Test Report PMP31404 3V to 42V Synchronous GaN Boost Converter Reference Design

TEXAS INSTRUMENTS

Description

The reference design is designed for high boost factor and high efficiency. The design operates over a wide input voltage range, starting from 3V using the LMG5126 boost converter with integrated Gallium Nitride (GaN) field-effect transistors (FETs). The reference design includes features such as spread spectrum, current limit, thermal shutdown, overvoltage protection, and undervoltage lockout.

Resources

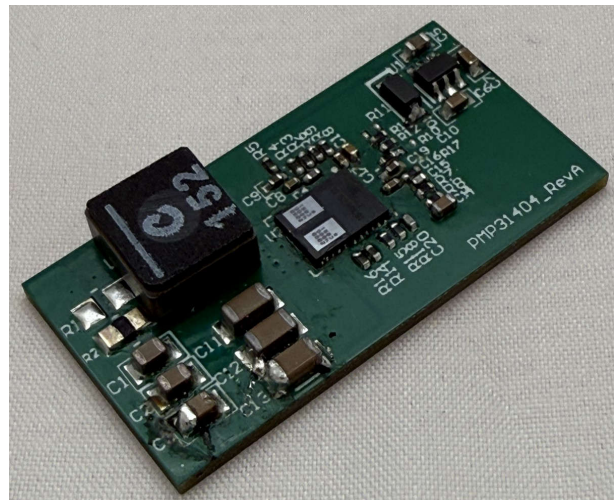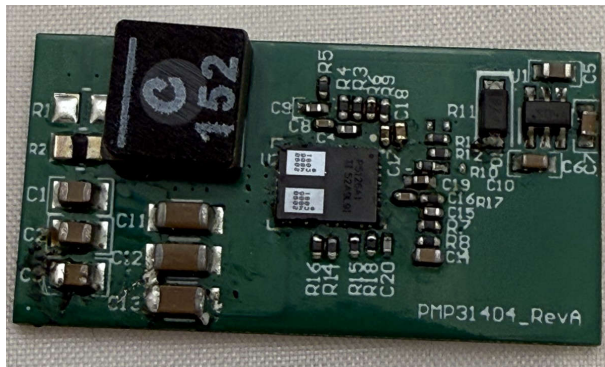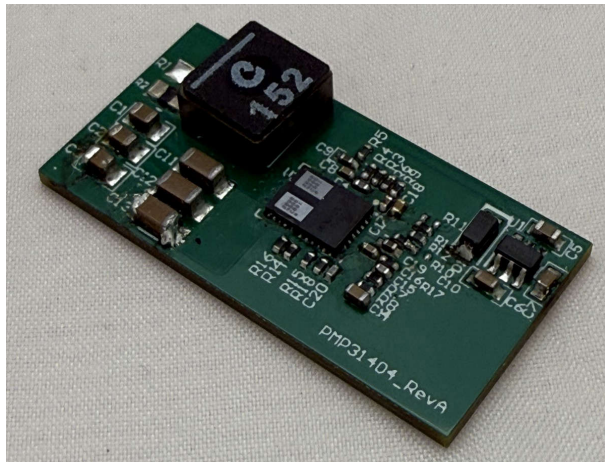|	
PMP31404	Design Folder
LMG5126	Product Folder
LM2665	Product Folder

Features

- Small form factor reference design
- Ultra-high boost factor
- Low input voltage of 3V
- Synchronous GaN boost converter
- Inductor current monitoring and average current limit
- Programmable line undervoltage lockout (UVLO) and hysteresis

Applications

- Portable Electronics

1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1-1. Voltage and Current Requirements

Parameter	Specifications
Input Voltage Range	3V to 6V
Output Voltage	42V
Maximum Output Current	0.45A
Topology	Boost
Actual Switching Frequency	588kHz

1.2 Considerations

Unless otherwise indicated the input voltage was set to 3V and the output current was adjusted to 0.45A with an electronic load.

1.3 Dimensions

The outline of the board is 35mm × 18mm. The copper thickness of the outer layers are 70μm and for the inner layer 105μm.

2 Testing and Results

2.1 Efficiency Graphs
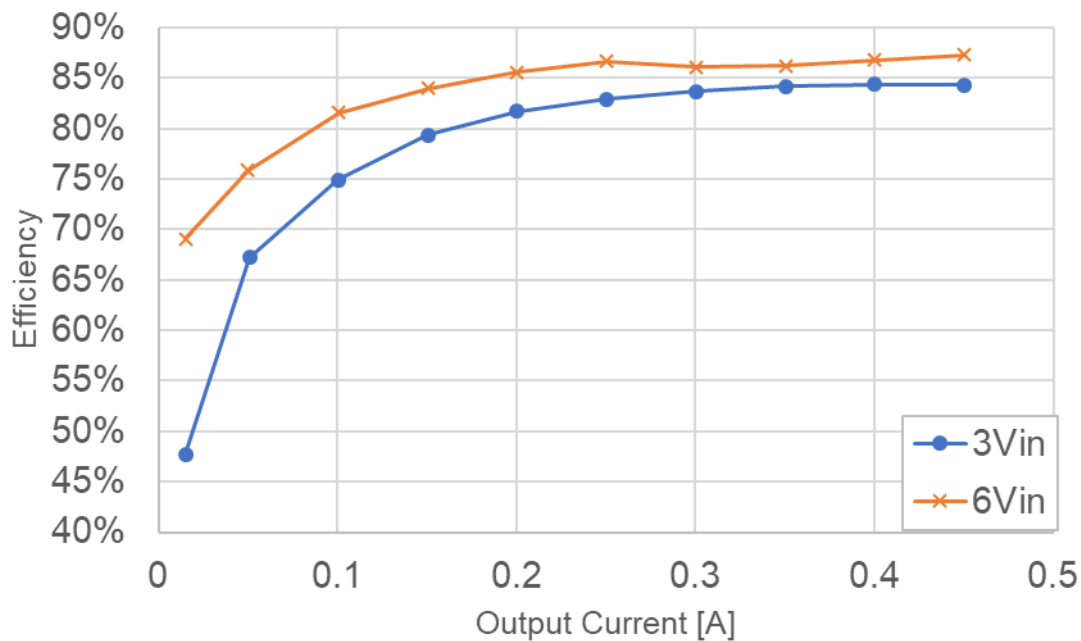
Bias supply was disconnected.

Figure 2-1. Efficiency Graph
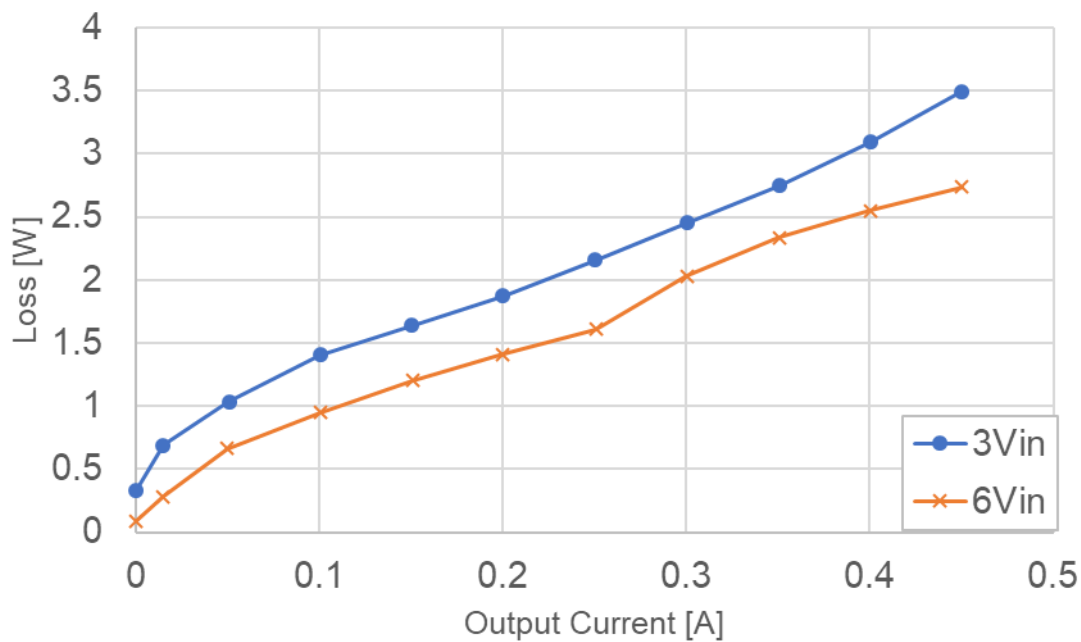
2.2 Loss Graph

Bias supply was disconnected.

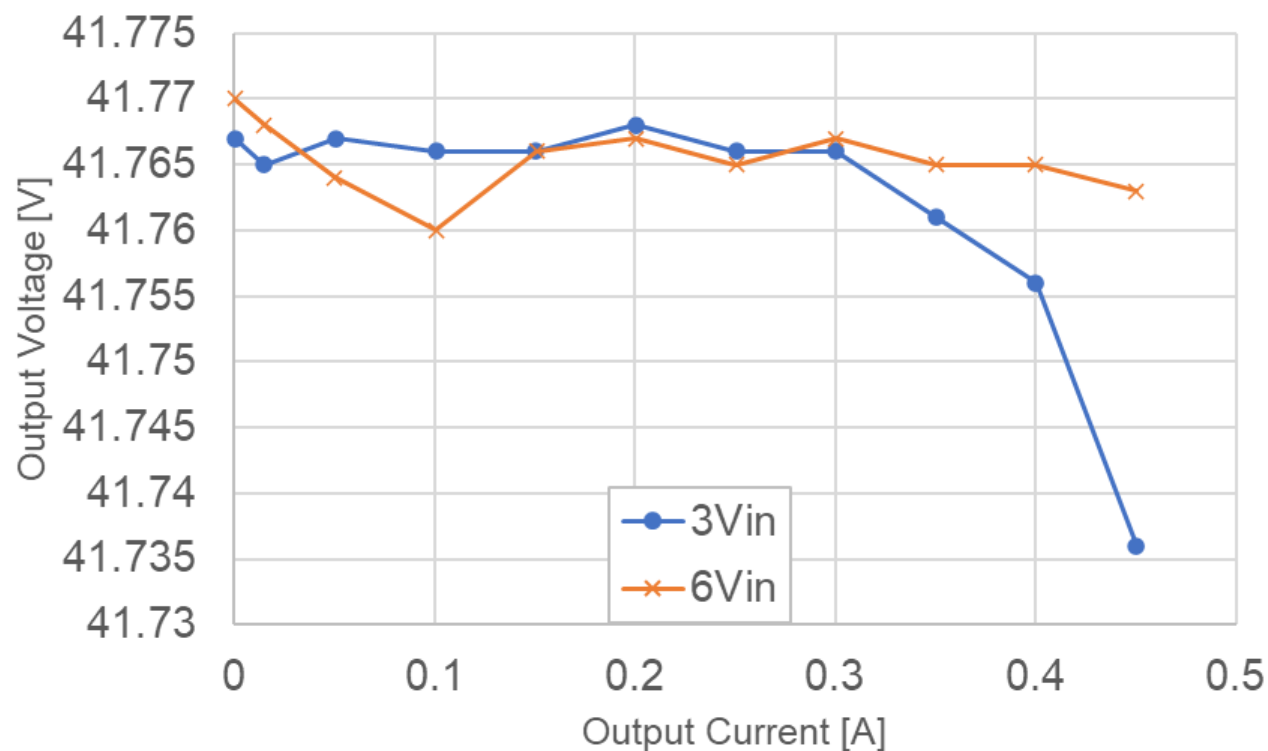**Figure 2-2. Loss Graph**

2.3 Load Regulation

Figure 2-3. Load Regulation Graph
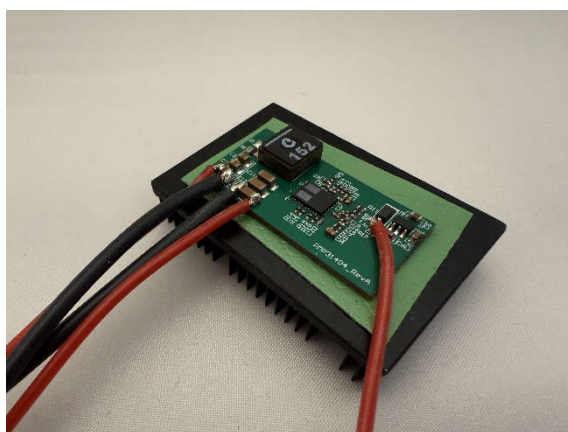
2.4 Thermal Image
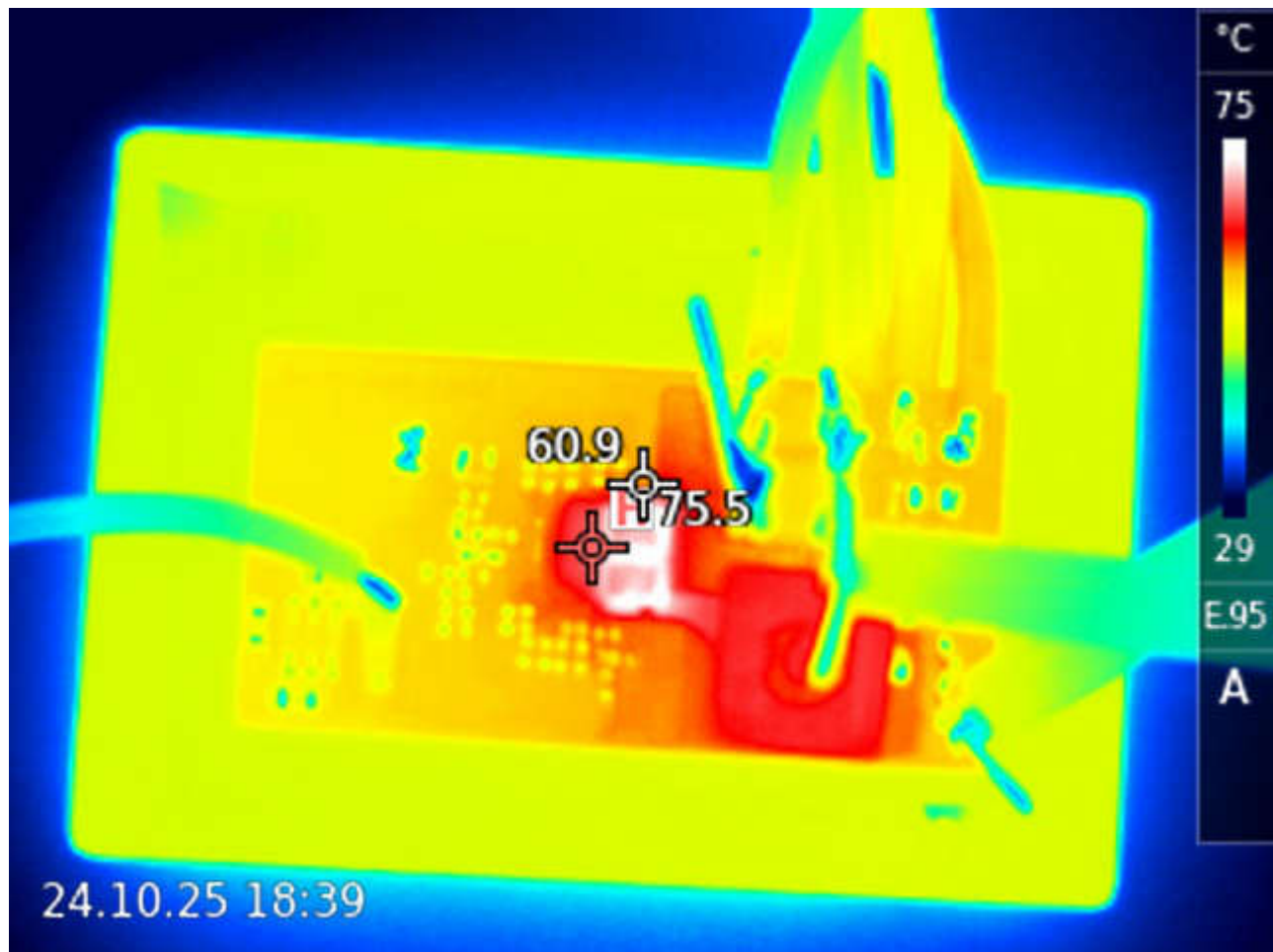

Figure 2-4. Heat Sink Connected to the Bottom of the Board

Figure 2-5. Thermal Image at 3V$_{IN}$ and 0.45A$_{OUT}$

3 Waveforms

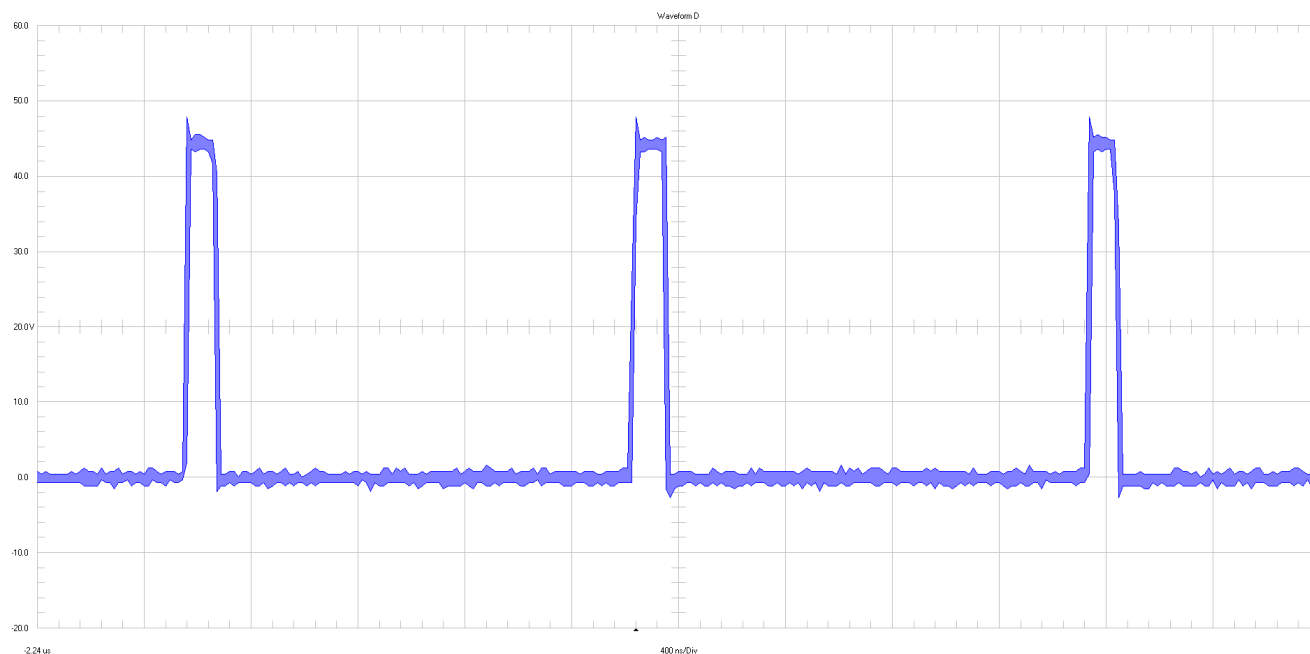## 3.1 Switching

3.1.1 3V Input Voltage

Figure 3-1. Switching With 3V Input Voltage (10V/div, 400ns/div, Full Bandwidth)
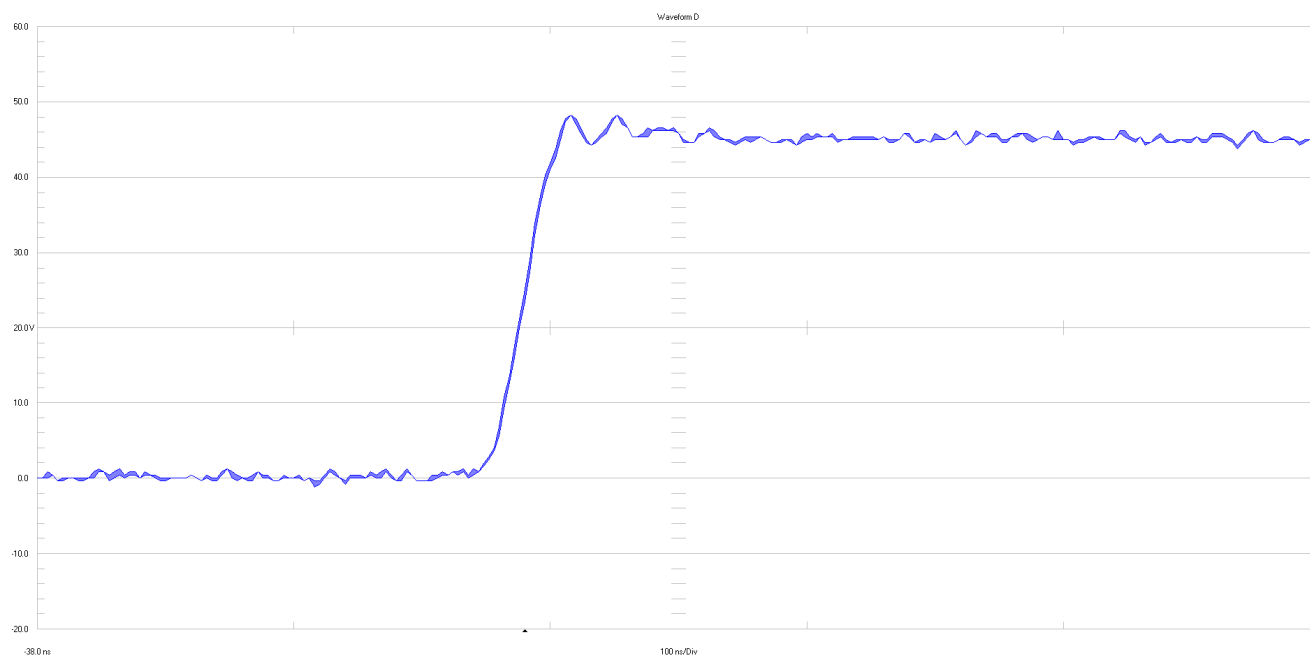

Figure 3-2. Switching With 3V Input Voltage Low High Transition (10V / div, 100ns Full Scale, Full Bandwidth)

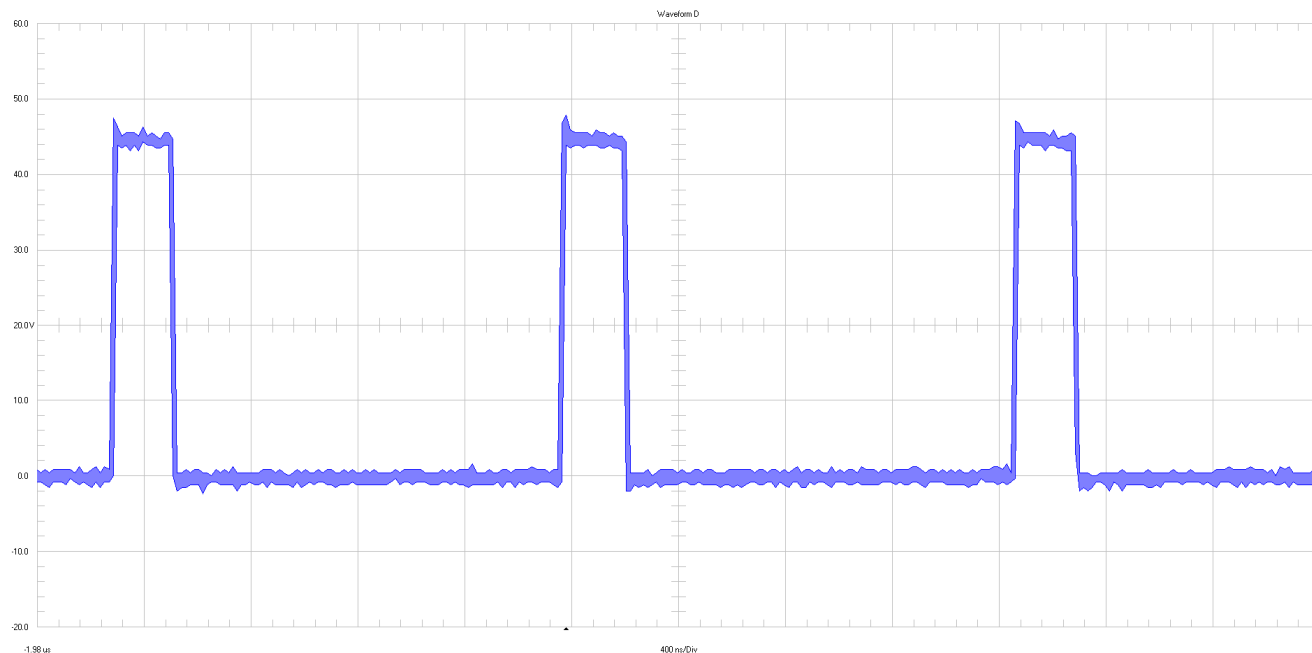### *3.1.2 6V Input Voltage*

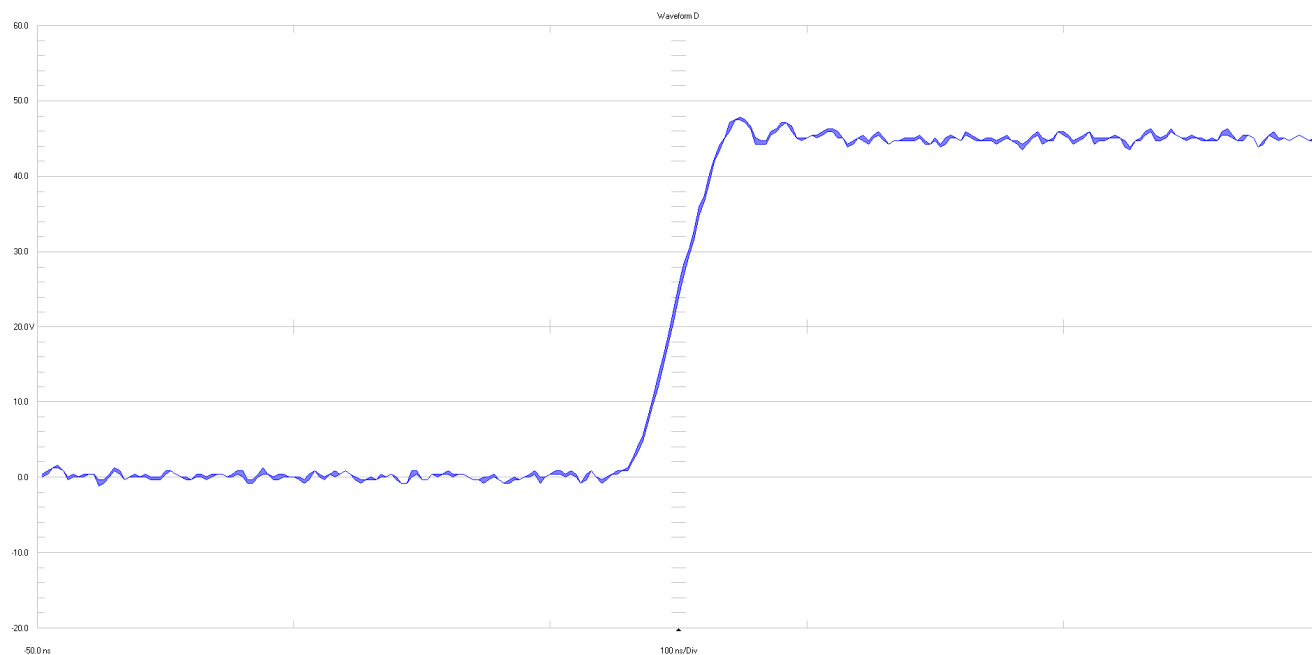Figure 3-3. Switching With 6V$_{IN}$ (10V/div, 400ns/div, Full Bandwidth)

Figure 3-4. Switching With 6V$_{IN}$ Voltage Low High Transition (10V / div, 100ns Full Scale, Full Bandwidth)
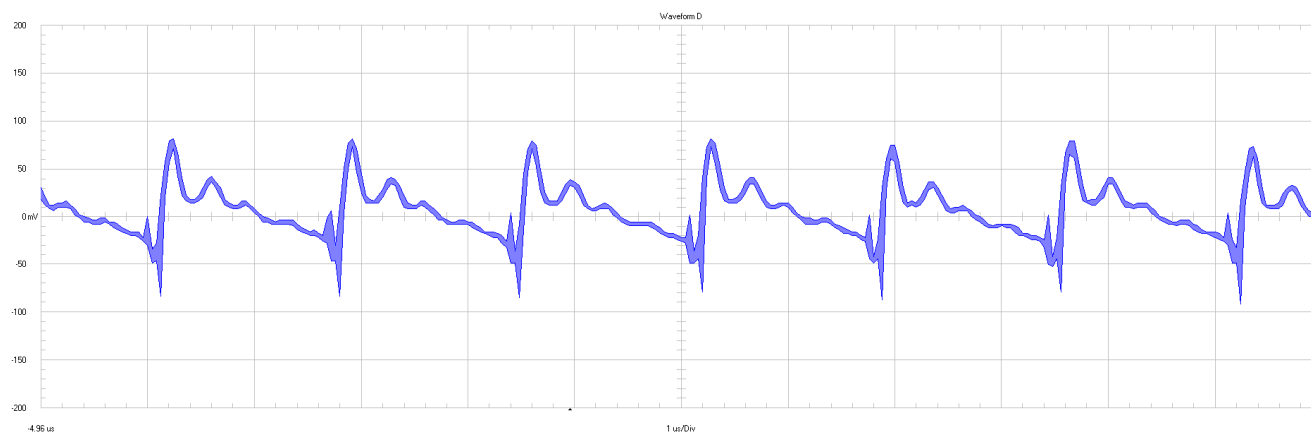
3.2 Output Voltage Ripple

Figure 3-5. Output Voltage Ripple With 3V$_{IN}$ (50mV/div, 1µs/div, 20MHz Bandwidth)

3.2.1 Input Voltage Ripple
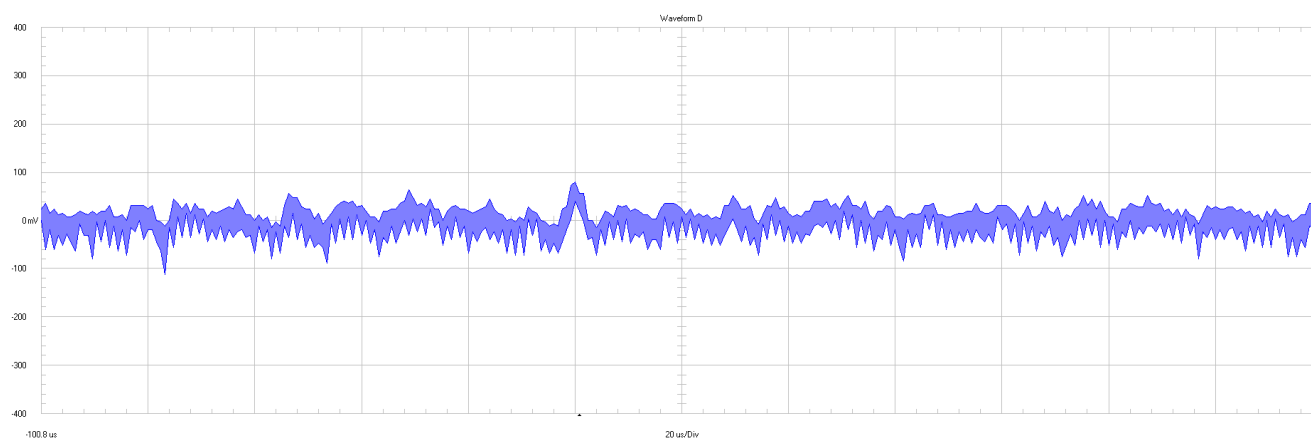

Figure 3-6. Input Voltage Ripple 3V$_{IN}$ (100mV/div, 20µs/div, 20MHz Bandwidth)

3.3 Load Transients

3.3.1 3V Input Voltage
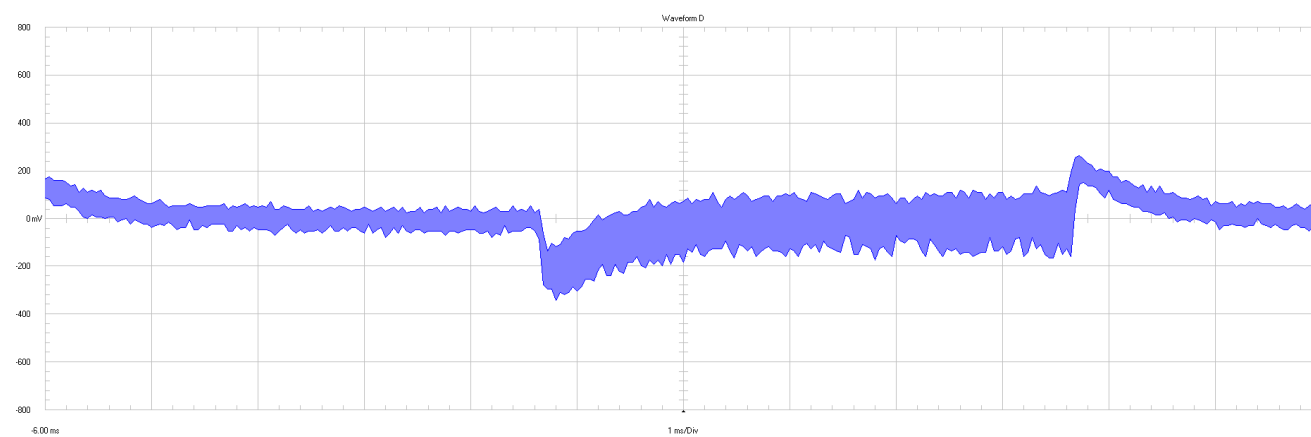
Figure 3-7. Load Transient 0.1A to 0.45A (V$_{OUT}$, 200mV / div, 1ms / div, 20MHz Bandwidth)

3.3.2 6V Input Voltage

3.3.2.1 0.1A to 0.45A

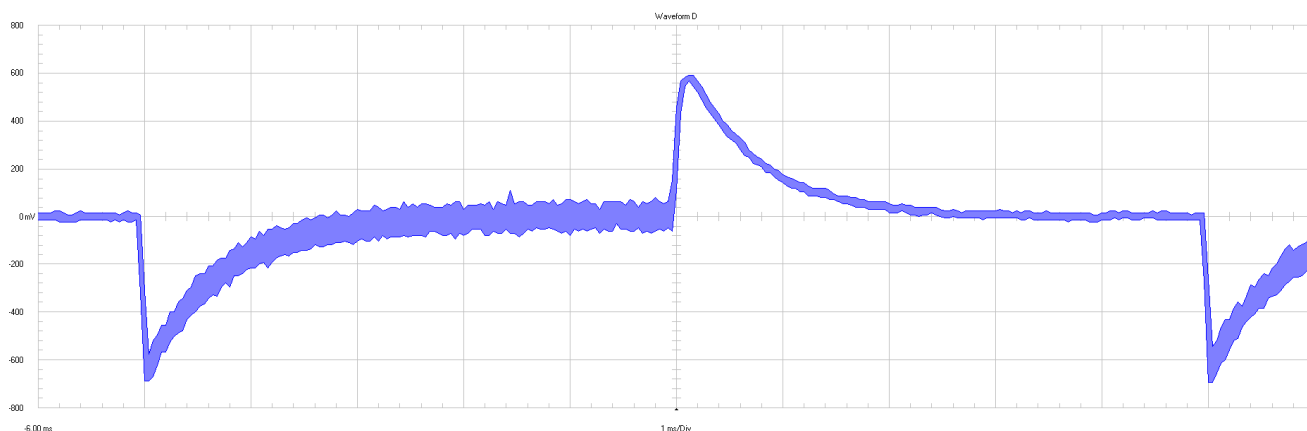**Figure 3-8. Load Transient 0.1A to 0.45A (V$_{OUT}$, 200mV / div, 1ms / div, 20MHz Bandwidth)**

3.4 Start-up Sequence

Figure 3-9. Start-Up With 3V$_{IN}$ (Bias Supply Was Connected)

- Input voltage (1V / div, 2ms / div, 20MHz bandwidth)
- Output voltage (10V / div, 2ms / div, 20MHz bandwidth)
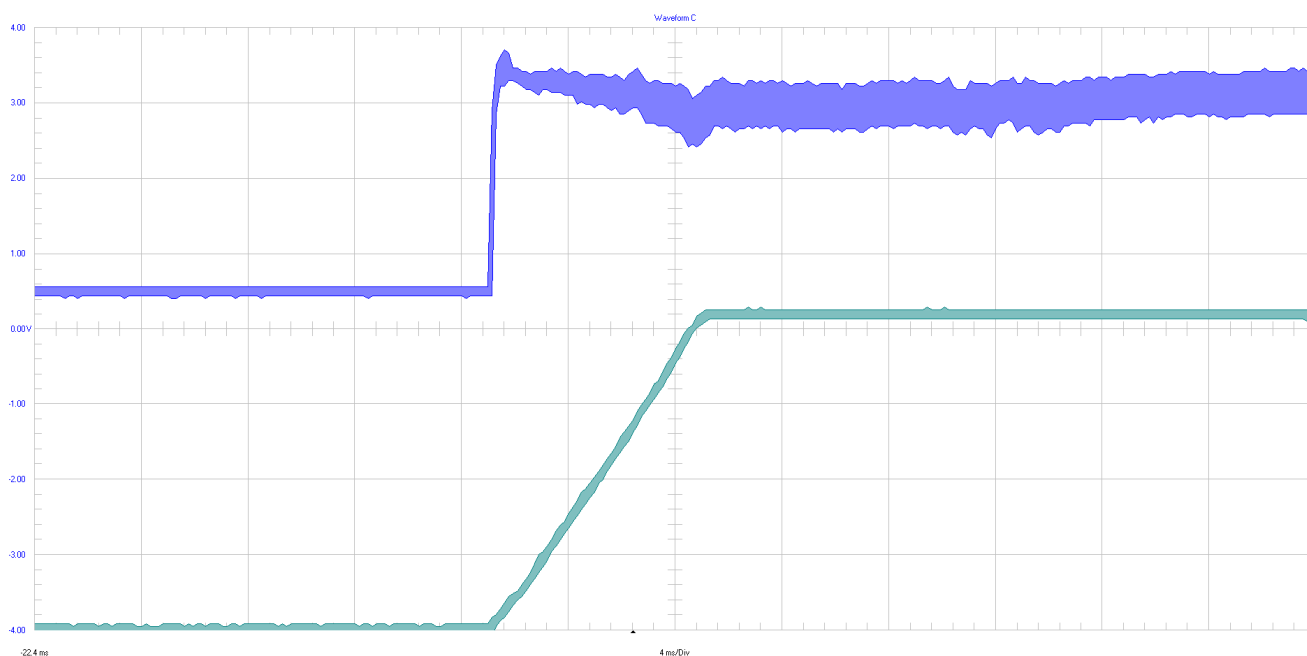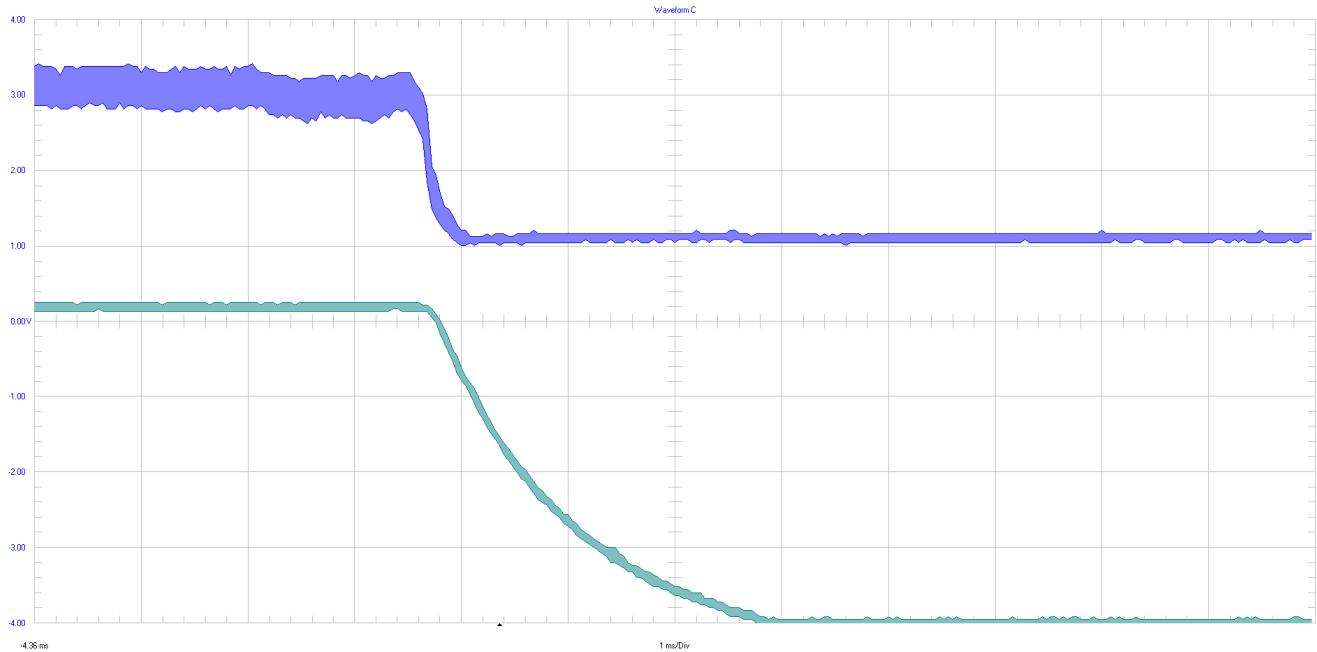
3.5 Shutdown Sequence

Figure 3-10. Shutdown With 3V_{IN} (Bias Supply Was Connected)

- Input voltage (1V / div, 1ms / div, 20MHz bandwidth)
- Output voltage (10V / div, 1ms / div, 20MHz bandwidth)

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