

PMP4486 Test Results

1 General

1.1 PURPOSE

Provide the detailed data for evaluating and verifying the PMP4486. The PMP4486 is the 3 outputs DC-DC converter with the GaN Mosfet and the Digital controller. It delivers up to 12V/10A, 29V/10A and 1.0V/40A output power. The converter could provide high efficiency with the good performance, which makes it an ideal choice for POL converter. For testing applications, cooling airflow is required.

1.2 TEST EQUIPMENTS

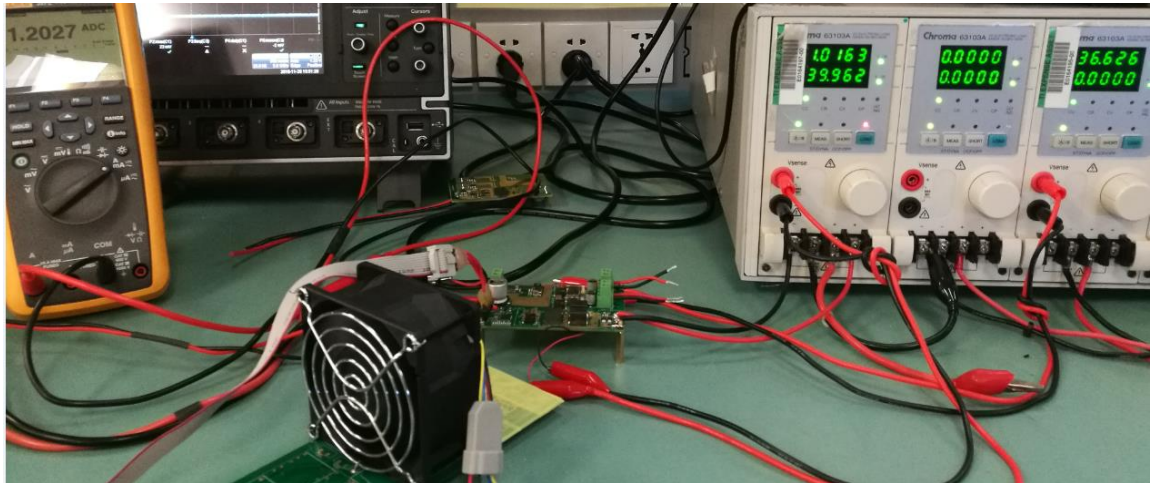
Multi-meter: Fluke Multimeter 287C, Agilent 34401A

DC Source: TDK-Lambda

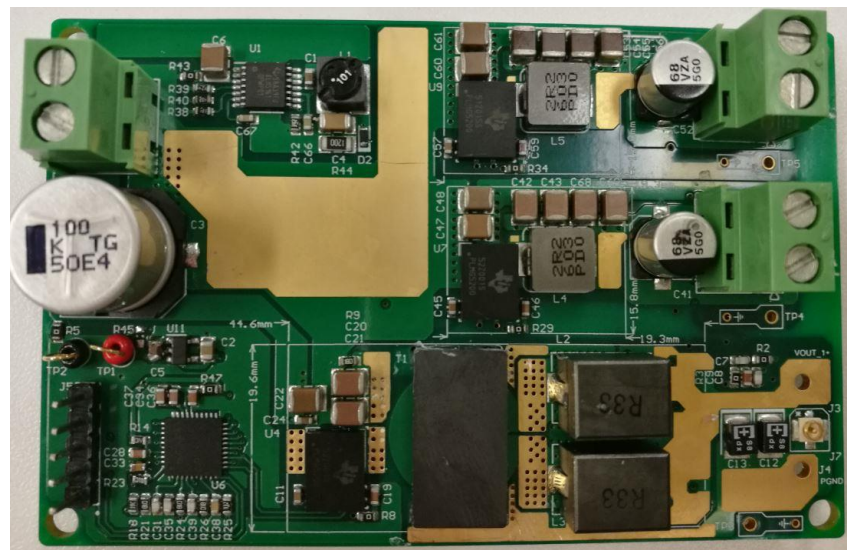
Ambient Temperature at 25DegC, Fan cooling

Oscilloscope: WaveSurfer 104Mxs-B

1.3 TEST Setup Photos



Testing Setup



Top View of the Board

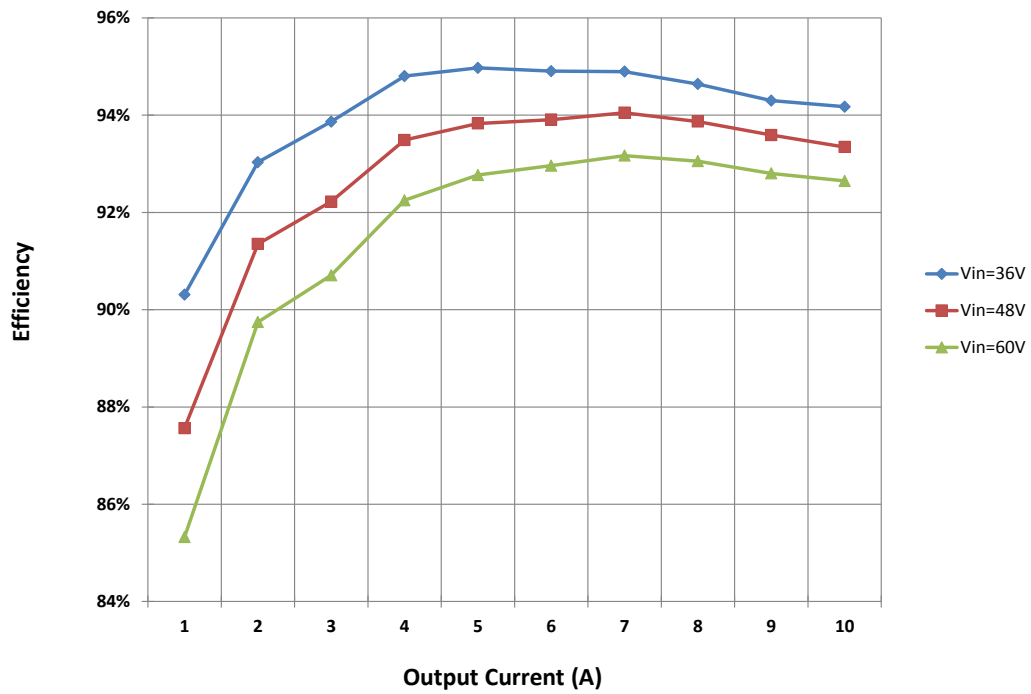
2 INPUT & Output CHARACTERISTICS

2.1: Efficiency vs Output Current

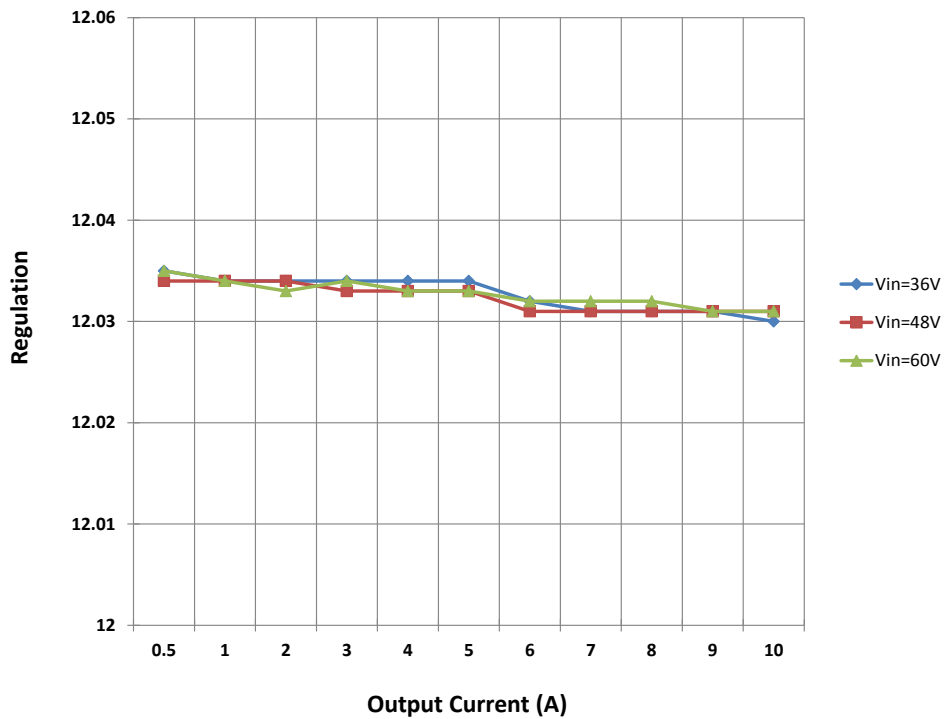
12.0V/10A Output Efficiency, @ 800 kHz

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.47	0.20	12.035	0.5	82.3%
36.41	0.37	12.034	1.0	90.3%
36.28	0.71	12.034	2.0	93.0%
36.15	1.06	12.034	3.0	93.9%
36.02	1.41	12.034	4.0	94.8%
35.92	1.76	12.034	5.0	95.0%
35.81	2.12	12.032	6.0	94.9%
35.71	2.49	12.031	7.0	94.9%
35.61	2.86	12.031	8.0	94.6%
35.50	3.23	12.031	9.0	94.3%
35.40	3.61	12.030	10.0	94.2%
48V Input				
48.55	0.16	12.034	0.5	77.8%
48.53	0.28	12.034	1.0	87.6%
48.45	0.54	12.034	2.0	91.4%
48.36	0.81	12.033	3.0	92.2%
48.28	1.07	12.033	4.0	93.5%
48.20	1.33	12.033	5.0	93.8%
48.12	1.60	12.031	6.0	93.9%
48.05	1.86	12.031	7.0	94.0%
47.97	2.14	12.031	8.0	93.9%
47.91	2.41	12.031	9.0	93.6%
47.84	2.69	12.031	10.0	93.3%
60V Input				
60.51	0.13	12.035	0.5	74.4%
60.48	0.23	12.034	1.0	85.3%
60.41	0.44	12.033	2.0	89.7%
60.34	0.66	12.034	3.0	90.7%
60.27	0.87	12.033	4.0	92.2%
60.19	1.08	12.033	5.0	92.8%
60.13	1.29	12.032	6.0	93.0%
60.07	1.50	12.032	7.0	93.2%
60.00	1.72	12.032	8.0	93.1%
59.96	1.95	12.031	9.0	92.8%
59.90	2.17	12.031	10.0	92.6%

Efficiency vs Output Current LMG5200@12V

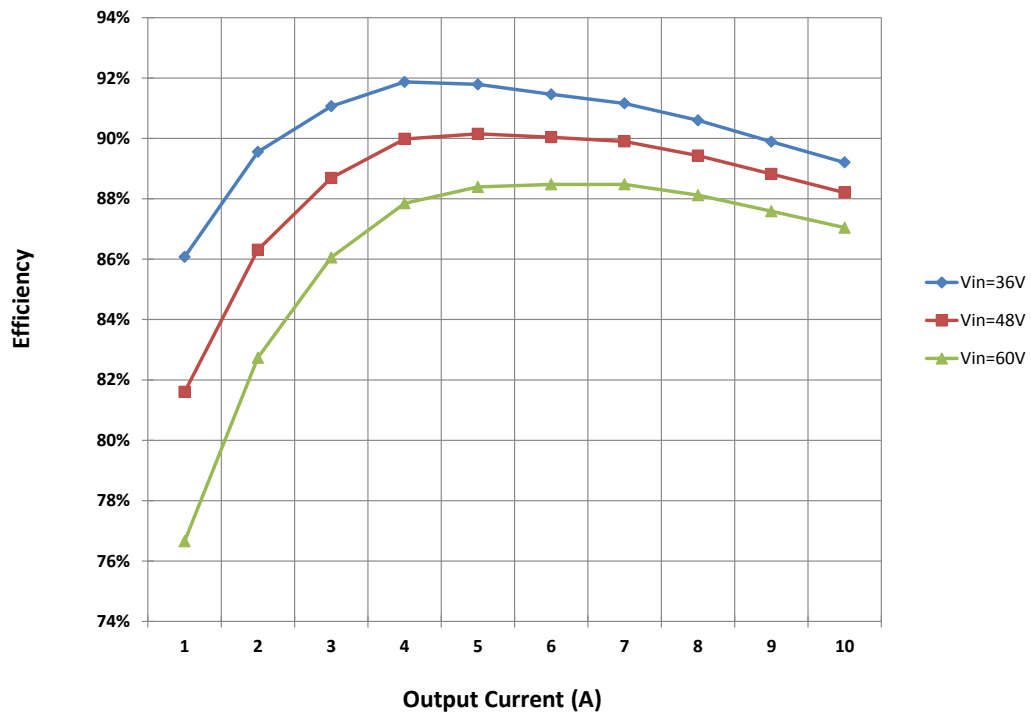
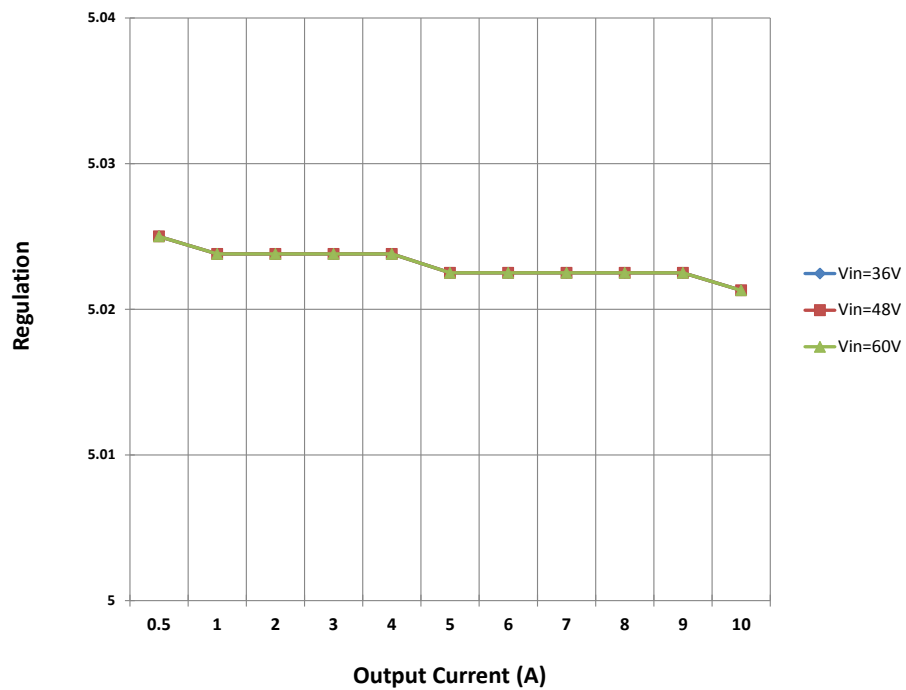


Regulation vs Output Current LMG5200@12V



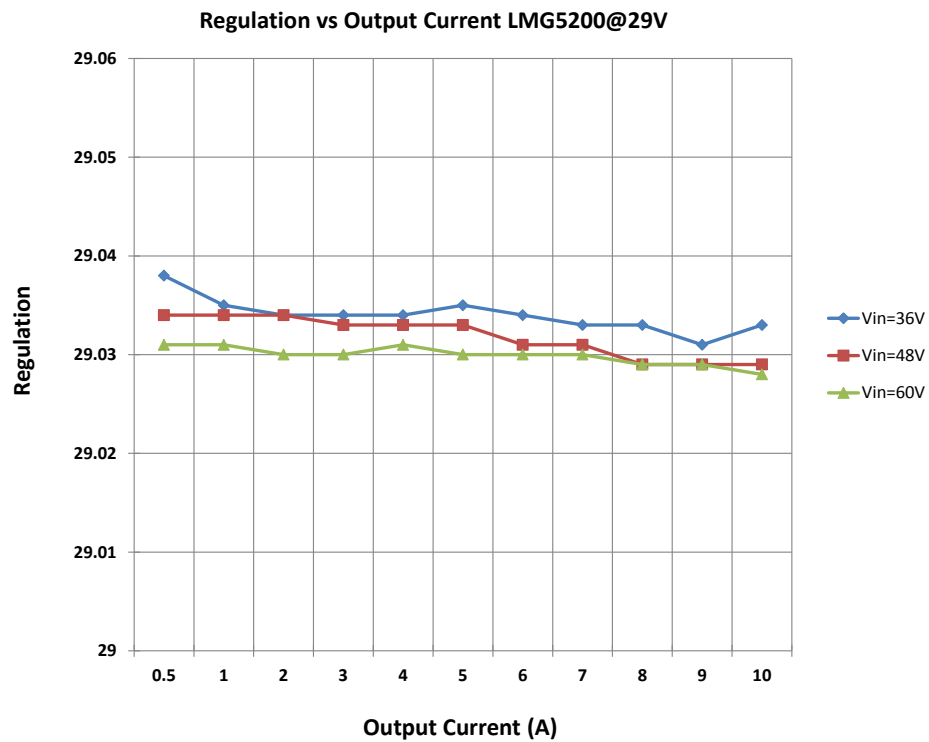
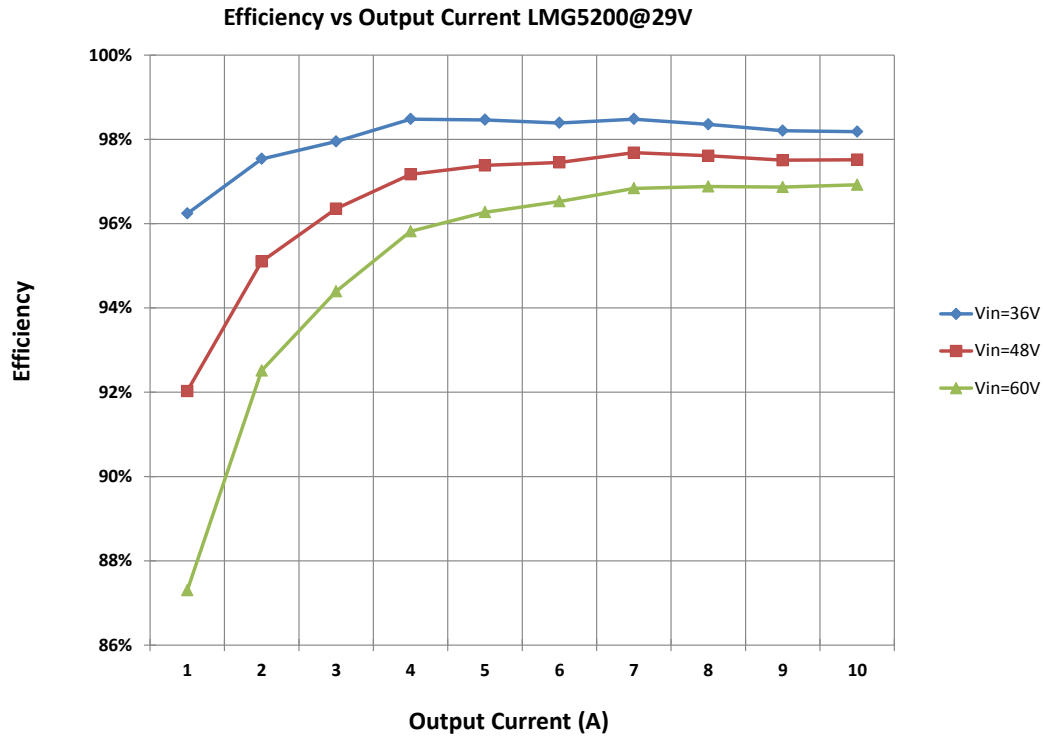
5.0V/10A Output Efficiency, @800kHz

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.217	0.0881	5.025	0.5	78.7%
36.208	0.1612	5.024	1.0	86.1%
36.192	0.3100	5.024	2.0	89.6%
36.175	0.4575	5.024	3.0	91.1%
36.159	0.6049	5.024	4.0	91.9%
36.141	0.7570	5.023	5.0	91.8%
36.124	0.9121	5.023	6.0	91.5%
36.107	1.0681	5.023	7.0	91.2%
36.088	1.2289	5.023	8.0	90.6%
36.070	1.3941	5.023	9.0	89.9%
36.051	1.5614	5.021	10.0	89.2%
48V Input				
48.144	0.0723	5.025	0.5	72.2%
48.137	0.1279	5.024	1.0	81.6%
48.124	0.2419	5.024	2.0	86.3%
48.112	0.3532	5.024	3.0	88.7%
48.099	0.4643	5.024	4.0	90.0%
48.086	0.5793	5.023	5.0	90.2%
48.073	0.6962	5.023	6.0	90.0%
48.060	0.8137	5.023	7.0	89.9%
48.047	0.9351	5.023	8.0	89.4%
48.033	1.0595	5.023	9.0	88.8%
48.019	1.1855	5.021	10.0	88.2%
60V Input				
60.140	0.0639	5.025	0.5	65.4%
60.130	0.1090	5.024	1.0	76.7%
60.120	0.2020	5.024	2.0	82.7%
60.120	0.2913	5.024	3.0	86.1%
60.100	0.3806	5.024	4.0	87.9%
60.090	0.4728	5.023	5.0	88.4%
60.080	0.5669	5.023	6.0	88.5%
60.070	0.6615	5.023	7.0	88.5%
60.060	0.7592	5.023	8.0	88.1%
60.050	0.8594	5.023	9.0	87.6%
60.040	0.9608	5.021	10.0	87.0%

Efficiency vs Output Current LMG5200@5.0V

Regulation vs Output Current LMG5200@5.0V


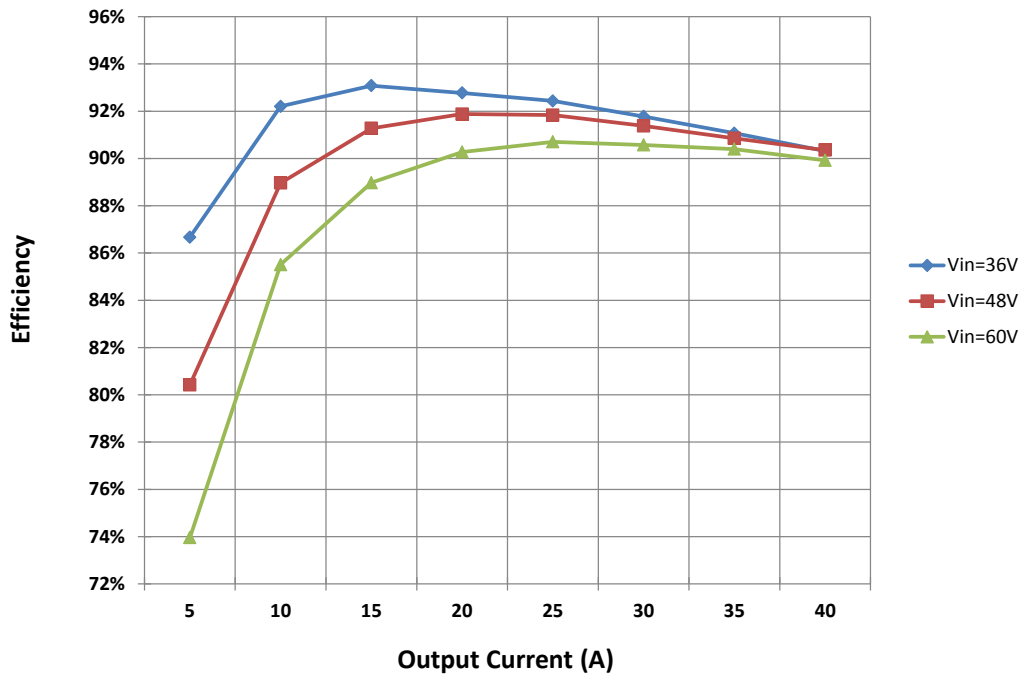
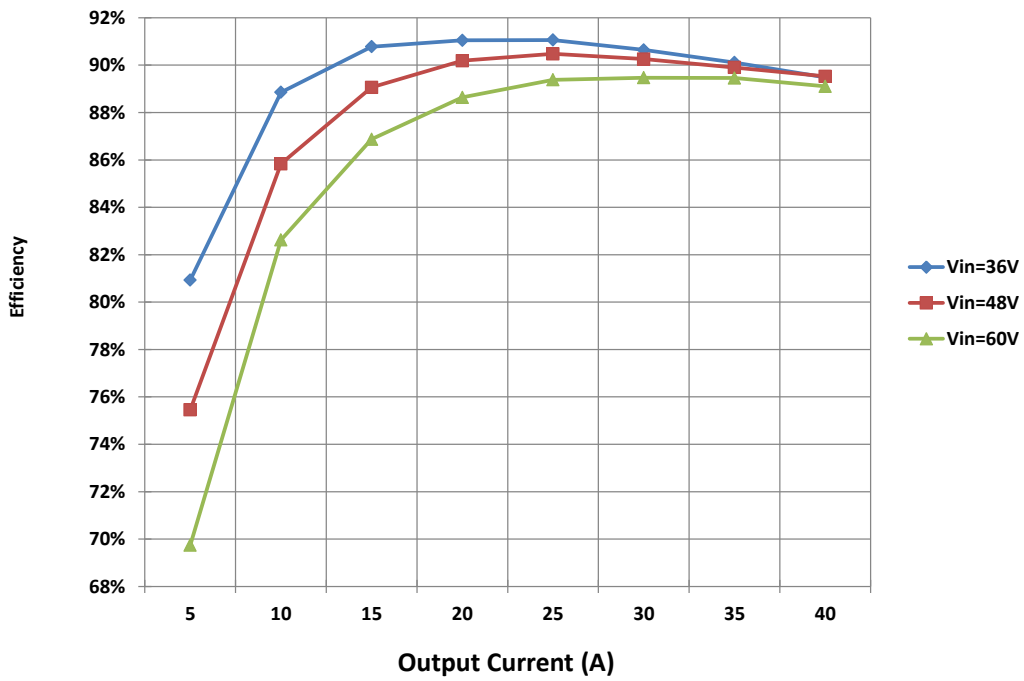
29.0V/10A Output Efficiency, @800kHz

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)
36V Input				
36.76	0.43	29.038	0.5	92.4%
36.71	0.82	29.035	1.0	96.2%
36.61	1.63	29.034	2.0	97.5%
36.51	2.44	29.034	3.0	97.9%
36.41	3.24	29.034	4.0	98.5%
36.31	4.06	29.035	5.0	98.5%
36.20	4.89	29.034	6.0	98.4%
36.10	5.72	29.033	7.0	98.5%
35.99	6.56	29.033	8.0	98.4%
35.88	7.42	29.031	9.0	98.2%
35.77	8.27	29.033	10.0	98.2%
48V Input				
48.57	0.35	29.034	0.5	85.2%
48.54	0.65	29.034	1.0	92.0%
48.46	1.26	29.034	2.0	95.1%
48.39	1.87	29.033	3.0	96.4%
48.31	2.47	29.033	4.0	97.2%
48.24	3.09	29.033	5.0	97.4%
48.16	3.71	29.031	6.0	97.5%
48.08	4.33	29.031	7.0	97.7%
48.01	4.96	29.029	8.0	97.6%
47.92	5.59	29.029	9.0	97.5%
47.84	6.22	29.029	10.0	97.5%
60V Input				
60.53	0.31	29.031	0.5	78.4%
60.50	0.55	29.031	1.0	87.3%
60.44	1.04	29.030	2.0	92.5%
60.38	1.53	29.030	3.0	94.4%
60.32	2.01	29.031	4.0	95.8%
60.26	2.50	29.030	5.0	96.3%
60.20	3.00	29.030	6.0	96.5%
60.14	3.49	29.030	7.0	96.8%
60.07	3.99	29.029	8.0	96.9%
60.01	4.49	29.029	9.0	96.9%
59.95	5.00	29.028	10.0	96.9%



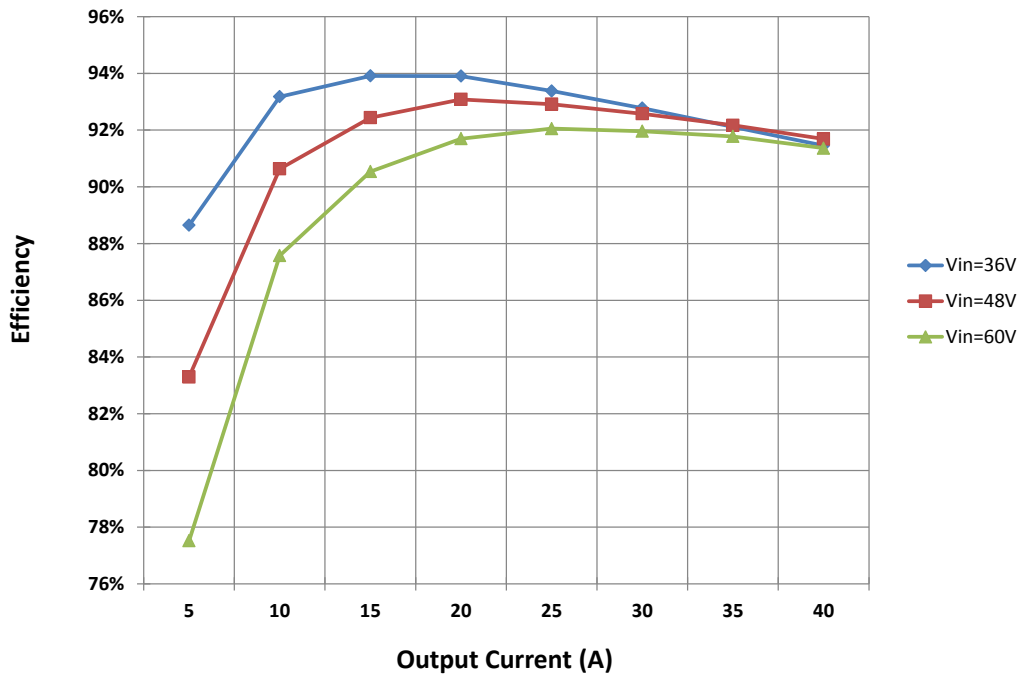
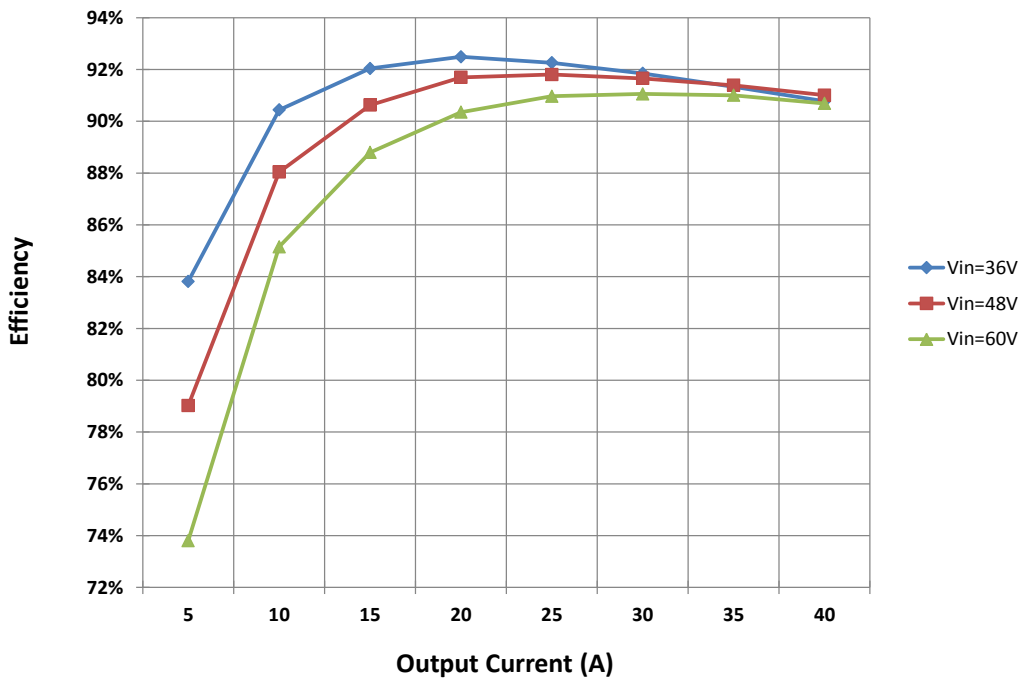
0.8V/40A Output Efficiency, @600kHz

Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)	Eff. with Driver Loss (%)
36V Input					
36.356	0.0194	0.806	0.0	0.7	1.0
36.354	0.0407	0.806	1.0	54.5%	44.6%
36.341	0.1280	0.806	5.0	86.7%	80.9%
36.324	0.2411	0.808	10.0	92.2%	88.9%
36.309	0.3584	0.808	15.0	93.1%	90.8%
36.389	0.4784	0.808	20.0	92.8%	91.0%
36.273	0.6021	0.808	25.0	92.4%	91.1%
36.253	0.7281	0.808	30.0	91.8%	90.6%
36.234	0.8565	0.808	35.0	91.1%	90.1%
36.214	0.9876	0.808	40.0	90.3%	89.5%
48V Input					
48.260	0.0239	0.808	0.0	1.2	1.5
48.258	0.0393	0.808	1.0	42.6%	36.3%
48.249	0.1039	0.806	5.0	80.4%	75.5%
48.235	0.1879	0.806	10.0	89.0%	85.8%
48.221	0.2752	0.808	15.0	91.3%	89.1%
48.210	0.3646	0.808	20.0	91.9%	90.2%
48.196	0.4561	0.808	25.0	91.8%	90.5%
48.183	0.5502	0.808	30.0	91.4%	90.3%
48.169	0.6458	0.808	35.0	90.9%	89.9%
48.154	0.7424	0.808	40.0	90.4%	89.5%
60V Input					
60.399	0.0274	0.808	0.0	1.7	2.0
60.398	0.0397	0.808	1.0	33.7%	29.6%
60.390	0.0904	0.808	5.0	74.0%	69.7%
60.380	0.1564	0.808	10.0	85.5%	82.6%
60.369	0.2255	0.808	15.0	89.0%	86.9%
60.359	0.2964	0.808	20.0	90.3%	88.6%
60.348	0.3688	0.808	25.0	90.7%	89.4%
60.336	0.4433	0.808	30.0	90.6%	89.5%
60.326	0.5191	0.809	35.0	90.4%	89.5%
60.315	0.5965	0.809	40.0	89.9%	89.1%

Efficiency vs Output Current LMG5200@0.8V w/o Driver Loss

Efficiency vs Output Current LMG5200@0.8V with Driver Loss


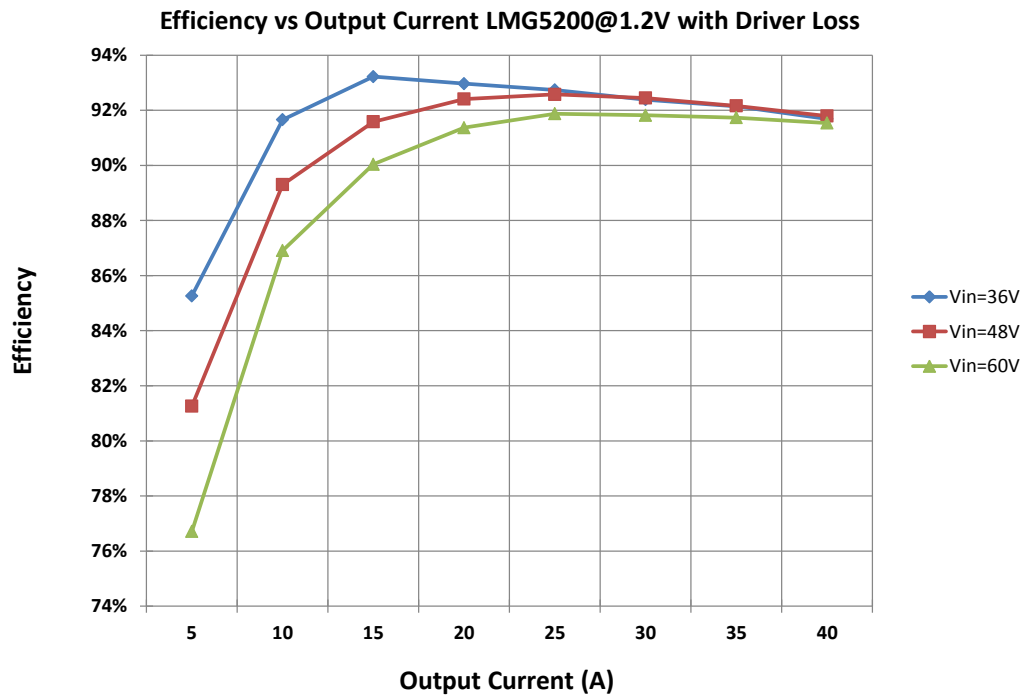
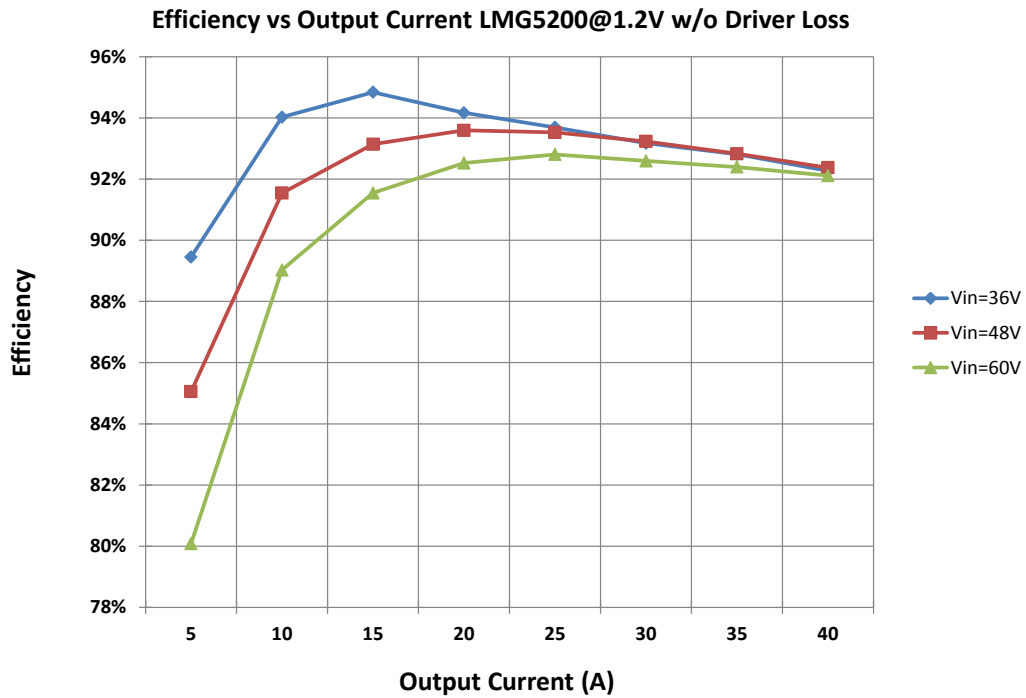
1.0V/40A Output Efficiency, @600kHz

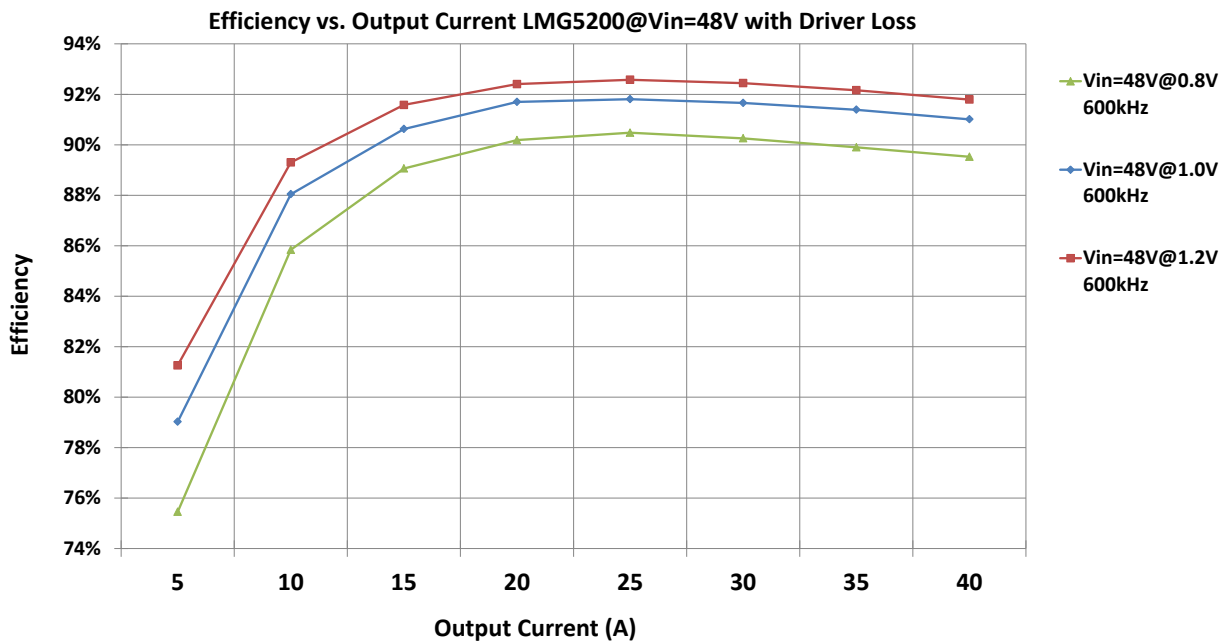
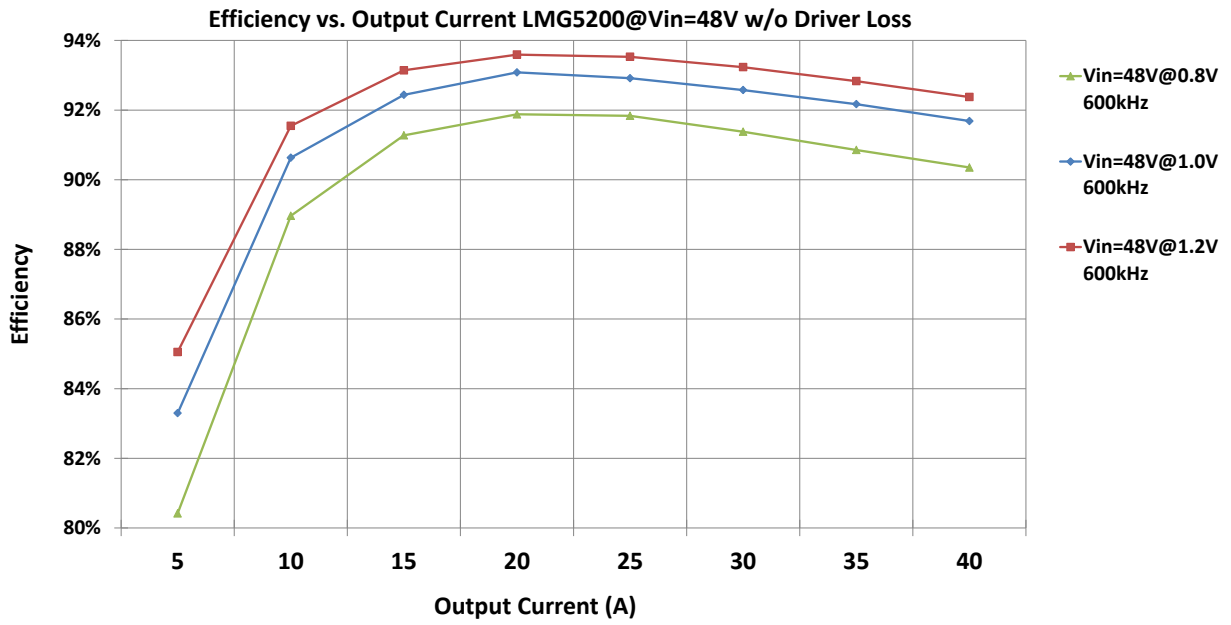
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)	Eff. with Driver Loss (%)
36V Input					
36.438	0.0202	1.015	0.0	0.7W	1.1W
36.434	0.0469	1.015	1.0	59.4%	49.8%
36.418	0.1572	1.015	5.0	88.6%	83.8%
36.395	0.2993	1.015	10.0	93.2%	90.4%
36.374	0.4457	1.015	15.0	93.9%	92.0%
36.351	0.5947	1.015	20.0	93.9%	92.5%
36.329	0.7471	1.014	25.0	93.4%	92.3%
36.308	0.9029	1.014	30.0	92.8%	91.9%
36.283	1.0617	1.014	35.0	92.1%	91.3%
36.258	1.2230	1.014	40.0	91.4%	90.8%
48V Input					
48.241	0.0243	1.016	0.0	1.2W	1.5W
48.238	0.0442	1.016	1.0	47.7%	41.3%
48.225	0.1265	1.016	5.0	83.3%	79.0%
48.209	0.2326	1.016	10.0	90.6%	88.0%
48.193	0.3422	1.016	15.0	92.4%	90.6%
48.176	0.4538	1.018	20.0	93.1%	91.7%
48.159	0.5678	1.016	25.0	92.9%	91.8%
48.143	0.6849	1.018	30.0	92.6%	91.7%
48.123	0.8029	1.018	35.0	92.2%	91.4%
48.105	0.9228	1.018	40.0	91.7%	91.0%
60V Input					
60.374	0.0281	1.016	0.0	1.7W	2.0W
60.373	0.0438	1.016	1.0	38.4%	34.2%
60.361	0.1086	1.016	5.0	77.5%	73.8%
60.349	0.1923	1.016	10.0	87.6%	85.2%
60.336	0.2794	1.018	15.0	90.5%	88.8%
60.323	0.3679	1.018	20.0	91.7%	90.4%
60.309	0.4582	1.018	25.0	92.1%	91.0%
60.296	0.5505	1.018	30.0	92.0%	91.1%
60.283	0.6445	1.019	35.0	91.8%	91.0%
60.268	0.7401	1.019	40.0	91.4%	90.7%

Efficiency vs. Output Current LMG5200@1.0V w/o Driver Loss

Efficiency vs. Output Current LMG5200@1.0V with Driver Loss


1.2V/40A Output Efficiency, @600kHz

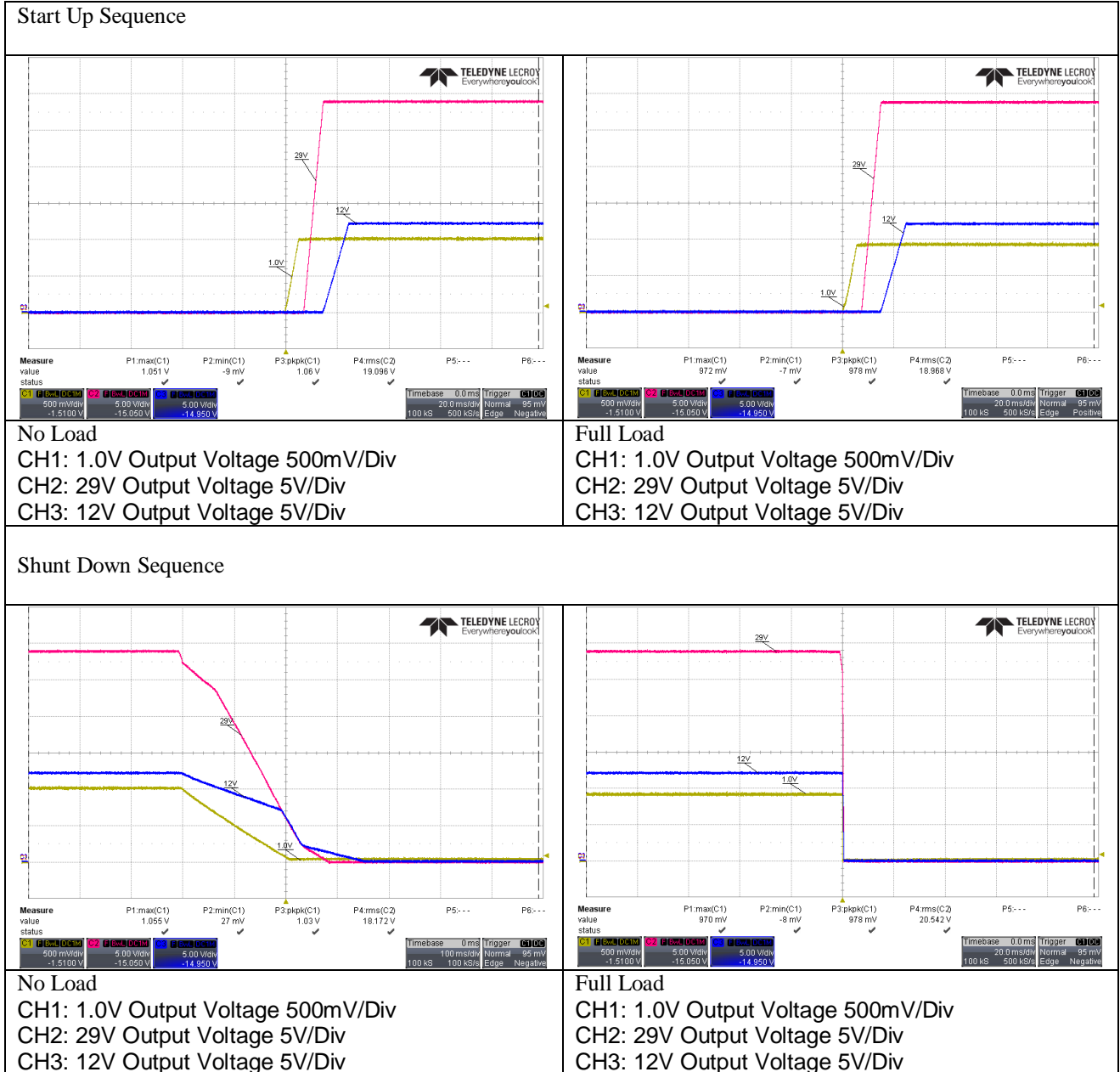
Vin (V)	Iin (A)	Vout (V)	Iout (A)	Eff. (%)	Eff. with Driver Loss (%)
36V Input					
36.436	0.0227	1.203	0.0	0.8W	1.2W
36.431	0.0542	1.203	1.0	60.9%	52.2%
36.414	0.1844	1.201	5.0	89.5%	85.3%
36.389	0.3511	1.201	10.0	94.0%	91.7%
36.363	0.5225	1.201	15.0	94.8%	93.2%
36.448	0.7000	1.201	20.0	94.2%	93.0%
36.311	0.8818	1.200	25.0	93.7%	92.7%
36.283	1.0638	1.199	30.0	93.2%	92.4%
36.255	1.2469	1.199	35.0	92.8%	92.1%
36.228	1.4345	1.199	40.0	92.3%	91.7%
48V Input					
48.241	0.0248	1.203	0.0	1.2W	1.5W
48.236	0.0485	1.203	1.0	51.4%	45.0%
48.221	0.1466	1.203	5.0	85.1%	81.3%
48.204	0.2725	1.203	10.0	91.5%	89.3%
48.185	0.4019	1.203	15.0	93.1%	91.6%
48.165	0.5335	1.203	20.0	93.6%	92.4%
48.146	0.6676	1.203	25.0	93.5%	92.6%
48.124	0.8049	1.204	30.0	93.2%	92.4%
48.104	0.9435	1.204	35.0	92.8%	92.2%
48.083	1.0841	1.204	40.0	92.4%	91.8%
60V Input					
60.125	0.0284	1.204	0.0	1.7W	2.0W
60.123	0.0471	1.204	1.0	42.5%	38.1%
60.111	0.1249	1.203	5.0	80.1%	76.7%
60.095	0.2250	1.204	10.0	89.0%	86.9%
60.080	0.3283	1.204	15.0	91.5%	90.0%
60.064	0.4332	1.204	20.0	92.5%	91.4%
60.049	0.5400	1.204	25.0	92.8%	91.9%
60.031	0.6497	1.204	30.0	92.6%	91.8%
60.016	0.7598	1.204	35.0	92.4%	91.7%
60.000	0.8721	1.205	40.0	92.1%	91.5%





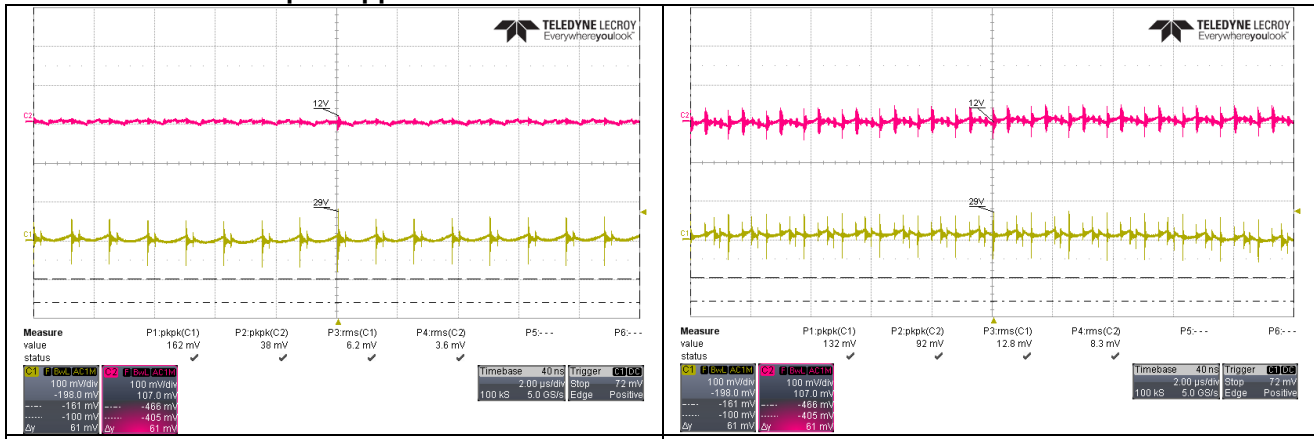
2.2: Start Up & Shut Down Waveforms

48V Input with Full Load & No Load



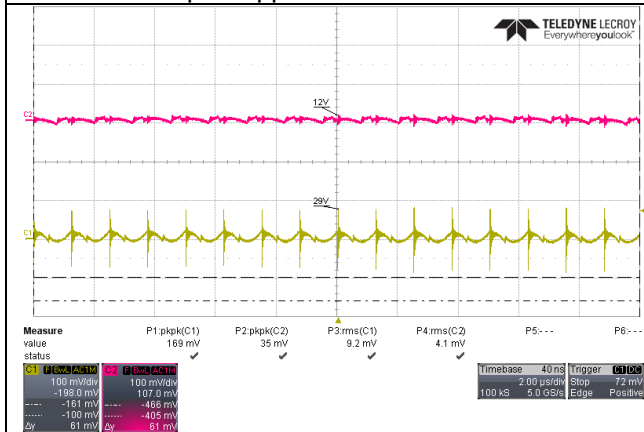
2.3: Output Ripple & Noise

12V/10A & 29V/10A Output Ripple & Noise



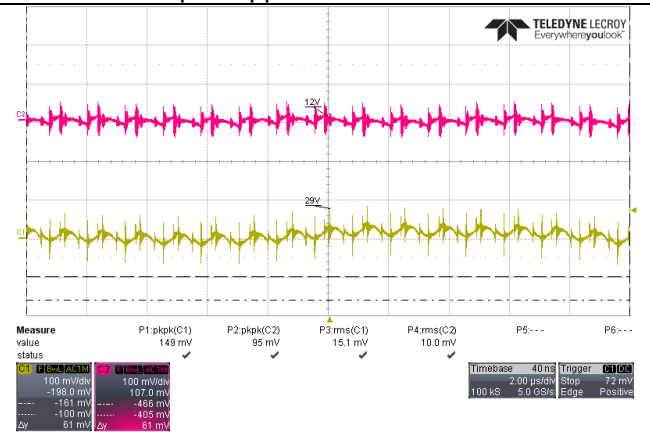
36V Input No Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div



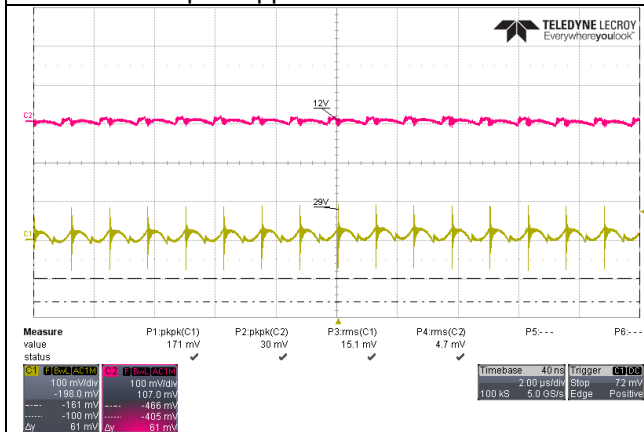
36V Input Full Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div



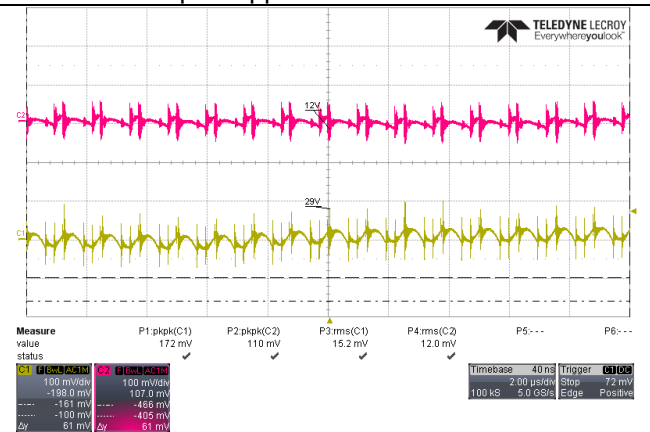
48V Input No Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div



48V Input Full Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div



60V Input No Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div

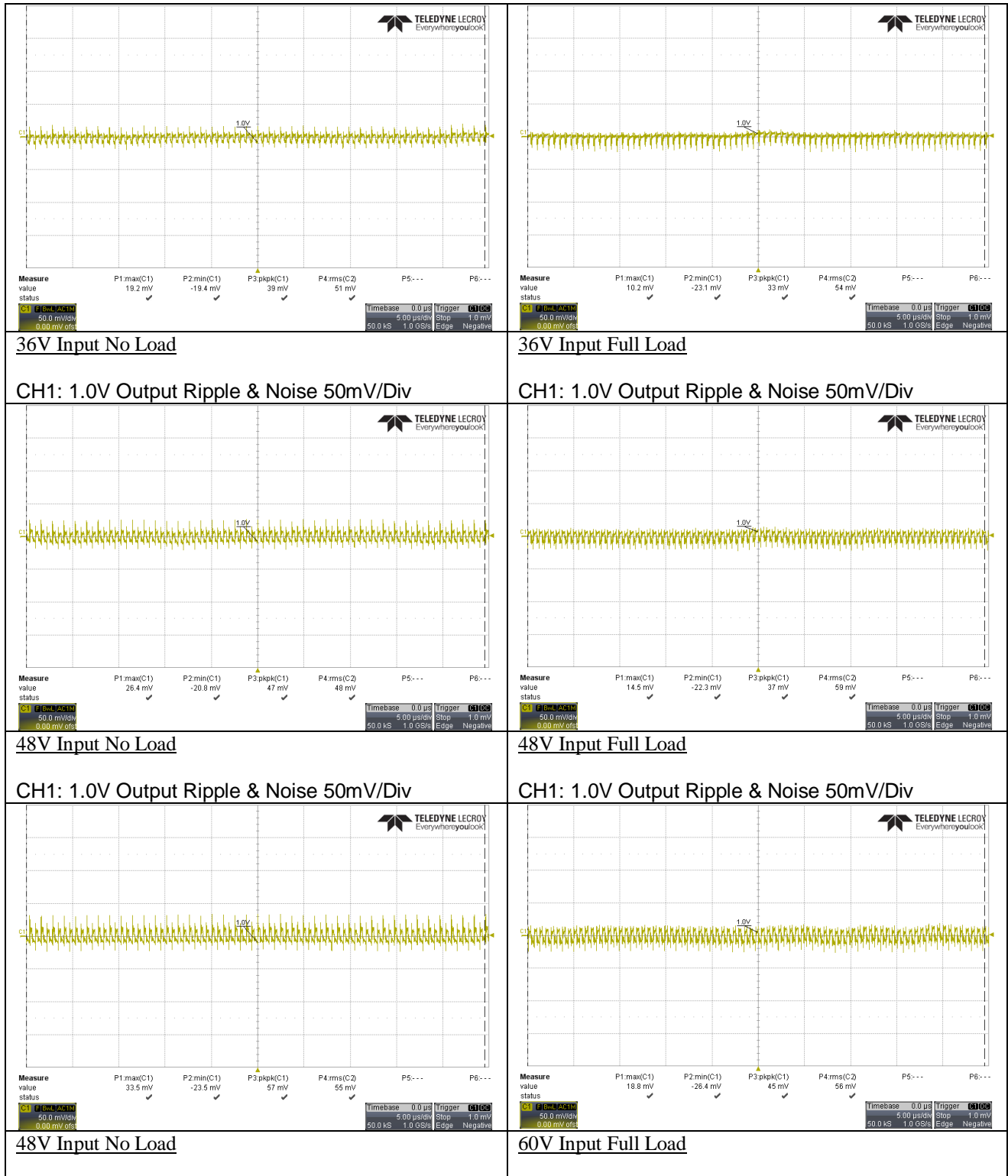


60V Input Full Load

CH1: 29V Output Ripple & Noise 100mV/Div
CH2: 12V Output Ripple & Noise 100mV/Div



1.0V/40A Output Ripple & Noise

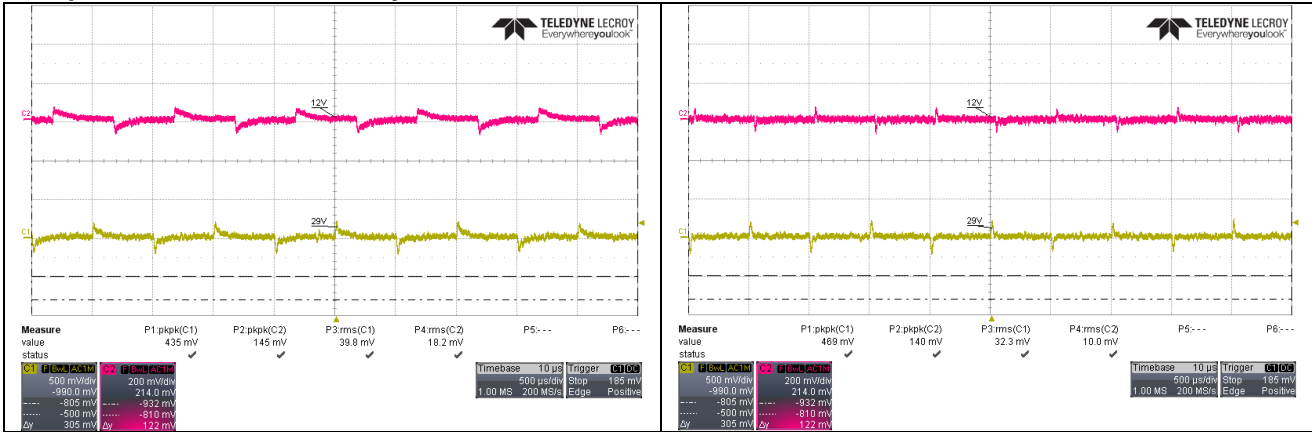


CH1: 1.0V Output Ripple & Noise 50mV/Div

CH1: 1.0V Output Ripple & Noise 50mV/Div

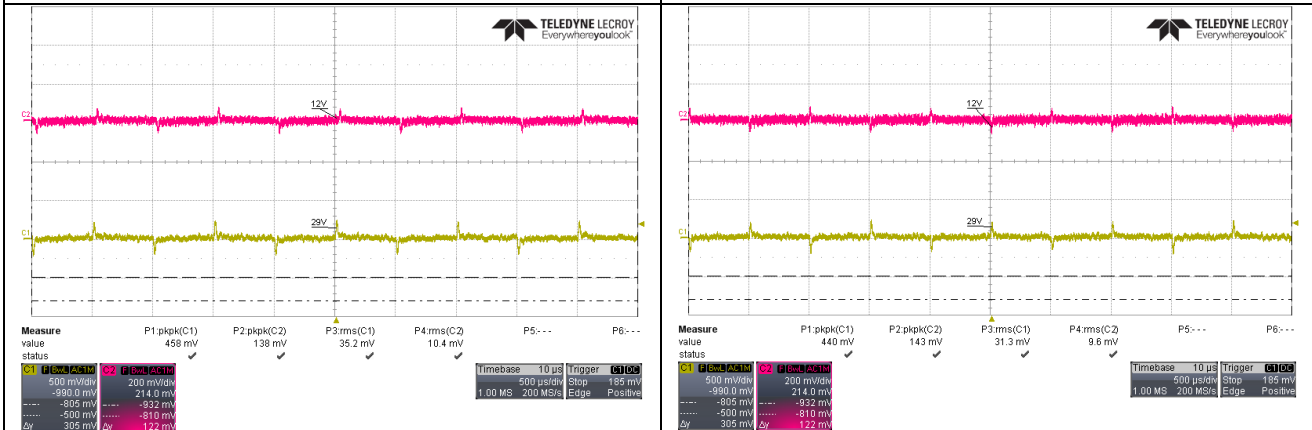
2.4: Dynamic Load Waveforms

48V Input, 29V/10A & 12V/10A Dynamic Load Waveforms



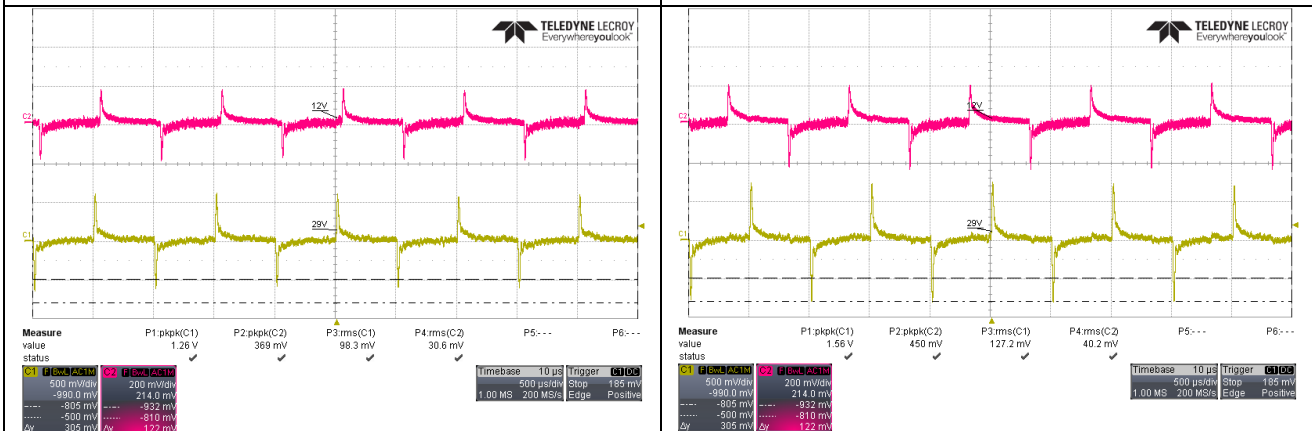
Dynamic Load (0% – 25%)
 CH1: 29V Overshoot & Undershoot 500mV/Div
 CH2: 12V Overshoot & Undershoot 200mV/Div

Dynamic Load (25% – 50%)
 CH1: 29V Overshoot & Undershoot 500mV/Div
 CH2: 12V Overshoot & Undershoot 200mV/Div



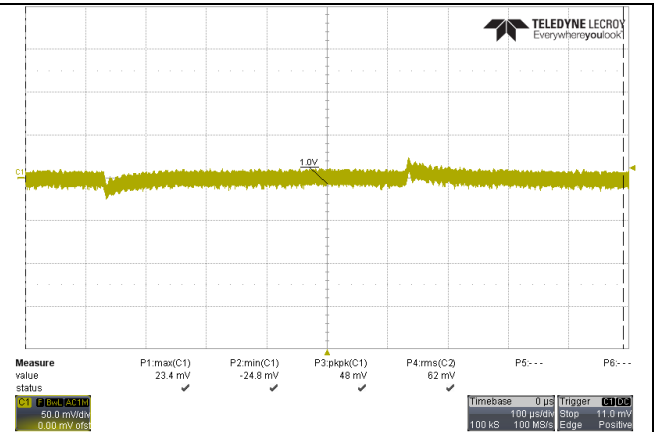
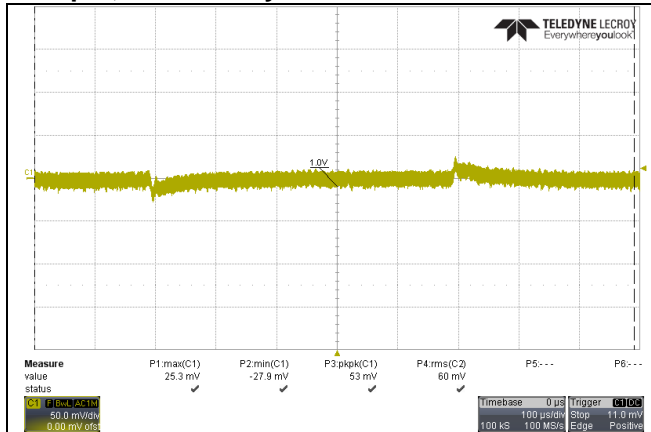
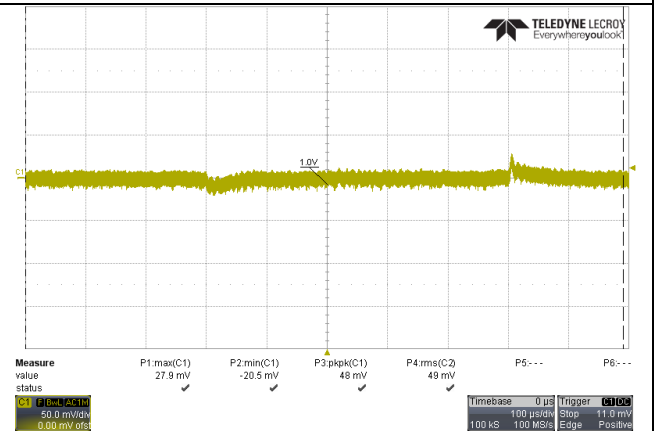
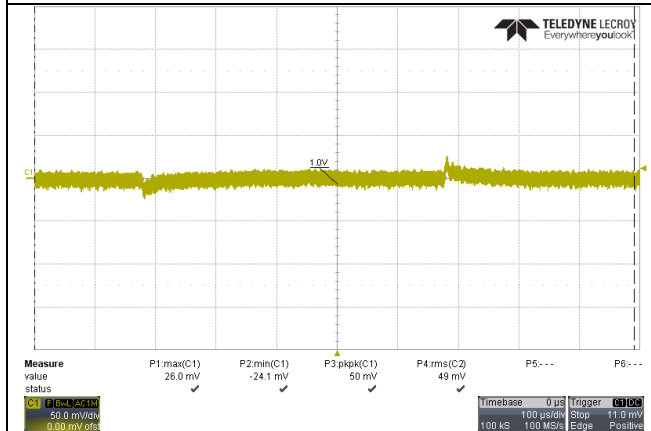
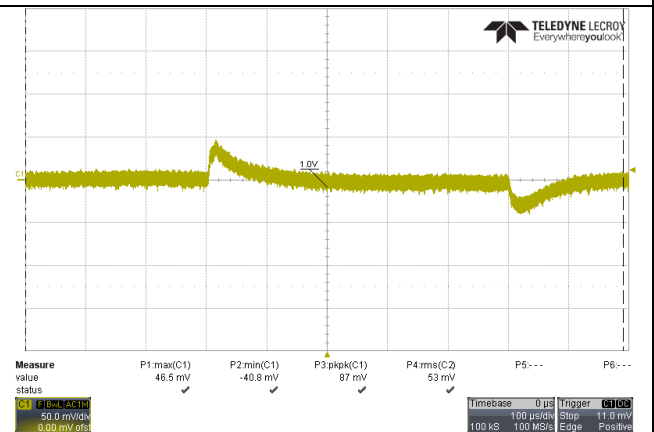
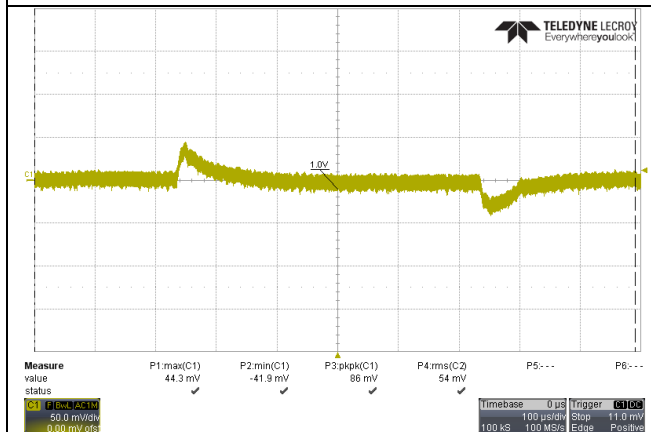
Dynamic Load (50% – 75%)
 CH1: 29V Overshoot & Undershoot 500mV/Div
 CH2: 12V Overshoot & Undershoot 200mV/Div

Dynamic Load (75% – 100%)
 CH1: 29V Overshoot & Undershoot 500mV/Div
 CH2: 12V Overshoot & Undershoot 200mV/Div

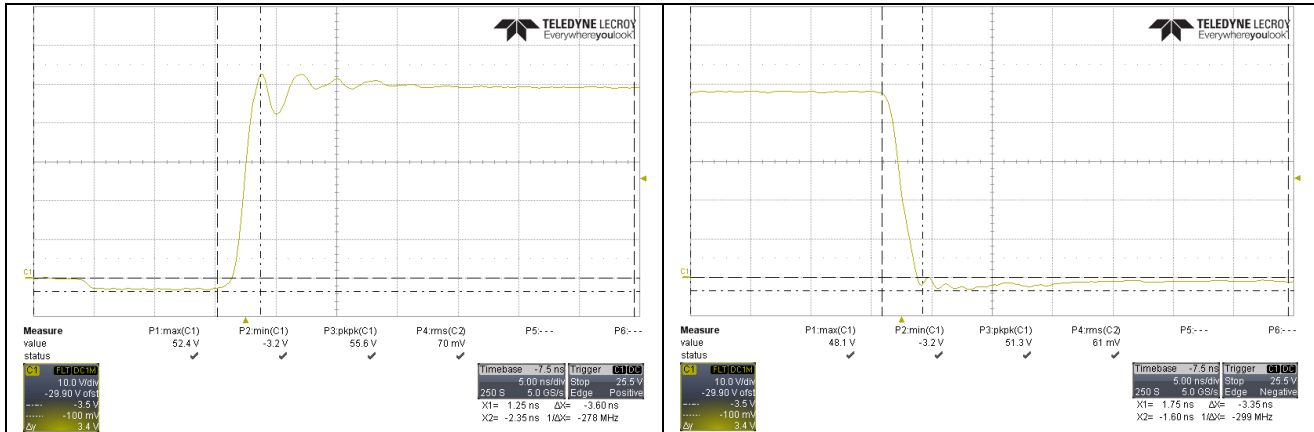


Dynamic Load (10% – 90%)
 CH1: 29V Overshoot & Undershoot 500mV/Div

Dynamic Load (0% – 100%)
 CH1: 29V Overshoot & Undershoot 500mV/Div

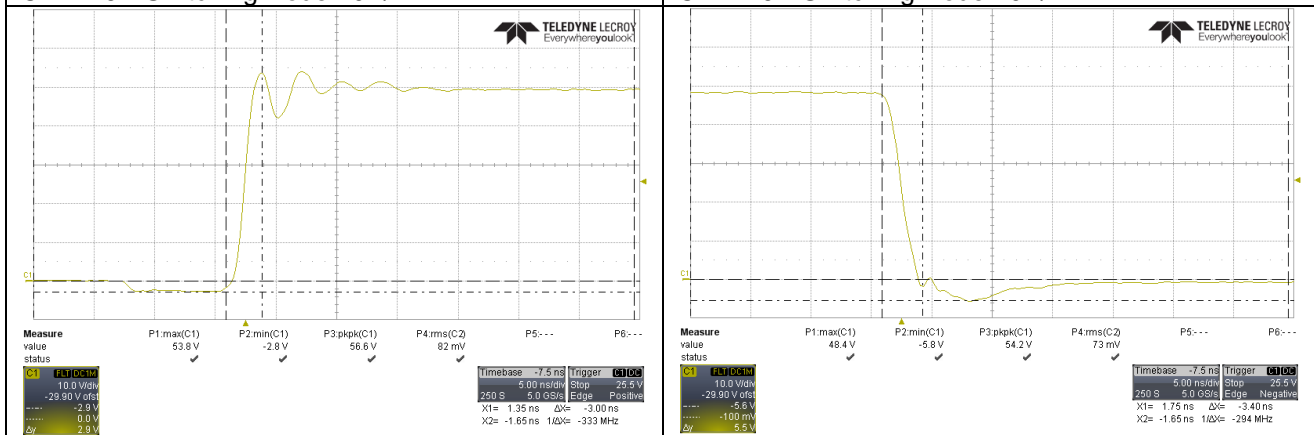
CH2: 12V Overshoot & Undershoot 200mV/Div
CH2: 12V Overshoot & Undershoot 200mV/Div
48V Input, 1.0V/40A Dynamic Load Waveforms

Dynamic Load (0% – 25%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div
Dynamic Load (25% – 50%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div

Dynamic Load (50% – 75%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div
Dynamic Load (75% – 100%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div

Dynamic Load (10% – 90%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div
Dynamic Load (0% – 100%)
CH1: 1.0V Overshoot & Undershoot 50mV/Div

48V Input, Switching Node Waveforms (Full Bandwidth)



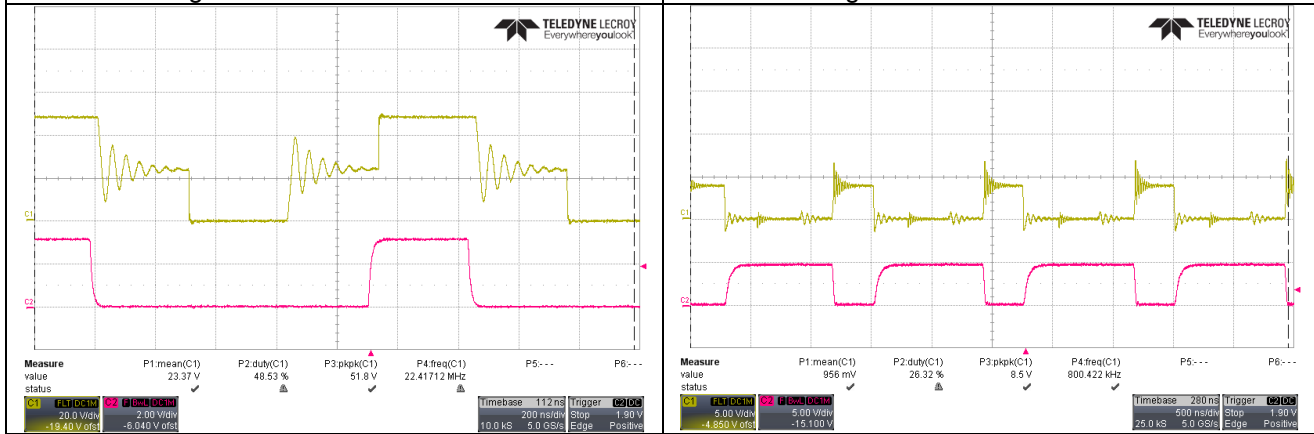
29V Rail Switching Node (Full Load)
CH1: 29V Switching Node 10V/Div

29V Rail Switching Node (Full Load)
CH1: 29V Switching Node 10V/Div



12V Rail Switching Node (Full Load)
CH1: Switching Node 10V/Div

12V Rail Switching Node (Full Load)
CH1: Switching Node 10V/Div

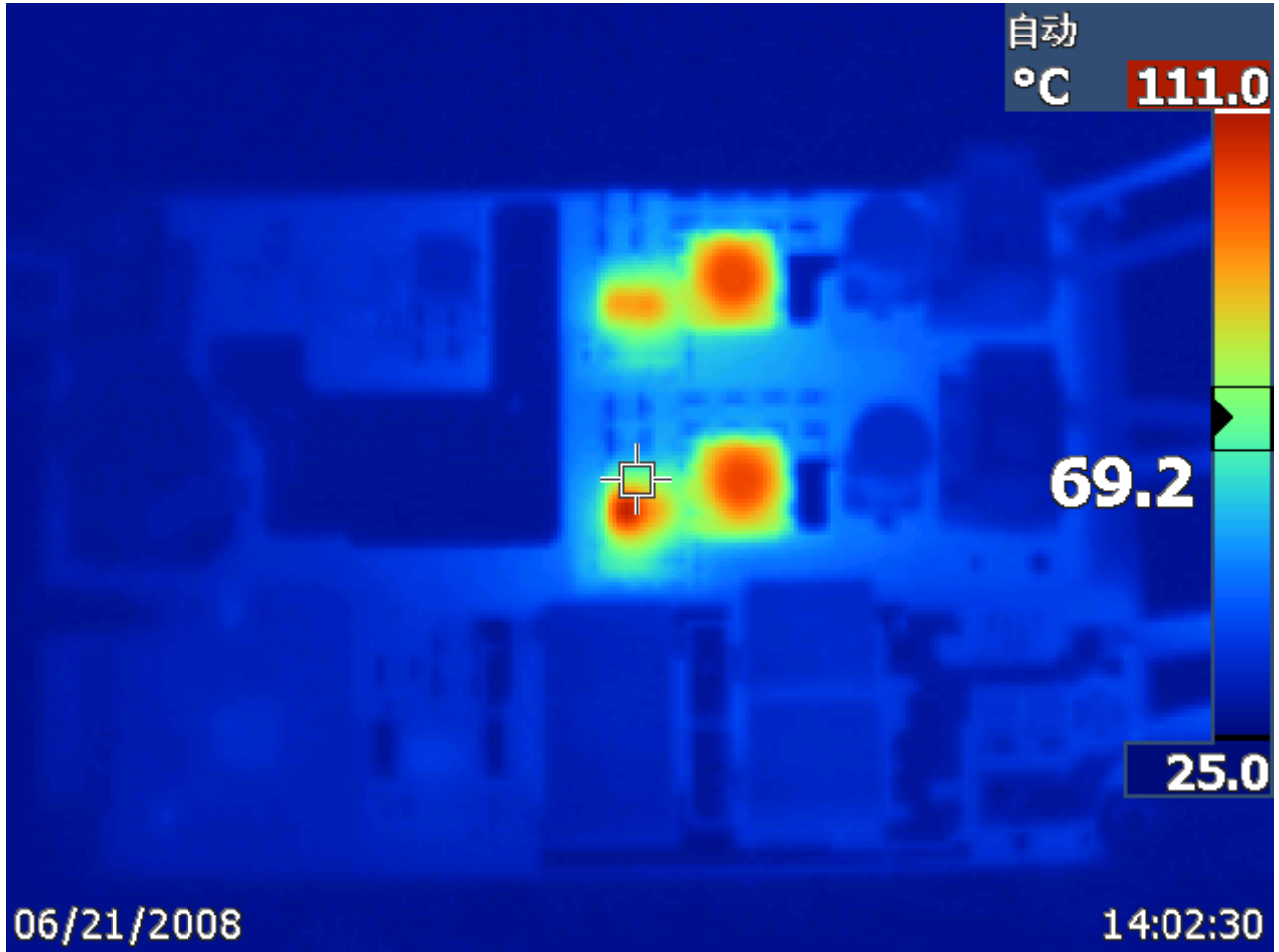


1.0V Rail Primary Switching Node
CH1: Primary Switching Node 20V/Div
CH2: Primary High Side Drive Signal 2.0V/Div

1.0V Rail Secondary Switching Node
CH1: Secondary Switching Node 5.0V/Div
CH2: Secondary Drive Signal 5.0V/Div

3 IR Scan Thermal Gradient (With Fan Cooling, $\approx 1\text{m/s}$)

48V Input, Full Load (12V/10A, 29V/10A, 1.0V/40A)



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