Test Data
For PMP10516
10/15/2014

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1. Design Specifications

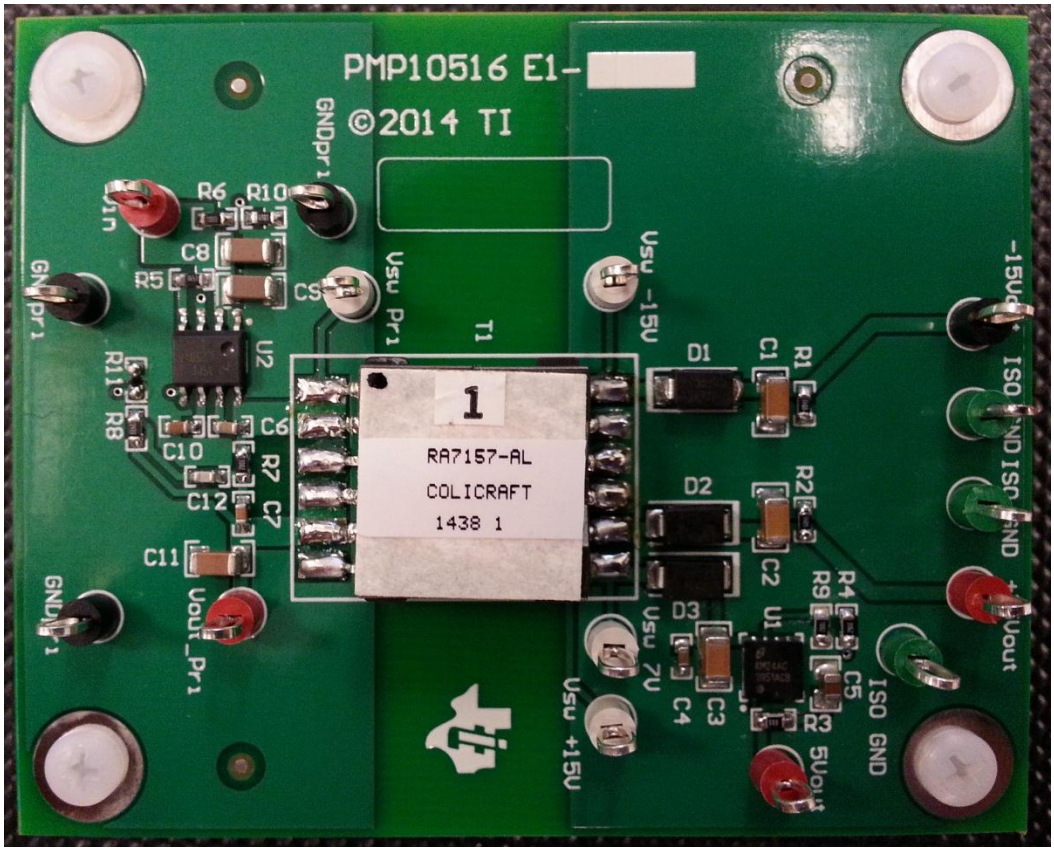
Vin Minimum	**20.4VDC**
Vin Maximum	**28.8VDC (40VDC Peak)**
Vout1	**+15VDC @ 200mA**
Vout2	**-15VDC @ 60mA**
Vout3	**+5VDC @ 100mA**
Nominal Switching Frequency	**≈ 315KHz**

2. Circuit Description

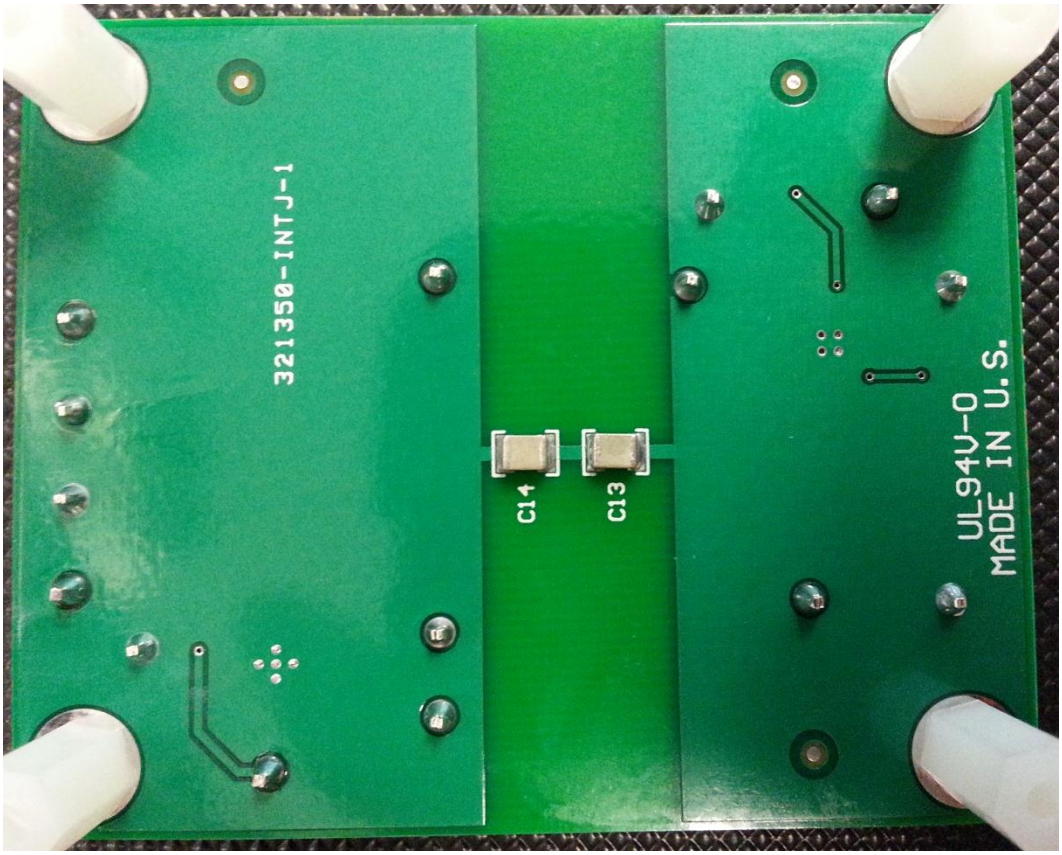
PMP10516 is an Isolated Flybuck Converter using the LM25017 regulator IC. The design accepts an input voltage of 20.4Vin to 28.8Vin (40Vin Max. Peak) and provides three isolated outputs: +15Vout capable of supplying 200mA, -15Vout capable of supplying 60mA, and +5Vout capable of supplying 100mA. The +5Vout rail is regulated for precision using the LP2951 linear regulator. The nominal switching frequency of the design is 315KHz. The board is a 4-layer PCB with 1 oz. copper on the top and bottom layers, and 0.5oz. Copper for the two mid-layers. All tests for this report were performed at 20.4Vin and 28.8Vin. Functional tests were performed at 40Vin and showed proper operation of the circuit.

3. PMP10516 Board Photos

Board Dimensions: 2.85” x 2.3”

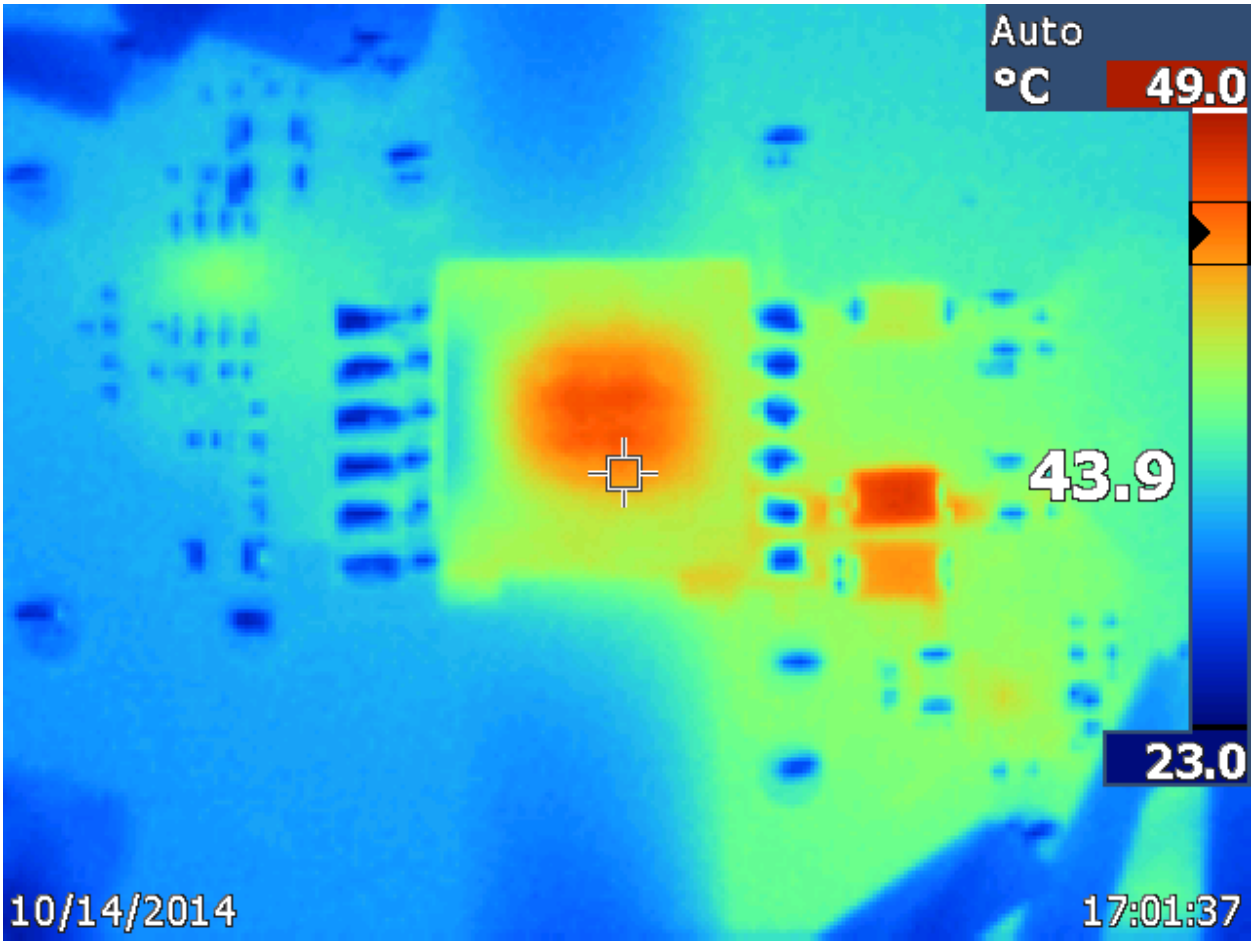


Board Photo (Top)

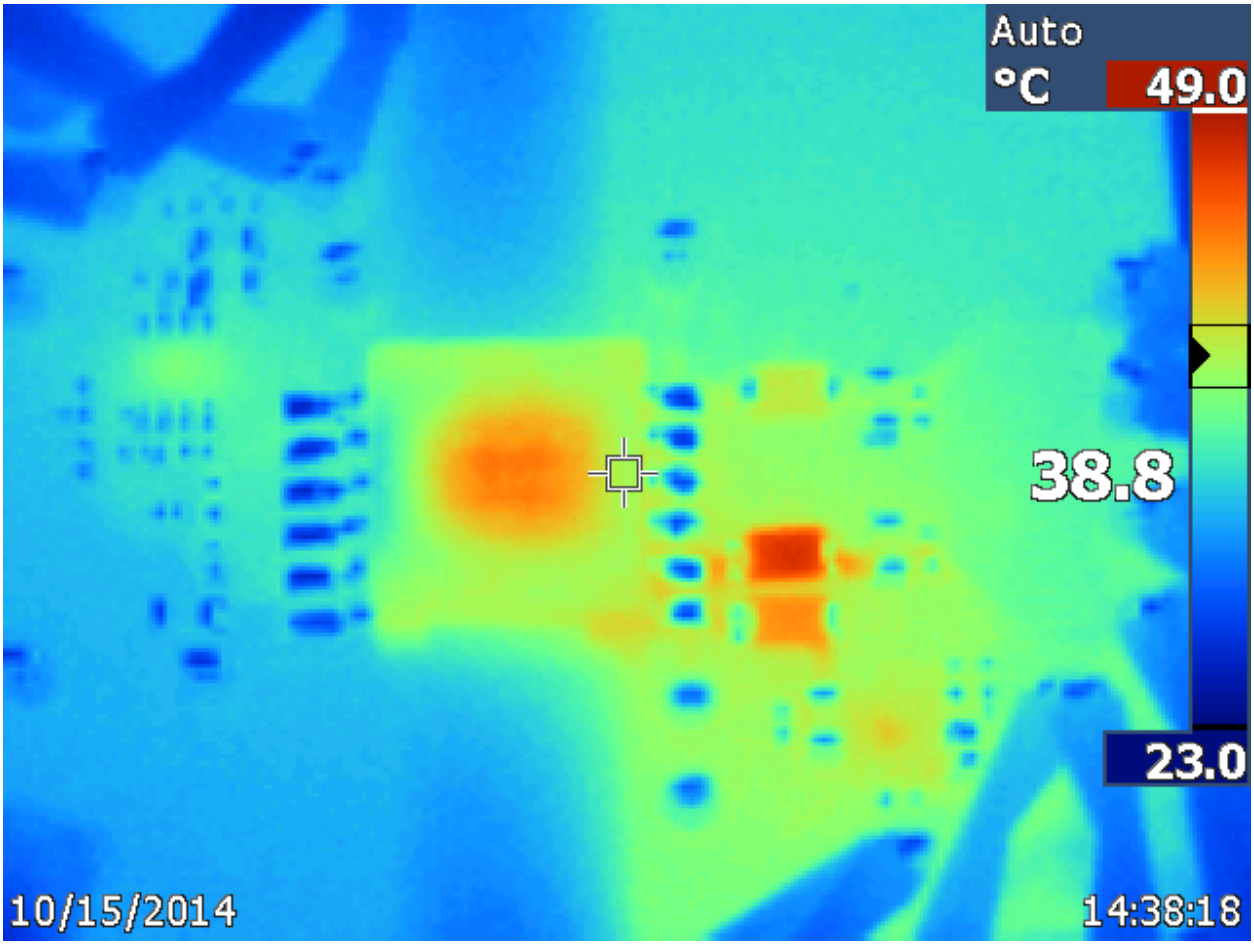


Board Photo (Bottom)

4. Thermal Data



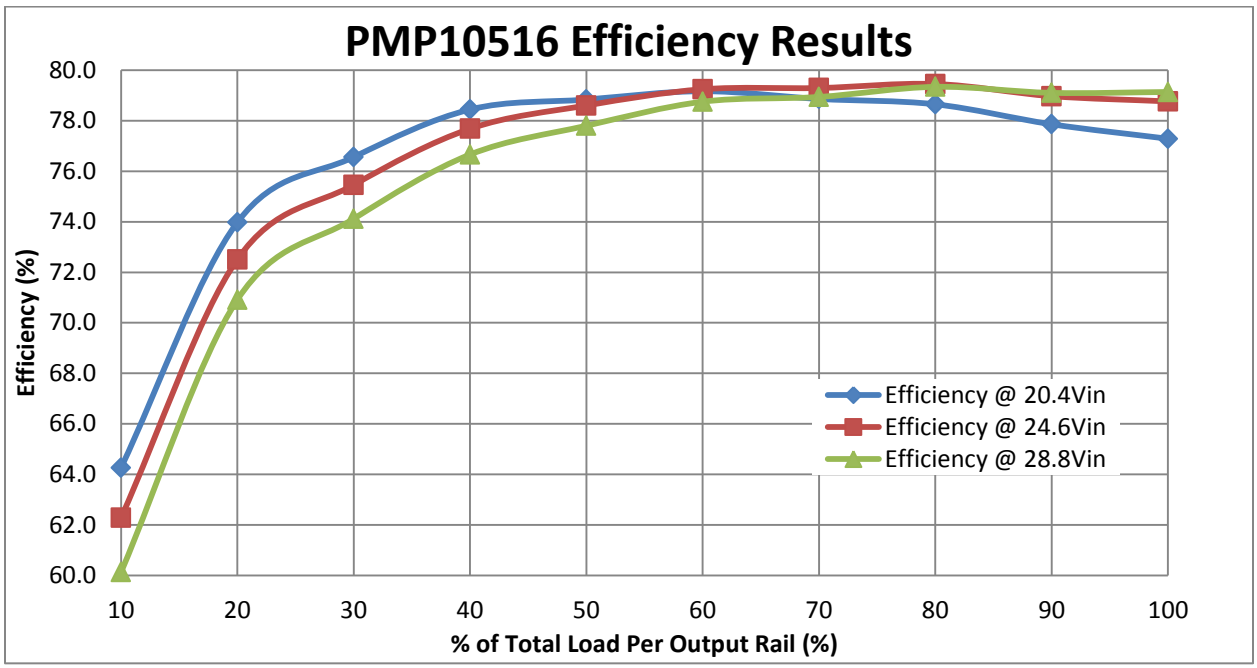
IR Thermal Image Taken at Steady State at 20.4Vin and All Rails at Full Load



IR Thermal Image Taken at Steady State at 28.8Vin and All Rails at Full Load

5. Efficiency

5.1 Efficiency Chart



5.2 Efficiency Data

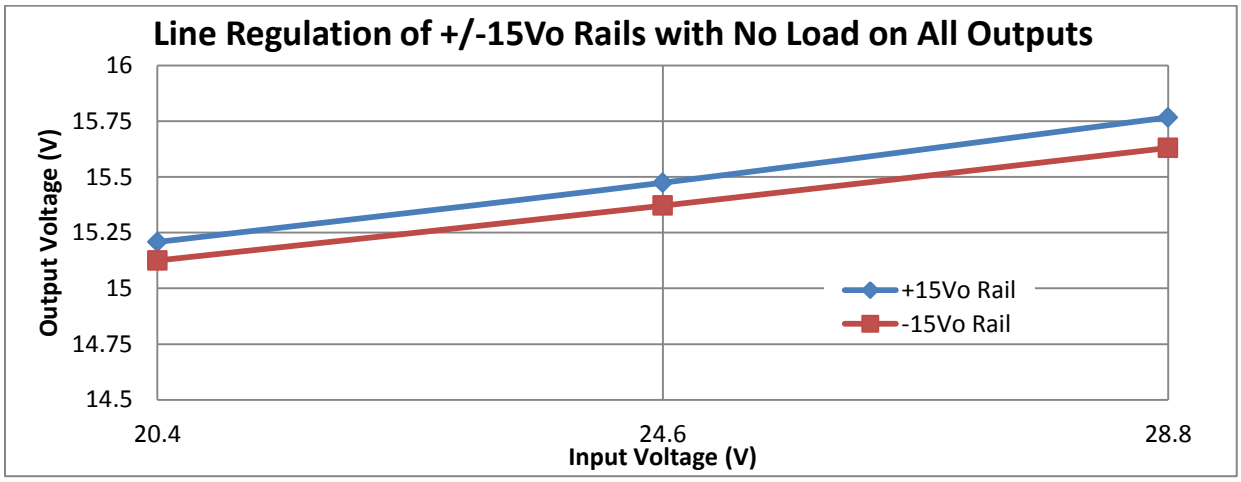
Vin (V)	Iin (A)	+15Vout (V)	+15V Iout (A)	-15Vout (V)	-15V Iout (A)	5Vout (V)	5V Iout (A)	Pin (W)	+15V Pout (W)	-15V Pout (W)	5V Pout (W)	Pout Total (W)	Ploss (W)	Efficiency (%)	% Load Per Output Rail
20.4	0.032	14.903	0.019	14.943	0.006	5.126	0.01	0.660	0.283	0.090	0.051	0.424	0.236	64.3	10
20.4	0.058	14.838	0.04	14.94	0.012	5.125	0.02	1.183	0.594	0.179	0.103	0.875	0.308	74.0	20
20.4	0.084	14.79	0.06	14.961	0.018	5.124	0.03	1.712	0.887	0.269	0.154	1.310	0.401	76.6	30
20.4	0.11	14.749	0.081	14.985	0.024	5.123	0.04	2.243	1.195	0.360	0.205	1.759	0.483	78.4	40
20.4	0.135	14.714	0.1	15.014	0.03	5.122	0.05	2.762	1.471	0.450	0.256	2.178	0.584	78.8	50
20.4	0.162	14.668	0.12	15.036	0.036	5.121	0.06	3.295	1.760	0.541	0.307	2.609	0.686	79.2	60
20.4	0.189	14.609	0.14	15.054	0.042	5.12	0.07	3.849	2.045	0.632	0.358	3.036	0.814	78.9	70
20.4	0.216	14.546	0.16	15.067	0.048	5.12	0.08	4.399	2.327	0.723	0.410	3.460	0.939	78.7	80
20.4	0.244	14.454	0.18	15.061	0.054	5.119	0.09	4.978	2.602	0.813	0.461	3.876	1.102	77.9	90
20.4	0.272	14.34	0.2	15.035	0.06	5.118	0.1	5.540	2.868	0.902	0.512	4.282	1.258	77.3	100

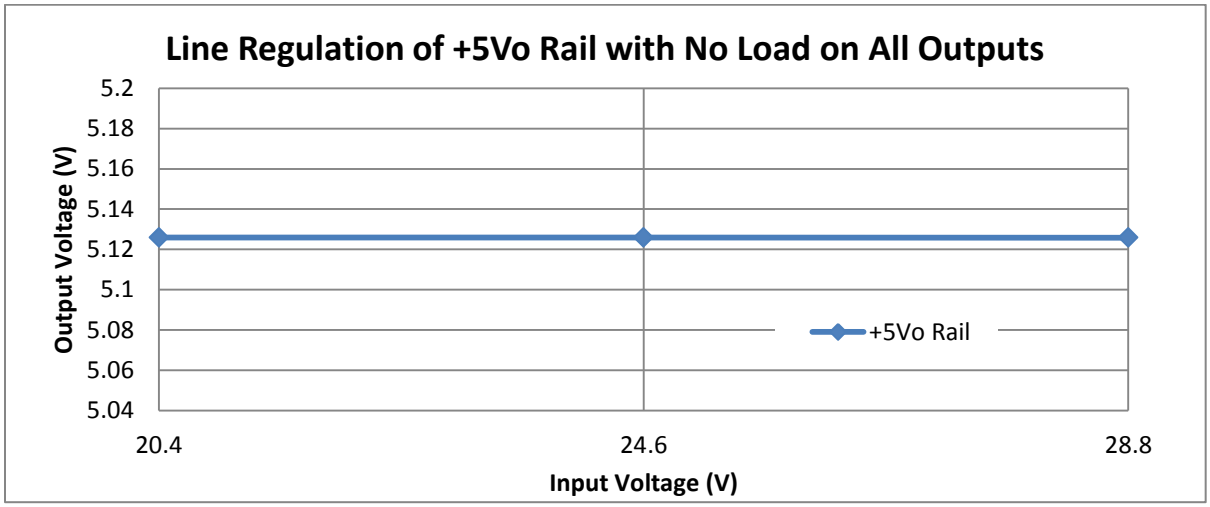
Vin (V)	Iin (A)	+15Vout (V)	+15V Iout (A)	-15Vout (V)	-15V Iout (A)	5Vout (V)	5V Iout (A)	Pin (W)	+15V Pout (W)	-15V Pout (W)	5V Pout (W)	Pout Total (W)	Ploss (W)	Efficiency (%)	% Load Per Output Rail
24.6	0.028	15.072	0.019	15.1	0.006	5.125	0.01	0.688	0.286	0.091	0.051	0.428	0.259	62.3	10
24.6	0.05	15.025	0.04	15.107	0.012	5.124	0.02	1.220	0.601	0.181	0.102	0.885	0.335	72.5	20
24.6	0.071	15.001	0.06	15.134	0.018	5.124	0.03	1.757	0.900	0.272	0.154	1.326	0.431	75.5	30
24.6	0.093	14.998	0.081	15.176	0.024	5.123	0.04	2.296	1.215	0.364	0.205	1.784	0.512	77.7	40
24.6	0.114	14.997	0.1	15.219	0.03	5.122	0.05	2.814	1.500	0.457	0.256	2.212	0.602	78.6	50
24.6	0.136	14.984	0.12	15.254	0.036	5.121	0.06	3.350	1.798	0.549	0.307	2.654	0.695	79.2	60
24.6	0.159	14.967	0.14	15.292	0.042	5.12	0.07	3.904	2.095	0.642	0.358	3.096	0.808	79.3	70
24.6	0.181	14.946	0.16	15.326	0.048	5.119	0.08	4.451	2.391	0.736	0.410	3.537	0.914	79.5	80
24.6	0.205	14.917	0.18	15.356	0.054	5.119	0.09	5.033	2.685	0.829	0.461	3.975	1.058	79.0	90
24.6	0.228	14.879	0.2	15.377	0.06	5.118	0.1	5.599	2.976	0.923	0.512	4.410	1.189	78.8	100

Vin (V)	Iin (A)	+15Vout (V)	+15V Iout (A)	-15Vout (V)	-15V Iout (A)	5Vout (V)	5V Iout (A)	Pin (W)	+15V Pout (W)	-15V Pout (W)	5V Pout (W)	Pout Total (W)	Ploss (W)	Efficiency (%)	% Load Per Output Rail
28.8	0.025	15.197	0.019	15.223	0.006	5.125	0.01	0.717	0.289	0.091	0.051	0.431	0.286	60.1	10
28.8	0.044	15.158	0.04	15.224	0.012	5.124	0.02	1.257	0.606	0.183	0.102	0.891	0.366	70.9	20
28.8	0.063	15.138	0.06	15.251	0.018	5.123	0.03	1.803	0.908	0.275	0.154	1.336	0.467	74.1	30
28.8	0.081	15.138	0.081	15.292	0.024	5.123	0.04	2.345	1.226	0.367	0.205	1.798	0.547	76.7	40
28.8	0.1	15.154	0.1	15.343	0.03	5.122	0.05	2.868	1.515	0.460	0.256	2.232	0.637	77.8	50
28.8	0.118	15.16	0.12	15.385	0.036	5.121	0.06	3.403	1.819	0.554	0.307	2.680	0.723	78.8	60
28.8	0.138	15.158	0.14	15.428	0.042	5.12	0.07	3.963	2.122	0.648	0.358	3.128	0.834	78.9	70
28.8	0.157	15.156	0.16	15.468	0.048	5.119	0.08	4.508	2.425	0.742	0.410	3.577	0.931	79.3	80
28.8	0.177	15.149	0.18	15.509	0.054	5.119	0.09	5.088	2.727	0.837	0.461	4.025	1.063	79.1	90
28.8	0.196	15.141	0.2	15.548	0.06	5.118	0.1	5.652	3.028	0.933	0.512	4.473	1.179	79.1	100

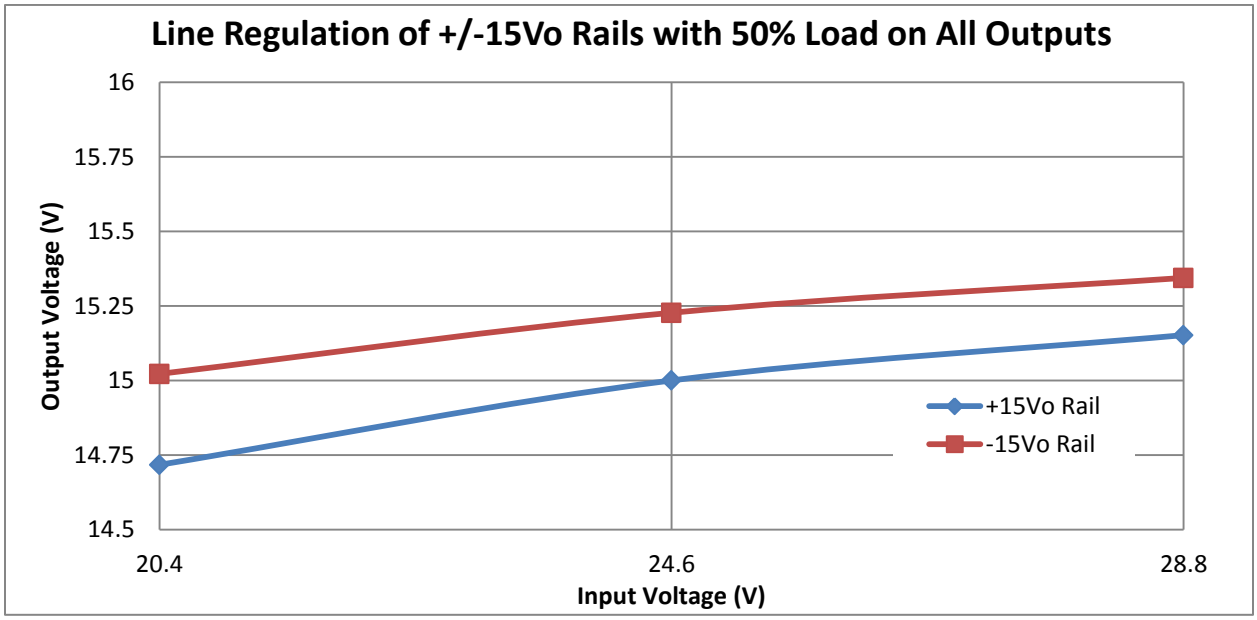
6 Output Voltage Regulation

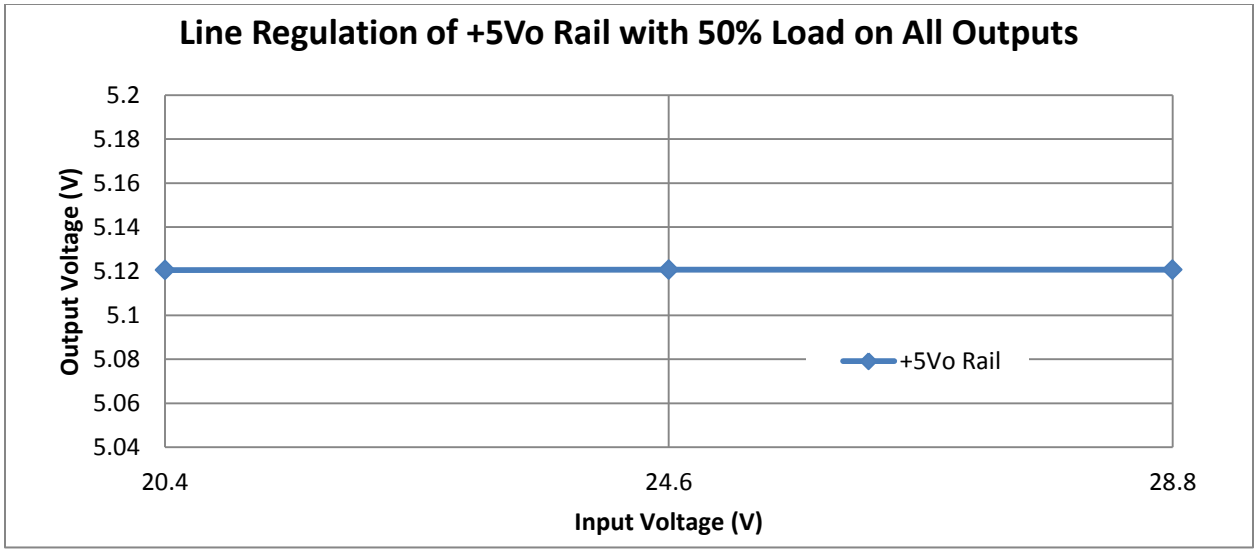
6.1 Line Regulation



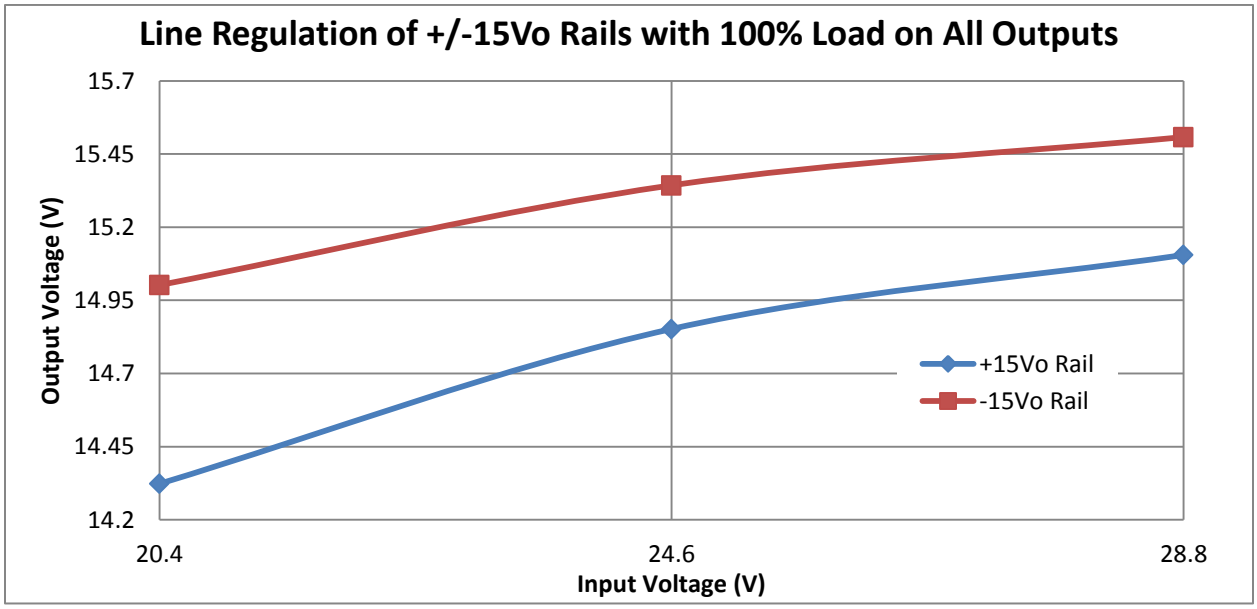


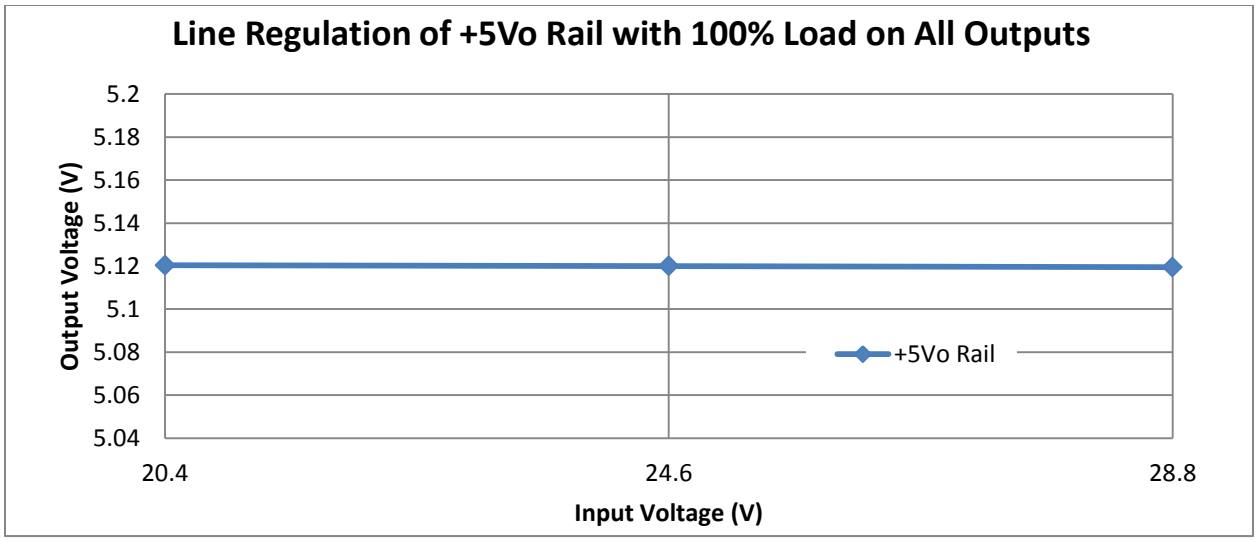
Line Regulation @ No Load			
Vin (V)	+15Vo (V)	-15Vo (V)	+5Vo (V)
20.4	15.208	15.125	5.1259
24.6	15.474	15.371	5.1259
28.8	15.767	15.63	5.1258





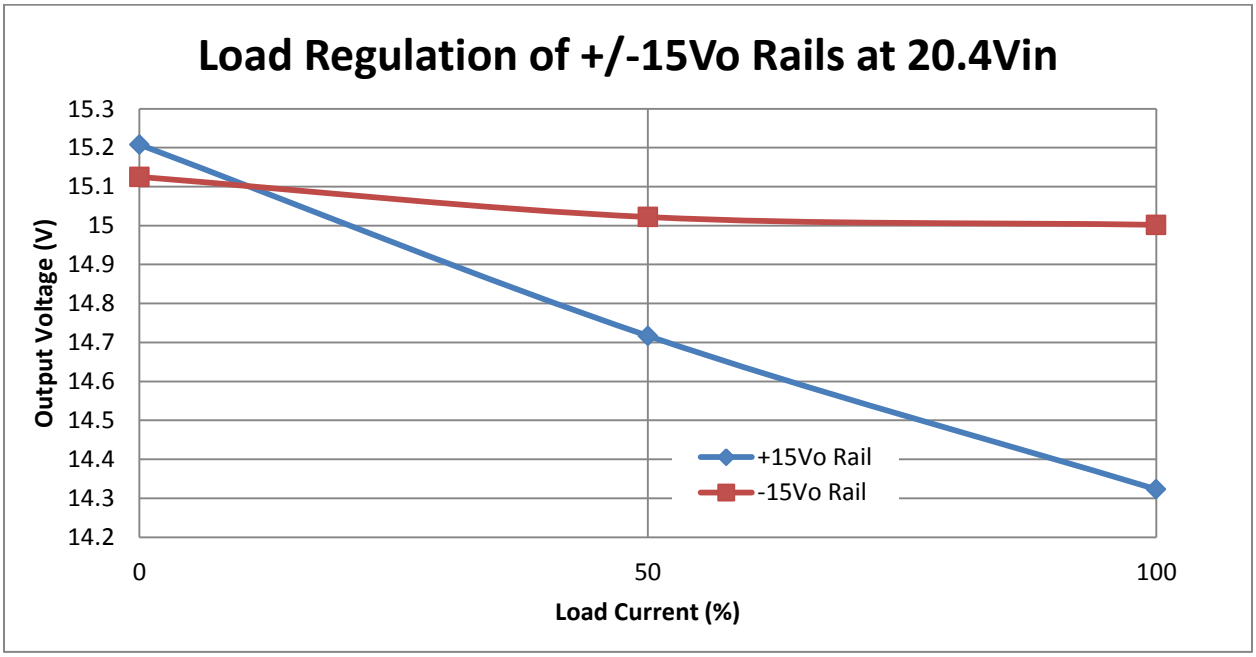
Line Regulation @ 50% Load			
Vin (V)	**+15Vo (V)**	**-15Vo (V)**	**+5Vo (V)**
20.4	14.717	15.022	5.1205
24.6	15	15.227	5.1207
28.8	15.152	15.344	5.1207

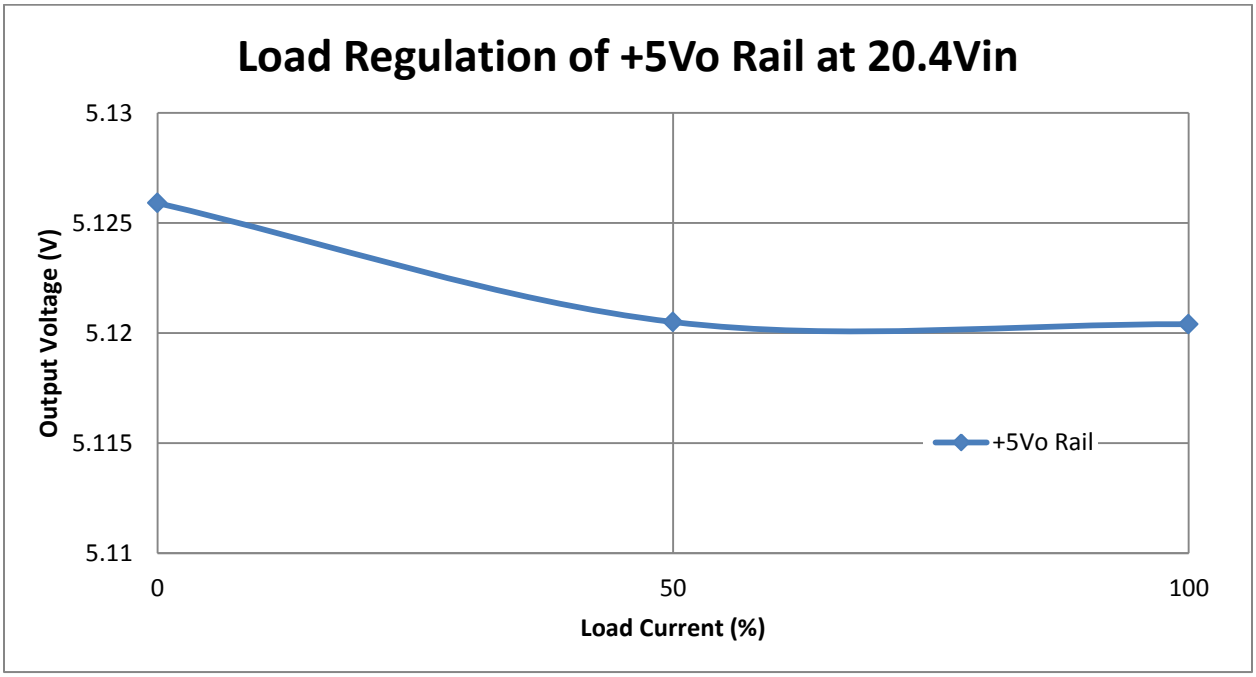




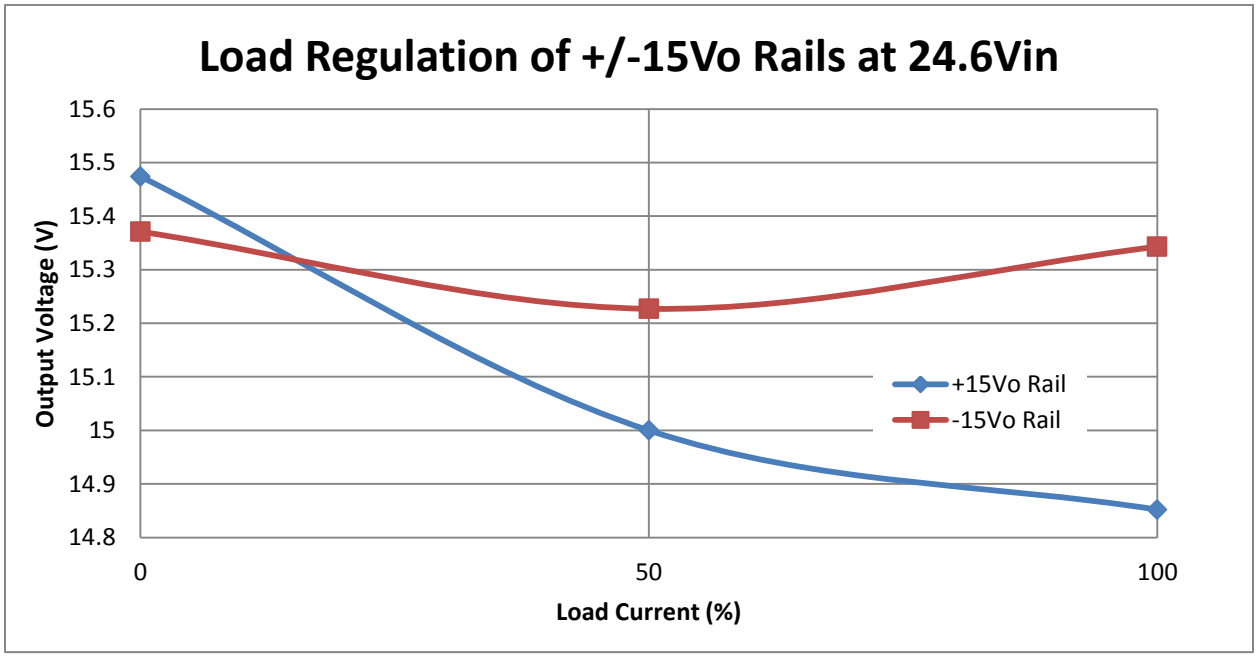
Line Regulation @ 100% Load			
Vin (V)	**+15Vo (V)**	**-15Vo (V)**	**+5Vo (V)**
20.4	14.323	15.002	5.1204
24.6	14.852	15.343	5.12
28.8	15.105	15.508	5.1195

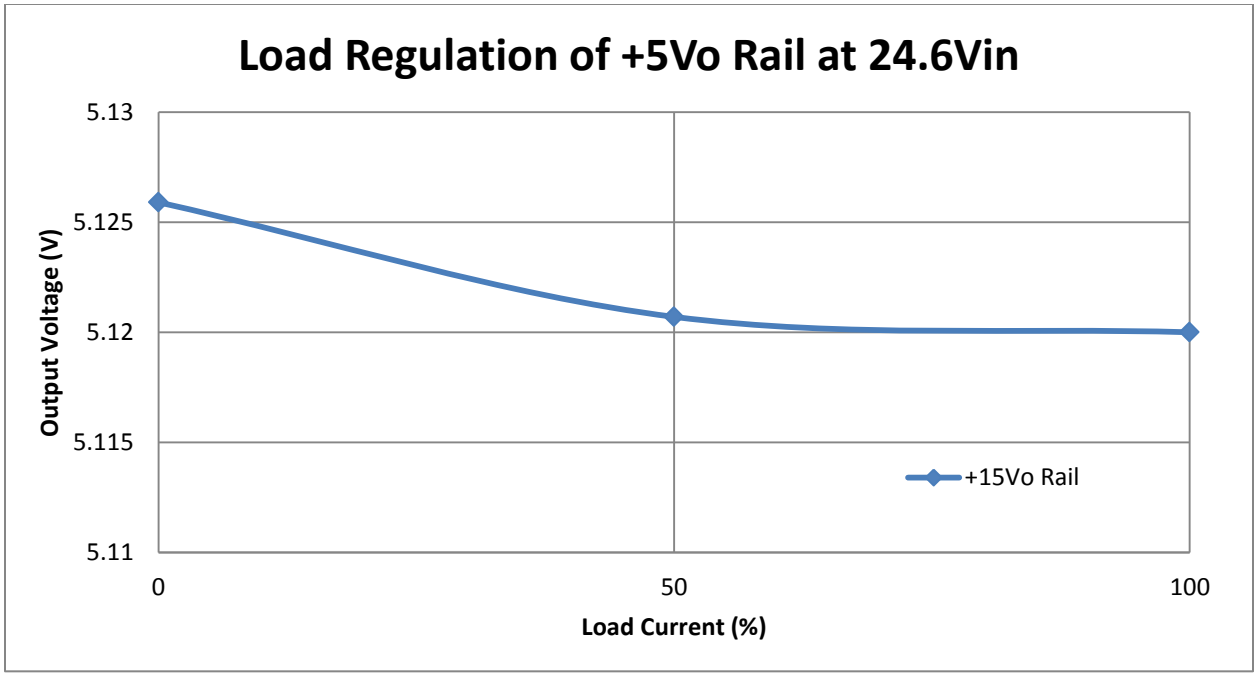
6.2 Load Regulation



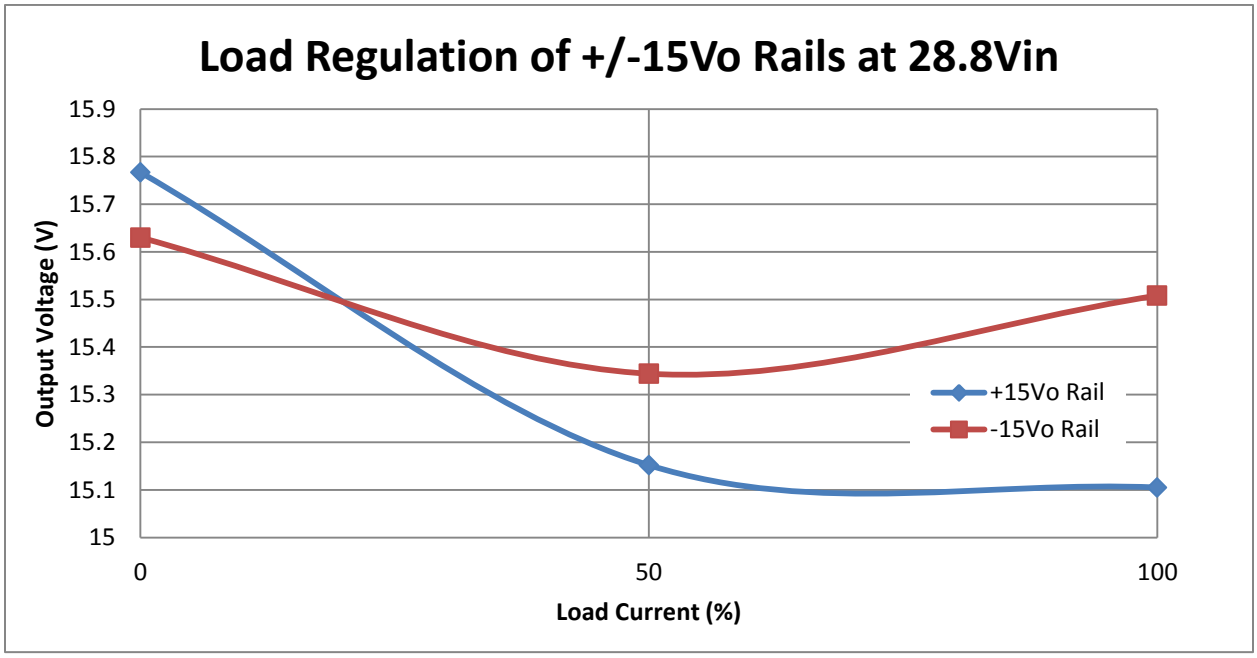


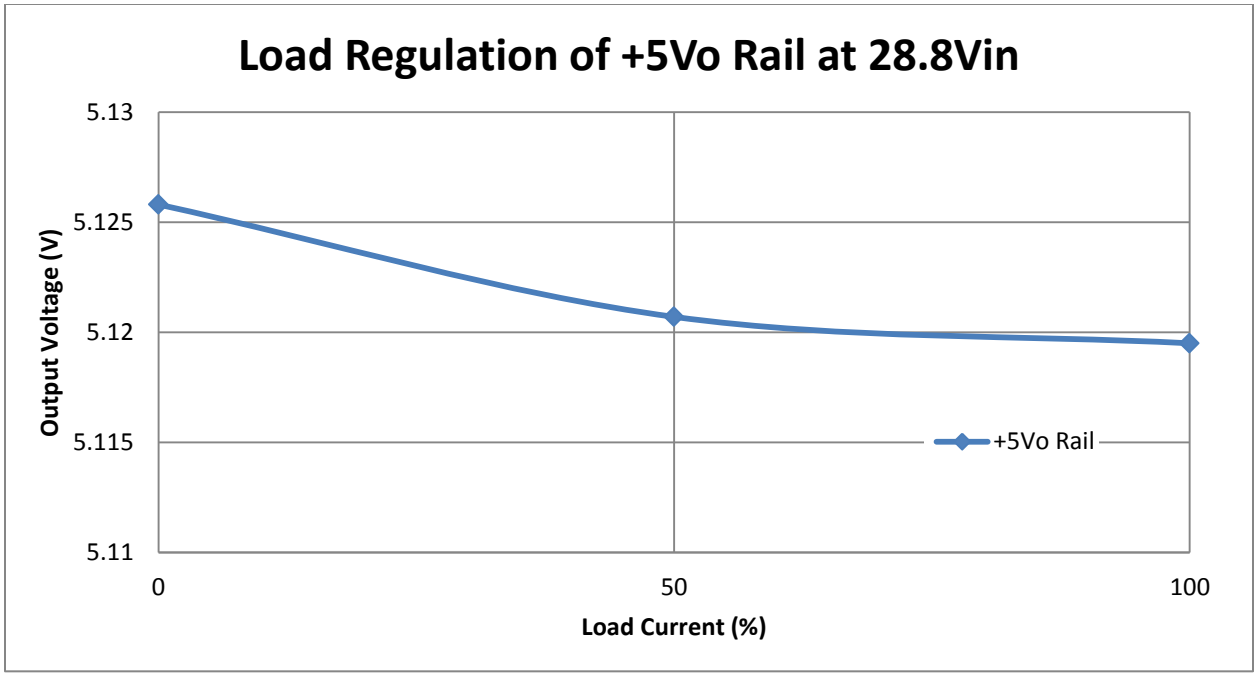
Load Regulation at 20.4Vin			
Load (%)	**+15Vo (V)**	**-15Vo (V)**	**+5Vo (V)**
0	15.208	15.125	5.1259
50	14.717	15.022	5.1205
100	14.323	15.002	5.1204





Load Regulation at 24.6Vin			
Load (%)	**+15Vo (V)**	**-15Vo (V)**	**+5Vo (V)**
0	15.474	15.371	5.1259
50	15	15.227	5.1207
100	14.852	15.343	5.12

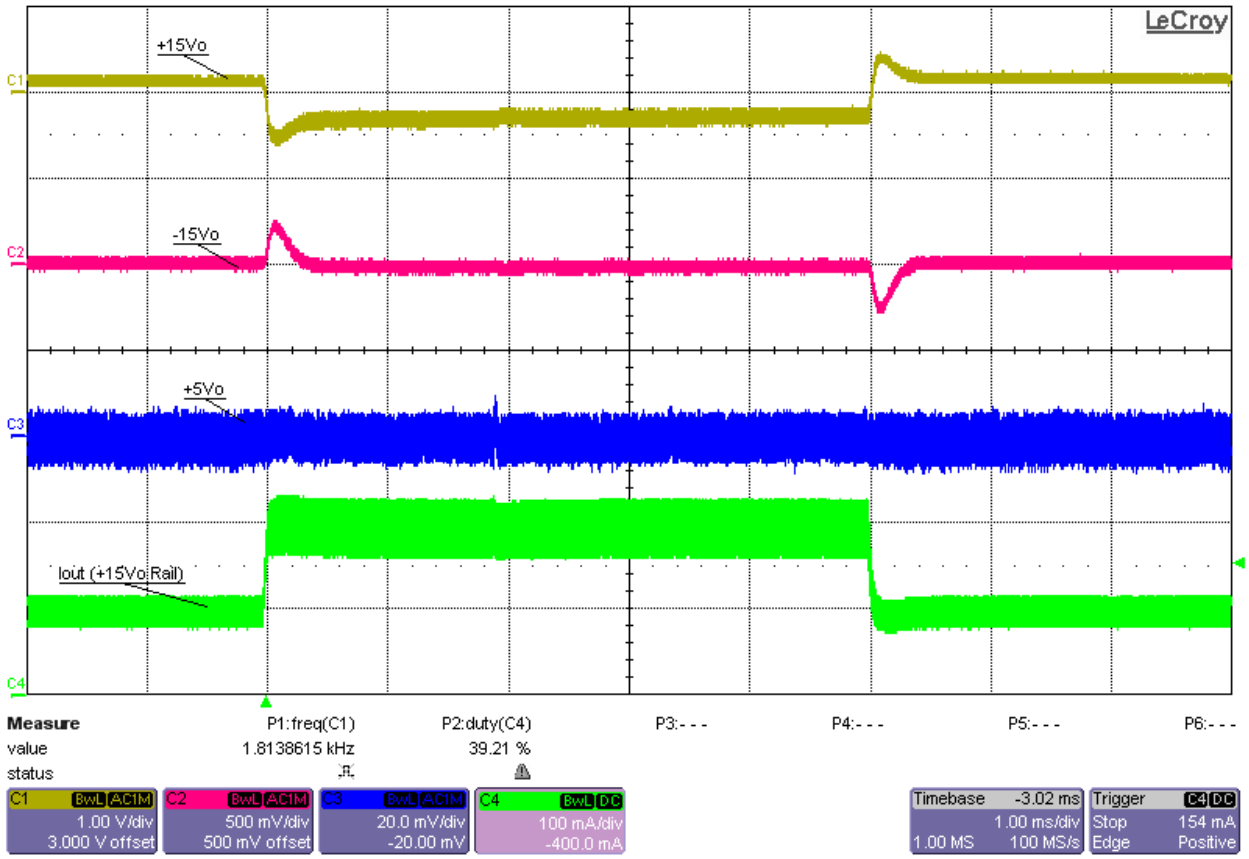




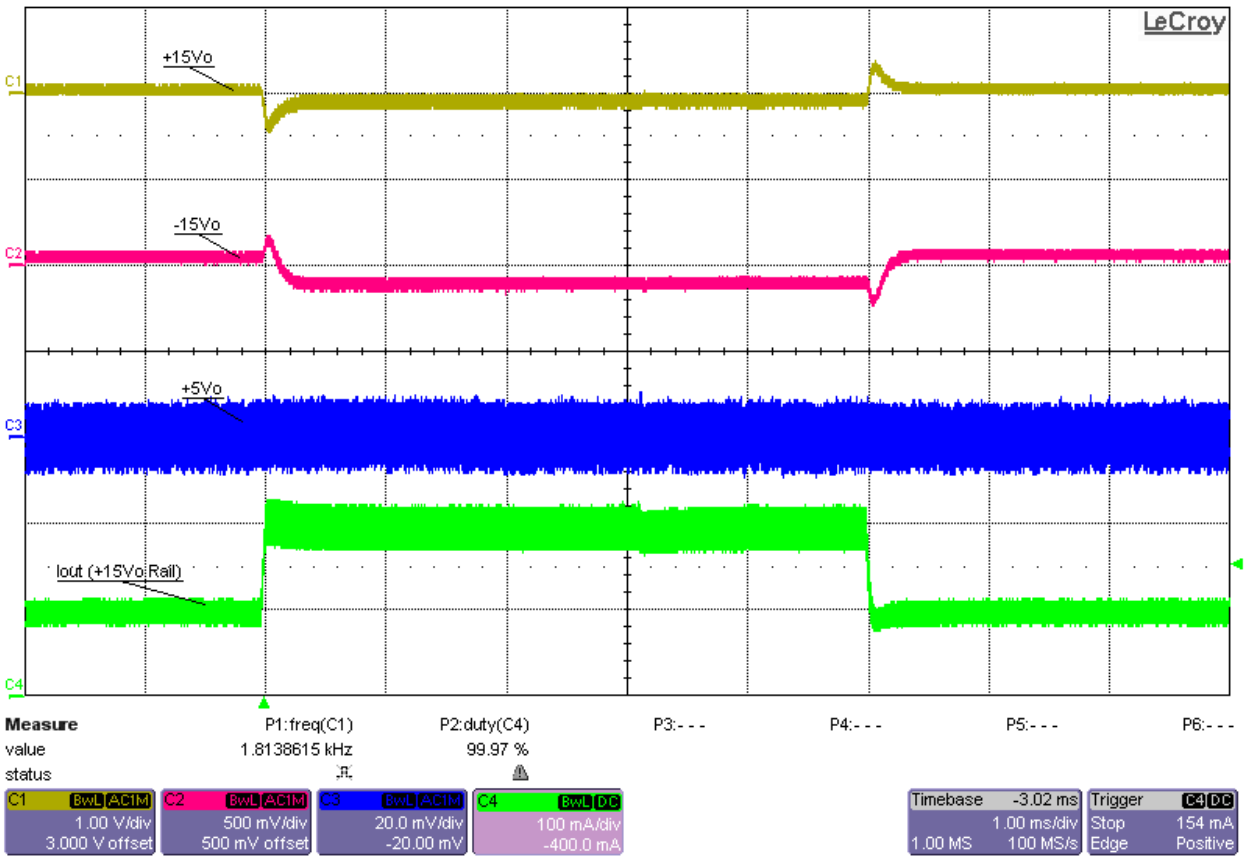
Load Regulation at 28.8Vin			
Load (%)	**+15Vo (V)**	**-15Vo (V)**	**+5Vo (V)**
0	15.767	15.63	5.1258
50	15.152	15.344	5.1207
100	15.105	15.508	5.1195

7 Waveforms

7.1 Load Transient Response

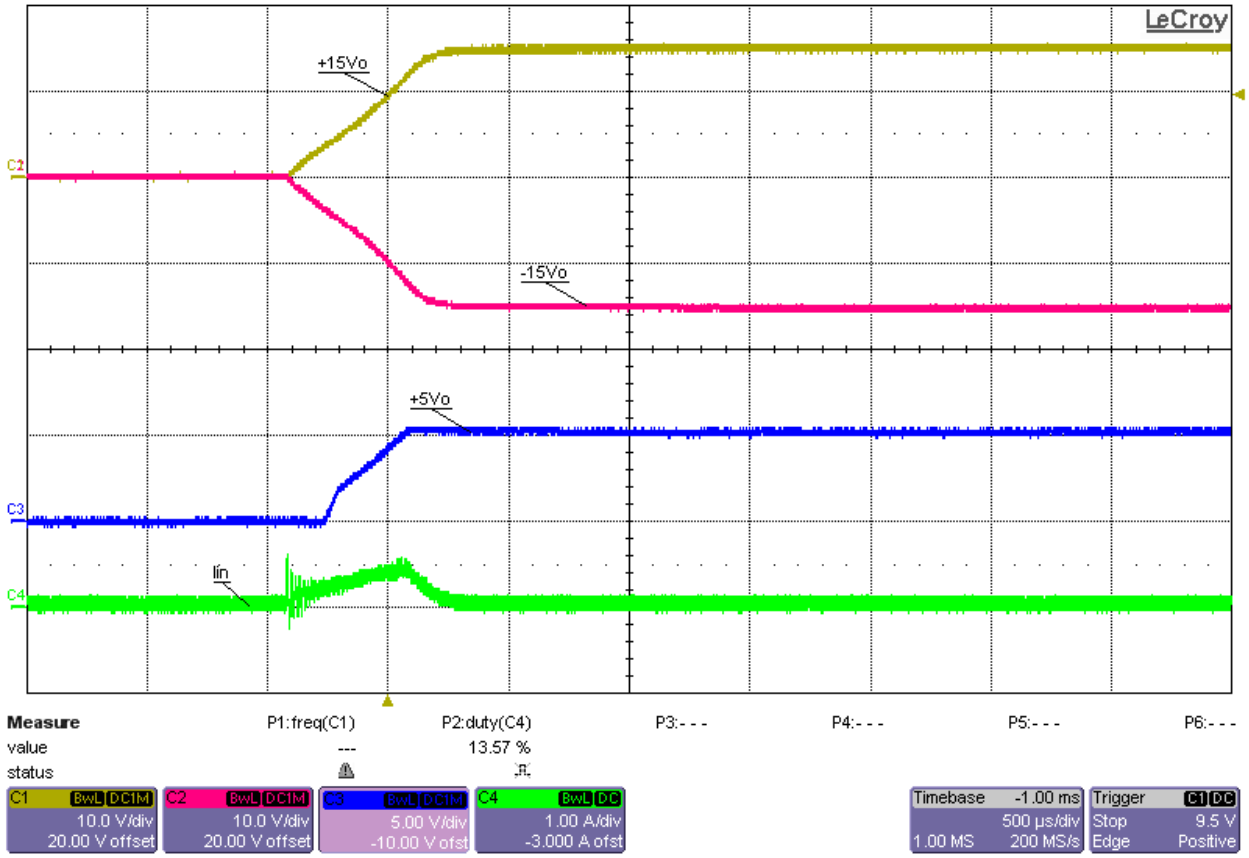


Load Transient Response of All Output Rails with +15V Rail Undergoing 50% to 100% (0.1A-to-0.2A) Load Step and All Other Rails at Full Load and Input Voltage at 20.4Vin

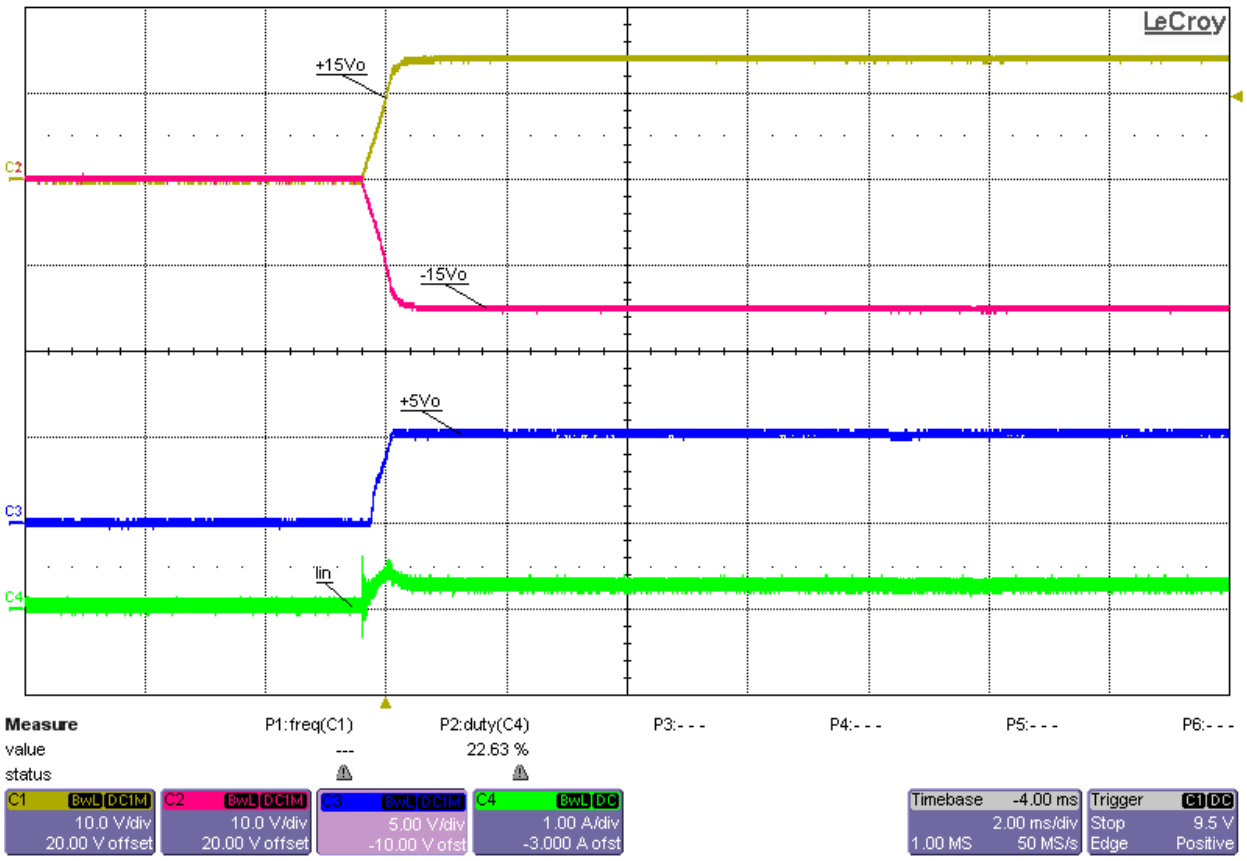


Load Transient Response of All Output Rails with +15V Rail Undergoing 50% to 100% (0.1A-to-0.2A) Load Step and All Other Rails at Full Load and Input Voltage at 28.8Vin

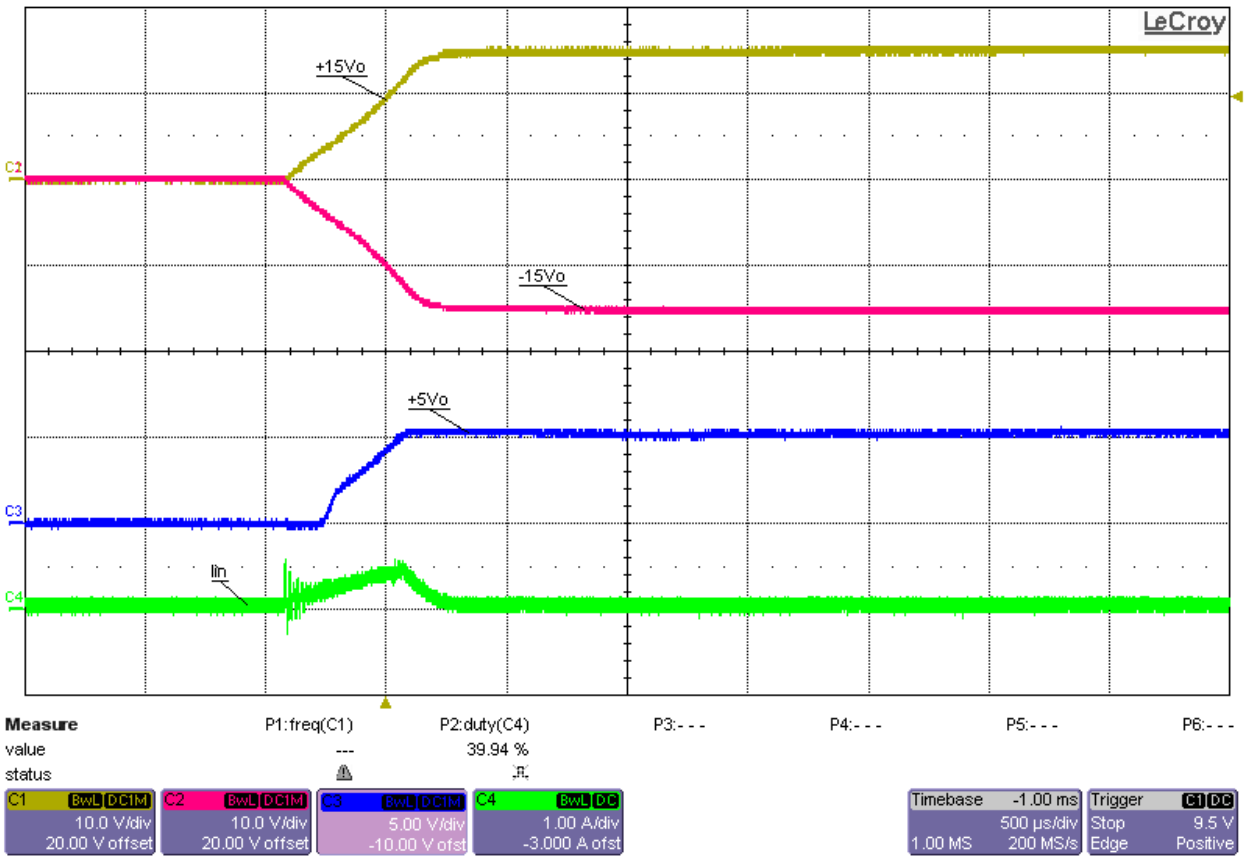
7.2 Startup



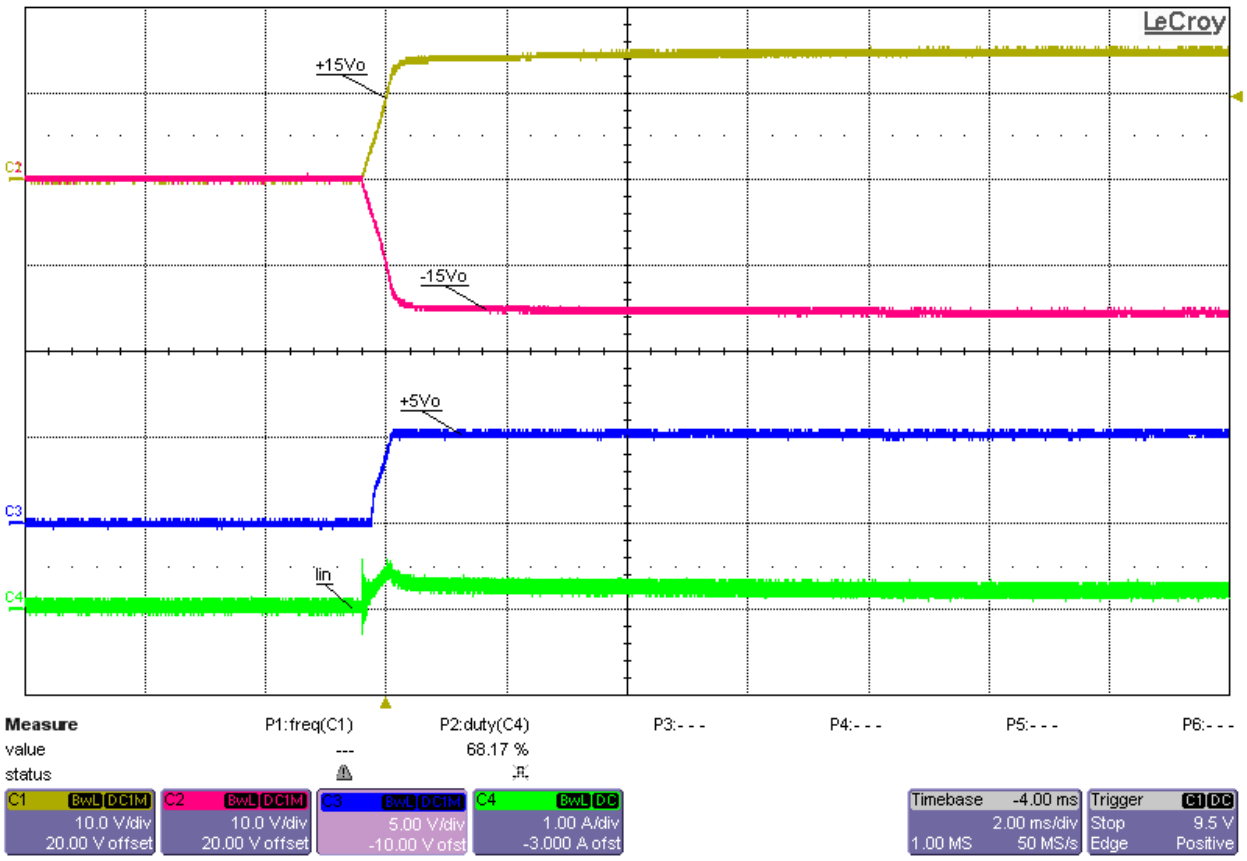
Startup into No Load (on All Output Rails) at 20.4Vin



Startup into Full Load (on All Output Rails) at 20.4Vin

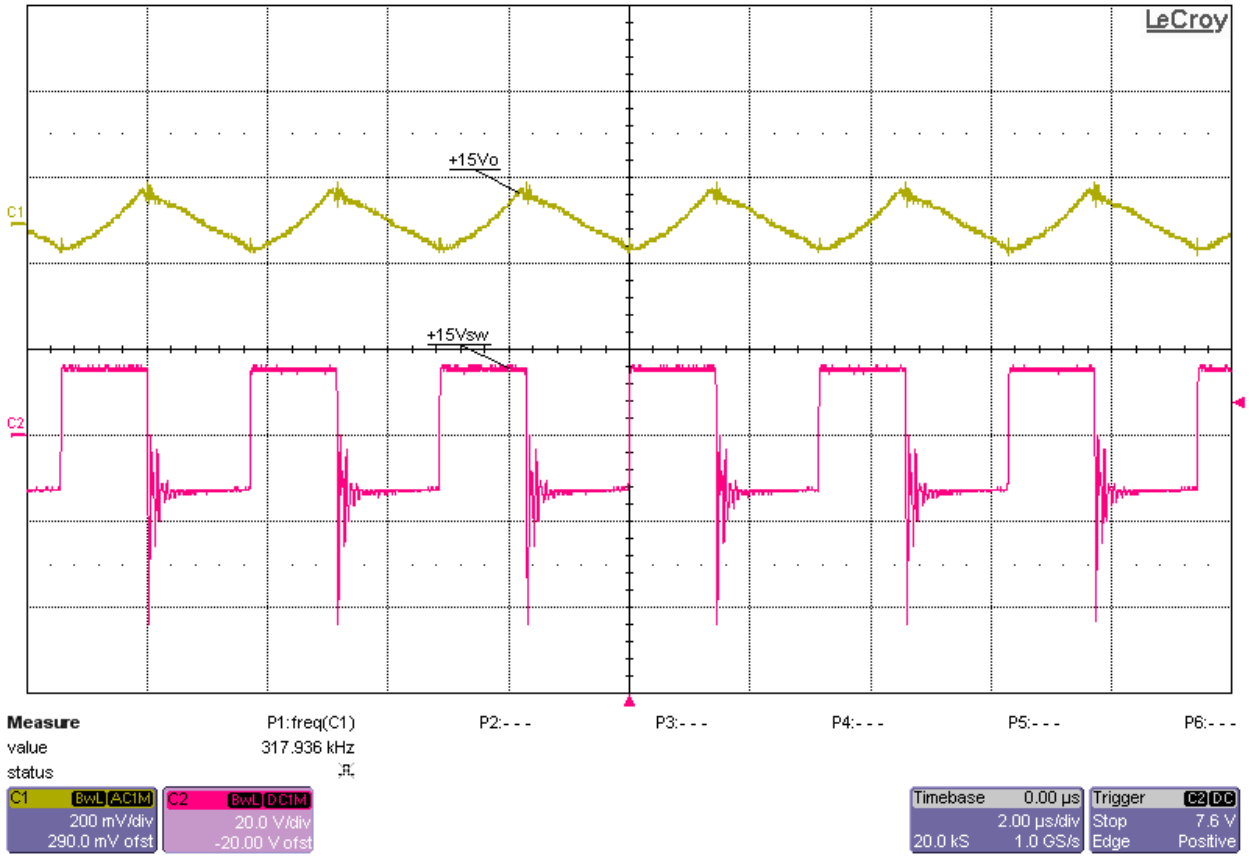


Startup into No Load (on All Output Rails) at 28.8Vin

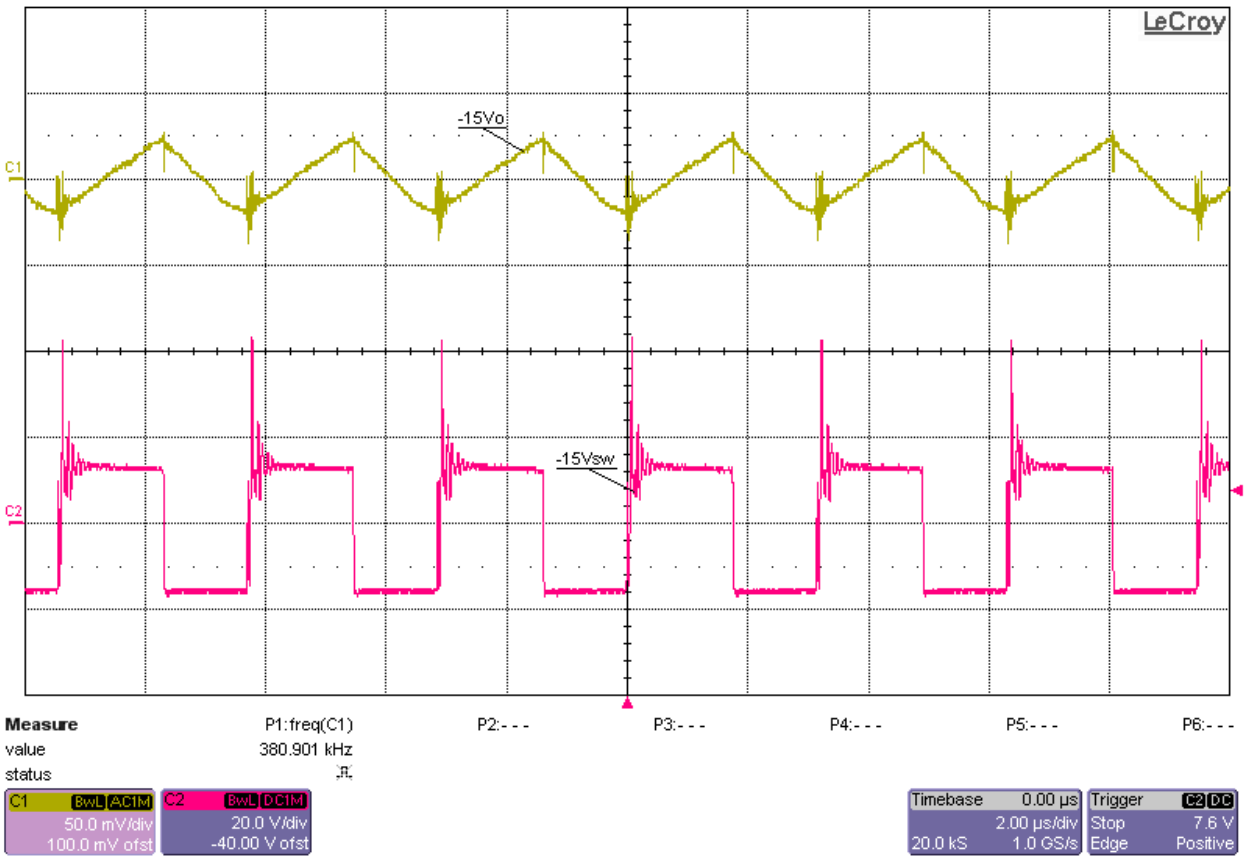


Startup into Full Load (on All Output Rails) at 28.8Vin

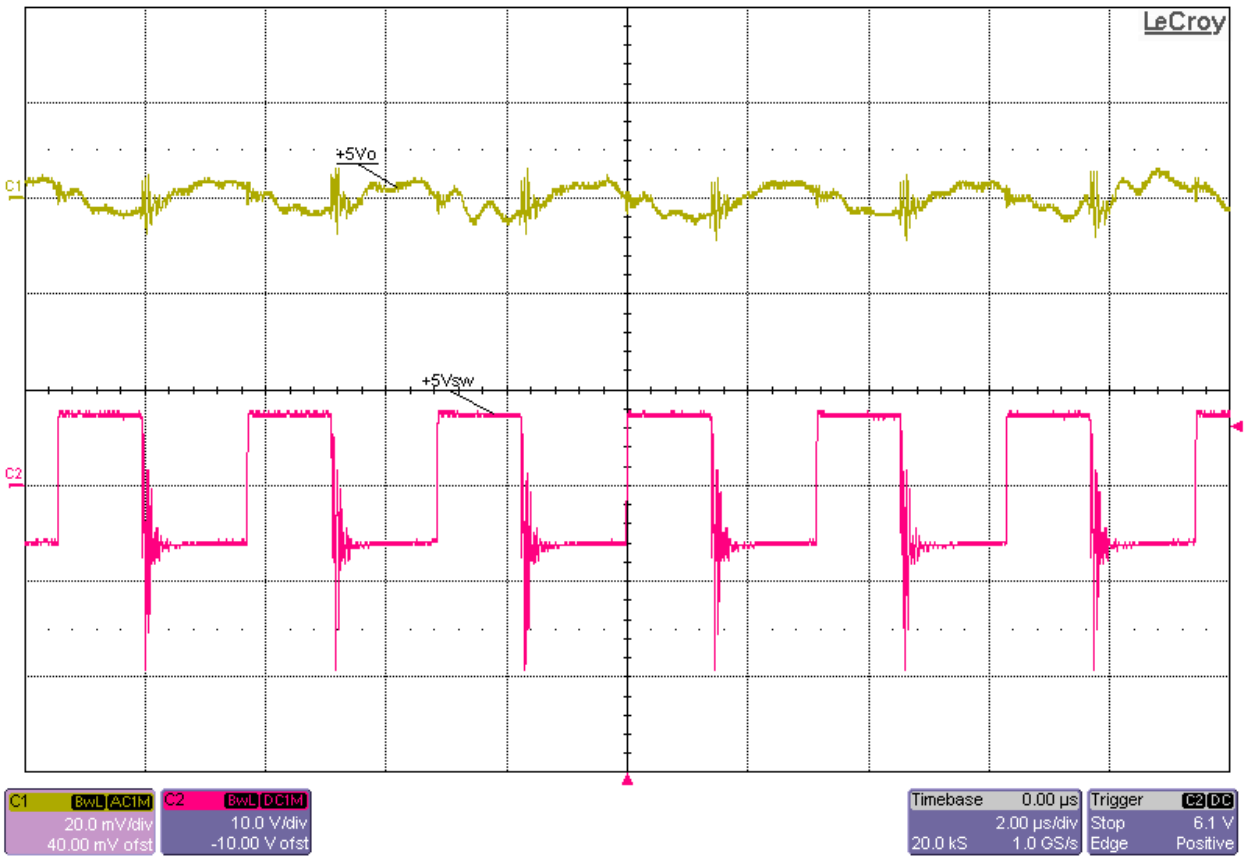
7.3 Output Voltage Ripple and Switch Node Voltage



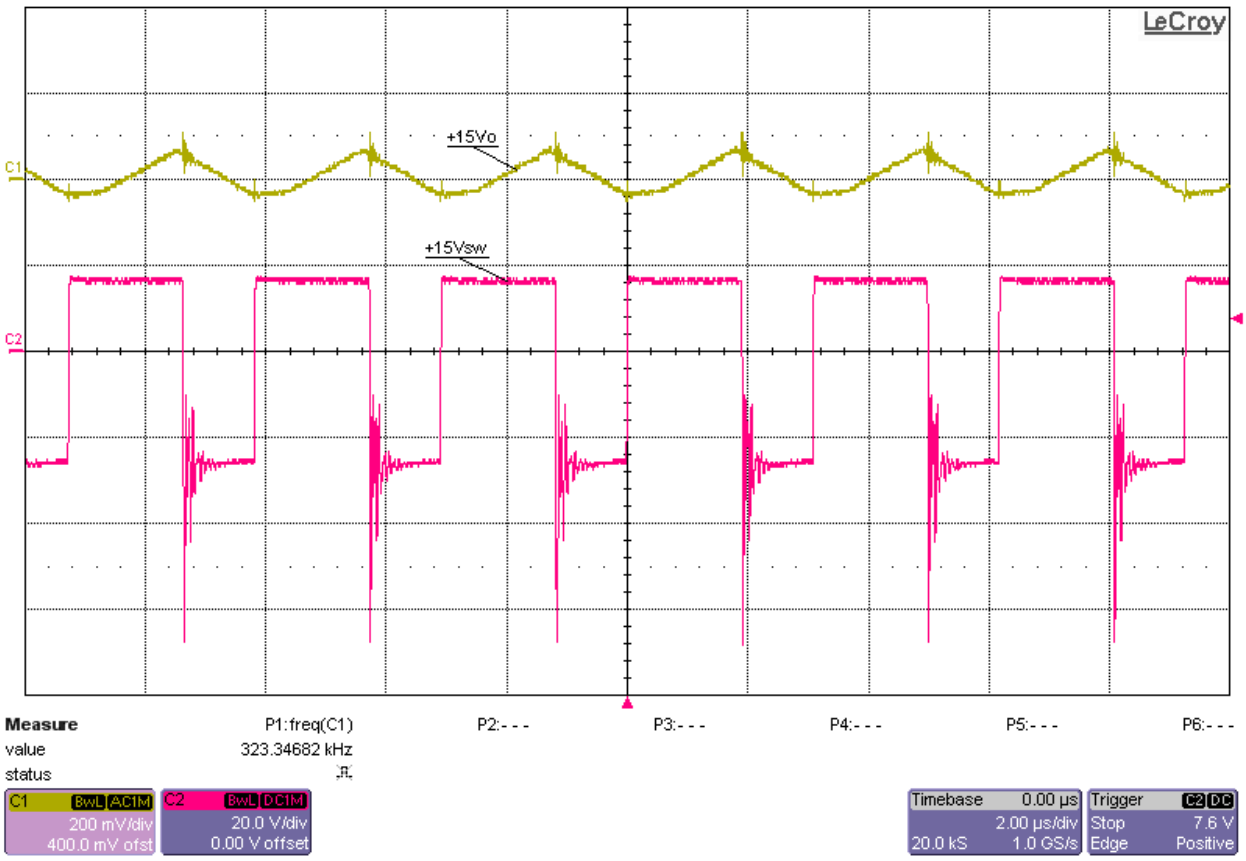
+15Vout Rail Switch Node Voltage and Output Voltage Ripple at 20.4Vin and All Output Rails at Full Load (Vripple ≈ 150mVp-p)



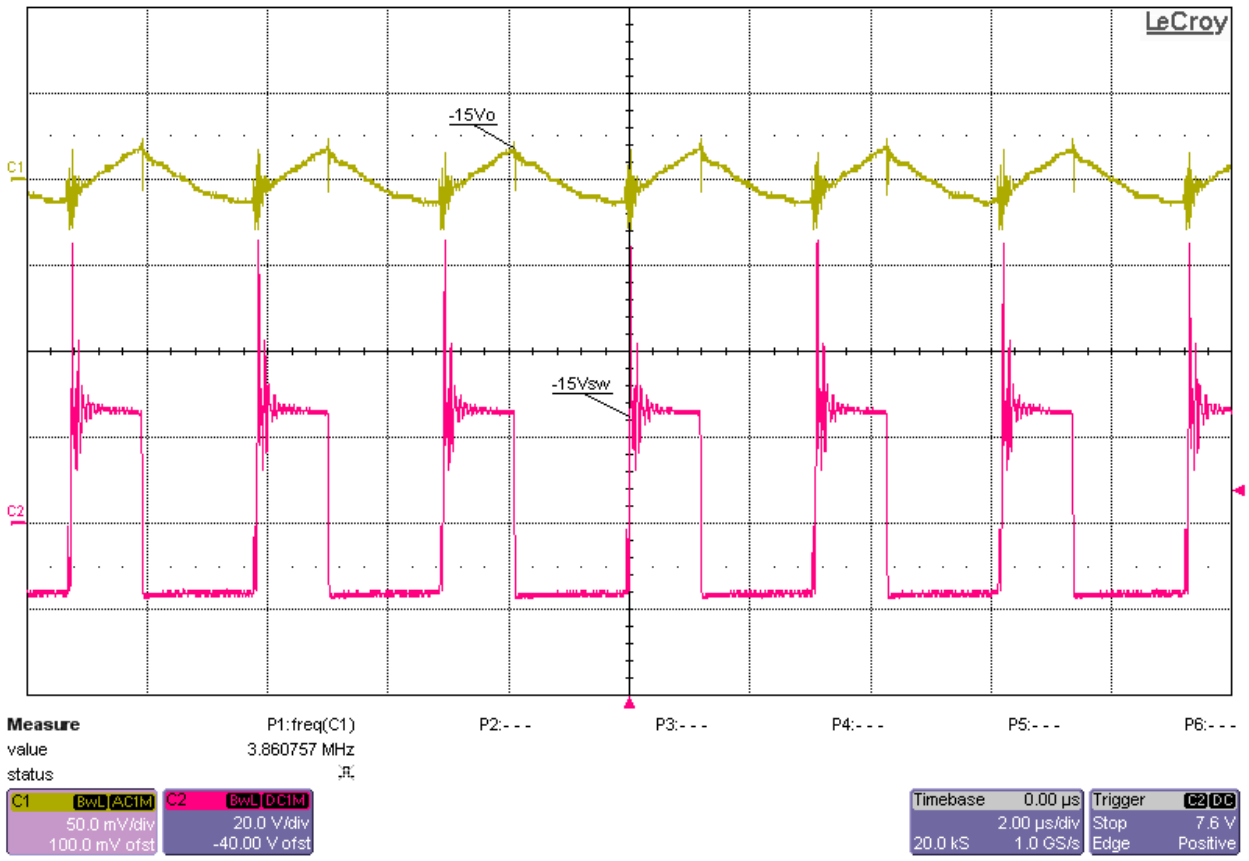
-15Vout Rail Switch Node Voltage and Output Voltage Ripple at 20.4Vin and All Output Rails at Full Load (Vripple ≈ 50mVp-p)



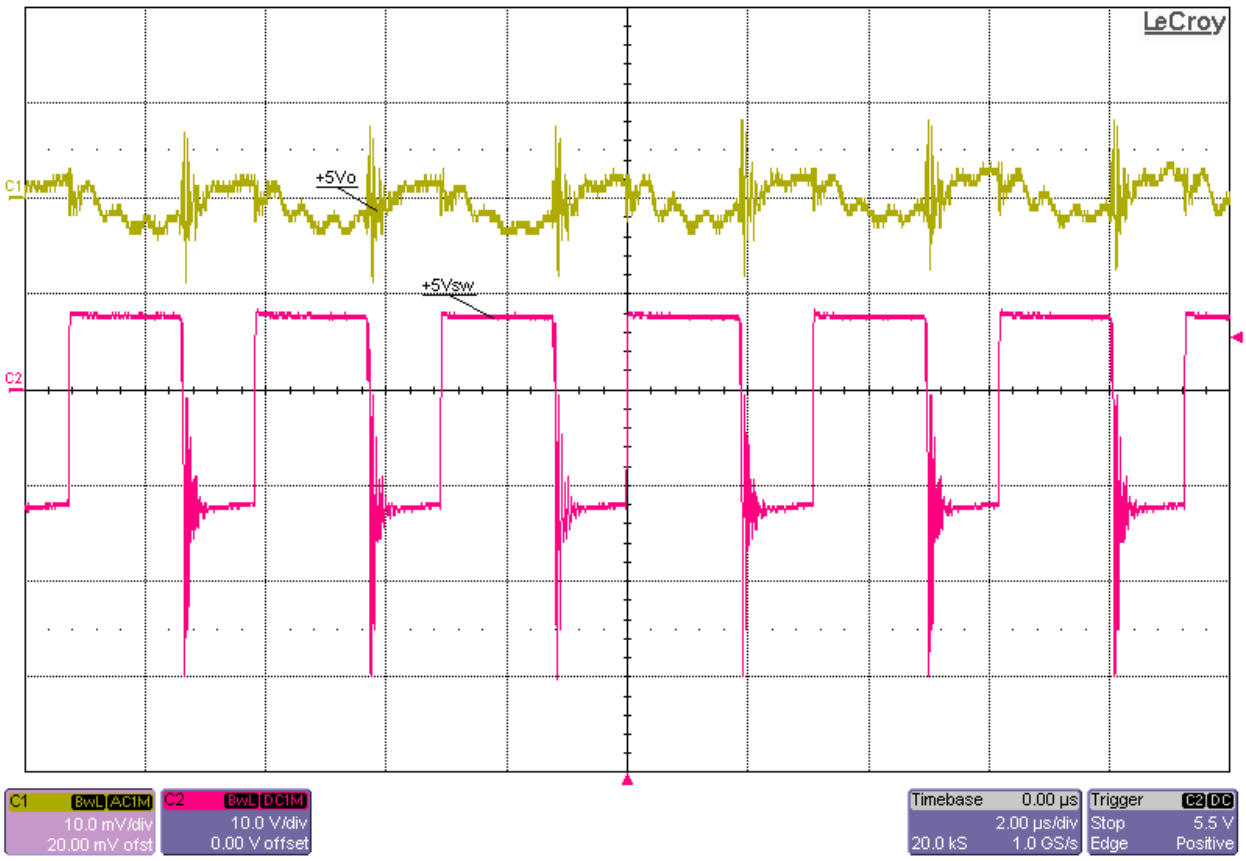
+5Vout Rail Switch Node Voltage and Output Voltage Ripple at 20.4Vin and All Output Rails at Full Load (Vripple ≈ 10mVp-p)



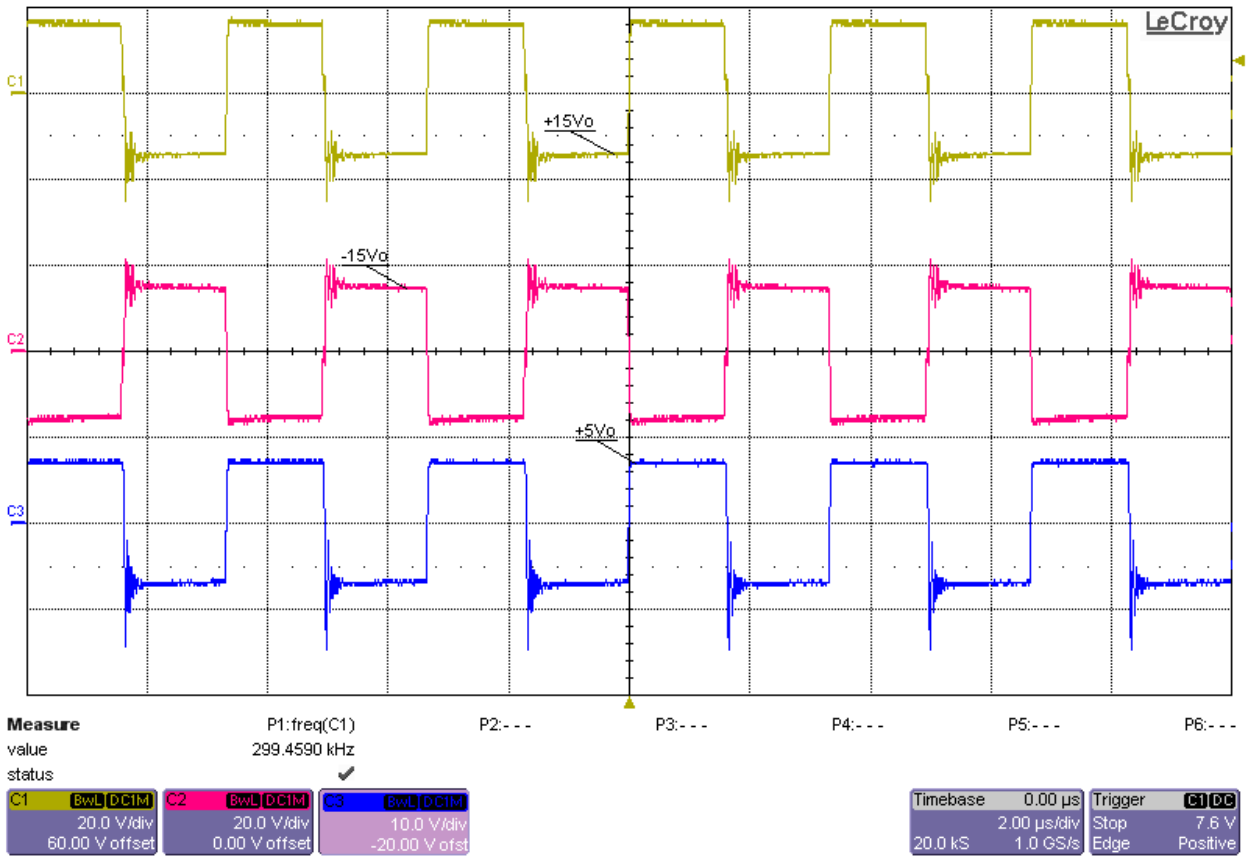
+15Vout Rail Switch Node Voltage and Output Voltage Ripple at 28.8Vin and All Output Rails at Full Load (Vripple ≈ 120mVp-p)



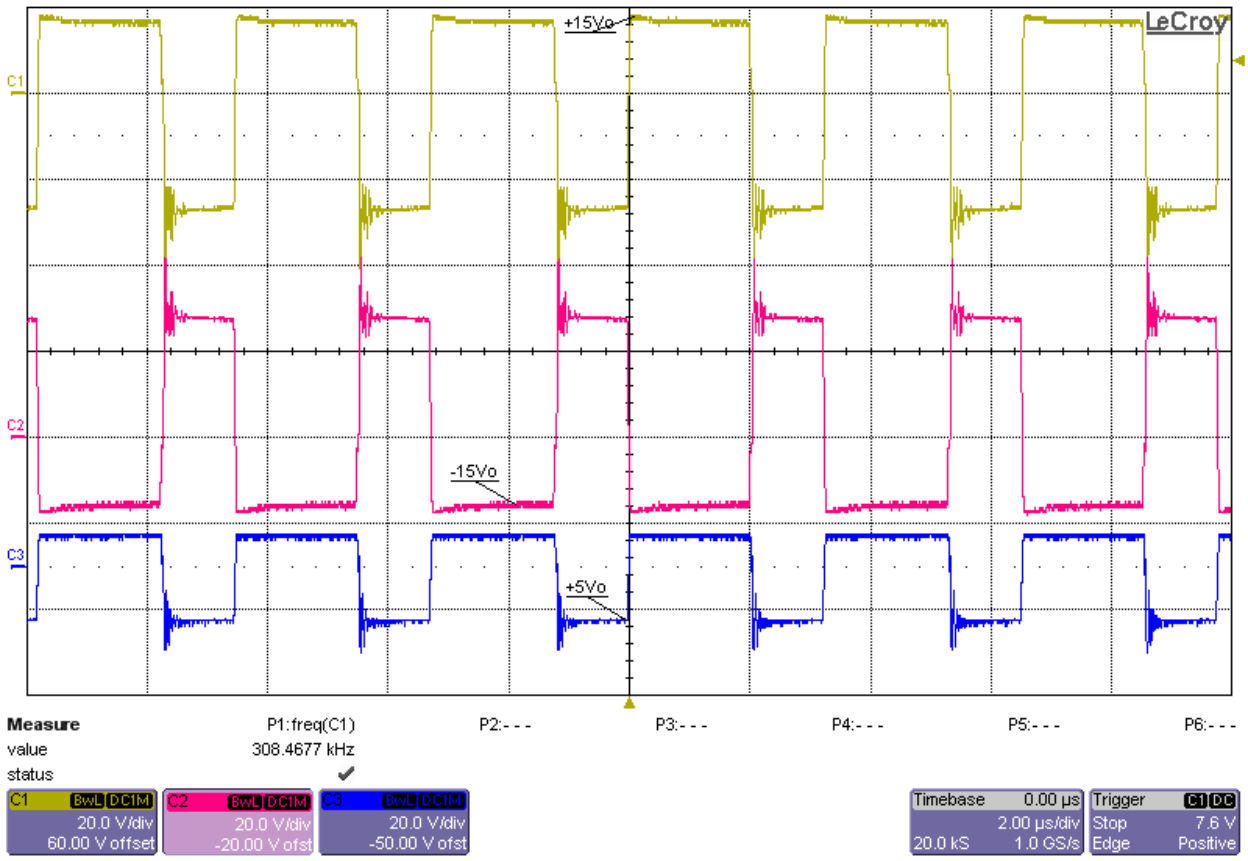
-15Vout Rail Switch Node Voltage and Output Voltage Ripple at 28.8Vin and All Output Rails at Full Load (Vripple ≈ 40mVp-p)



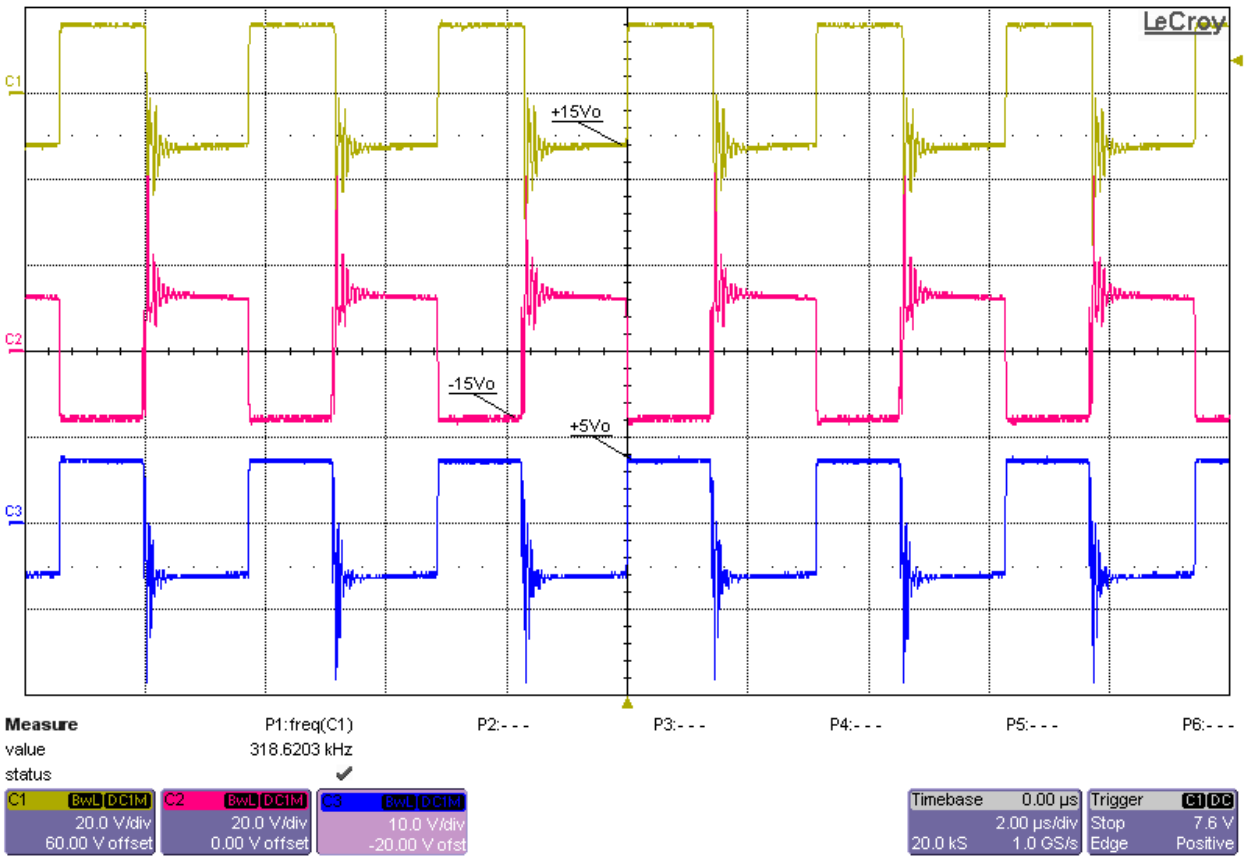
+5Vout Rail Switch Node Voltage and Output Voltage Ripple at 28.8Vin and All Output Rails at Full Load (Vripple ≈ 8mVp-p)



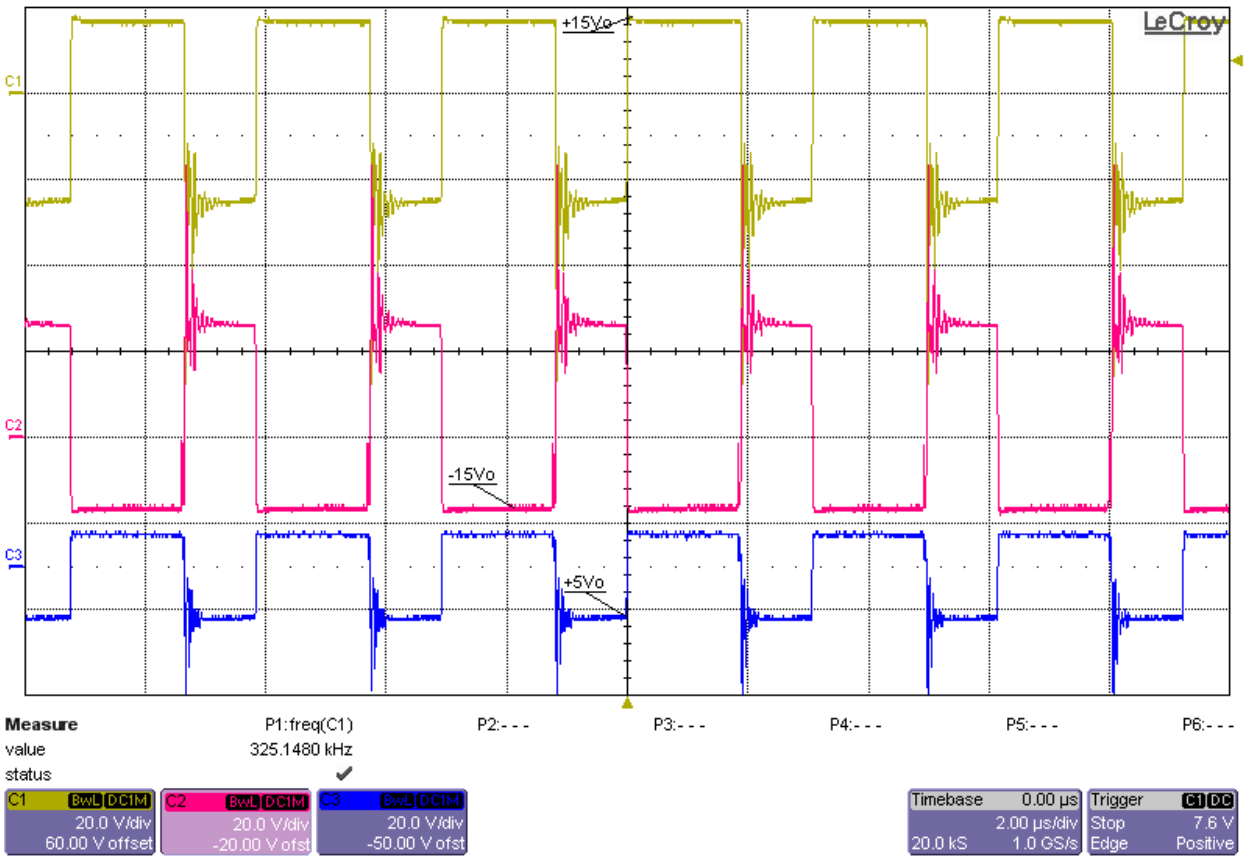
Switch Node Voltages of All Three Output Voltage Rails at 20.4Vin and All Output Rails at No Load



Switch Node Voltages of All Three Output Voltage Rails at 28.8Vin and All Output Rails at No Load

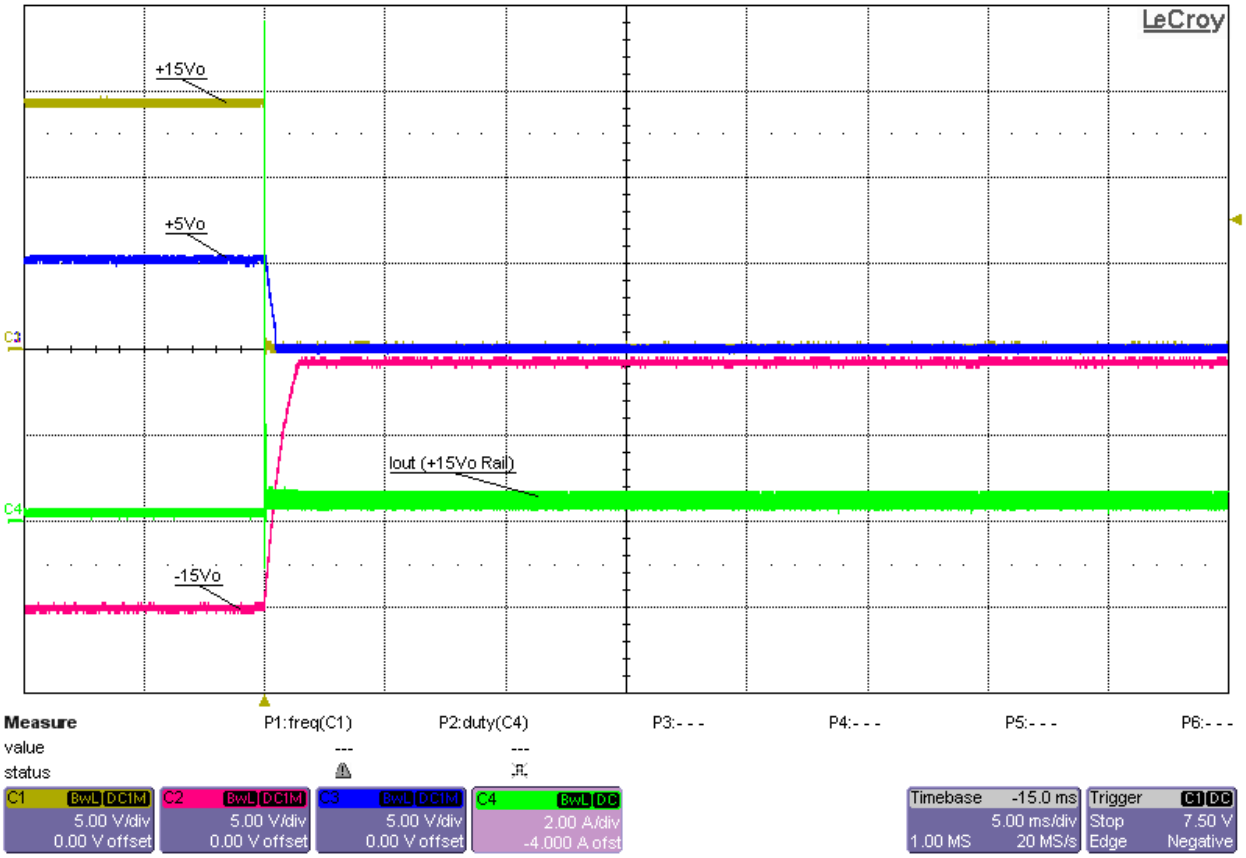


Switch Node Voltages of All Three Output Voltage Rails at 20.4Vin and All Output Rails at Full Load

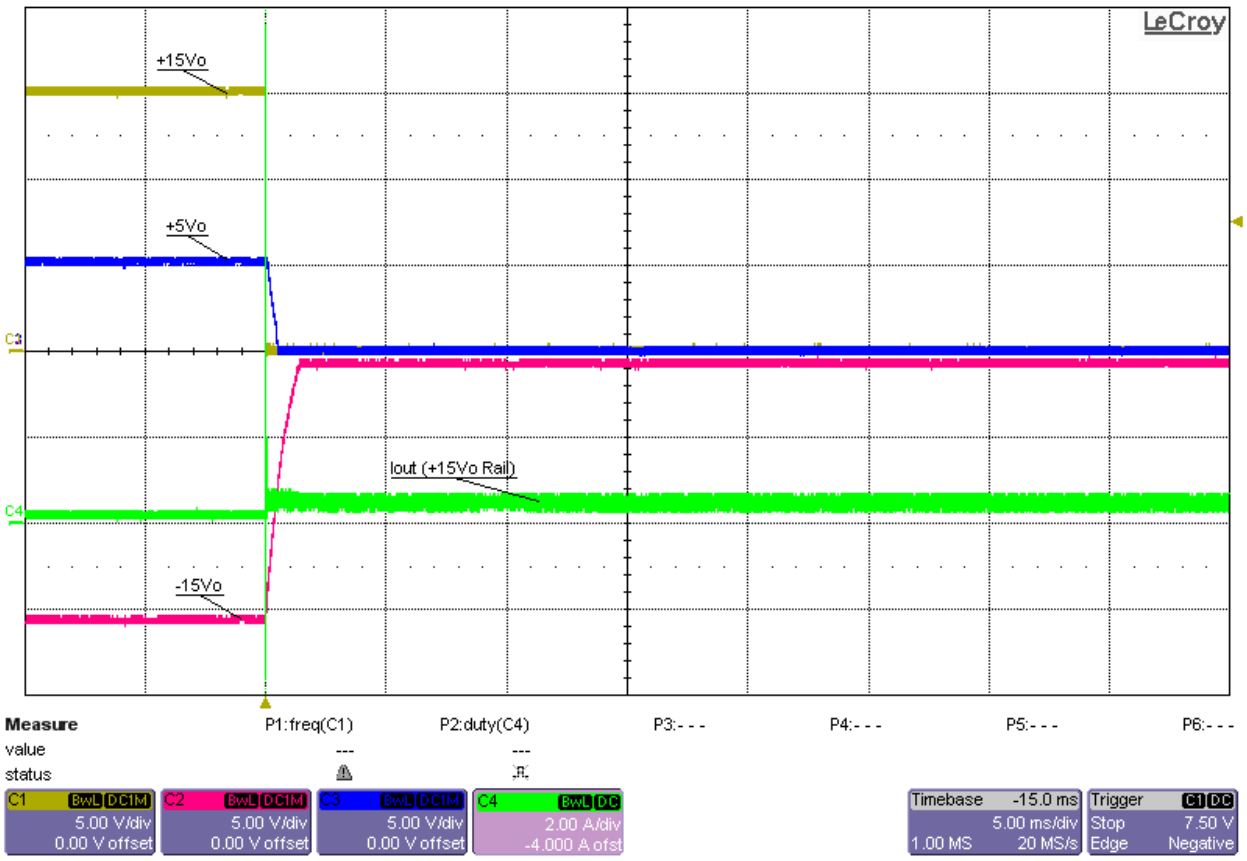


Switch Node Voltages of All Three Output Voltage Rails at 28.8Vin and All Output Rails at Full Load

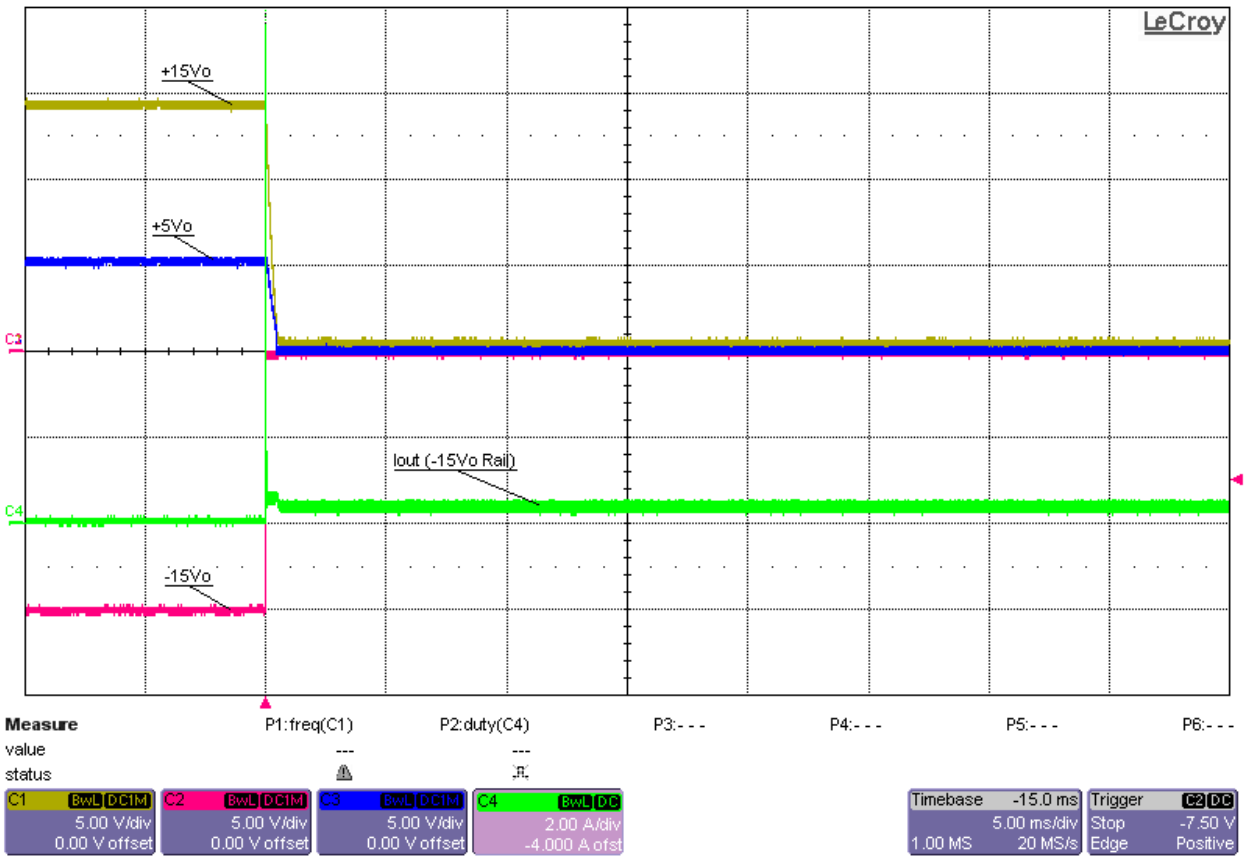
7.4 Short Circuit Application



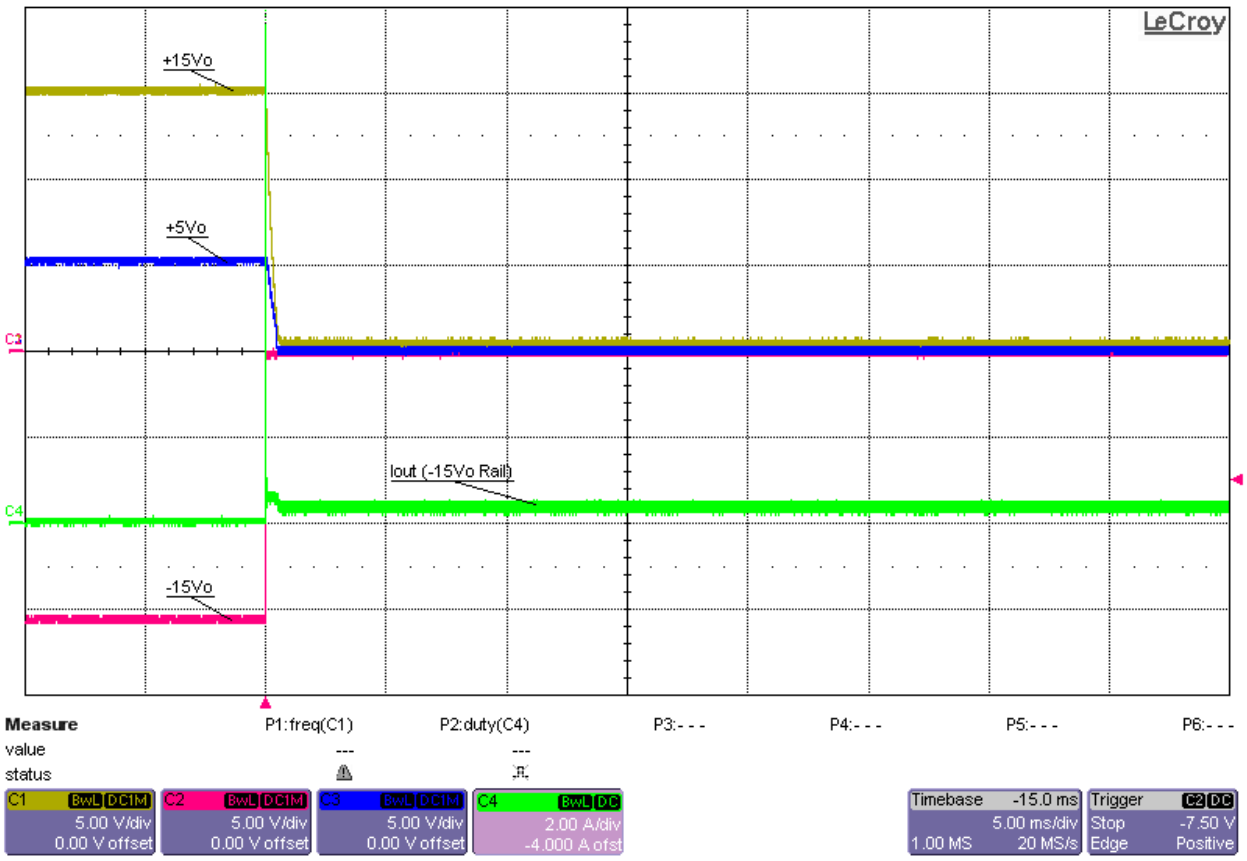
Short Circuit Applied to +15V Output Rail with All Output Rails at Full Load and Input Voltage at 20.4V



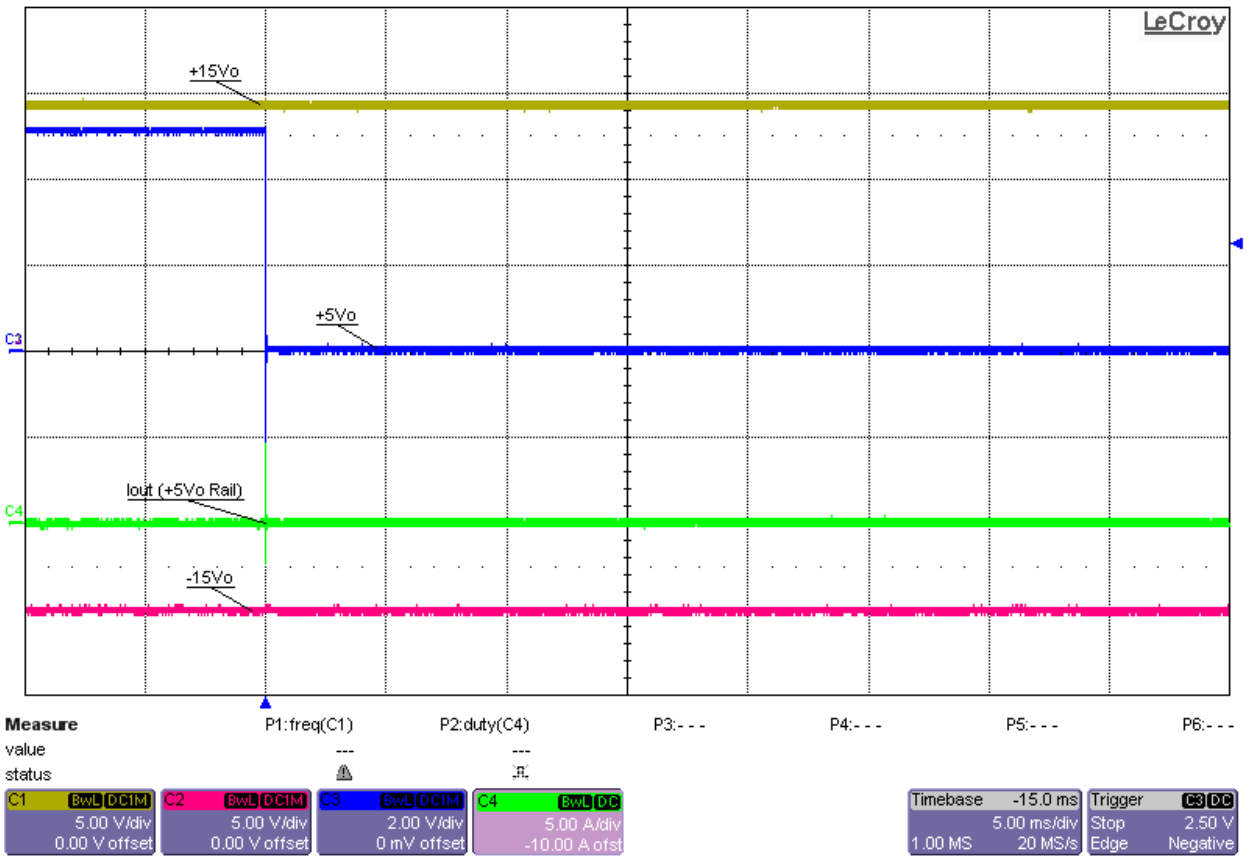
Short Circuit Applied to +15V Output Rail with All Output Rails at Full Load and Input Voltage at 28.8V



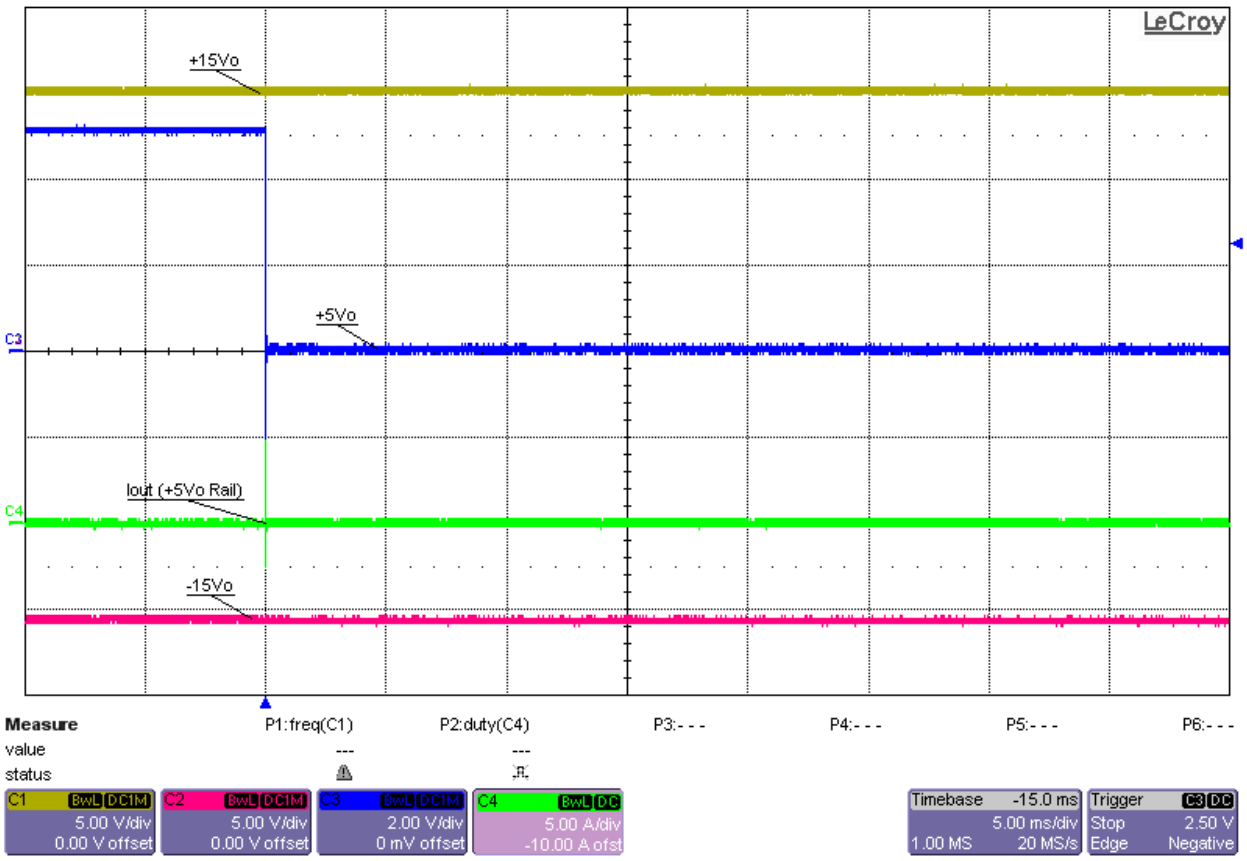
Short Circuit Applied to -15V Output Rail with All Output Rails at Full Load and Input Voltage at 20.4V



Short Circuit Applied to -15V Output Rail with All Output Rails at Full Load and Input Voltage at 28.8V

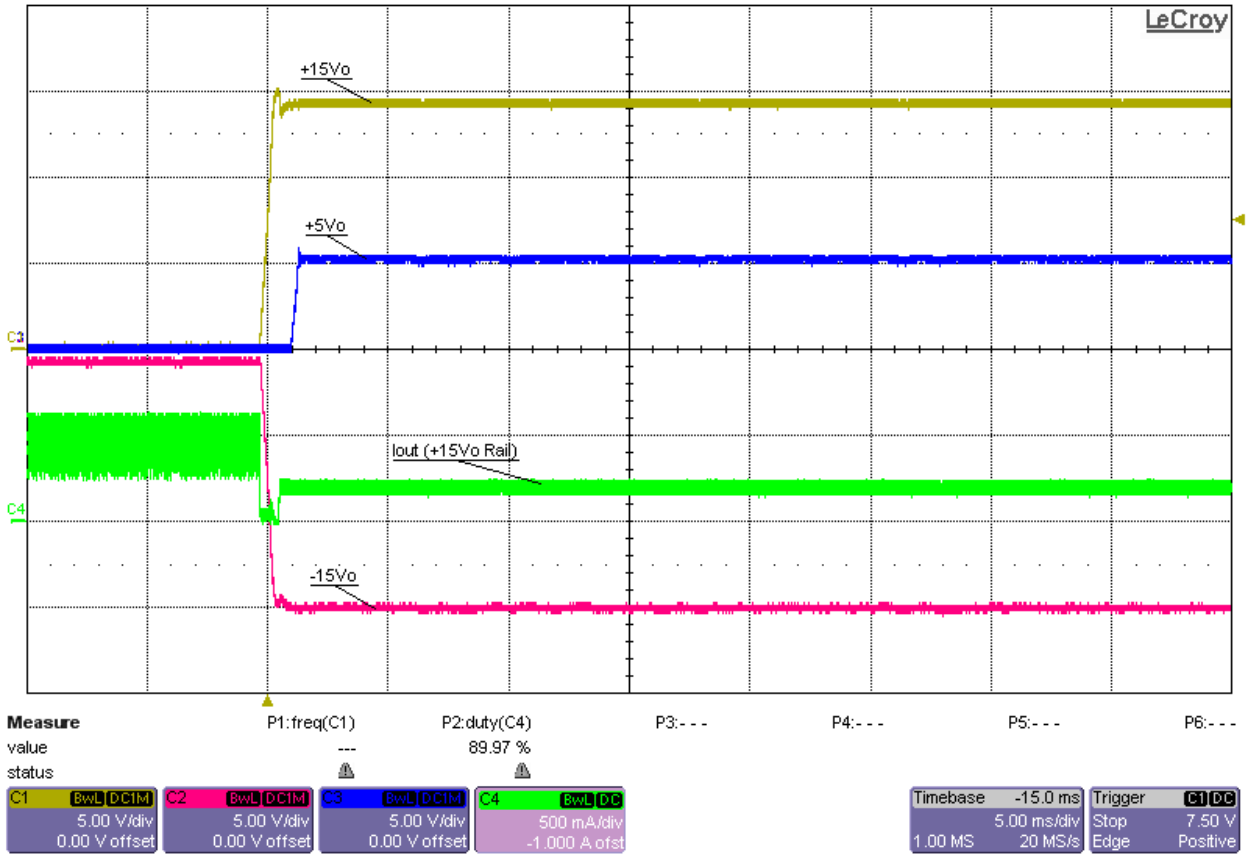


Short Circuit Applied to +5V Output Rail with All Output Rails at Full Load and Input Voltage at 20.4V

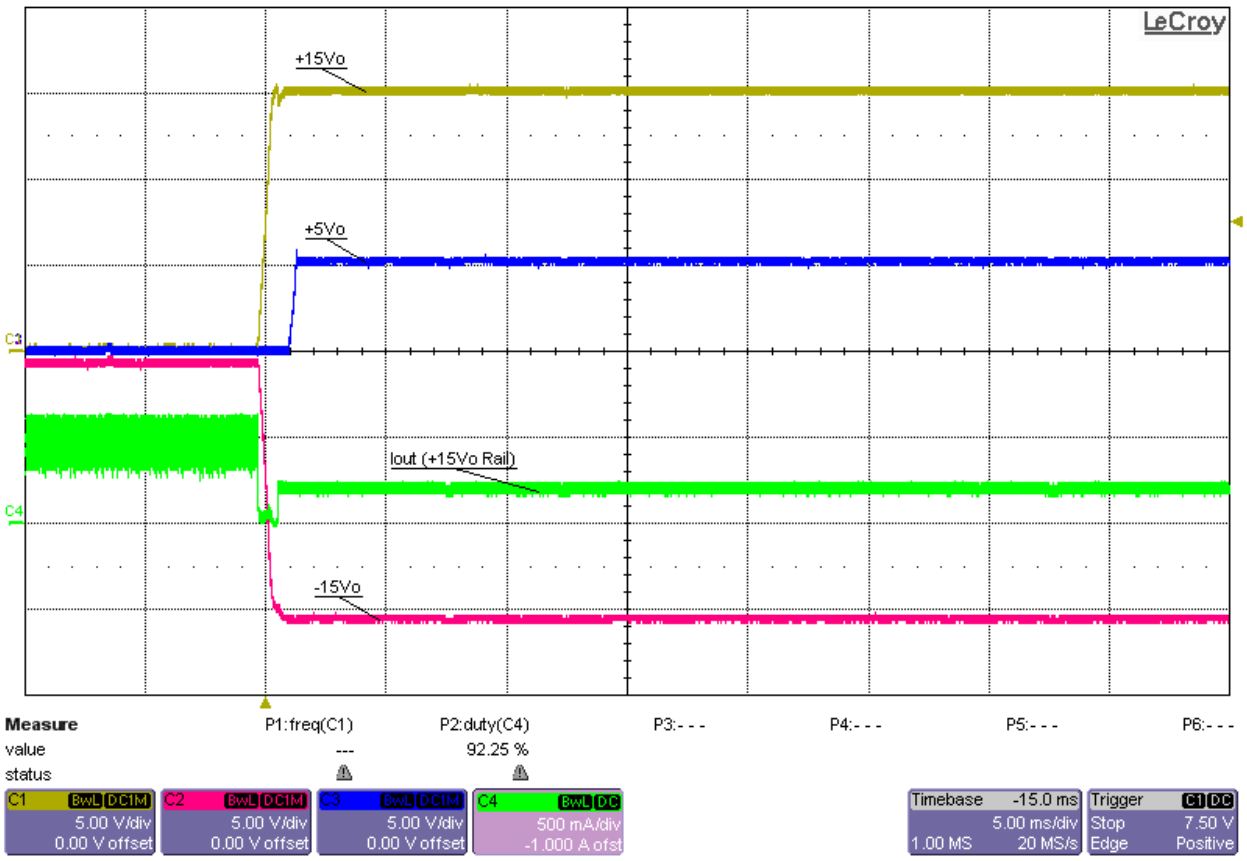


Short Circuit Applied to +5V Output Rail with All Output Rails at Full Load and Input Voltage at 28.8V

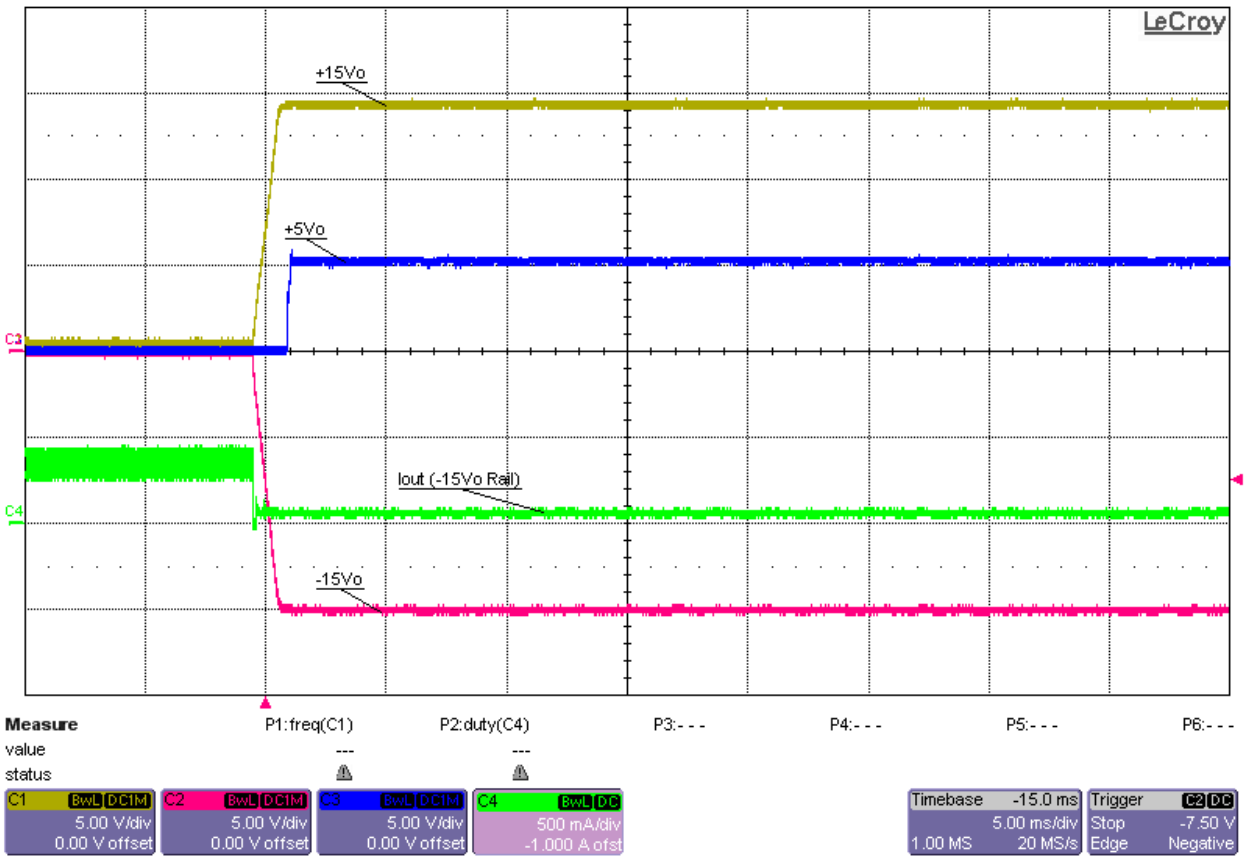
7.5 Short Circuit Recovery



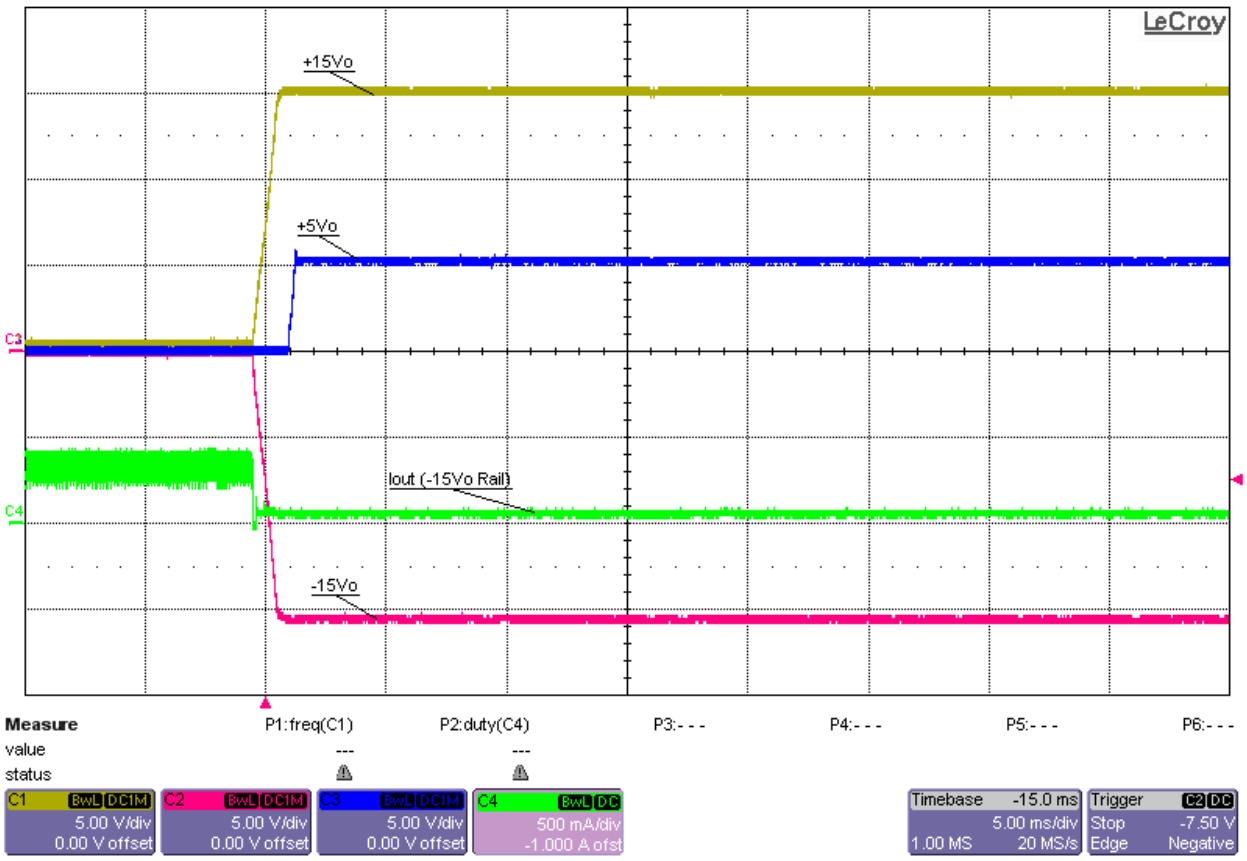
Short Circuit Recovery of +15V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 20.4V



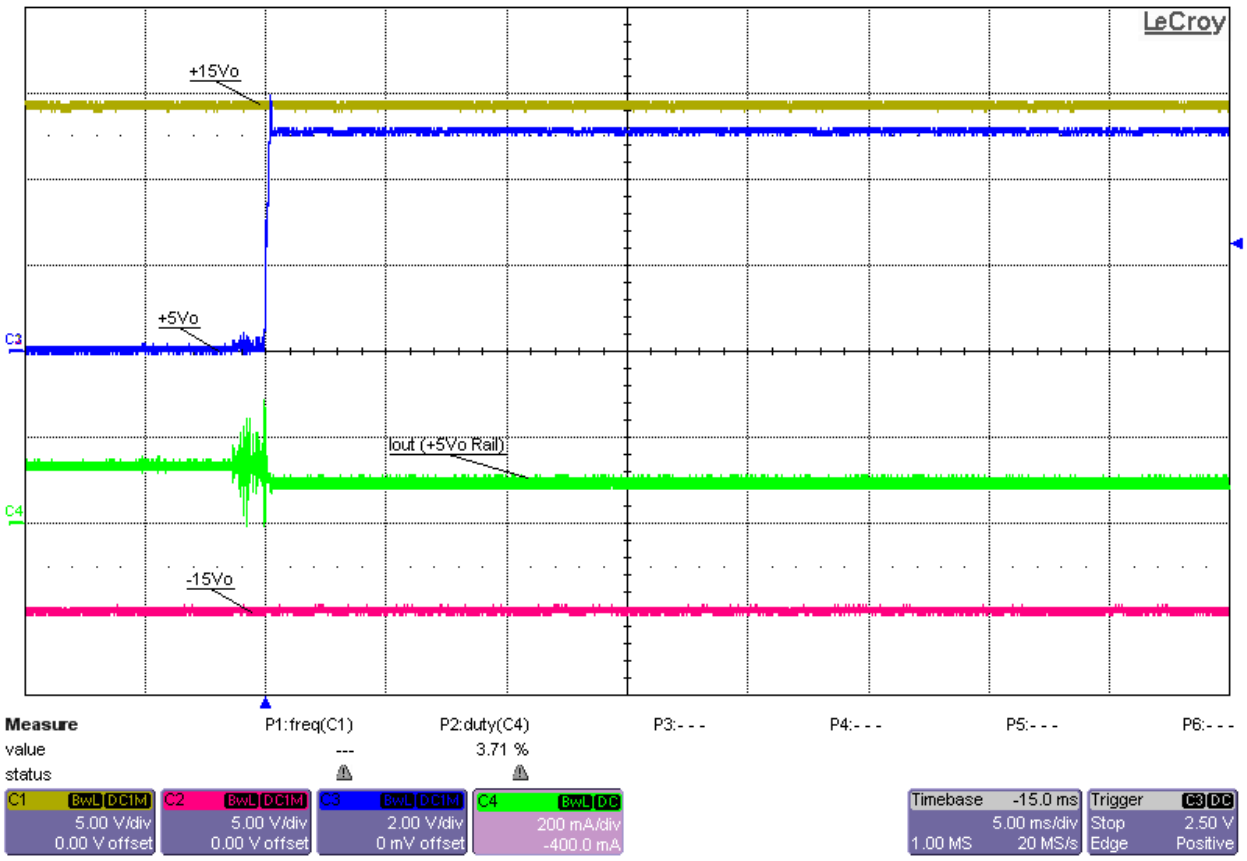
Short Circuit Recovery of +15V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 28.8V



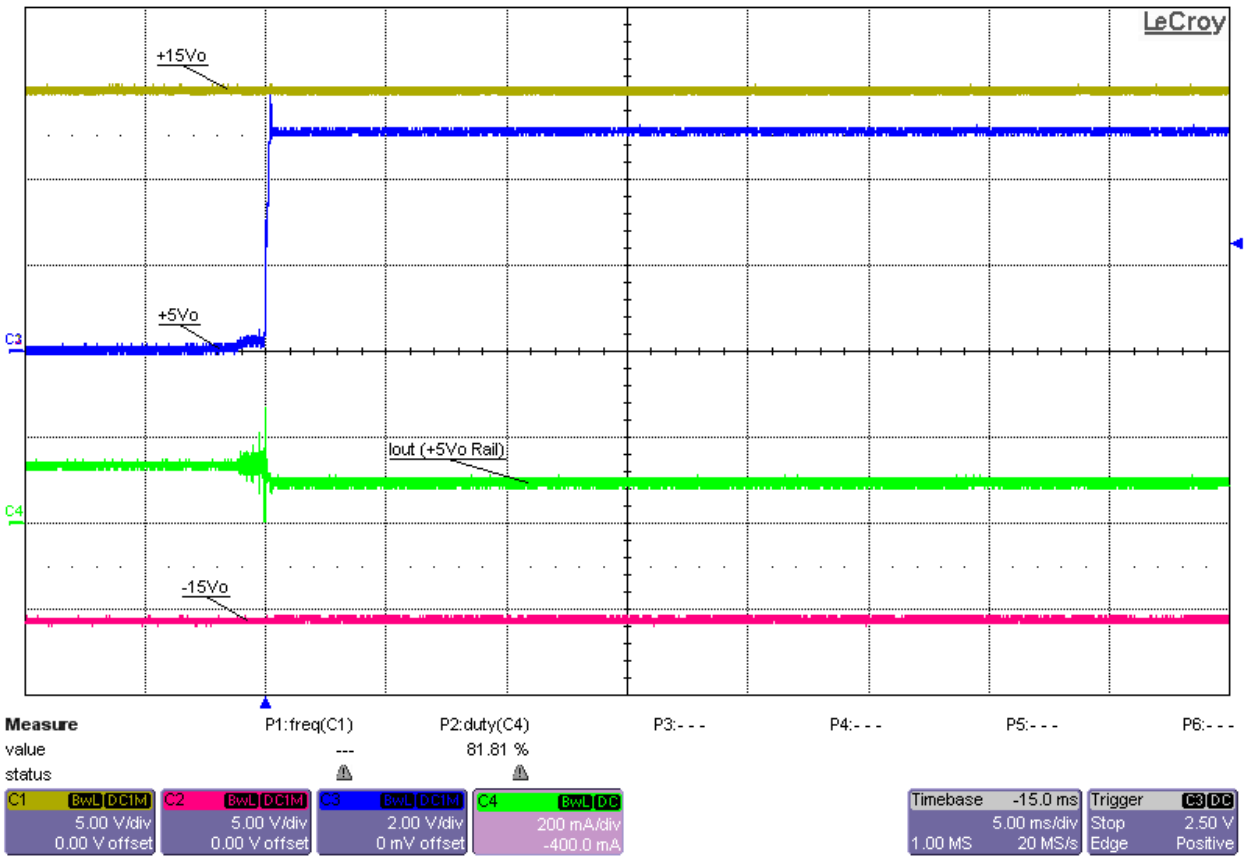
Short Circuit Recovery of -15V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 20.4V



Short Circuit Recovery of -15V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 28.8V



Short Circuit Recovery of +5V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 20.4V



Short Circuit Recovery of +5V Output Rail into Full Load with All Other Output Rails at Full Load and Input Voltage at 28.8V

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