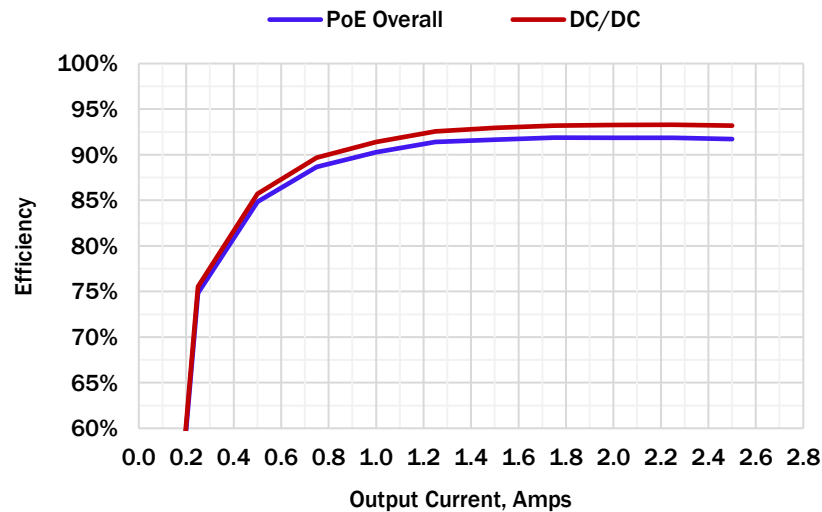
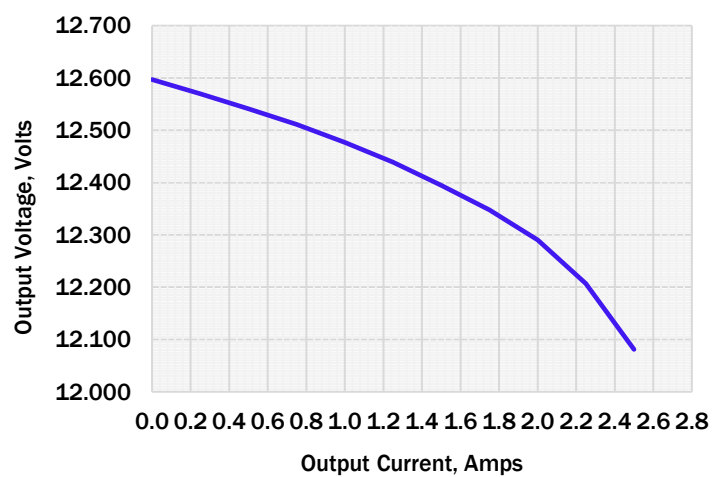


## Class 4 PoE PD Flyback Converter (12 V, 2.5 A) Reference Design (Mar/19/2025)

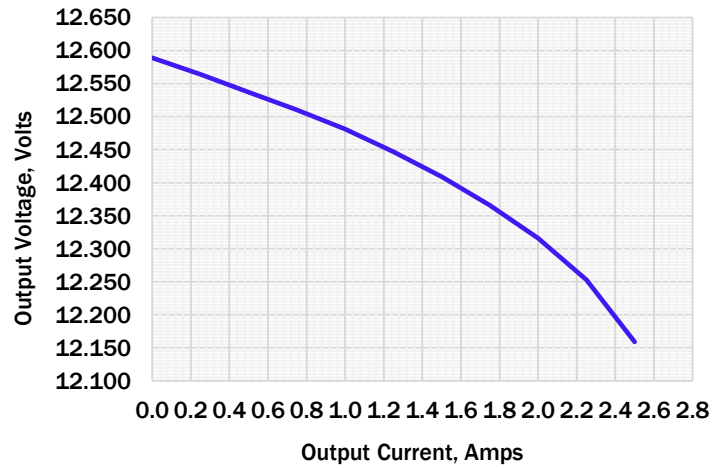
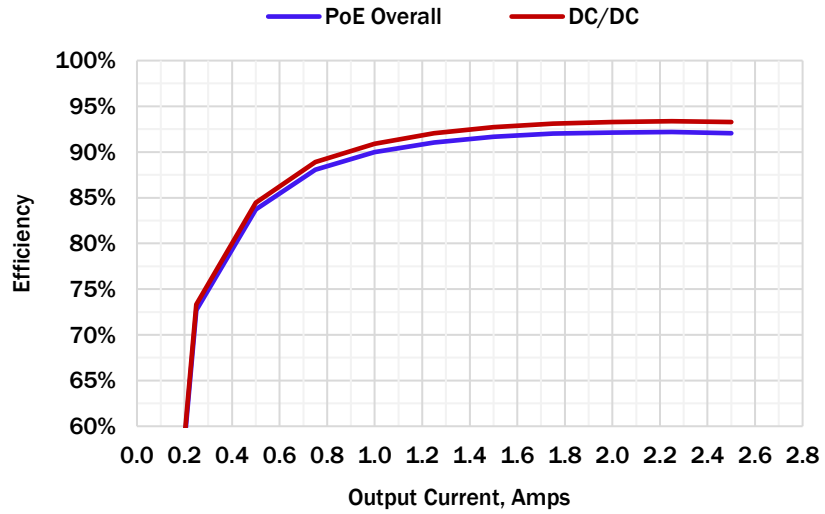
### Efficiency and Vout regulation:

| POE Input Voltage (V) | PoE Input Current (A) | DC/DC Input Voltage (V) | Output Voltage (V) | Output Current (A) | PoE Efficiency | DC/DC Efficiency |
|-----------------------|-----------------------|-------------------------|--------------------|--------------------|----------------|------------------|
| 42                    | 0.025                 | 41.673                  | 12.597             | 0.000              | 0.0%           | 0.0%             |
| 42                    | 0.100                 | 41.602                  | 12.570             | 0.250              | 74.8%          | 75.5%            |
| 42                    | 0.176                 | 41.561                  | 12.541             | 0.500              | 84.8%          | 85.7%            |
| 42                    | 0.252                 | 41.526                  | 12.511             | 0.750              | 88.7%          | 89.7%            |
| 42                    | 0.329                 | 41.493                  | 12.477             | 1.000              | 90.3%          | 91.4%            |
| 42                    | 0.405                 | 41.471                  | 12.439             | 1.250              | 91.4%          | 92.6%            |
| 42                    | 0.483                 | 41.417                  | 12.395             | 1.500              | 91.7%          | 92.9%            |
| 42                    | 0.560                 | 41.410                  | 12.348             | 1.750              | 91.9%          | 93.2%            |
| 42                    | 0.637                 | 41.382                  | 12.290             | 2.000              | 91.9%          | 93.2%            |
| 42                    | 0.712                 | 41.351                  | 12.207             | 2.250              | 91.8%          | 93.3%            |
| 42                    | 0.784                 | 41.333                  | 12.081             | 2.500              | 91.7%          | 93.2%            |



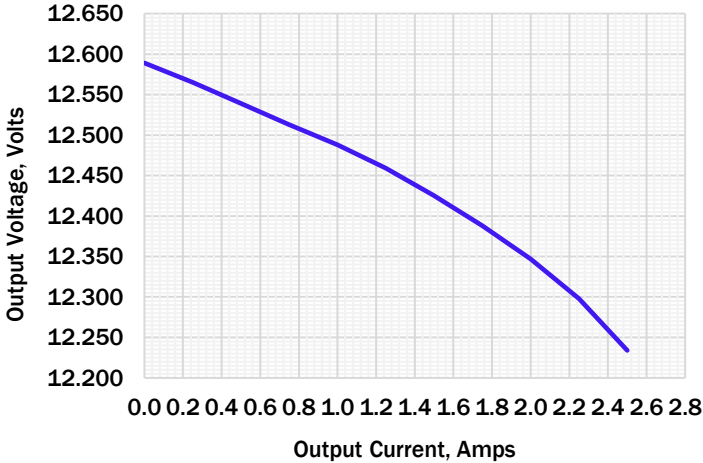
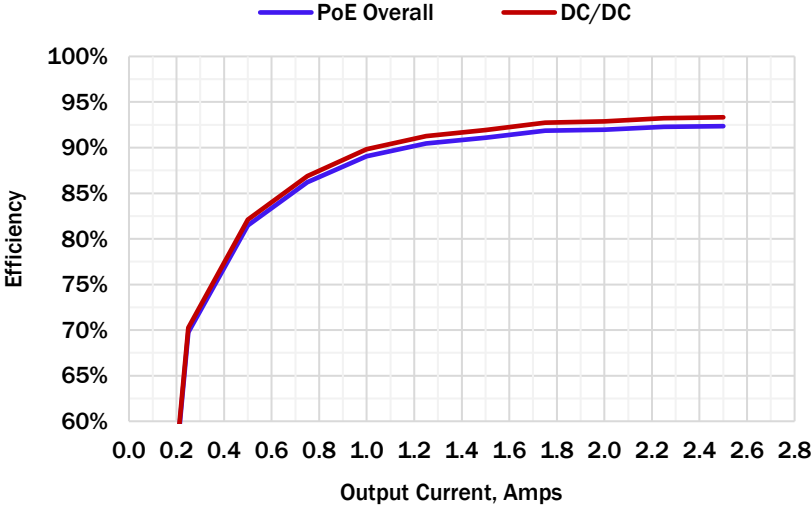


| POE Input Voltage (V) | PoE Input Current (A) | DC/DC Input Voltage (V) | Output Voltage (V) | Output Current (A) | PoE Efficiency | DC/DC Efficiency |
|-----------------------|-----------------------|-------------------------|--------------------|--------------------|----------------|------------------|
| 48                    | 0.025                 | 47.668                  | 12.589             | 0.000              | 0.0%           | 0.0%             |
| 48                    | 0.090                 | 47.604                  | 12.564             | 0.250              | 72.7%          | 73.3%            |
| 48                    | 0.156                 | 47.569                  | 12.537             | 0.500              | 83.7%          | 84.5%            |
| 48                    | 0.222                 | 47.544                  | 12.510             | 0.750              | 88.0%          | 88.9%            |
| 48                    | 0.289                 | 47.515                  | 12.481             | 1.000              | 90.0%          | 90.9%            |
| 48                    | 0.356                 | 47.482                  | 12.447             | 1.250              | 91.1%          | 92.0%            |
| 48                    | 0.423                 | 47.462                  | 12.409             | 1.500              | 91.7%          | 92.7%            |
| 48                    | 0.490                 | 47.441                  | 12.366             | 1.750              | 92.0%          | 93.1%            |
| 48                    | 0.557                 | 47.415                  | 12.316             | 2.000              | 92.1%          | 93.3%            |
| 48                    | 0.623                 | 47.394                  | 12.253             | 2.250              | 92.2%          | 93.4%            |
| 48                    | 0.688                 | 47.366                  | 12.159             | 2.500              | 92.0%          | 93.3%            |



| POE Input Voltage (V) | PoE Input Current (A) | DC/DC Input Voltage (V) | Output Voltage (V) | Output Current (A) | PoE Efficiency | DC/DC Efficiency |
|-----------------------|-----------------------|-------------------------|--------------------|--------------------|----------------|------------------|
| 57                    | 0.025                 | 56.655                  | 12.589             | 0.000              | 0.0%           | 0.0%             |
| 57                    | 0.079                 | 56.604                  | 12.565             | 0.250              | 69.8%          | 70.2%            |
| 57                    | 0.135                 | 56.564                  | 12.539             | 0.500              | 81.5%          | 82.1%            |
| 57                    | 0.191                 | 56.549                  | 12.513             | 0.750              | 86.2%          | 86.9%            |
| 57                    | 0.246                 | 56.521                  | 12.488             | 1.000              | 89.1%          | 89.8%            |
| 57                    | 0.302                 | 56.499                  | 12.459             | 1.250              | 90.5%          | 91.3%            |
| 57                    | 0.359                 | 56.479                  | 12.425             | 1.500              | 91.1%          | 91.9%            |
| 57                    | 0.414                 | 56.459                  | 12.388             | 1.750              | 91.9%          | 92.7%            |
| 57                    | 0.471                 | 56.440                  | 12.347             | 2.000              | 92.0%          | 92.9%            |

|    |       |        |        |       |       |       |
|----|-------|--------|--------|-------|-------|-------|
| 57 | 0.526 | 56.429 | 12.298 | 2.250 | 92.3% | 93.2% |
| 57 | 0.581 | 56.406 | 12.234 | 2.500 | 92.4% | 93.3% |



**Thermal images (Vin = 48 V, output = 12 V 2.5 A, after 60 mins):**

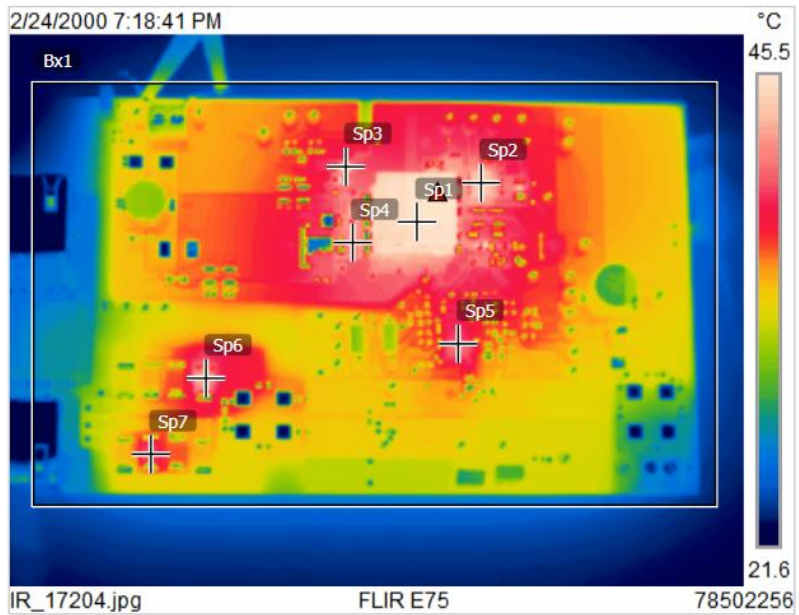
**Top:**

### Measurements

|     |     |         |
|-----|-----|---------|
| Bx1 | Max | 46.0 °C |
| Sp1 |     | 45.3 °C |
| Sp2 |     | 44.3 °C |
| Sp3 |     | 44.1 °C |
| Sp4 |     | 42.5 °C |
| Sp5 |     | 41.4 °C |
| Sp6 |     | 43.1 °C |
| Sp7 |     | 40.4 °C |

### Parameters

|             |       |
|-------------|-------|
| Emissivity  | 0.94  |
| Refl. temp. | 20 °C |



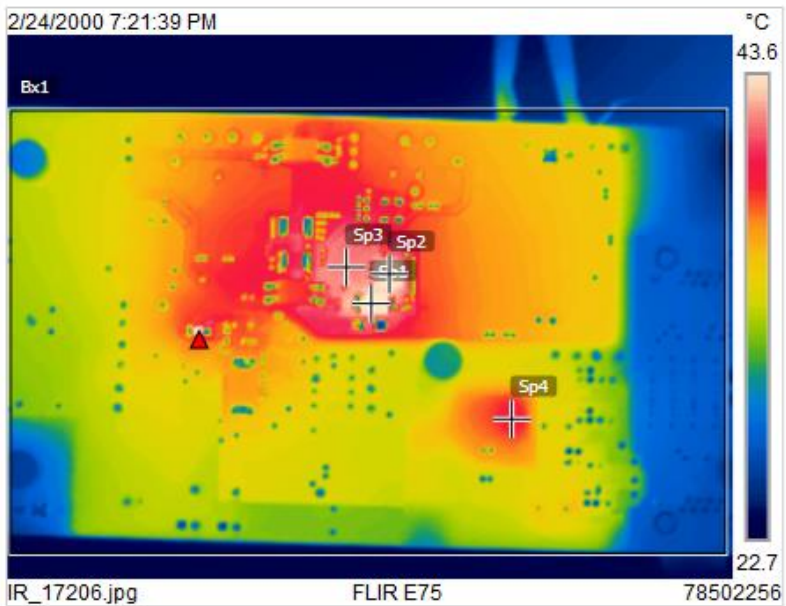
**Bottom:**

### Measurements

|     |     |         |
|-----|-----|---------|
| Bx1 | Max | 49.5 °C |
| Sp1 |     | 46.1 °C |
| Sp2 |     | 44.1 °C |
| Sp3 |     | 41.7 °C |
| Sp4 |     | 39.4 °C |

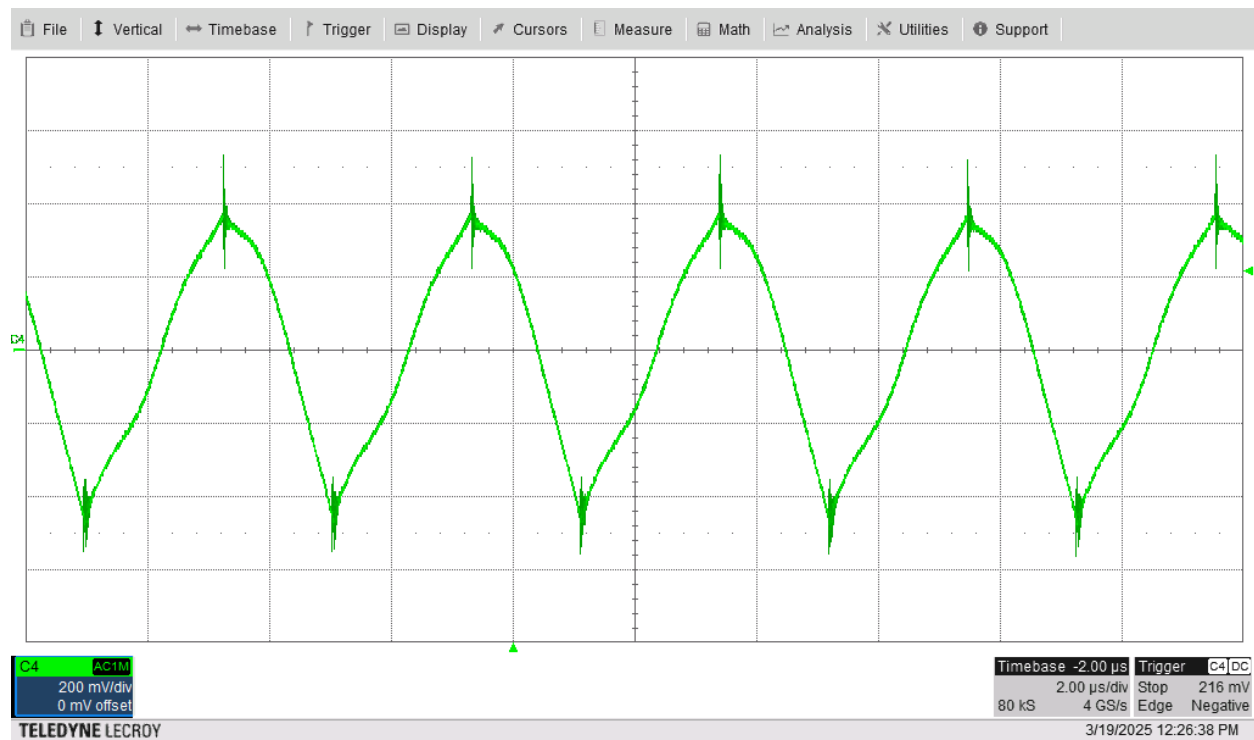
### Parameters

|             |       |
|-------------|-------|
| Emissivity  | 0.94  |
| Refl. temp. | 20 °C |

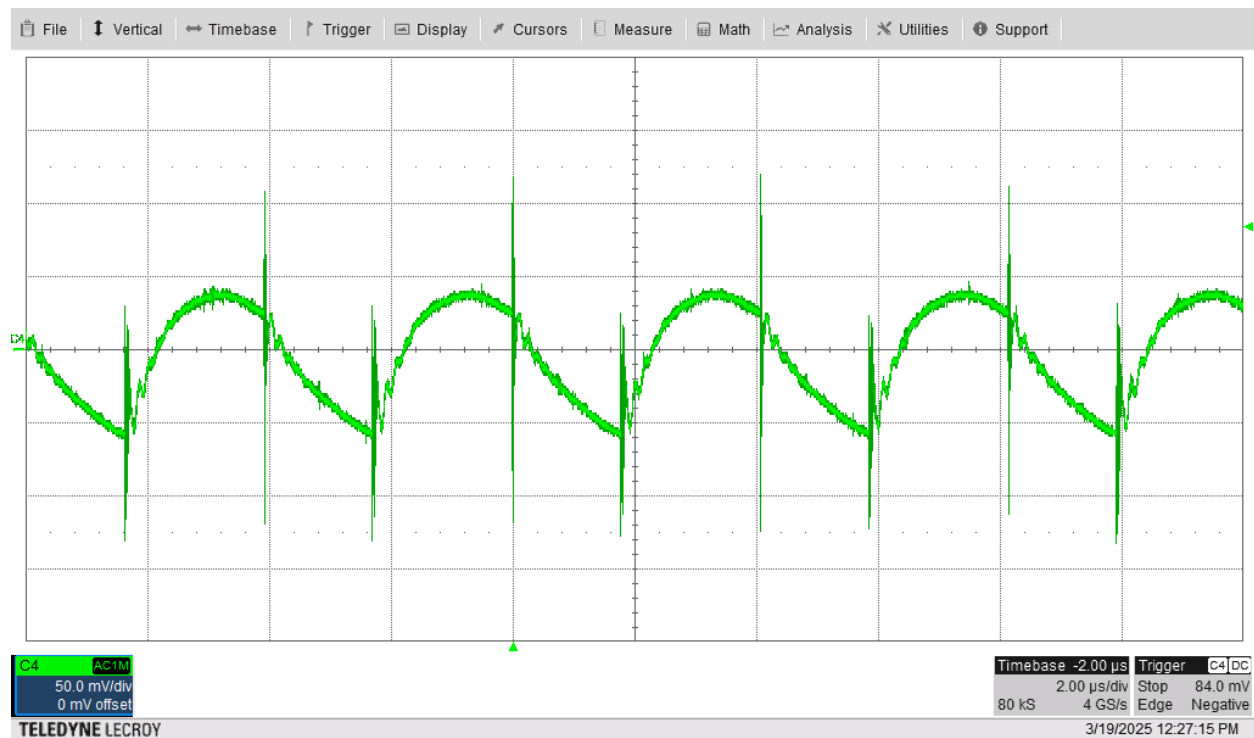


**Voltage ripple at Vbulk and Vout (Vin = 48 V, output = 12 V 2.5 A):**

**Vbulk:**

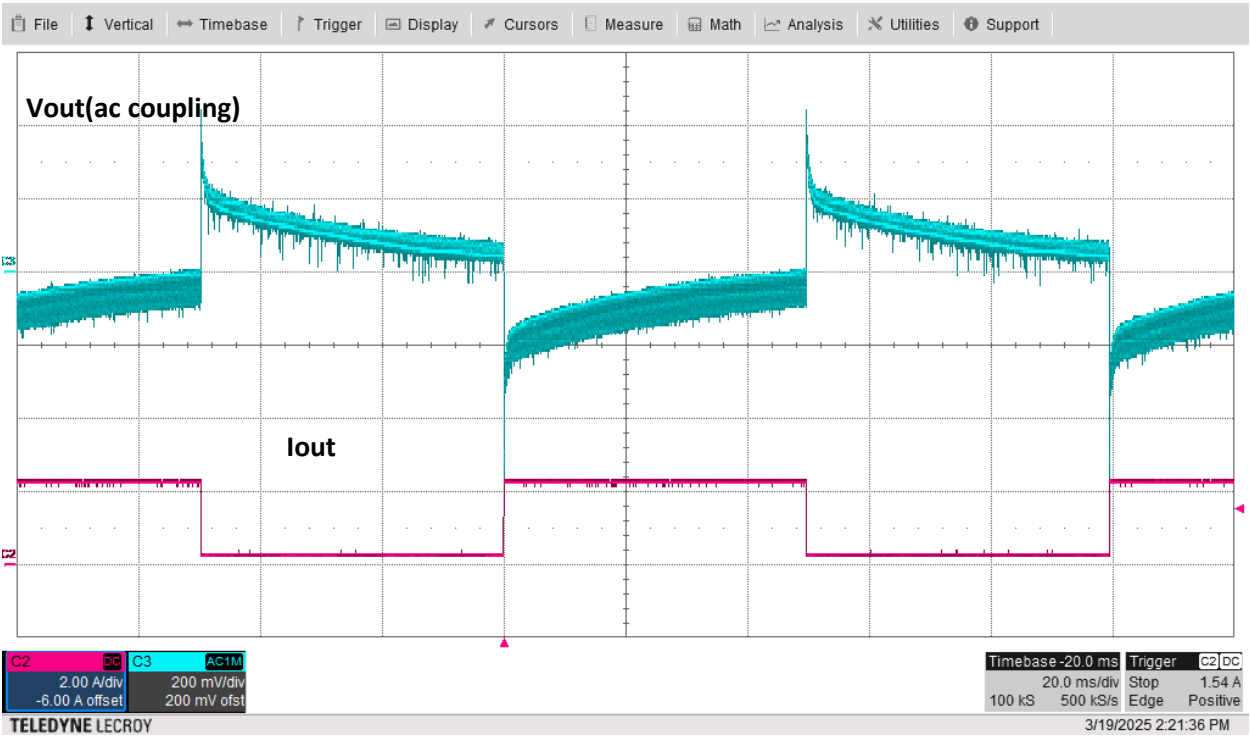


Vout:



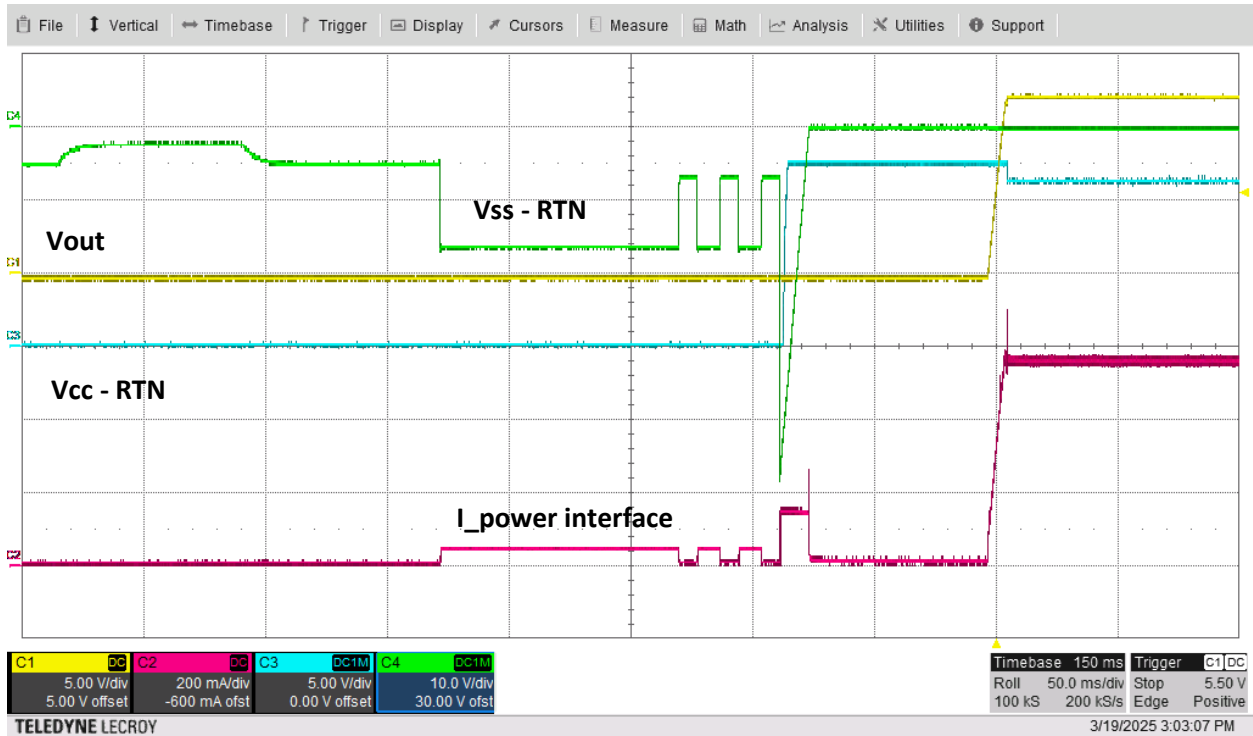
Load Transients ( $V_{in} = 48$  V):

**$I_{out} = 0.25\text{ A to }2.25\text{ A}$ , frequency = 10 kHz**



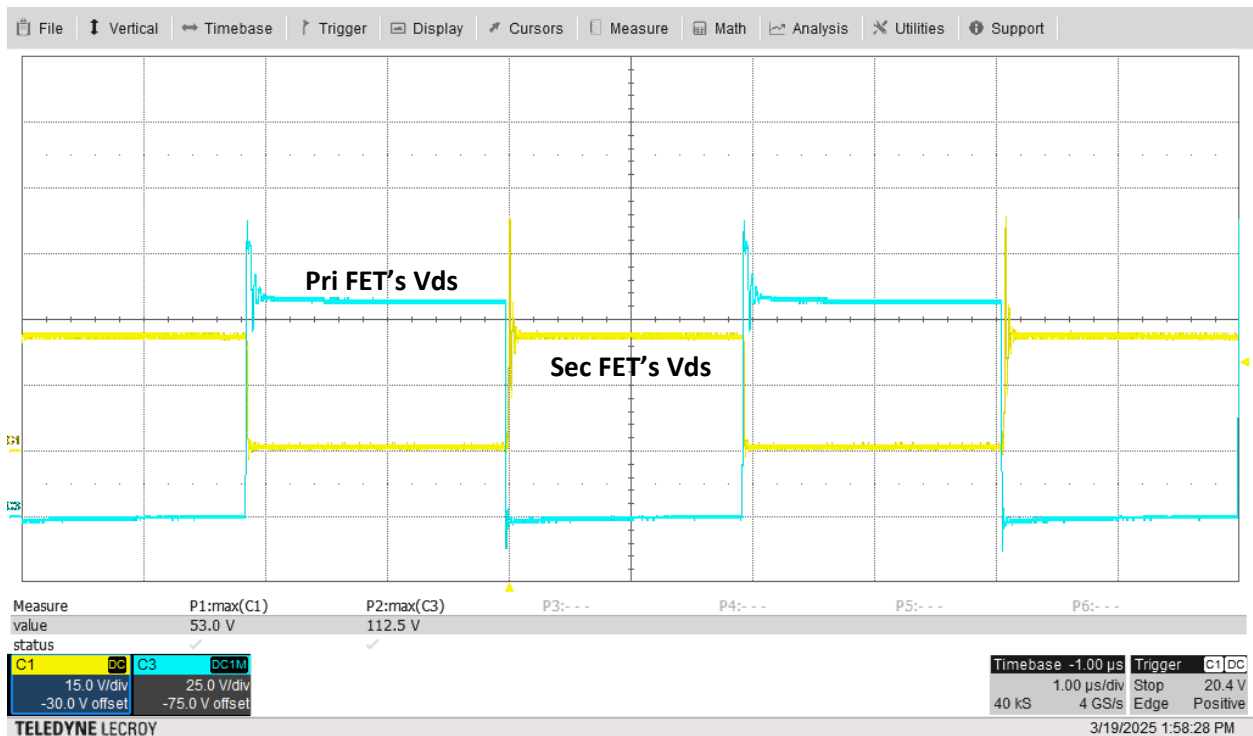
**Startup ( $V_{in} = 48\text{ V}$ ):**

**$I_{out} = 2\text{ A}$**



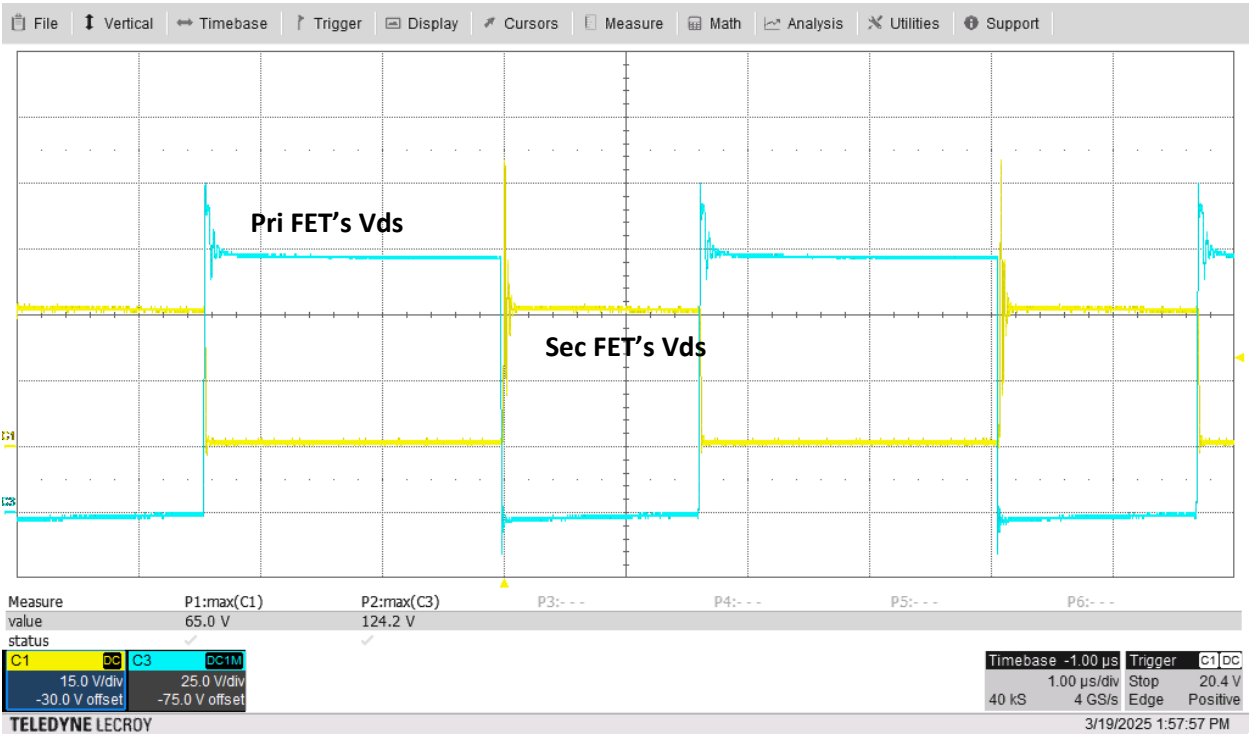
## Switching Transient:

Vin = 42 V, Iout = 2.5 A:



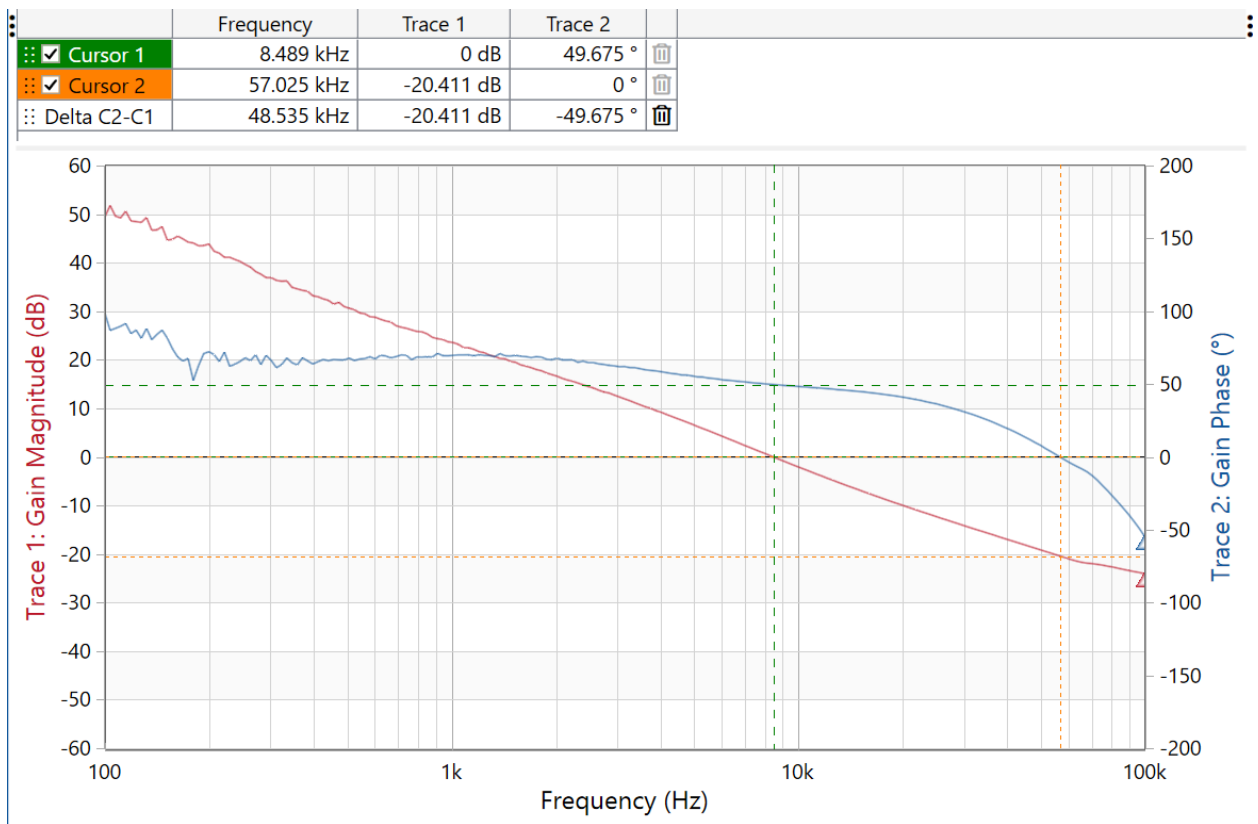


Vin = 57 V, Iout = 2 A:



Bode Plot (Vin = 48 V):

Iout = 0.1 A: Phase 49.675°, Gain 20.411 dB



**Iout = 2.5 A: Phase 59.118°, Gain 21.279 dB**

|             | Frequency  | Trace 1    | Trace 2   |  |
|-------------|------------|------------|-----------|--|
| Cursor 1    | 4.676 kHz  | 0 dB       | 59.118 °  |  |
| Cursor 2    | 83.541 kHz | -21.279 dB | 0 °       |  |
| Delta C2-C1 | 78.866 kHz | -21.279 dB | -59.118 ° |  |

