

Initial Design

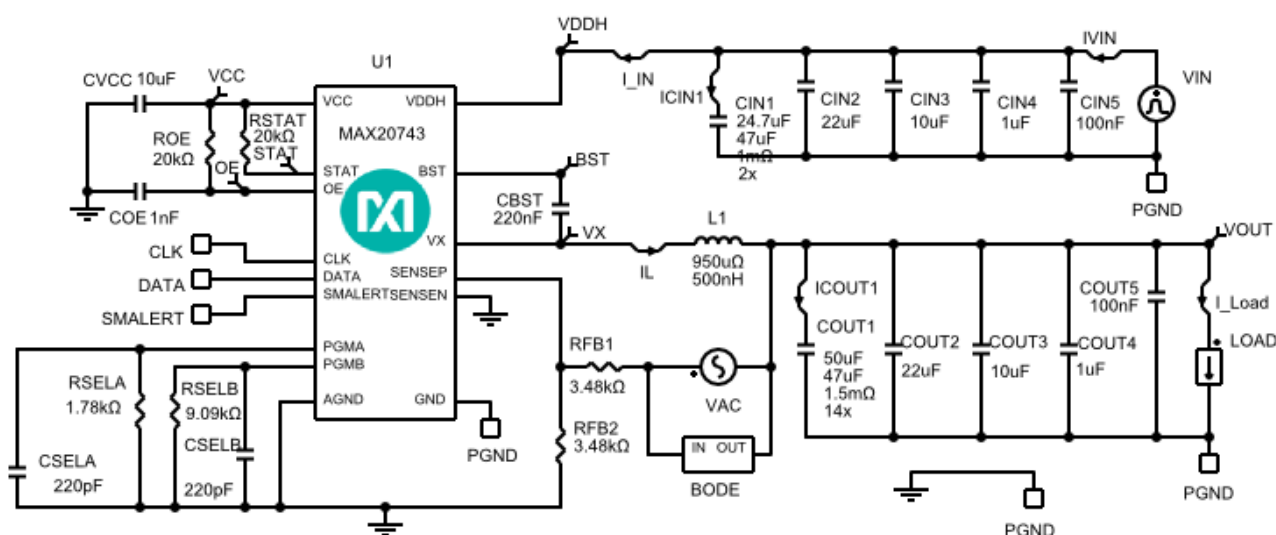
1.0

Design Requirements

Parameter	Value
Minimum Input Voltage	10V
Maximum Input Voltage	14V
Nominal Input Voltage	12V
Input Voltage Ripple	1%
Output Voltage	1.8V
Output Current	20A
Output Voltage Ripple	1%
Load Step Start Current	10A
Load Step Current	20A
Load Step Edge Rate	5A/us
Output Voltage Load Step Over/Undershoot	5%
Performance Priority	Balance Efficiency and Size
BOM Priority	Cost
Ambient Temperature	25°C
Inductor Current Ratio (LIR)	0.3
PMBus Address	1010000
Parameter Programming Method	Boot Components
Vboot Reference Voltage	0.8984 V
PMBus Reference Voltage	0.7V
Switching Frequency	600 KHz
Rgain	1.8 mOhm
Soft Start Ramp Time	3 ms
STAT Blanking Time	125 us

Parameter	Value
OCP Threshold	Setting 0
Overtemperature Protection Threshold	150 °C

Schematic



Over-temperature Protection (OTP) and Over-current Protection (OCP) are not modeled in EE-Sim.

Increasing COUT1 will decrease the loop bandwidth and increase the phase margin. Decreasing COUT1 will have the opposite effect.

This note only applies to the online EE-Sim Design Tool: RSELA, CSELA, RSELB and CSELB are set to the proper values for the design requirements entered. To change any of the chip parameters that these components set, change the design requirements accordingly and create a new design.

BOM

Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX20743	Maxim Integrated	4.5V to 16V, Integrated Step-Down Switching Regulator 35A, with PMBus
CBST	1	CC0402KRX5R6BB224	Yageo	Cap Ceramic 0.22uF 10V X5R 10% Pad SMD 0402 85°C T/R
CIN1	2	C1210C476K4PAC	Kemet	Cap Ceramic 47uF 16V 1210 85C
CIN2	1	CL31A226KOHNNNE	Samsung Electro-Mechanics	Cap Ceramic 22uF 16V X5R 10% Pad SMD 1206 85°C T/R
CIN3	1	GRM21BR61C106KE15L	Murata Manufacturing	Cap Ceramic 10uF 16V X5R 10% Pad SMD 0805 85°C T/R
CIN4	1	EMK105BJ105KV-F	Taiyo Yuden	Cap Ceramic 1uF 16V X5R 10% Pad SMD 0402 85°C T/R

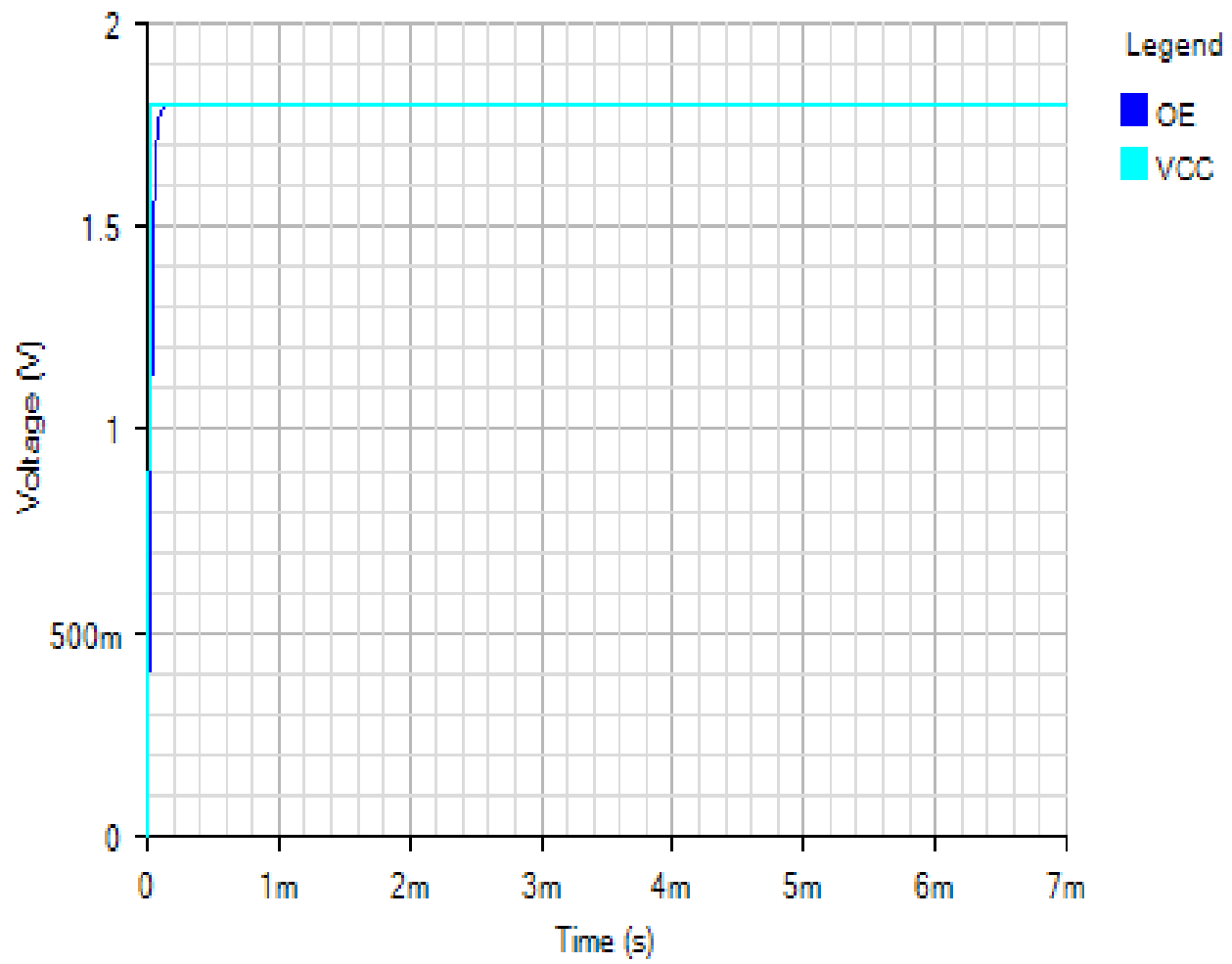
CIN5	1	CC0402KRX7R8BB104	Yageo	Cap Ceramic 0.1uF 25V X7R 10% Pad SMD 0402 125°C T/R
COE	1	CC0402KRX7R8BB102	Yageo	Cap Ceramic 0.001uF 25V X7R 10% Pad SMD 0402 125°C T/R
COUT1	14	GRM32ER71A476ME15L	Murata	Cap Ceramic 47uF 10V X7R 20% SMD 1210 125C Embossed T/R
COUT2	1	JMK212BJ226KG-T	Taiyo Yuden	Cap Ceramic 22uF 6.3V X5R 10% Pad SMD 0805 85°C T/R
COUT3	1	C1608X5R1A106K080AC	TDK	Cap Ceramic 10uF 10V X5R 10% Pad SMD 0603 85°C T/R
COUT4	1	EMK105BJ105KV-F	Taiyo Yuden	Cap Ceramic 1uF 16V X5R 10% Pad SMD 0402 85°C T/R
COUT5	1	CC0402KRX7R8BB104	Yageo	Cap Ceramic 0.1uF 25V X7R 10% Pad SMD 0402 125°C T/R
CSELA	1	C0402C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0402 125°C T/R
CSELB	1	C0402C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0402 125°C T/R
CVCC	1	NMC0402X5R106K6.3TRPF	NIC Components	Cap Ceramic 10uF 6.3V X5R 10% Pad SMD 0402 85°C T/R
L1	1	MLC1565-501MLB	Coilcraft	Inductor 500nH 20% 0.86mOhm 47A Isat 26.9A Irms
RFB1	1	ERJ2RKF3481X	Panasonic	Res Thick Film 0402 3.48K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RFB2	1	ERJ2RKF3481X	Panasonic	Res Thick Film 0402 3.48K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
ROE	1	ERJ2GEJ203X	Panasonic	Res Thick Film 0402 20K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
RSELA	1	ERJ2RKF1781X	Panasonic	Res Thick Film 0402 1.78K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RSELB	1	ERJ2RKF9091X	Panasonic	Res Thick Film 0402 9.09K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RSTAT	1	ERJ2GEJ203X	Panasonic	Res Thick Film 0402 20K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R

Simulation Results

Start Up - Sun Nov 18 2018 15:33:58

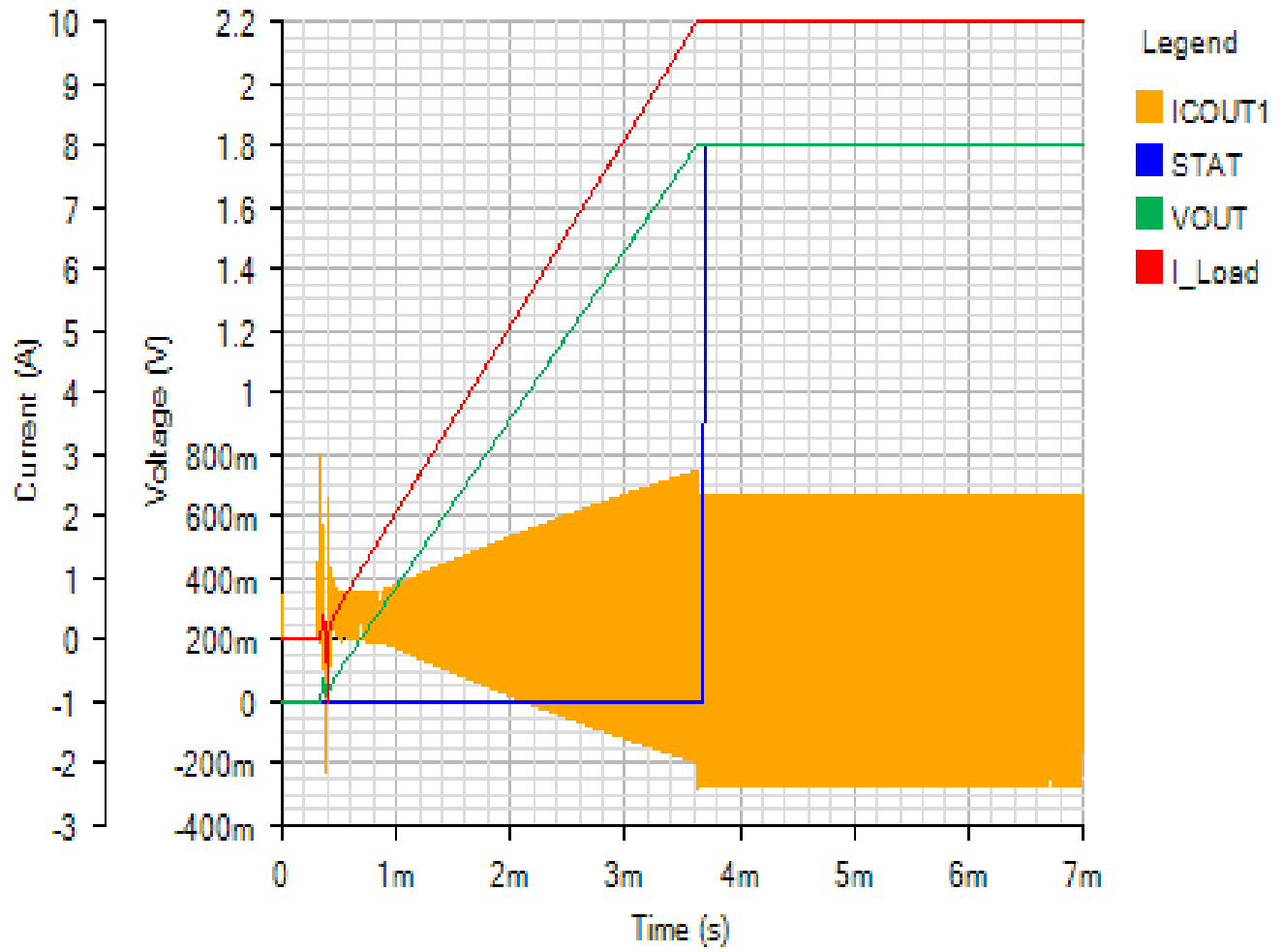
IC

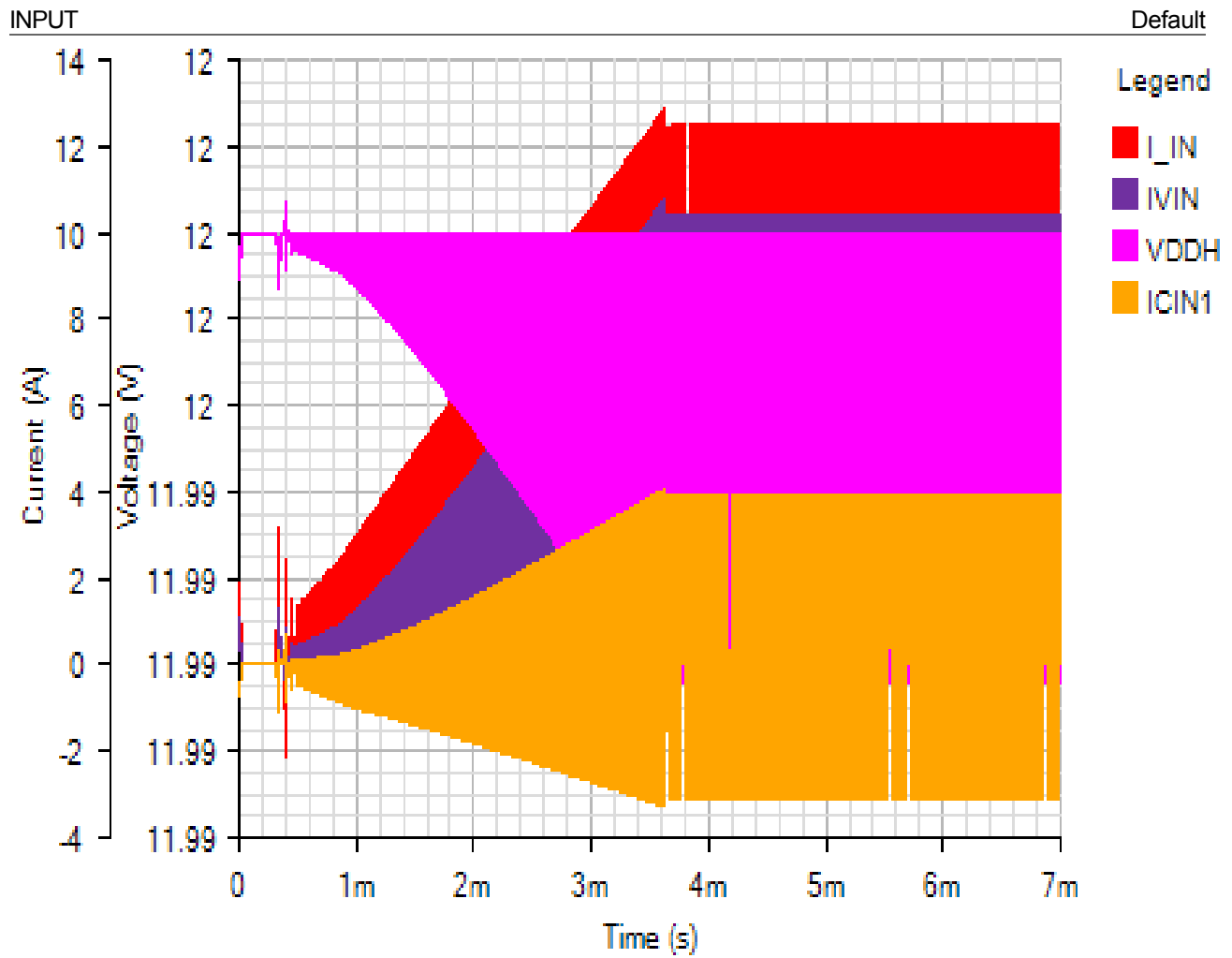
Default



OUTPUT

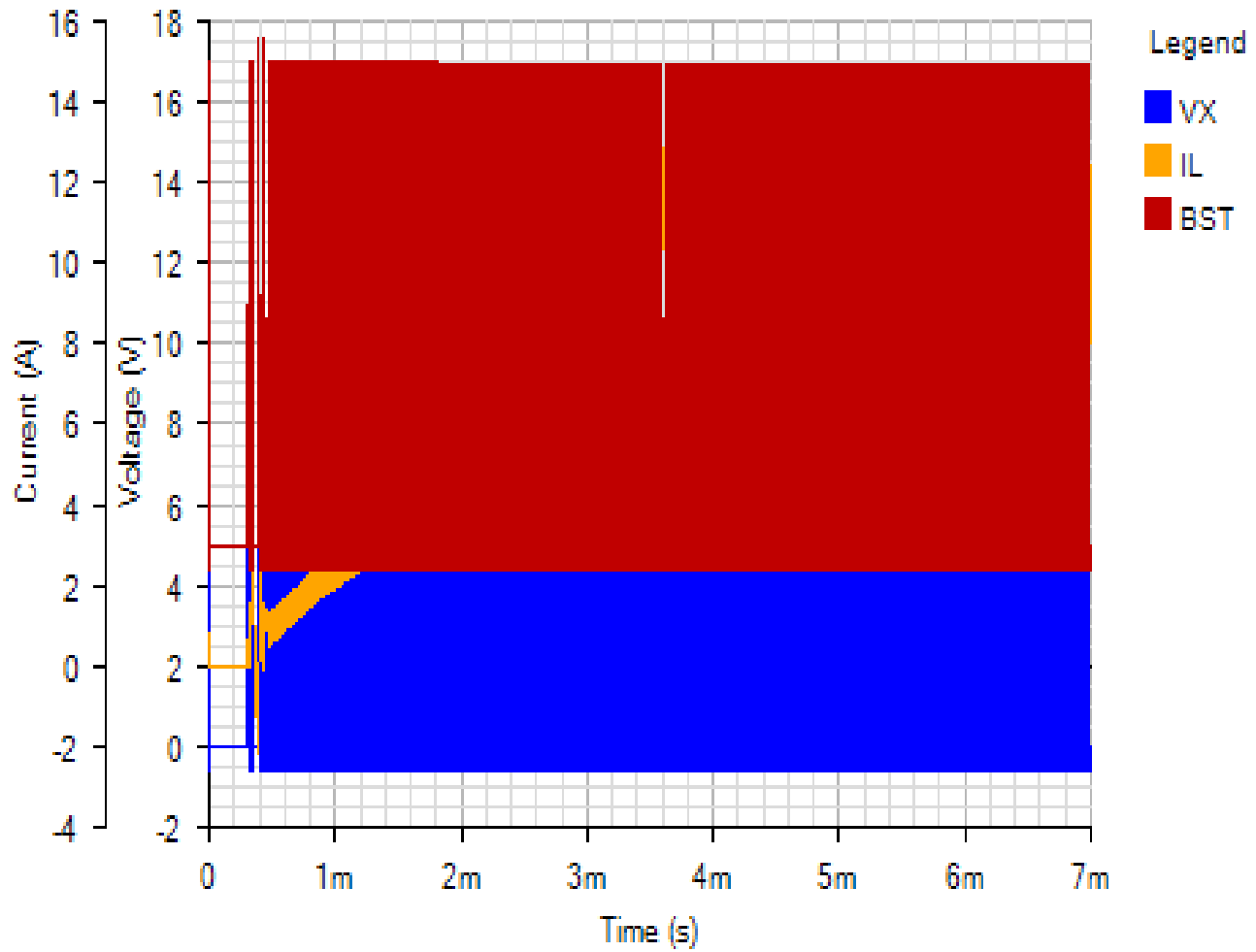
Default





SWITCHING

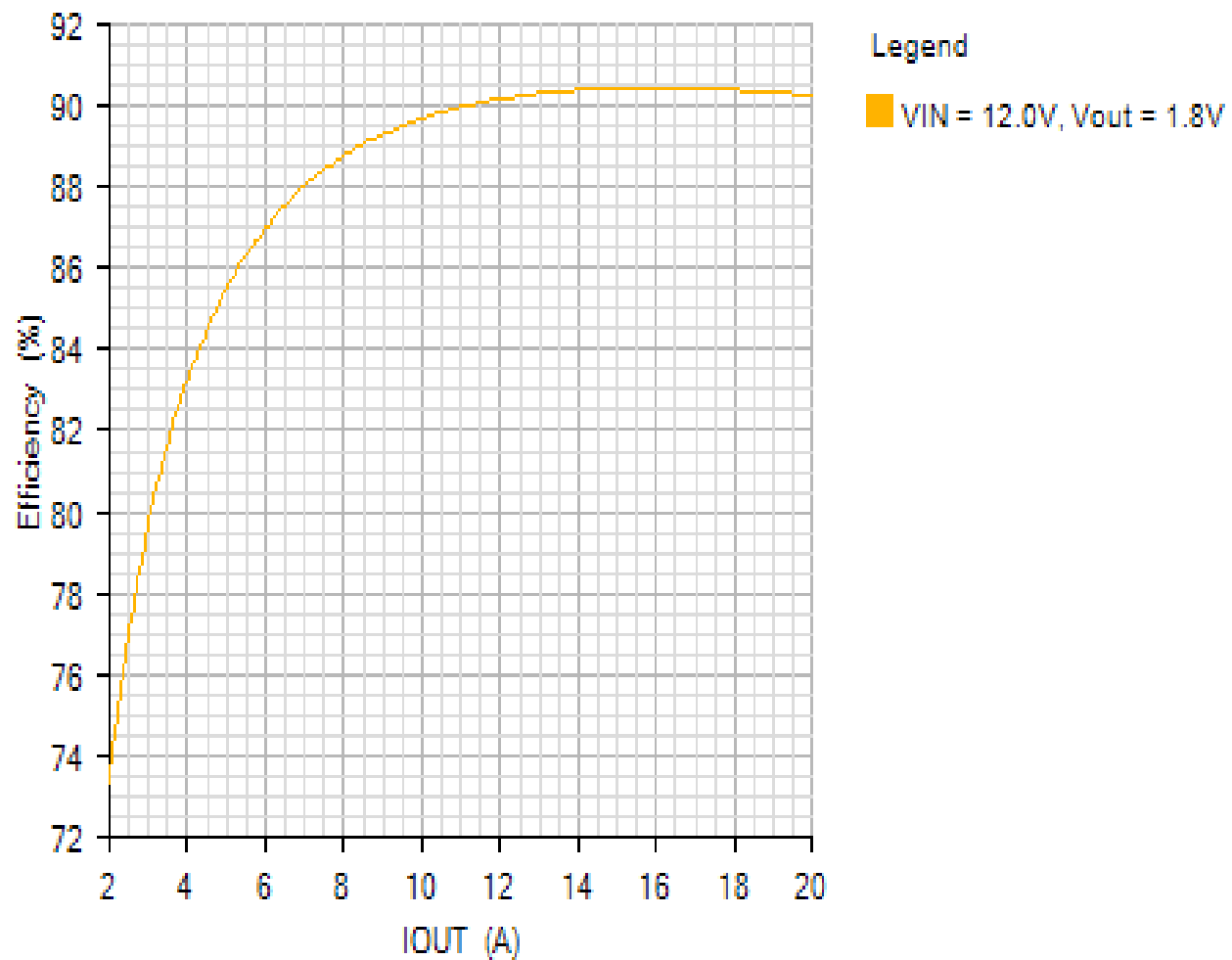
Default



Efficiency - Sun Nov 18 2018 15:33:58

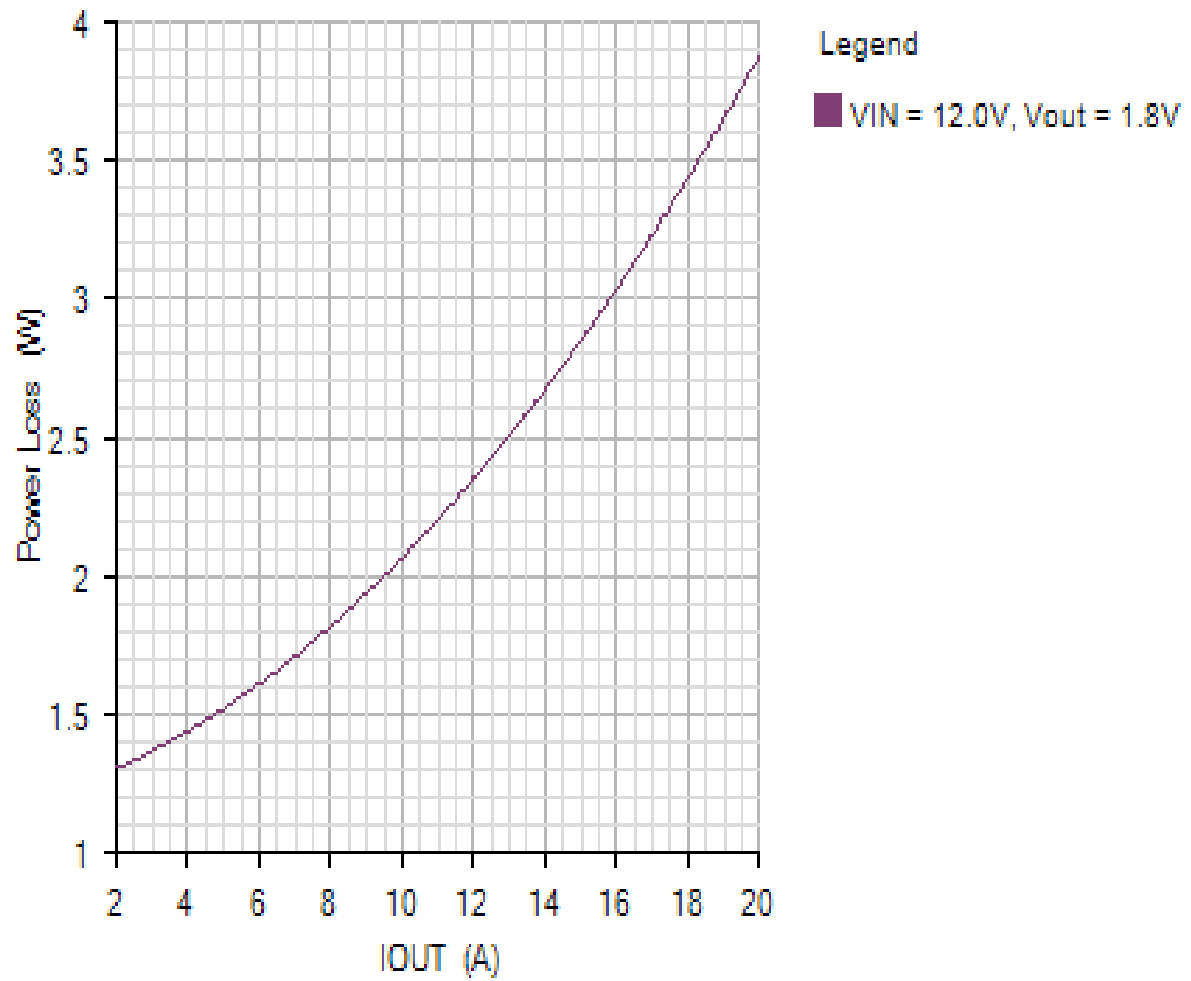
EFFICIENCY_PLOT

Default



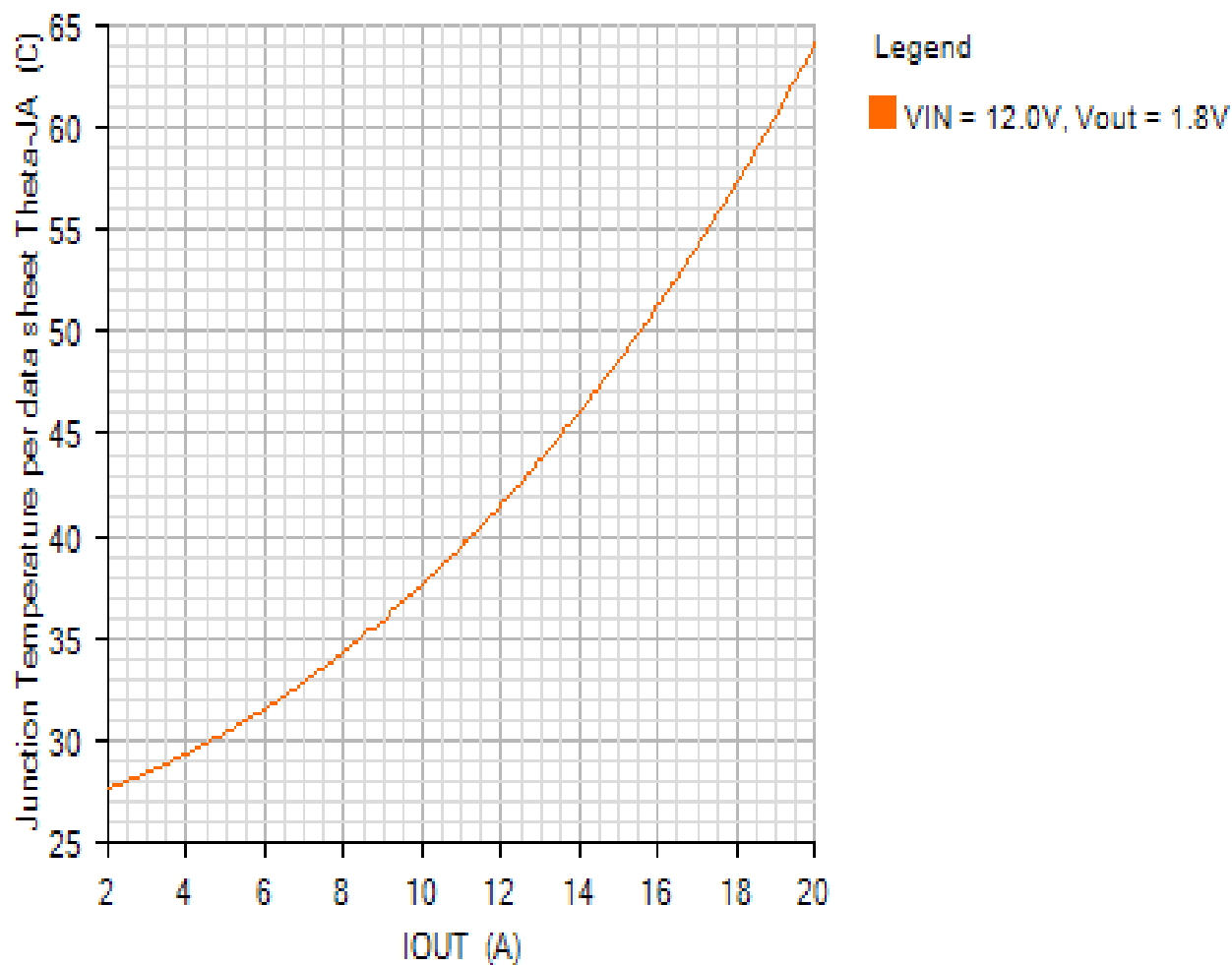
POWER_LOSS_PLOT

Default

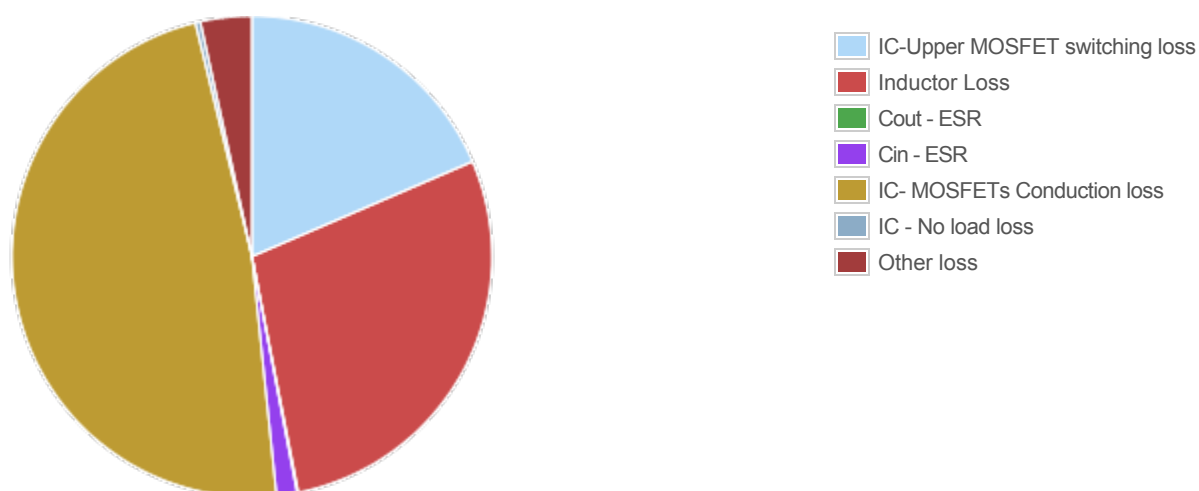


JUNCTION_TEMPERATURE_PLOT

Default



Losses



Component

Loss (W)

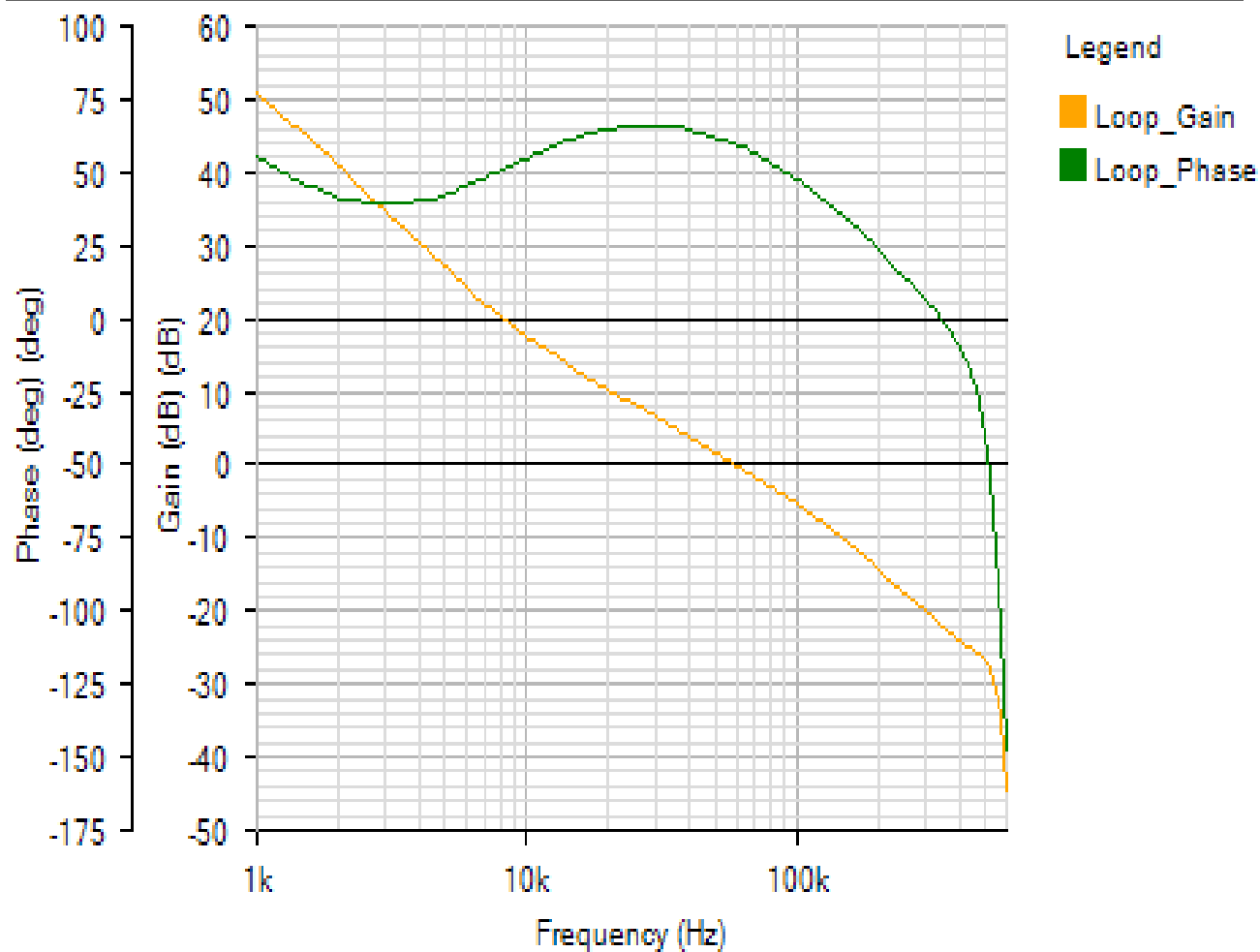
% of total

Component	Loss (W)	% of total
IC-Upper MOSFET switching loss	0.719	18.5
Inductor Loss	1.1	28.4
Cout - ESR	0.0032	0.1
Cin - ESR	0.0534	1.4
IC- MOSFETs Conduction loss	1.855	47.8
IC - No load loss	0.0132	0.3
Other loss	0.134	3.5
Total	3.8778	100

AC Loop - Sun Nov 18 2018 15:33:58

BODE

Default



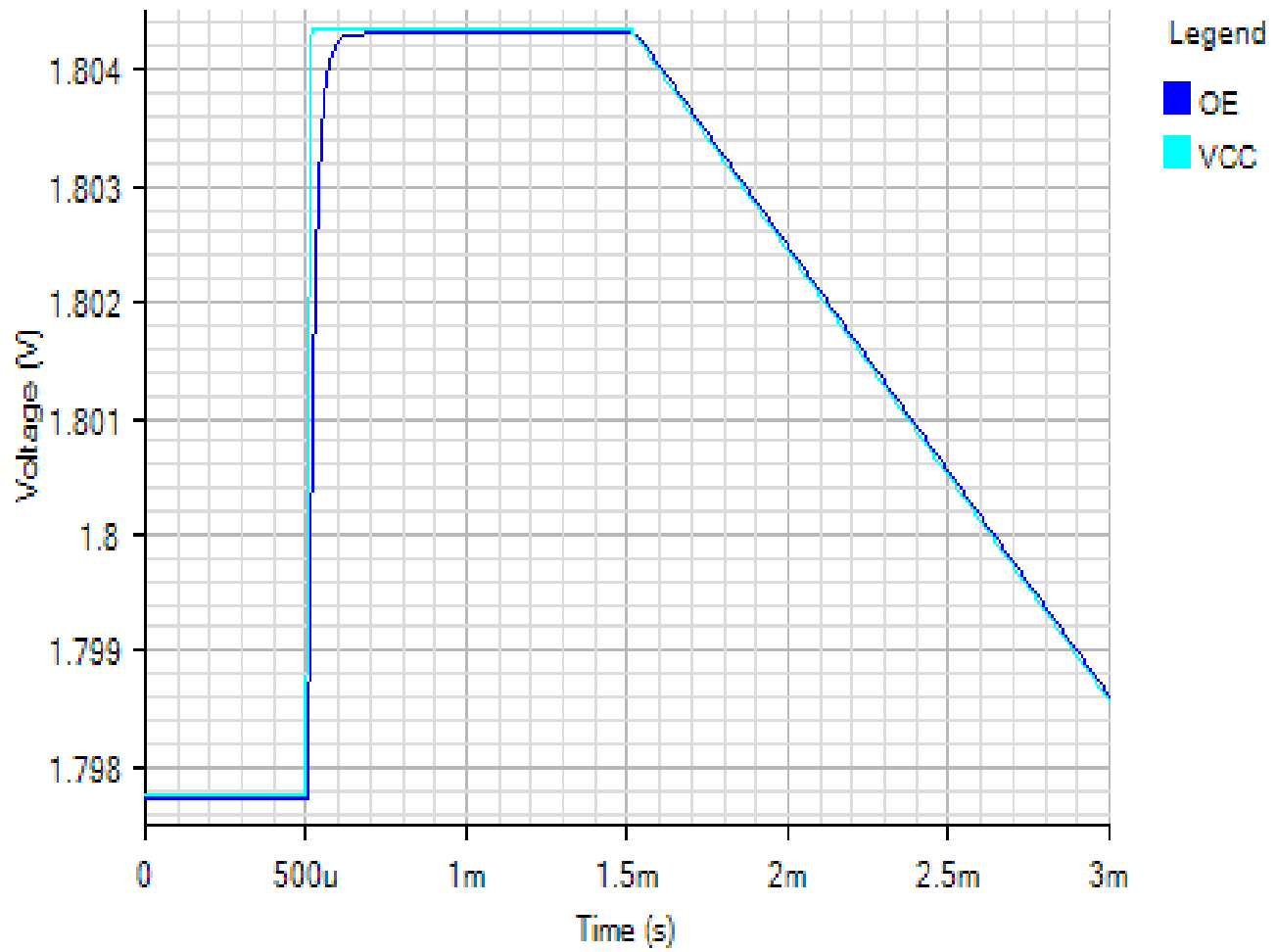
Phase Margin: 59.46° at a crossover frequency of 59.9kHz



Line Transient - Sun Nov 18 2018 15:33:58

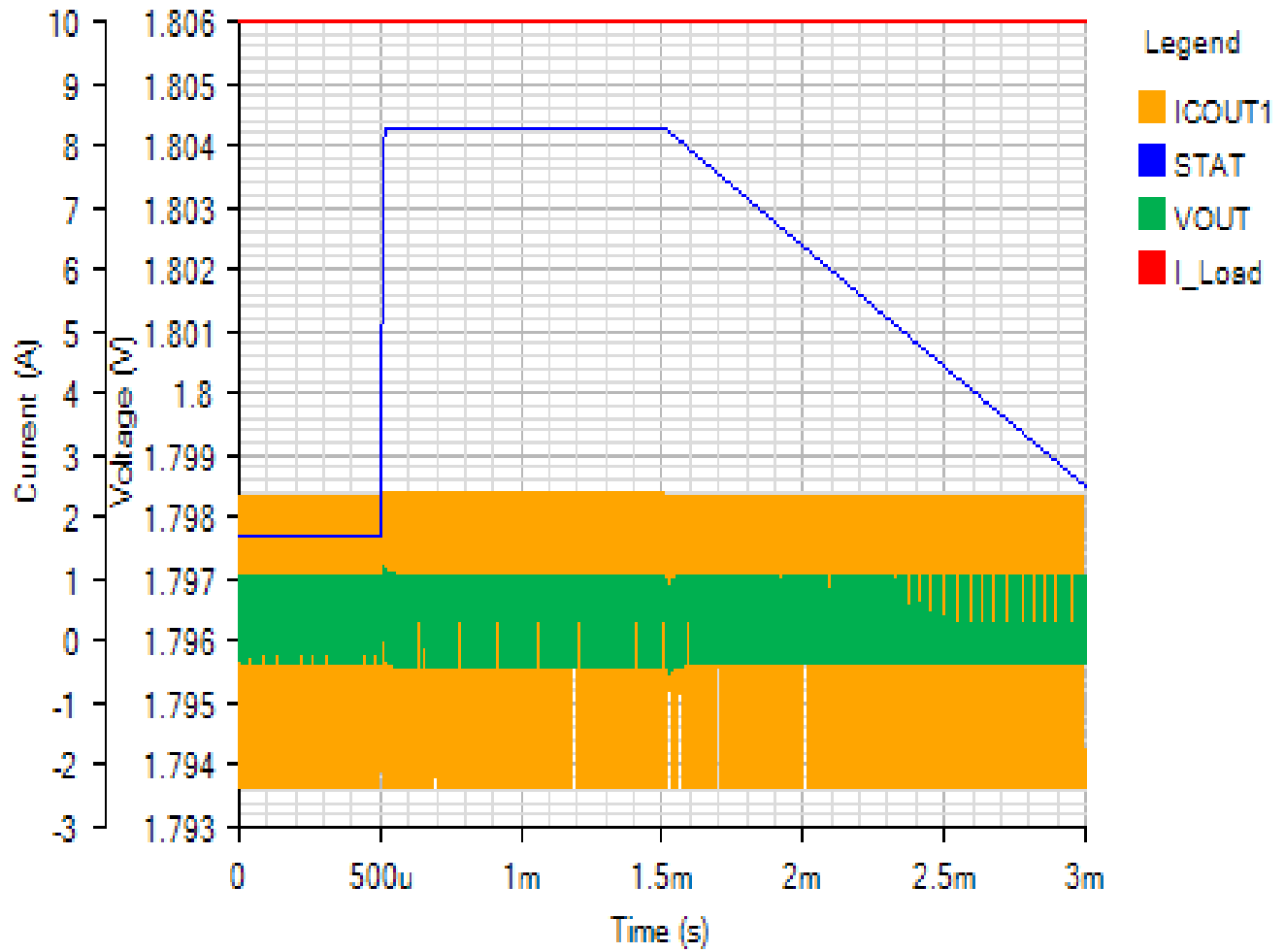
IC

Default



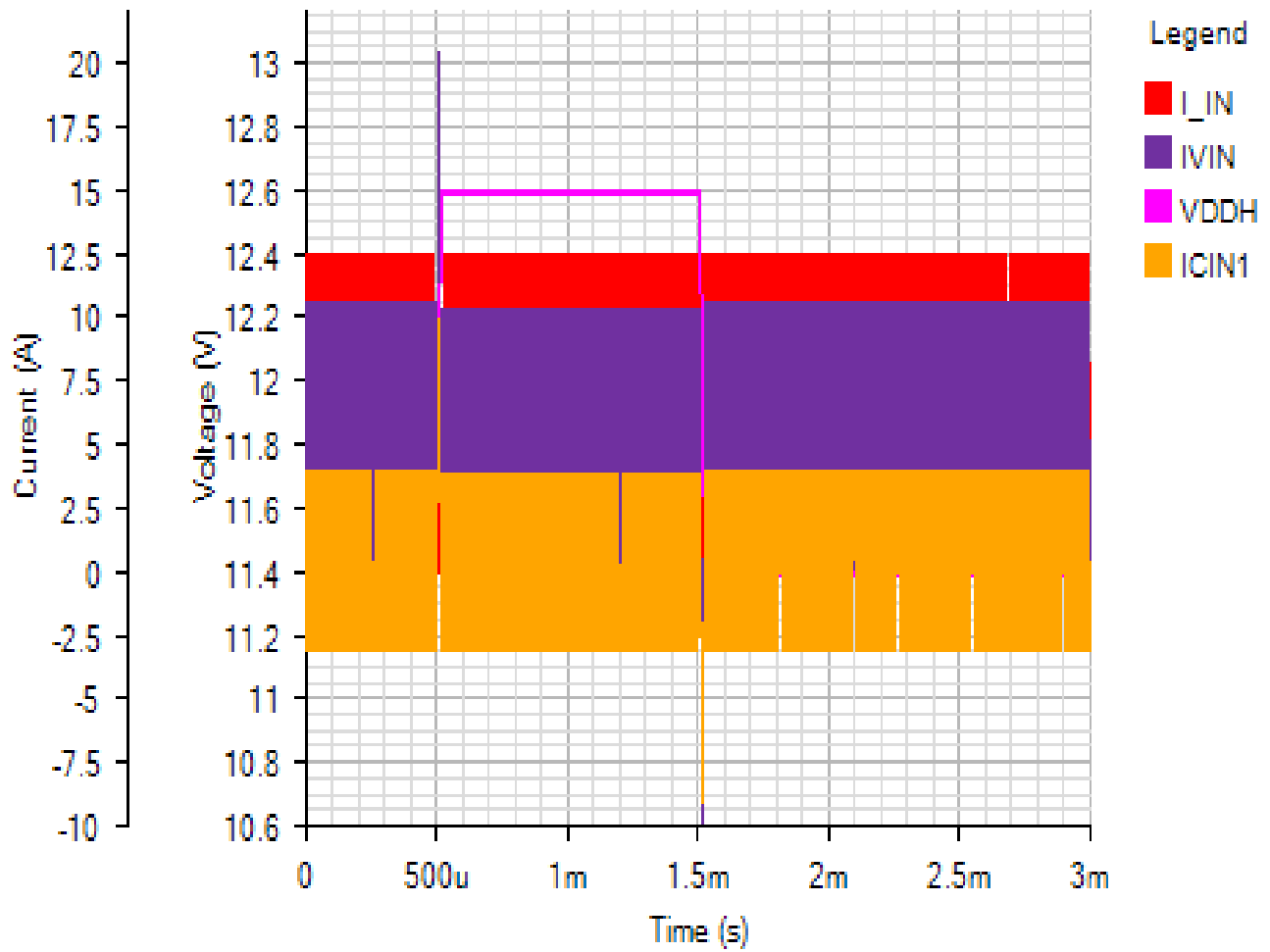
OUTPUT

Default



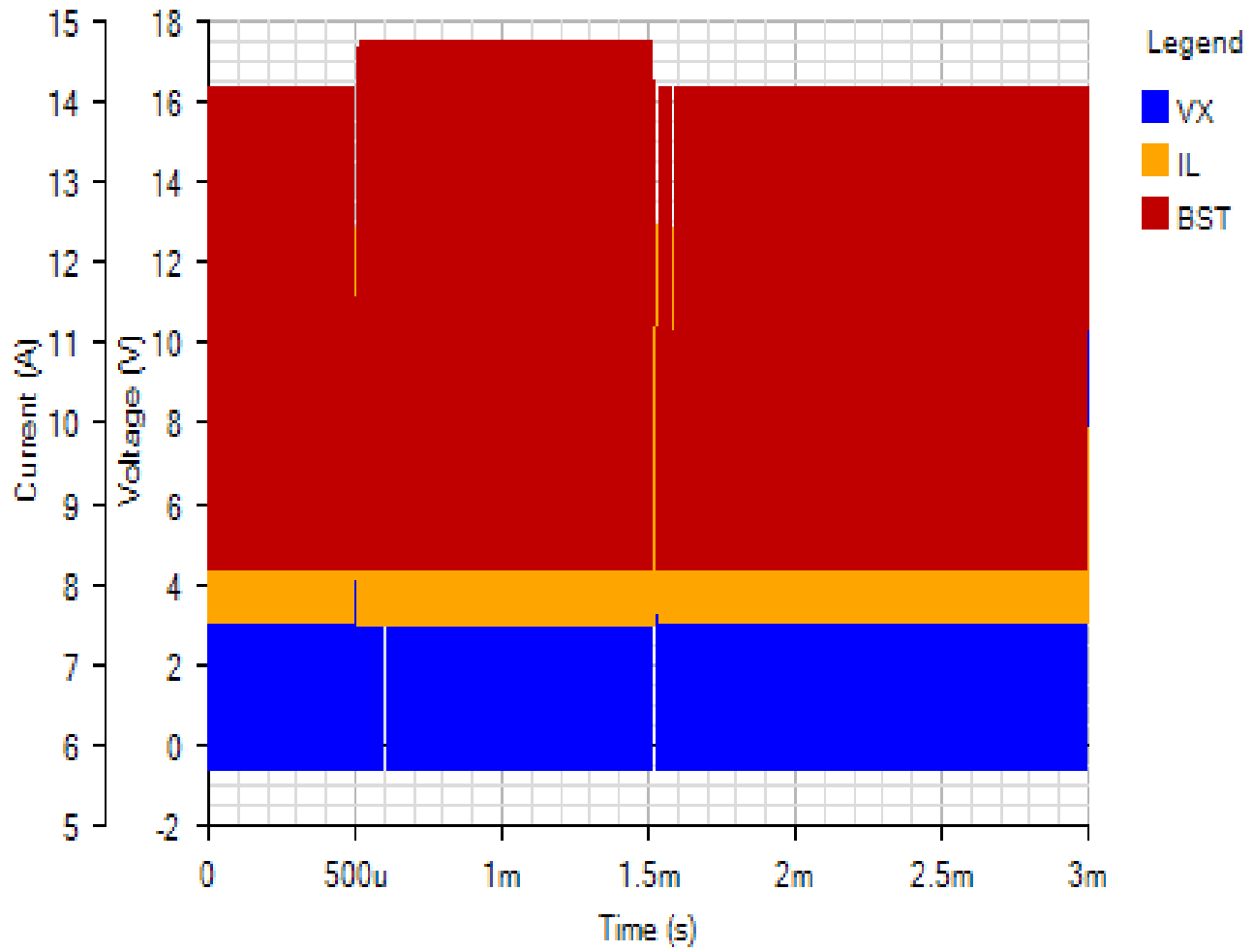
INPUT

Default

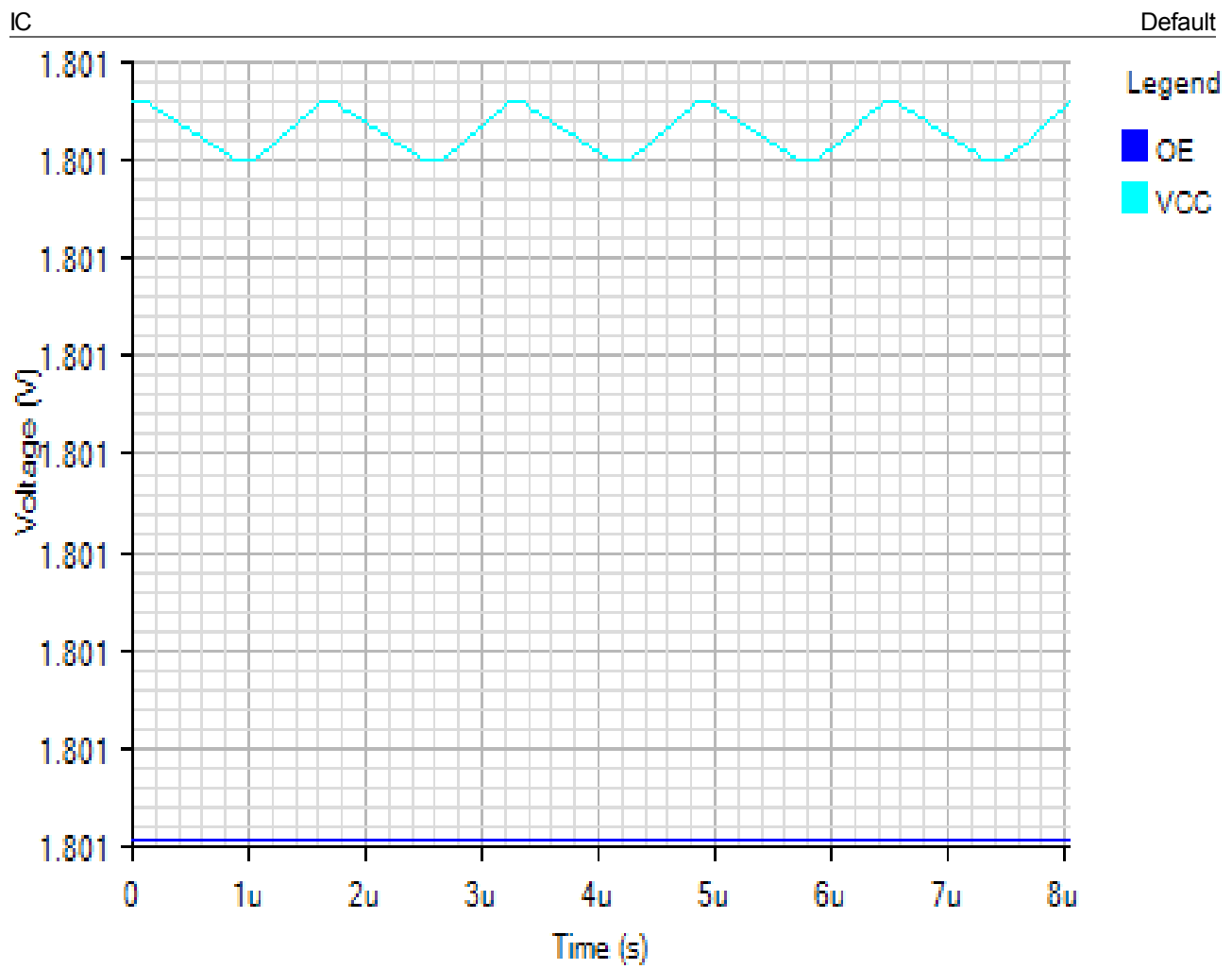


SWITCHING

Default

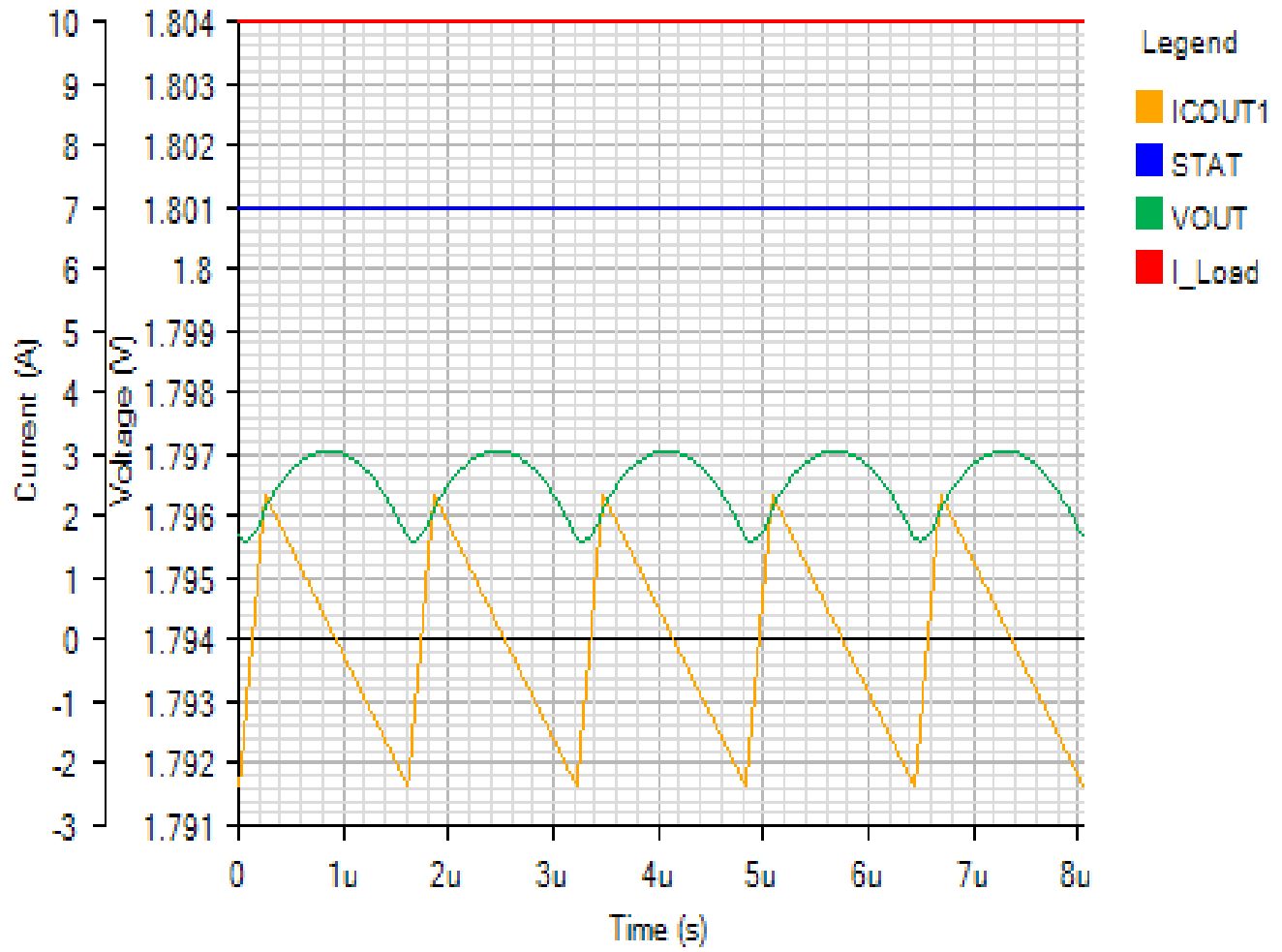


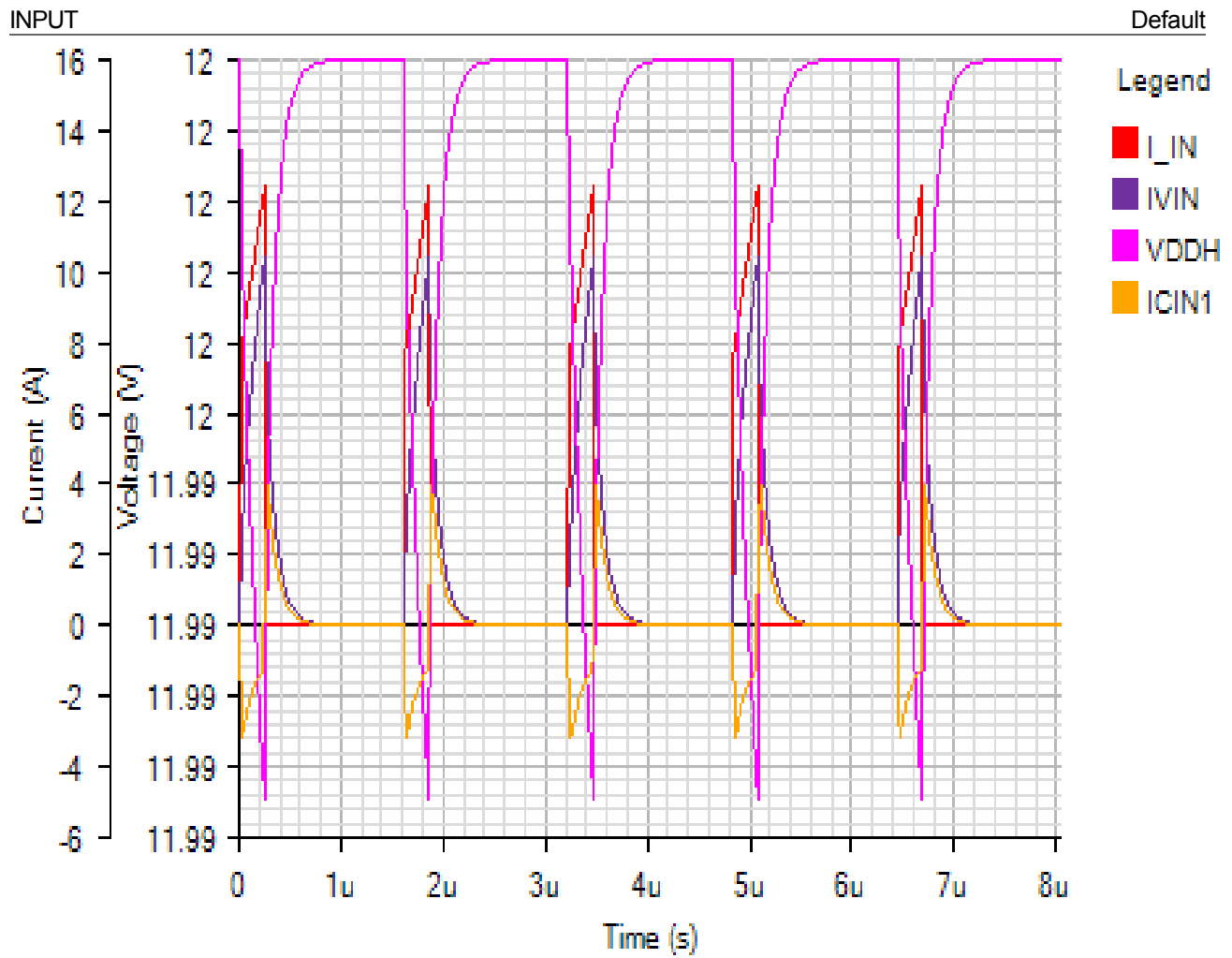
Steady State - Sun Nov 18 2018 15:33:58



OUTPUT

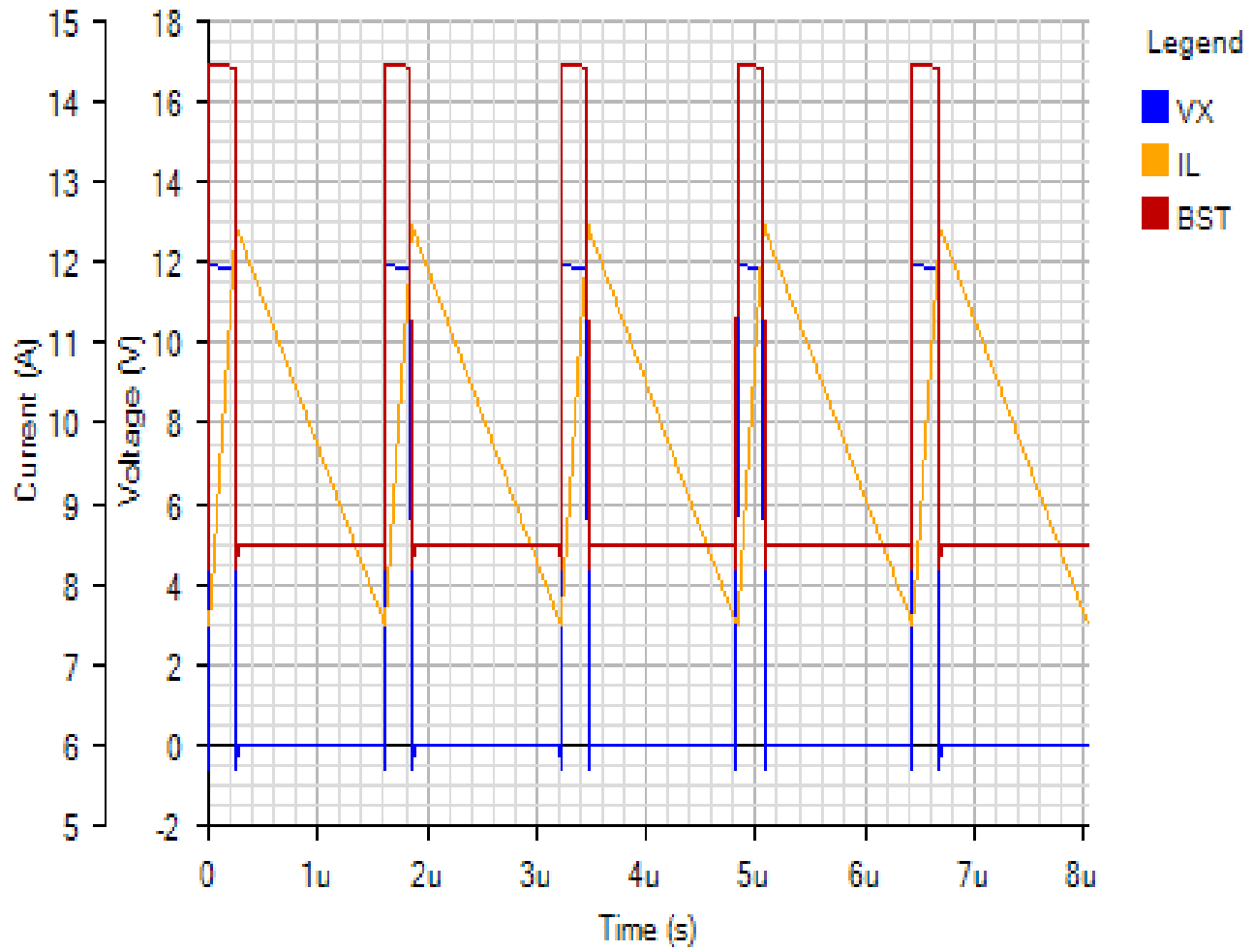
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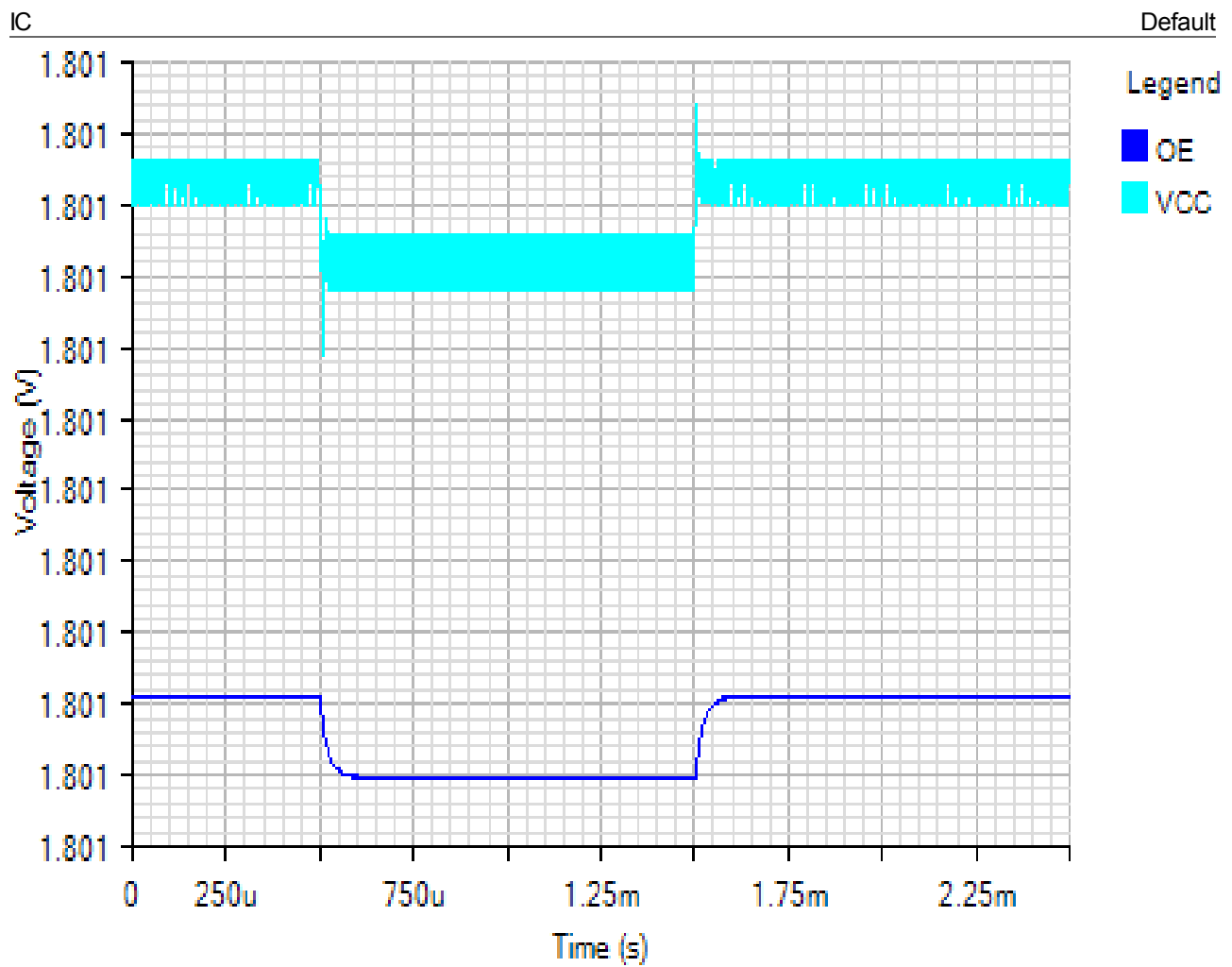


SWITCHING

Default



Load Step - Sun Nov 18 2018 15:33:58



OUTPUT

Default

