

Initial Design

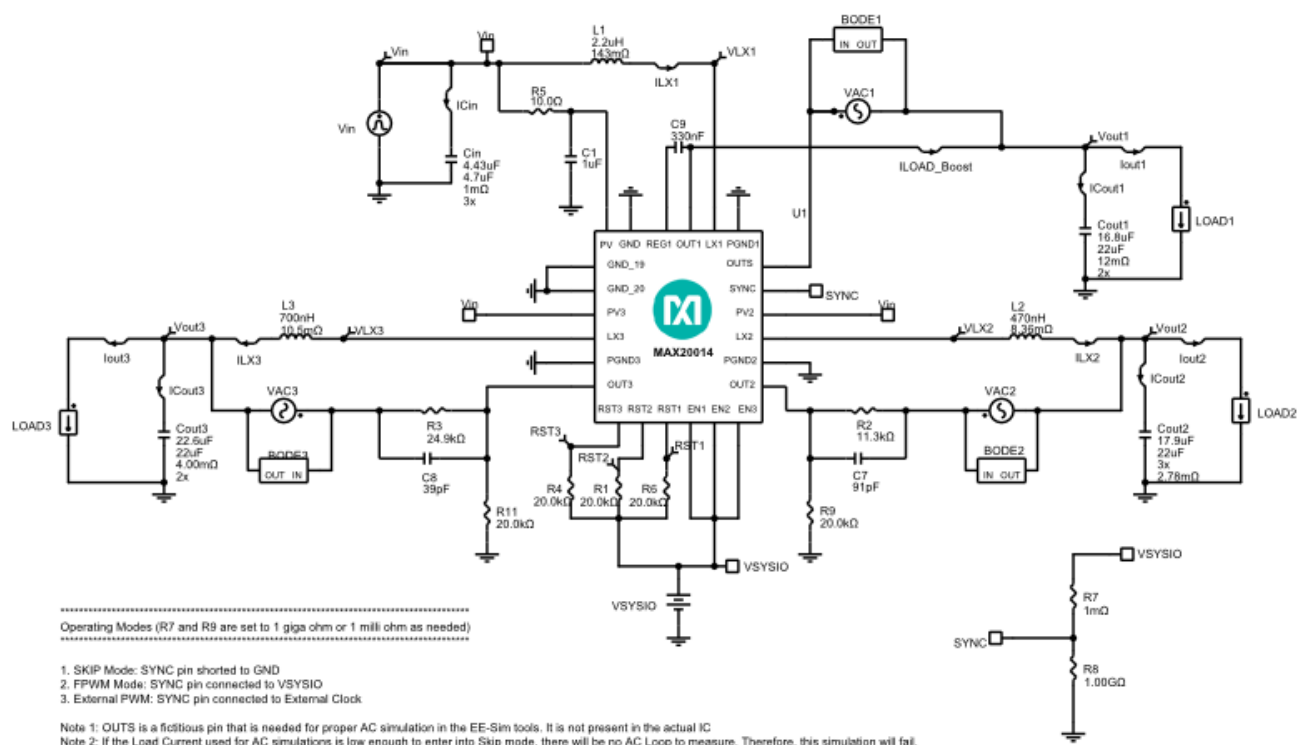
1.0

Design Requirements

Parameter	Value
Minimum Input Voltage	3.4V
Nominal Input Voltage	3.6V
Maximum Input Voltage	3.8V
Output Voltage 1	5V
Output Current 1	0.75A
Load Step Current 1	0.375A
Load Step Start Current 1	0.75A
Output Voltage Ripple 1	1%
Output Voltage Load Step Over/Undershoot 1	5%
Load Step Edge Rate 1	0.5A/us
Buck Output Voltage Type	External Resistive Divider
Output Voltage 2	1.25V
Output Current 2	3A
Load Step Current 2	1.5A
Load Step Start Current 2	3A
Output Voltage Ripple 2	1%
Output Voltage Load Step Over/Undershoot 2	5%
Load Step Edge Rate 2	1.5A/us
Output Voltage 3	1.8V
Output Current 3	3A
Load Step Current 3	1.5A
Load Step Start Current 3	3A
Output Voltage Ripple 3	1%

Parameter	Value
Output Voltage Load Step Over/Undershoot 3	5%
Load Step Edge Rate 3	1.5A/us
Performancy Priority	Balance Efficiency and Size
BOM Priority	Cost
SYNC Connection	Forced-PWM Mode
Switching Frequency	2200KHz
Converter 1 Boost : Inductor Current Ratio (LIR1)	0.3
Converter 2 Buck : Inductor Current Ratio (LIR2)	0.3
Converter 3 Buck : Inductor Current Ratio (LIR3)	0.3

Schematic



BOM

Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX20014ATGA/V+	User-Defined	IC

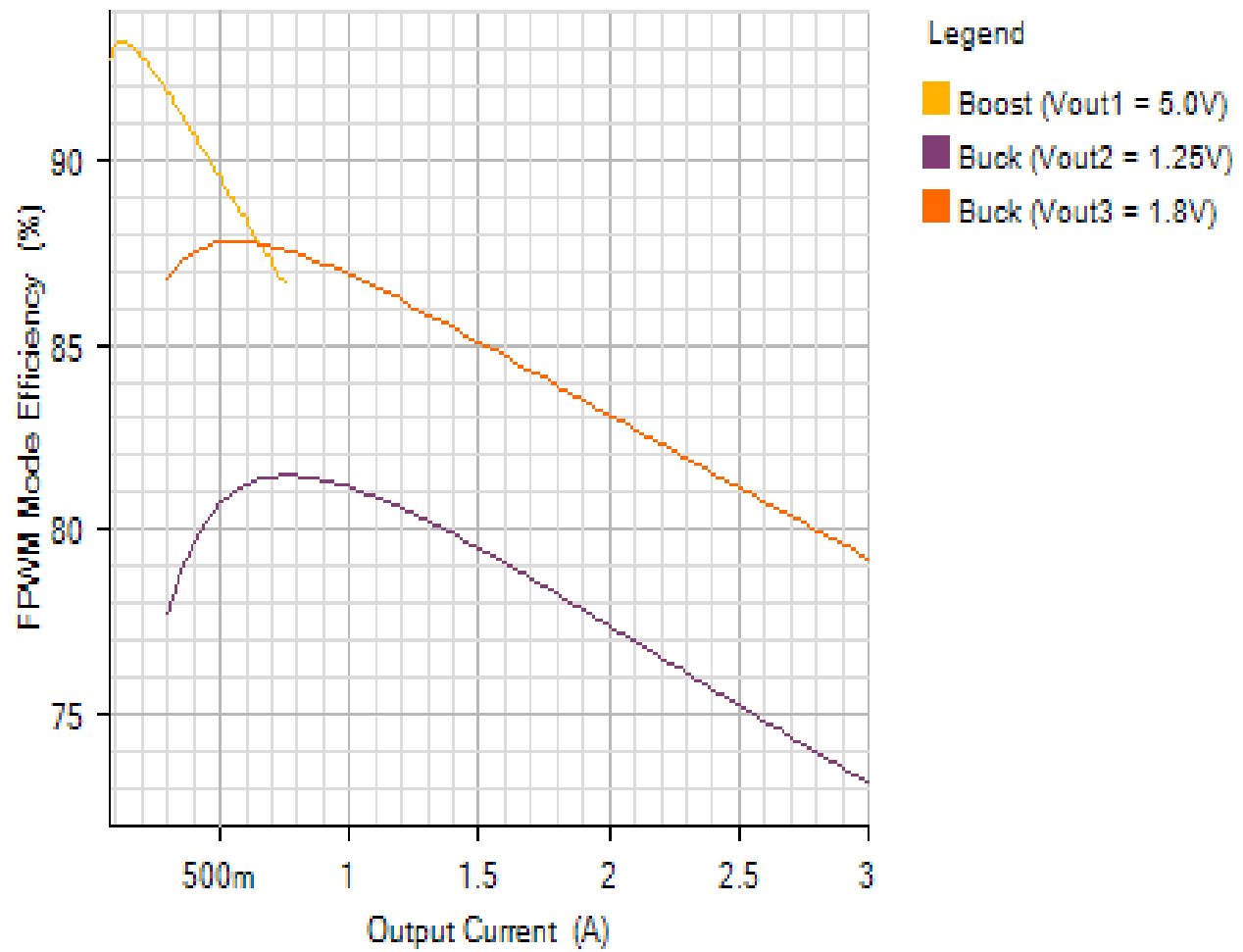
C1	1	CGA5L3X7R1H105K160AB	TDK	Cap Ceramic 1uF 50V X7R 10% Pad SMD 1206 125°C Automotive T/R
C7	1	C0603C910J5GACTU	KEMET Corporation	Cap Ceramic 91pF 50V C0G 5% Pad SMD 0603 125°C T/R
C8	1	CGA3E2C0G1H390J080AA	TDK	Cap Ceramic 39pF 50V C0G 5% Pad SMD 0603 125°C Automotive T/R
C9	1	0805YC334KAT2A	AVX	Cap Ceramic 0.33uF 16V X7R 10% Pad SMD 0805 125°C T/R
Cin	3	C1210C475K4PAC	Kemet	Cap Ceramic 4.7uF 16V X5R 10% SMD 1210 85C Bulk
Cout1	2	GRM32DR61C226KE18L	Murata	Cap Ceramic 22uF 16V X5R 10% SMD 1210 85C Embossed T/R
Cout2	3	GRM187R61A226ME15D	Murata	Cap Ceramic 22uF 10V 0603 85C
Cout3	2	GRM32DR61C226KE18L	Murata	Cap Ceramic 22uF 16V X5R 10% SMD 1210 85C Embossed T/R
L1	1	MLP2520S2R2ST0S1	TDK	Inductor 2.2uH 20% 110mOhm 1.203A Isat 1.2A Irms
L2	1	XFL4015-471MEB	Coilcraft	Inductor 470nH 20% 7.6mOhm 6A Isat 11.2A Irms
L3	1	XFL4015-701MEB	Coilcraft	Inductor 700nH 20% 9.5mOhm 6.1A Isat 10.1A Irms
R1	1	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R2	1	ERJ3EKF1132V	Panasonic	Res Thick Film 0603 11.3K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R3	1	ERJ3EKF2492V	Panasonic	Res Thick Film 0603 24.9K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R4	1	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R5	1	ERJ2RK10R0X	Panasonic	Res Thick Film 0402 10 Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R6	1	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R9	1	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R11	1	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R

Simulation Results

Efficiency - Fri Jan 04 2019 16:02:50

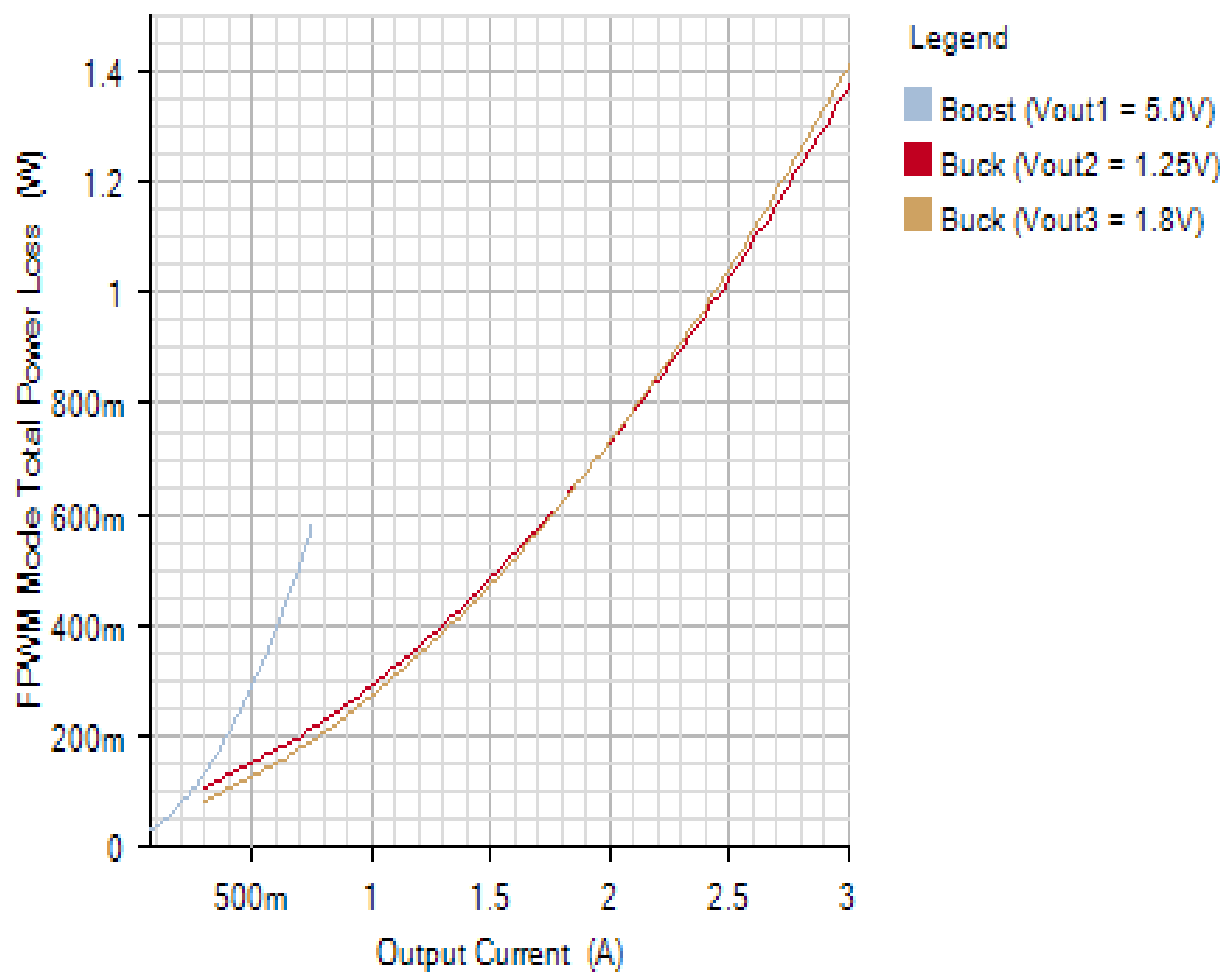
EFFICIENCY

Default



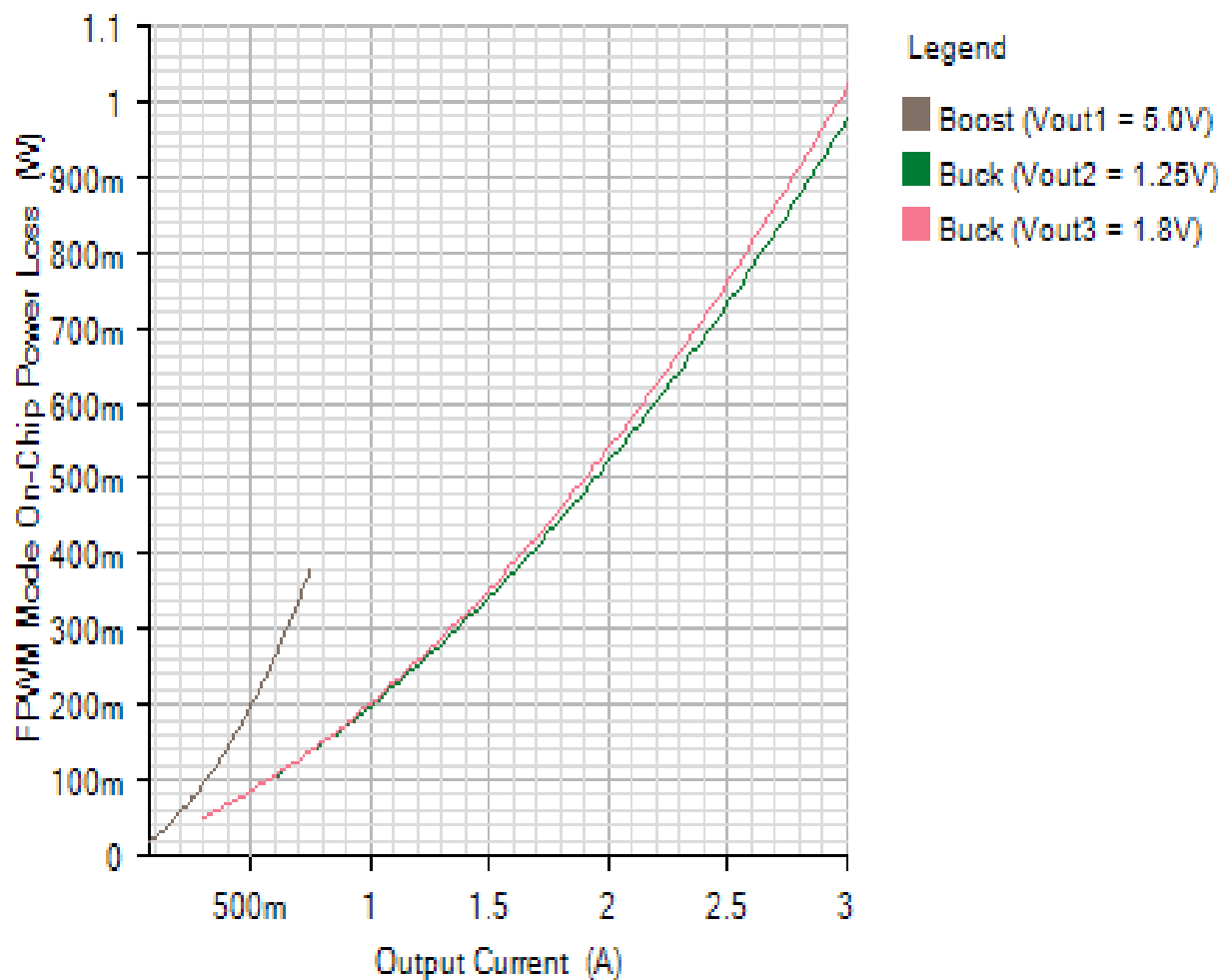
TOTAL_POWER_LOSS

Default



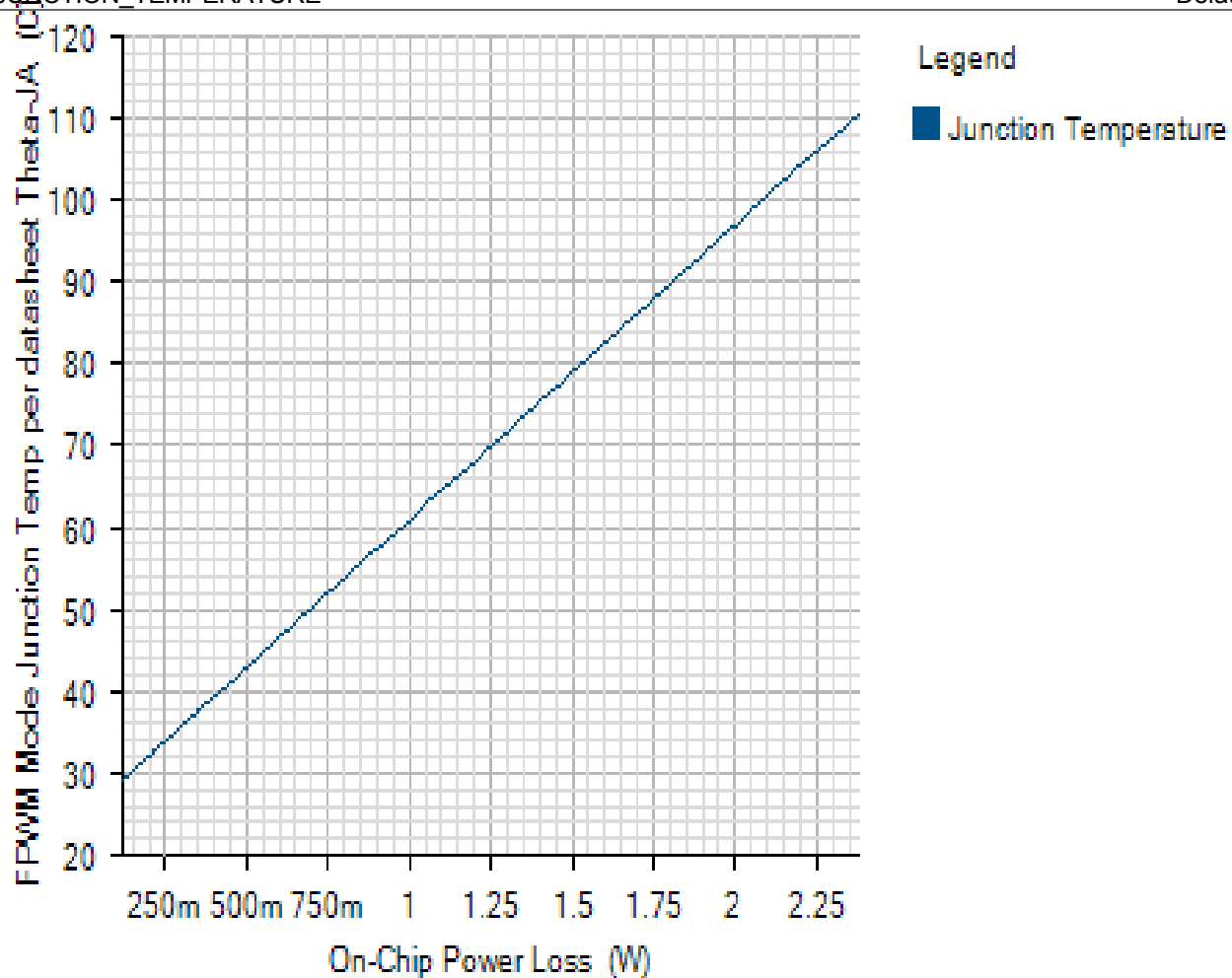
ON-CHIP_POWER_LOSS

Default

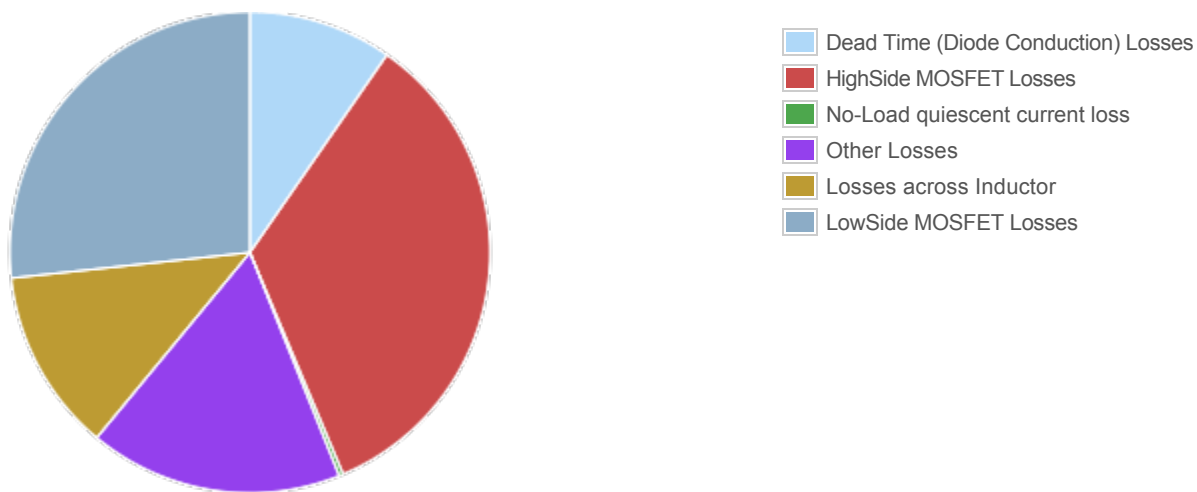


JUNCTION_TEMPERATURE

Default



Losses



Component

Loss (W)

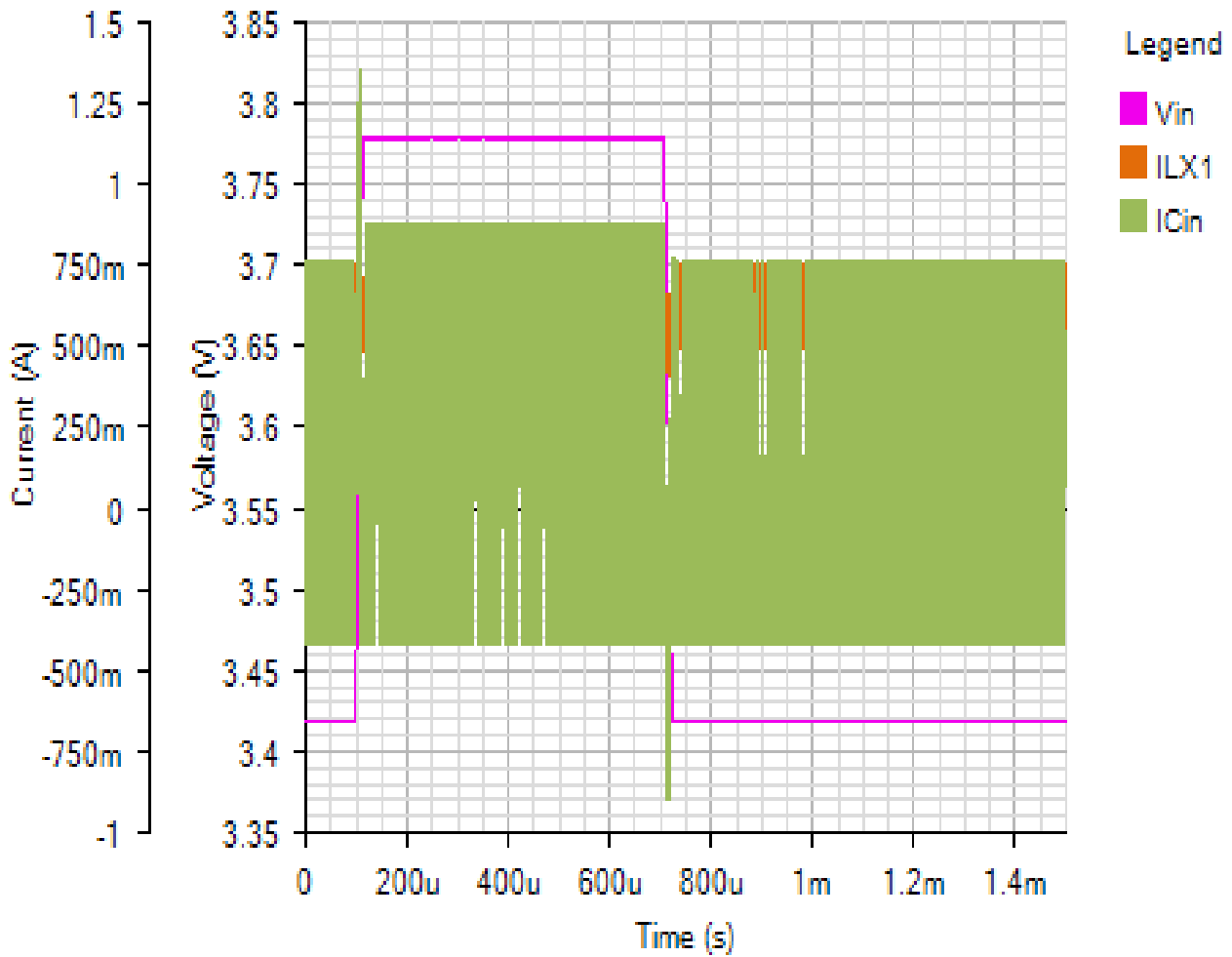
% of total

Component	Loss (W)	% of total
Dead Time (Diode Conduction) Losses	0.325325	9.7
HighSide MOSFET Losses	1.144913	34
No-Load quiescent current loss	0.00972	0.3
Other Losses	0.575071	17.1
Losses across Inductor	0.413741	12.3
LowSide MOSFET Losses	0.89937	26.7
Total	3.36814	100

Line Transient - Fri Jan 04 2019 16:02:50

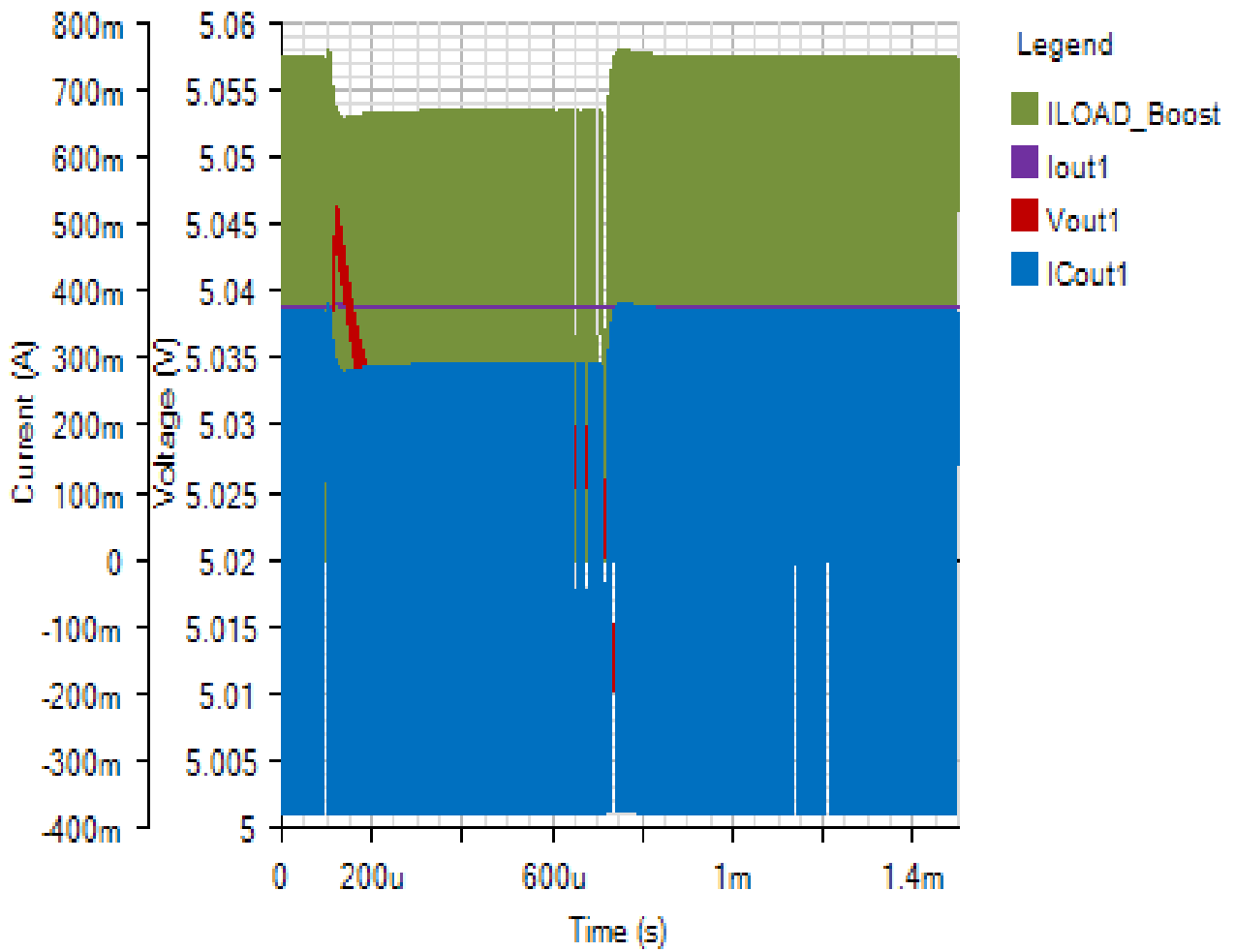
INPUT

Default



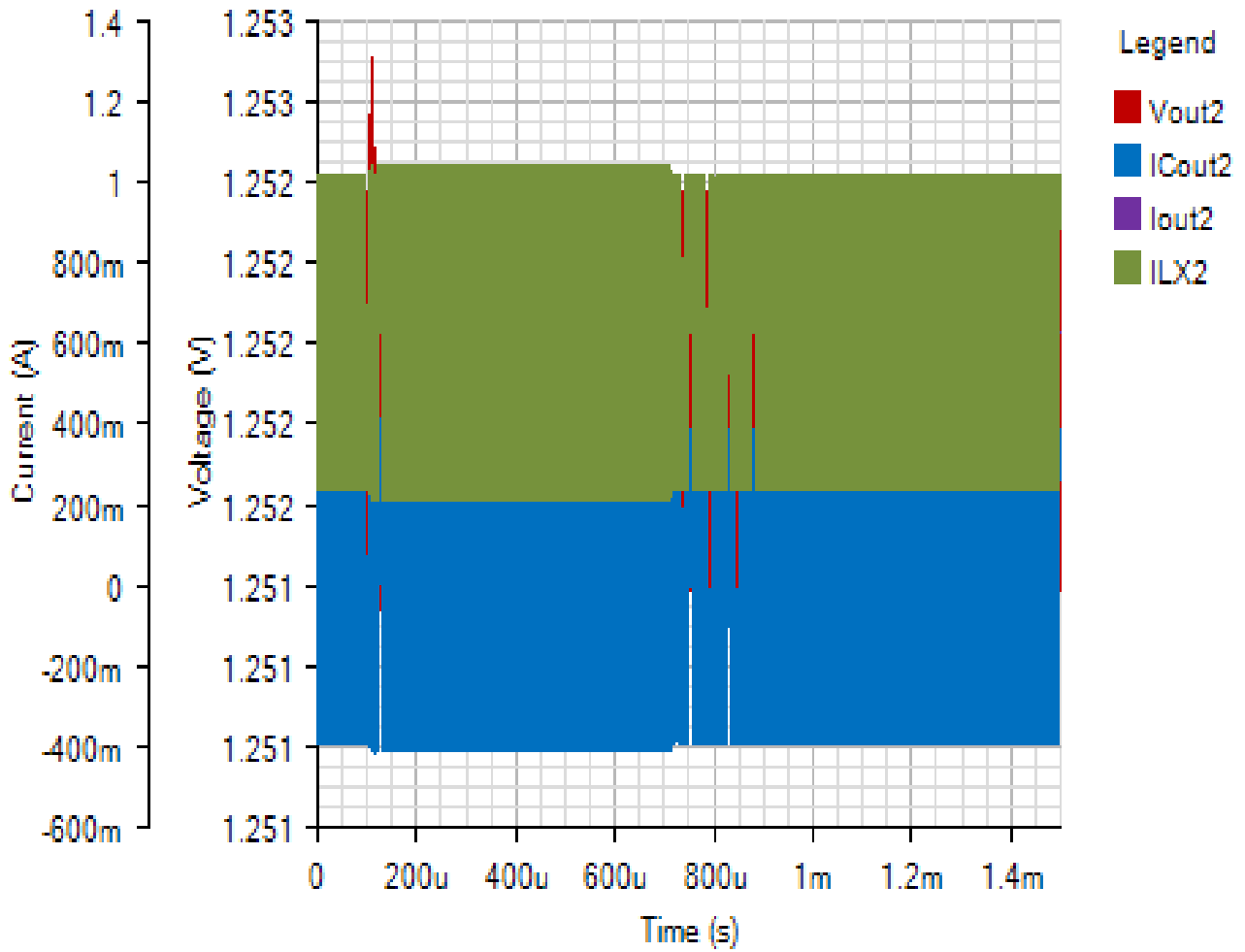
OUTPUT-BOOST1

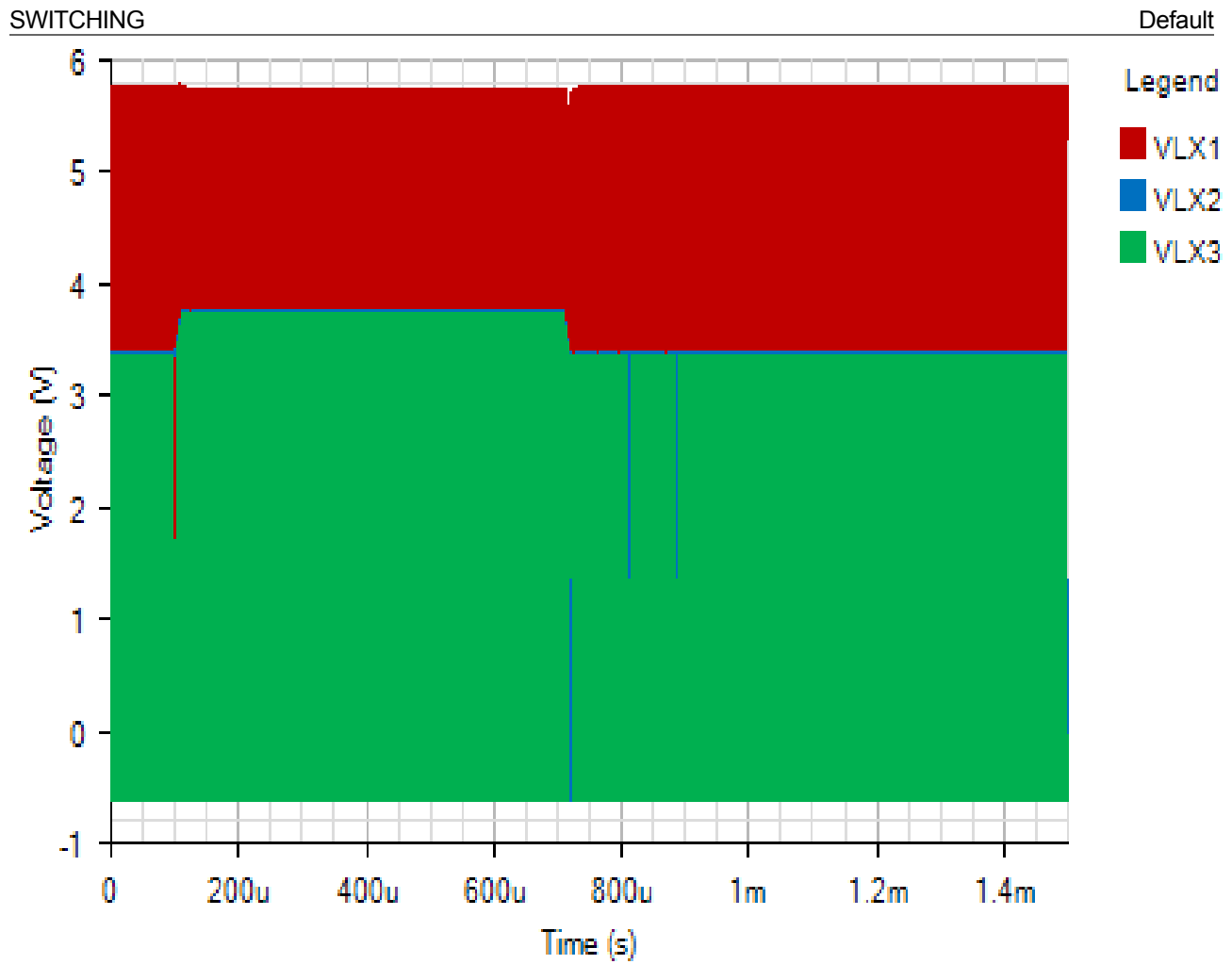
Default



OUTPUT-BUCK2

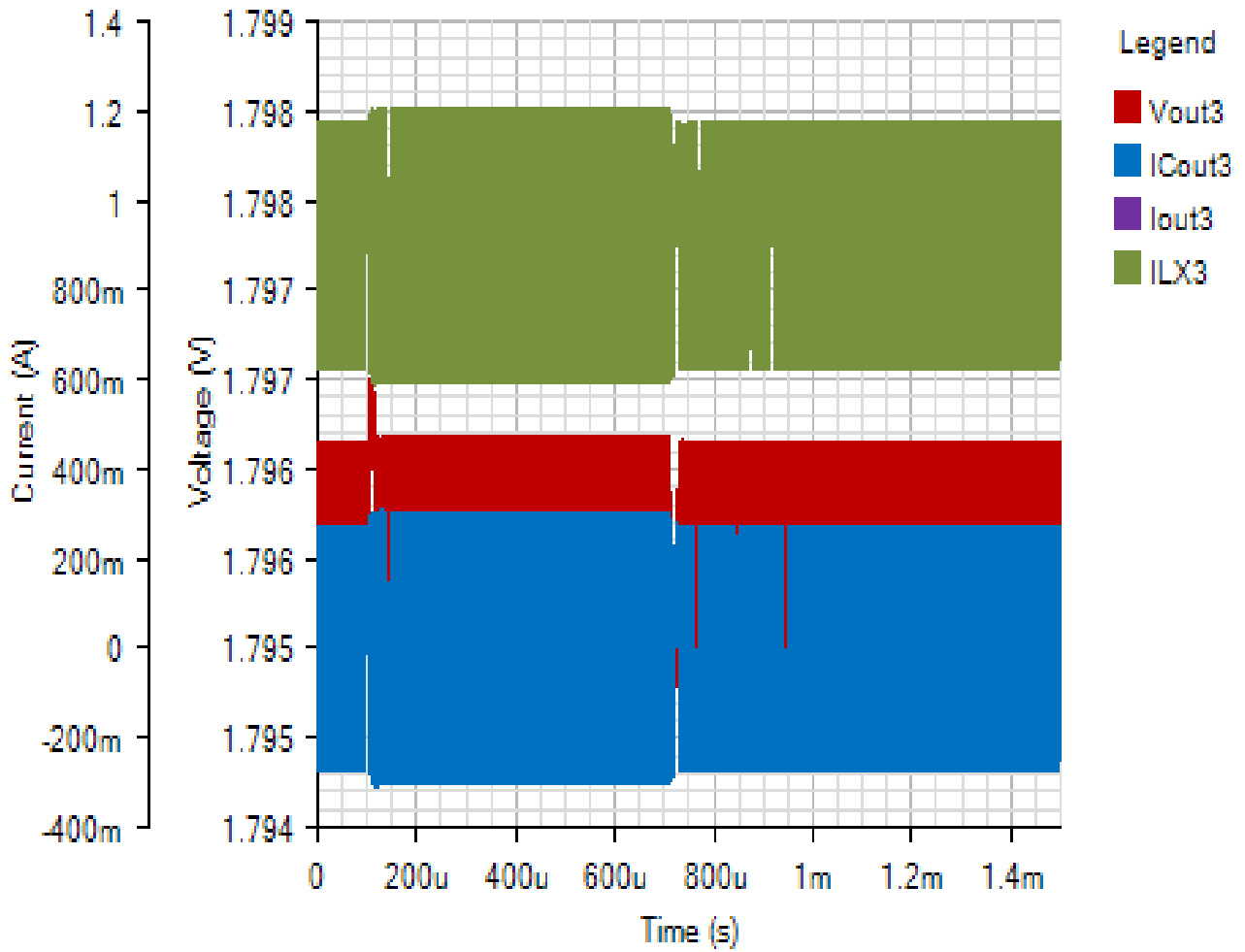
Default



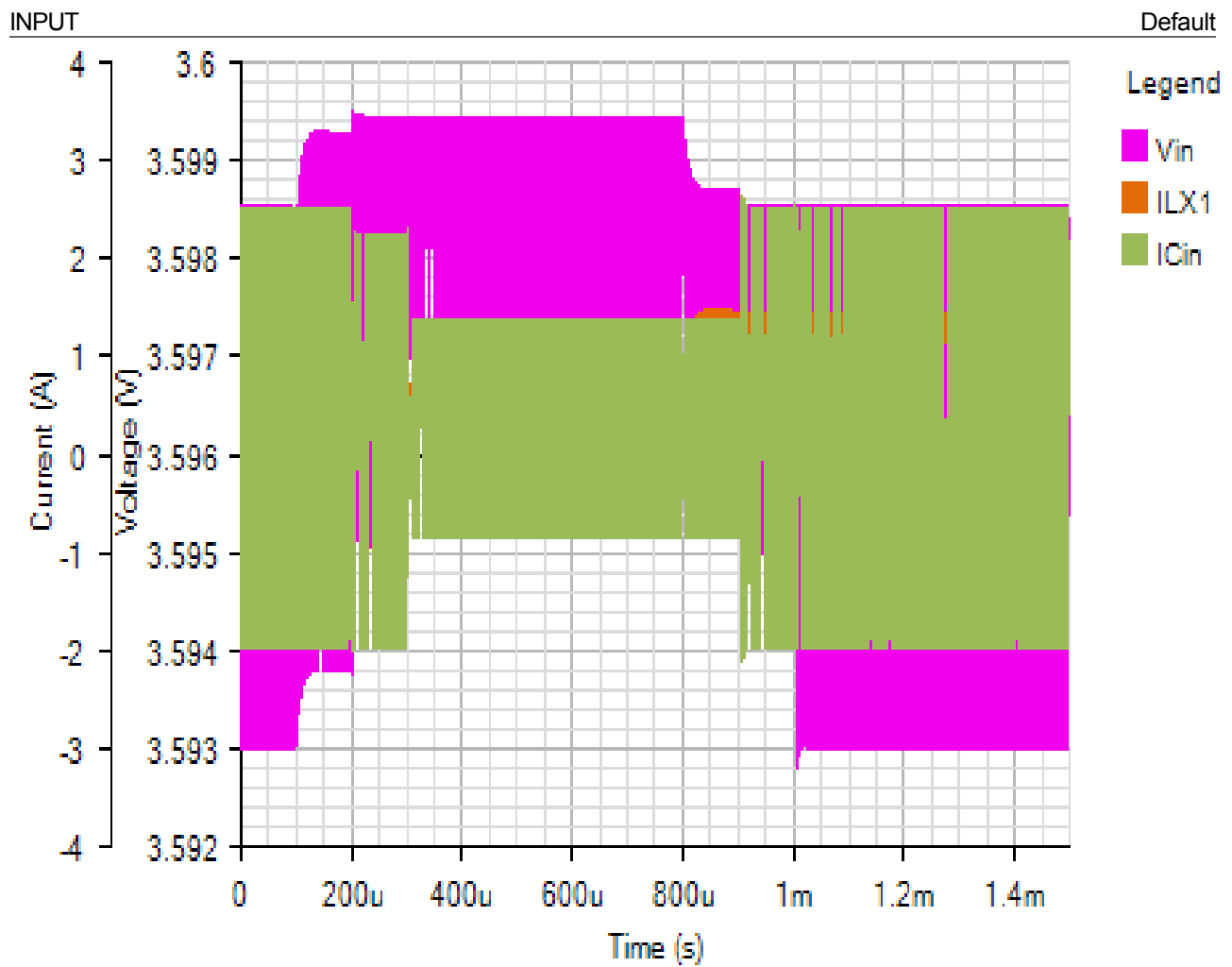


OUTPUT-BUCK3

Default

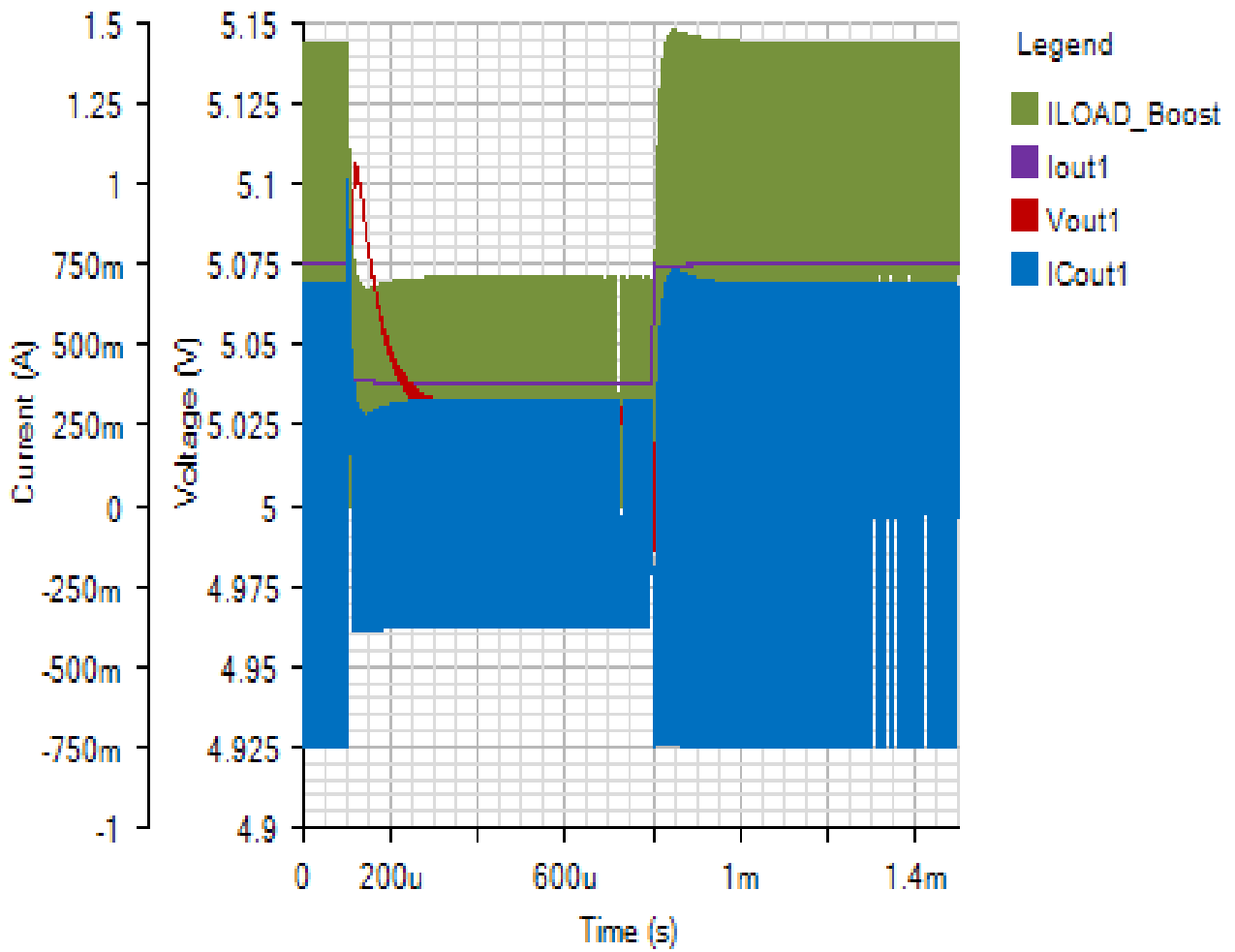


Load Step - Fri Jan 04 2019 16:02:50



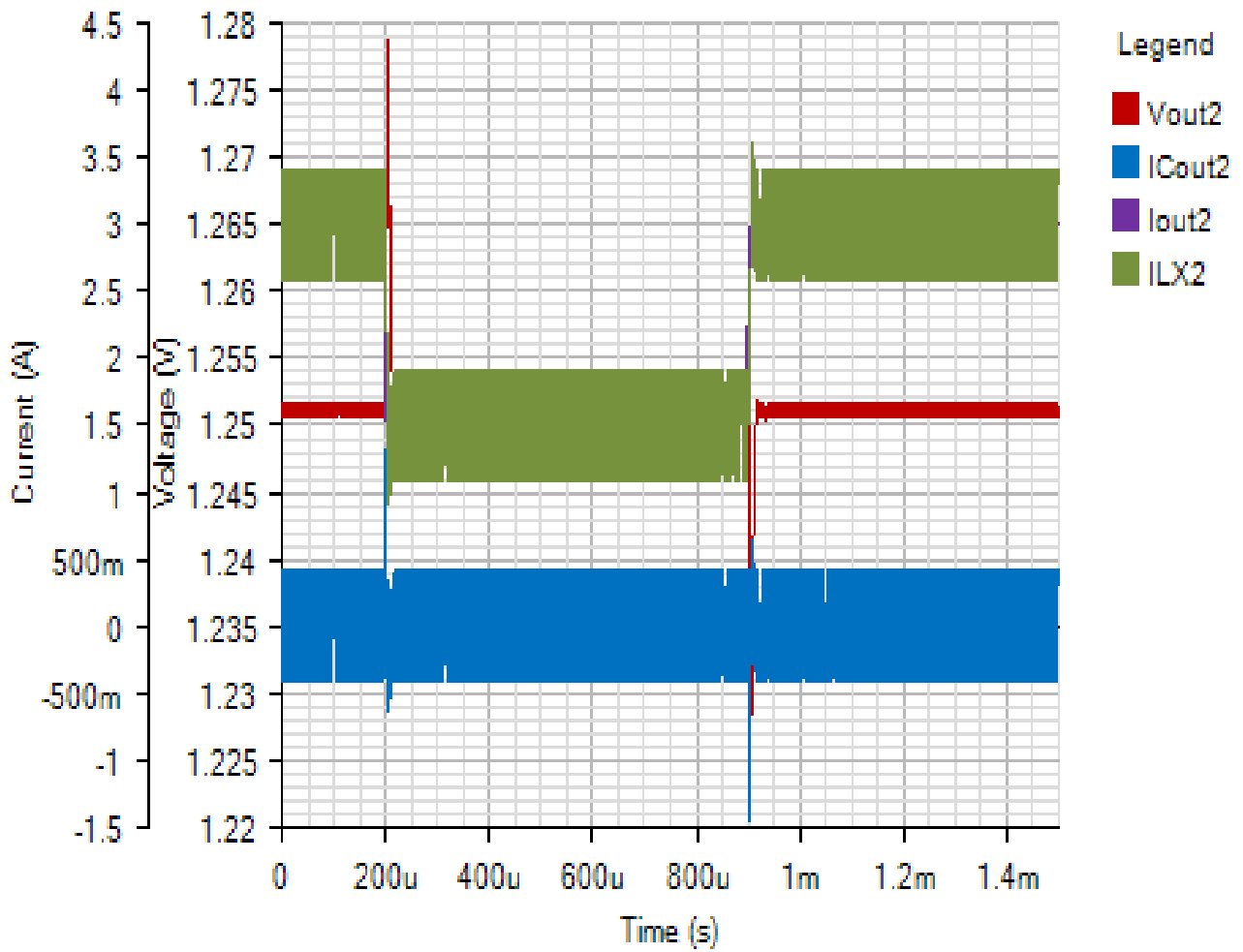
OUTPUT-BOOST1

Default



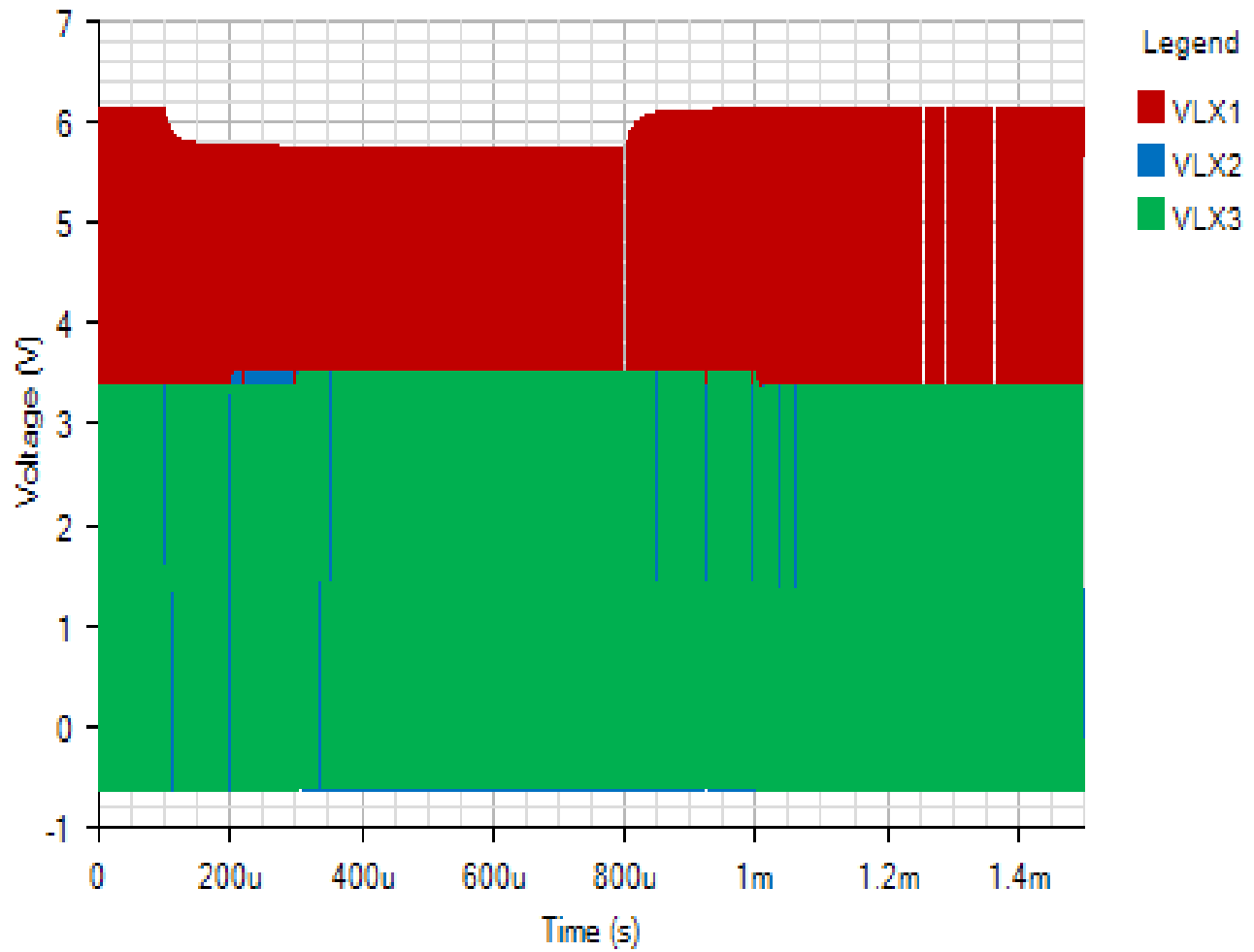
OUTPUT-BUCK2

Default



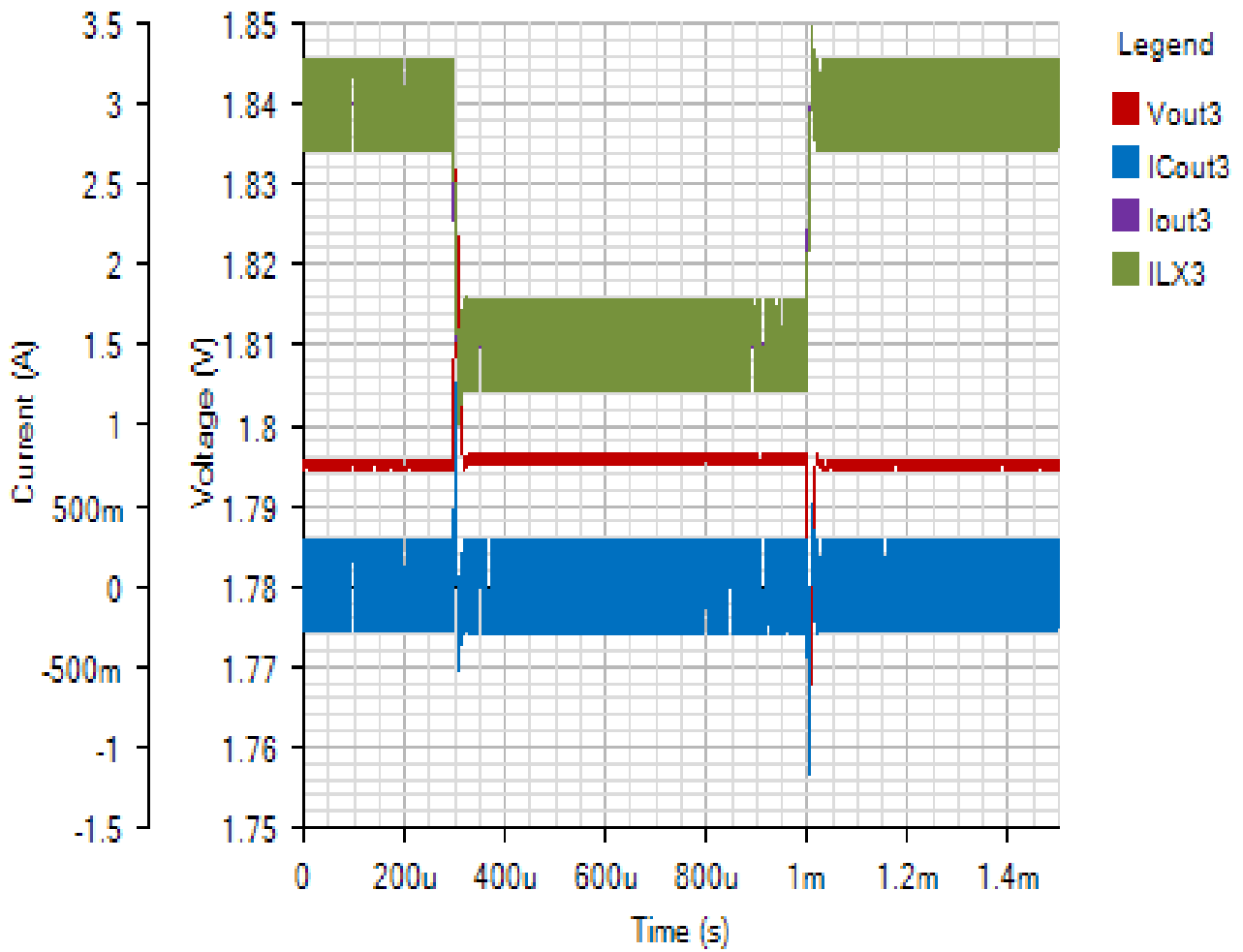
SWITCHING

Default



OUTPUT-BUCK3

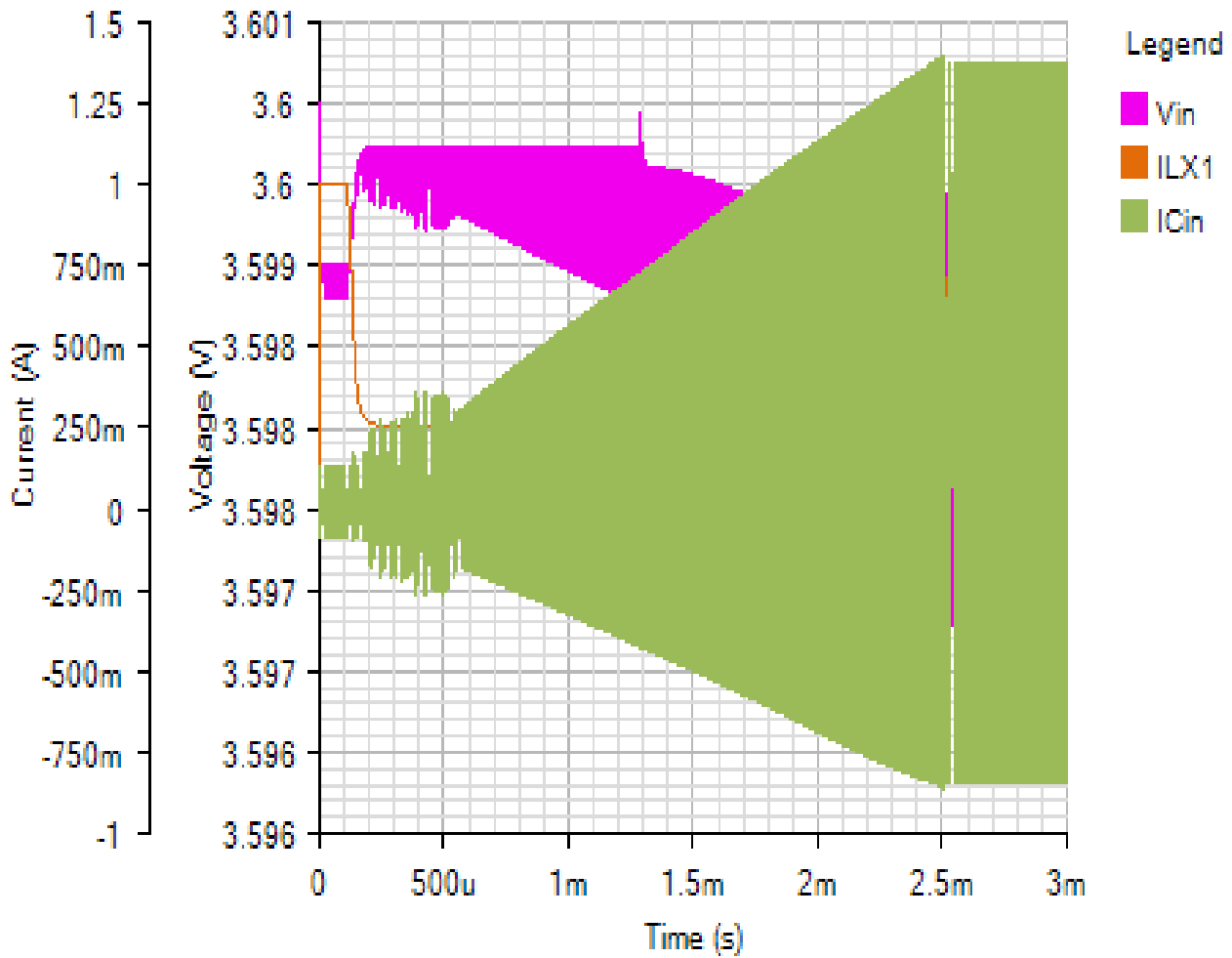
Default



Start Up - Fri Jan 04 2019 16:02:50

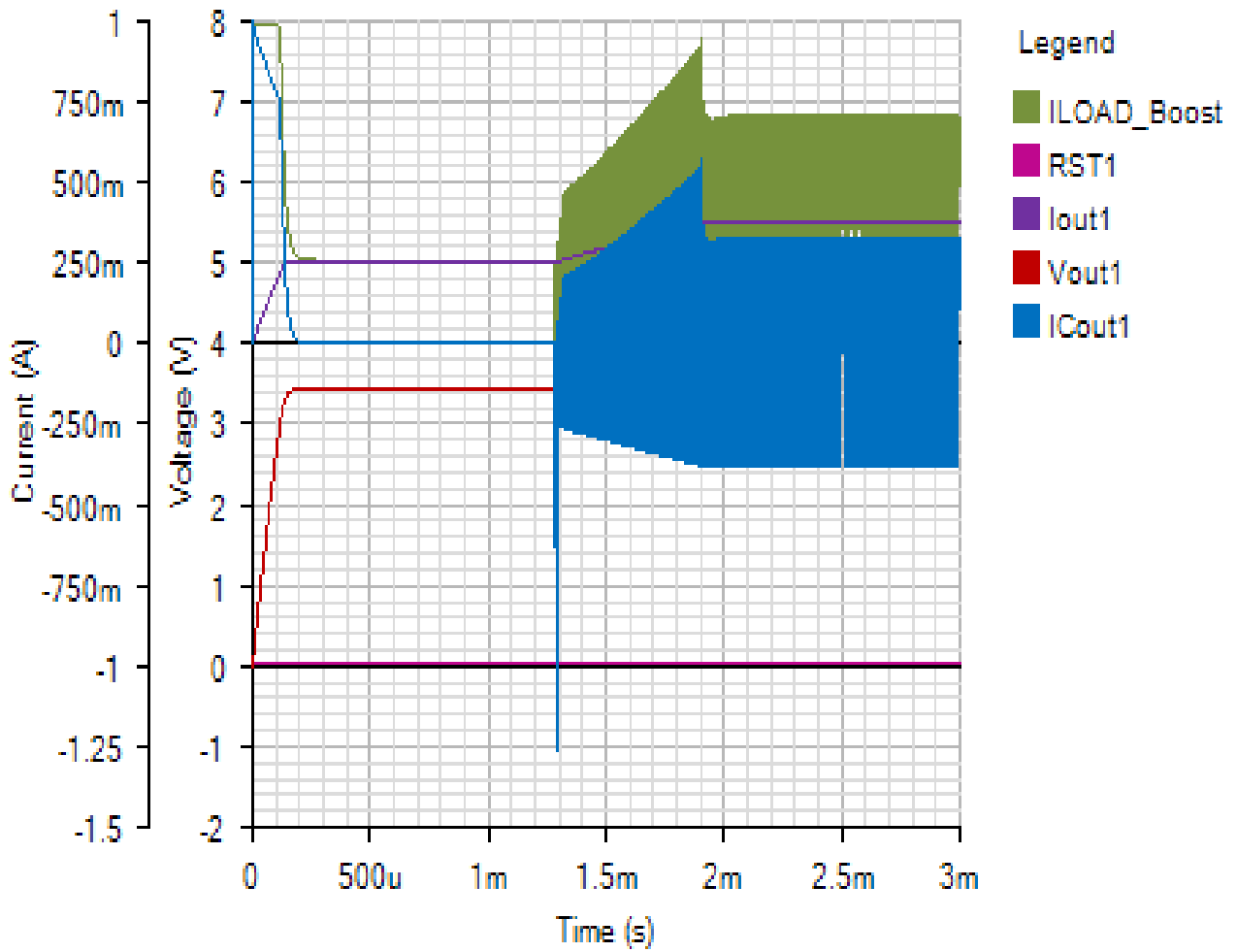
INPUT

Default



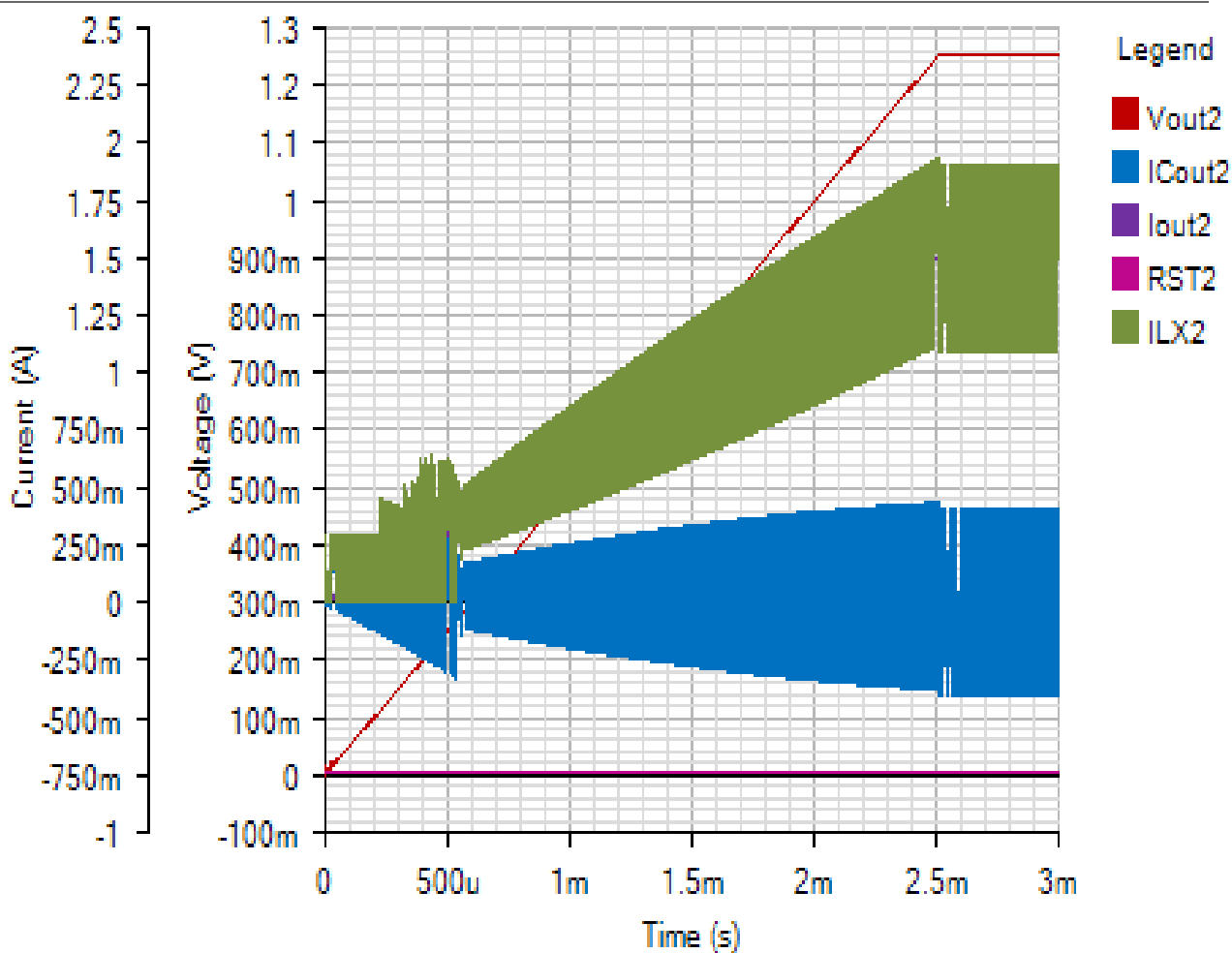
OUTPUT-BOOST1

Default



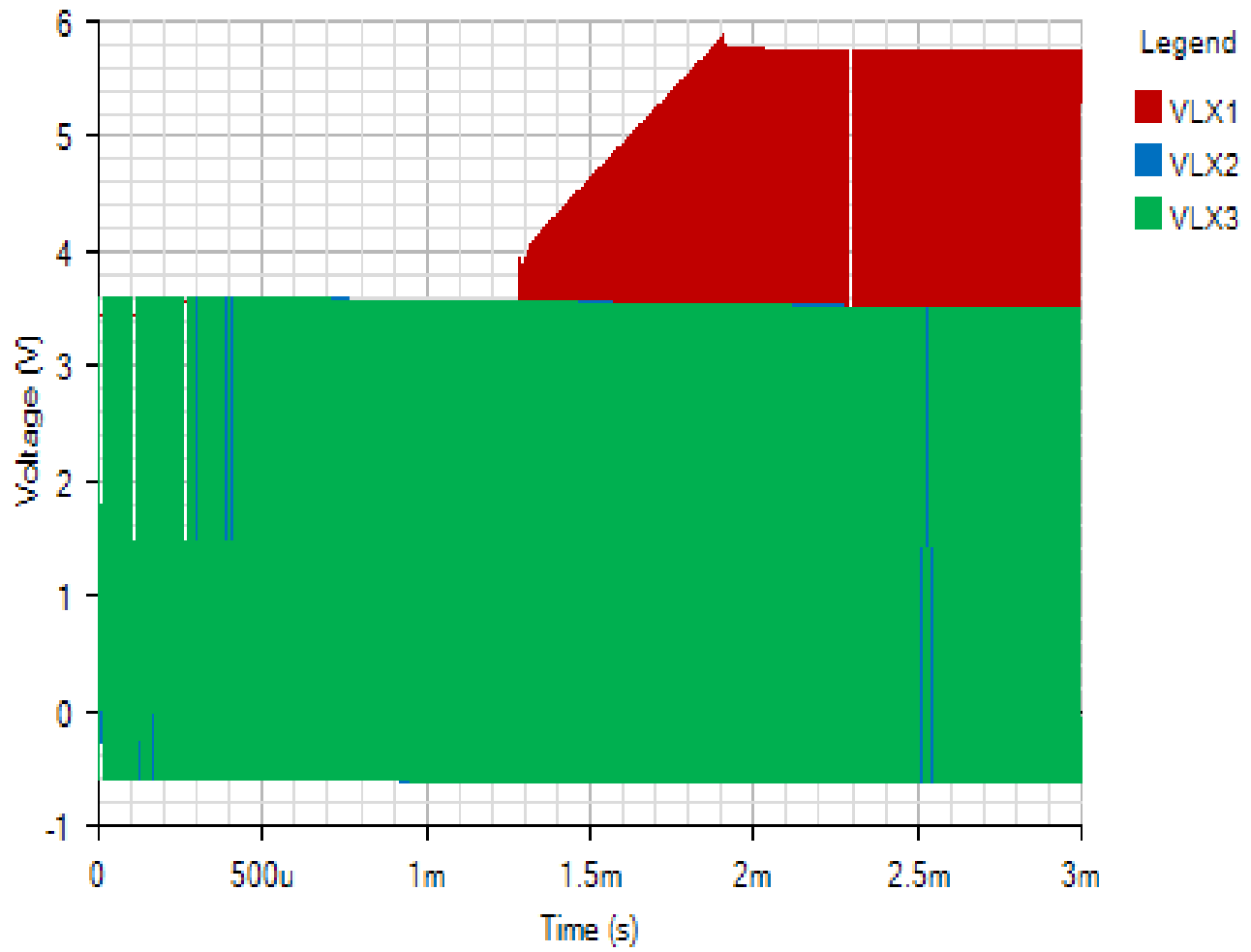
OUTPUT-BUCK2

Default



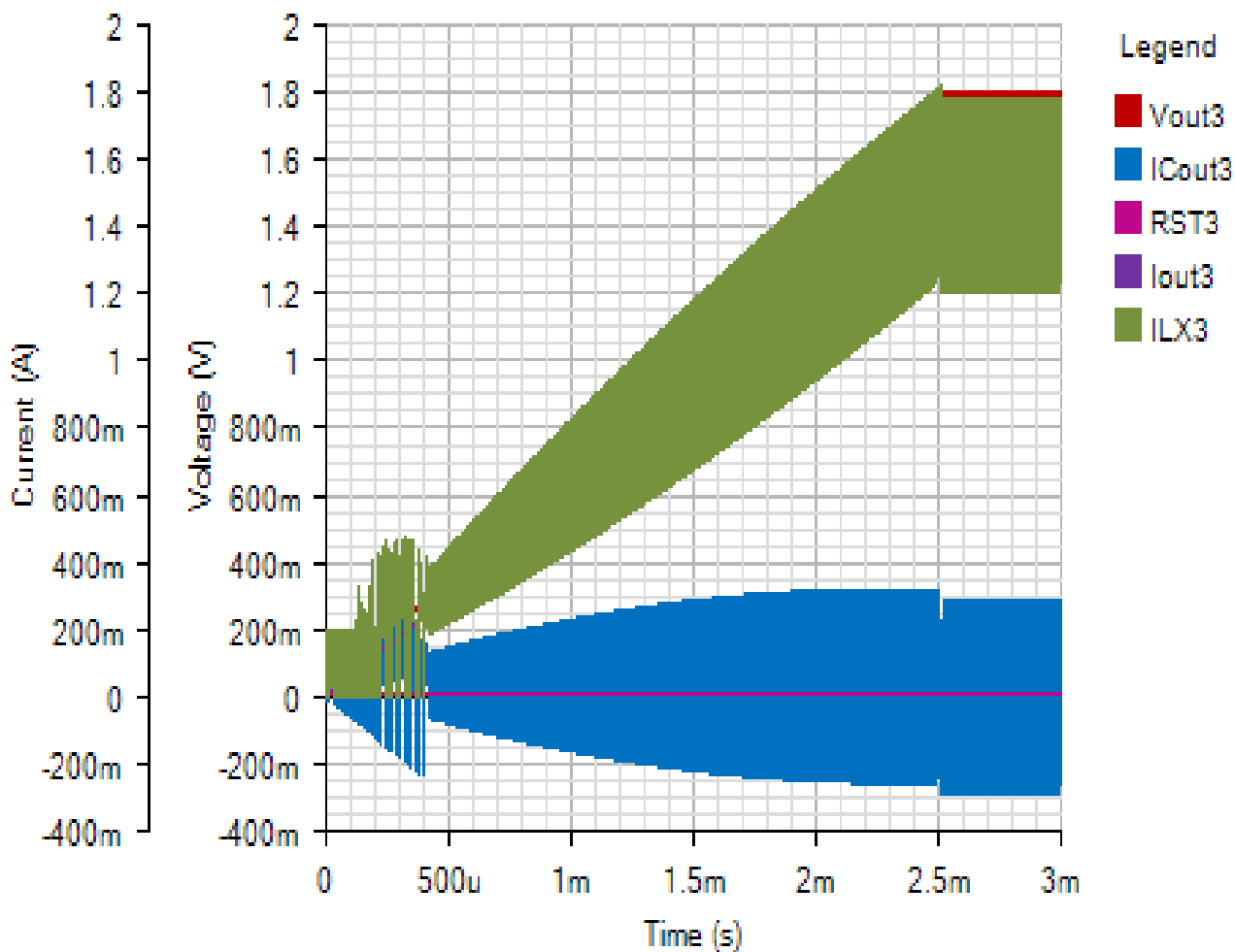
SWITCHING

Default



OUTPUT-BUCK3

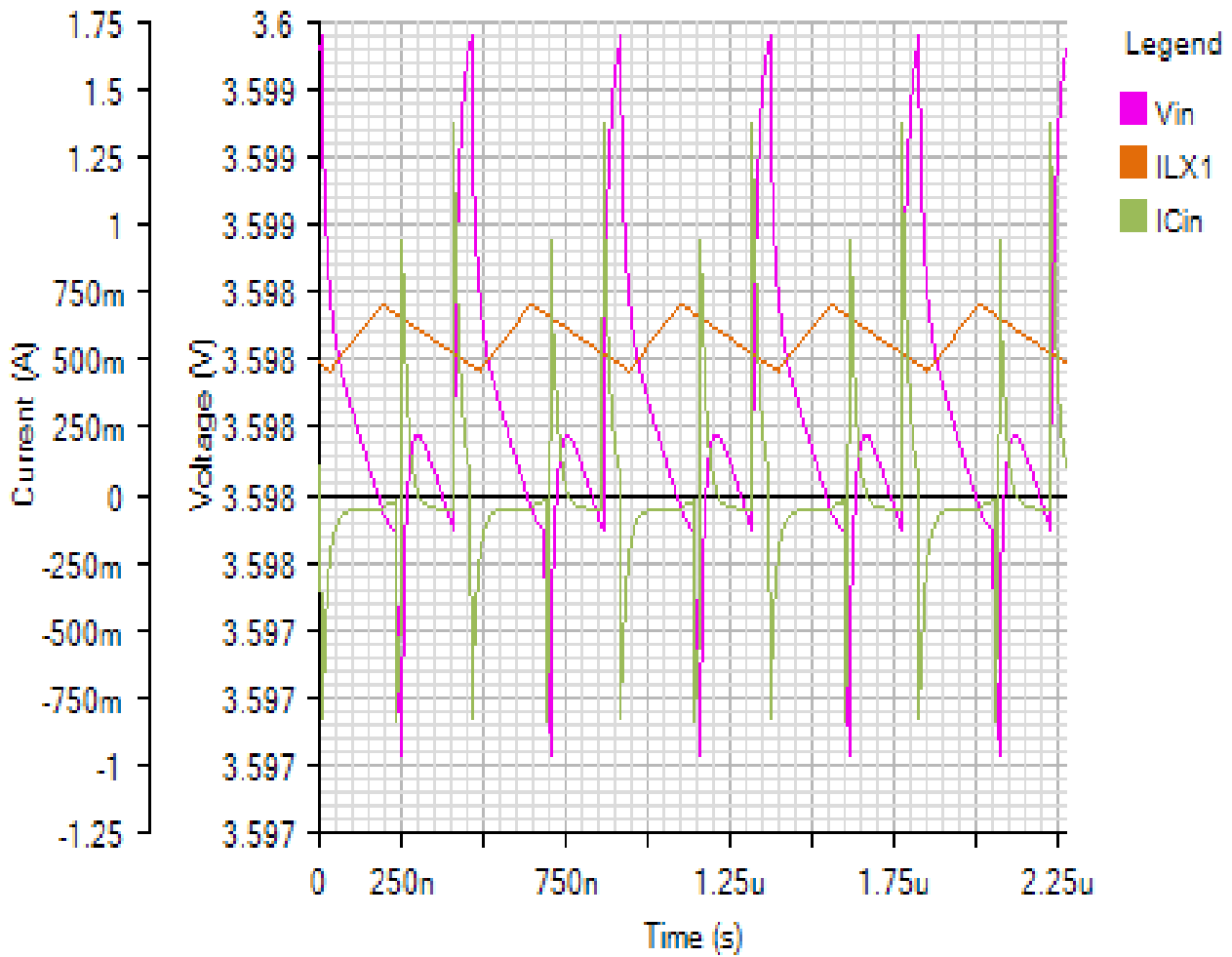
Default



Steady State - Fri Jan 04 2019 16:02:50

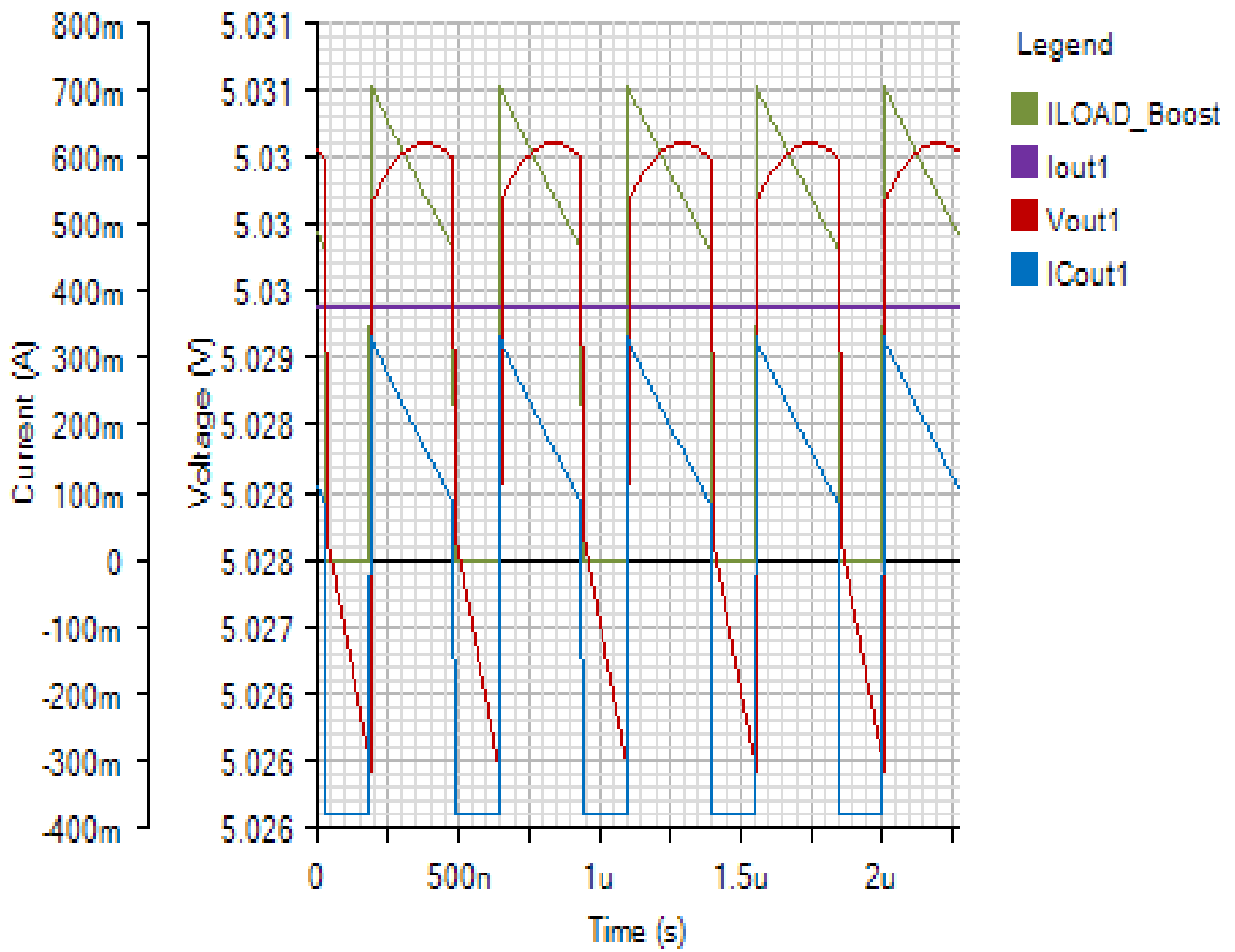
INPUT

Default



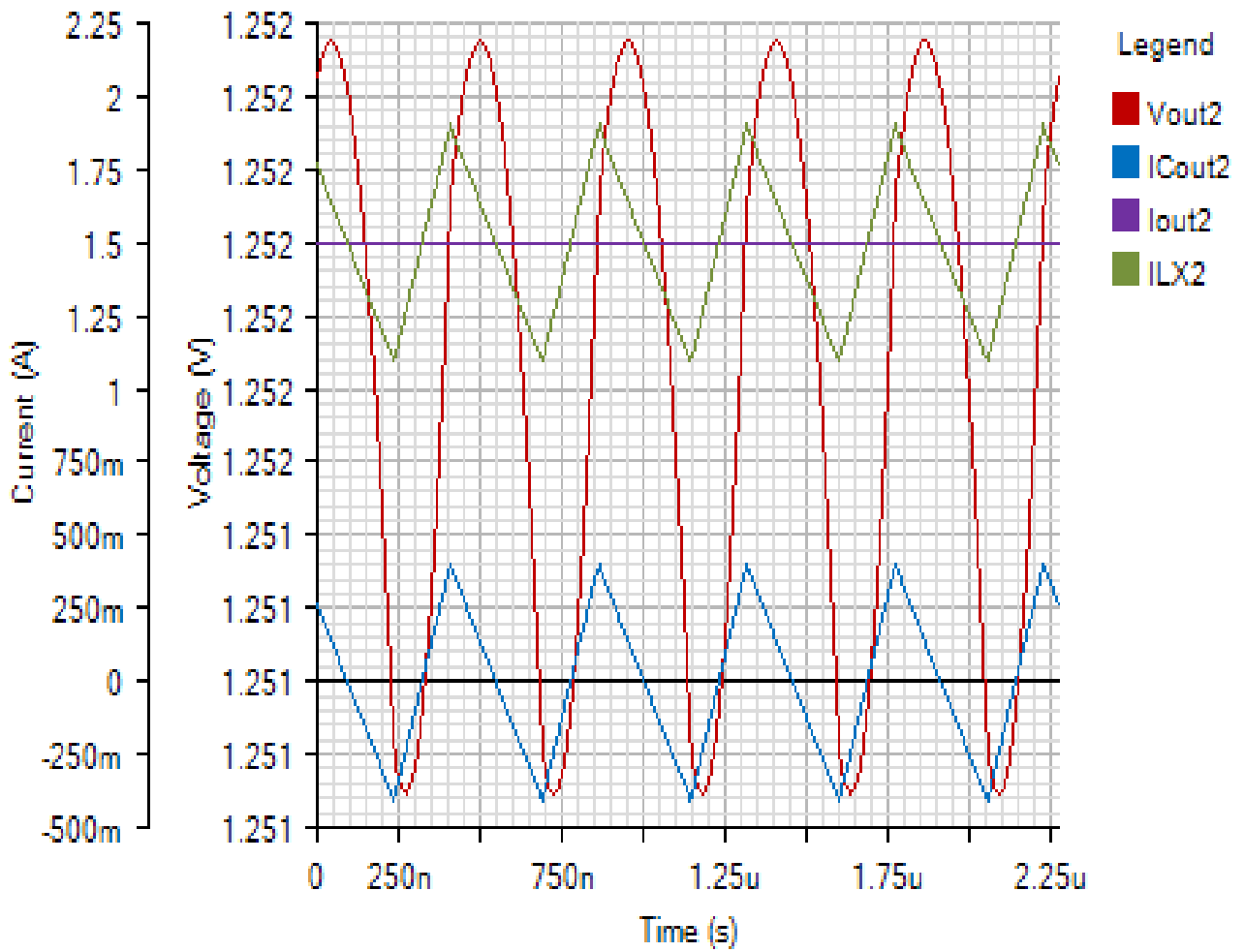
OUTPUT-BOOST1

Default



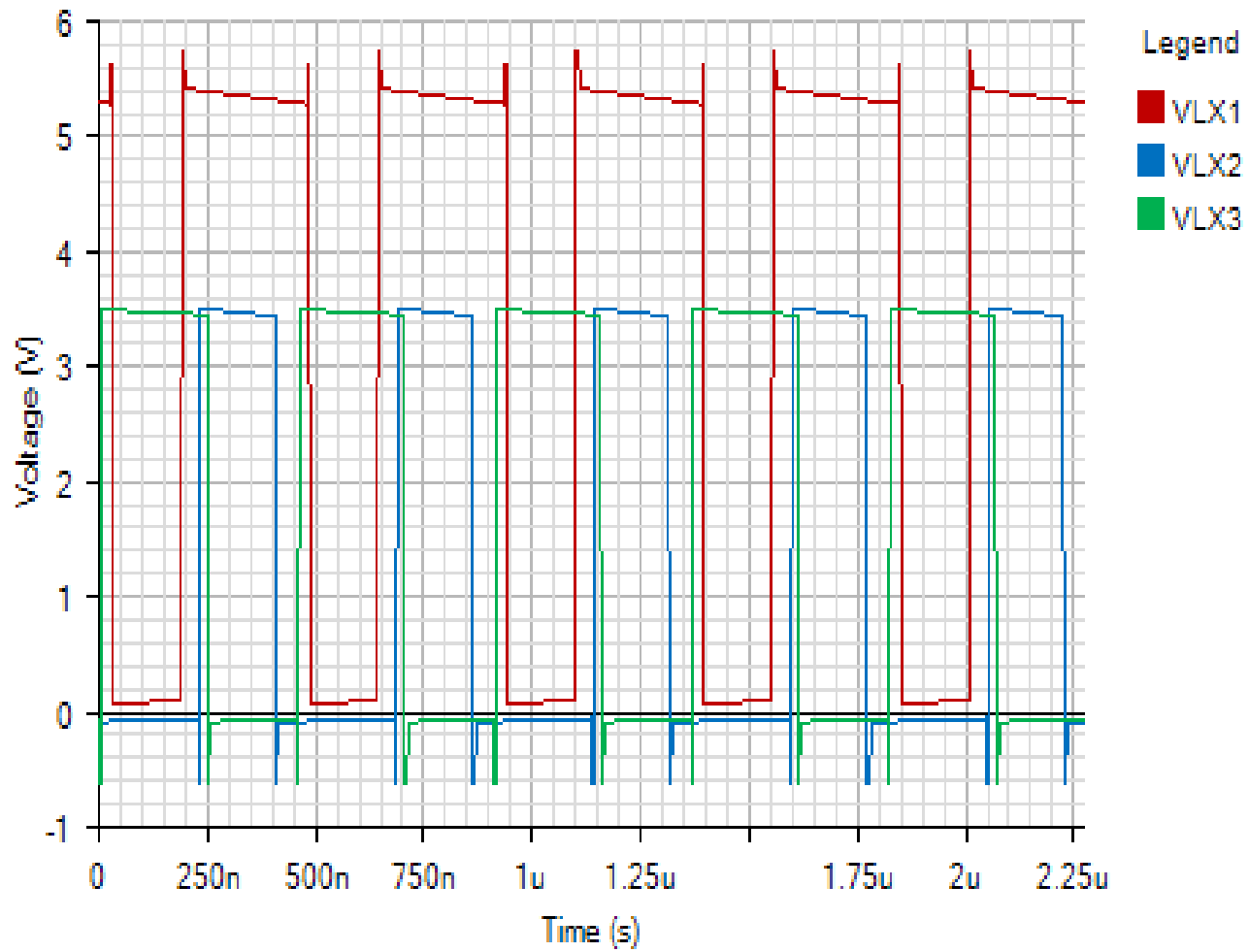
OUTPUT-BUCK2

Default



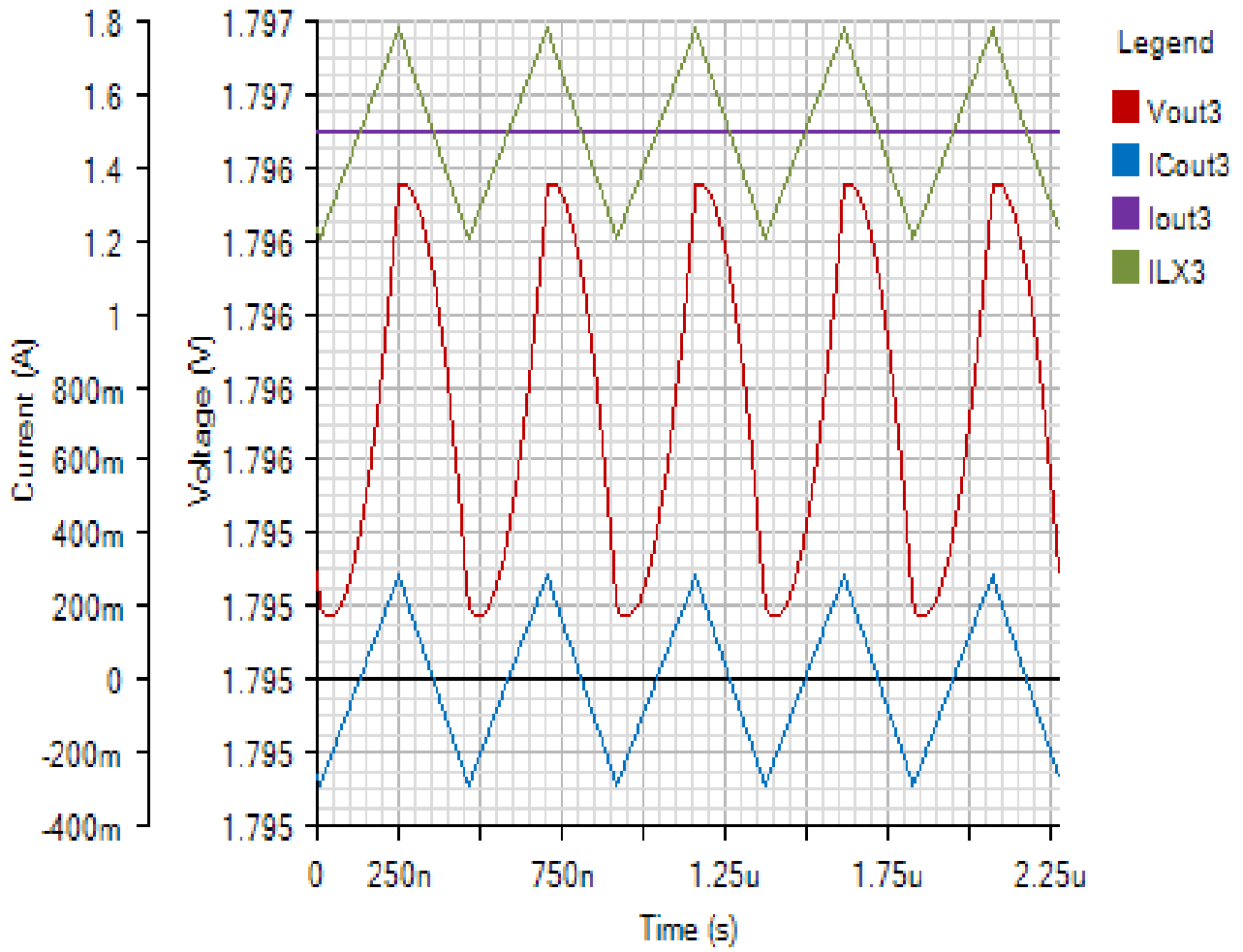
SWITCHING

Default



OUTPUT-BUCK3

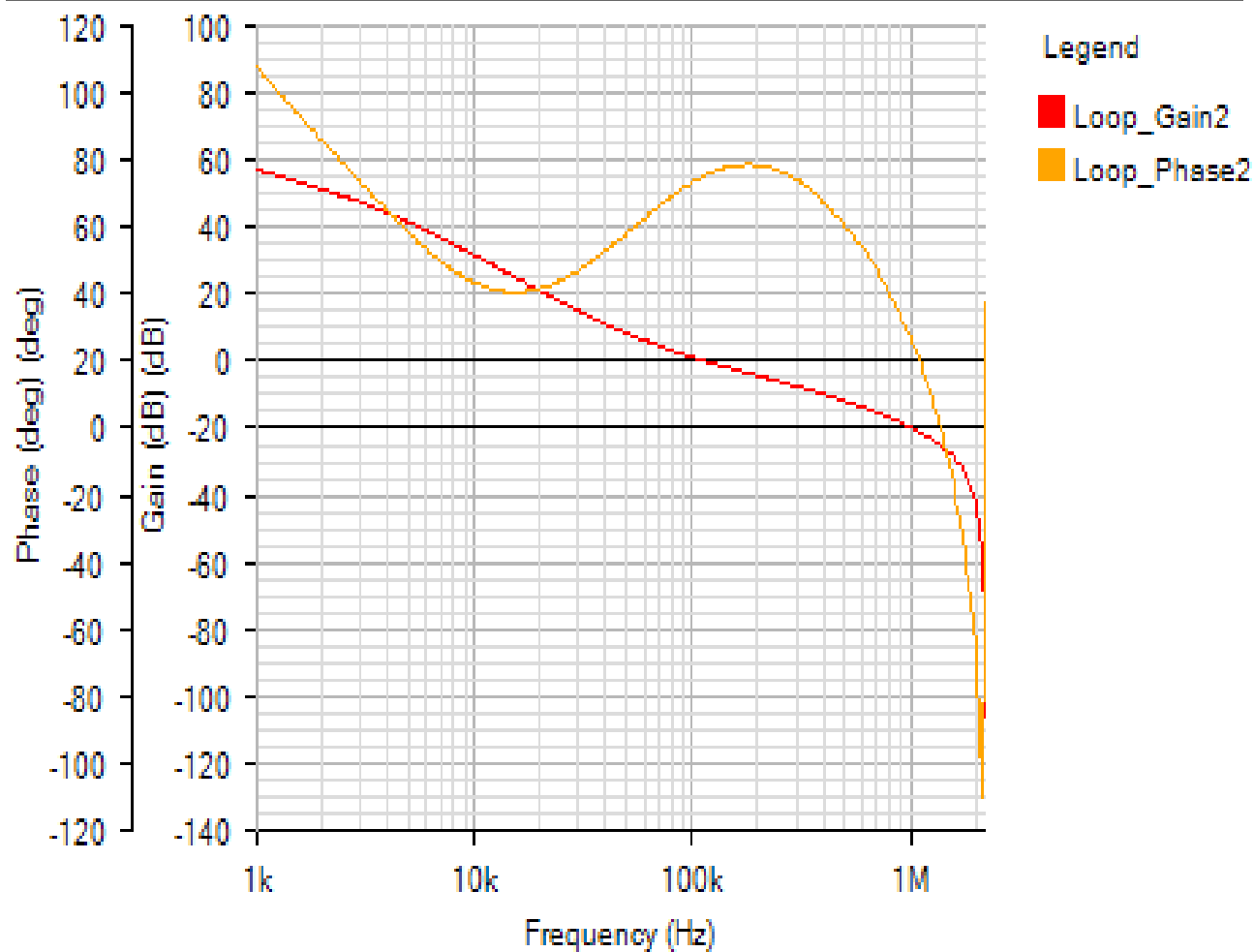
Default



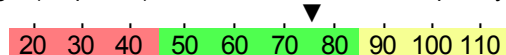
AC Loop - Fri Jan 04 2019 16:02:50

BODE2

Default

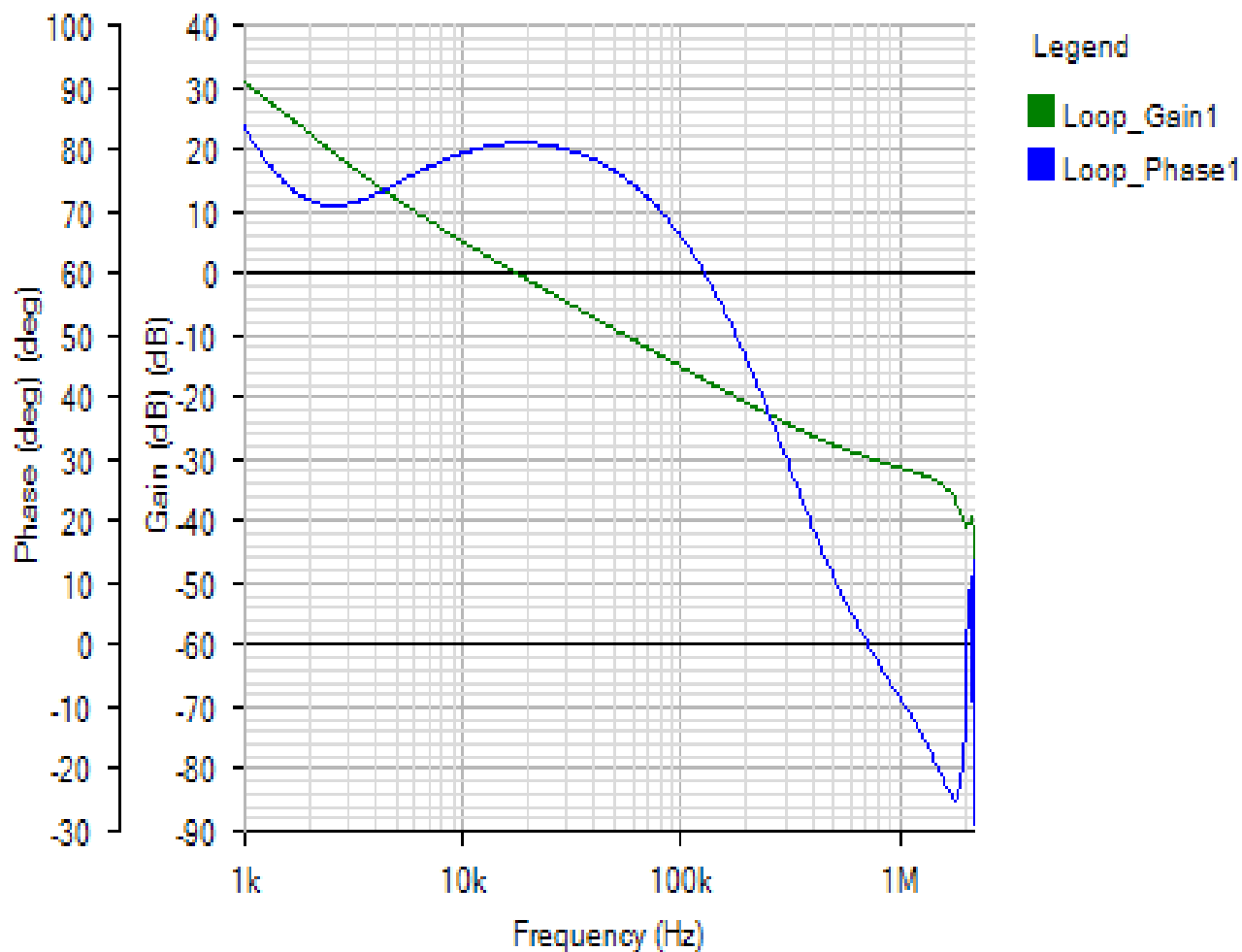


Phase Margin (output #2): 75.45° at a crossover frequency of 114.6kHz

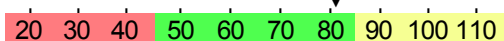


BODE1

Default

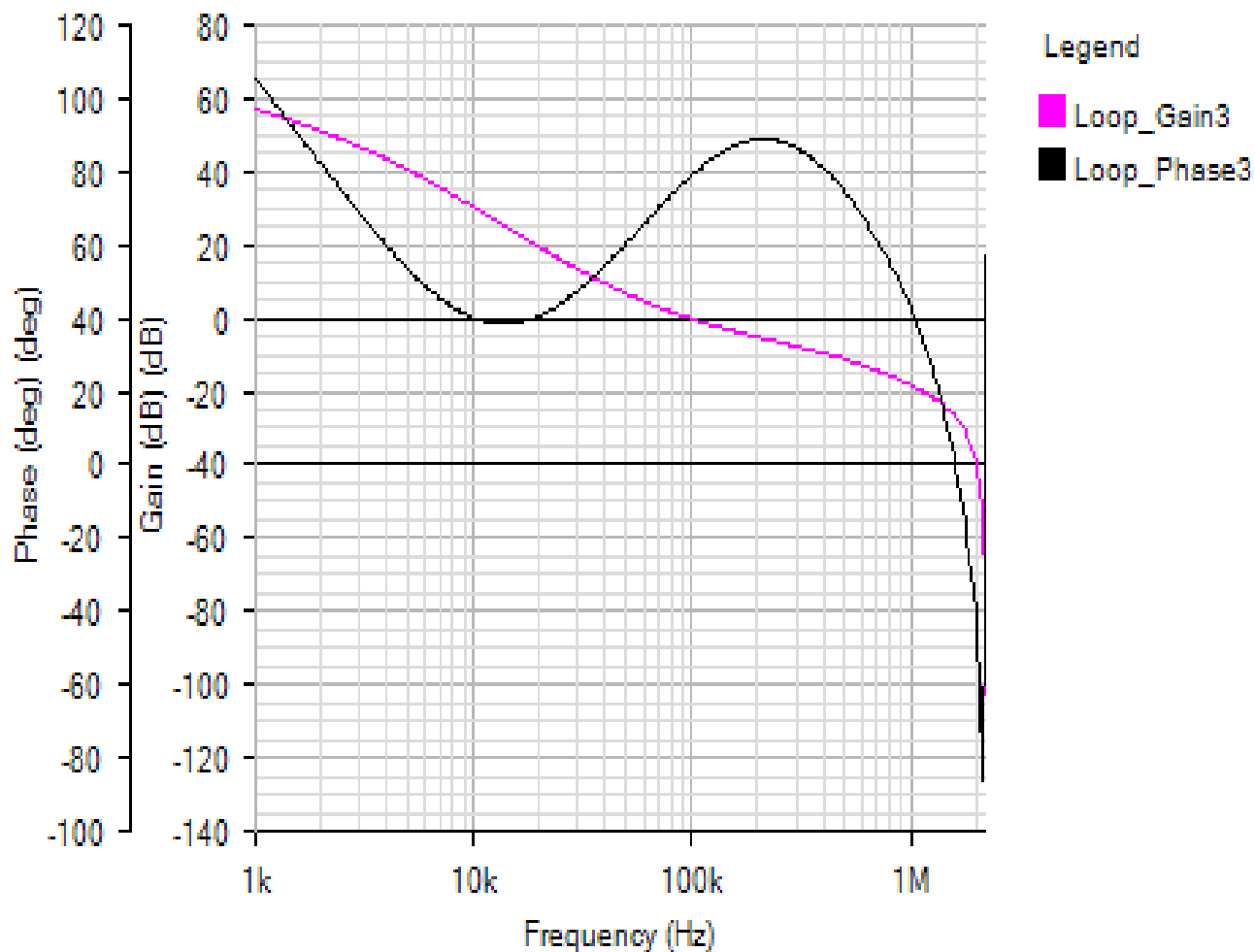


Phase Margin (output #1): 80.97° at a crossover frequency of 17.6kHz



BODE3

Default



Phase Margin (output #3): 78.51° at a crossover frequency of 97.3kHz

