

**Test Report
For PMP11422
10/28/2015**



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1. Design Specifications

Vin Minimum	5VDC
Vin Maximum	8.6VDC
Vout	12VDC
Iout	3A continuous, 6A transient
Approximate Switching Frequency	~300KHz

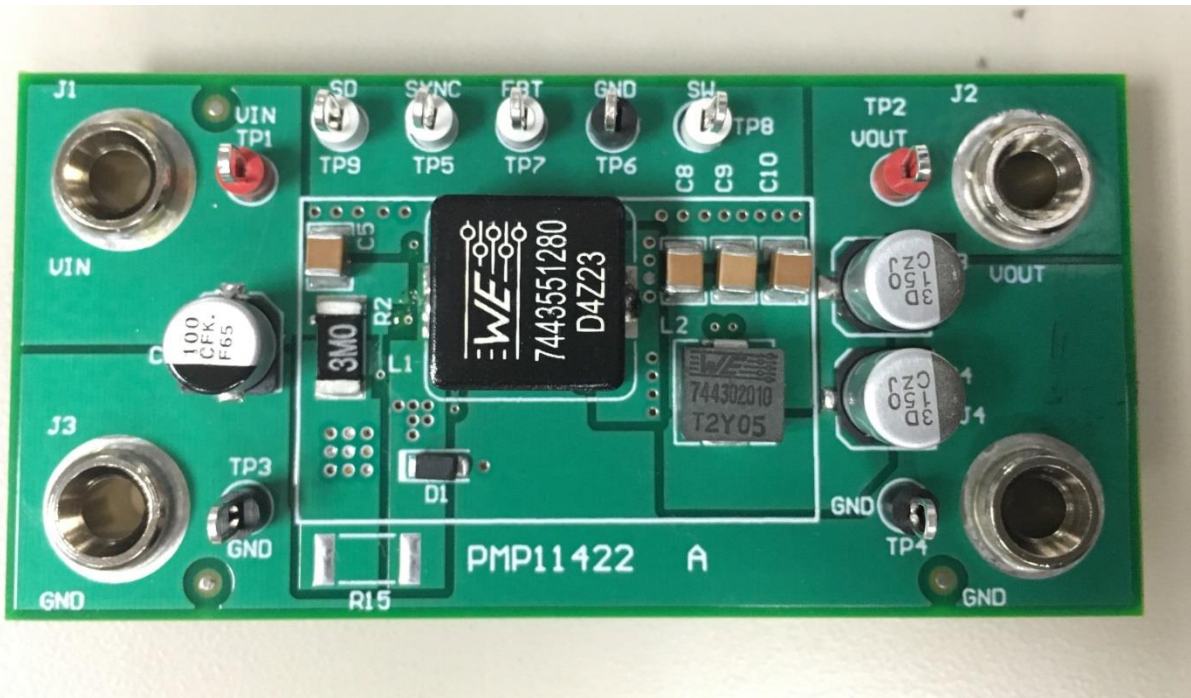
2. Circuit Description and PCB details

PMP11422 is a synchronous boost power supply using the LM5121 controllers. The design accepts an input voltage of 5Vin to 8.6Vin, and boosts a 12Vout rail capable of sourcing 6A continuous current. The LM5121 integrates an input disconnection switch feature which allows boost short circuit protection, the device turns off the switch when a short circuit event occurs.

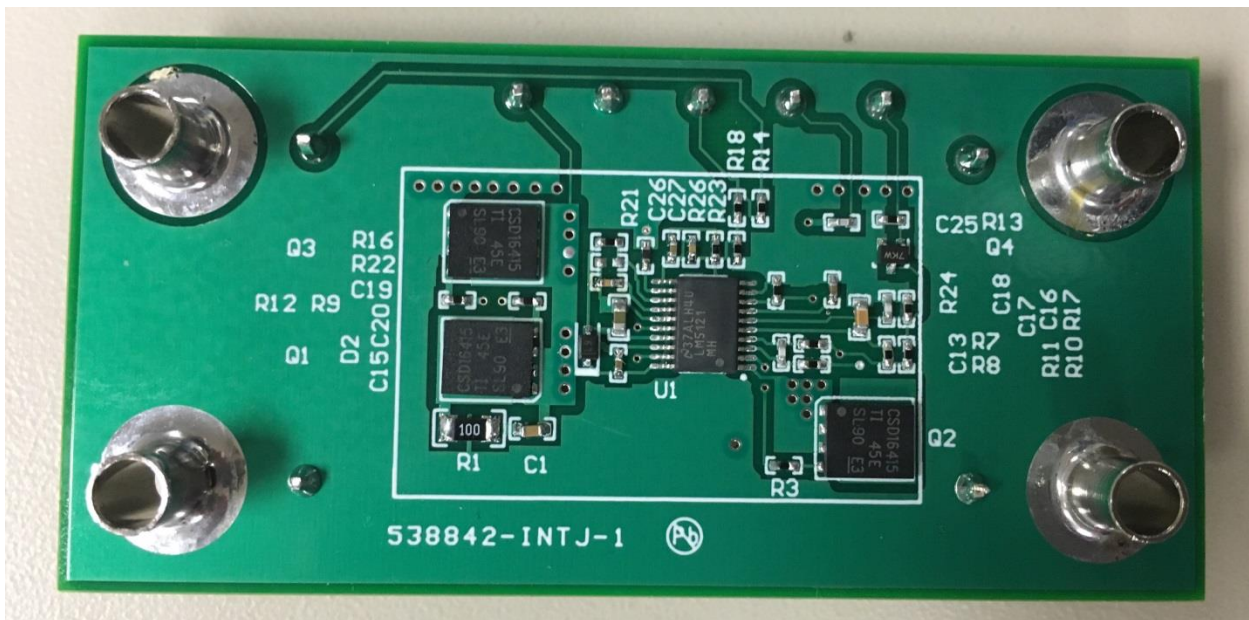
The design was built on PMP11422 with a dimension of 78.7mm * 38mm. Four layer PCB was used for the design, 1 oz. copper on top and bottom layer, 0.5 oz. copper on the internal layers.

3. PMP11422 Board Photos

Board Dimensions: 78.7mm x 38mm

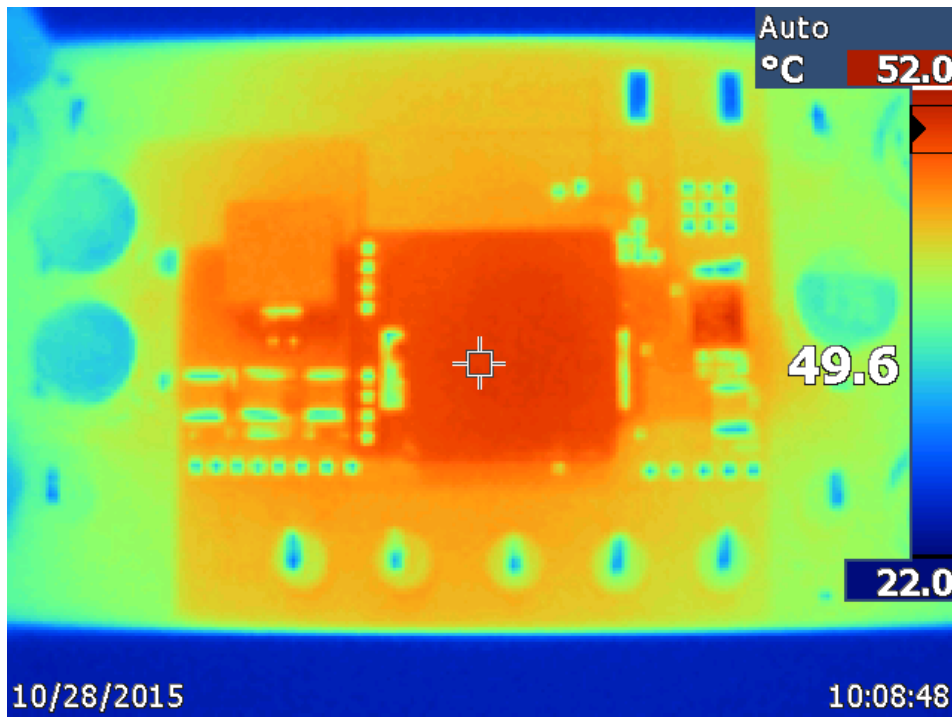


Board Photo (Top)

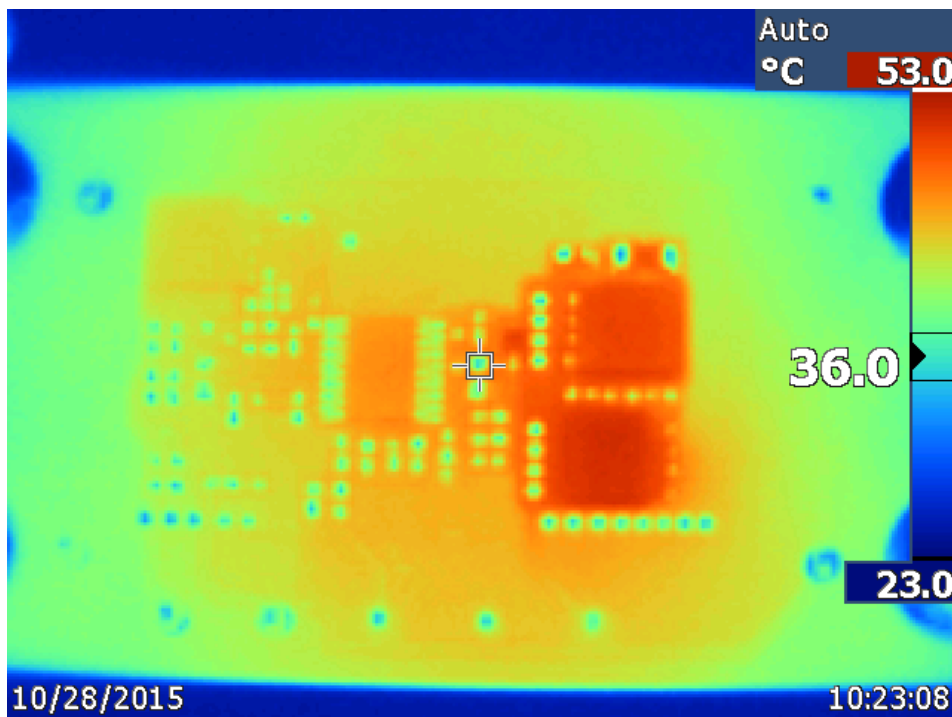


Board Photo (Bottom)

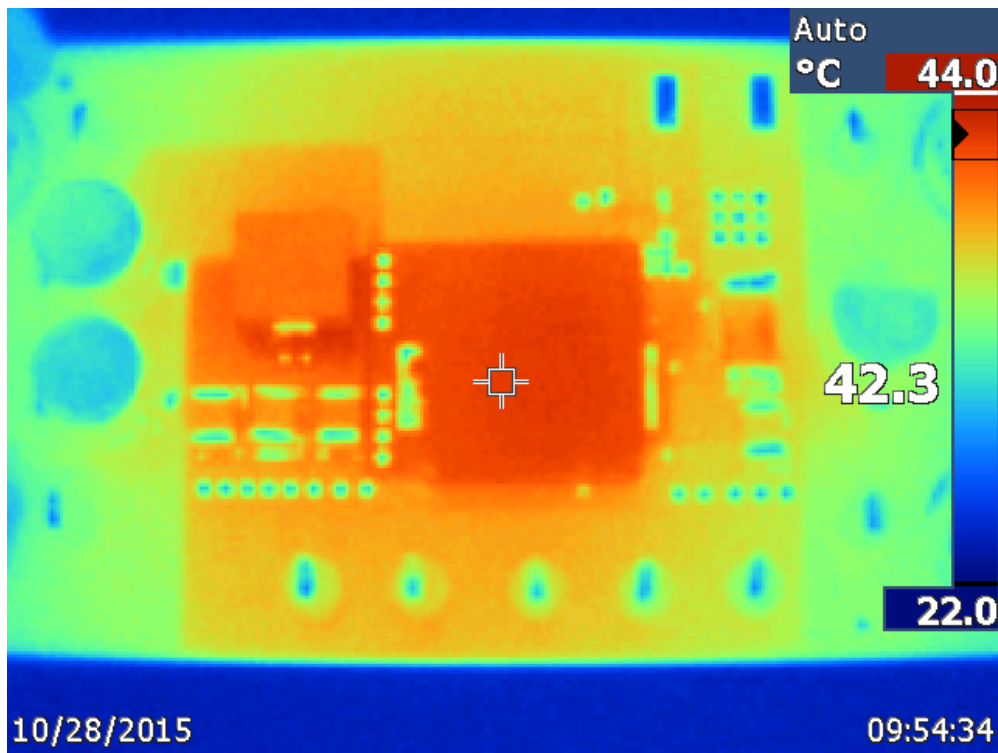
4. Thermal Data



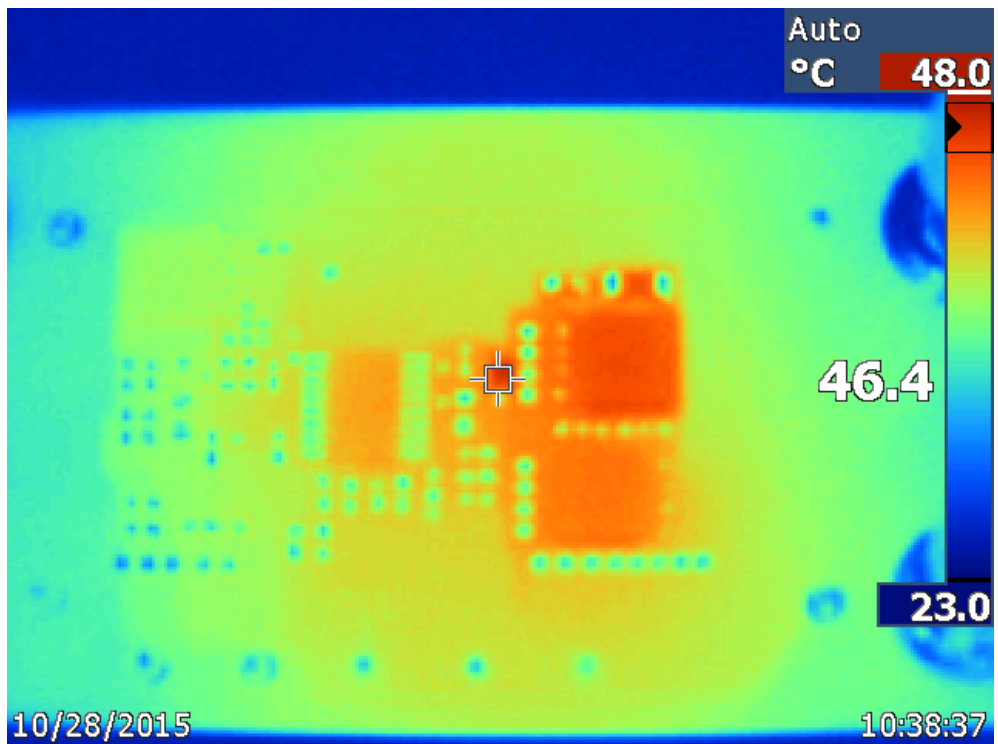
IR thermal image taken at steady state with 5Vin and 3A load top (no airflow)



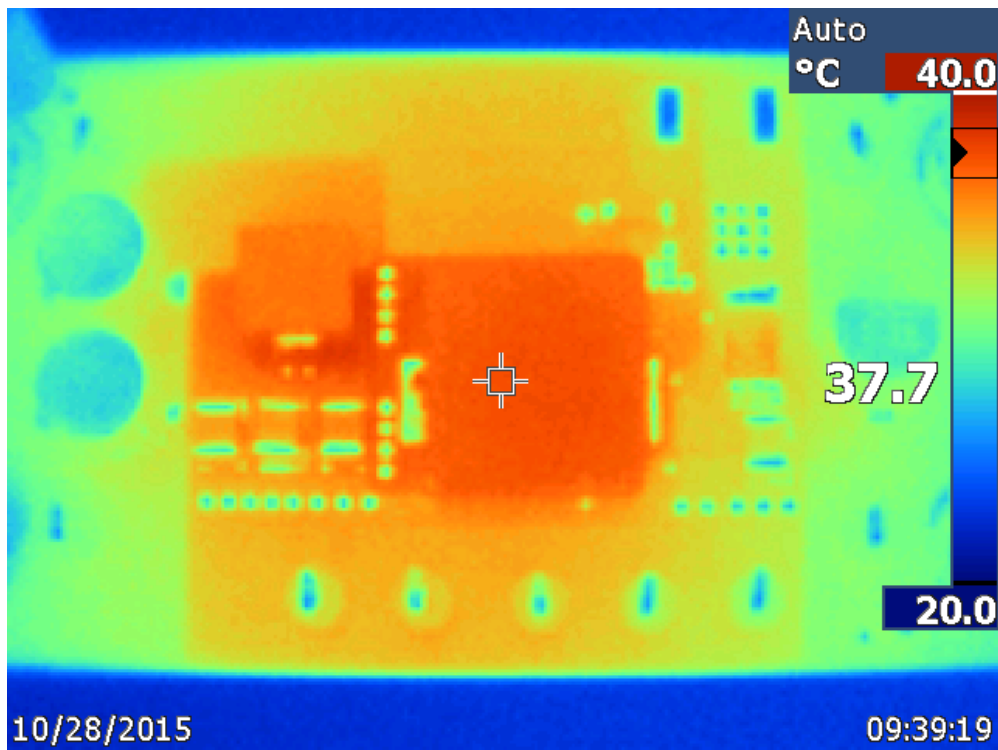
IR thermal image taken at steady state with 5Vin and 3A load bottom (no airflow)



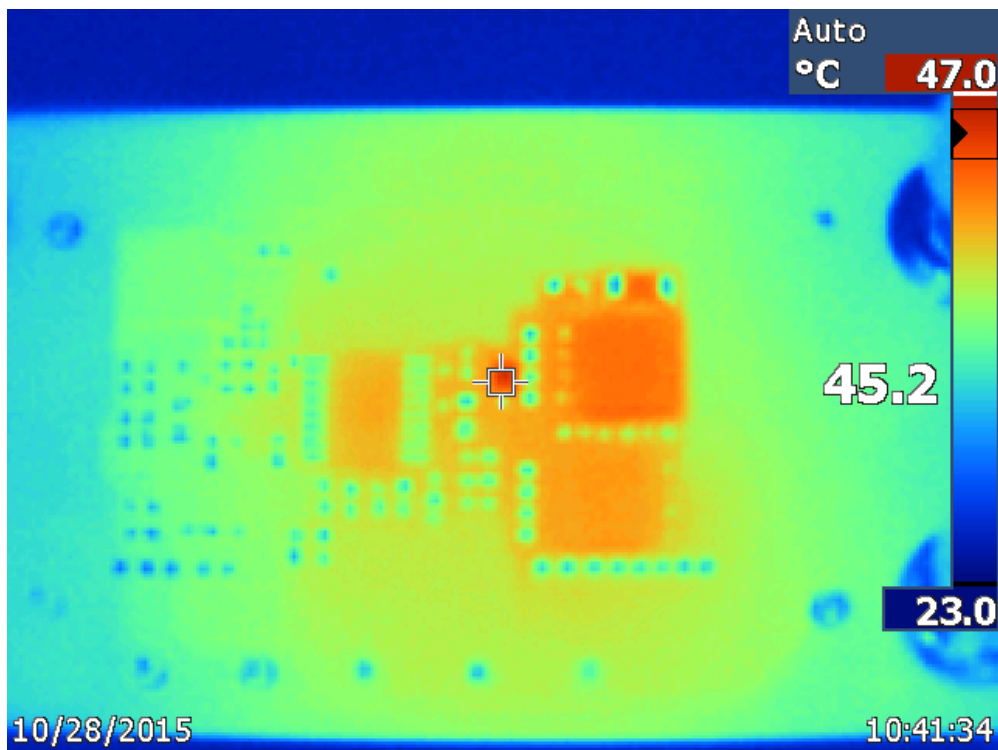
IR thermal image taken at steady state with 6.8V_{in} and 3A load top (no airflow)



IR thermal image taken at steady state with 6.8V_{in} and 3A load bottom (no airflow)



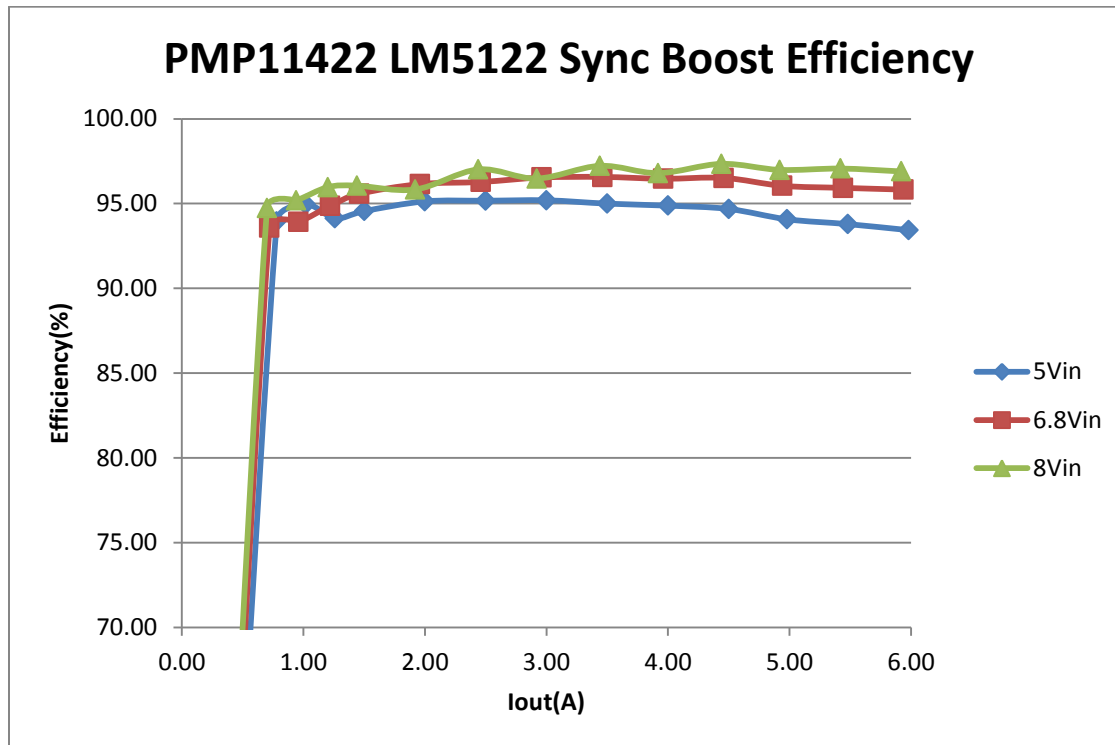
IR thermal image taken at steady state with 8.6Vin and 3A load top (no airflow)



IR thermal image taken at steady state with 8.6Vin and 3A load bottom (no airflow)

5. Efficiency

5.1 Efficiency Chart



5.2 Efficiency Data

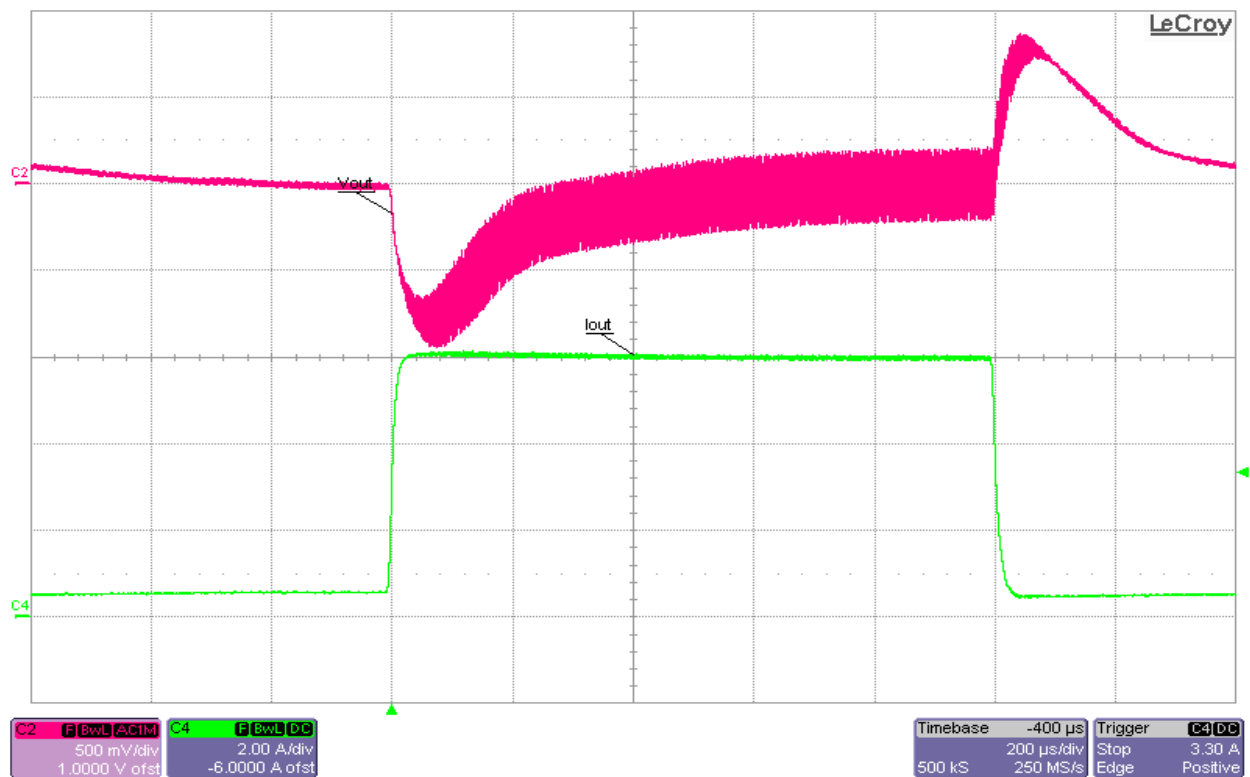
Vin(V)	Iin(A)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Losses(W)	Efficiency(%)
5.00	0.06	0.30	12.11	0.00	0.00	0.30	0.00
5.00	2.01	10.05	12.11	0.78	9.44	0.61	93.94
5.00	2.60	13.01	12.11	1.02	12.35	0.66	94.96
5.00	3.24	16.21	12.11	1.26	15.26	0.95	94.14
5.00	3.84	19.21	12.11	1.50	18.16	1.05	94.56
5.00	5.09	25.46	12.11	2.00	24.22	1.24	95.13
5.00	6.36	31.81	12.11	2.50	30.27	1.54	95.17
5.00	7.63	38.16	12.11	3.00	36.32	1.83	95.20
5.00	8.92	44.61	12.11	3.50	42.38	2.23	95.00
5.00	10.21	51.05	12.11	4.00	48.44	2.61	94.88
5.00	11.51	57.55	12.11	4.50	54.49	3.06	94.68
5.00	12.82	64.10	12.11	4.98	60.30	3.80	94.08
5.00	14.15	70.75	12.11	5.48	66.36	4.39	93.79
5.00	15.50	77.50	12.11	5.98	72.41	5.09	93.44
5.00	16.87	84.35	12.11	6.48	78.47	5.88	93.03
5.00	18.25	91.23	12.11	6.98	84.52	6.71	92.64

5.00	19.65	98.23	12.11	7.48	90.58	7.66	92.21
5.00	21.07	105.33	12.11	7.98	96.63	8.70	91.74
5.00	22.51	112.53	12.11	8.48	102.68	9.84	91.25
5.00	9.26	46.31	4.38	8.96	39.25	7.06	84.76
5.00	9.70	48.51	4.40	9.46	41.64	6.87	85.85
5.00	10.15	50.76	4.35	9.96	43.33	7.43	85.35
5.00	10.64	53.21	4.34	10.46	45.34	7.87	85.22
6.80	0.06	0.41	12.11	0.00	0.00	0.41	0.00
6.80	1.37	9.32	12.11	0.72	8.72	0.60	93.58
6.80	1.82	12.38	12.11	0.96	11.63	0.75	93.92
6.80	2.29	15.57	12.11	1.22	14.77	0.80	94.86
6.80	2.72	18.50	12.11	1.46	17.68	0.82	95.58
6.80	3.63	24.69	12.11	1.96	23.74	0.95	96.15
6.80	4.55	30.94	12.11	2.46	29.79	1.15	96.28
6.80	5.46	37.13	12.11	2.96	35.85	1.28	96.54
6.80	6.38	43.39	12.11	3.46	41.90	1.49	96.58
6.80	7.31	49.72	12.11	3.96	47.96	1.76	96.47
6.80	8.23	55.96	12.11	4.46	54.02	1.95	96.52
6.80	9.16	62.29	12.11	4.94	59.83	2.46	96.05
6.80	10.10	68.68	12.11	5.44	65.88	2.80	95.93
6.80	11.04	75.07	12.11	5.94	71.94	3.13	95.83
6.80	11.98	81.46	12.11	6.44	77.99	3.47	95.74
6.80	12.94	87.99	12.11	6.94	84.06	3.93	95.53
6.80	13.90	94.52	12.11	7.44	90.11	4.41	95.34
6.80	14.86	101.05	12.11	7.94	96.17	4.88	95.17
6.80	15.83	107.63	12.11	8.44	102.23	5.40	94.98
6.80	16.79	114.16	12.11	8.94	108.28	5.87	94.85
6.80	17.77	120.82	12.11	9.44	114.34	6.48	94.64
6.80	18.76	127.55	12.11	9.94	120.39	7.16	94.39
6.80	19.76	134.35	12.11	10.44	126.46	7.89	94.13
8.61	0.04	0.34	12.11	0.00	0.00	0.34	0.00
8.61	1.04	8.95	12.11	0.70	8.48	0.47	94.74
8.61	1.39	11.96	12.11	0.94	11.39	0.58	95.19
8.61	1.76	15.14	12.11	1.20	14.53	0.61	95.97
8.61	2.11	18.16	12.11	1.44	17.44	0.72	96.06
8.61	2.82	24.27	12.11	1.92	23.26	1.01	95.83
8.61	3.54	30.46	12.11	2.44	29.55	0.91	97.02
8.61	4.26	36.66	12.11	2.92	35.37	1.29	96.48

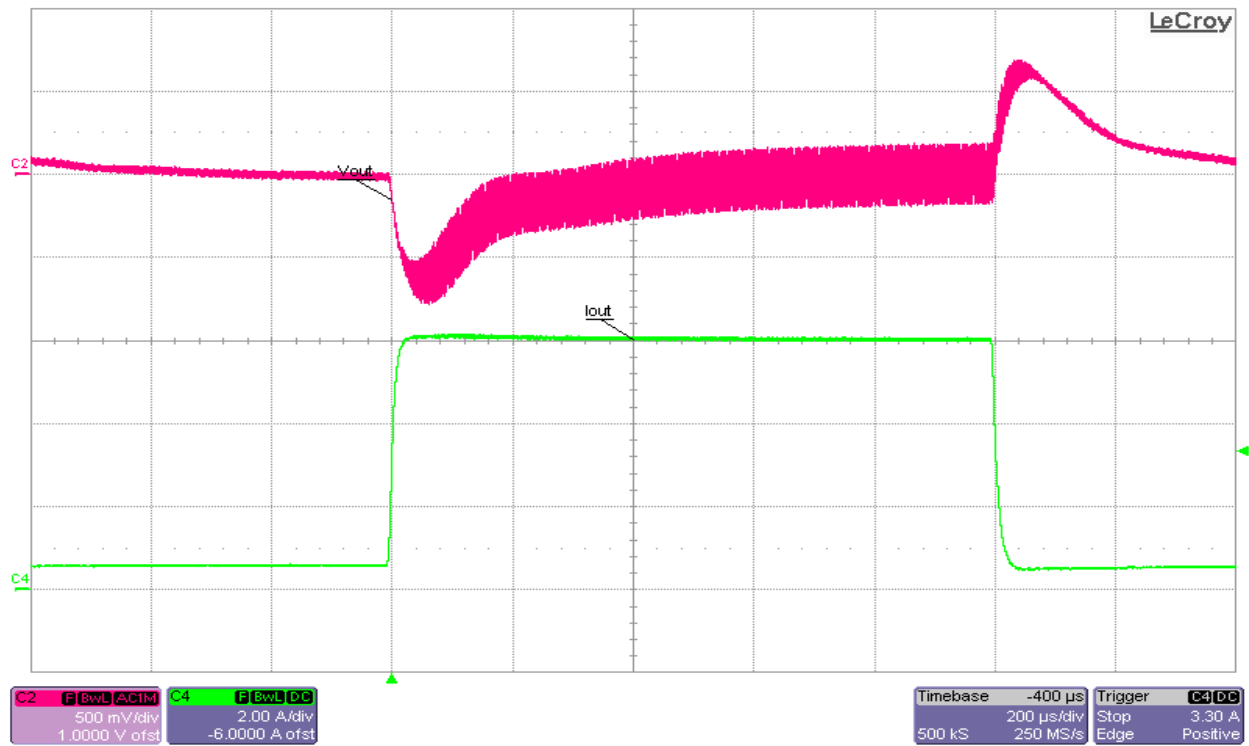
8.61	4.98	42.85	12.11	3.44	41.67	1.19	97.23
8.61	5.70	49.05	12.11	3.92	47.48	1.57	96.80
8.61	6.42	55.24	12.11	4.44	53.78	1.47	97.35
8.61	7.14	61.44	12.11	4.92	59.59	1.85	96.99
8.61	7.86	67.64	12.11	5.42	65.65	1.98	97.07
8.61	8.60	74.00	12.11	5.92	71.71	2.29	96.90
8.61	9.33	80.28	12.11	6.42	77.77	2.52	96.86
8.60	10.06	86.56	12.11	6.92	83.82	2.73	96.84
8.60	10.80	92.92	12.11	7.42	89.88	3.04	96.72
8.60	11.54	99.29	12.11	7.92	95.93	3.36	96.62
8.60	12.28	105.66	12.11	8.42	101.99	3.67	96.53
8.60	13.00	111.85	12.11	8.92	108.05	3.80	96.60
8.60	13.76	118.39	12.11	9.42	114.10	4.29	96.38
8.60	14.50	124.76	12.11	9.92	120.16	4.60	96.32
8.60	15.26	131.30	12.11	10.42	126.22	5.08	96.13

6 Waveforms

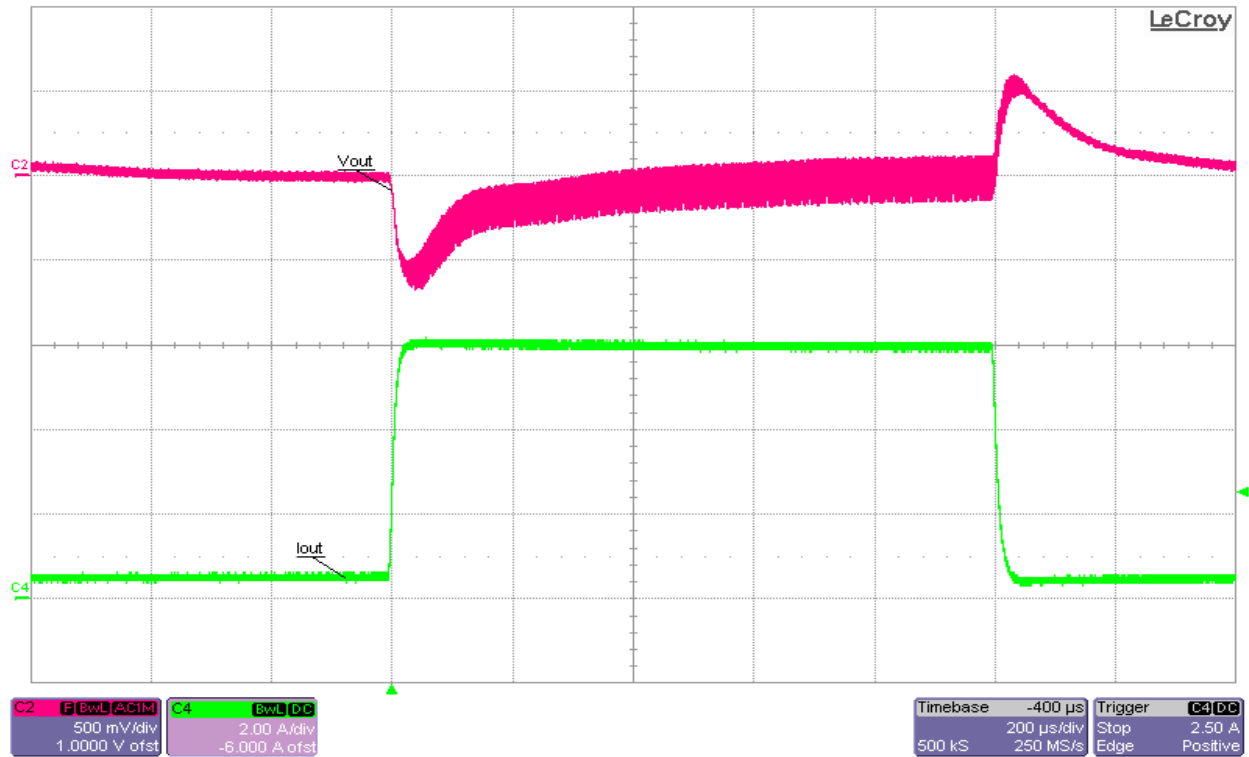
6.1 Load Transient Response



Load Transient Response at 5Vin and 0.5A-to-6A Load Step, Ch2 – Vout (AC coupled), Ch4- Iout.

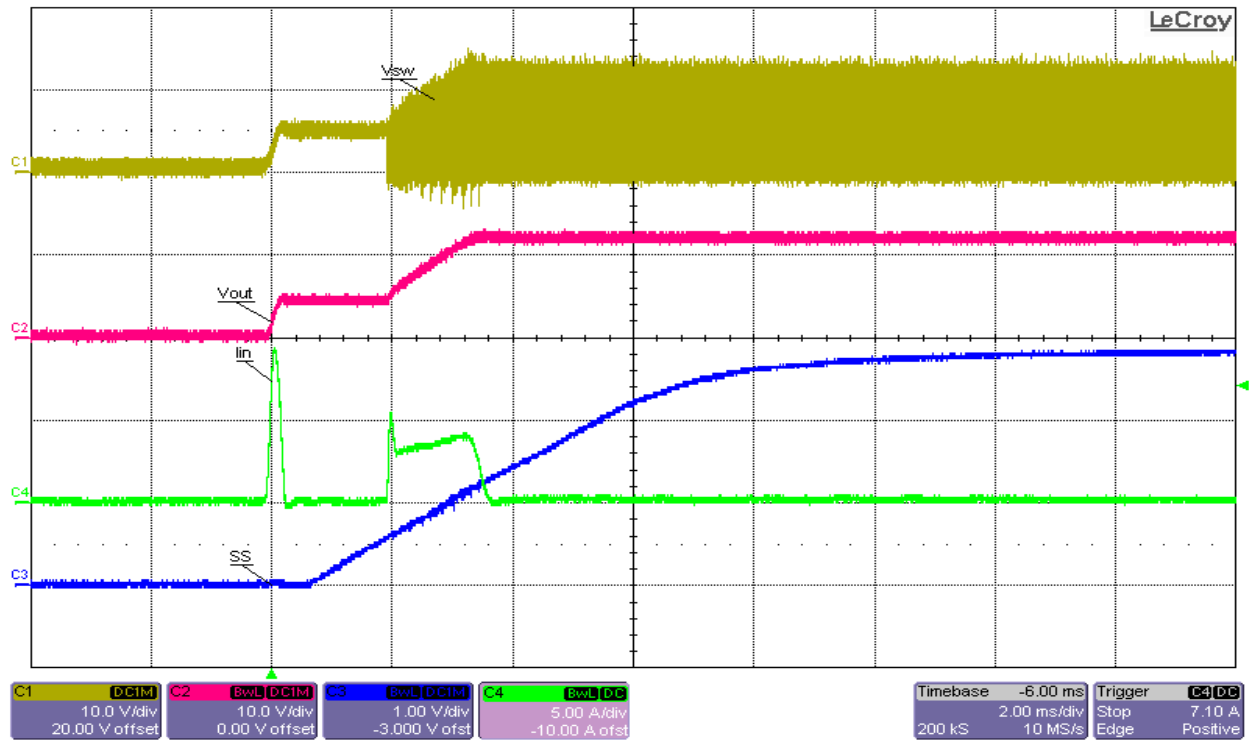


Load Transient Response at 6.8V_{in} and 0.5A-to-6A Load Step, Ch2 – Vout (AC coupled), Ch4- Iout.

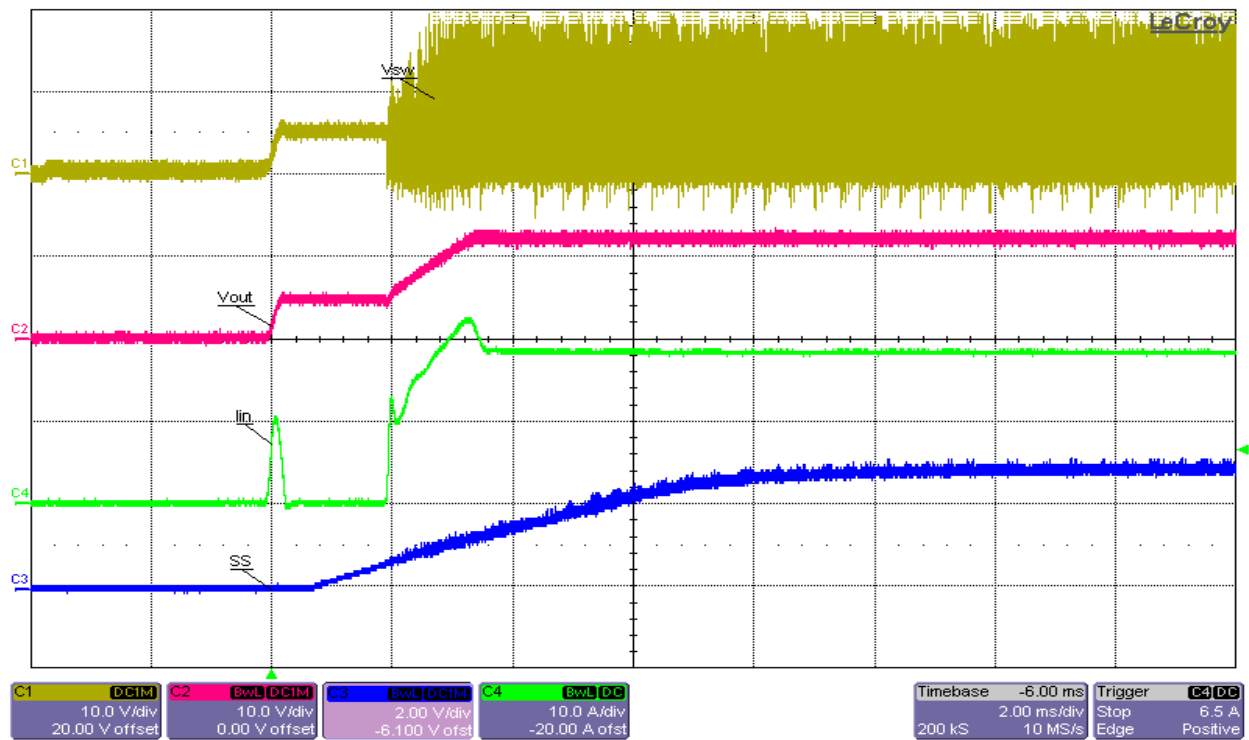


Load Transient Response at 8.6V_{in} and 0.5A-to-6A Load Step, Ch2 – Vout (AC coupled), Ch4- Iout.

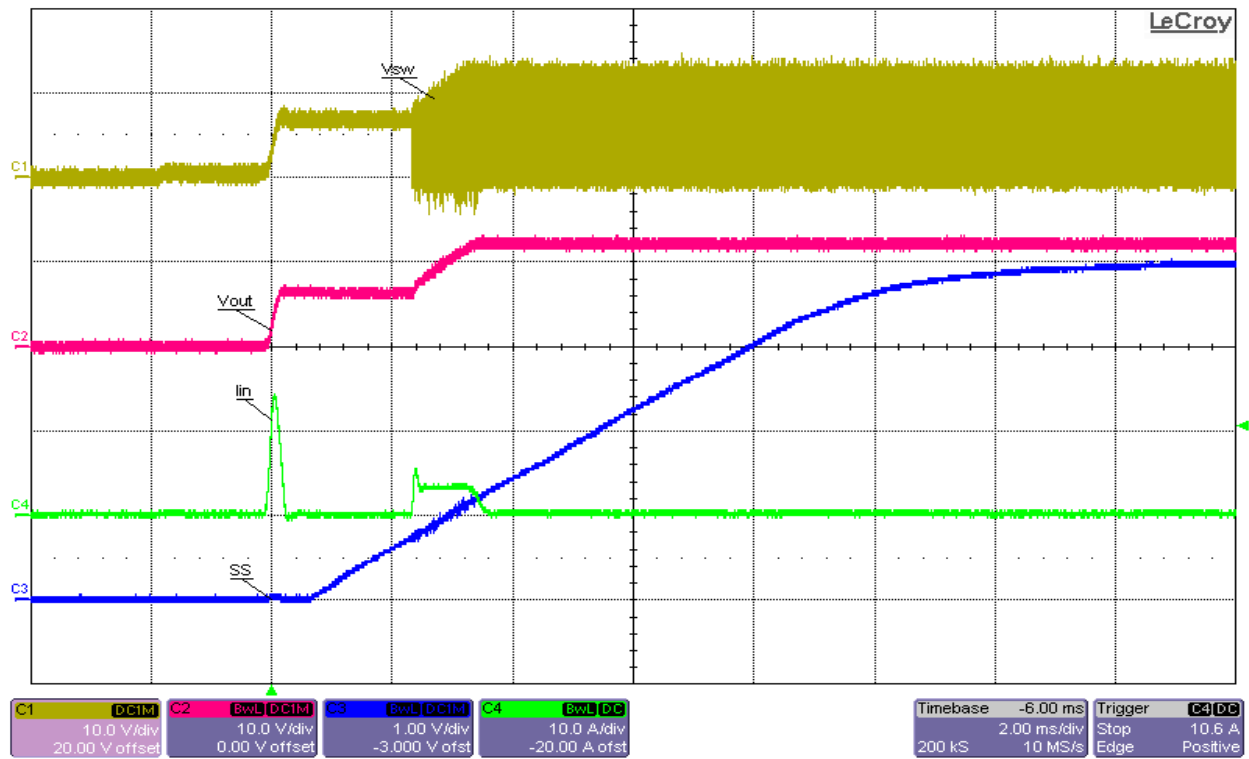
6.2 Startup from SD



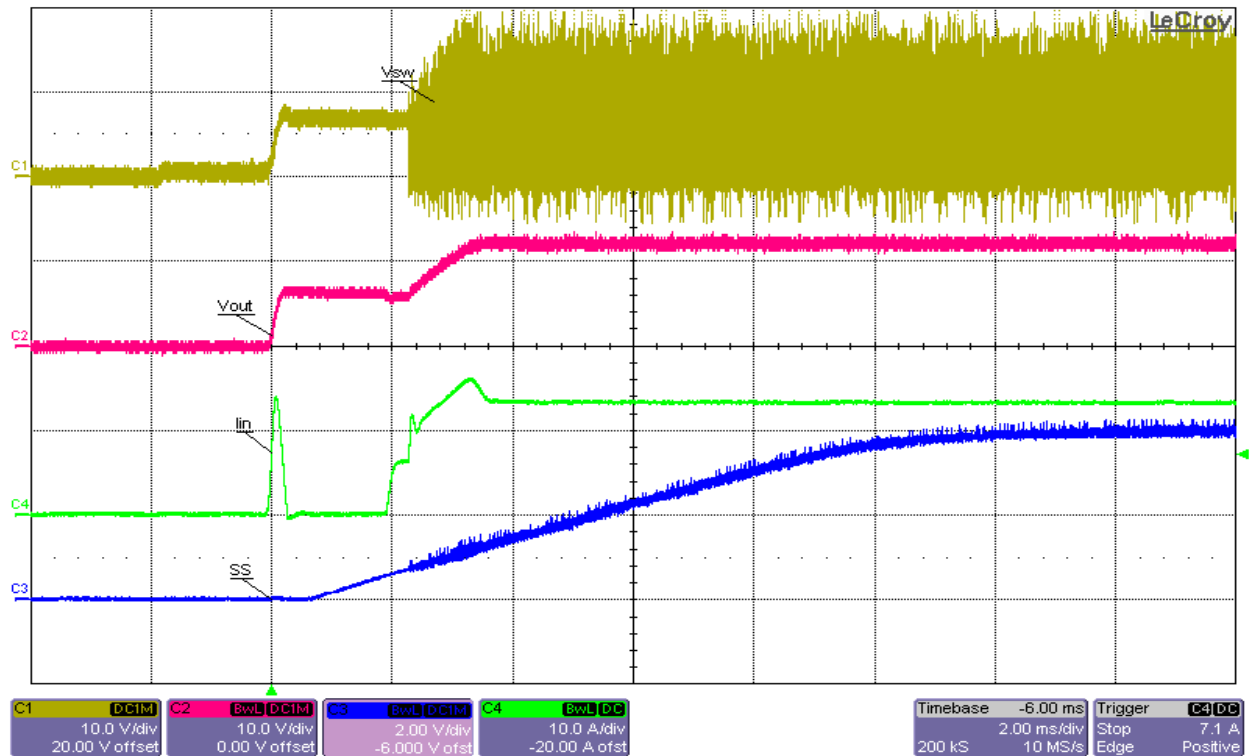
Startup into no Load at 5Vin, Ch1-Vsw, Ch2-Vout, Ch3-SS, Ch4-lin



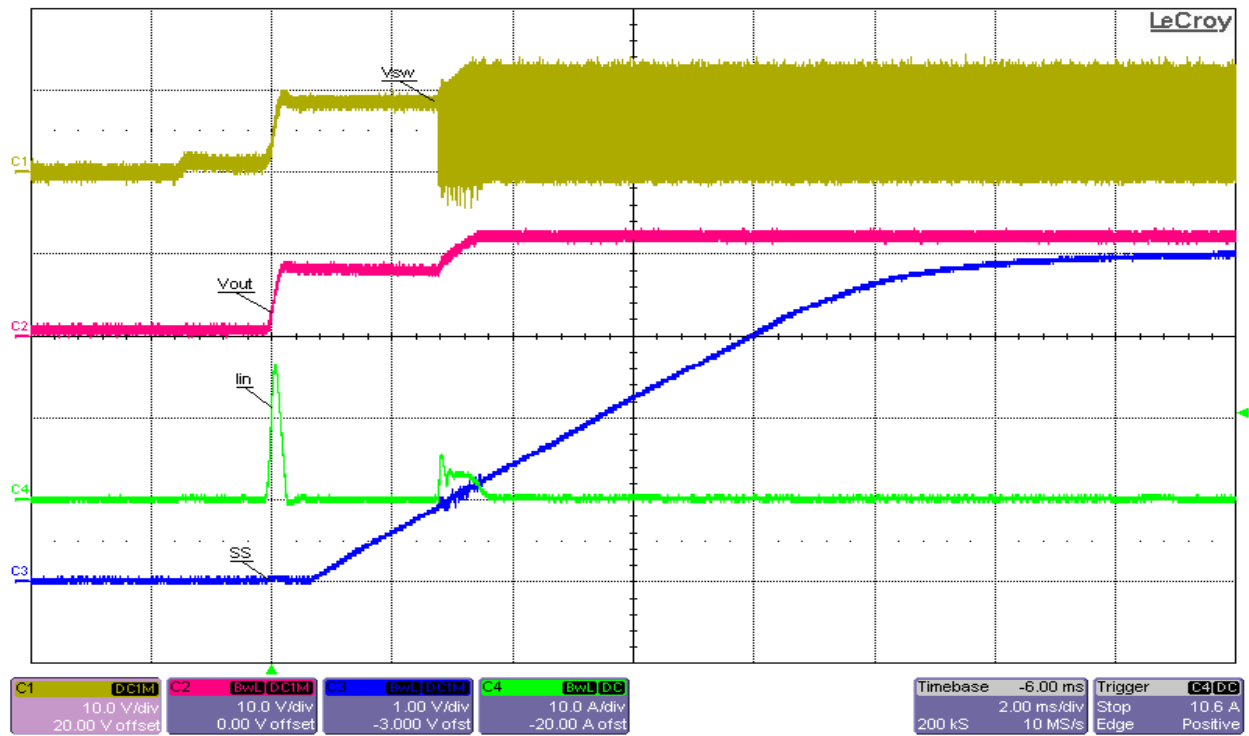
Startup into 6A Full Load at 5Vin, Ch1-Vsw, Ch2-Vout, Ch3-SS, Ch4-lin



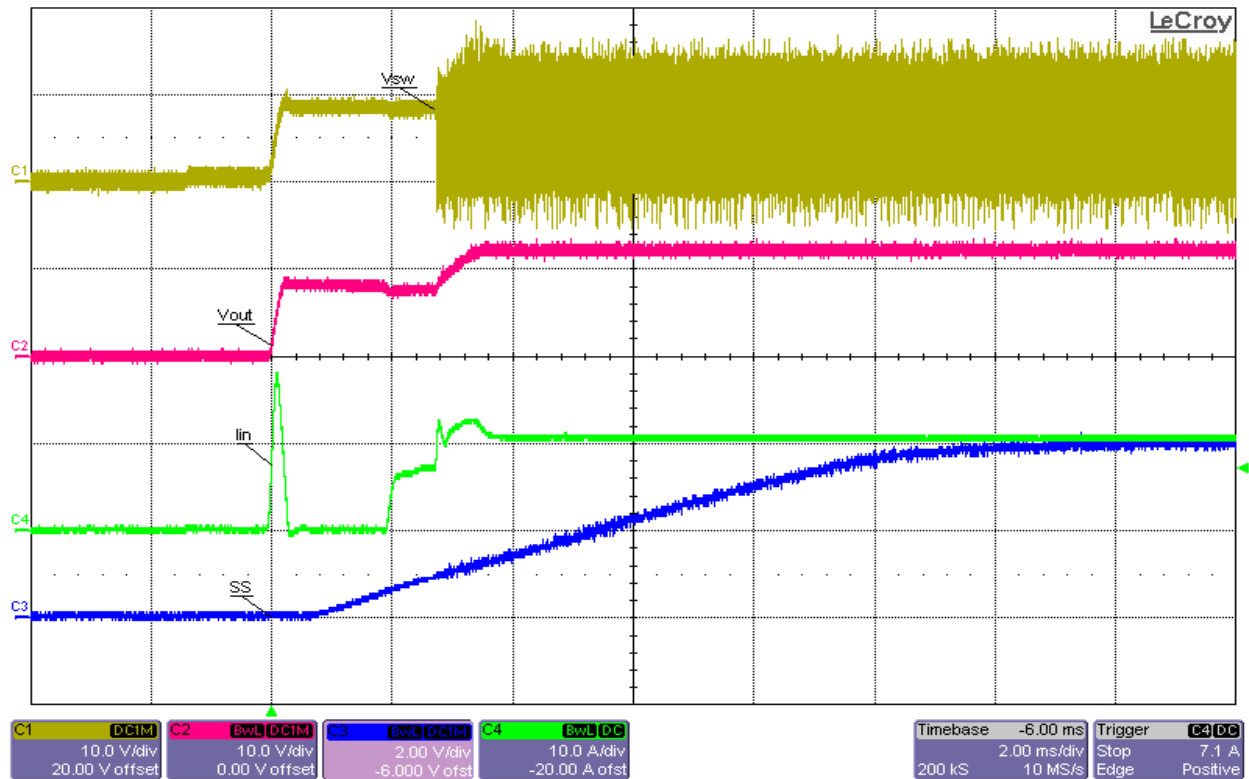
Startup into no Load at 6.8Vin, Ch1-Vsw, Ch2-Vout, Ch3-SS, Ch4-lin



Startup into 6A Full Load at 6.8Vin, Ch1-Vsw, Ch2-Vout, Ch3-SS, Ch4-lin

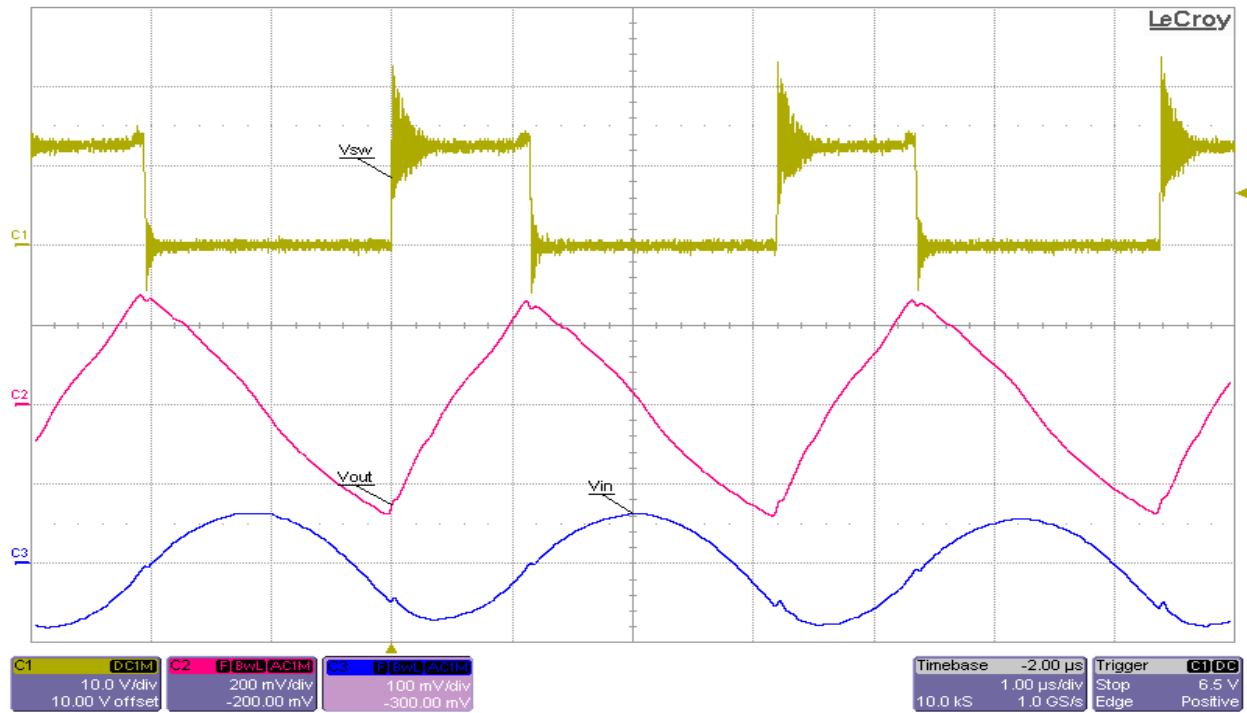


Startup into no Load at 8.6V_{in}, Ch1-V_{sw}, Ch2-V_{out}, Ch3-SS, Ch4-I_{in}

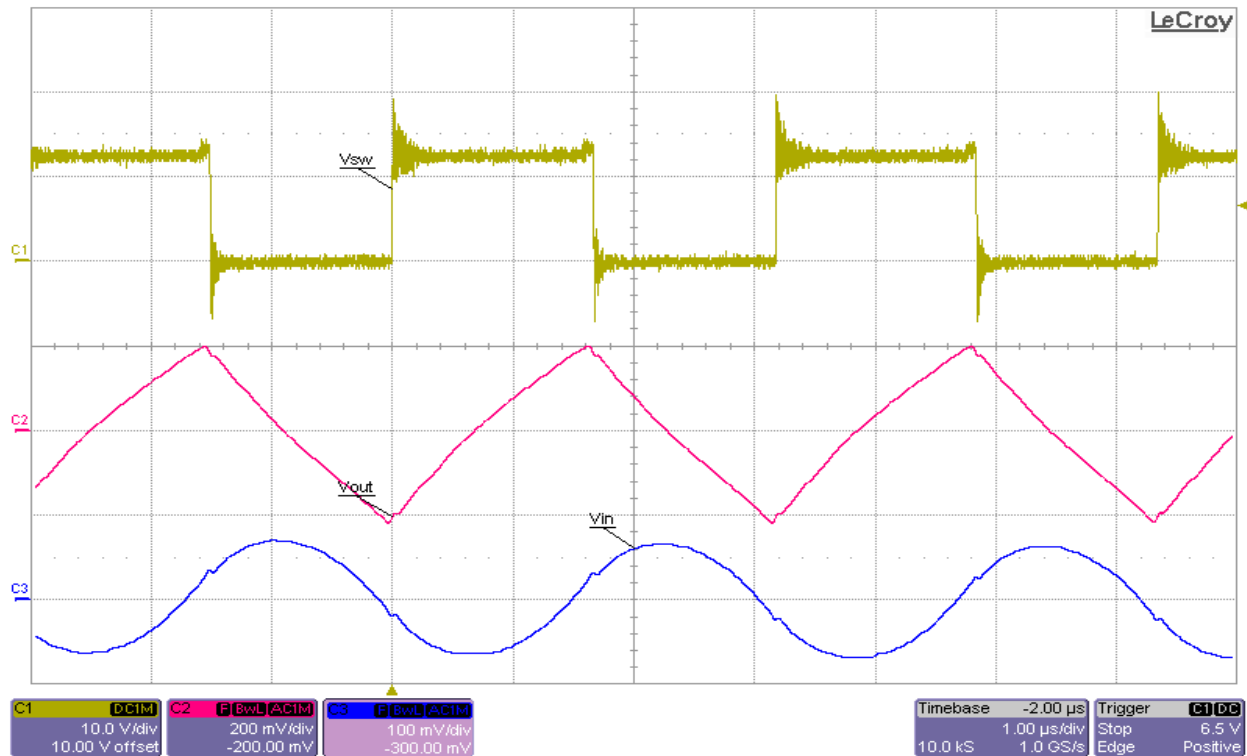


Startup into 6A Full Load at 8.6V_{in}, Ch1-V_{sw}, Ch2-V_{out}, Ch3-SS, Ch4-I_{in}

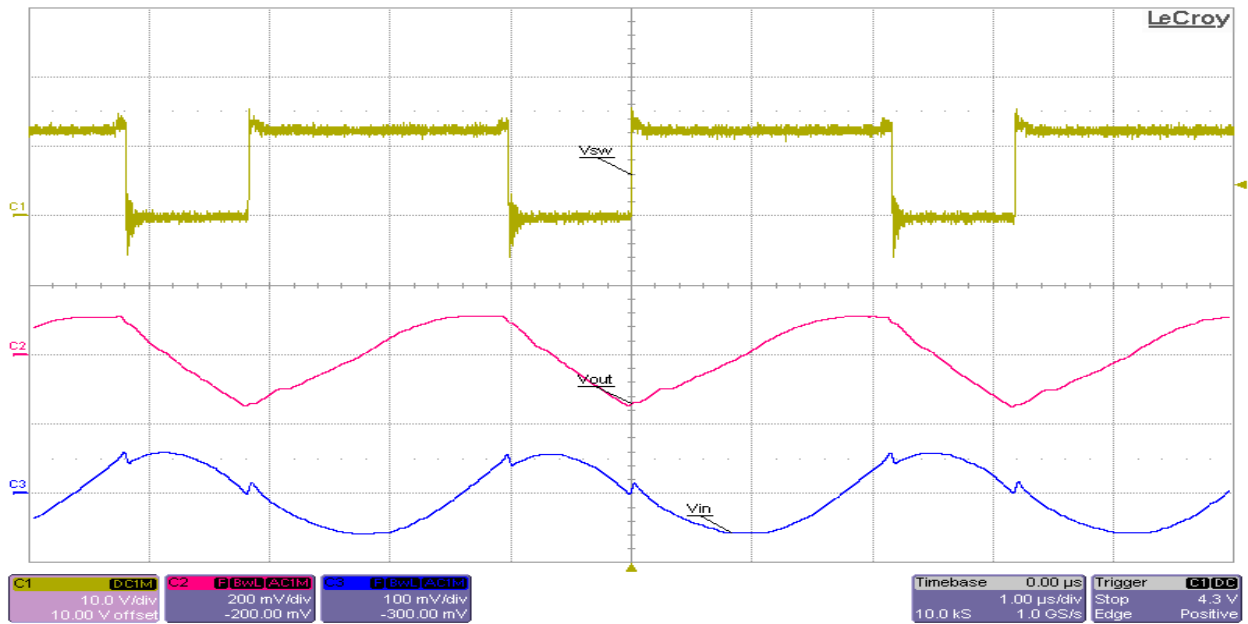
6.3 Switch Node Voltage and Input/Output Ripple



Switch Node Voltage of 5Vin and Full Load. Ch2-Vout (AC Coupled), Ch1-SW, Ch3- Vin (AC Coupled).



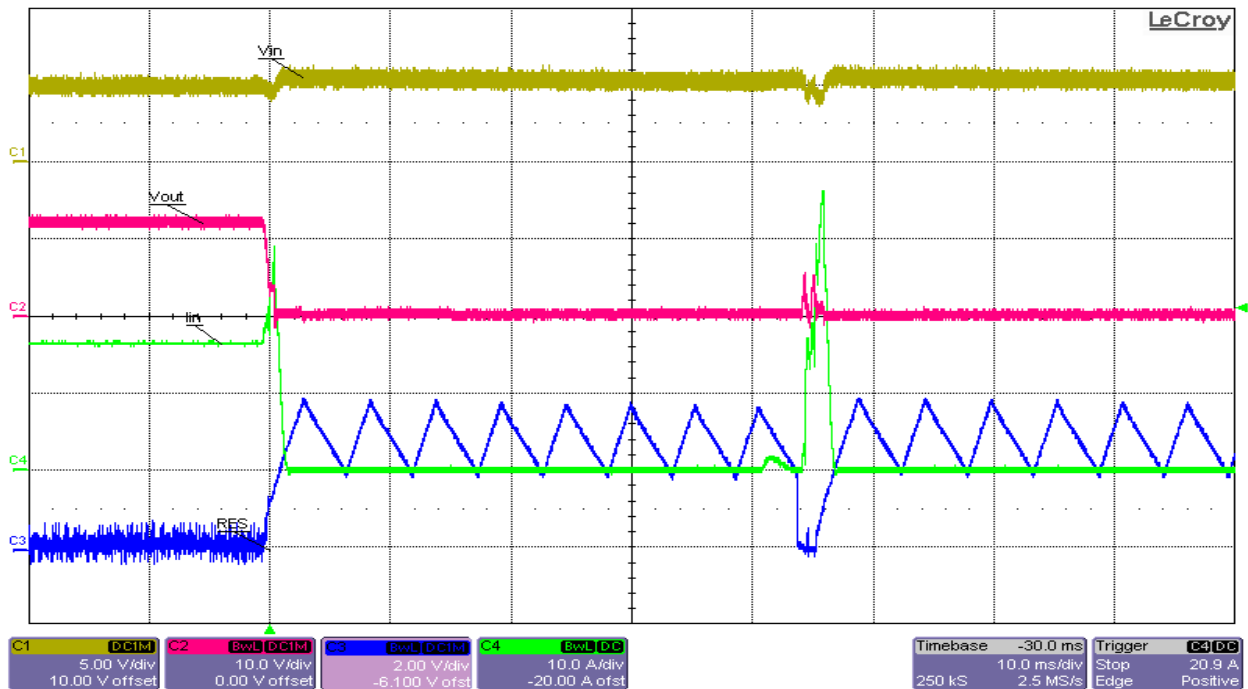
Switch Node Voltage of 6.8Vin and Full Load. Ch2-Vout (AC Coupled), Ch1-SW, Ch3- Vin (AC Coupled).



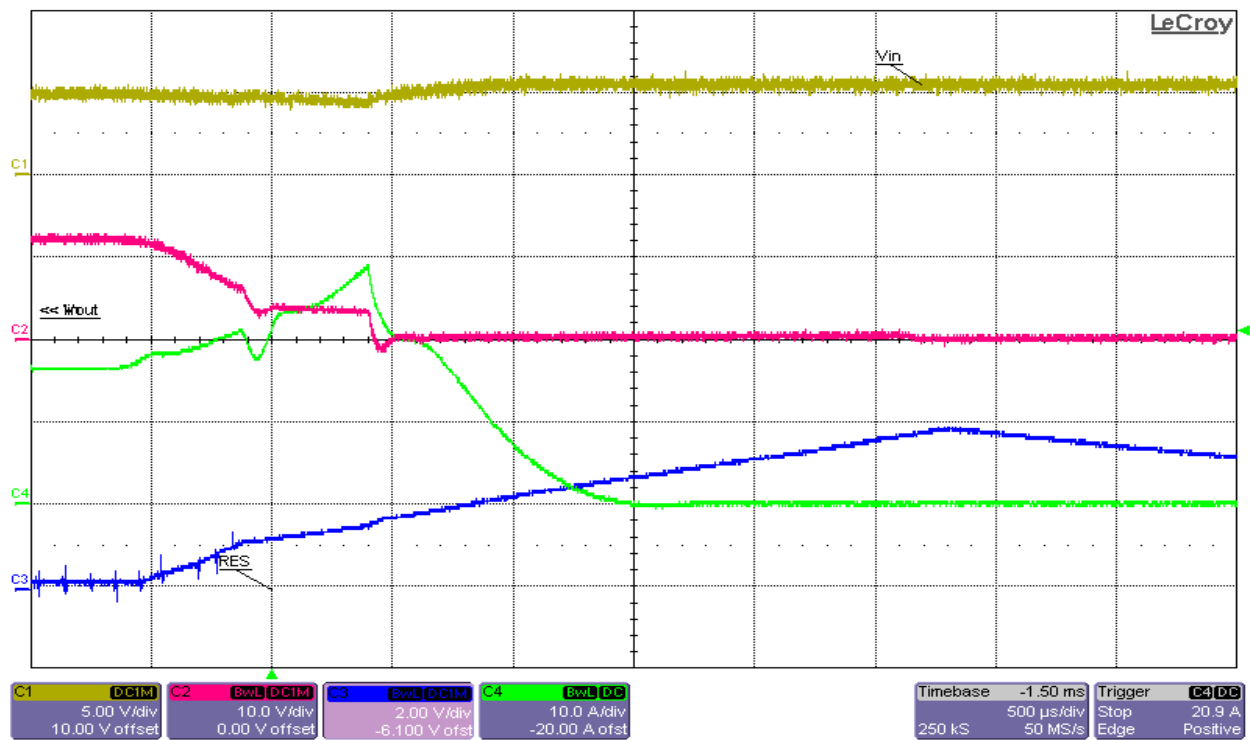
Switch Node Voltage of 8.6Vin and Full Load. Ch2-Vout (AC Coupled), Ch1-SW, Ch3- Vin (AC Coupled).

6.4 Short Circuit

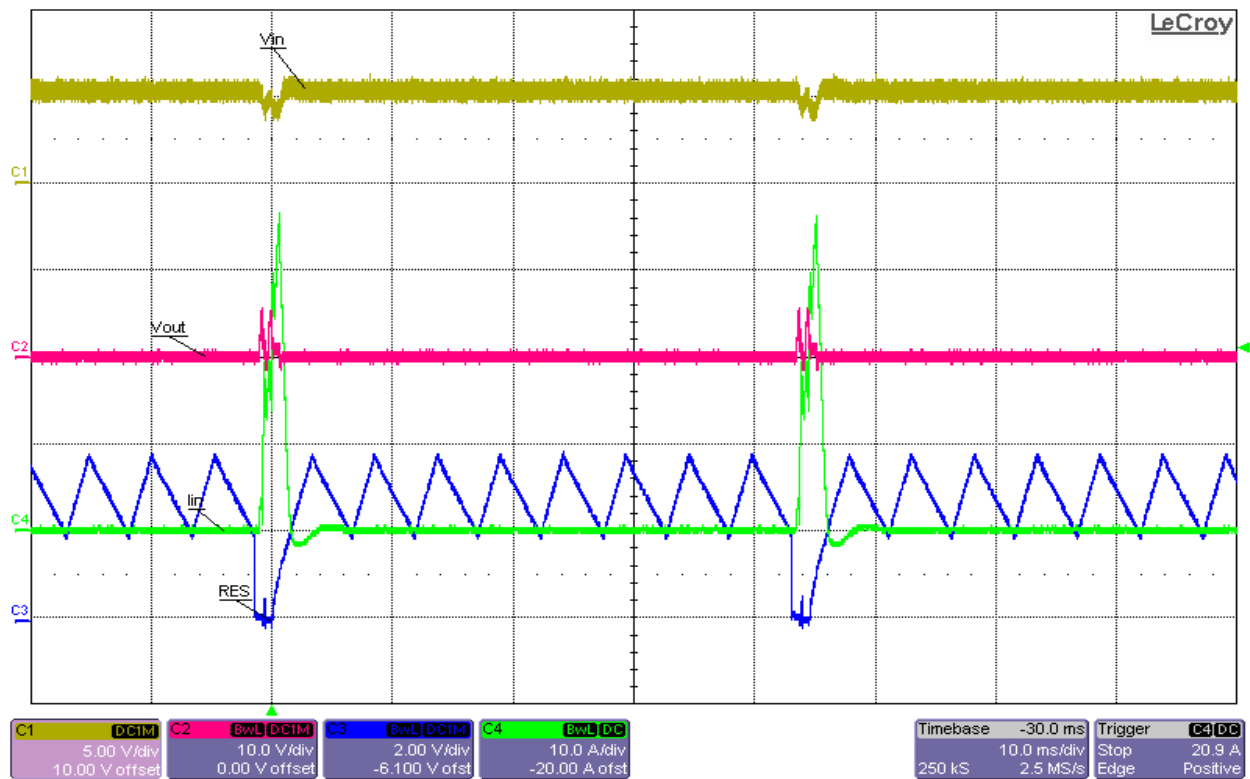
For input disconnection switch short circuit test, six 1500uF bulk caps are installed to damp input supply voltage ripple and wire inductance voltage spikes. Input supply and load need to be capable of sourcing and sinking 60A of current to properly trigger input disconnection switch function.



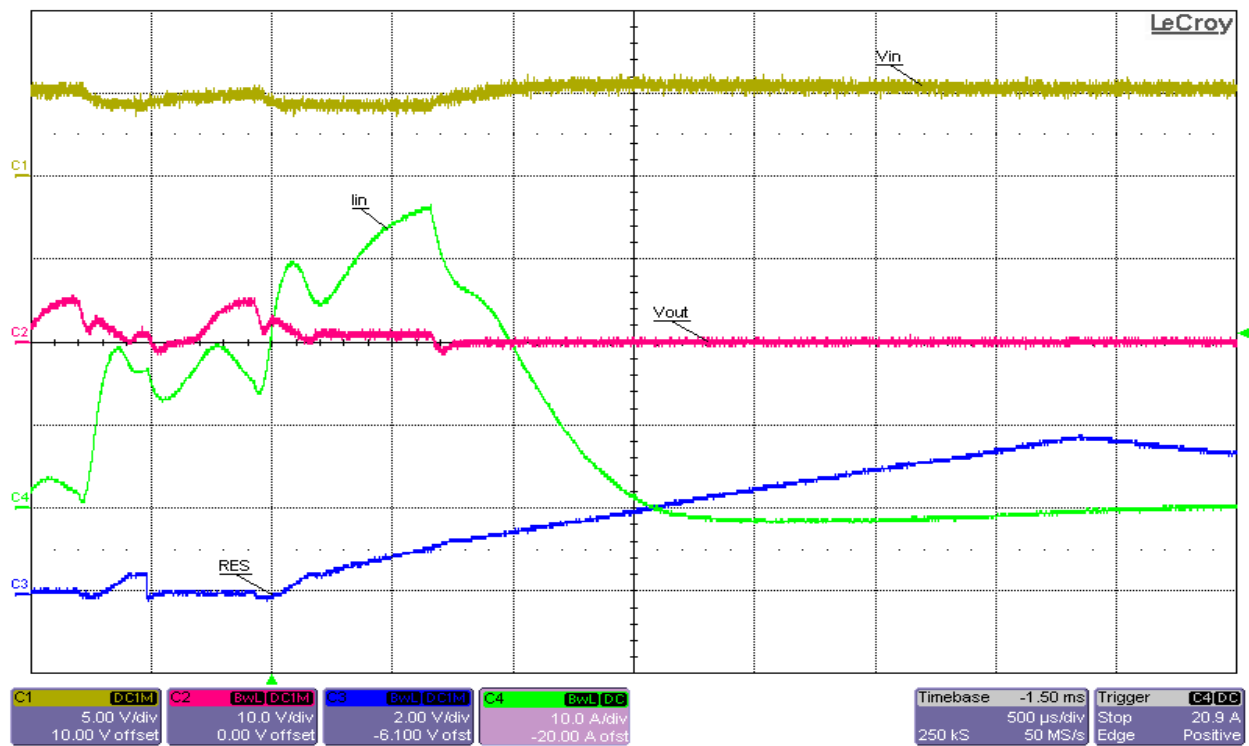
Initial Short Circuit at 5.3Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.



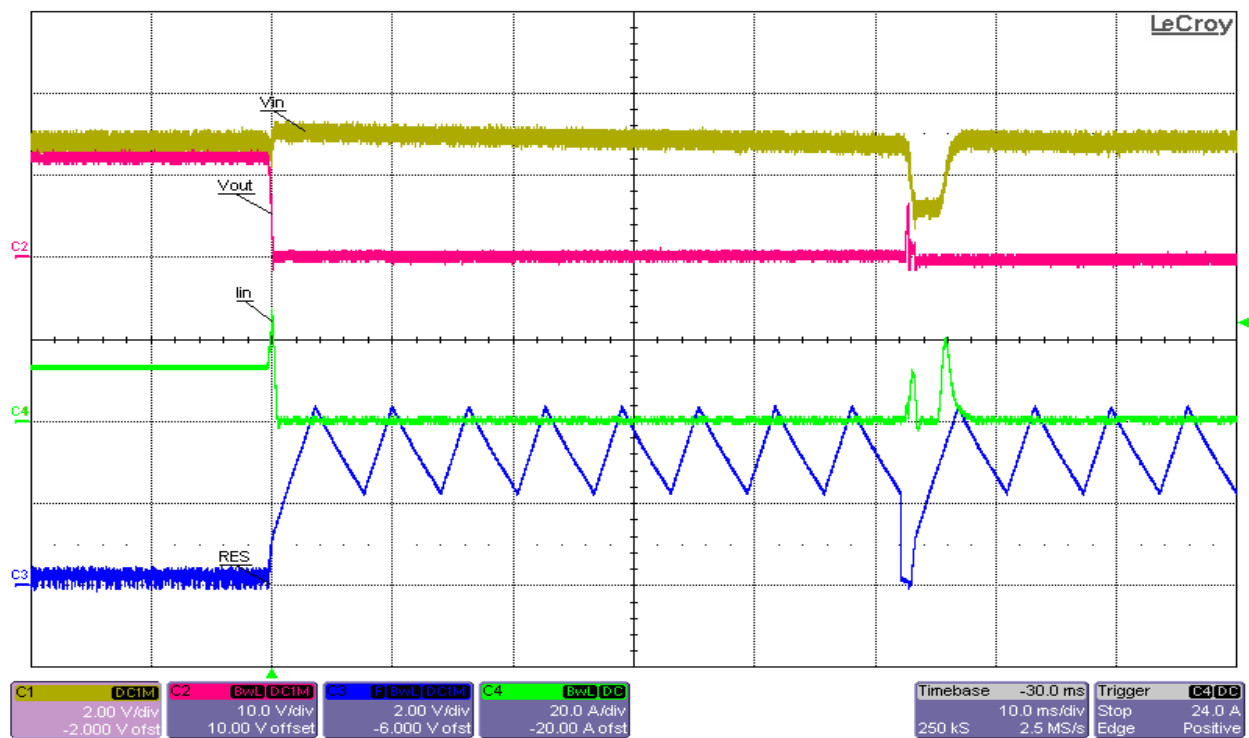
Initial Zoomed Short Circuit at 5.3Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.



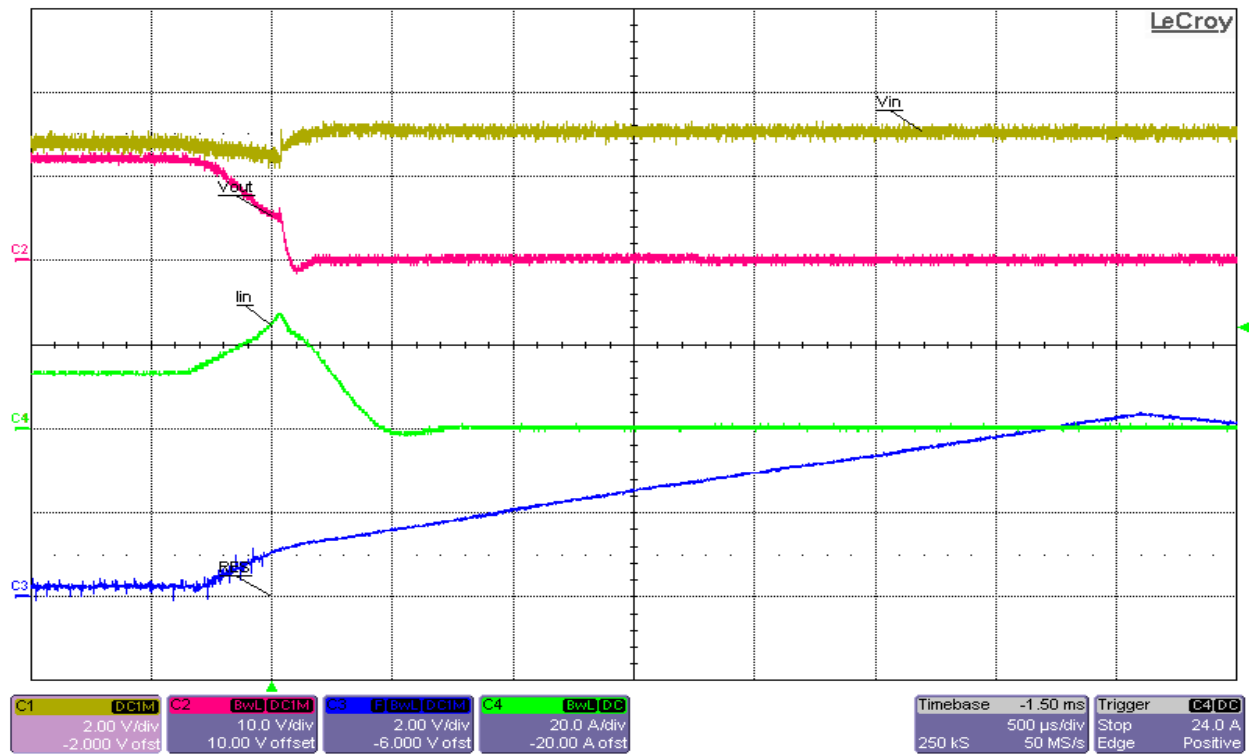
Continuous Short Circuit Hiccup Mode at 5.3Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.



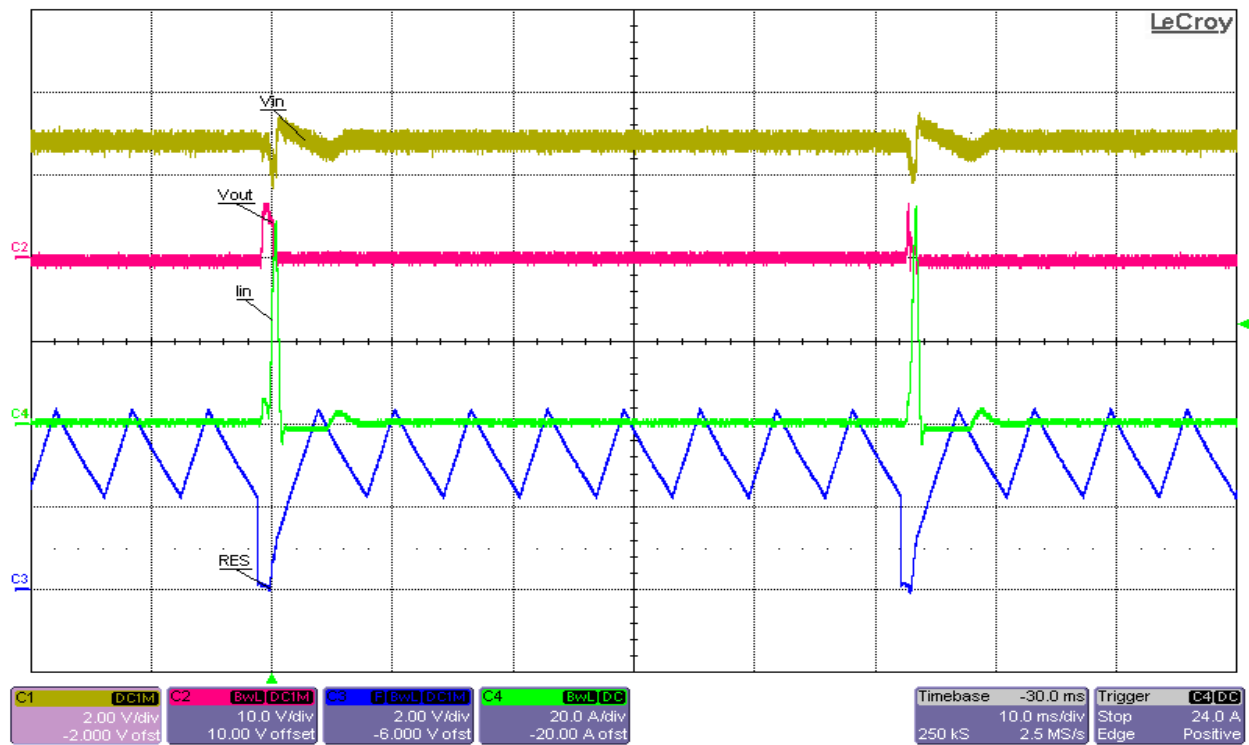
Continuous Zoomed Short Circuit Hiccup Mode at 5.3V_{in} at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-lin.



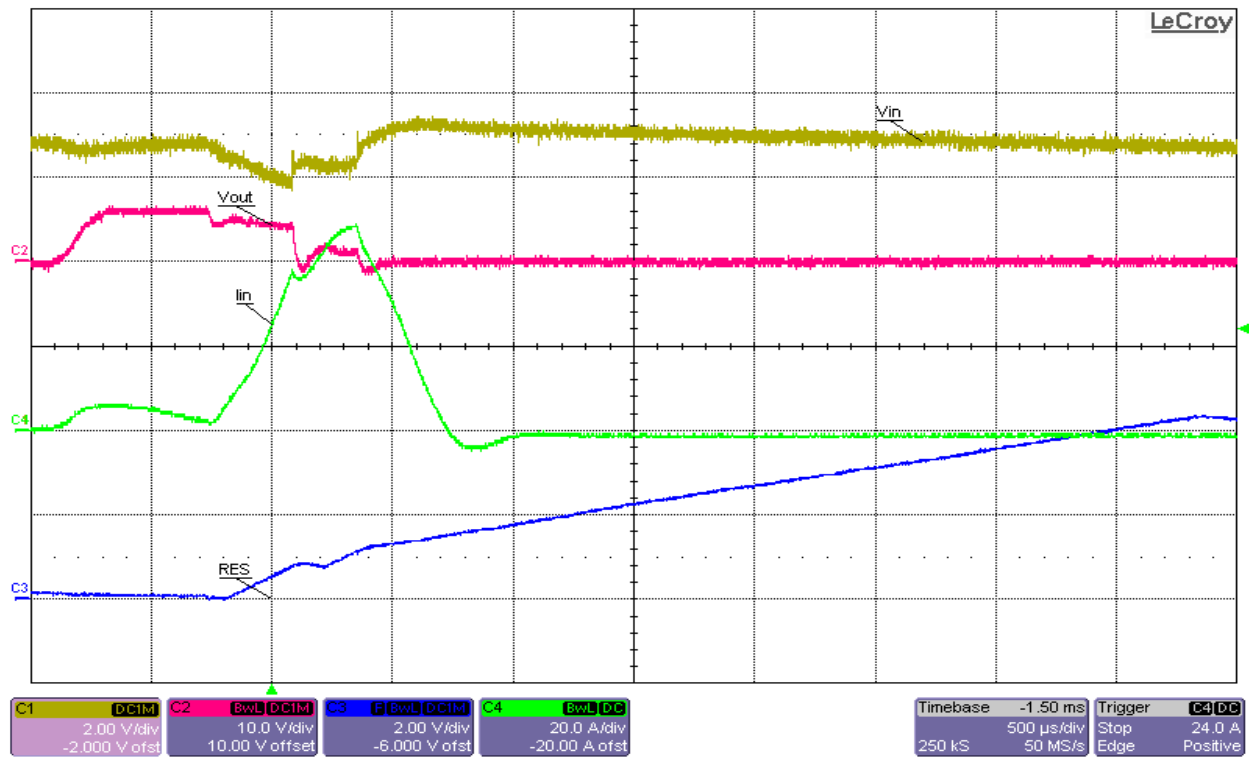
Initial Short Circuit at 6.8V_{in} at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-lin.



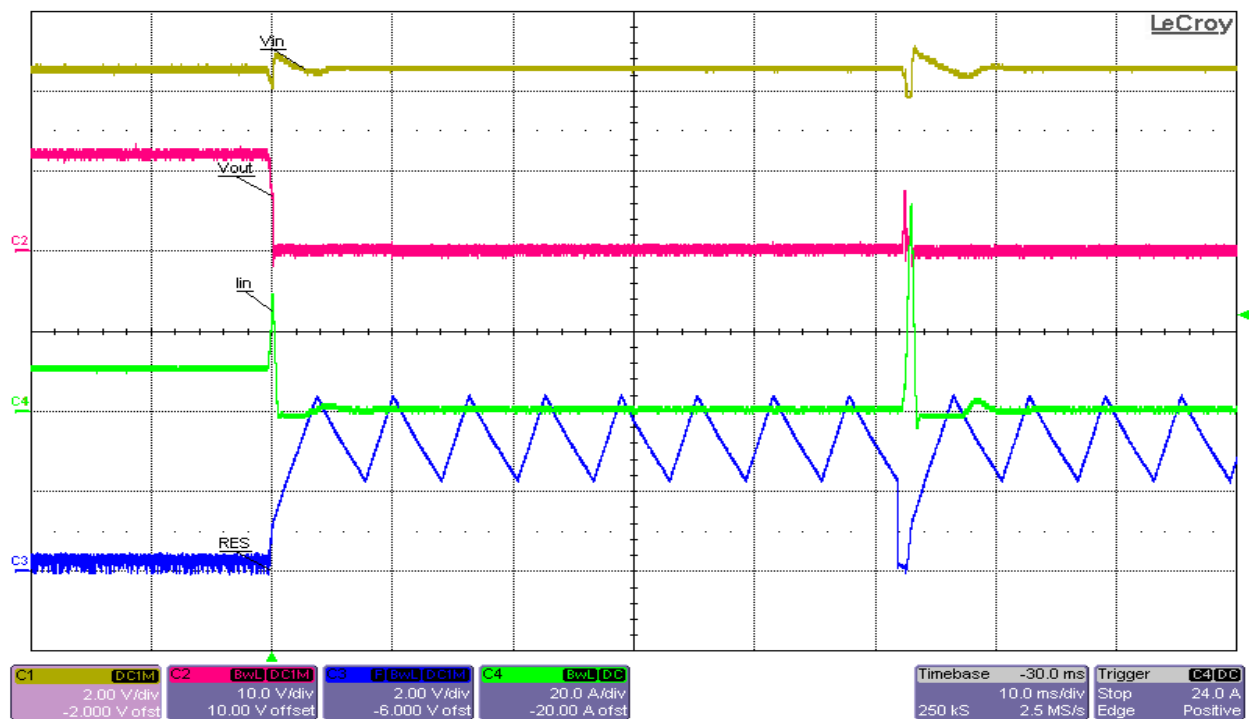
Initial Zoomed Short Circuit at 6.8Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.



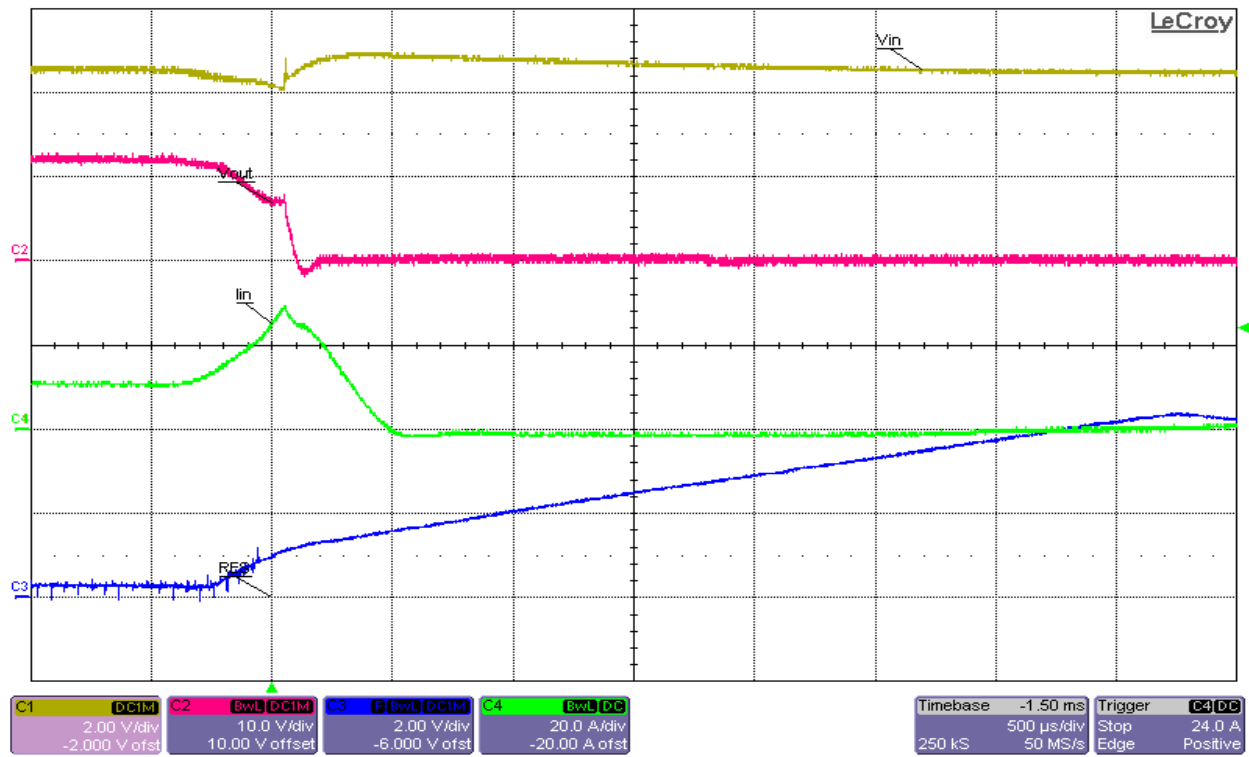
Continuous Short Circuit Hiccup Mode at 6.8Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.



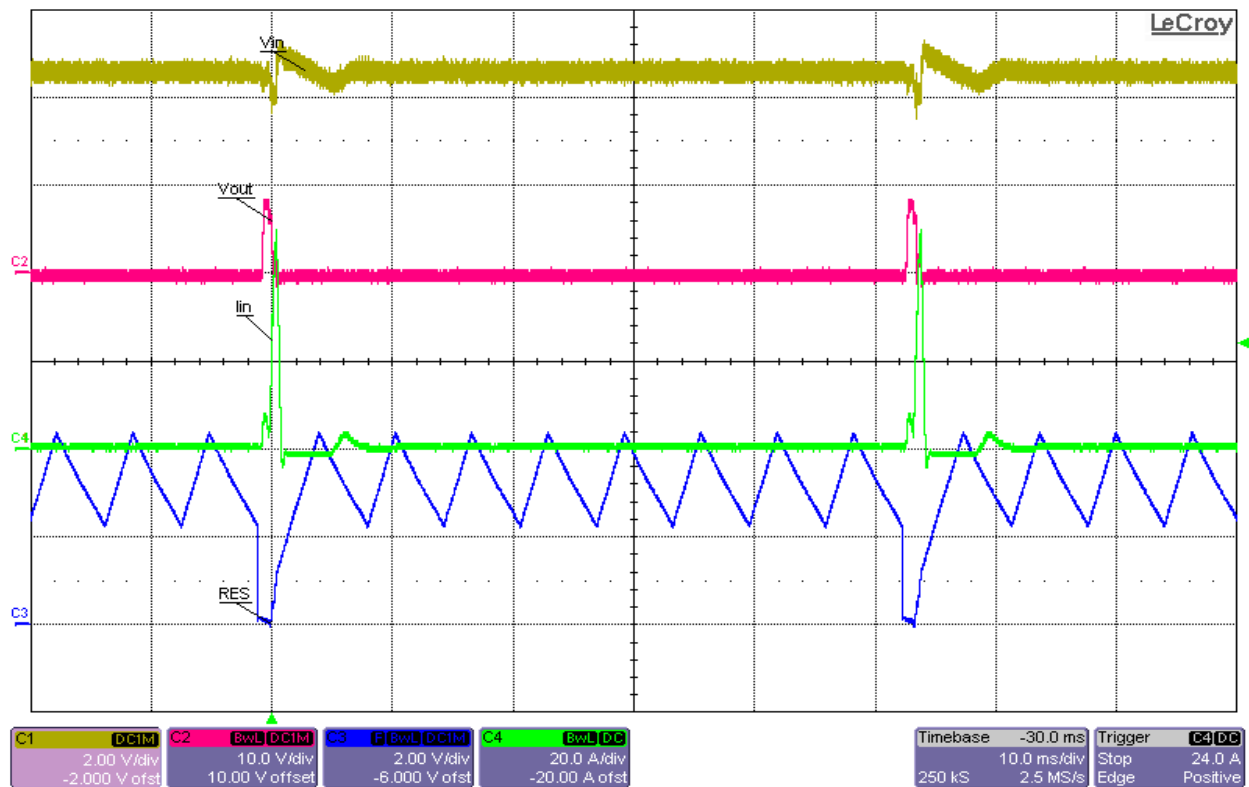
Continuous Zoomed Short Circuit Hiccup Mode at 6.8V_{in} at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-I_{in}.



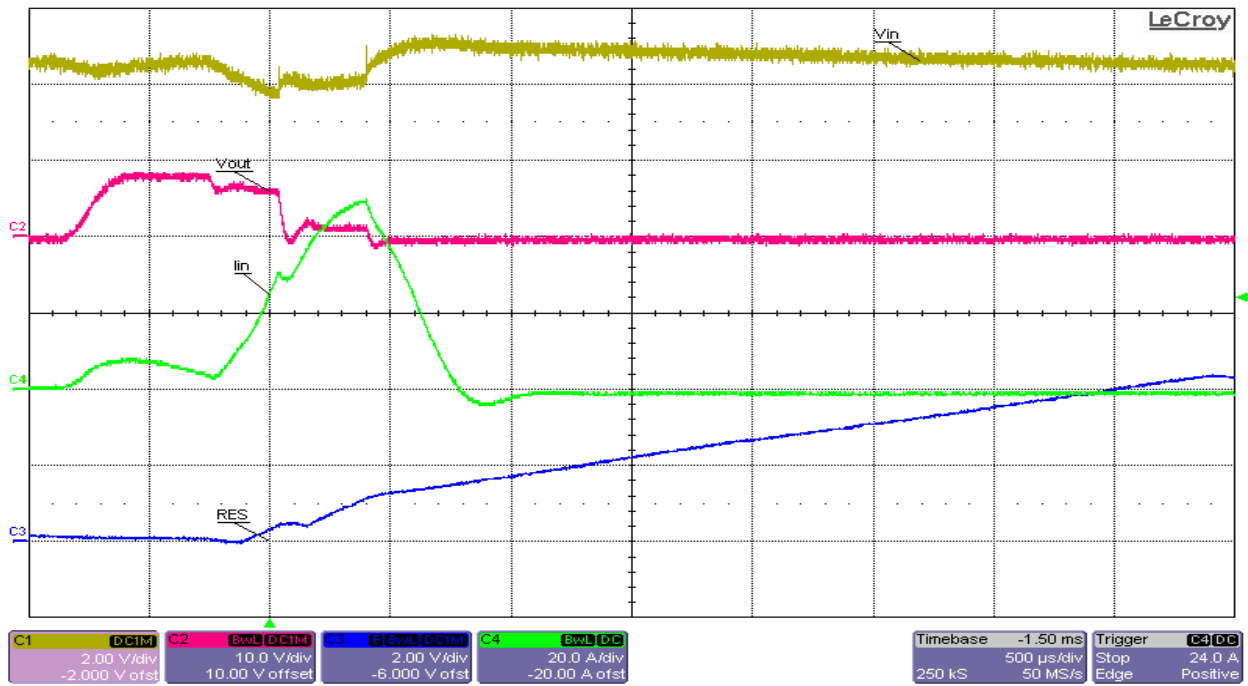
Initial Short Circuit at 8.6V_{in} at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-I_{in}.



Initial Zoomed Short Circuit at 8.6Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.

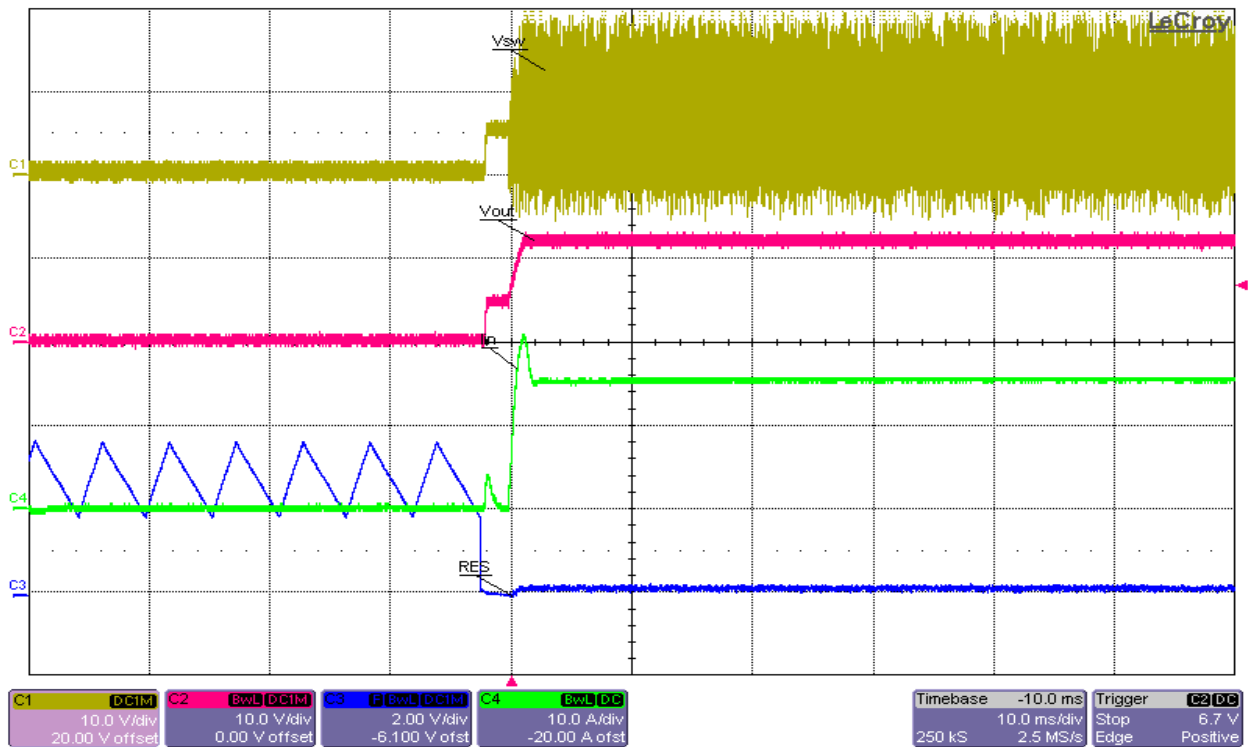


Continuous Short Circuit Hiccup Mode at 8.6Vin at 6A Full Load. Ch1- Vin, Ch2- Vout, Ch3- RES, Ch4-Iin.

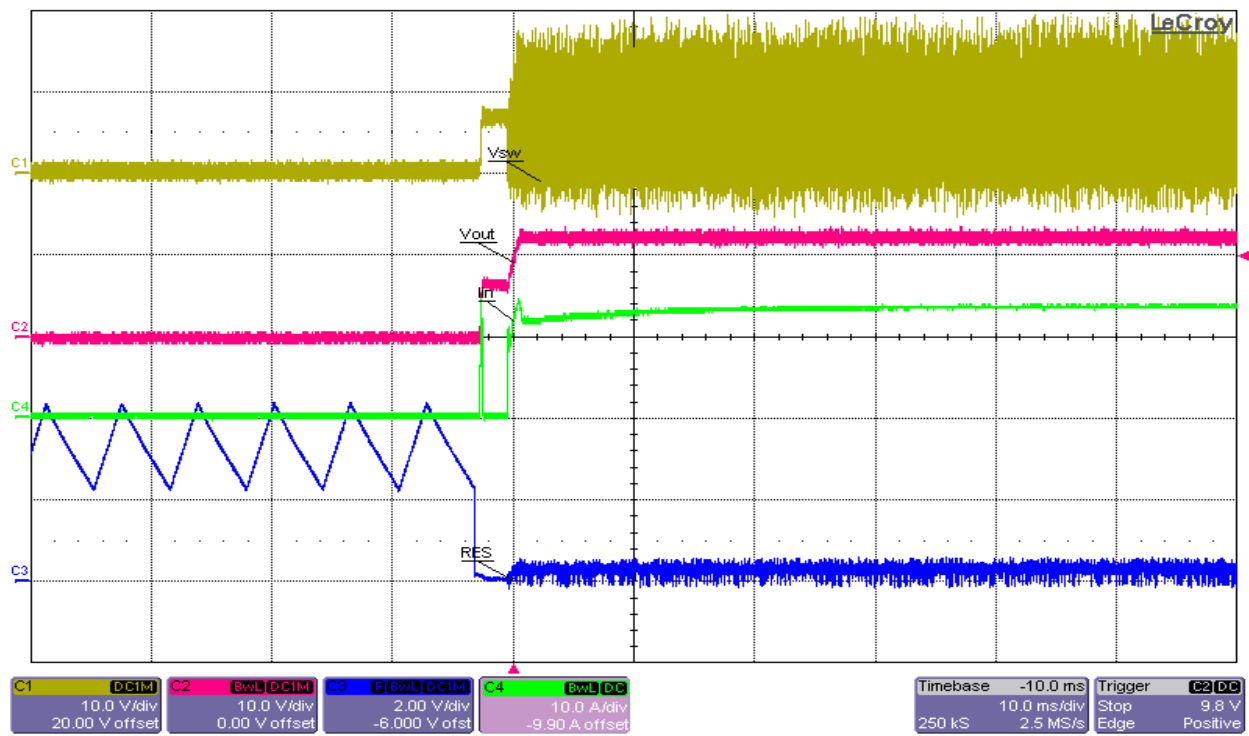


Continuous Zoomed Short Circuit Hiccup Mode at 8.6V_{in} at 6A Full Load. Ch1- V_{in}, Ch2- V_{out}, Ch3- RES, Ch4-I_{in}.

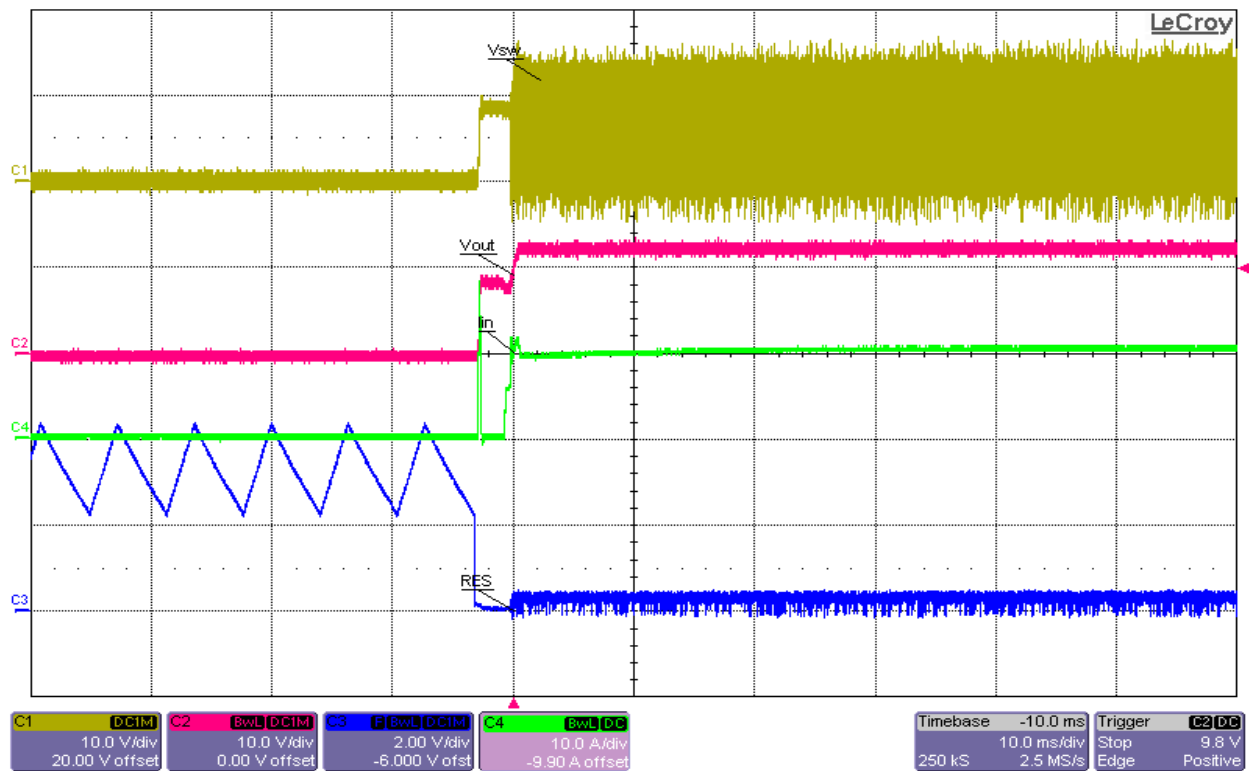
6.5 Short Circuit Recovery



Short Circuit Recovery at 5.3V_{in} and 6A Full Load. Ch1- V_{sw}, Ch2- V_{out}, Ch3- RES, Ch4-I_{in}.

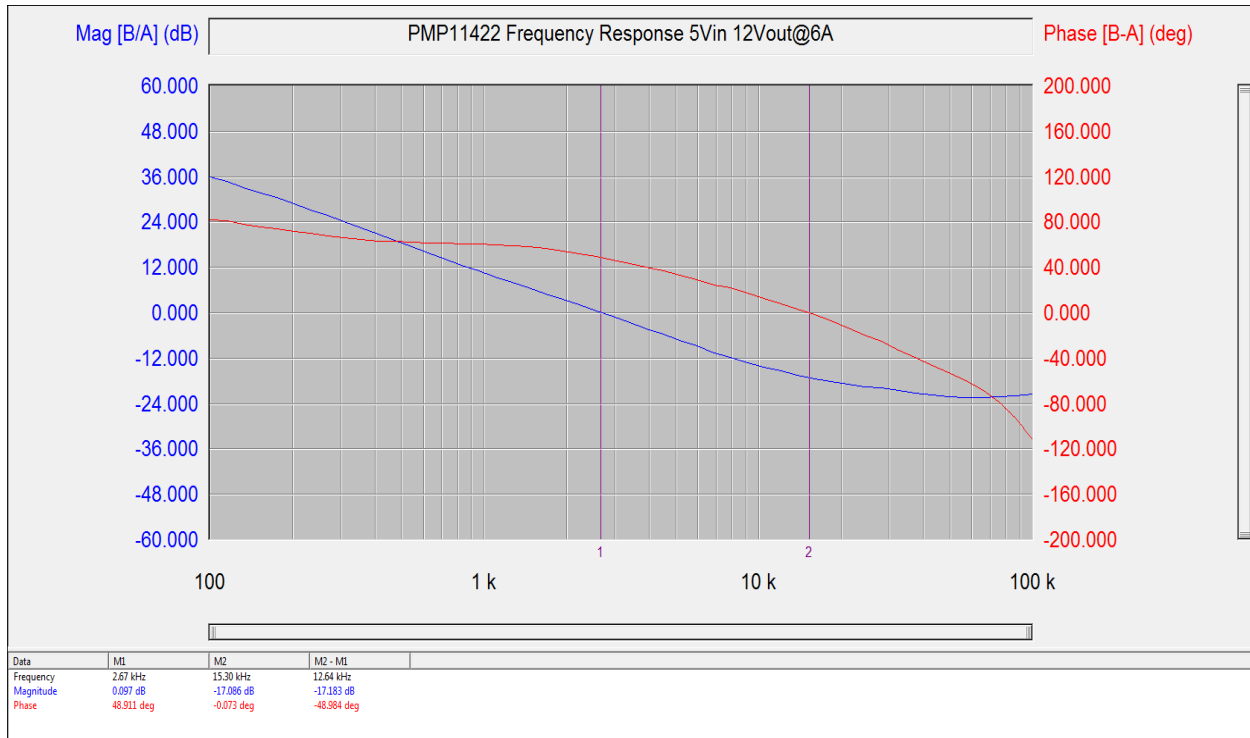


Short Circuit Recovery at 6.8Vin and 6A Full Load. Ch1- Vsw, Ch2- Vout, Ch3- RES, Ch4-Iin.

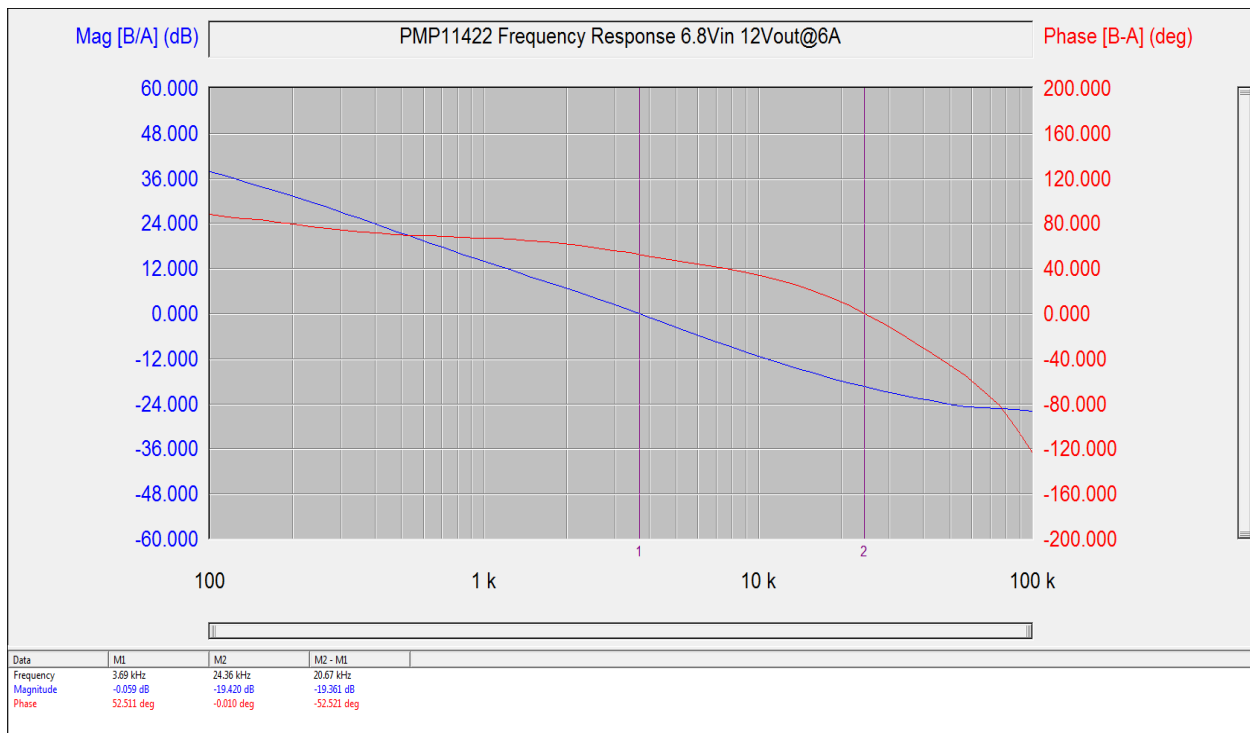


Short Circuit Recovery at 8.6Vin and 6A Full Load. Ch1- Vsw, Ch2- Vout, Ch3- RES, Ch4-Iin.

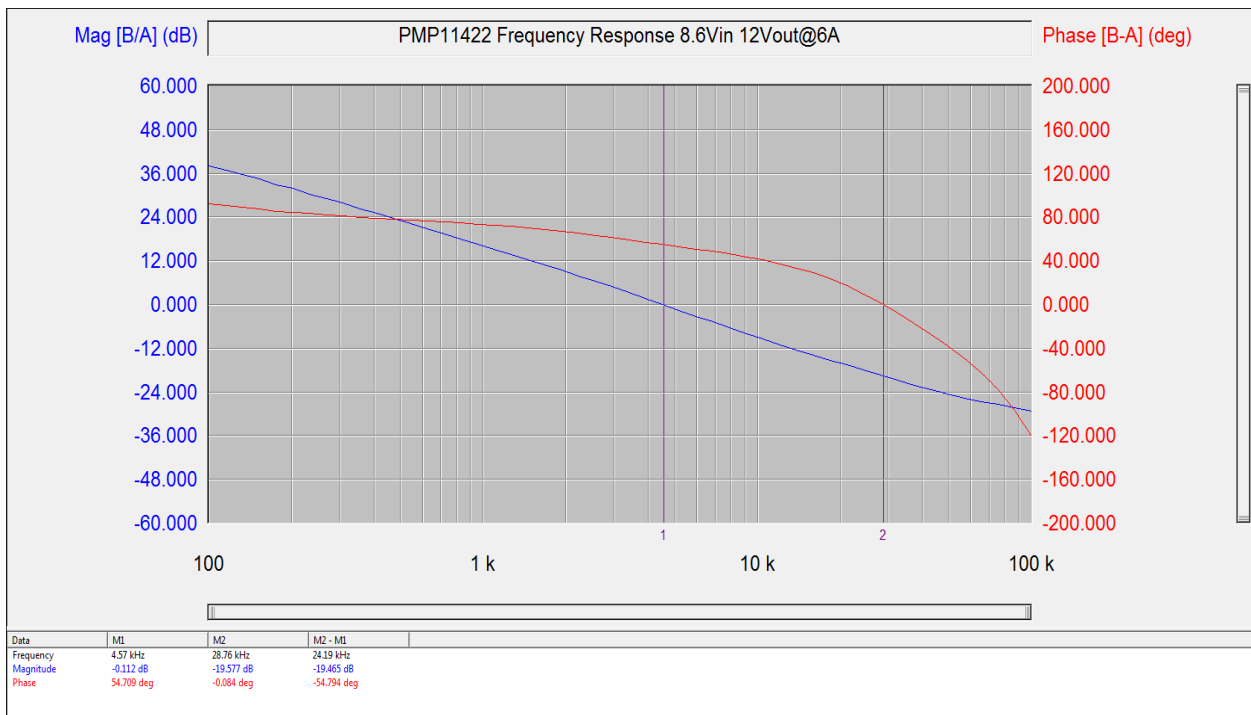
6.6 Frequency Analysis



Control Loop Analysis at 5Vin 6A Full Load, Phase Margin of 49 deg, Gain Margin of 17dB.

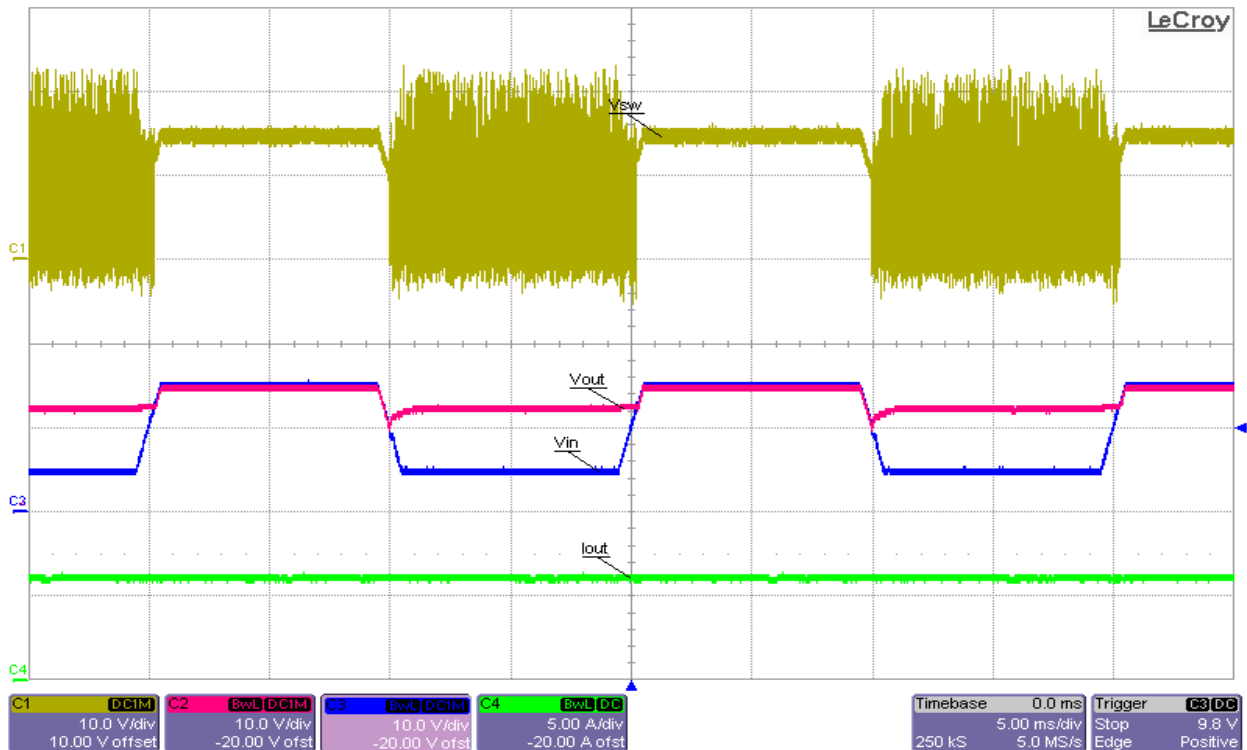


Control Loop Analysis at 6.8Vin 6A Full Load, Phase Margin of 52.5 deg, Gain Margin of 19.2dB.

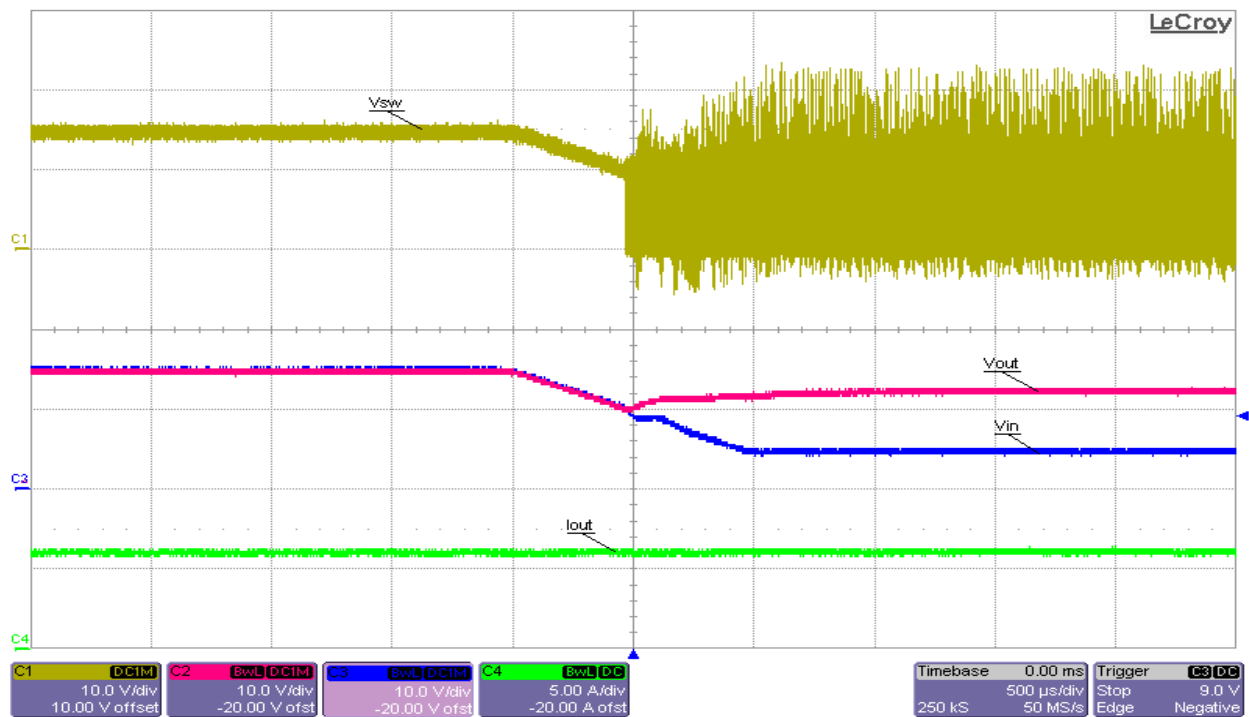


Control Loop Analysis at 8.6Vin 6A Full Load, Phase Margin of 54.3 deg, Gain Margin of 19.6dB.

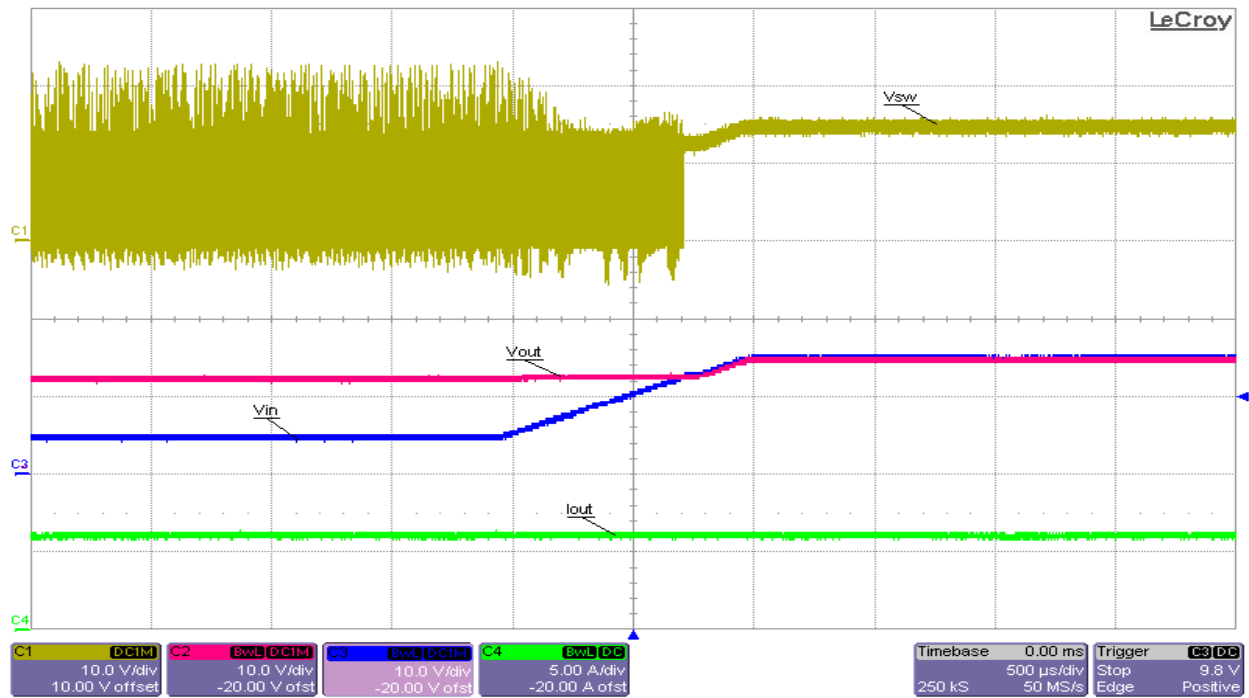
6.7 By-Pass Feature



6A Load Bypass operation, Vin steps from 5V to 15V, Ch1 – Vsw, Ch2 – Vout, Ch3 – Vin, Ch4 - Iout.



6A Load Bypass operation Falling Edge, Vin steps from 5V to 15V, Ch1 – Vsw, Ch2 – Vout, Ch3 – Vin, Ch4 - Iout.



6A Load Bypass operation Rising Edge, Vin steps from 5V to 15V, Ch1 – Vsw, Ch2 – Vout, Ch3 – Vin, Ch4 - Iout.

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