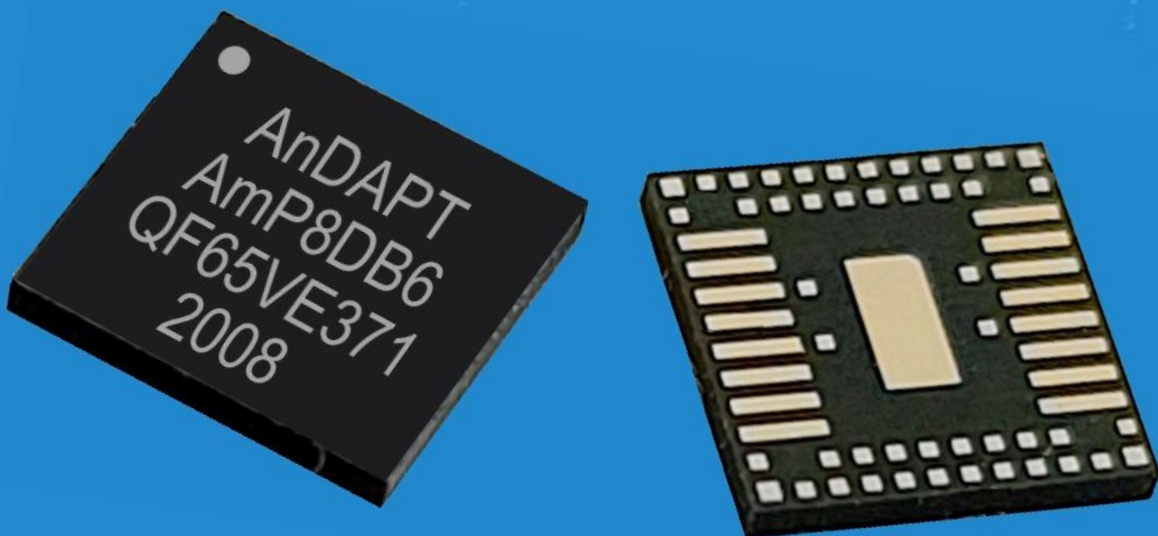


Xilinx Versal AI Core (Low Voltage, Full Power Management) Power Solution

Power Mapping

AnDAPT Marketing Team

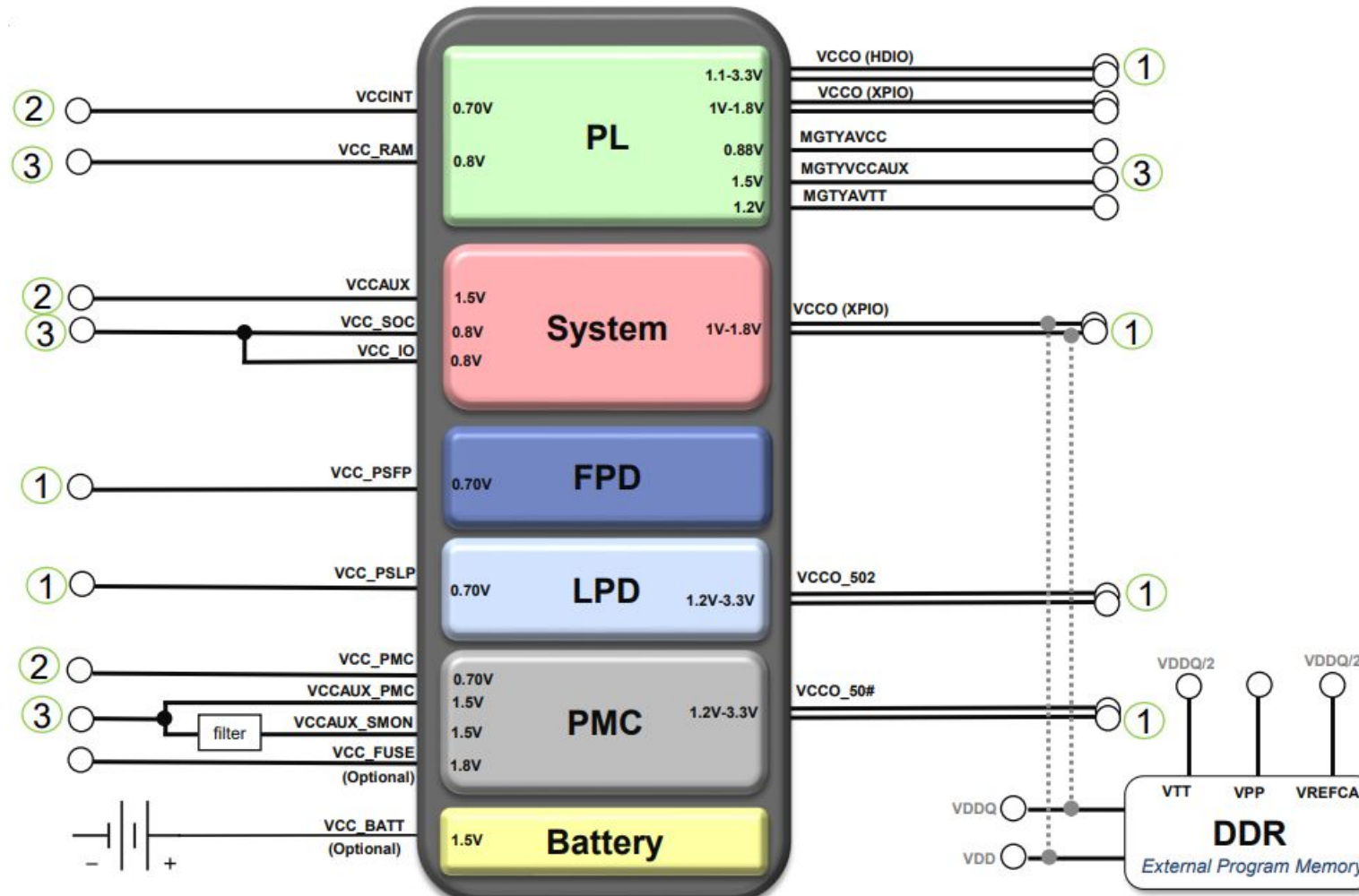
AnDAPT



Versal AI Core Power Mapping Highlights

- Power tree mappings completed per data received from Xilinx Power Management team
- Both Typical and Upper use-cases are served by the same design
- Data gathered and bench tested by applications team at AnDAPT
 - Data meets or exceeds Xilinx power and timing specifications
- Total 15 power rails covered by 3x AmP ICs including memory and termination rails
- VCCINT (core rail) draws current from 125 A to 156 A and thus will be served using an external IC enabled/disabled by AmP IC
- Total solution area (excluding external core rail) is 1613.65 mm²
- Presentation contains thermal views of all ICs

Xilinx Versal AI Core Power Tree



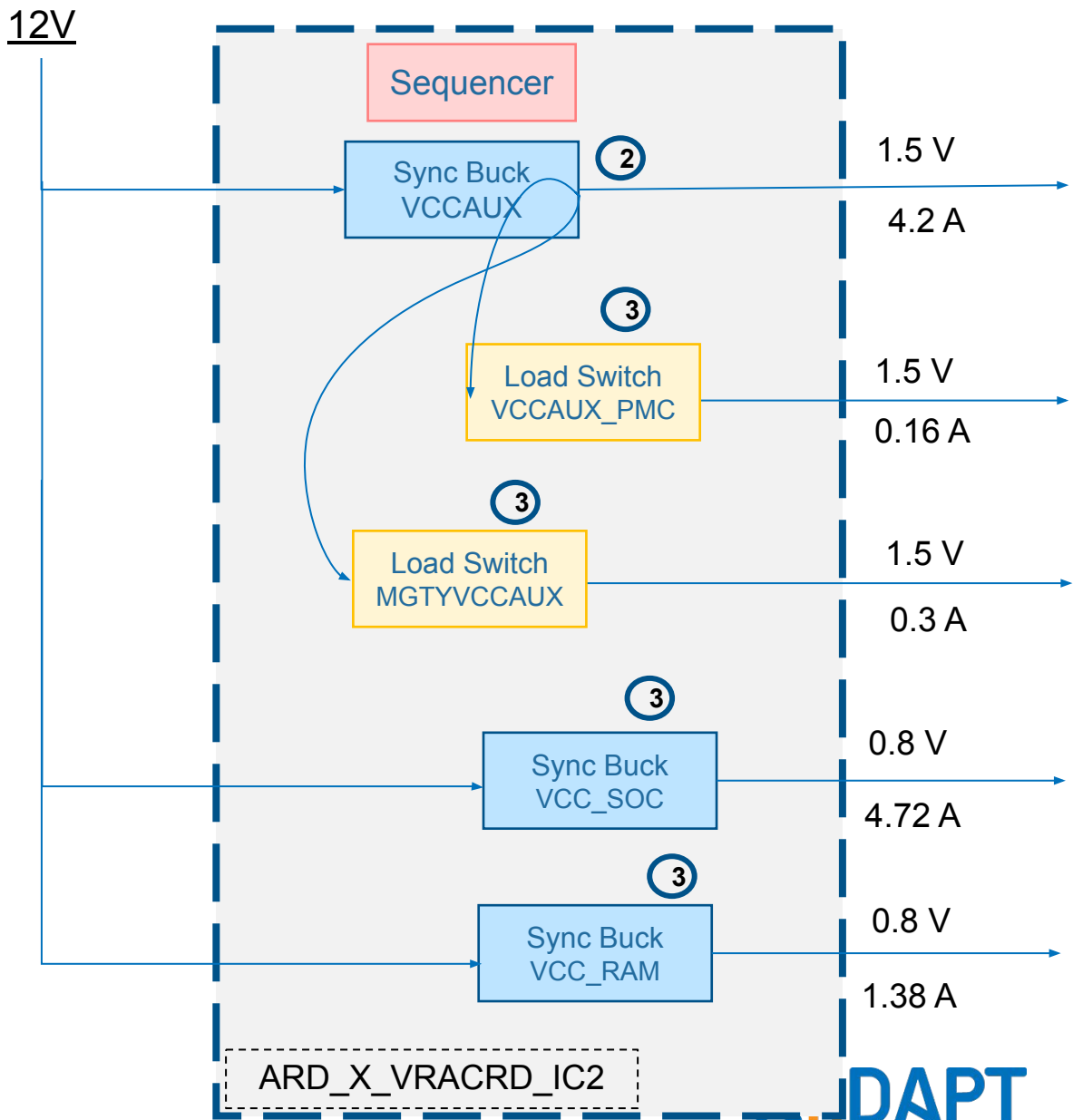
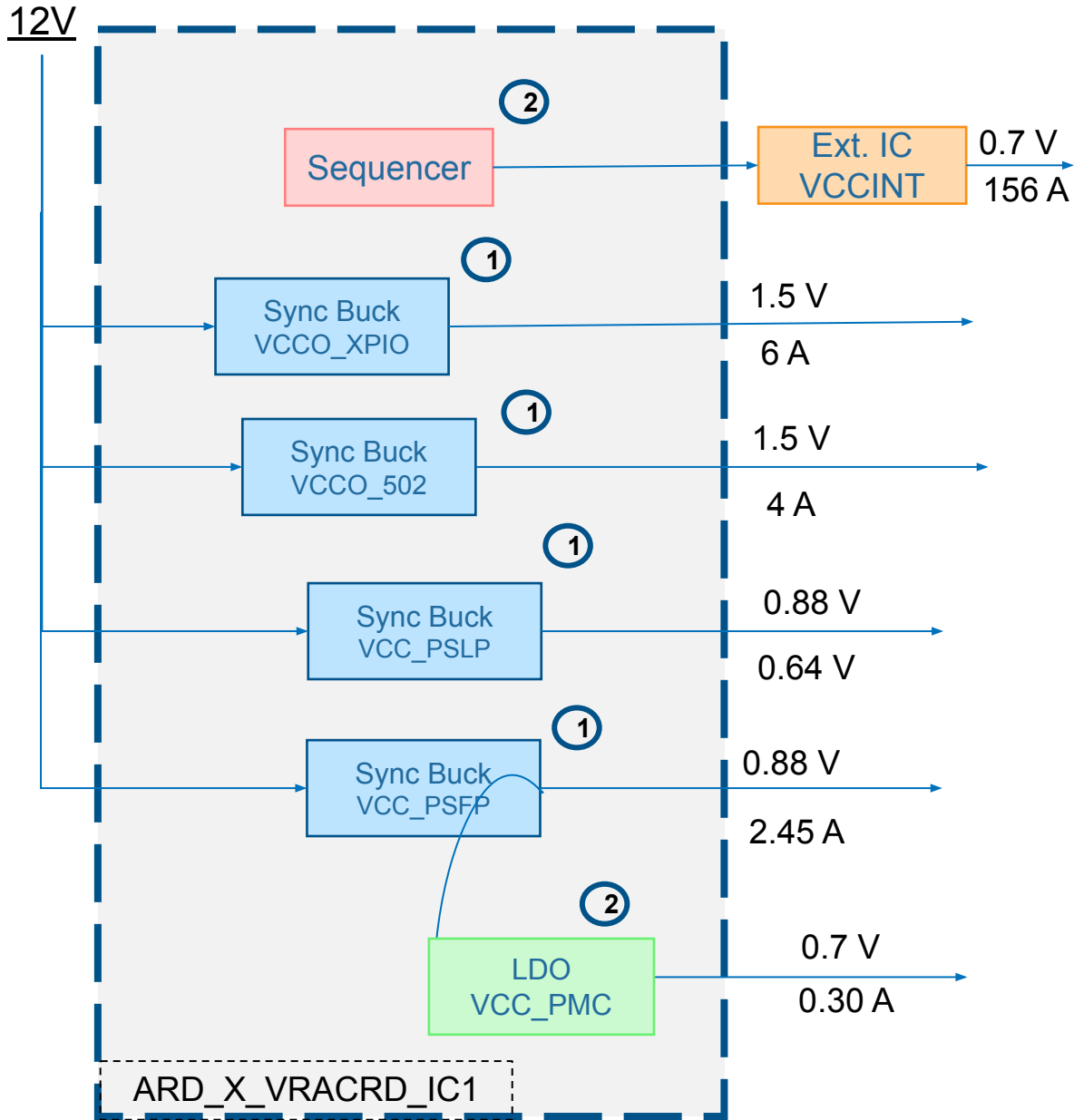
Versal AI Core Power Rails: Low Voltage, Full Power Management (Typical & Upper)

		Voltage (V)	Versal AI Core	
			Typical (A)	Upper (A)
Rail 1	VCC_PMC	0.70V	0.24	0.3
Rail 2	VCCINT	0.70V	124.66	155.82
Rail 3	VCC_PSLP	0.8/0.88V	0.51	0.64
Rail 4	VCC_PSFP	0.8/0.88V	1.72	2.15
Rail 5	VCC_SOC	0.8V	3.77	4.72
Rail 6	VCCINT_IO, VCCRAM	0.8V	1.10	1.38
Rail 7	VCCAUX_PMC/VCCAUX_SMON	1.5V	0.12	0.16
Rail 8	VCCAUX	1.5V	2.99	3.74
Rail 9	MGTAVCC	0.88V	2.47	3.08
Rail 10	MGTAVAUX	1.5V	0.23	0.29
Rail 11	MGTAVTT	1.2V	3.85	4.81
Rail 12	VCCO_PMIO[0..], VCCO[0..] (HDIO), VCCO[0..] (XPIO)	1.2-3.3V, 1.1- 3.3V, 1-1.8V	3.39	4.24
Current Total (A)			138.52	173.15

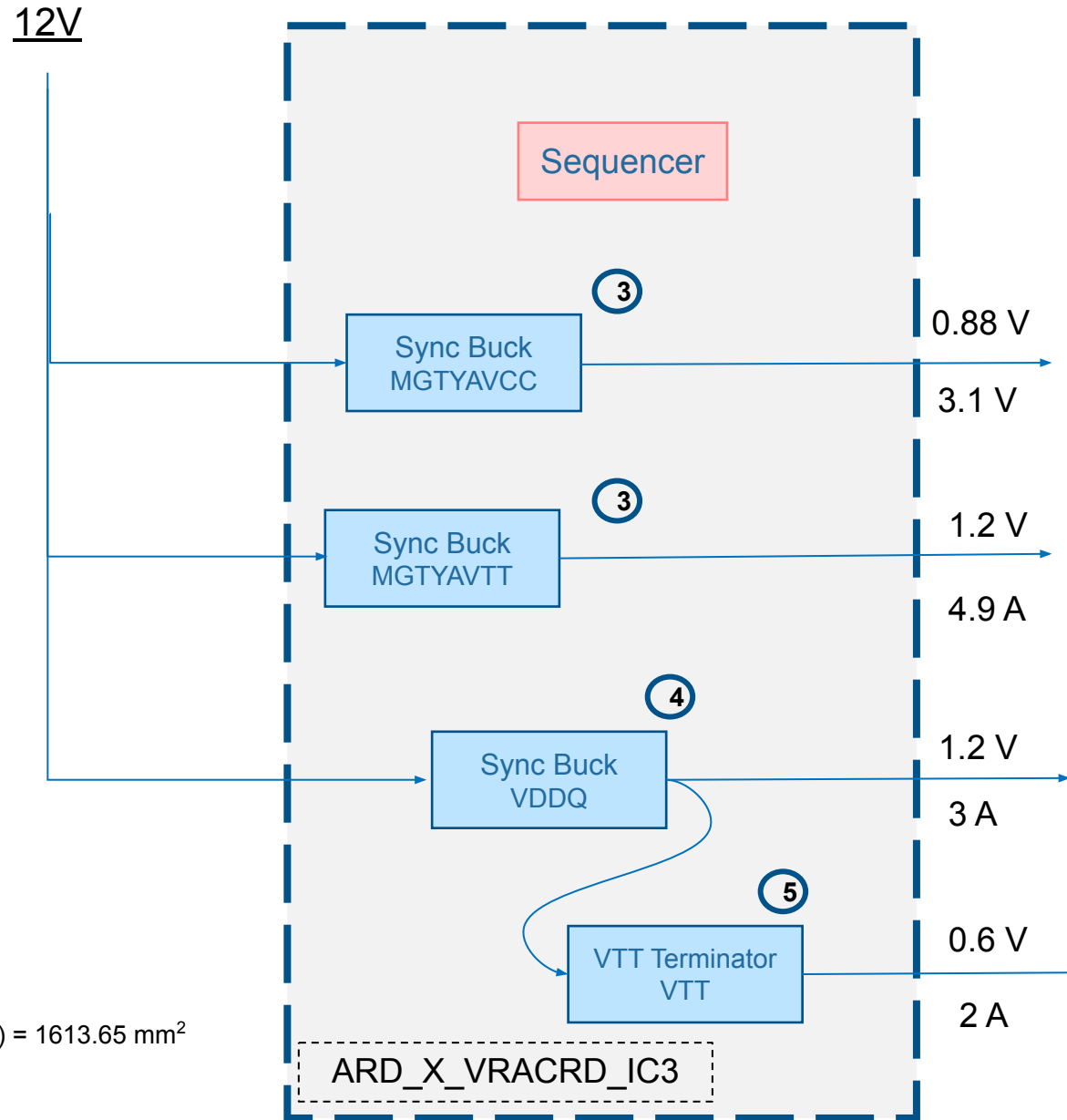
Power Tree Mapping: Versal AI Core

#	Rail	Seq	Power Component	Type	Upstream Rail	Vinput (V)	Vout (V)	Iout (A)	AnDAPT PMIC
1	VCCO_XPIO (VCCO_XPIO, VCCO_HDIO)	1	Sync Buck	C200	PVIN	12	1.5	6	ARD_X_VRACRD_IC1
2	VCCO_502 (VCCO_502, VCCO_50X)	1	Sync Buck	C200	PVIN	12	1.5	4	
3	VCC_PSLP	1	Async Buck	C150	PVIN	0.8/0.88	0.8/0.88	0.64	
4	VCC_PSFP	1	Sync Buck	C200	PVIN	12	0.8/0.88	2.15+0.3	
5	VCCINT	2	Ext IC	-	PVIN	12	0.7	156	
6	VCC_PMC	2	LDO	C710	VCC_PSFP	0.8/0.88	0.7	0.30	
7	VCCAUX	2	Sync Buck	C200	PVIN	12	1.5	3.74+0.16+0.3	ARD_X_VRACRD_IC2
8	VCC_SOC (VCC_IO)	3	Sync Buck	C200	PVIN	12	0.8	4.72	
9	VCC_RAM (VCC_RAM, VCCINT_IO)	3	Sync Buck	C200	PVIN	12	0.8	1.38	
10	VCCAUX_PMC (VCCAUX_SMON)	3	Load Switch	C750	VCCAUX	1.5	1.5	0.16	
	MGTYVCCAUX	3	Load Switch	C750	VCCAUX	1.5	1.5	0.3	
11	MGTYAVCC	3	Sync Buck	C200	PVIN	12	0.88	3.1	ARD_X_VRACRD_IC3
13	MGTYAVTT	3	Sync Buck	C200	PVIN	12	1.2	4.9	
14	VDDQ	4	Sync Buck	C200	PVIN	12	1.2	3 + 2	
15	VTT	5	VTT Terminator	C210	VDDQ	1.2	0.6	2	

Power Tree Mapping

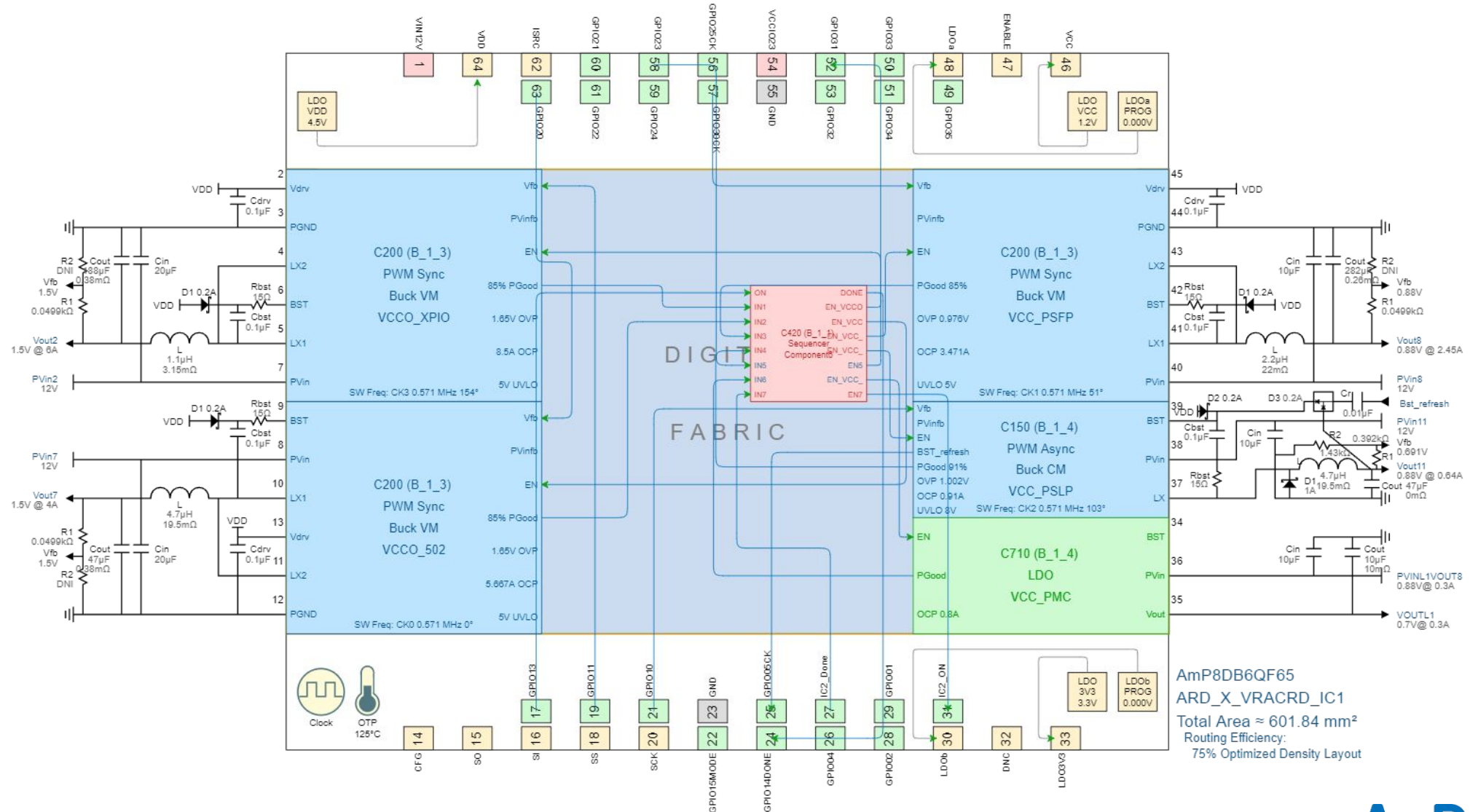


Power Tree Mapping

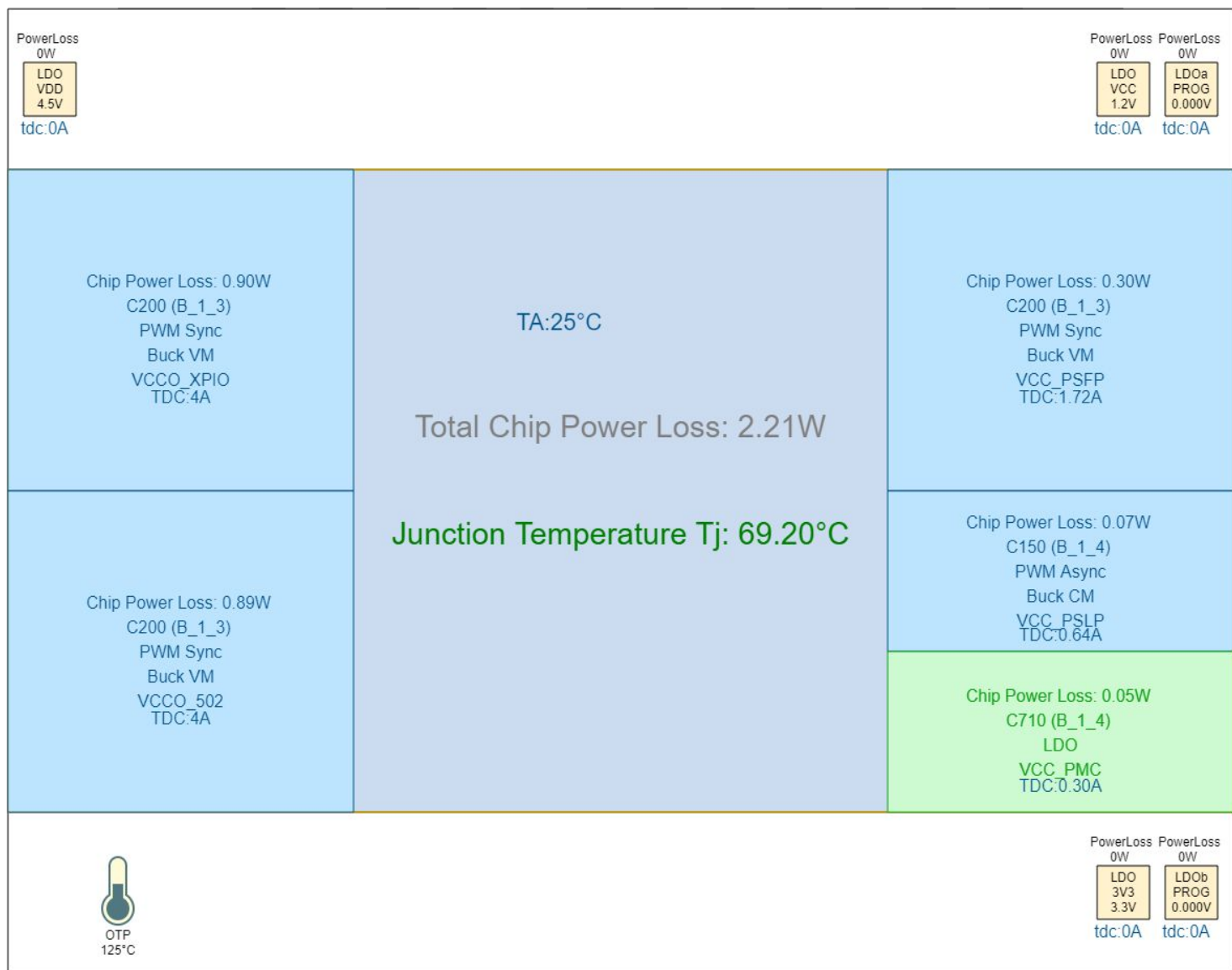


Estimated total area (IC1+IC2+IC3) = 1613.65 mm²

Mapping (WebAmP View) Design –IC1



Mapping (Thermal View) –IC1



AmP8DB6QF65

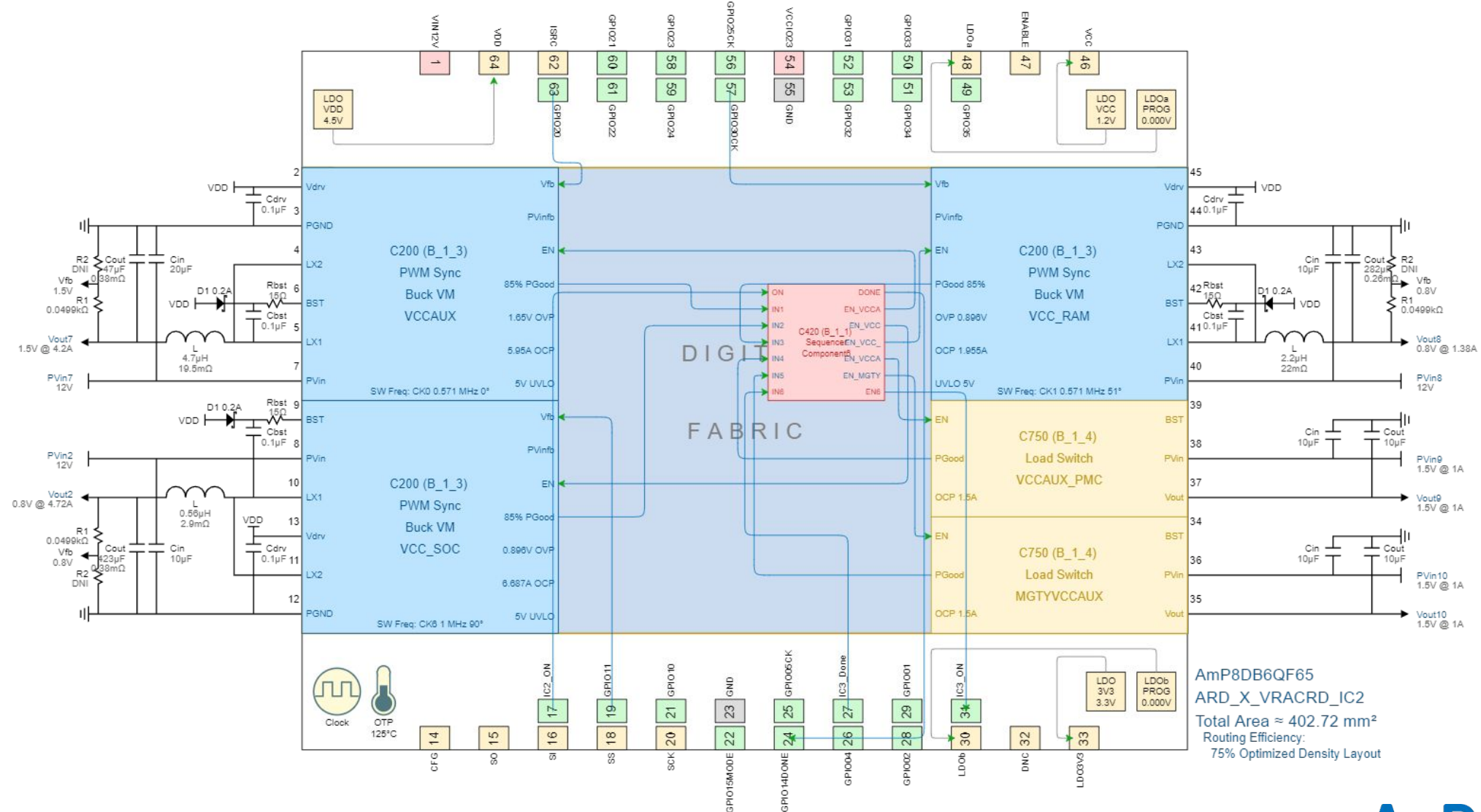
ARD_X_VRACRD_IC1

Total Area ≈ 601.84 mm²

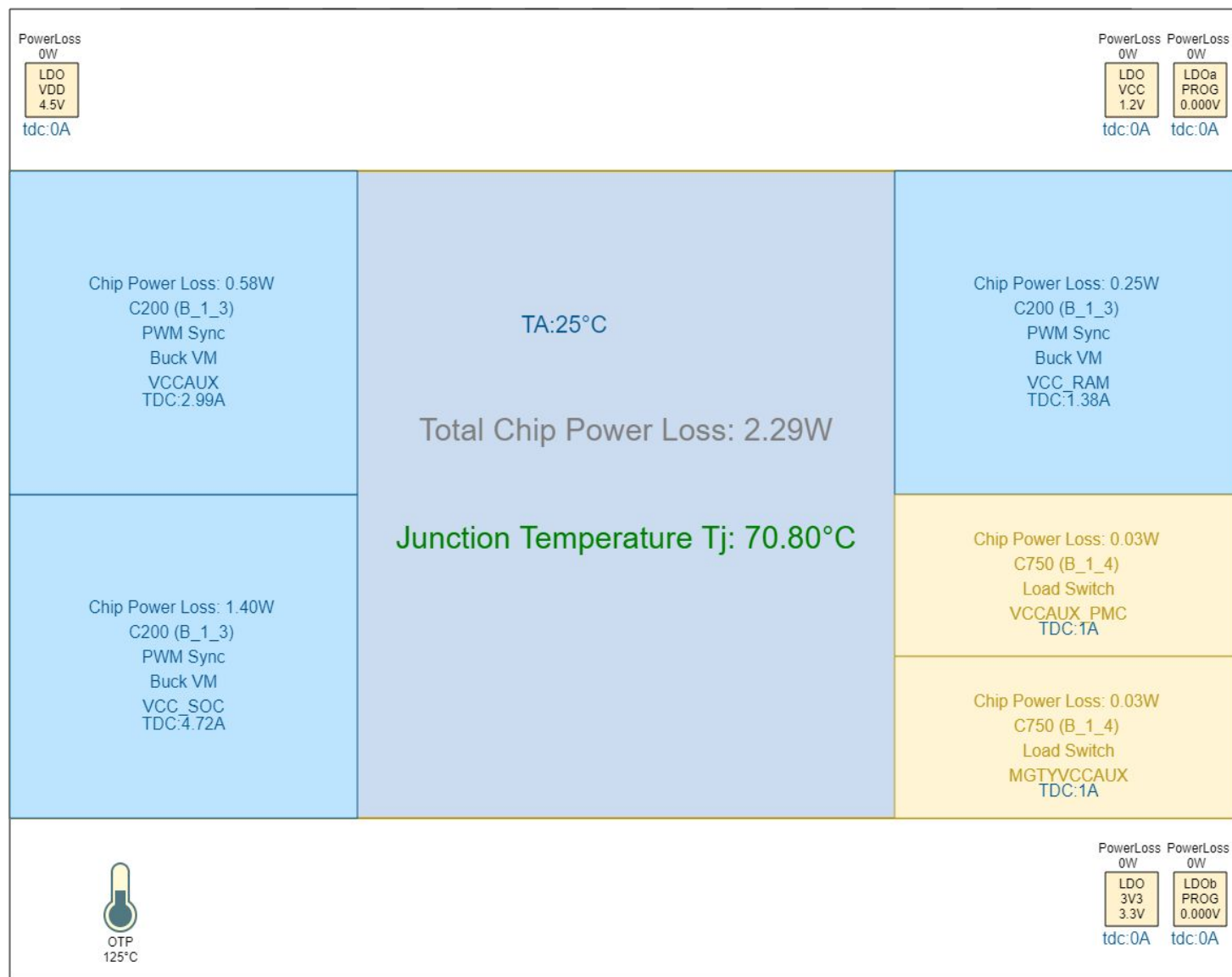
Routing Efficiency:

75% Optimized Density Layout

Mapping (WebAmP View) Design –IC2

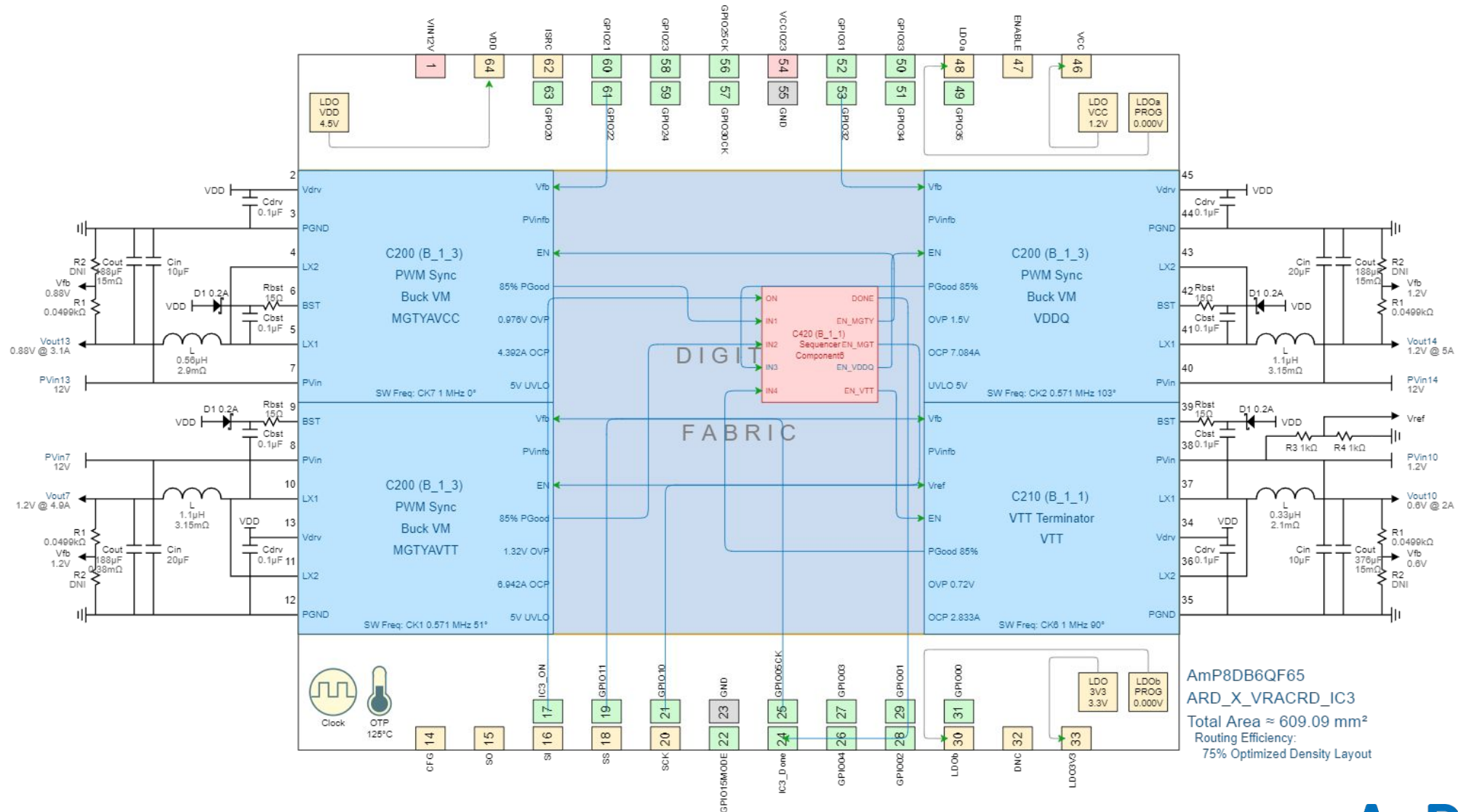


Mapping (Thermal View) –IC2

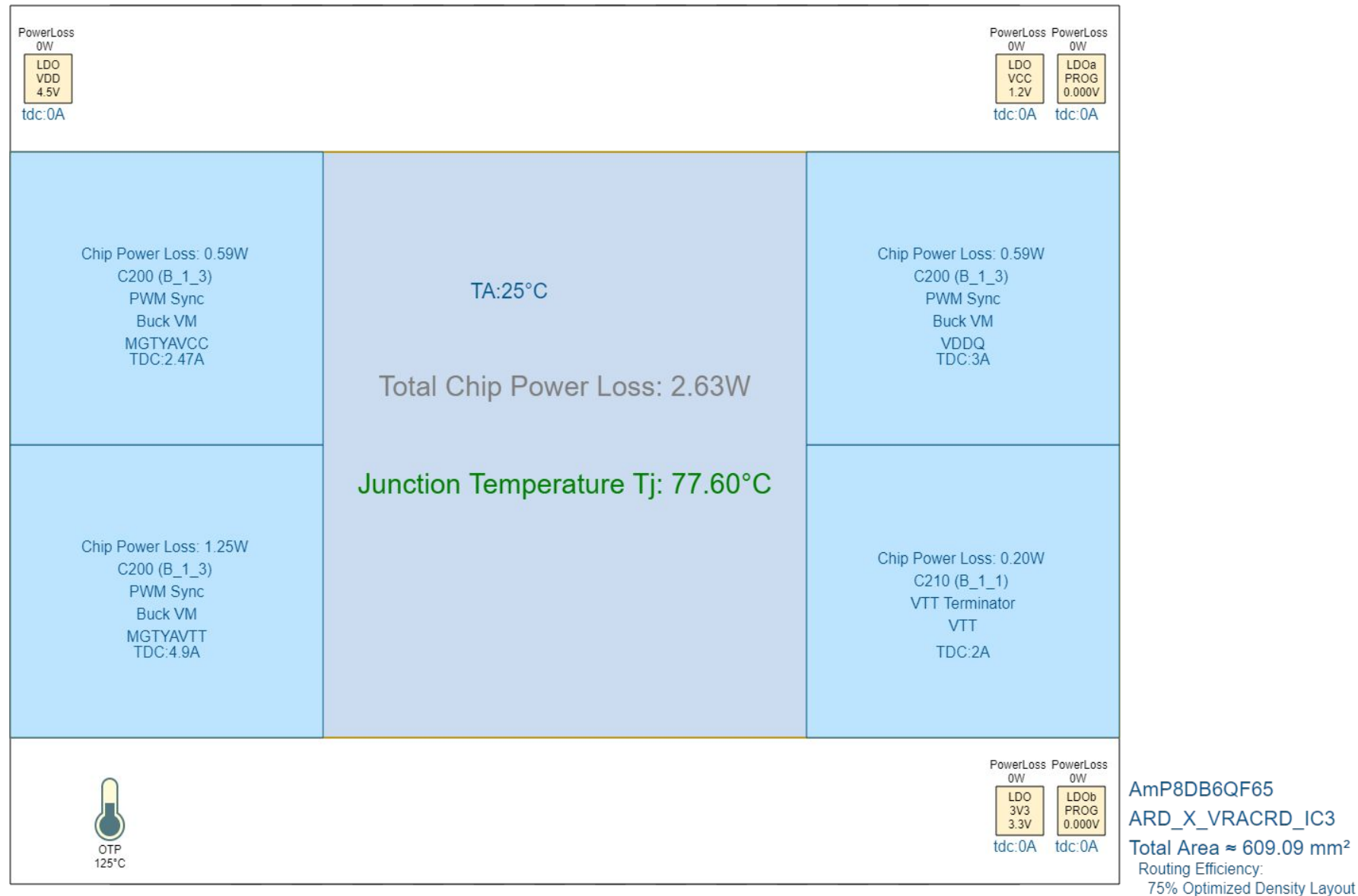


AmP8DB6QF65
ARD_X_VRACRD_IC2
Total Area $\approx 402.72 \text{ mm}^2$
Routing Efficiency:
75% Optimized Density Layout

Mapping (WebAmP View) Design –IC3



Mapping (WebAmP View) Design –IC3

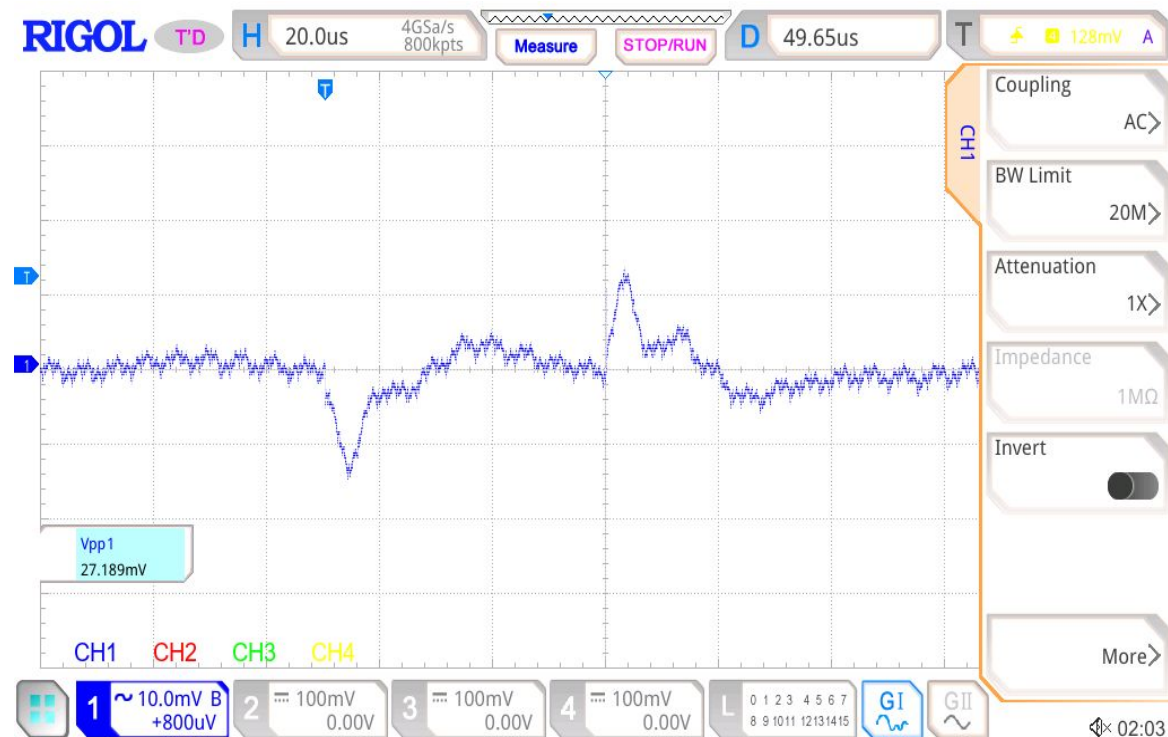
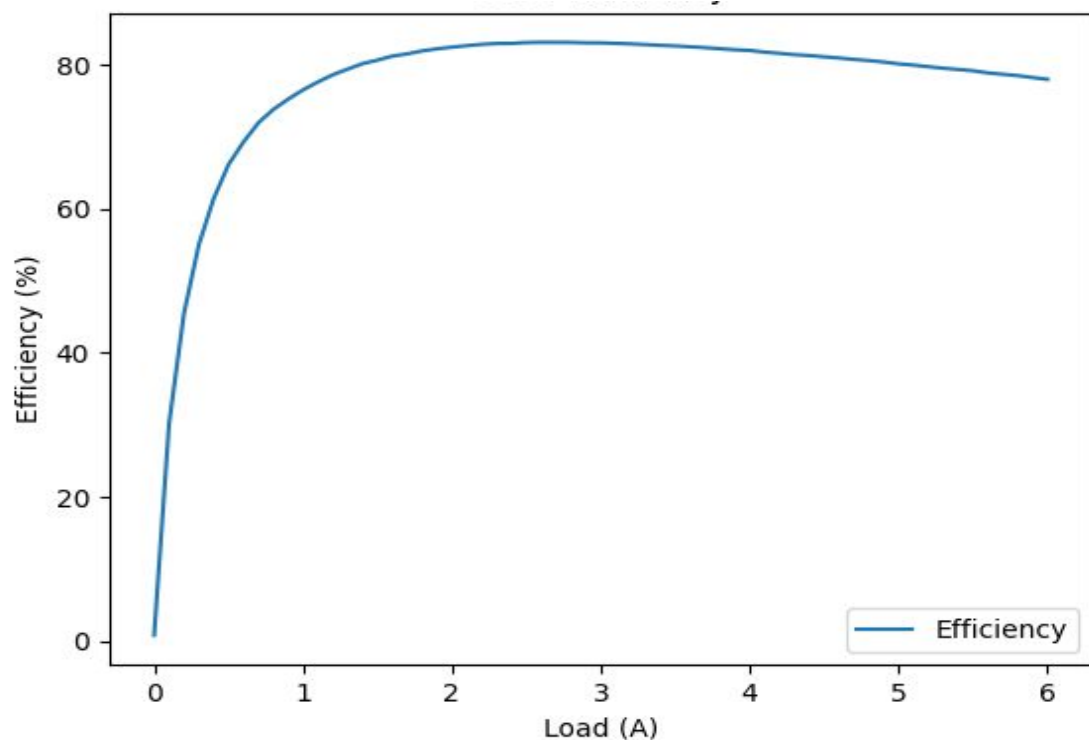


VCCO_XPIO

1.5 V / 6 A

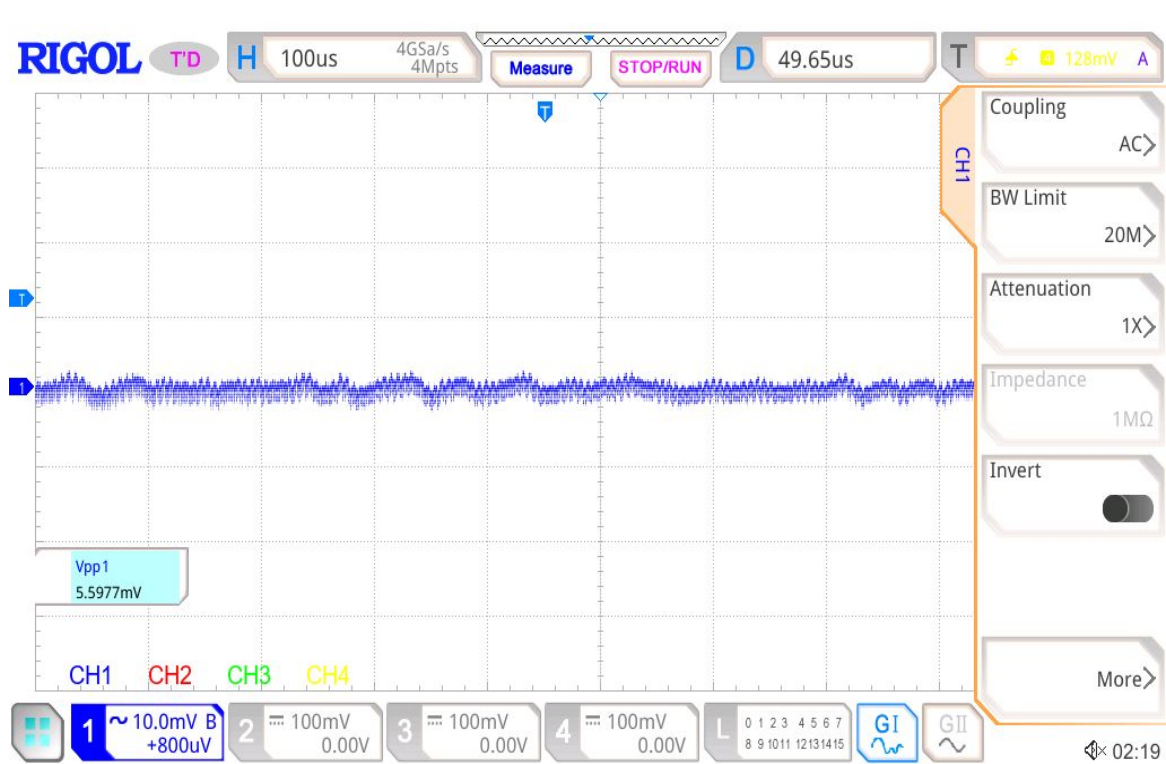
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 1.1 \text{ } \mu\text{H}$, P/N Wurth 744314110
- $C = 4 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

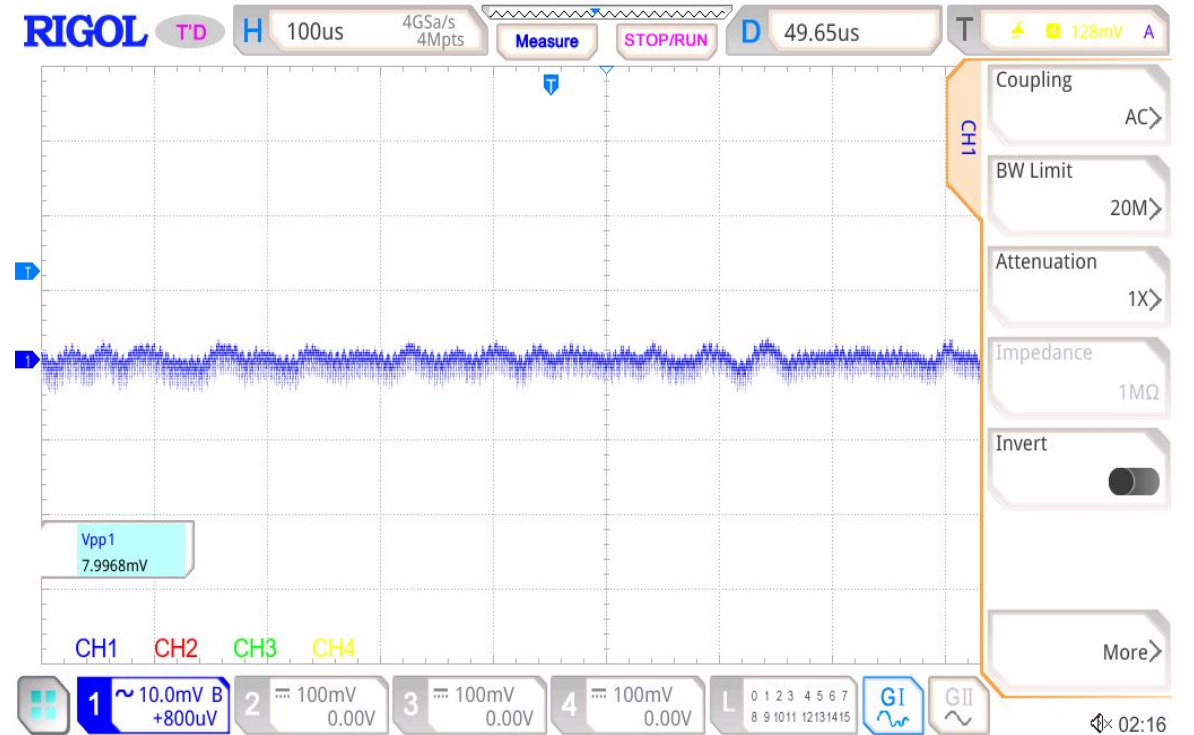


Vout = 1.5V
Transient 4.5 – 6 A@10 A/μs
 $V_{PP} = 27.18 \text{ mV}$
Fsw = 0.571 MHz
L = 1.1 μH, C = 4x47 uF

Ripple



No Load
 $V_{PP} = 5.59 \text{ mV}$



6 A Load
 $V_{PP} = 7.99 \text{ mV}$

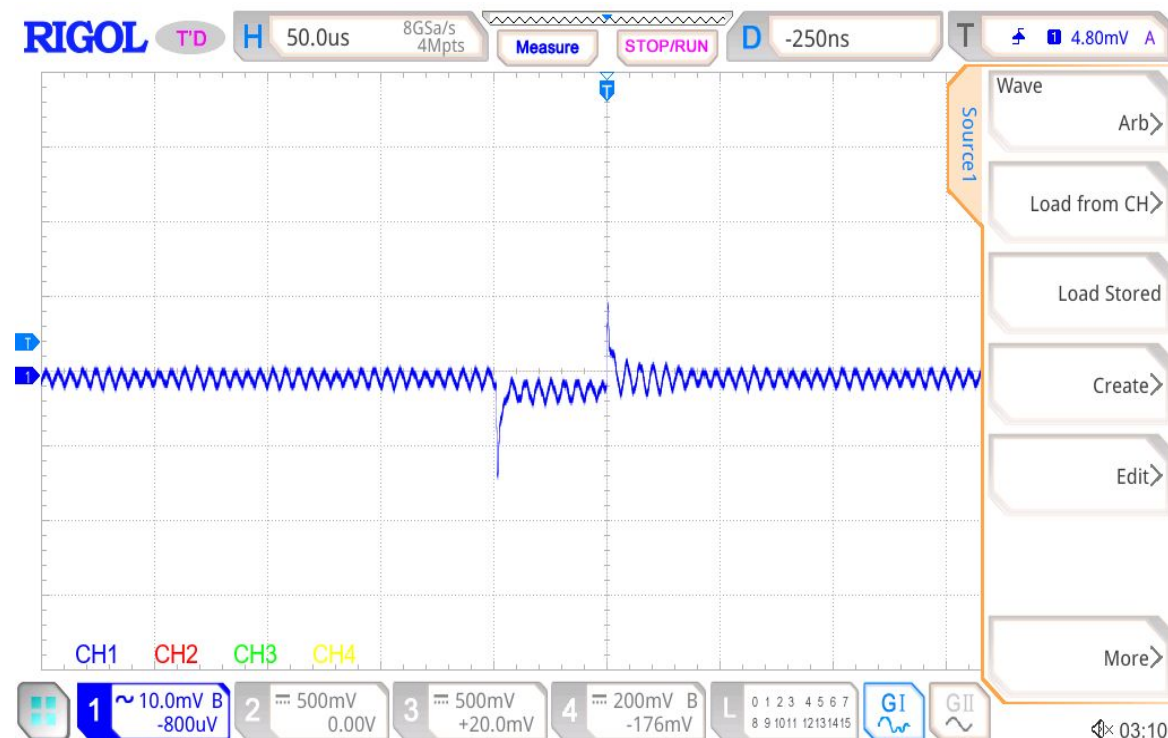
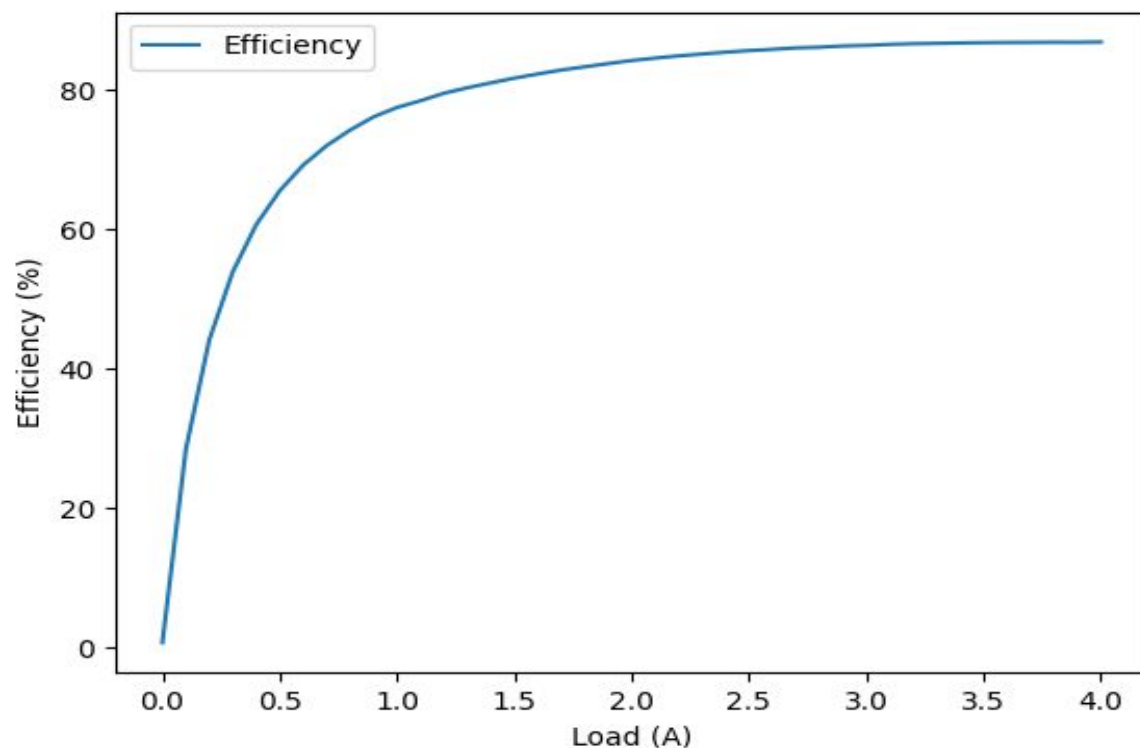
$V_{out} = 1.5 \text{ V}$

VCCO_502

1.5 V / 4 A

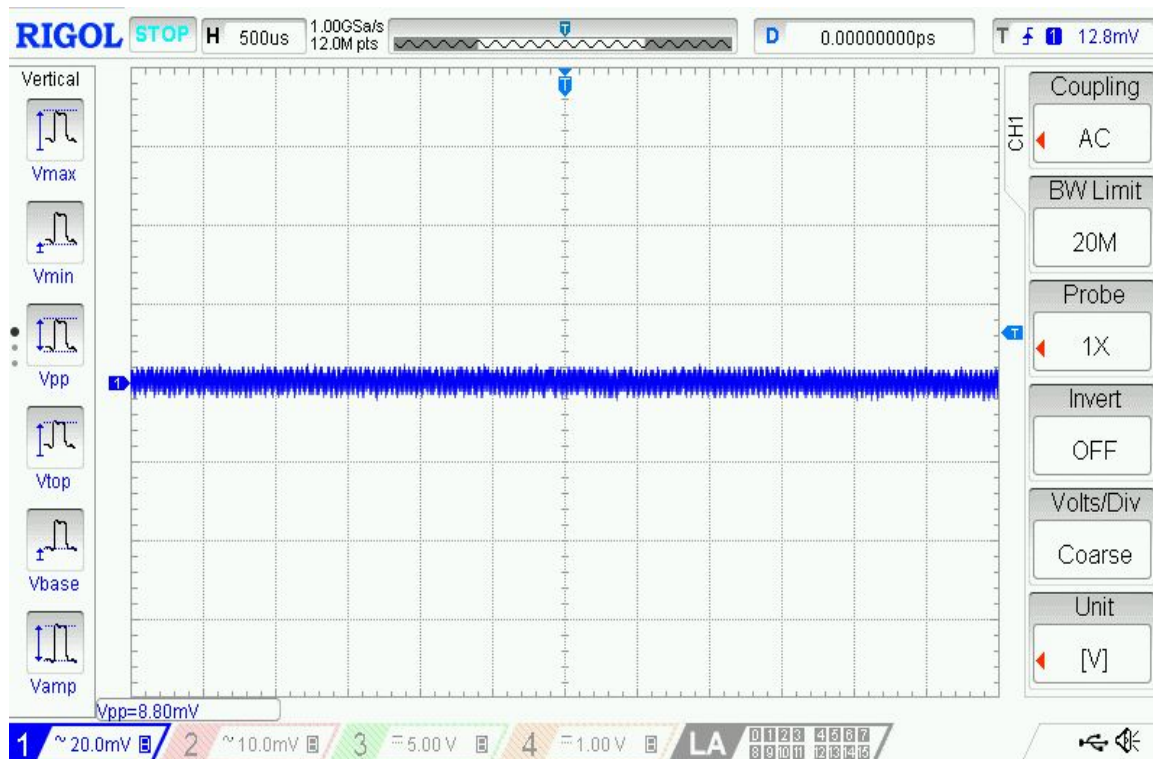
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 4.7 \text{ } \mu\text{H}$, P/N Wurth 744311470
- $C = 1 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

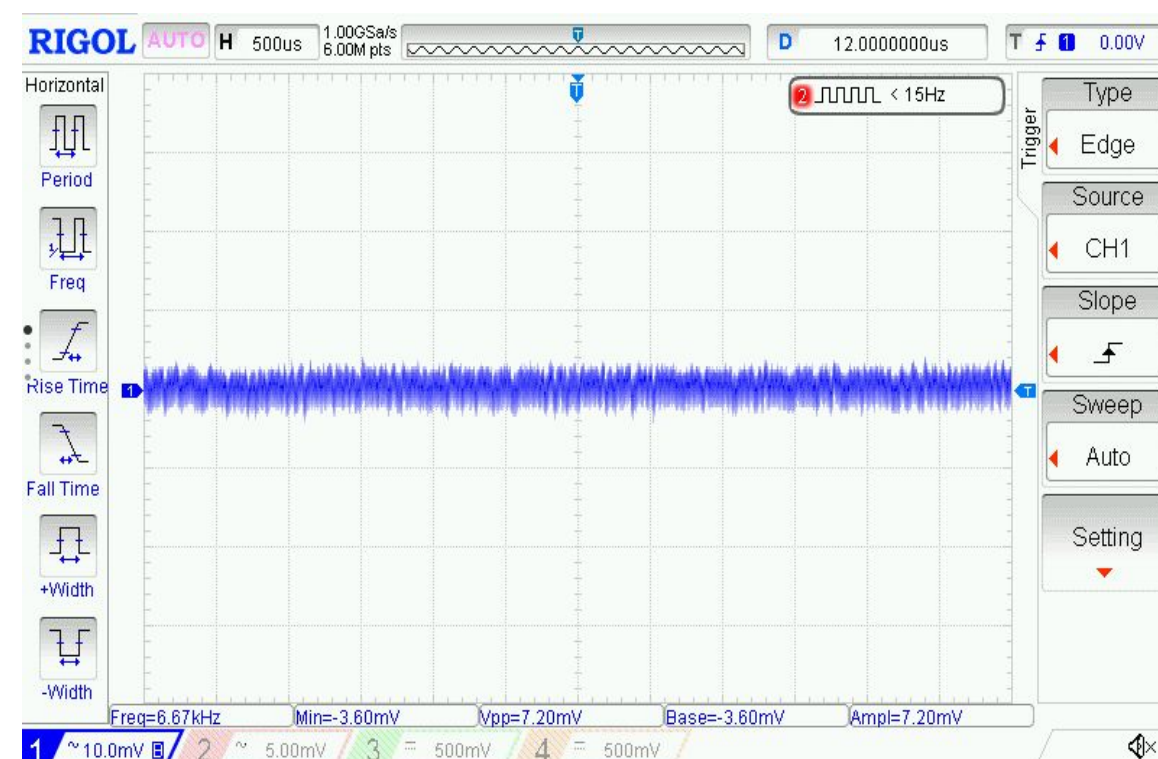


V_{out} = 1.5V
Transient 2.68A – 4A @ 10 A/μs
V_{pp} = 25 mV
F_{sw} = 0.571 MHz
L = 4.7 μH, C = 1x47 uF

Ripple



No Load
 $V_{PP} = 8.80 \text{ mV}$



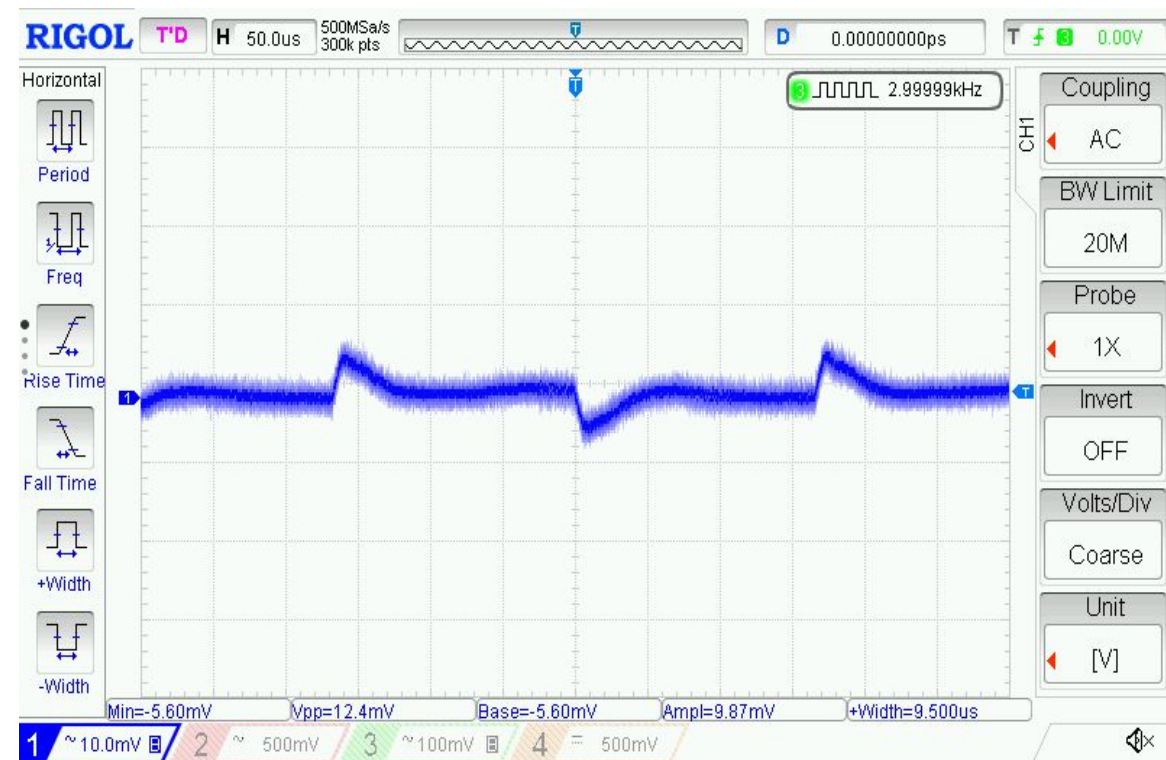
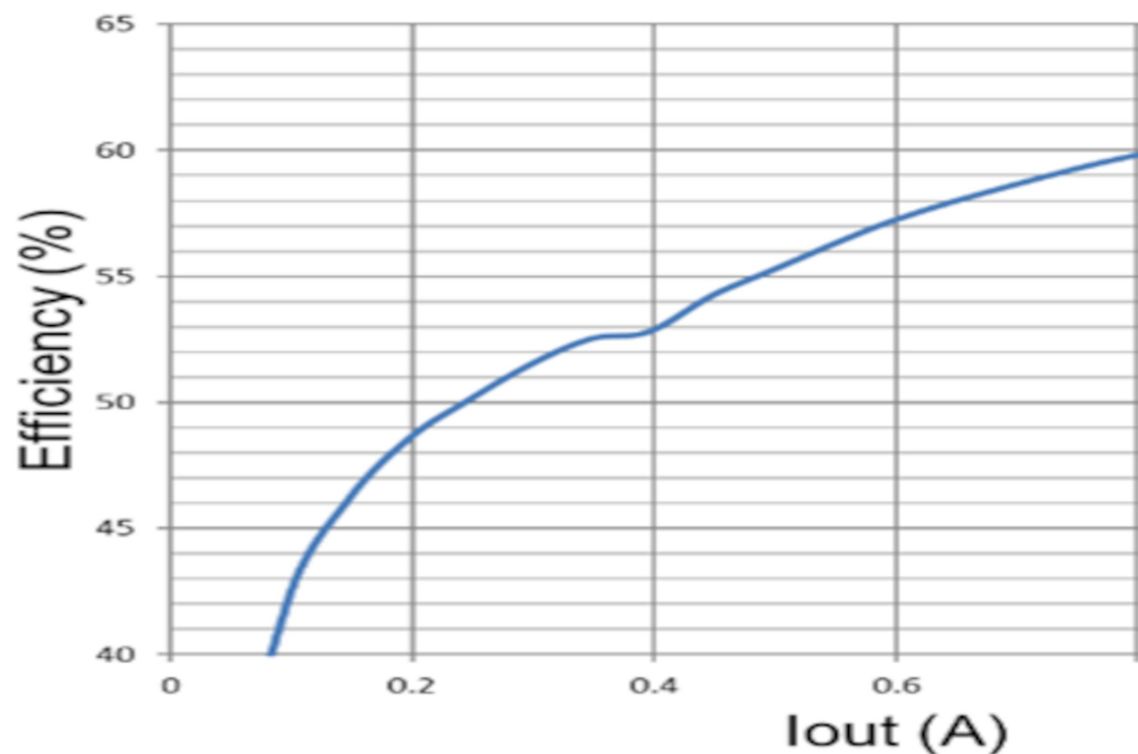
4 A Load
 $V_{PP} = 7.20 \text{ mV}$

VCC_PSLP

0.88 $\bar{V}$ / 0.64 A

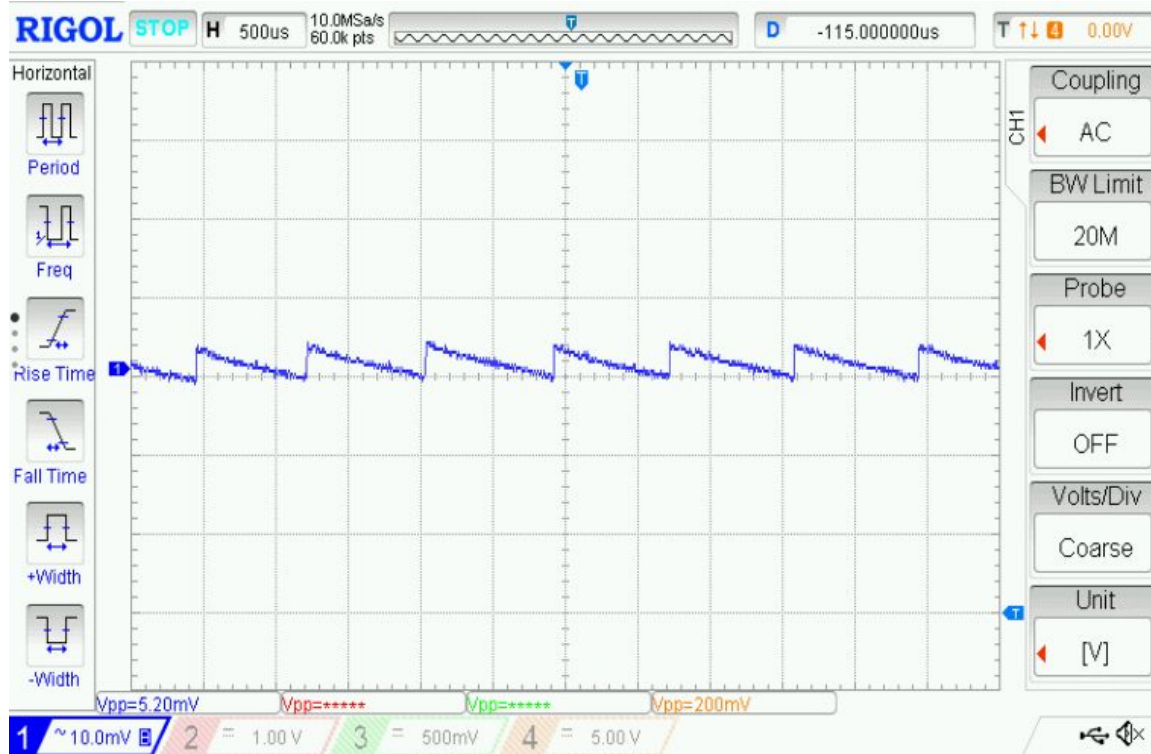
- C150 (Asynchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 4.7 \text{ } \mu\text{H}$, P/N Wurth 744311470
- $C = 1 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

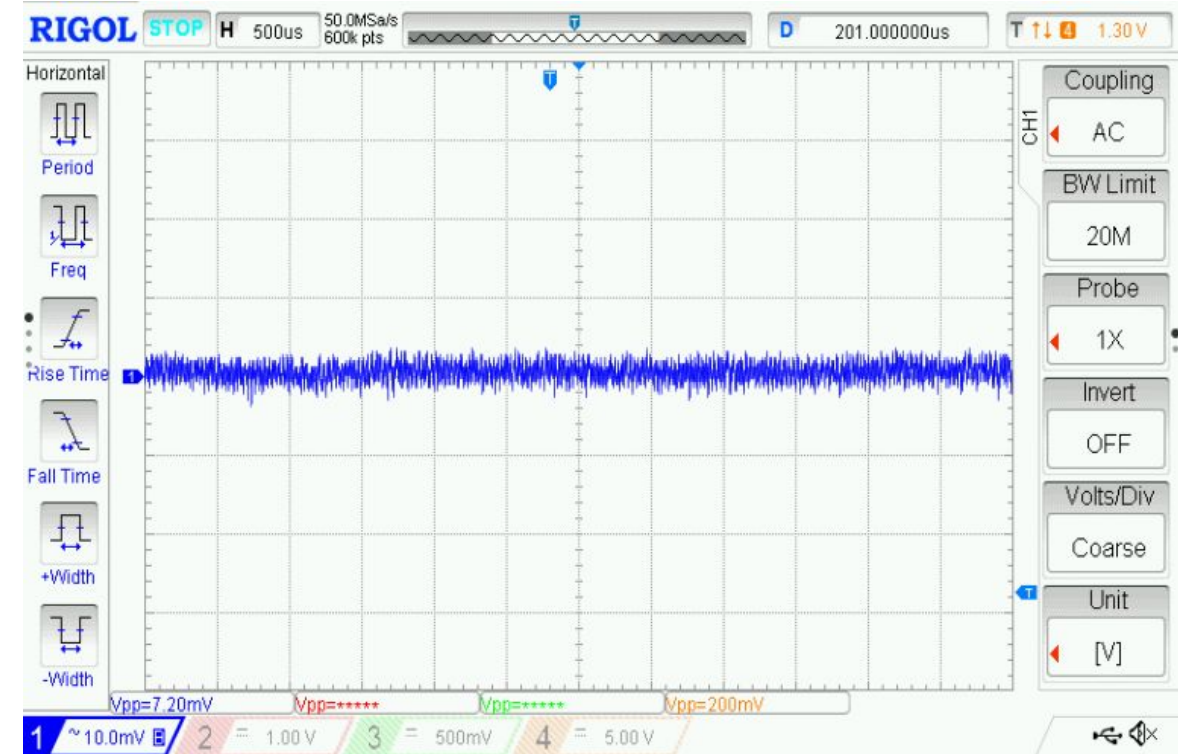


Vout = 0.88 V
Transient 0.48 A – 0.64A @ 100 A/μs
V_{PP} = 12.4 mV
Fsw = 0.571 MHz
L = 4.7 μH, C = 1x47 uF

Ripple



No Load
 $V_{PP} = 5.20 \text{ mV}$



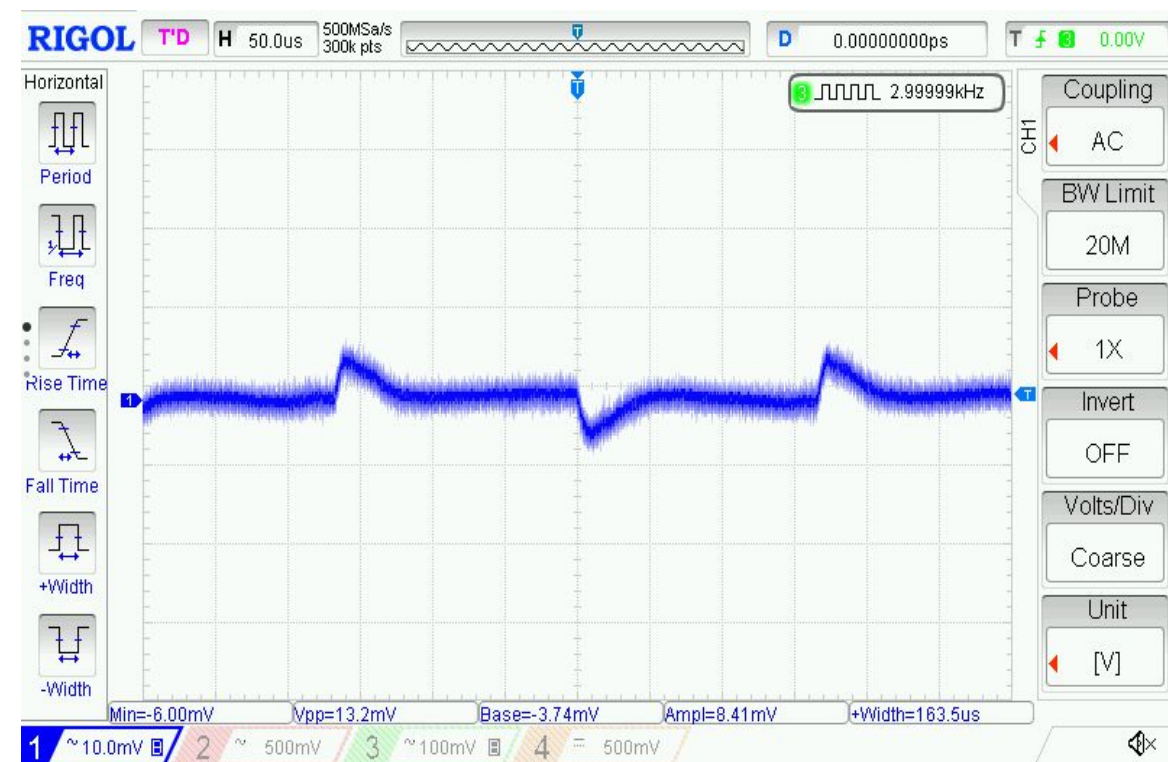
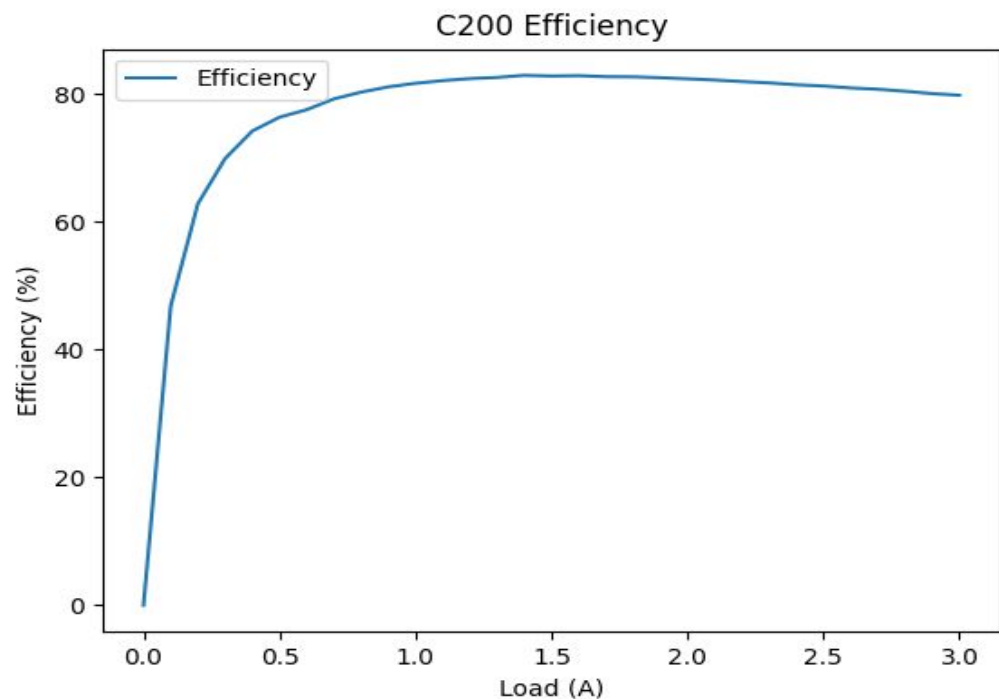
0.64 A Load
 $V_{PP} = 7.20 \text{ mV}$

VCC_PSFP

0.88 $\bar{V}$ / 2.45 A

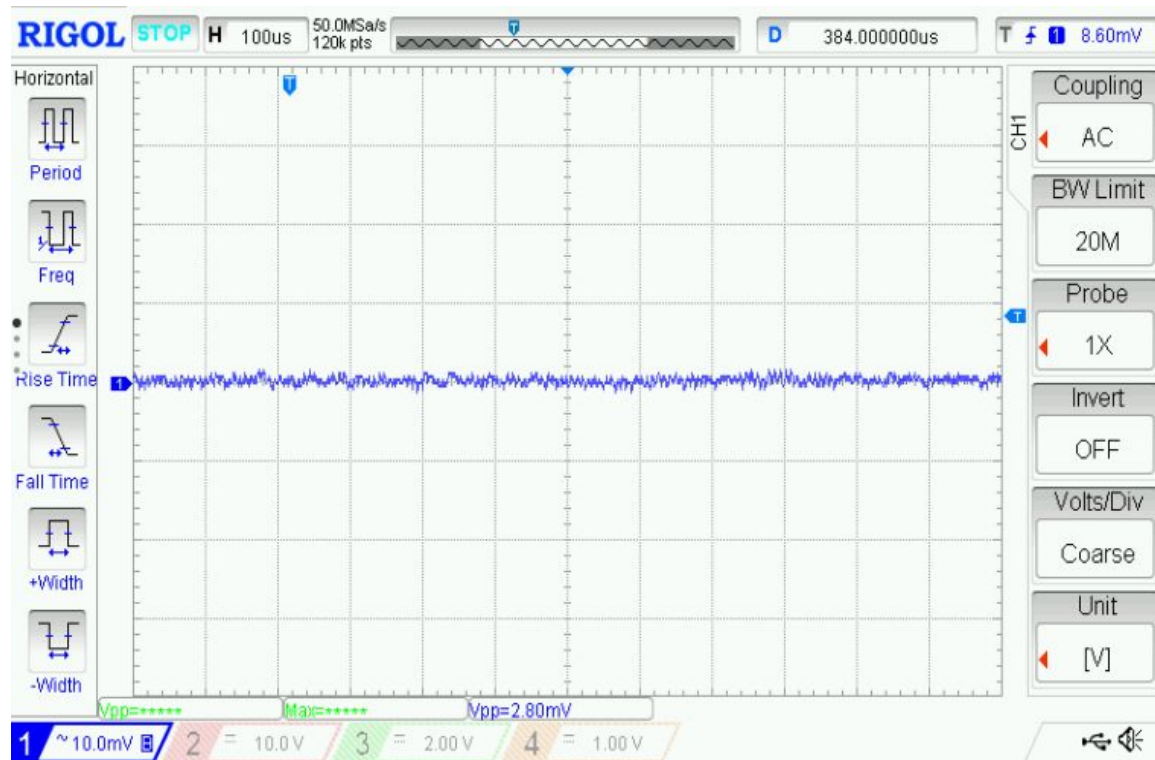
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 2.2 \mu\text{H}$, P/N Wurth 74438357022
- $C = 6 \times 47 \mu\text{F}$

Efficiency & Transient

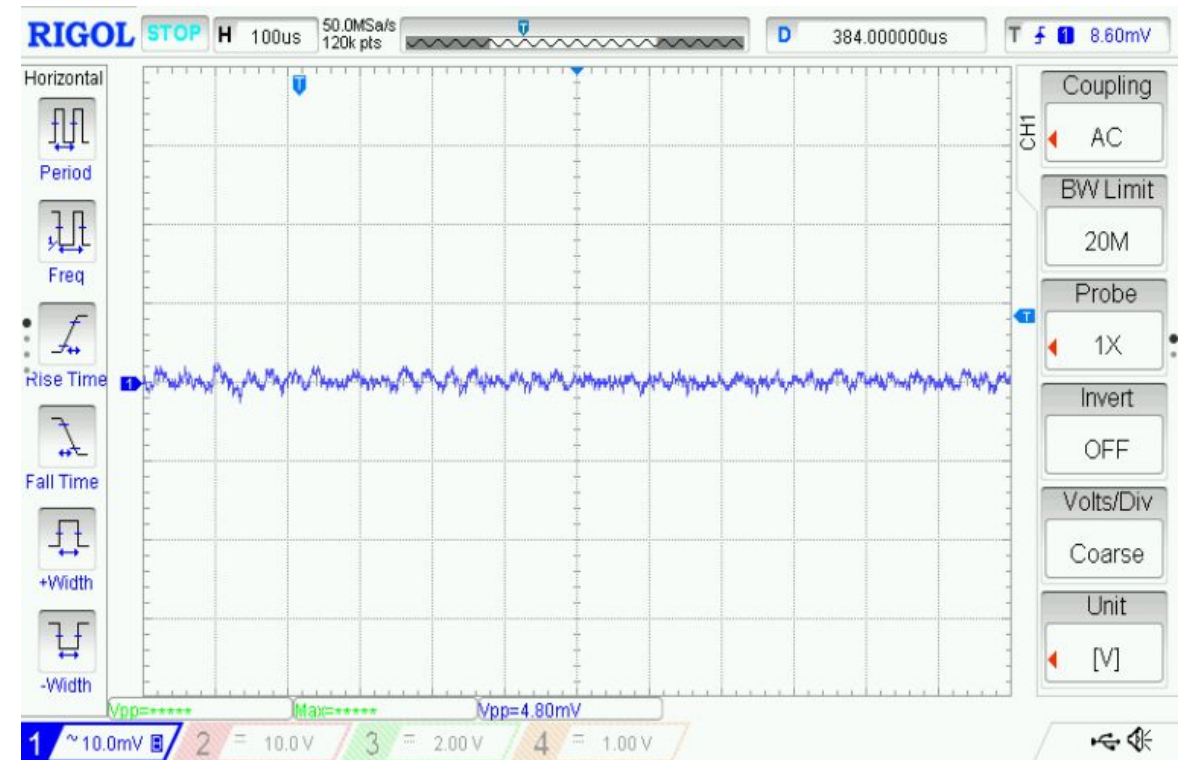


Vout = 0.88 V
Transient 1.83A – 2.45A @ 10 A/ μ s
 V_{PP} = 13.2 mV
Fsw = 0.571 MHz
L = 2.2 μ H, C = 6x47 μ F

Ripple



No Load
 $V_{PP} = 2.80 \text{ mV}$



2.45 A Load
 $V_{PP} = 4.80 \text{ mV}$

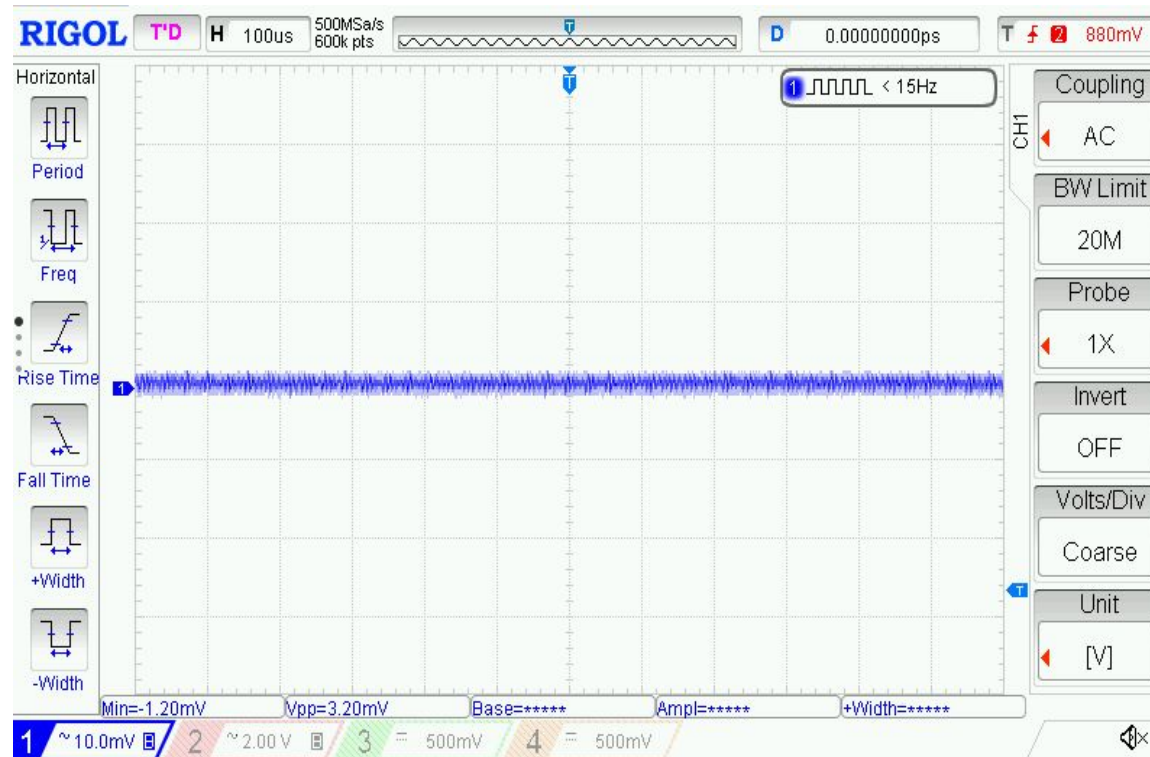
$V_{out} = 0.88 \text{ V}$

VCC_PMC

0.7 V / 0.30 A

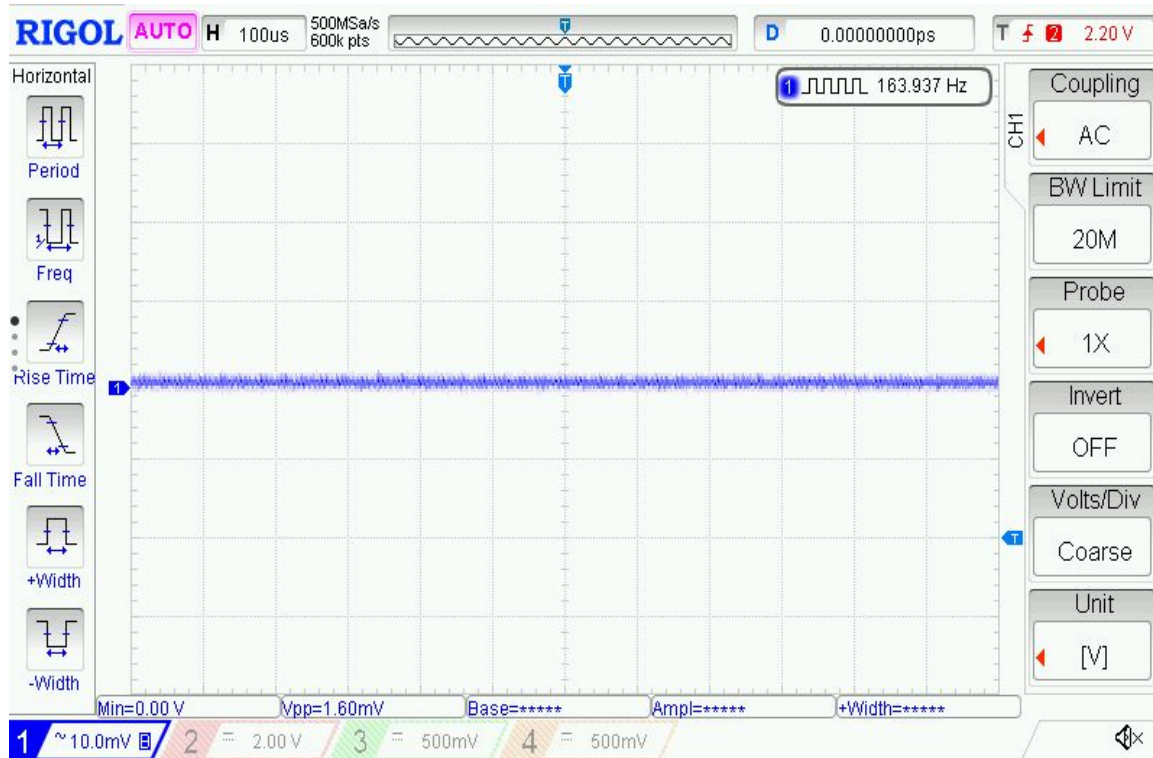
- C710 (LDO)

Transient

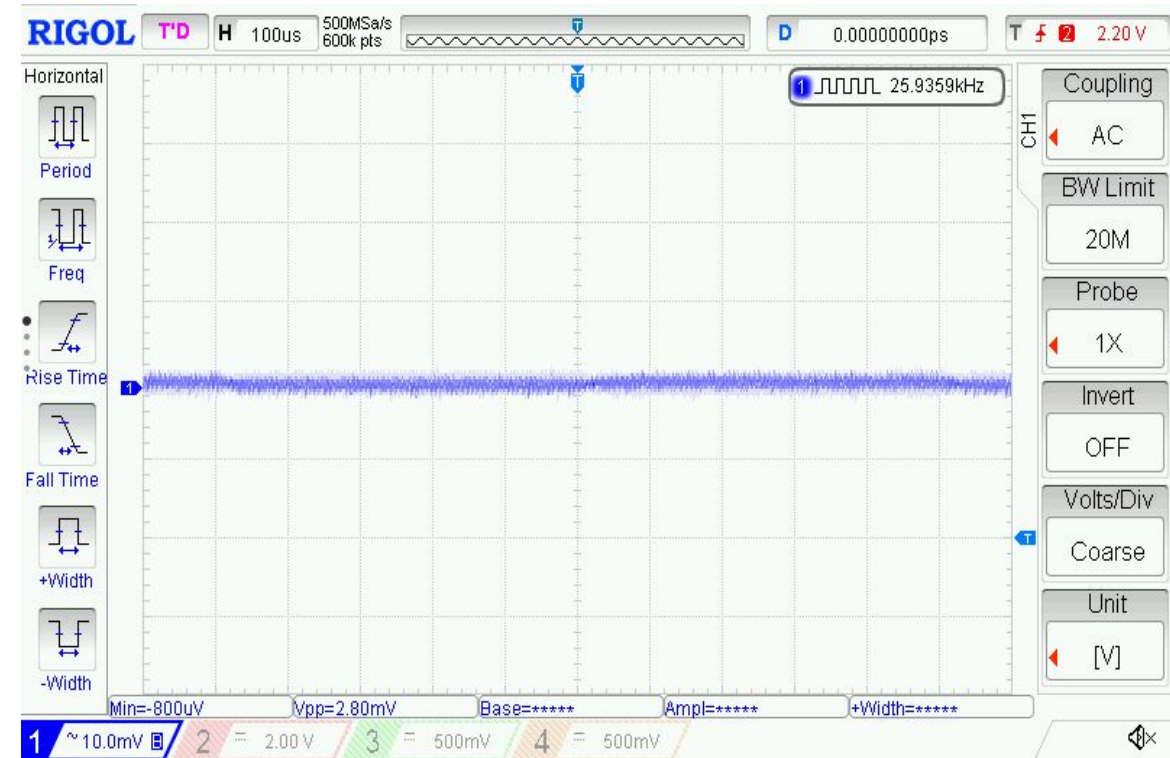


$V_{out} = 0.7V$
Transient $0.27A - 0.3A @ 10 A/\mu s$
 $V_{PP} = 3.20 mV$

Ripple



No Load
 $V_{PP} = 1.60 \text{ mV}$



0.30 A Load
 $V_{PP} = 2.80 \text{ mV}$

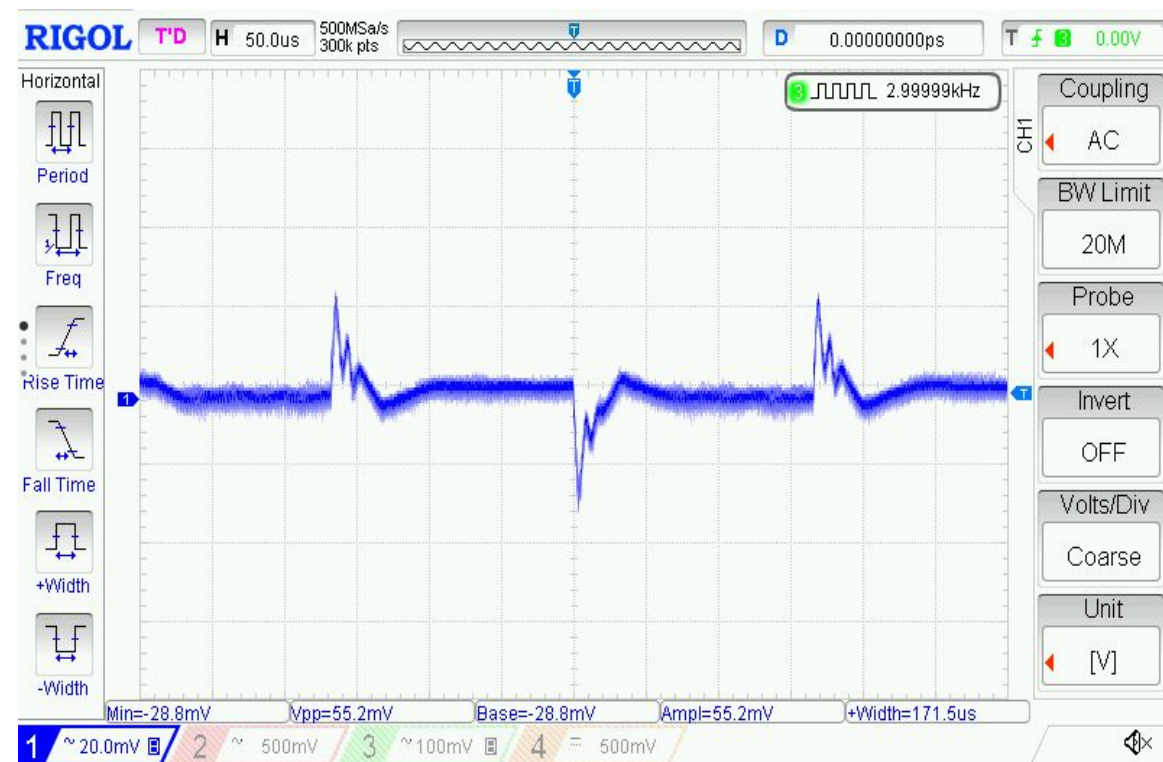
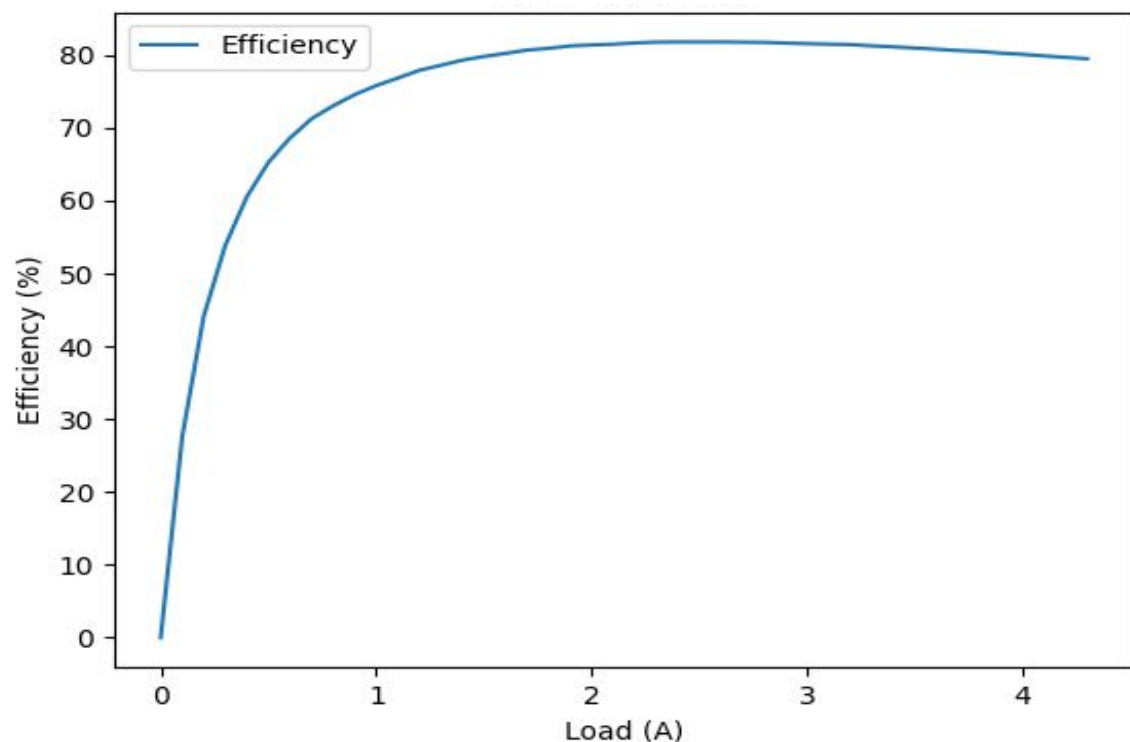
$V_{out} = 0.7 \text{ V}$

VCCAUX

1.5 V / 4.2 A

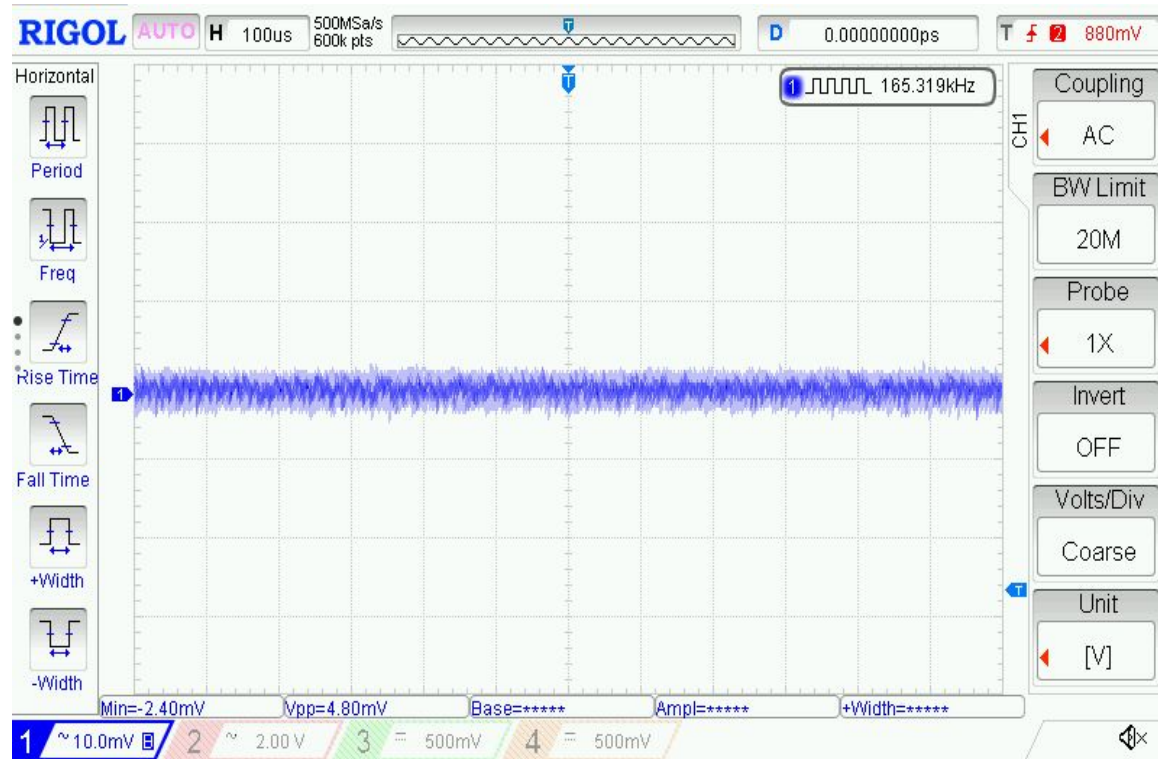
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 4.7 \text{ } \mu\text{H}$, P/N Wurth 744311470
- $C = 1 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

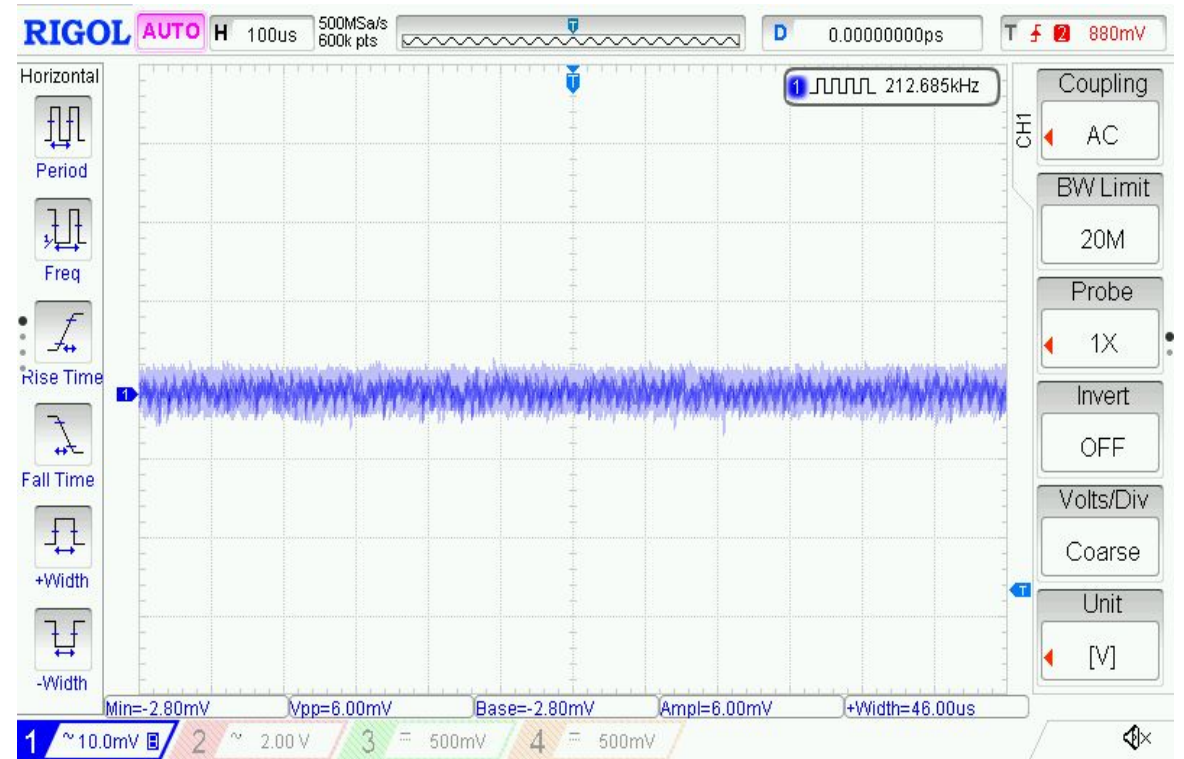


$V_{out} = 1.5V$
Transient 0.42A – 4.2A @ 10 A/ μ s
 $V_{PP} = 55.2\text{ mV}$
 $F_{sw} = 0.571\text{ MHz}$
 $L = 4.7\text{ }\mu\text{H}$, $C = 1x47\text{ }\mu\text{F}$

Ripple



No Load
 $V_{PP} = 4.80 \text{ mV}$



$V_{out} = 1.5 \text{ V}$

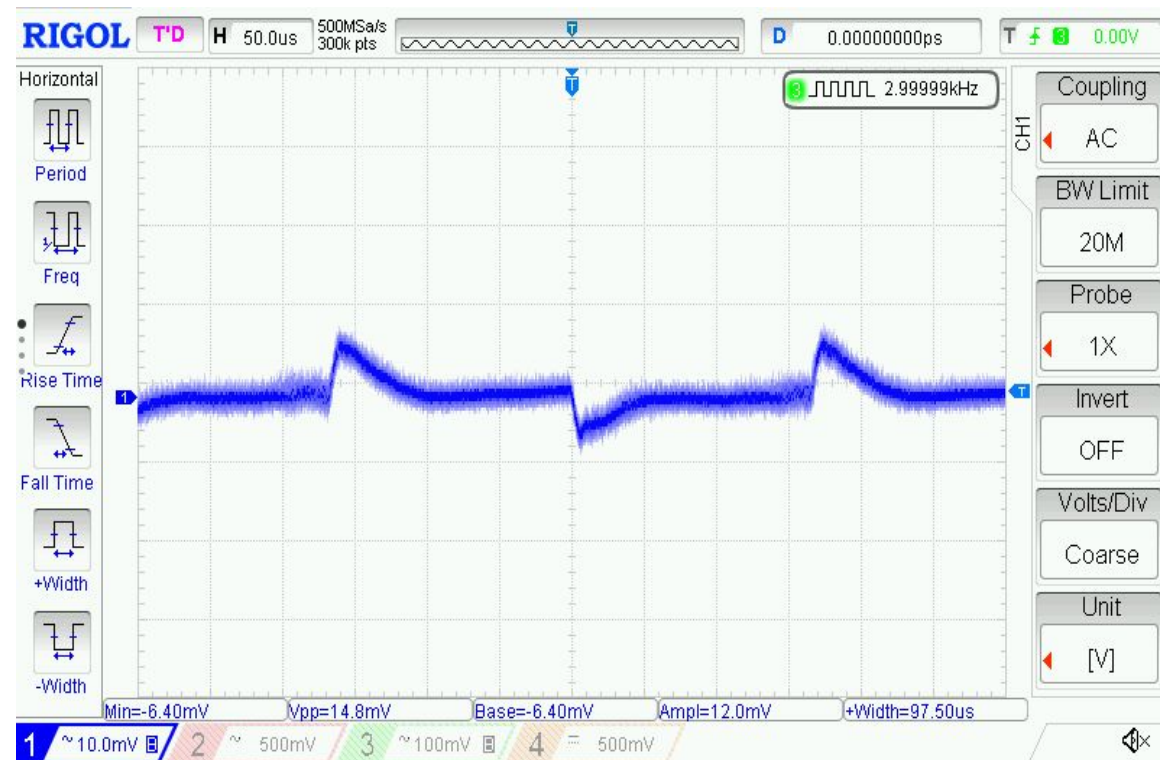
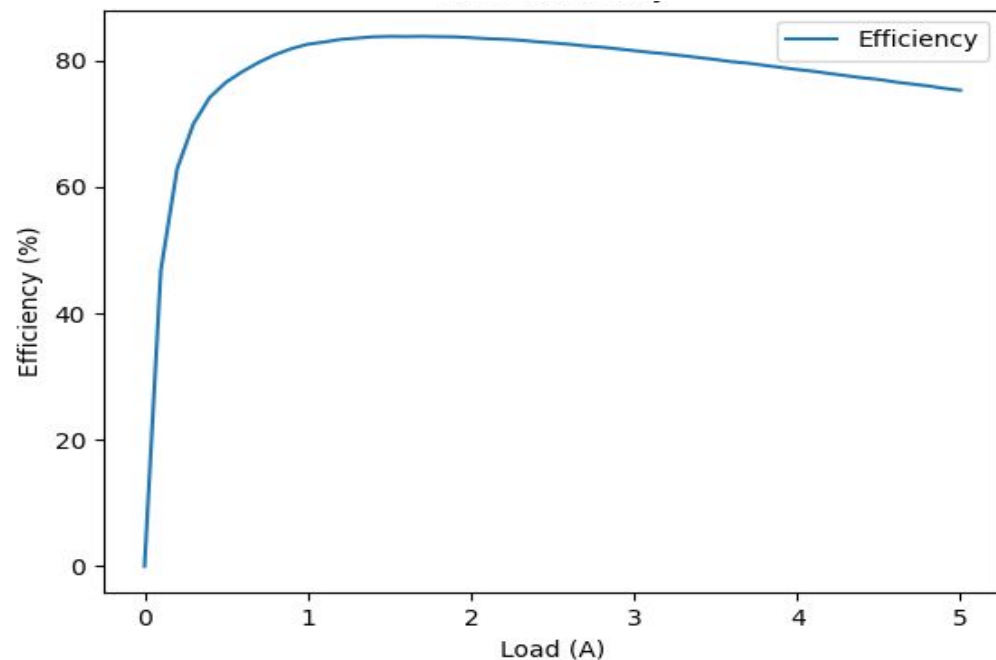
4.2 A Load
 $V_{PP} = 6 \text{ mV}$

VCC_SOC

0.8 V / 4.72 A

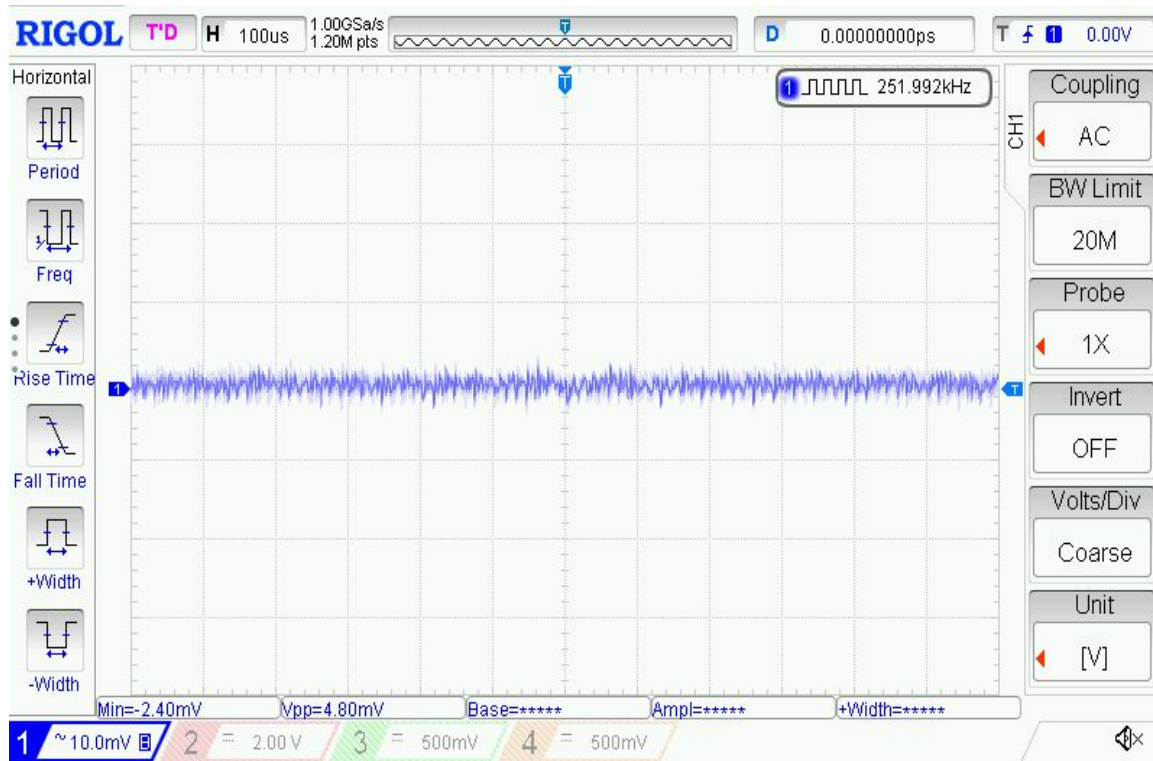
- C200 (Synchronous Buck)
- $F_{sw} = 1 \text{ MHz}$
- $L = 0.56 \text{ } \mu\text{H}$, P/N Wurth 744393440056
- $C = 9 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

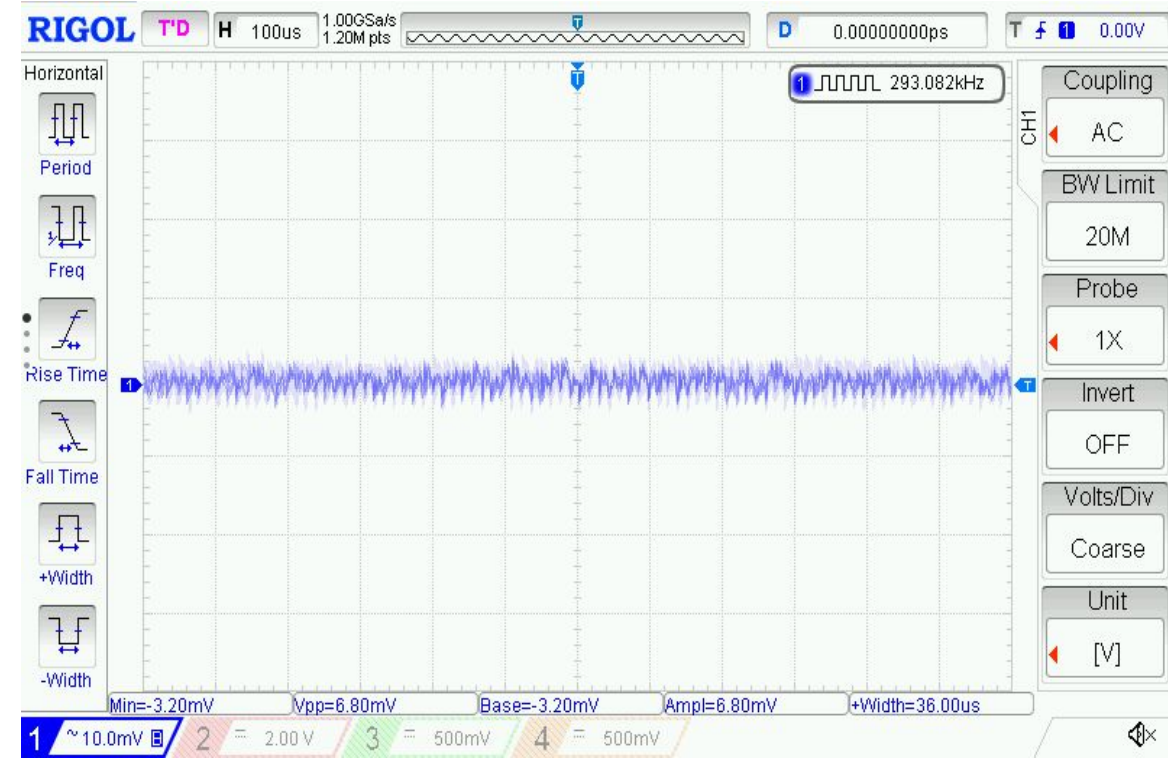


Vout = 0.8 V
Transient 0.47A – 4.72A @ 10 A/ μ s
 V_{PP} = 14.8 mV
Fsw = 1 MHz
L = 0.56 μ H, C = 9x47 μ F

Ripple



No Load
 $V_{PP} = 4.80 \text{ mV}$



4.72 A Load
 $V_{PP} = 6.80 \text{ mV}$

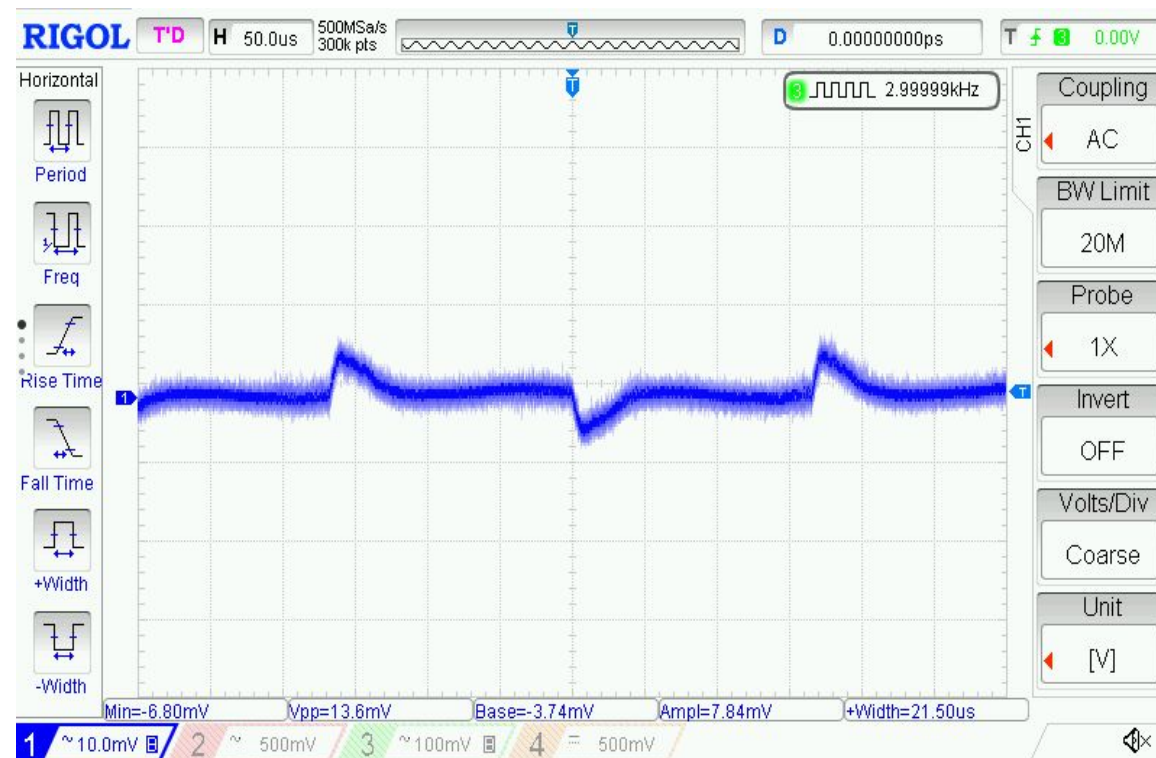
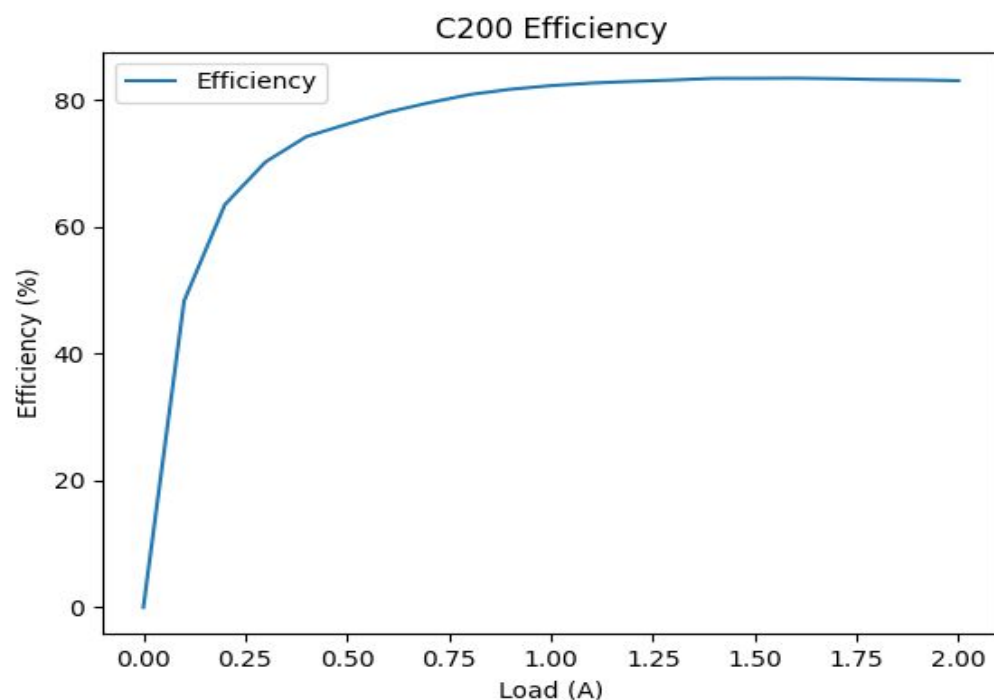
$V_{out} = 0.8 \text{ V}$

VCC_RAM

0.8 V / 1.38 A

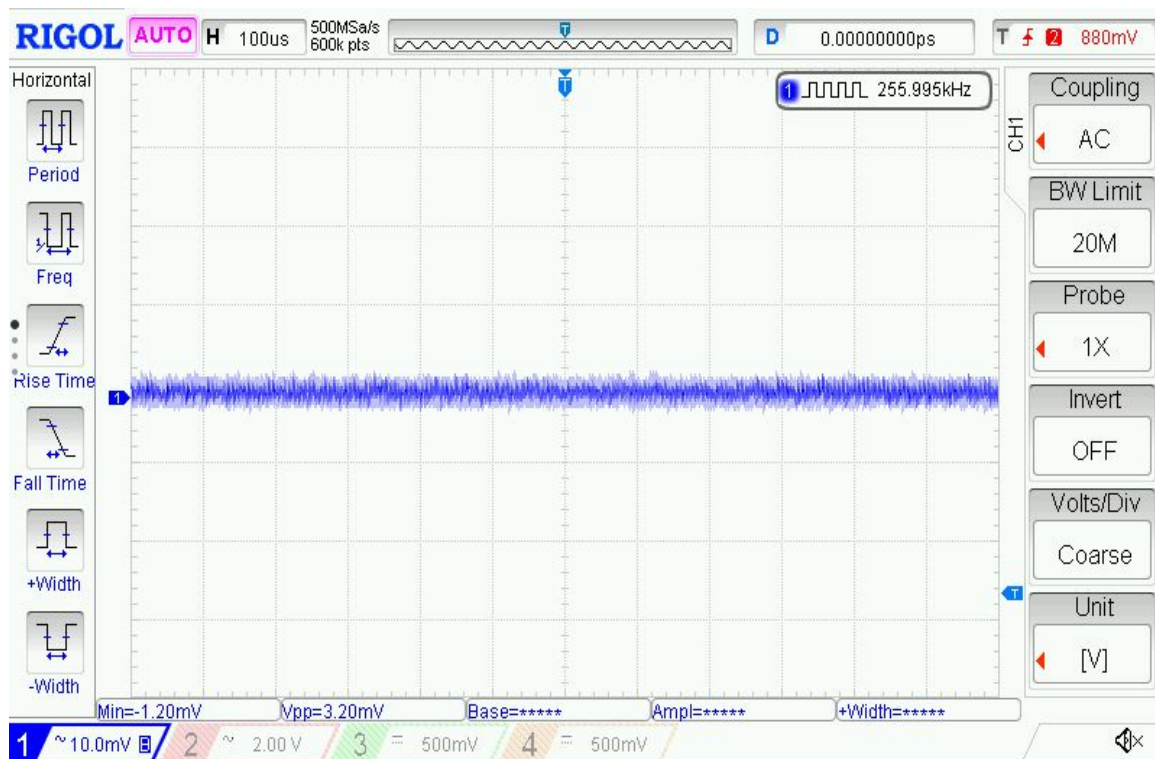
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 2.2 \mu\text{H}$, P/N Wurth 74438357022
- $C = 6 \times 47 \mu\text{F}$

Efficiency & Transient

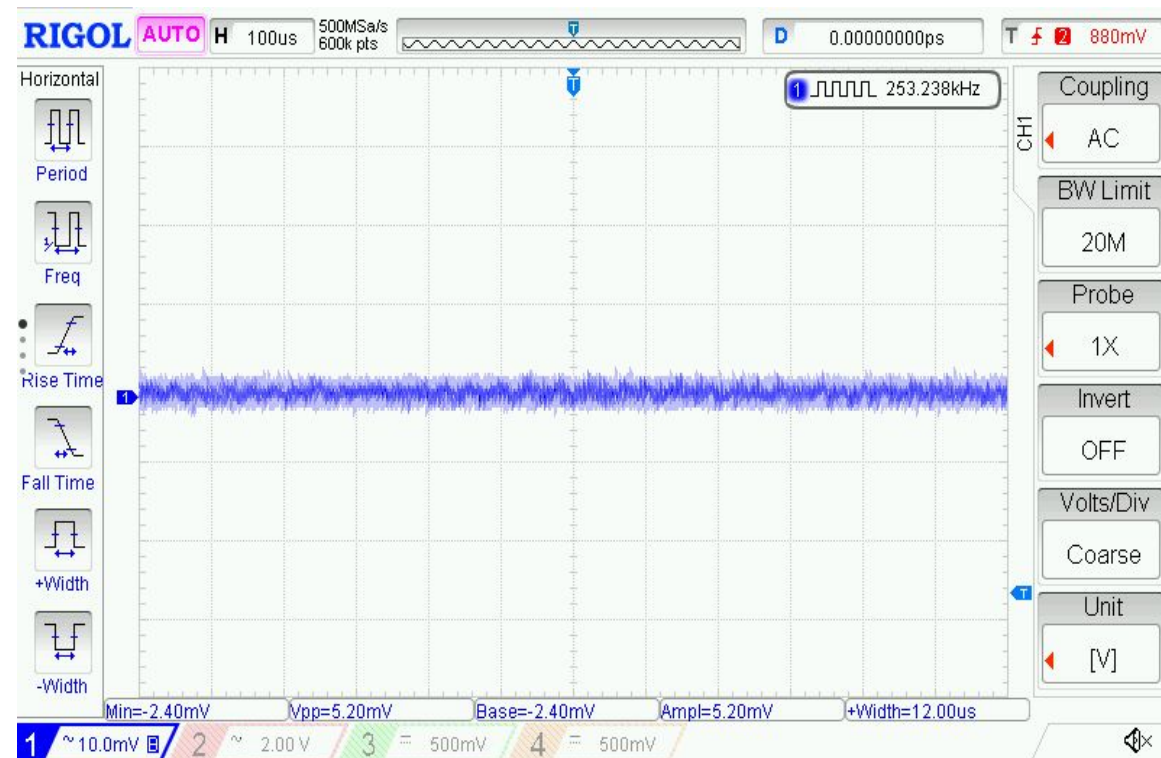


$V_{out} = 0.8V$
Transient 0.82A – 1.38A @ 10 A/ μ s
 $V_{pp} = 13.6\text{ mV}$
 $F_{sw} = 0.571\text{ MHz}$
 $L = 2.2\text{ }\mu\text{H}$, $C = 6 \times 47\text{ }\mu\text{F}$

Ripple



No Load
 $V_{PP} = 3.20 \text{ mV}$



1.38 A Load
 $V_{PP} = 5.20 \text{ mV}$

$V_{out} = 0.8 \text{ V}$

VCCAUX_PMC

1.5 V / 0.16 A

- C750 (Load Switch)

MGTYVCCAUX

1.5 V / 0.3 A

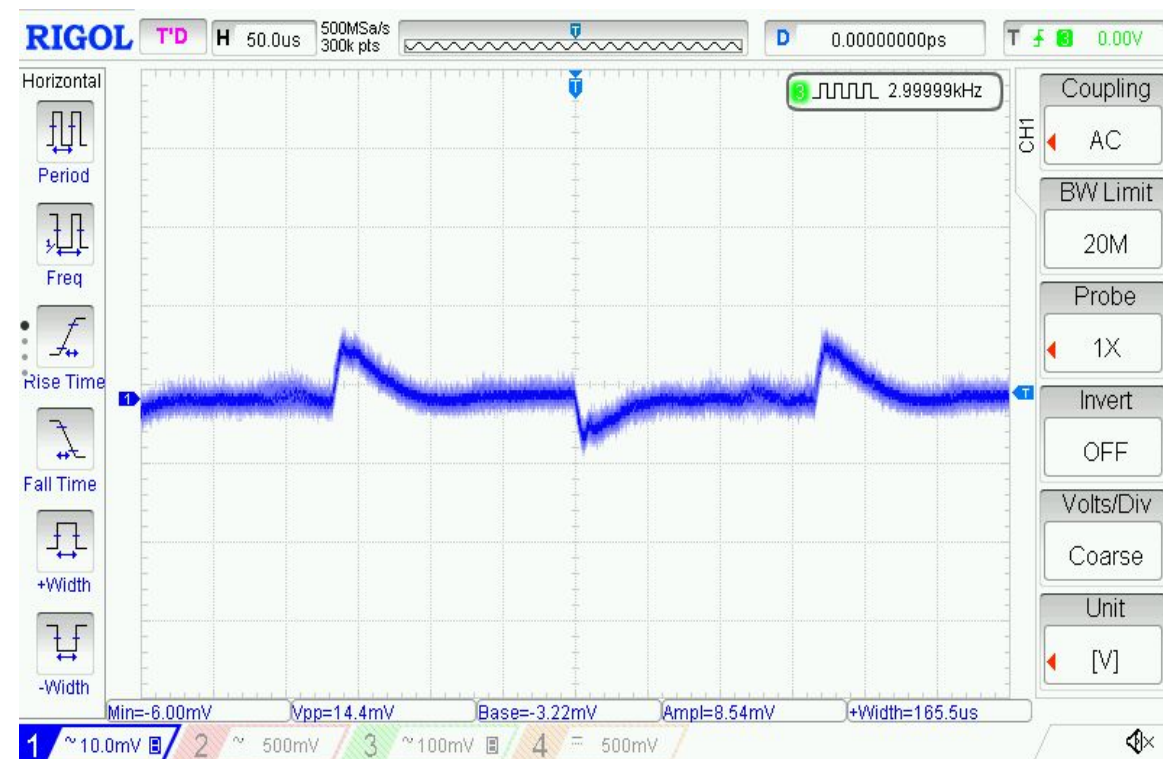
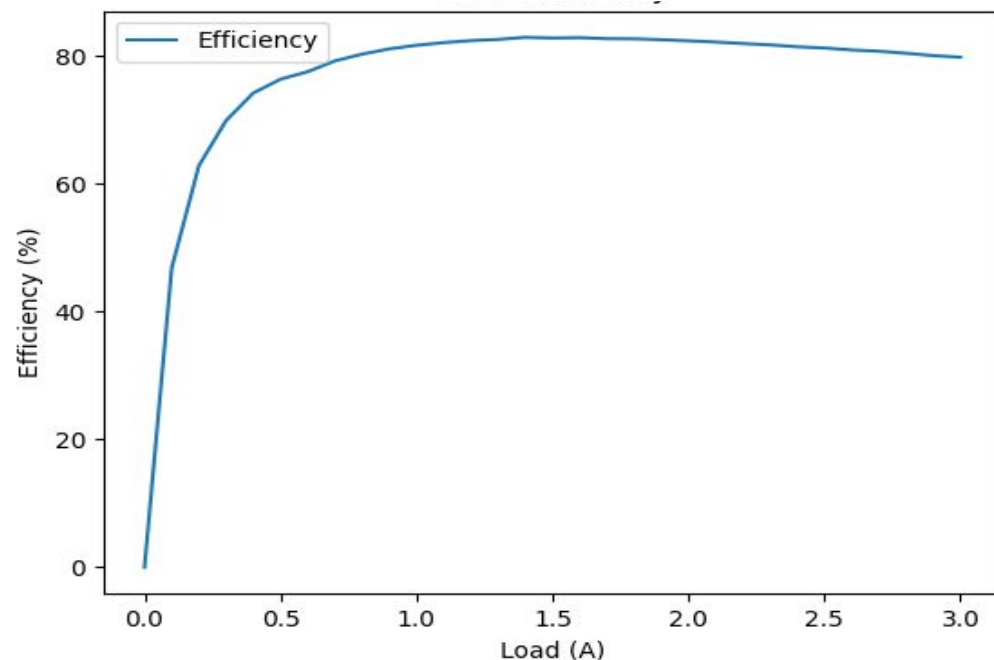
- C750 (Load Switch)

MGTYAVCC

0.88 V / 3.1 A

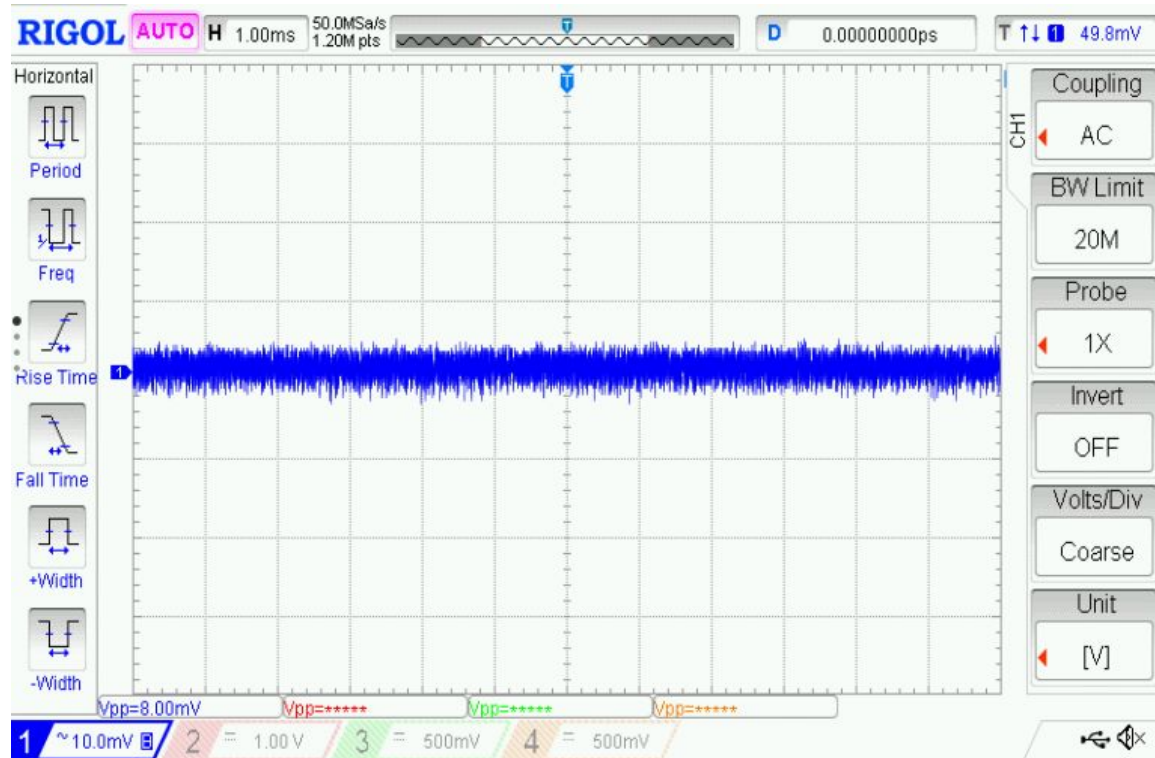
- C200 (Synchronous Buck)
- $F_{sw} = 1 \text{ MHz}$
- $L = 0.56 \text{ } \mu\text{H}$, P/N Wurth 744393440056
- $C = 4 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

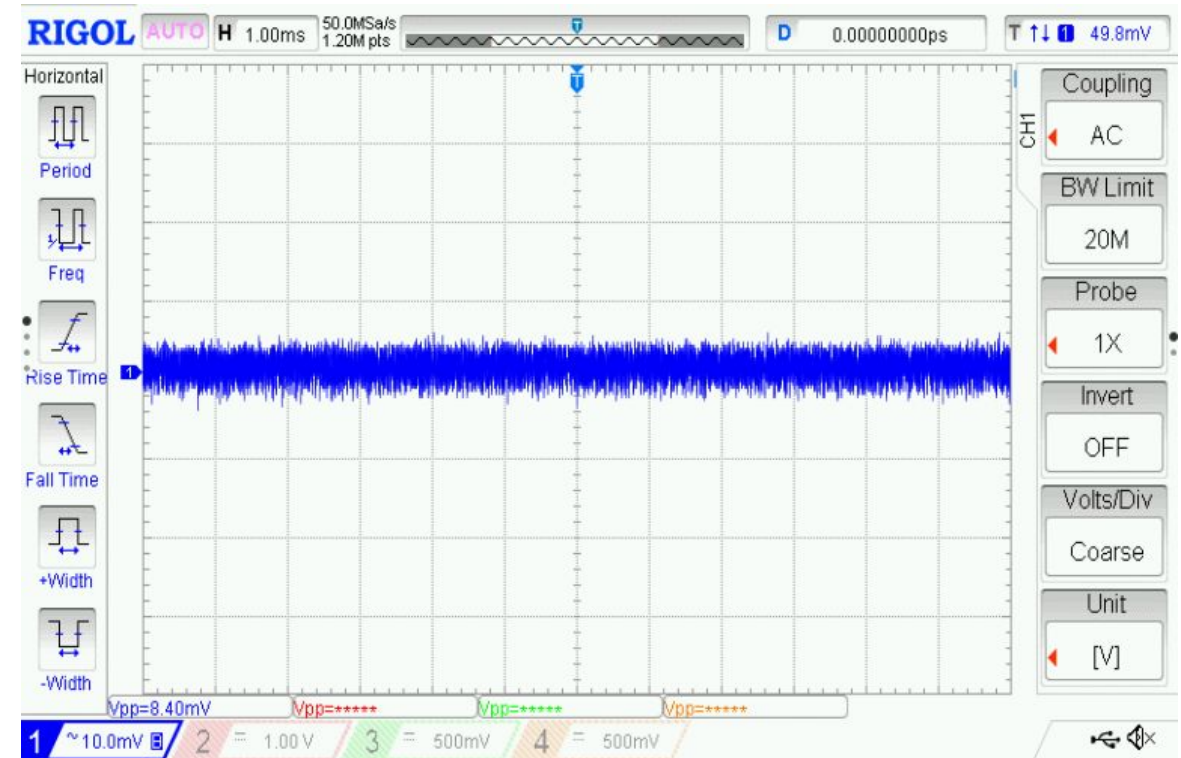


Vout = 0.88V
Transient 2.32A – 3.1A @ 10 A/μs
 $V_{PP} = 14.4 \text{ mV}$
Fsw = 1 MHz
L = 0.56 μH, C = 4x47 uF

Ripple



No Load
 $V_{PP} = 8\text{ mV}$



3.1 A Load
 $V_{PP} = 8.40\text{ mV}$

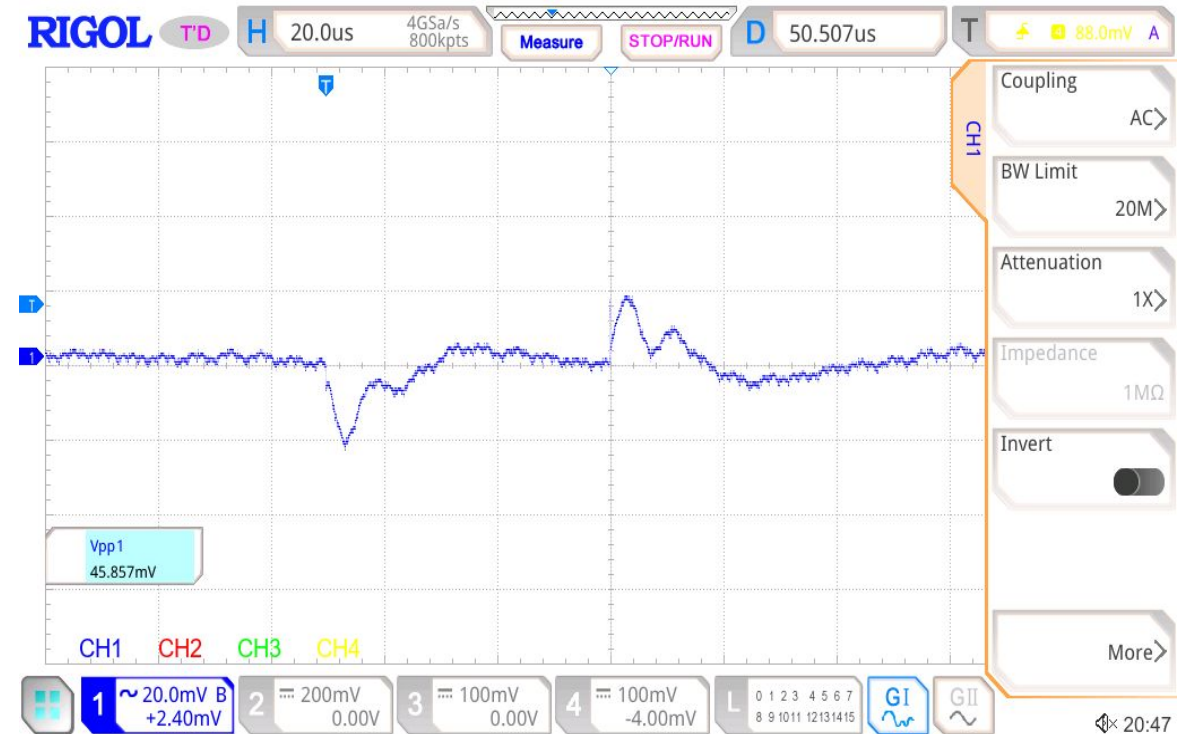
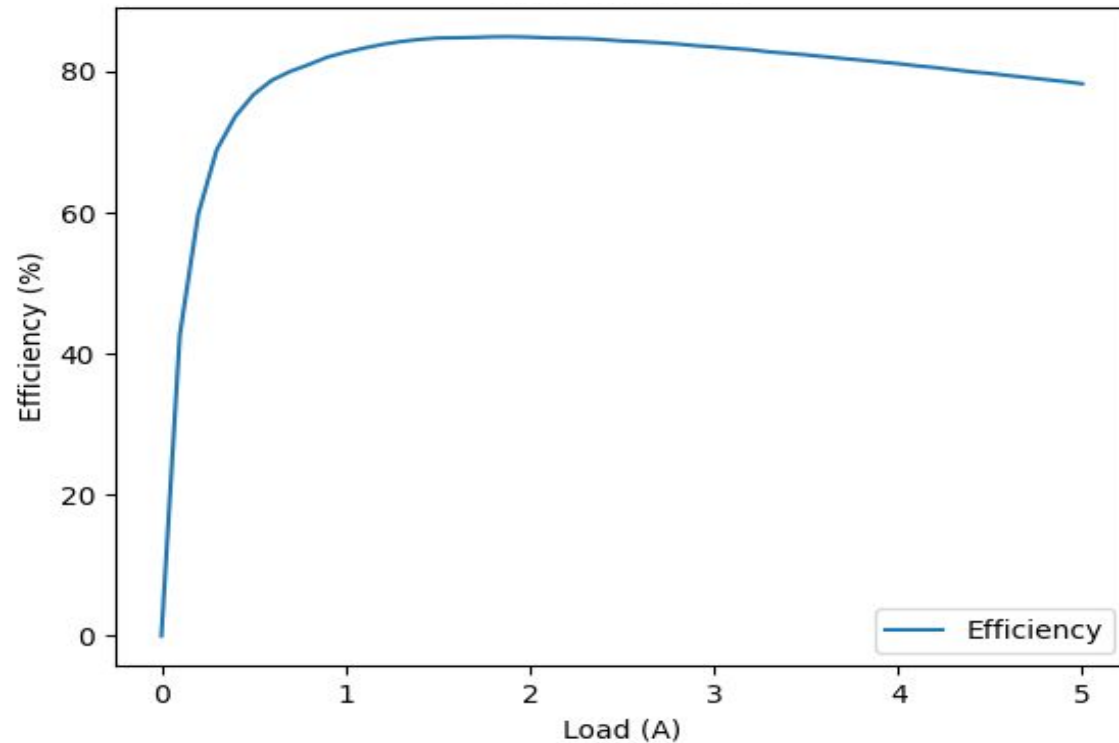
$V_{out} = 0.88\text{ V}$

MGTYAVTT

1.2 V / 4.9 A

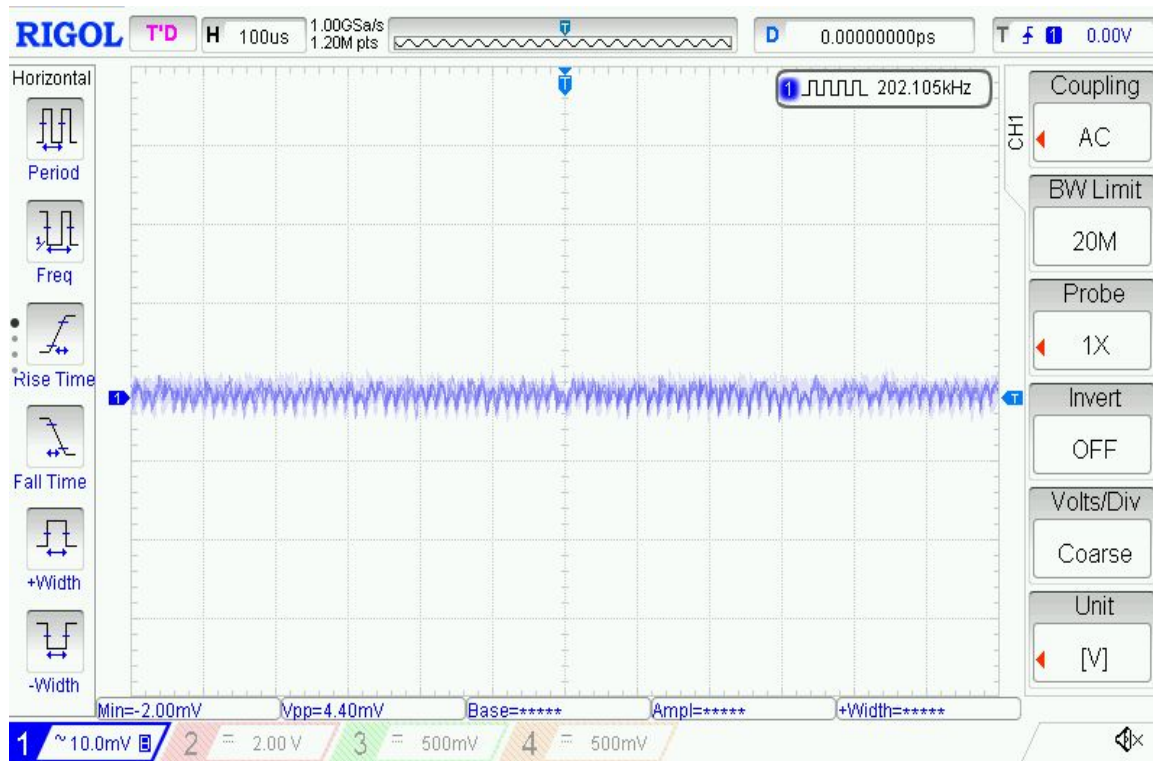
- C200 (Synchronous Buck)
- $F_{sw} = 0.571 \text{ MHz}$
- $L = 1.1 \text{ } \mu\text{H}$, P/N Wurth 744314110
- $C = 4 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

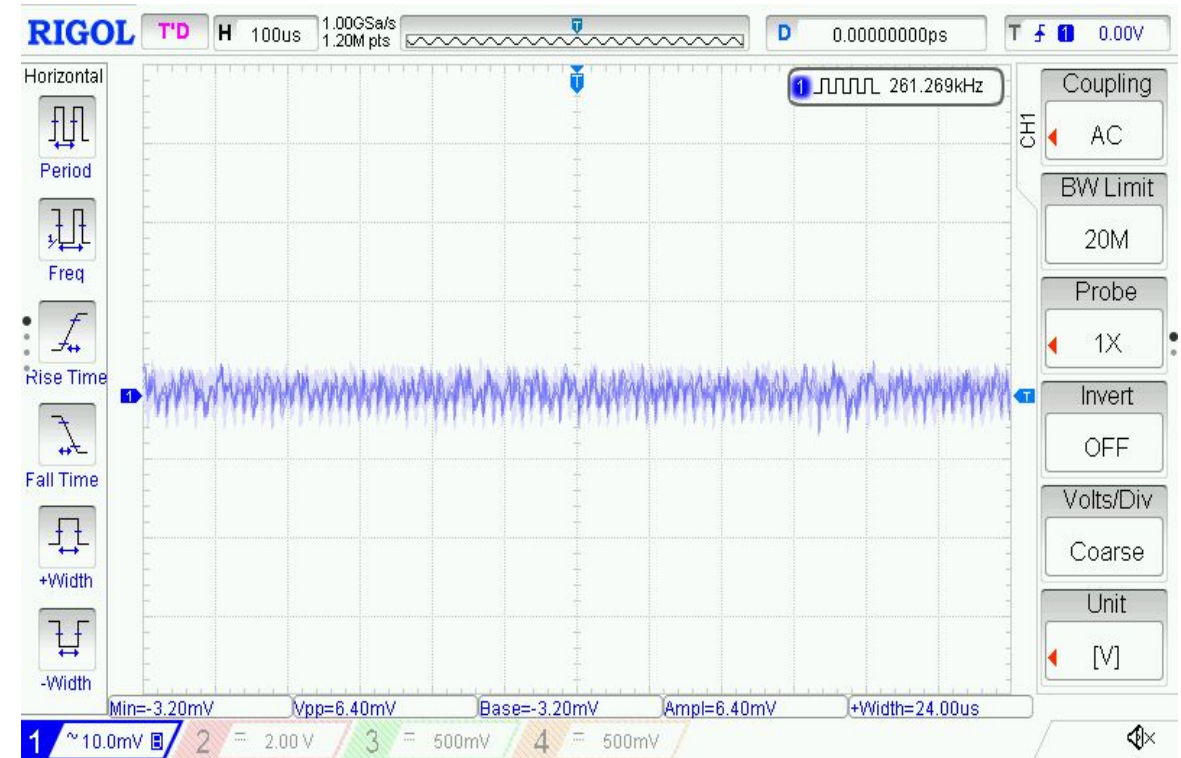


Vout = 1.2V
Transient 3.675 – 4.9A @ 10 A/μs
 $V_{PP} = 45.85 \text{ mV}$
Fsw = 0.571 MHz
L = 1.1 μH, C = 4x47 uF

Ripple



No Load
 $V_{PP} = 4.40 \text{ mV}$



4.9 A Load
 $V_{PP} = 6.40 \text{ mV}$

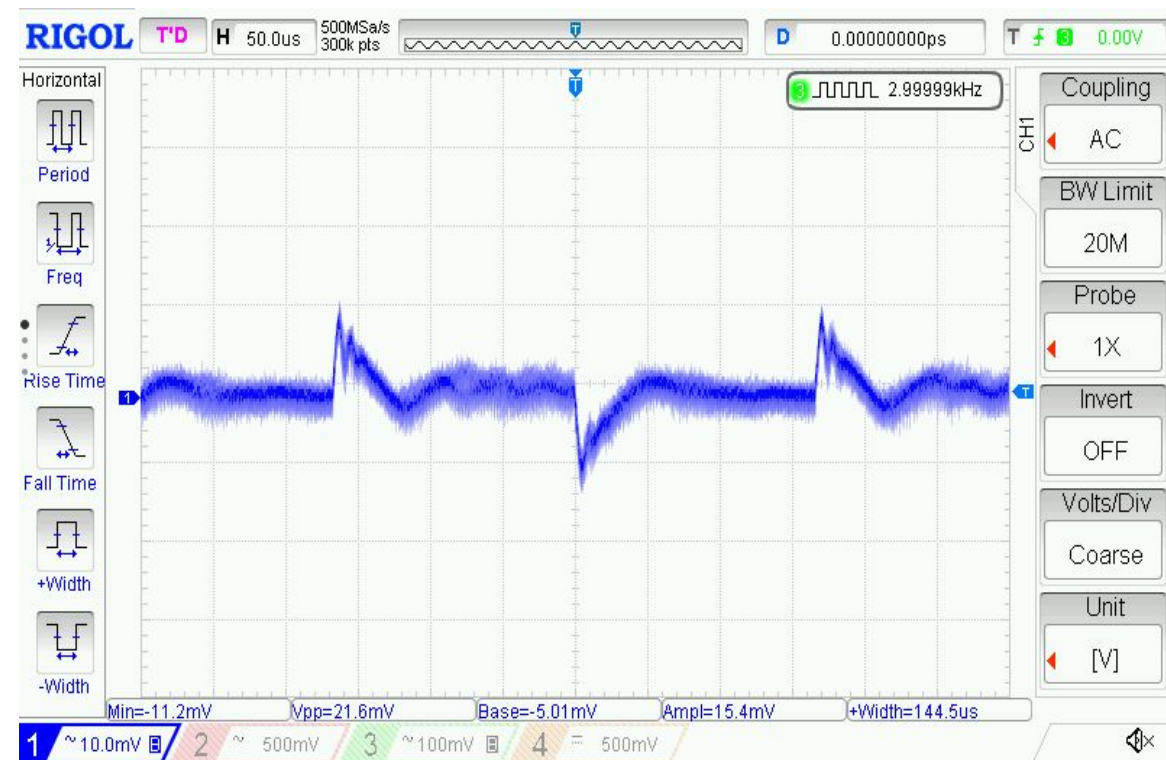
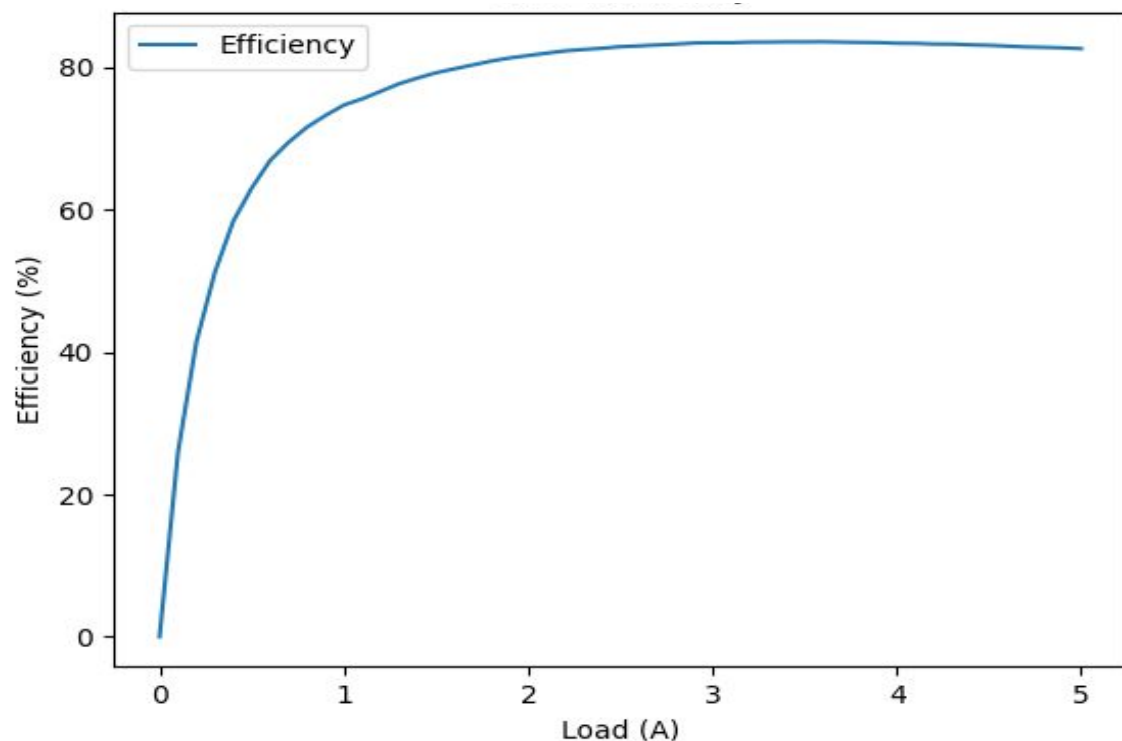
$V_{out} = 1.2 \text{ V}$

VDDQ

1.2 V / 5 A

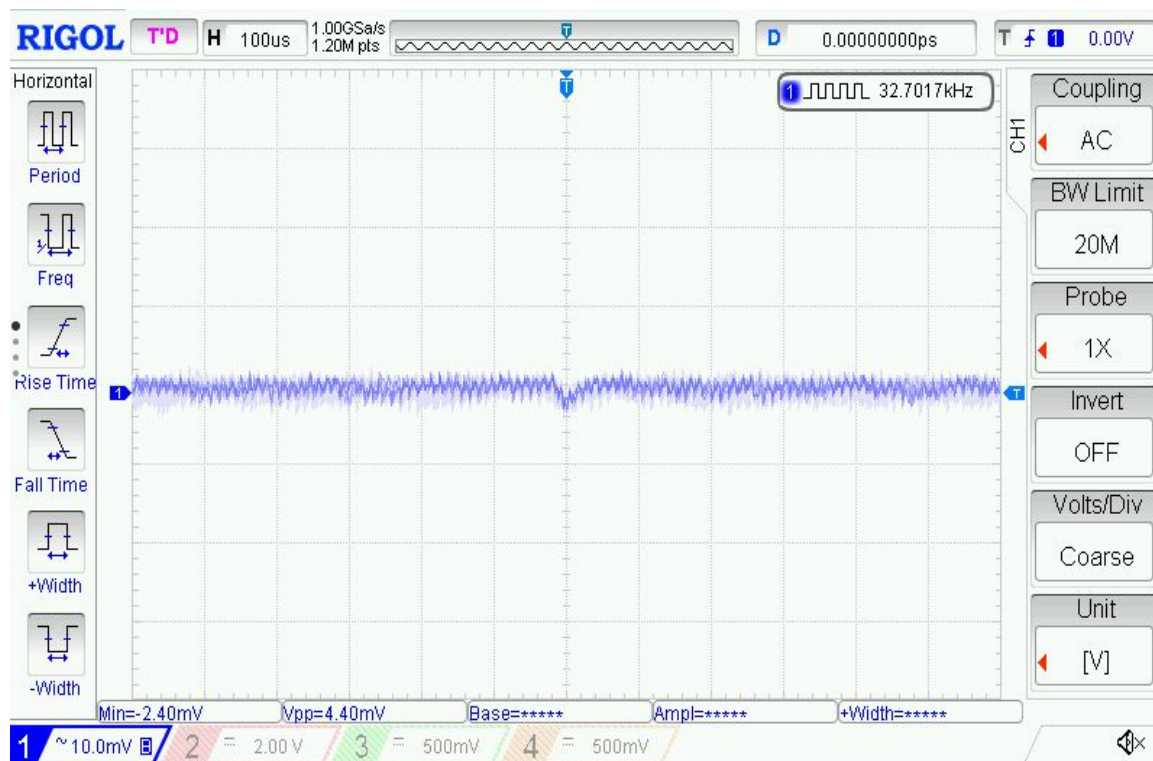
- C200 (Synchronous Buck)
- $F_{sw} = 1 \text{ MHz}$
- $L = 1.1 \text{ } \mu\text{H}$, P/N Wurth 744383560056
- $C = 4 \times 47 \text{ } \mu\text{F}$

Efficiency & Transient

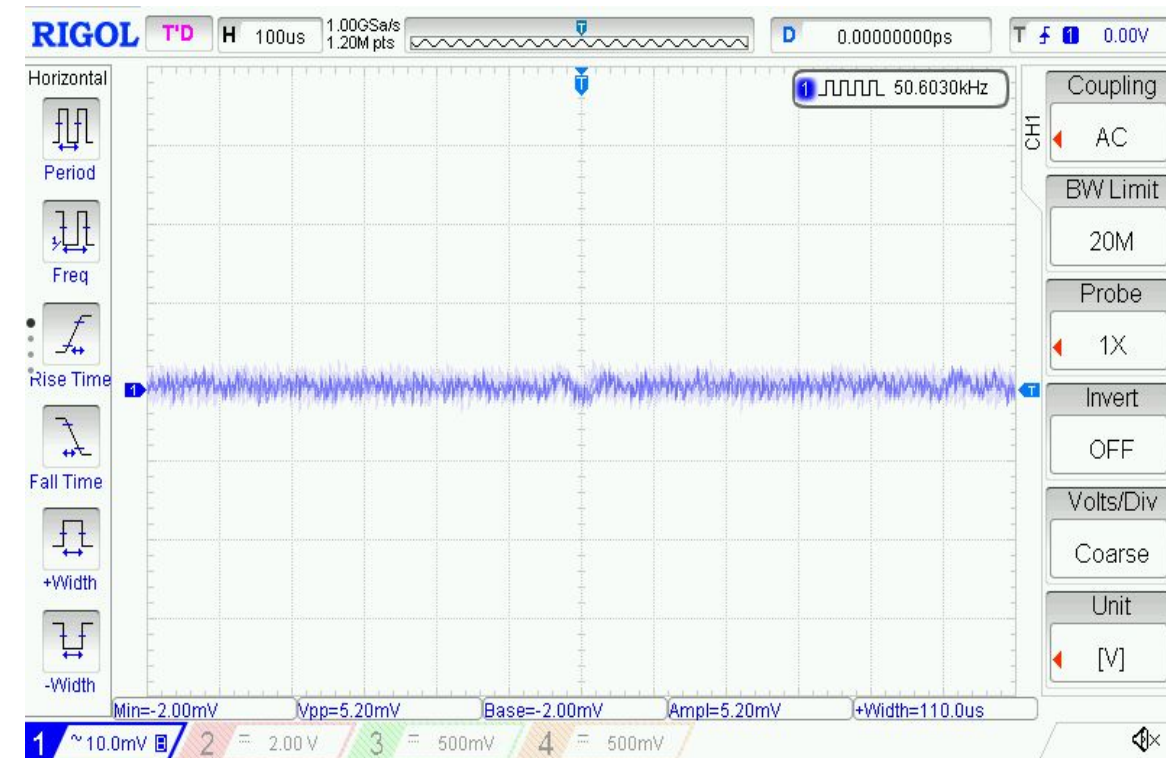


Vout = 1.2V
Transient 0.5 – 5A @ 10 A/ μ s
 V_{PP} = 21.6 mV
Fsw = 1 MHz
L = 1.1 μ H, C = 4x47 μ F

Ripple



No Load
 $V_{PP} = 4.40 \text{ mV}$



5 A Load
 $V_{PP} = 5.20 \text{ mV}$

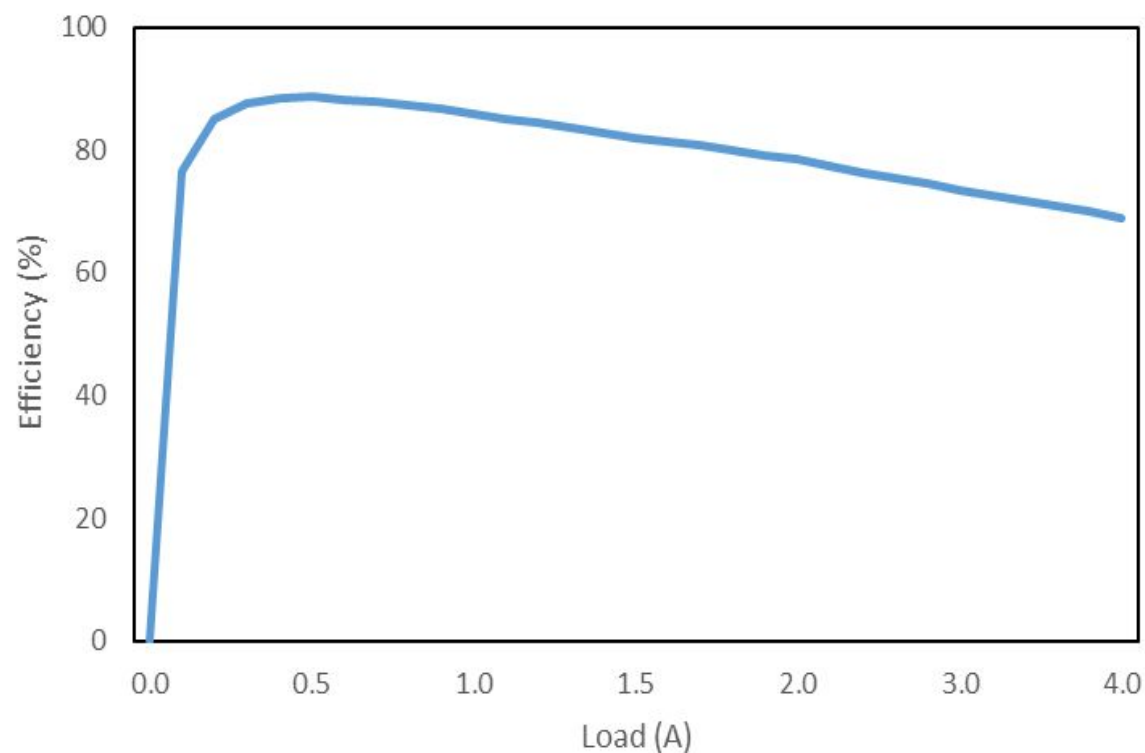
$V_{out} = 1.2 \text{ V}$

VTT

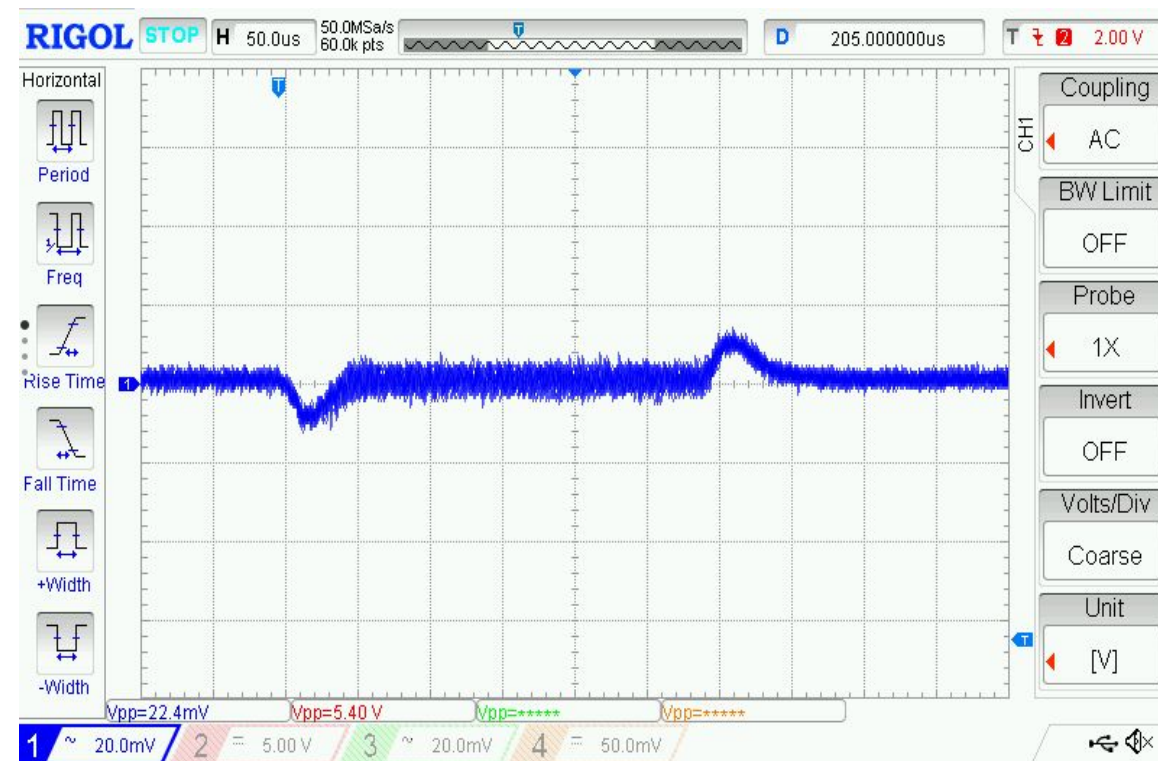
0.6 V / 2 A

- C210 (VTT Terminator)
- $F_{sw} = 1 \text{ MHz}$
- $L = 0.33 \text{ } \mu\text{H}$, P/N Wurth 744393440033
- $C = 8 \times 47 \text{ } \mu\text{F}$

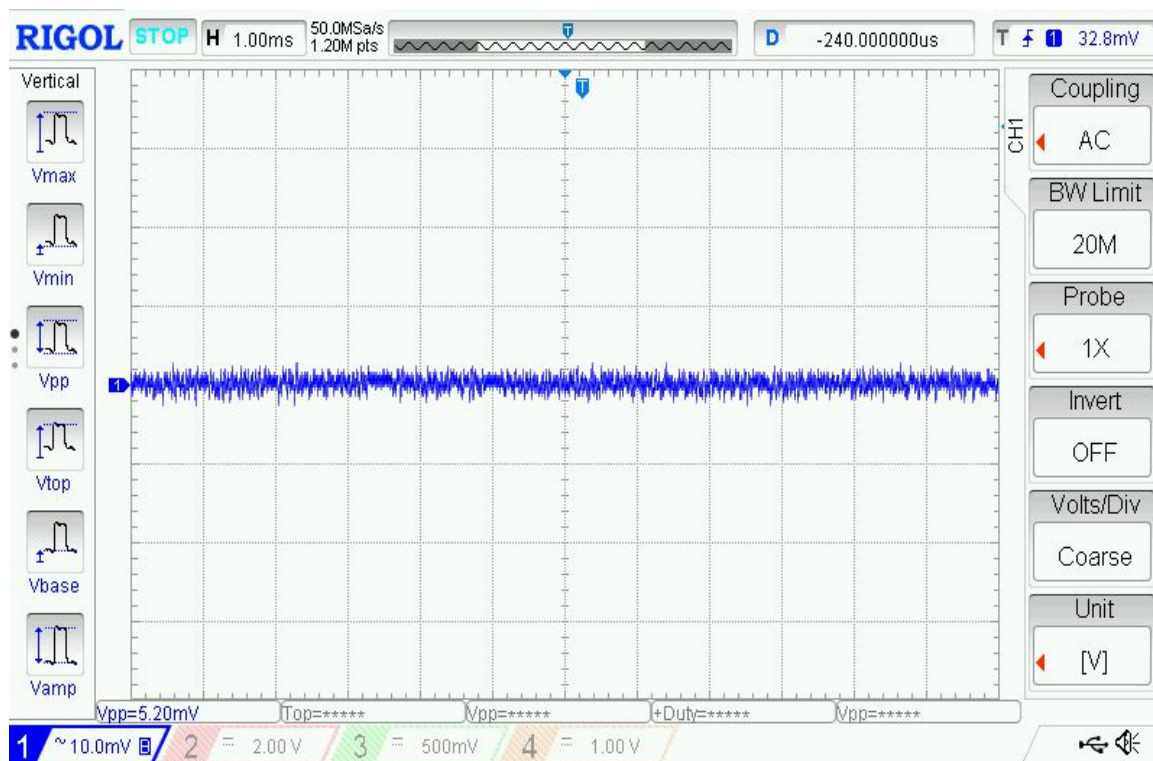
Efficiency & Transient



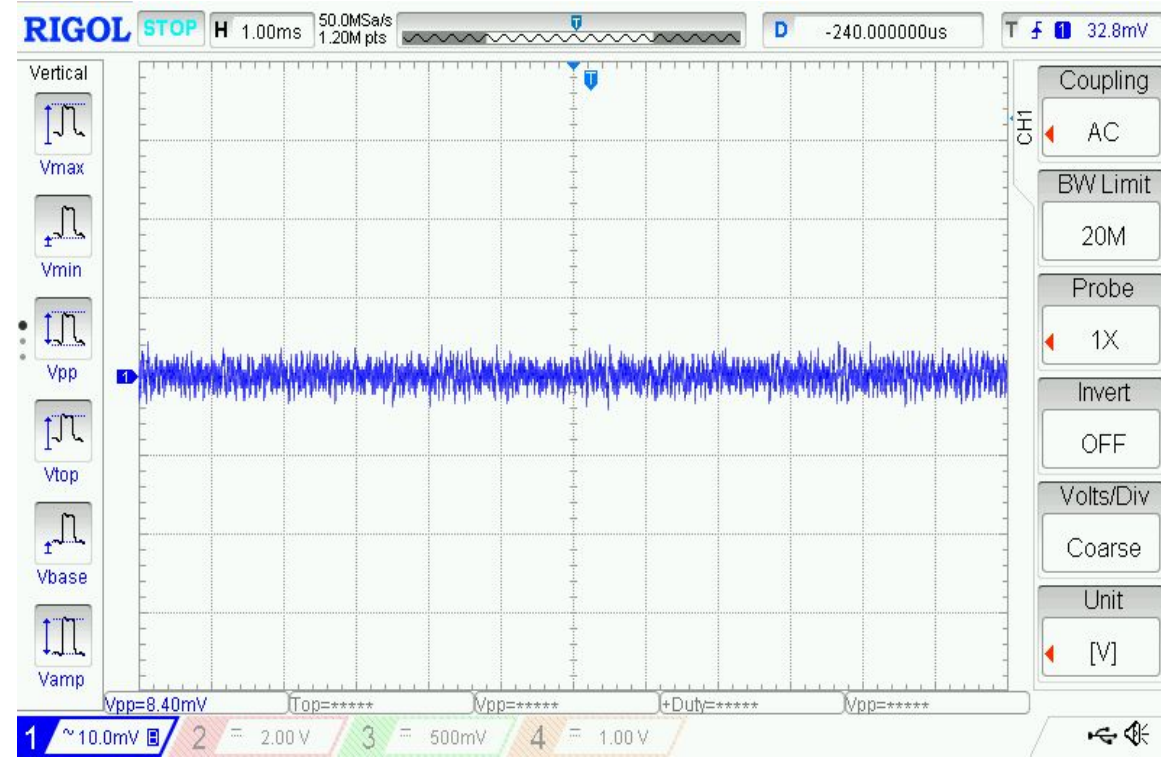
Vout = 0.6V
Transient 3 – 4A @ 10 A/ μ s
 $V_{PP} = 22.4$ mV
Fsw = 1 MHz
L = 0.33 μ H, C = 8x47 μ F



Ripple

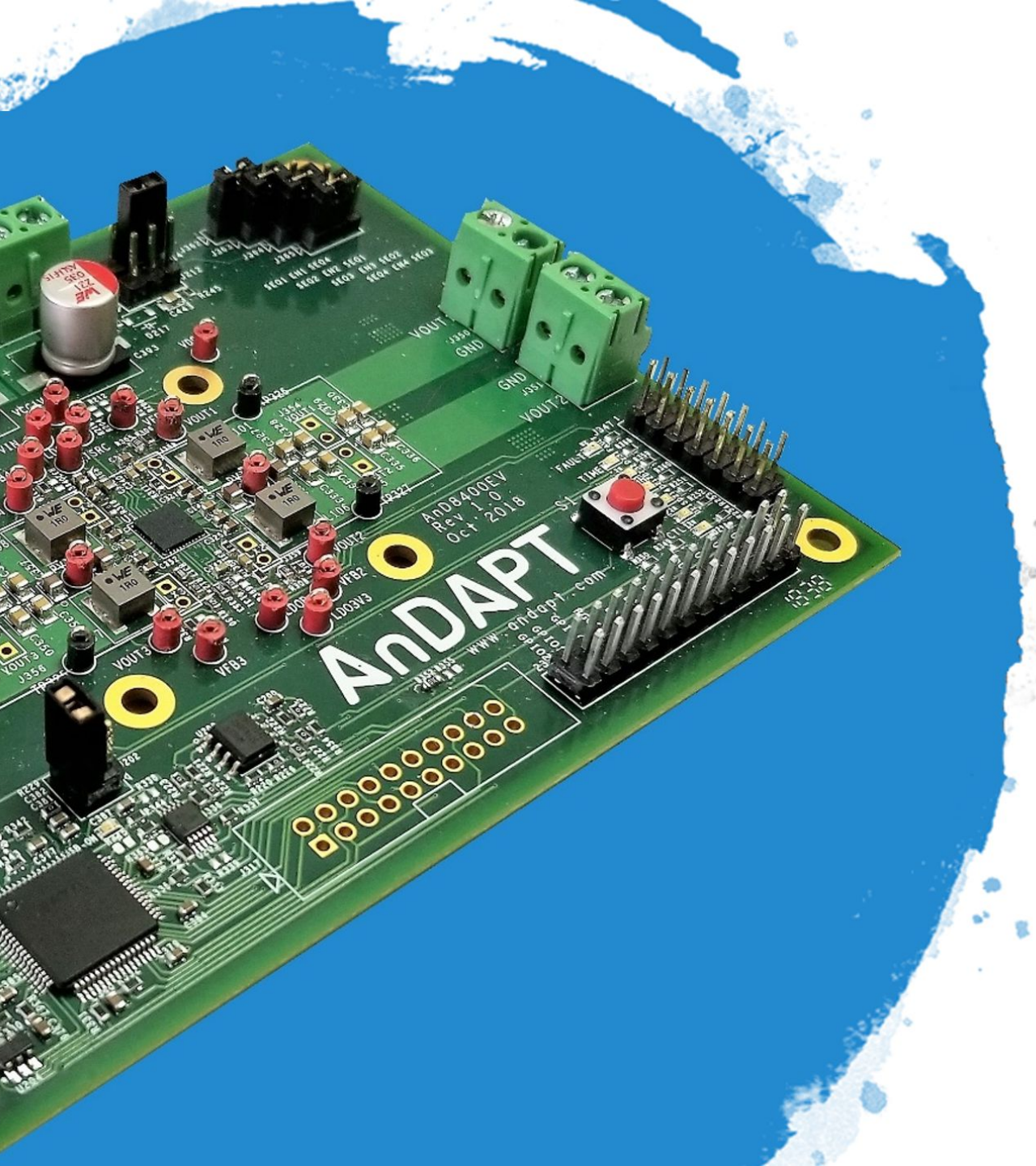


No Load
 $V_{PP} = 5.20 \text{ mV}$



4 A Load
 $V_{PP} = 8.40 \text{ mV}$

$V_{out} = 0.6 \text{ V}$



Thank You