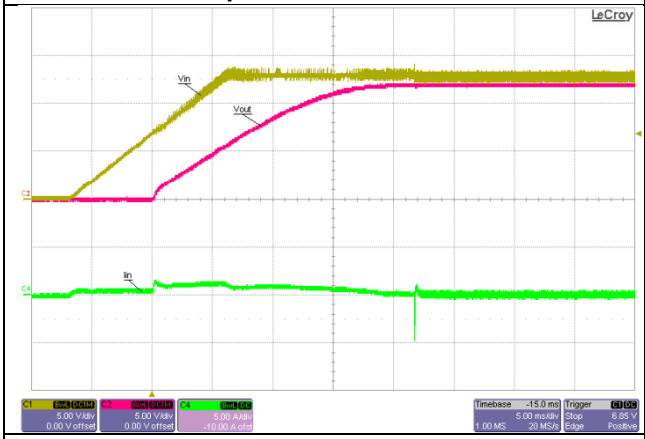
6.2 Startup



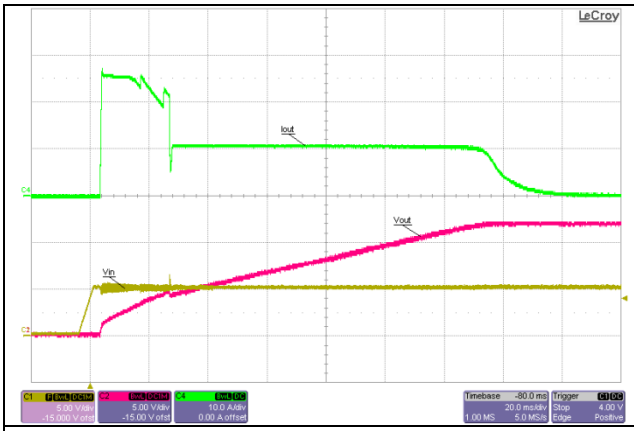
Startup into No Load at 5Vin



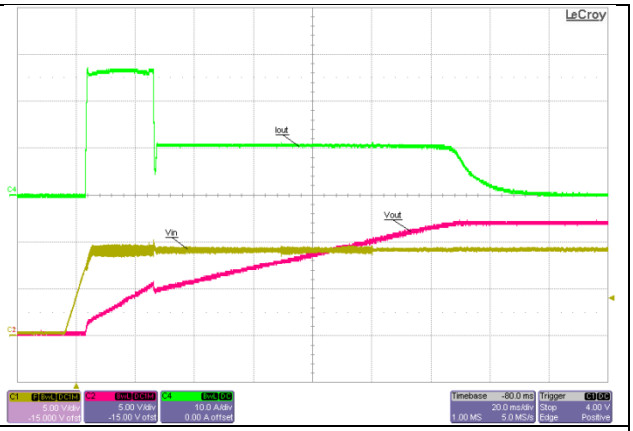
Startup into No Load at 9Vin



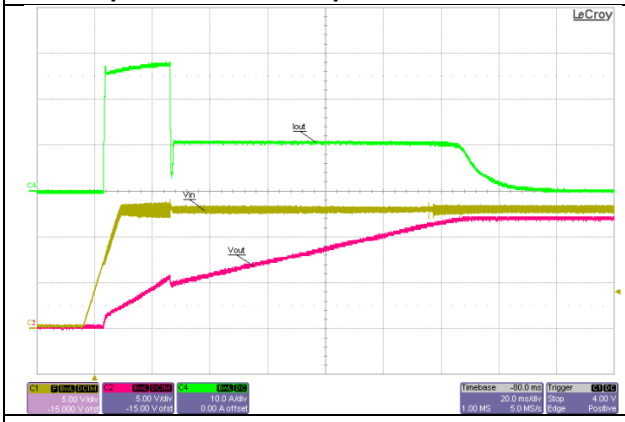
Startup into No Load at 13Vin



Startup at 5Vin into a Capacitor Bank of ≈ 0.17F



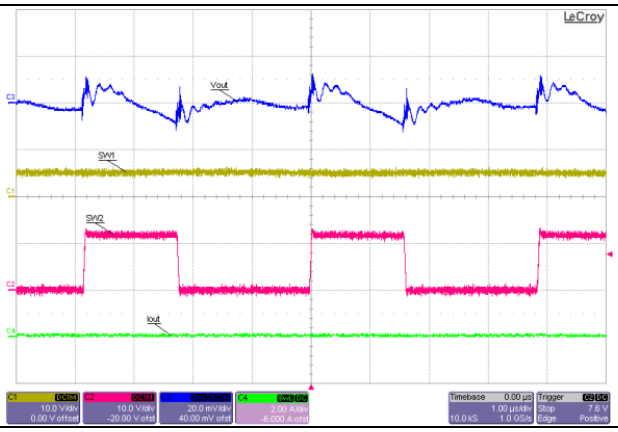
Startup at 9Vin into a Capacitor Bank of ≈ 0.17F



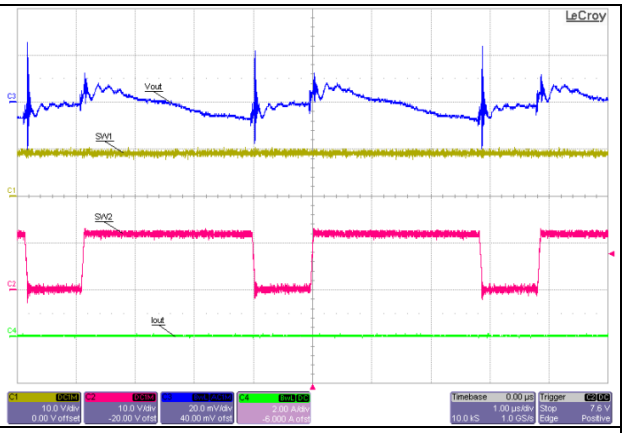
Startup at 13Vin into a Capacitor Bank of ≈ 0.17F

***NOTE: Bank of capacitors is comprised of 25 pieces of 6.8mF 63V through hole capacitors (Nichicon P/N: UVZ1J682MRD) connected together on copper clad PCB, providing an approximate 0.17F of capacitance.**

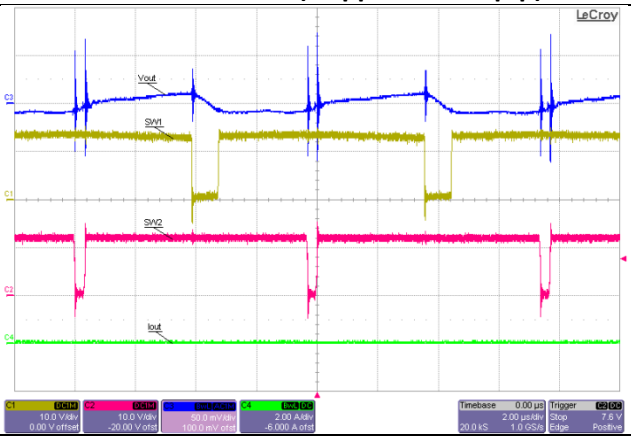
6.3 Output Voltage Ripple and Switch Node Voltages



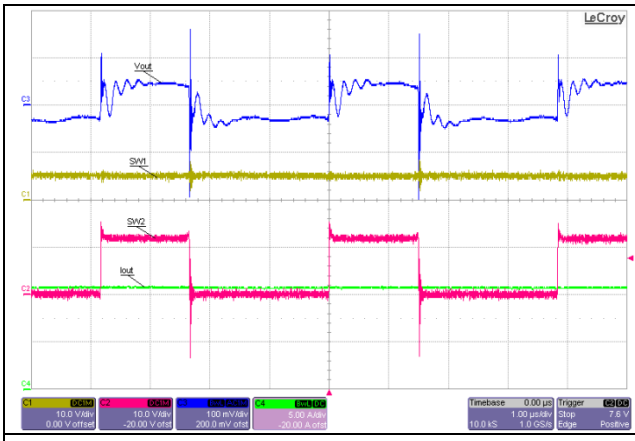
Switch Node Voltage and Output Voltage Ripple at 5Vin and No Load (Vripple ≈ 24mVp-p)



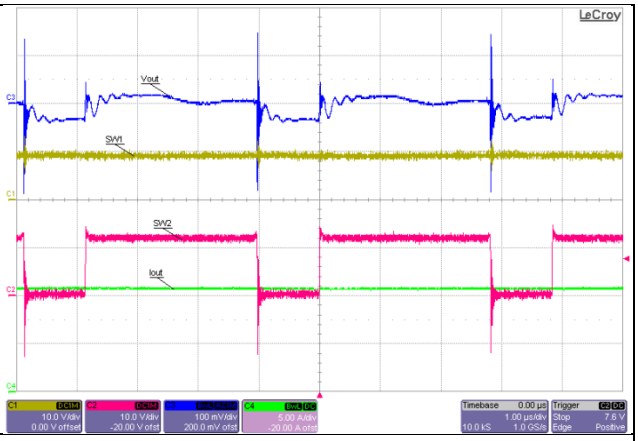
Switch Node Voltage and Output Voltage Ripple at 9Vin and No Load (Vripple ≈ 24mVp-p)



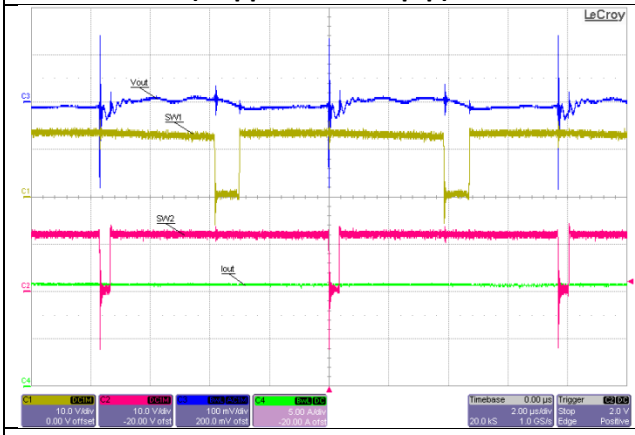
Switch Node Voltage and Output Voltage Ripple at 13Vin and No Load (Vripple ≈ 45mVp-p)



Switch Node Voltage and Output Voltage Ripple at 5Vin and 12Vo @ 11A Load (Vripple ≈ 120mVp-p)



Switch Node Voltage and Output Voltage Ripple at 9Vin and 12Vo @ 11A Load (Vripple ≈ 100mVp-p)



Switch Node Voltage and Output Voltage Ripple at 13Vin and 12Vo @ 11A Load (Vripple ≈ 80mVp-p)

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