PMP40294 Test Results

1 General

1.1 Purpose

This test report is to provide the detailed data for evaluating and verifying the PMP40294 which performs a battery powered bi-directional system. It employs a bidirectional Buck-Boost Controller ---- BQ25703A with a user command switch. It can support any adaptor input within 5V-20V. And the system can also output multiple output options including 5/9/12/14.5/15/16/19/20V.the max output power is designed as 45W and valid battery voltage is from 9V to 13.2V.

1.2 Reference Documentation

Schematic: PMP40294_Sch.pdf

Gerber: PMP40294_GerberNCdrills.zip

Layer Plot: PMP40294_PCBlayers.pdf

Assembly Drawing: PMP40294_Assy.pdf

CAD File: PMP40294_CAD.zip

BOM: PMP40294_BOM.pdf

1.3 Test Equipment

Multi-meter (current): Fluke 287C

Multi-meter (voltage): Fluke 287C

DC Source: Chroma 62006P-100-25

E-Load: Chroma 63105A module

Oscilloscope: Tektronix DPO3054

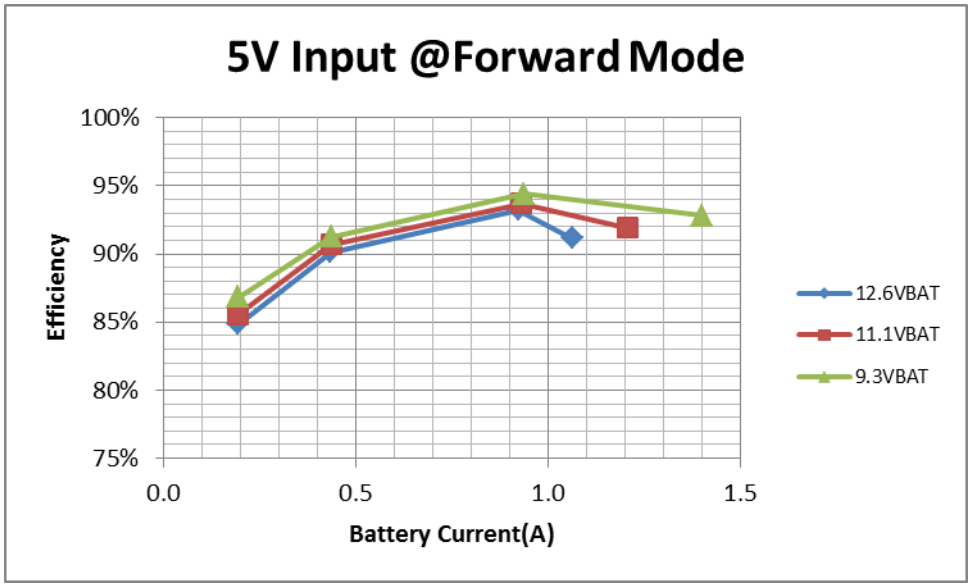
Electrical Thermography: Fluke Ti9

2 Performance Data and Waveform

2.1 Efficiency

2.1.1 5V Input in Forward Mode

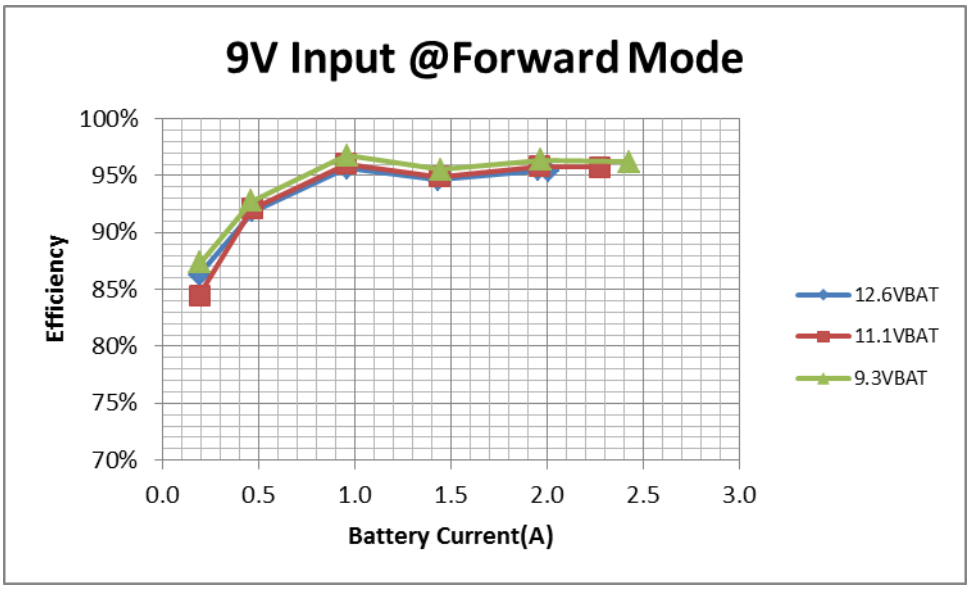
V_{IN}(V)	I_{IN}(A)	V_{BAT}(V)	I_{BAT}(A)	Efficiency
5.077	0.409	9.294	0.194	86.83%
5.057	0.878	9.294	0.436	91.24%
5.016	1.842	9.294	0.938	94.39%
4.975	2.823	9.294	1.403	92.81%
5.073	0.496	11.095	0.194	85.59%
5.050	1.056	11.095	0.436	90.70%
5.001	2.205	11.096	0.931	93.67%
4.970	2.938	11.096	1.209	91.90%
5.070	0.565	12.523	0.194	84.86%
5.044	1.196	12.523	0.434	90.12%
4.989	2.486	12.523	0.923	93.23%
4.970	2.938	12.523	1.063	91.17%



2.1.2 9V Input in Forward Mode

V_{IN}(V)	I_{IN}(A)	V_{BAT}(V)	I_{BAT}(A)	Efficiency
9.091	0.226	9.294	0.193	87.35%
9.079	0.510	9.294	0.462	92.77%

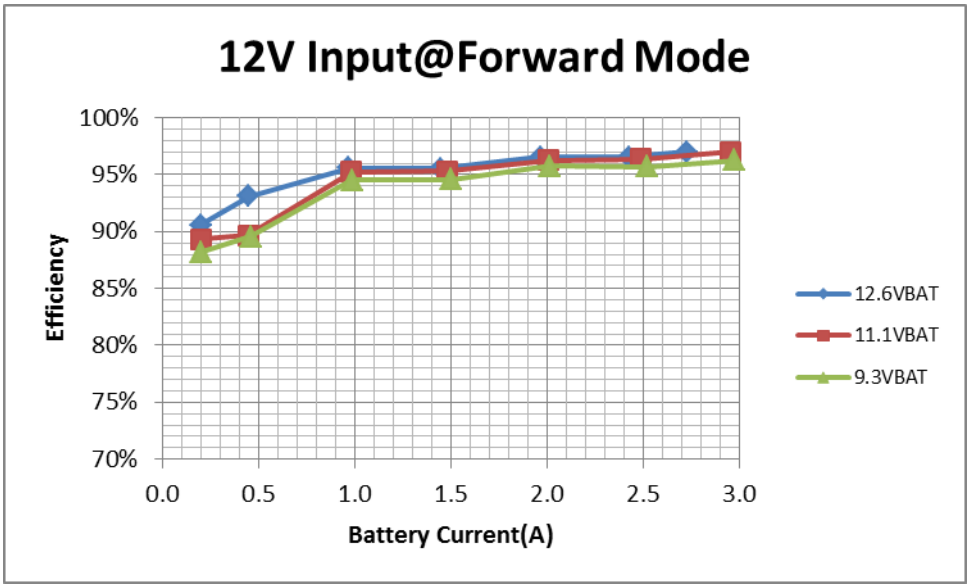
9.058	1.017	9.294	0.959	96.76%
9.035	1.558	9.294	1.447	95.51%
9.012	2.107	9.294	1.969	96.36%
8.990	2.612	9.294	2.431	96.21%
9.089	0.275	11.095	0.190	84.47%
9.075	0.616	11.095	0.464	92.11%
9.049	1.221	11.095	0.956	96.03%
9.022	1.863	11.095	1.438	94.93%
8.994	2.525	11.095	1.961	95.82%
8.976	2.940	11.095	2.277	95.74%
9.088	0.307	12.523	0.192	86.27%
9.071	0.703	12.523	0.468	91.87%
9.042	1.387	12.523	0.958	95.67%
9.012	2.102	12.524	1.432	94.65%
8.980	2.857	12.524	1.956	95.46%
8.977	2.939	12.524	2.010	95.41%



2.1.3 12V Input in Forward Mode

V_{IN}(V)	I_{IN}(A)	V_{BAT}(V)	I_{BAT}(A)	Efficiency
12.095	0.174	9.294	0.200	88.19%
12.085	0.392	9.294	0.457	89.58%
12.068	0.803	9.294	0.985	94.50%
12.051	1.223	9.294	1.500	94.59%

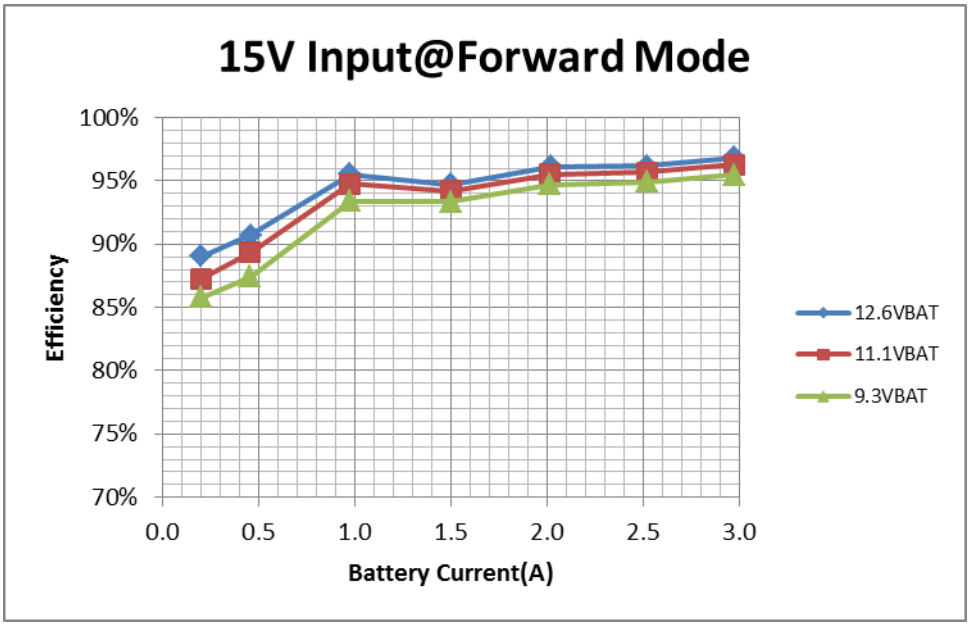
12.033	1.627	9.294	2.017	95.75%
12.016	2.039	9.294	2.523	95.70%
12.001	2.395	9.294	2.978	96.28%
12.093	0.206	11.095	0.201	89.34%
12.082	0.457	11.095	0.446	89.68%
12.062	0.947	11.095	0.981	95.25%
12.042	1.435	11.096	1.484	95.30%
12.021	1.923	11.096	2.005	96.26%
12.000	2.389	11.095	2.491	96.40%
11.982	2.824	11.095	2.958	96.98%
12.092	0.225	12.523	0.197	90.58%
12.080	0.499	12.523	0.448	93.09%
12.057	1.051	12.523	0.968	95.61%
12.036	1.577	12.523	1.448	95.56%
12.013	2.122	12.523	1.966	96.58%
11.991	2.626	12.523	2.427	96.53%
11.977	2.938	12.523	2.726	97.02%



2.1.4 15V Input in Forward Mode

V_{IN}(V)	I_{IN}(A)	V_{BAT}(V)	I_{BAT}(A)	Efficiency
15.093	0.144	9.294	0.201	85.78%
15.086	0.321	9.294	0.456	87.44%
15.073	0.645	9.294	0.977	93.39%

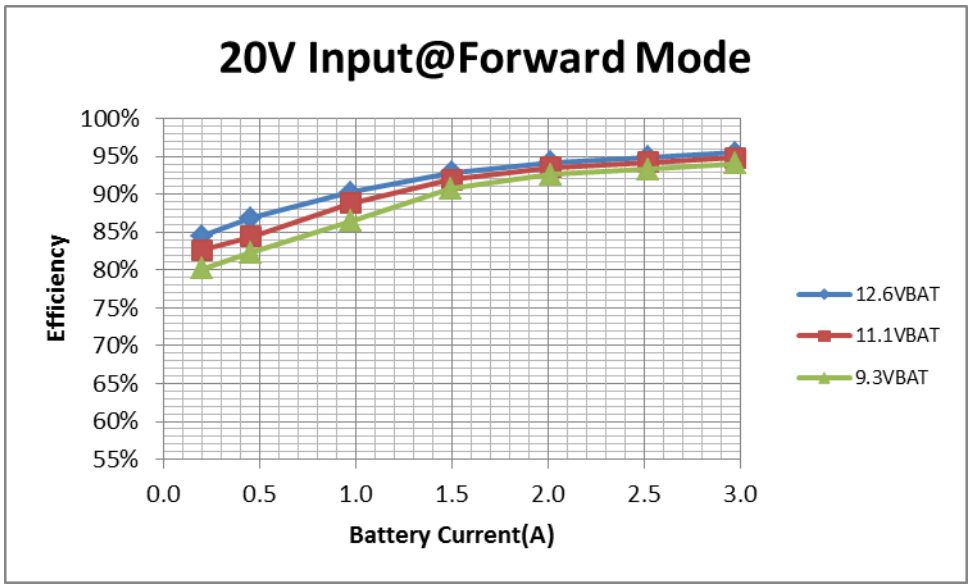
15.058	0.991	9.294	1.499	93.36%
15.044	1.315	9.294	2.017	94.74%
15.030	1.642	9.294	2.520	94.90%
15.018	1.928	9.294	2.975	95.48%
15.093	0.169	11.095	0.201	87.26%
15.084	0.375	11.095	0.456	89.36%
15.068	0.759	11.096	0.977	94.78%
15.050	1.174	11.095	1.500	94.19%
15.033	1.559	11.096	2.018	95.52%
15.018	1.947	11.096	2.521	95.66%
15.002	2.286	11.096	2.977	96.31%
15.092	0.187	12.524	0.201	89.02%
15.082	0.418	12.524	0.457	90.71%
15.064	0.850	12.524	0.977	95.55%
15.044	1.318	12.523	1.500	94.74%
15.026	1.751	12.524	2.019	96.12%
15.007	2.188	12.524	2.522	96.19%
14.991	2.568	12.524	2.977	96.84%



2.1.5 20V Input in Forward Mode

V_{IN}(V)	I_{IN}(A)	V_{BAT}(V)	I_{BAT}(A)	Efficiency
20.037	0.116	9.294	0.201	80.21%

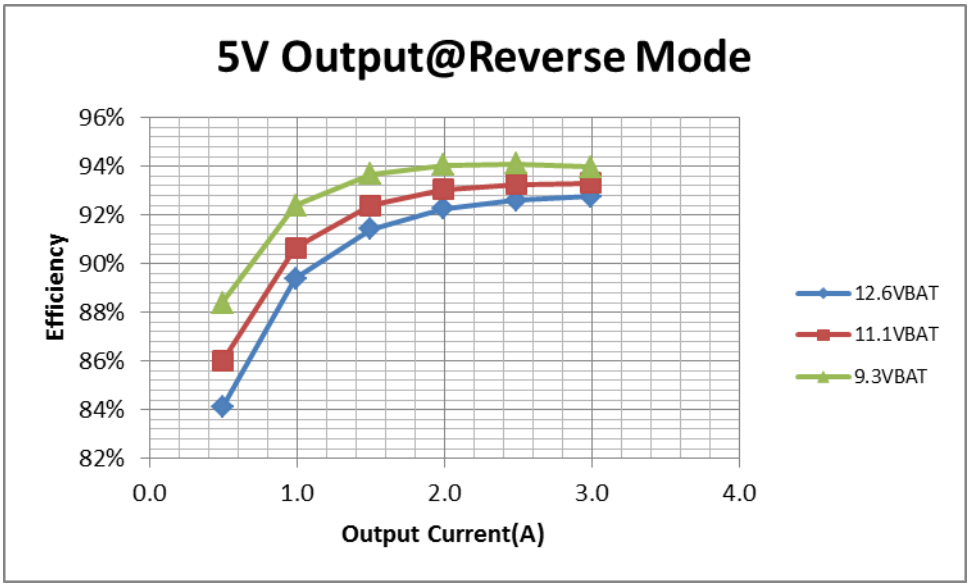
20.088	0.255	9.294	0.454	82.33%
20.076	0.520	9.294	0.971	86.47%
20.066	0.764	9.294	1.497	90.77%
20.055	1.009	9.294	2.017	92.62%
20.045	1.252	9.294	2.519	93.29%
20.036	1.467	9.294	2.974	94.03%
20.092	0.134	11.095	0.201	82.67%
20.085	0.297	11.095	0.454	84.40%
20.072	0.605	11.095	0.972	88.83%
20.060	0.902	11.095	1.500	91.98%
20.048	1.194	11.096	2.018	93.52%
20.036	1.481	11.095	2.520	94.22%
20.025	1.737	11.096	2.974	94.86%
20.092	0.148	12.523	0.201	84.48%
20.084	0.327	12.523	0.456	86.87%
20.070	0.672	12.524	0.972	90.28%
20.055	1.009	12.524	1.500	92.84%
20.041	1.338	12.524	2.018	94.27%
20.028	1.661	12.524	2.520	94.87%
20.016	1.949	12.524	2.974	95.47%



2.1.6 5V Output in Reverse Mode

V_{BAT}(V)	I_{BAT}(A)	V_o(V)	I_o(A)	Efficiency
9.292	0.305	5.033	0.498	88.40%

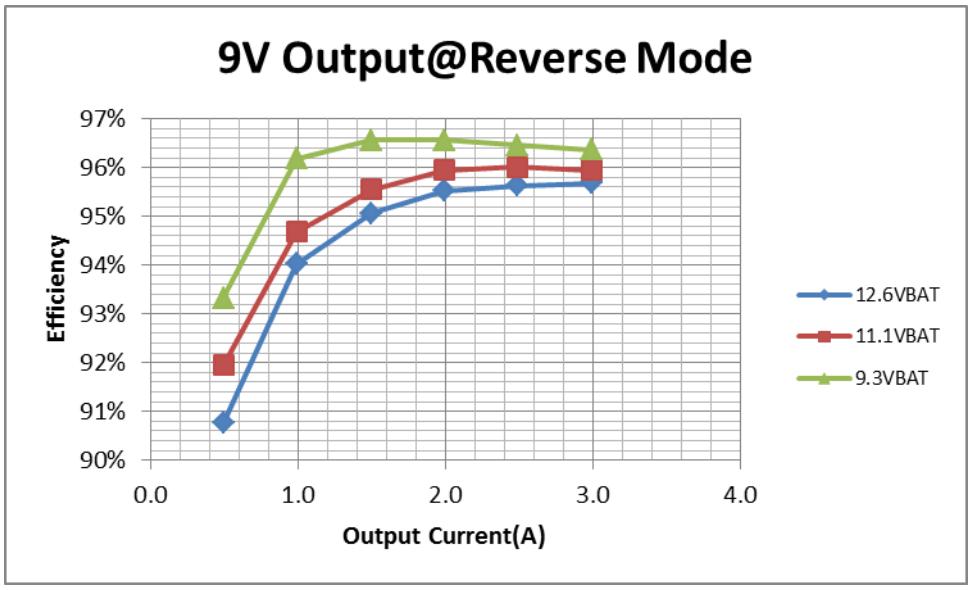
9.283	0.582	5.028	0.993	92.39%
9.274	0.868	5.021	1.502	93.69%
9.264	1.149	5.015	1.996	94.04%
9.255	1.432	5.009	2.490	94.11%
9.245	1.727	5.003	2.999	93.97%
11.093	0.262	5.030	0.497	86.00%
11.085	0.496	5.025	0.992	90.65%
11.077	0.736	5.019	1.501	92.40%
11.069	0.971	5.013	1.995	93.04%
11.061	1.208	5.005	2.490	93.27%
11.053	1.454	5.000	2.999	93.31%
12.593	0.236	5.030	0.497	84.10%
12.587	0.443	5.025	0.992	89.39%
12.580	0.655	5.019	1.501	91.42%
12.573	0.862	5.013	1.995	92.27%
12.566	1.071	5.005	2.490	92.60%
12.559	1.287	4.999	2.999	92.75%



2.1.7 9V Output in Reverse Mode

V_{BAT}(V)	I_{BAT}(A)	V_o(V)	I_o(A)	Efficiency
9.285	0.521	9.104	0.496	93.32%
9.268	1.013	9.099	0.992	96.18%
9.251	1.526	9.088	1.500	96.56%
9.235	2.030	9.079	1.994	96.57%

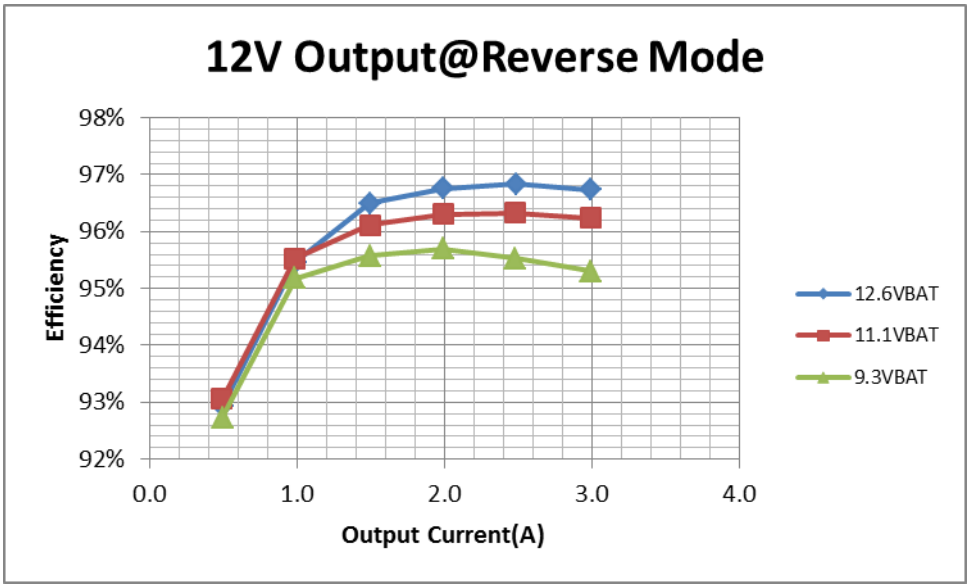
9.218	2.538	9.070	2.488	96.46%
9.200	3.064	9.060	2.998	96.36%
11.086	0.443	9.106	0.496	91.95%
11.073	0.861	9.100	0.992	94.68%
11.058	1.292	9.095	1.501	95.55%
11.044	1.711	9.088	1.995	95.94%
11.030	2.135	9.080	2.490	96.01%
11.016	2.574	9.074	2.998	95.94%
12.588	0.396	9.105	0.497	90.76%
12.576	0.764	9.100	0.993	94.03%
12.563	1.143	9.095	1.501	95.06%
12.551	1.512	9.086	1.995	95.52%
12.539	1.885	9.078	2.490	95.63%
12.526	2.270	9.072	2.999	95.69%



2.1.8 12V Output in Reverse Mode

V_{BAT}(V)	I_{BAT}(A)	V_o(V)	I_o(A)	Efficiency
9.278	0.705	12.231	0.496	92.73%
9.256	1.373	12.218	0.990	95.18%
9.233	2.072	12.205	1.498	95.58%
9.211	2.756	12.194	1.992	95.70%
9.187	3.452	12.185	2.486	95.53%
9.163	4.177	12.173	2.996	95.30%

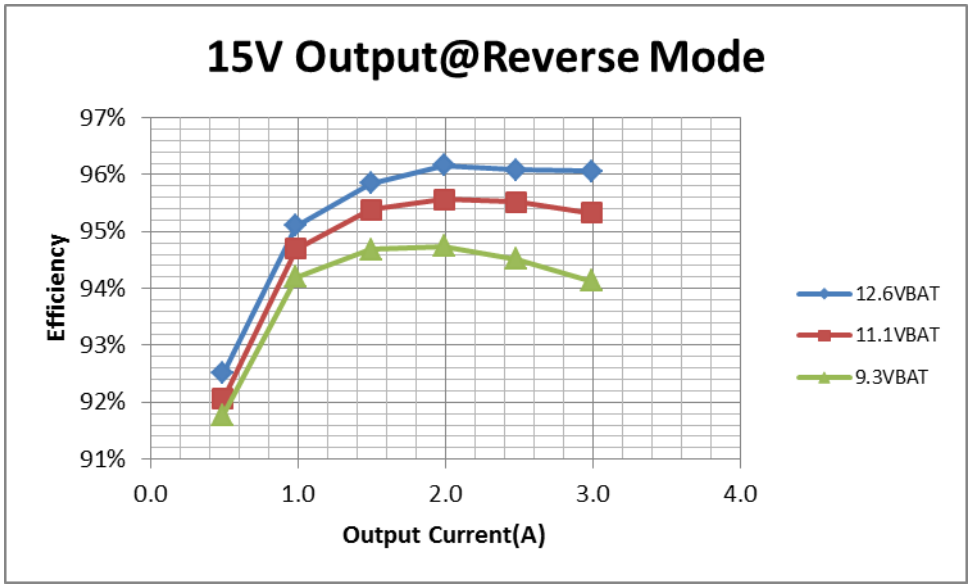
11.082	0.587	12.229	0.495	93.06%
11.063	1.143	12.213	0.989	95.53%
11.044	1.721	12.201	1.497	96.11%
11.026	2.286	12.190	1.991	96.30%
11.007	2.856	12.179	2.486	96.32%
10.987	3.449	12.171	2.996	96.24%
12.586	0.518	12.216	0.496	92.92%
12.568	1.008	12.204	0.991	95.46%
12.551	1.510	12.199	1.499	96.49%
12.535	2.003	12.190	1.993	96.76%
12.518	2.500	12.180	2.488	96.84%
12.501	3.016	12.170	2.997	96.74%



2.1.9 15V Output in Reverse Mode

V_{BAT}(V)	I_{BAT}(A)	V_o(V)	I_o(A)	Efficiency
9.272	0.885	15.213	0.495	91.77%
9.244	1.727	15.205	0.989	94.21%
9.215	2.607	15.193	1.497	94.69%
9.187	3.473	15.181	1.991	94.75%
9.158	4.356	15.165	2.486	94.52%
9.127	5.279	15.146	2.994	94.13%
11.077	0.737	15.210	0.494	92.06%
11.053	1.435	15.201	0.988	94.70%
11.029	2.162	15.191	1.497	95.38%

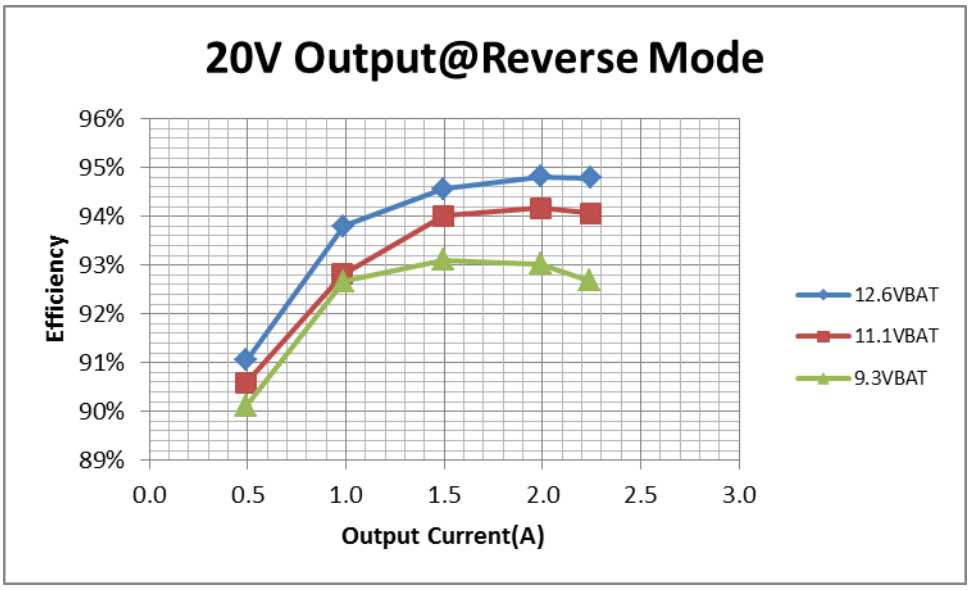
11.006	2.874	15.180	1.991	95.56%
10.982	3.594	15.169	2.485	95.52%
10.957	4.344	15.153	2.994	95.33%
12.580	0.647	15.211	0.495	92.51%
12.559	1.259	15.203	0.989	95.10%
12.538	1.893	15.194	1.497	95.85%
12.518	2.513	15.184	1.992	96.16%
12.497	3.140	15.170	2.485	96.08%
12.475	3.789	15.159	2.995	96.06%



2.1.9 20V Output in Reverse Mode

V_{BAT}(V)	I_{BAT}(A)	V_o(V)	I_o(A)	Efficiency
9.262	1.200	20.235	0.495	90.12%
9.224	2.338	20.224	0.988	92.66%
9.184	3.536	20.206	1.496	93.10%
9.145	4.723	20.188	1.990	93.03%
9.125	5.349	20.174	2.243	92.69%
11.068	0.999	20.235	0.495	90.59%
11.037	1.941	20.224	0.983	92.81%
11.005	2.925	20.211	1.497	94.01%
10.973	3.892	20.195	1.991	94.16%
10.956	4.396	20.186	2.244	94.07%
12.573	0.875	20.235	0.495	91.05%

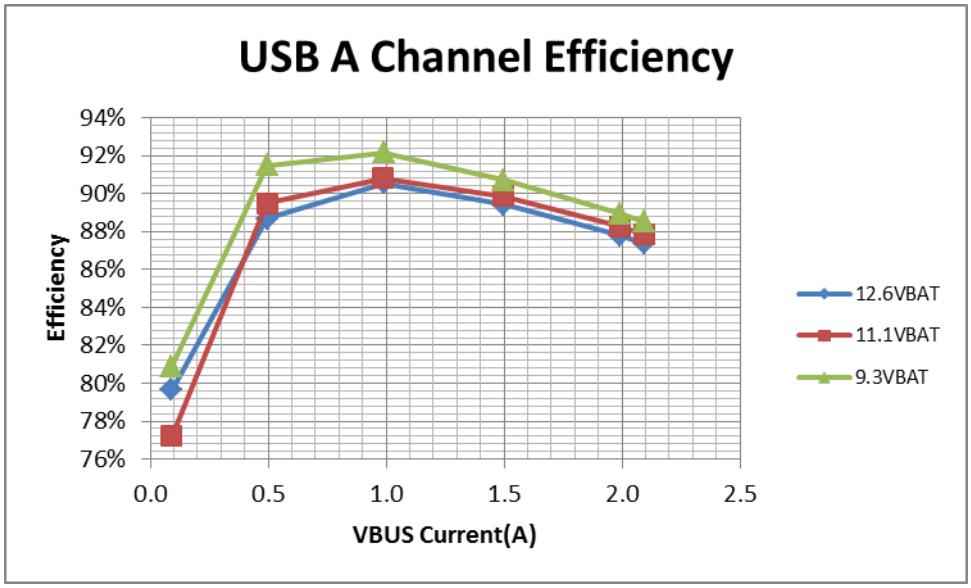
12.545	1.700	20.225	0.989	93.80%
12.517	2.557	20.214	1.497	94.56%
12.489	3.397	20.199	1.991	94.81%
12.474	3.833	20.193	2.244	94.79%



2.1.11 USB Type A

V_{BAT}(V)	I_{BAT}(A)	V_{VBUS}(V)	I_{VBUS}(A)	Efficiency
9.304	0.063	5.140	0.092	80.89%
9.299	0.297	5.108	0.495	91.48%
9.293	0.586	5.070	0.990	92.17%
9.286	0.894	5.028	1.498	90.72%
9.279	1.203	4.988	1.991	88.97%
9.278	1.271	4.978	2.096	88.51%
11.103	0.054	5.143	0.090	77.19%
11.099	0.255	5.108	0.495	89.50%
11.094	0.497	5.068	0.988	90.81%
11.088	0.756	5.028	1.498	89.85%
11.083	1.015	4.985	1.991	88.28%
11.081	1.072	4.978	2.096	87.84%
12.603	0.047	5.140	0.092	79.66%
12.599	0.226	5.108	0.495	88.67%
12.595	0.440	5.068	0.990	90.53%
12.590	0.669	5.028	1.498	89.42%
12.585	0.898	4.985	1.991	87.80%

12.584	0.949	4.978	2.096	87.37%

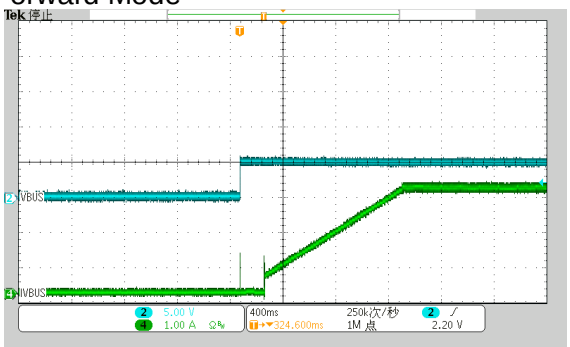


2.2 Standby Current

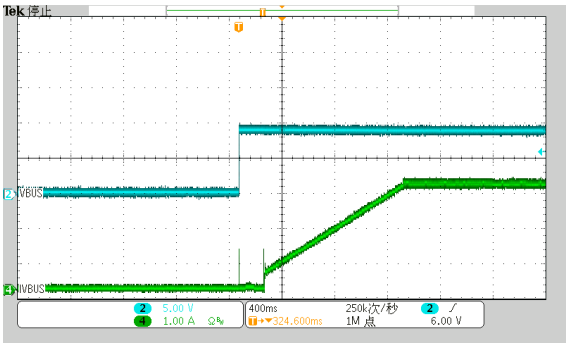
PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
I_{STD}	Standby current	V_{BAT}=9.3V, Connectors Unattached		100		uA
		V_{BAT}=11.1V, Connectors Unattached		102		uA
		V_{BAT}=12.6V, Connectors Unattached		103		uA

2.3 Start up

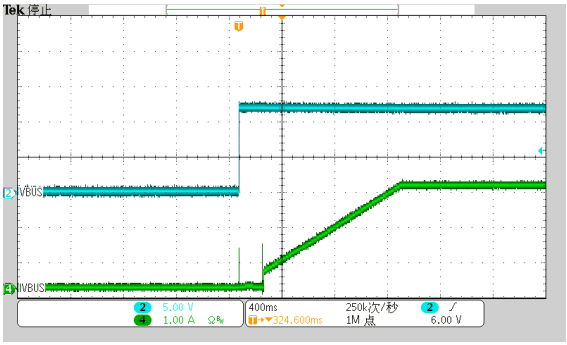
2.3.1 Forward Mode



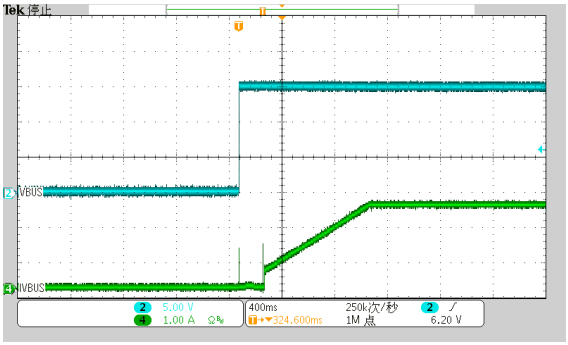
5V Input
CH2: Vin 5V/Div
CH4: Input Current 1A/Div



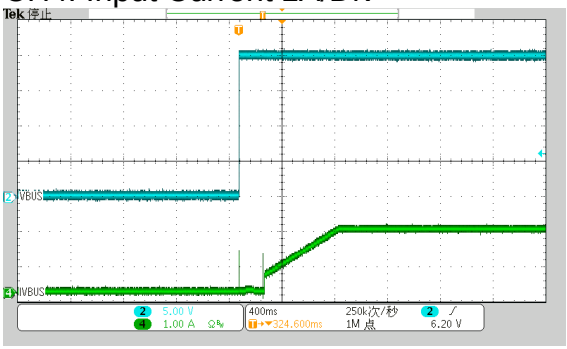
9V Input
CH2: Vin 5V/Div
CH4: Input Current 1A/Div



12V Input
CH2: Vin 5V/Div
CH4: Input Current 1A/Div

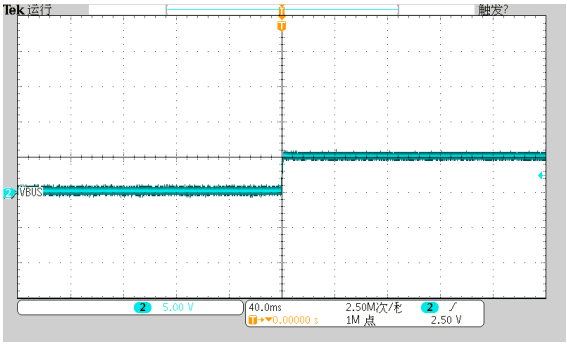


15V Input
CH2: Vin 5V/Div
CH4: Input Current 1A/Div

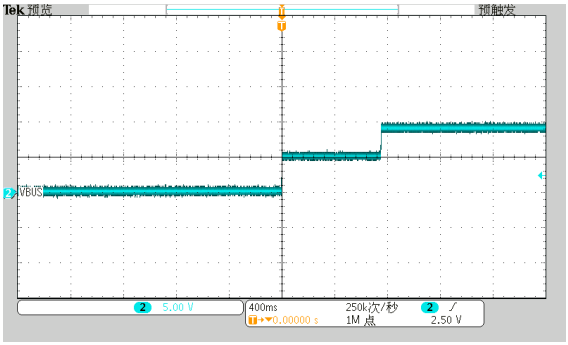


20V Input
CH2: Vin 5V/Div
CH4: Input Current 1A/Div

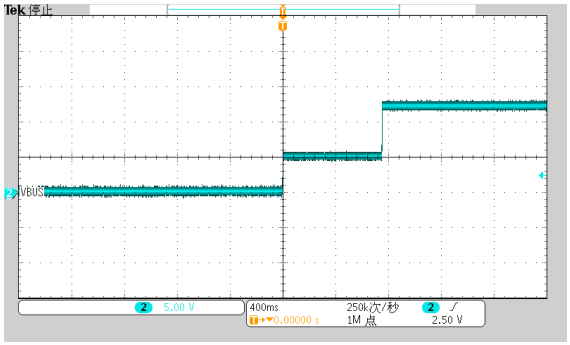
2.3.2 Reverse Mode



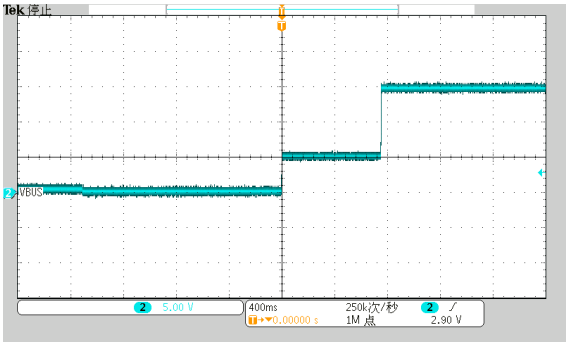
5V Output
CH2: Vo 5V/Div



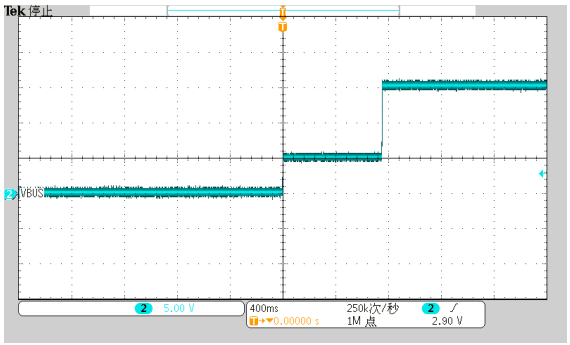
9V Output
CH2: Vo 5V/Div



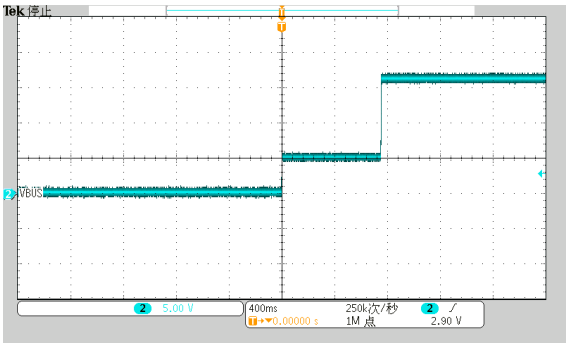
12V Output
CH2: Vo 5V/Div



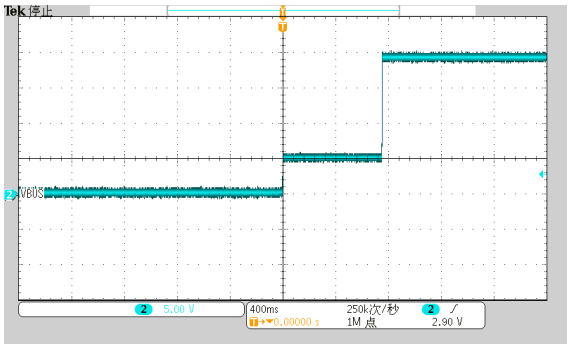
14.5V Output
CH2: Vo 5V/Div



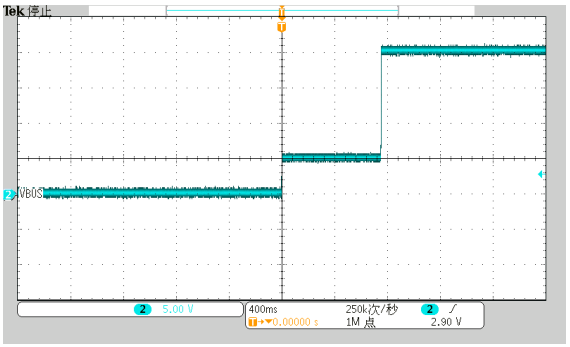
15V Output
CH2: Vo 5V/Div



16V Output
CH2: Vo 5V/Div



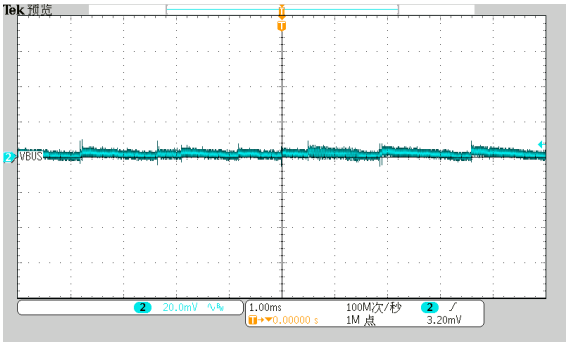
19V Output
CH2: Vo 5V/Div



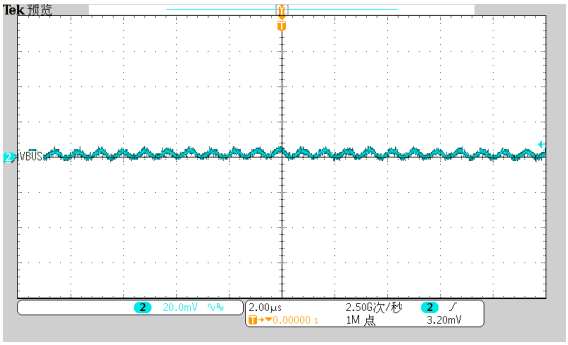
20V Output
CH2: Vo 5V/Div

2.4 Output Voltage Ripple in Reverse Mode

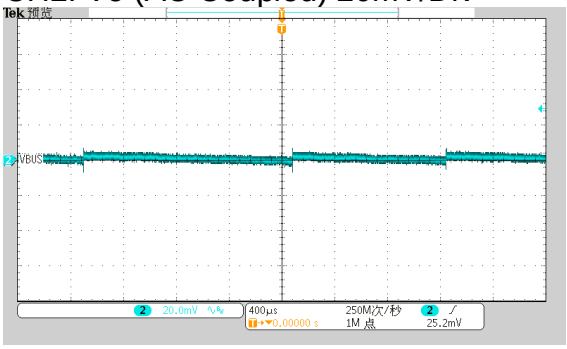
2.4.1 Output Voltage: 5V



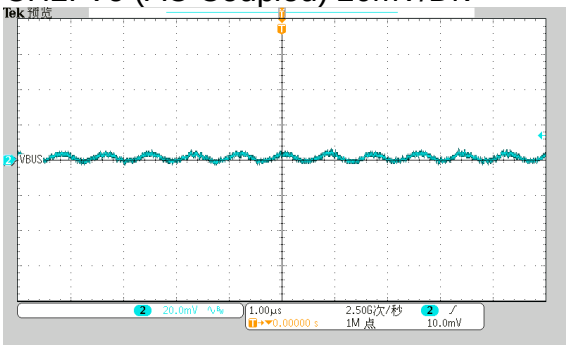
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



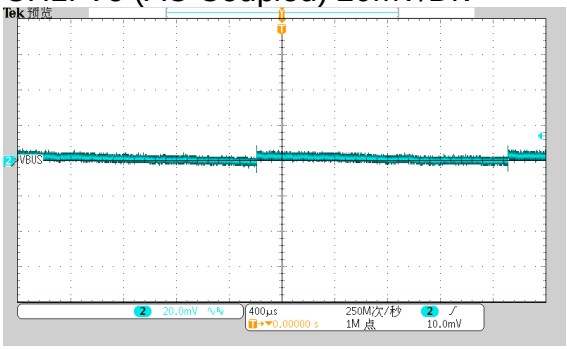
V_{BAT}=9.3V and Full Load
CH2: Vo (AC Coupled) 20mV/Div



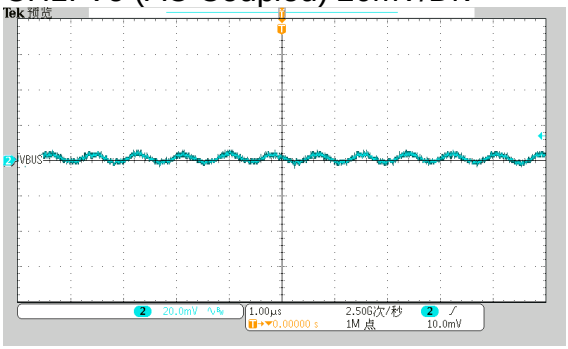
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 20mV/Div

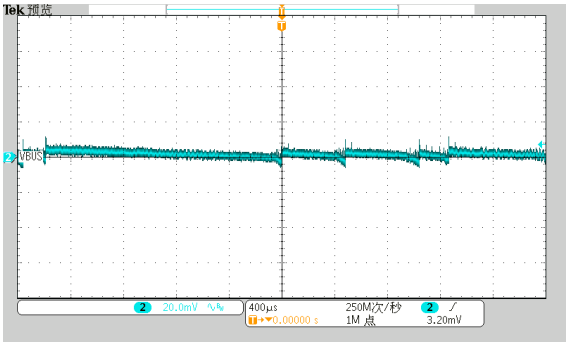


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 20mV/Div

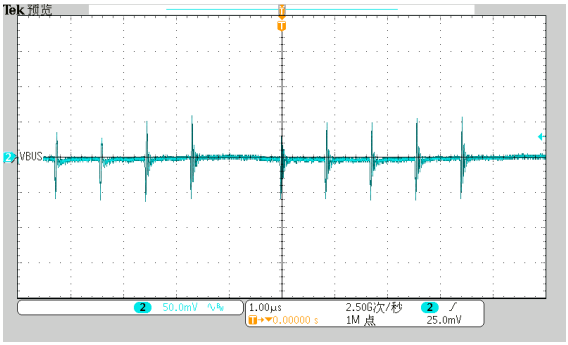


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 20mV/Div

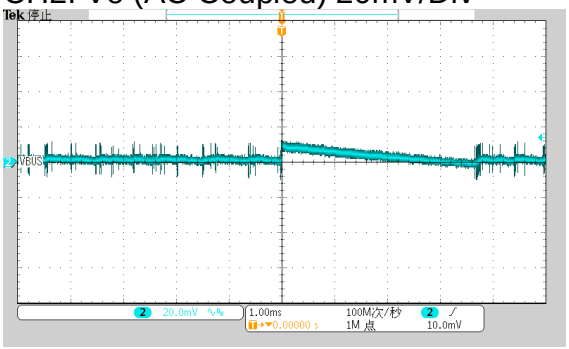
2.4.2 Output Voltage: 9V



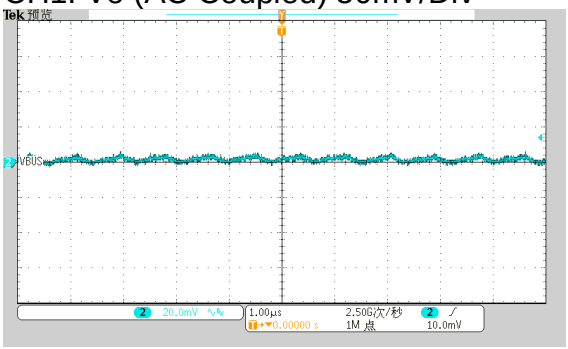
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



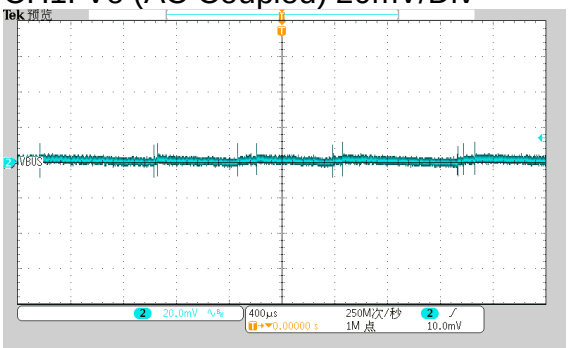
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



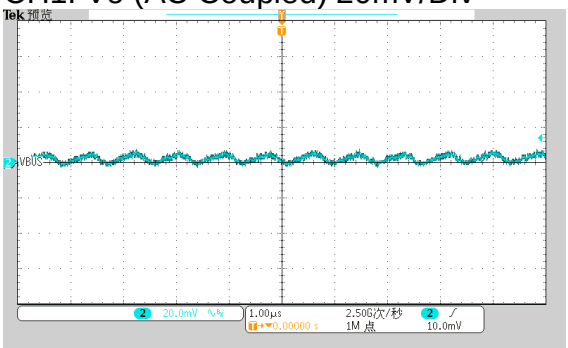
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 20mV/Div

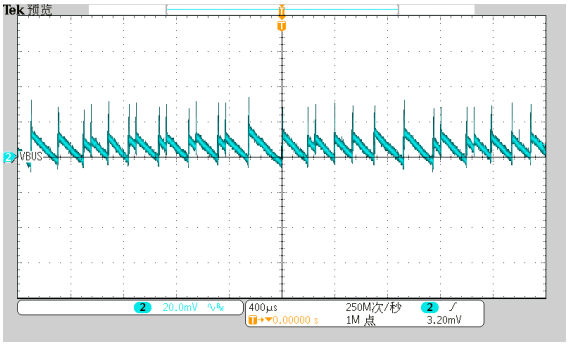


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 20mV/Div

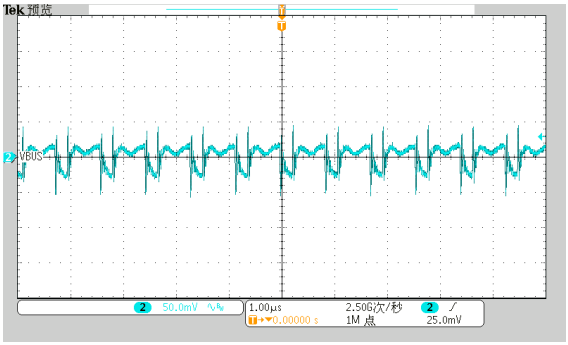


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 20mV/Div

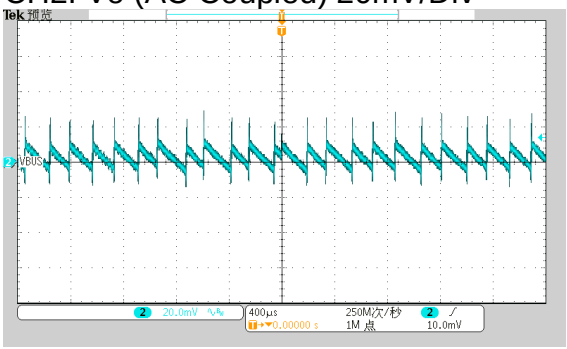
2.4.3 Output Voltage: 12V



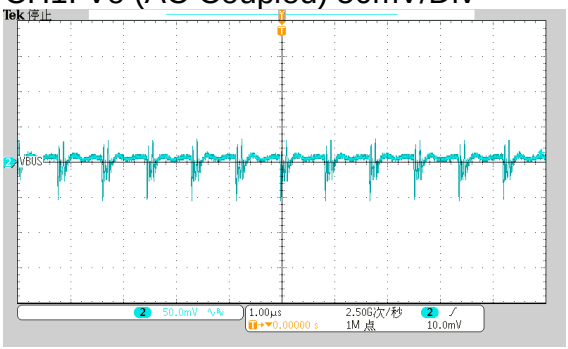
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



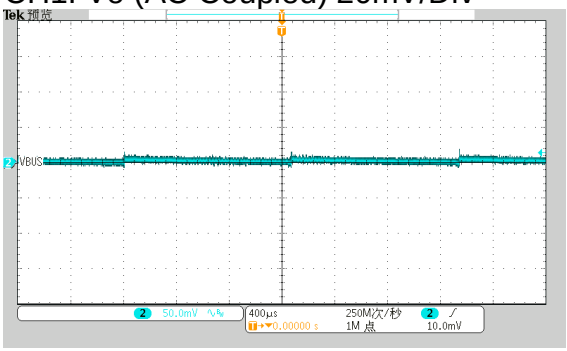
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



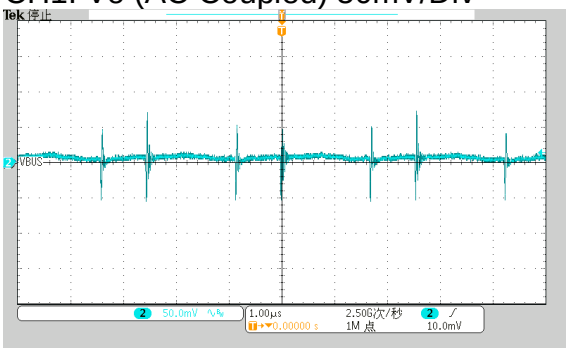
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

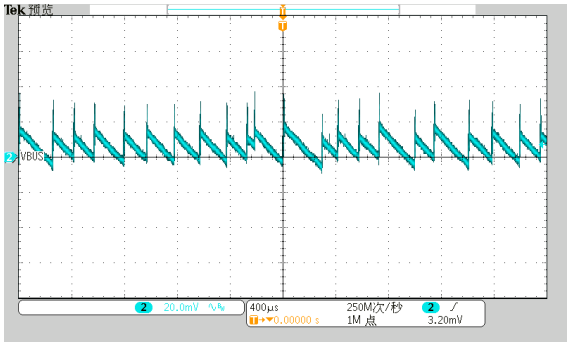


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div

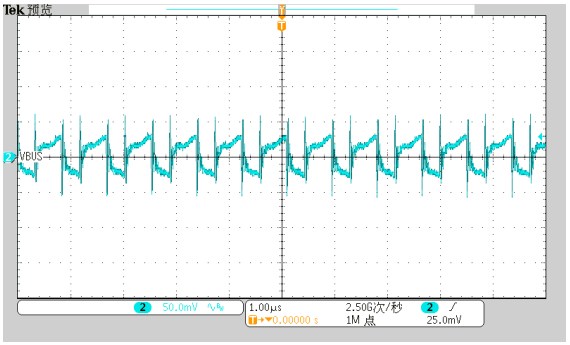


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

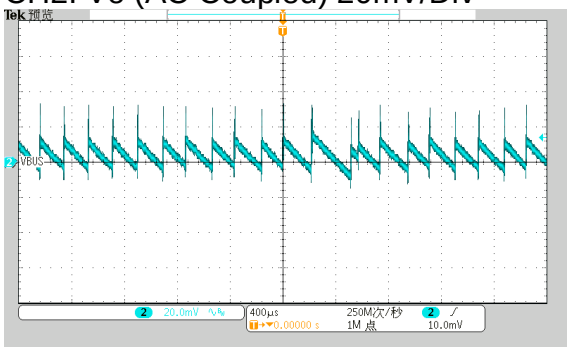
2.4.4 Output Voltage: 14.5V



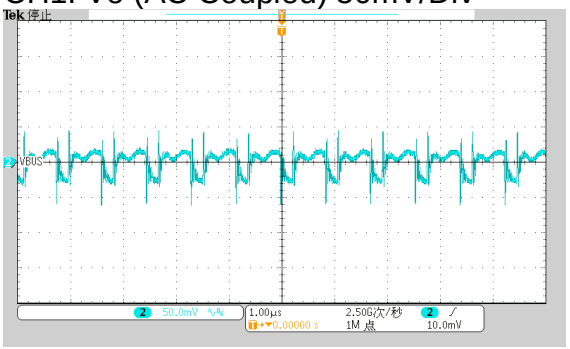
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



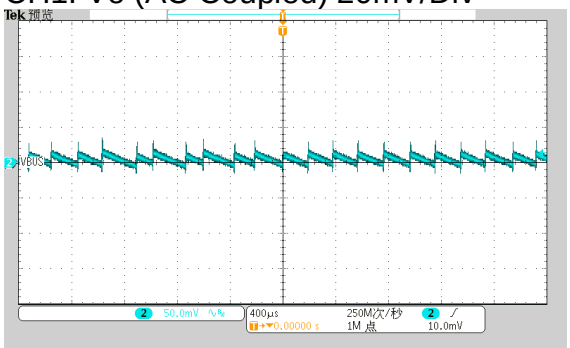
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



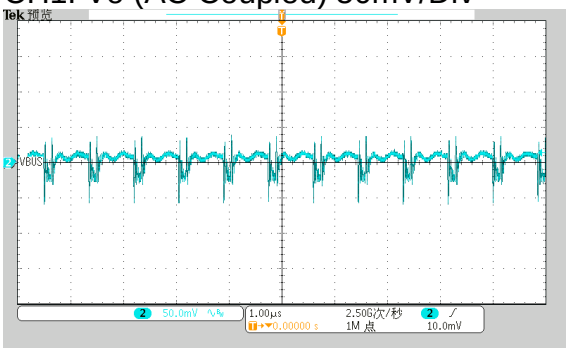
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

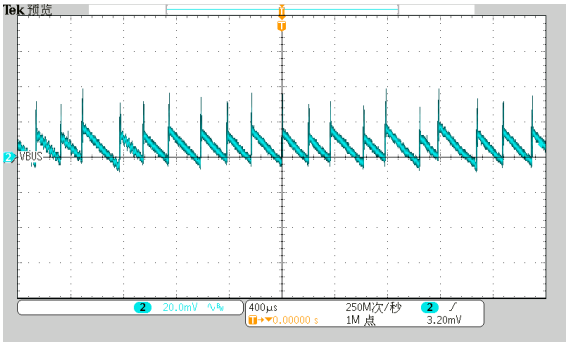


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div

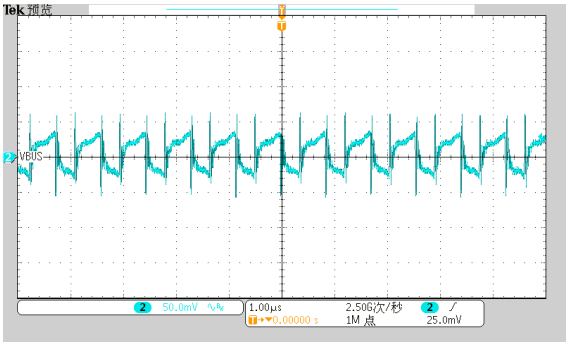


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

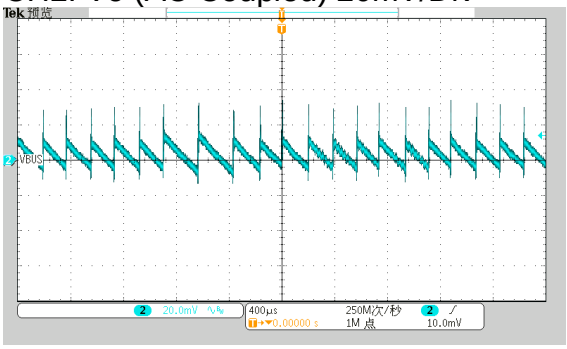
2.4.5 Output Voltage: 15V



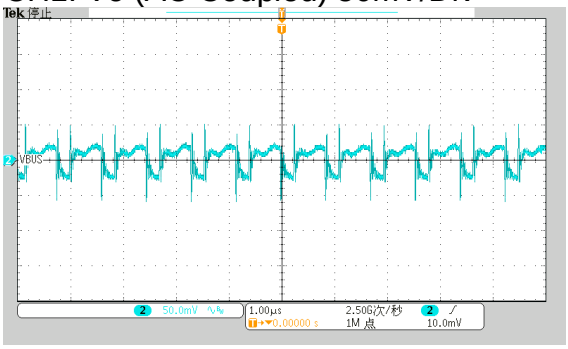
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



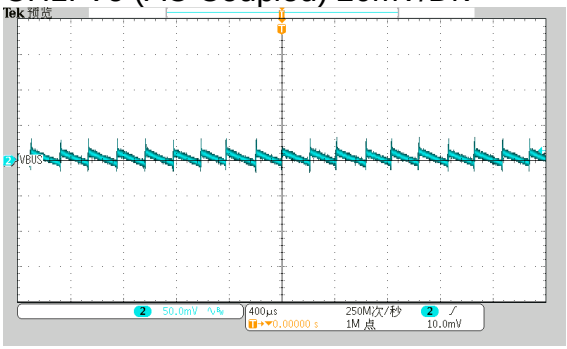
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



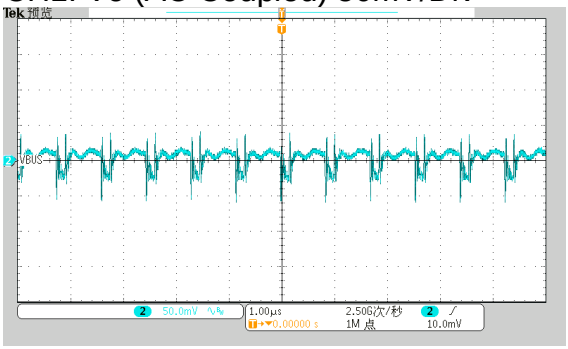
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

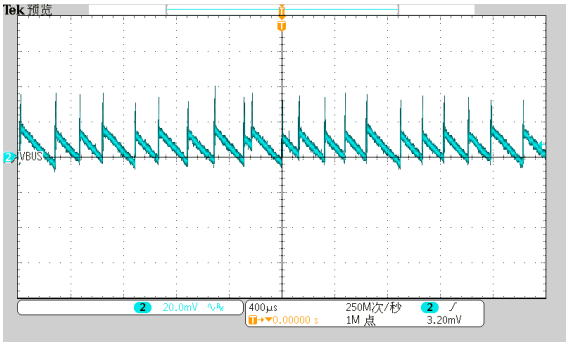


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div

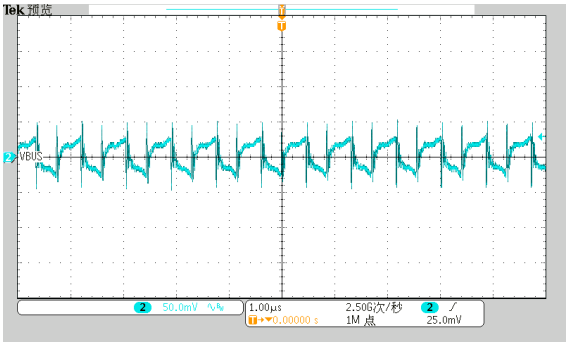


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

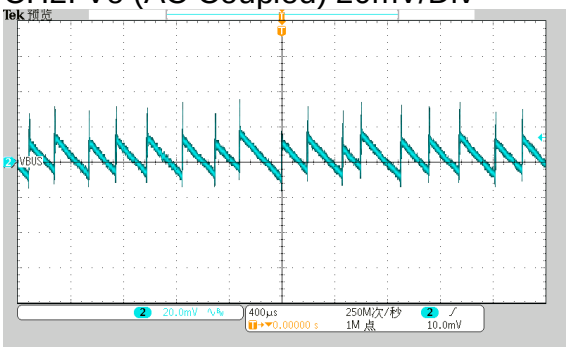
2.4.6 Output Voltage: 16V



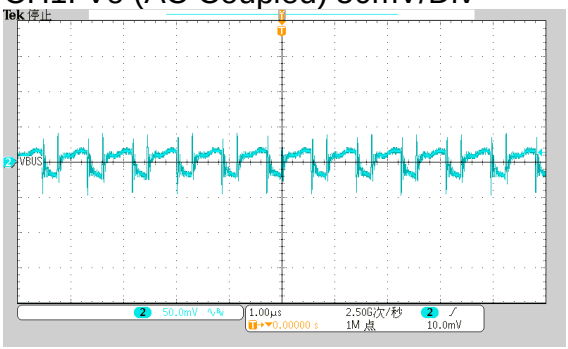
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



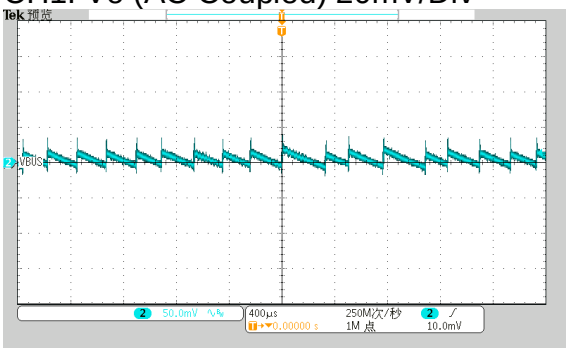
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



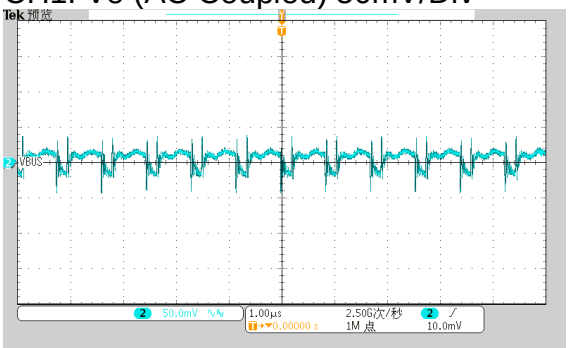
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

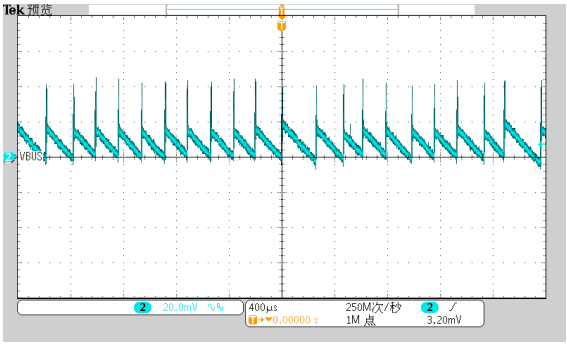


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div

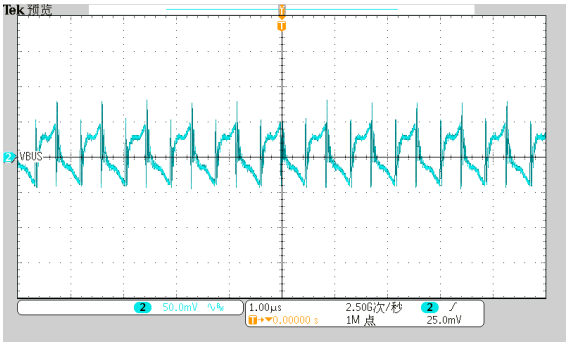


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

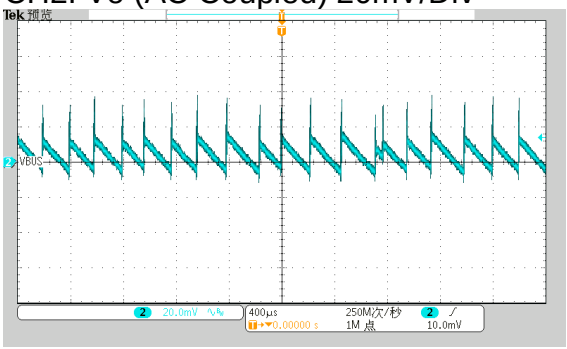
2.4.7 Output Voltage: 19V



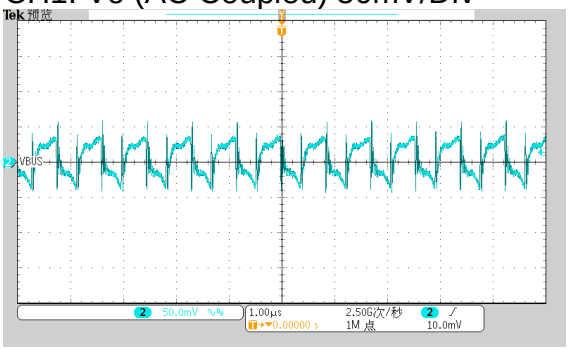
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



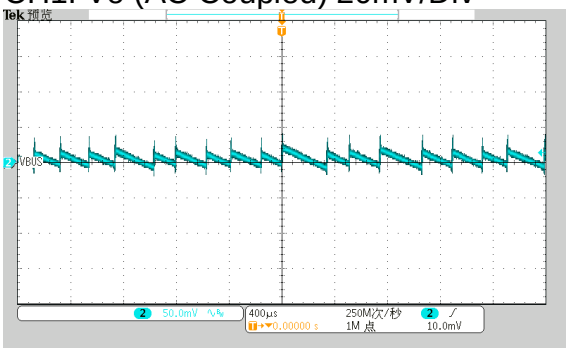
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



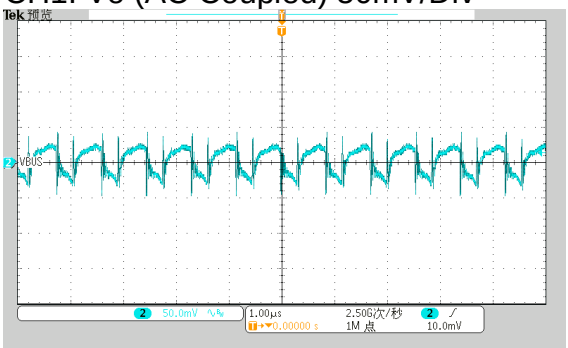
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

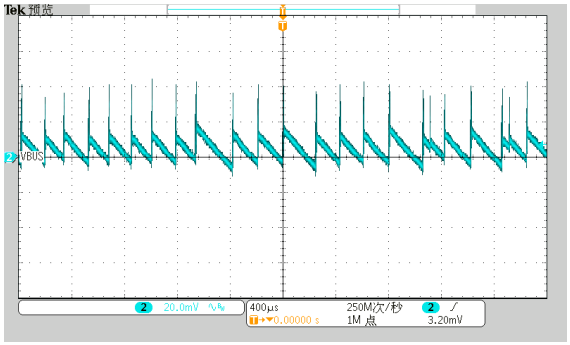


V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div

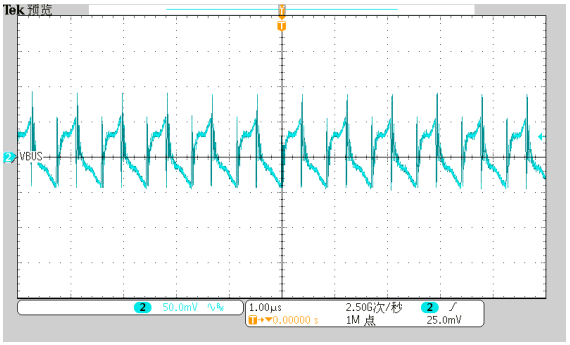


V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

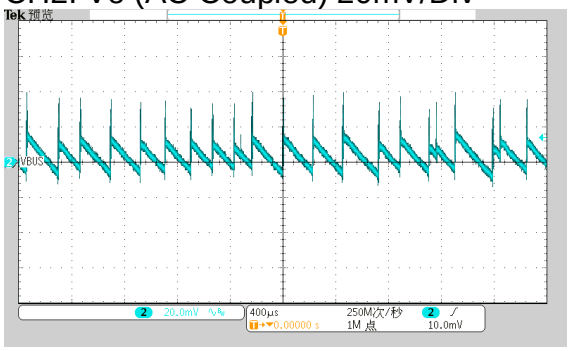
2.4.8 Output Voltage: 20V



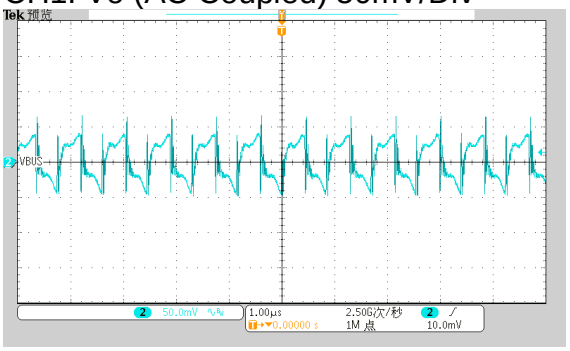
V_{BAT}=9.3V and No Load
CH2: Vo (AC Coupled) 20mV/Div



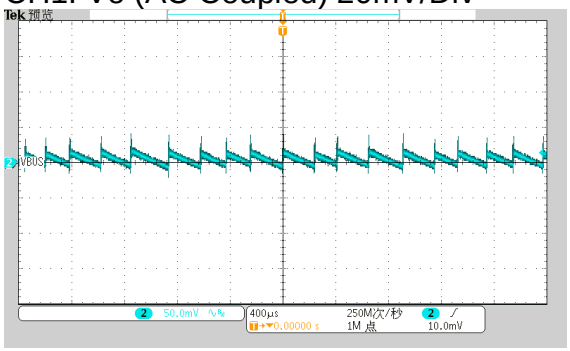
V_{BAT}=9.3V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



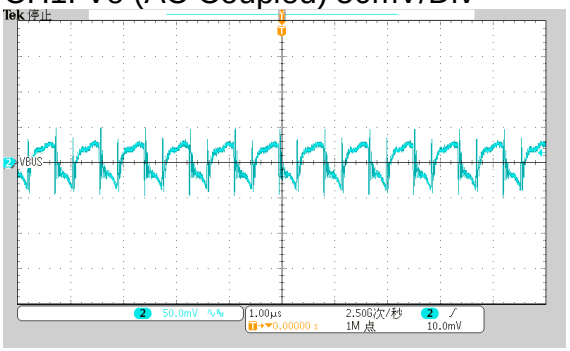
V_{BAT}=11.1V and No Load
CH1: Vo (AC Coupled) 20mV/Div



V_{BAT}=11.1V and Full Load
CH1: Vo (AC Coupled) 50mV/Div



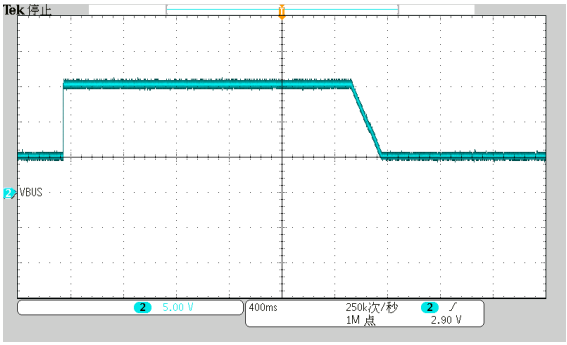
V_{BAT}=12.6V and No Load
CH1: Vo (AC Coupled) 50mV/Div



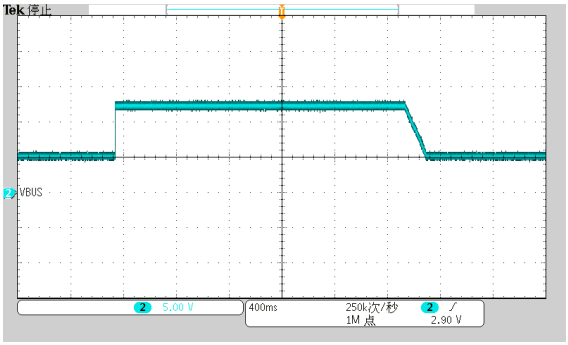
V_{BAT}=12.6V and Full Load
CH1: Vo (AC Coupled) 50mV/Div

2.5 Dynamic Performance

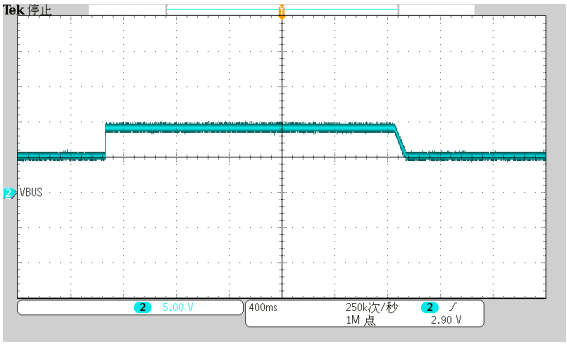
2.5.1 Output Voltage Transition in Reverse Mode



User Command: 5V↔15V
V_{BAT}=11.1V and No Load
CH2: Vo 5V/Div



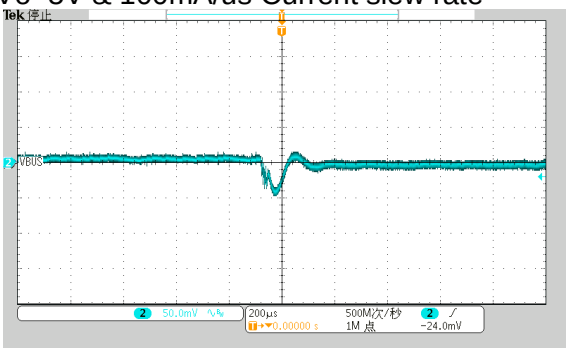
User Command: 5V↔12V
V_{BAT}=11.1V and No Load
CH2: Vo 5V/Div



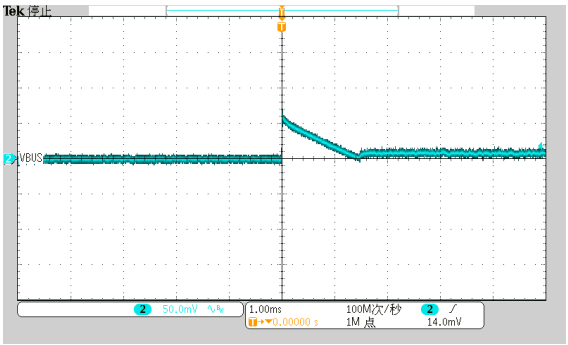
User Command: 5V↔9V
V_{BAT}=11.1V and No Load
CH2: Vo 5V/Div

2.5.2 Output Current Transition in Reverse Mode

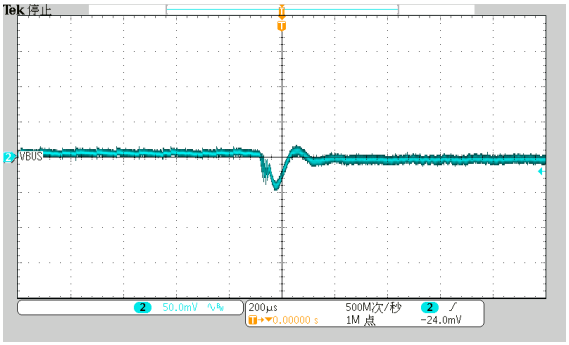
Vo=5V & 100mA/us Current slew rate



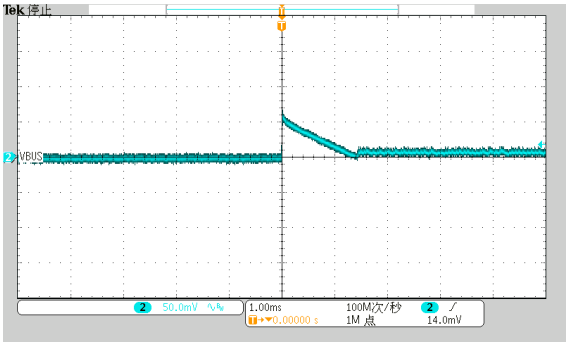
V_{BAT}=9.3V and 0 to 25% load
CH2: Vo (AC Coupled) 50mV/Div



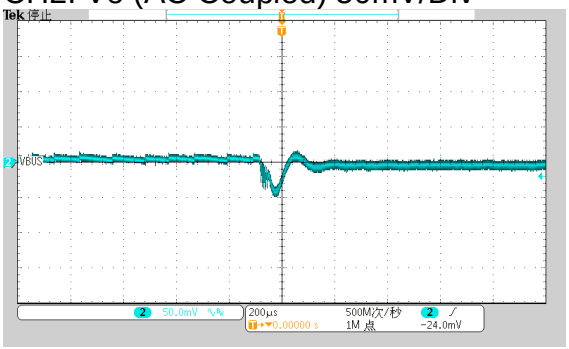
V_{BAT}=9.3V and 25% to 0 load
CH2: Vo (AC Coupled) 50mV/Div



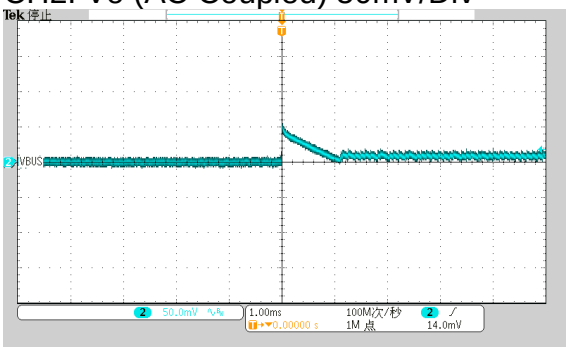
VBAT=11.1V and 0 to 25% load
CH2: Vo (AC Coupled) 50mV/Div



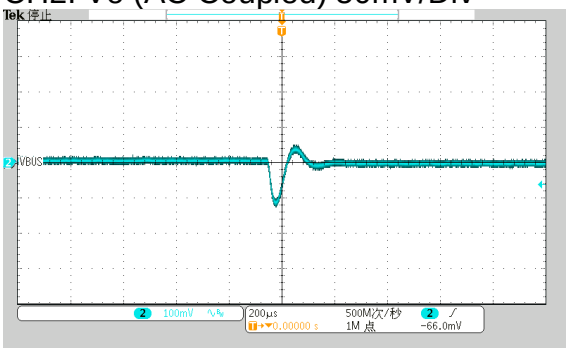
VBAT=11.1V and 25% to 0 load
CH2: Vo (AC Coupled) 50mV/Div



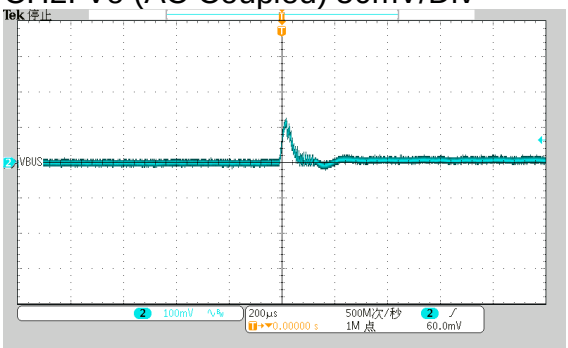
VBAT=12.6V and 0 to 25% load
CH2: Vo (AC Coupled) 50mV/Div



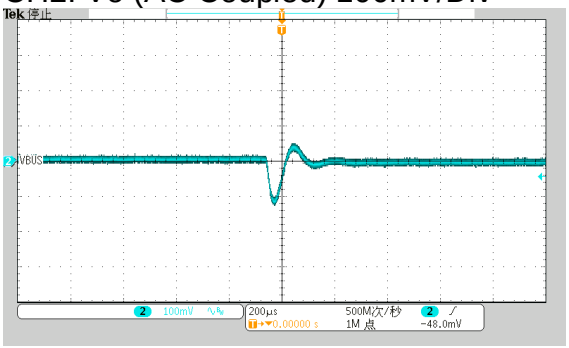
VBAT=12.6V and 25% to 0 load
CH2: Vo (AC Coupled) 50mV/Div



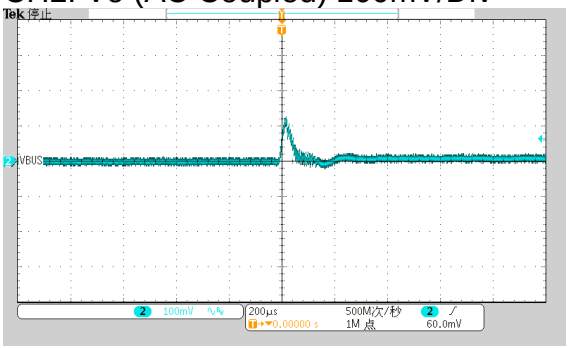
VBAT=9.3V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



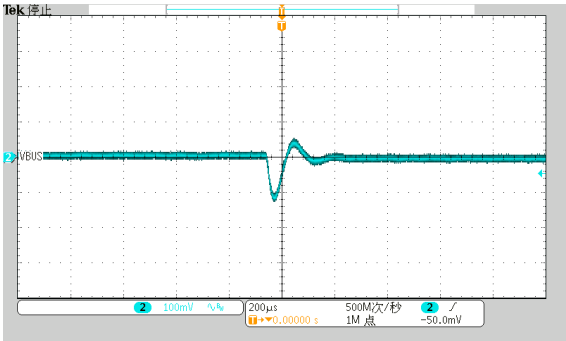
VBAT=9.3V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



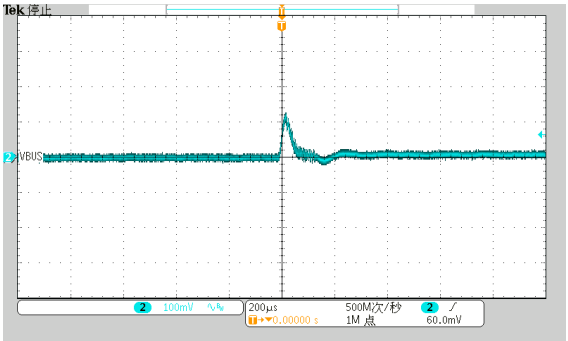
VBAT=11.1V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



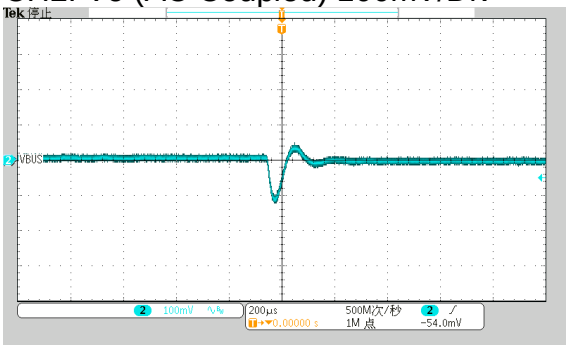
VBAT=11.1V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



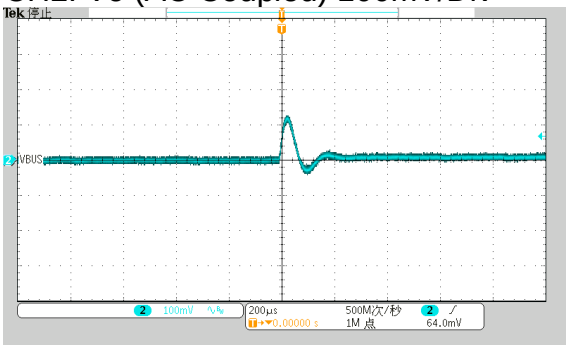
VBAT=12.6V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



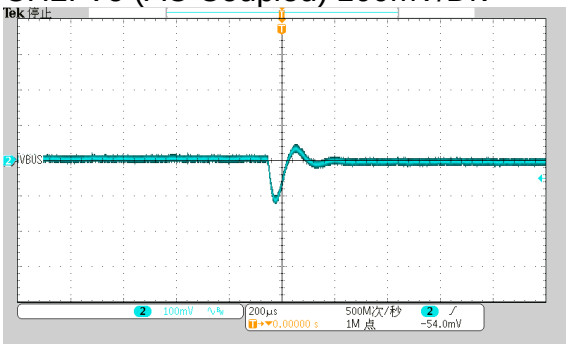
VBAT=12.6V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



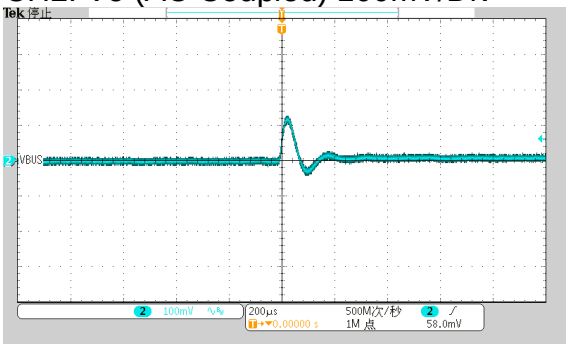
VBAT=9.3V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



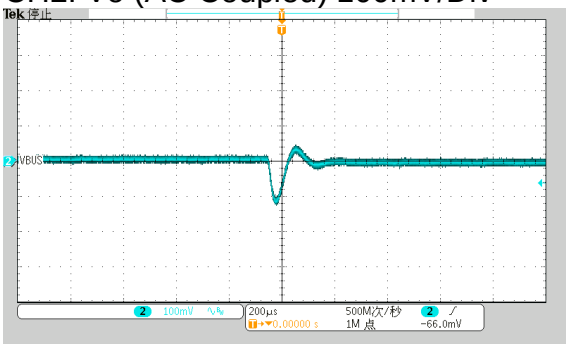
VBAT=9.3V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



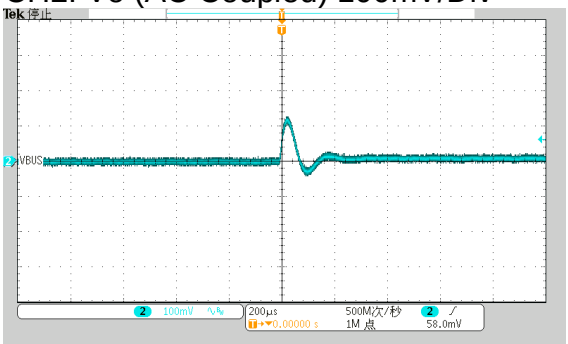
VBAT=11.1V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



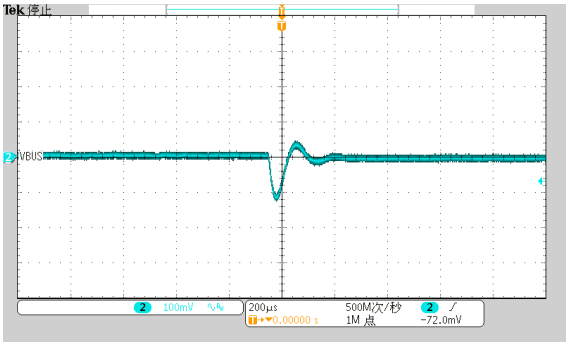
VBAT=11.1V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



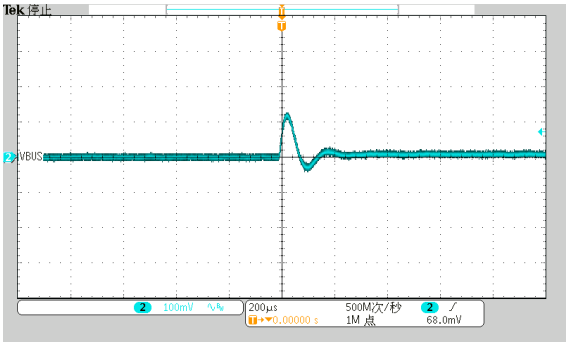
VBAT=12.6V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



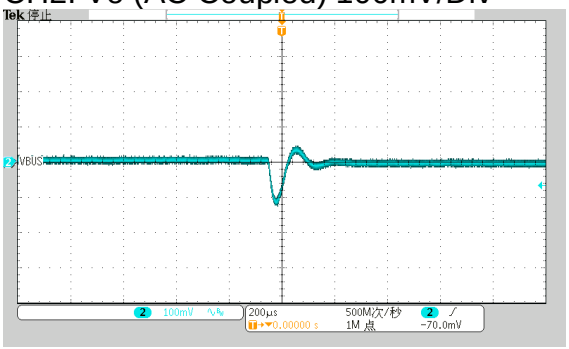
VBAT=12.6V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



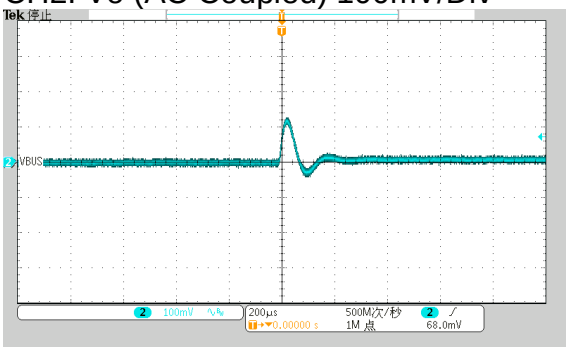
VBAT=9.3V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



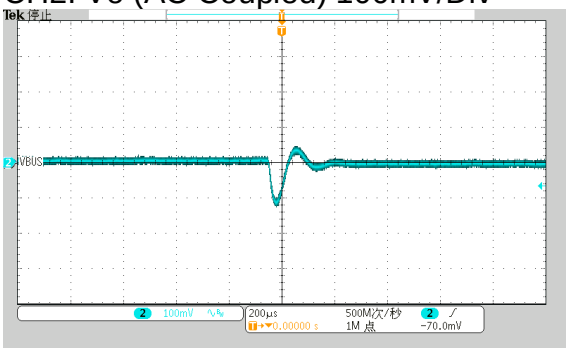
VBAT=9.3V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



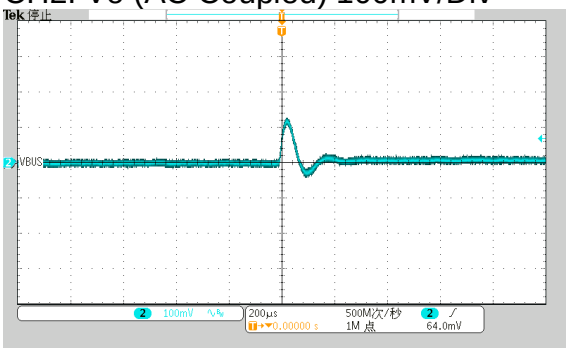
VBAT=11.1V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

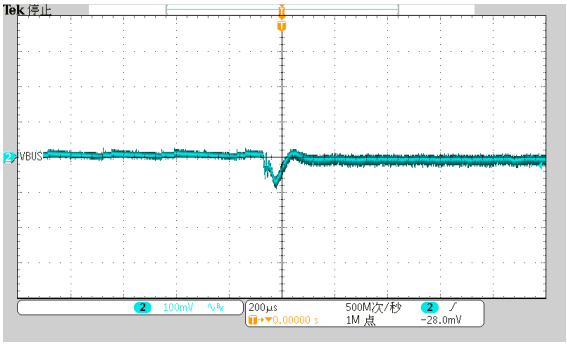


VBAT=12.6V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div

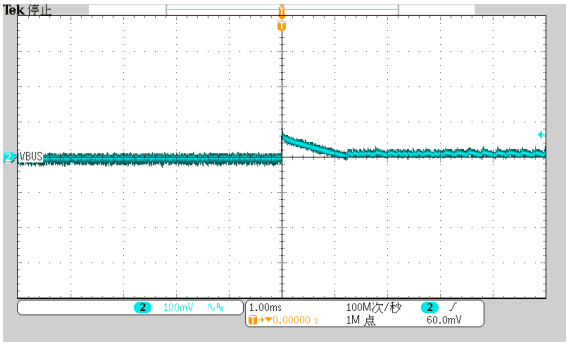


VBAT=12.6V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

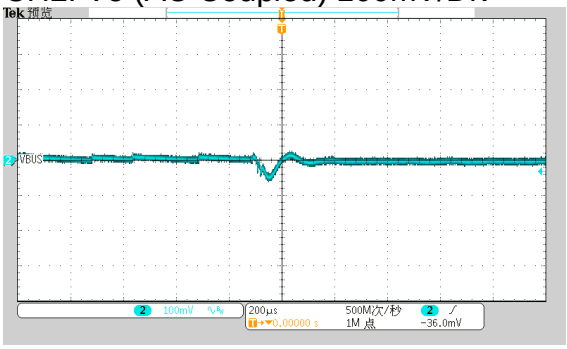
Vo=9V & 100mA/us Current slew rate



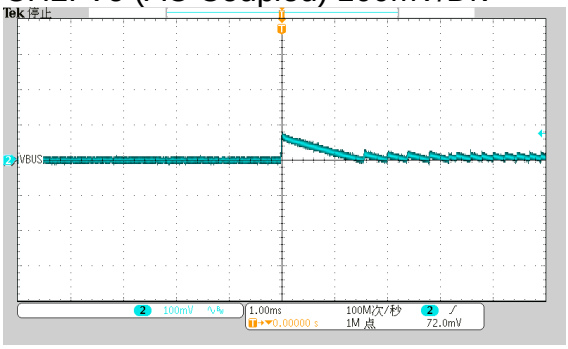
V_{BAT}=9.3V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



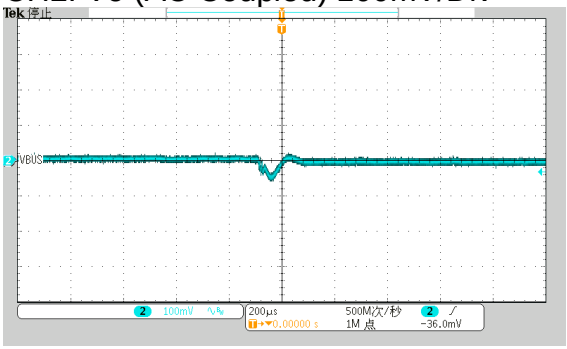
V_{BAT}=9.3V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



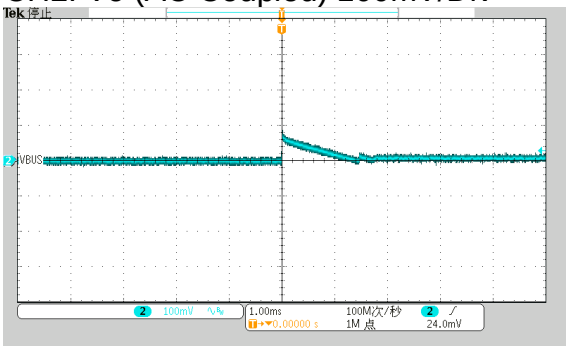
VBAT=11.1V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



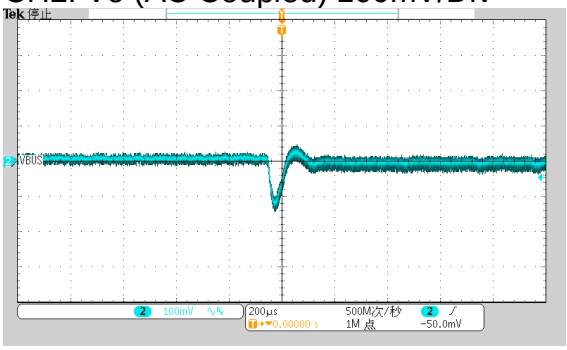
VBAT=11.1V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



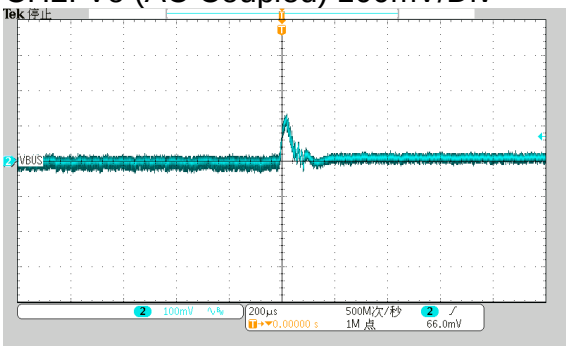
VBAT=12.6V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



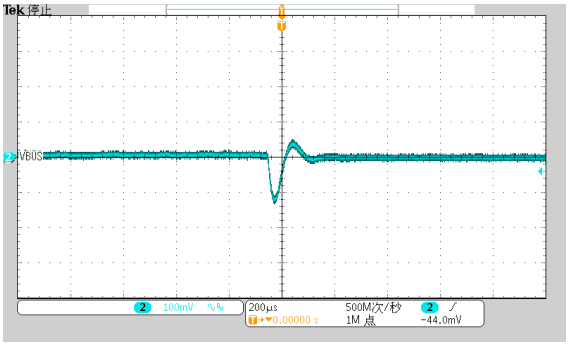
VBAT=12.6V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



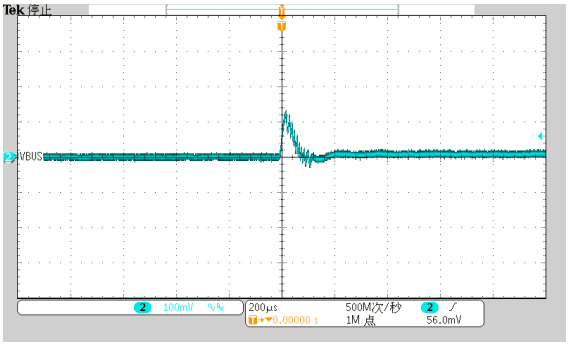
VBAT=9.3V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



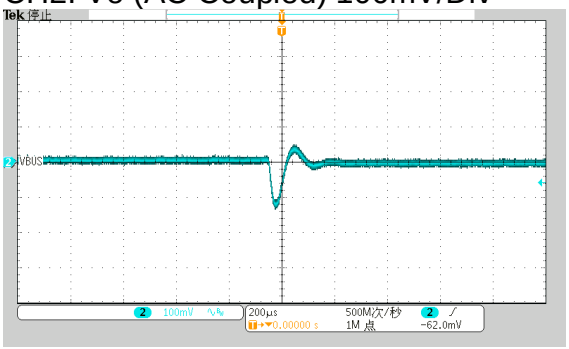
VBAT=9.3V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



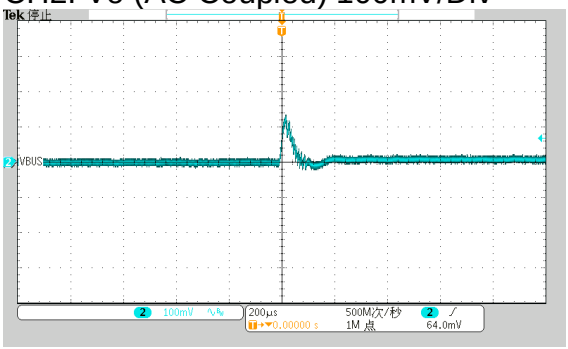
VBAT=11.1V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



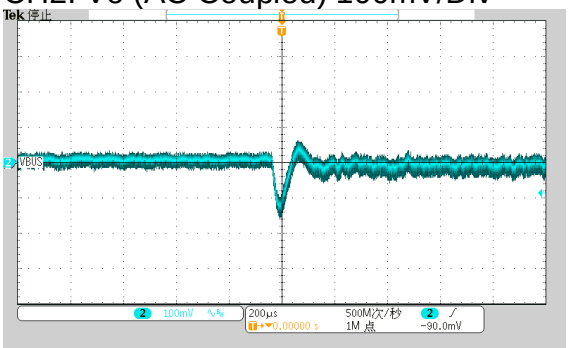
VBAT=11.1V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



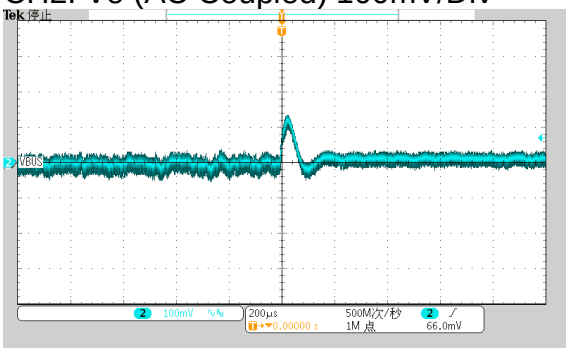
VBAT=12.6V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



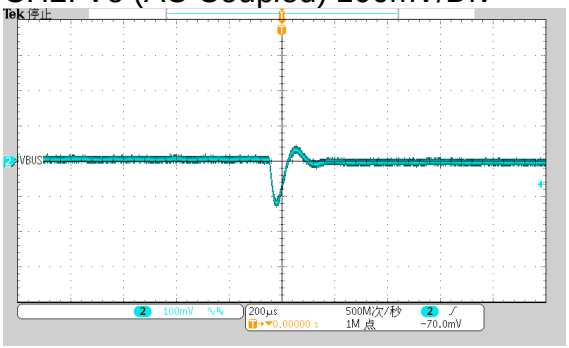
VBAT=12.6V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



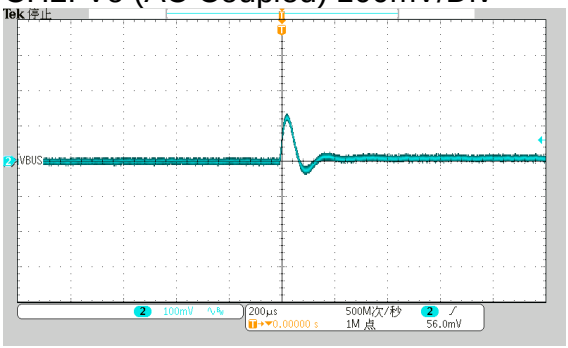
VBAT=9.3V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



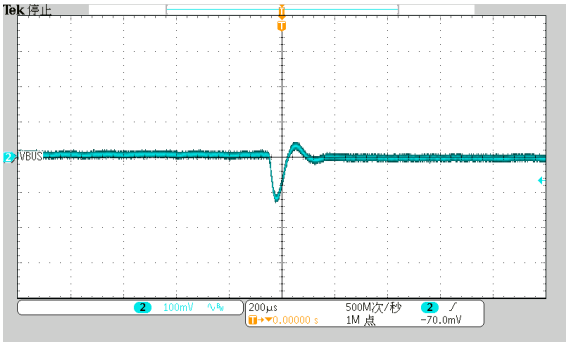
VBAT=9.3V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



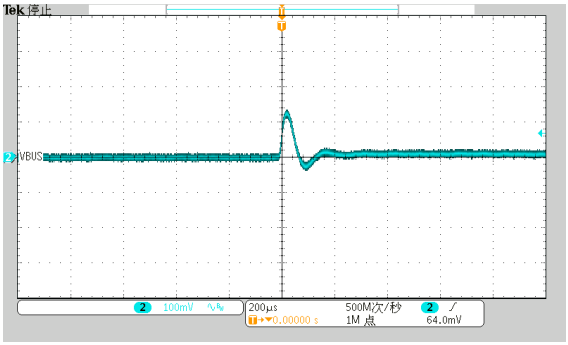
VBAT=11.1V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



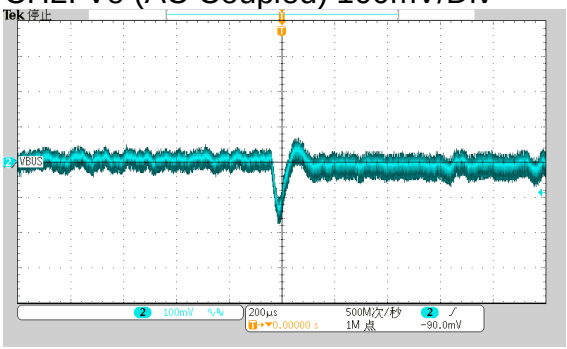
VBAT=11.1V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



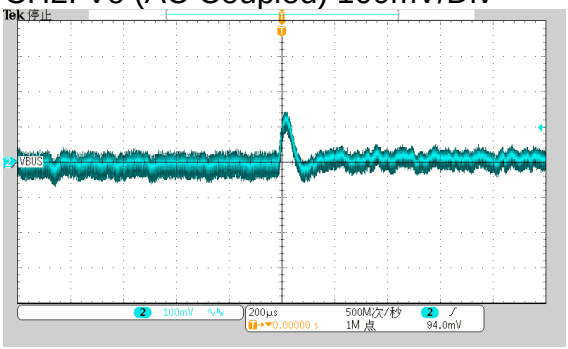
VBAT=12.6V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



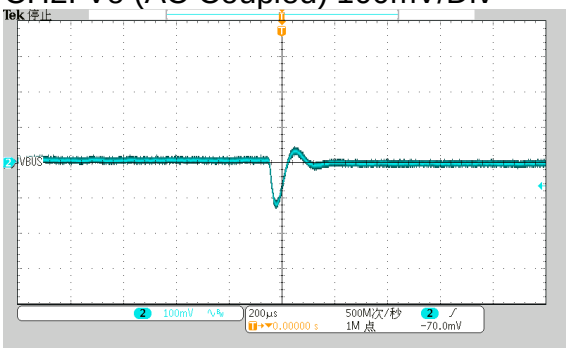
VBAT=12.6V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



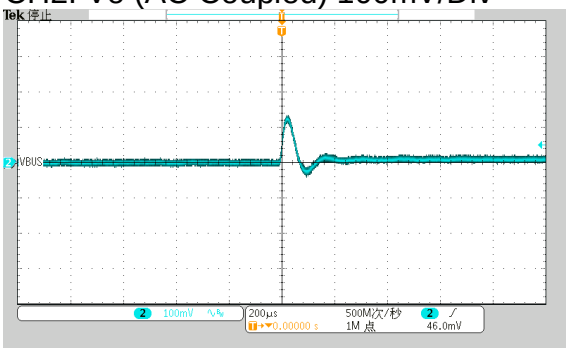
VBAT=9.3V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



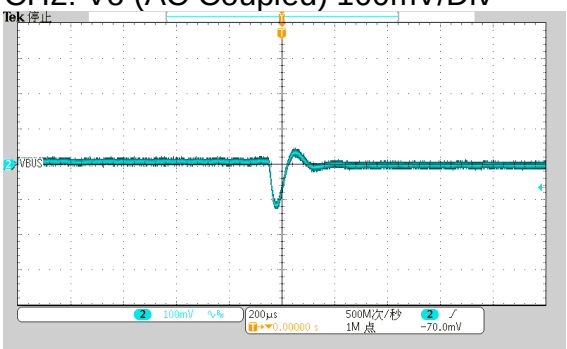
VBAT=9.3V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



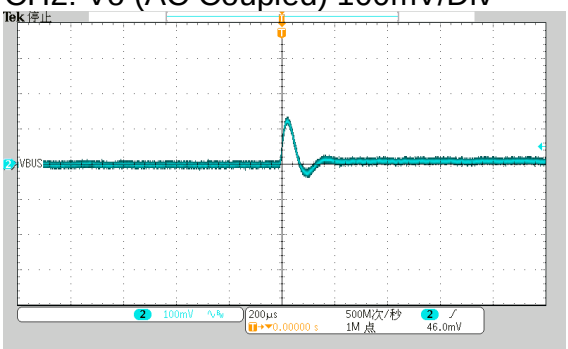
VBAT=11.1V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

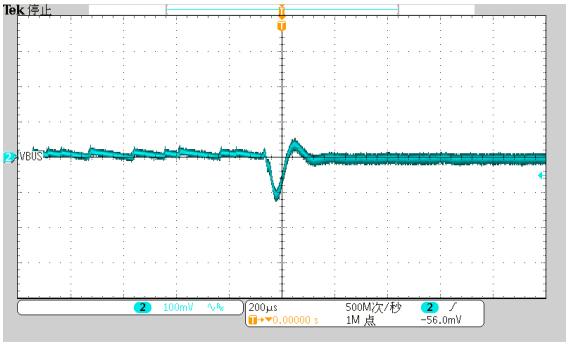


VBAT=12.6V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div

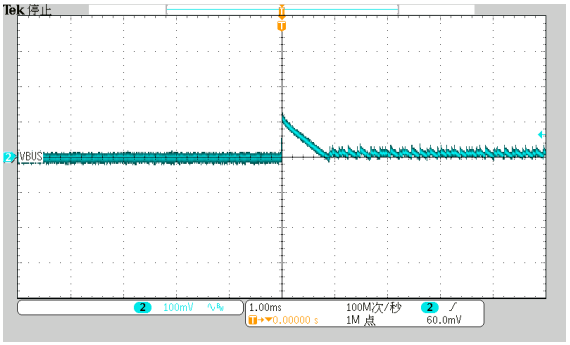


VBAT=12.6V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

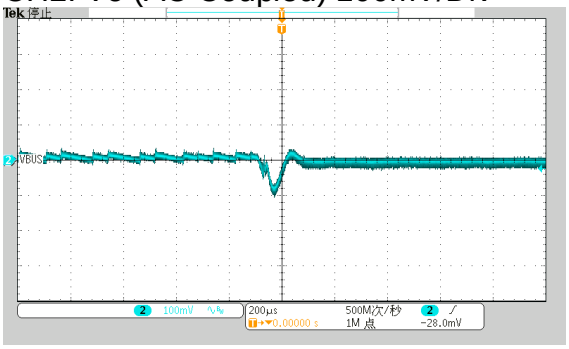
Vo=12V & 100mA/us Current slew rate



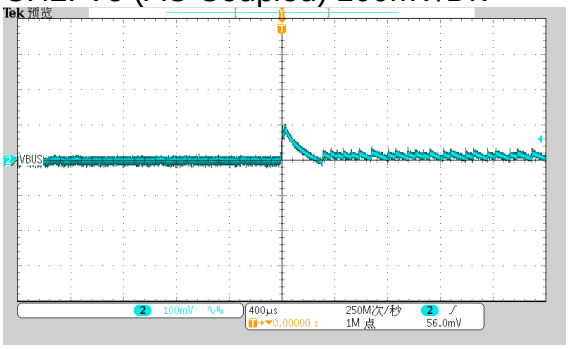
V_{BAT}=9.3V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



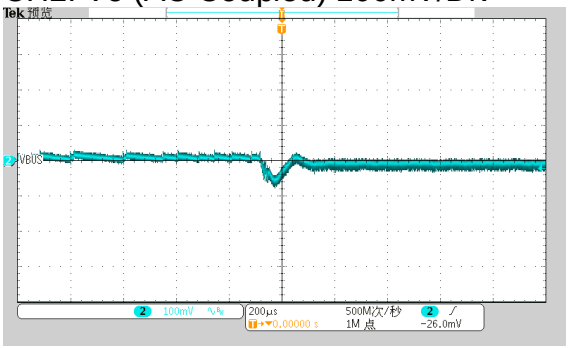
V_{BAT}=9.3V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



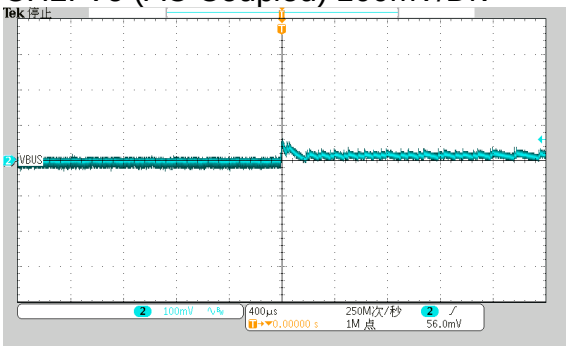
VBAT=11.1V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



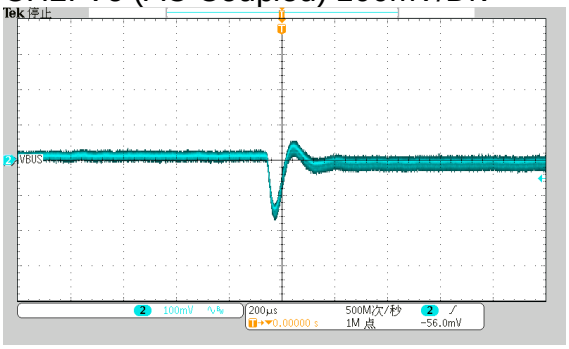
VBAT=11.1V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



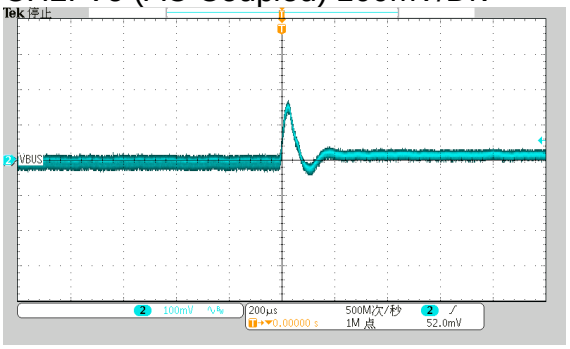
VBAT=12.6V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



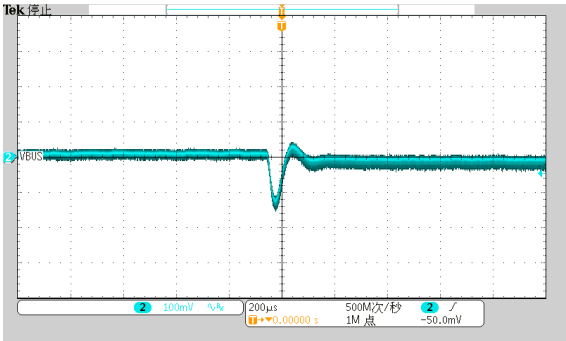
VBAT=12.6V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



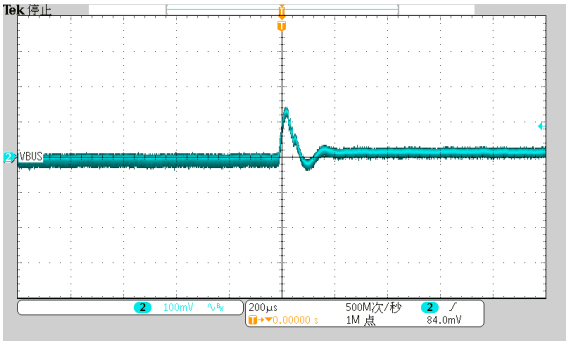
VBAT=9.3V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



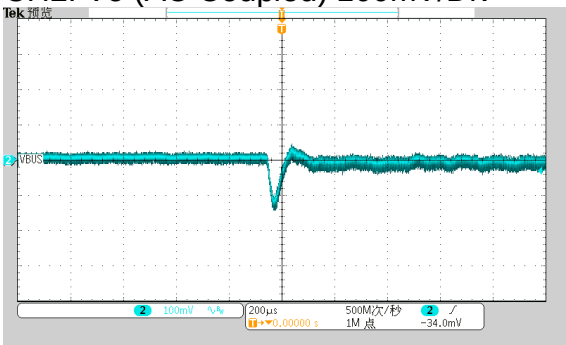
VBAT=9.3V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



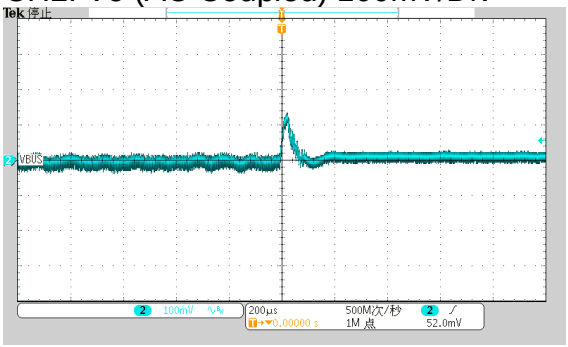
VBAT=11.1V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



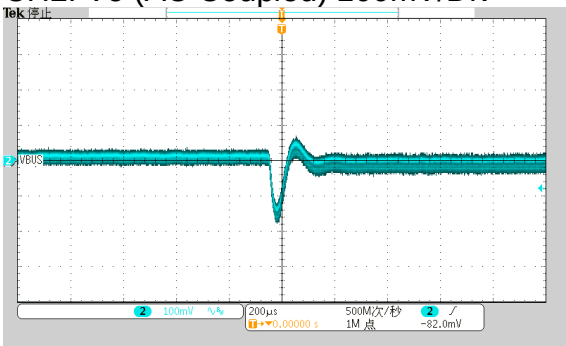
VBAT=11.1V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



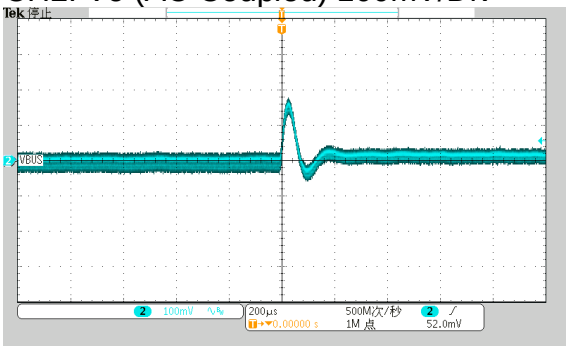
VBAT=12.6V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



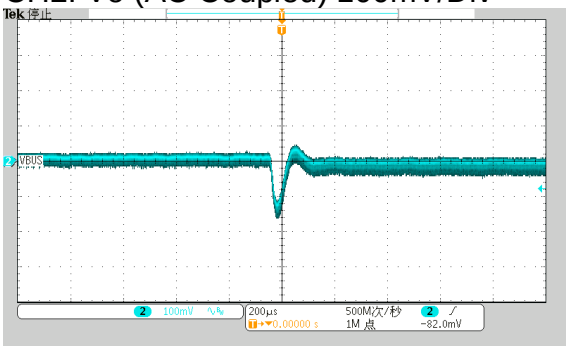
VBAT=12.6V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



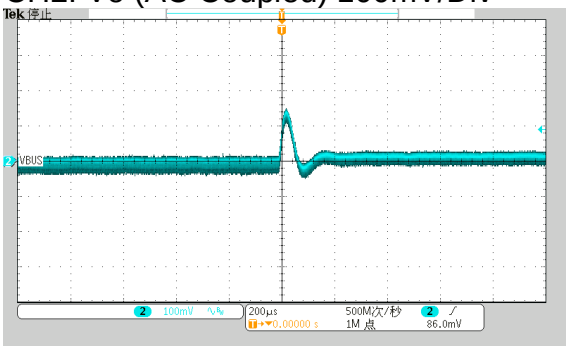
VBAT=9.3V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



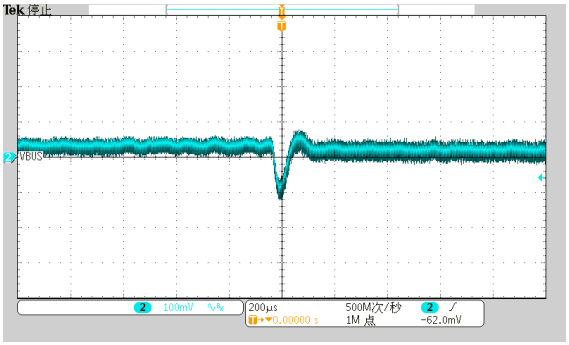
VBAT=9.3V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



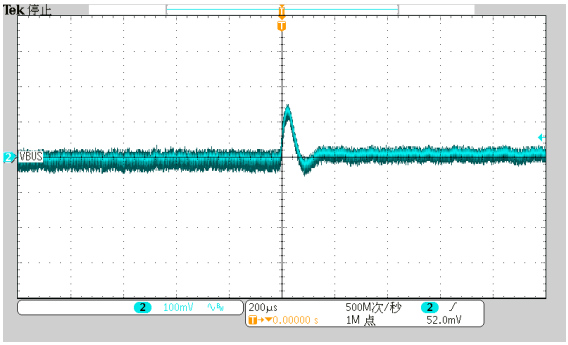
VBAT=11.1V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



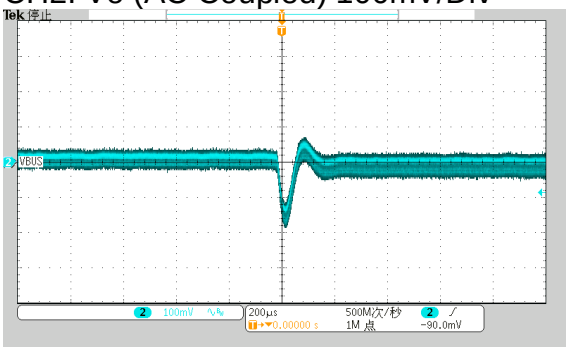
VBAT=11.1V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



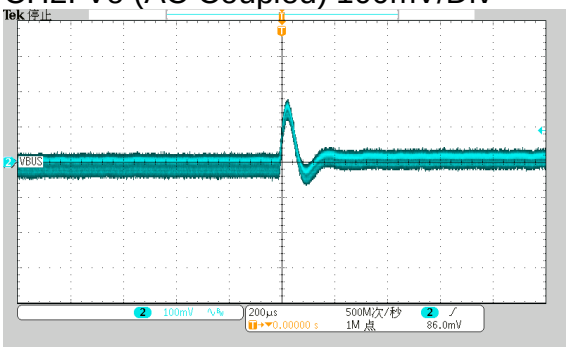
VBAT=12.6V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



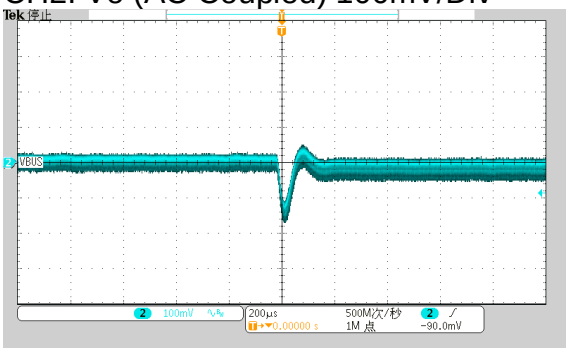
VBAT=12.6V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



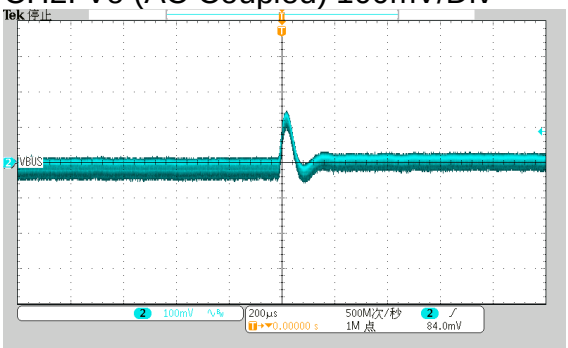
VBAT=9.3V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



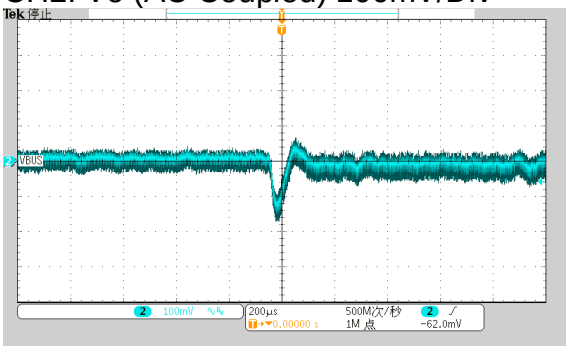
VBAT=9.3V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



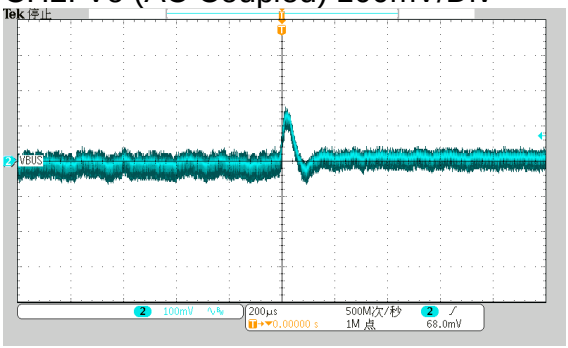
VBAT=11.1V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

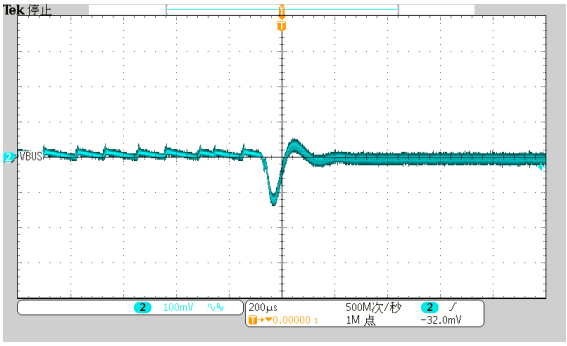


VBAT=12.6V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div

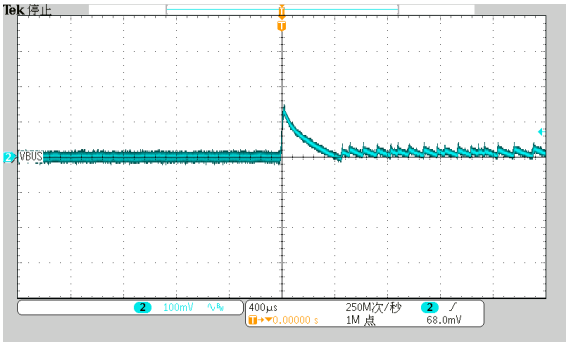


VBAT=12.6V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

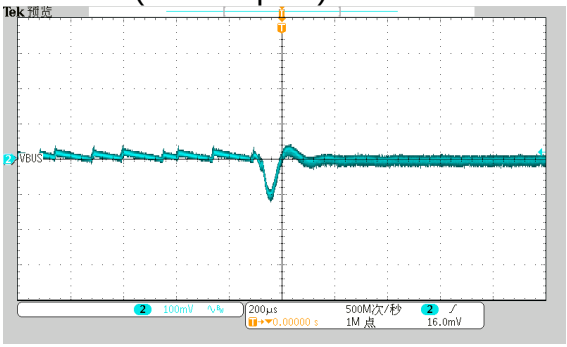
Vo=15V & 100mA/us Current slew rate



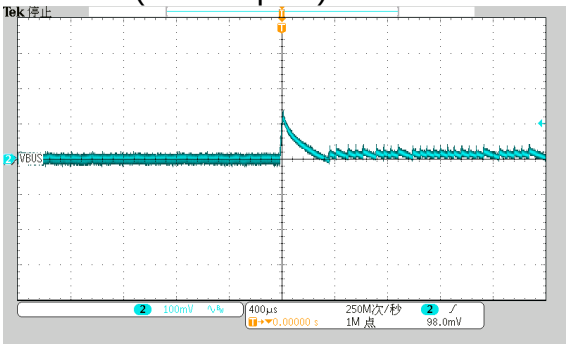
V_{BAT}=9.3V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



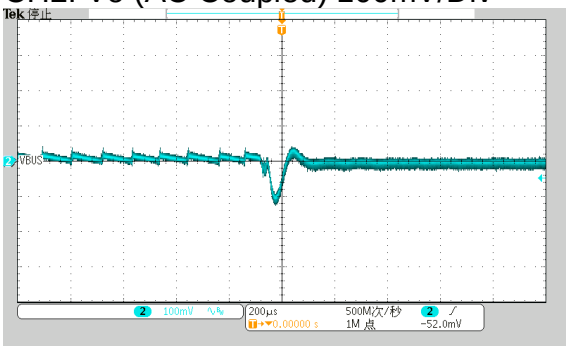
V_{BAT}=9.3V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



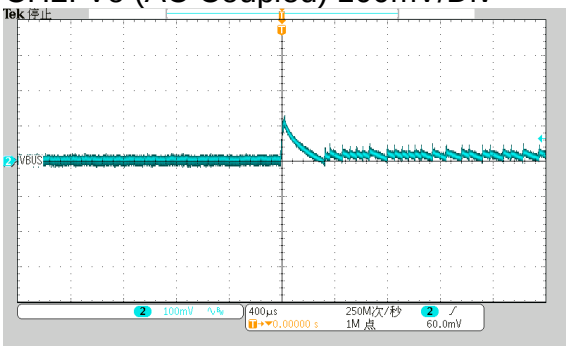
VBAT=11.1V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



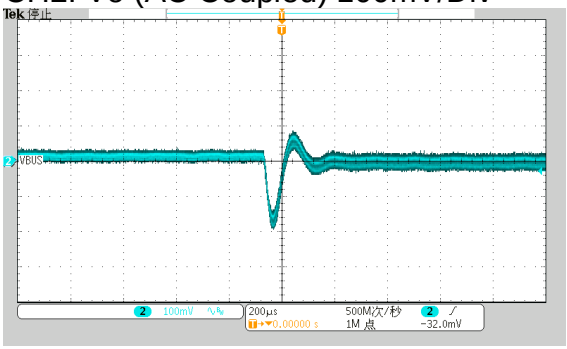
VBAT=11.1V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div

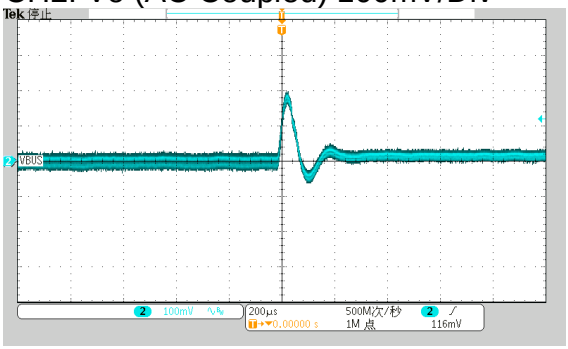


VBAT=12.6V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div

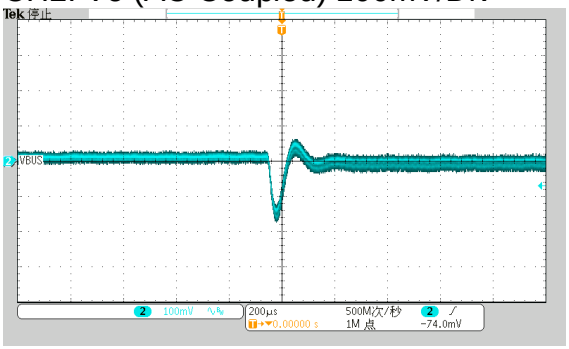


VBAT=12.6V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div

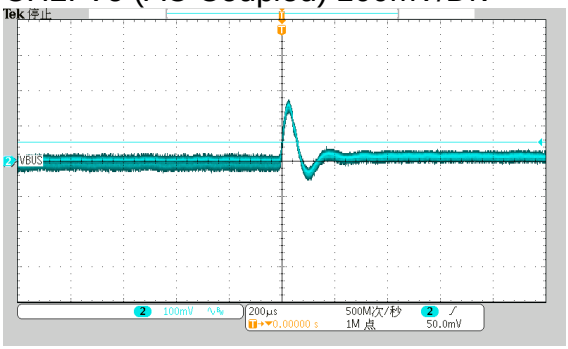




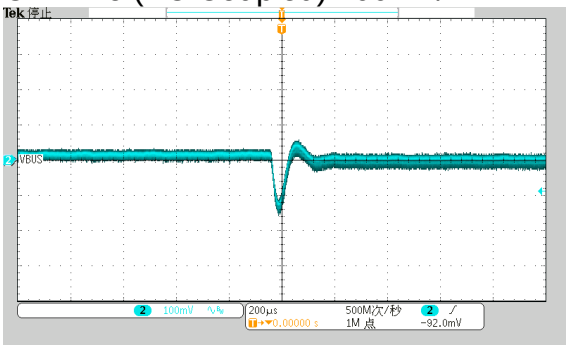
VBAT=9.3V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



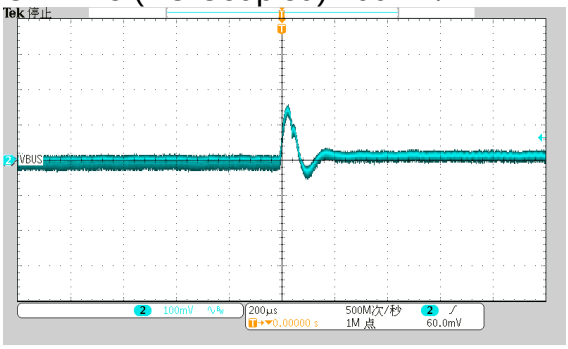
VBAT=9.3V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



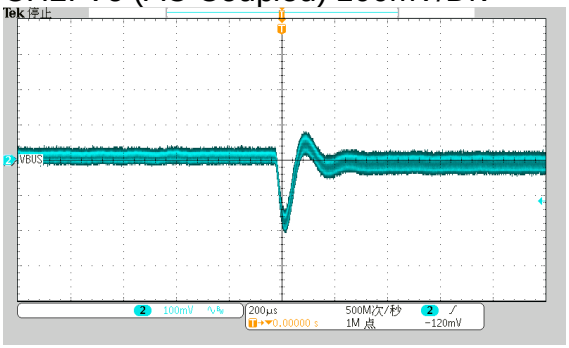
VBAT=11.1V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



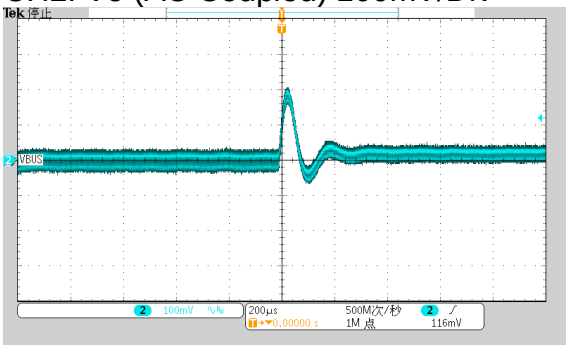
VBAT=11.1V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



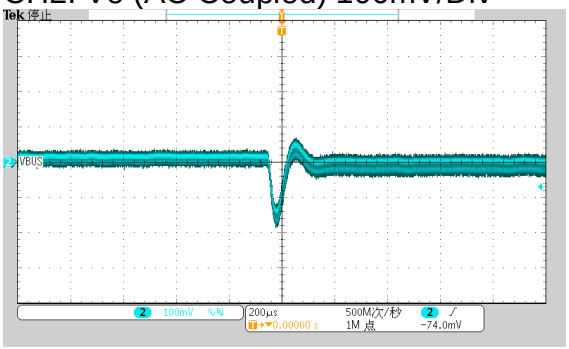
VBAT=12.6V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



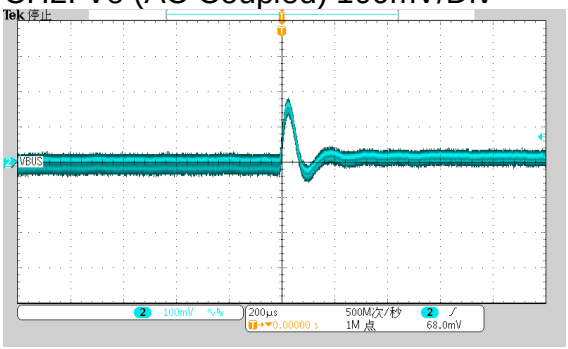
VBAT=12.6V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=9.3V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



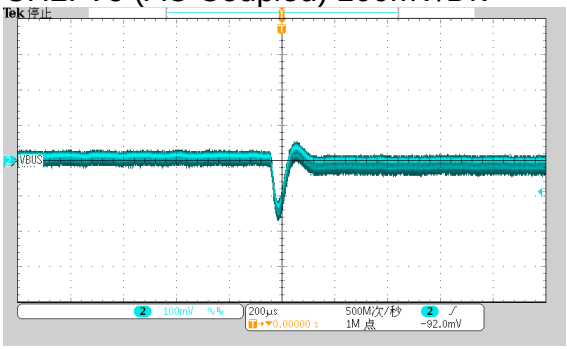
VBAT=9.3V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 50% to 75% load

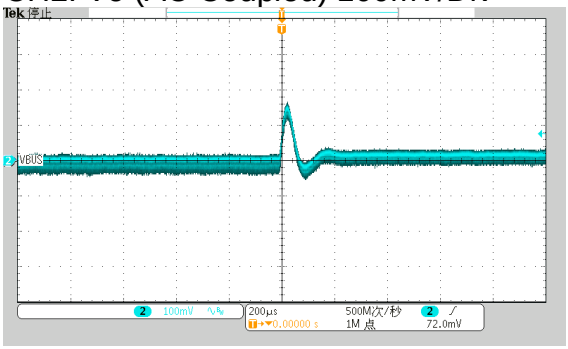
VBAT=11.1V and 75% to 50% load

CH2: Vo (AC Coupled) 100mV/Div

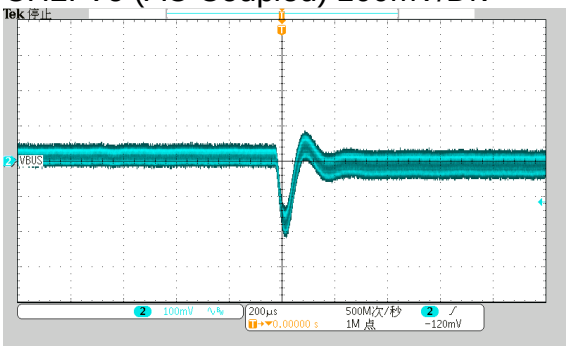


VBAT=12.6V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

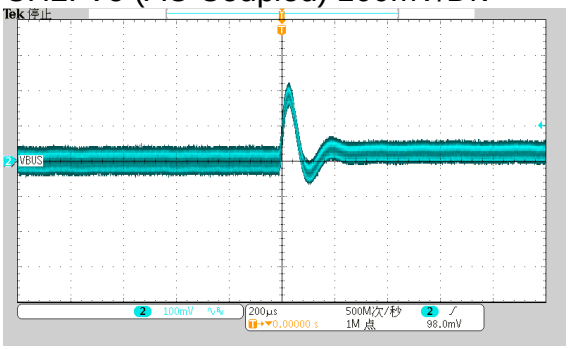
CH2: Vo (AC Coupled) 100mV/Div



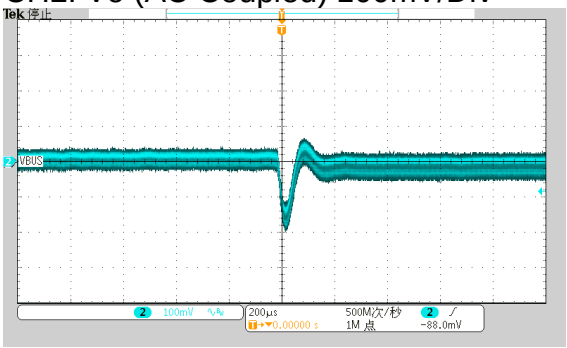
VBAT=12.6V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



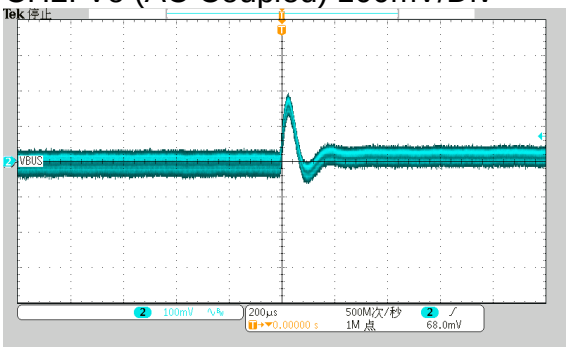
VBAT=9.3V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



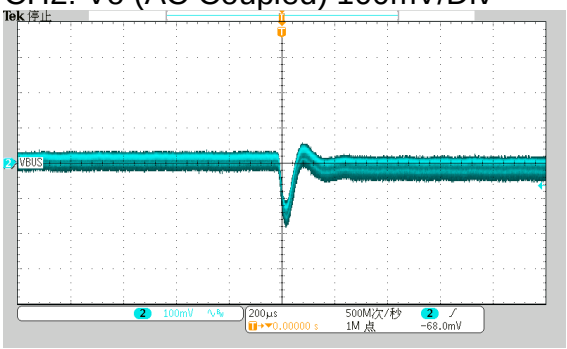
VBAT=9.3V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



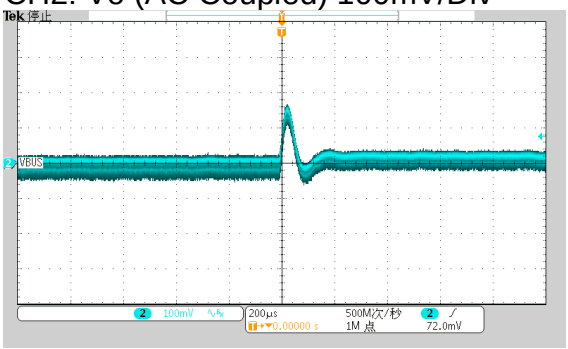
VBAT=11.1V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

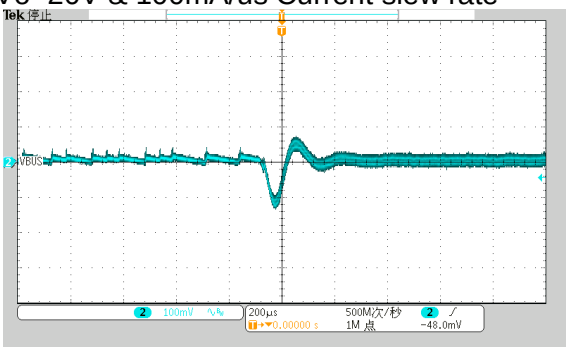


VBAT=12.6V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div

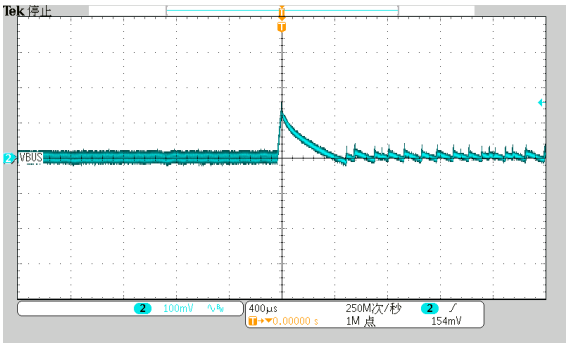


VBAT=12.6V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

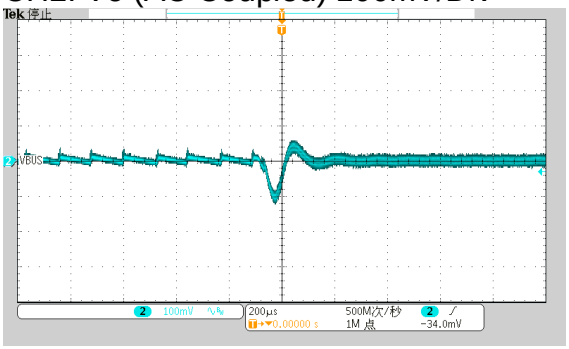
Vo=20V & 100mA/us Current slew rate



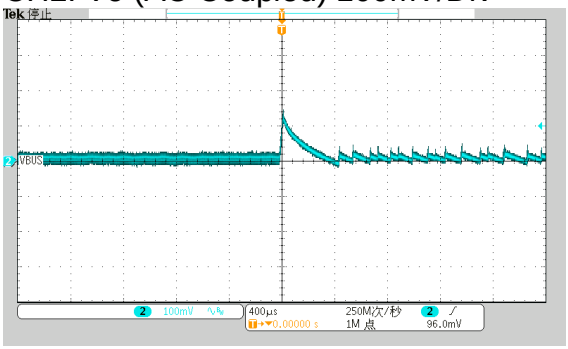
V_{BAT}=9.3V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



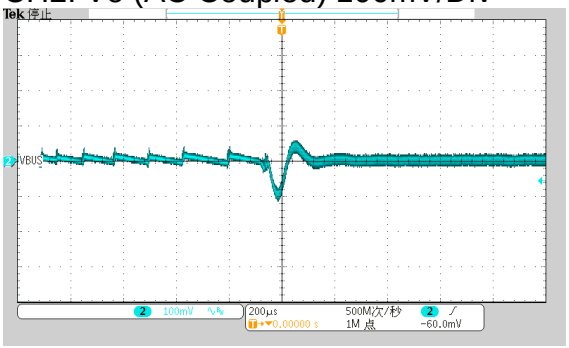
V_{BAT}=9.3V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div



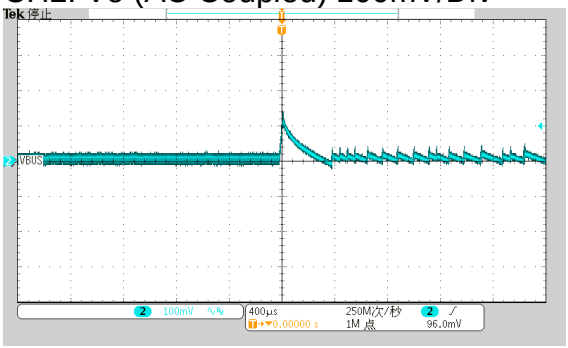
VBAT=11.1V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div



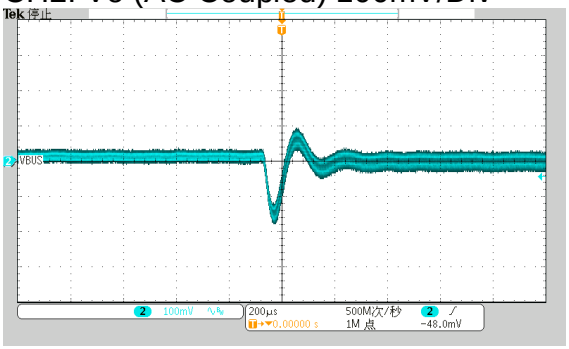
VBAT=11.1V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div

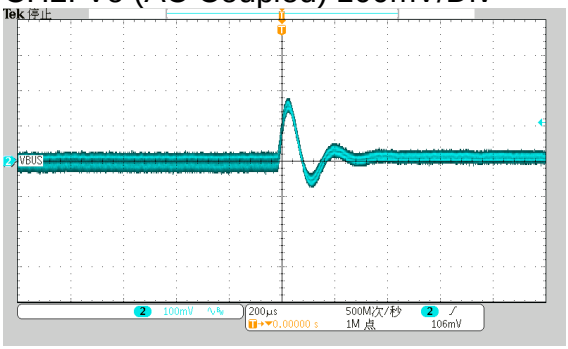


VBAT=12.6V and 0 to 25% load
CH2: Vo (AC Coupled) 100mV/Div

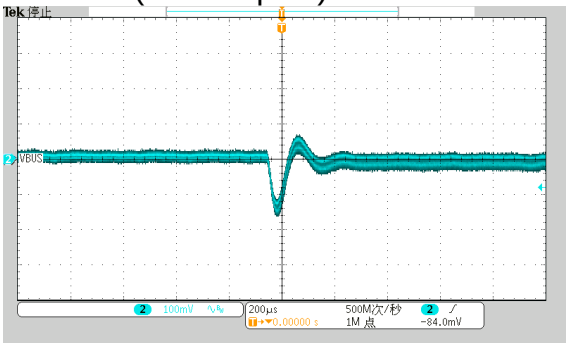


VBAT=12.6V and 25% to 0 load
CH2: Vo (AC Coupled) 100mV/Div

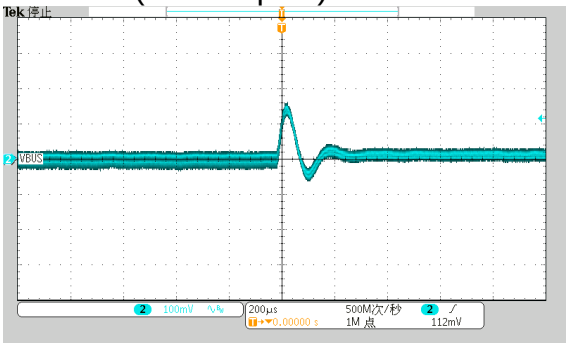




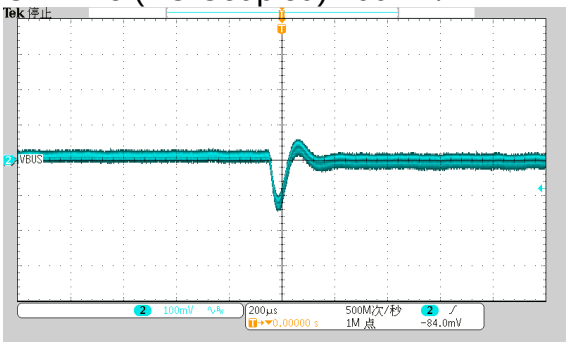
VBAT=9.3V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



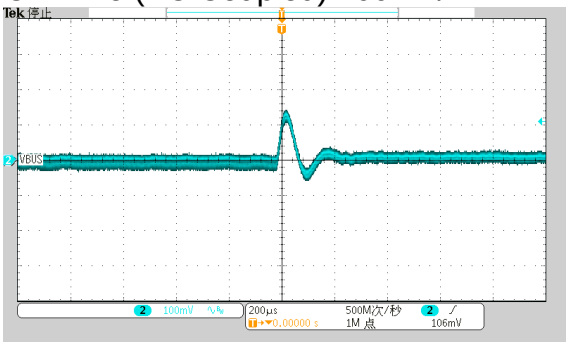
VBAT=9.3V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



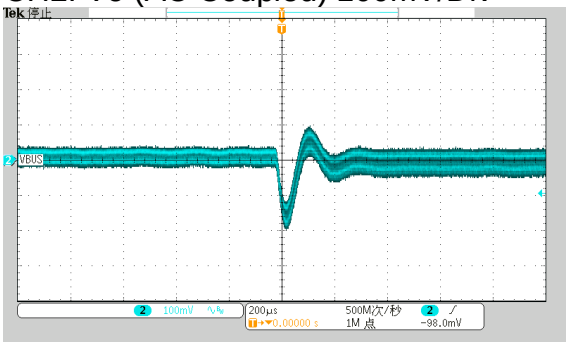
VBAT=11.1V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



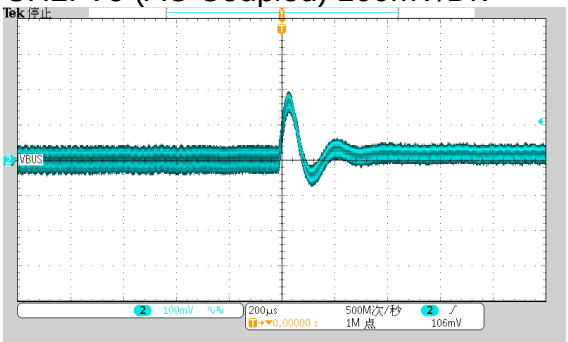
VBAT=11.1V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



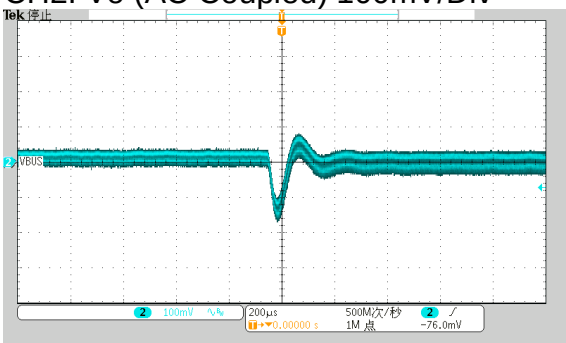
VBAT=12.6V and 25% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



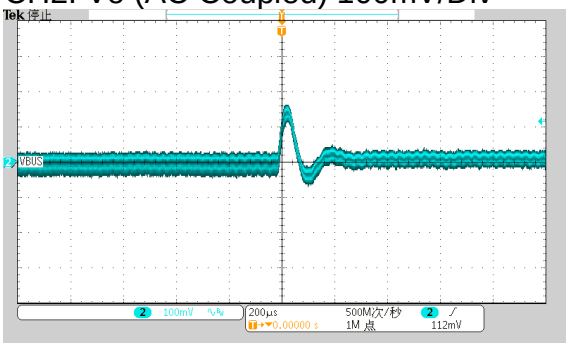
VBAT=12.6V and 50% to 25% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=9.3V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



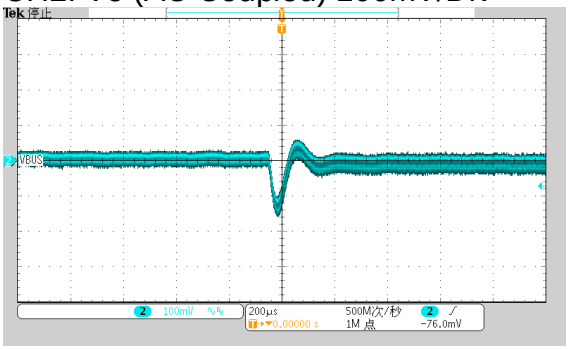
VBAT=9.3V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



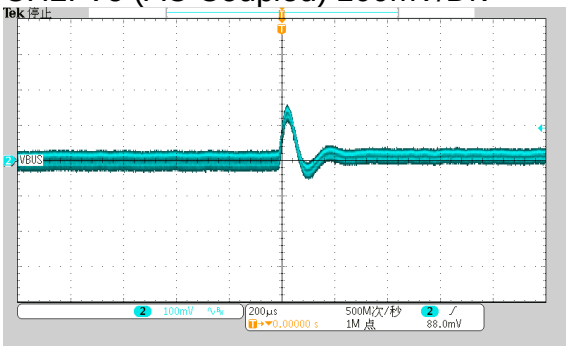
VBAT=11.1V and 50% to 75% load

VBAT=11.1V and 75% to 50% load

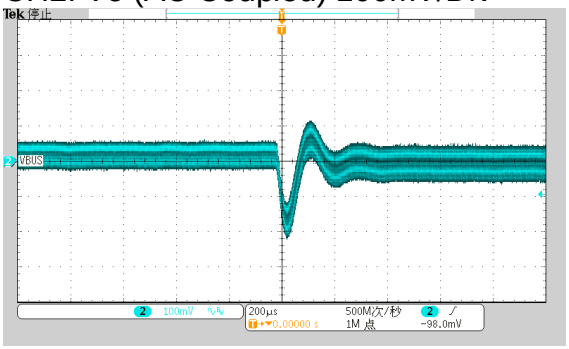
CH2: Vo (AC Coupled) 100mV/Div



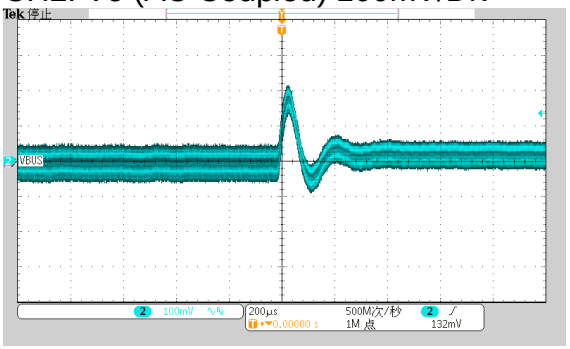
CH2: Vo (AC Coupled) 100mV/Div



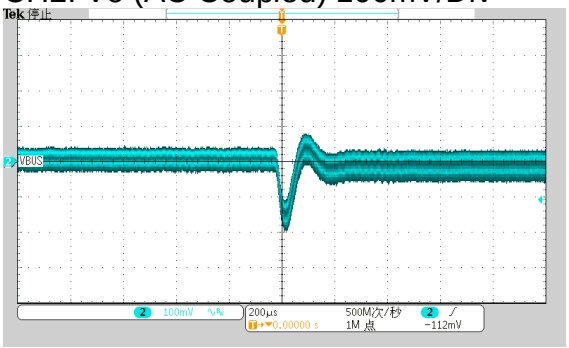
VBAT=12.6V and 50% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



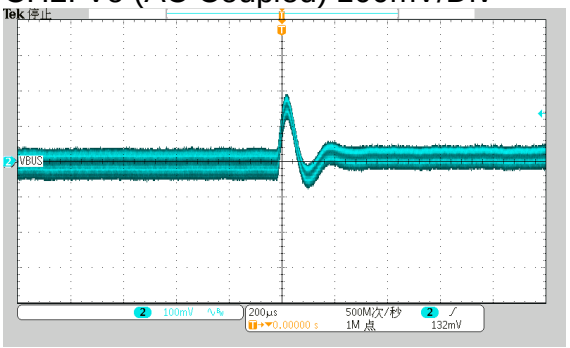
VBAT=12.6V and 75% to 50% load
CH2: Vo (AC Coupled) 100mV/Div



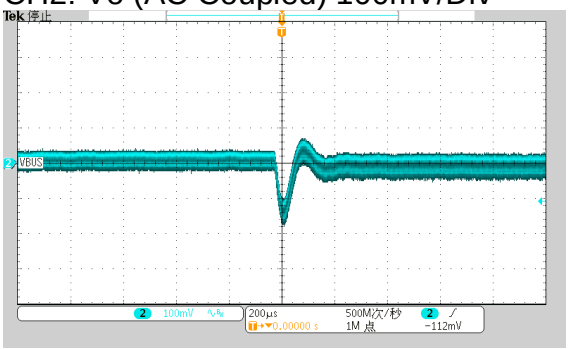
VBAT=9.3V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



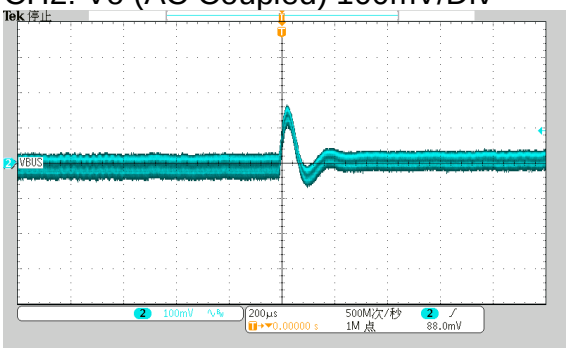
VBAT=9.3V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div



VBAT=11.1V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

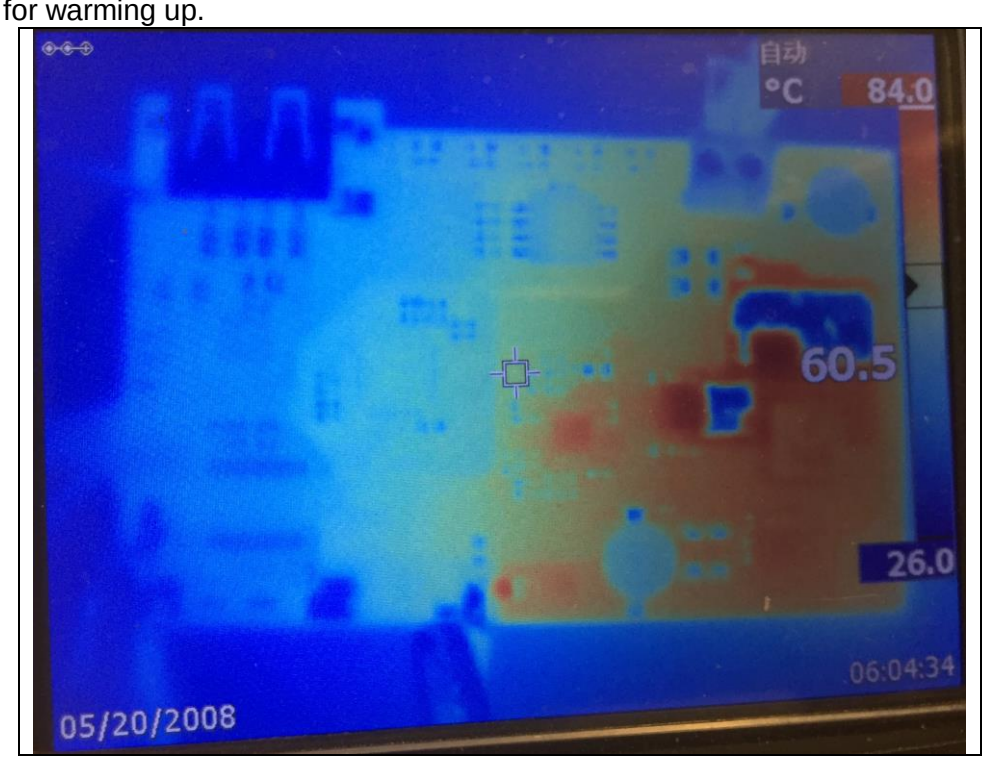


VBAT=12.6V and 75% to 100% load
CH2: Vo (AC Coupled) 100mV/Div

VBAT=12.6V and 100% to 75% load
CH2: Vo (AC Coupled) 100mV/Div

2.6 Thermal Performance

The board is applied a 9.3V battery pack and output 20V/2.25A load at the connector. Run about 10min for warming up.



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