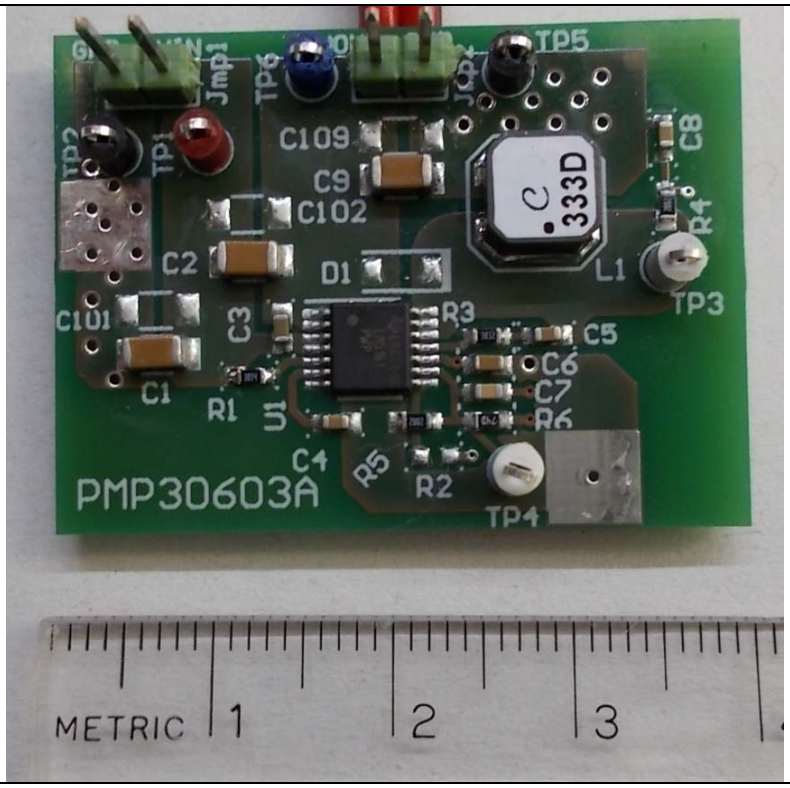
Test Report: PMP30603
-60 V Inverting buck-boost reference design

Description

This tiny reference design delivers -60 V output voltage from an input voltage around 5V typically generated by an automotive pre regulator. The controller in that circuit is LM5161-Q1 providing two internal MosFETs.
In general this converter is used as auxiliary supply for LiDAR applications. Due to duty cycle limitations some controllers are limited inverting 5V input to -60V output – PMP30602 and PMP30603 are offering cost effective solution to do so.
Features PMP30603:

- Small board space 35mm x 30mm, two layers, single side assembly
- Internal FETs providing synchronous rectification
- Capability to drive up to 40mA peak for pulsed applications
- Temperature rise less than +30K at full load
- Load regulation 30mV means only 0.05% output voltage deviation
- No switch node ringing results in low radiated emissions
- Output voltage ripple only around 100mVpp to supply sensitive load



1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
Input Voltage Range	4.5 V to 5.5 V
Output Voltage	-60 V
Maximum Output Current	20 mA

1.2 Considerations

The switching frequency is around 208 kHz.
Unless otherwise mentioned, all measurements were done with 5 V input voltage and 20 mA.
The circuit starts with switching with 4.5 V.
Resistors were used as load.

2 Testing and Results

2.1 Efficiency Graphs

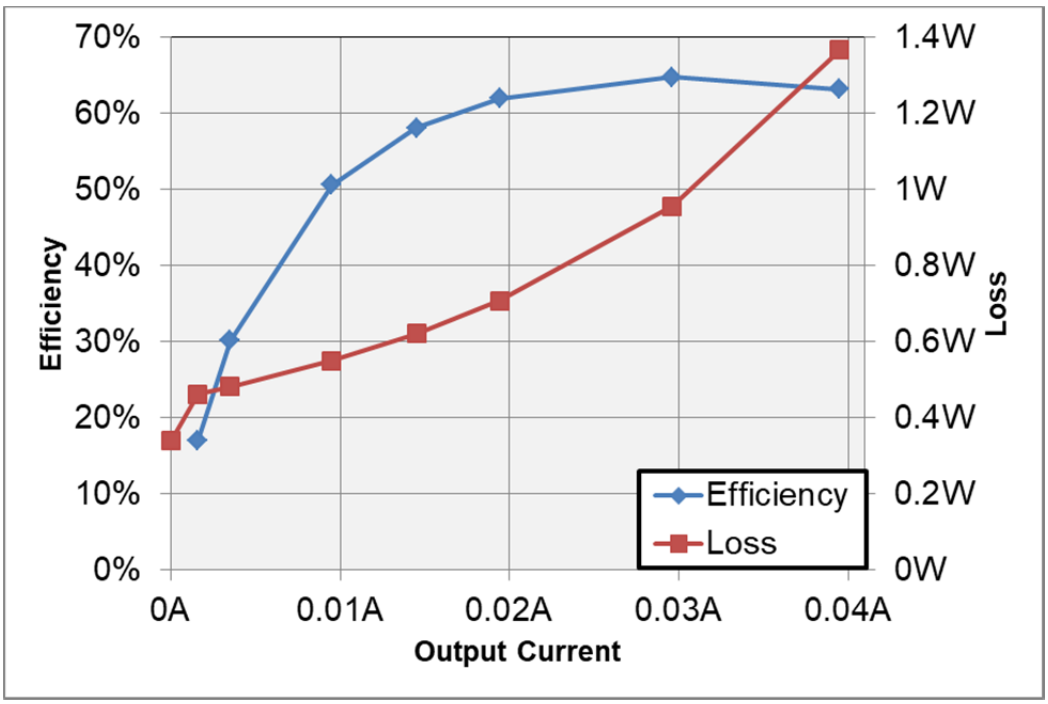


Figure 1 Efficiency and Loss vs Output Current

2.2 Load Regulation

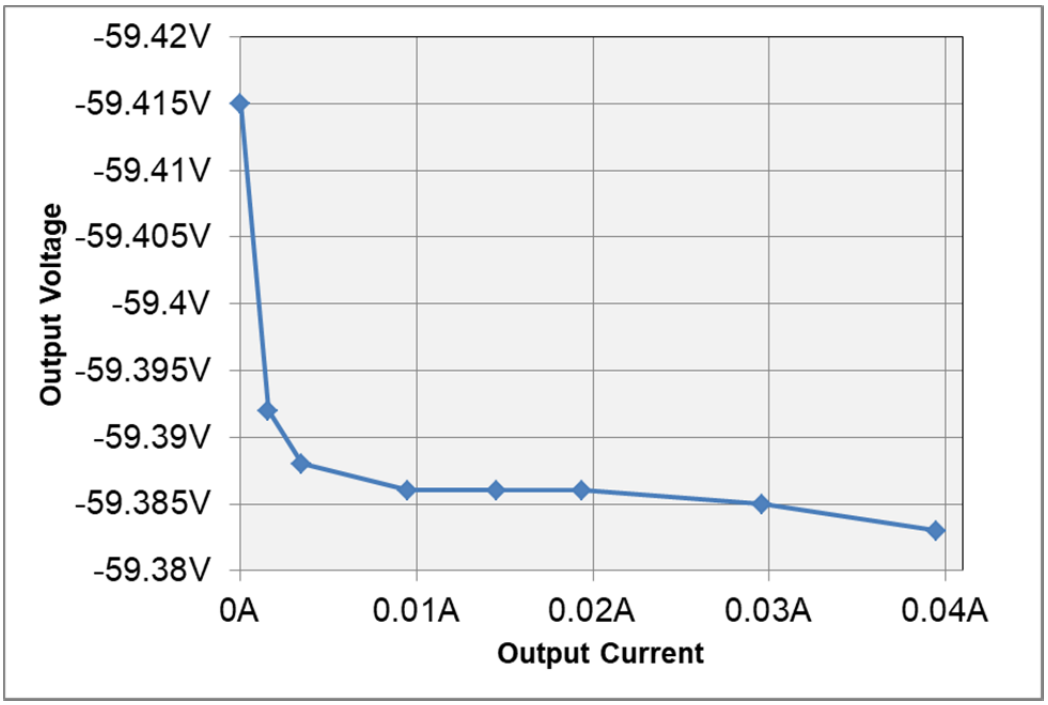


Figure 2 Output Voltage vs Output Current

2.3 Thermal Images

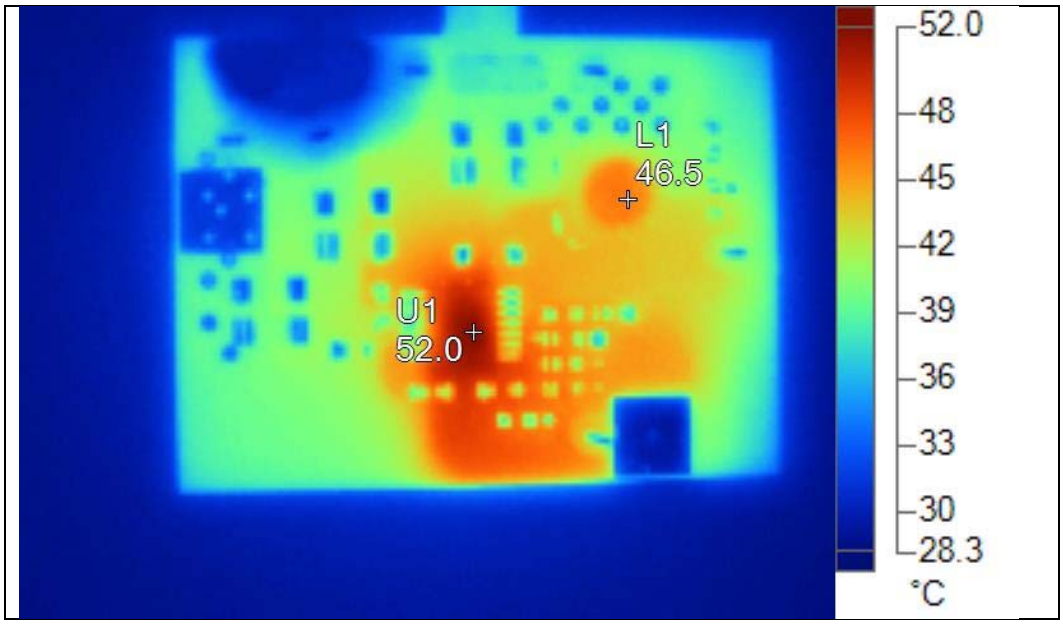


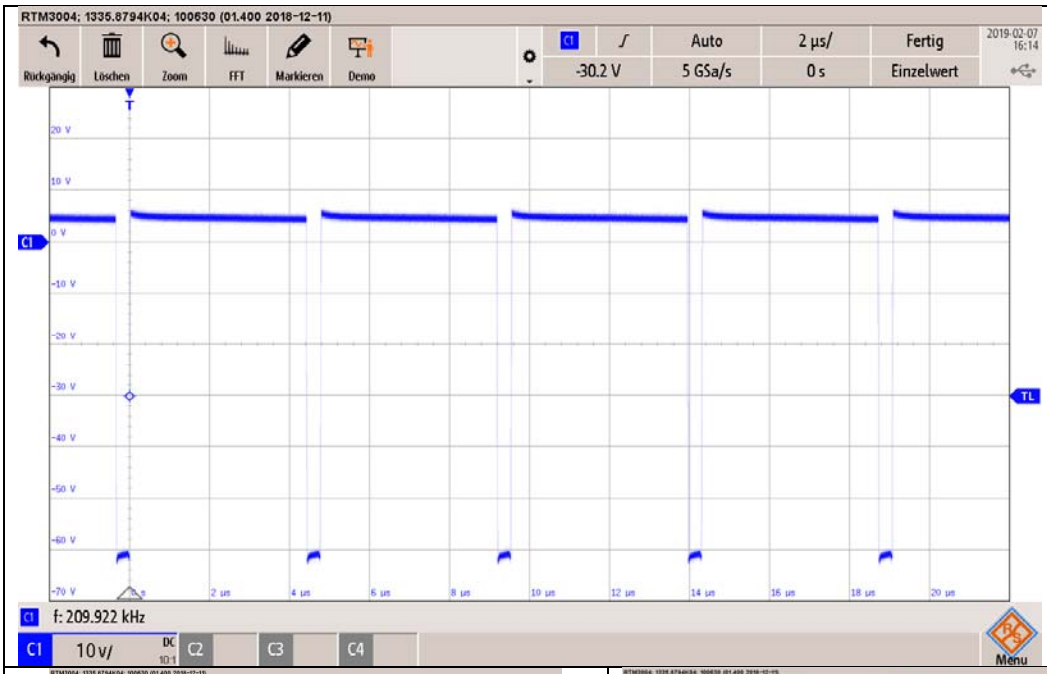
Figure 3 thermal IR-Foto

Name	Temperature
L1	46.5°C
U1	52.0°C

3 Waveforms

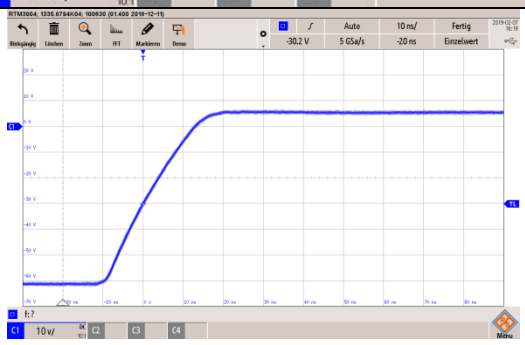
3.1 Switching

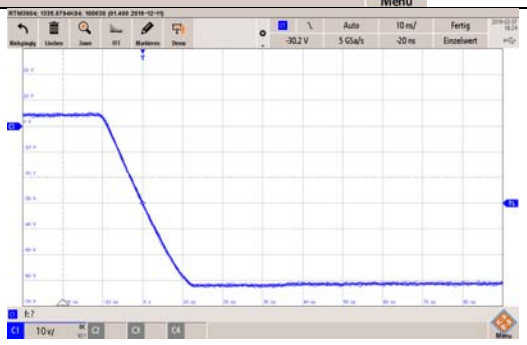
3.1.1 TP3 to GND



10 V/ div
2 µs/ div

full bandwidth





10 V/ div
10 ns/ div

full bandwidth

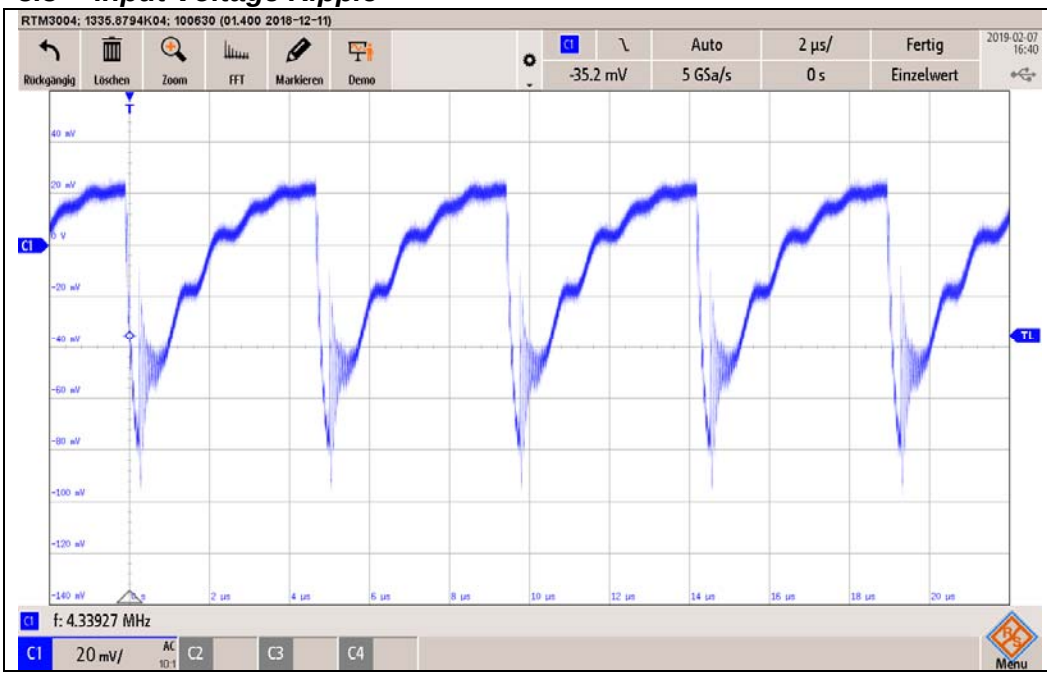
Figure 4 Switchnode (TP3)

3.2 Output Voltage Ripple

	20 mV/div 2 µs/div full bandwidth

Figure 5 Output Voltage Ripple

3.3 Input Voltage Ripple

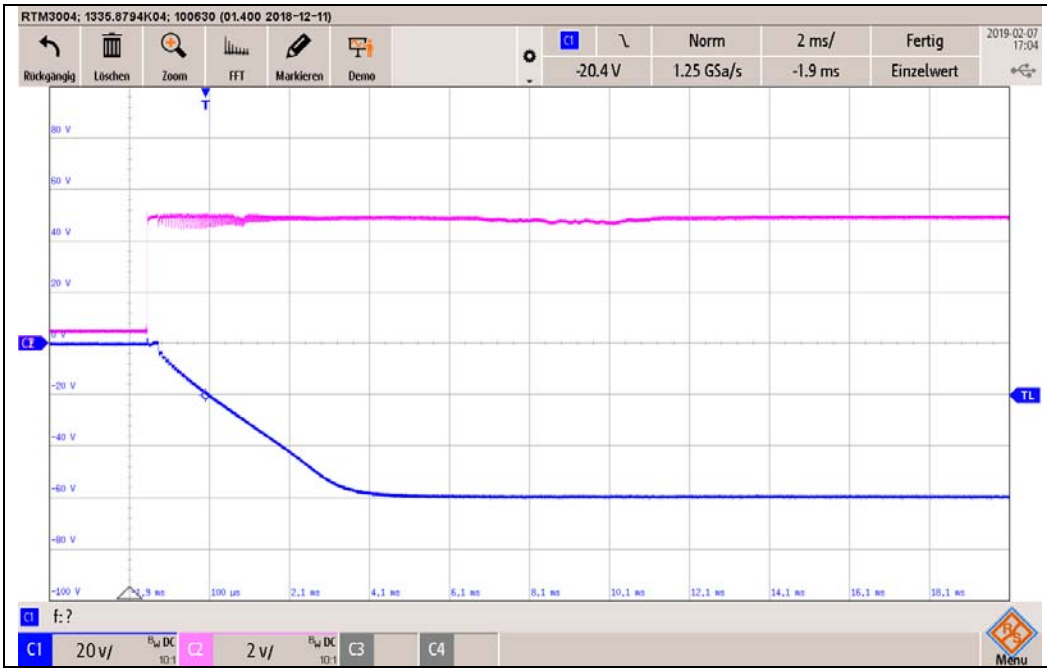


	20 mV/div 2 µs/div full bandwidth

Figure 6 Input Voltage Ripple

3.4 Start-up Sequence

Power supply was plugged in.



Channel 2 => input voltage
2 V/div

Channel 1 => output voltage
20 V/div

2 ms/div

20MHz bandwidth

Figure 7 Start-up Sequence

3.5 Shutdown Sequence

Power supply was disconnected.

Channel 2 => input voltage
2 V/div

Channel 1 => output voltage
20 V/div

5 ms/div

20MHz bandwidth

Figure 8 Shutdown Sequence

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