

Report Summary

Products tested	VCCR300-xx
Products Description	300W DC/DC Single Output Power Supply
Design Phase	3 – Verification
Tested Products and Serials	VCCR300-12 (S/N 10111311001100003) VCCR300-24 (S/N 10111312001100002) VCCR300-36 (S/N 10111313001100001) VCCR300-48 (S/N 10111314001100006)
Test Goals	Test according to EN50155:2021 cl. 13.4.4
Test dates	13 TH March to 29 TH April 2023
Report date	2 ND May 2023

Authorisation

Jorge Almendros

2ND May 2023

Test performed by (Print)

Date

Jorge Almendros

2ND May 2023

Test report written by (Print)

Date

Brian McDonald

2ND May 2023

Test report Authorised by (Signed)

Date

Brian McDonald

2ND May 2023

Test report reviewed by (Signed)

Date

1 Objective

Low Temperature Test is a mandatory test required to comply with EN50155 standard. The objective of this report is to show compliance with the requirements of EN50155 clause 13.4.4 for Low temperature test.

2 Executive Summary

The low temperature test verifies the correct operation of the power supply under low temperature conditions bringing the product to the minimum thermal ratings for prolonged times and ensuring of correct operation under these conditions. The test was carried out in accordance with EN50155 clause 13.4.4 on all VCCR300 series models.

The test temperature for the product as per defined in the referred standard is: $T_{TEST} = -40^{\circ}\text{C}$ (OT4 temperature class)

The converter start-up condition was tested at 48V and 110V input voltage by undergoing multiple ON/OFF cycles for each voltage.

The test profiles for 48V and 110V input voltages were sequenced in a single cycle, providing that the stabilisation time and that the continuous operational checks time were respected at the specified test temperature for both test voltages.

All models of VCCR300 series operated correctly on the low temperature profile as shown in the continuous operational checks and functional test results in Appendix A. The definition of continuous operational checks and functional test can be found in the sections 3.2 and 3.3 of this report respectively.

It can be concluded that the low temperature test was passed successfully.

3 Test Equipment and Setup

3.1 Description of Test Equipment

The test equipment listed in Table 1 below was used to conduct the continuous operational checks and functional testing for the Low Temperature test.

Table 1 – Equipment description				
Description	Manufacturer	Model	S/N	Calibration Certificate
Thermal test Chamber	Votsch	VT7010	521/83674 (VOX0015)	Not required
AC Source	Chroma	61505	000685 (VOX0097)	VOX0097-0522
Electronic Load	Chroma	6314A+63103Ax4	0003599 (VOX0098)	VOX0098-0522
Oscilloscope	Keysight	DSO2014A	MY53160421 (VOX0095)	VOX0095-0522
Datalogger	Agilent	34970A	MY41025109 (VOX0070)	VOX0070-0522
Power Meter	Chroma	66202	662021001062 (VOX0101)	VOX0101-0522

3.2 Continuous Operational Checks Data Collection

Various environmental, electrical and product performance data were collected and logged at regular intervals throughout the process. Thermocouples were attached to various points on the devices.

The data collected is listed in Table 3 and the test results are detailed in appendix A.

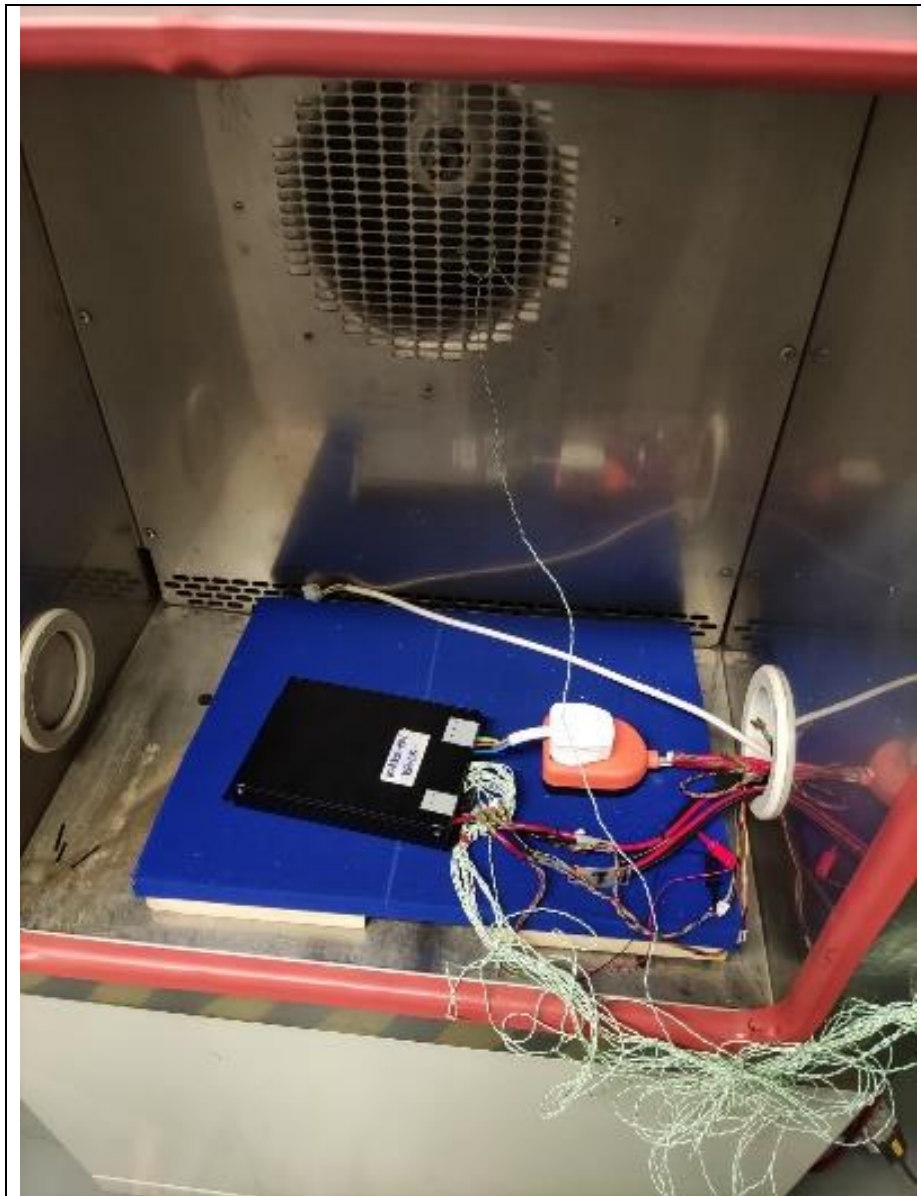
Table 3 – Data to be collected	
Type	Description
Time	Time stamp
Step #	Step number of test sequence
Chamber Temp	Chamber air temperature (Read from Chamber)
Chamber Temp DL	Chamber air temperature (Read from calibrated Datalogger - thermocouple)
Product Temp DL	Product temperature – (Read from calibrated Datalogger - thermocouple)
Vo1	Product output voltage
Io1	Product output current in load channel 1
Io2	Product output current in load channel 2
Iout	Product output current total
Vin	Product input voltage
Pin	Product input power
Pout	Product output power
Eff	Product efficiency

3.3 Functional Test Description

The device under test was connected to external equipment and was functionally tested when required. The set of functional tests are listed in Table 4.

Table 4 – Functional Test List	
Type	Description
Unit_Trim_TestOption	Output voltage model, Output voltage trim and test option
Sheet	Current test cycle
Step	Step number of test sequence
Time	Time stamp
Chamber Temp	Chamber air temperature
Product Temp	Product temperature
Vout	Output voltage reading. $V_{IN} = 110V_{DC}$, $P_{OUT} = 0W$
EFF_48V	Efficiency. $V_{IN} = 48V_{DC}$
EFF_110V	Efficiency. $V_{IN} = 110V_{DC}$
HOLDUP_300W	Holdup test for 300W output power. $V_{IN} = 48V_{DC}$, $P_{OUT} = 300W$, $T_{DROP} = 12.5mS$
HOLDUP_180W	Holdup test for 180W output power. $V_{IN} = 48V_{DC}$, $P_{OUT} = 180W$, $T_{DROP} = 22mS$
Loadreg	Load regulation test. $V_{IN} = 110V_{DC}$, $P_{OUT} = 0W$ to $300W$.
Linereg	Line regulation test. $V_{IN} = 48V_{DC}$ to $110V_{DC}$, $P_{OUT} = 0W$ & $300W$.
Ripple_0%Load	Ripple test. $V_{IN} = 110V_{DC}$, $P_{OUT} = 0W$
Ripple_100%Load	Ripple test. $V_{IN} = 110V_{DC}$, $P_{OUT} = 300W$
Vtrans	Transient peak voltage. $V_{IN} = 110V_{DC}$, $P_{OUT} = 75W$ to $225W$, $1A/uS$
Ttrans	Transient recovery time. $V_{IN} = 110V_{DC}$, $P_{OUT} = 75W$ to $225W$, $1A/uS$
Trise_0%Load	Rise time. $V_{IN} = 110V_{DC}$, $P_{OUT} = 0W$
Trise_100%Load	Rise time. $V_{IN} = 110V_{DC}$, $P_{OUT} = 300W$
OCP	Over current protection tripping point. $V_{IN} = 110V_{DC}$, Load = $CV_{MODE} V_{NOM} * 0.9$

3.4 Test Setup Pictures

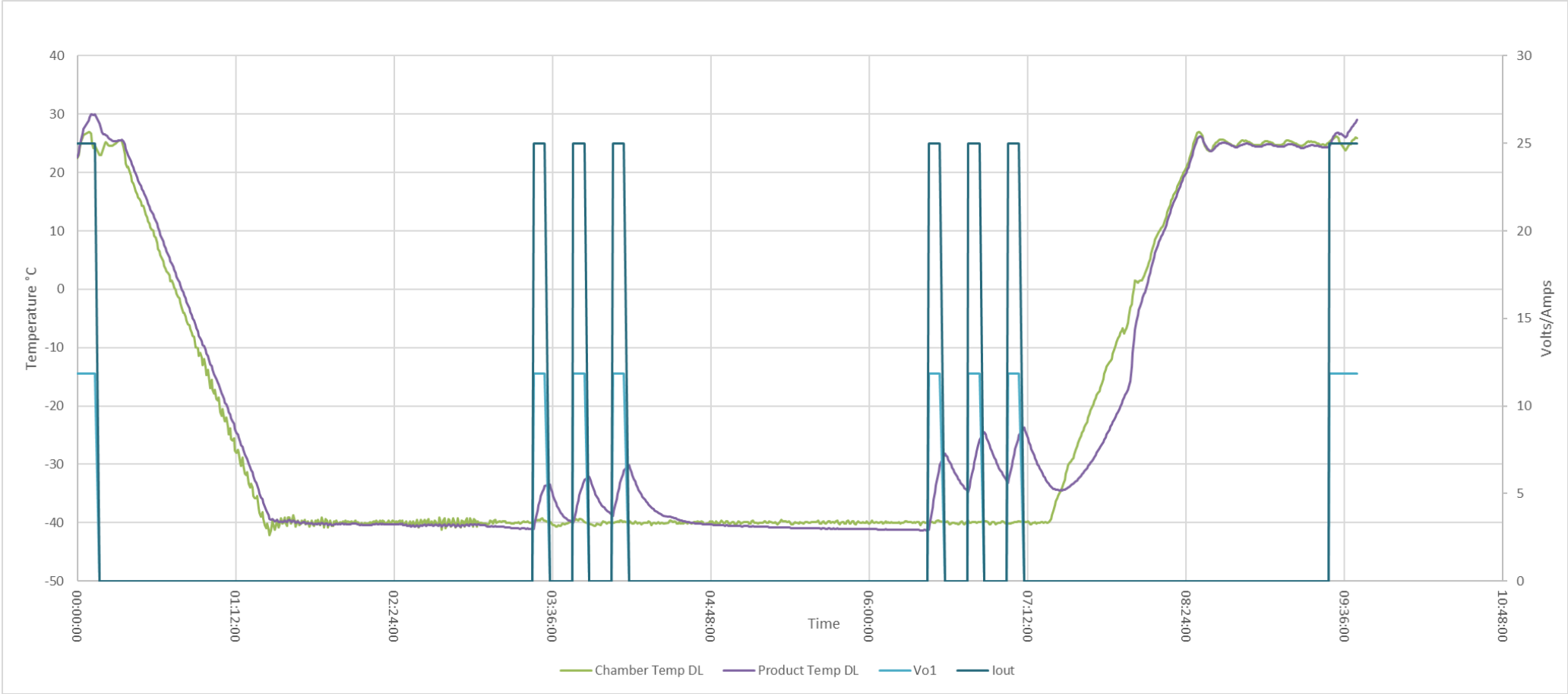


4 Appendix A: Test Results

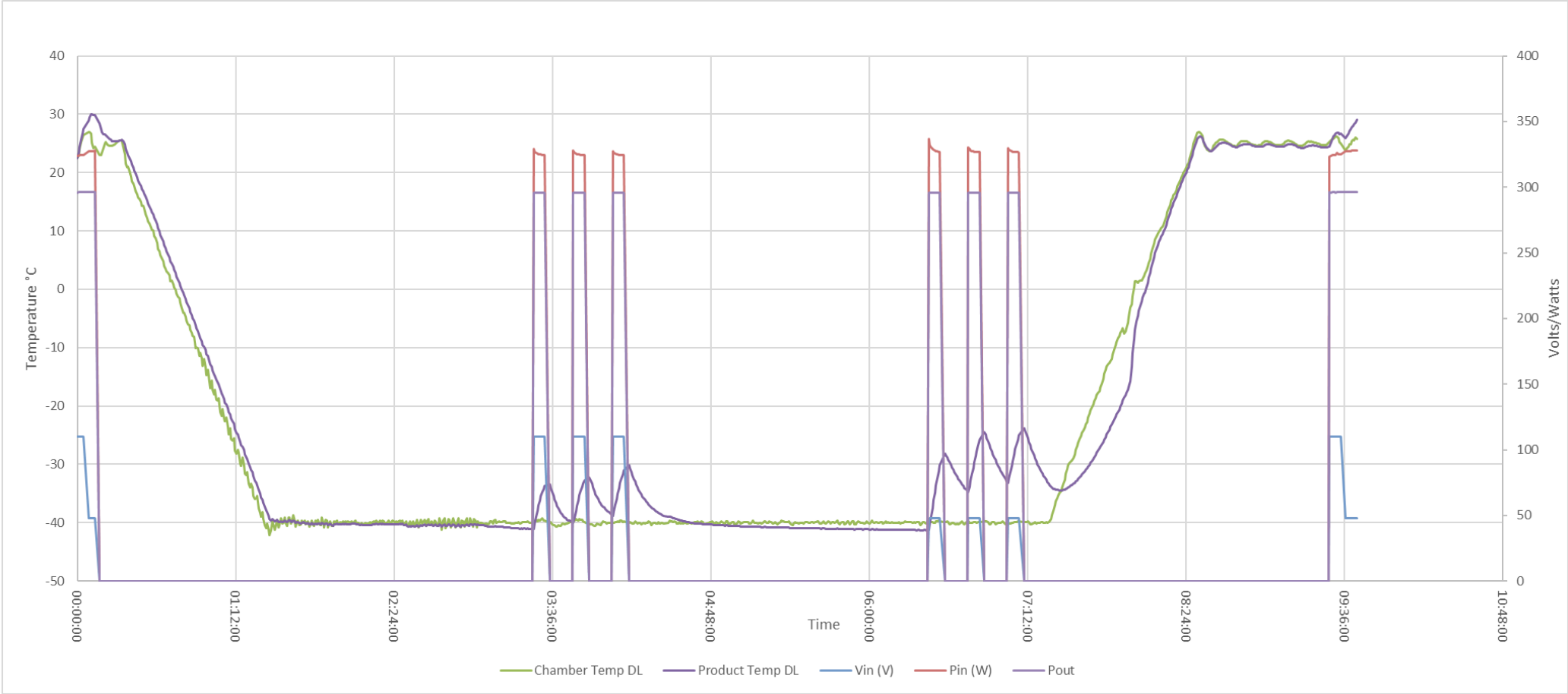
4.1 VCCR300-12

4.1.1 Operational Check Graphs

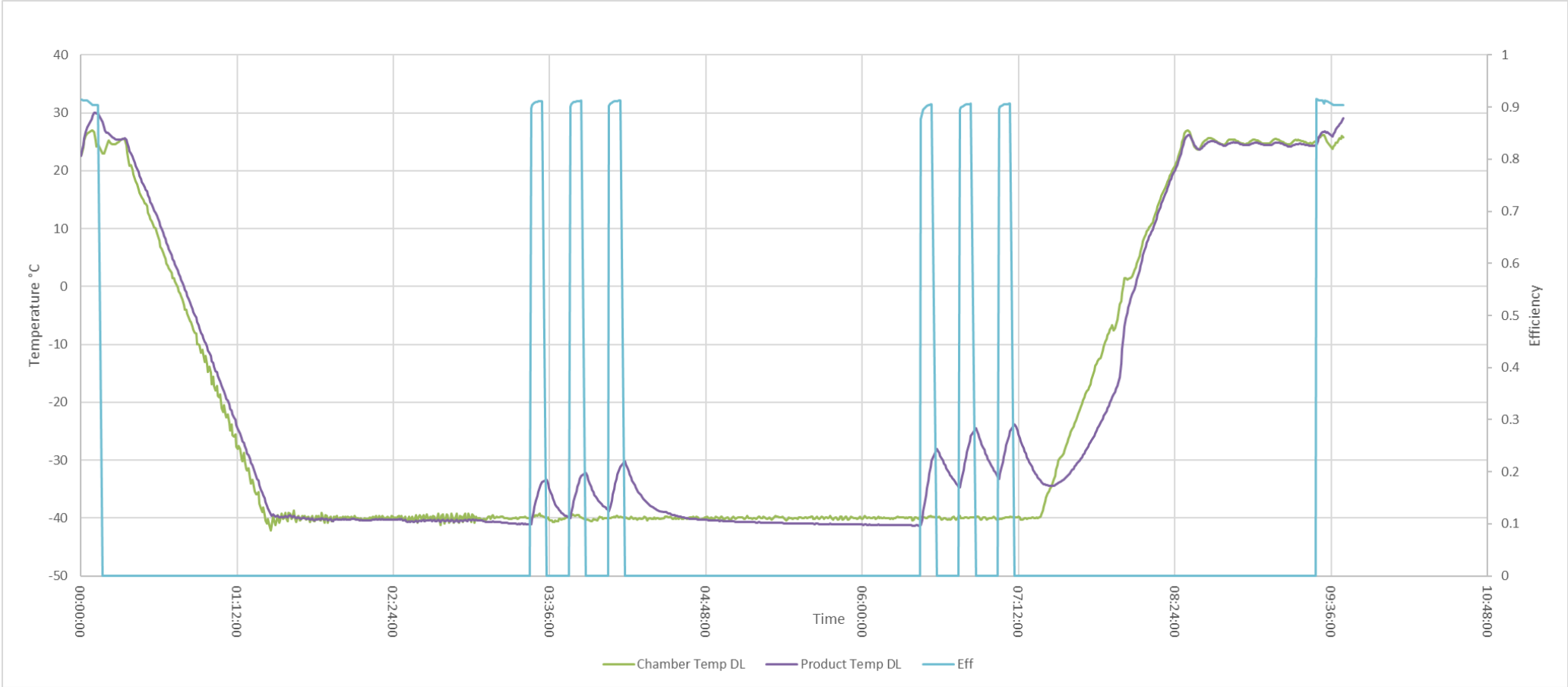
4.1.1.1 Output Voltage & Output Current



4.1.1.2 Input Voltage, Input Power & Output Power



4.1.1.3 Efficiency



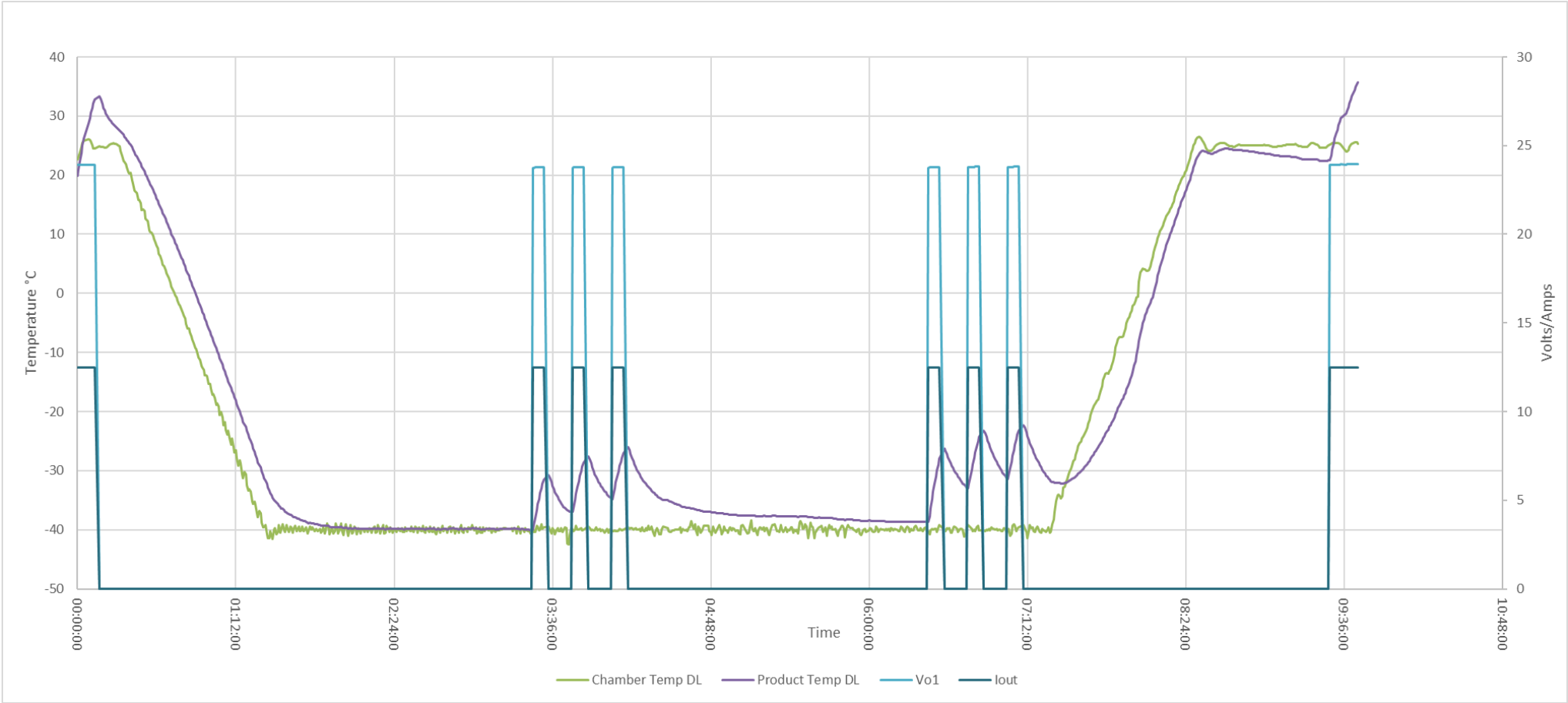
4.1.2 Functional Test Results

Unit_Trim _TestOption	Sheet	Step	Time	Chamber Temp (°C)	Product Temp (°C)	Vout (V)	EFF 48V (%)	EFF 110V (%)	HOLDUP 300W (ΔV)	HOLDUP 180W (ΔV)	Loadreg (ΔV)	Linereg (ΔV)	Ripple 0%Load (V)	Ripple 100%Load (V)	Vtrans (V)	Ttrans (S)	Trise 0%Load (S)	Trise 100%Load (S)	OCP (A)
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	0	00:03:19	26.444	28.23	11.85	0.905	0.913	-0.1700	-0.1000	0.0432410	0.0050380	0.1390	0.0990	0.521	0.0003410	0.035318	0.035746	27.53
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	1	00:08:24	25.15	30.12	11.85	0.905	0.913	-0.1700	-0.1000	0.0473630	-0.0007590	0.1390	0.0830	0.557	0.0003430	0.035414	0.035200	27.52
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	5	03:32:57	-39.58	-33.35	11.84	0.899	0.912	-0.6000	-0.3100	0.0416250	0.0088220	0.1070	0.3280	0.521	0.0003600	0.033476	0.032516	27.47
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	7	03:50:59	-39.71	-32.28	11.84	0.900	0.913	-0.5500	-0.2900	0.0290740	0.0113080	0.1150	0.3080	0.513	0.0003670	0.032496	0.032610	27.53
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	9	04:08:55	-39.94	-30.54	11.84	0.901	0.913	-0.5100	-0.2900	0.0413900	0.0070840	0.1150	0.2630	0.506	0.0003810	0.032828	0.032814	27.55
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	12	06:27:51	-39.88	-29.19	11.84	0.906	0.915	-0.4300	-0.2400	0.0377530	0.0004180	0.1230	0.2310	0.502	0.0003770	0.032916	0.033160	27.58
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	14	06:45:50	-39.95	-25.08	11.84	0.907	0.915	-0.3900	-0.2200	0.0365870	0.0057200	0.1190	0.1990	0.495	0.0003880	0.033520	0.033308	27.59
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	16	07:03:51	-39.72	-24.25	11.84	0.907	0.915	-0.3600	-0.1900	0.0374230	0.0008030	0.1270	0.1990	0.495	0.0003800	0.033168	0.033174	27.60
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	20	09:30:06	25.12	26.73	11.85	0.905	0.913	-0.1700	-0.1000	0.0400260	-0.0014520	0.1390	0.0830	0.526	0.0003470	0.034964	0.035628	27.54
VCCR300- 12V_NOMINAL_Norm	LowTemp Cycle	21	09:37:23	25.36	30.77	11.85	0.905	0.912	-0.1700	-0.1000	0.0476400	-0.0022880	0.1310	0.0910	0.531	0.0003480	0.034972	0.035914	27.54

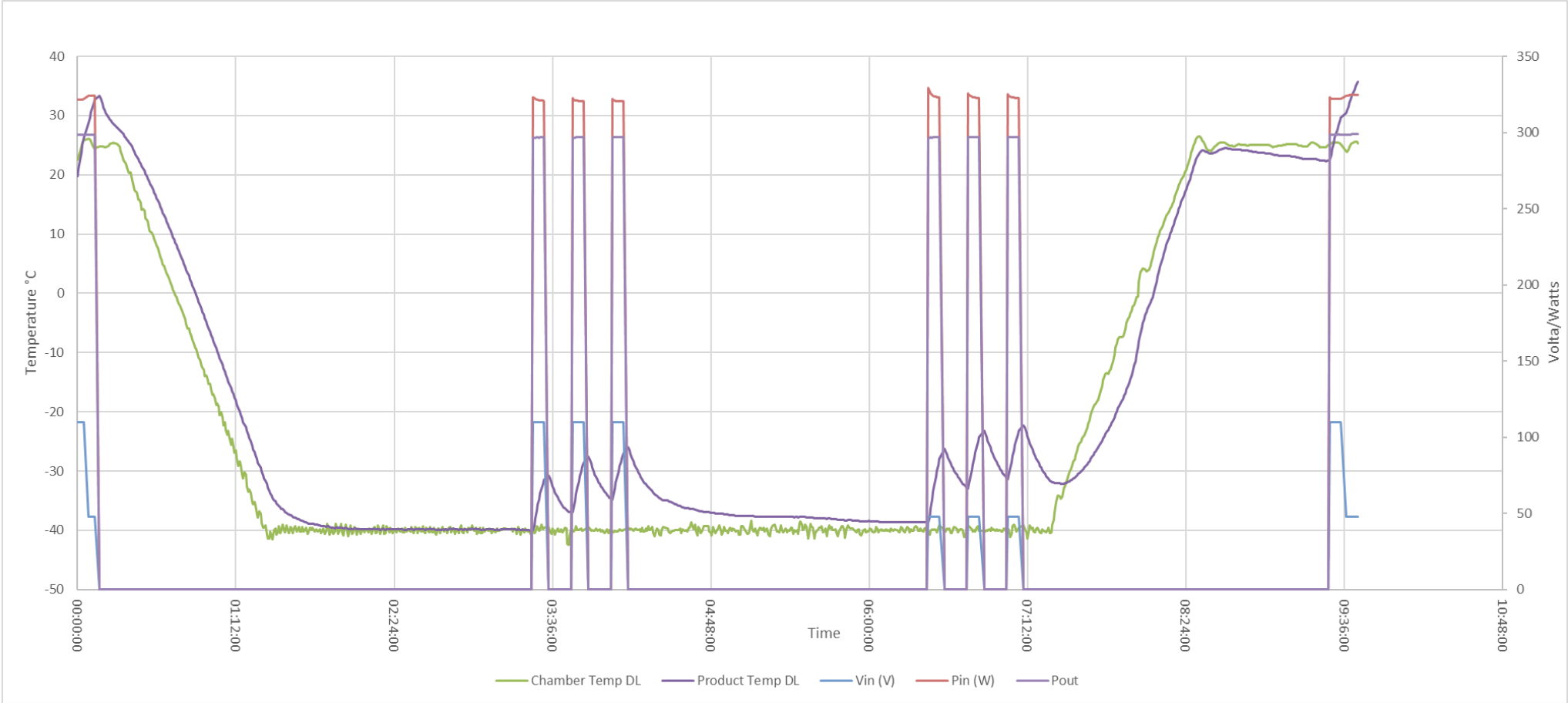
4.2 VCCR300-24

4.2.1 Operational Check Graphs

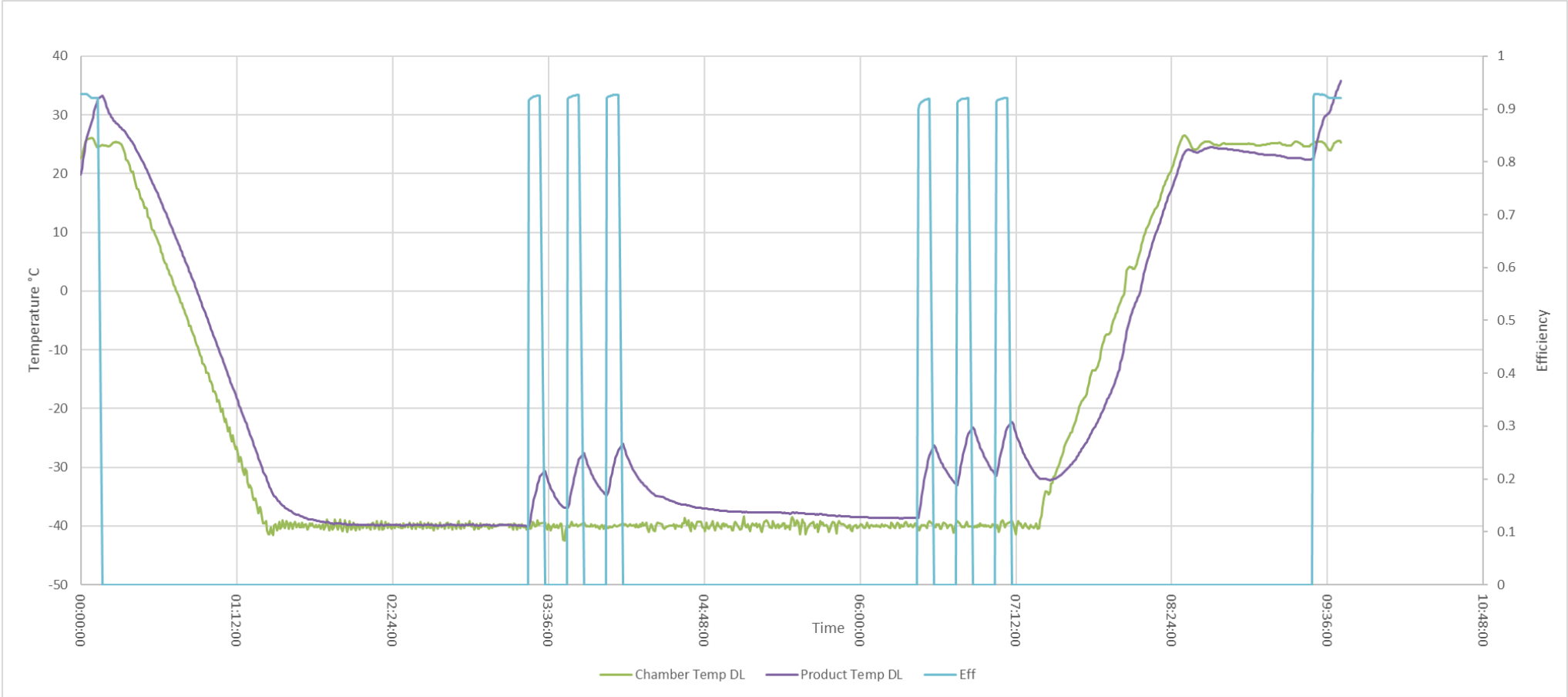
4.2.1.1 Output Voltage & Output Current



4.2.1.2 Input Voltage, Input Power & Output Power



4.2.1.3 Efficiency



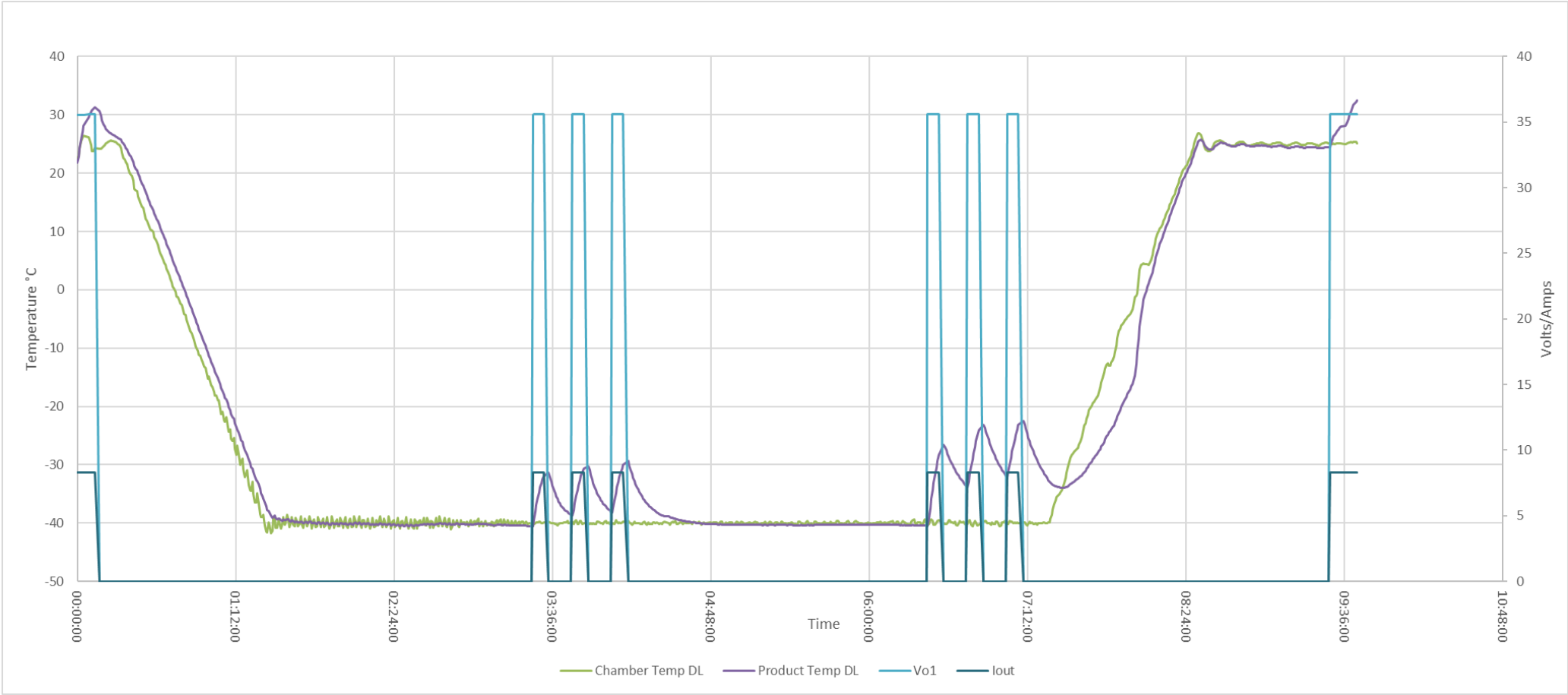
4.2.2 Functional Test Results

Unit Trim _TestOption	Sheet	Step	Time	Chamber Temp (°C)	Product Temp (°C)	Vout (V)	EFF 48V (%)	EFF 110V (%)	HOLDUP 300W (ΔV)	HOLDUP 180W (ΔV)	Loadreg (ΔV)	Linereg (ΔV)	Ripple 0%Load (V)	Ripple 100%Load (V)	Vtrans (V)	Ttrans (S)	Trise 0%Load (S)	Trise 100%Load (S)	OCP (A)
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	0	00:03:18	26.04	27.15	23.92	0.921	0.928	-0.1900	-0.1500	0.0371850	0.0022070	0.1900	0.1250	0.646	0.0004110	0.036252	0.036596	13.75
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	1	00:08:23	24.66	33.31	23.94	0.921	0.928	-0.1900	-0.1500	0.0324400	0.0044140	0.1800	0.1250	0.654	0.0004050	0.036506	0.036808	13.74
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	5	03:32:35	-39.37	-30.95	23.79	0.913	0.926	-0.6300	-0.3400	0.0278060	0.0059590	0.1000	0.4850	0.860	0.0003560	0.033810	0.033520	13.74
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	7	03:50:38	-39.57	-28.09	23.80	0.916	0.927	-0.5800	-0.3400	0.0280270	0.0032000	0.1300	0.4650	0.730	0.0003930	0.033694	0.033360	13.76
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	9	04:08:41	-39.54	-26.33	23.81	0.917	0.927	-0.5800	-0.2900	0.0317790	0.0038620	0.1200	0.3750	0.647	0.0004300	0.033672	0.033230	13.77
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	12	06:27:45	-39.48	-27.16	23.80	0.920	0.929	-0.5300	-0.3400	0.0311170	0.0034200	0.1200	0.3750	0.749	0.0004340	0.033542	0.033152	13.78
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	14	06:45:47	-40.23	-23.64	23.81	0.921	0.929	-0.5300	-0.2900	0.0295720	0.0050760	0.1200	0.3250	0.646	0.0004860	0.033586	0.033566	13.79
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	16	07:03:49	-39.84	-22.56	23.82	0.921	0.929	-0.4300	-0.2900	0.0294610	0.0033110	0.1300	0.3050	0.616	0.0004740	0.033634	0.033400	13.81
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	20	09:30:20	24.96	30.11	23.93	0.921	0.928	-0.1900	-0.1500	0.0389510	-0.0022060	0.2000	0.1250	0.646	0.0004030	0.036686	0.036746	13.74
VCCR300-24V NOMINAL_Norm	LowTemp Cycle	21	09:38:10	25.19	36.15	23.95	0.921	0.928	-0.1900	-0.1500	0.0421920	-0.0039730	0.1800	0.1250	0.663	0.0004030	0.036750	0.036808	13.74

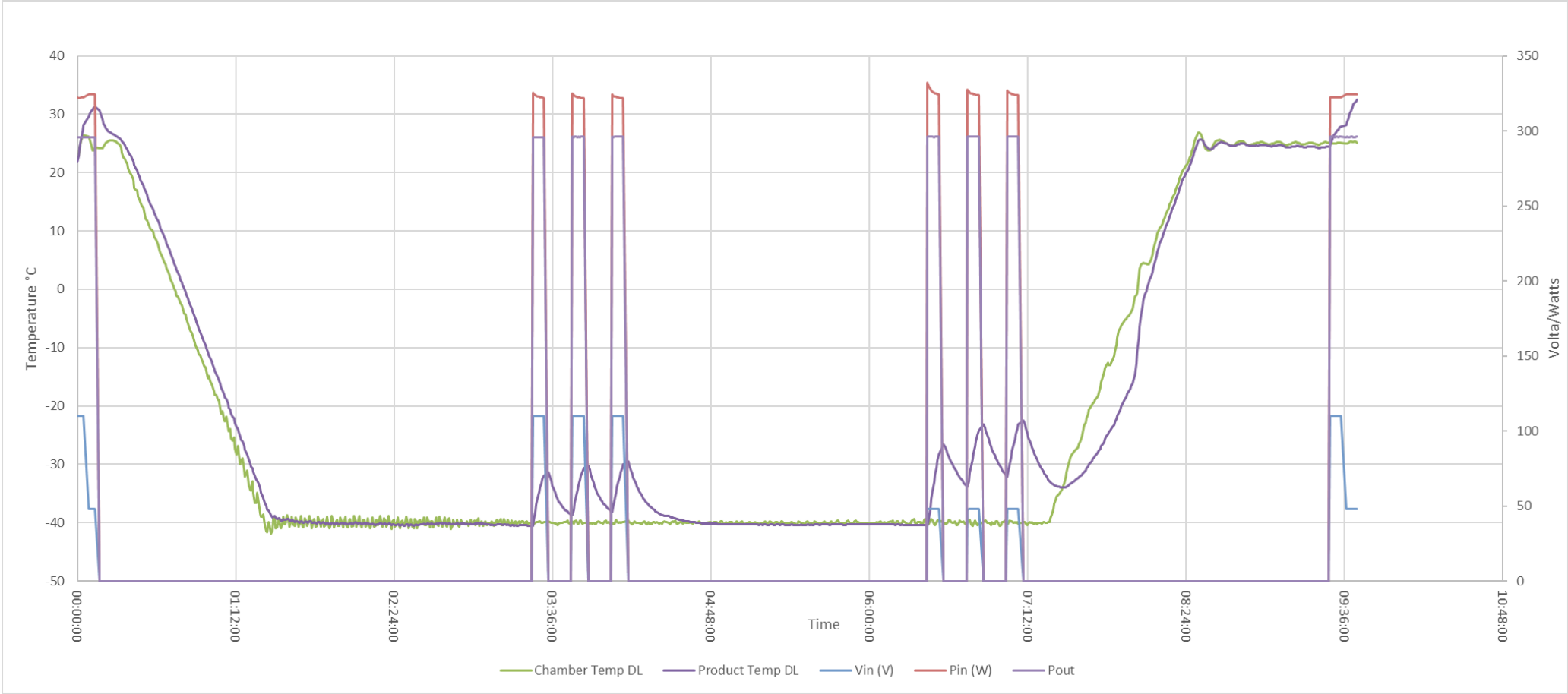
4.3 VCCR300-36

4.3.1 Operational Check Graphs

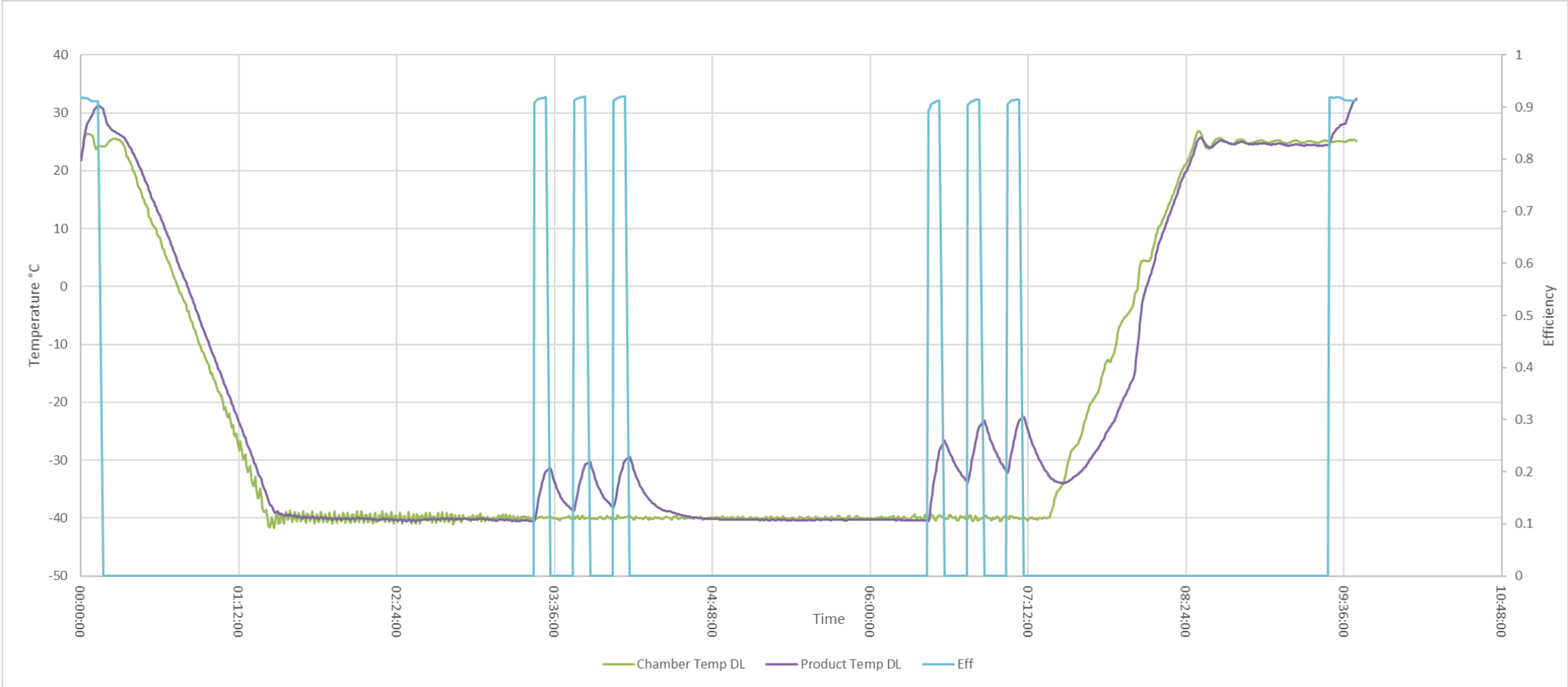
4.3.1.1 Output Voltage & Output Current



4.3.1.2 Input Voltage, Input Power & Output Power



4.3.1.3 Efficiency



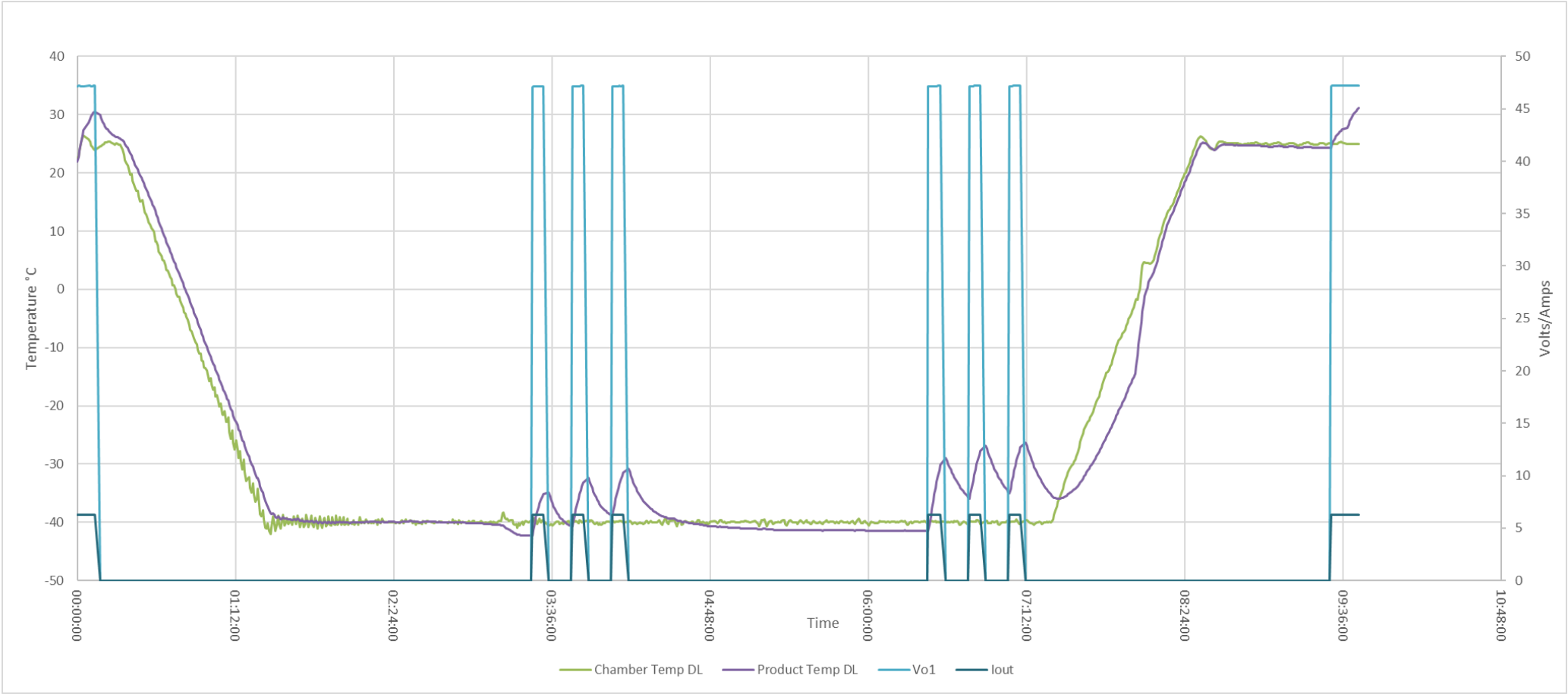
4.3.2 Functional Test Results

Unit_Trim _TestOption	Sheet	Step	Time	Chamber Temp (°C)	Product Temp (°C)	Vout (V)	EFF 48V (%)	EFF 110V (%)	HOLDUP 300W (ΔV)	HOLDUP 180W (ΔV)	Loadreg (ΔV)	Linereg (ΔV)	Ripple 0%Load (V)	Ripple 100%Load (V)	Vtrans (V)	Ttrans (S)	Trise 0%Load (S)	Trise 100%Load (S)	OCP (A)
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	0	00:03:20	26.36	28.87	35.57	0.912	0.919	-0.0700	-0.0700	0.0483300	0.0016550	0.1700	0.0700	0.840	0.0003760	0.035768	0.035644	9.12
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	1	00:08:25	24.49	31.69	35.57	0.912	0.919	-0.1400	-0.0700	0.0405780	-0.0057380	0.1700	0.0600	0.840	0.0003660	0.035672	0.035782	9.12
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	5	03:32:30	-39.55	-31.36	35.61	0.906	0.920	-0.5100	-0.2200	0.0386240	0.0030900	0.1500	0.3400	0.740	0.0004140	0.033192	0.032722	9.04
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	7	03:50:34	-40.09	-30.21	35.62	0.907	0.921	-0.4300	-0.2200	0.0370790	0.0044130	0.1500	0.3000	0.730	0.0004110	0.033102	0.032714	9.06
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	9	04:08:38	-39.92	-29.49	35.62	0.908	0.921	-0.4300	-0.2200	0.0374090	-0.0088270	0.1500	0.2900	0.720	0.0004060	0.033178	0.032666	9.04
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	12	06:27:27	-39.78	-27.40	35.62	0.913	0.923	-0.3600	-0.2200	0.0390650	0.0040830	0.1400	0.2700	0.714	0.0003930	0.033146	0.032748	9.07
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	14	06:45:31	-39.88	-23.41	35.63	0.915	0.923	-0.3600	-0.1400	0.0380720	-0.0069510	0.1400	0.2200	0.730	0.0003890	0.033334	0.032898	9.09
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	16	07:03:35	-40.09	-22.54	35.63	0.915	0.924	-0.2900	-0.1400	0.0418230	0.0049650	0.1500	0.1800	0.724	0.0003550	0.033332	0.033048	9.12
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	20	09:30:11	25.11	28.20	35.60	0.912	0.921	-0.1400	-0.0700	0.0415340	0.0121380	0.1800	0.0700	0.840	0.0003750	0.036284	0.035642	9.12
VCCR300-36V NOMINAL_Norm	LowTemp Cycle	21	09:37:33	24.90	32.61	35.63	0.913	0.920	-0.1500	-0.0700	0.0290240	-0.0156690	0.1800	0.0600	0.840	0.0003670	0.036038	0.035952	9.13

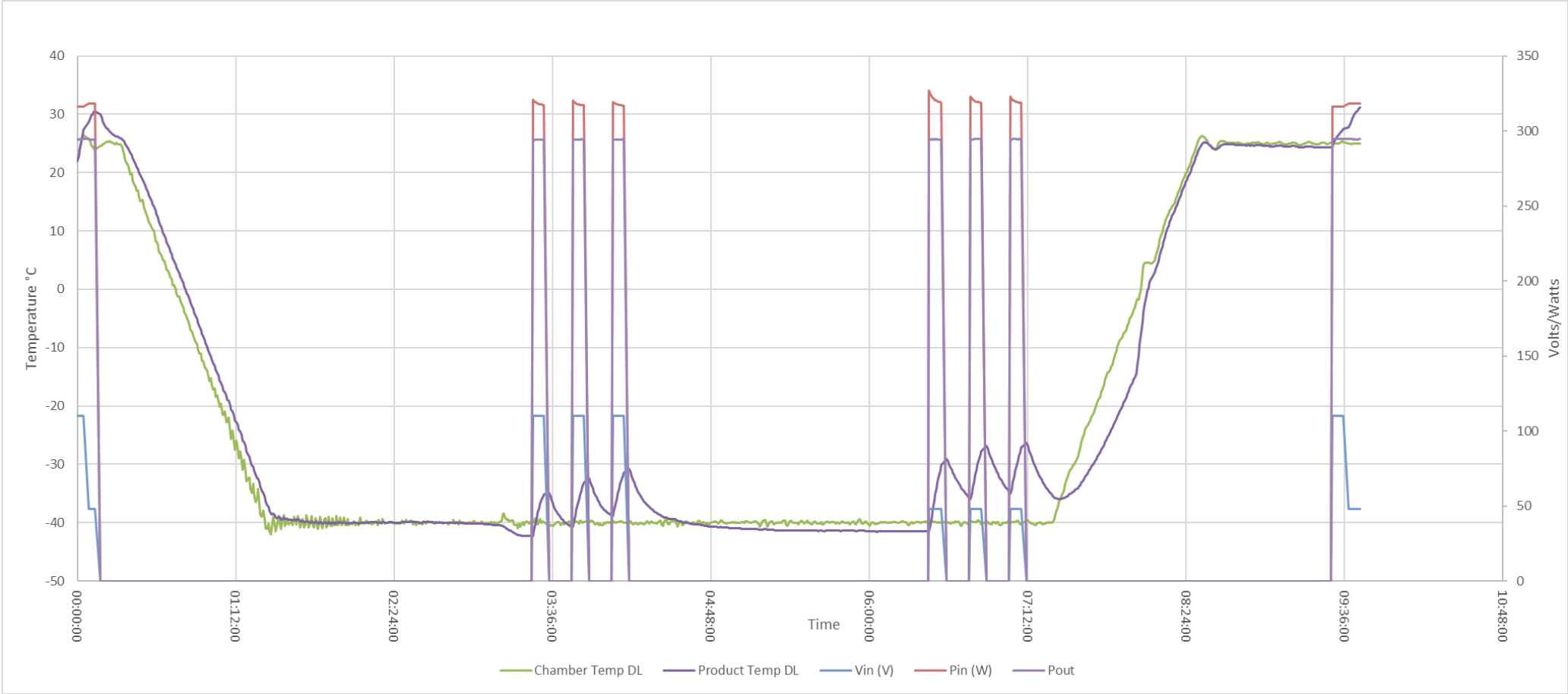
4.4 VCCR300-48

4.4.1 Operational Check Graphs

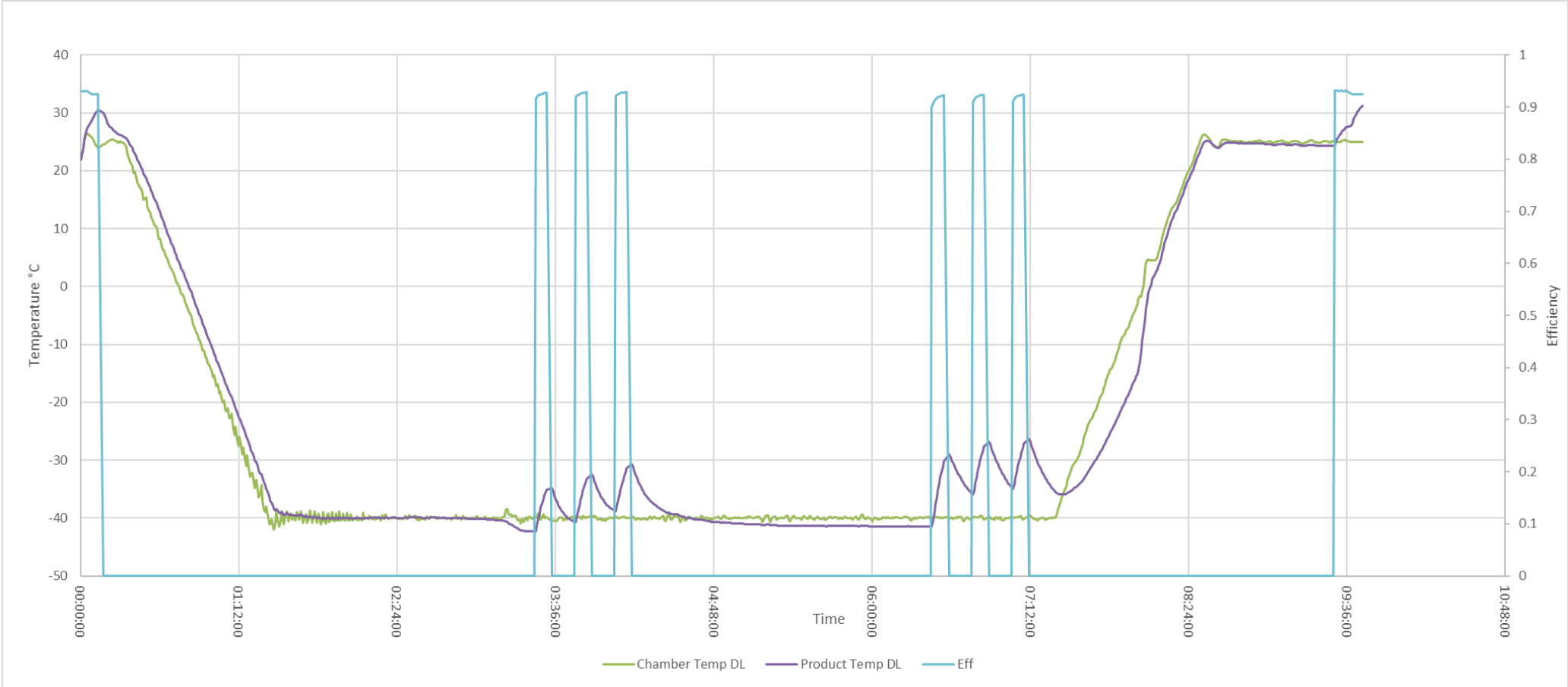
4.4.1.1 Output Voltage & Output Current



4.4.1.2 Input Voltage, Input Power & Output Power



4.4.1.3 Efficiency



4.4.2 Functional Test Results

Unit_Trim _TestOption	Sheet	Step	Time	Chamber Temp (°C)	Product Temp (°C)	Vout (V)	EFF 48V (%)	EFF 110V (%)	HOLDUP 300W (ΔV)	HOLDUP 180W (ΔV)	Loadreg (ΔV)	Linereg (ΔV)	Ripple 0%Load (V)	Ripple 100%Load (V)	Vtrans (V)	Ttrans (S)	Trise 0%Load (S)	Trise 100%Load (S)	OCP (A)
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	0	00:03:20	26.244	28.03	47.18	0.924	0.931	-0.4800	-0.3800	0.0388420	0.0078340	0.3900	0.1400	1.120	0.0005200	0.036212	0.035598	6.89
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	1	00:08:31	23.92	30.66	47.18	0.925	0.932	-0.5700	-0.3800	0.0489940	-0.0032000	0.4000	0.1300	1.160	0.0006050	0.036232	0.035940	6.89
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	5	03:32:34	-40.57	-34.75	47.17	0.914	0.928	-2.0100	-1.0500	0.0403870	0.0030890	0.3100	1.4500	1.330	0.0006130	0.033442	0.032906	6.71
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	7	03:50:42	-39.62	-32.68	47.18	0.916	0.930	-1.8200	-0.9600	0.0473360	-0.0037520	0.3200	1.1600	1.210	0.0005890	0.033512	0.032898	6.74
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	9	04:08:57	-39.93	-30.94	47.18	0.918	0.930	-1.7200	-0.9600	0.0471180	0.0045260	0.3200	1.0900	1.130	0.0005780	0.033474	0.032648	6.76
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	12	06:28:35	-39.69	-29.50	47.19	0.923	0.932	-1.5400	-0.9600	0.0437360	-0.0046350	0.3200	0.9500	1.105	0.0006020	0.033476	0.032898	6.75
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	14	06:46:45	-40.16	-27.12	47.20	0.924	0.932	-1.4400	-0.8600	0.0346470	-0.0024270	0.3200	0.8200	1.060	0.0006050	0.033628	0.033150	6.77
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	16	07:04:57	-40.01	-26.57	47.20	0.924	0.932	-1.4400	-0.8600	0.0483300	-0.0008820	0.3200	0.8000	1.100	0.0005820	0.033640	0.032898	6.79
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	20	09:31:21	25.07	27.67	47.20	0.925	0.932	-0.4800	-0.3800	0.0485500	-0.0043030	0.4700	0.1400	1.120	0.0005610	0.036232	0.035746	6.89
VCCR300-48V NOMINAL_Norm	LowTemp Cycle	21	09:38:46	25.02	31.35	47.20	0.925	0.932	-0.4800	-0.3800	0.0499980	-0.0349790	0.4000	0.1300	1.150	0.0005420	0.036215	0.035956	6.89