# NCP1083 Evaluation Board User's Manual

## PoE−PD Interface & Flyback Controller Board

# NCP1083REF12VC4GEVB

EA Certified 2.0

### General

The NCP1083REF12VC4GEVB board allows easy implementation and evaluation of a Power−over−Ethernet powered equipment that is able to operate with an assigned power level up to 25.5 W. The evaluation board is based on PoE Powered Device controller NCP1083 (U2) with integrated PoE PD interface controller and Flyback DC/DC controller. The Flyback converter on this NCP1083 based reference design generates a 12 V output voltage that is isolated from the Ethernet link conductors.

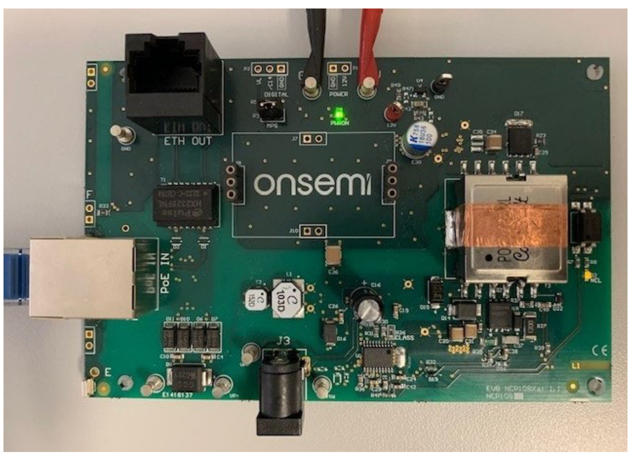


**Figure 1. Operational NCP1083REF12VC4GEVB showing Basic Interconnections**

The NCP1083REF12VC4GEVB board is designed as a PoE splitter: having a PoE−enabled Ethernet port (labeled "PoE IN") as input and generating an isolated 12 V supply while passing through the data to another Ethernet port (labeled "ETH OUT").

### Quick Start Guide

Step 1: Make sure the jumper is mounted on header P3 (labeled "MPS").

Step 2: Insert the Ethernet cable (cf. blue cable in the picture on the left) coming from the PSE in the Ethernet connector J2 labeled "PoE IN".

Step 3: Observe the status LEDs.

If the PSE powers up the system, the green POWER−ON LED (labeled "PWRON") should be ON.

The status of the yellow LED (labeled "NCL") depends on the PSE being used.

Step 4: Optionally connect the turret terminals that are labeled "GND" and "12V" to a DC electronic load (cf. black and red clips in the picture on the left). The DC electronic load behind the NCP1083 EVB should be operational over a 11 V to 13 V voltage range.

### Assigned Power

The NCP1083REF12VC4GEVB will request Class 4 during Physical Layer classification. PDs need to consider that they can be underpowered and eventually be assigned to Class 3.

The state of the nCLASS_AT output provides information about the power level that the PSE has assigned to the NCP1083REF12VC4GEVB during classification. See Table 1 to determine the assigned power based on the status of the orange NCL led.

**Table 1. CLASSIFICATION RESULT**

| NCL Led | Assigned Class | Assigned Power |
|---|---|---|
| off | 3 | 13 W |
| on | 4 | 25.5 W |

Figure 2 shows that the load on the 12 V output should be limited to **1.82 A** to meet the maximum input average power for **Class 4** over the complete input DC voltage range. Likewise, Figure 3 shows that the load on the 12 V output should be limited to **0.92 A** to meet the maximum input average power for **Class 3** over the complete input DC voltage range.

The application should always operate at or below the assigned power limit. Failure to do so will result in the PSE disconnecting the PD !

### Maintain Power Signature (MPS)

A PD should draw a minimum amount of current in order to prevent the PSE from removing power. The load resistor R15 was added on the bottom side of the board to be able to make sure the load current is always sufficient and the NCP1083REF12VC4GEVB remains powered. This load resistor R15 is enabled when a **jumper** is placed on header P3 labeled "MPS". As can be seen in Figure 4, the input current remains well above 10 mA over the complete PSE output voltage range when the jumper is mounted on the "MPS" header P3.

Depending on the minimum current the system may draw, the resistance value of R15 should be increased for the final design in order not to waste power unnecessarily.

For some systems, the load resistor can even be omitted.

### Earth Connection

A Powered Device (PD) can operate without an earth connection.

In case NCP1083REF12VGEVB would need to be earthed, it should be the frame ground "Frame" that is connected to earth. This could be implemented in one of the following ways:

- Soldering an earthed wire in the 1.6 mm hole (labeled "E")
- Connecting an earthed wire with alligator clip on the SMT Test Point on the top (TP12) or the SMT Test Point on the bottom (TP17)
- Connecting a shielded Ethernet cable of which the shield is earthed to the PoE−enabled Ethernet port J2 (labeled "PoE IN")

If NCP1083REF12VGEVB is earthed, the internal system ground "GND" should not be driven more than 15 V above or below earth potential in order not to overstress TVS diode D21.

### Auxiliary Supply

The NCP1083REF12VC4GEVB supports drawing power from an alternate or local power source in applications connected to non−PoE enabled networks. A rear auxiliary supply can be inserted in connector J3.

The recommended voltage of the auxiliary supply is 48 V, but eventually the NCP1083REF12VC4GEVB is able to operate with a higher auxiliary supply voltage up to 57 V.

### Requested Power

As mentioned before, the NCP1083REF12VC4GEVB will request Class 4 during Physical Layer classification. If a lower Class or power level is preferred, resistor R26 labeled "CLASS" should be changed. See the NCP1083 datasheet for the nominal resistance values.

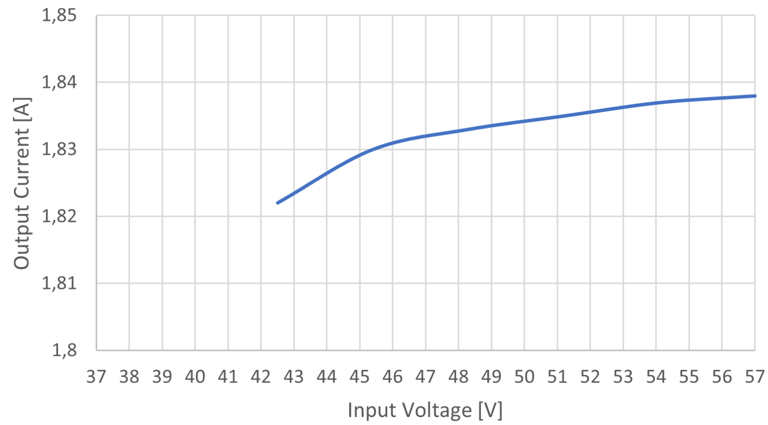


**Figure 2. Output Current vs. PoE Input Voltage – Full Input Power Load (Class 4)**

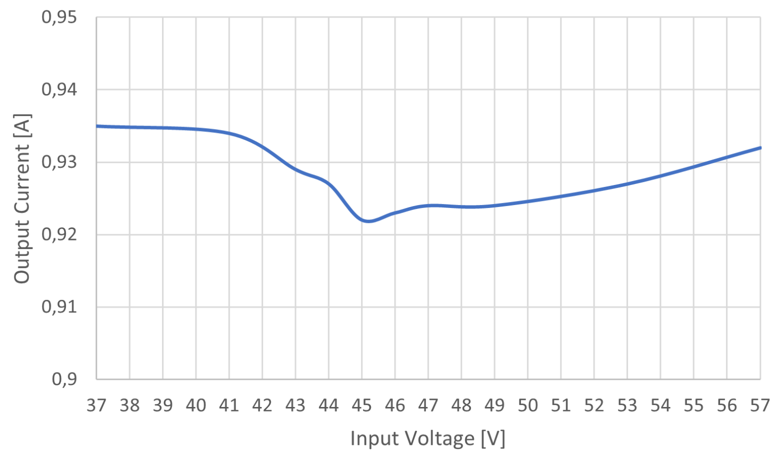


**Figure 3. Output Current vs. PoE Input Voltage – Full Input Power Load (Class 3)**

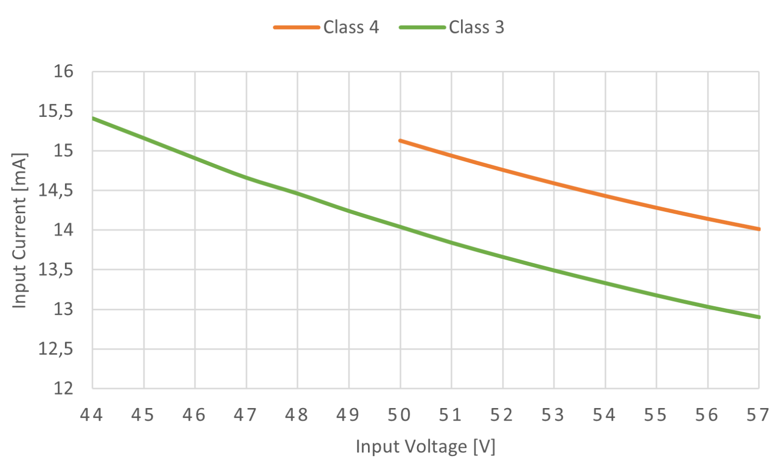


**Figure 4. PoE Input Current vs PoE Input Voltage – No Output Load except R15**

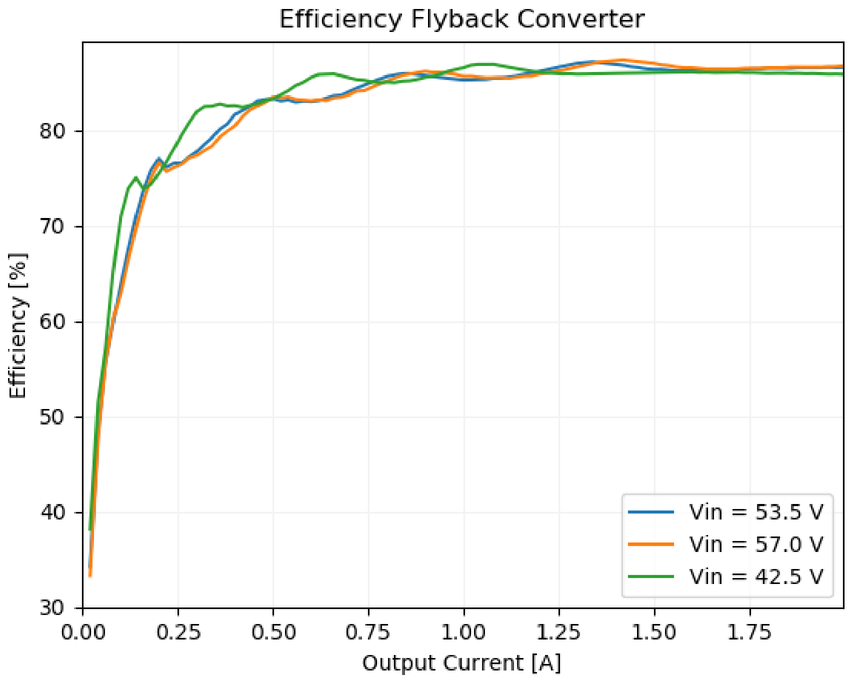


**Figure 5. Efficiency vs. Output Current**

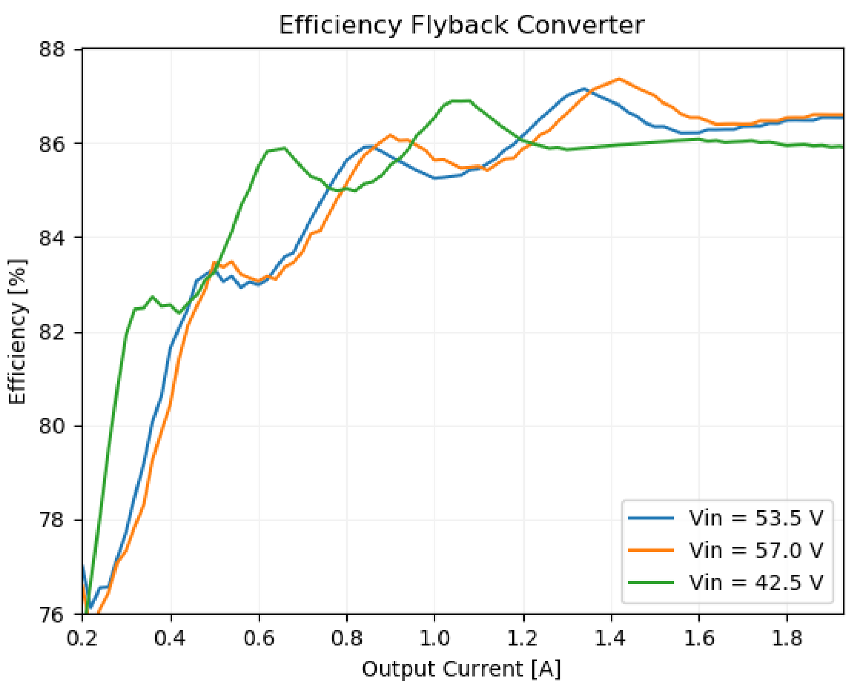


**Figure 6. Efficiency vs. Output Current – Zoom In**

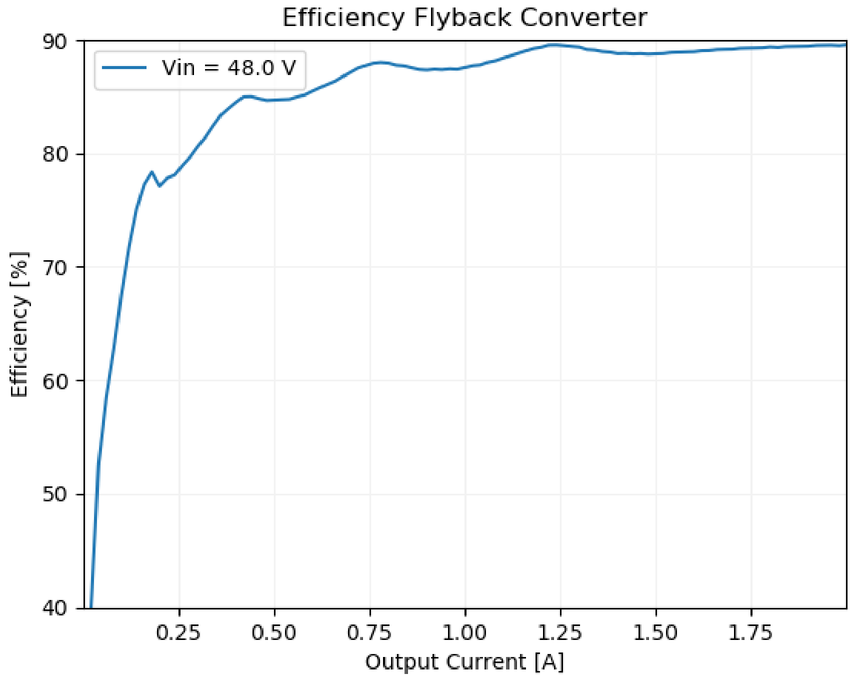


**Figure 7. Efficiency vs. Output Current – from (VPP,RTN) to (12V,GND)**

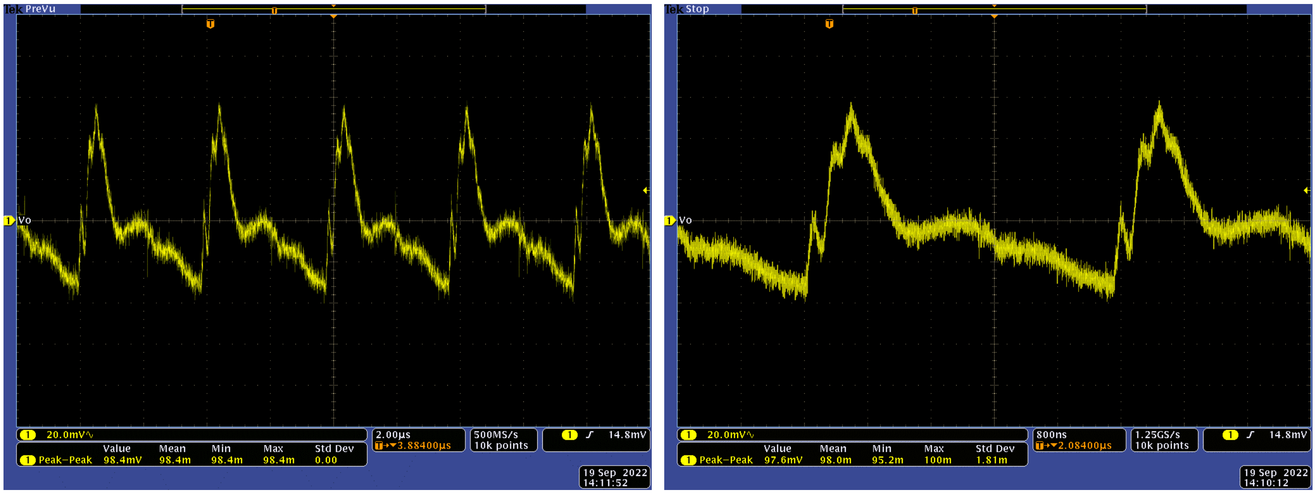


Figure 8. 12 V Output Ripple and Noise

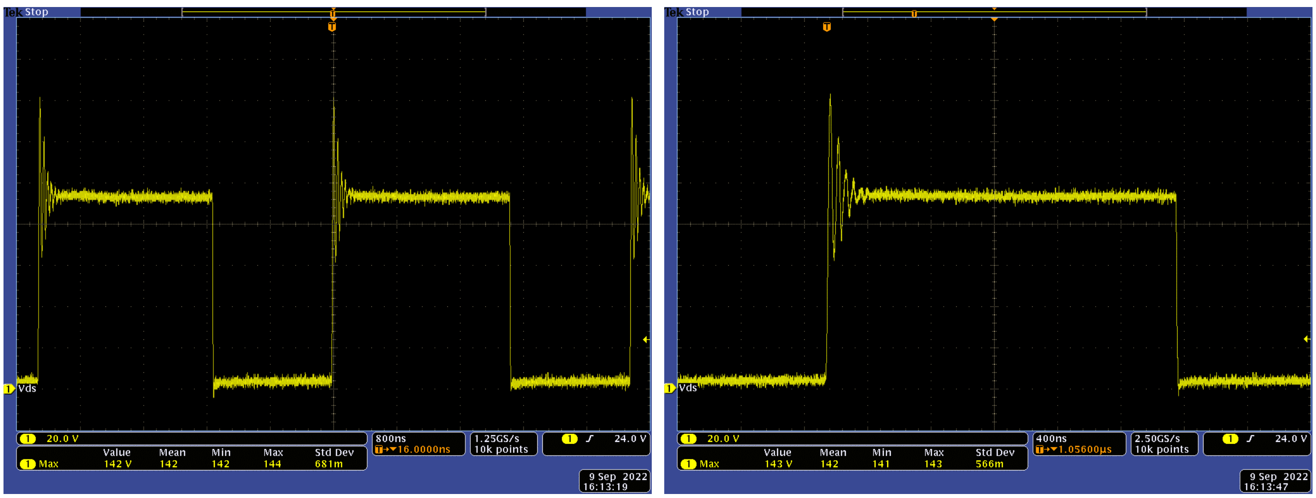


Figure 9. $V_{DrainSource}$ Primary Mosfet Q2 ($V_{PD}$ = 57 V)

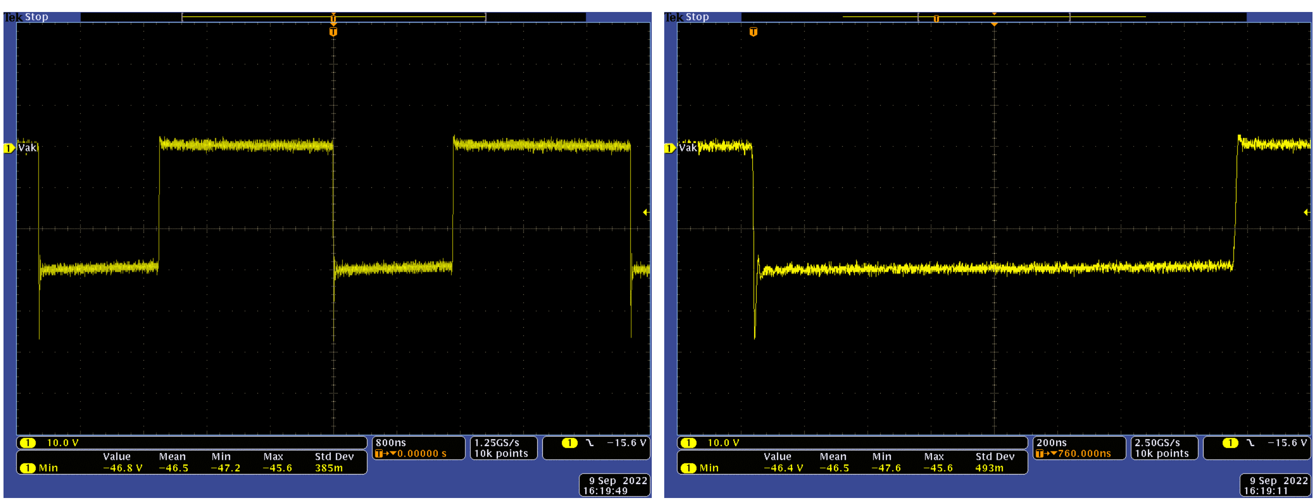


Figure 10. $V_{CathodeAnode}$ Secondary Diode D17 ($V_{PD}$ = 57 V)


Figure 11. Thermal Image − Top

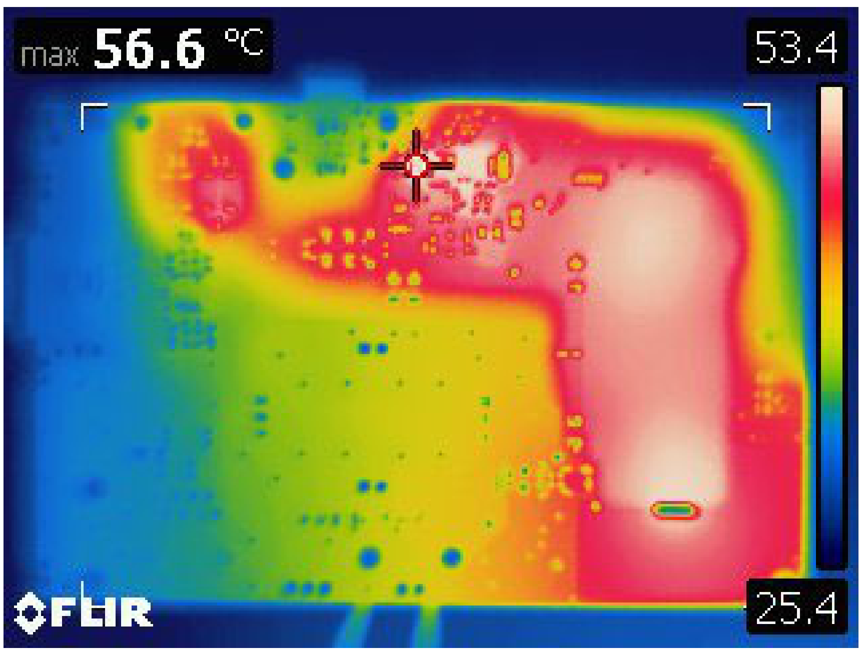


Figure 12. Thermal Image − Bottom


Figure 13. Emission Test DUT: NCP1083REF12VGEVB with 7.3 Ω Load

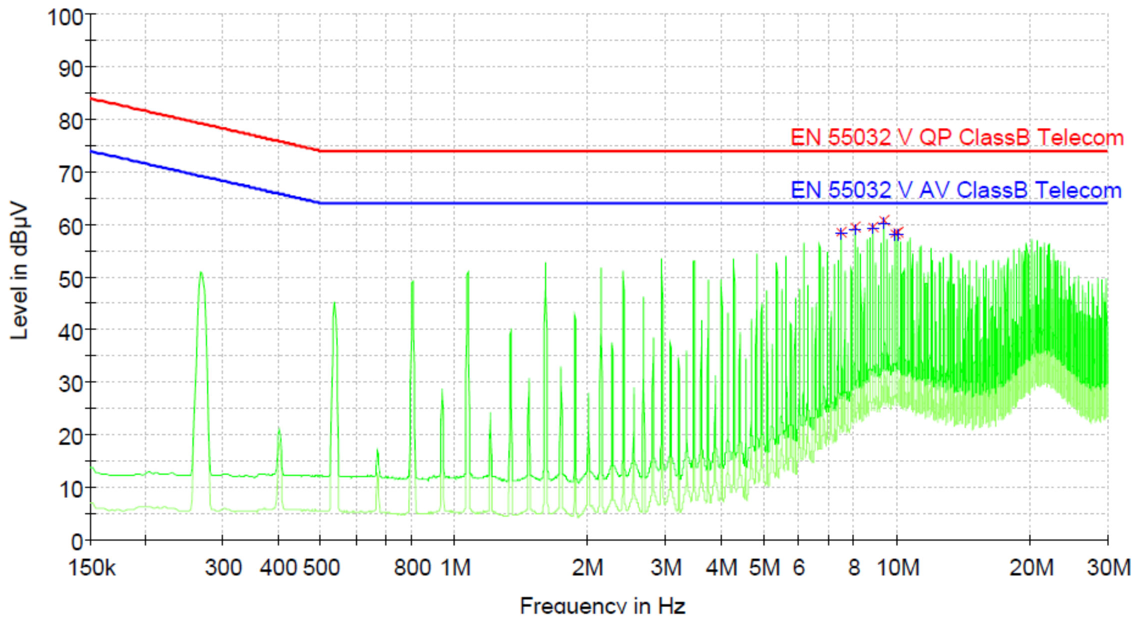


**Figure 14. Conducted Emission – Preview Result and Final Result**

**Table 2. CONDUCTED EMISSION – FINAL RESULT QPK**

| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Corr. (dB) |
|---|---|---|---|---|
| 7.503000 | 58.48 | 74.00 | 15.52 | 9.6 |
| 8.038500 | 59.38 | 74.00 | 14.62 | 9.7 |
| 8.841750 | 59.61 | 74.00 | 14.39 | 9.7 |
| 9.379500 | 60.63 | 74.00 | 13.37 | 9.7 |
| 9.915000 | 58.32 | 74.00 | 15.68 | 9.7 |
| 10.047750 | 58.47 | 74.00 | 15.53 | 9.7 |

**Table 3. CONDUCTED EMISSION – FINAL RESULT CAV**

| Frequency (MHz) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Corr. (dB) |
|---|---|---|---|---|
| 7.503000 | 58.25 | 64.00 | 5.76 | 9.6 |
| 8.038500 | 59.12 | 64.00 | 4.88 | 9.7 |
| 8.844000 | 59.30 | 64.00 | 4.70 | 9.7 |
| 9.379500 | 60.29 | 64.00 | 3.71 | 9.7 |
| 9.915000 | 57.94 | 64.00 | 6.06 | 9.7 |
| 10.047750 | 58.08 | 64.00 | 5.92 | 9.7 |

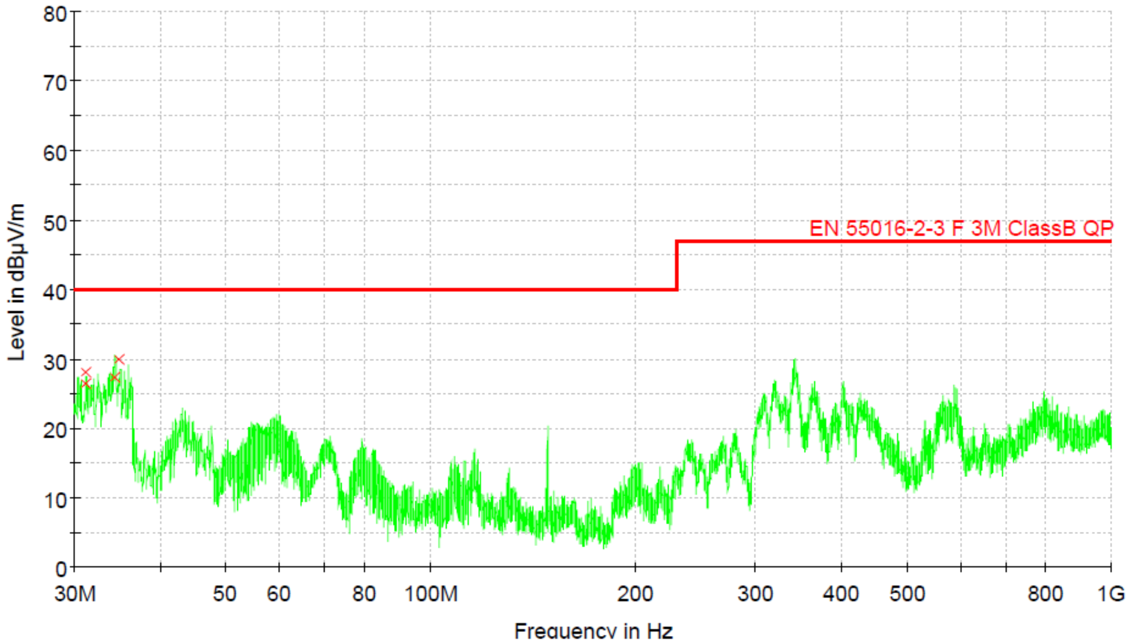


**Figure 15. Radiated Emission – Preview Result and Final Result**

**Table 4. RADIATED EMISSION – FINAL RESULT QPK**

| Frequency (MHz) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 31.160000 | 28.15 | 40.00 | 11.85 | 1000.0 | 120.000 | 98.0 | V | 173.0 | –9.9 |
| 31.180000 | 26.45 | 40.00 | 13.55 | 1000.0 | 120.000 | 122.0 | V | 253.0 | –9.9 |
| 34.360000 | 27.29 | 40.00 | 12.71 | 1000.0 | 120.000 | 103.0 | V | 138.0 | –11.8 |
| 34.900000 | 29.86 | 40.00 | 10.14 | 1000.0 | 120.000 | 98.0 | V | 309.0 | –12.1 |

# NCP1083REF12VC4GEVB

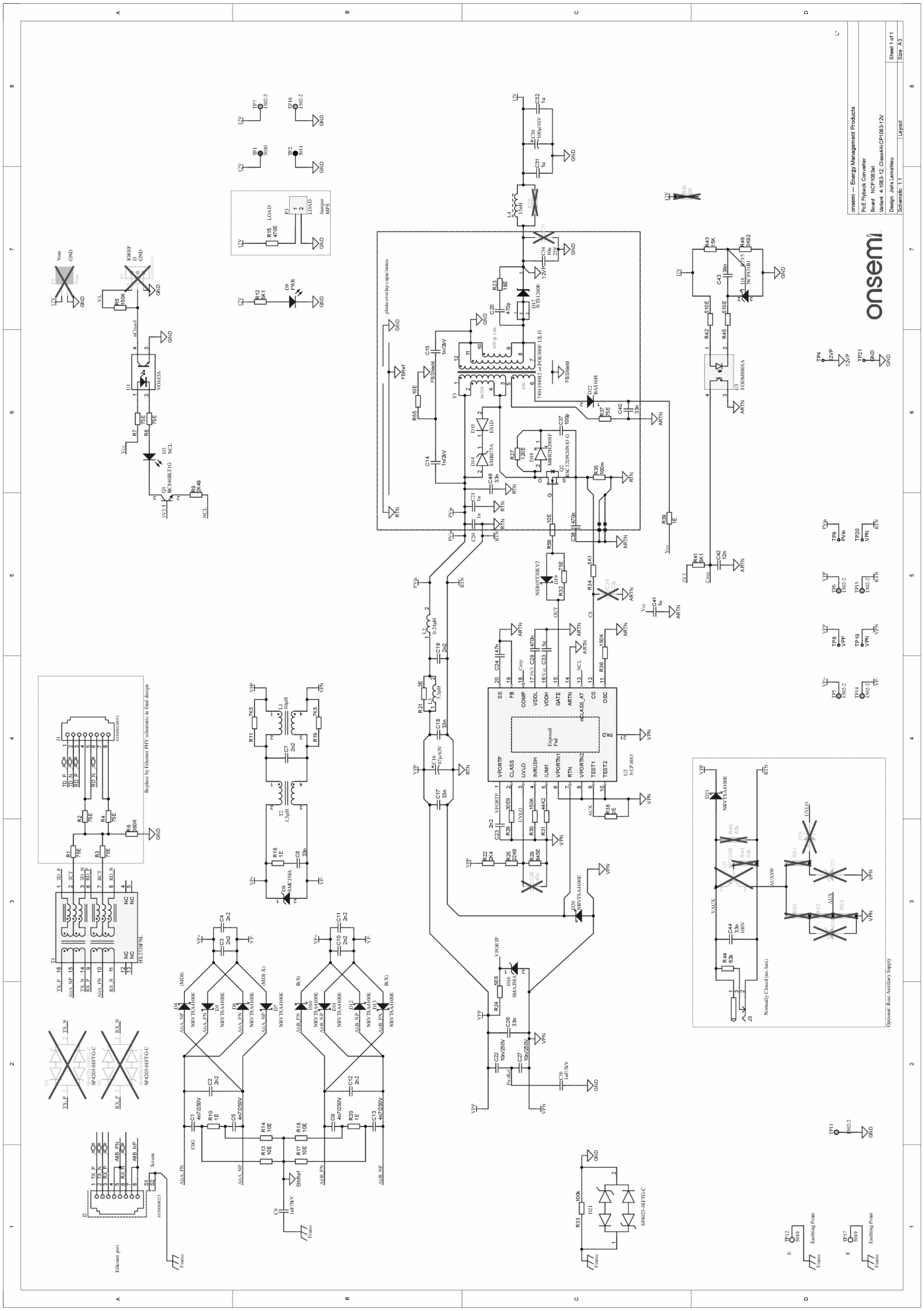

**Figure 16. Schematic Diagram NCP1083REF12VC4GEVB**

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