

**Test Data
For PMP9474
09/11/2014**



Power Specification

Specs:

V_{in}: 18V – 36V;

V_{out}:

3.3V non-isolated output port, maximum load current 300mA;

5V isolated output port, maximum load current 100mA;

F_{sw} = 350kHz

Board Photo

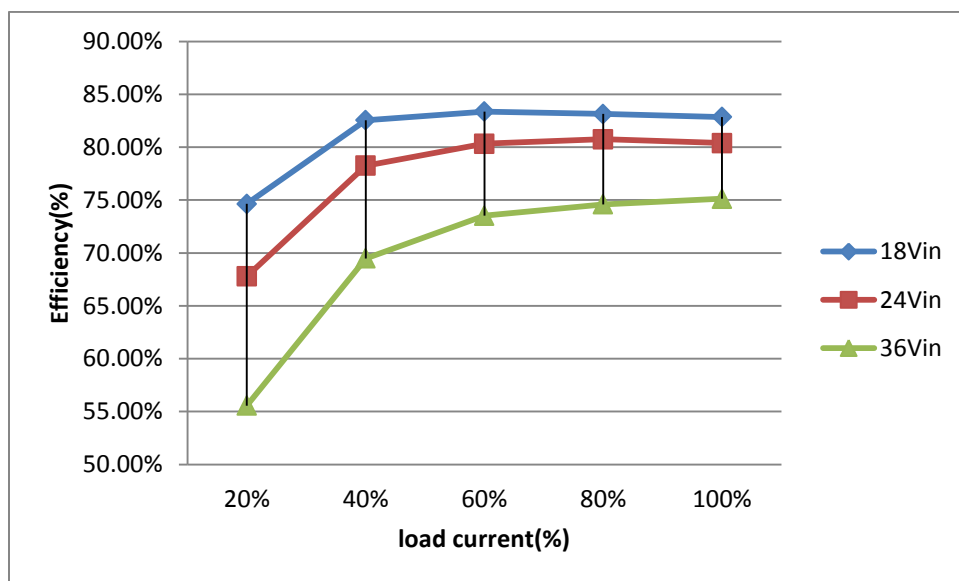


Efficiency

	Vin	lin	Vopri	Iopri	Vosec	Iosec	Efficiency
1	18.1347	5.26	3.3404	0	5.17739	0	0.00%
2	18.09	22.8578	3.3365	60.1	4.98084	21.7	74.63%
3	18.0446	40.93	3.3347	120.5	4.99551	41.6	82.54%
4	17.9953	60.336	3.32	179.9	5.0225	61.3	83.36%
5	17.9429	81.1569	3.3138	240.2	5.0575	82	83.14%
6	17.889	102.425	3.3295	300.5	5.09347	101.6	82.85%

	Vin	lin	Vopri	Iopri	Vosec	Iosec	Efficiency
1	24.1839	5.84475	3.3466	0	5.2243	0	0
2	24.1506	18.9285	3.3418	60.1	5.00247	21.8	67.79%
3	24.1165	32.388	3.34	120.6	5.00947	41.6	78.25%
4	24.0795	46.96	3.3338	179.9	5.03428	61.3	80.33%
5	24.0396	62.694	3.3349	240.2	5.07245	82	80.75%
6	23.9989	78.8724	3.3332	300.6	5.11419	101.6	80.38%

	Vin	lin	Vopri	Iopri	Vosec	Iosec	Efficiency
1	36.2817	6.78	3.3549	0	5.31281	0	0.00%
2	36.2595	15.4439	3.3425	60.1	5.05693	21.8	55.56%
3	36.237	24.3258	3.3468	120.5	5.03918	41.5	69.47%
4	36.2118	34.2557	3.3443	179.9	5.06144	61.3	73.51%
5	36.1846	45.0249	3.3263	240.2	5.0825	81.9	74.59%
6	36.1563	56.1258	3.3376	300.6	5.12979	101.6	75.12%



Cross Line Regulation

Vopri(3.3V) port with full load, Vosec(5V) with various load current, and to test the regulation ratio of Vopri. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vopri has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	regulation ratio of Vopri
decimal	decimal	decimal	decimal	decimal	
36	3.31656	0.300672	5.12613	0.101618	0.50%
36	3.31595	0.300666	5.14132	0.091249	0.48%
36	3.3153	0.300669	5.1551	0.0819158	0.46%
36	3.3146	0.300668	5.1713	0.0715598	0.44%
36	3.31391	0.300653	5.18801	0.0611956	0.42%
36	3.31336	0.300661	5.20374	0.0518725	0.40%
36	3.31263	0.300665	5.22242	0.0415077	0.38%
36	3.31210	0.300671	5.24306	0.0311643	0.37%
36	3.31174	0.300671	5.26438	0.0218401	0.36%
36	3.31158	0.300674	5.29470	0.0114575	0.35%
36	3.31211	0.300679	5.33591	0.00216137	0.37%
24	3.31336	0.300665	5.11207	0.10161100	0.40%
24	3.31223	0.300677	5.1285	0.0912425	0.37%
24	3.31137	0.300671	5.1433	0.0819046	0.34%
24	3.31028	0.300676	5.16005	0.0715638	0.31%
24	3.30928	0.300672	5.17722	0.0611991	0.28%
24	3.30854	0.300671	5.19306	0.0518738	0.26%
24	3.30768	0.300666	5.21177	0.0415097	0.23%
24	3.30681	0.300672	5.23227	0.0311689	0.21%
24	3.30618	0.300671	5.25355	0.0218425	0.19%
24	3.30572	0.300668	5.28468	0.0114627	0.17%
24	3.30589	0.300672	5.32978	0.0021728	0.18%
18	3.31426	0.30066	5.08575	0.101615	0.43%
18	3.31262	0.30066	5.10562	0.091246	0.38%
18	3.31114	0.300664	5.12332	0.0819104	0.34%
18	3.30969	0.300669	5.14296	0.0715593	0.29%
18	3.30833	0.300663	5.16278	0.0612017	0.25%
18	3.30694	0.300665	5.18102	0.0518722	0.21%
18	3.30533	0.300657	5.20217	0.0415061	0.16%
18	3.30453	0.300656	5.22500	0.0311632	0.14%
18	3.30355	0.300654	5.24902	0.0218274	0.11%

18	3.30279	0.300649	5.28586	0.0114490	0.08%
18	3.30286	0.300645	5.34355	0.0021516	0.09%

Vopri(3.3V) port with no load, Vosec(5V) with various load current, and to test the regulation ratio of Vopri. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vopri has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation ratio of Vopri
decimal	decimal	decimal	decimal	decimal	
36	3.36274	0.000904459	4.80463	0.101624	1.90%
36	3.36105	0.000904943	4.82550	0.091259	1.85%
36	3.3595	0.000920132	4.84508	0.0819134	1.80%
36	3.3577	0.000889487	4.86772	0.0715700	1.75%
36	3.35572	0.000911379	4.89147	0.0612018	1.69%
36	3.35347	0.000907700	4.91409	0.0518772	1.62%
36	3.35057	0.000905168	4.94205	0.0415161	1.53%
36	3.34917	0.000914763	4.97719	0.0311740	1.49%
36	3.3497	0.000896961	5.02723	0.0218458	1.51%
36	3.3525	0.000909180	5.13852	0.0114648	1.59%
36	3.35475	0.000910708	5.272	0.00216851	1.66%
24	3.36003	0.000922155	4.768	0.10161500	1.82%
24	3.35864	0.000923115	4.7866	0.0912461	1.78%
24	3.35737	0.000922599	4.8035	0.0819091	1.74%
24	3.35572	0.000926626	4.82423	0.0715609	1.69%
24	3.35367	0.000925578	4.84741	0.0612067	1.63%
24	3.35151	0.000930629	4.87014	0.0518728	1.56%
24	3.34857	0.000938821	4.89778	0.0415118	1.47%
24	3.34577	0.000929135	4.92978	0.0311752	1.39%
24	3.34428	0.000929869	4.96770	0.0218383	1.34%
24	3.34481	0.00091892	5.05109	0.011463	1.36%
24	3.34667	0.00093629	5.18615	0.002174	1.41%
18	3.3579	0.00092362	4.73827	0.101618	1.75%
18	3.3560	0.00091949	4.75814	0.091250	1.70%
18	3.35421	0.000929572	4.77663	0.0819104	1.64%
18	3.35226	0.000910634	4.79791	0.0715608	1.58%
18	3.35039	0.000929014	4.81936	0.0612012	1.53%
18	3.34849	0.000920513	4.84036	0.0518665	1.47%
18	3.34588	0.000906342	4.8669	0.0415042	1.39%
18	3.34286	0.000919525	4.8978	0.0311599	1.30%
18	3.34067	0.000907723	4.93279	0.0218273	1.23%

18	3.33965	0.000915242	4.99523	0.0114463	1.20%
18	3.34091	0.000894171	5.13503	0.00215284	1.24%

Vosec(5V) port with full load, Vopri(3.3V) with various load current, and to test the regulation ratio of Vosec. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vosec has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation Ratio of Vosec
decimal	decimal	decimal	decimal	decimal	
36	3.31828	0.300661	5.12208	0.10159	2.44%
36	3.32279	0.270477	5.08764	0.10160	1.75%
36	3.32714	0.240326	5.05403	0.101593	1.08%
36	3.33137	0.210144	5.02080	0.101599	0.42%
36	3.33546	0.179957	4.98849	0.101595	-0.23%
36	3.33947	0.150833	4.95786	0.101592	-0.84%
36	3.34338	0.120661	4.92558	0.101587	-1.49%
36	3.34724	0.090500	4.89235	0.101592	-2.15%
36	3.35263	0.0603189	4.85985	0.10159	-2.80%
36	3.35752	0.0301495	4.83069	0.10159	-3.39%
36	3.36239	0.000922202	4.80666	0.101587	-3.87%
24	3.31427	0.300654000	5.11065	0.101597	2.21%
24	3.3165	0.270471	5.07567	0.101597	1.51%
24	3.3204	0.240334	5.03978	0.101593	0.80%
24	3.3249	0.210145	5.00332	0.101596	0.07%
24	3.3300	0.179967	4.96704	0.101580	-0.66%
24	3.3344	0.150828	4.93266	0.101585	-1.35%
24	3.3390	0.120650	4.89713	0.101584	-2.06%
24	3.34375	0.0904992	4.86272	0.101584	-2.75%
24	3.34918	0.0603079	4.83044	0.101586	-3.39%
24	3.35458	0.0301481	4.79946	0.101588	-4.01%
24	3.35982	0.0009136	4.76962	0.101588	-4.61%
18	3.31013	0.300665	5.08782	0.101591	1.76%
18	3.31401	0.270475	5.05597	0.101588	1.12%
18	3.31822	0.240326	5.0225	0.101595	0.45%
18	3.32261	0.210136	4.9878	0.101586	-0.24%
18	3.32702	0.179954	4.95231	0.101585	-0.95%
18	3.33165	0.150815	4.91740	0.101582	-1.65%
18	3.33627	0.120649	4.88037	0.101589	-2.39%
18	3.34119	0.090490	4.84285	0.101593	-3.14%
18	3.34684	0.0602883	4.8067	0.101579	-3.87%

18	3.35251	0.0301291	4.7717	0.101590	-4.57%
18	3.35765	0.000896727	4.73859	0.101587	-5.23%
18	3.3150	0.0154170	4.75282	0.1015988	-4.94

Note that when Vopri has 15mA pre-load, Vosec regulation ratio will fall into 5% range. (Added on Sep, 12nd, 2014)

Vosec(5V) port with no load, Vopri(3.3V) with various load current, and to test the regulation ratio of Vosec. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vosec has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation Ratio of Vosec
decimal	decimal	decimal	decimal	decimal	
36	3.31168	0.30067	5.33284	0.00216692	6.66%
36	3.31602	0.27047	5.30625	0.00217135	6.13%
36	3.32046	0.240331	5.27998	0.00216783	5.60%
36	3.32511	0.210147	5.25164	0.00217186	5.03%
36	3.32948	0.179966	5.22965	0.00217093	4.59%
36	3.33329	0.150825	5.21917	0.00217422	4.38%
36	3.33704	0.12065	5.21847	0.00217543	4.37%
36	3.34095	0.09050	5.22363	0.00217350	4.47%
36	3.34529	0.0603084	5.23656	0.00217214	4.73%
36	3.34891	0.0301446	5.25700	0.00217510	5.14%
36	3.35435	0.000923312	5.27475	0.00217162	5.50%
24	3.30515	0.300670000	5.32807	0.00217305	6.56%
24	3.30935	0.270488	5.29285	0.00217189	5.86%
24	3.31356	0.240336	5.26087	0.00217355	5.22%
24	3.31774	0.21015	5.23259	0.00217514	4.65%
24	3.32187	0.17997	5.20750	0.00216527	4.15%
24	3.32577	0.150818	5.18473	0.00217427	3.69%
24	3.32995	0.120655	5.15887	0.00217460	3.18%
24	3.3341	0.0905079	5.14578	0.00216852	2.92%
24	3.3383	0.0603118	5.14979	0.00216555	3.00%
24	3.34132	0.0301454	5.1688	0.00217613	3.38%
24	3.34640	0.0009227	5.1898	0.00217030	3.80%
18	3.30161	0.300668	5.3477	0.00217167	6.95%
18	3.30553	0.270482	5.3088	0.00216799	6.18%
18	3.30944	0.240314	5.26976	0.0021668	5.40%
18	3.31323	0.210145	5.23220	0.0021660	4.64%
18	3.31714	0.17996	5.19821	0.00216361	3.96%
18	3.32080	0.15082	5.17018	0.00216448	3.40%

18	3.32436	0.120651	5.14531	0.00216126	2.91%
18	3.32825	0.090494	5.12035	0.00215662	2.41%
18	3.33263	0.0603025	5.1059	0.0021555	2.12%
18	3.33583	0.0301191	5.1162	0.0021487	2.32%
18	3.34082	0.000904531	5.13577	0.0021546	2.72%

Vopri (3.3V) port and Vosec(5V) port load changes with same step. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vopri and Vosec has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation ratio of Vopri	Regulation ratio of Vosec
decimal	decimal	decimal	decimal	decimal		
36	3.31685	0.300675	5.11879	0.101611	0.51%	2.38%
36	3.32088	0.270482	5.10025	0.091247	0.63%	2.01%
36	3.32449	0.240335	5.08278	0.0819165	0.74%	1.66%
36	3.32774	0.210154	5.06925	0.0715595	0.84%	1.39%
36	3.33091	0.179979	5.05701	0.0612016	0.94%	1.14%
36	3.33434	0.150836	5.04341	0.0518711	1.04%	0.87%
36	3.33743	0.120662	5.03508	0.0415066	1.13%	0.70%
36	3.33916	0.090507	5.03766	0.0311625	1.19%	0.75%
36	3.3423	0.0603259	5.05281	0.0218339	1.28%	1.06%
36	3.3465	0.0301561	5.12901	0.0114565	1.41%	2.58%
36	3.35433	0.000931855	5.27218	0.00216624	1.65%	5.44%
24	3.31235	0.300673000	5.10689	0.10161200	0.37%	2.14%
24	3.31553	0.270486	5.08847	0.0912465	0.47%	1.77%
24	3.31915	0.240324	5.06799	0.0819137	0.58%	1.36%
24	3.32274	0.21014	5.04925	0.0715643	0.69%	0.98%
24	3.32616	0.17997	5.03252	0.0612041	0.79%	0.65%
24	3.32927	0.150823	5.01856	0.0518716	0.89%	0.37%
24	3.33192	0.120652	5.00891	0.0415110	0.97%	0.18%
24	3.33491	0.0904999	5.00116	0.0311739	1.06%	0.02%
24	3.33824	0.0603103	5.00276	0.0218438	1.16%	0.06%
24	3.34004	0.0301356	5.04936	0.0114631	1.21%	0.99%
24	3.34636	0.0009229	5.18664	0.0021750	1.40%	3.73%
18	3.31292	0.300673	5.08299	0.101612	0.39%	1.66%
18	3.31486	0.270473	5.07110	0.091249	0.45%	1.42%
18	3.31726	0.240333	5.05487	0.0819052	0.52%	1.10%
18	3.31987	0.210143	5.03869	0.0715616	0.60%	0.77%
18	3.3228	0.179966	5.02151	0.0611946	0.69%	0.43%
18	3.3256	0.150824	5.00414	0.0518633	0.78%	0.08%

18	3.32804	0.120649	4.99013	0.0415058	0.85%	-0.20%
18	3.33056	0.090489	4.98187	0.0311563	0.93%	-0.36%
18	3.3338	0.0602969	4.97709	0.0218215	1.02%	-0.46%
18	3.3359	0.0301186	5.00209	0.0114414	1.09%	0.04%
18	3.34094	0.000904541	5.13519	0.00214981	1.24%	2.70%

Note that to test regulation ratio under higher load current conditions, we further increase the load current of the primary side output Vopri from 300mA to 400mA. And since Vosec regulation ratio is more easily to get influenced, so we focus on Vosec regulation ratio (Added on Sep 12nd, 2014).

And the data are as below.

Vosec(5V) port with no load, Vopri(3.3V) with various load current, and to test the regulation ratio of Vosec. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vosec has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation Ratio of Vosec
decimal	decimal	decimal	decimal	decimal	
36.00	3.32602	0.400534	5.41055	0.00211876	8.21%
36.00	3.32772	0.380768	5.38854	0.00211330	7.77%
36.00	3.3294	0.359973	5.36652	0.00211509	7.33%
36.00	3.3310	0.340201	5.34626	0.00211537	6.93%
36.00	3.33241	0.320443	5.32748	0.00211031	6.55%
36.00	3.33387	0.300666	5.31050	0.00211537	6.21%
24.00	3.31731	0.400537	5.41532	0.00212349	8.31%
24.00	3.31884	0.380766	5.39247	0.00211881	7.85%
24.00	3.32038	0.359967	5.36852	0.00211663	7.37%
24.00	3.32189	0.340202	5.34592	0.00212232	6.92%
24.00	3.32346	0.320433	5.32391	0.00211654	6.48%
24.00	3.32500	0.300662	5.30297	0.00211659	6.06%
18.00	3.31424	0.400533	5.40759	0.00211234	8.15%
18.00	3.31530	0.380755	5.38871	0.00211368	7.77%
18.00	3.31644	0.359959	5.36825	0.00211118	7.37%
18.00	3.31761	0.340189	5.34786	0.00210808	6.96%
18.00	3.31877	0.320422	5.3268	0.00210527	6.54%
18.00	3.32000	0.300641	5.3045	0.00210096	6.09%

Vosec(5V) port with full load, Vopri(3.3V) with various load current, and to test the regulation ratio of Vosec. For Vin, there're three groups, 18V, 24V and 36V. All data shows that Vosec has good regulation ratio.

Vin(V)	Vopri(V)	Iopri(A)	Vosec(V)	Iosec(A)	Regulation Ratio of Vosec
decimal	decimal	decimal	decimal	decimal	
36.00	3.33048	0.400535	5.23986	0.101546	4.80%
36.00	3.33234	0.380769	5.21555	0.101545	4.31%
36.00	3.33428	0.359967	5.19051	0.101542	3.81%
36.00	3.33620	0.340189	5.16685	0.101537	3.34%
36.00	3.33798	0.320442	5.14392	0.101541	2.88%
36.00	3.33979	0.300665	5.12154	0.101538	2.43%
24.00	3.32665	0.400521	5.2156	0.101549	4.31%
24.00	3.32783	0.380754	5.1944	0.101545	3.89%
24.00	3.3291	0.359961	5.17204	0.101545	3.44%
24.00	3.3303	0.340188	5.15056	0.101545	3.01%
24.00	3.33166	0.320427	5.12898	0.101536	2.58%
24.00	3.33302	0.300658	5.10741	0.101534	2.15%
18.00	3.32755	0.400523	5.1745	0.101538	3.49%
18.00	3.32847	0.380742	5.1557	0.101531	3.11%
18.00	3.32936	0.359945	5.13596	0.101532	2.72%
18.00	3.33025	0.340175	5.11707	0.101526	2.34%
18.00	3.33113	0.320412	5.09775	0.101519	1.95%
18.00	3.33204	0.300641	5.07727	0.101525	1.55%

Start-up vs. Shut-down

Vopri(3.3V) and Vosec(5V)

Test condition: The input voltage was set at 24V, and all outputs were set at no load.

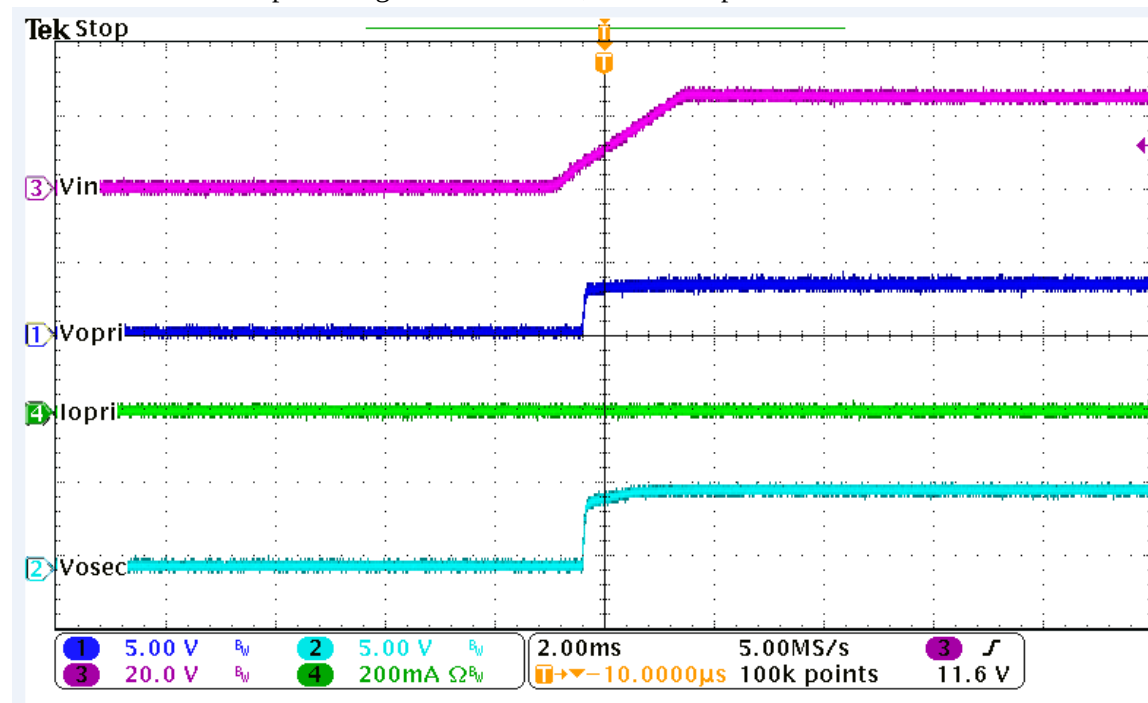


Fig. Start-up

Test condition: The input voltage was set at 24V, and all outputs were set at full load(Though the figure only shows the current waveform of the Vopri channel).

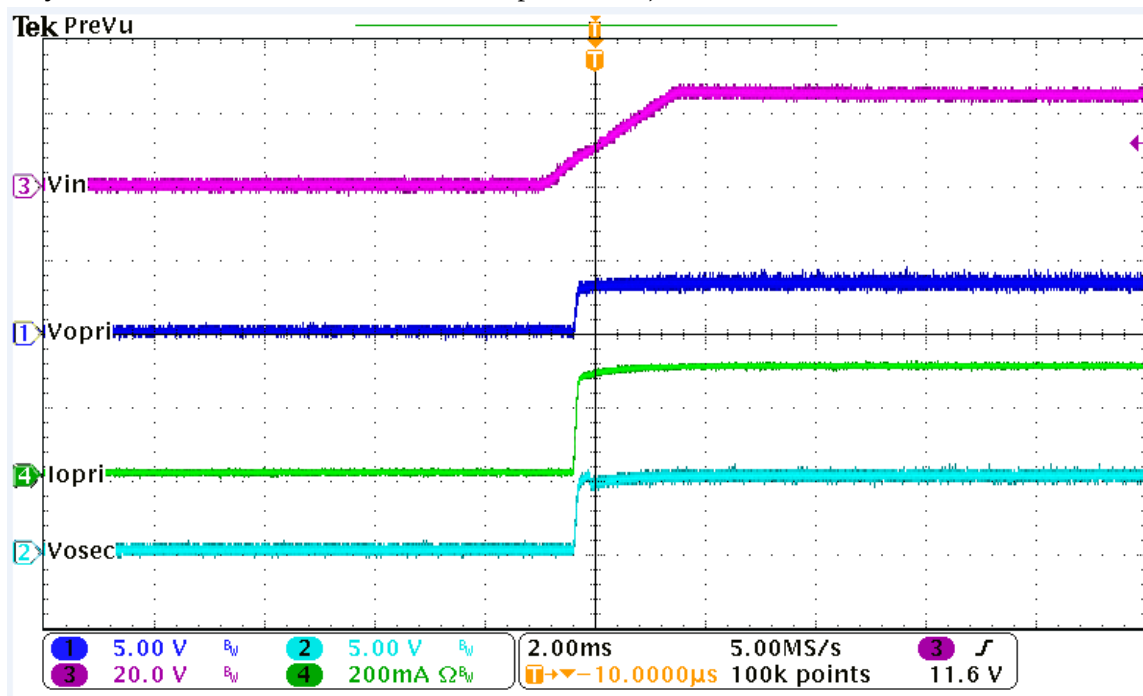
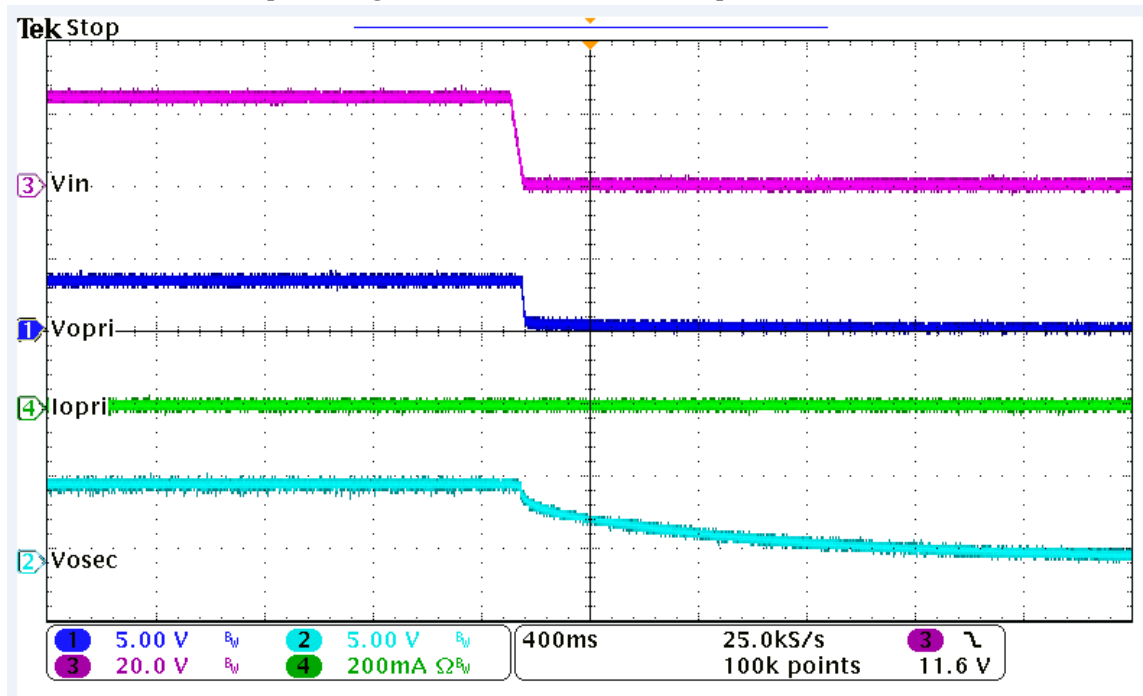


Fig. Start-up.

Test condition: The input voltage was set at 24V, and all outputs were set at no load before shut-down.



Test condition: The input voltage was set at 24V, and all outputs were set at full load before shut-down(Though only current waveform of Vopri is only shown).

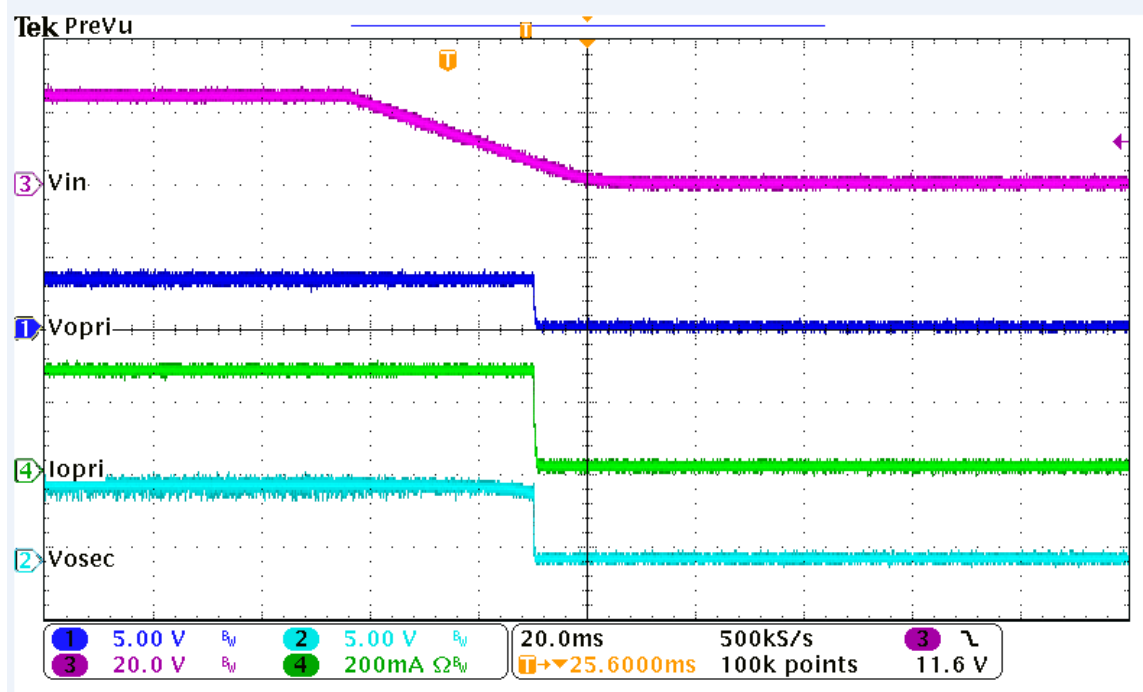
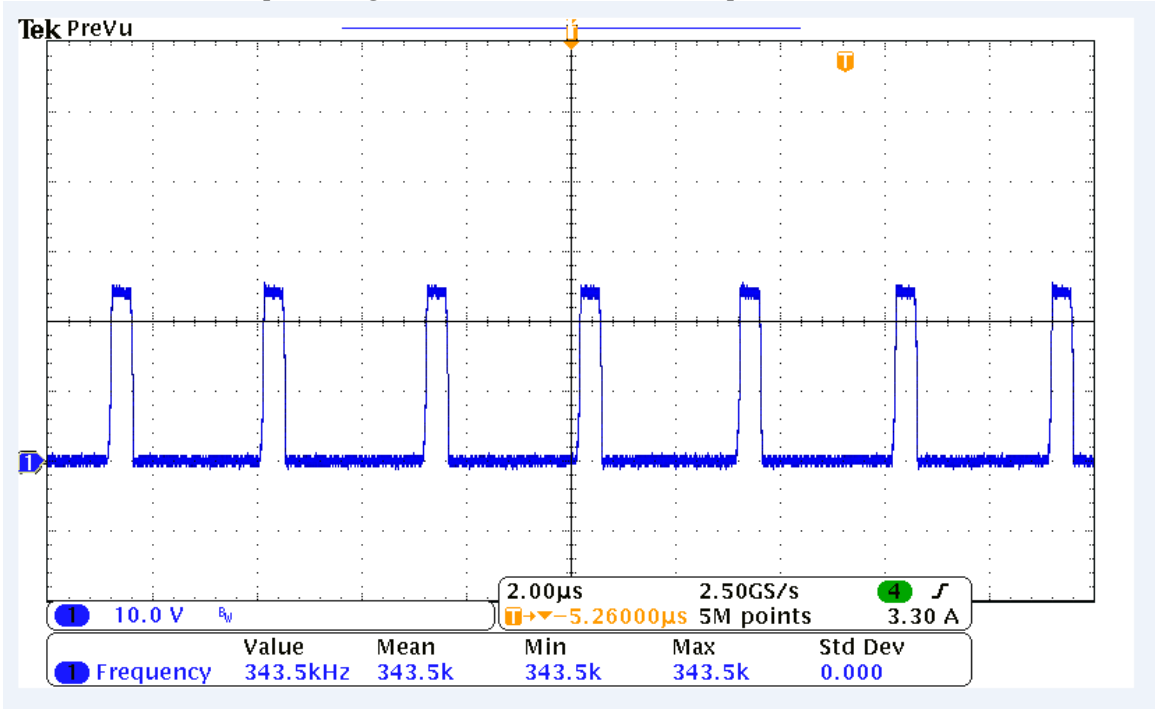


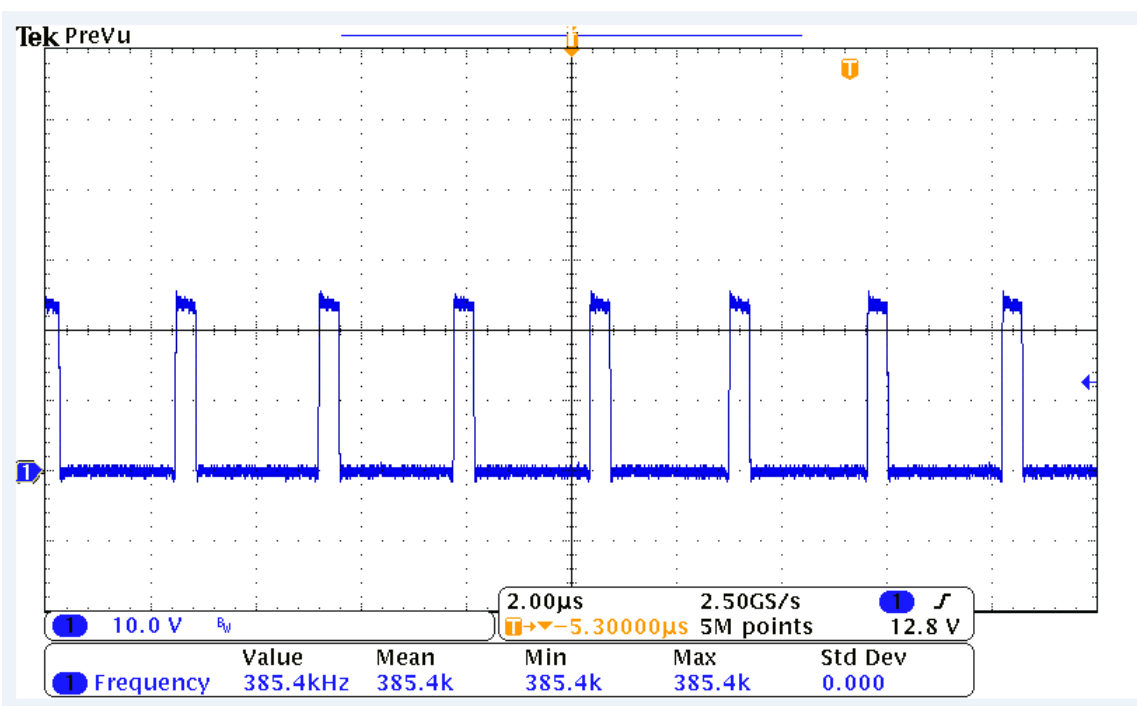
Fig. Shut-down

Switching Waveforms

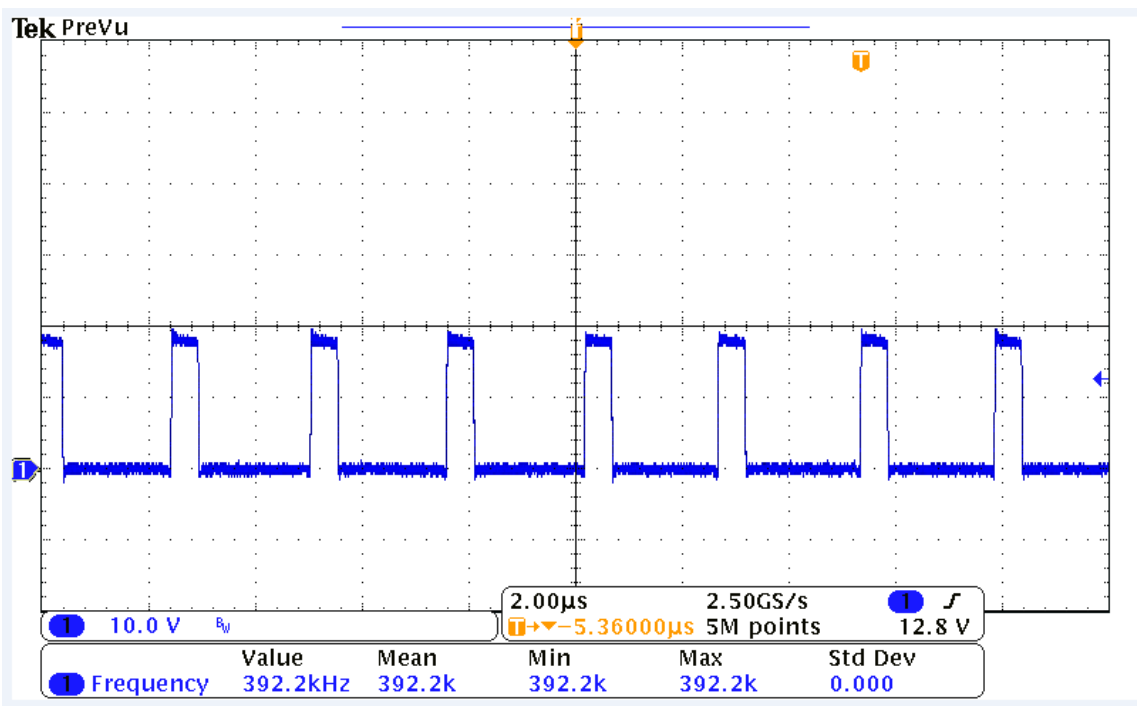
- 1. Test condition: The input voltage was set at 24V, and two outputs were set at no load.



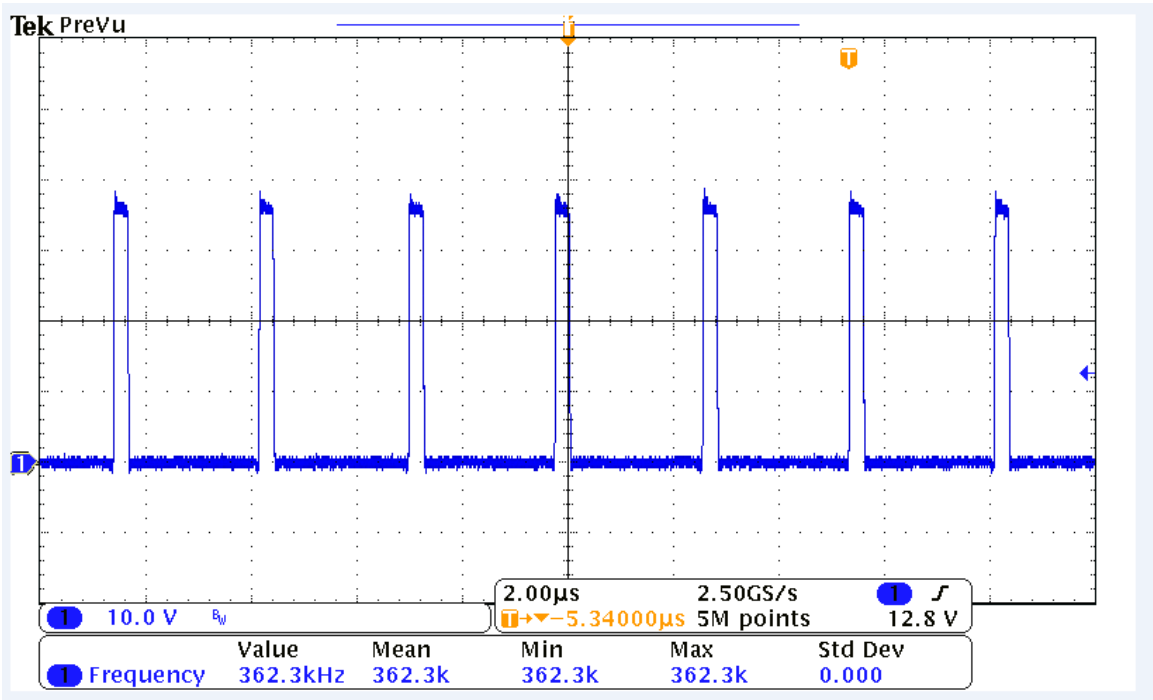
- 2. Test condition: The input voltage was set at 24V, and two outputs were set at full load.



3. Test condition: The input voltage was set at 18V, and two outputs were set at full load.



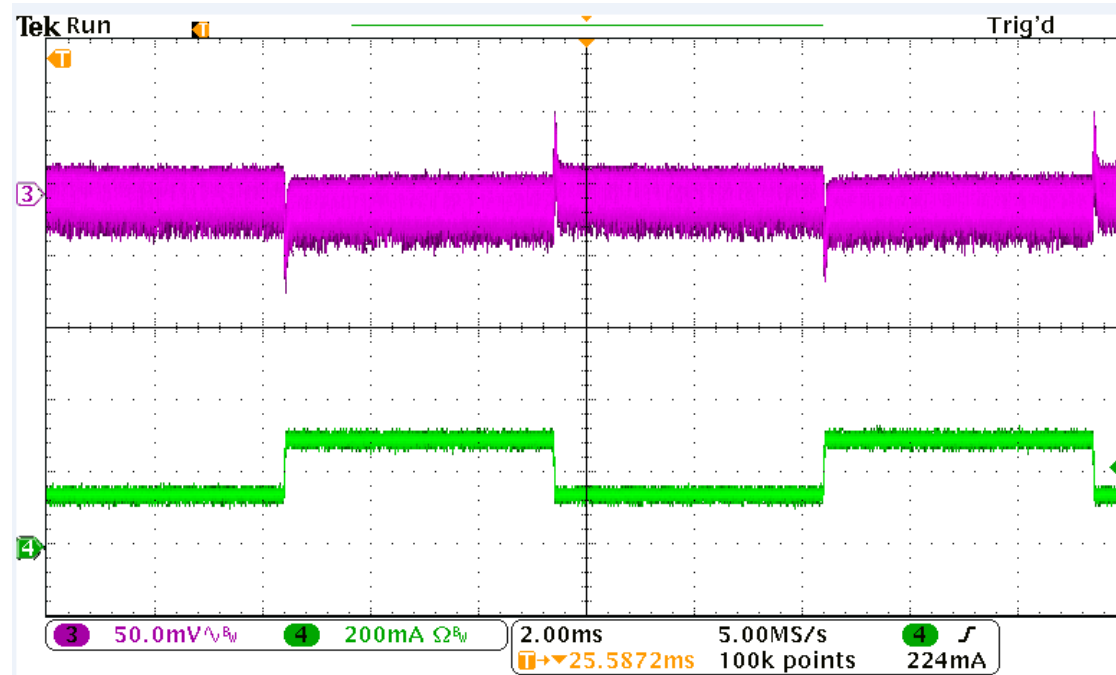
4. Test condition: The input voltage was set at 36V, and two outputs were set at full load.



Load Transients

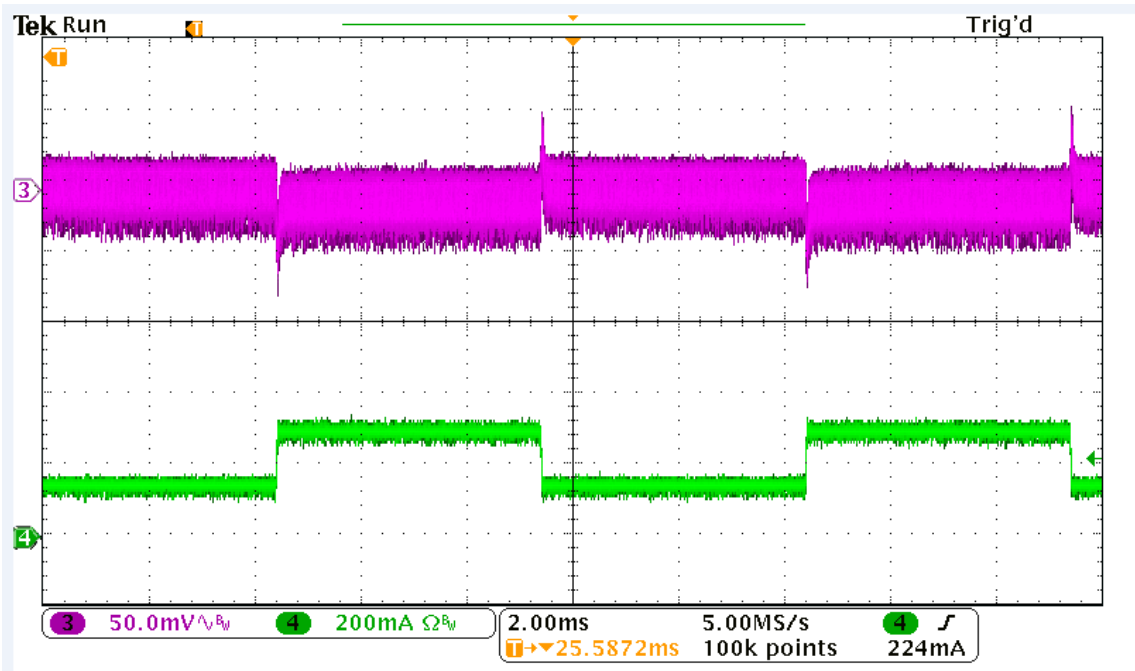
Vopri(3.3V) Output Load Step

Test condition: $V_{in} = 18V$, Vopri(3.3V) load from 150mA to 300mA, full load on Vosec output(100mA).



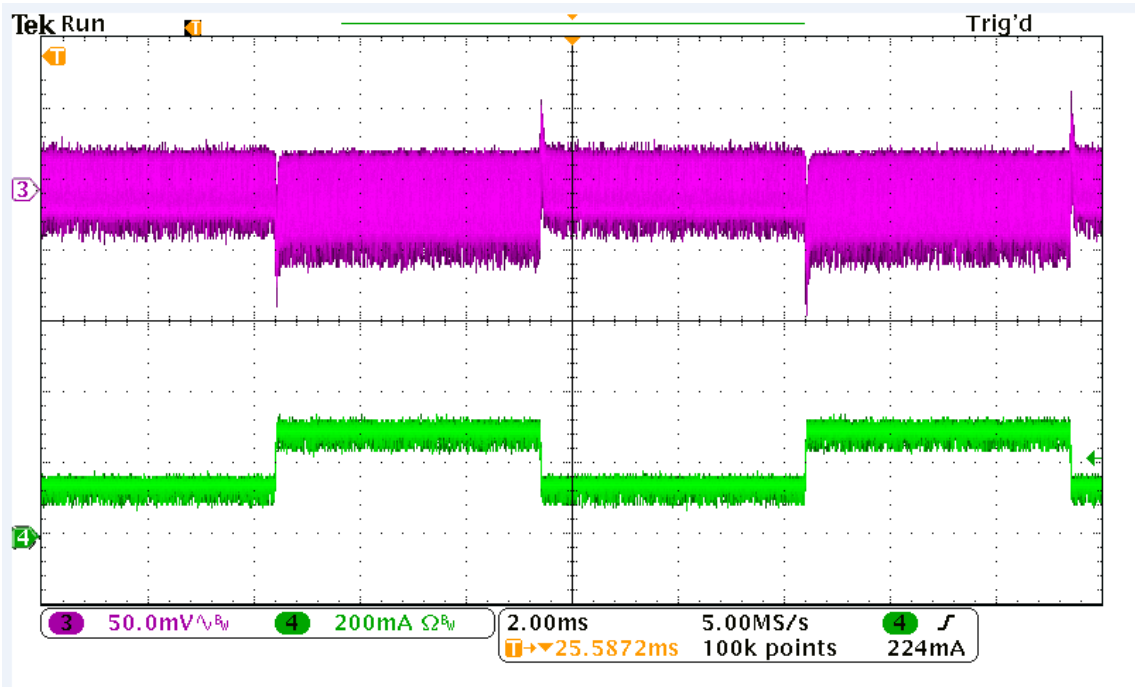
Vopri(3.3V) Output Load Step

Test condition: Vin = 24V, Vopri(3.3V) load from 150mA to 300mA, full load on Vosec output(100mA).



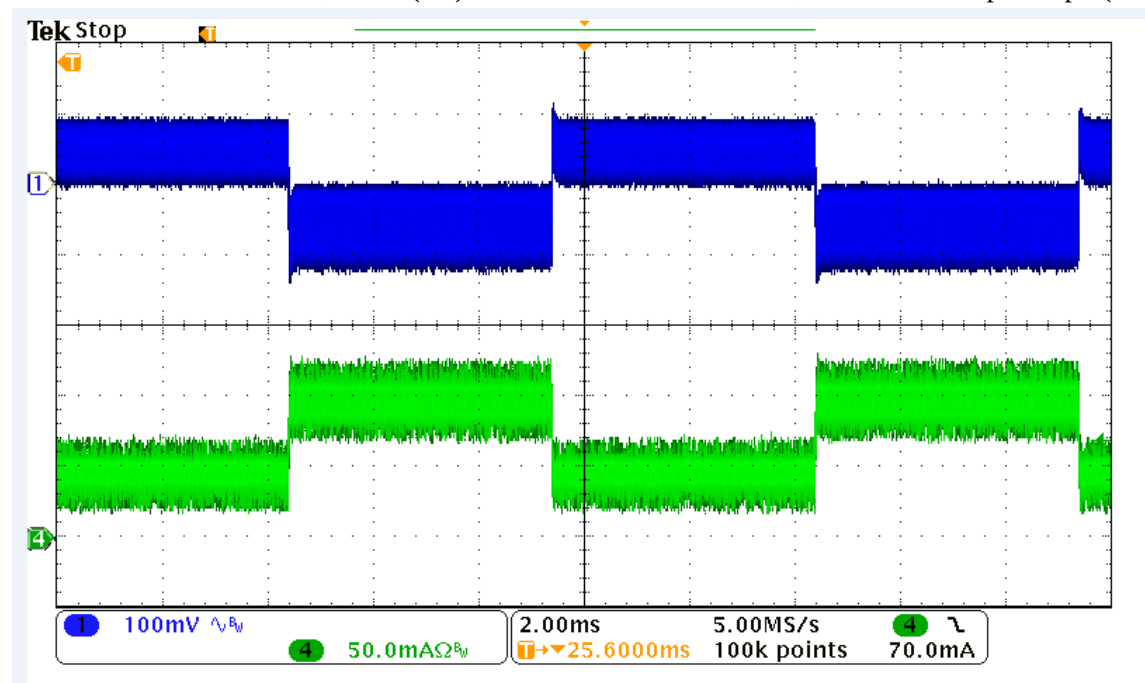
Vopri(3.3V) Output Load Step

Test condition: Vin = 36V, Vopri(3.3V) load from 150mA to 300mA, full load on Vosec output(100mA).



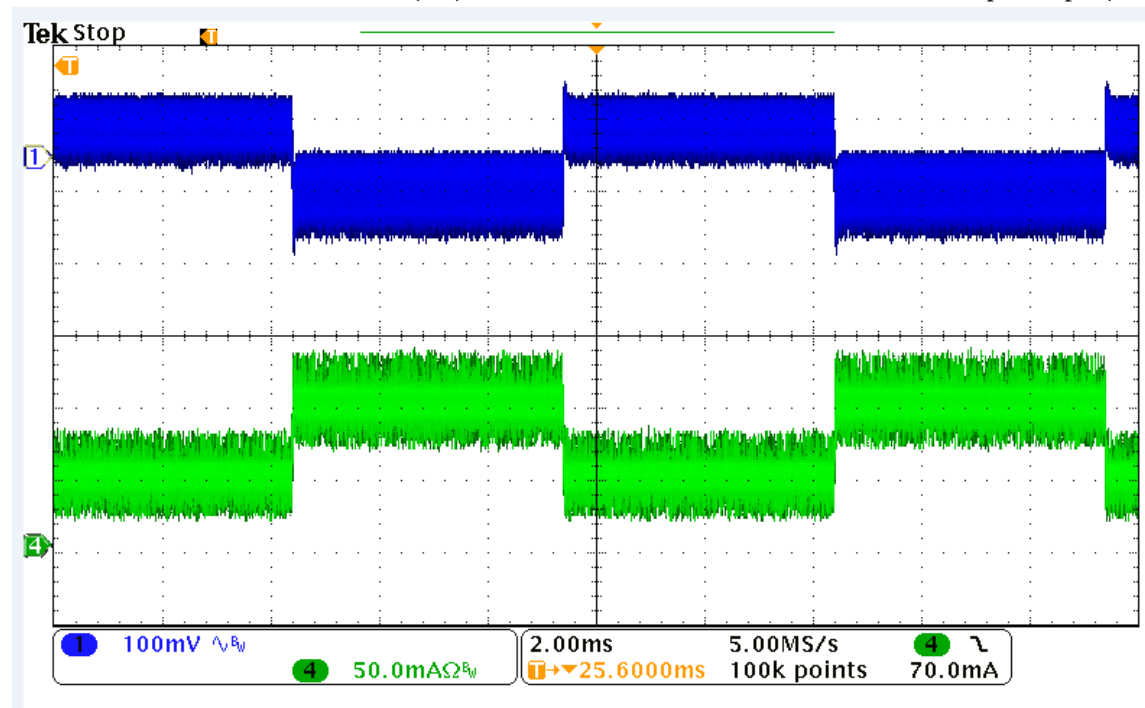
Vosec(5V) Output Load Step

Test condition: $V_{in} = 18V$, Vosec(5V) load from 50mA to 100mA, full load on Vopri output(300mA).



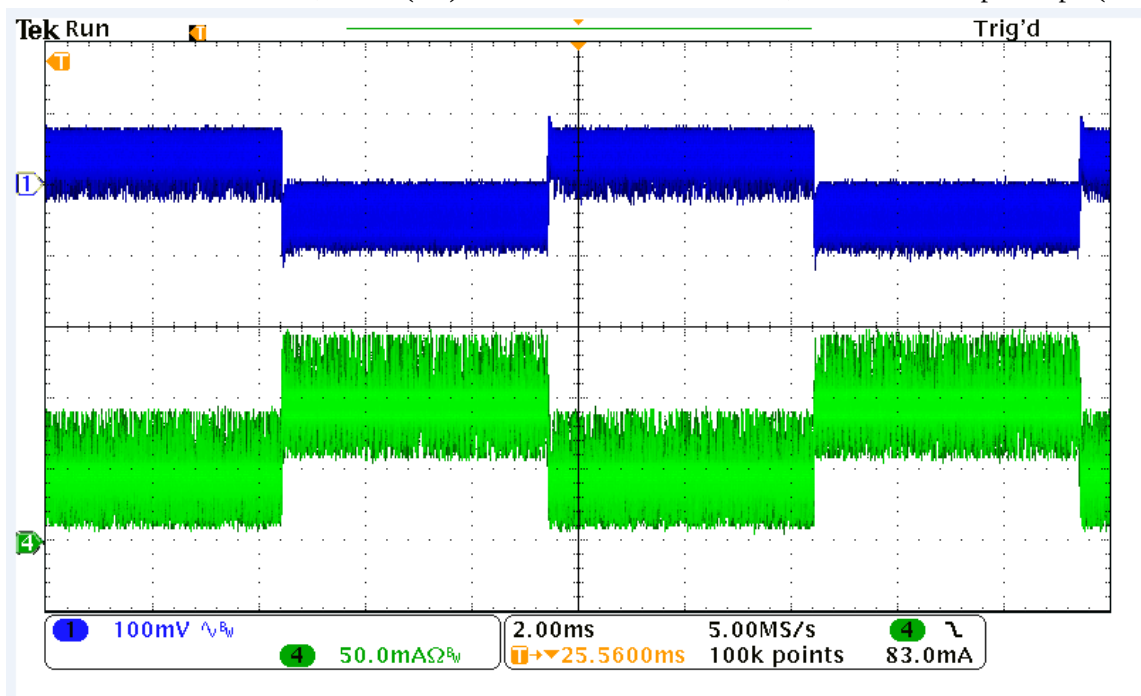
Vosec(5V) Output Load Step

Test condition: $V_{in} = 24V$, Vosec(5V) load from 50mA to 100mA, full load on Vopri output(300mA).



Vosec(5V) Output Load Step

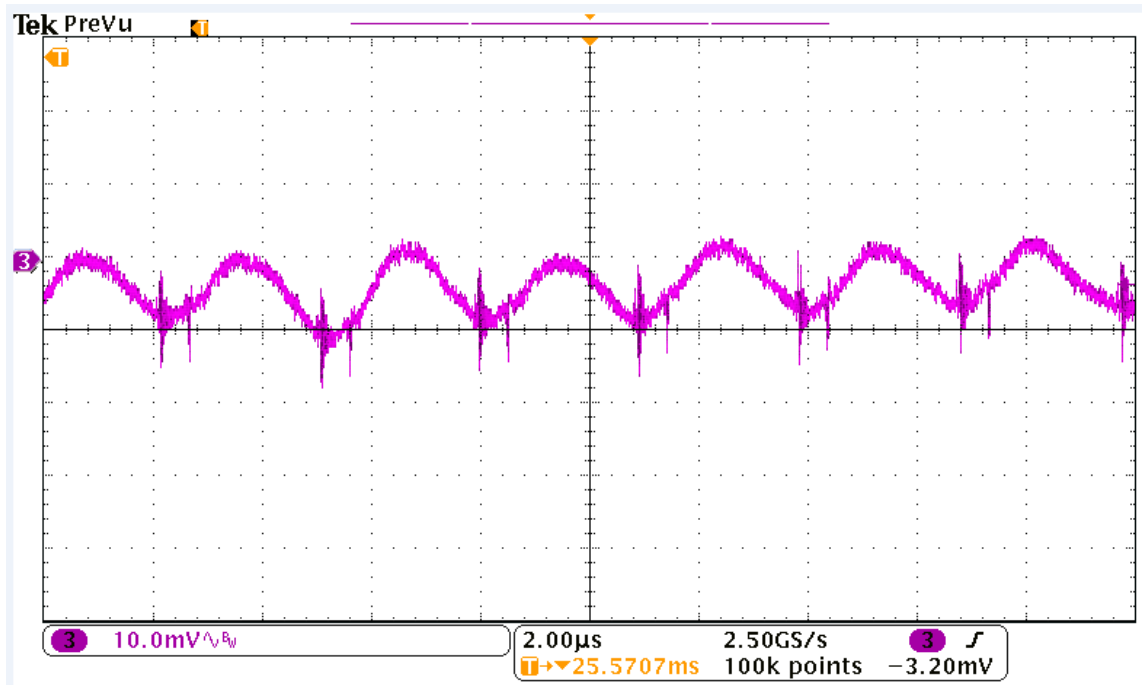
Test condition: $V_{in} = 36V$, Vosec(5V) load from 50mA to 100mA, full load on Vopri output(300mA).



Output Voltage Ripples

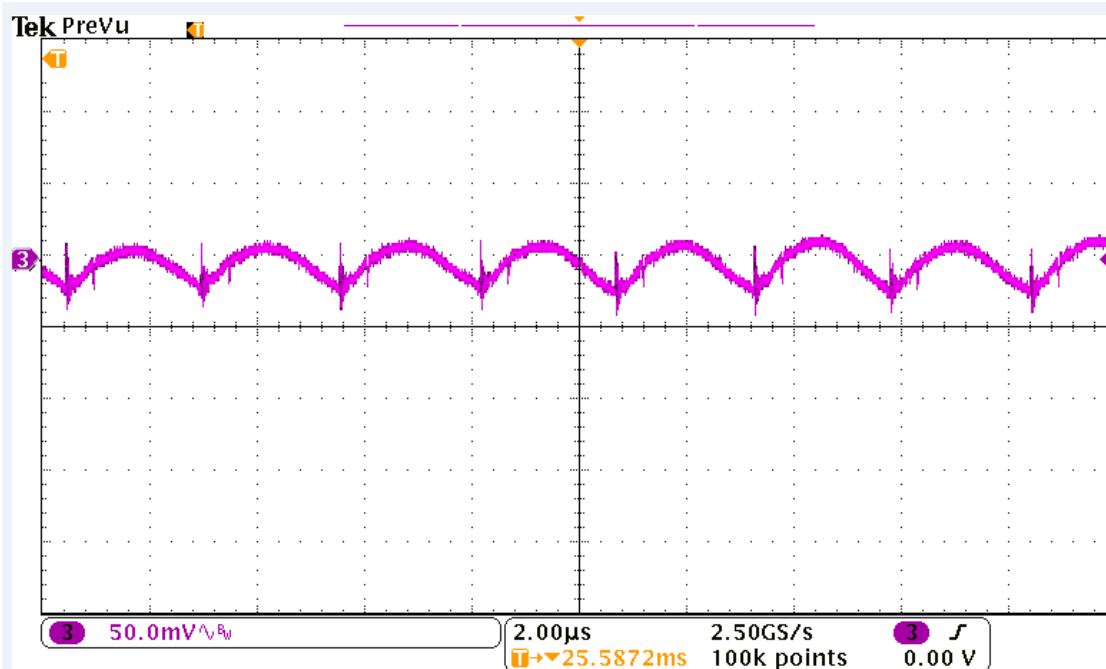
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 18V$, $V_{opri}(3.3V)$ no load, no load on V_{osec} output.



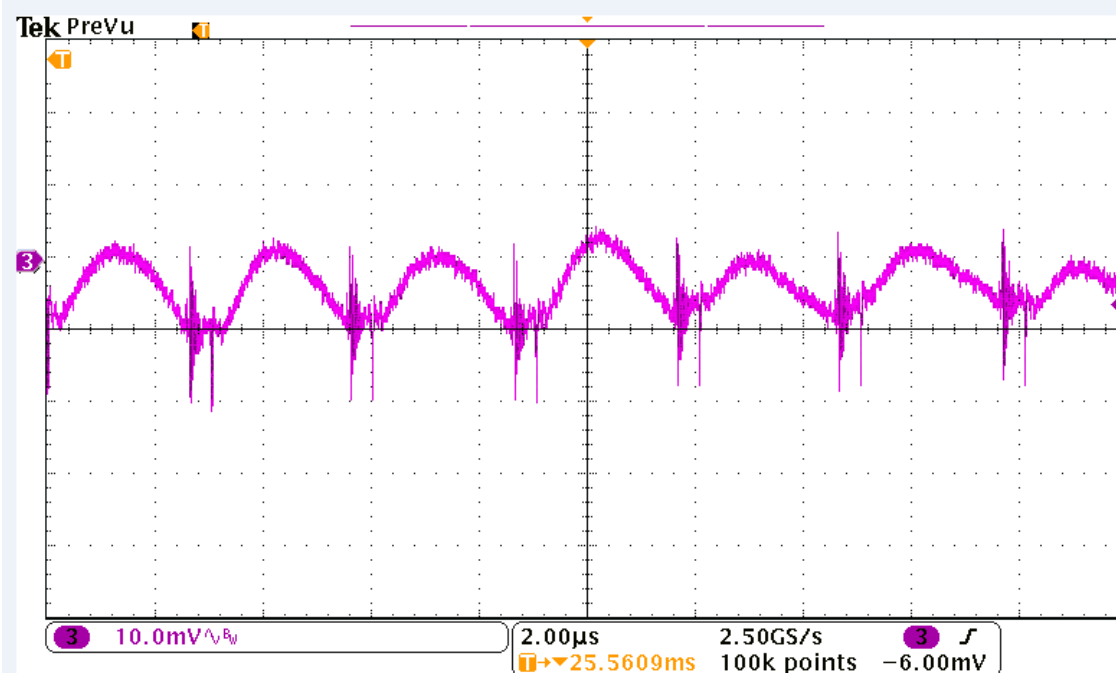
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 18V$, Vopri(3.3V) full load, full load on Vosec output(100mA).



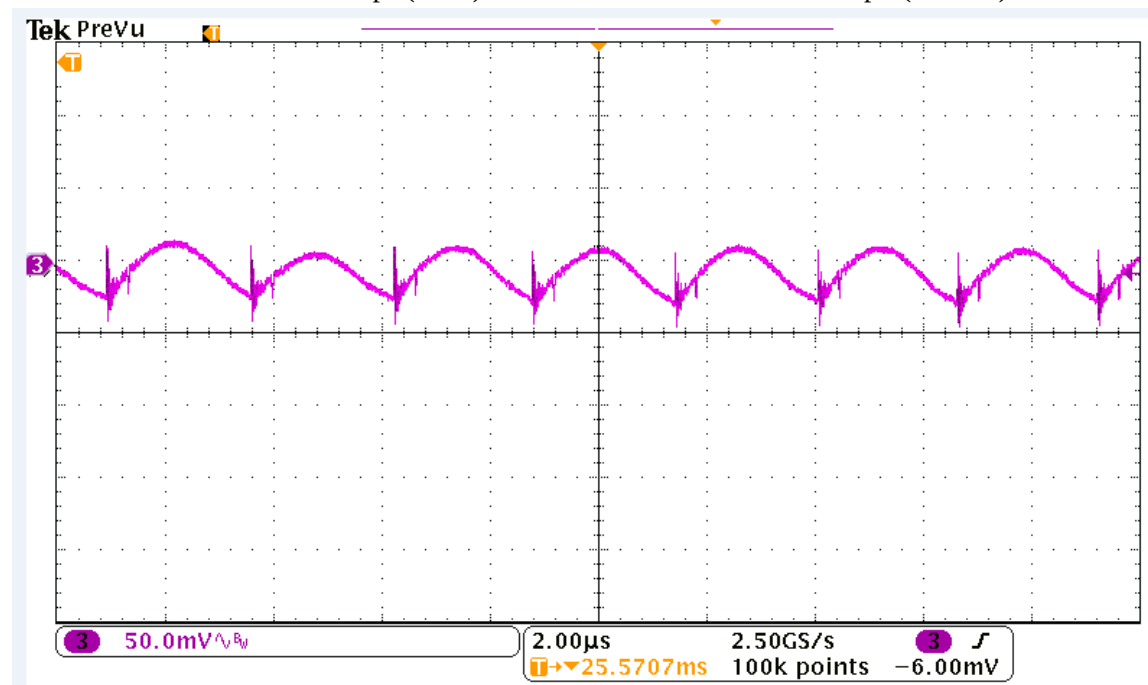
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 24V$, Vopri(3.3V) no load, no load on Vosec output.



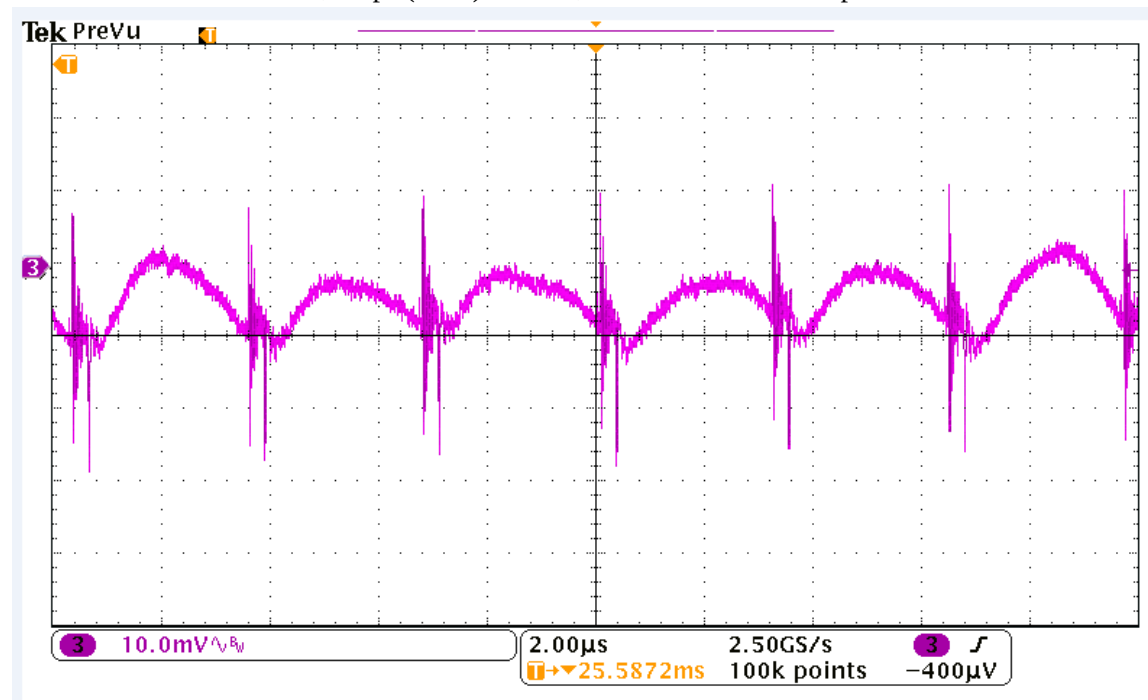
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 24V$, Vopri(3.3V) full load, full load on Vosec output(100mA).



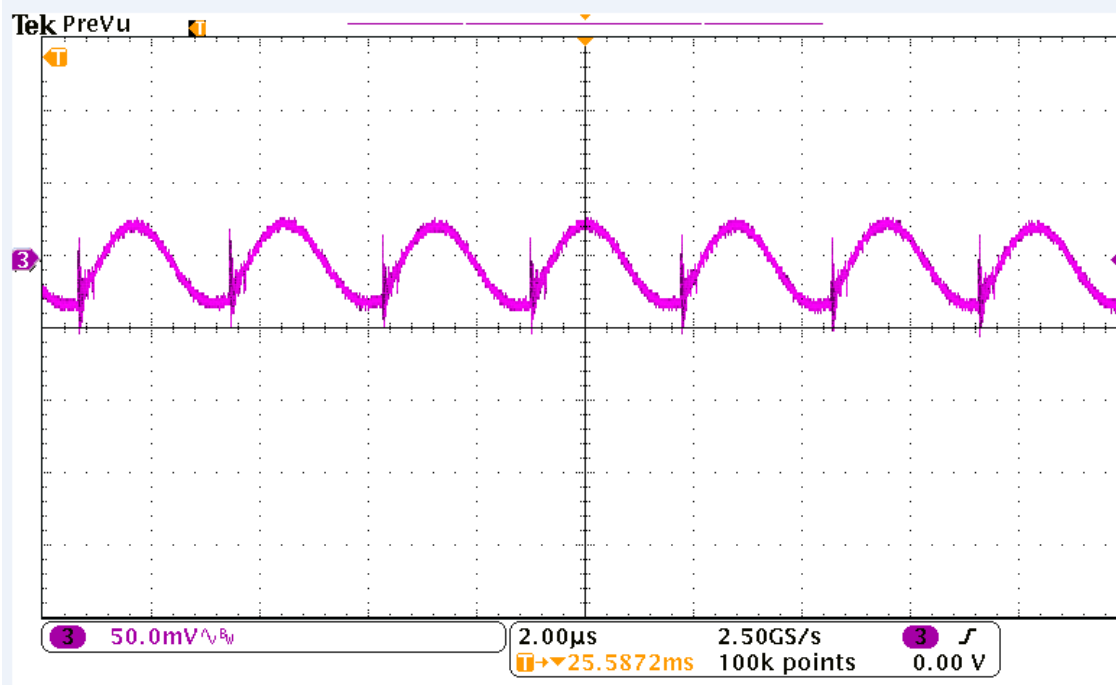
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 36V$, Vopri(3.3V) no load, no load on Vosec output.



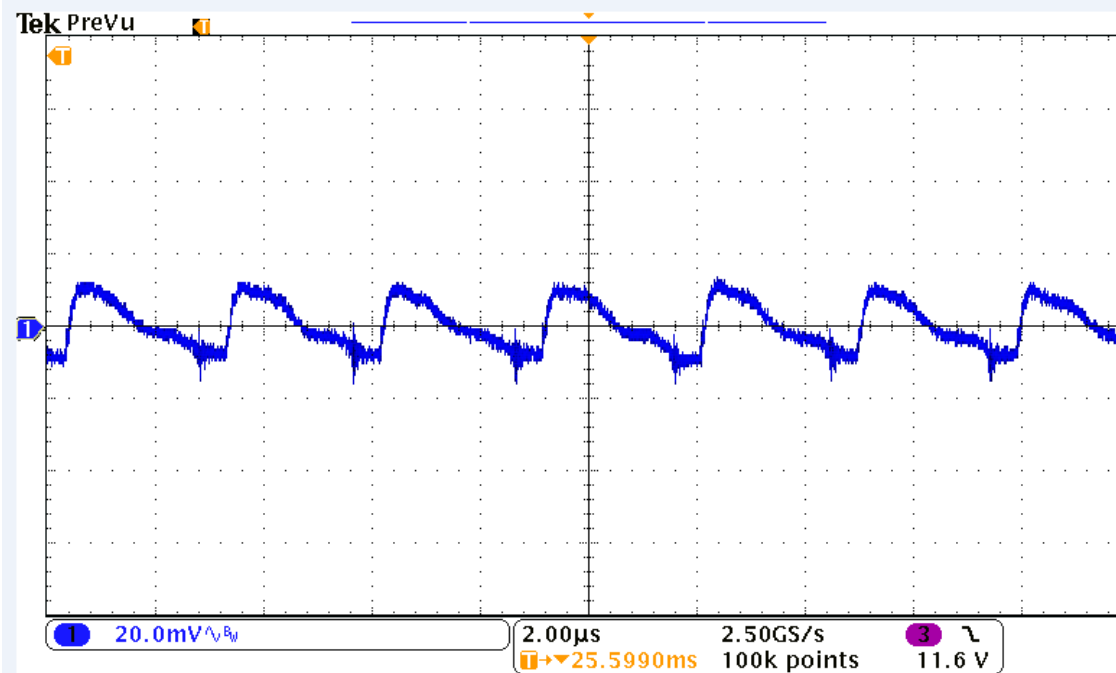
Vopri(3.3V) Output Ripple

Test condition: $V_{in} = 36V$, Vopri(3.3V) full load, full load on Vosec output(100mA).



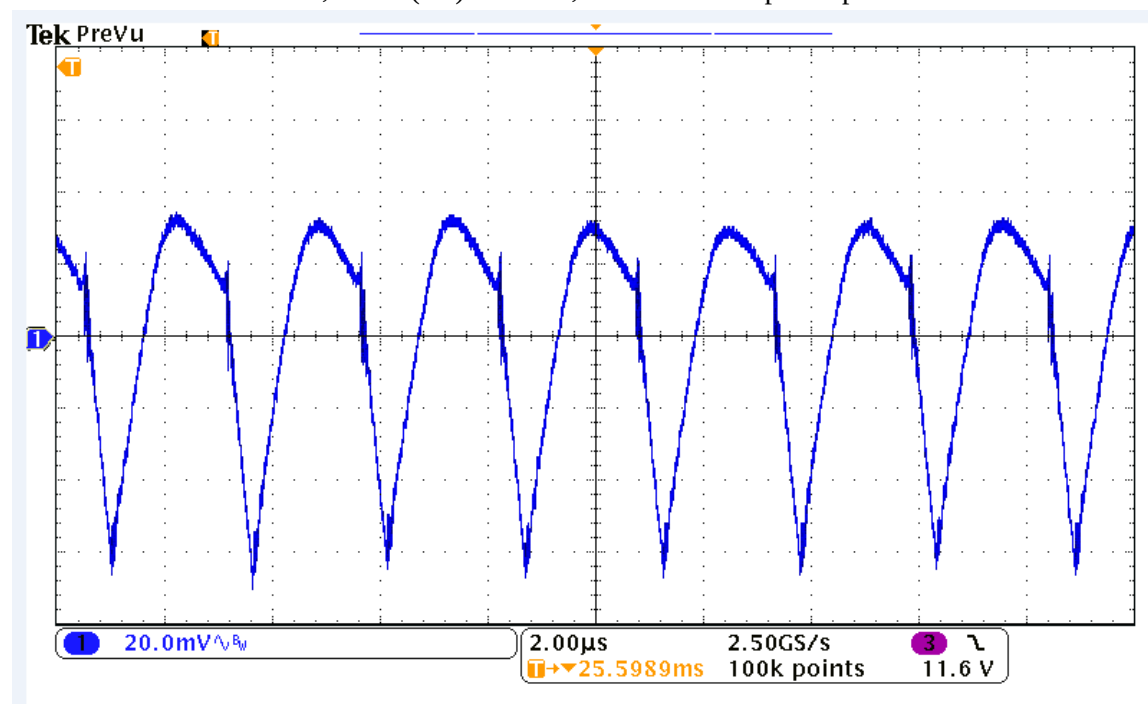
Vosec(5V) Output Ripple

Test condition: $V_{in} = 18V$, Vosec(5V) no load, no load on Vopri output.



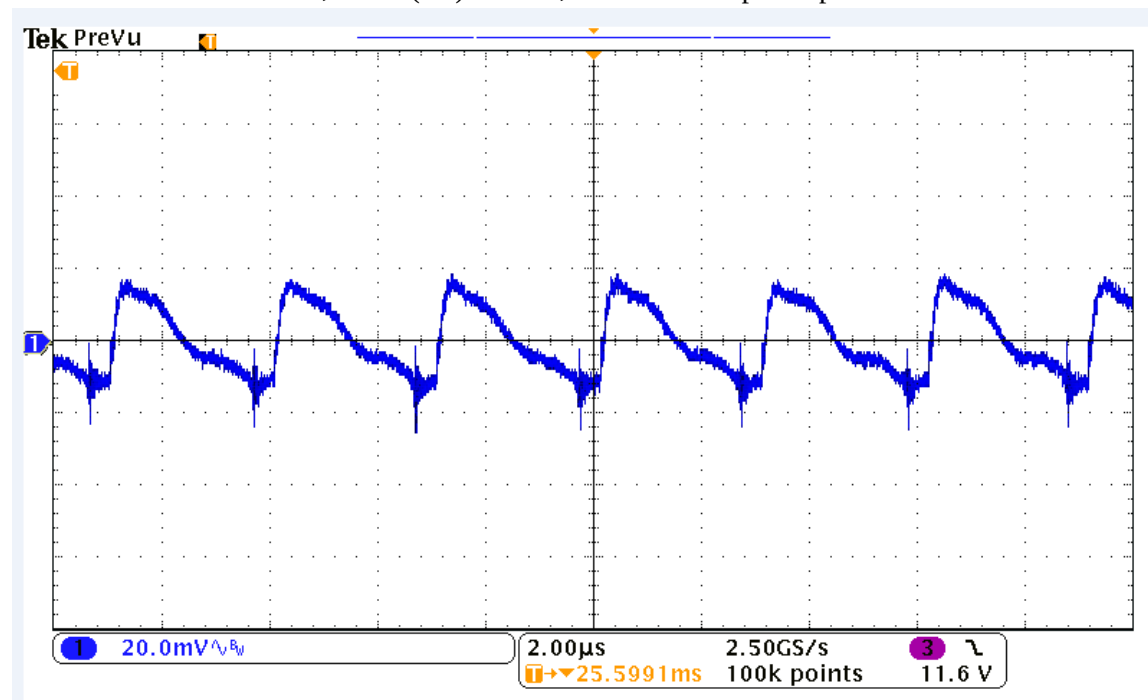
Vosec(5V) Output Ripple

Test condition: $V_{in} = 18V$, Vosec(5V) full load, full load on Vopri output.



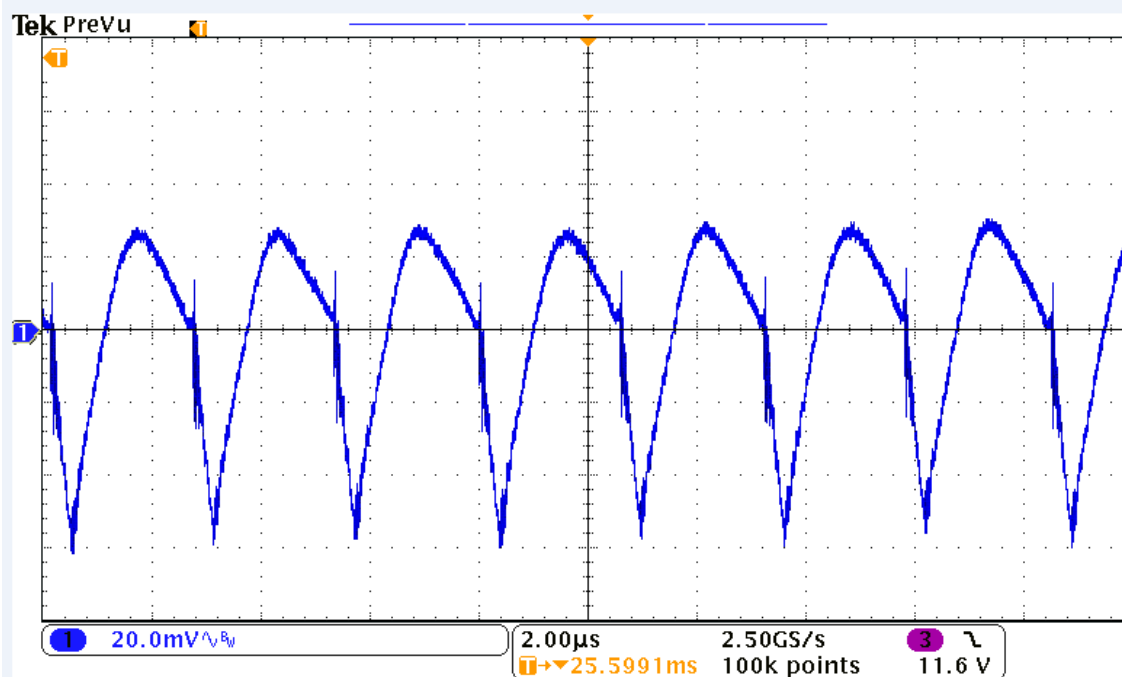
Vosec(5V) Output Ripple

Test condition: $V_{in} = 24V$, Vosec(5V) no load, no load on Vopri output.



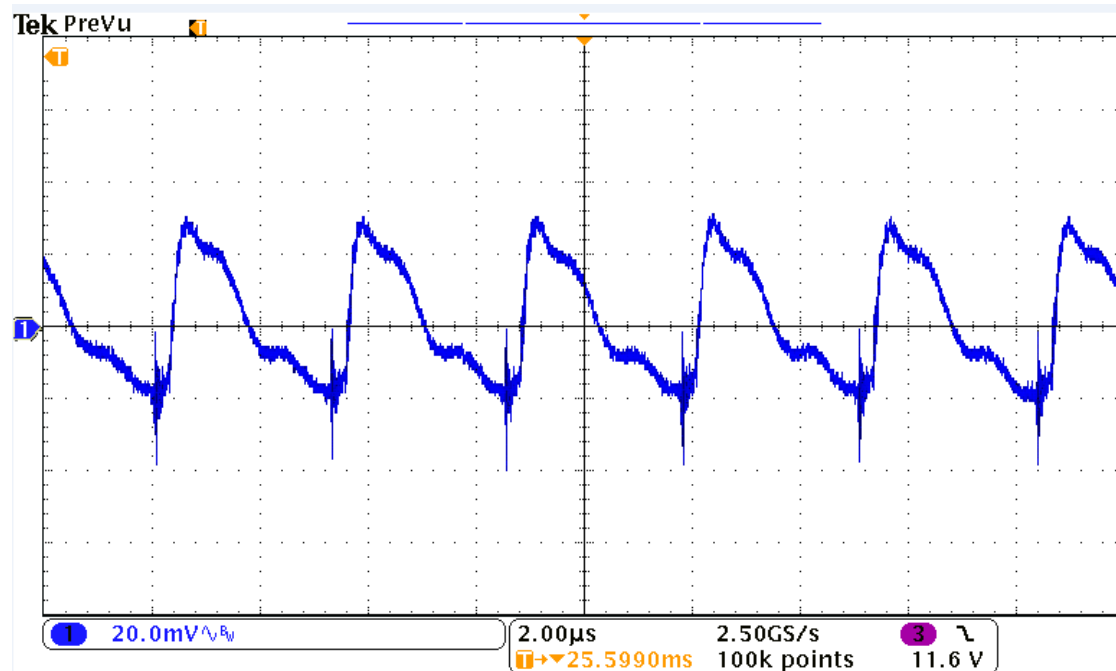
Vosec(5V) Output Ripple

Test condition: $V_{in} = 24V$, Vosec(5V) full load, full load on Vopri output.



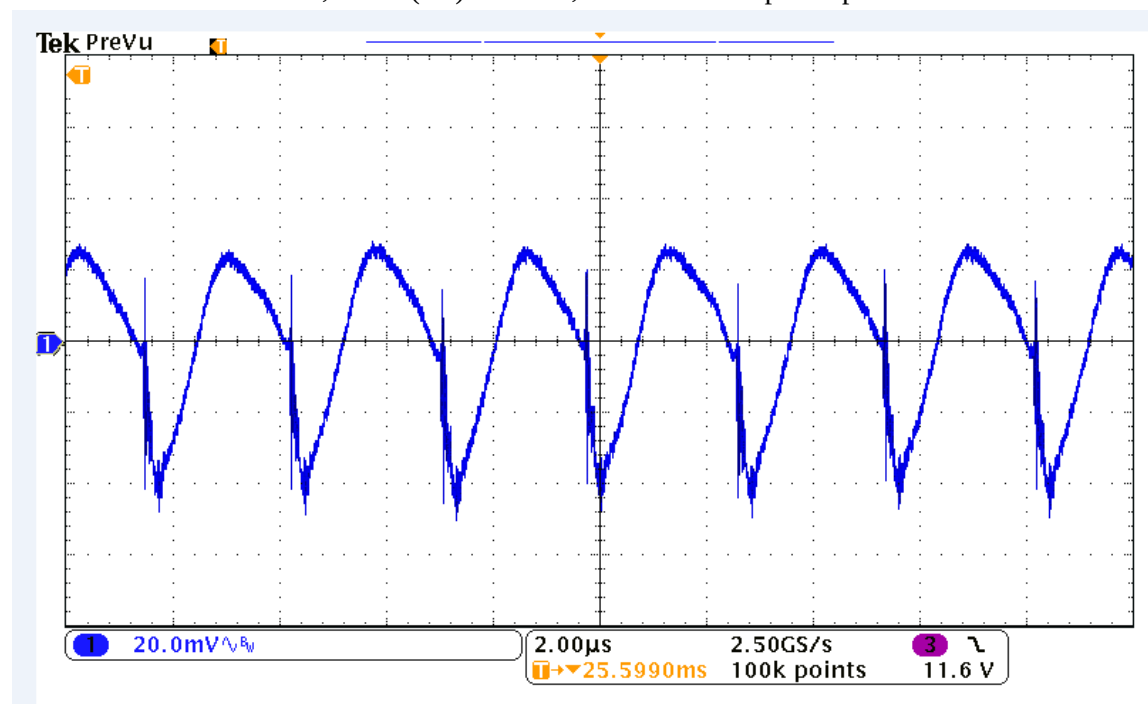
Vosec(5V) Output Ripple

Test condition: $V_{in} = 36V$, Vosec(5V) no load, no load on Vopri output.



Vosec(5V) Output Ripple

Test condition: $V_{in} = 36V$, Vosec(5V) full load, full load on Vopri output.



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