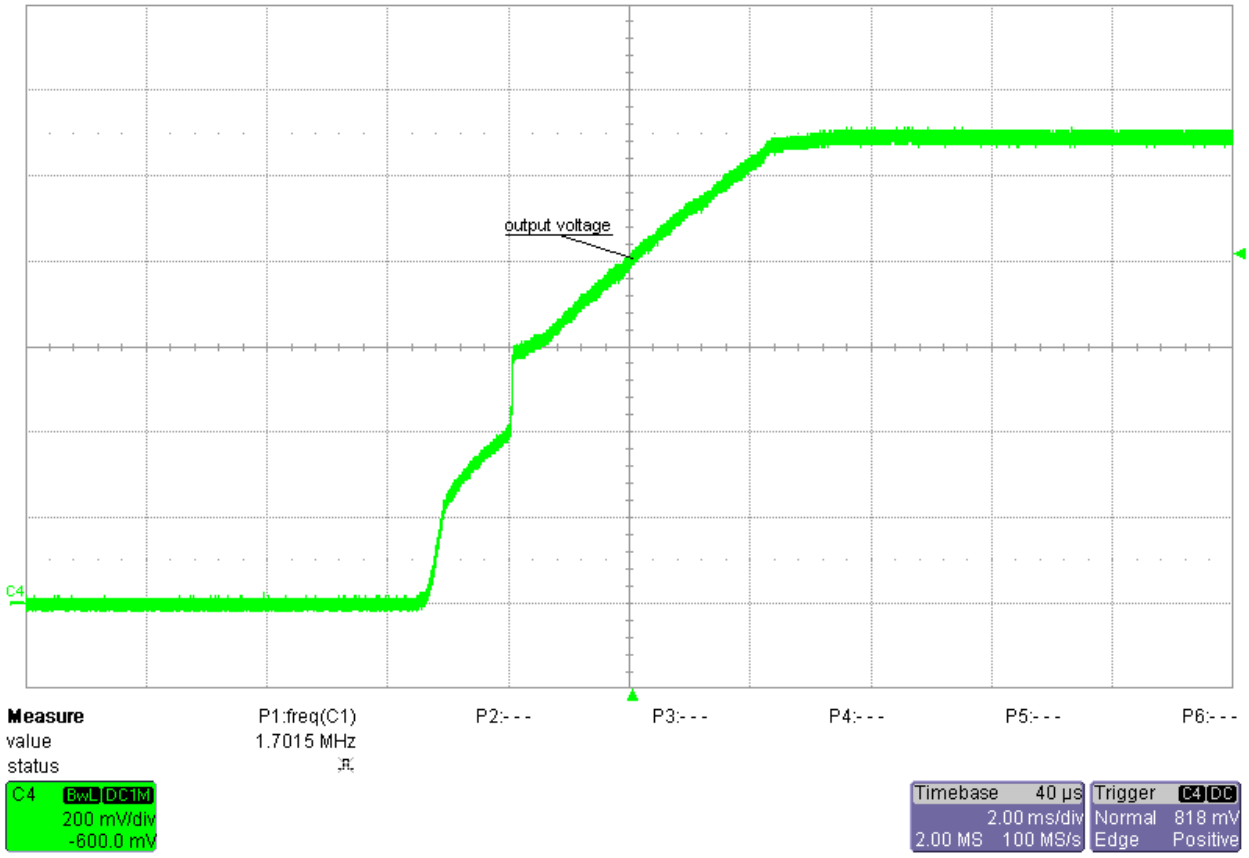
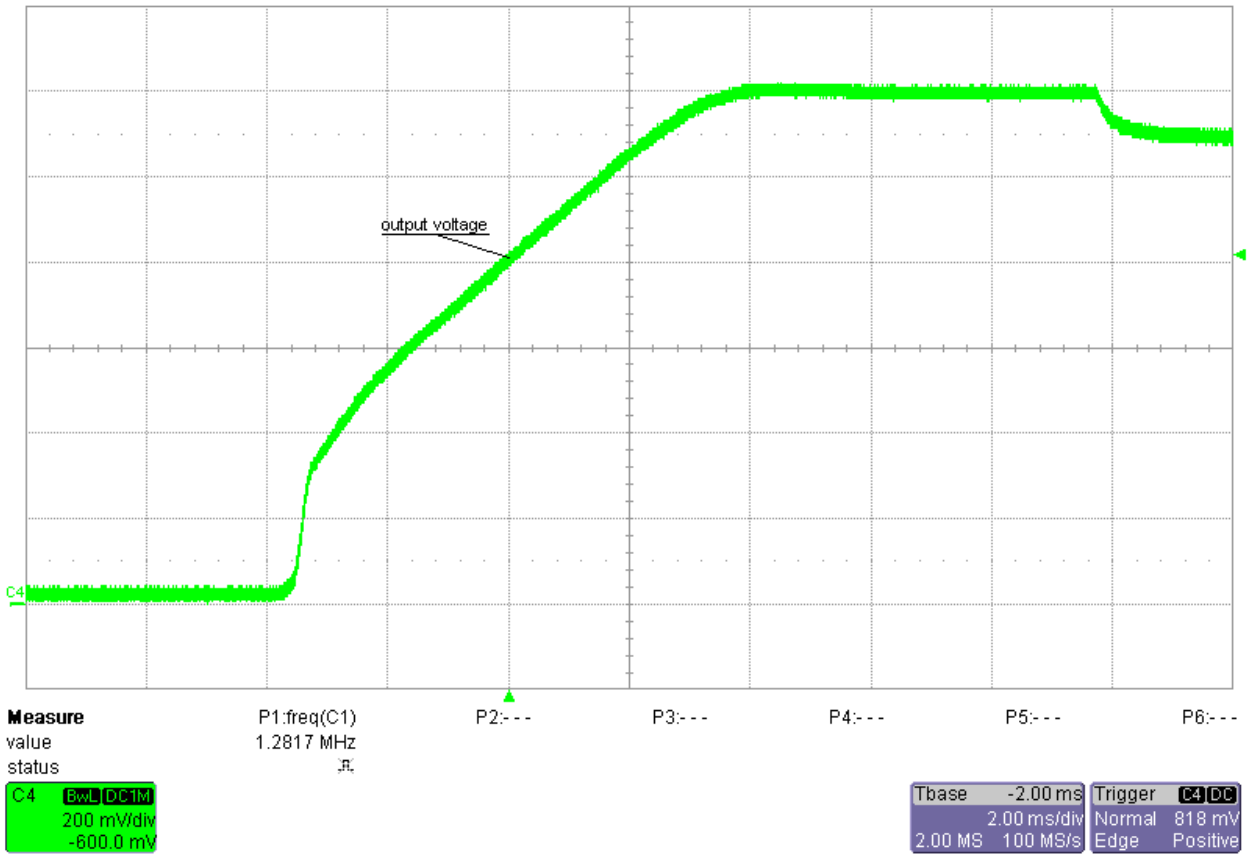
# 1 Startup

Input voltage = 13.5V
Output voltage = 1.1V
Load current = 25A

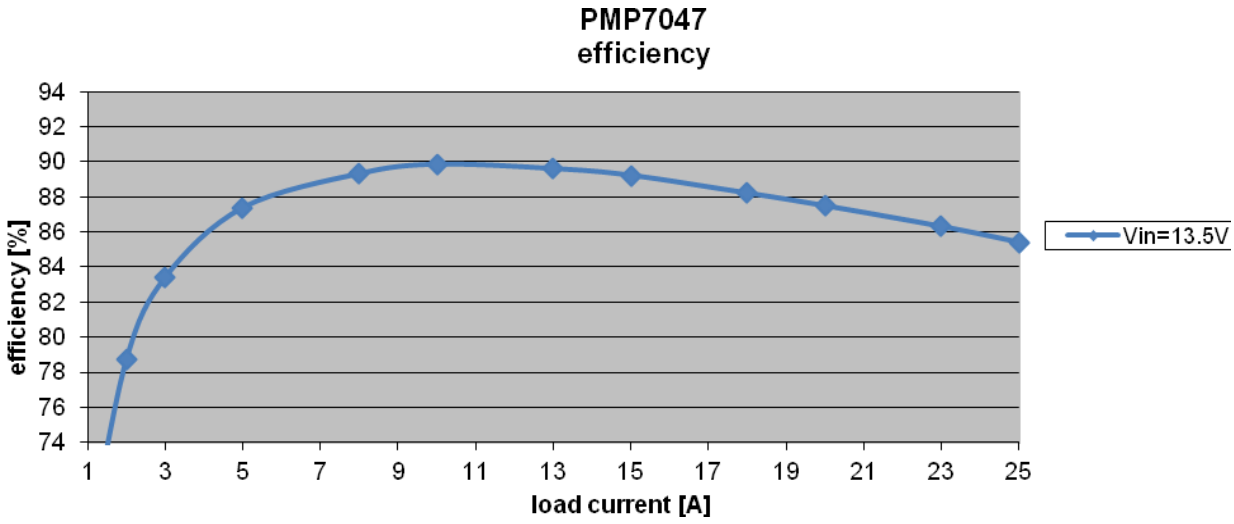


Input voltage = 13.5V
Output voltage = 1.1V
Load current = 0A



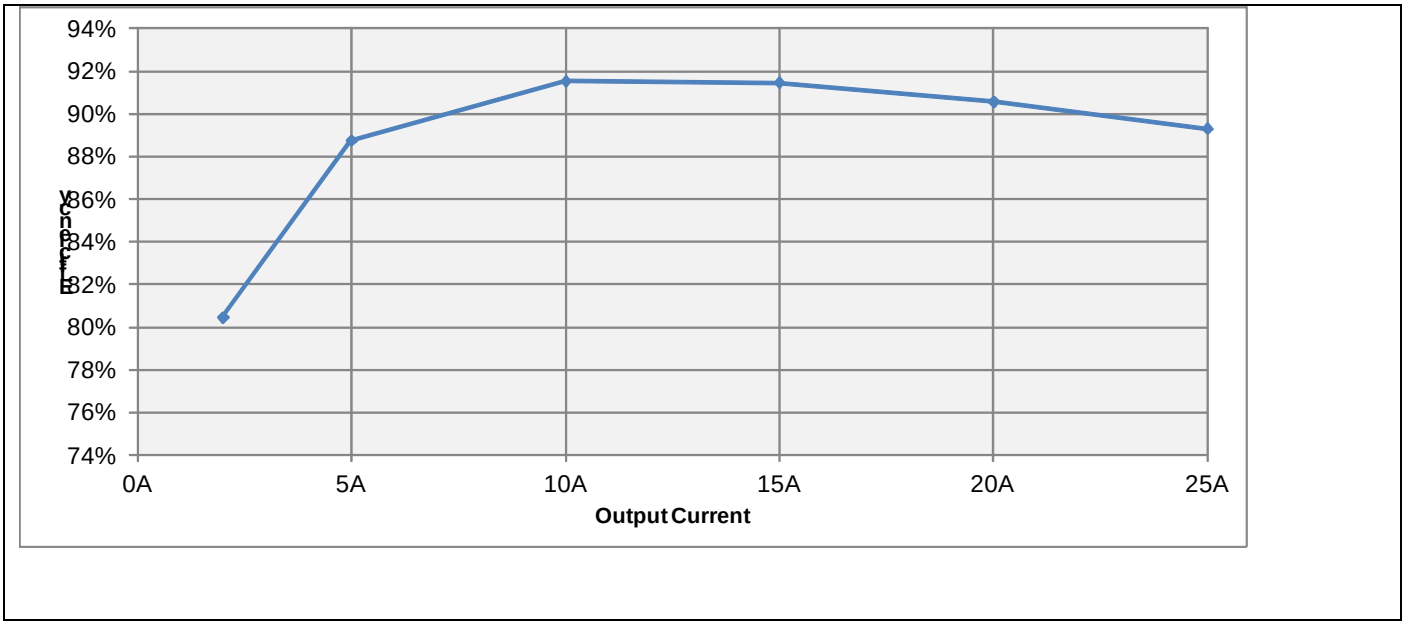
# 2 Efficiency

## *2.1 First board with 35µm/one ounce Cu per layer ( four layers in total)*



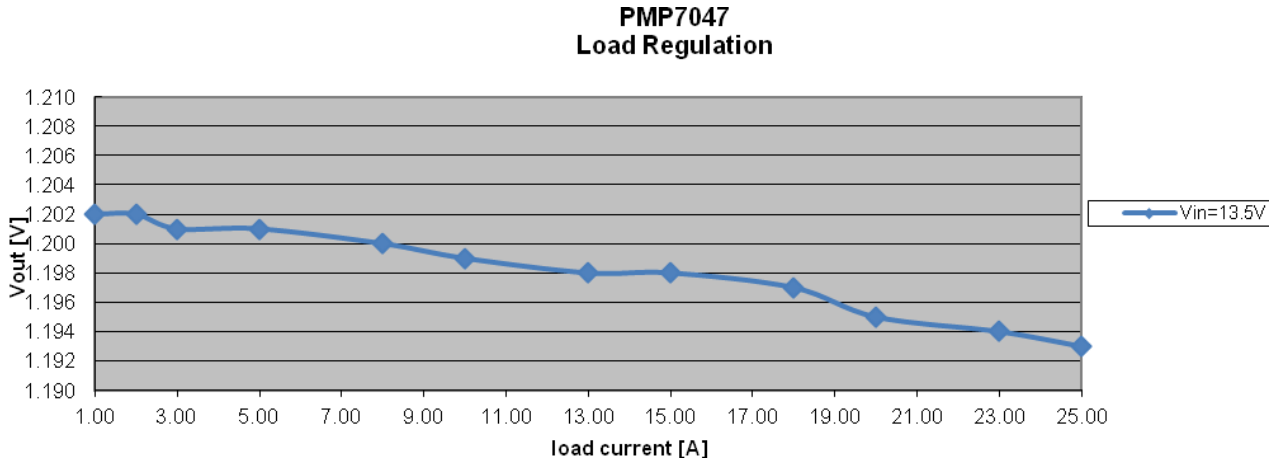

| input | | output | | efficiency |
|---|---|---|---|---|
| voltage [V] | current [A] | voltage [V] | current [A] | [%] |
| 13.690 | 0.1293 | 1.202 | 1.00 | 67.905 |
| 13.680 | 0.2233 | 1.202 | 2.00 | 78.697 |
| 13.680 | 0.3158 | 1.201 | 3.00 | 83.400 |
| 13.660 | 0.5031 | 1.201 | 5.00 | 87.379 |
| 13.650 | 0.7874 | 1.200 | 8.00 | 89.319 |
| 13.630 | 0.9790 | 1.199 | 10.00 | 89.855 |
| 13.610 | 1.2770 | 1.198 | 13.00 | 89.609 |
| 13.590 | 1.4820 | 1.198 | **15.00** | **89.224** |
| 13.600 | 1.7960 | 1.197 | 18.00 | 88.211 |
| 13.470 | 2.0280 | 1.195 | 20.00 | 87.491 |
| 13.420 | 2.3710 | 1.194 | 23.00 | 86.307 |
| 13.420 | 2.6020 | 1.193 | **25.00** | **85.412** |

### 2.2 *Revised* board with 2x 130µm Cu outer, 2x 105um Cu inner layers:

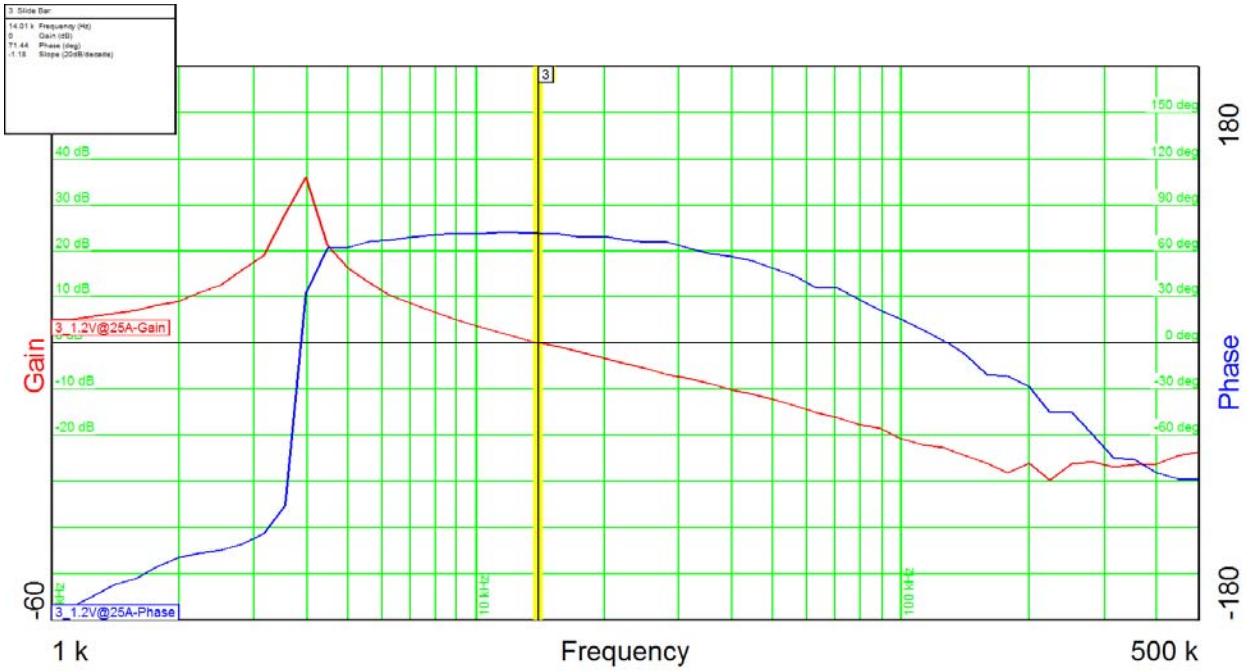



| input | | output | | |
|---|---|---|---|---|
| voltage [V] | current[A] | voltage [V] | current[A] | efficiency |
| 13.501 | 0.2214 | 1.2023 | 2 | 80.445% |
| 13.506 | 0.5015 | 1.2022 | 5 | 88.746% |
| 13.503 | 0.974 | 1.2025 | 10.01 | 91.523% |
| 13.506 | 1.461 | 1.2032 | **15** | **91.464%** |
| 13.504 | 1.969 | 1.2034 | 20.01 | 90.563% |
| 13.507 | 2.496 | 1.2043 | **25** | **89.304%** |

## 3 Load regulation



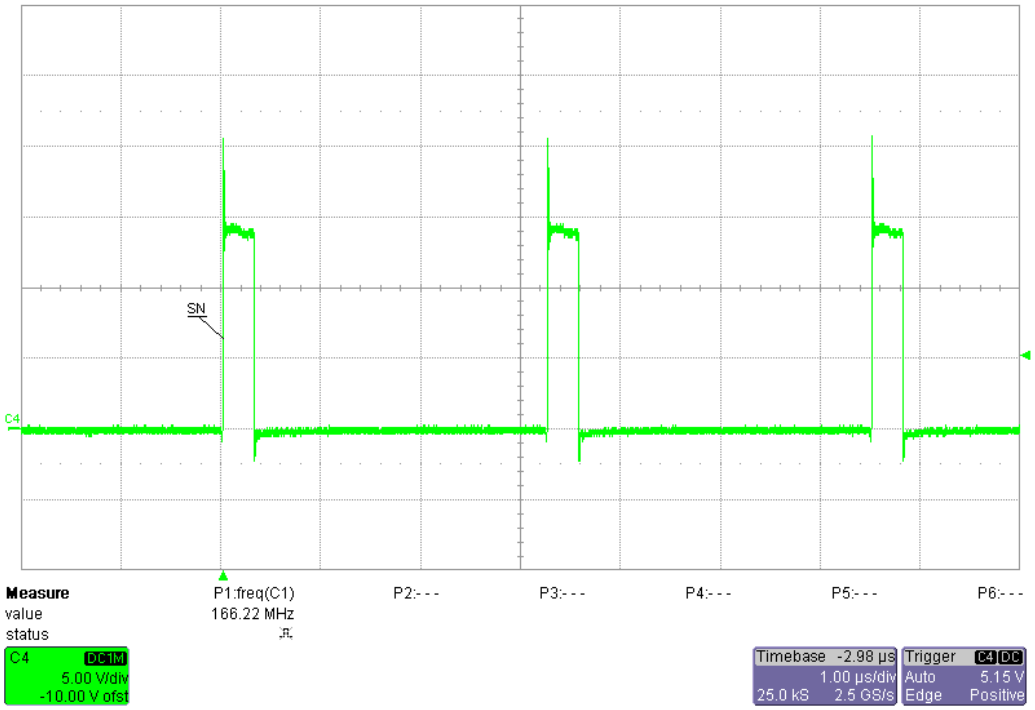
## 4 Control Loop Frequency Response

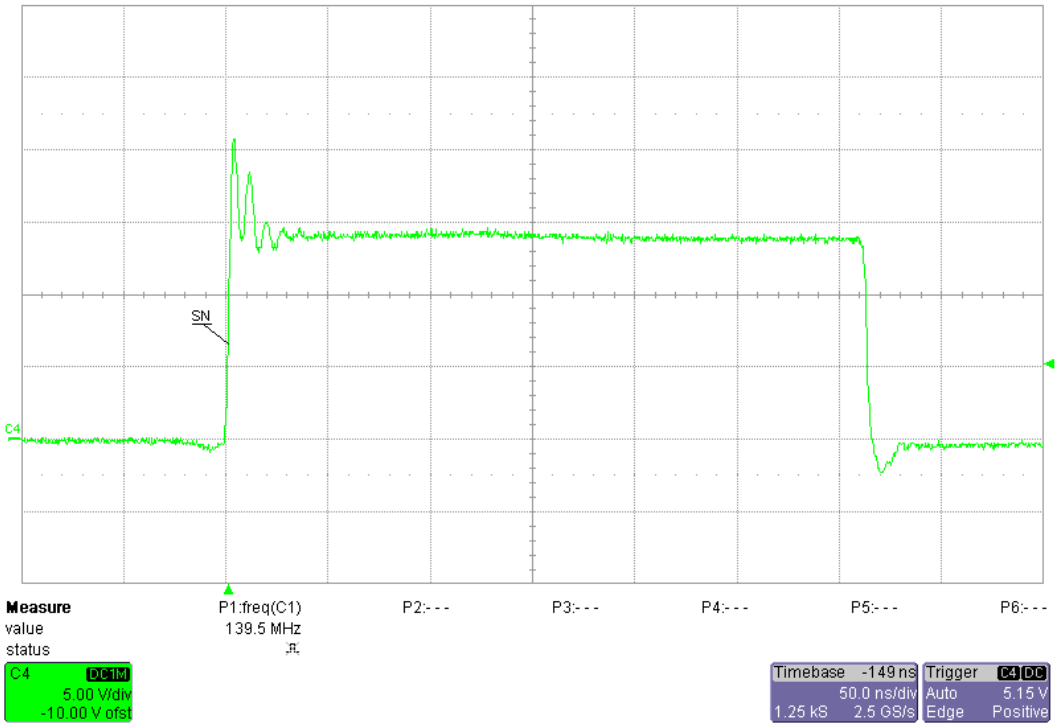



| | |
|---|---|
| Input voltage | = 13.5VDC |
| Output voltage | = 1.2V |
| Load current | = 25A |
| Phase margin | = 71.4° |
| Bandwidth | = 14kHz |

## 5 Switch node Waveform

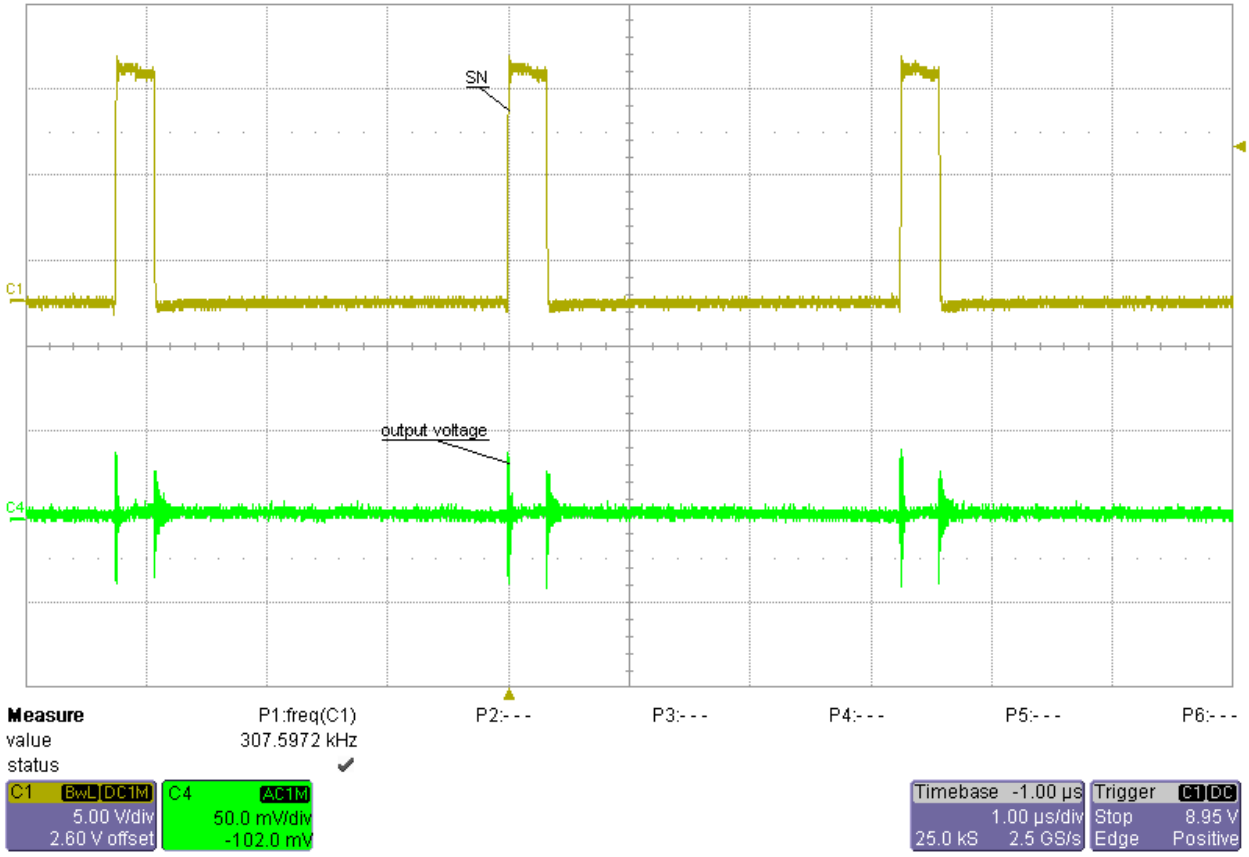
Input voltage = 14V
Output voltage = 1.2V
Load current = 25A




SN
C4
Measure
value
status
P1:freq(C1)
139.5 MHz
P2:- - -
P3:- - -
P4:- - -
P5:- - -
P6:- - -
C4 DC1M
5.00 V/div
-10.00 V ofst
Timebase -149 ns
50.0 ns/div
1.25 kS 2.5 GS/s
Trigger C4 DC
Auto 5.15 V
Edge Positive

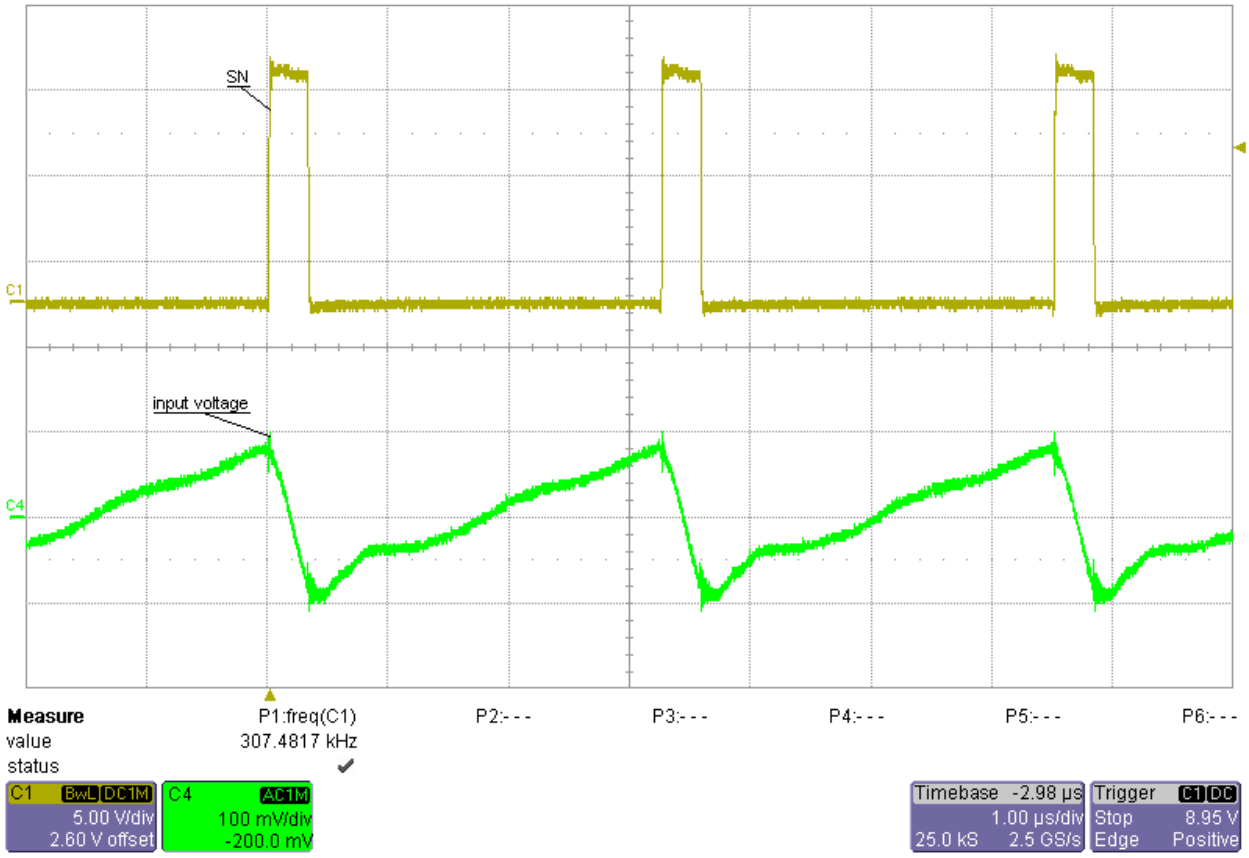
## 6 Output ripple voltage

Input voltage = 13.5V
Output voltage = 1.2V
Load current = 25A



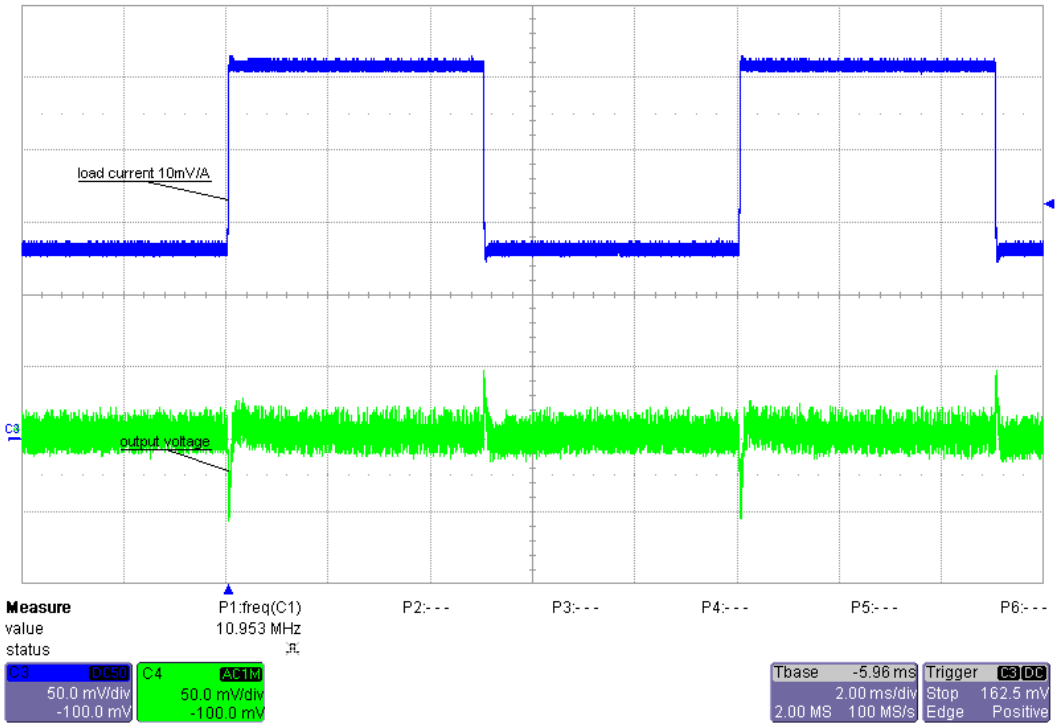
## 7 input ripple voltage

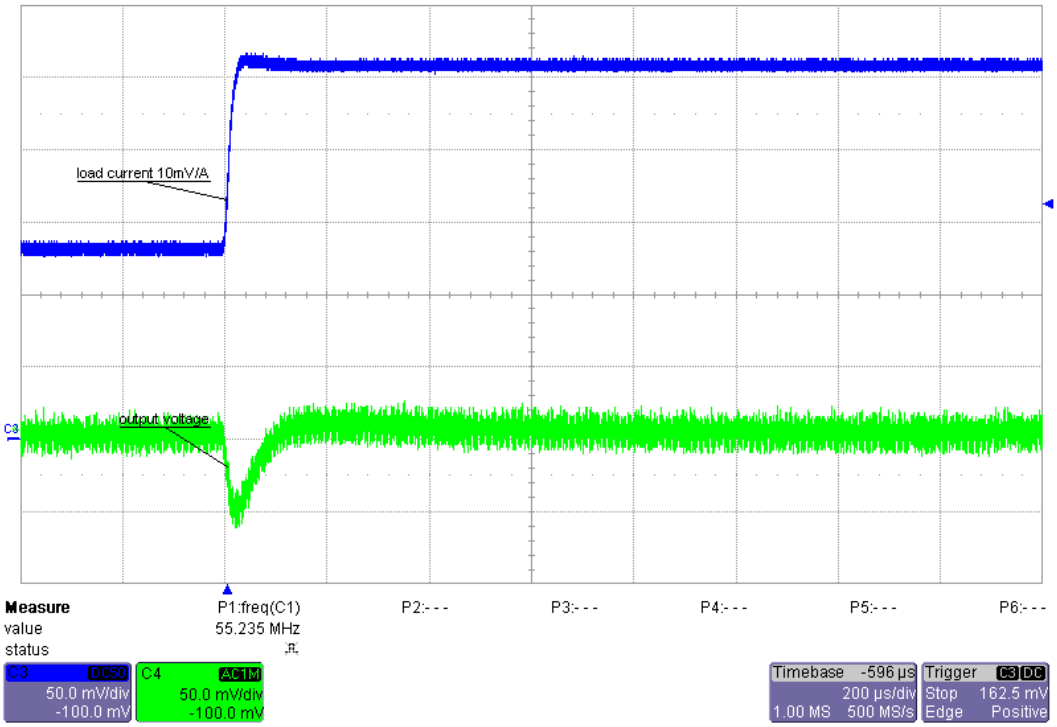
without bulk capacitors C104, C110
Input voltage = 13.5V
Output voltage = 1.2V
Load current = 25A

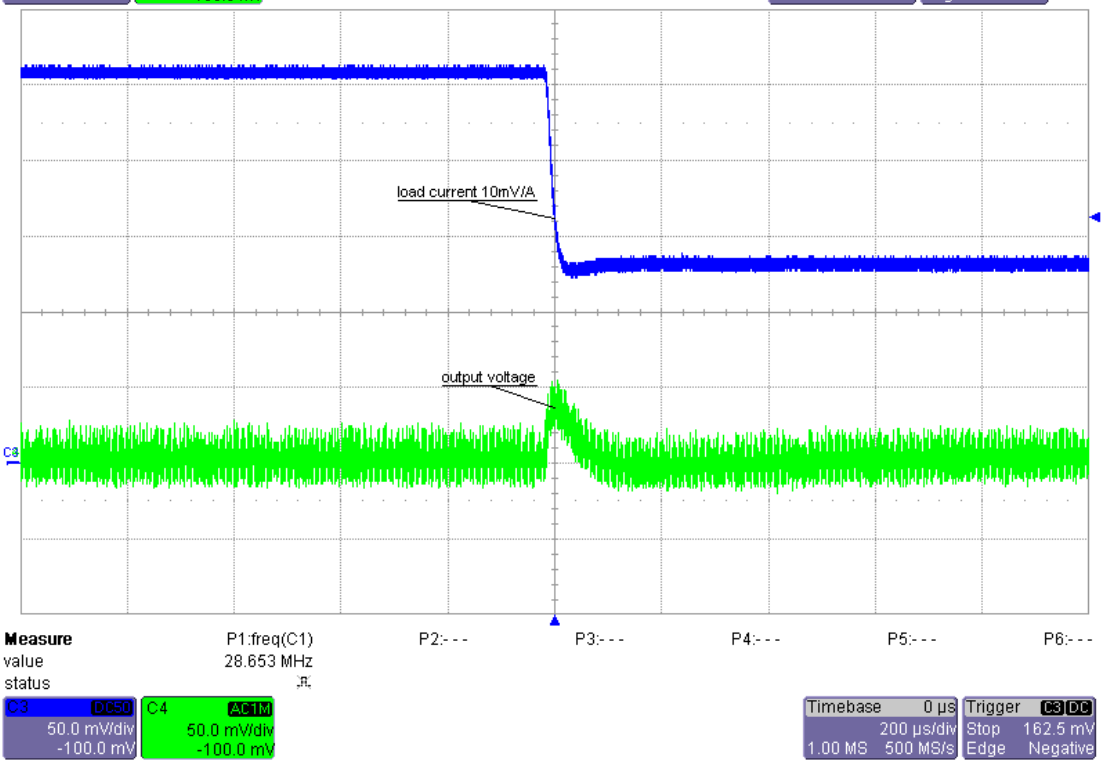


## 8 Load Transients

Input voltage = 13.5V
Output voltage = 1.2V
Load current = 12.5A – 25A




load current 10mV/A
output voltage
C3
Measure
value
status
P1:freq(C1)
55.235 MHz
P2:- - -
P3:- - -
P4:- - -
P5:- - -
P6:- - -
C3 DC50
50.0 mV/div
-100.0 mV
C4 AC1M
50.0 mV/div
-100.0 mV
Timebase -596 µs
200 µs/div
1.00 MS 500 MS/s
Trigger C3 DC
Stop 162.5 mV
Edge Positive

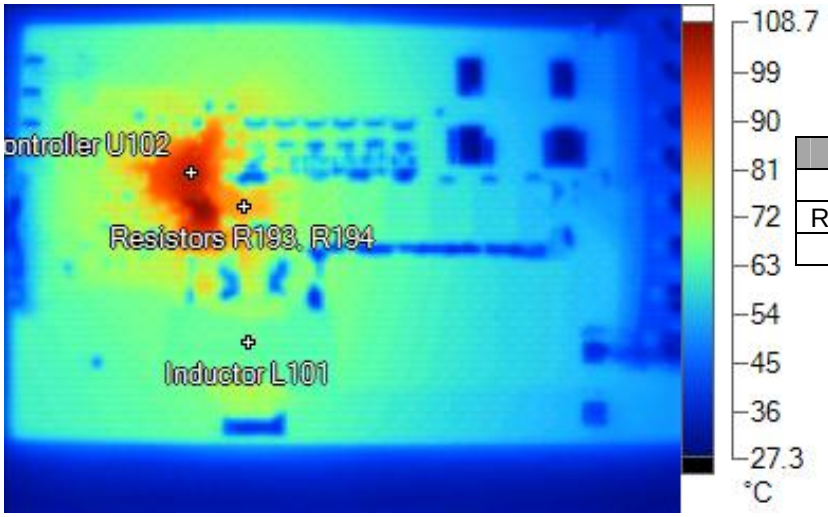

load current 10mV/A
output voltage
C3
Measure
value
status
P1:freq(C1)
28.653 MHz
P2:- - -
P3:- - -
P4:- - -
P5:- - -
P6:- - -
C3 DC50
50.0 mV/div
-100.0 mV
C4 AC1M
50.0 mV/div
-100.0 mV
Timebase 0 µs
200 µs/div
1.00 MS 500 MS/s
Trigger C3 DC
Stop 162.5 mV
Edge Negative

# 9 Thermal Analysis

## 9.1 First board with 35µm Cu (all 4 layers)

The images below show the infrared images taken from the FlexCam after 15min at full load (1.2V@25A).

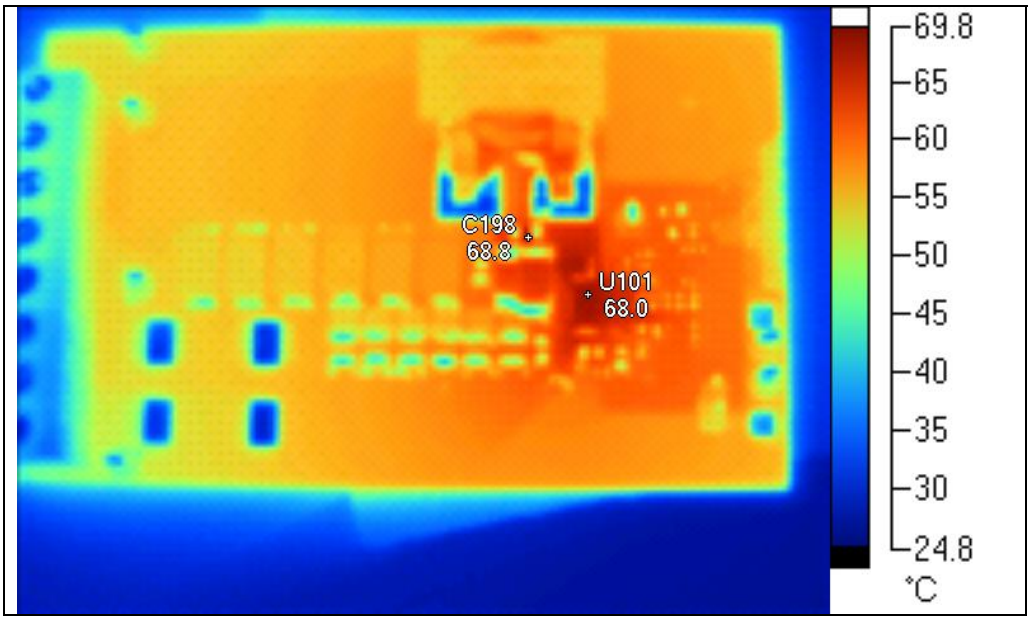
Input voltage = 13.5VDC




| Name | Temperature |
|---|---|
| **Controller U102** | **102.1°C** |
| Resistors R193, R194 | 84.5°C |
| Inductor L101 | 65.0°C |

## 9.2 *Revised* board with 130µm-105µm-105µm-130µm Cu

Input Voltage 13.5V **1.09V out** @25A




| Name | Temperature |
|---|---|
| C198 | 68.8°C |
| **U102** | **68.0°C** |

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