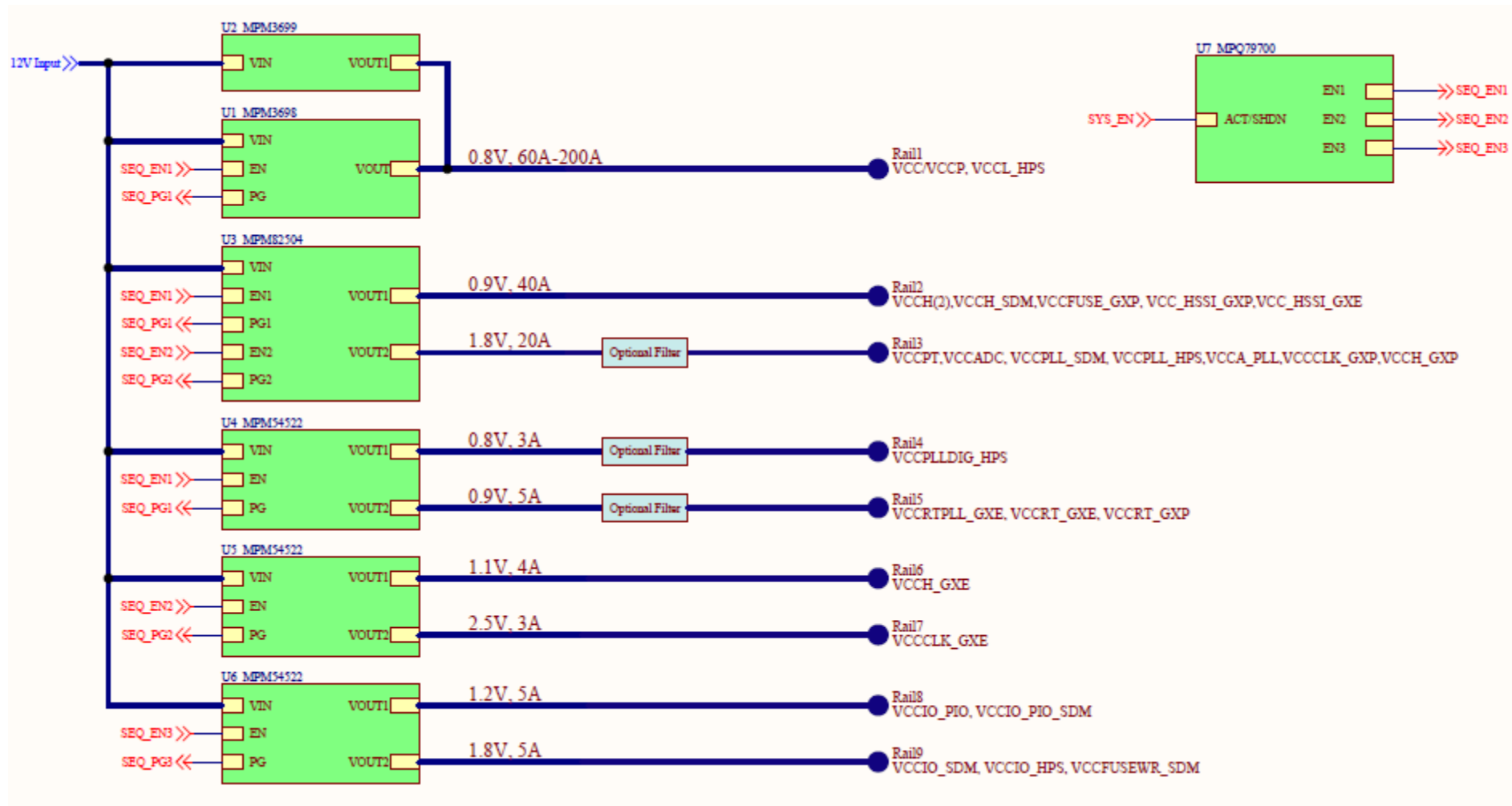


EVINAG-01-A Test Report

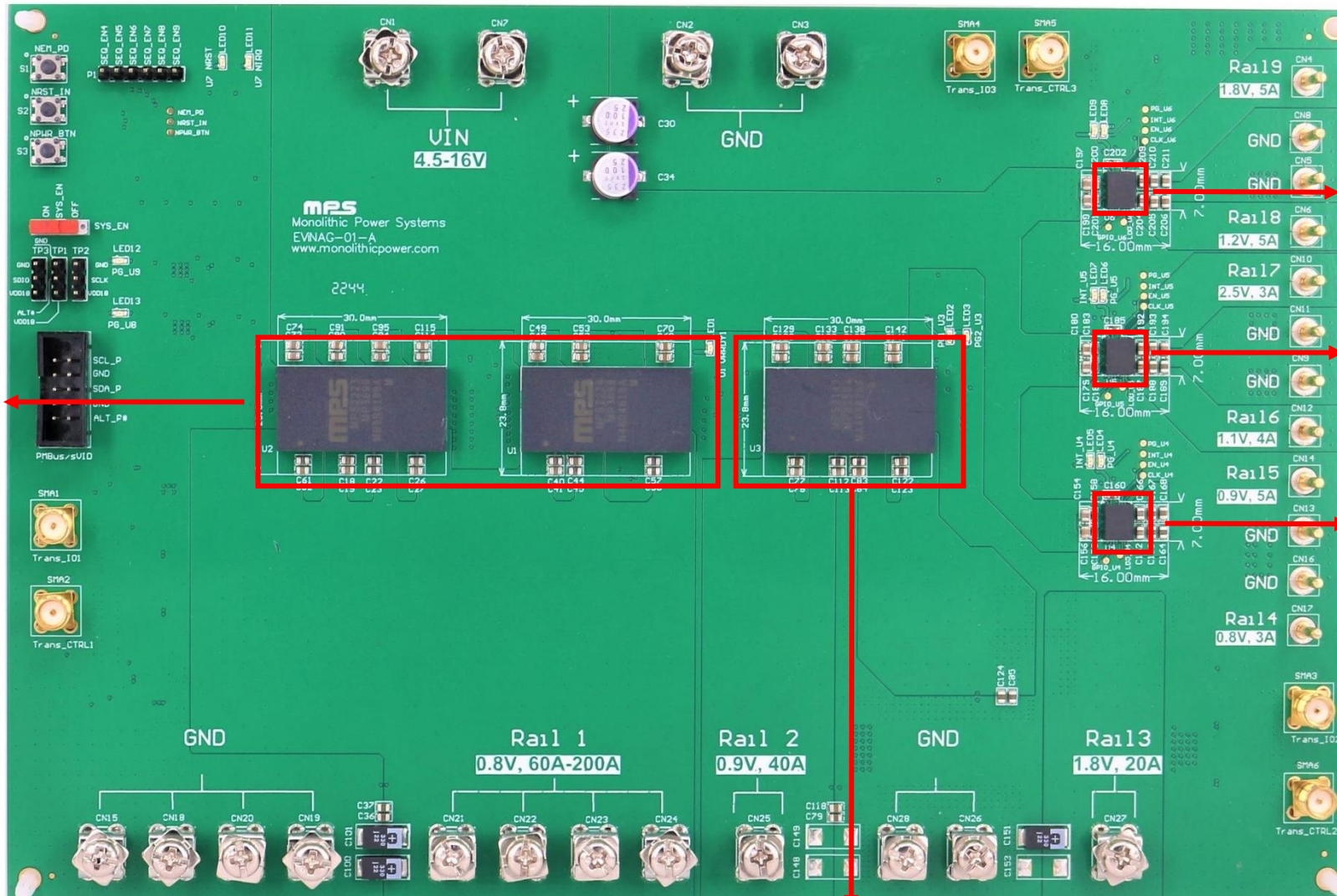
Feb 2023

1. Power Tree
2. Test Specifications
3. DC Voltage Accuracy
4. Rail1 – Ripple, Transient
5. Rail2 – Ripple, Transient
6. Rail3 – Ripple, Transient
7. Rail4 – Ripple, Transient
8. Rail5 – Ripple, Transient
9. Rail6 – Ripple, Transient
10. Rail7 – Ripple, Transient
11. Rail8 – Ripple, Transient
12. Rail9 – Ripple, Transient
13. Power sequence

EVINAG-01-A FPGA for Intel-Altera AGILEX



EVINAG-01-A FPGA for Intel-Altera AGILEX



Rail1:
MPM3698+MPM3699
0.8V, 60A-200A

Rail2/3:
MPM82504
0.9V, 40A/1.8V, 20A

Rail8/9:
MPM54522
1.2V, 5A/1.8V, 5A

Rail6/7:
MPM54522
1.1V, 4A/ 2.5V, 3A

Rail4/5:
MPM54522
0.8V, 3A/0.9V, 4A

Test Specs

Rail#	Rail name	MPS part	Spec	AC Ripple + DC Tolerance	Transient Load (Step size, Slew Rate)	Power Sequence
Rail1	VCC/VCCP, VCCL_HPS	MPM3698/99	0.8V, 60A-200A	+/-2%	100A→150A→100A, 100A/μs	1
Rail2	VCCH(2),VCCH_SDM,VCCFUSE_GXP, VCC_HSSI_GXP,VCC_HSSI_GXE	MPM82504 (Vout1)	0.9V, 40A	+/-2%	20A→30A→20A, 50A/μs	1
Rail3	VCCPT,VCCADC, VCCPLL_SDM, VCCPLL_HPS,VCCA_PLL,VCCCLK_GXP,VCCH_GXP	MPM82504 (Vout2)	1.8V, 20A	+/-2%	10A→15A→10A, 50A/μs	2
Rail4	VCCPLLDIG_HPS	MPM54522 (Vout1)	0.8V, 3A	+/-2%	1.5A→2.25A→1.5A, 10A/μs	1
Rail5	VCCRTPLL_GXE, VCCRT_GXE, VCCRT_GXP	MPM54522 (Vout2)	0.9V, 5A	+/-2%	2.5A→3.75A→2.5A, 10A/μs	1
Rail6	VCCH_GXE	MPM54522 (Vout1)	1.1V, 4A	+/-2%	2A→3A→2A, 10A/μs	2
Rail7	VCCCLK_GXE	MPM54522 (Vout2)	2.5V, 3A	+/-2%	1.5A→2.25A→1.5A, 10A/μs	2
Rail8	VCCIO_PIO, VCCIO_PIO_SDM	MPM54522 (Vout1)	1.2V, 5A	+/-3%	2.5A→3.75A→2.5A, 10A/μs	3
Rail9	VCCIO_SDM, VCCIO_HPS, VCCFUSEWR_SDM	MPM54522 (Vout2)	1.8V, 5A	+/-3%	2.5A→3.75A→2.5A, 10A/μs	3

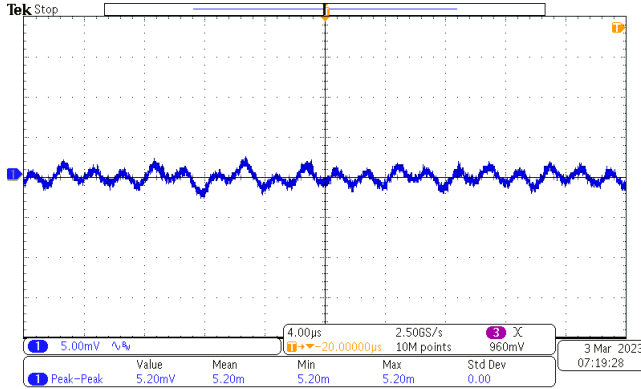
Test Results – DC Accuracy

Rail#	Rail name	MPS part	Vout (target)	Vout (No load)	Vout (50% load)	Vout (Full load)	Max DC error %
Rail1	VCC/VCCP, VCCL_HPS	MPM3698/99	0.8V, 60A-200A	0.800V	0.799V	0.799V	0.16%
Rail2	VCCH(2),VCCH_SDM,VCCFUSE_GXP, VCC_HSSI_GXP,VCC_HSSI_GXE	MPM82504 (Vout1)	0.9V, 40A	0.895V	0.894V	0.894V	0.11%
Rail3	VCCPT,VCCADC, VCCPLL_SDM, VCCPLL_HPS,VCCA_PLL,VCCCLK_GXP,VCCH_GXP	MPM82504 (Vout2)	1.8V, 20A	1.808V	1.809V	1.808V	0.05%
Rail4	VCCPLLDIG_HPS	MPM54522 (Vout1)	0.8V, 3A	0.802V	0.801V	0.802V	0.16%
Rail5	VCCRTPLL_GXE, VCCRT_GXE, VCCRT_GXP	MPM54522 (Vout2)	0.9V, 5A	0.899V	0.898V	0.897V	0.22%
Rail6	VCCH_GXE	MPM54522 (Vout1)	1.1V, 4A	1.098V	1.098V	1.097V	0.090%
Rail7	VCCCLK_GXE	MPM54522 (Vout2)	2.5V, 3A	2.499V	2.498V	2.497V	0.08%
Rail8	VCCIO_PIO, VCCIO_PIO_SDM	MPM54522 (Vout1)	1.2V, 5A	1.200V	1.119V	1.119V	0.08%
Rail9	VCCIO_SDM, VCCIO_HPS, VCCFUSEWR_SDM	MPM54522 (Vout2)	1.8V, 5A	1.811V	1.809V	1.807V	0.11%

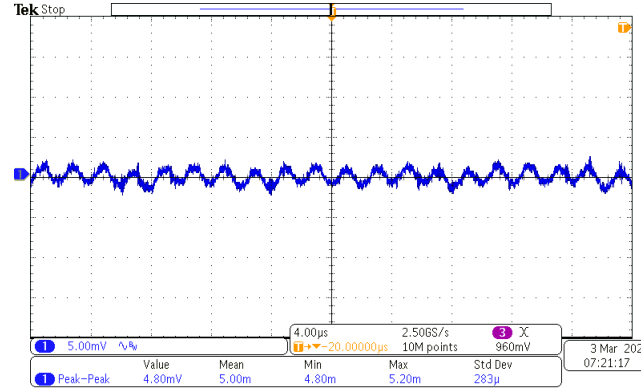
Test Results – Rail1 Ripple

Test condition: $V_{in}=12V$, $V_o=0.8V$, $F_{sw}=500k$, $C_{out}=40*47\mu F$ MLCC+ $6*330\mu F$ POSCAP, $100A/\mu s$,

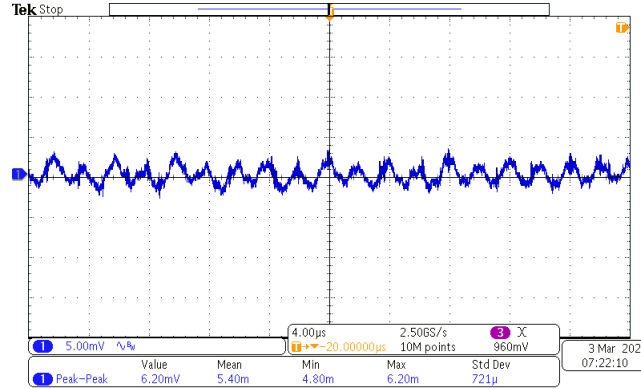
No Load=0A



Typ Load=100A



Max Load=200A



VOUT/AC

VOUT/AC

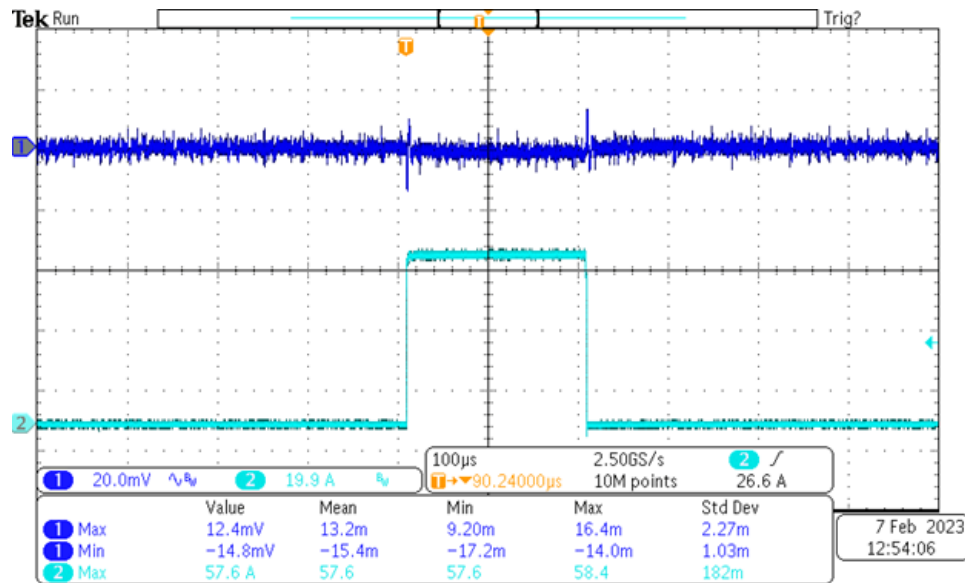
VOUT/AC

Parameter	Value(mV)
No Load	5.2
Typ load	4.8
Max load	5

Test Results – Rail1 Transients

Test condition: $V_{in}=12V$, $V_o=0.8V$, $F_{sw}=500k$, $C_{out}=40*47\mu F$ MLCC+ $6*330\mu F$ POSCAP, $100A/\mu s$,

IOUT=100A-150A-200A



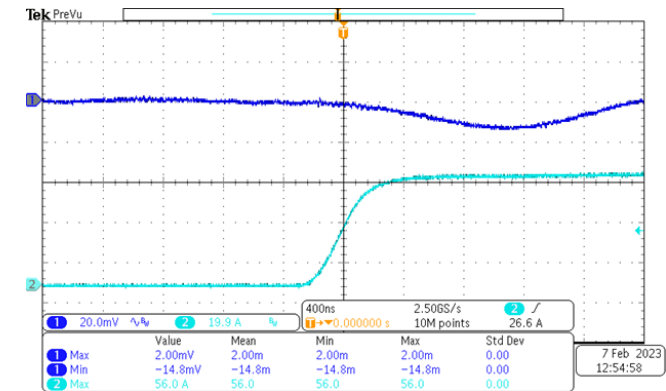
VOUT/AC

ITRAN

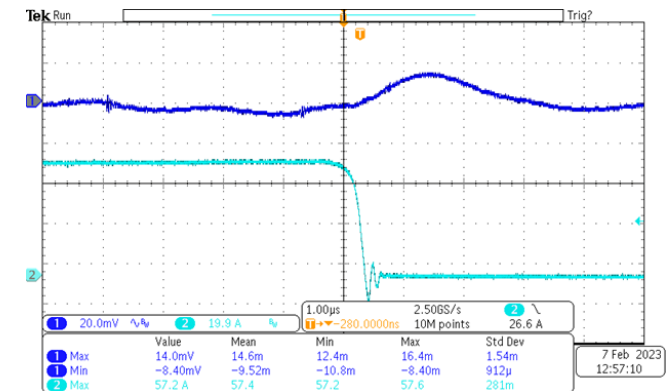
Note: 50A transient load is provided by MOSFET; 100A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-12.4	-1.55
Overshoot	14.8	1.85

Rising Edge



Falling Edge



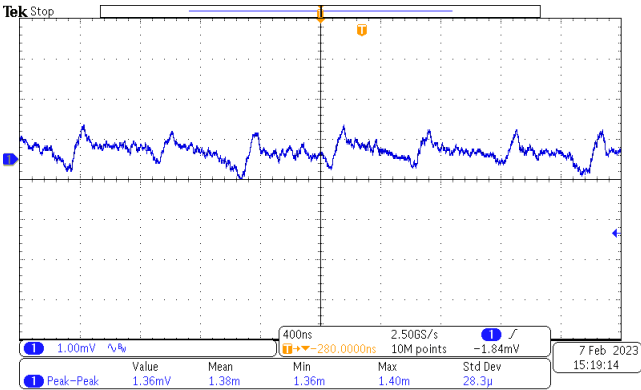
Test Results – Rail2 Ripple

Test condition: Vin=12V, Vo=0.9V, Fsw=1000k, Cout=12*47uF MLCC+1*330uF POSCAP, 50A/us

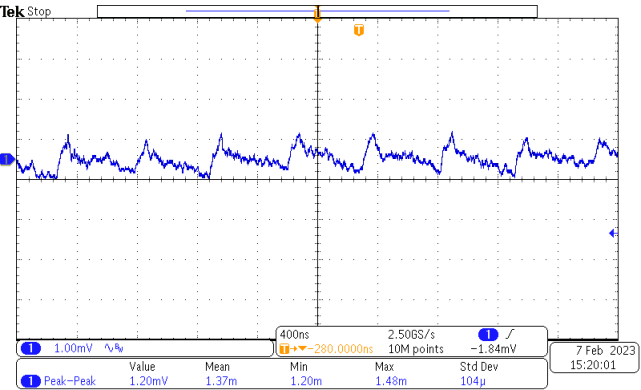
No Load=0A

Typ Load=20A

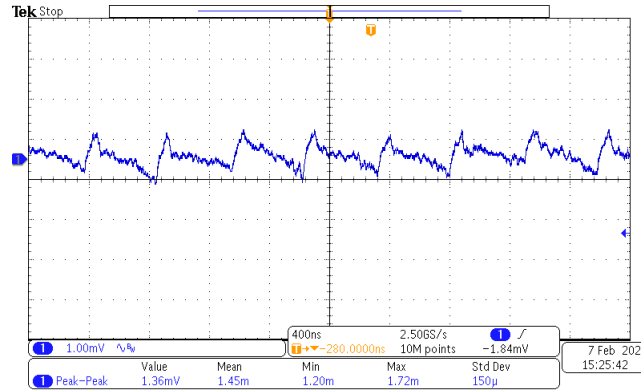
Max Load=40A



VOUT/AC



VOUT/AC



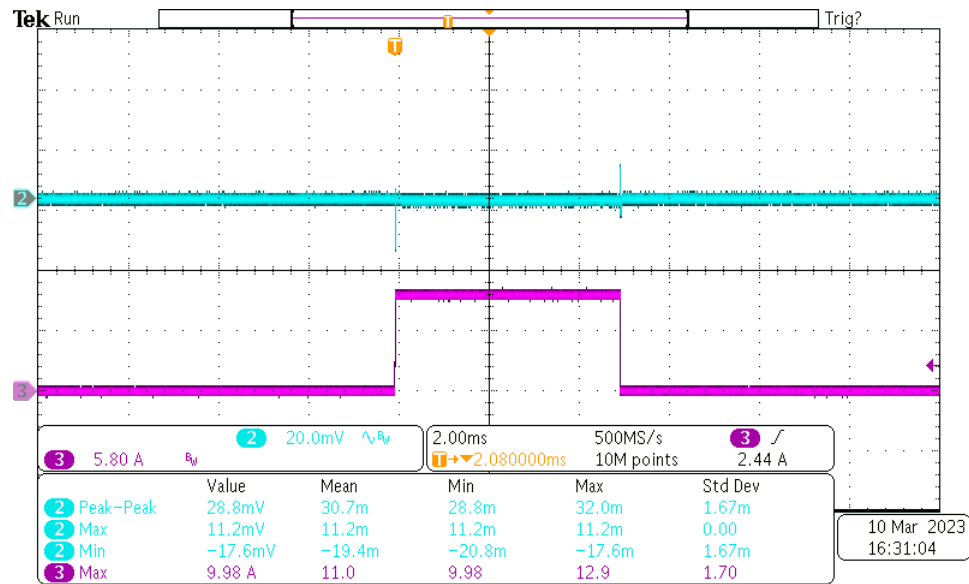
VOUT/AC

Parameter	Value(mV)
No Load	1.36
Typ load	1.2
Max load	1.36

Test Results – Rail2 Transients

Test condition: Vin=12V, Vo=0.9V, Fsw=1000k, Cout=12*47uF MLCC+1*330uF POSCAP, 50A/us

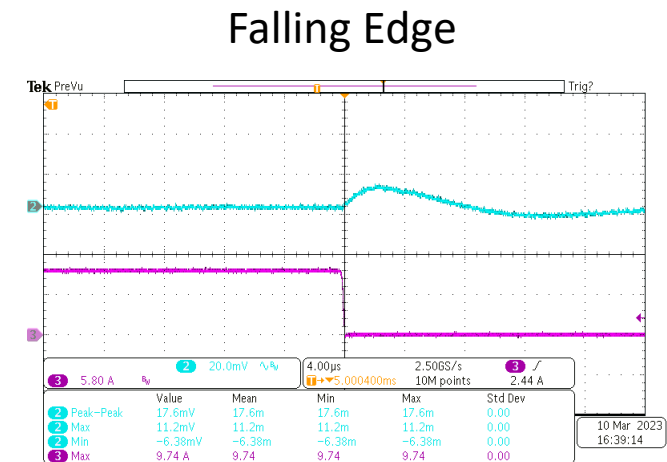
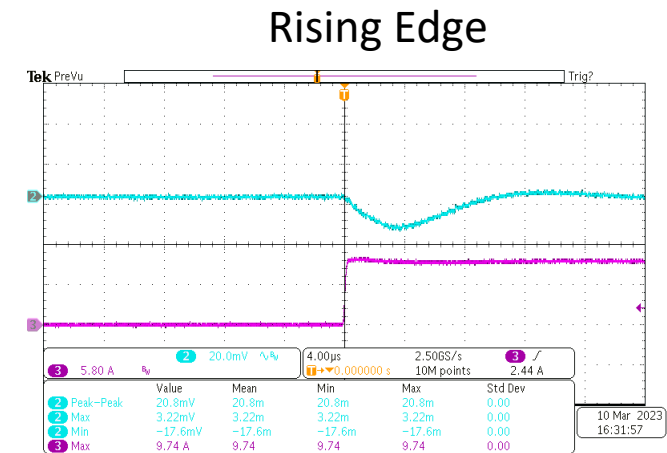
IOUT=20A-30A-20A



VOUT/AC ITRAN

Note: 10A transient load is provided by MOSFET; 20A load is provide by E-load(Chroma 63206A)

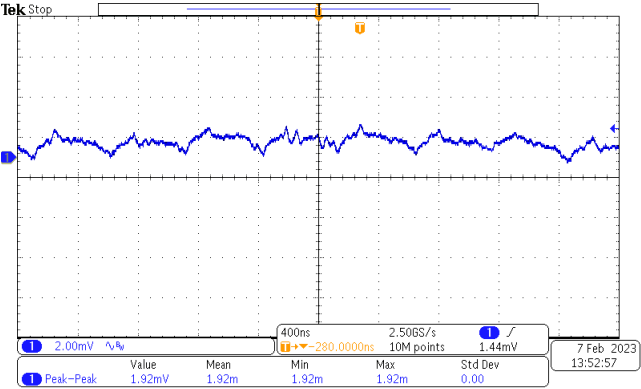
Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-17.6	1.95
Overshoot	11.2	1.24



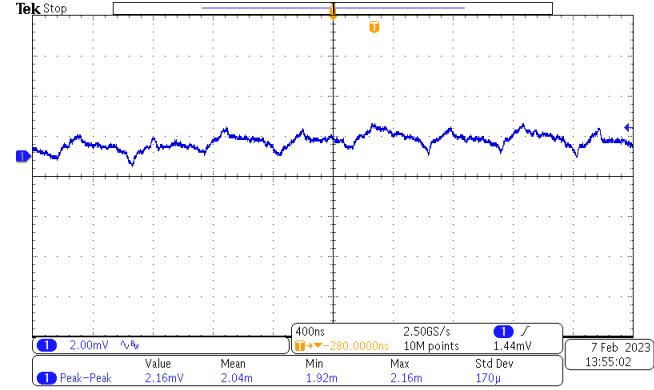
Test Results – Rail3 Ripple

Test condition: $V_{in}=12V$, $V_o=1.8V$, $F_{sw}=1000k$, $C_{out}=12*47\mu F$ MLCC+1*330 μF POSCAP, 50A/us

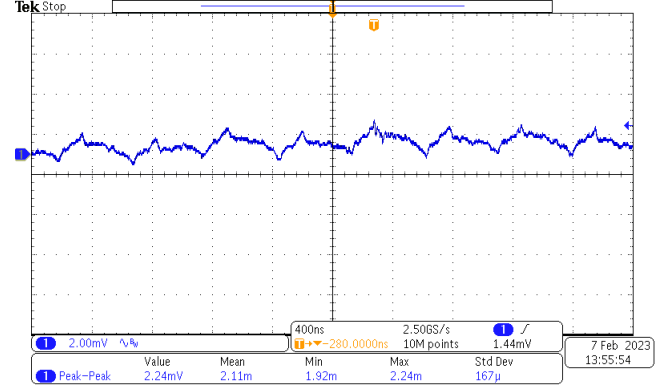
No Load=0A



Typ Load=10A



Max Load=20A



VOUT/AC

VOUT/AC

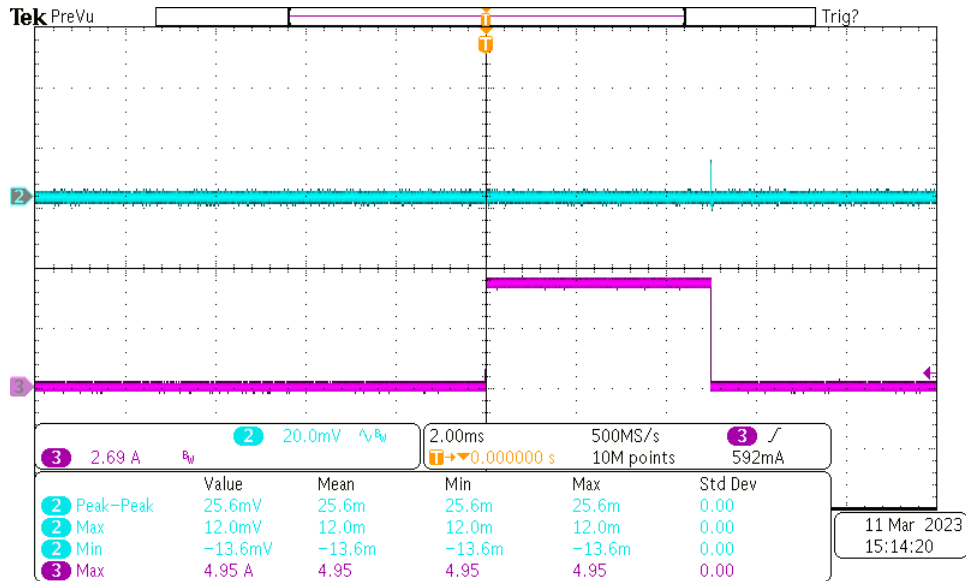
VOUT/AC

Parameter	Value(mV)
No Load	1.92
Typ load	2.16
Max load	2.24

Test Results – Rail3 Transients

Test condition: $V_{in}=12V$, $V_o=1.8V$, $F_{sw}=1000k$, $C_{out}=12*47\mu F$ MLCC+1*330 μF POSCAP, 50A/us

IOUT=10A-15A-10A



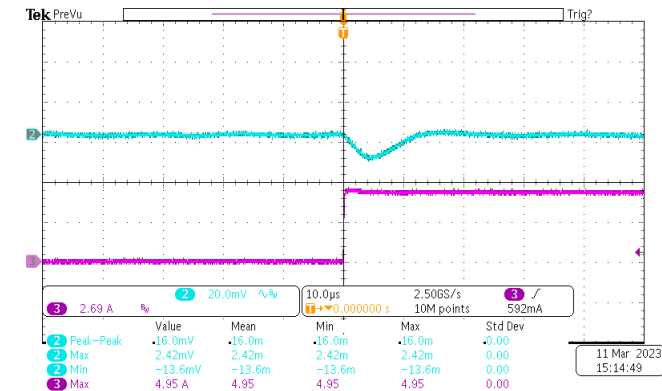
VOUT/AC

ITRAN

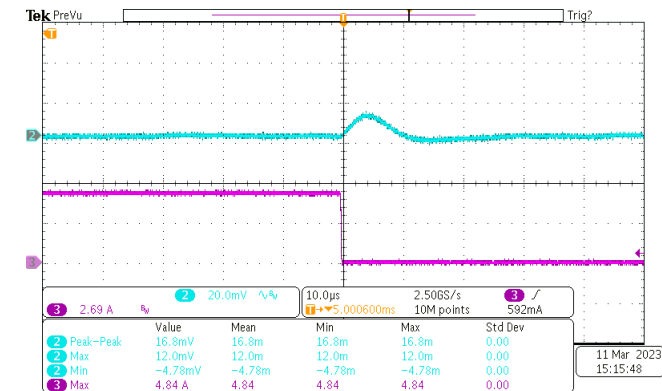
Notes: 5A transient load is provided by MOSFET; 10A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-13.6	-0.75
Overshoot	12	0.67

Rising Edge



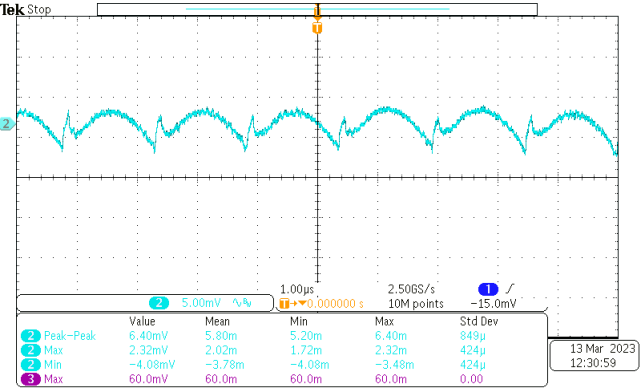
Falling Edge



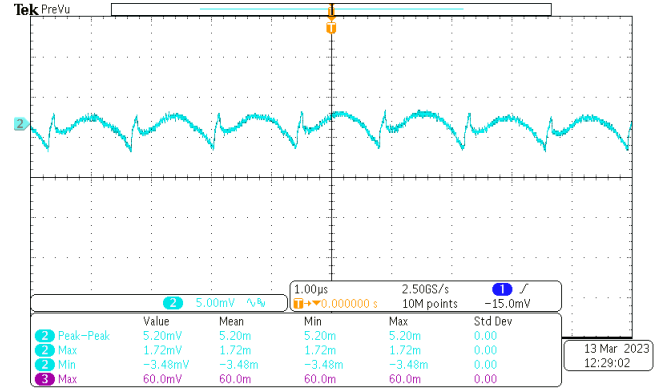
Test Results – Rail4 Ripple

Test condition: Vin=12V, Vo=0.8V, Fsw=750k, Cout=8*47uF MLCC, 10A/us

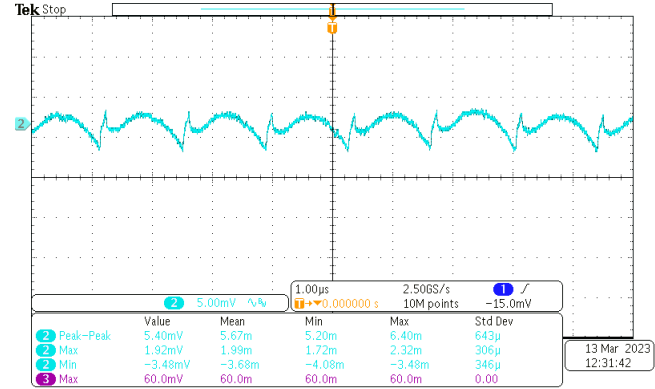
No Load=0A



Typ Load=1.5A



Max Load=3A



VOUT/AC

VOUT/AC

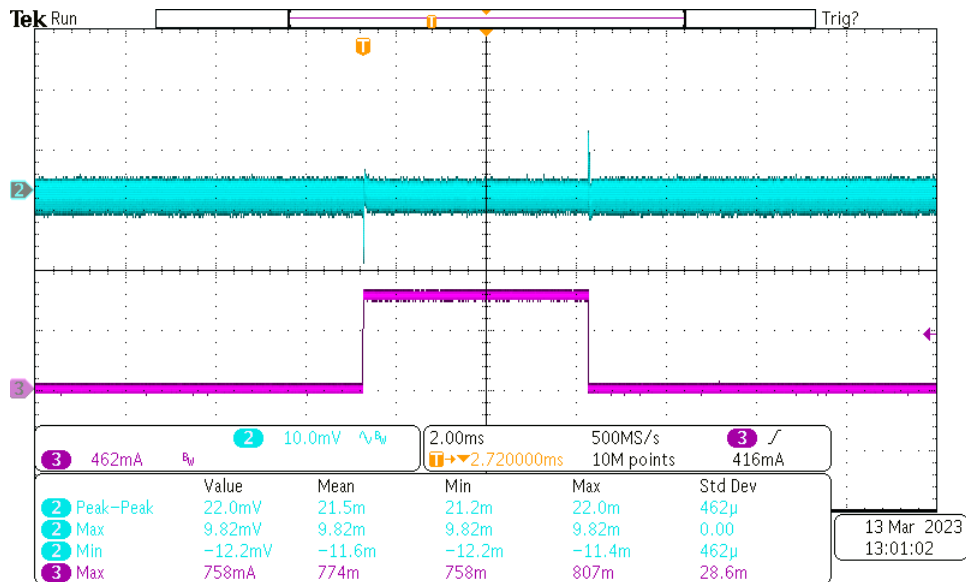
VOUT/AC

Parameter	Value(mV)
No Load	6
Typ load	5.4
Max load	5.2

Test Results – Rail4 Transients

Test condition: $V_{in}=12V$, $V_o=0.8V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/\mu s$

IOUT=1.5A-2.25A-1.5A



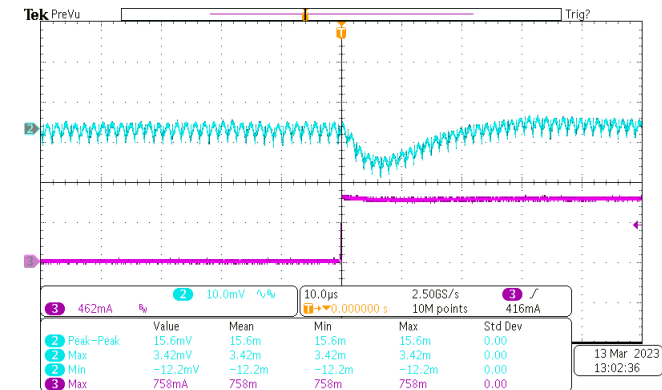
VOUT/AC

ITRAN

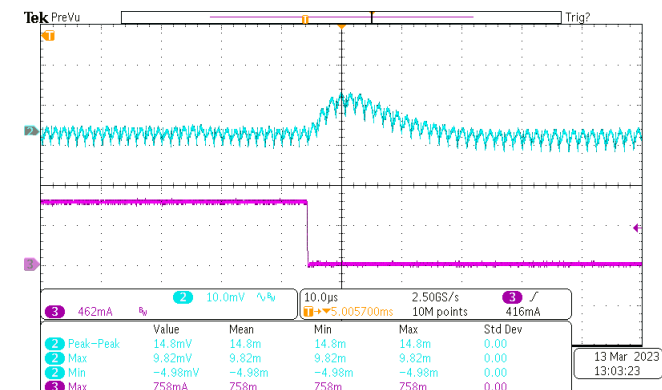
Notes: 0.75A transient load is provided by MOSFET; 1.5A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-12.2	-1.525
Overshoot	9.82	1.22

Rising Edge



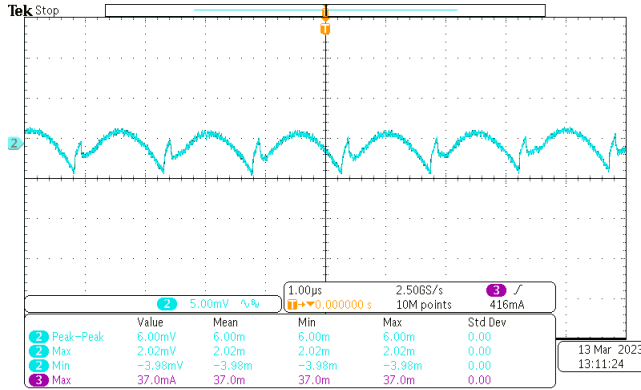
Falling Edge



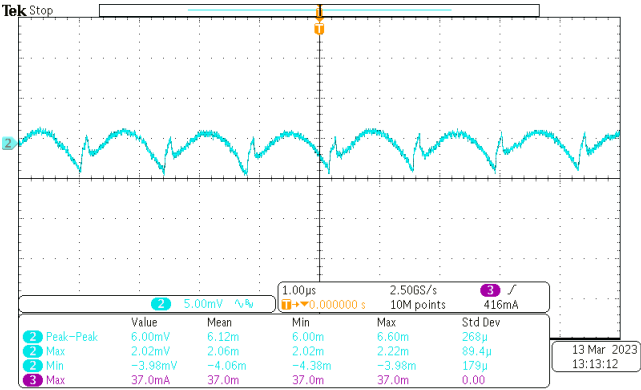
Test Results – Rail5 Ripple

Test condition: Vin=12V, Vo=0.9V, Fsw=750k, Cout=8*47uF MLCC, 10A/us

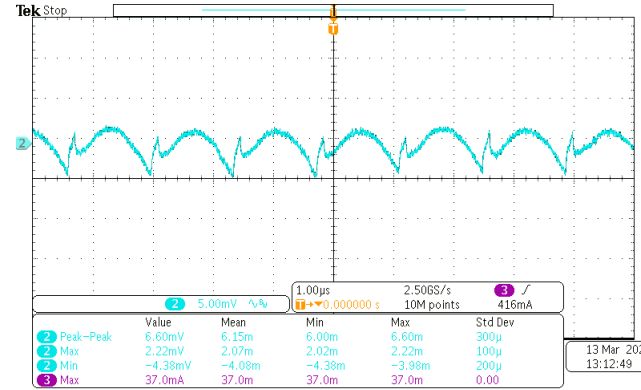
No Load=0A



Typ Load=2.5A



Max Load=5A



VOUT/AC

VOUT/AC

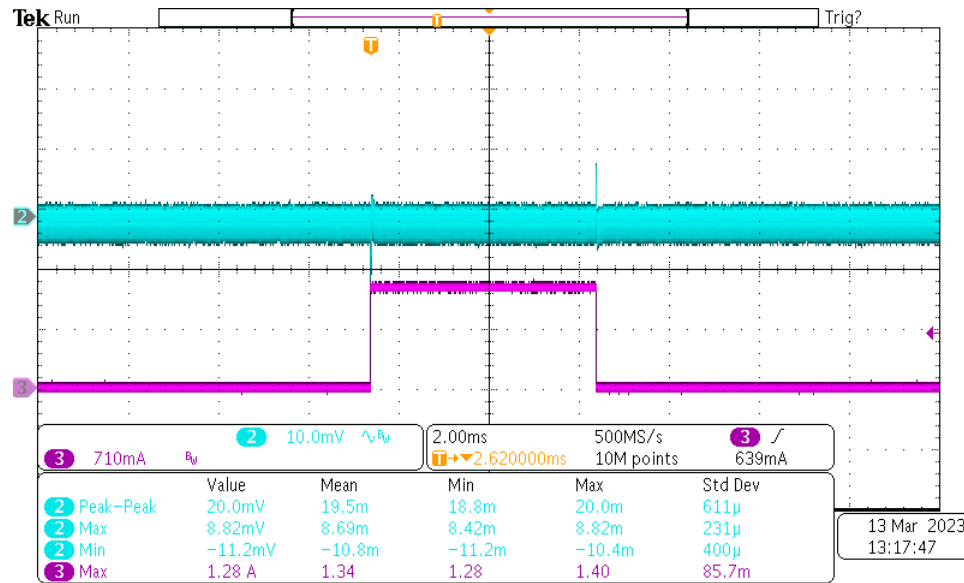
VOUT/AC

Parameter	Value(mV)
No Load	6
Typ load	6
Max load	6.6

Test Results – Rail5 Transients

Test condition: $V_{in}=12V$, $V_o=0.9V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/\mu s$

IOUT=2.5A-3.75A-2.5A



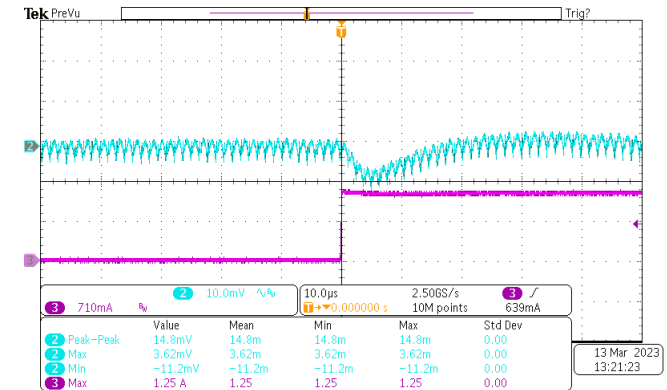
VOUT/AC

ITRAN

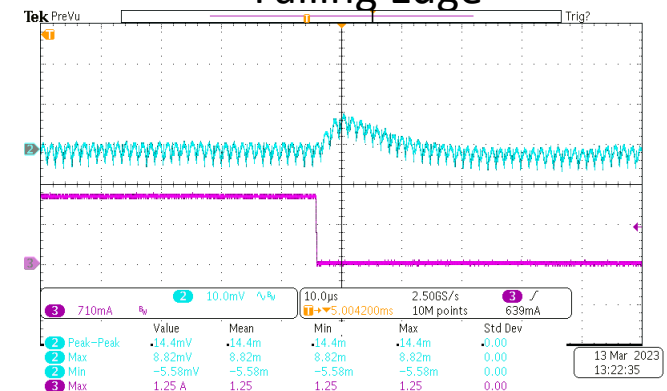
Notes: 1.25A transient load is provided by MOSFET; 2.5A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-11.2	1.24
Overshoot	8.82	0.92

Rising Edge



Falling Edge



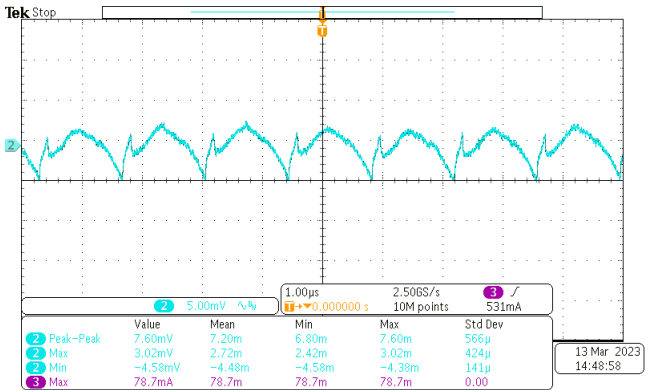
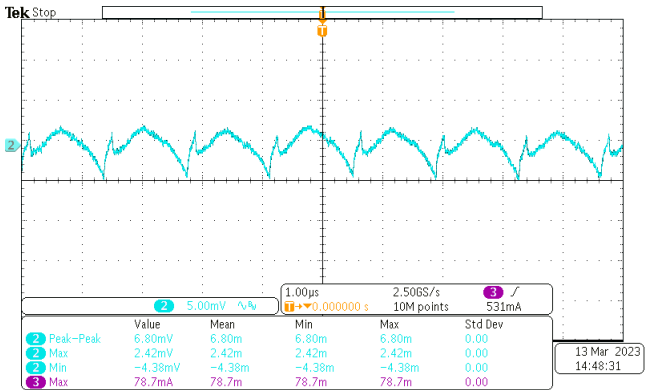
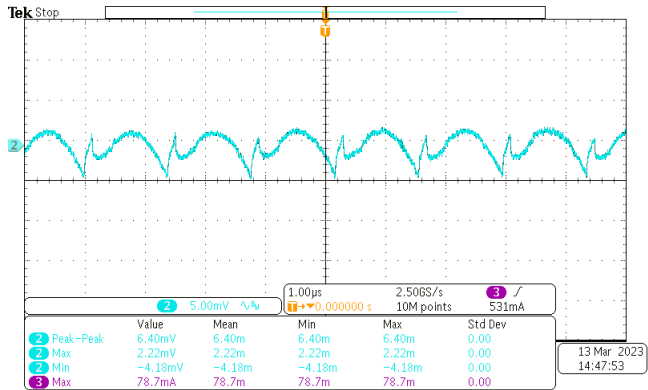
Test Results – Rail6 Ripple

Test condition: $V_{in}=12V$, $V_o=1.1V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/us$

No Load=0A

Typ Load=2A

Max Load=4A



VOUT/AC

VOUT/AC

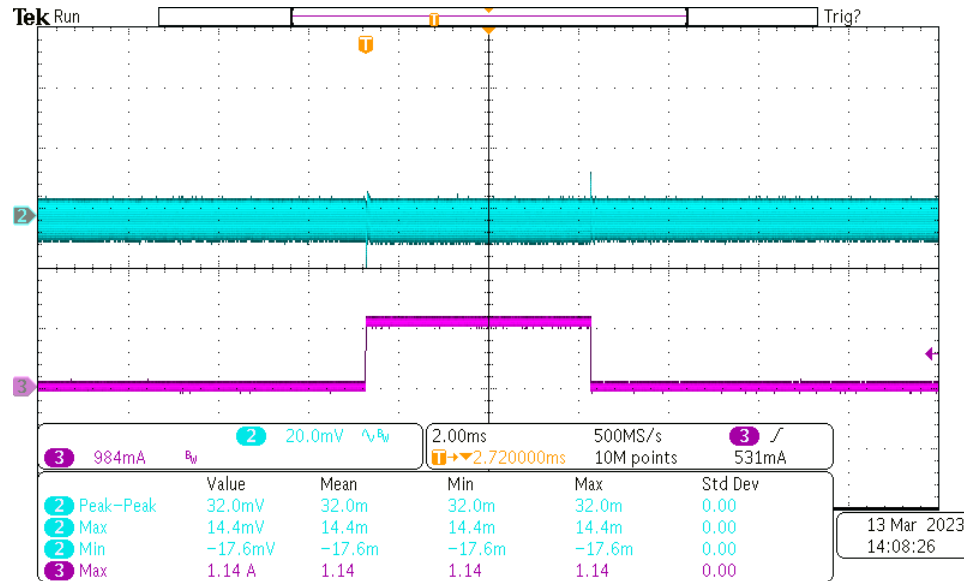
VOUT/AC

Parameter	Value(mV)
No Load	6.4
Typ load	6.8
Max load	7.6

Test Results – Rail6 Transients

Test condition: $V_{in}=12V$, $V_o=1.1V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/us$

IOUT=2A-3A-2A



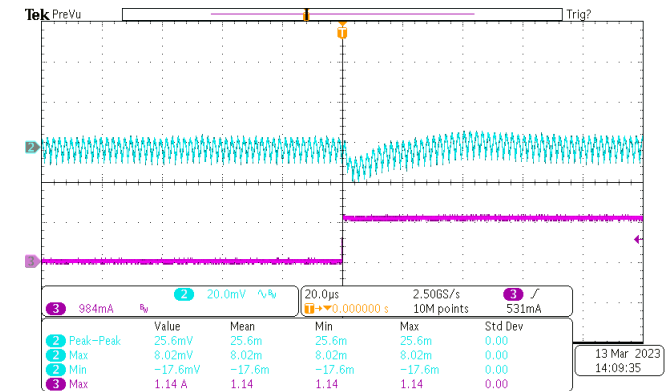
VOUT/AC

ITRAN

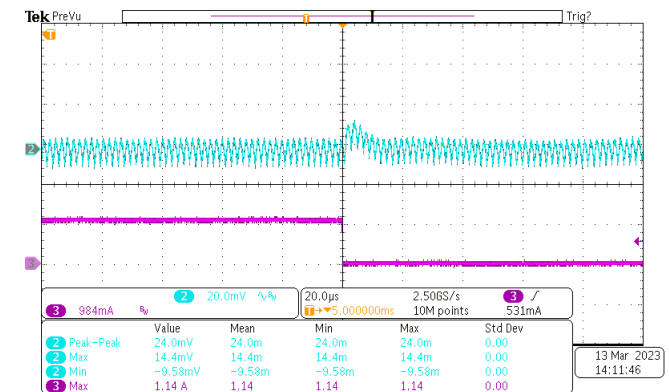
Notes: 1A transient load is provided by MOSFET; 2A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-17.6	1.6
Overshoot	14.4	1.31

Rising Edge



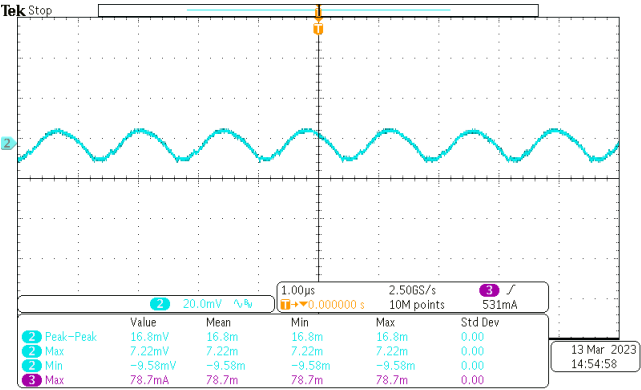
Falling Edge



Test Results – Rail7 Ripple

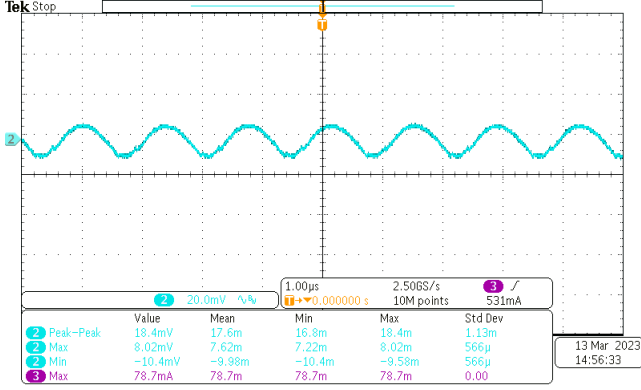
Test condition: Vin=12V, Vo=2.5V, Fsw=750k, Cout=8*47uF MLCC, 10A/us

No Load=0A



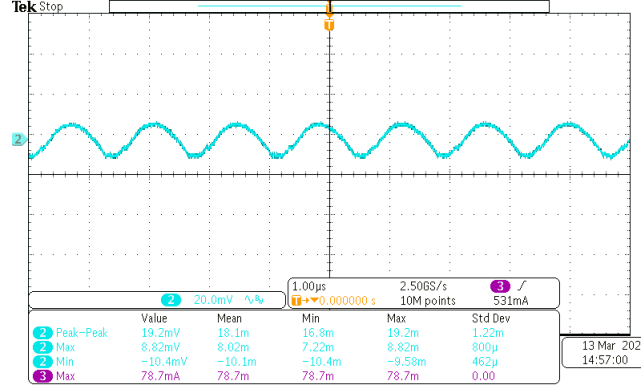
VOUT/AC

Typ Load=1.5A



VOUT/AC

Max Load=3A



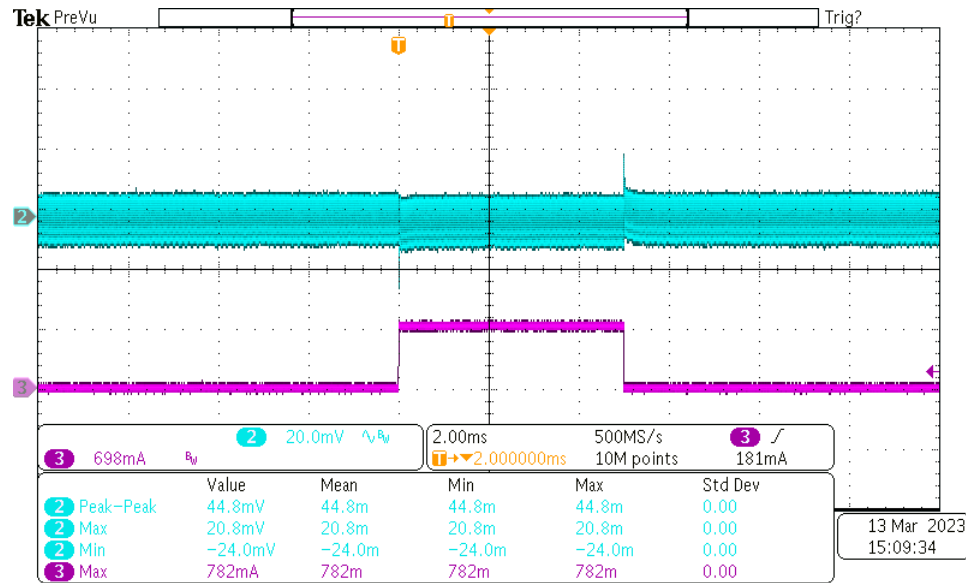
VOUT/AC

Parameter	Value(mV)
No Load	16.8
Typ load	18.4
Max load	19.2

Test Results – Rail7 Transients

Test condition: $V_{in}=12V$, $V_o=2.5V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/\mu s$

IOUT=1.5A-2.25A-1.5A



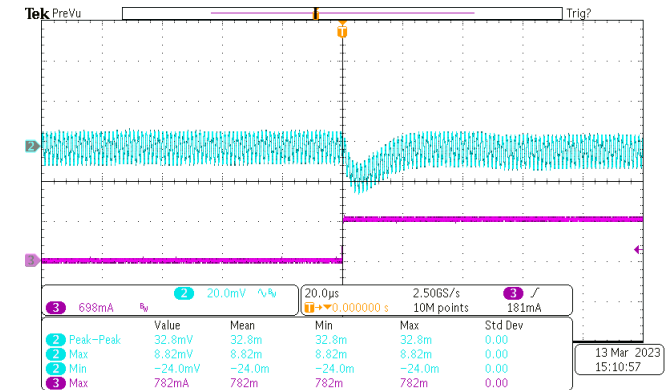
VOUT/AC

ITRAN

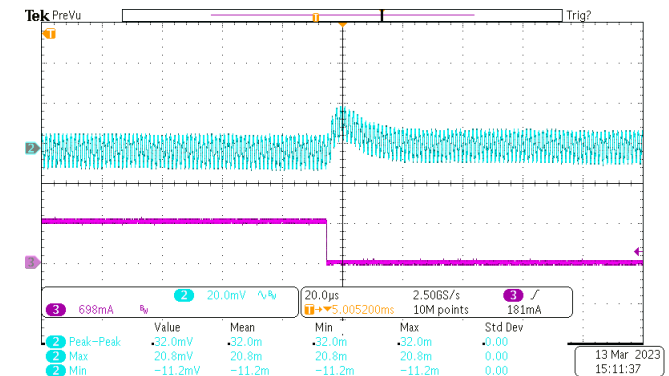
Notes: 0.75A transient load is provided by MOSFET; 1.5A load is provided by E-load (Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-24	0.96
Overshoot	20.8	0.86

Rising Edge



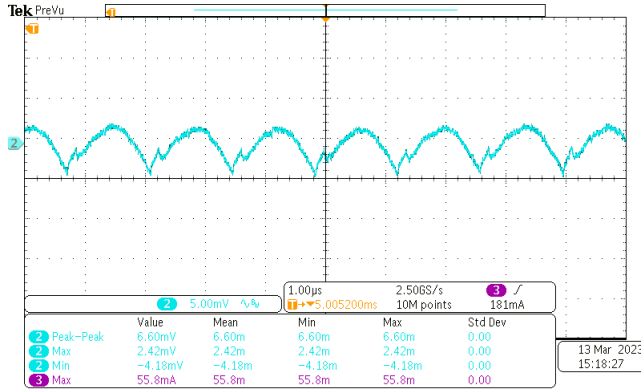
Falling Edge



Test Results – Rail8 Ripple

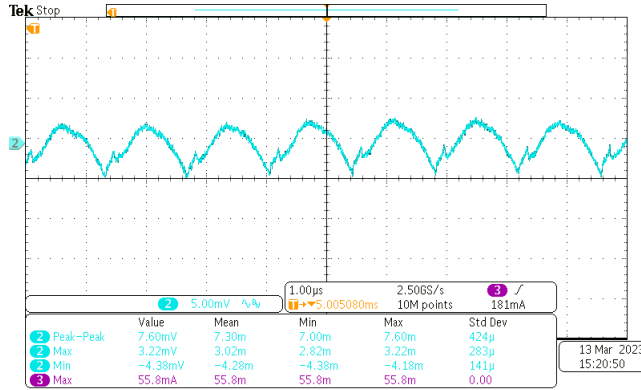
Test condition: $V_{in}=12V$, $V_o=1.2V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/\mu s$

No Load=0A



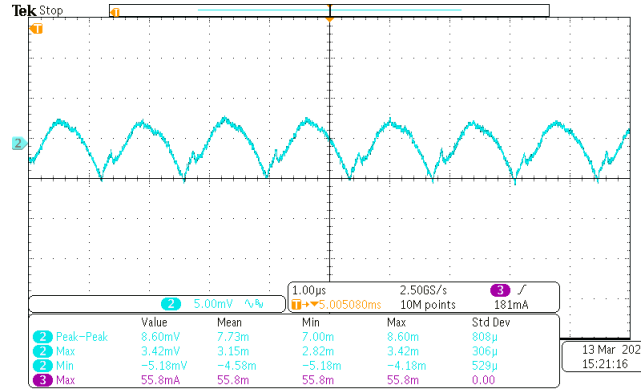
VOUT/AC

Typ Load=2.5A



VOUT/AC

Max Load=5A



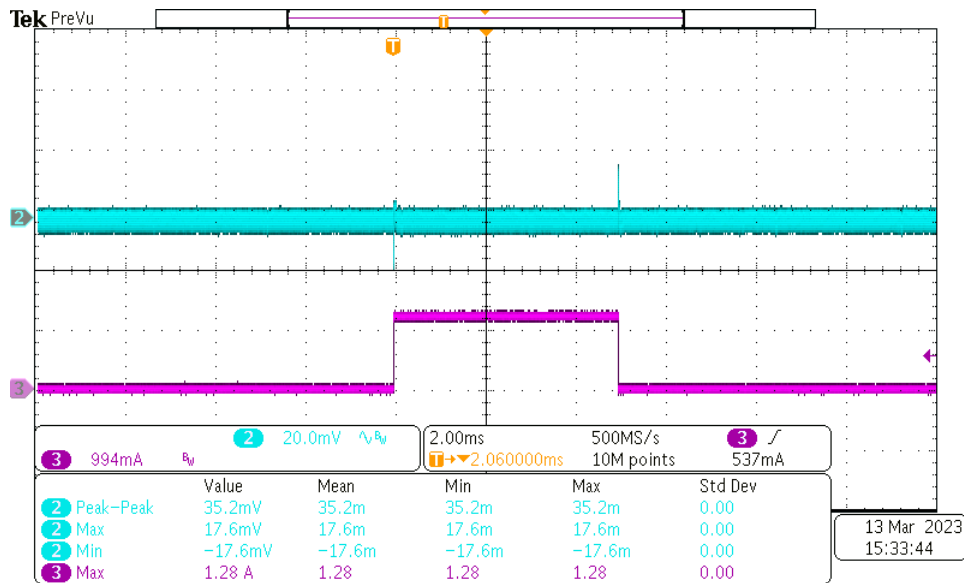
VOUT/AC

Parameter	Value(mV)
No Load	6.6
Typ load	7.6
Max load	8.6

Test Results – Rail8 Transients

Test condition: $V_{in}=12V$, $V_o=1.2V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$ MLCC, $10A/\mu s$

IOUT=2.5A-3.75A-2.5A



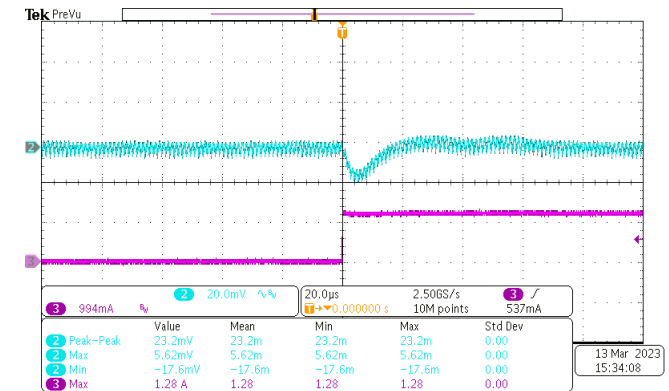
VOUT/AC

ITRAN

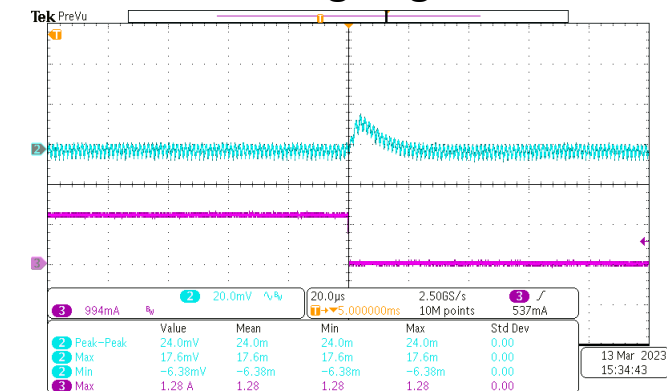
Notes: 1.25A transient load is provided by MOSFET; 2.5A load is provided by E-load (Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-17.6	1.4
Overshoot	17.6	1.2

Rising Edge



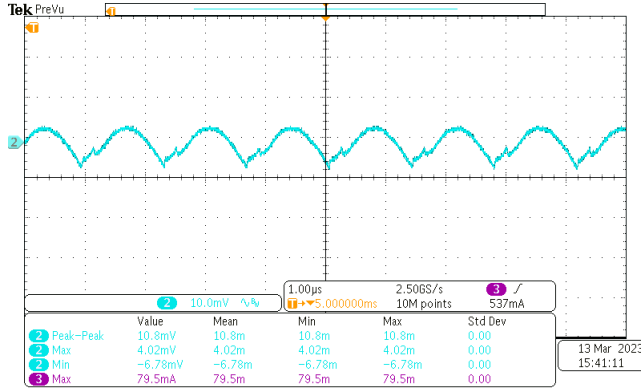
Falling Edge



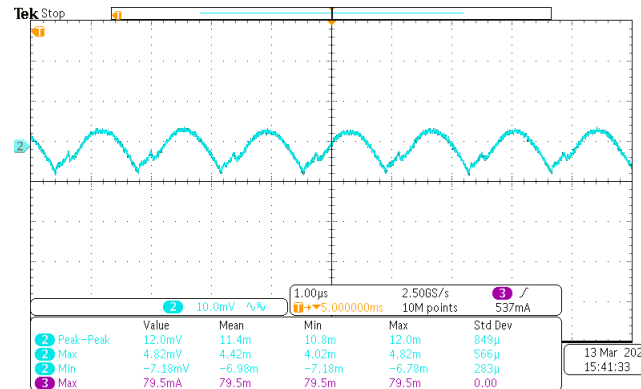
Test Results – Rail9 Ripple

Test condition: Vin=12V, Vo=1.8V, Fsw=750k, Cout=8*47uF, 10A/us

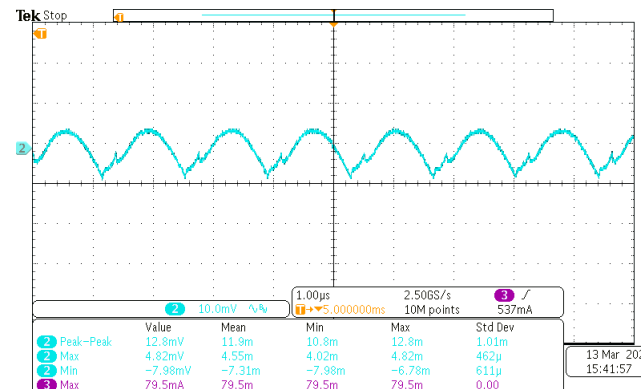
No Load=0A



Typ Load=2.5A



Max Load=5A



VOUT/AC

VOUT/AC

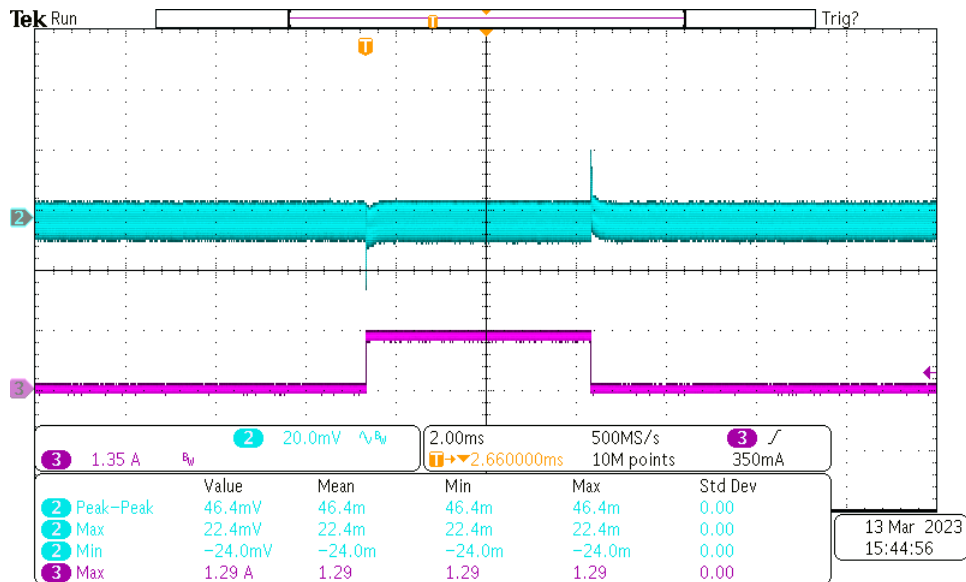
VOUT/AC

Parameter	Value(mV)
No Load	10.8
Typ load	12
Max load	12.8

Test Results – Rail9 Transients

Test condition: $V_{in}=12V$, $V_o=1.8V$, $F_{sw}=750k$, $C_{out}=8*47\mu F$, $10A/\mu s$

IOUT=2.5A-3.75A-2.5A



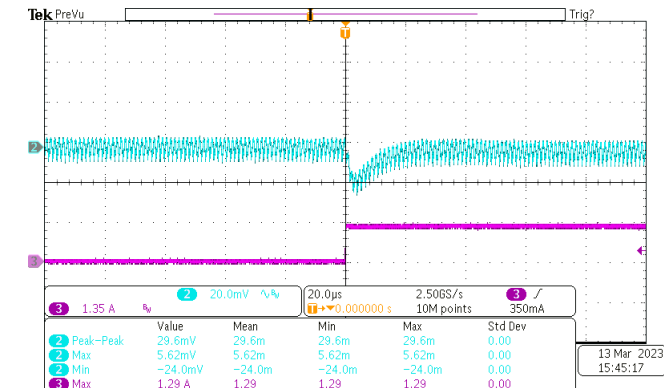
VOUT/AC

ITRAN

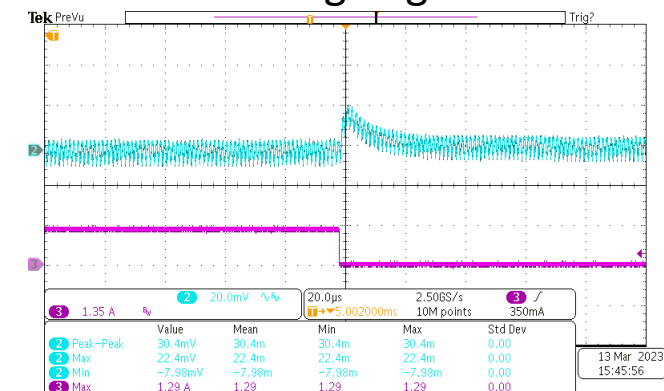
Notes: 1.25A transient load is provided by MOSFET; 2.5A load is provide by E-load(Chroma 63206A)

Parameter	Value(mV)	AC Accuracy(%)
Undershoot	-24	1.33
Overshoot	22.4	1.24

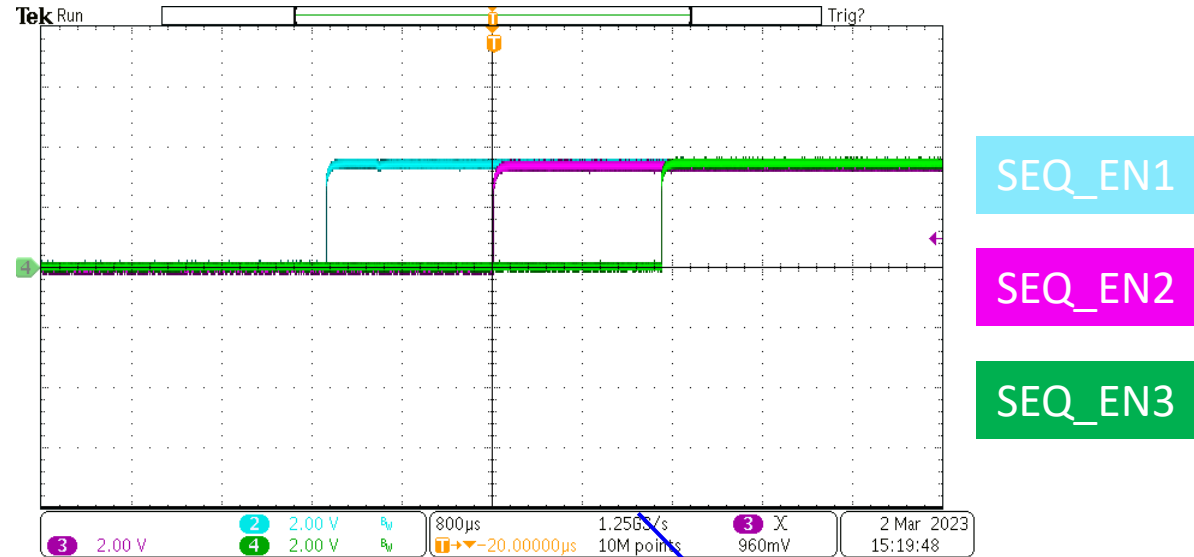
Rising Edge



Falling Edge

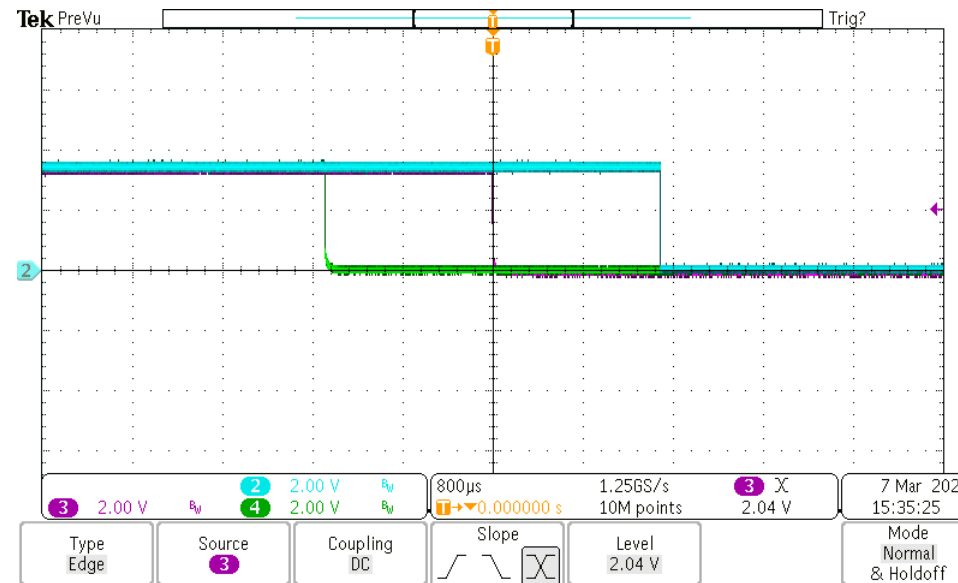


Power Up Sequence



Power sequence delay is 1.5ms of each channel.

Power Down Sequence



SEQ_EN1

SEQ_EN2

SEQ_EN3

Power sequence delay is 1.5ms of each channel.

Thank you