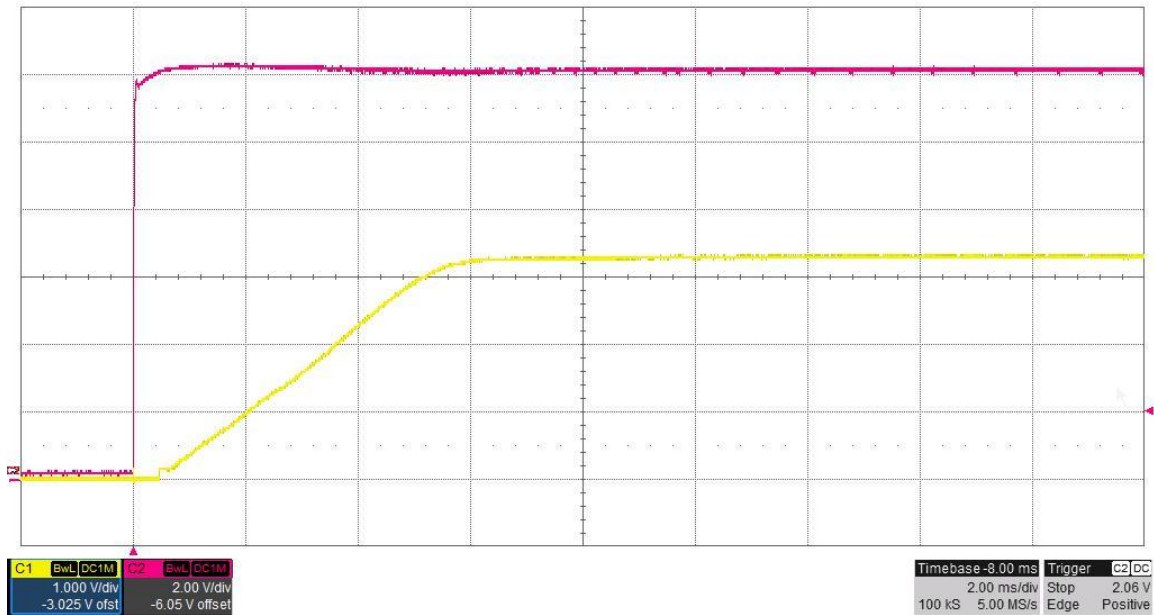# PMP11136 REVB Test Results

TEXAS INSTRUMENTS

1 Startup

The photo below shows the **3.3VSW** output voltage startup waveform after 12V is applied.
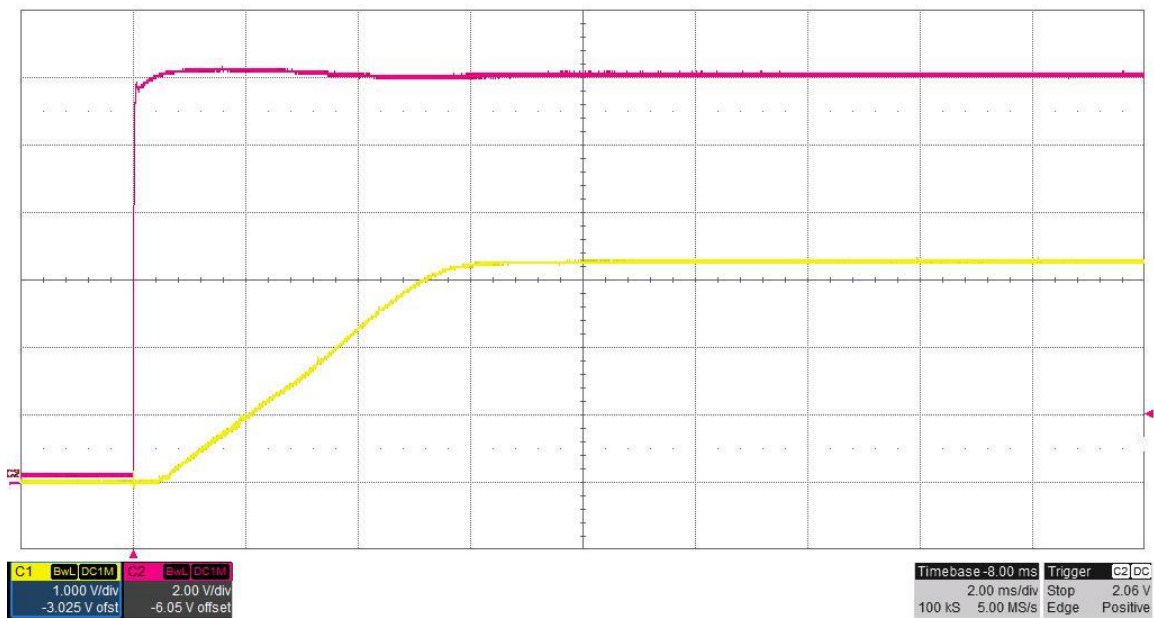VIN (Red), 3.3VSW (Yellow), 3.3V output is loaded to 0A.
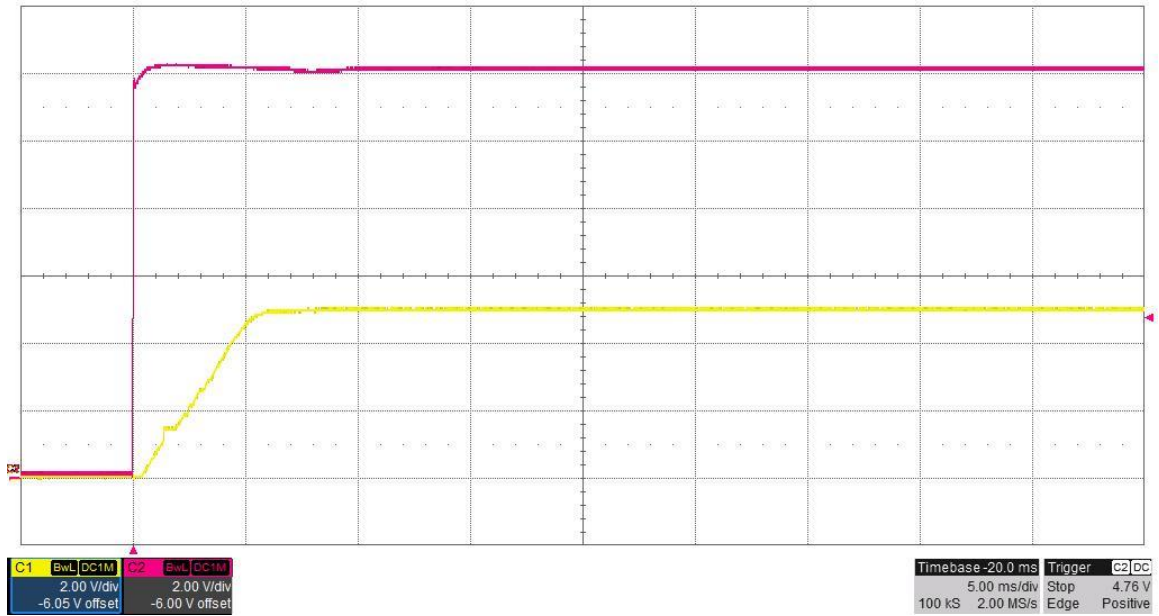(VIN is 2V/DIV, 3.3V is 1V/DIV, 2mS/DIV)

The photo below shows the **3.3VSW** output voltage startup waveform after 12V is applied.
VIN (Red), 3.3VSW (Yellow), 3.3V output is loaded to 2.5A.
(VIN is 2V/DIV, 3.3V is 1V/DIV, 2mS/DIV)

Power Management Solutions

The photo below shows the **LMR14030 5V USB** output voltage startup waveform after 12V is applied.
VIN (Red), LMR14030 5V USB (Yellow), 5V output is loaded to 0A.
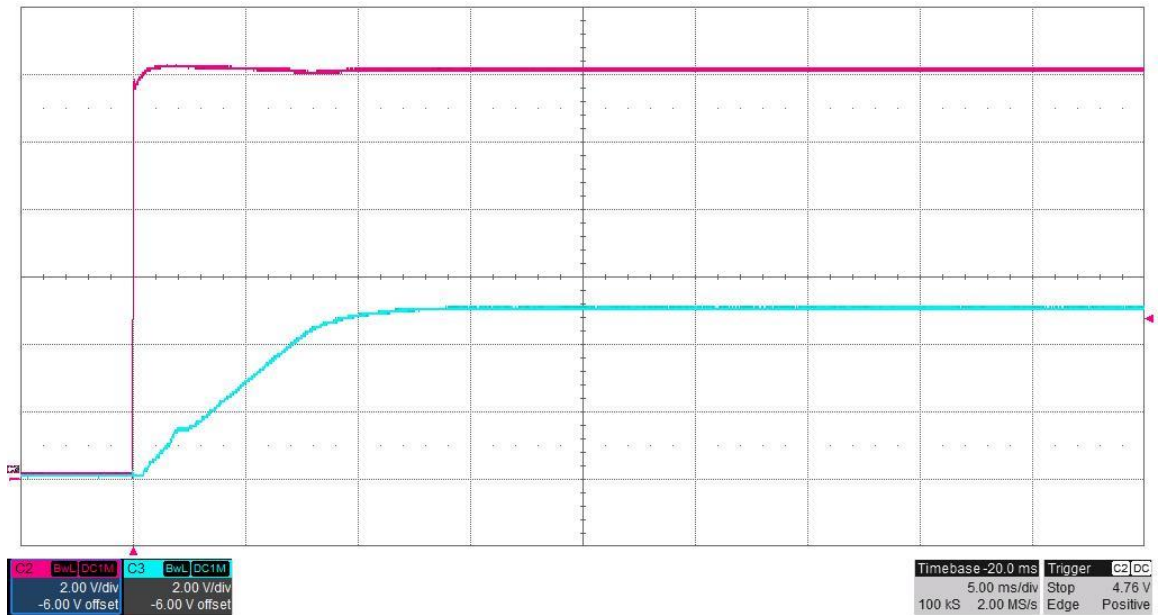(2V/DIV, 5mS/DIV)

The photo below shows the **LMR14030 5V USB** output voltage startup waveform after 12V is applied.
VIN (Red), LMR14030 5V USB (Yellow), 5V output is loaded to 2.1A.
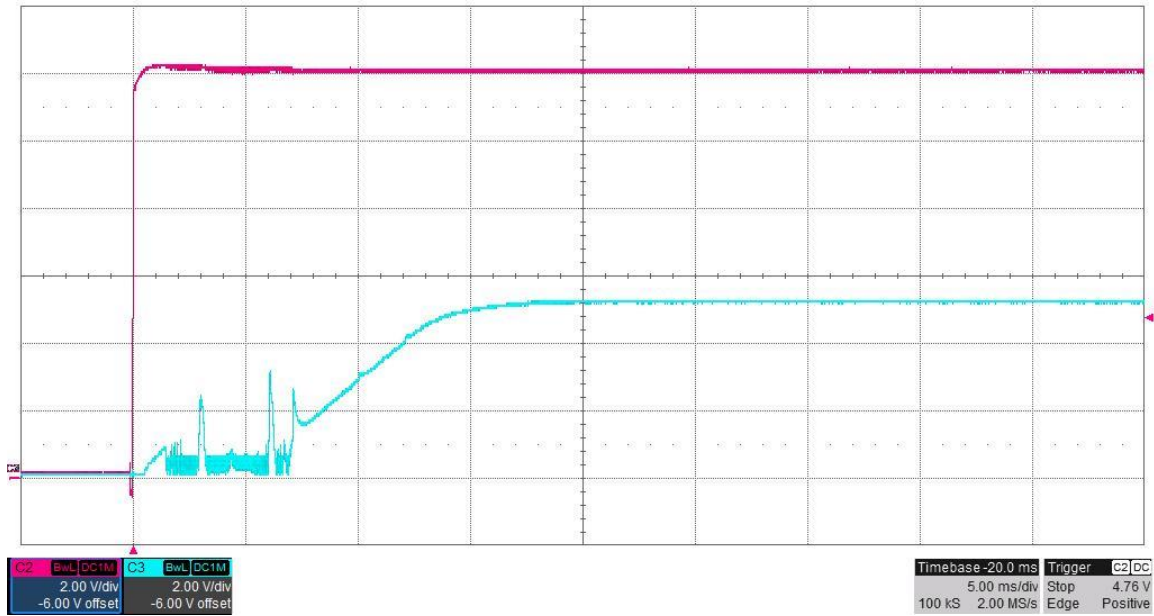(2V/DIV, 5mS/DIV)
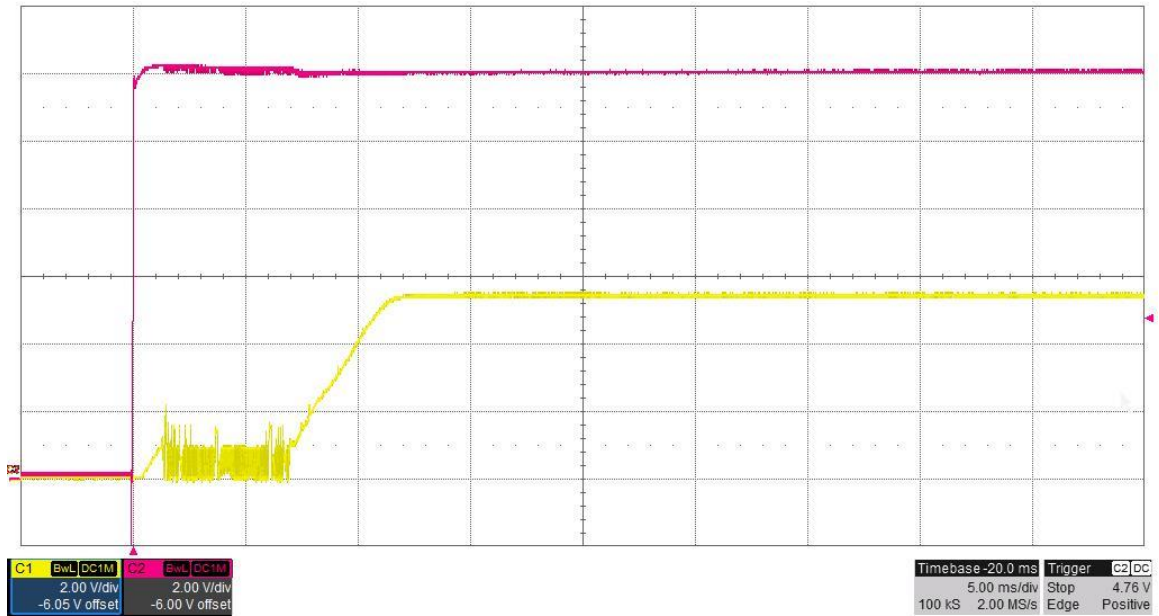
Power Management Solutions

The photo below shows the **LMR14030 5V USB** output voltage after the EN signal (Green) is applied. VIN (Red), LMR14030 5V USB (Yellow), 5V output is loaded to 2.1A. Vin =12V
(2V/DIV, 5mS/DIV)

The photo below shows the **TPS57140 5V USB** output voltage startup waveform after 12V is applied. VIN (Red), TPS57140 5V USB (Blue), 5V output is loaded to 0A.
(2V/DIV, 5mS/DIV)

The photo below shows the **TPS57140 5V USB** output voltage startup waveform after 12V is applied.
VIN (Red), TPS57140 5V USB (Blue), 5V output is loaded to 1A.
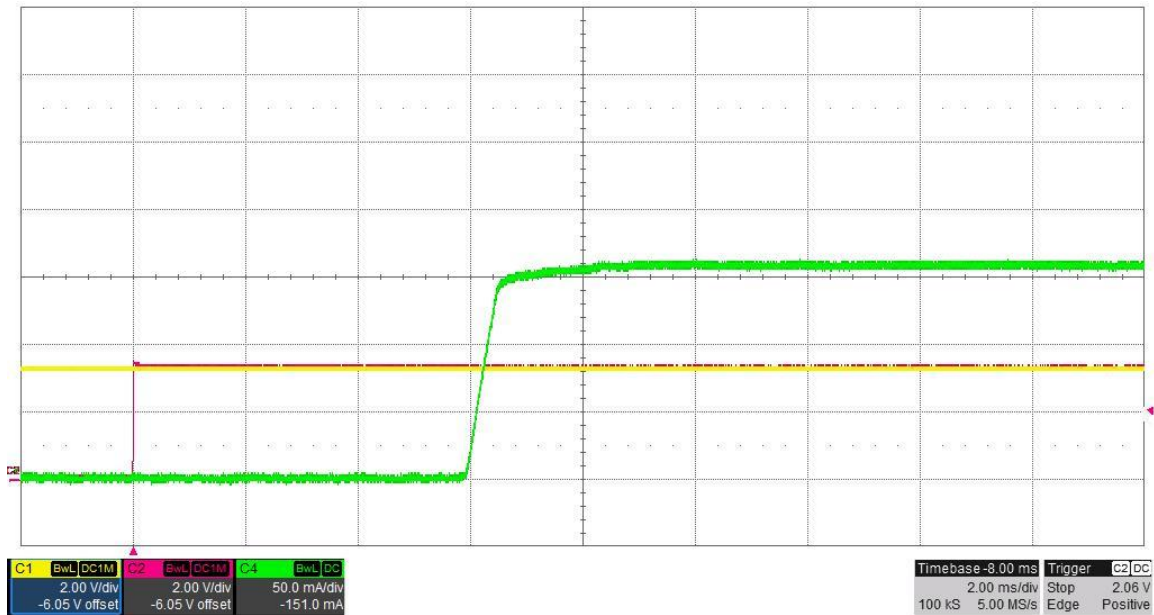(2V/DIV, 5mS/DIV)

The photo below shows the **TPS57140 5V USB** output voltage after the EN signal (Green) is applied.
VIN (Red), TPS57140 5V USB (Blue), 5V output is loaded to 1A. Vin =12V
(2V/DIV, 5mS/DIV)
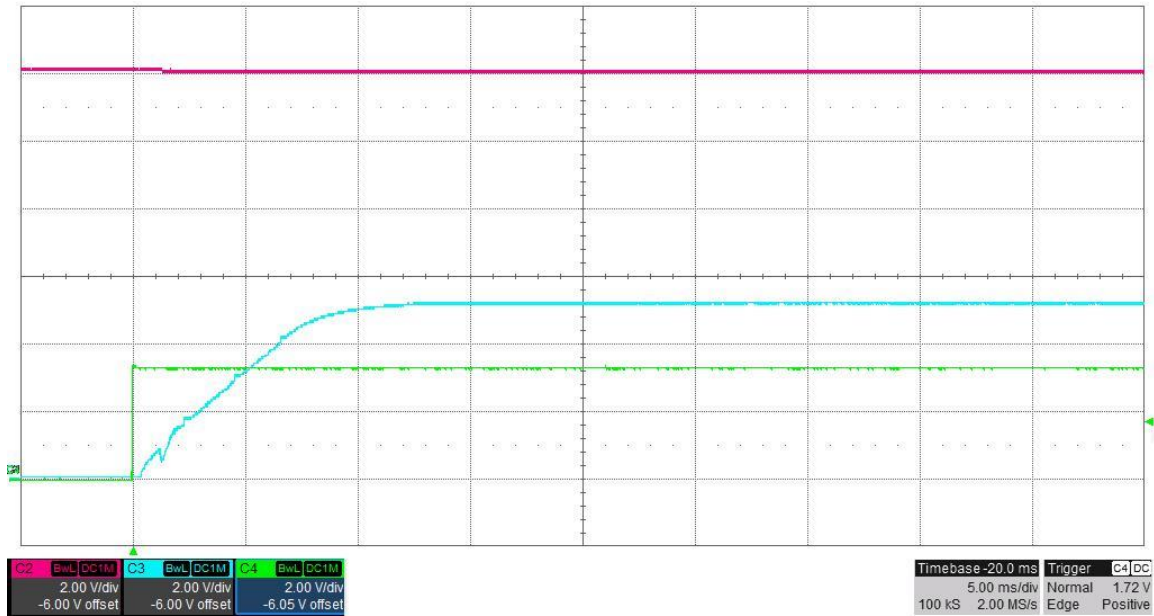
The photo below shows the **TPS61175 LED** current startup waveform after 12V is applied.
VIN (Yellow), 3.3VSW (Red), TPS61175 LED current (Green), 3 White LEDs, 3.3VSW@1A
(Vin is 5V/DIV, 3.3VSW is 2V/DIV, LED current is 50mA/DIV, 2mS/DIV)
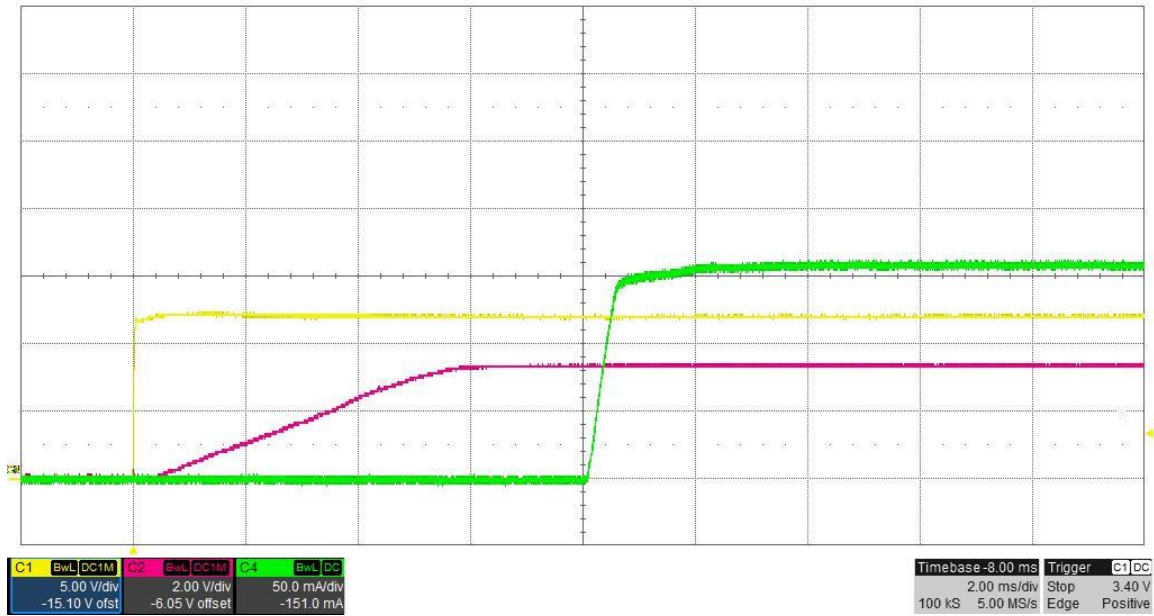
The photo below shows the **TPS61175 LED** current startup waveform after the EN signal (Red) is applied.
3.3VSW (Yellow), TPS61175 Enable (Red), TPS61175 LED current (Green), 3 White LED, 3.3VSW@1A
(2V/DIV, 50mA/DIV, 2mS/DIV)

The photo below shows the **3.3VSW, 1.2V, 1.8V and 1.2V PG1 signal** startup waveforms after 12V is applied. 3.3VSW (Red), 1.2V (Green), 1.8V (Yellow), 1.2V PG1 (Blue), 0A loads on all outputs. (0.5V/DIV, 5mS/DIV)
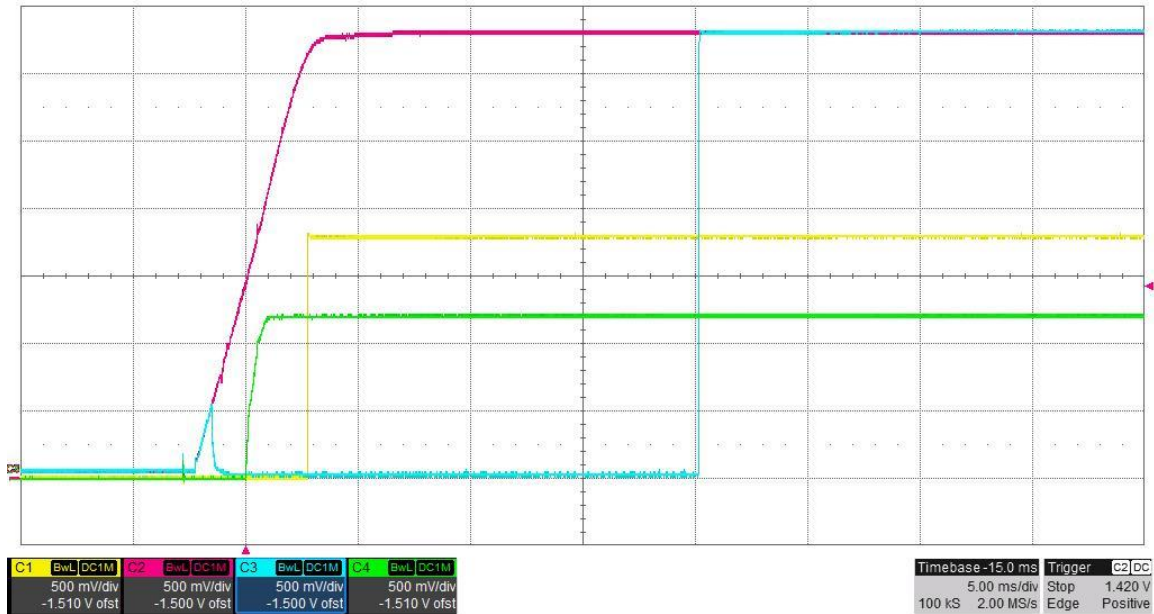

The photo below shows the **5V STBY, 3.3V STBY, and 3.3V MIC** startup waveforms after 12V is applied. 12Vin (Red), 5V STBY (Blue), 3.3V STBY (Green), 3.3V MIC (Yellow), 0A loads on all outputs. (2V/DIV, 100uS/DIV)

Power Management Solutions
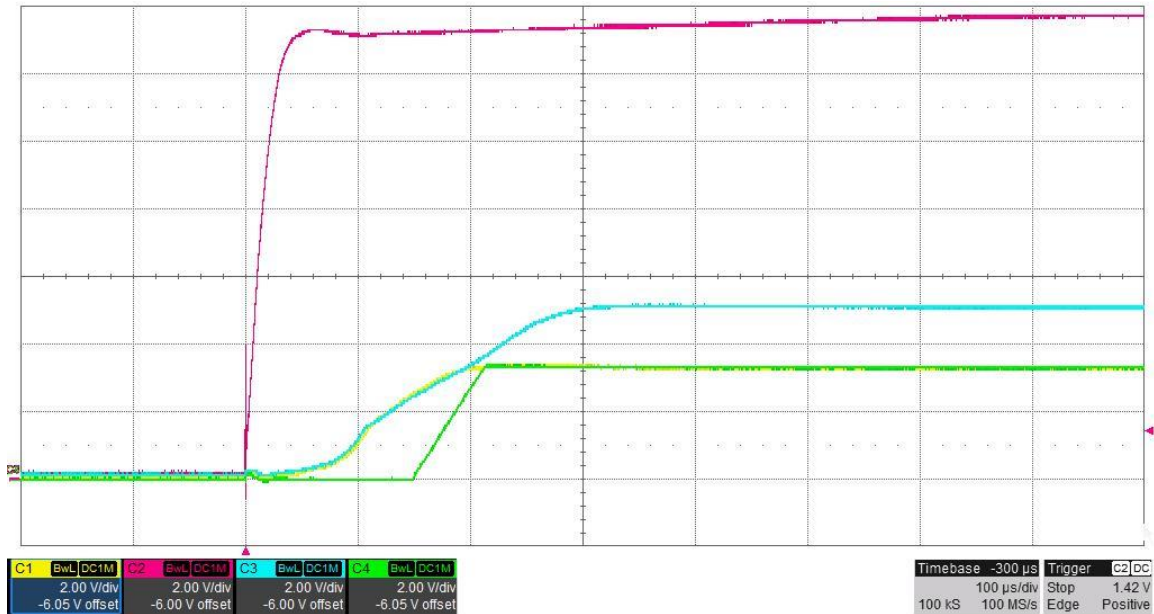
The photo below shows the **3.3VSW and PG signal** waveforms after 12V is applied.
3.3VSW (Red), 3.3VSW Power Good (Yellow), 0A loads on all outputs.
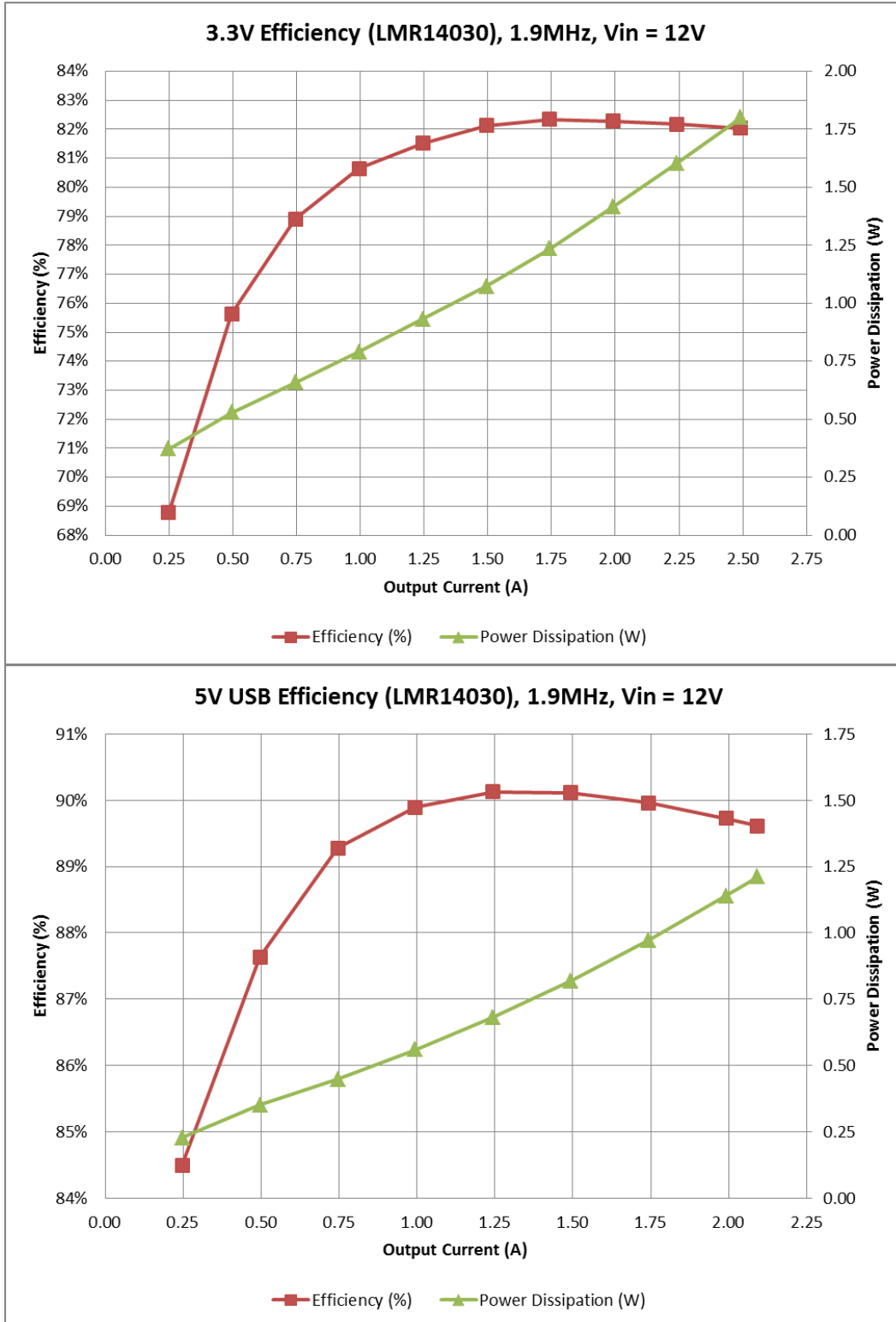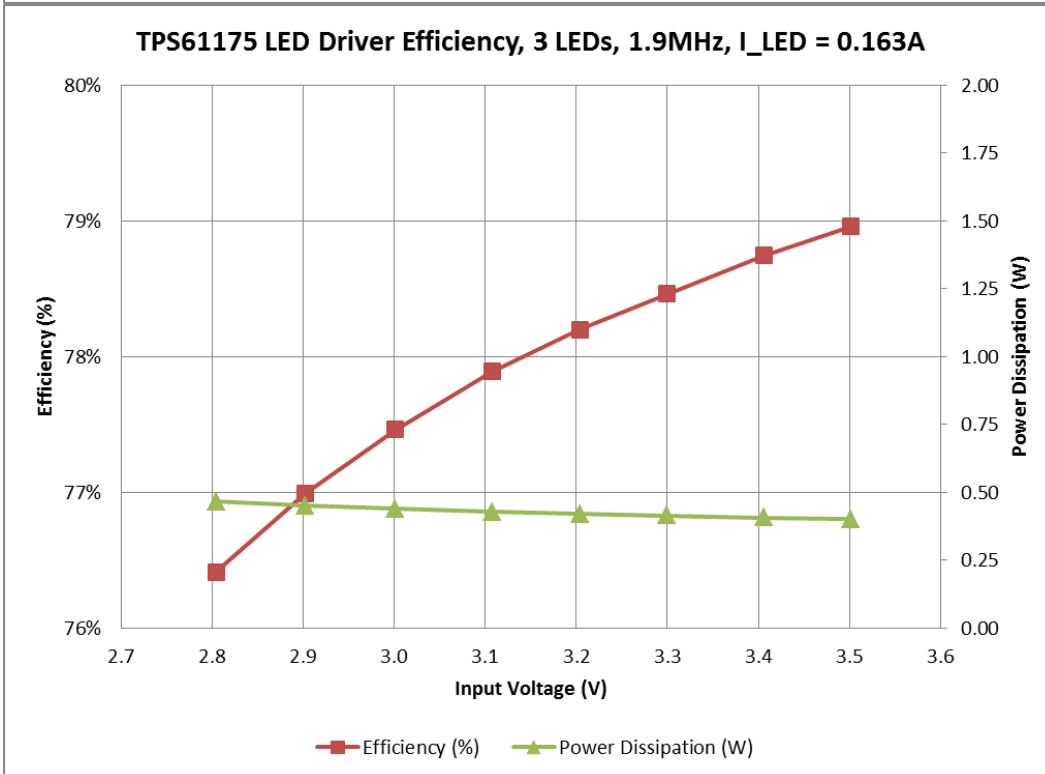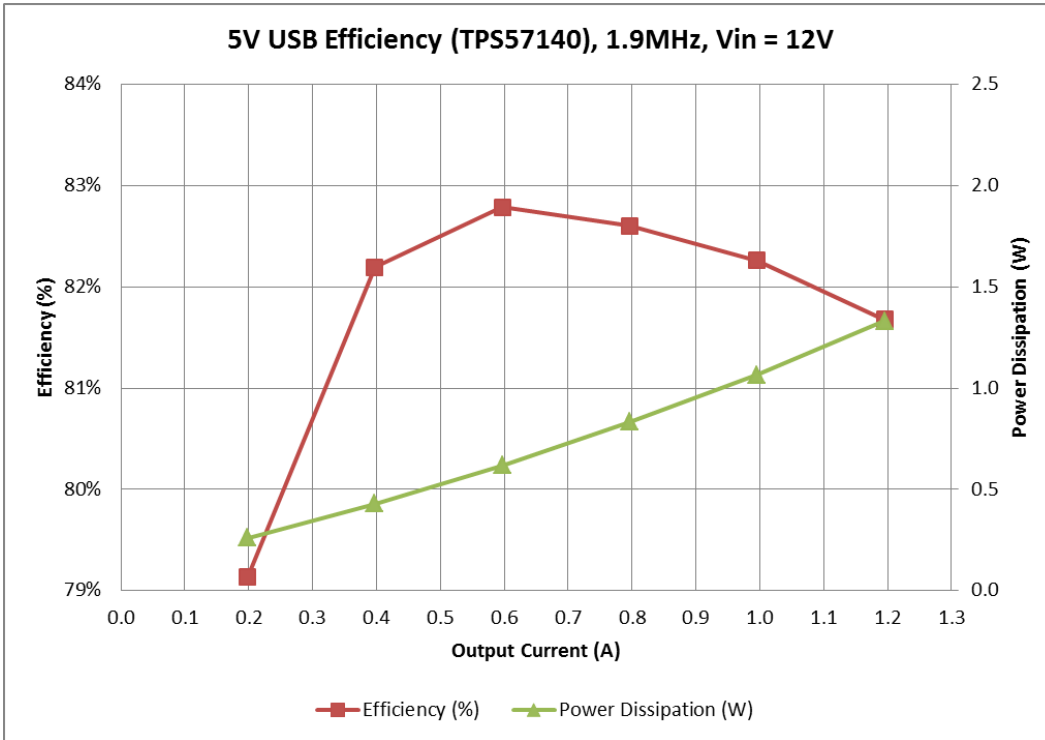(1V/DIV, 2mS/DIV)

The photo below shows the **12V ANT** startup waveforms after 12V is applied.
12Vin (Red), 12V ANT (Yellow), 50mA loads on output, 12V ANT ENABLE connected to Vin.
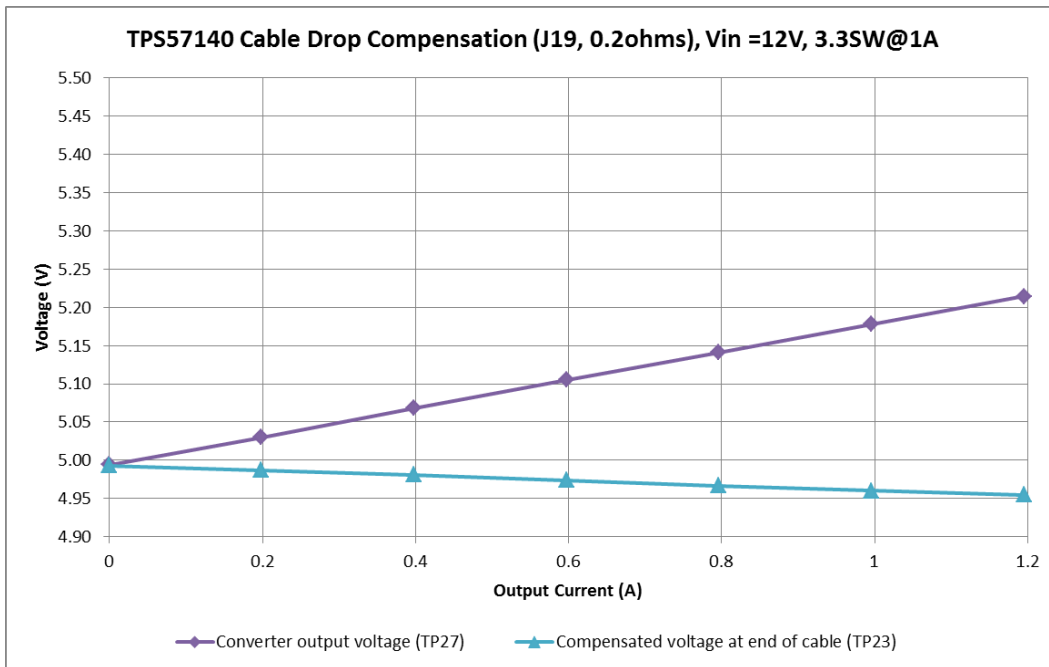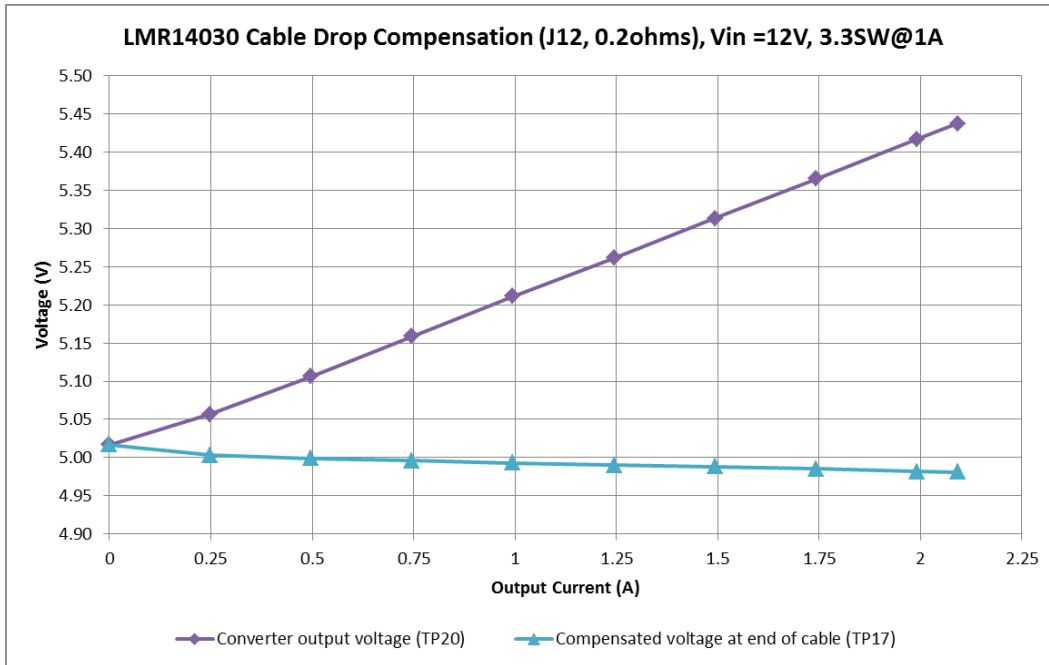(2V/DIV, 200uS/DIV)
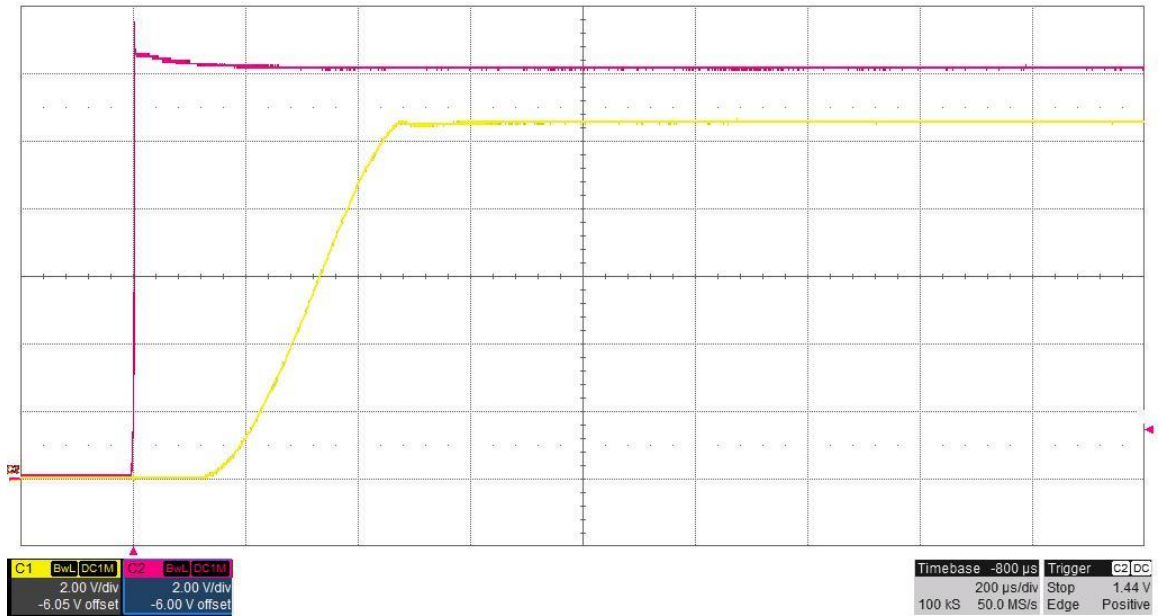
2 Efficiency

Each converters is independently free-running (non-sync operation). 5V USB outputs are not cable voltage drop compensated.


3.3V Efficiency (LMR14030), 1.9MHz, Vin = 12V

5V USB Efficiency (LMR14030), 1.9MHz, Vin = 12V

Power Management Solutions

5V USB Efficiency (TPS57140), 1.9MHz, Vin = 12V

TPS61175 LED Driver Efficiency, 3 LEDs, 1.9MHz, I_LED = 0.163A

3   USB Cable Drop Compensation

LMR14030 Cable Drop Compensation (J12, 0.2ohms), Vin =12V, 3.3SW@1A

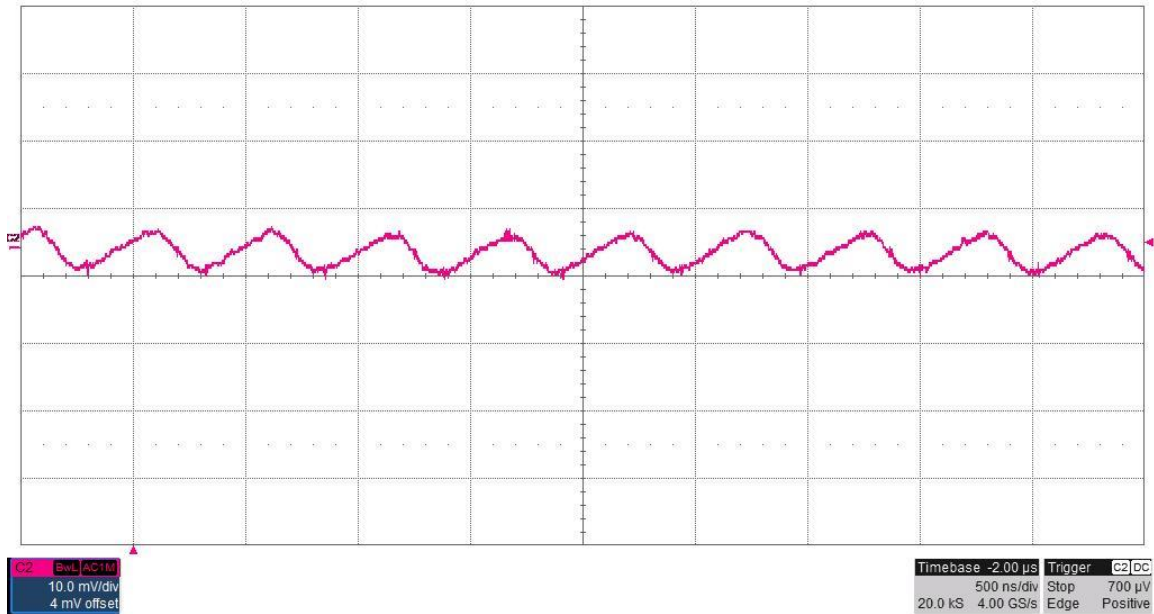TPS57140 Cable Drop Compensation (J19, 0.2ohms), Vin =12V, 3.3SW@1A
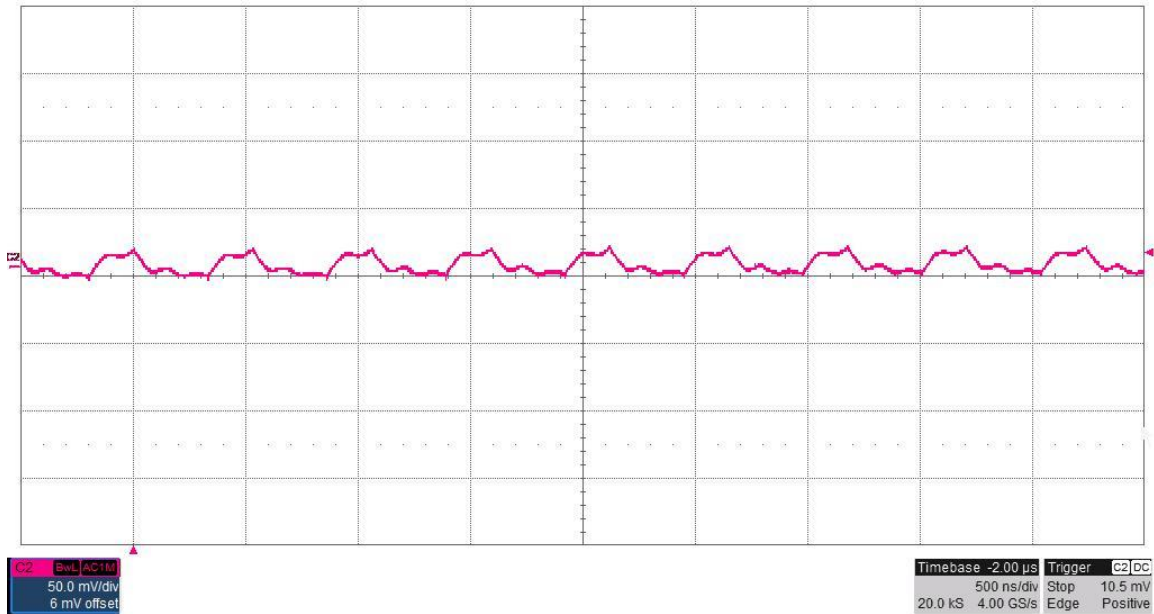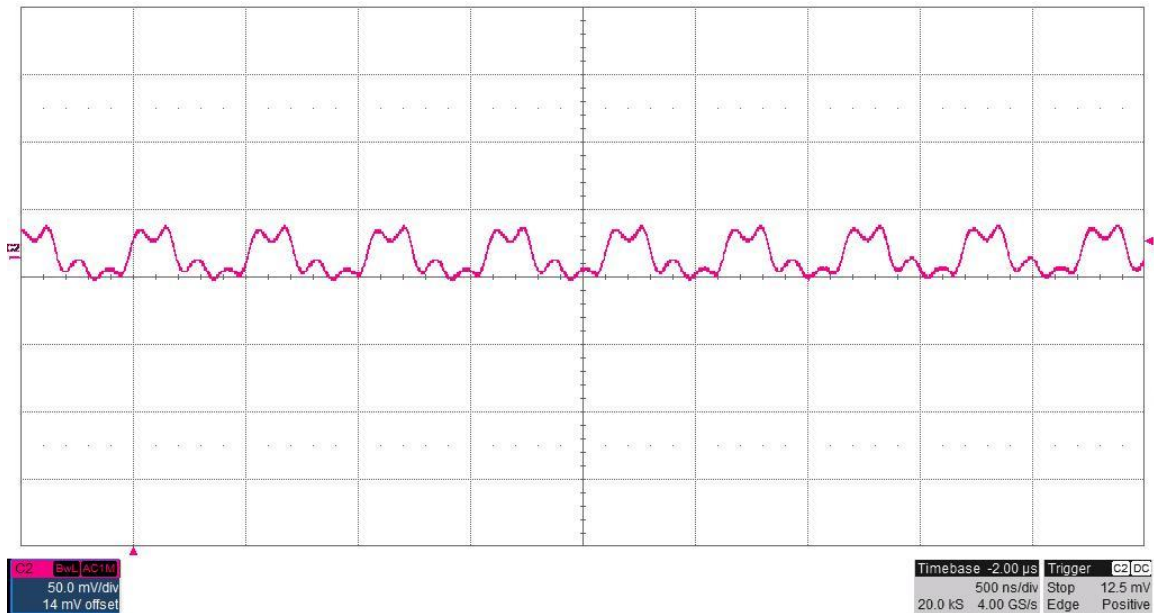
4   Output Ripple Voltage

The **3.3VSW** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C16 with the output loaded to 2.5A. The input voltage is set to 7V.
(10mV/DIV, 500nS/DIV)
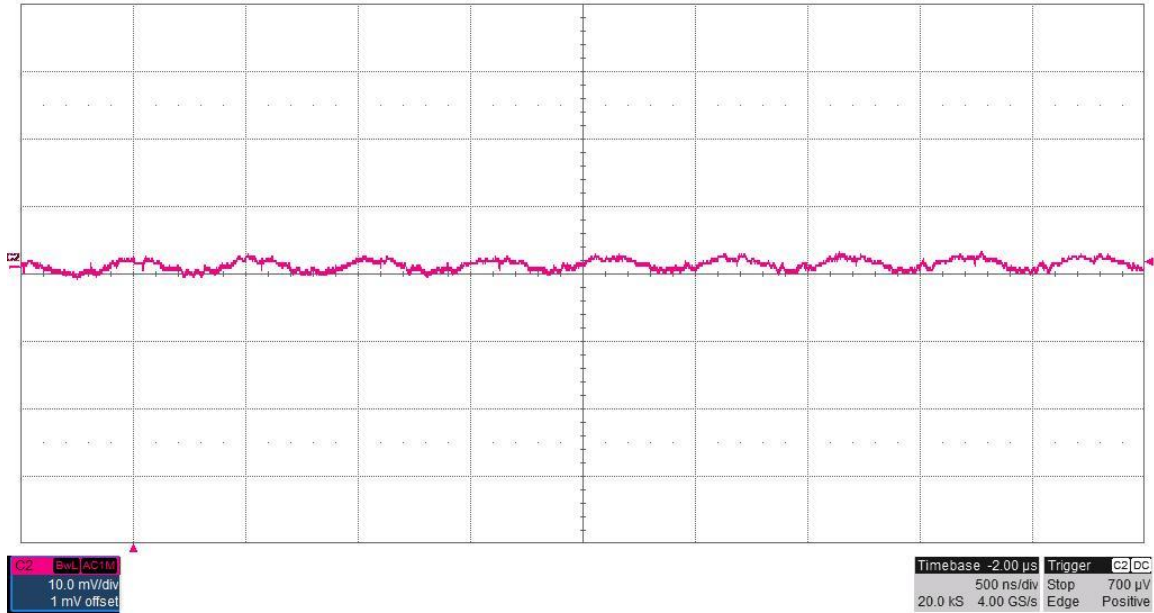
The **3.3VSW** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C16 with the output loaded to 2.5A. The input voltage is set to 16V.
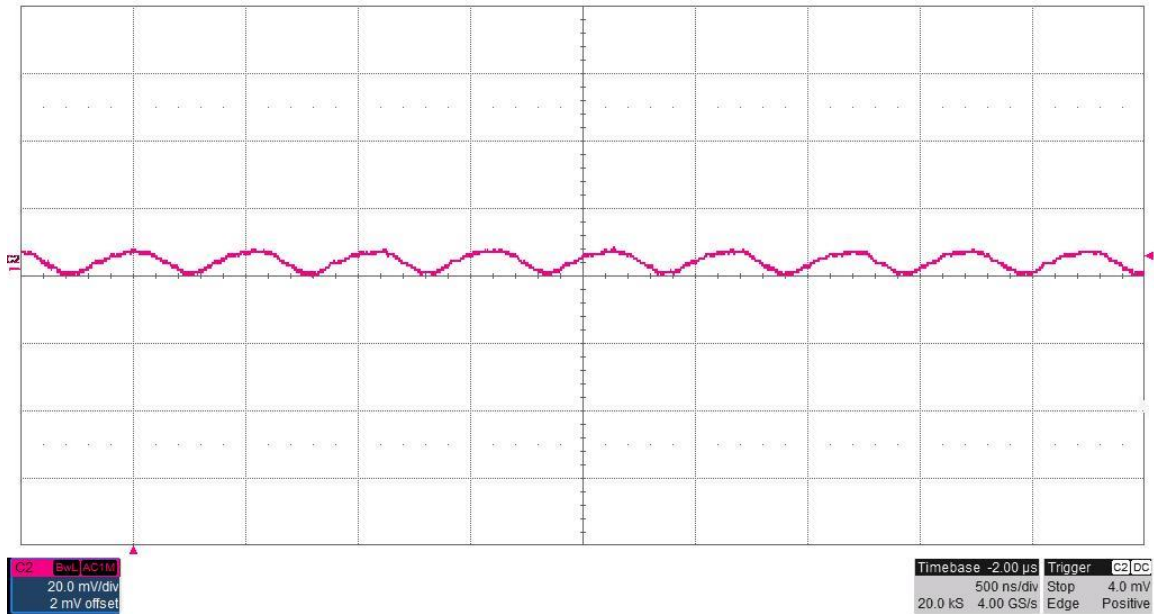(10mV/DIV, 500nS/DIV)

The **LMR14030 5V USB** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C29 with the output loaded to 2.1A. The input voltage is set to 16V. (50mV/DIV, 500nS/DIV)
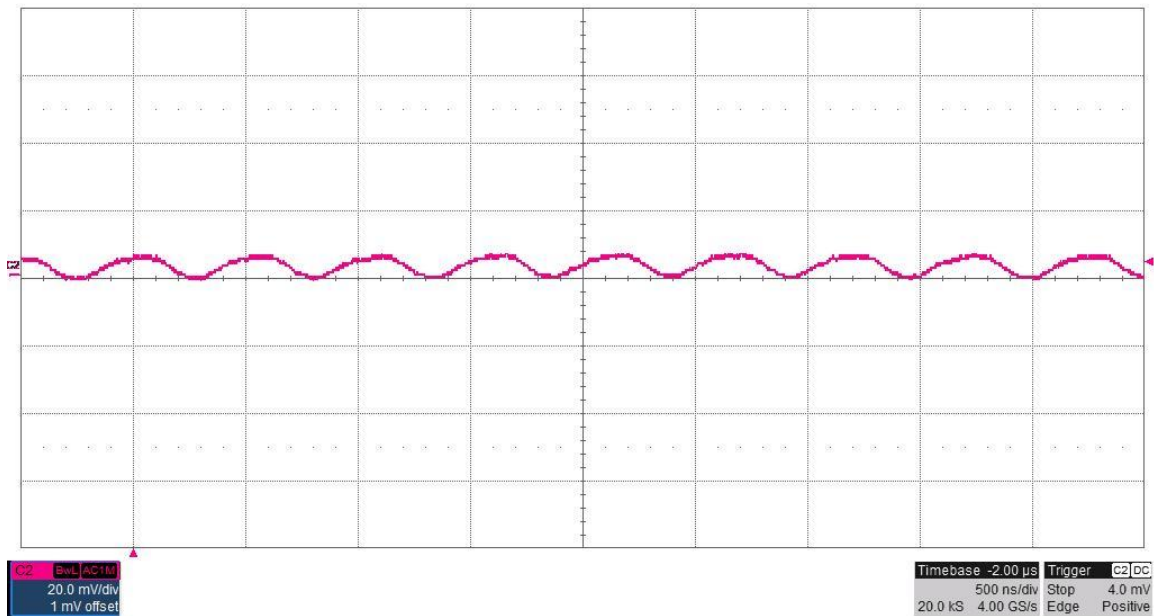

The **LMR14030 5V USB** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C28 with the output loaded to 2.1A. The input voltage is set to 16V. (50mV/DIV, 500nS/DIV)
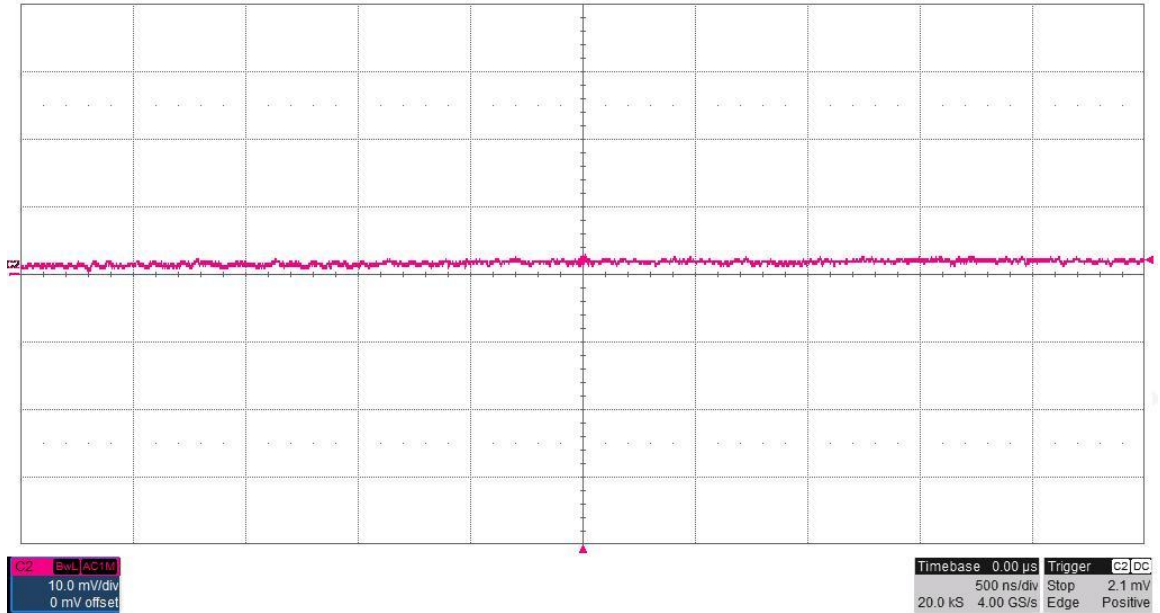
The **TPS57140 5V USB** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C42 with the output loaded to 1A. The input voltage is set to 16V.
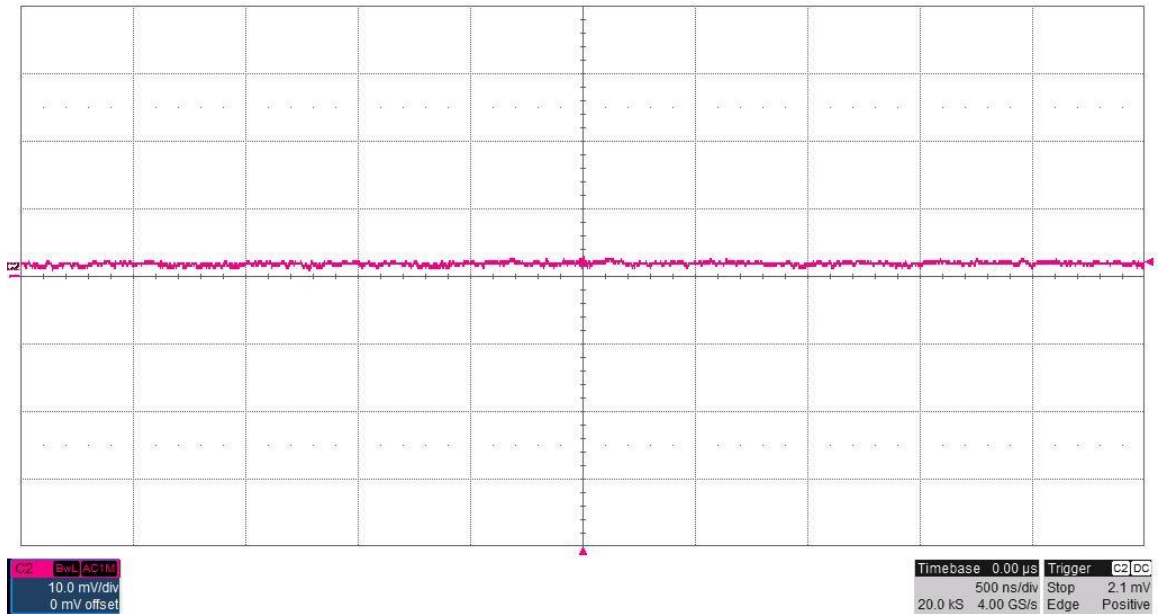(20mV/DIV, 500nS/DIV)

The **TPS57140 5V USB** output ripple voltage (AC coupled) is shown in the figure below. The voltage is measured across C45 with the output loaded to 1A. The input voltage is set to 16V.
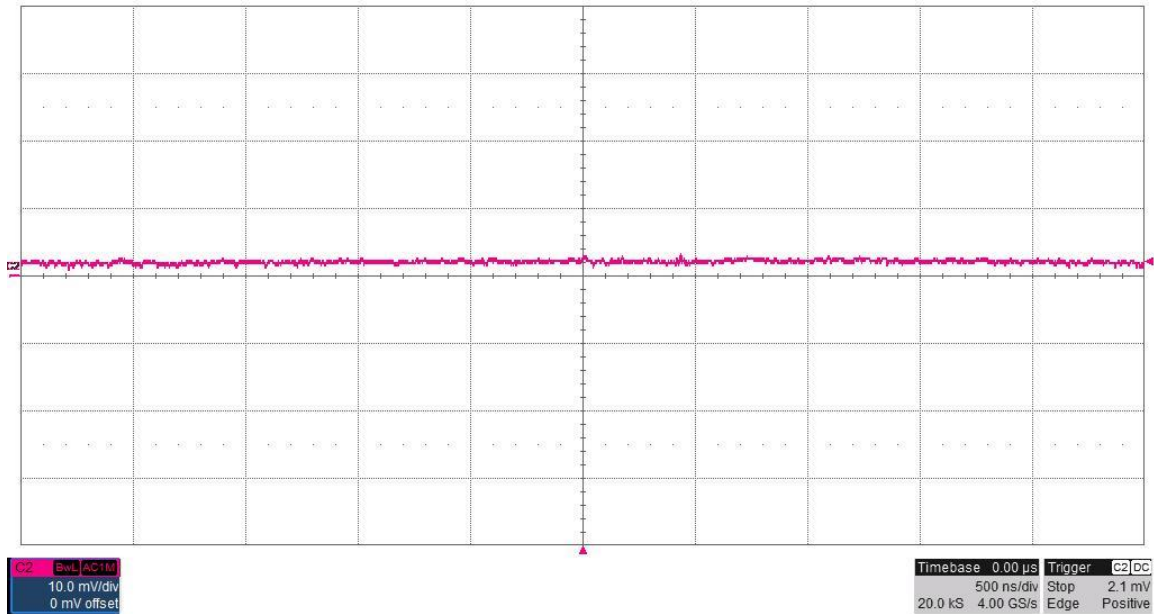(20mV/DIV, 500nS/DIV)

The **TPS74701 1.2V Lin Reg** output ripple voltage (AC coupled) is shown below. The voltage is measured across C56 with the output loaded to 0.7A. The input voltage is set to 12V. 3.3VSW@1A (10mV/DIV, 500nS/DIV)
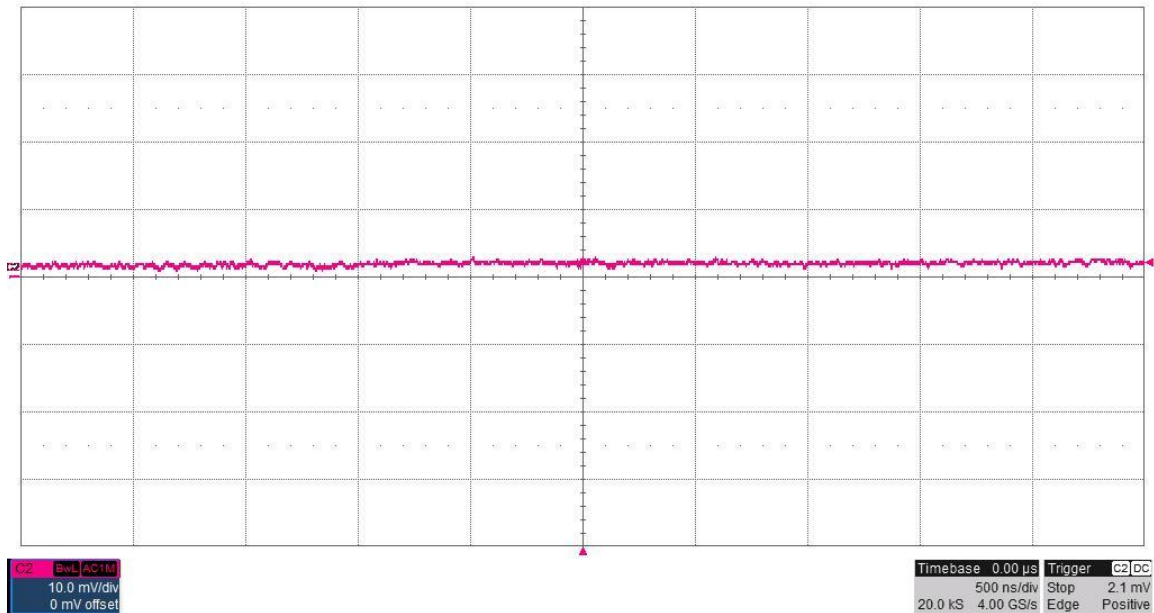

The **TLV70018 1.8V Lin Reg** output ripple voltage (AC coupled) is shown below. The voltage is measured across C54 with the output loaded to 0.155A. The input voltage is set to 12V. 3.3VSW@1A (10mV/DIV, 500nS/DIV)

The **TPS7B6933 3.3V MIC Lin Reg** output ripple voltage (AC coupled) is shown below. The voltage is measured across C47 with the output loaded to 0.15A. The input voltage is set to 12V.
(10mV/DIV, 500nS/DIV)

The **TPS7B6950 5.0V STBY Lin Reg** output ripple voltage (AC coupled) is shown below. The voltage is measured across C49 with the output loaded to 0.15A. The input voltage is set to 12V.
(10mV/DIV, 500nS/DIV)

Power Management Solutions

PMP11136 REVB Test Results

TEXAS
INSTRUMENTS

The **TLV70033 3.3V STBY Lin Reg** output ripple voltage (AC coupled) is shown below. The voltage is measured across C52 with the output loaded to 0.05A. The input voltage is set to 12V. (10mV/DIV, 500nS/DIV)

Power Management Solutions

PMP11136 REVB Test Results
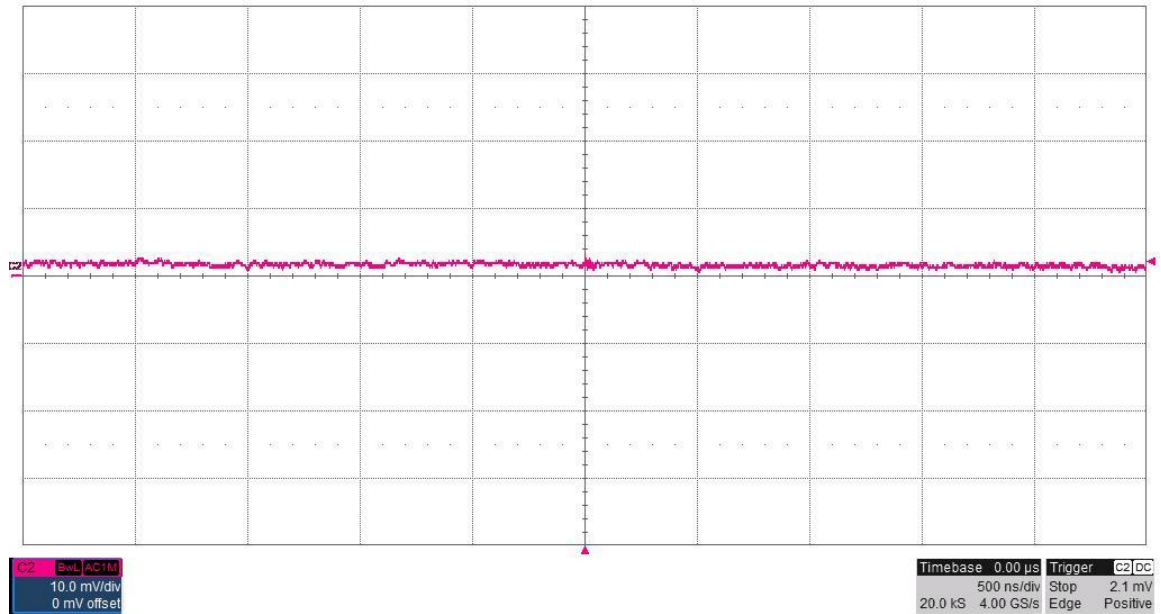
5   Load Transients

The **3.3VSW** load transient response (ac coupled) is shown for a load current step between 1.5A and 2.5A.
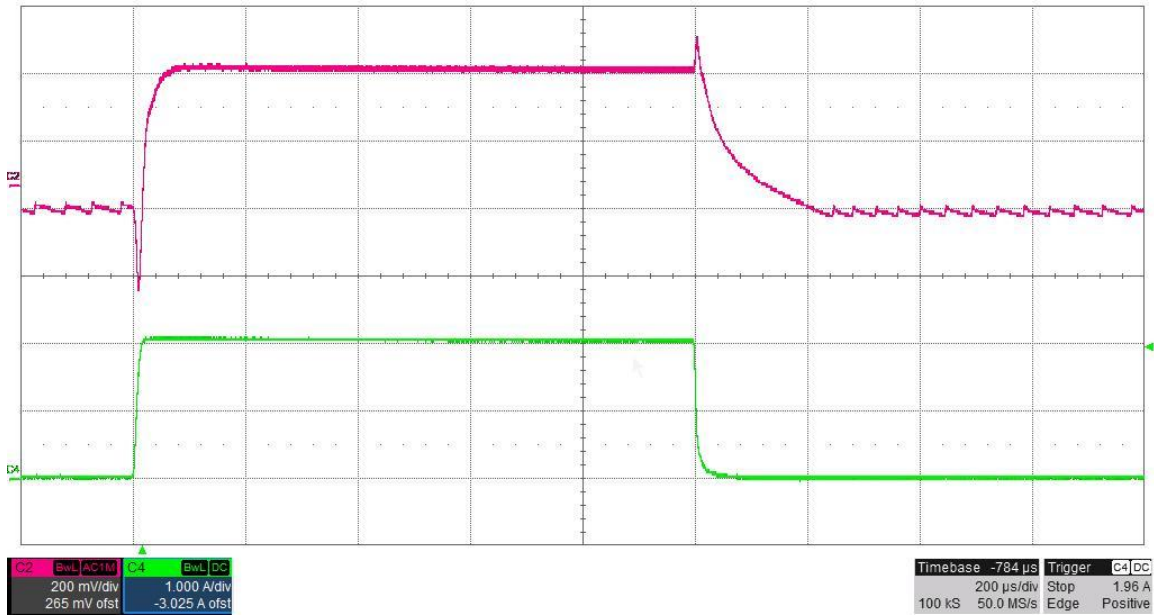Vin = 12V.
(100mV/DIV, 1A/DIV, 100uS/DIV)
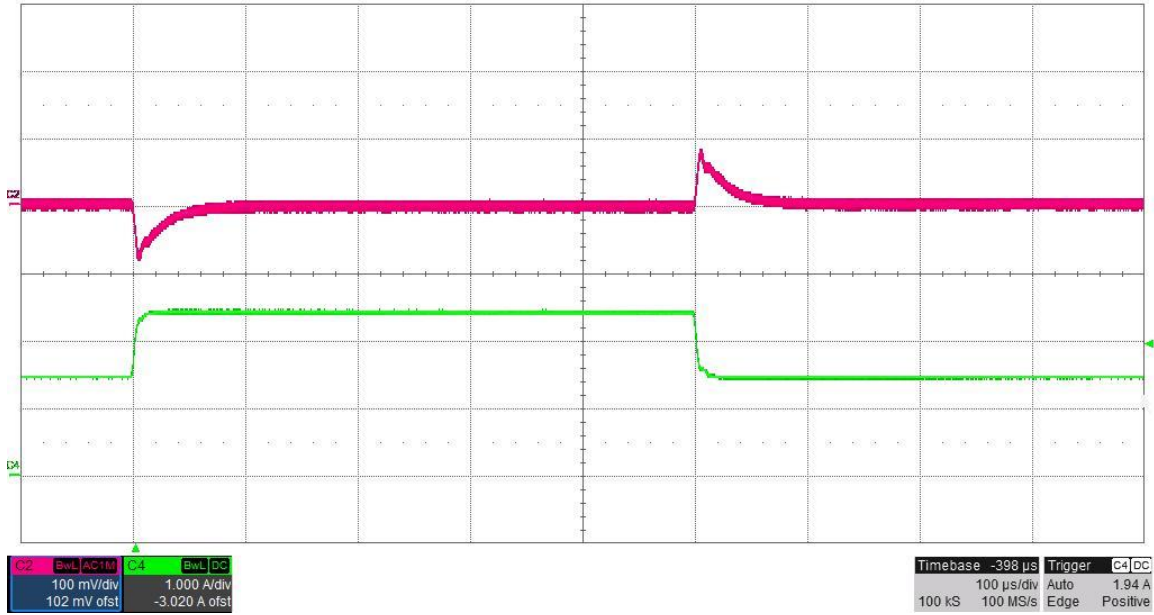
The **3.3VSW** load transient response (ac coupled) is shown for a load current step between 0.5A and 2.5A.
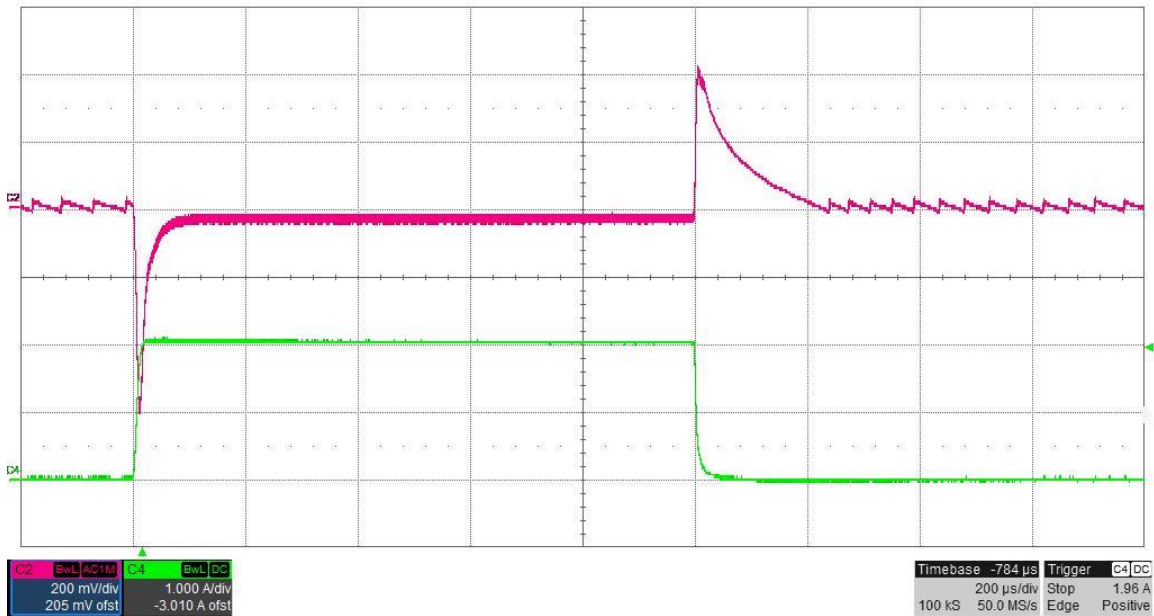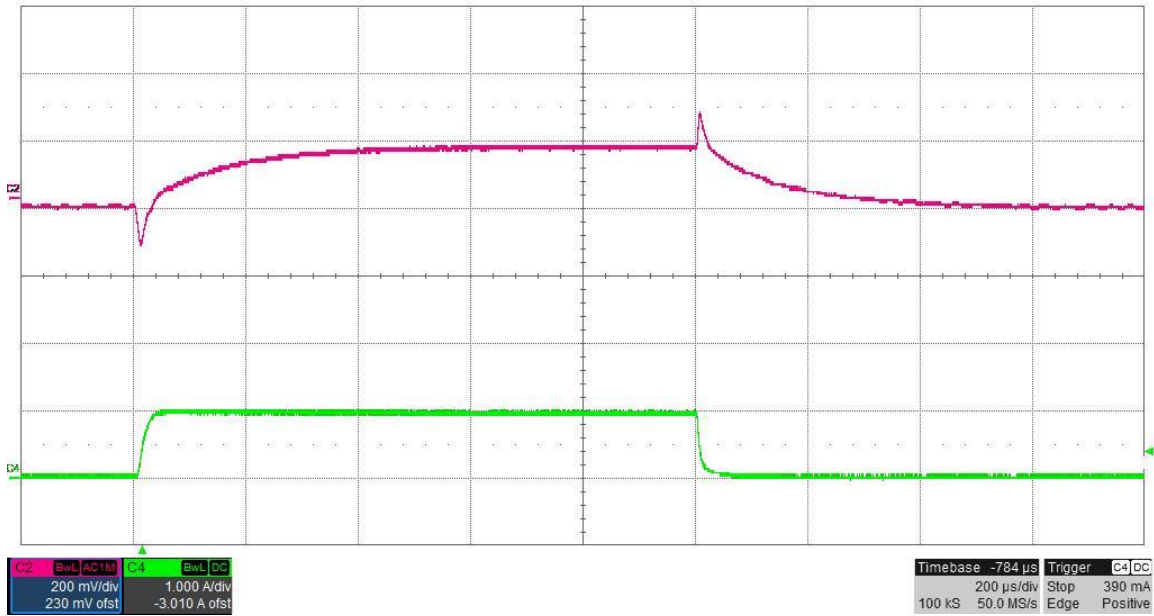Vin = 12V.
(100mV/DIV, 1A/DIV, 100uS/DIV)
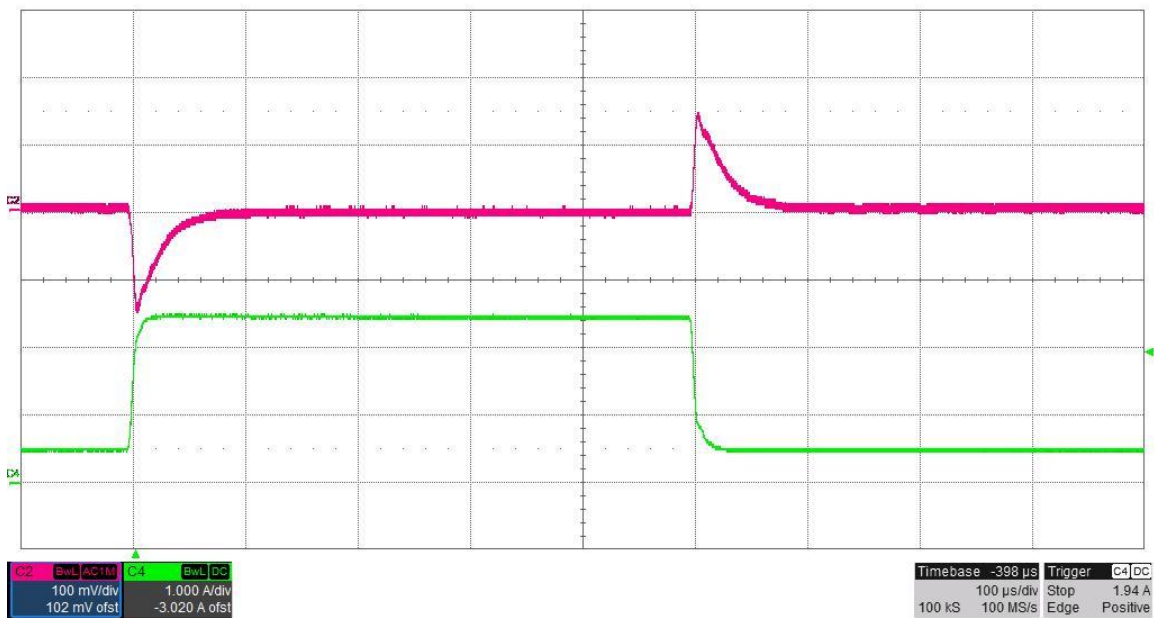
The **LMR14030 5V USB** load transient response (ac coupled) is shown for a load current step between 0A and 2.1A. Vin = 12V. The voltage is measured at C29 (before cable drop compensation). (200mV/DIV, 1A/DIV, 200uS/DIV)

The **LMR14030 5V USB** load transient response (ac coupled) is shown for a load current step between 0A and 2.1A. Vin = 12V. The voltage is measured at R22 (0.2 Ohm resistor, after cable drop compensation). (200mV/DIV, 1A/DIV, 200uS/DIV)

The **TPS57140 5V USB** load transient response (ac coupled) is shown for a load current step between 0A and 1A. Vin = 12V. The voltage is measured at C42 (before cable drop compensation).
(200mV/DIV, 1A/DIV, 200uS/DIV)

The **TPS57140 5V USB** load transient response (ac coupled) is shown for a load current step between 0A and 1A. Vin = 12V. The voltage is measured at R35 (0.2 Ohm resistor, after cable drop compensation).
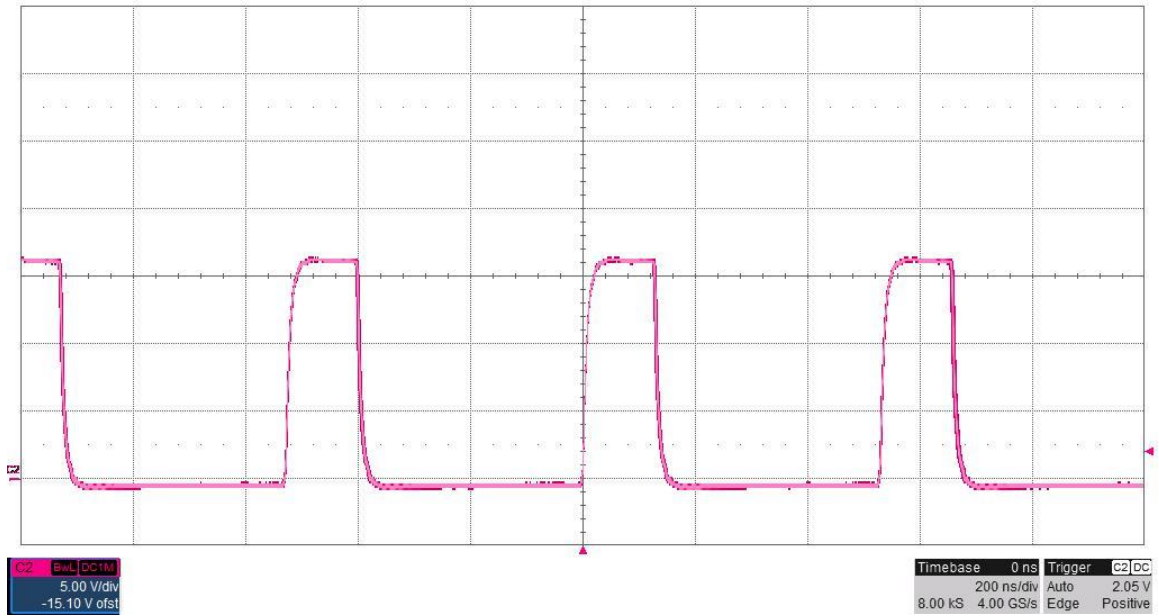(200mV/DIV, 1A/DIV, 200uS/DIV)

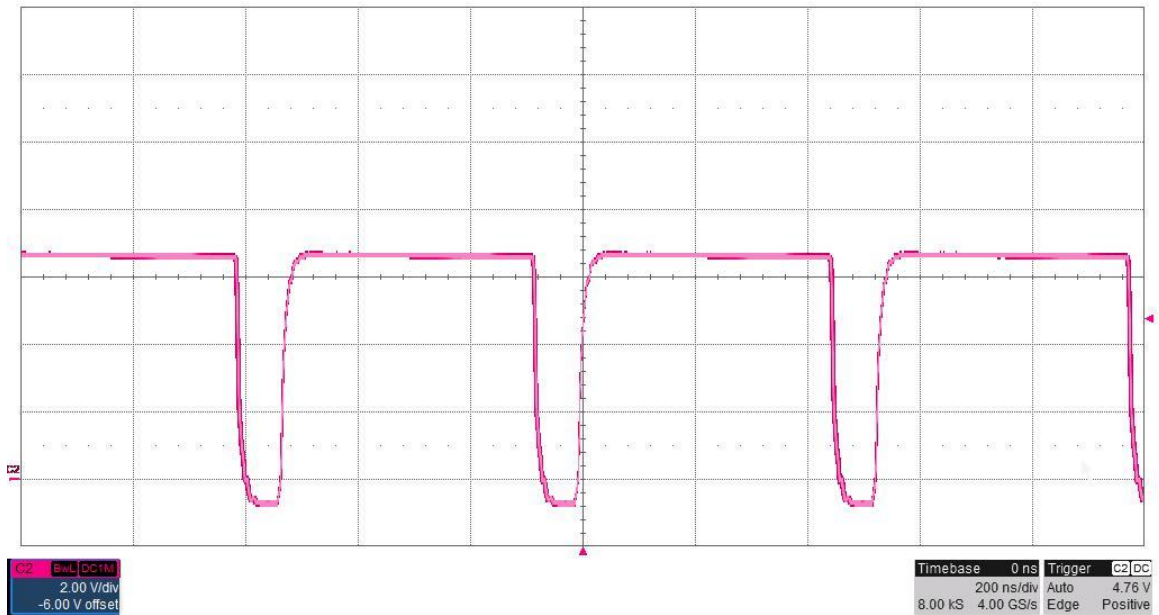# PMP11136 REVB Test Results
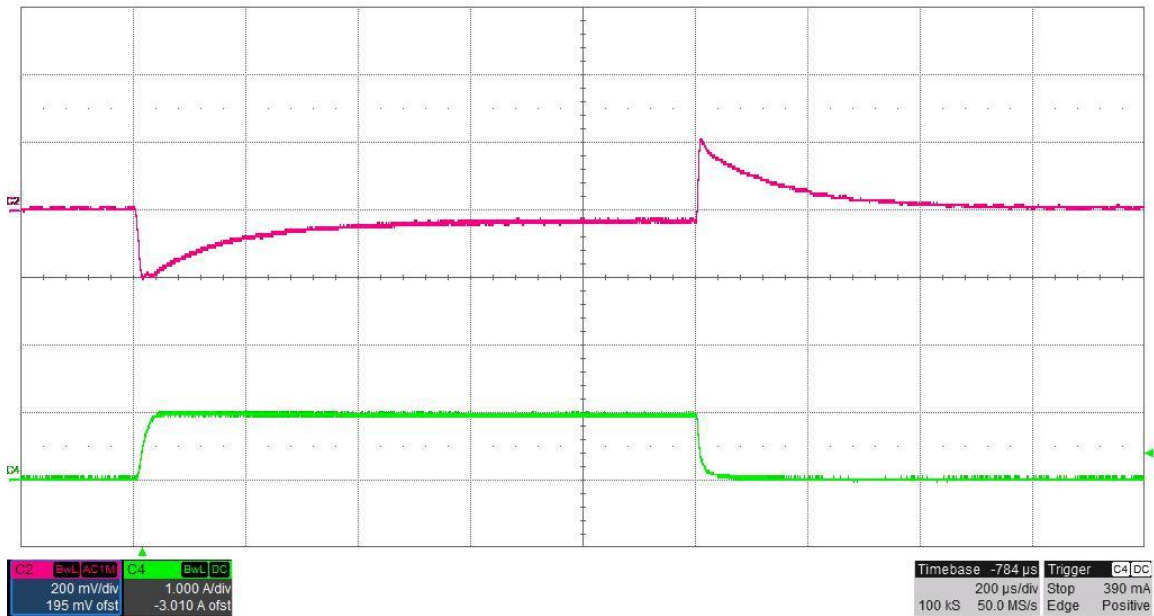
6   Switch Node Waveforms

The photo below shows the **3.3VSW** switching voltage for an input voltage of 6V and a 2.5A load.
(2V/DIV, 200nS/DIV)
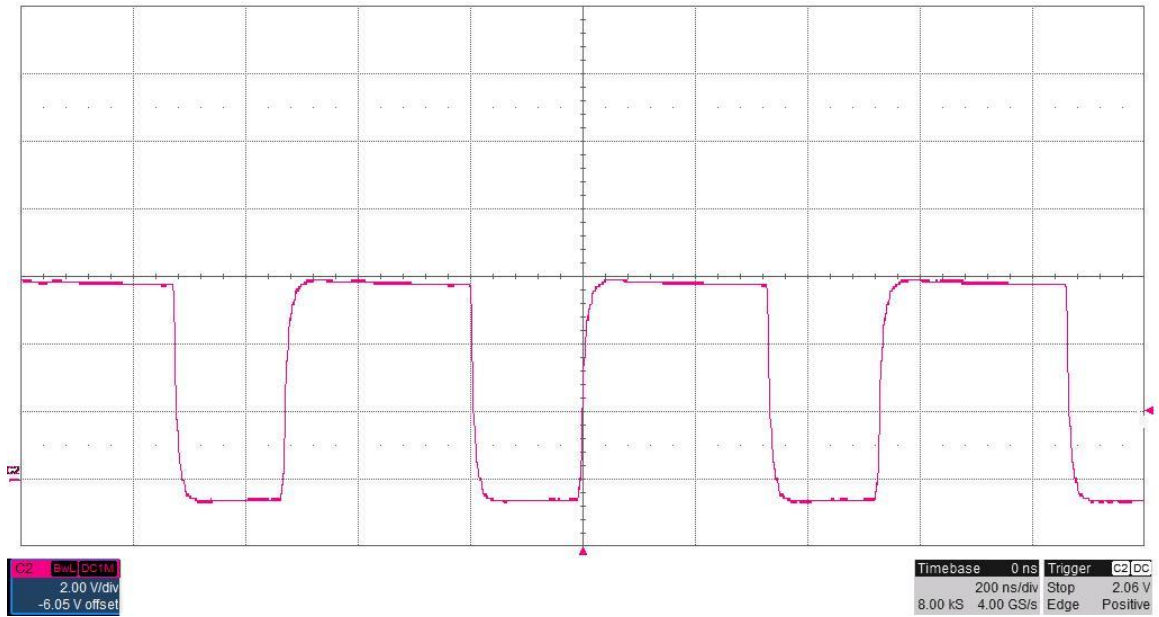
The photo below shows the **3.3VSW** switching voltage for an input voltage of 16V and a 2.5A load.
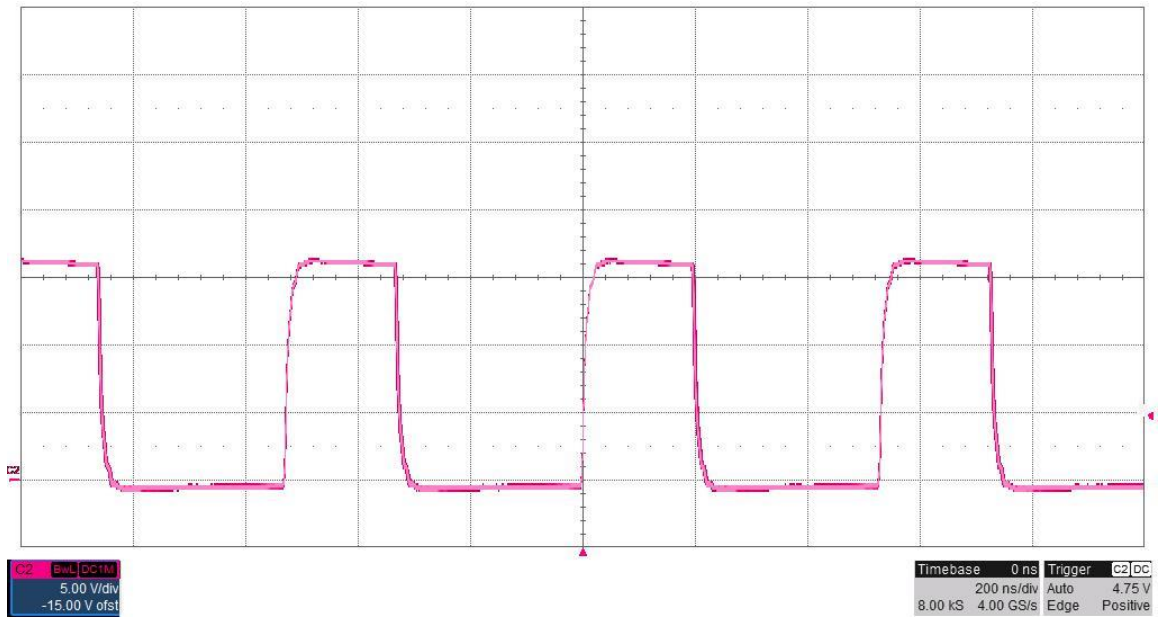(5V/DIV, 200nS/DIV)

Power Management Solutions

The photo below shows the **3.3VSW** switching voltage for an input voltage of 12V and a 0A load. (2V/DIV, 1uS/DIV)

The photo below shows the **LMR14030 5V USB** switching voltage for an input voltage of 7V and a 2.1A load. (2V/DIV, 200nS/DIV)
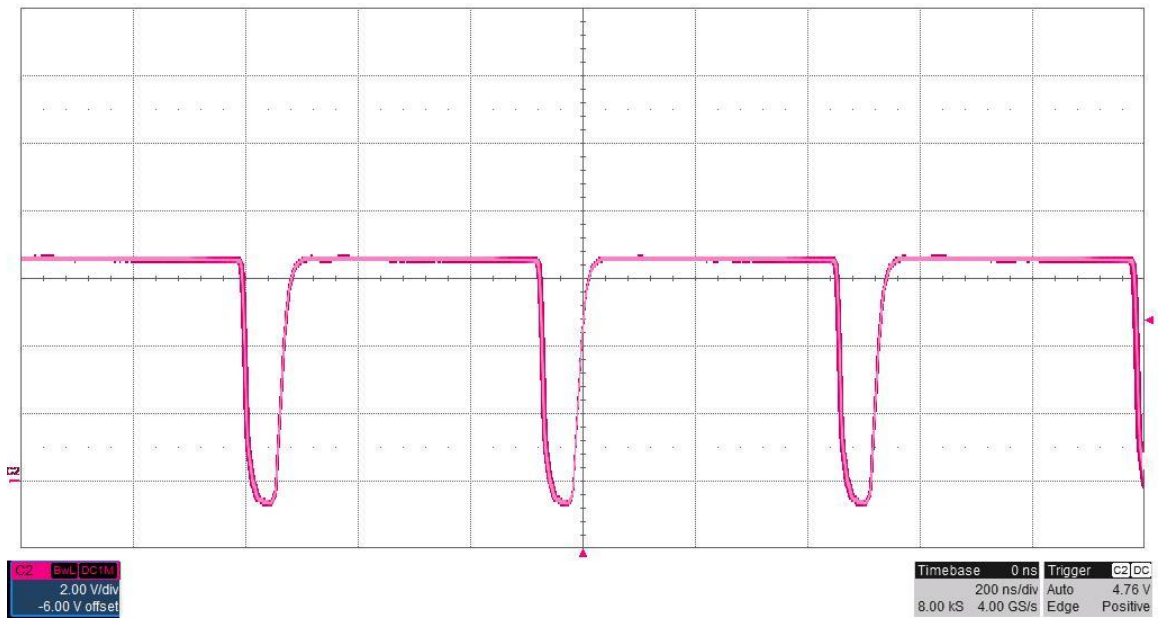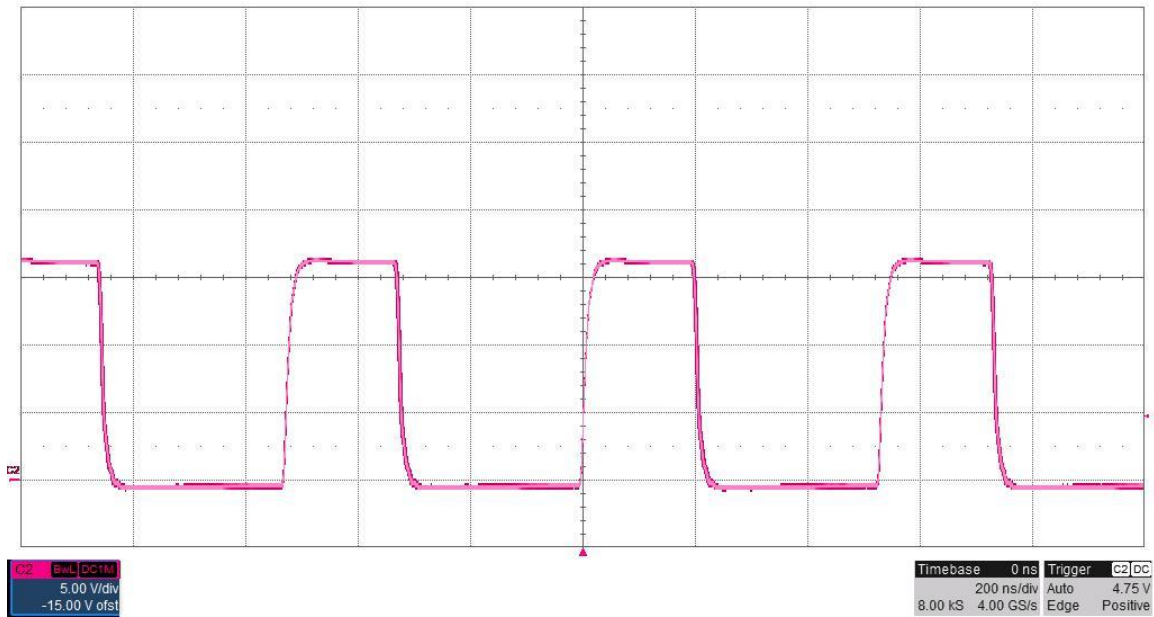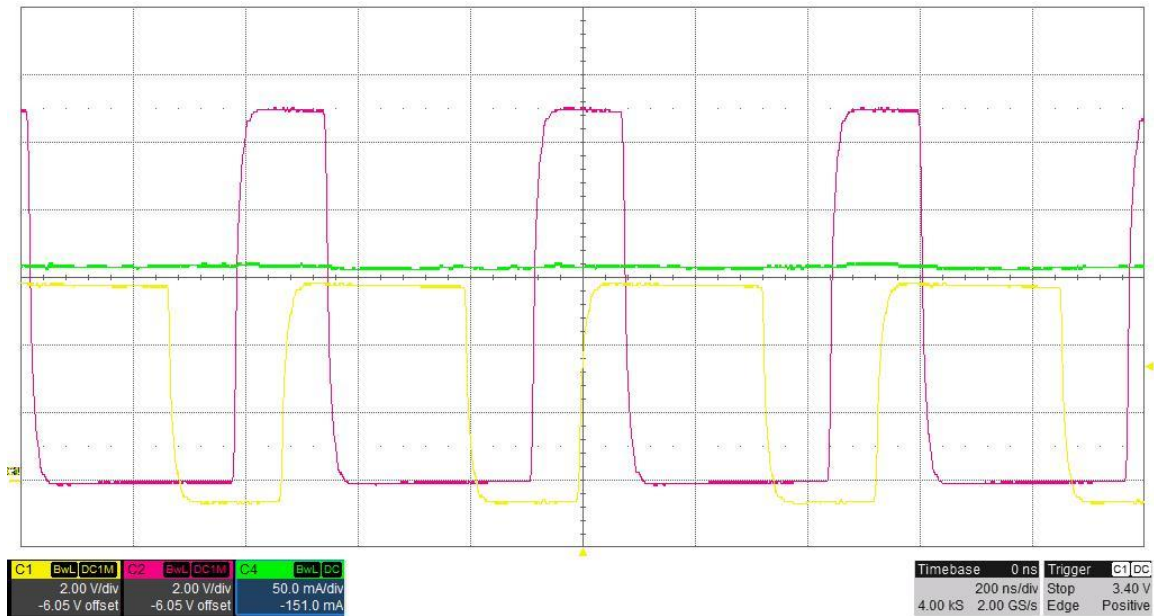
Power Management Solutions

The photo below shows the **LMR14030 5V USB** switching voltage for an input voltage of 16V and a 2.1A load. (5V/DIV, 200nS/DIV)

The photo below shows the **TPS57140 5V USB** switching voltage for an input voltage of 7V and a 1A load. (2V/DIV, 200nS/DIV)

Power Management Solutions

The photo below shows the **TPS57140 5V USB** switching voltage for an input voltage of 16V and a 2.1A load. (5V/DIV, 200nS/DIV)
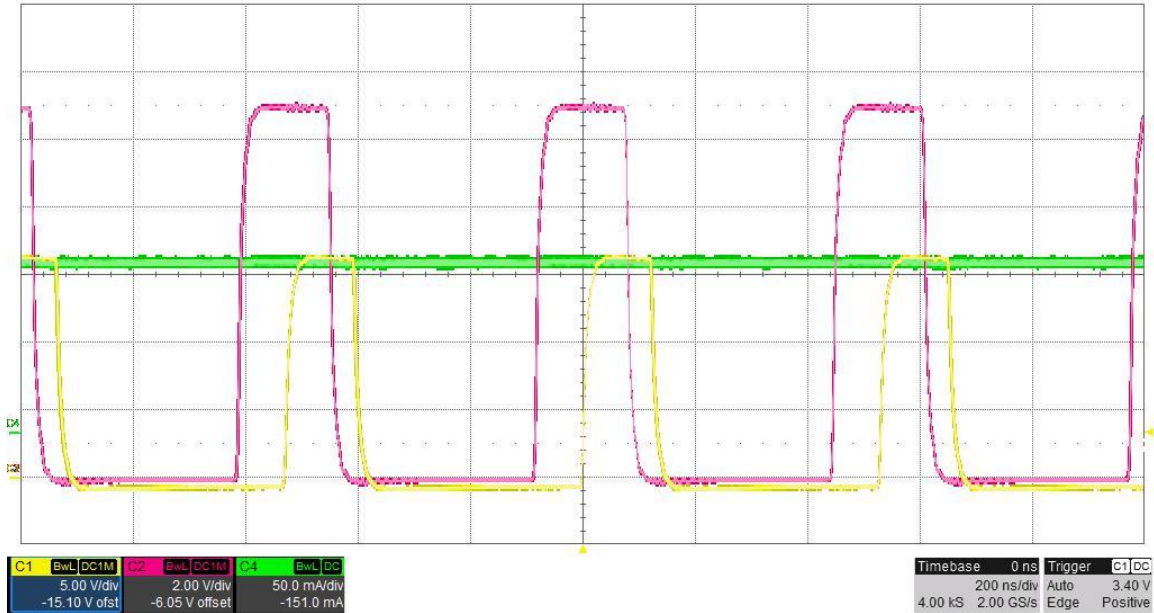

The photo below shows the **TPS61175 LED driver** switching voltage for an input voltage of 6V and driving 3 white LEDs. 3.3VSW@1A
3.3VSW Switch Node (Yellow), TPS61175 Switch Node (Red), TPS61175 LED current (Green)
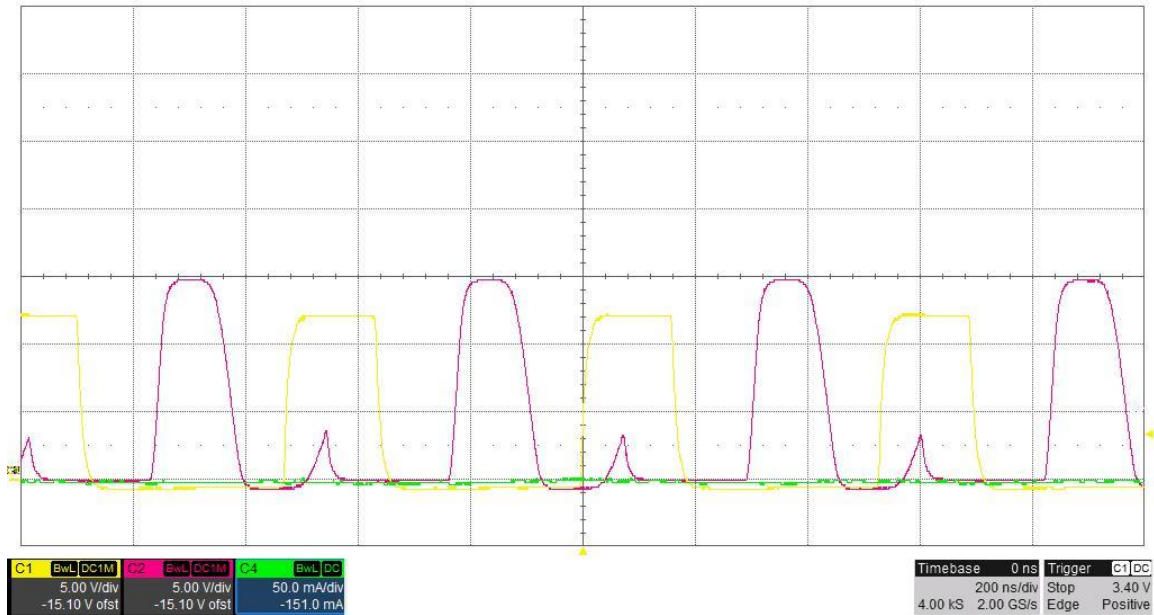(2V/DIV, 50mA/DIV, 200nS/DIV)

The photo below shows the **TPS61175 LED driver** switching voltage for an input voltage of 16V and driving 3 white LEDs. 3.3VSW@1A
3.3VSW Switch Node (Yellow), TPS61175 Switch Node (Red), TPS61175 LED current (Green)
(3.3VSW is 5V/DIV, TPS61175 is 2V/DIV, 50mA/DIV, 200nS/DIV)

The photo below shows the **TPS61175 LED driver** switching voltage for an input voltage of 12V with open LEDs (fault condition). 3.3VSW@1A
3.3VSW Switch Node (Yellow), TPS61175 Switch Node (Red), TPS61175 LED current (Green)
(5V/DIV, 50mA/DIV, 200nS/DIV)

Power Management Solutions

PMP11136 REVB Test Results

The photo below shows the **TPS61175 LED driver** switching voltage and the **sync signal** at R21. The input voltage is 12V and the load is 3 white LEDs. 3.3VSW@1A
R21 Sync Signal (Yellow), TPS61175 Switch Node (Red), TPS61175 LED current (Green)
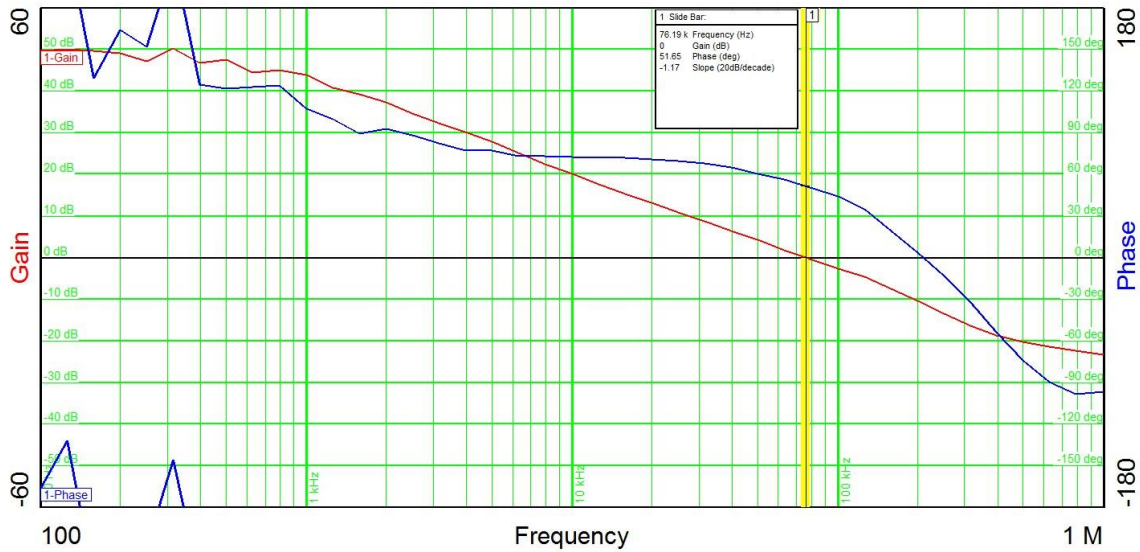(sync signal is 1V/DIV, TPS61175 switch node is 2V/DIV, 50mA/DIV, 200nS/DIV)

Power Management Solutions

PMP11136 REVB Test Results
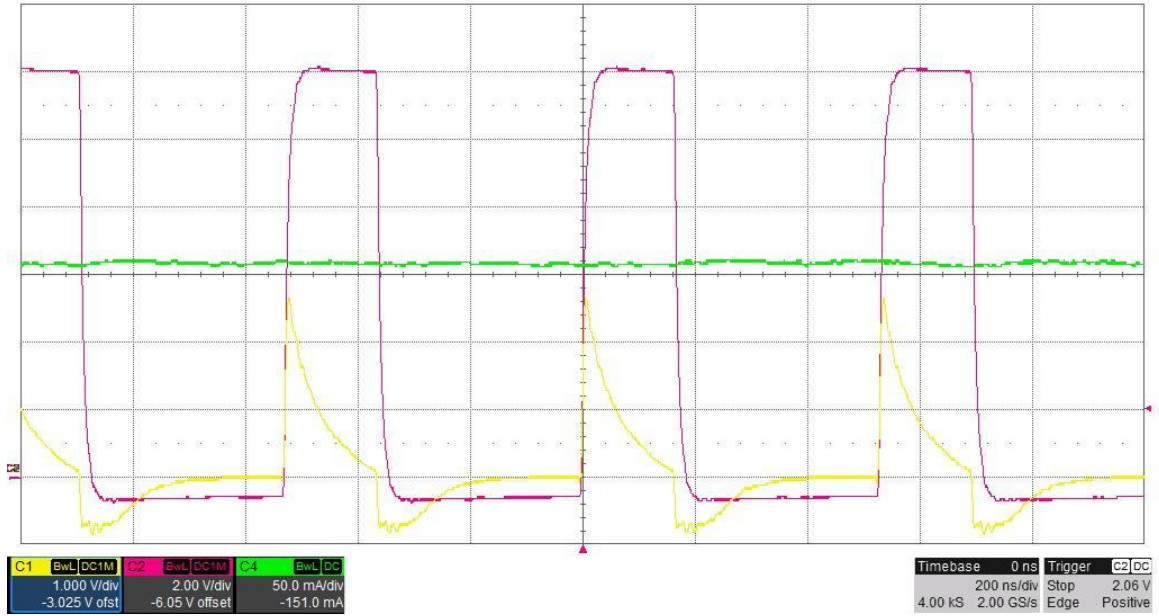
7   Loop Gain

The plot below shows the **3.3VSW** loop gain for 12Vin and load of 2.5A.

Loop Gain (Vin = 12V)   BW: 76.2KHz   PM: 52 degrees

The plot below shows the **LMR14030 5V USB** loop gain for 12Vin and load of 2.1A. R33 opened.

Loop Gain (Vin = 12V)   BW: 52.2KHz   PM: 58 degrees
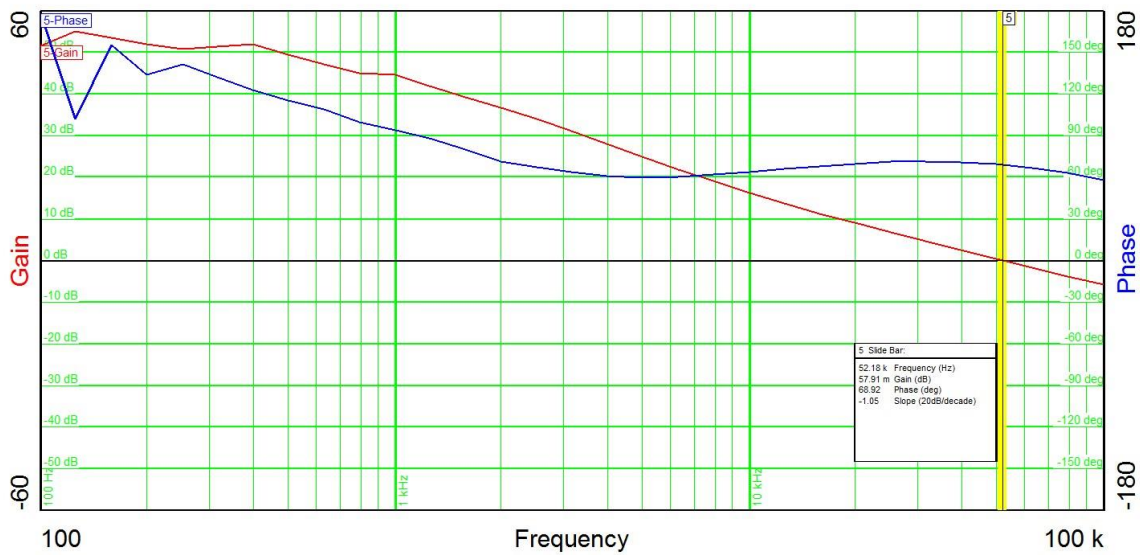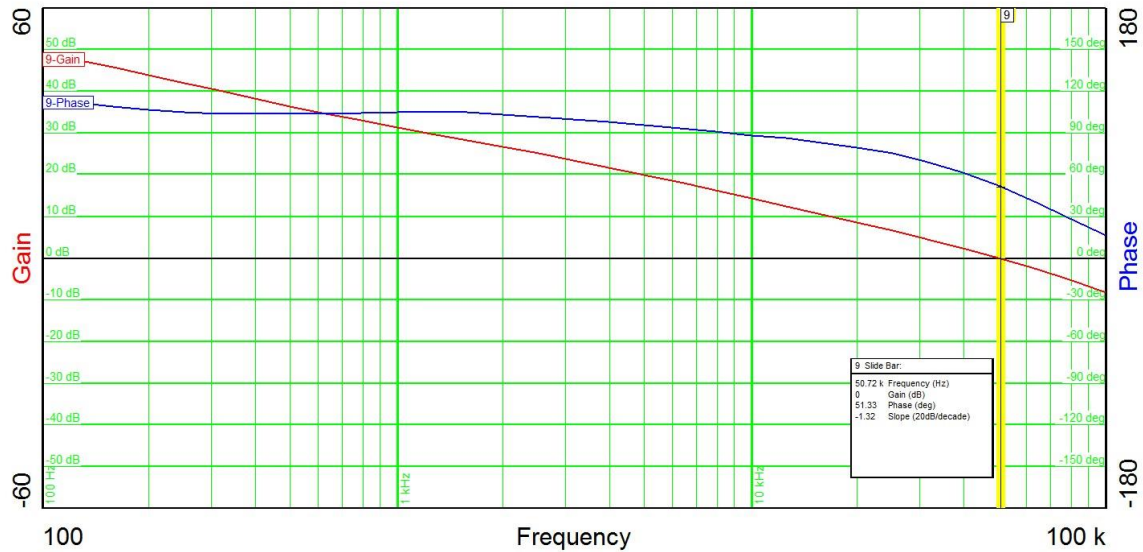

The plot below shows the **LMR14030 5V USB** loop gain for 12Vin and load of 2.1A. R33 installed.

Loop Gain (Vin = 12V)   BW: 47.2KHz   PM: 69 degrees
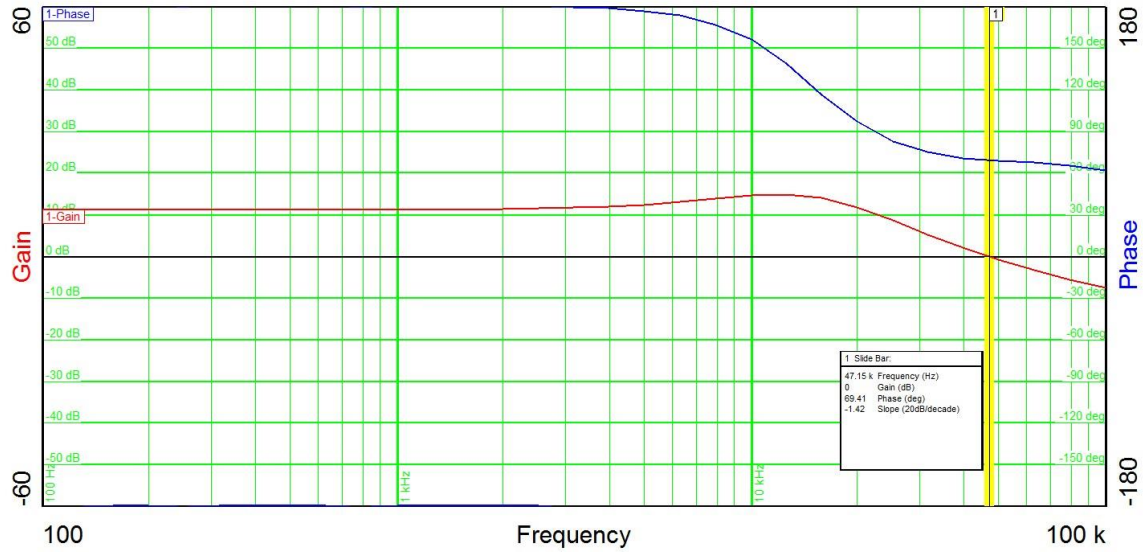
The plot below shows the **TPS57140 5V USB** loop gain for 12Vin and load of 1A. R48 opened.

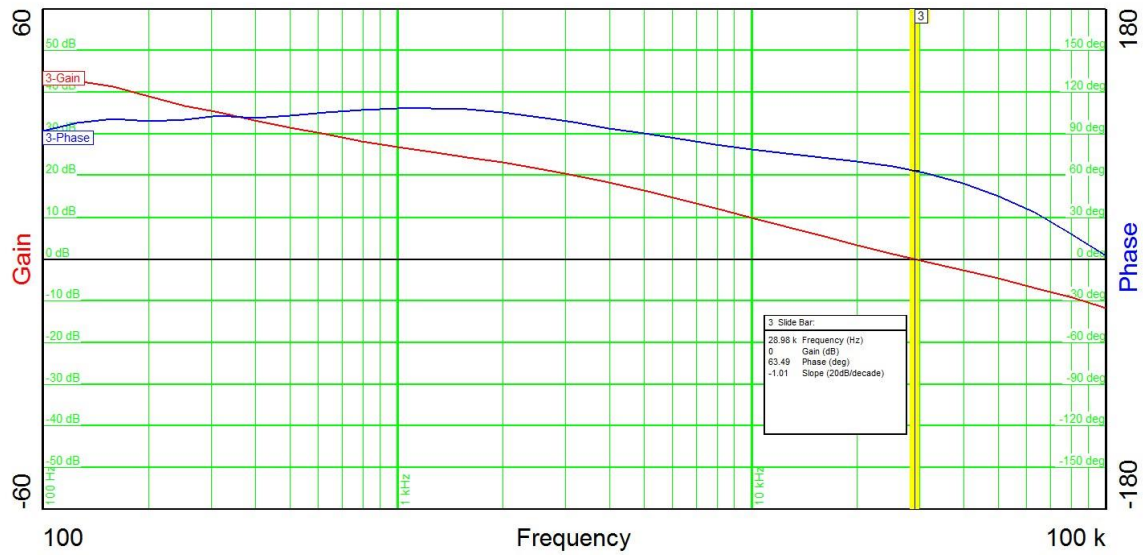Loop Gain (Vin = 12V)   BW: 50.7KHz   PM: 51 degrees

The plot below shows the **TPS57140 5V USB** loop gain for 12Vin and load of 1A. R48 installed.

Loop Gain (Vin = 12V)   BW: 48.2KHz   PM: 59 degrees
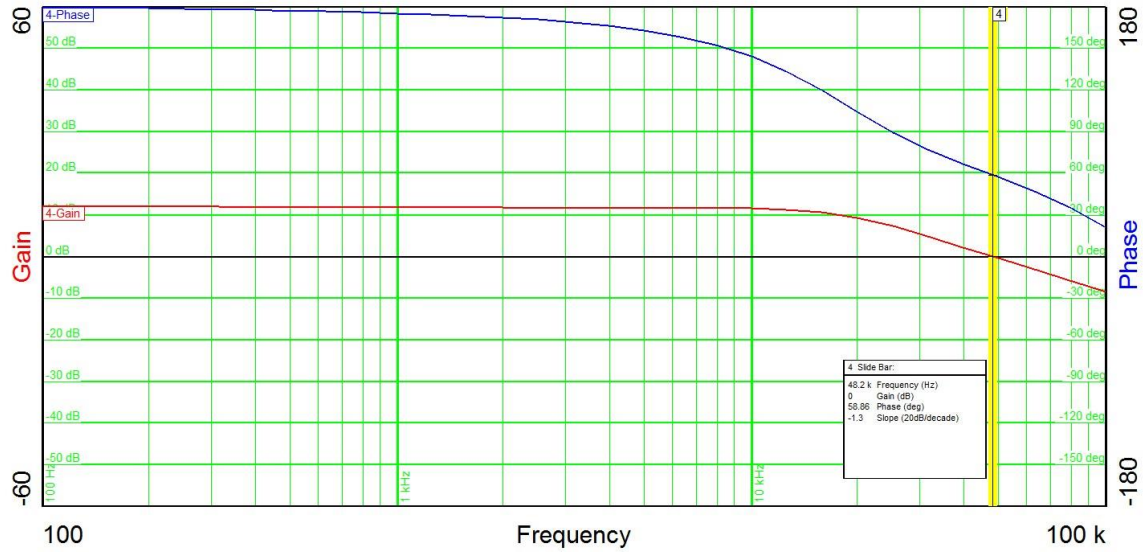
The plot below shows the **TPS61175 LED Driver** loop gain for 12Vin and a 3 white LED load (0.163A).

Loop Gain (Vin = 12V)   BW: 29.0KHz   PM: 63 degrees

TEXAS
INSTRUMENTS

8 MISC Waveforms

The photo below shows the **12V ANT** output voltage during an overload. The 12V ANT load current is ramped up from 0A to 150mA. The **12V ANT SHORT** signal trips at 78mA.
12V ANT (Yellow), 12V ANT SHORT signal (Red), 12V ANT current (Green)
(2V/DIV, 50mA/DIV, 200uS/DIV)

Power Management Solutions
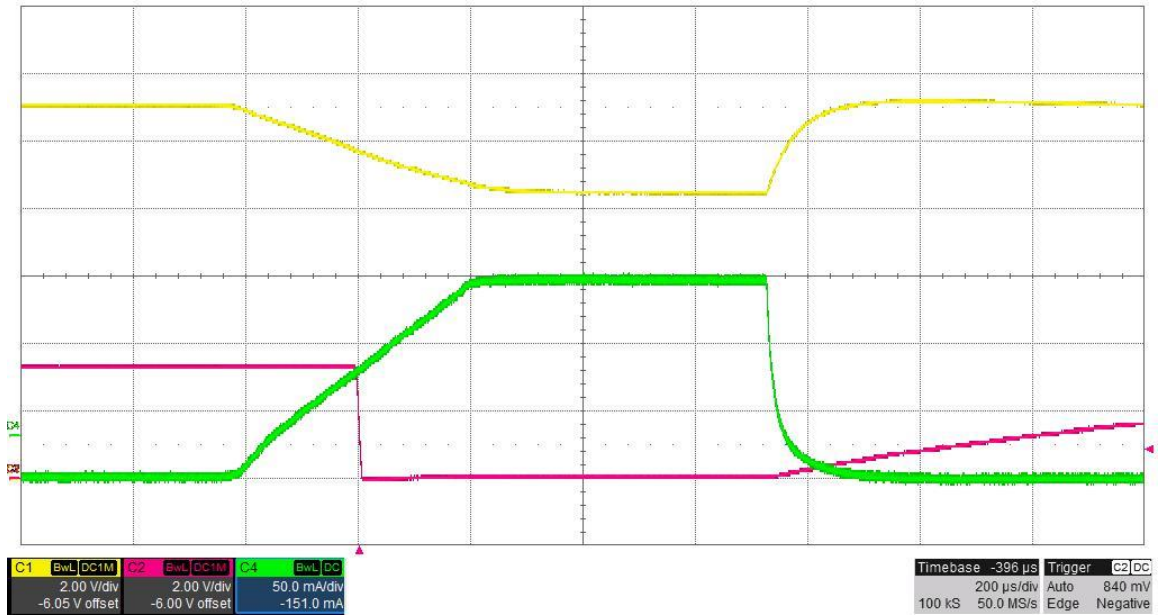
9 Photo

The photo below shows the PMP11136 REVB assy.
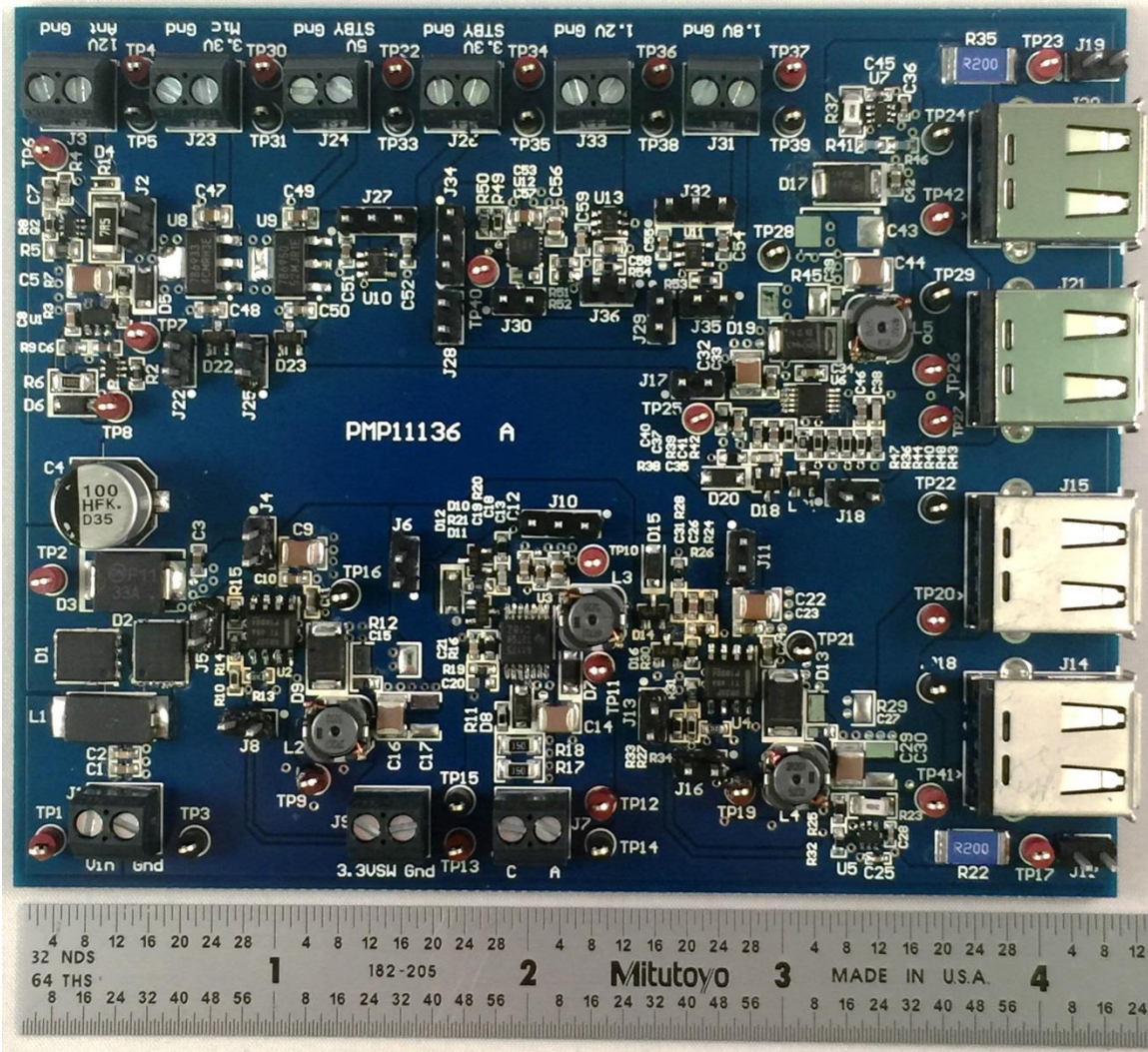
10 Thermal Image

A thermal image is shown below operating at 12V input and room temp with no airflow. The outputs are loaded to:

3.3VSW @ 1.5A
3X White LED @ 0.163A (~10.5V)
12V ANT @ 48mA (10.56V out, 220 ohms)
5V USB @ 2.25A (5.46V out)
5V USB @ 1A (5.14V out)
3.3V MIC @ 48mA (3.29V, 68.1 ohm)
5V STBY @ 93mA (5.01V, 53.6 ohm)
3.3V STBY @ 48mA (3.29V, 68.1 ohm)
1.2V @ 0.7A
1.8V @ 0.123A (1.802, 14.6 ohm)

Power Management Solutions
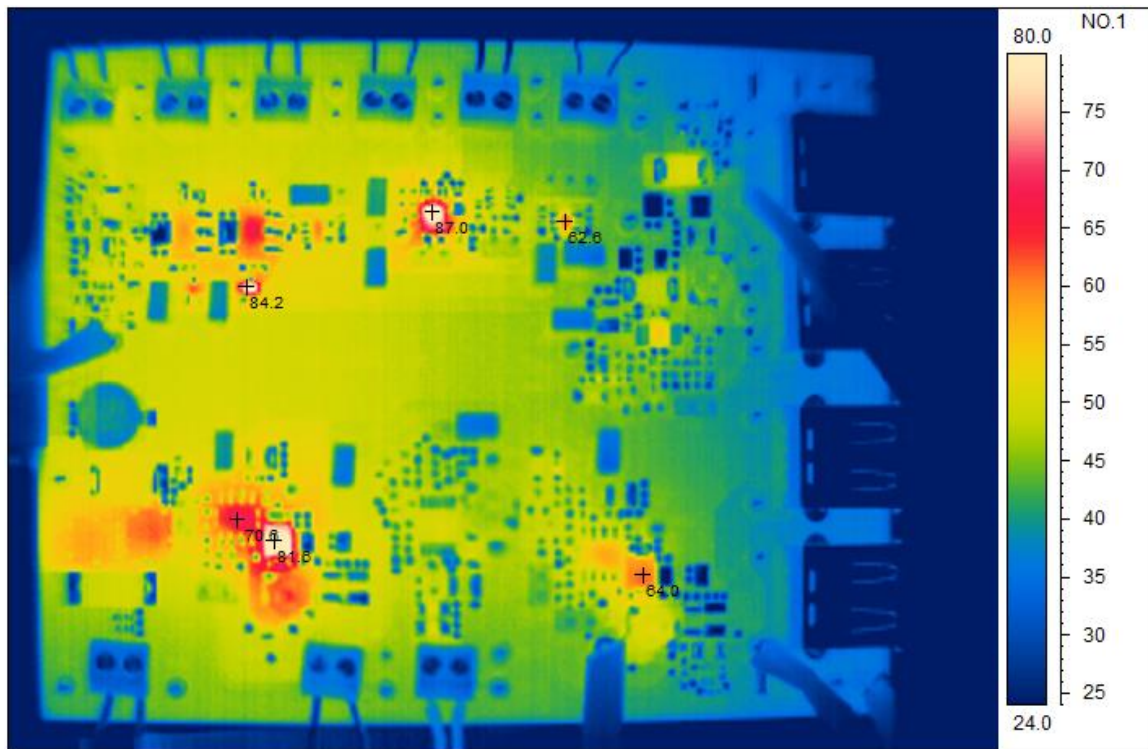
IMPORTANT NOTICE AND DISCLAIMER