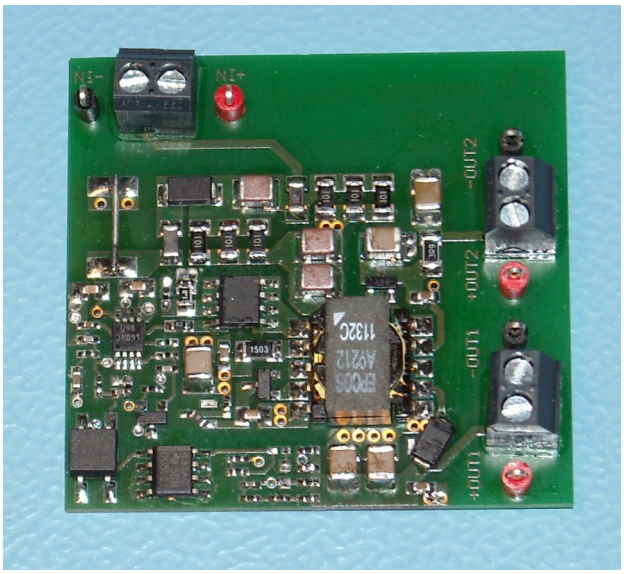
## Isolated Flyback with 5.0V @ 300mA and 12.0V @ 80mA

- Input 36 ..60V DC
- Output 5.0V @ 300mA and 12.0V @ 80mA
- Controller UCC3809-1
- Free-Running switching frequency of 300 kHz
- Built on PCB PMP8580 Rev.A



# 1 Startup

The startup waveform is shown in Figure 1. The input voltage is set at 48V, with no load on the 5.0V and 12.0V output.

Channel C1: **48V Input voltage**
10V/div, 100ms/div

Channel C2: **5.0V Output voltage**
5V/div, 100ms/div

Channel C3: **12.0V Output voltage**
5V/div, 100ms/div

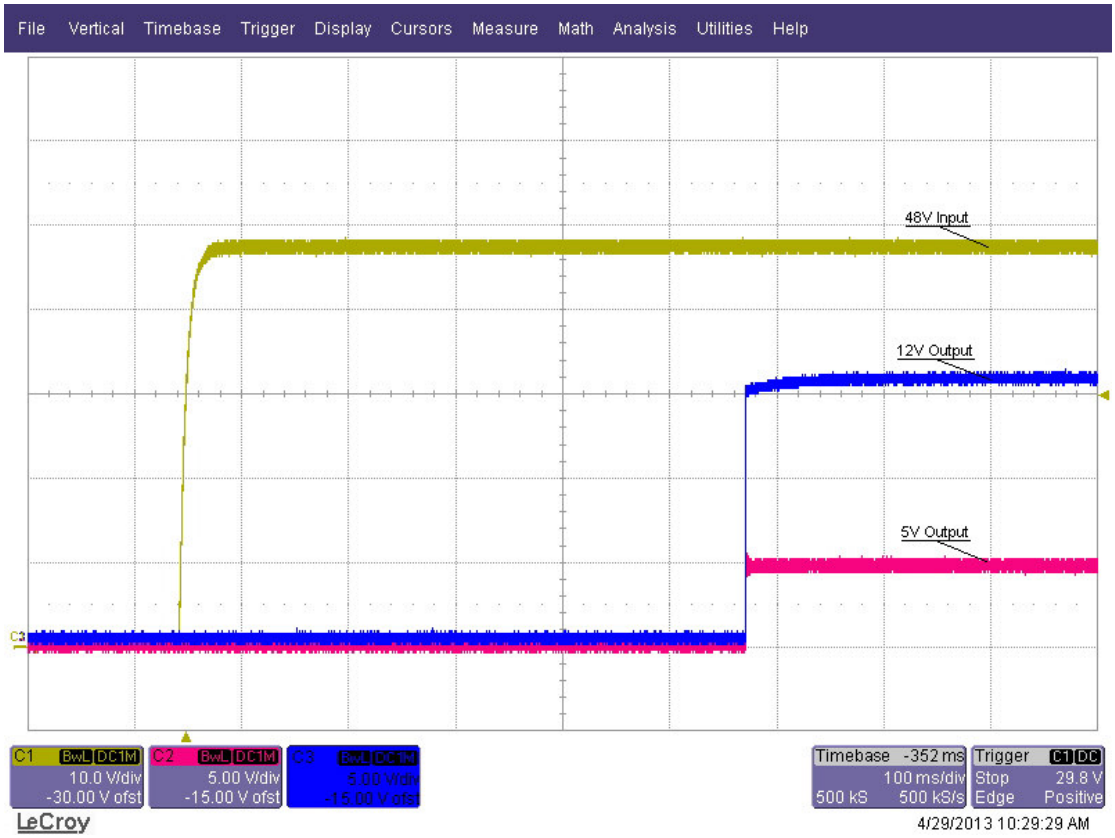



**Figure 1**

## 2 Shutdown

The shutdown waveform is shown in Figure 2. The input voltage is set at 48V with a 300mA load on the 5.0V output and a 80mA load on the 12.0V output.

Channel C1: **48V Input voltage**
10V/div, 20ms/div

Channel C2: **5.0V Output voltage**
5V/div, 20ms/div

Channel C3: **12.0V Output voltage**
5V/div, 20ms/div


**Figure 2**

## 3 Efficiency

The efficiency and load regulation are shown in Figure 3 and Figure 4.

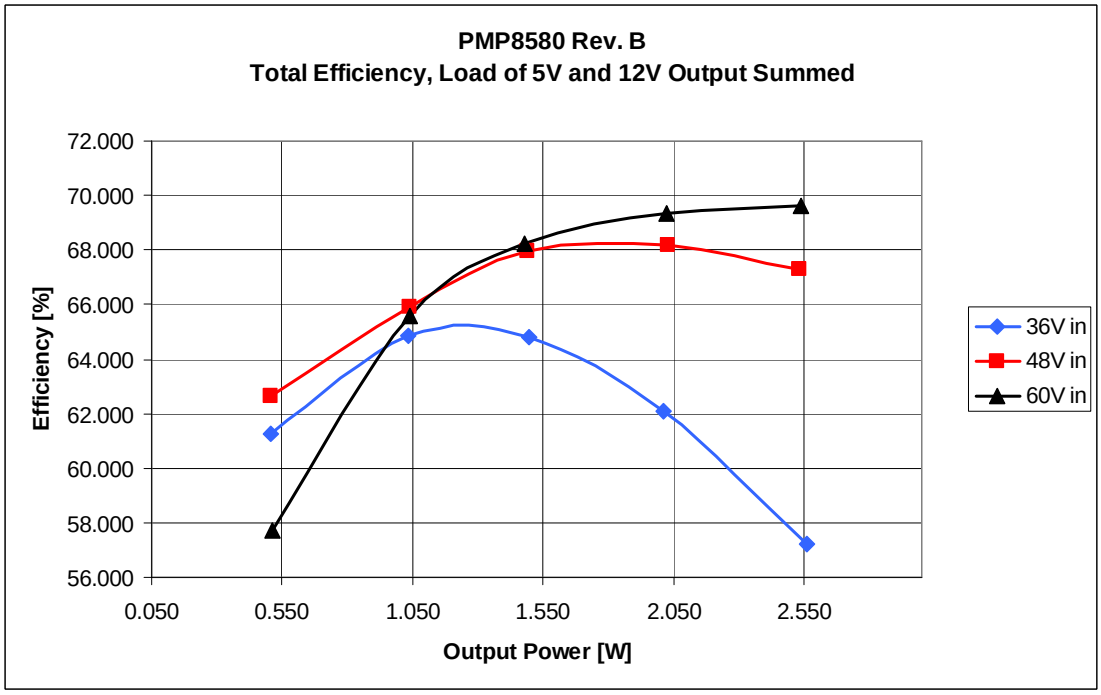



**Figure 3**

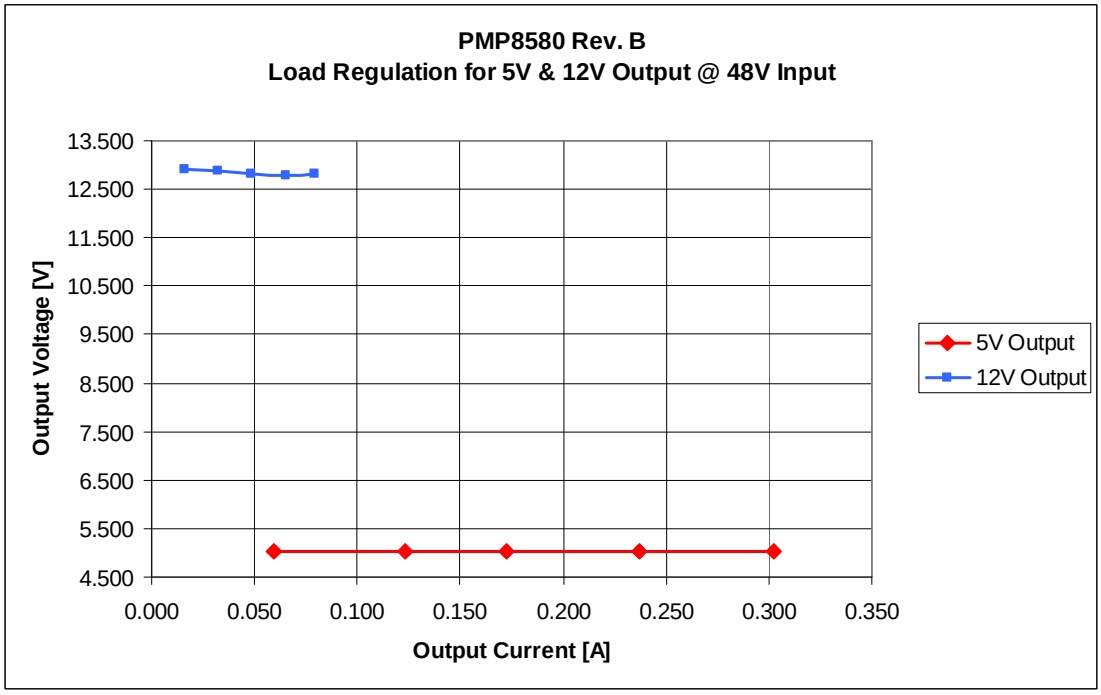



**Figure 4**

# 4 Output ripple voltage

The output ripple voltage at 36V, 48V and 60V input voltage for the 5.0V output are shown in Figure 5.

Channel M1: **Output voltage**, AC coupled, 42mV peak-peak @ 36V input voltage 20mV/div, 5us/div

Channel M2: **Output voltage**, AC coupled, 36mV peak-peak @ 48V input voltage 20mV/div, 5us/div

Channel M3: **Output voltage**, AC coupled, 31mV peak-peak @ 60V input voltage 20mV/div, 5us/div

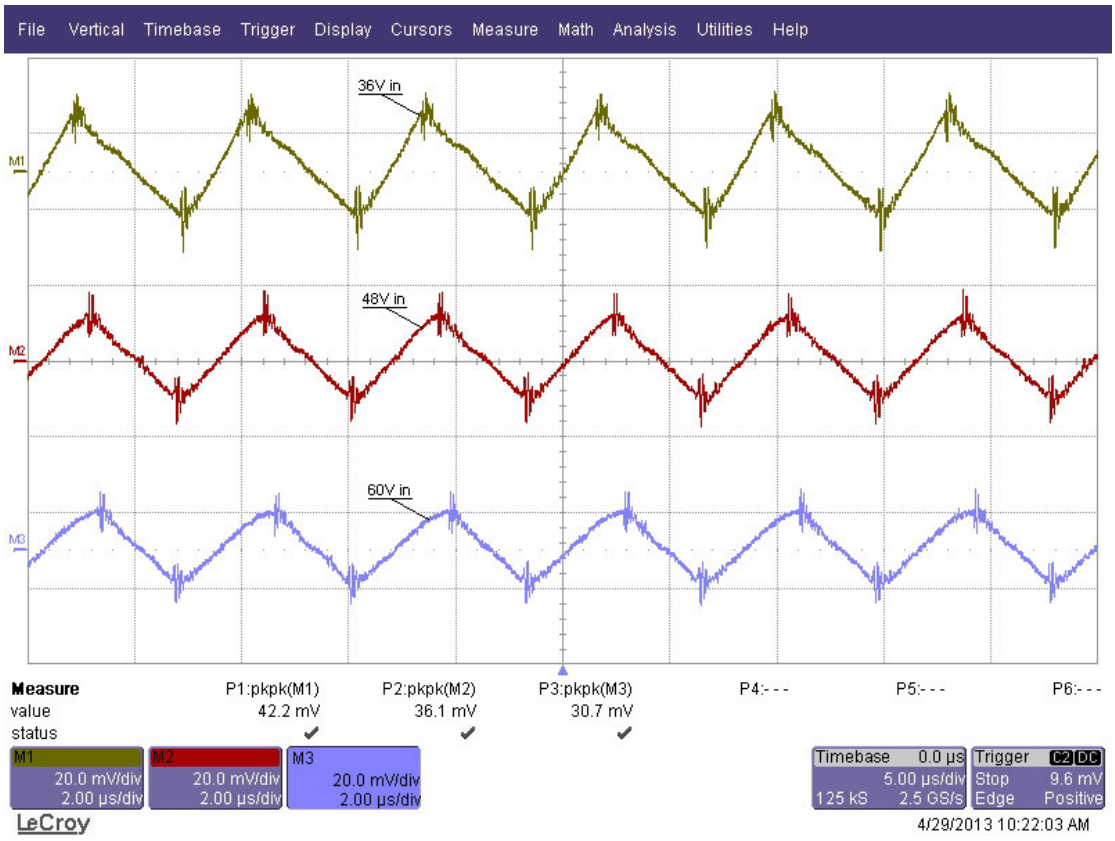



**Figure 5**

**The output ripple of the 12.0V output could not be measured due to its very low value in the single millivolt range.**

# 5 Load step

The response to a load step and a load dump for the 5.0V output at an input voltage of 48V is shown in Figure 6.

Channel C2: **Output voltage**, -317mV undershoot, 163mV overshoot
200mV/div, 1ms/div, AC coupled

Channel C1: **Load current**, load step 100mA to 200mA and vice versa
200mA/div, 1ms/div


**Figure 6**

# 6 Frequency response

Figure 7 shows the loop response at 36V, 48V and 60V input voltage at 2.5W load.

**36V input**

- 67 deg phase margin @ crossover frequency 1.3 kHz
- -19 db gain margin

**48V input**

- 76 deg phase margin @ crossover frequency 1.3 kHz
- -21 db gain margin

**60V input**

- 78 deg phase margin @ crossover frequency 1.3 kHz
- -22 db gain margin

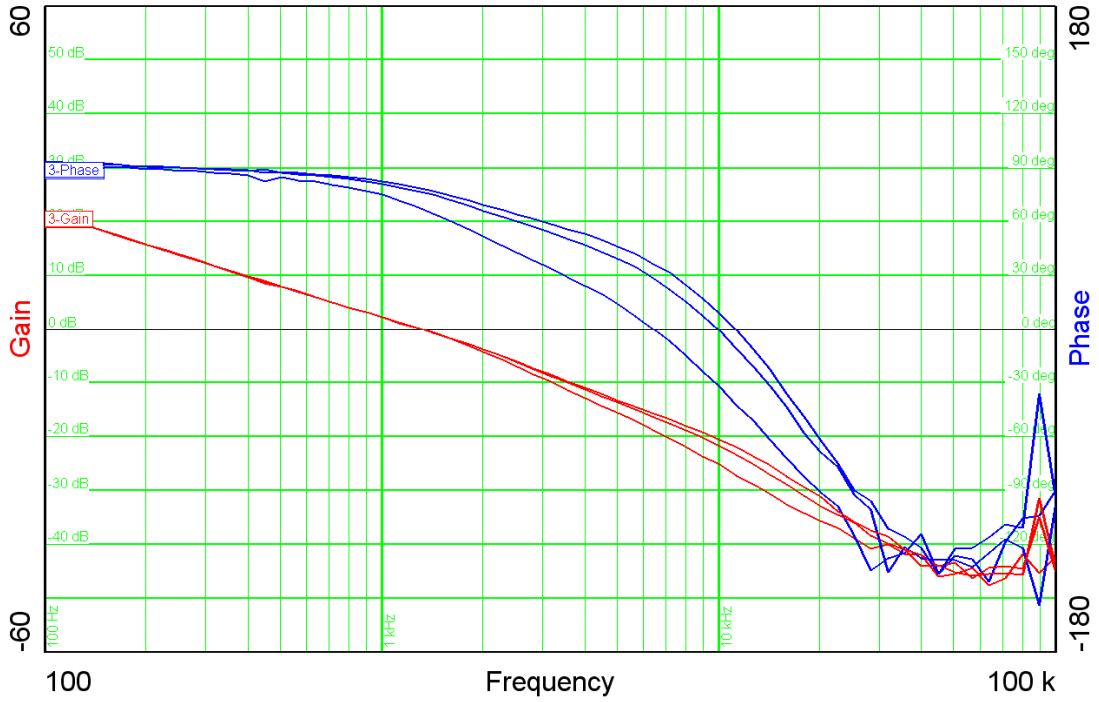



**Figure 7**

# 7 Switching Node

The drain-source voltage on the switching node is shown in Figure 8. The image was captured with 60V input and 2.5W load.

Channel C2: **Drain-source voltage**, -5.5V minimum voltage, 140V maximum voltage 20V/div, 2us/div

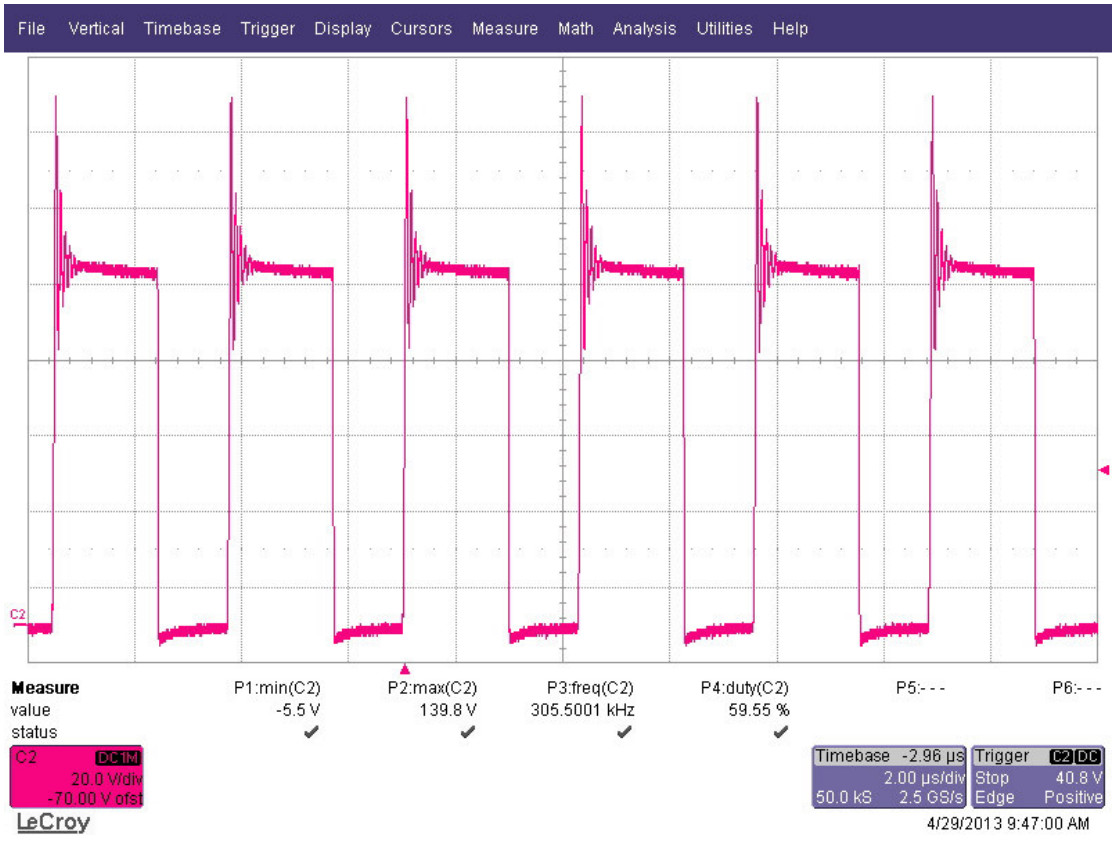



**Figure 8**

# 8 Thermal measurement

The thermal image (Figure 9) shows the circuit at an ambient temperature of 21 °C with an input voltage of 48V and a load of 2.5W.

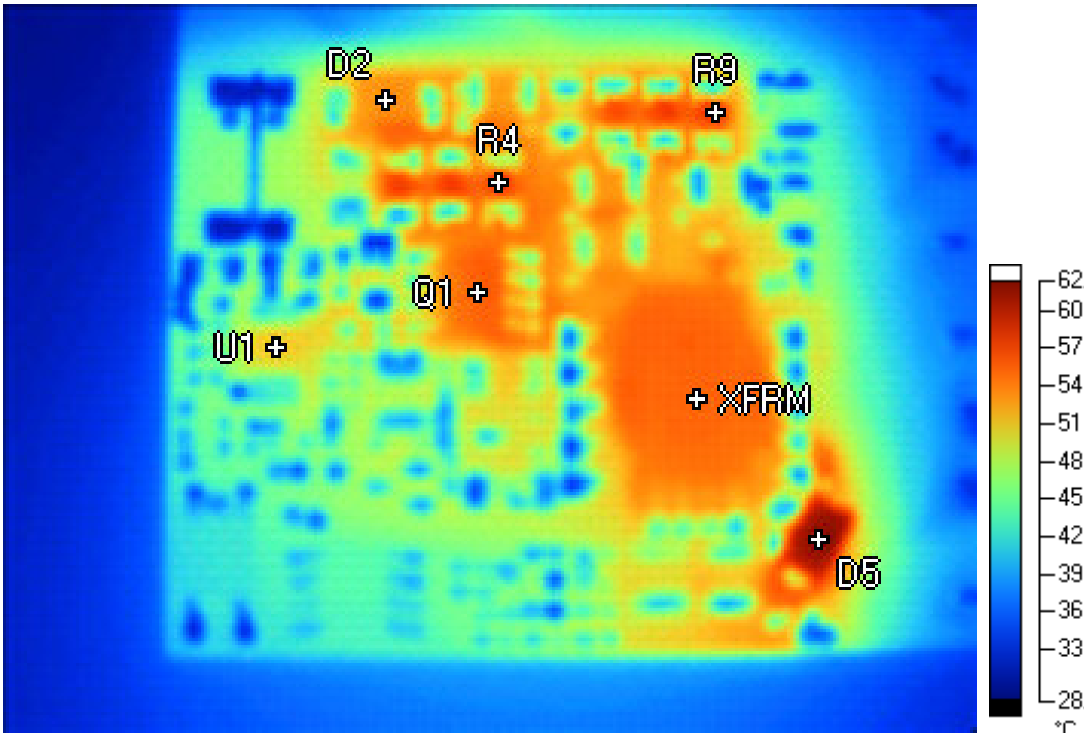



**Figure 9**

**Markers**

| Label | Temperature | Emissivity | Background |
|---|---|---|---|
| D5 | 62.0 °C | 0.95 | 21.0 °C |
| XFRM | 55.2 °C | 0.95 | 21.0 °C |
| Q1 | 55.6 °C | 0.95 | 21.0 °C |
| U1 | 50.9 °C | 0.95 | 21.0 °C |
| D2 | 53.3 °C | 0.95 | 21.0 °C |
| R9 | 57.8 °C | 0.95 | 21.0 °C |
| R4 | 57.7 °C | 0.95 | 21.0 °C |

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