WLC1115 Qi PTx 15-W MP-A11 plus CCG7SC USB-C PD 60 W solution reference board (REF_ TX15W_PD60W_N1) test report

Devices - WLC1115 + CCG7SC

About this document

Scope and purpose

REF_TX15W_PD60W_N1 smart charging solution is a wireless charging plus wired charging solution based on WLC1115 combined with CCG7SC. It has Infineon Technologies AG's unique power sharing and bypass functions.

This test report presents electrical performance parameters like efficiency, in-band communication, active charging area, thermal performance, and foreign object detection. The test report also captures Qi v1.3.3 compliance test results and USB-C PD compliance test results along with the conducted emission performance of the board.

Intended audience

This document is intended for anyone using the REF_TX15W_PD60W_N1 smart charging solution for smart-phone, smart speakers, portable accessories, docking stations, furniture, and home goods applications.

Table of contents

1 Introduction and overview

This document is a test report for the REF_TX15W_PD60W_N1 Reference Board. This solution combines wired and wireless charging functions in parallel or individually. This solution uses Infineon's WLC1115 wireless charging transmitter IC and the EZ-PD™ CCG7SC USB-C PD IC. This solution passed the compliance tests of Qi V1.3.3 and USB-C PD. The solution provides power to a wireless power receiver and to a USB-C sink device using smart power sharing to manage power for each load. The solution manages the source PD power adapter input by adjusting the wireless and wired output power levels based on the input power source capability.

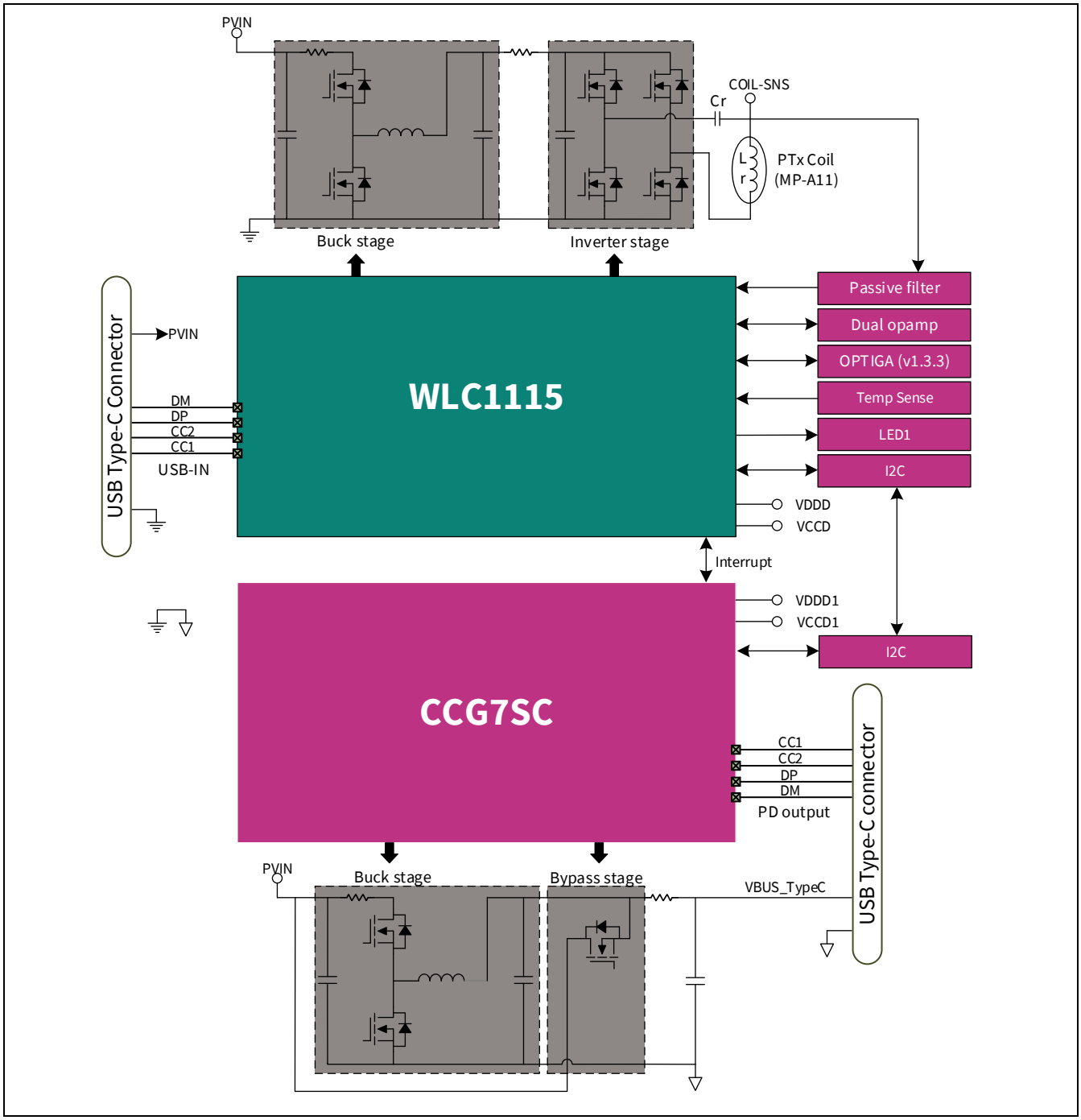


Figure 1 REF_TX15W_PD60W_N1 block diagram

2 Hardware and firmware

Table 1 DUT hardware and firmware version

DUT contents	Description
REF_TX15W_PD60W_N1	Combine Qi PTx and USB-C PD with power sharing and bypass
Firmware version	Qi PTx output – WLC1115: 1.0.1.221
	USB-C PD output – CCG7SC: 4.0.1.41_1.3
Hardware changes	[1] 2nd Revision

2.1 Hardware and firmware configuration

2.1.1 Firmware parameters

Table 2 Firmware parameters table

Main firmware parameters	Specification
Qi PTx Buck Fsw (switching frequency)	400 KHz
Qi PTx Inverter Fsw (switching frequency)	127.7 KHz
USB-C PD Buck Fsw (switching frequency)	400 KHz
Qi PTx output	Compliant with Qi v1.3.3, supports BPP 5 W and EPP 15 W
USB-C PDOs	5 V/3 A, 9 V/3 A, 12 V/3 A, 15 V/3 A, 20 V/3 A, and PPS 3.3-16 V/3 A
Qi PTx and USB-C PD max output power	60 W (Qi PTx output max 15 W, USB-C PD output max 60 W)

2.1.2 Hardware parameters

Table 3 Hardware parameters table

Key hardware components	Specification
Power inductor	L2 = 6.8 µH, L102 = 10 µH
USB-C PD buck MOSFET	BSZ063N04LS6
USB-C PD VBUS provider FET	BSZ0920NS
Qi PTx buck and inverter MOSFET	BSZ0910LS

3 Test setup

3.1 DUT (device under test)

The device under test (DUT) is the REF_TX15W_PD60W_N1 Solution Board, which combines the WLC1115 Qi PTx and CCG7SC USB-C PD with power sharing and bypass (version 2.0).

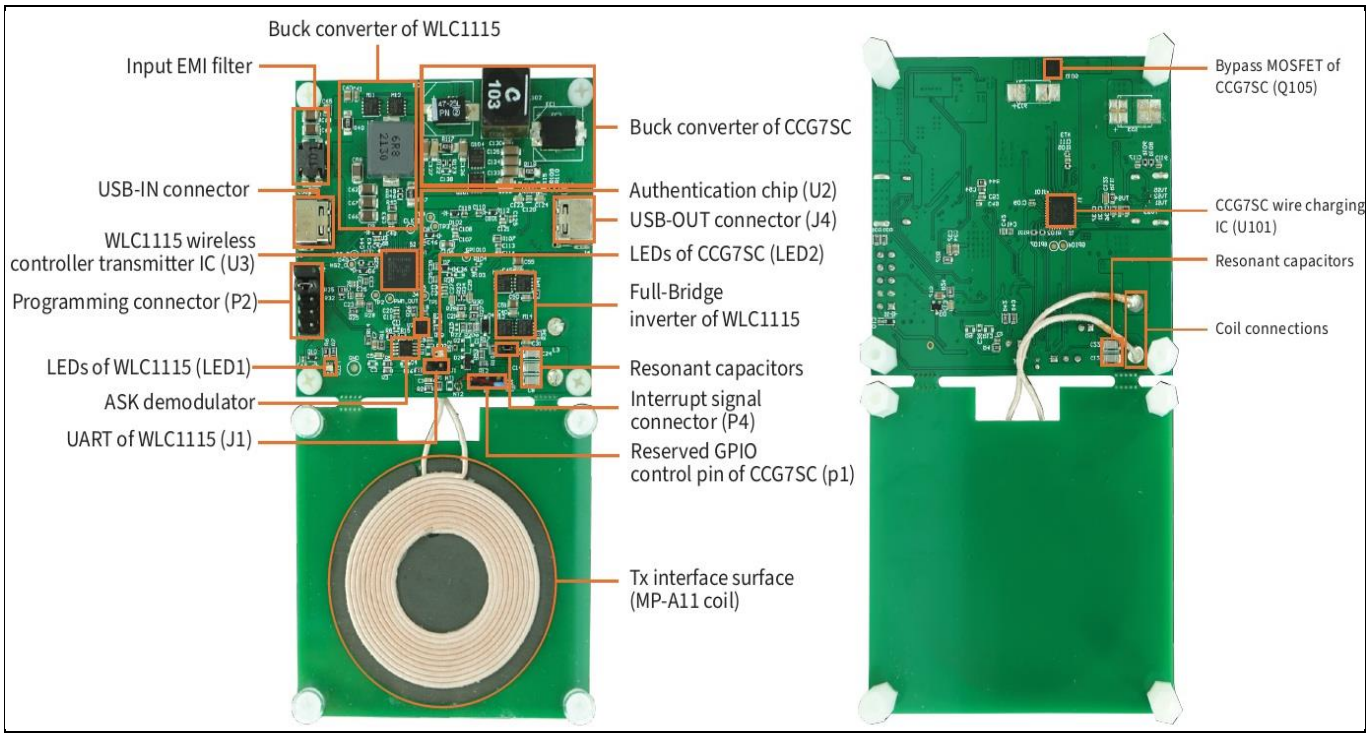


Figure 2 REF_TX15W_PD60W_N1 Solution Board – Top and bottom view (length × width = 64.8 × 62.4 in mm)

3.2 DUT specifications

- Wide input voltage range from 9 V to 24 V.
- Wireless charging supports BPP, EPP, and up to Qi 1.3.3 compatible.
- Wire charging supports dual modes: One is PDO mode, the other is PPS mode. PDO mode supports 3 A with 5 V, 9 V, 12 V, 15 V, 20 V, and 60 W max. And PPS mode supports 3 A from 3.3 V to 16 V.
- Built-in Infineon's proprietary bypass technology and power sharing technology to maximize the power distribution and maximize power levels to each output at optimal efficiency.
- When the PDO capacity is greater than 45 W, it supports notebook charging.
- LED indicator to alert faults and status.

Table 4 Power sharing table

No.	Input power	USB power input		Only PD	WLC+PD (W)		WLC+PD (W)	
		V	A		WLC (BPP)	PD	WLC (EPP)	PD
1	27	9	3	27	10	17	18	9
2	24	12	2	24	10	14	18	6
3	36	12	3	36	10	26	18	18
4	30	15	2	30	10	20	18	12
5	45	15	3	45	10	35	18	27
6	20	20	1	20	10	10	18	2
7	40	20	2	40	10	30	18	22
8	60	20	3	60	10	50	18	42
9	100	20	5	60	10	60	18	60

3.3 DUT setup

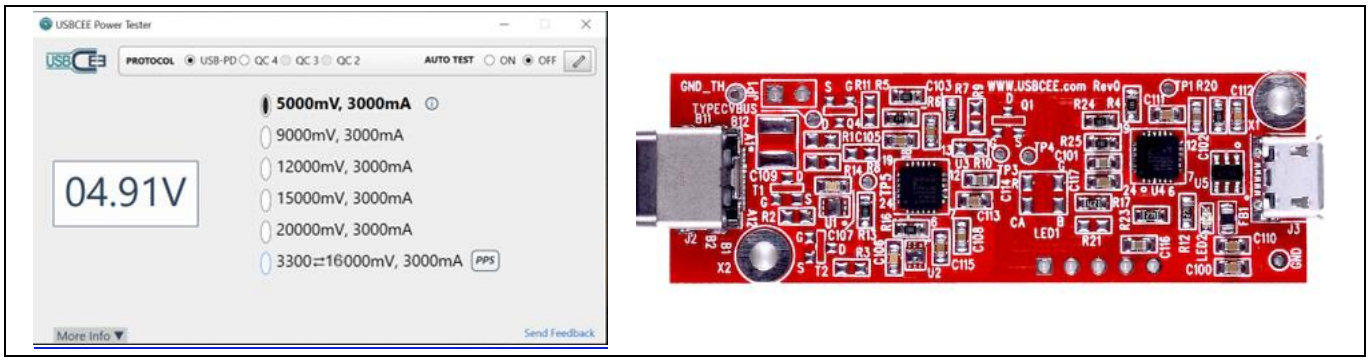


Figure 3 PAT UI and PAT tester (CCPROG PAT)

The DUT is connected to PAT tester (CCPROG PAT) using a USB Type-C cable. Once a successful connection is established, PAT UI does a PDO discovery and displays the same on the UI. In this case, the solution kit is preconfigured with the following PDOs:

- PDO 1: 5 V, 3 A FIXED
- PDO 2: 9 V, 3 A FIXED
- PDO 3: 12 V, 3 A FIXED
- PDO 4: 15 V, 3 A FIXED
- PDO 5: 20 V, 3 A FIXED
- PDO 6: 3.3 V-16 V, 3 A PPS

Figure 4 Confirm Qi PTx capabilities using Qi Sniffer and Qi Receiver Simulator

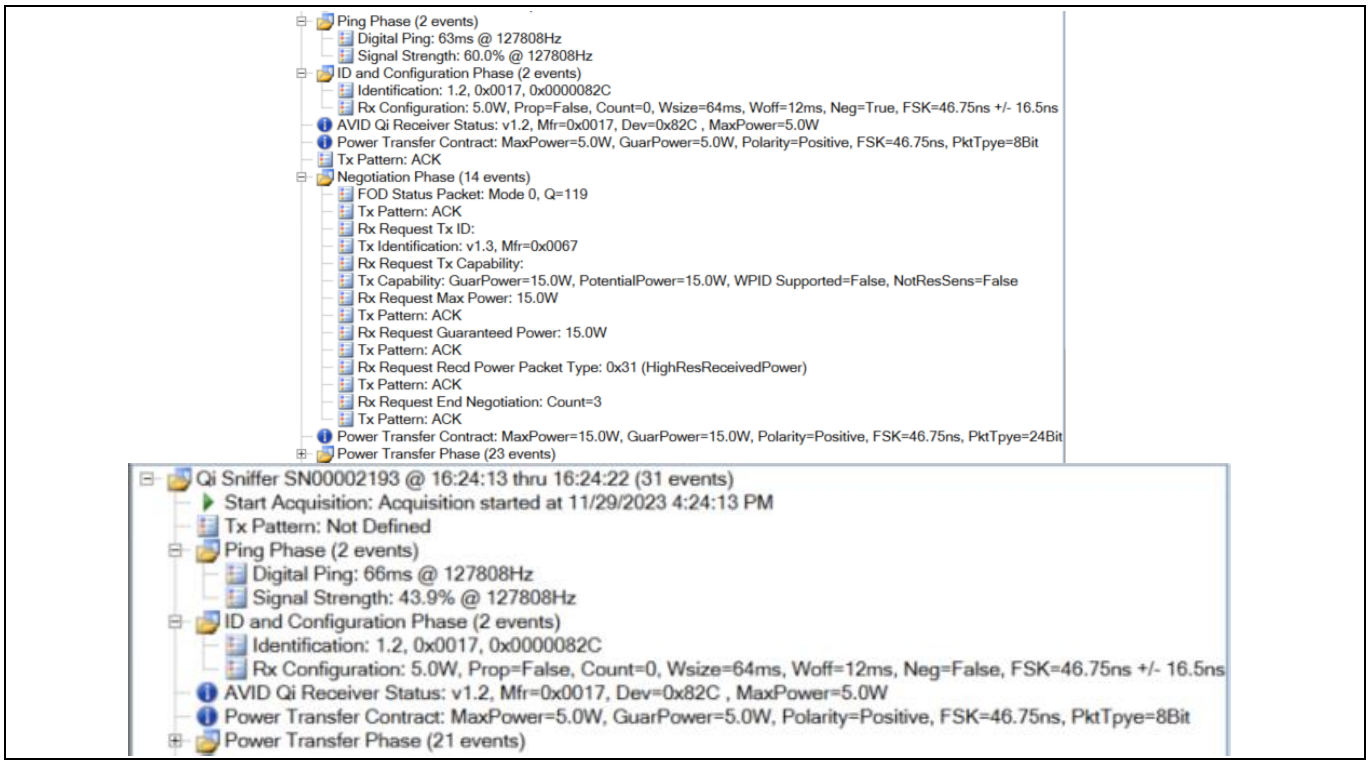


Figure 5 Qi PTx can support EPP 15 W and BPP 5 W

3.4 Test equipment

Table 5 Test equipment

Test setup	Description
Oscilloscope	LeCroy Waverunner 9104
Programmable DC source	Chroma 62012P-80-60
Electronic load	Chroma 63630-80-60
Thermal recorder	Agilent 34970A
Electronic load (for thermal)	Chroma 63010
Electronic load (for thermal)	Keithley 2380-120-60
Power source	ANKER 65W USB-C Adapter
Wireless PRx receiver	TDK WRM483265-10F5-12V-G

3.5 Test points of voltage and current

Figure 6 shows the input and output voltage test points. Use the Type-C Connection Board shown in Figure 7 to measure the input and output current.

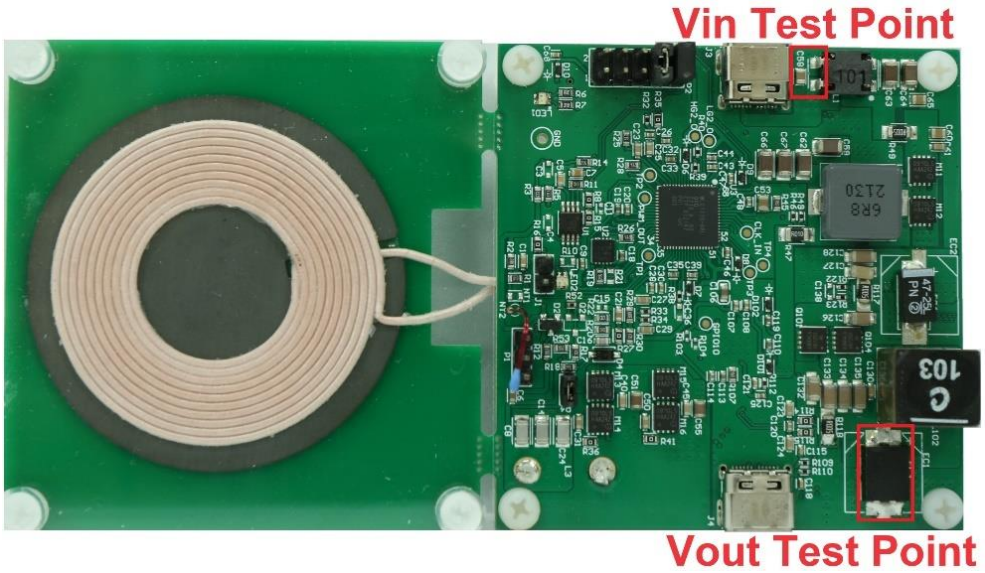


Figure 6 The test point of Vin and Vout

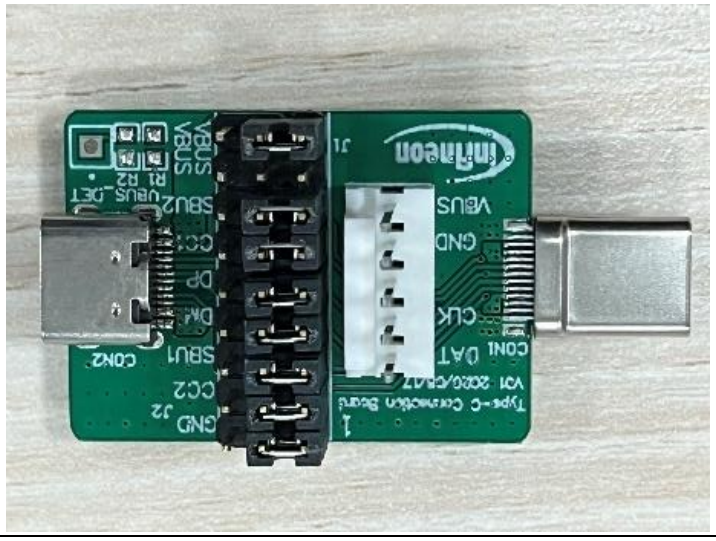


Figure 7 Type-C Connection Board to test the input and output current

4 Performance and functionality test results

4.1 Efficiency (Combine Qi PTx and USB-C PD)

Efficiency measurement of WLC1115 wireless charging is done with a standard receiver module (WRM483265-10F5-12V-G), the receiver output terminals are connected to an electronic load. Efficiency measurement of CCG7SC wire charging is done with the Infineon PD Voltage Deception Board. The Infineon PD Voltage Deception Board output terminals are connected to an electronic load. At an ambient temperature of 25°C, measure the efficiency of wireless charging and wired charging at different output combinations and record them with numbers and charts. The dz between wireless charging PTx and PRx is 3.5 mm in all efficiency tests.

Note: dz is the distance from the surface of the PTx coil to the interface surface of the power receiver product.

4.1.1 Standalone Qi PTx BPP/EPP output (USB-C PD output as standby)

Table 6 Efficiency table: Standalone Qi PTx BPP/EPP output (USB-C PD output as standby)

Vin = 9 V, Qi PTx BPP 5 W		Vin = 15 V, Qi PTx EPP 15 W		Vin = 20 V, Qi PTx EPP 15 W	
WLC load (W)	**Efficiency (%)**	**WLC load (W)**	**Efficiency (%)**	**WLC load (W)**	**Efficiency (%)**
0.376 W	27.61%	0.233 W	10.08%	0.236 W	8.71%
0.498 W	35.89%	0.479 W	18.35%	0.483 W	15.93%
0.751 W	45.45%	0.712 W	24.82%	0.715 W	21.88%
0.998 W	55.49%	0.955 W	32.98%	0.958 W	28.99%
1.498 W	64.79%	1.191 W	37.77%	1.192 W	33.93%
1.997 W	71.01%	2.385 W	57.62%	2.387 W	52.48%
2.497 W	74.08%	3.583 W	66.66%	3.583 W	62.17%
2.989 W	75.88%	4.779 W	72.36%	4.778 W	68.32%
3.485 W	76.99%	5.975 W	75.80%	5.976 W	72.05%
3.982 W	77.91%	7.156 W	78.04%	7.157 W	74.57%
4.476 W	77.91%	8.349 W	80.01%	8.348 W	76.57%
4.967 W	77.46%	9.547 W	81.03%	9.541 W	78.08%
-	-	10.743 W	81.87%	10.731 W	79.11%
-	-	11.919 W	82.55%	11.914 W	79.82%
-	-	13.112 W	82.80%	13.103 W	80.42%
-	-	14.304 W	83.22%	14.291 W	80.89%
-	-	14.956 W	83.41%	14.957 W	80.90%

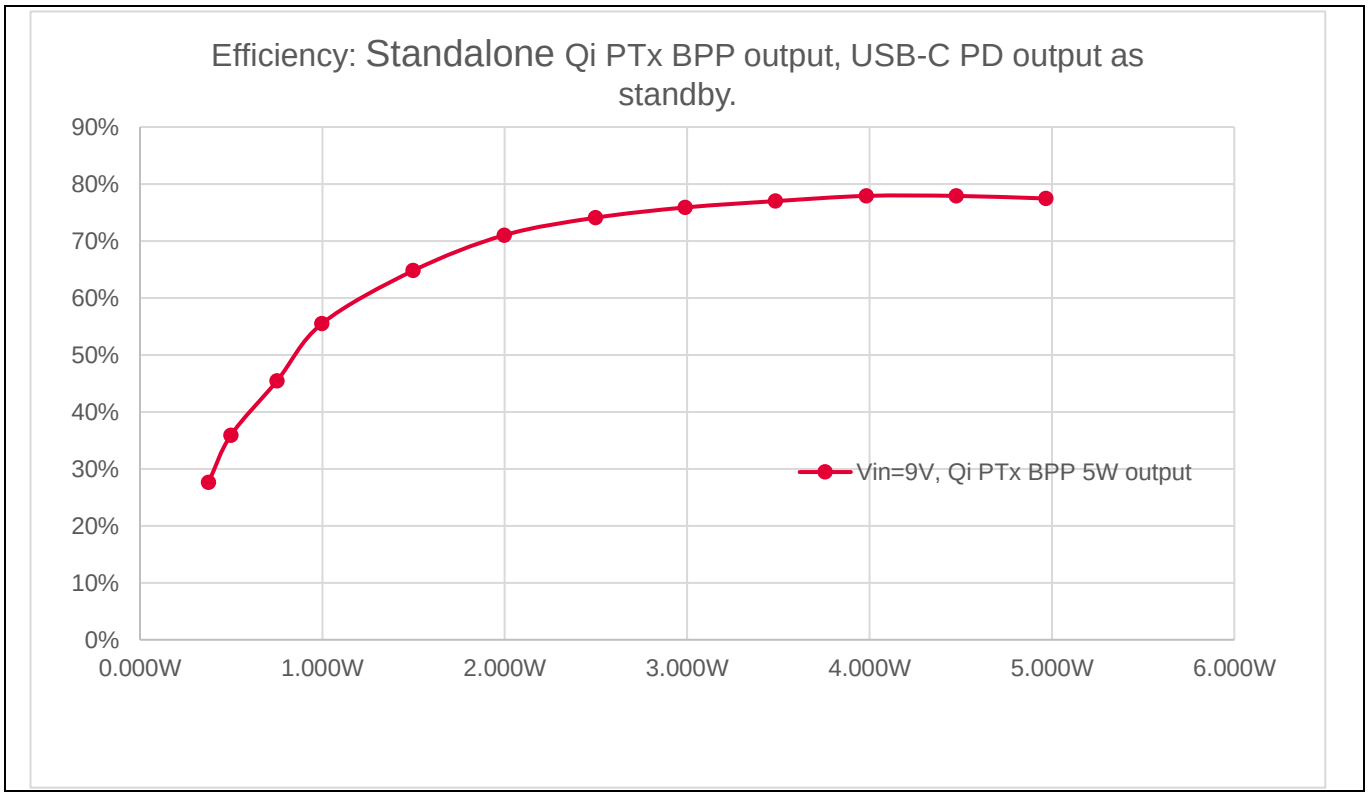


Figure 8 Efficiency curve: Standalone Qi PTx BPP output (USB-C PD output as standby)

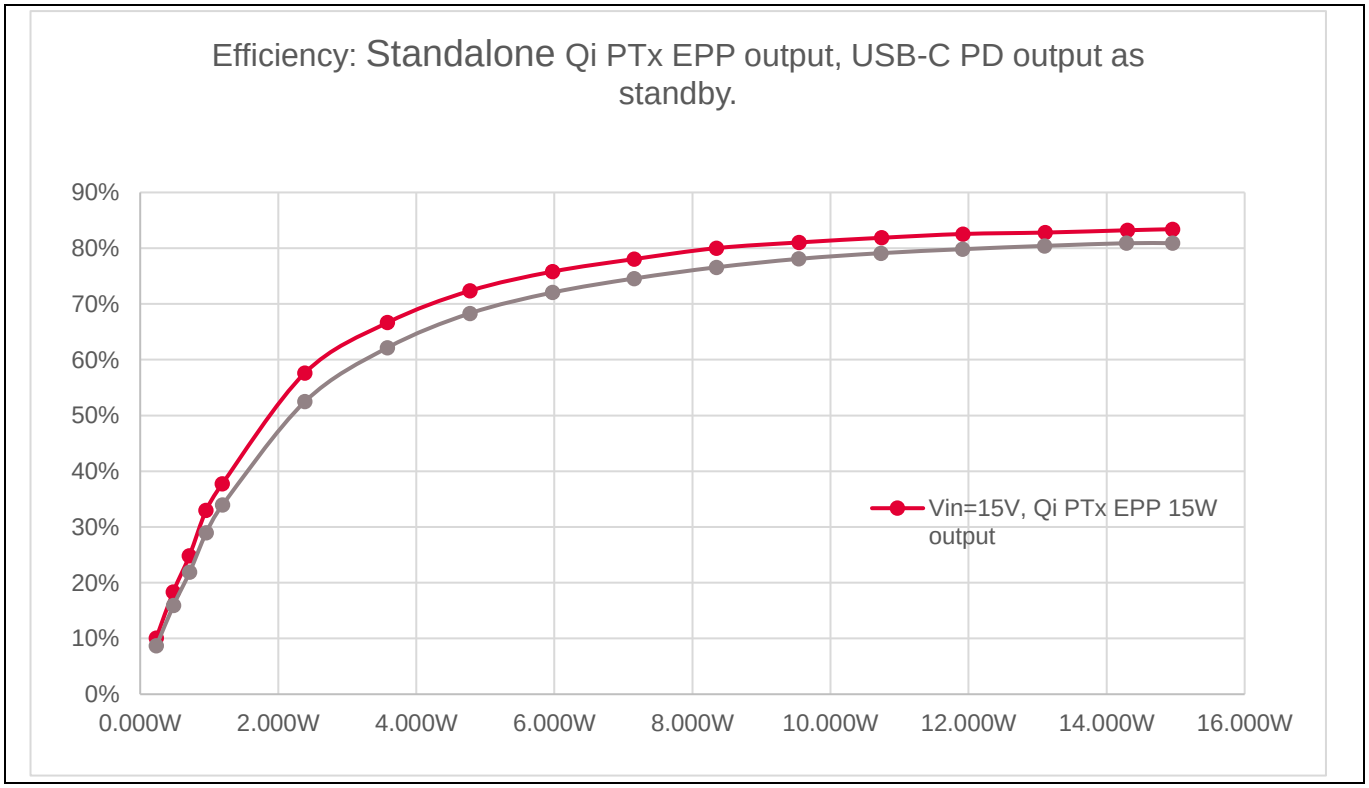


Figure 9 Efficiency curve: Standalone Qi PTx EPP output (USB-C PD output as standby)

4.1.2 Standalone USB-C PD output (Qi PTx as standby)

Table 7 Efficiency table: Standalone USB-C PD output (Qi PTx as standby)

Vin = 9 V, USB-C PDO 5 V		Vin = 9 V, USB-C PDO 9 V		Vin = 15 V, USB-C PDO 15 V		Vin = 20 V, USB-C PDO 20 V	
PD load (W)	Efficiency (%)	PD load (W)	Efficiency (%)	PD load (W)	Efficiency (%)	PD load (W)	Efficiency (%)
0.25 W	44.74%	0.45 W	63.51%	0.75 W	63.41%	1.00 W	62.93%
0.50 W	61.31%	0.89 W	77.29%	1.49 W	77.54%	1.99 W	77.02%
0.75 W	68.69%	1.34 W	83.66%	2.24 W	83.77%	2.99 W	83.50%
1.00 W	74.76%	1.78 W	87.07%	2.97 W	87.30%	3.97 W	87.01%
1.25 W	77.82%	2.23 W	89.42%	3.73 W	89.56%	4.98 W	89.32%
2.50 W	86.88%	4.43 W	94.32%	7.42 W	94.37%	9.92 W	94.38%
3.74 W	90.96%	6.60 W	95.95%	11.07 W	96.00%	14.81 W	96.00%
4.99 W	92.66%	8.75 W	96.73%	14.72 W	96.89%	19.71 W	96.92%
6.24 W	93.64%	10.88 W	97.16%	18.34 W	97.35%	24.56 W	97.37%
7.49 W	94.22%	12.98 W	97.41%	21.95 W	97.72%	29.41 W	97.75%
8.75 W	94.80%	15.05 W	97.54%	25.52 W	97.92%	34.22 W	97.95%
10.00 W	95.03%	17.10 W	97.61%	29.07 W	98.03%	39.01 W	98.10%
11.25 W	95.15%	19.13 W	97.64%	32.59 W	98.11%	43.80 W	98.25%
12.50 W	95.22%	21.16 W	97.76%	36.11 W	98.22%	48.54 W	98.32%
13.75 W	94.99%	23.13 W	97.74%	39.56 W	98.18%	53.27 W	98.39%
15.03 W	94.81%	25.09 W	97.73%	43.01 W	98.18%	57.99 W	98.45%

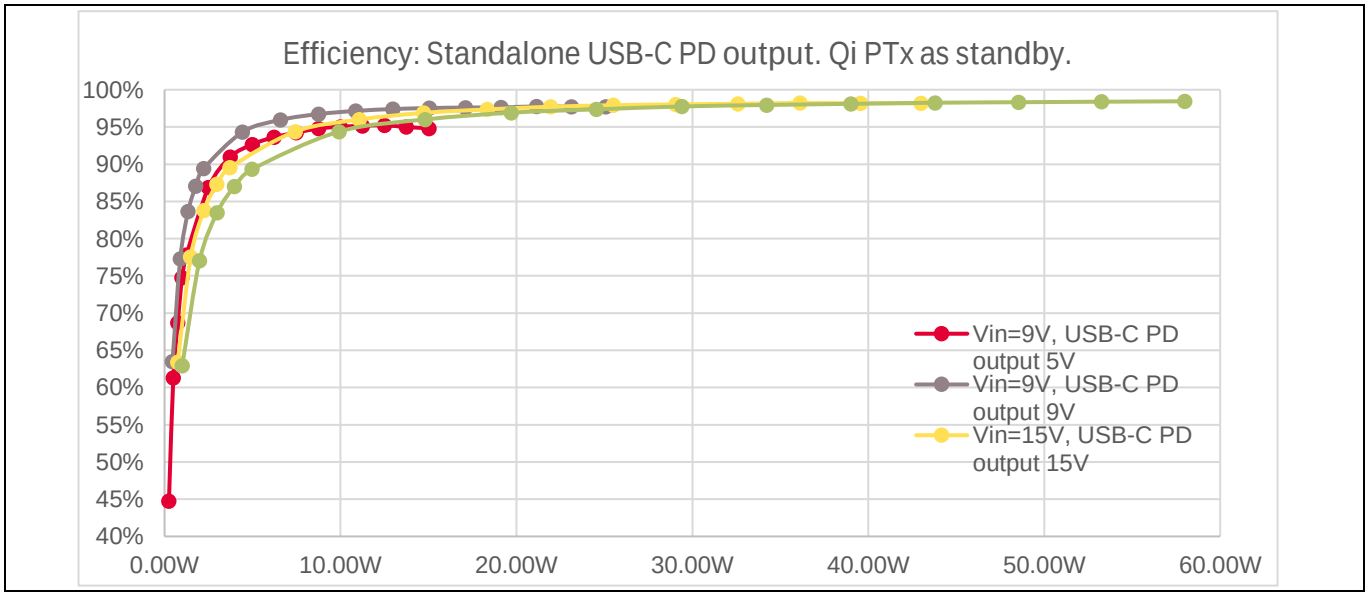


Figure 10 Efficiency curve: Standalone USB-C PD output (Qi PTx as standby)

4.1.3 Standalone USB-C PD output (Qi PTx as standby)

Table 8 Efficiency table: Qi PTx EPP 15 W output (USB-C PD output from 0 W – 42 W)

Vin = 15 V, Qi PTx EPP 15 W USB-C PDO 5 V		Vin = 15 V, Qi PTx EPP 15 W USB-C PDO 9 V		Vin = 15 V, Qi PTx EPP 15 W USB-C PDO 15 V		Vin = 20 V, Qi PTx EPP 15 W USB-C PDO 20 V	
Total load (W)	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**
14.86 W	81.79%	14.89 W	81.91%	14.88 W	80.91%	14.86 W	79.42%
15.11 W	81.71%	15.33 W	81.75%	15.61 W	82.01%	15.84 W	80.36%
15.36 W	81.73%	15.79 W	82.08%	16.31 W	82.63%	16.84 W	81.54%
15.61 W	81.88%	16.25 W	82.54%	17.03 W	83.13%	17.82 W	82.24%
15.86 W	82.04%	16.70 W	82.80%	17.73 W	83.74%	18.78 W	83.00%
16.11 W	82.22%	17.14 W	83.17%	18.46 W	84.24%	19.77 W	83.77%
17.36 W	83.05%	19.41 W	84.55%	21.99 W	86.40%	24.62 W	86.41%
18.62 W	83.91%	21.68 W	85.80%	25.47 W	87.67%	29.43 W	88.39%
19.87 W	84.73%	23.91 W	86.72%	28.97 W	88.94%	34.24 W	89.79%
21.11 W	85.35%	26.16 W	87.60%	32.45 W	89.89%	39.03 W	90.85%
22.38 W	85.98%	28.42 W	88.42%	35.92 W	90.55%	43.80 W	91.61%
23.63 W	86.46%	30.68 W	88.97%	39.39 W	91.09%	48.55 W	92.35%
24.88 W	86.88%	32.94 W	89.48%	42.85 W	91.66%	53.26 W	92.92%
26.14 W	87.32%	35.20 W	89.94%	46.28 W	91.91%	-	-
27.38 W	87.61%	37.46 W	90.46%	49.72 W	92.33%	-	-
28.63 W	87.88%	39.72 W	90.81%	53.15 W	92.59%	-	-
29.84 W	88.19%	41.97 W	91.00%	56.57 W	92.82%	-	-

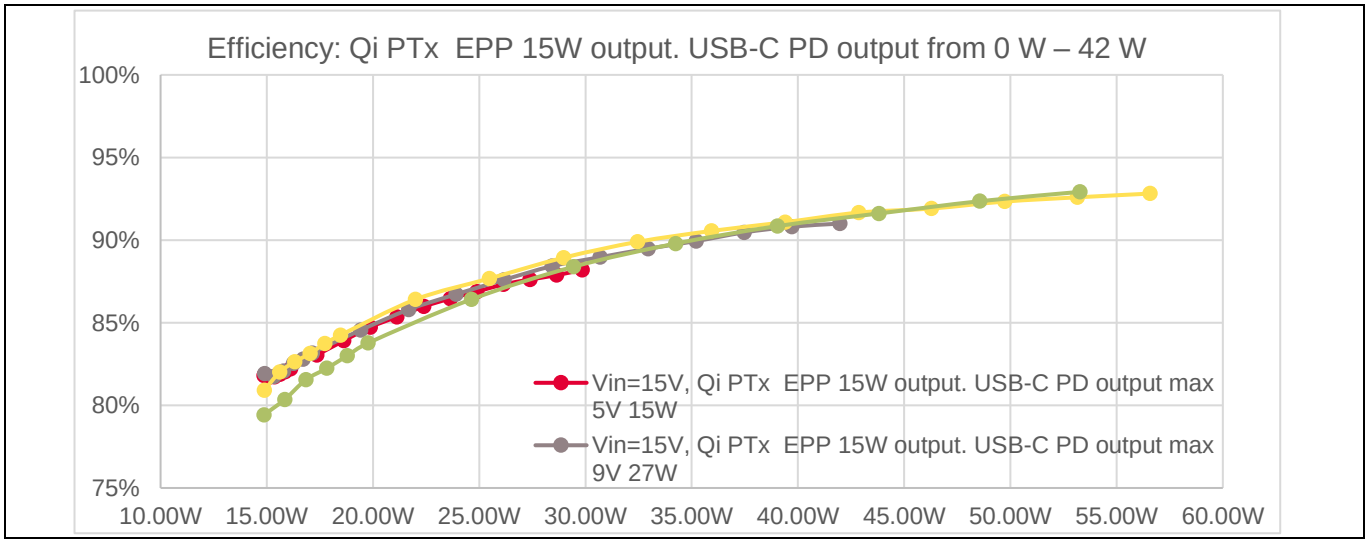


Figure 11 Efficiency curve: Qi PTx EPP 15 W output (USB-C PD output from 0 W – 42 W)

4.1.4 Qi PTx BPP 5 W output (USB-C PD output from 0 W – 50 W)

Table 9 Efficiency table: Qi PTx BPP 5 W output (USB-C PD output from 0 W – 50 W)

Vin = 9 V, Qi PTx BPP 5 W USB-C PDO 5 V		Vin = 9 V, Qi PTx BPP 5 W USB-C PDO 9 V		Vin = 15 V, Qi PTx BPP 5 W USB-C PDO 15 V		Vin = 20 V, Qi PTx BPP 5 W USB-C PDO 20 V	
Total load (W)	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**	**Total load (W)**	**Efficiency (%)**
4.97 W	76.00%	4.97 W	74.79%	4.97 W	69.81%	4.97 W	65.74%
5.22 W	76.32%	5.40 W	76.41%	5.69 W	72.63%	5.94 W	69.76%
5.47 W	76.98%	5.83 W	77.88%	6.40 W	74.92%	6.89 W	72.84%
5.72 W	77.78%	6.26 W	79.00%	7.12 W	76.94%	7.85 W	75.30%
5.97 W	78.35%	6.68 W	80.07%	7.82 W	78.47%	8.79 W	77.46%
6.22 W	78.91%	7.12 W	80.97%	8.54 W	79.98%	9.75 W	79.20%
7.47 W	81.50%	9.23 W	84.45%	12.06 W	84.78%	14.47 W	84.91%
8.71 W	83.62%	11.32 W	86.69%	15.55 W	87.56%	19.14 W	87.97%
9.96 W	85.26%	13.42 W	88.31%	19.05 W	89.42%	23.82 W	89.90%
11.21 W	86.43%	15.51 W	89.45%	22.53 W	90.72%	28.50 W	91.29%
12.46 W	87.30%	17.57 W	90.23%	26.00 W	91.64%	33.16 W	92.24%
13.72 W	88.16%	19.64 W	90.87%	29.47 W	92.38%	37.81 W	92.96%
14.97 W	88.79%	21.69 W	91.40%	32.93 W	92.94%	42.46 W	93.53%
16.22 W	89.15%	23.74 W	91.79%	36.36 W	93.32%	47.10 W	94.00%
17.47 W	89.45%	25.77 W	92.05%	39.80 W	93.67%	51.74 W	94.36%
18.75 W	89.85%	27.80 W	92.31%	43.24 W	93.94%	56.33 W	94.59%
20.00 W	89.96%	29.82 W	92.49%	46.65 W	94.15%	-	-

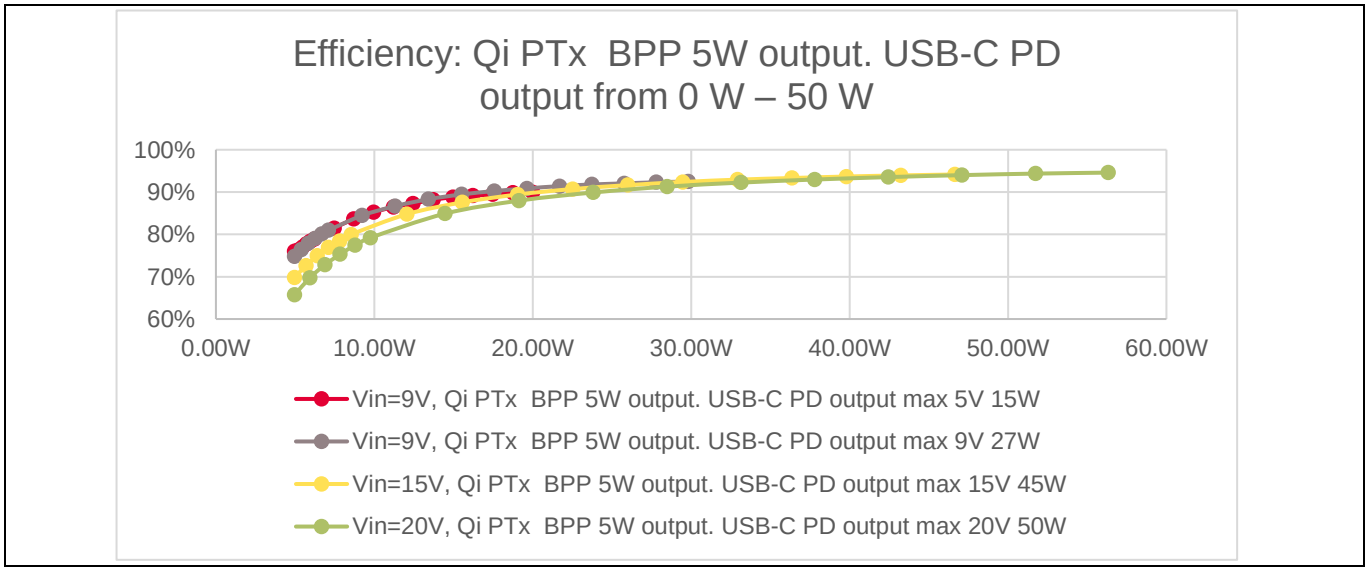


Figure 12 Efficiency curve: Qi PTx BPP 5 W output (USB-C PD output from 0 W – 50 W)

4.2 Active charging area (Qi PTx output – WLC1115)

The active charging area is defined based on the reliable operation of the receiver for a wide range of misalignment between the transmitter and the receiver coils. The active area boundary is decided based on the signal strength value of the receiver, and the demodulation success rate over the active region. There should not be false FOD trips in the active area of the operation. The demodulation success rate is calculated as follows:

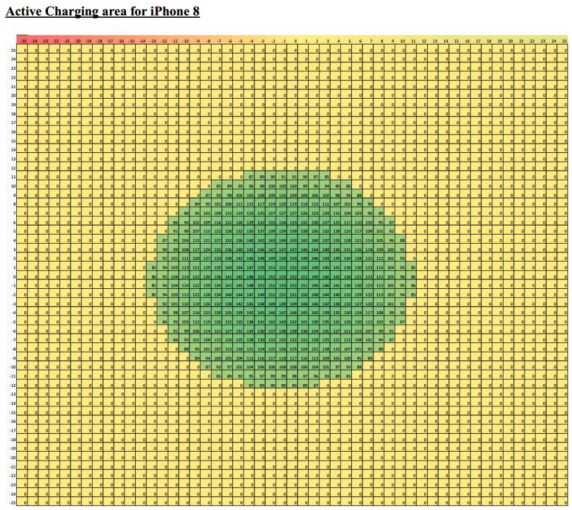
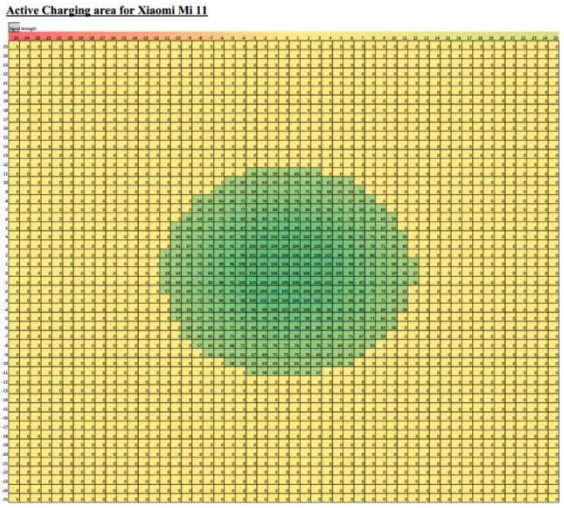
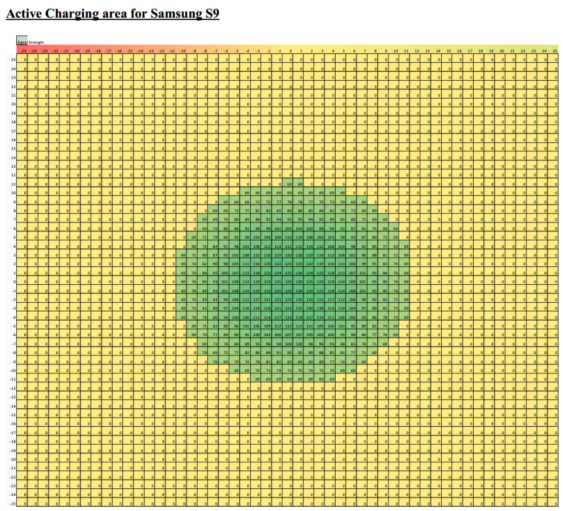
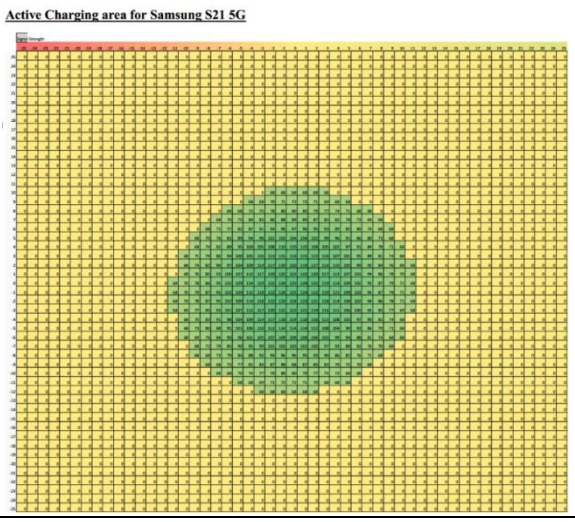
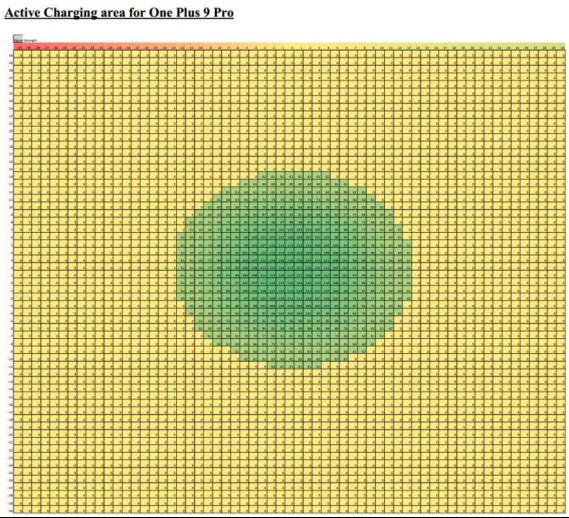
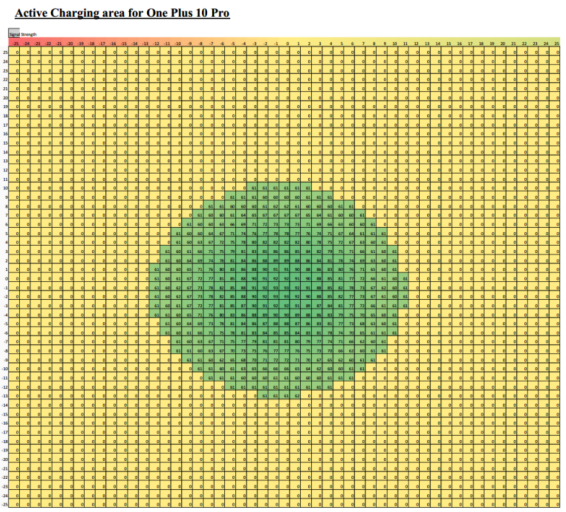
$$\text{Demod sucess rate } (\%) = \frac{\text{No. of successfully decoded packets}}{(\text{No. of successfully decoded packets} + \text{Packets failed to decode})} \text{ x } 100$$

The automated test setup will read the number of ASK passes and ASK failures reported in the UART log to calculate this value. Each success rate is calculated from a 15-second UART log, which translates to approximately 150-200 packets. The demod success rate should be >85%. The dz between the wireless charging TX and RX is 5 mm in all active charging area tests.

Table 10 Active charging area table of different mobile phones

Mobile phone list	Approximate active range	Charging area
iPhone 8	±12 mm	465 mm^2
XiaoMi Mi 11	±11 mm	424 mm^2
Samsung S9	±11 mm	406 mm^2
Samsung S21 5G	±11 mm	407 mm^2
One Plus 9 Pro	±13 mm	539 mm^2
One Plus 10 Pro	±12 mm	436 mm^2

Table 11 Active charging area of different mobile phones

iPhone 8	Xiaomi Mi 11
	
Samsung S9	**Samsung S21 5G**
	
One Plus 9 Pro	**One Plus 10 Pro**
	

4.3 Charge cycle testing (Qi PTx output – WLC1115)

Charge cycle testing is performed on the BPP, EPP, and Samsung phone with a proprietary extension from deeply discharged state to full charge state that also includes trickle charging of the phone.

Four mobile phones of different brands were used to test their charging status from the battery being fully discharged at 0% to the battery being 100% fully charged (see Figure 14 to Figure 17). And the recorded results of Max USB-C input power and charging time are listed inTable 11.

Table 12 Charging cycle testing table of different mobile phones

Mobile phone list	Max USB-C input power	Charging time (0~100%)
XiaoMi Mi 11 Pro	9.8 W	2 hours and 33 minutes
Samsung Galaxy S21 5G	10 W	2 hours and 13 minutes
OnePlus 10 Pro 5G	17 W	2 hours and 38 minutes
iPhone 13	12.5 W	2 hours and 47 minutes

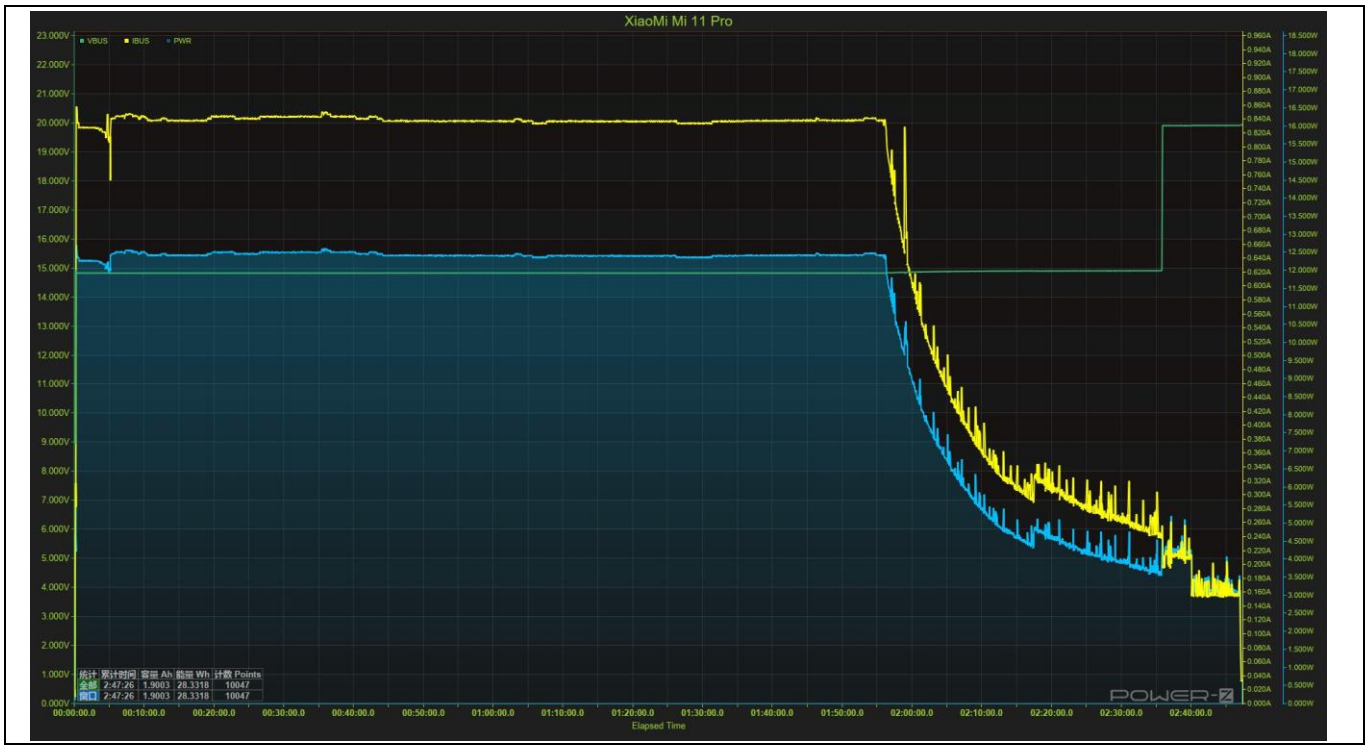


Figure 13 Charge cycle results for the Xiaomi Mi 11 pro (Green: VBUS, Yellow: IBUS, Blue: Watt)

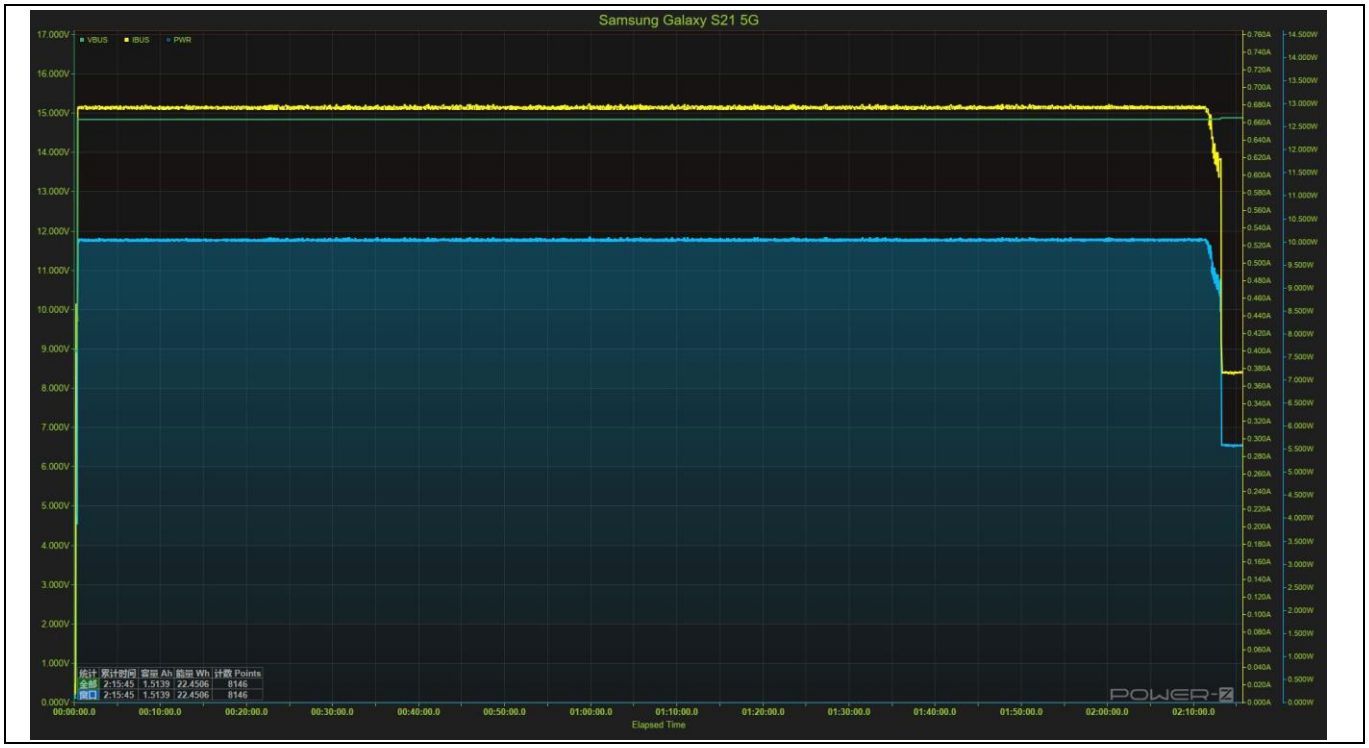


Figure 14 Charge cycle result for Samsung Galaxy S21 5G (Green: VBUS, Yellow: IBUS, Blue: Watt)

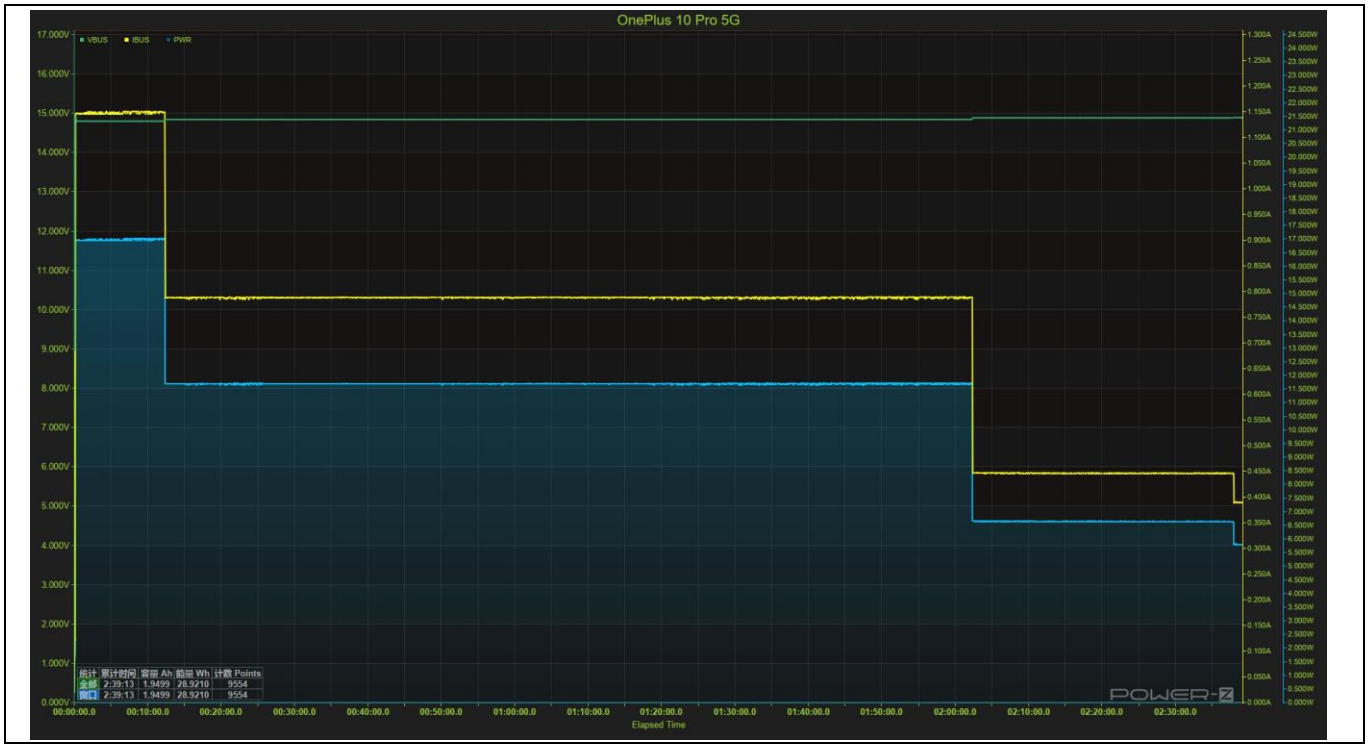


Figure 15 Charge cycle result for OnePlus 10 Pro 5G (Green: VBUS, Yellow: IBUS, Blue: Watt)

Figure 16 Charge cycle results for Apple iPhone 13 (Green: VBUS, Yellow: IBUS, Blue: Watt)

4.4 Thermal capture (combine Qi PTx and USB-C PD)

Thermal data is obtained by running the WLC1115 Qi PTx at output 12 V/1.25 A and the CCG7SC USB-C PD at output 20 V/2 A for more than 3 hours, covering the DUT at 25°C room temperature.

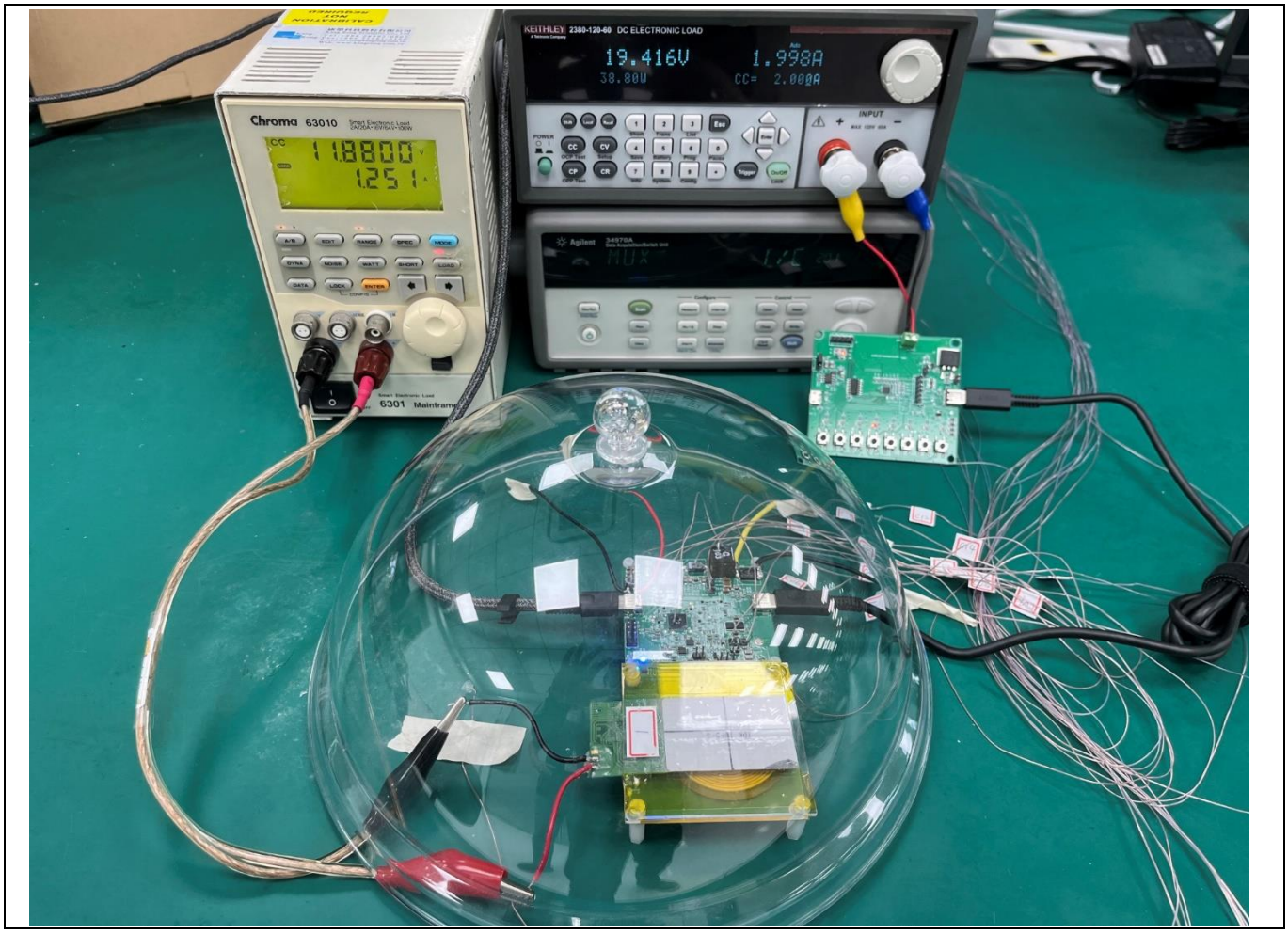


Figure 17 Diagram of the test environment and connection method for thermal testing of the DUT

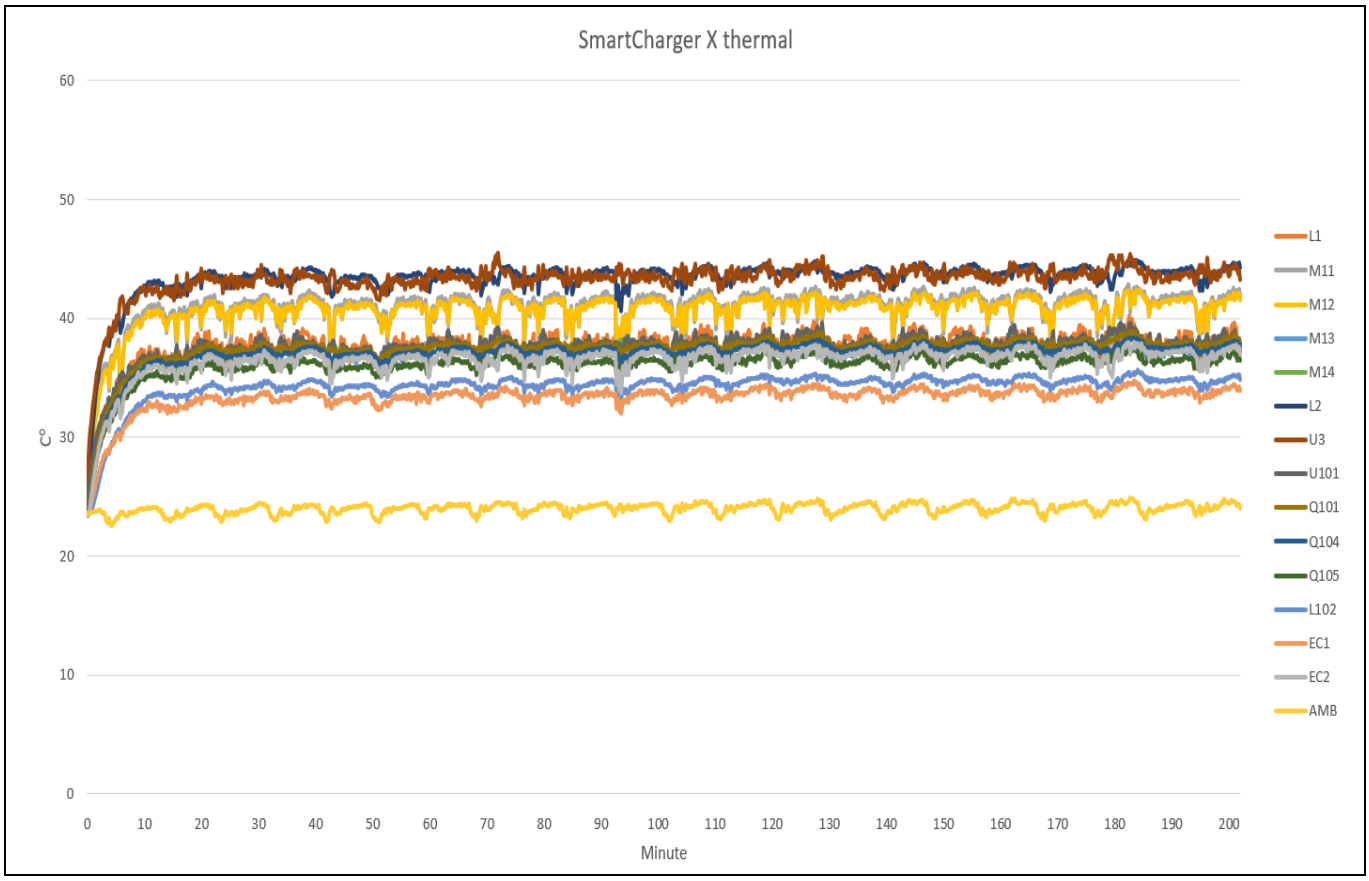


Figure 18 Thermal rise curve of the main components on the DUT during thermal testing

The temperature of some key components is measured when they are run for 200 minutes as listed in Table 13. The thermal measurements are done using the thermocouples (Type-T).

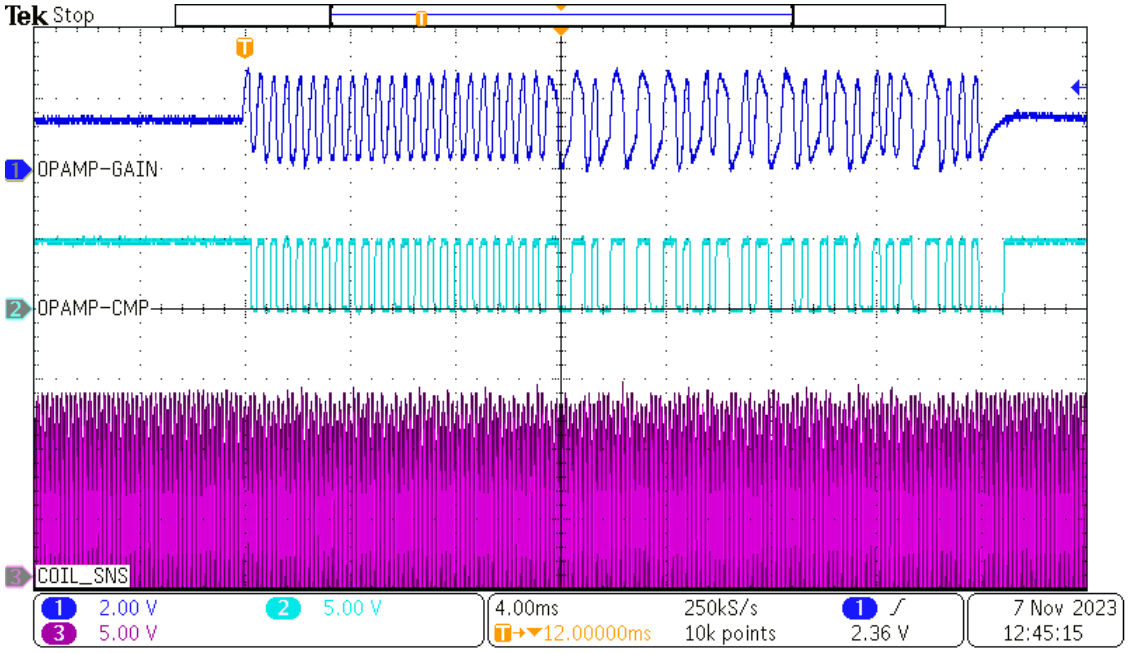
Table 13 Temperature of key components with 20 V input and 15 W wireless charging load plus 40 W wire charging load when run for 200 minutes

Key parts	Part number and position	Temperature (°C)
Input Common Choke	L1	38.33
High Side MOSFET	BSZ0910LS (M11)	42.26
Low Side MOSFET	BSZ0910LS (M12)	41.73
High Side MOSFET	BSZ0910LS (M13)	37.73
Low Side MOSFET	BSZ0910LS (M14)	38.08
Power Inductor	GSTM1040P-6R8M (L2)	44.30
Controller Chip	WLC1115-68LQXQ (U3)	43.56
Controller Chip	CCG7SC (U101)	38.06
High Side MOSFET	BSZ063N04LS6 (Q101)	38.15
Low Side MOSFET	BSZ063N04LS6 (Q104)	37.86

4.5 ASK demodulator (Qi PTx output – WLC1115)

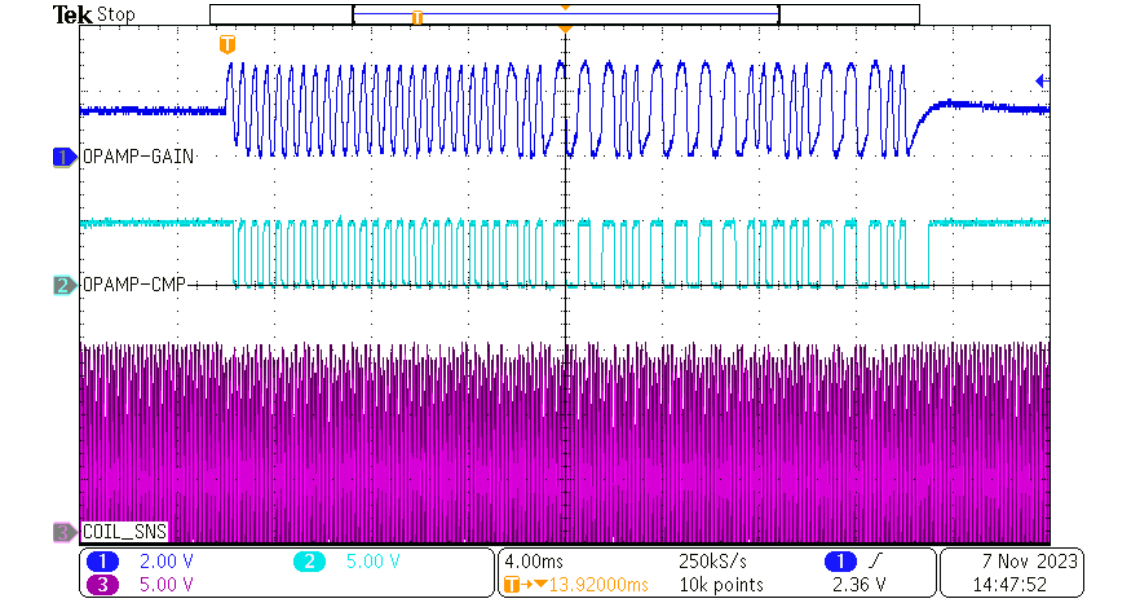
The ASK demodulator circuit has to reliably operate at all operating conditions. The demodulation of coil voltage and DC current ensures reliable demodulator performance in a variety of mobile phones.

For a 15 W EPP-compliant TPR, the following figures show the key ASK demodulator circuit waveforms.



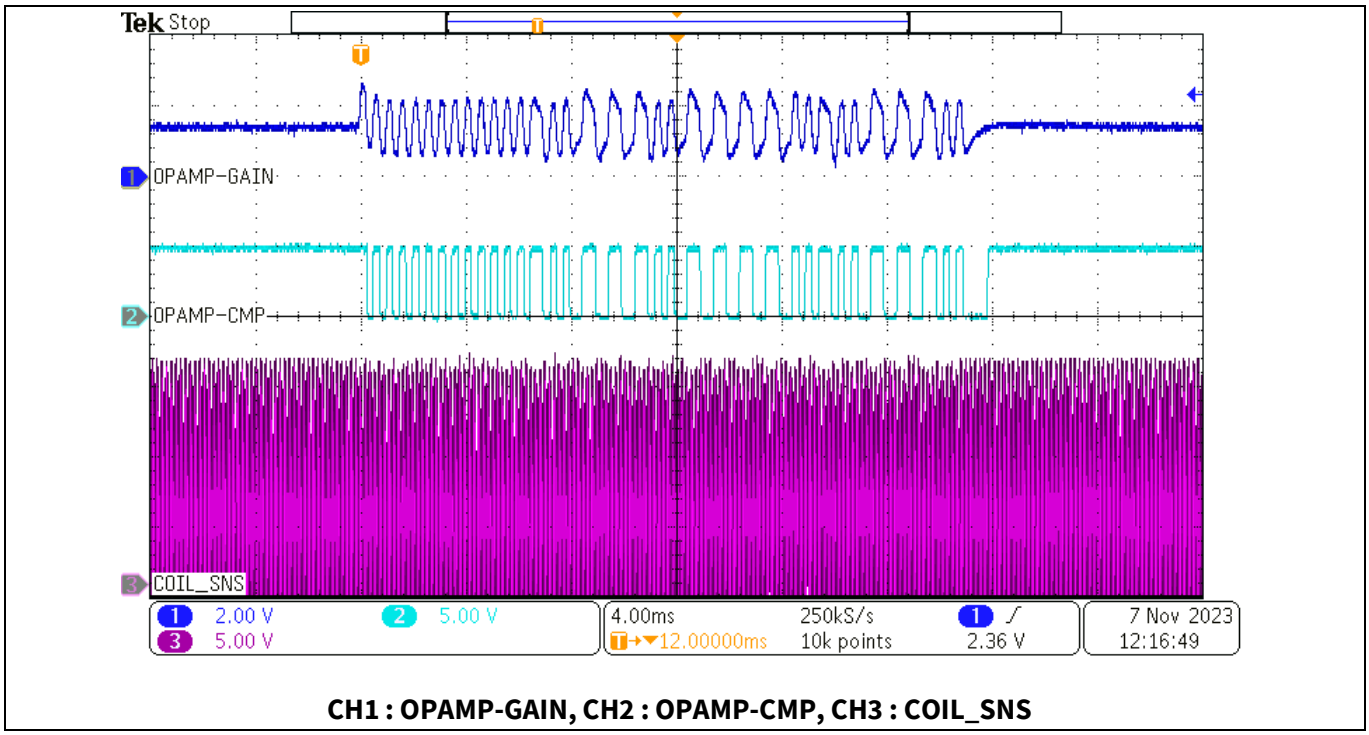
CH1 : OPAMP-GAIN, CH2 : OPAMP_CMP, CH3 : COIL_SNS

Figure 19 Demodulator waveforms for iPhone 11



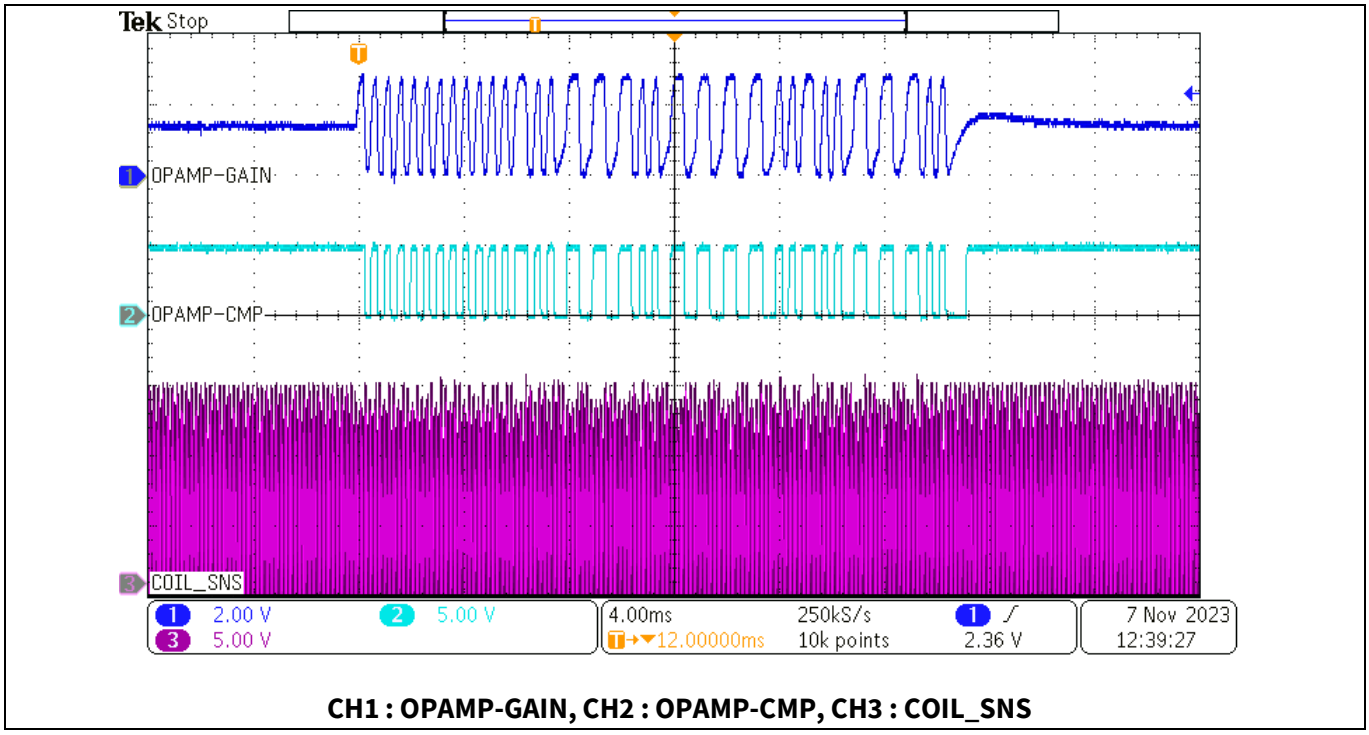
CH1 : OPAMP-GAIN, CH2 : OPAMP_CMP, CH3 : COIL_SNS

Figure 20 Demodulator waveforms for iPhone 13



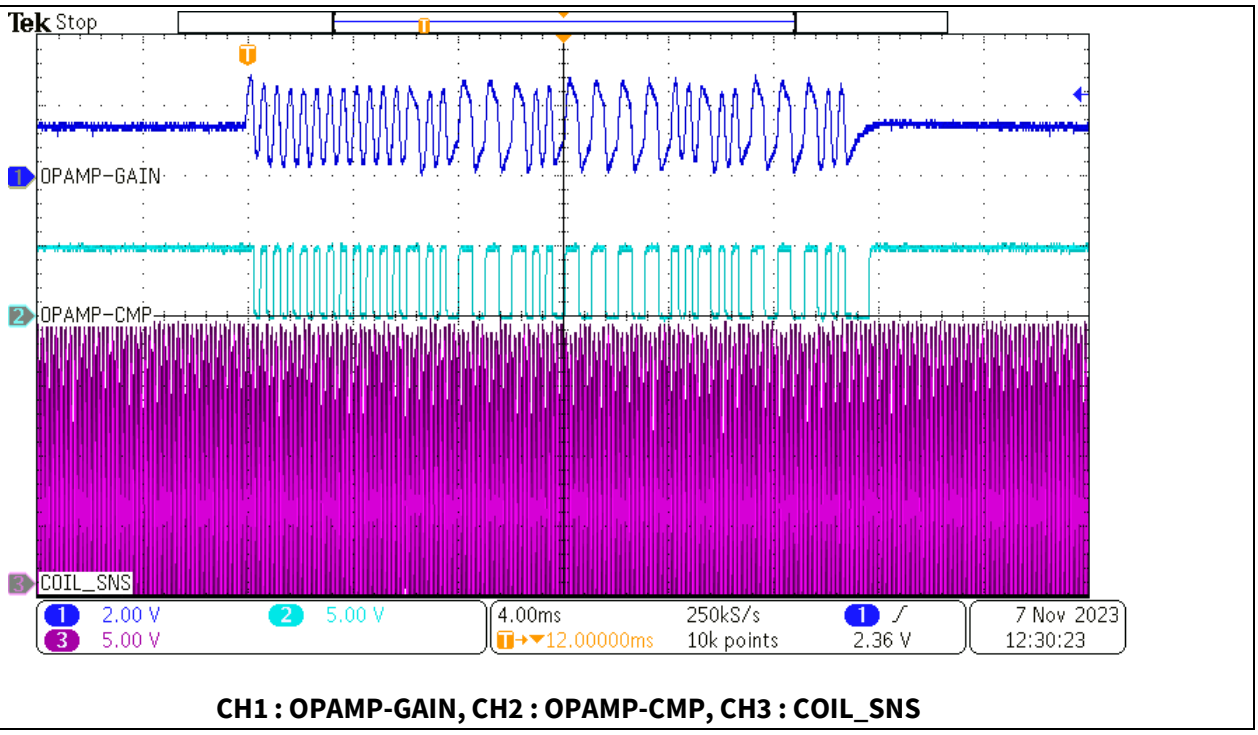
CH1 : OPAMP-GAIN, CH2 : OPAMP-CMP, CH3 : COIL_SNS

Figure 21 Demodulator waveforms for Xaiomi Mi 11 Pro



CH1 : OPAMP-GAIN, CH2 : OPAMP-CMP, CH3 : COIL_SNS

Figure 22 Demodulator waveforms for Samsung Galaxy S21 5G



CH1 : OPAMP-GAIN, CH2 : OPAMP-CMP, CH3 : COIL_SNS

Figure 23 Demodulator waveforms for OnePlus 10 Pro 5G

4.6 Standby power (Combine Qi PTx and USB-C PD)

Test conditions: Vin = 5.5 Vdc, Output cable is unattached, and using power meters to measure the voltage on the PCB End & input current as shown in the following figure.

Detailed data: PCB end VIN = 5.4912 V, input current = 20.681 mA, input power = 113.47 mW

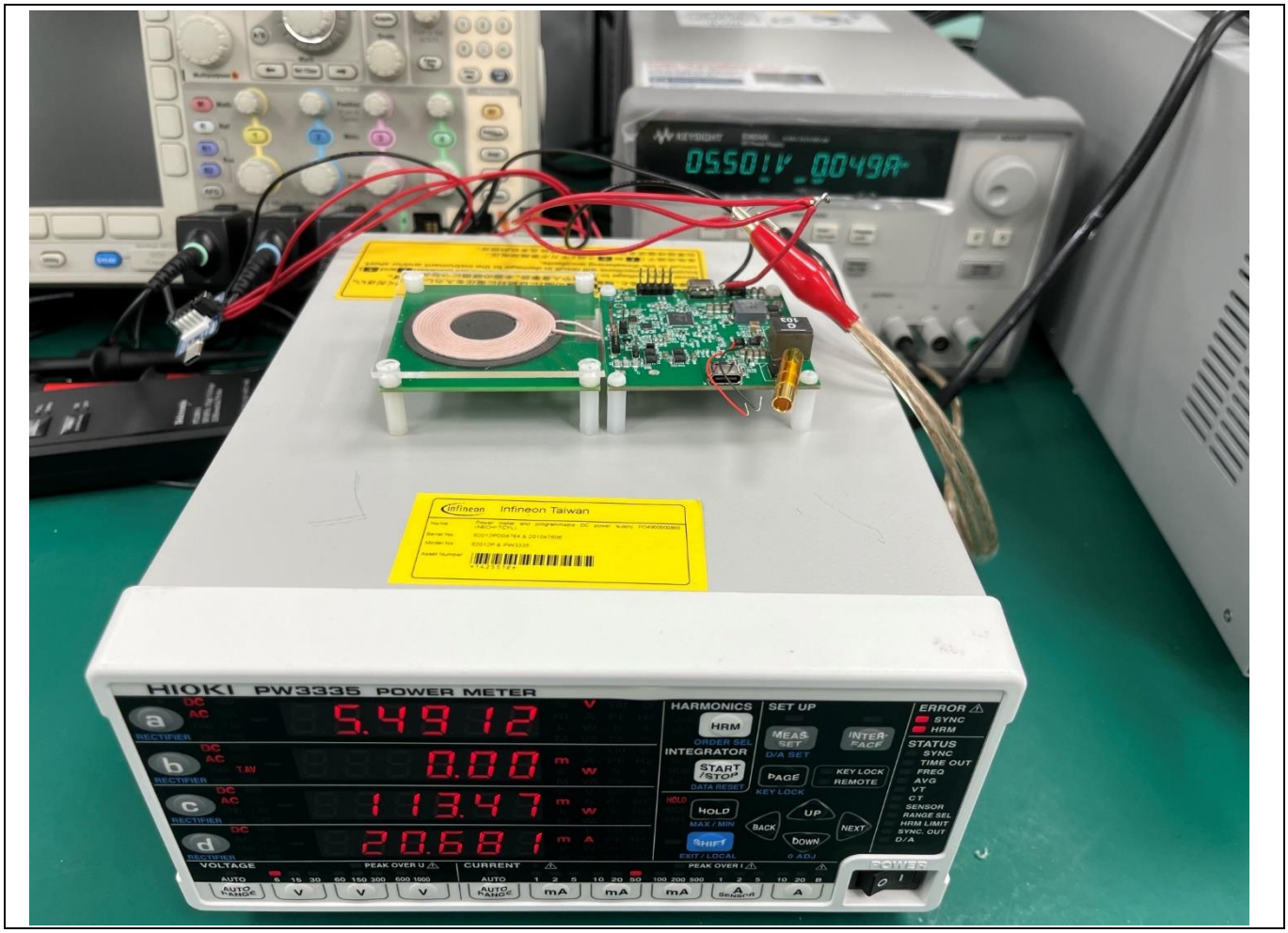


Figure 24 Standby power of REF_TX15W_PD60W_N1

4.7 Output ripple voltage peak-peak (USB-C PD output – CCG7SC)

The data are captured at Vo at Type-C Connector Board VBUS_C end, set oscilloscope 5 ms/div.

Table 14 Output ripple voltage peak-peak in various conditions

Ripple & noise (mV)	Vin = 20 V	Vin = 22 V
PDO = 5 V/0 A	16 mV	24 mV
PDO = 5 V/3 A	31 mV	36 mV
PDO = 9 V/0 A	19 mV	21 mV
PDO = 9 V/3 A	48 mV	48 mV
PDO = 12 V/0 A	20 mV	21 mV
PDO = 12 V/3 A	51 mV	56 mV
PDO = 15 V/0 A	23 mV	21 mV
PDO = 15 V/3 A	45 mV	86 mV
PDO = 20 V/0 A	N/A	35 mV
PDO = 20 V/3 A	N/A	38 mV

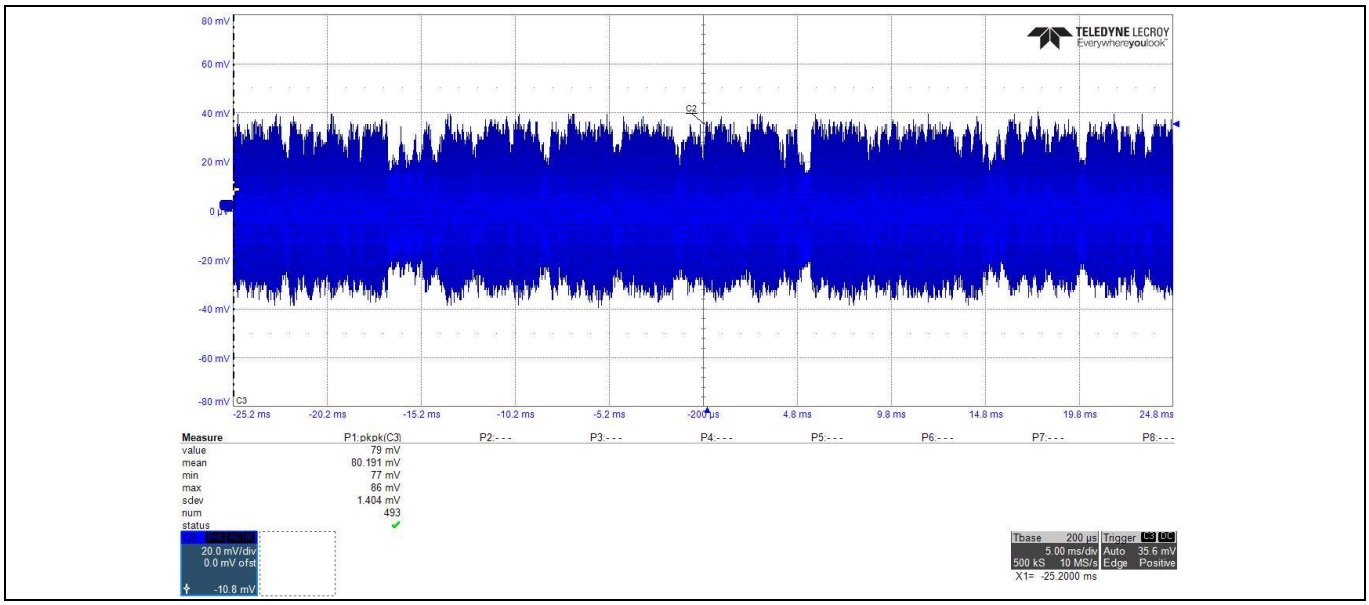


Figure 25 Output ripple voltage peak-peak @Vin = 22 V, output = 15 V 3 A

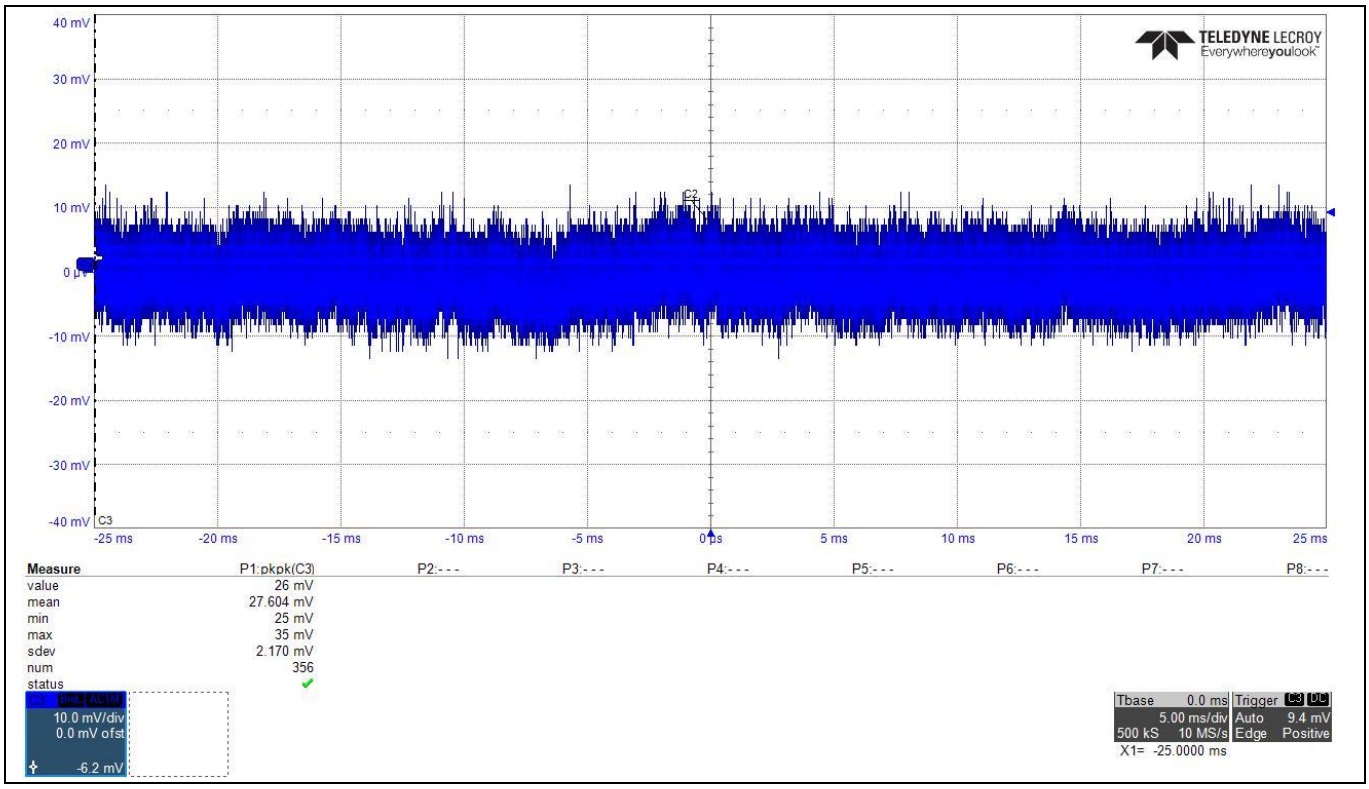


Figure 26 Output ripple voltage peak-peak @Vin = 22 V, output = 20 V 3 A

4.8 Output voltage dynamic response (USB-C PD output – CCG7SC)

Use the Infineon USB-C PD Voltage Switching Board to switch the voltage of the CCG7SC USB-C PD output, then connect the electronic load for dynamic load switching, and use an oscilloscope to record the dynamic response capability of the CCG7SC USB-C PD.

Table 15 Test conditions: Load = 100%-10%, T1 = T2 = 20 ms, Slew = 0.5 A/µs, Vin = 22 Vdc (CH1: Io, CH3: Vus-c or Vout)

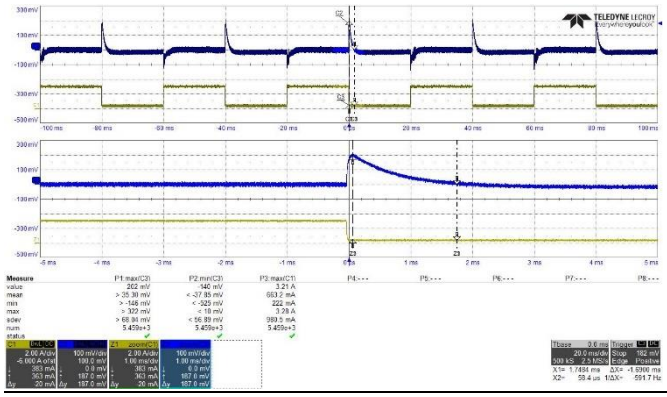
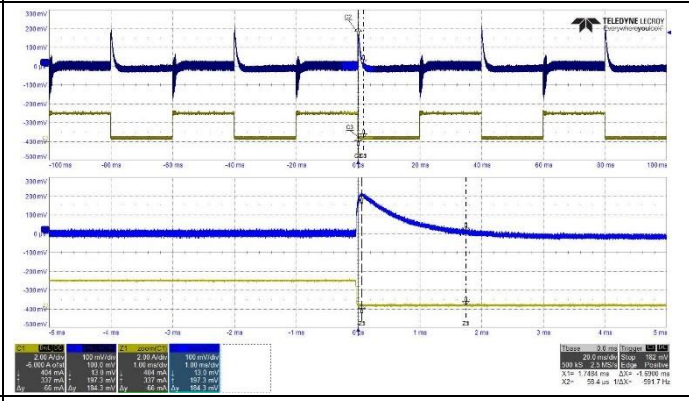
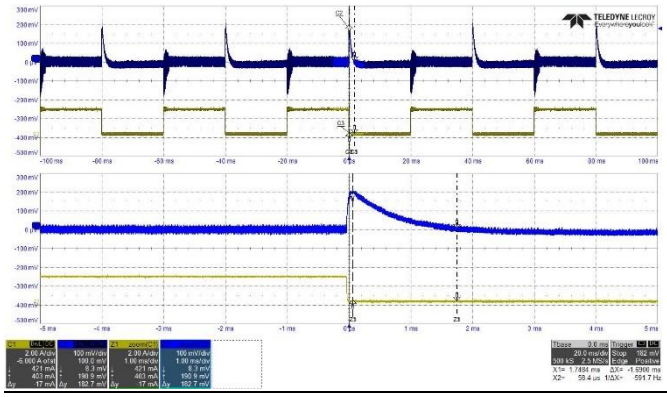
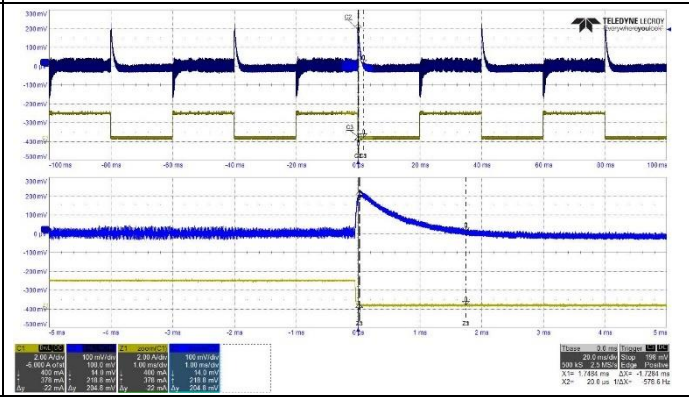
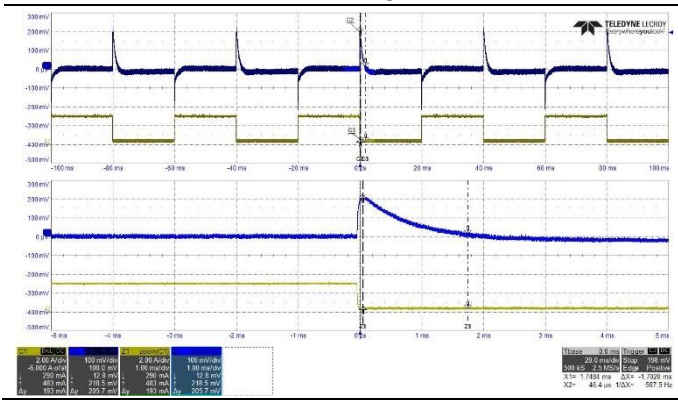
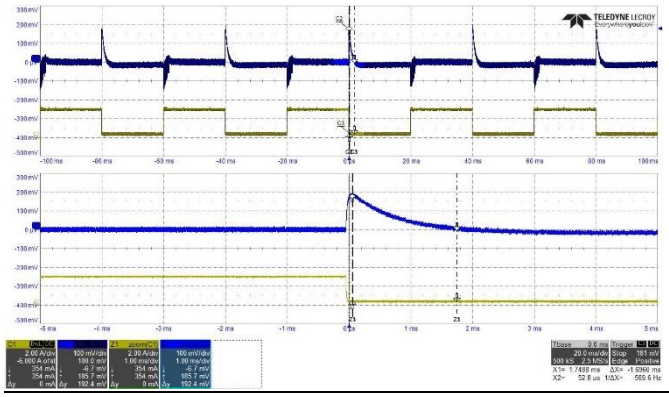
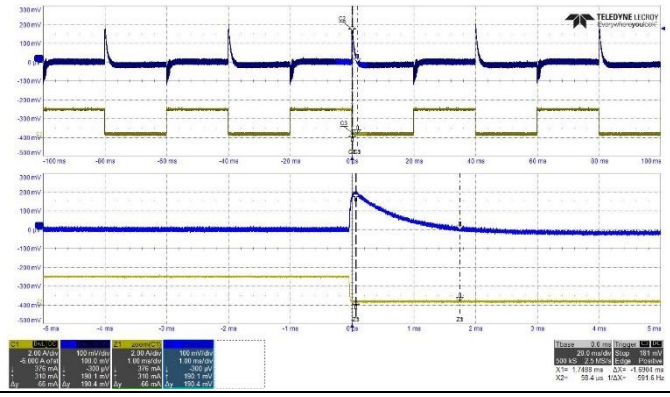
5 V, Vspike = 187 mV, Setting time=1.69 ms	9 V, Vspike = 184.3 mV, Setting time= 1.69 ms
	
12 V, Vspike = 182.7 V, Setting time = 1.692 ms	15 V, Vspike = 204.8 mV, Setting time = 1.728 ms
	
20 V, Vspike = 205.7 mV, Setting time = 1.702 ms	
	

Table 16 **Test condition: Load = 100%-10%, T1 = T2 = 20 ms, Slew=0.5 A/µs, Vin = 13 Vdc (CH1: Io, CH3: Vus-c or Vout)**

5 V, Vspike = 192.4 mV, Setting time = 1.696 ms	9 V, Vspike = 190.4 mV, Setting time = 1.69 ms
	

12 V, Vspike = 193.8 mV, Setting time = 1.696 ms

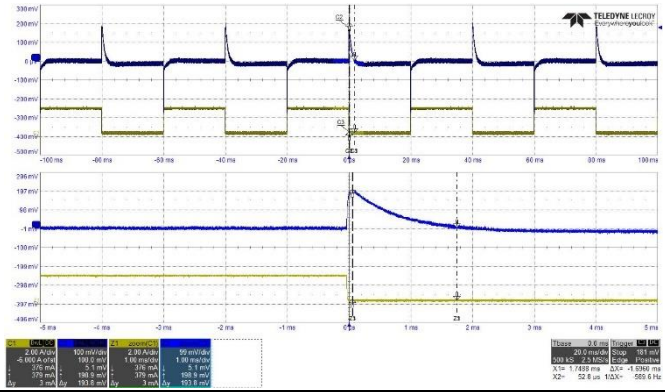
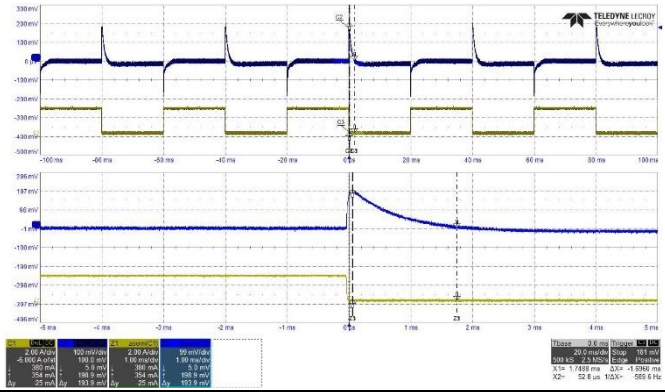


Table 17 **Test conditions: Load=100%-10%, T1 = T2 = 20 ms, Slew=0.5 A/µs, Vin = 9 Vdc (CH1: Io, CH3: Vus-c or Vout)**

5 V, Vspike = 193.9 mV, Setting time = 1.696 ms



4.9 Transient response (Qi PTx output – WLC1115)

Use TDK WRM483265-10F5-12V-G as the PRx for testing, connect the PRx to the electronic load for dynamic load switching, and use an oscilloscope to record the dynamic response capability of the WLC1115 Qi PTx output.

Table 18 Transient of Qi PTx output, Ch1: Vin, Ch2: Iin, Ch3: VBRG, Ch4: VOUT-Rx (load: BPP)

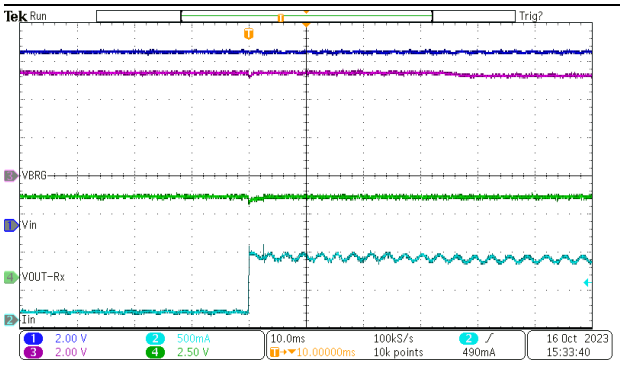
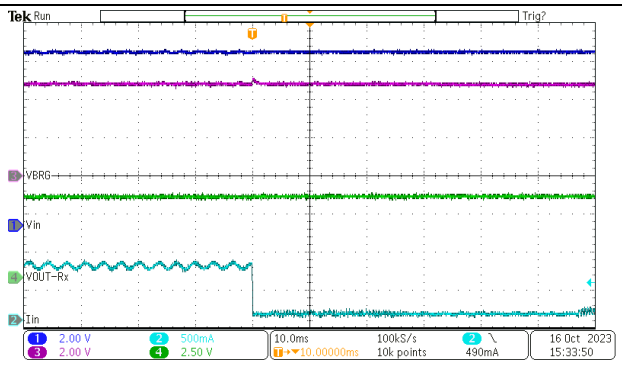
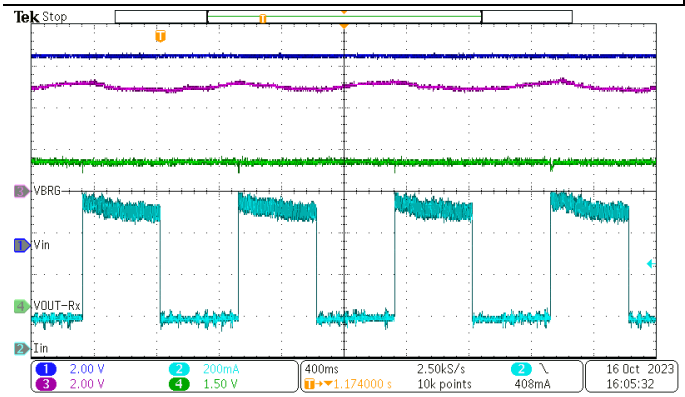
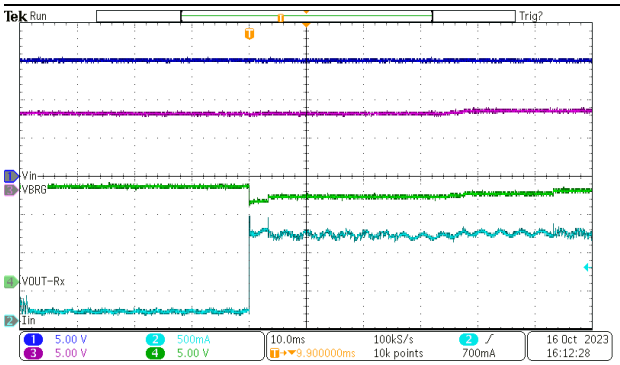
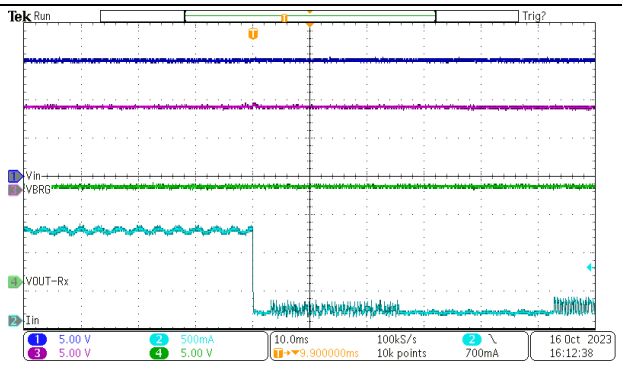
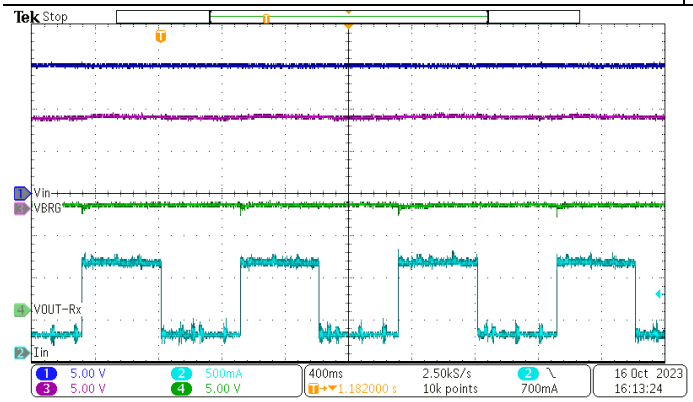
BPP load on	BPP load off
	
	

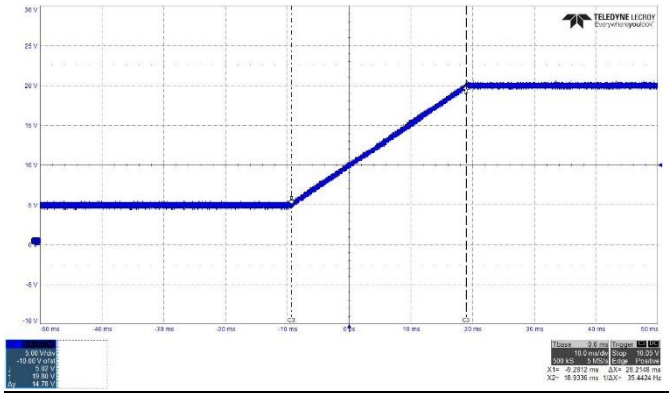
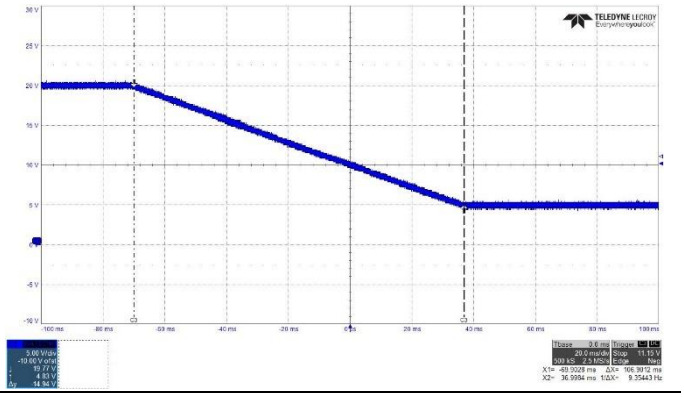
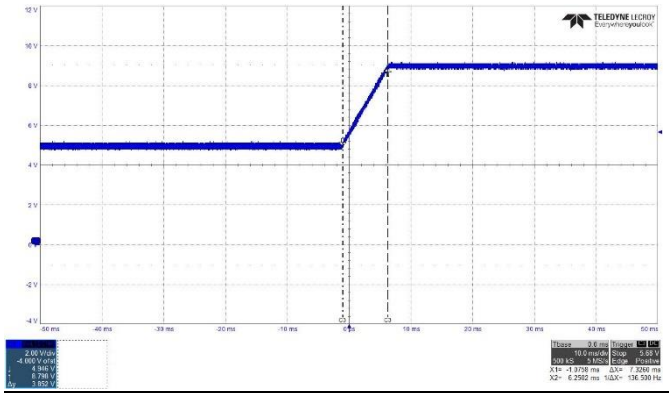
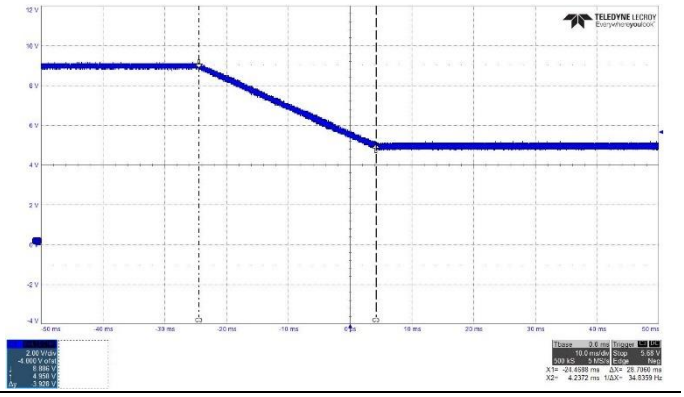
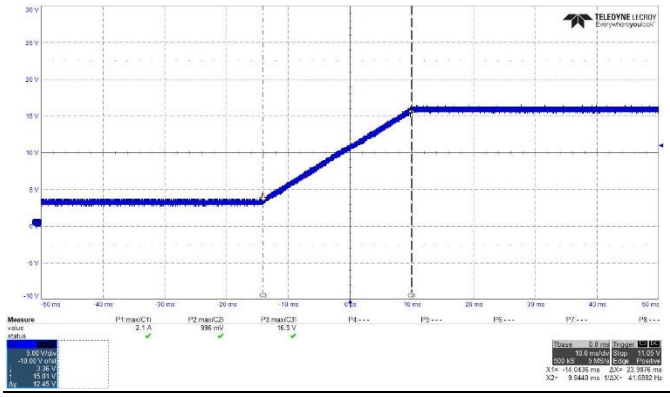
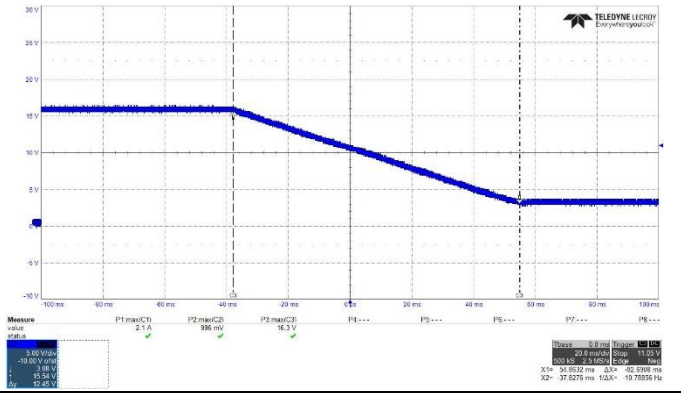
Table 19 Transient of Qi PTx output, Ch1: Vin, Ch2: Iin, Ch3: VBRG, Ch4: VOUT-Rx (load: EPP)

EPP load on	EPP load off
	
	

4.10 Output voltage transition (USB-C PD output – CCG7SC)

Use the Infineon USB-C PD Voltage Switching Board to switch the voltage of the CCG7SC USB-C PD output, and use an oscilloscope to record the changes in the CCG7SC USB-C PD output voltage. The input voltage condition for all tests is Vin = 22 Vdc.

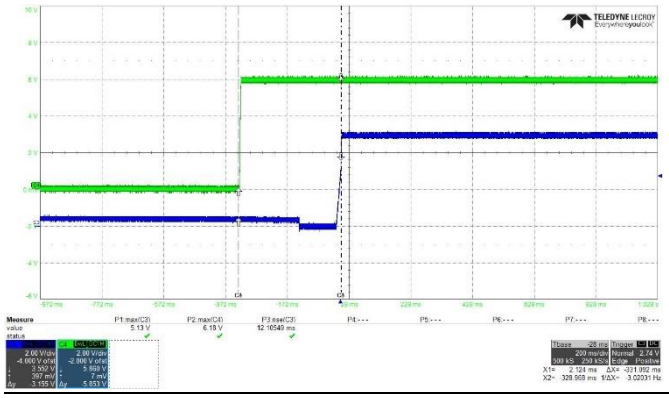
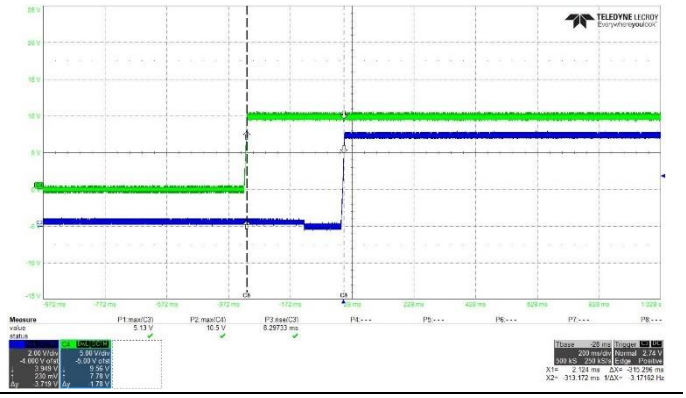
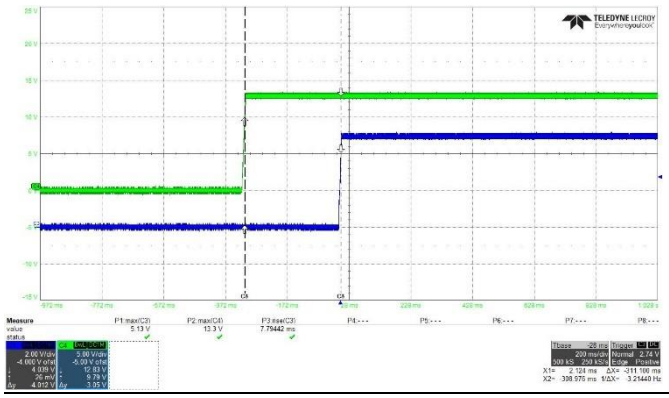
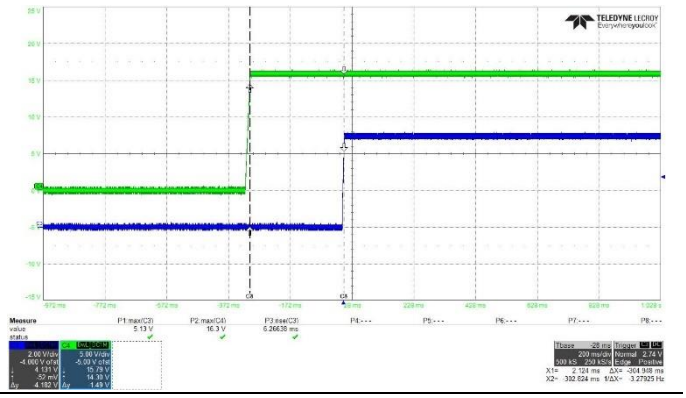
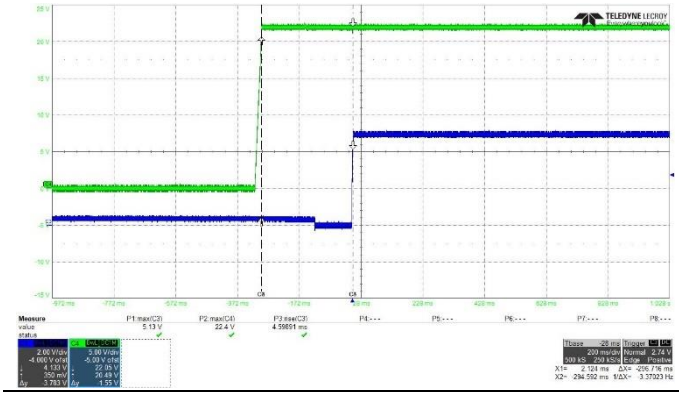
Table 20 Transient of CCG7SC USB-C PD output voltage, test condition: Vin = 22 Vdc

From 5 V 0 A to 20 V 0 A, Transition time = 28.21 ms	**From 20 V 0 A to 5 V 0 A, Transition time = 106.9 ms**
	
From 5 V 0 A to 9 V 0 A, Transition time = 7.33 ms	From 9 V 0 A to 5 V 0 A, Transition time = 28.71 ms
	
From PPS 3.3 V 0 A to 16 V 0 A, Transition time = 23.99 ms	From PPS 16 V 0 A to 3.3 V 0 A, Transition time = 92.69 mS
	

4.11 Start-up turn on delay (USB-C PD output – CCG7SC)

Test the start-up turn-on delay time of CCG7SC USB-C PD. The input voltage condition is 6 Vdc~22 Vdc and the output is 5 V/0 A.

Table 21 Start-up turn on delay time of CCG7SC USB-C PD, test condition: Vin = 6 V~22 Vdc, with 5 V/0 A output. (CH3: Vbus-c, CH4: Vdc_in)

Vin = 6 Vdc, Vo delay time = 331.09 ms, Vo rise time = 12.105 ms	**Vin=10 Vdc, Vo delay time=315.3 ms, Vo rise time = 8.3 ms**
	
Vin=13 Vdc, Vo delay time=311.1 ms, Vo rise time=7.794 ms	**Vin=16 Vdc, Vo delay time=304.95 ms, Vo rise time=6.266 ms**
	
Vin = 22 Vdc, Vo delay time = 296.72 ms, Vo rise time = 4.599 ms	
	

4.12 Switch voltage stress (USB-C PD output – CCG7SC)

Measure voltage stress on MOSFETs of high side and low side.

Test conditions: Vin = 22 Vdc,

1. Oscilloscope set at 120 MHz bandwidth to test MOSFETs of high side.
2. Oscilloscope set at full bandwidth to test MOSFETs of low side.

Table 22 Voltage stress on MOSFETs of high side

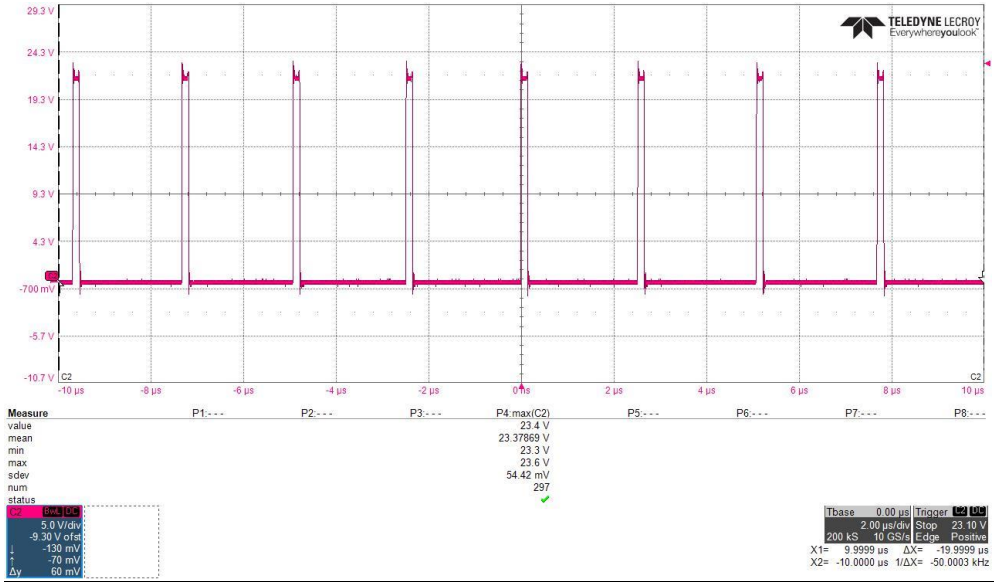
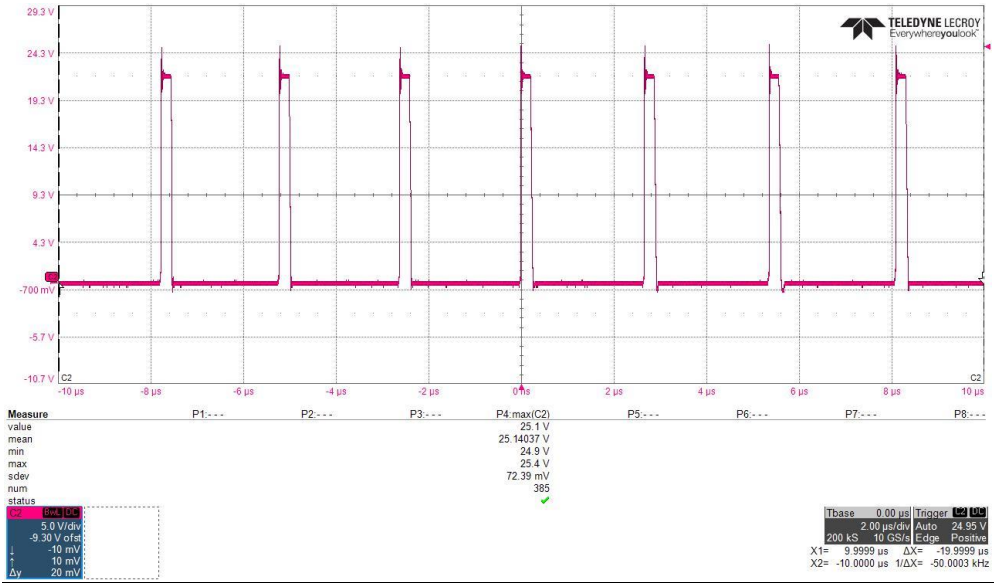
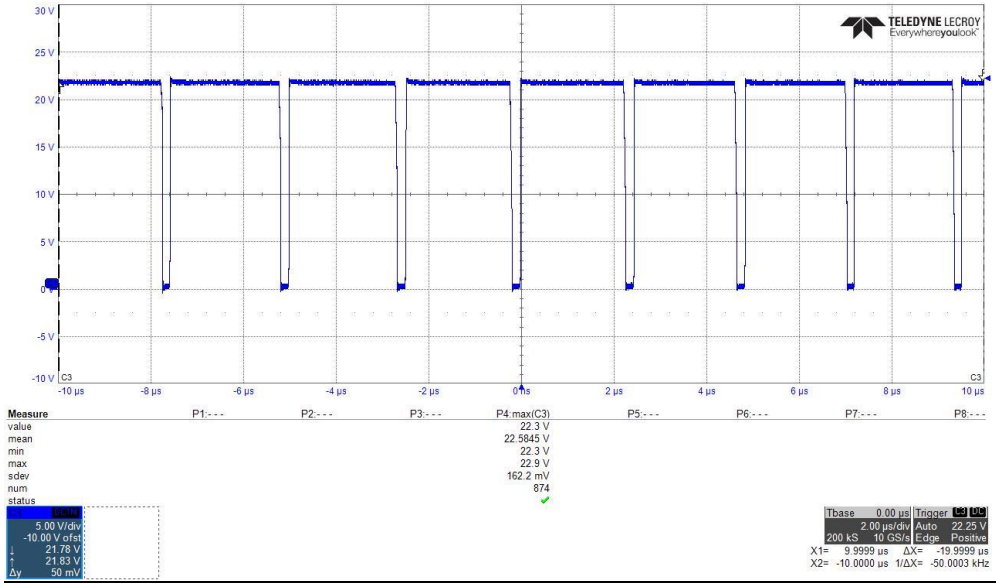
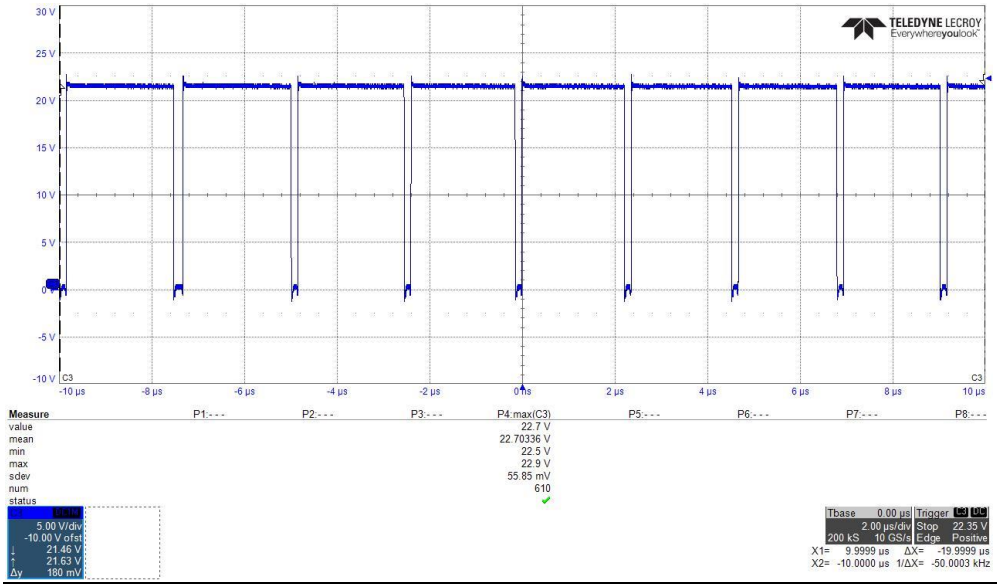
High side MOSFET Q101 Stress @ 20 V/3 A, Vds = 24 V < 40 V Spec

High side MOSFET Q101Stress @ 20 V/0 A, Vds = 26 V < 40 V Spec


Table 23 Voltage stress on MOSFETs of low side

Low side MOSFET Q104Stress @20 V/0 A, Vds= 23 V< 40 V Spec



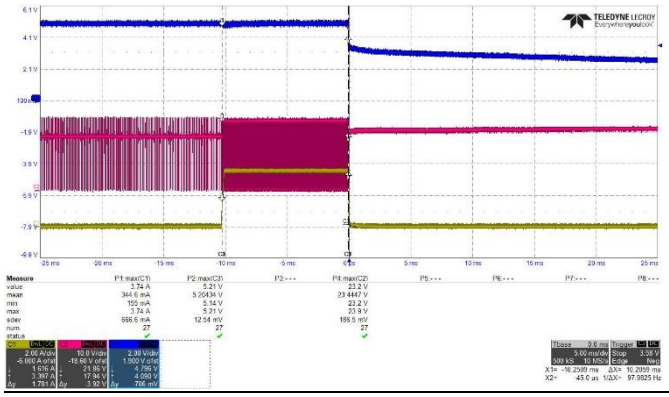
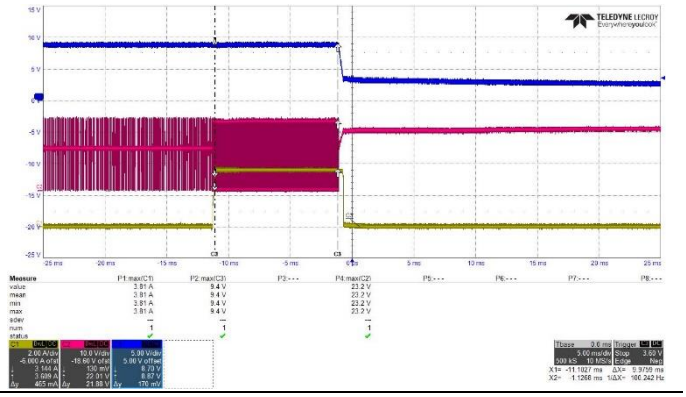
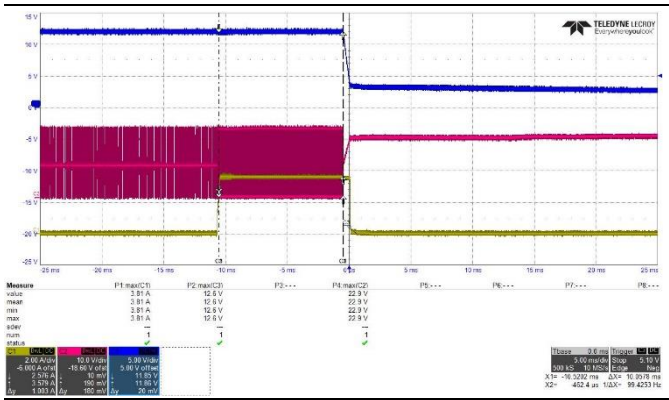
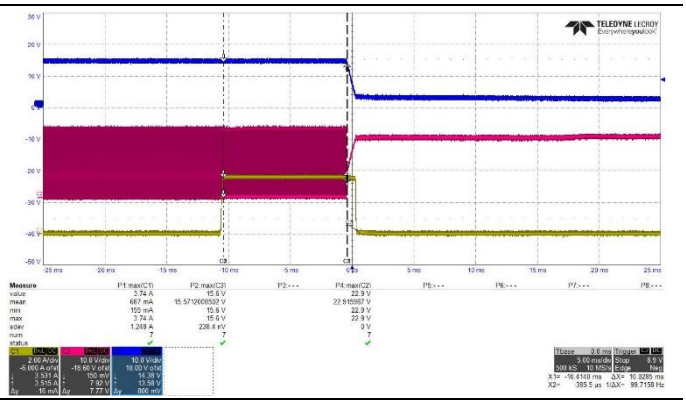
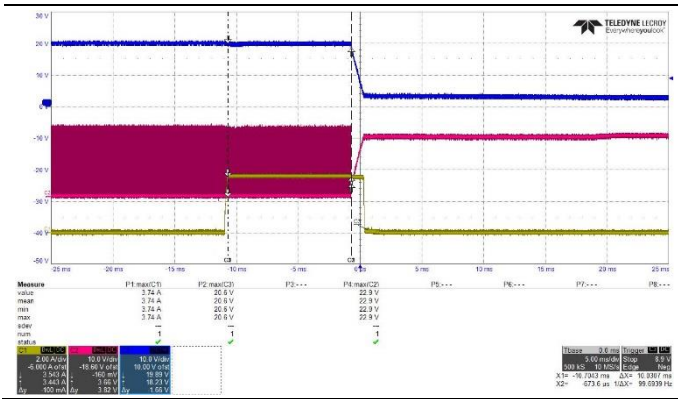
Low side MOSFET Q104Stress @20 V/3 A, Vds = 23 V < 40 V Spec



4.13 Overcurrent protection (USB-C PD output – CCG7SC)

Test the overcurrent protection status of CCG7SC USB-C PD and record it with an oscilloscope.

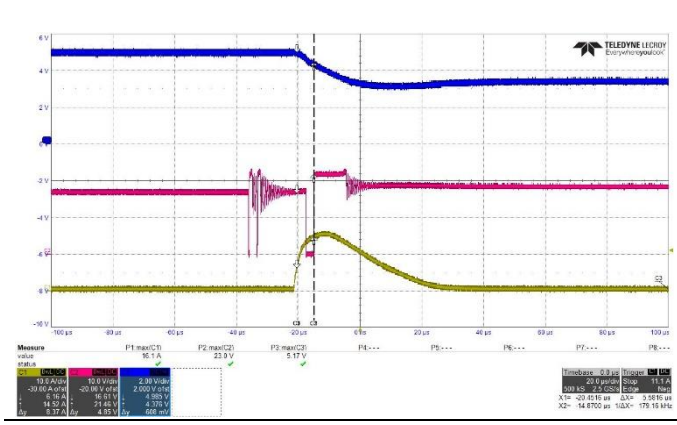
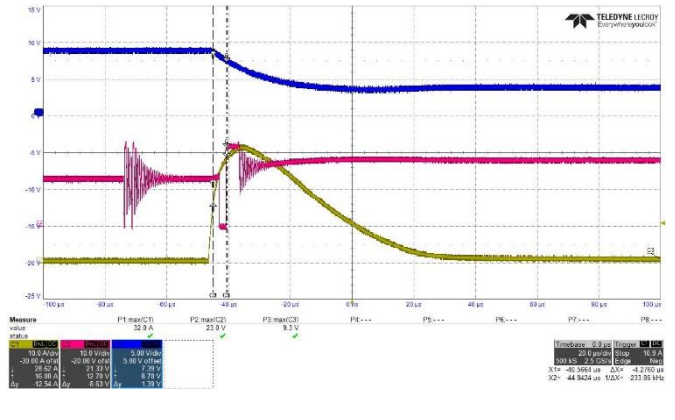
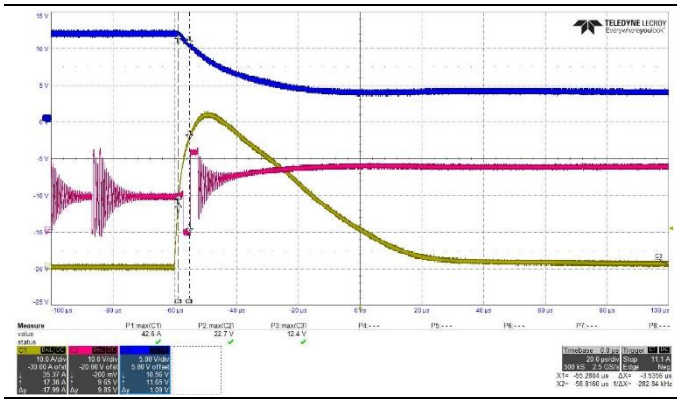
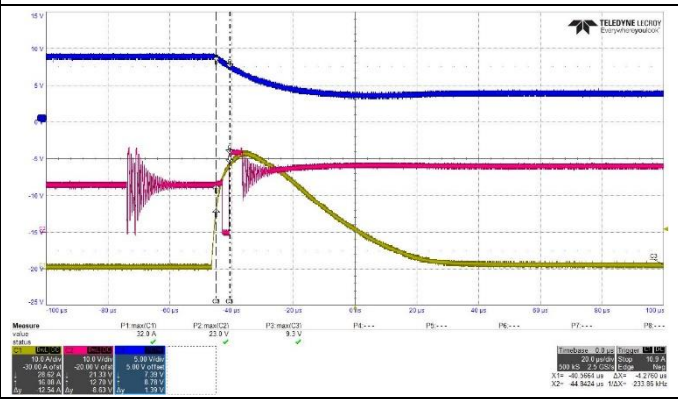
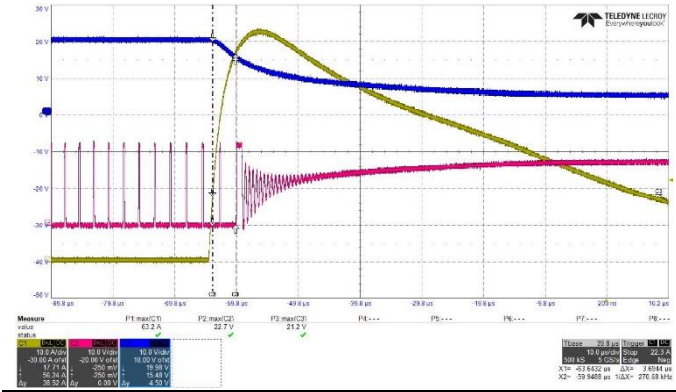
Table 24 Overcurrent protection of CCG7SC USB-C PD output (CH1: Iout, CH2: Q101 Vds, CH3: Vbus_c)

Fixed-PDO: 5 V, 0 A, OCP = 3.65 A	Fixed-PDO: 9 V, 0 A, OCP = 3.7 A
	
Fixed-PDO: 12 V, 0 A, OCP = 3.7 A	**Fixed-PDO: 15 V, 0 A, OCP = 3.7A**
	
Fixed-PDO: 20 V, 0 A, OCP = 3.7 A	
	

4.14 Short-circuit protection (USB-C PD output – CCG7SC)

Test the short circuit protection status of CCG7SC USB-C PD and record it with an oscilloscope.

Table 25 Short-circuit protection of CCG7SC USB-C PD output. Test conditions: Vin = 22 Vdc, short the output at E-load (CH1: Iout, CH2:Q101 Vds, CH3: Vbus_c)

Fixed-PDO: 5 V, 0 A	Fixed-PDO: 9 V, 0 A
	
Fixed-PDO: 12 V, 0 A	**Fixed-PDO: 15 V, 0 A**
	
Fixed-PDO: 20 V, 0 A	
	

4.15 Power sharing (Combine Qi PTx and USB-C PD)

Testing Infineon's unique power sharing function of REF_TX15W_PD60W_N1, which can intelligently allocate a total power of 60 W to WLC1115 Qi PTx and CCG7SC USB-C PD.

Using a 65 W ANKER USB-C PD adapter as the input power supply, the CCG7SC USB-C PD can share the full 60 W output capability when the WLC1115 Qi PTX does not detect PRx.

Figure 27 WLC1115 Qi PTx as standby, CCG7SC USB-C PD output have all of capability 60 W

Using a 65 W ANKER USB-C PD adapter as the input power supply and a Qi Sniffer as the BPP PRx, the WLC1115 Qi PTX will first reserve 8 W for PRx and the remaining 52 W for the CCG7SC USB-C PD.

Figure 28 Reserve 8 W for WLC1115 Qi PTx BPP, share remaining 52 W to CCG7SC USB-C PD

Using a 65 W ANKER USB-C PD adapter as the input power supply and a Qi Sniffer as the EPP PRx, the WLC1115 Qi PTX will first leave 20 W for PRx and the remaining 40 W for the CCG7SC USB-C PD.

When the CCG7SC USB-C PD output capability is lower than 45 W, the system LED2 will light up red to remind that the PD output capability is lower than 45 W. Even though the PDO still has a 20 V capability, it is not recommended to charge a notebook.

Figure 29 Reserve 20 W for WLC1115 Qi PTx EPP, share remaining 40 W to CCG7SC USB-C PD

5 Compliance tests

5.1 Nok9 Qi v1.3.3 compliance tests (Qi PTx output – WLC1115)

WLC1115 Qi PTx of REF_TX15W_PD60W_N1 is a Qi v.1.3.3 certified reference solution with Qi ID 12383.
For a detailed report on compliance and interoperability, contact Infineon sales team.

CATS II BST - Quality Report

Test Session Information

Project Name	Compliance Testing_230508_095005
Test Session ID	
Report generation date	2023-05-17
Playlist	Compliance Testing
Test Tool PRMC Code	0xCFBC (DUT PRMC Excluded)
Randomization Seed	-1712022074
Optimal Position Requirement	Enabled

Test Facility & Operator

Laboratory Name	P-ADS
Laboratory Location	TPE
Laboratory Manager	
Test Engineer	Aaron Kuo
Phone	
Mail	
Note	

Test Equipment

Brand	nok9
Product Name	CATS II BST
Calibration Date	2021-11-08

Specifications/Standards Tested

Qi 1.2.4	-
Qi 1.3.0 / 1.3.1 / 1.3.2	-
Qi 1.3.3	100.0 %
Qi Market Inspection	-
IEC FOD (by proxy)	-
Samsung Proprietary Extension 1.0.4	-
Samsung Proprietary Extension 1.1.0	-
WPT Efficiency	-
IEC efficiency (draft)	-
CE4A	-
MPP (draft)	-

Overview

Started	2023-05-08 10:07:06
Finished	2023-05-17 09:58:36
Total Number of tests	653
Total Execution Time	07:28:11:318

Passed 100.0 % (653) | Failed 0.0 % (0) | Inconclusive 0.0 % (0) | Not Run 0.0 % (0)

Figure 30 NoK9 test report

5.2 USB-PD compliance testing (Combine Qi PTx and USB-C PD)

USB-PD source test – Ellisys and QuadraMax

Table 26 Test results of USB-PD source test – Ellisys and QuadraMax

Work sheet	Number of test cases	Run	Pass
Ellisys	69	69	69
QuadraMax – Load test	36	36	36
QuadraMax – Hard reset test	4	4	4
QuadraMax – Capabilities test	5	5	5
QuadraMax – Overcurrent test	31	31	31
QuadraMax – PPS voltage step test	4763	4763	4761
QuadraMax – PPS current limit test	1630	1630	1630

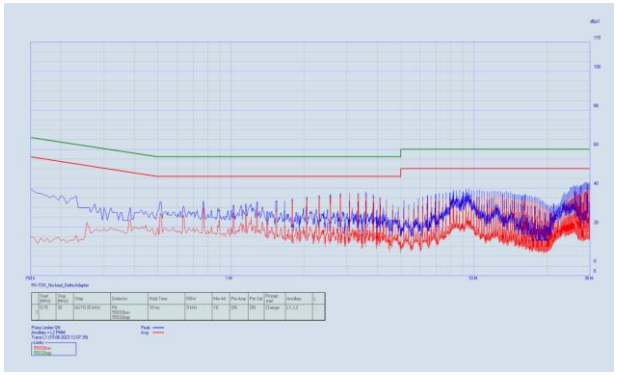
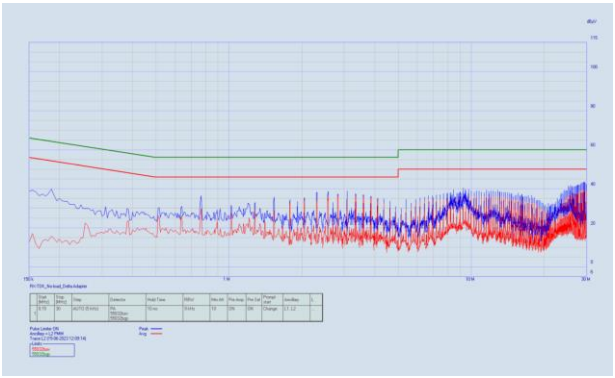
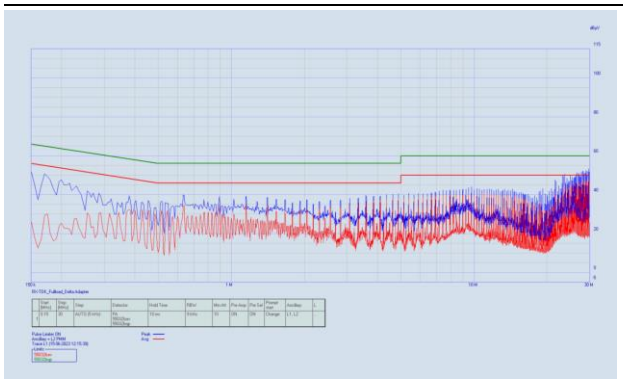
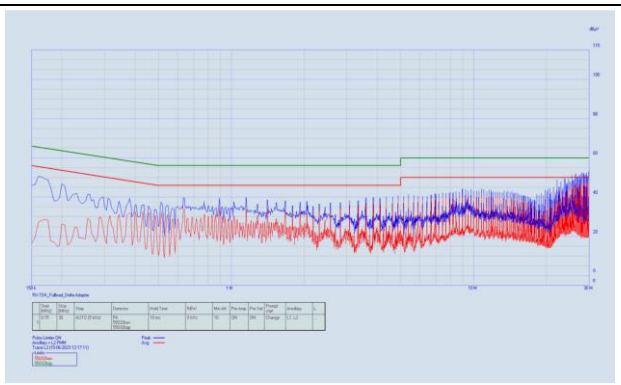
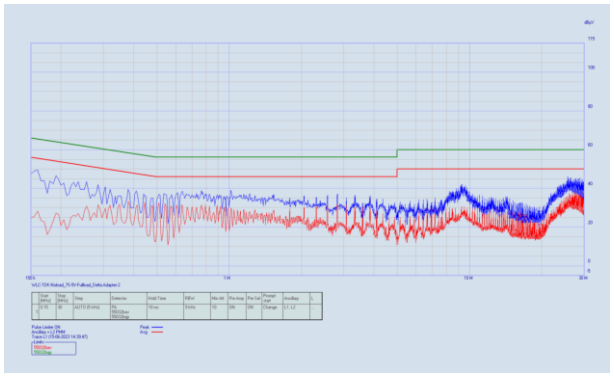
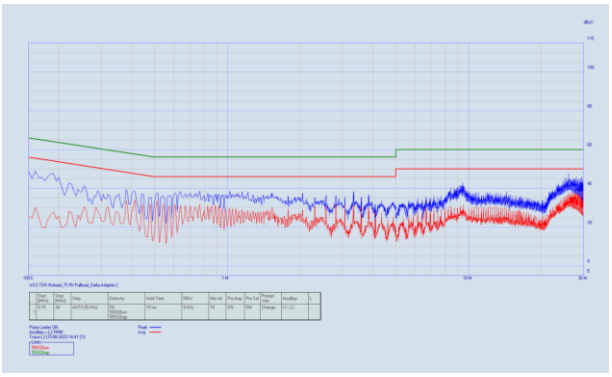
Note:

1. *QuadraMax PPS voltage step test with two failed items that should be the equipment issue.*
2. *QuadraMax current limit test with DC 20 V input.*

5.3 Conducted emission testing (Combine Qi PTx and USB-C PD)

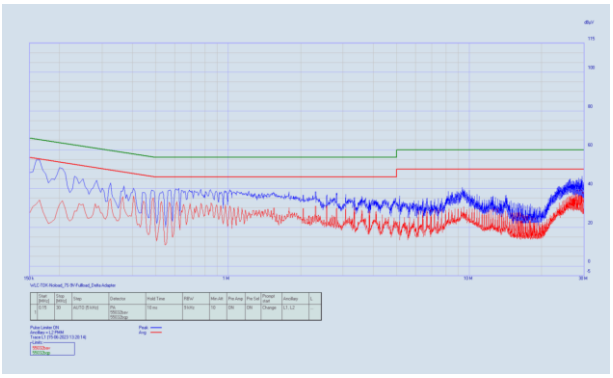
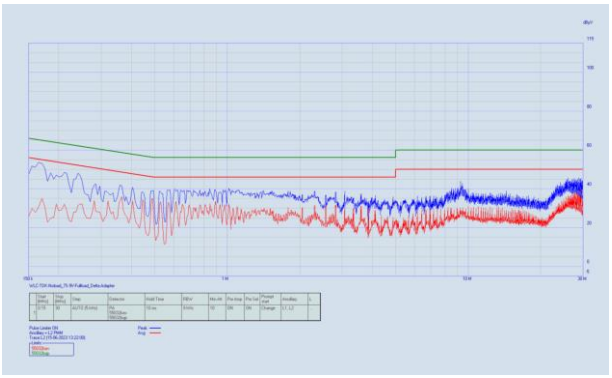
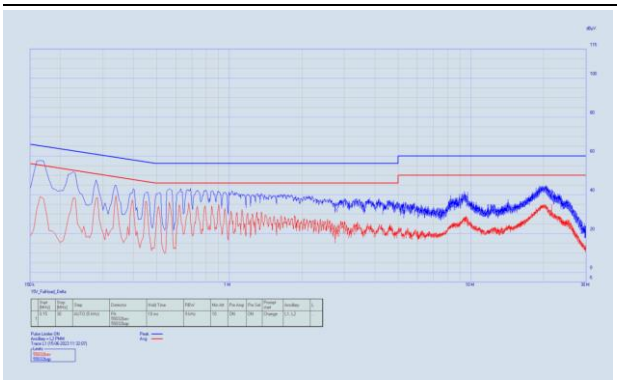
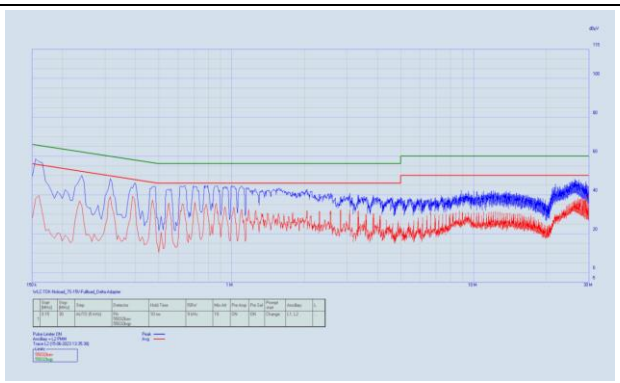
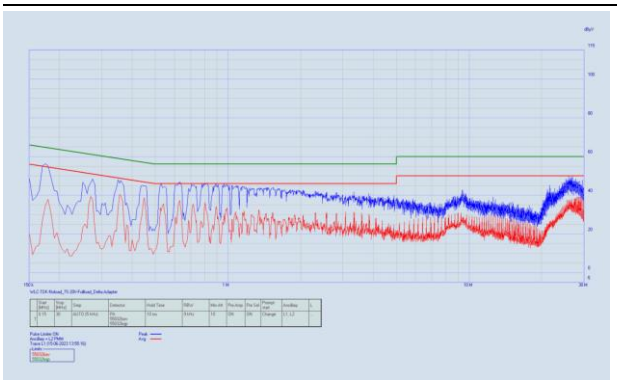
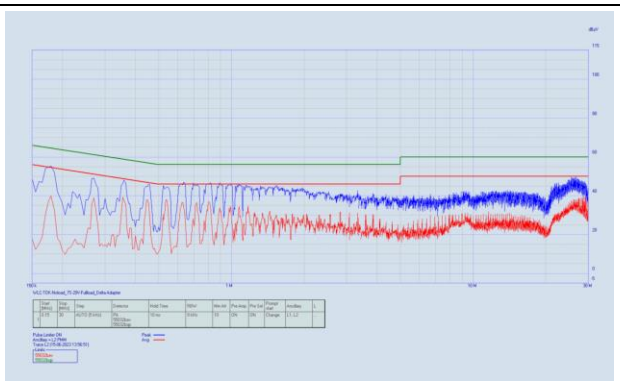
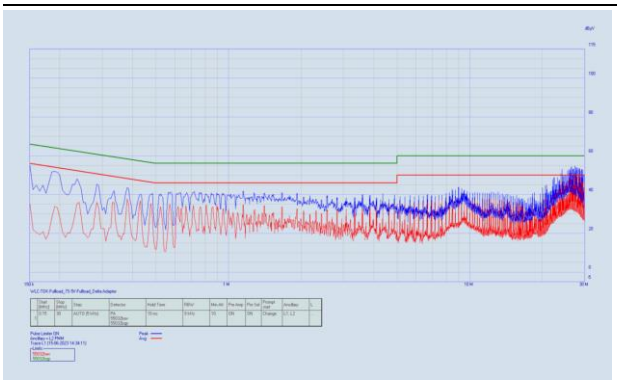
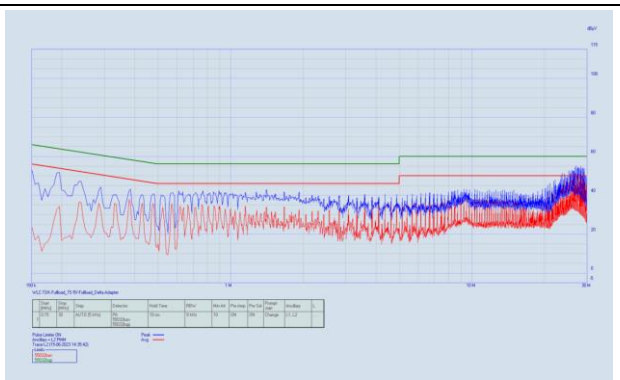
The following emission testing performance is to test REF_TX15W_PD60W_N1 in a room temperature of 25°C. The test output conditions are WLC1115 Qi PTx and CCG7SC USB-C PD at various output powers. The input power supply comes from delta's 100 W PD adapter.

Table 27 CE testing results of REF_TXW_PD´W_N's WLC1115 Qi PTx and CCG7SC USB-C PD at various output powers

 Qi PTx and USB-C PD are both as standby – L1 trace	 Qi PTx and USB-C PD are both as standby – L2 trace
 Qi PTx EPP 15 W + USB-C PD as standby – L1 trace	 Qi PTx EPP 15 W + USB-C PD as standby – L2 trace
 Qi PTx as standby + USB-C PD 5 V 3 A – L1 trace	 Qi PTx as standby + USB-C PD 5 V 3 A – L2 trace

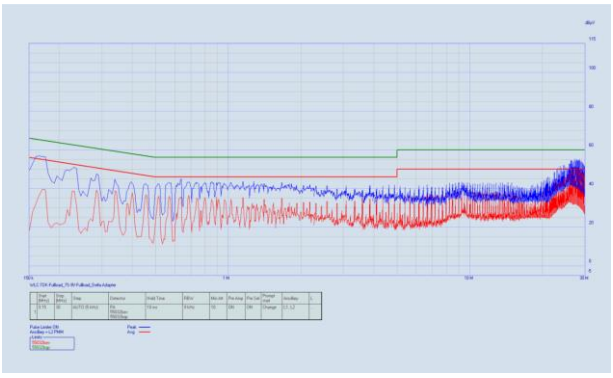
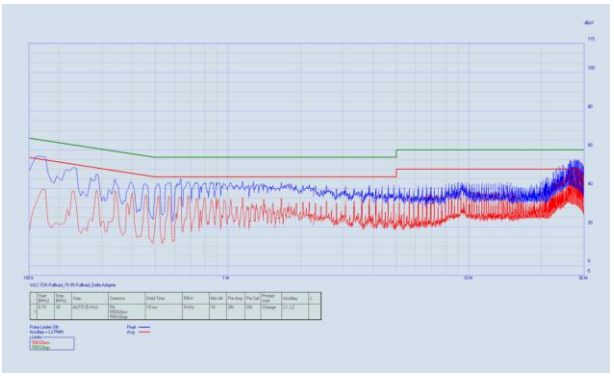
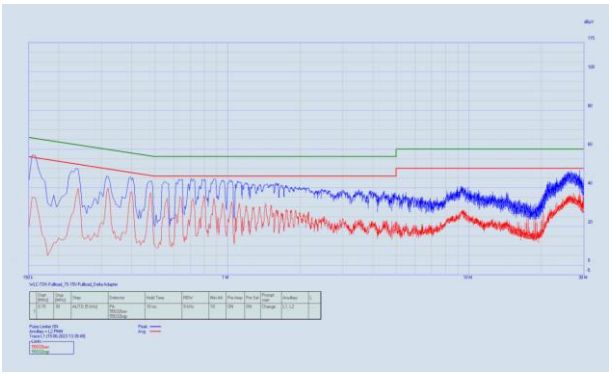
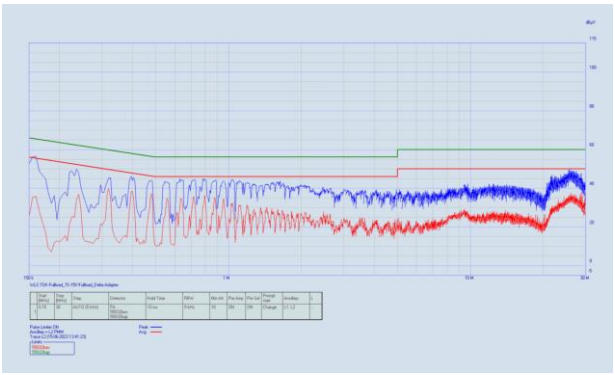
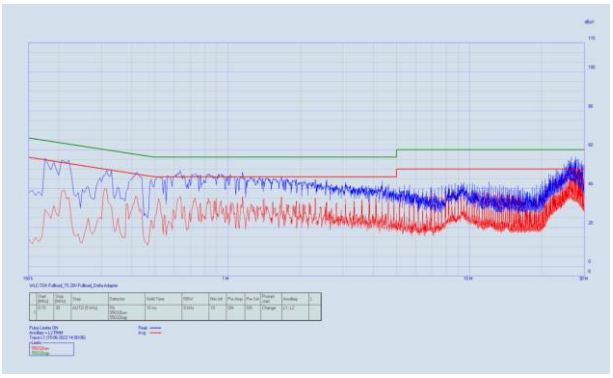
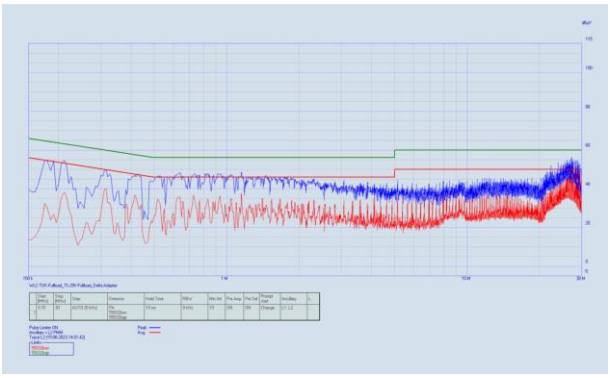
Devices - WLC1115 + CCG7SC

Compliance tests

	
Qi PTx as standby + USB-C PD 9 V 3 A – L1 trace	Qi PTx as standby + USB-C PD 9 V 3 A – L2 trace
	
Qi PTx as standby + USB-C PD 15 V 3 A – L1 trace	Qi PTx as standby + USB-C PD 15 V 3 A – L2 trace
	
Qi PTx as standby + USB-C PD 20 V 3 A – L1 trace	Qi PTx as standby + USB-C PD 20 V 3 A – L2 trace
	
Qi PTx EPP 15 W + USB-C PD 5 V 3 A – L1 trace	Qi PTx EPP 15 W + USB-C PD 5 V 3 A – L2 trace

Devices - WLC1115 + CCG7SC

Compliance tests

	
Qi PTx EPP 15 W + USB-C PD 9 V 3 A – L1 trace	Qi PTx EPP 15 W + USB-C PD 9 V 3 A – L1 trace
	
Qi PTx EPP 15 W + USB-C PD 15 V 3 A – L1 trace	Qi PTx EPP 15 W + USB-C PD 15 V 3 A – L2 trace
	
Qi PTx EPP 15 W + USB-C PD 20 V 3 A – L1 trace	Qi PTx EPP 15 W + USB-C PD 20 V 3 A – L2 trace

6 Appendix: Design files

6.1 Schematics

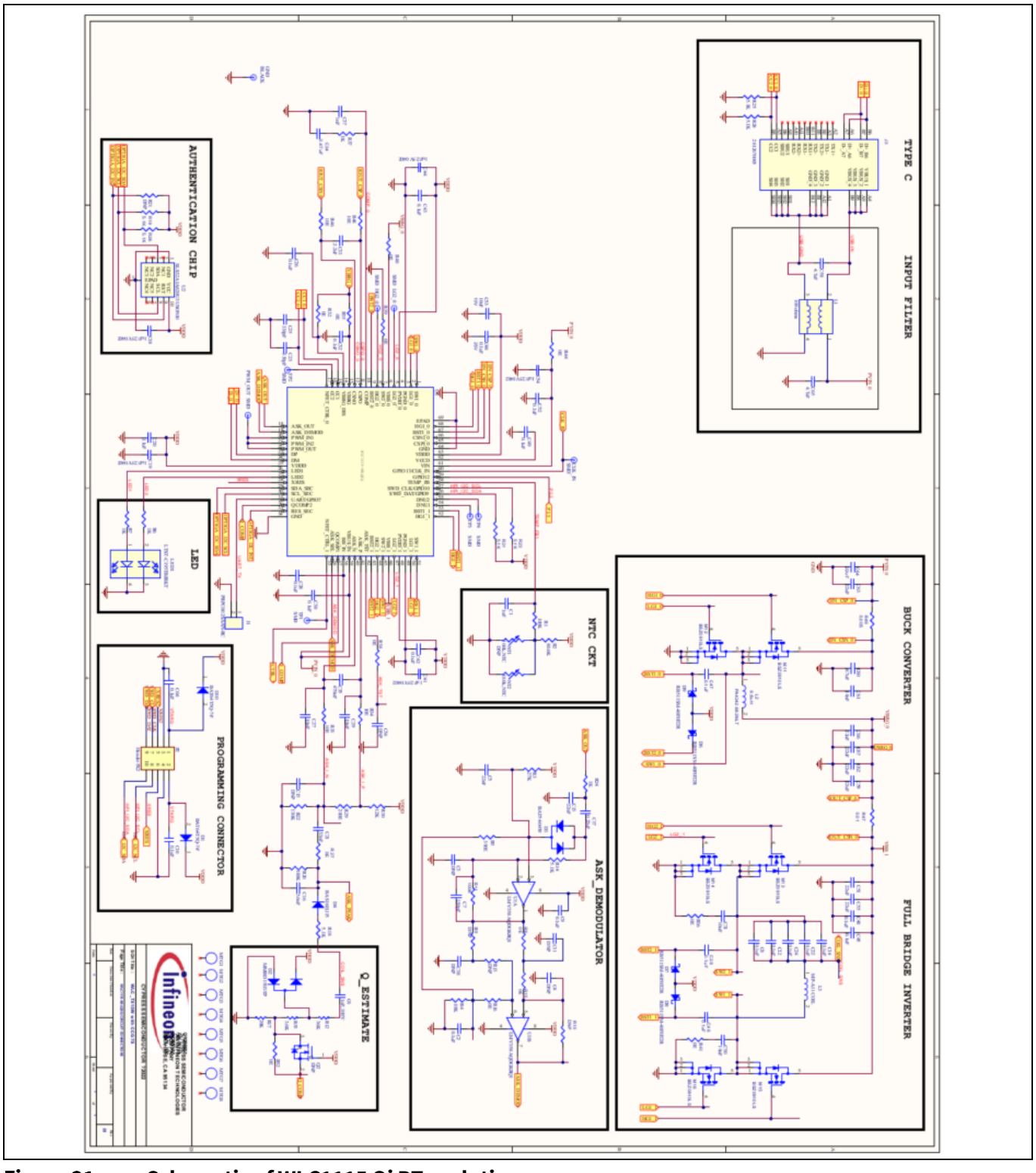


Figure 31 Schematic of WLC1115 Qi PTx solution

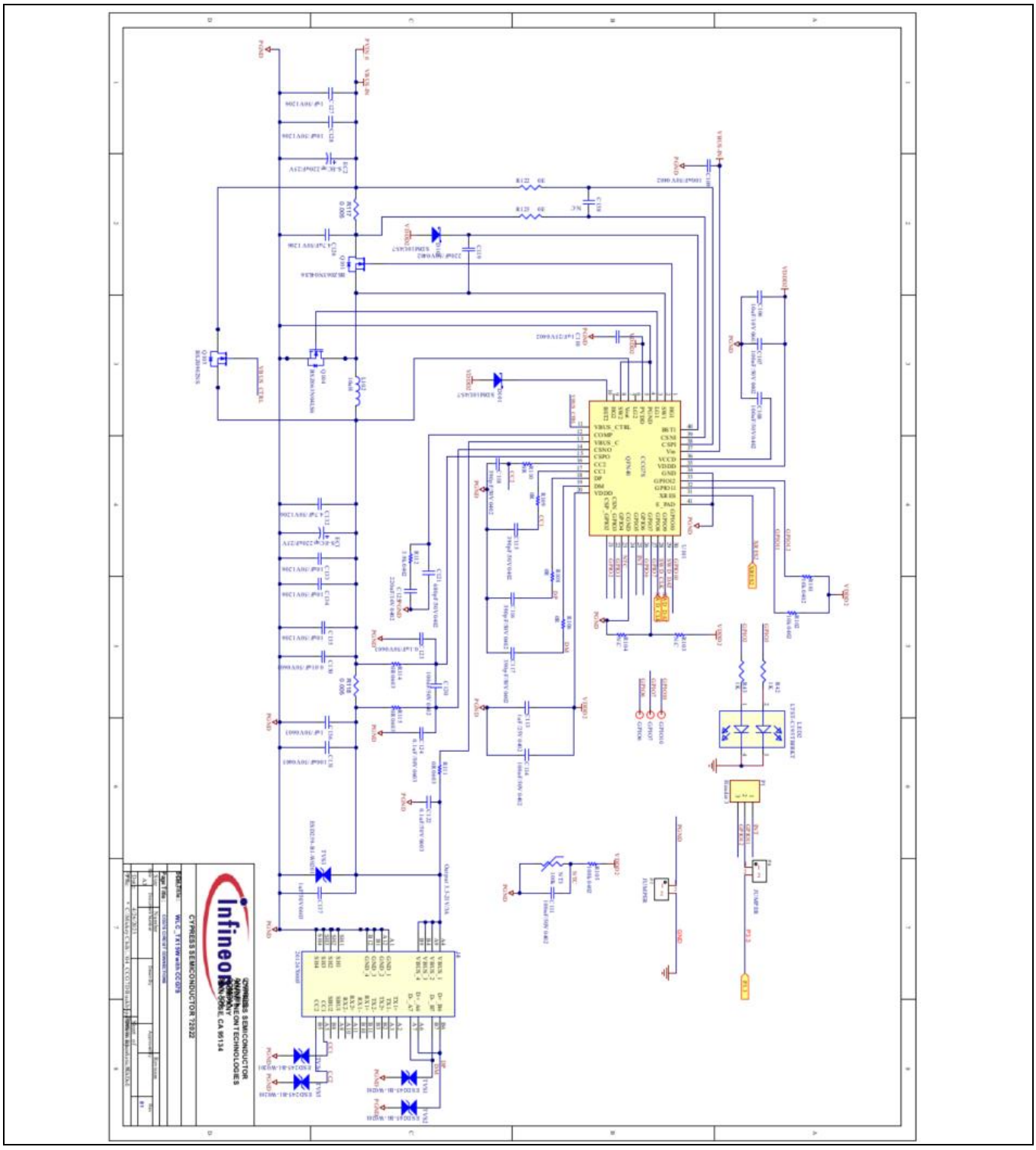


Figure 32 Schematic of CCG7SC USB-C PD solution

6.2 Board layout

Table 28 PCB details

PCB layer	Copper thickness	Details
Top layer	2 oz	Components and traces
Bottom layer	2 oz	Traces and power components thermal pads
Board size	64.8 mm × 62.4 mm 64.8 mm × 62.4 mm	Main Board PCB Coil PCB
Board thickness	1.6 mm	-

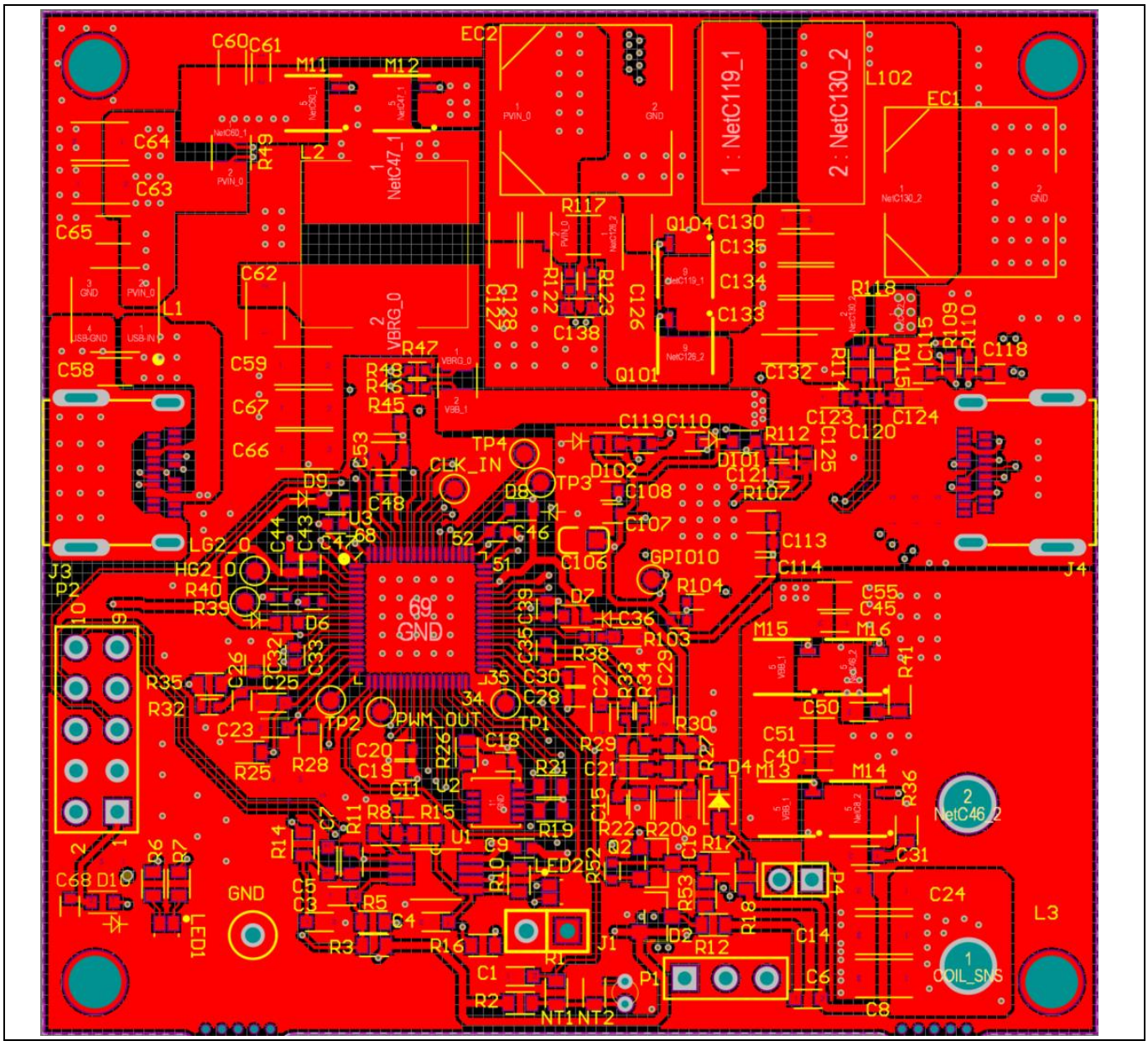


Figure 33 Top layer view

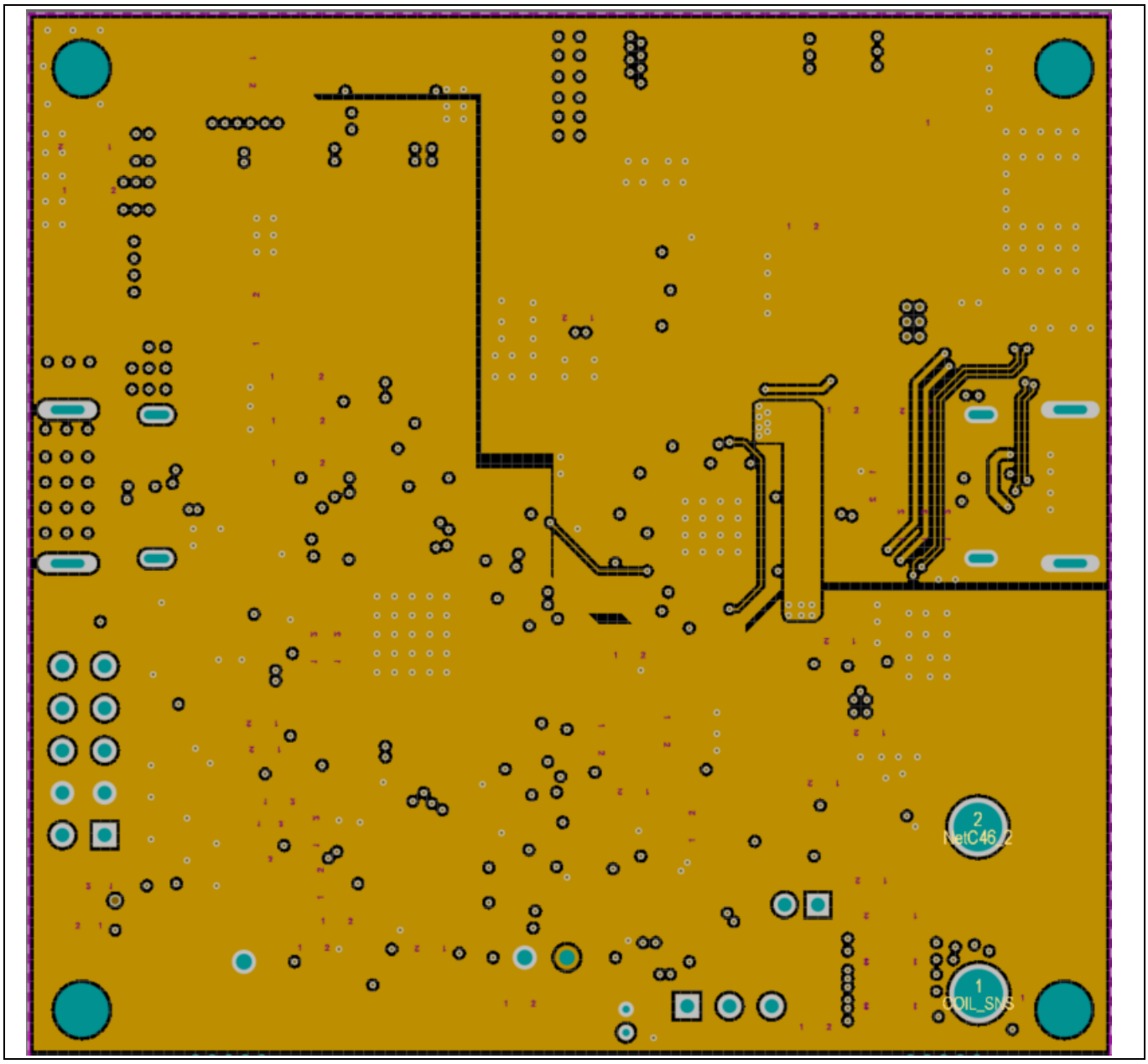


Figure 34 GND layer view

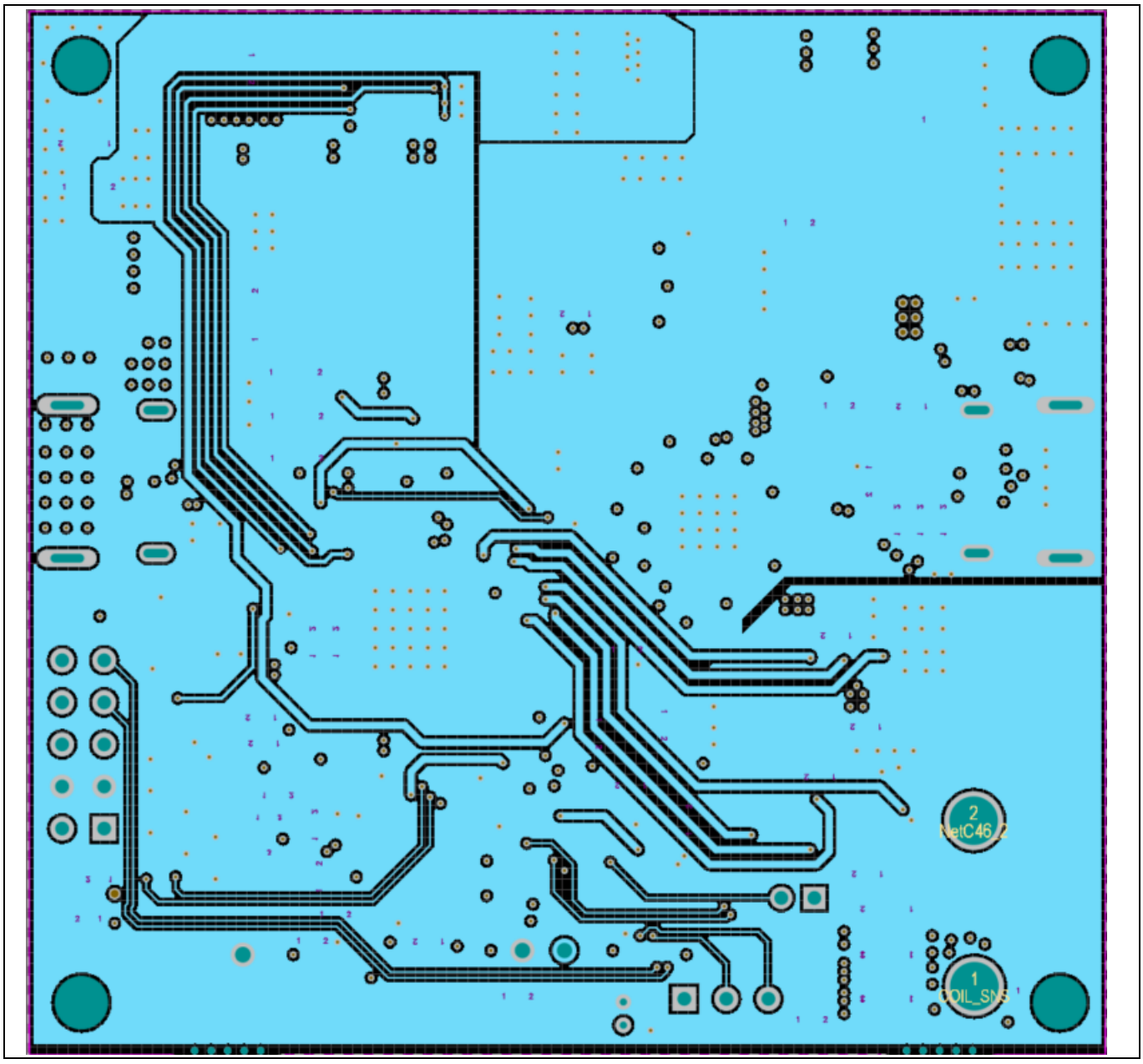


Figure 35 SIG layer view

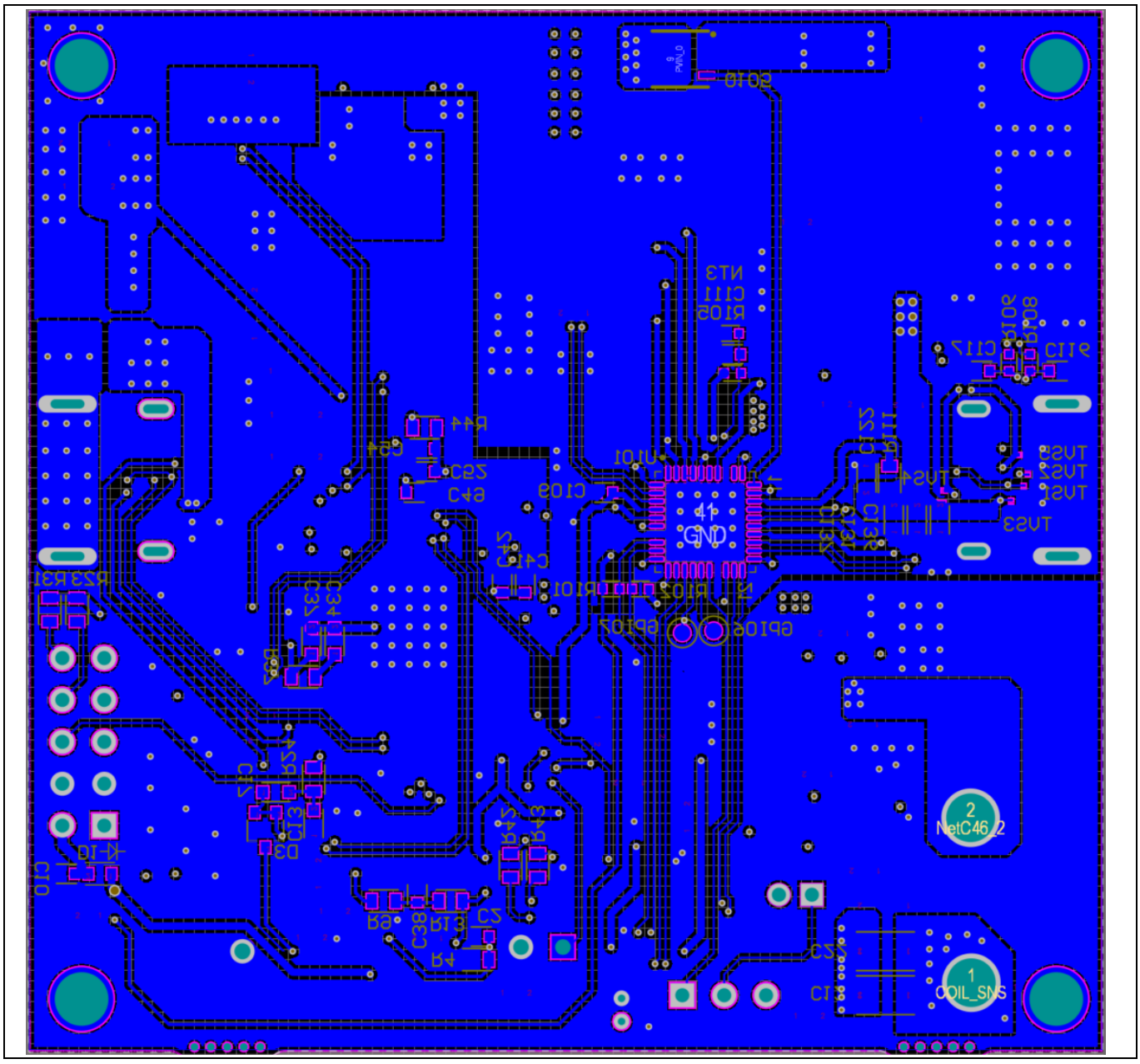


Figure 36 Bottom layer view

6.3 Bill of materials

Quantity	Designator	Comment	Description	Footprint
2	C1, C37	1 nF	CAP CER 1000 PF 25 V X7R 0603	capc1608x90n_ty
17	C2, C9, C10, C20, C26, C28, C30, C32, C39, C42, C43, C46, C47, C48, C49, C52, C68	0.1 uF	CAP CER 0.1UF 25 V X7R 0402	capc1005x56n_cyps
2	C5, C13	22 nF	CAP CER 0.022UF 25 V X7R 0603	capc1608x90n_ty
1	C6	1 nF	CAP CER 1000 PF 100 V X7R 0603	capc1608x90n_ty
1	C7	150 pF	CAP CER 150 PF 25 V X7R 0603	capc1608x90n_ty
5	C8, C12, C14, C22, C24	0.1 uF	CAP CER 0.1UF 100 V C0G/NP0 1206	CAPC3216X190N_A
1	C16	5.6 nF	CAP CER 5600 PF 100 V C0G 0603	capc1608x90n_ty
1	C17	0.22 uF	CAP CER 0.22UF 25 V X7R 0603	capc1608x90n_ty
7	C18, C19, C41, C44, C54, C110, C113	MLCC 0402 1uF	MLCC 1uF/25V X5R 0402	CAPC1005X56N_CYPS
1	C21	33 nF	CAP CER 0.033UF 50 V X7R 0603	capc1608x90n_ty
2	C23, C25	330 pF	CAP CER 330 PF 25 V X7R 0603	capc1608x90n_ty
5	C27, C29, C31, C50, C61	10 nF	CAP CER 10000 PF 25 V X7R 0603	capc1608x90n_ty
1	C33	2.2 uF	CAP CER 2.2UF 6.3 V X5R 0402	capc1005x56n_cyps
1	C34	0.47 uF	CAP CER 0.47UF 25 V X7R 0603	capc1608x90n_ty
1	C35	470 nF	CAP CER 0.47UF 6.3 V X5R 0402	capc1005x56n_cyps
2	C40, C45	0.1 uF	CAP CER 0.1UF 25 V X7R 0603	capc1608x90n_ty
2	C51, C55	22 uF	CAP CER 22UF 25 V X5R 0805	capc2012X70n_murata
1	C53	10 uF	CAP CER 10UF 10 V X7R 0805	capc2012X70n_murata
3	C58, C60, C65	4.7 uF	CAP CER 4.7UF 25 V X5R 0805	capc2012X70n_murata
6	C59, C62, C63, C64, C66, C67	22 uF	CAP CER 22UF 25V X6S 1206	CAPC3216X190N_A
1	C106	MLCC 0603 10uF	MLCC 10 uF/10 V NPO 0603	CAPC1005X56N_CYPS

Quantity	Designator	Comment	Description	Footprint
6	C107, C108, C109, C111, C114, C120	MLCC 0402 100 nF	MLCC 100 nF/50 V X7R 0402 ?0%	CAPC1005X56N_CYPS
4	C115, C116, C117, C118	MLCC 0402 390 pF	MLCC 390pF/50V X7R 0402 ?0%	CAPC1005X56N_CYPS
1	C119	MLCC 0402 220nF 50V	MLCC 220nF/50V X7R 0402 ?0%	CAPC1005X56N_CYPS
1	C121	MLCC 0402 680 pF	MLCC 680pF/50V X7R 0402 ?0%	CAPC1005X56N_CYPS
4	C122, C123, C124, C131	MLCC 0603 100 nF	MLCC 100nF/50V X7R 0603 ?0%	CAPC1608X90N_TY
1	C125	MLCC 0402 220 nF	MLCC 220nF/16V X7R 0402 ?0%	CAPC1005X56N_CYPS
2	C126, C132	MLCC 1206 4.7uF	MLCC 4.7uF/50V X7R 1206 ?0%	CAPC3216X180N_TDK
1	C127	MLCC 1206 1uF	MLCC 1uF/50V X7R 1206 ?0%	CAPC3216X180N_TDK
4	C128, C133, C134, C135	MLCC 1206 10uF	MLCC 10uF/50V X7R 1206 ?0%, MLCC 10uF/50V X7R 1206?0%	CAPC3216X180N_TDK
1	C130	MLCC 0603 0.01uF	MLCC 0.01uF/50V X7R 0603 ?0%	CAPC1608X90N_TY
2	C136, C137	MLCC 0603 1uF	MLCC 1uF/50V X7R 0603 ?0%	CAPC1608X90N_TY
1	D1, D10	BAT64T5Q-7-F	Diode Schottky 40 V 250 mA (DC) Surface Mount SOD-523 AEC-Q101	BAT64T5Q-7-F
1	D2	MMBD1503-TP	DIODE ARRAY GP 180 V 200 MA SOT23	sot23_1_2_3
1	D4	BAS16H,115	DIODE GP 100 V 215 MA SOD123F	SOD123F_NXP
4	D6, D7, D8, D9	RB511SM-40FHT2R	Diode Schottky 40 V 100 mA Surface Mount EMD2 AEC-Q101	SOD-523N
2	D101, D102	SDM10U45-7	Schottky Diode SDM10U45-7 SOD323	SOD-523N
1	EC1, EC2	S-ECap 220uF/25V	Solid Electrolytic Capacitor 220uF/25V	CAP_PC_10X12P7
1	L1	100 ohms	CMC 6A 2LN 100 OHM SMD	DLW5BTM101TQ2L
1	L2	6.8 uH	FIXED IND 6.8UH 8.5A 23.3MOHM SM	PA4342-682NLT
1	L3	MP-A11 COIL	1 Coil, 1 Layer 6.3µH Wireless Charging Coil Transmitter 45mOhm Max	WURTH_760308103146_CYPS_OFFSET
1	L102	10 uH	XAL1010-822 8.2uH	INDC110100X1000N
2	LED1, LED2	LTST-C195TBJRKT	LED BLUE/RED CLEAR CHIP SMD	LTST-C195TBJRKT

Quantity	Designator	Comment	Description	Footprint
1	NT2	100k, NTC	NTC Thermistor 100k Bead	NXFT15WF104FEAB021
1	NT3	Ntc 100k	100k Thermistor 0402	RESC1005X40N_PEC
3	R1, R11, R20	100 K	RES 100 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R2	80.6 K	RES 80.6 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R3	27 K	RES 27 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R4	10 K	RES 10K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R5	390E	RES 390 OHM 1% 1/10W 0603	resc1608x55n_pec
6	R6, R7, R24, R37, R42, R43	1 K	RES 1 K OHM 1% 1/10W 0603	resc1608x55n_pec
8	R8, R15, R16, R27, R35, R36, R41, R44	0E	RES 0 OHM JUMPER 1/10W 0603	resc1608x55n_pec
1	R12	36 K	RES 36 K OHM 1% 1/10W 0603	resc1608x55n_pec
8	R14, R18, R19, R23, R25, R26, R28, R31	5.1 K	RES 5.1 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R17	20 K	RES 20 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R22	130 K	RES 130 K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R29	200E	RES 200 OHM 1% 1/10W 0603	resc1608x55n_pec
1	R30	12 K	RES 12 K OHM 1% 1/10W 0603	resc1608x55n_pec
7	R32, R38, R39, R40, R52, R122, R123	0E	RES 0 OHM JUMPER 1/16W 0402	RESC1005X40N_PEC
4	R33, R34, R46, R48	10E	RES 10 OHM 1% 1/16W 0402	RESC1005X40N_PEC
1	R47	0.01	RES 0.01 OHM 1% 1 W 1206	R1206_OHMITE
1	R49, R117, R118	0.005	RES 0.005 OHM 1% 1 W 1206	R1206_OHMITE
1	R53	3.6 K	RES 3.6 K OHM 1% 1/10W 0603	resc1608x55n_pec
2	R101, R102	R0402 10 kO	Resistor 10 kO 0402 1% 1/16W	RESC1005X40N_PEC
1	R105	R0402 100 kO	Resistor 100 kO 0402 1% 1/16W	RESC1005X40N_PEC
4	R106, R108, R109, R110	R0402 0O	Resistor 0O 0402 1% 1/16W	RESC1005X40N_PEC
3	R111, R114, R115	R0603 0O	Resistor 0O 0603 1% 1/10W	RESC1608X55N_PEC
1	R112	R0402 3.9 kO	Resistor 3.9 kO 0402 1% 1/16W	RESC1005X40N_PEC

Quantity	Designator	Comment	Description	Footprint
1	U1	LMV358AQDGKRQ1	AEC-Q100, 2-CHANNEL, 1-MHZ, INDU	DGK8
8	CLK_IN, HG2_0, LG2_0, PWM_OUT, TP1, TP2, TP3, TP4	SMD		SMDTP
1	J1	PRPC002SAAN-RC	CONN HEADER VERT 2POS 2.54MM	HDR2X1
2	J3, J4	2012670005	USB-C (USB TYPE-C) USB 3.1 (USB 3.1 Gen 2, Superspeed+) Receptacle Connector 24 Position Surface Mount, Right Angle; Through Hole	MOLEX_2012670005
1	GND	BLACK	TEST POINT PC MINI .040"D BLACK	TP-43R_S
3	GPIO6, GPIO7, GPIO10	TEST POINT	—	SMDTP
8	MTG1, MTG2, MTG3, MTG4, MTG5, MTG6, MTG7, MTG8	MTG_125	—	MTG330_390
1	P1	Header 3	Header, 3-Pin	HDR1X3
1	P2	Header 5X2	Header, 5-Pin, Dual row	HDR2X5
2	P4, P7	JUMPER	—	HDR-TH_2P-P2.00-V-M
Infineon parts				
1	D3	BAT54-04W	DIODE ARRAY SCHOTTKY 30 V SOT323	BAT5404W
6	M11, M12, M13, M14, M15, M16	BSZ0910LS	N-Channel 30 V 18A (Ta), 40A (Tc) 2.1 W (Ta), 37 W (Tc) Surface Mount PG-TDSON-8 FL	INFINEON-PG-TSDSON-8-32
2	Q101, Q104	BSZ063N04LS6	Nmos BSZ063N04LS6 40V 6.3mO 40A PG-TSDSON-8_3.3*3.3	PG-TSDSON-8_L3.3-W3.3-P0.65-BL
1	Q105	BSZ0902NS	Nmos BSZ0920LS 30V 2.6mO 40A PG-TSDSON-8_3.3*3.3	PG-TSDSON-8_L3.3-W3.3-P0.65-BL
4	TVS1, TVS2, TVS4, TVS5	ESD245-B1-W0201	ESD protection ESD245-B1-W0201 Vc=7.5 V 8 kV (air), 5 kV (contact discharge) 0201	DFN58X28X16-2N
1	TVS3	ESD239-B1-W0201	ESD protection ESD239-B1-W0201 Vc=27 V 0201	DFN58X28X16-2N
1	U2	SLS32AIA020U3 USON10	enhanced wireless charging authentication solution; available in two temperature ranges: ; SLS32AIA020U2 standard: -25 to +85°C;	PG-USON-10-2

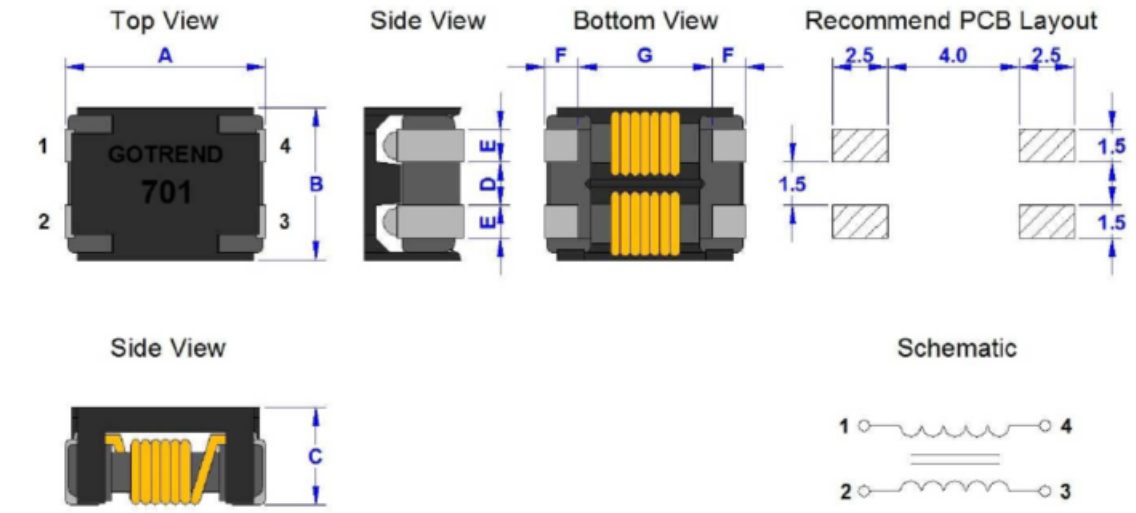
Quantity	Designator	Comment	Description	Footprint
			SLS32AIA020U3 extended: -40 to +105°C	
1	U3	WLC1115-68LQXQ	15 W wireless power transmitter with integrated USB Type-C PD sink controller	QFN40P800X800X60-69N_cus
1	U101	CCG7S	—	QFN50P600X600X60-41N_CYPS
Mechanical accessories				
8	STAND OFF	STAND OFF	HEX STANDOFF M3 NYLON 15MM	—
4	SCREW	SCREW	MACH SCREW FLAT SLOTTED #4-40	—
4	SCREW	SCREW	MACH SCREW PAN HEAD SLOTTED 4-40	—
4	SPACER	SPACER	ROUND SPACER #6 NYLON 3/16"	—
1	ACRYLIC	ACRYLIC	1COIL 68X61mm Size 2 mm thickness countersunk drill hole (refer drawing)	—
1	TAPE	TAPE	Double-sided Thermal tape as per the coil dimensions	—
DNP				
1	C3	DNP	CAP CER 330 PF 25 V X7R 0603	capc1608x90n_ty
1	C4	DNP	CAP CER 10000 PF 25 V X7R 0603	capc1608x90n_ty
2	C11, C38	DNP	CAP CER 0.1UF 25 V X7R 0402	capc1005x56n_cyps
1	C15	DNP	CAP CER 0.1UF 25 V X7R 0402	capc1005x56n_cyps
1	C36	DNP	CAP CER 10 PF 25 V C0G/NPO 0603	capc1608x90n_ty
1	C138	DNP	N.C	CAPC1608X90N_TY
1	NT1	DNP	THERM NTC 100KOHM 4419K 0603	resc1608x55n_pec
1	Q2	DNP	MOSFET N-CH 60 V 230 MA SOT23-3	SOT23_1_2_3
2	R9, R13	DNP	RES 10K OHM 1% 1/10W 0603	resc1608x55n_pec
1	R10	DNP	RES 1M OHM 1% 1/10W 0603	resc1608x55n_pec
1	R21	DNP	RES 10K OHM 1% 1/10W 0603	resc1608x55n_pec
2	R103, R104	N.C	N.C	RESC1005X40N_PEC

6.4 Inductors

Product Series :	**GACM**	**Brand :**	GOTREND
File Version :	GACM-SERIES-V1R0	**Editor :**	David Wang
Established Date :	2023.01.03	**Description :**	SMD Common Mode Choke
Latest Edit Date :	2023.01.03	**Product Type :**	☑ Standard ☐ Customize

GACM706038P-SERIES

Dimension [mm] :



Size	A (+/-0.5)	B (+/-0.5)	C (Max.)	D (+/-0.2)	E (+/-0.2)	F (+/-0.2)	G (Ref.)
706038	7.0	6.0	3.8	1.5	1.5	1.5	4.0

Electrical Characteristics :

GOTREND PN	Impedance(Ω) @100MHz		DC Resistance N1 , N2 (mΩ) Max.	Rated Current (A) Max.	Insulation Resistance (M Ohm) Min.	Rated Voltage (V) Max.	Marking
	Min.	Typ.					
GACM706038P-101-2P	100.0	140.0	6.00	9.0	10.0	80.0	101
GACM706038P-301-2P	225.0	300.0	8.00	5.5	10.0	80.0	301
GACM706038P-501-2P	275.0	500.0	10.00	5.0	10.0	80.0	501
GACM706038P-701-2P	500.0	700.0	15.00	4.0	10.0	80.0	701
GACM706038P-901-2P	700.0	900.0	20.00	3.0	10.0	80.0	901

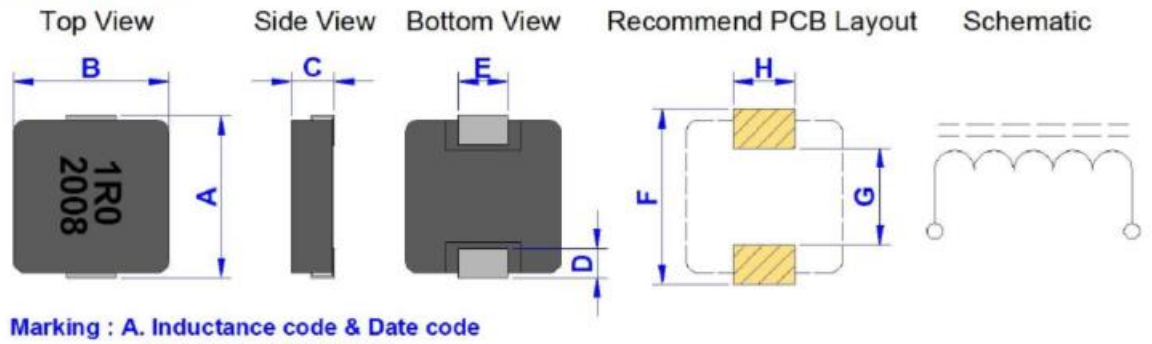
■ Rated Current : The actual value of DC current when the top surface of test sample temperature rise is △T = 40℃ (Ta = 25℃).

Figure 37 Specification of L1: Gotrend GACM706038P-101-2P

Product Series :	**GSTM**	**Brand :**	GOTREND
File Version :	GSTM-SERIES-AE-V3R2	**Editor :**	David Wang
Established Date :	2012.09.26	**Description :**	High Current Inductor
Latest Edit Date :	2021.11.09	**Product Type :**	☑ Standard ☐ Customize

GSTM1040P-SERIES-AE

Dimension [mm] :



Marking : A. Inductance code & Date code
(1) Year ex. 2020 = 20
(2) Weekly serial number 01 ~ 52

A (+/-0.5)	B (+/-0.3)	C (+/-0.2)	D (+/-0.3)	E (+/-0.3)	F (Ref.)	G (Ref.)	H (Ref.)
11.0	10.0	3.8	2.3	3.0	13.6	5.4	3.5

Electrical Characteristics :

Part No.	Inductance (uH)	Inductance Tolerance	DCR (m Ohm) Typ.	DCR (m Ohm) Max.	Isat (Amp) Typ.	Irms (Amp) Typ.
GSTM1040P-R22M-AE	0.22	M	0.80	1.00	60.0	35.0
GSTM1040P-R36M-AE	0.36	M	1.05	1.20	60.0	31.0
GSTM1040P-R39M-AE	0.39	M	1.10	1.30	60.0	30.0
GSTM1040P-R45M-AE	0.45	M	1.30	1.50	45.0	29.0
GSTM1040P-R56M-AE	0.56	M	1.60	1.80	40.0	25.0
GSTM1040P-R68M-AE	0.68	M	2.40	2.70	39.0	22.0
GSTM1040P-1R0M-AE	1.00	M	3.00	3.30	36.0	18.0
GSTM1040P-1R5M-AE	1.50	M	4.00	4.60	33.0	16.0
GSTM1040P-2R2M-AE	2.20	M	6.50	7.00	27.0	12.0
GSTM1040P-3R3M-AE	3.30	M	10.80	11.80	20.0	11.0
GSTM1040P-4R7M-AE	4.70	M	15.00	15.50	17.0	10.0
GSTM1040P-5R6M-AE	5.60	M	17.00	19.30	14.0	9.0
GSTM1040P-6R8M-AE	6.80	M	17.50	23.30	13.5	8.5
GSTM1040P-8R2M-AE	8.20	M	20.00	22.50	12.5	8.0
GSTM1040P-100M-AE	10.00	M	27.00	30.00	12.0	7.5
GSTM1040P-150M-AE	15.00	M	40.00	45.00	10.0	6.3
GSTM1040P-220M-AE	22.00	M	64.00	74.00	7.0	5.0
GSTM1040P-330M-AE	33.00	M	92.00	112.00	5.0	3.5
GSTM1040P-470M-AE	47.00	M	145.00	167.00	4.5	3.0
GSTM1040P-680M-AE	68.00	M	205.00	240.00	3.0	2.0
GSTM1040P-820M-AE	82.00	M	265.00	320.00	2.5	1.5

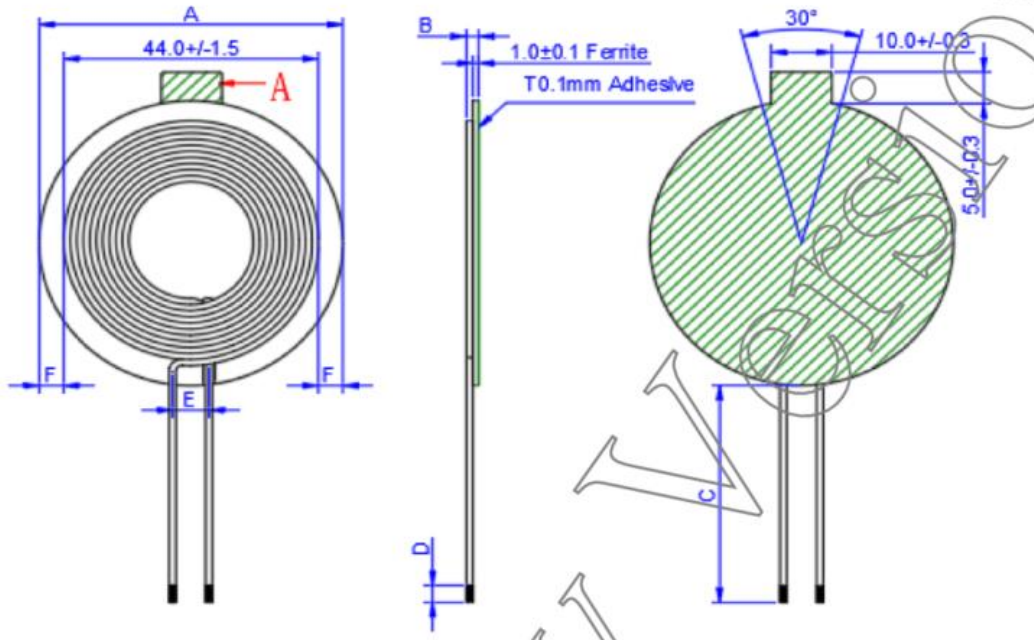
* Test Condition @100KHz , 1.0Vrms , 25°C Ambient
* Inductance Tolerance : M = +/-20%
* Irms : Rated Current Loading when temperature rise approximately 40°C
* Isat : Saturated Current measured at the point of L drop approximately 30%

Figure 38 Specification of L2: Gotrend GSTM1040P-6R8M

Product Series :	**GW**	**Brand :**	GOTREND
File Version :	GW05030PT-10A10RN11-V0R9	**Editor :**	HaiFeng Liang
Established Date :	2023.04.26	**Description :**	Wireless Charging Coils
Latest Edit Date :	2023.04.26	**Product Type :**	☐ Standard ☑ Customize

GW05030PT-10A10RN11

Dimension [mm] :



A ： 離形紙撕把統一此方向黏貼左右偏移小於 30 度

A	B	C	D	E	F		
50.0+/-1.0	2.80 Max.	50.0+/-3.0	4.0+/-1.5	6.0 REF.	2.0 Min.		

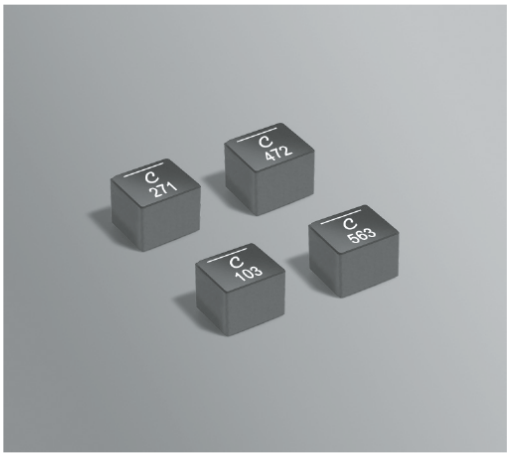
Electrical Characteristics :

Part No.	Inductance (uH)	DCR (m Ω)	Isat (A)
GW05030PT-10A10RN11	6.30 +/- 10%	35.0 Typ. / 50.0 Max.	2.0 Max.

* Inductance & Isat Test Condition@100KHz, 1.0Vrms, 25℃ Ambient

Figure 39 Specification of L3: Gotrend MP-A11-GW05030PT-10A10RN2

Shielded Power Inductors – XGL1010



- Industry's lowest DCR and low power losses
- Wide inductance range up to 56 uH
- High current handling with soft saturation characteristics
- AEC-Q200 Grade 1 (–40°C to +125°C) with a 165°C max part temperature

Designer's Kit C516 contains 3 of each value
Core material Composite
Core and winding loss See www.coilcraft.com/coreloss
Environmental RoHS compliant, halogen free
Terminations RoHS compliant tin-silver (96.5/3.5) over copper. Other terminations available at additional cost.
Weight 6.0 – 6.9 g
Operating voltage: 0 – 60 V
Ambient temperature –40°C to +125°C with (40°C rise) Irms current.
Maximum part temperature +165°C (ambient + temp rise). Derating.
Storage temperature Component: –55°C to +165°C.
Tape and reel packaging: –55°C to +80°C
Resistance to soldering heat Max three 40 second reflows at +260°C, parts cooled to room temperature between cycles
Moisture Sensitivity Level (MSL) 1 (unlimited floor life at <30°C / 85% relative humidity)
PCB washing Tested to MIL-STD-202 Method 215 plus an additional aqueous wash. See Doc787_PCB_Washing.pdf.

Part number[1]	Inductance[2] ±20% (µH)	DCR (mOhms)[3] typ	DCR (mOhms)[3] max	SRF typ[4] (MHz)	Isat (A)[5] 10% drop	Isat (A)[5] 20% drop	Isat (A)[5] 30% drop	Irms (A)[6] 20°C rise	Irms (A)[6] 40°C rise
XGL1010-271MED	0.27	0.47	0.57	96	44	74	117	40.8	54.0
XGL1010-521MED	0.52	0.68	0.80	56	33	54	76	39.8	52.0
XGL1010-801MED	0.80	0.88	1.1	47	29	46	64	36.0	48.0
XGL1010-122MED	1.2	1.2	1.4	37	24	39	50	31.5	41.5
XGL1010-152MED	1.5	1.5	1.7	31	21	33	45	31.1	40.7
XGL1010-222MED	2.2	2.3	2.6	25	15	26	36	24.6	33.0
XGL1010-332MED	3.3	3.2	3.7	21	14	24	34	19.2	26.0
XGL1010-472MED	4.7	4.0	4.6	18	12	21	29	18.0	24.7
XGL1010-562MED	5.6	5.2	5.9	16	10	17	24	17.5	24.0
XGL1010-682MED	6.8	6.2	7.0	14	9.3	16	22	15.7	21.2
XGL1010-822MED	8.2	8.0	9.0	13	8.7	14	20	14.1	18.7
XGL1010-103MED	10	8.7	9.7	12	8.3	13	18	13.7	18.2
XGL1010-153MED	15	13.6	15.2	10	7.0	11	16	11.4	15.4
XGL1010-223MED	22	19.6	22.0	8.0	5.6	9.3	13	9.8	13.2
XGL1010-333MED	33	29.9	33.5	6.6	4.6	7.6	10	6.1	8.5
XGL1010-473MED	47	40.9	46.9	4.9	3.7	6.1	8.4	5.1	7.0
XGL1010-563MED	56	49.9	55.9	4.6	3.3	5.3	7.6	4.6	6.3

1. When ordering, please specify **termination** code:

XGL1010-563MED

Termination: **E** = RoHS compliant tin-silver over copper.
Special order: **T** = RoHS tin-silver-copper (95.5/4/0.5) or **S** = non-RoHS tin-lead (63/37).
Packaging: **D** = 13″ machine-ready reel. EIA-481 embossed plastic tape (300 parts per full reel). Quantities less than full reel available: in tape (not machine ready) or with leader and trailer ($25 charge).

2. Inductance tested at 1 MHz, 0.1 Vrms, 0 Adc.
3. DCR measured on a micro-ohmmeter.
4. SRF measured using Agilent/HP 4395A or equivalent.
5. DC current at 25°C that causes an inductance drop from its value without current.
6. Current that causes the specified temperature rise from 25°C ambient. This information is for reference only and does not represent absolute maximum ratings. Click for temperature derating information.
7. Electrical specifications at 25°C.

Refer to Doc 362 "Soldering Surface Mount Components" before soldering.

Irms Testing

Irms testing was performed on 0.75 inch wide x 0.25 inch thick copper traces in still air.

Temperature rise is highly dependent on many factors including pcb land pattern, trace size, and proximity to other components. Therefore temperature rise should be verified in application conditions.

Figure 40 Specification of L101: Coilcraft XGL1010-103MED

Acronyms

Table 29 Abbreviations

Abbreviations	Abbreviations
AFC	Adaptive Fast Charge
ASK	Amplitude Shift Keying
BPP	Basic Power Profile
CE	Conducted Emission
DUT / EUT	Device Under Test/Equipment Under Test
EMI	Electromagnetic Interference
EPP	Extended Power Profile
FET	MOSFET (Metal Oxide Semiconductor Field Effect Transistor)
FOD	Foreign Object Setection
FSK	Frequency Shift Keying
LED	Light-Emitting Diode
NTC	Negative Temperature Coefficient
OCP	Overcurrent Protection
OTP	Over-Temperature Protection
OVP	Overvoltage Protection
PCB	Printed Circuit Board
PDO	Power Data Object
PPS	Programmable Power Supply
PRx	Power Receiver
PTx	Power Transmitter
QC	Quick Charge
Qi	Wireless Charging Standards
RE	Radiated Emission
SCP	Short-Circuit Protection
TPR	Test Power Receiver
UART	Universal Asynchronous Receiver-Transmitter
USB PD	Universal Serial Bus Power Delivery
UVP	Undervoltage Protection
WPC	Wireless Power Consortium
WPT	Wireless Power Transmitter

Revision history

Document revision	Date	Description of changes
**	2024-05-08	Initial release.

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

Edition 2024-05-08

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

002-39377 Rev. **

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics (“Beschaffenheitsgarantie”)

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer’s compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer’s products and any use of the product of Infineon Technologies in customer’s applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer’s technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies’ products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.