PMP8730RevB Test Results

Topology: LED Boost
Device: TPS40210, for reuse go for TPS40211 and set sense resistor to 1.3 Ohm
                (here TPS40210 on customers demand)

Unless otherwise mentioned, the measurements were done with synchronization to Fsw 348kHz and the load was resistive 150Ohm, resulted in Vout 30V.
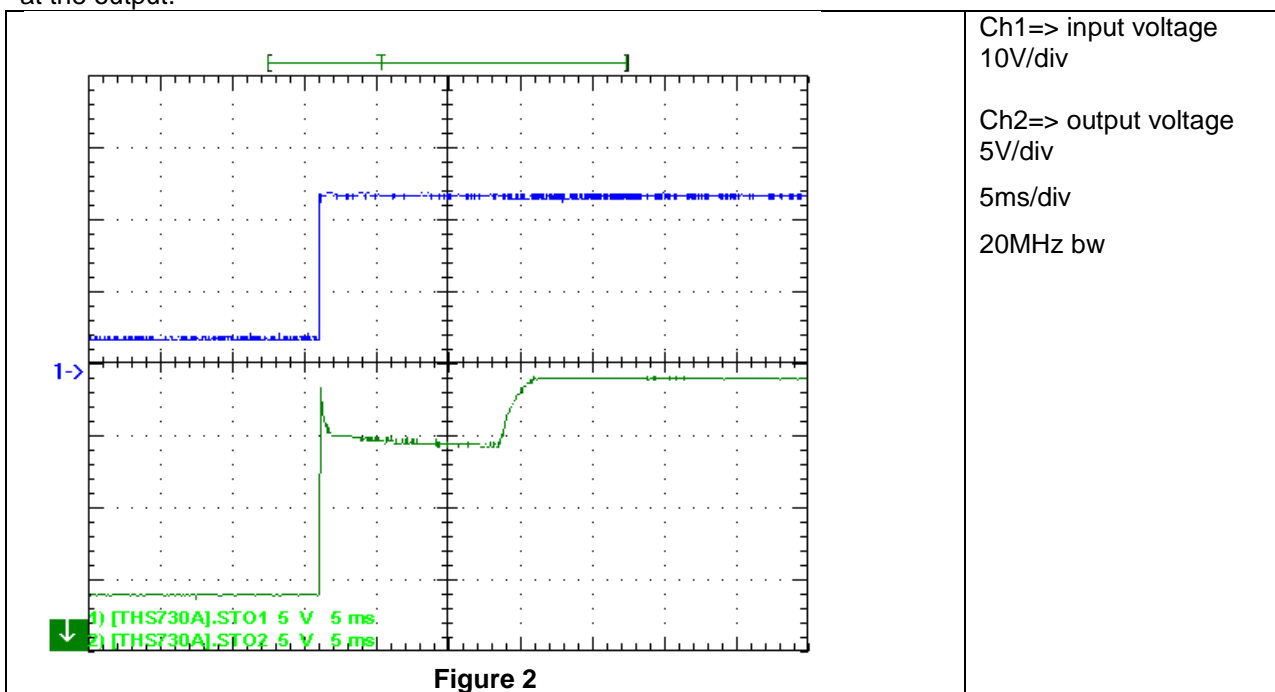
For crosschecking LED array was used, resulted in Vout approx. 20V

PMP8730RevB Test Results

TEXAS INSTRUMENTS

1   Startup

The startup waveform is shown in the Figure 1. The input voltage was set at 12V, with resistive load (150Ohms) at the output.

Ch1=> input voltage 5V/div

Ch2=> output voltage 10V/div

5ms/div

20MHz bw
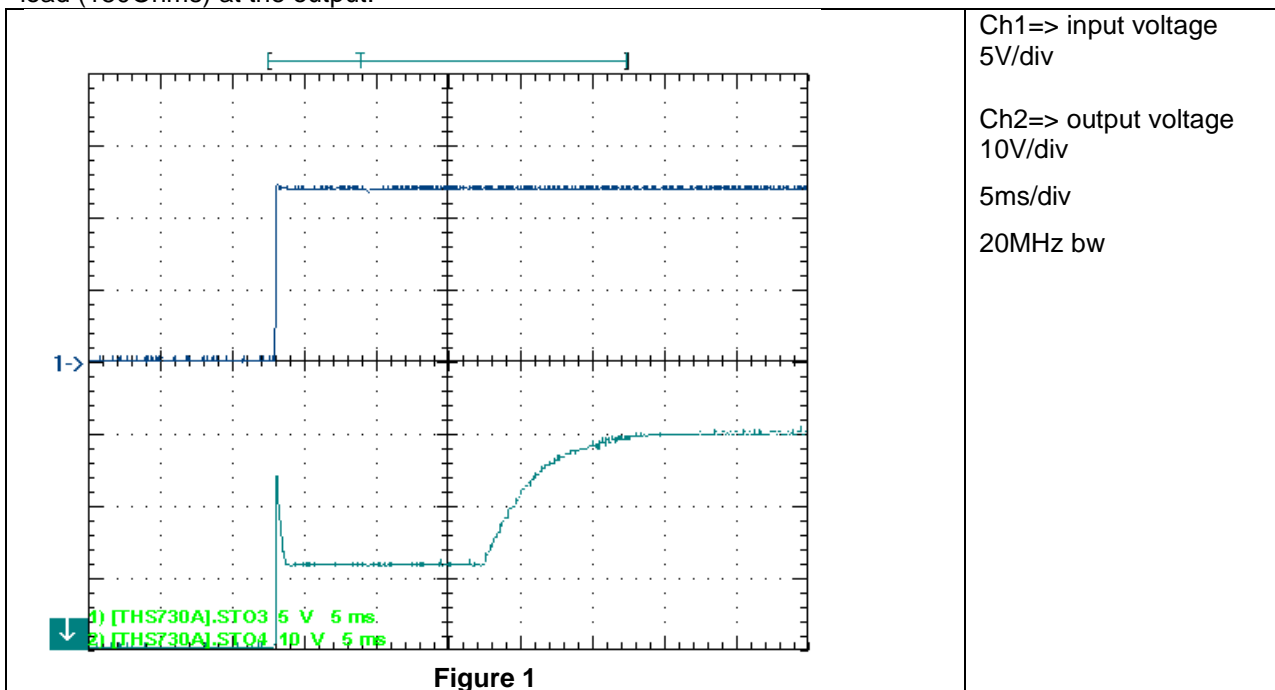
Figure 1

The startup waveform is shown in the Figure 2. The input voltage was set at 12V, with LED load at the output.

Ch1=> input voltage 10V/div

Ch2=> output voltage 5V/div

5ms/div

20MHz bw

Figure 2

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2 Shutdown

The shutdown waveform is shown in the Figure 3. The input voltage was set at 12V, with resistive load on the output. One input cable was disconnected.
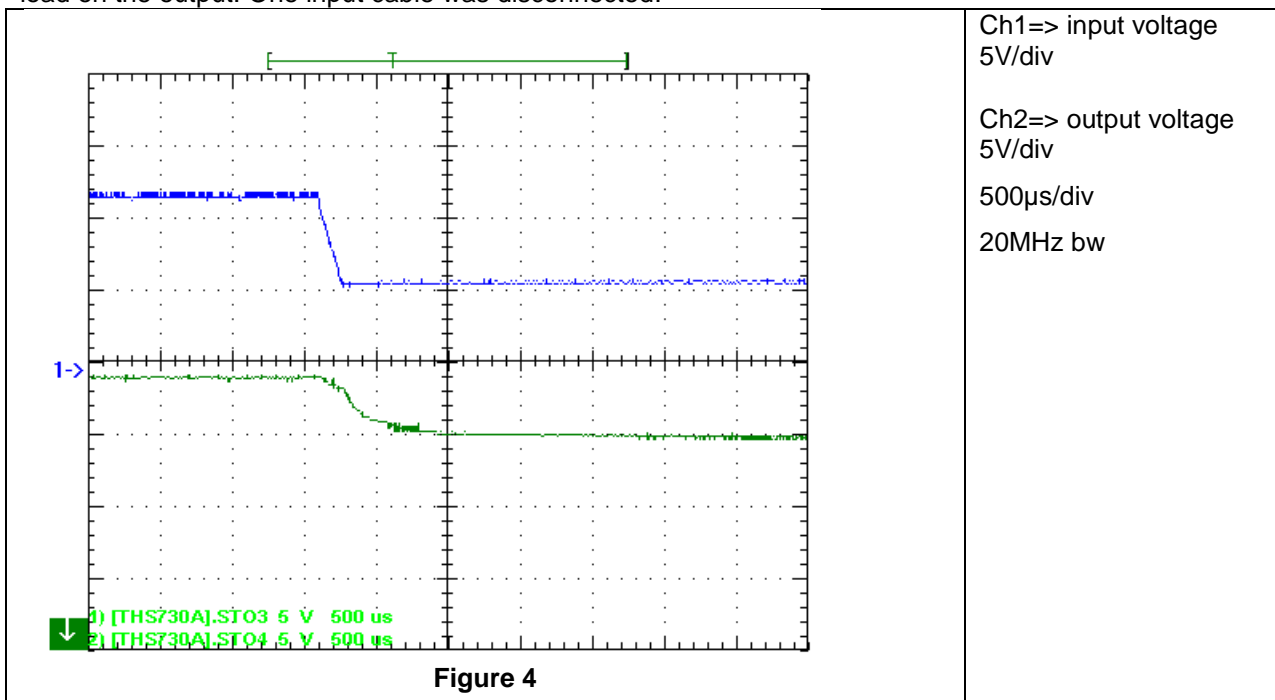

Ch1=> input voltage 5V/div

Ch2=> output voltage 10V/div

200µs/div

20MHz bw
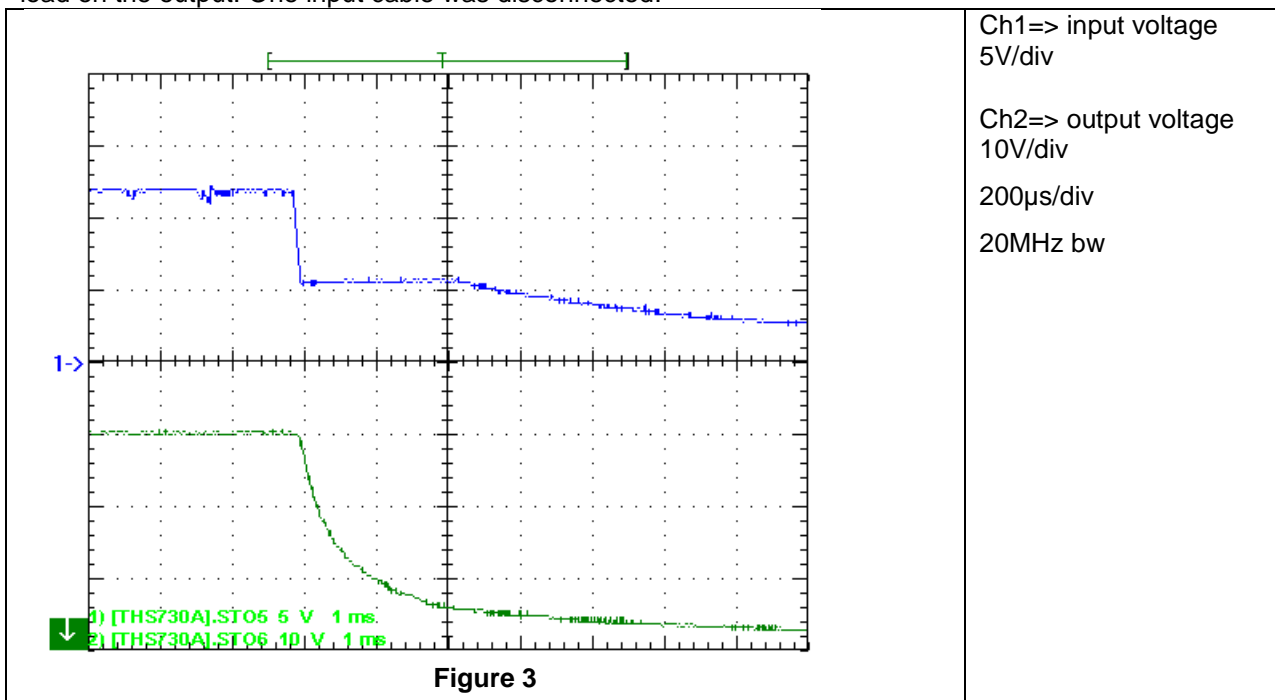
Figure 3

The shutdown waveform is shown in the Figure 4. The input voltage was set at 12V, with LED load on the output. One input cable was disconnected.

Ch1=> input voltage 5V/div

Ch2=> output voltage 5V/div
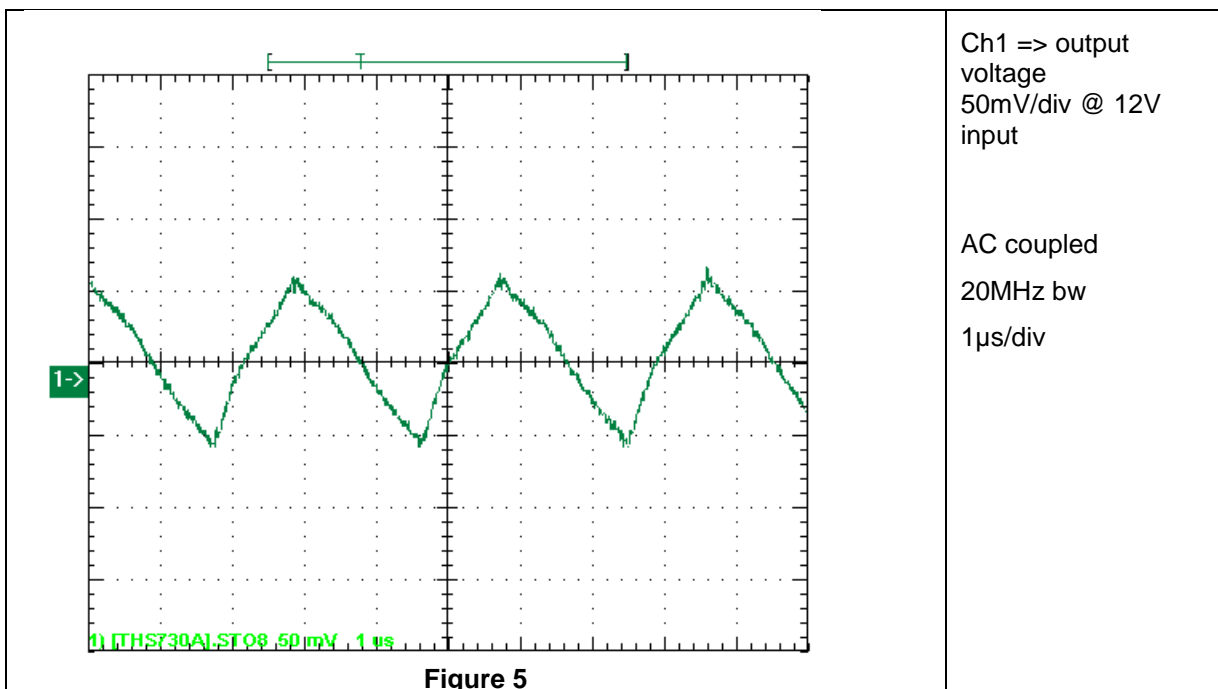
500µs/div

20MHz bw

Figure 4

3 Efficiency

The efficiencies are shown in the table below. The input voltage was set to 6V, 12V and 18V. Also measurements with and without synchronization were done.

sync R-load						
Vin	*Iin*	*Vout*	*Iout*	*Pin*	*Pout*	***Effcy***
6.40	1.0988	30.618	0.2000	7.03	6.12	87.07%
12.01	0.5417	30.348	0.1986	6.50	6.03	92.67%
18.00	0.3624	30.492	0.1992	6.52	6.07	93.12%
free running R-load						
Vin	*Iin*	*Vout*	*Iout*	*Pin*	*Pout*	***Effcy***
6.40	1.0958	30.622	0.2000	7.01	6.13	87.33%
12.00	0.5417	30.359	0.1987	6.50	6.03	92.78%
18.00	0.3623	30.507	0.1992	6.52	6.08	93.20%
sync LED						
Vin	*Iin*	*Vout*	*Iout*	*Pin*	*Pout*	***Effcy***
12.00	0.3449	19.064	0.1985	4.14	3.78	91.40%
free-running LED						
Vin	*Iin*	*Vout*	*Iout*	*Pin*	*Pout*	***Effcy***
12.01	0.3446	19.061	0.1987	4.14	3.79	91.55%

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4 Output Ripple Voltage

The output ripple voltage is shown in Figure 5, here around 120mVpp.

Ch1 => output voltage
50mV/div @ 12V input

AC coupled

20MHz bw

1µs/div

Figure 5

5 Input Ripple Voltage

The output ripple voltage is shown in Figure 6, here 20mVpp.

Ch1 => input voltage@12Vin
50mV/div

AC coupled

20MHz bw

1µs/div

Figure 6

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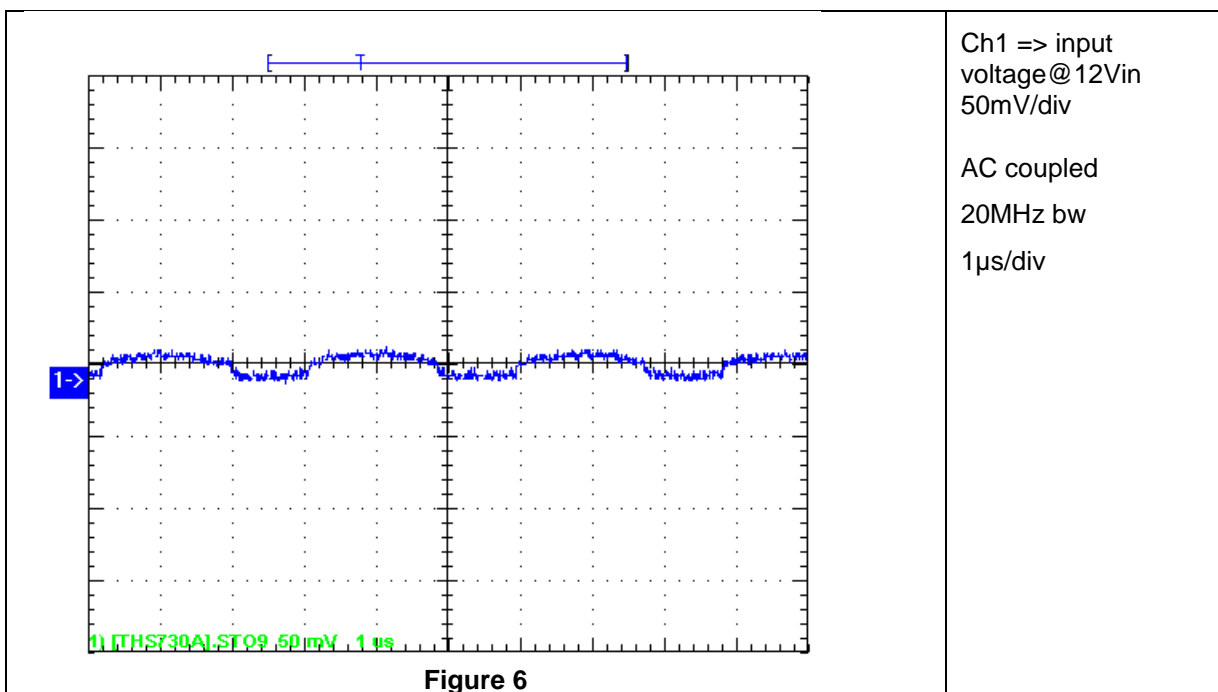
6 Control Loop Frequency Response

Figure 7 shows the loop response. 150Ohm-resistor were connected. The input voltage was set to 6V.(not synchronized), RHPZ around 10kHz (duty cycle 80%)
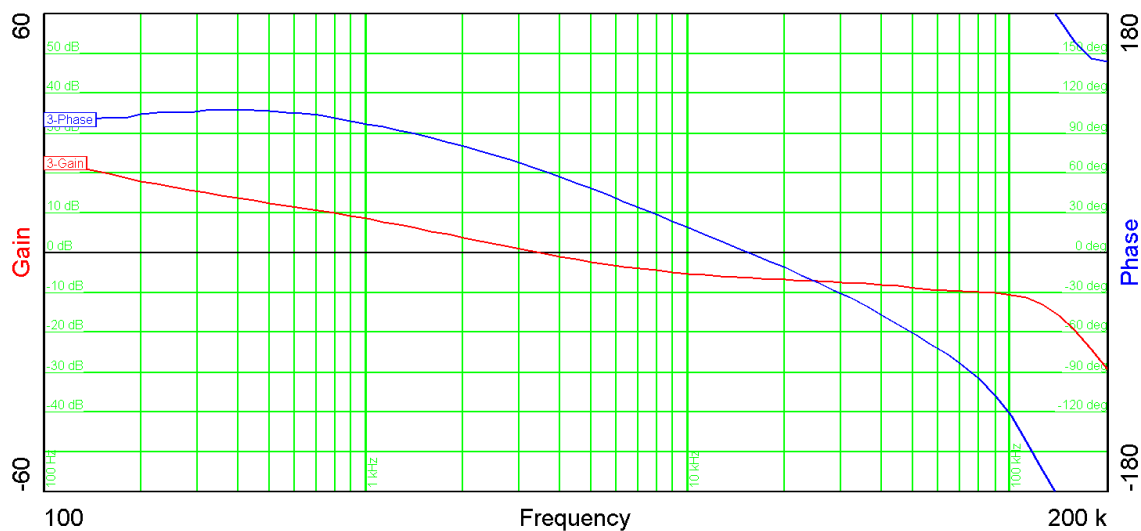

Figure 7

Figure 8 shows the loop response. 150Ohm-resistor were connected. The input voltage was set to 12V. (not synchronized)
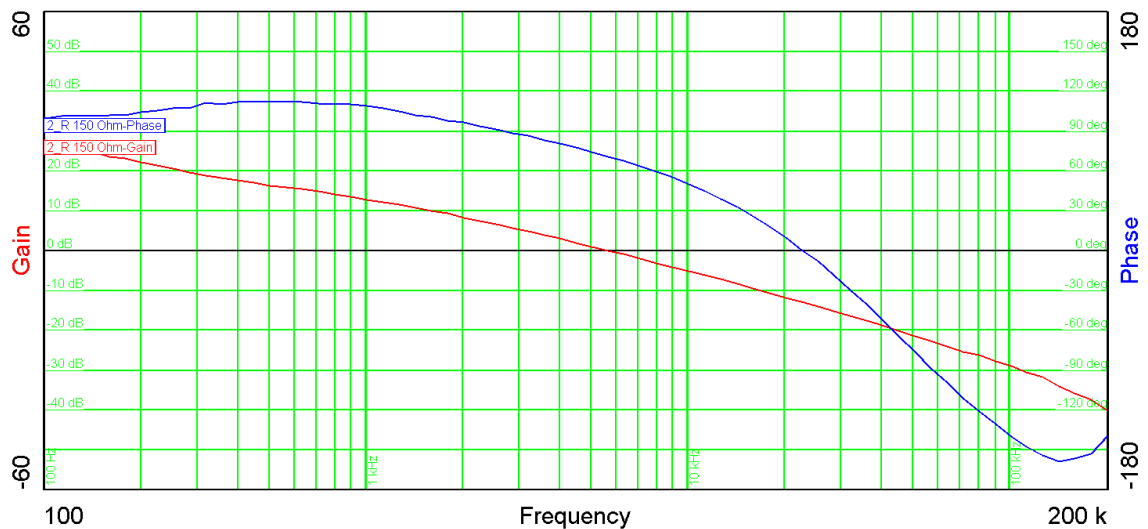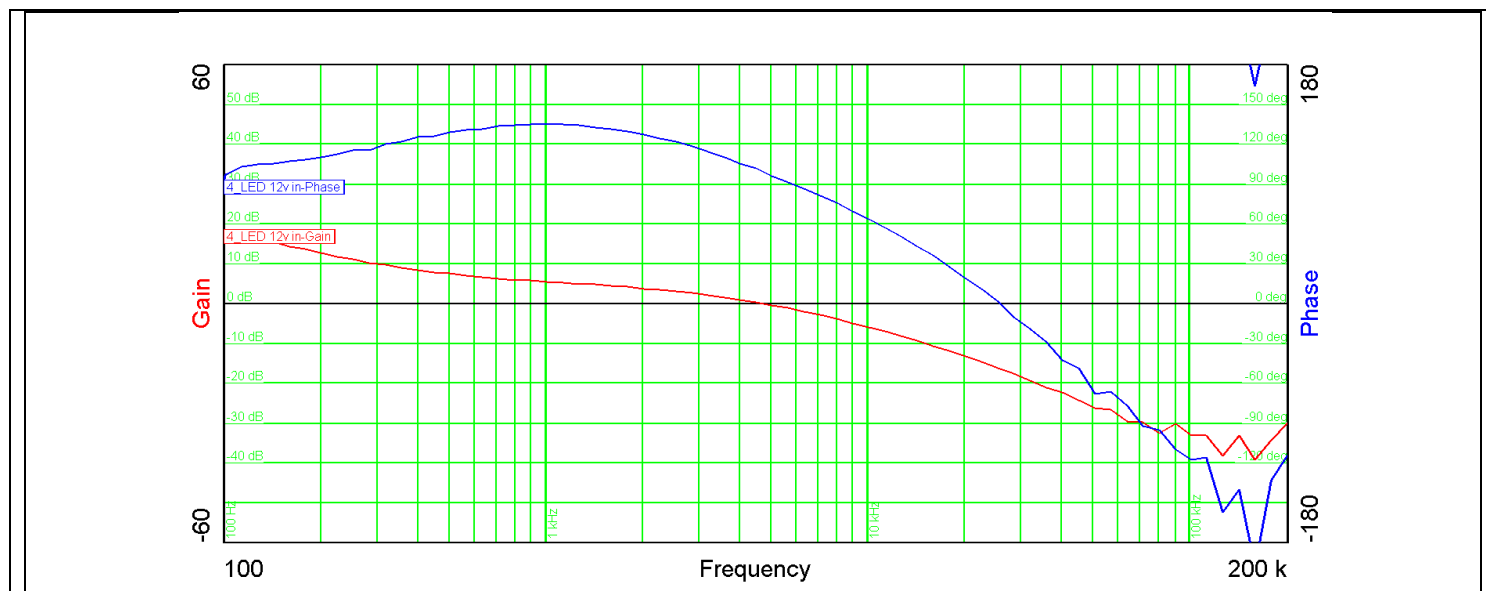

Figure 8

Figure 9 shows the loop response. LED was connected as nonlinear load. The input voltage was set to 12V.

Figure 9

Table 1 summarizes the results from Figure 7 Figure 8 and Figure 9.

Vin	6V	12V	12V LED
Bandwidth (kHz)	3.43	5.63	4.76
Phase margin	63°	71	99
slope (20dB/decade)	-0.74	-1.03	-0.73
gain margin (dB)	-6.35	-13	-16.4
slope (20dB/decade)	-0.23	-1.16	-1.55
freq (kHz)	15.4	22.8	25.7

Table 1

7 Miscellaneous Waveforms

7.1 150R Load

The waveform of the voltage on Q1 (Drain-Source) is shown in Figure 10. Input voltage was set to 12V and 150Ohm as load.

Figure 10

PMP8730RevB Test Results
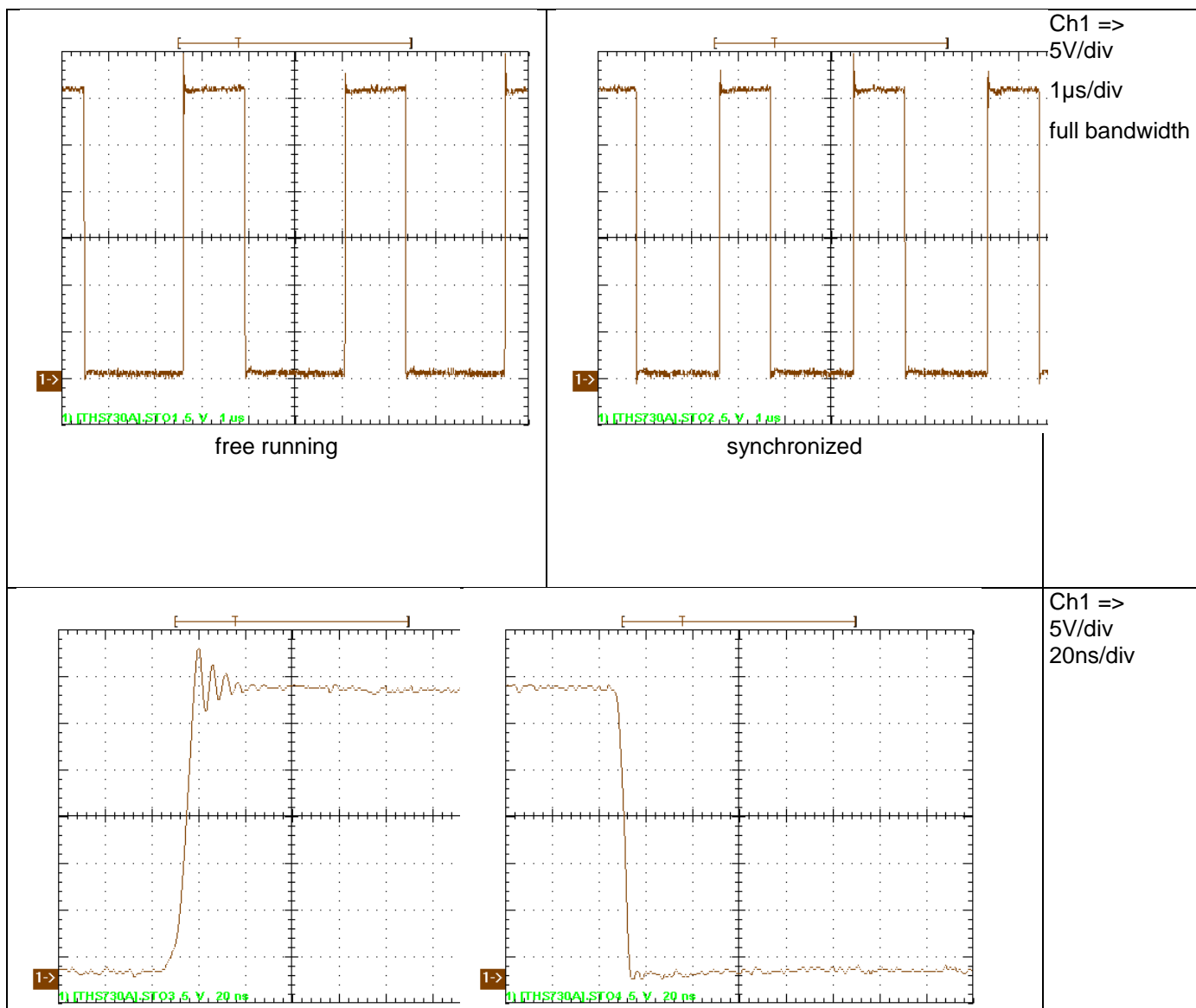
The waveform of the voltage on the gate to source is shown in Figure 11. Input voltage was set to 12V and 150Ohm as load.
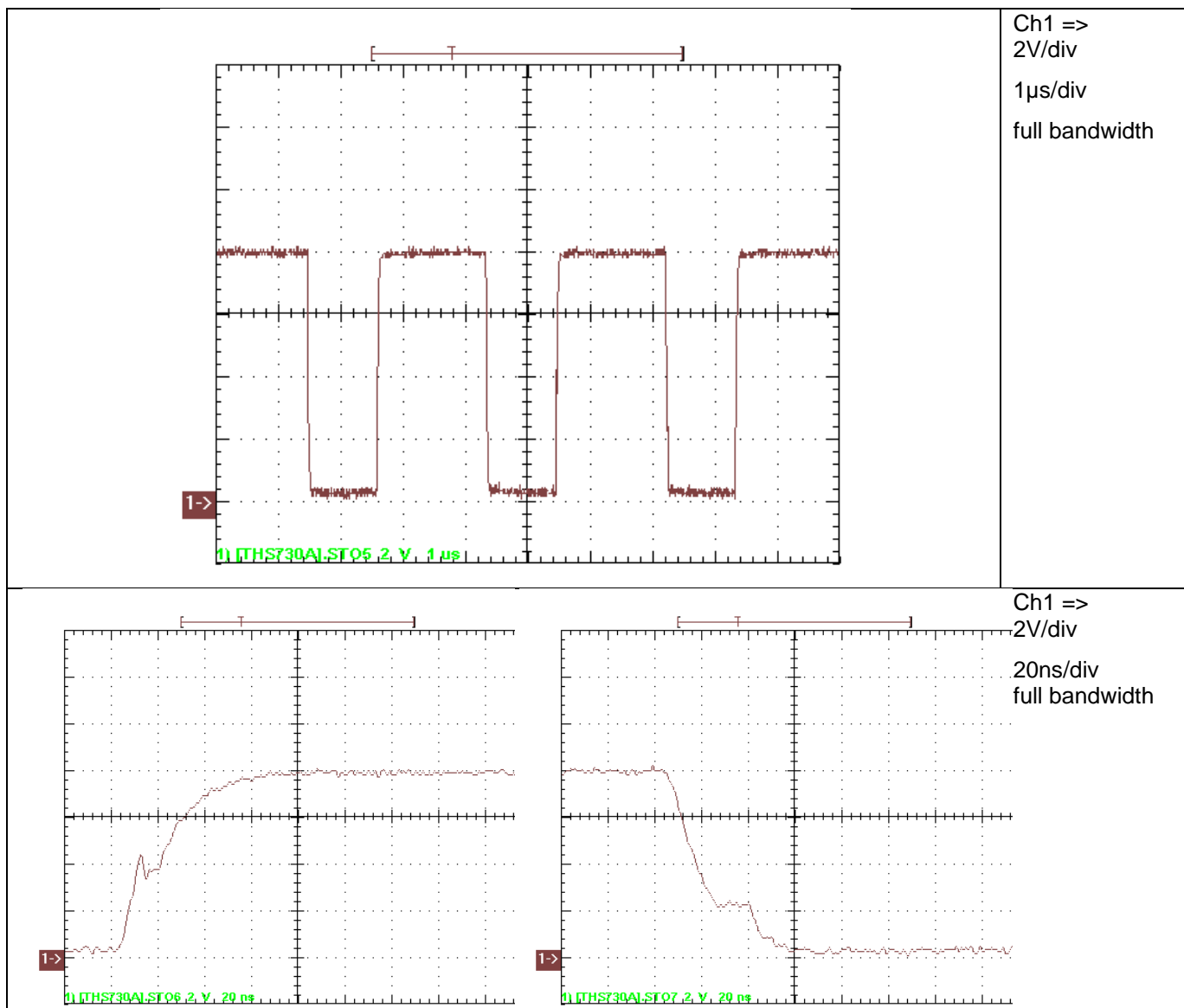

Figure 11

The waveform of the voltage on diode (referenced to Vout) is shown in Figure 12. Input voltage was set to 12V and 150Ohm as load.

Ch1 =>
5V/div

1µs/div

full bandwidth

Ch1 =>
5V/div

20ns/div
full bandwidth
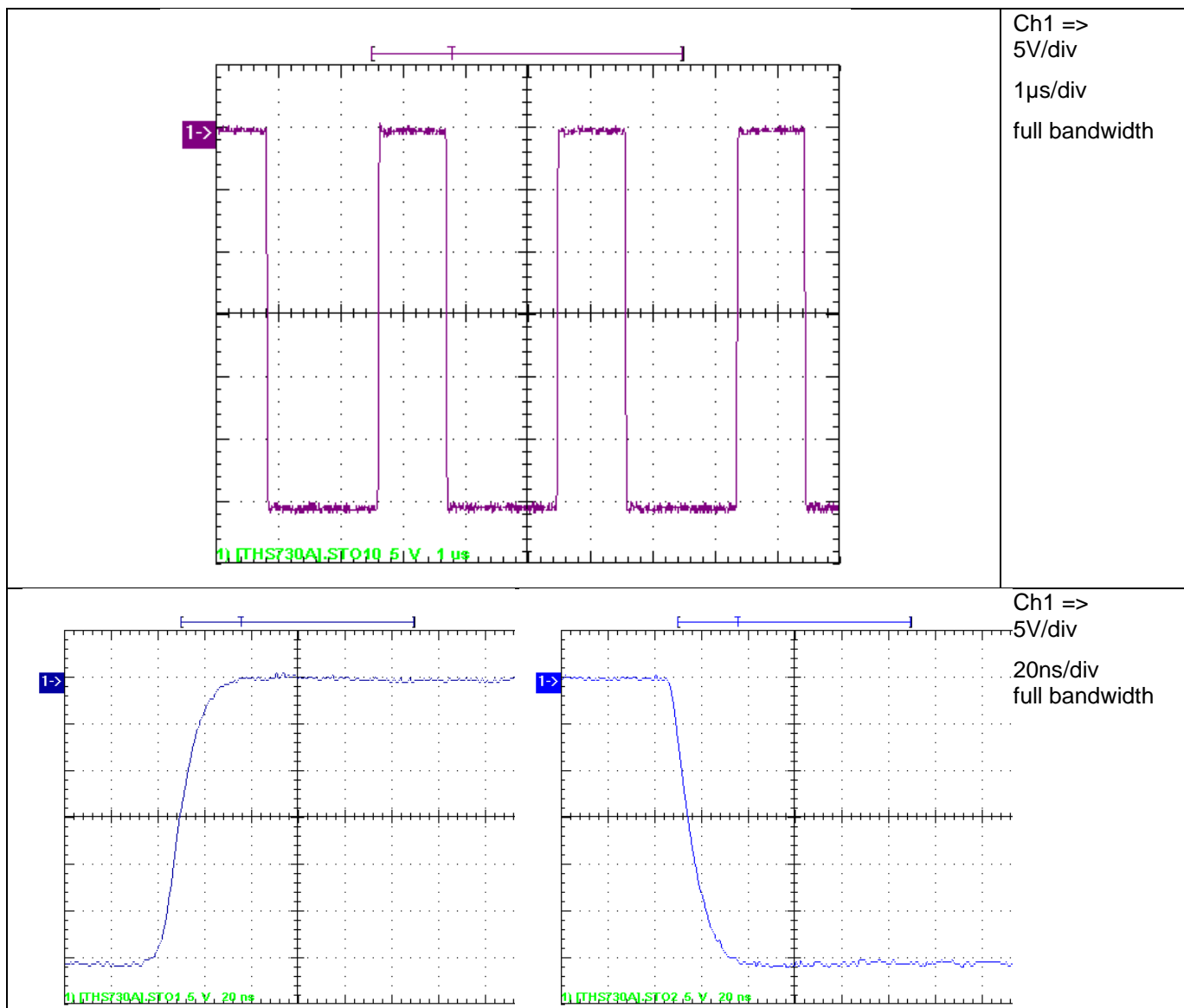
Figure 12

PMP8730RevB Test Results

TEXAS INSTRUMENTS

7.2 LED Load

The waveform of the voltage on Q1 (Drain-Source) is shown in Figure 13. Input voltage was set to 12V and LED-load

Ch1 =>
5V/div

1µs/div

full
bandwidth

free running

synchronized

Ch1 =>
5V/div
20ns/div

Figure 13

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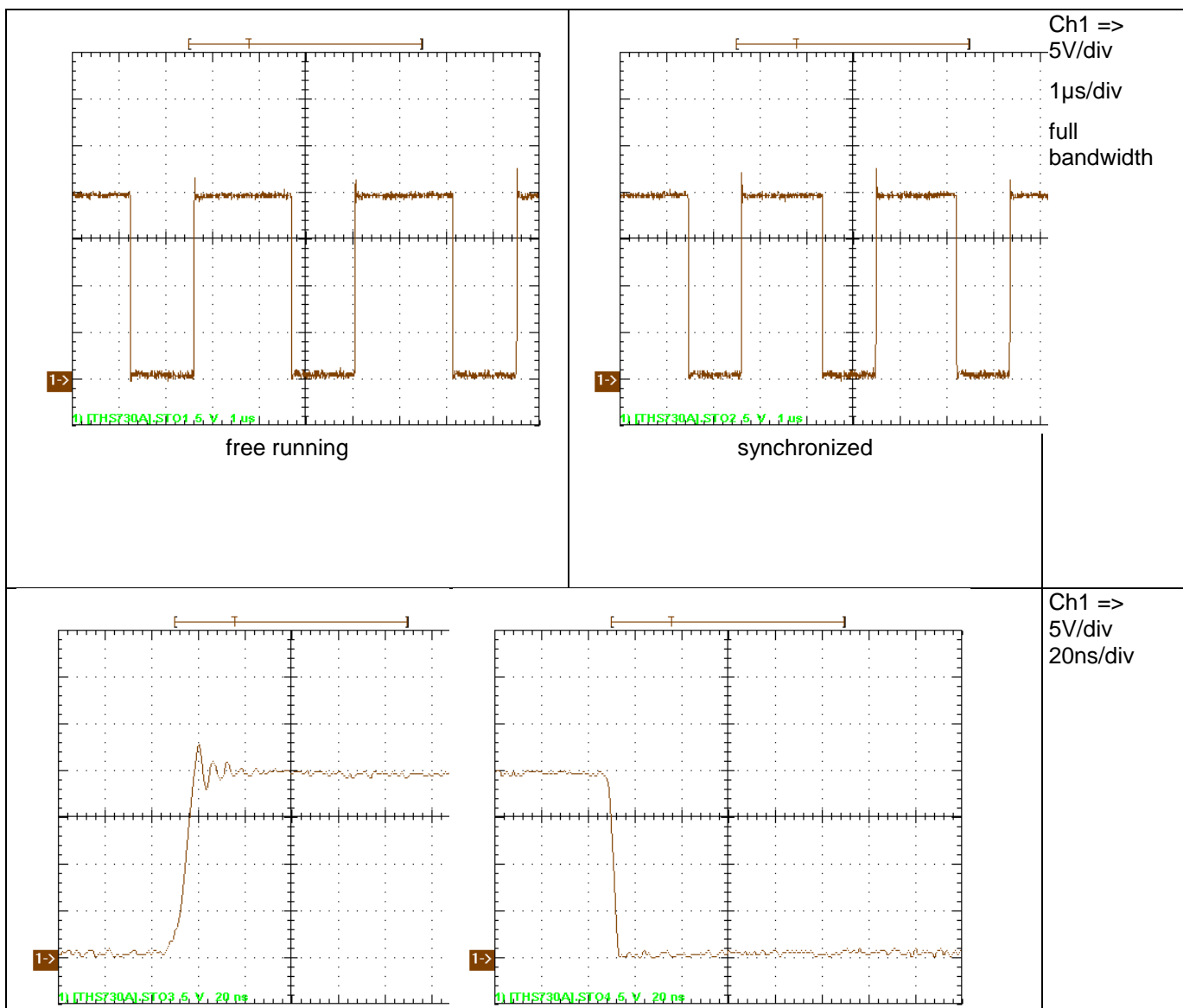
The waveform of the voltage on the gate to source is shown in Figure 14. Input voltage was set to 12V and LED-load.

Ch1 =>
2V/div

1µs/div

full bandwidth

Ch1 =>
2V/div

20ns/div
full bandwidth

Figure 14

8   Thermal Image

Figure 15 shows the thermal image at 12V input voltage and 150R output (30V)
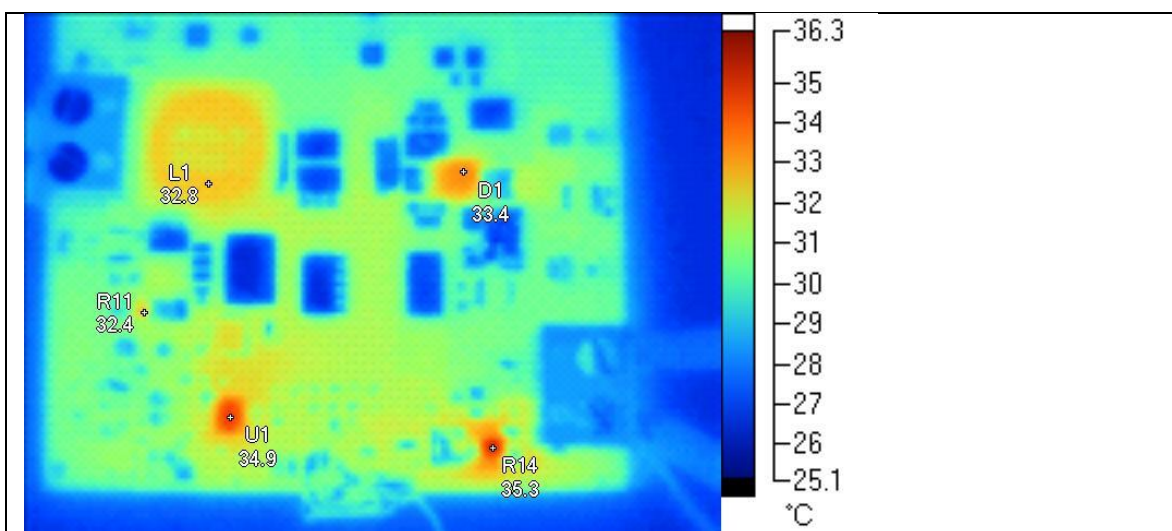
Figure 15

Name	Temperature
R14	35.3°C
D1	33.4°C
U1	34.9°C
R11	32.4°C
L1	32.8°C

Figure 16 shows the thermal image at 6.2V input voltage and 150R output (30V).
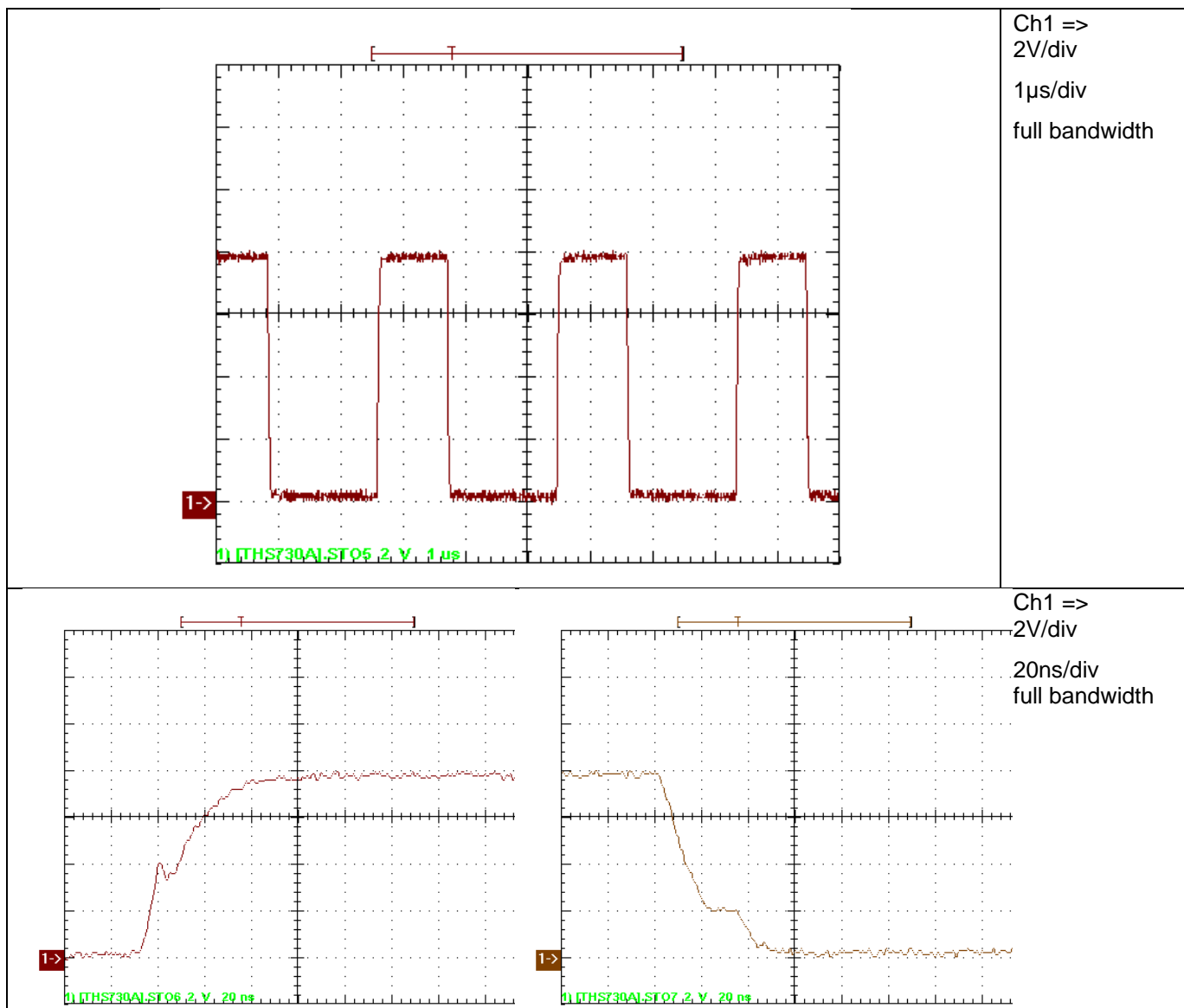
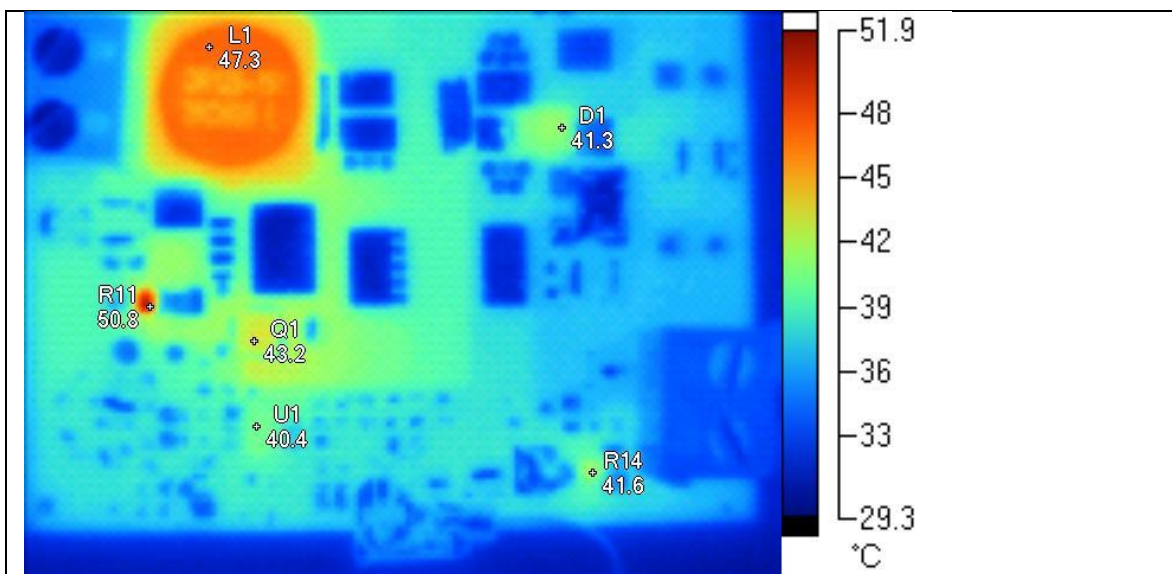The design itself is fine for continuous operation at 6V input, so max. boost factor.

Figure 16

Name	Temperature
R11	50.8°C
R14	41.6°C
D1	41.3°C
L1	47.3°C
Q1	43.2°C
U1	40.4°C

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