

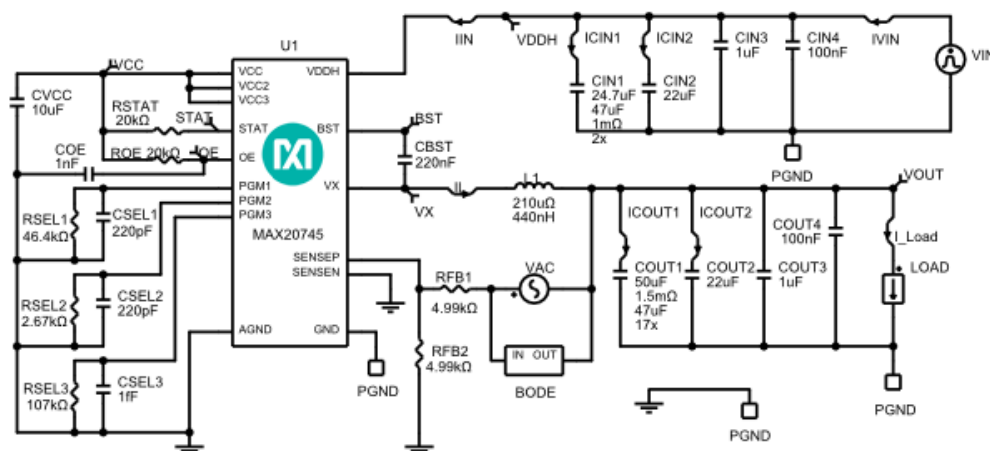
Initial Design

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
Inductor Current Ratio (LIR)	0.3
Switching Frequency	500 KHz
Reference Voltage value	0.8984 V
Over Temperature Protection Value	150 °C
Rgain value	1.8 mOhm
STAT Blanking Time	125 us
Soft Start Ramp Time	1.5 ms
Ambient Temperature	25°C

Schematic



Overtemperature Protection (OTP) and Overcurrent 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: RSEL1, CSEL1, RSEL2, CSEL2, RSEL3 and CSEL3 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	MAX20745	Maxim Integrated	4.5V to 16V High Efficiency Step-Down Switching Regulator upto 25A Maximum Load
CBST	1	0805YC224KAT2A	AVX	Cap Ceramic 0.22uF 16V X7R 10% Pad SMD 0805 125°C T/R
CIN1	2	C1210C476K4PAC	Kemet	Cap Ceramic 47uF 16V 1210 85C
CIN2	1	GCM32ER71C226KE19L	Murata Manufacturing	Cap Ceramic 22uF 16V X7R 10% Pad SMD 1210 125°C Automotive T/R
CIN3	1	CGA4J2X7R1C105K125AA	TDK	Cap Ceramic 1uF 16V X7R 10% Pad SMD 0805 125°C Automotive T/R
CIN4	1	0805YC104KAT2A	AVX	Cap Ceramic 0.1uF 16V X7R 10% Pad SMD 0805 125°C T/R
COE	1	C0603C102K8RACTU	KEMET Corporation	Cap Ceramic 0.001uF 10V X7R 10% Pad SMD 0603 125°C T/R
COUT1	17	GRM32ER71A476ME15L	Murata	Cap Ceramic 47uF 10V X7R 20% SMD 1210 125C Embossed T/R
COUT2	1	GCM32ER71A226KE12L	Murata Manufacturing	Cap Ceramic 22uF 10V X7R 10% Pad SMD 1210 125°C Automotive T/R
COUT3	1	CC0603KRX7R6BB105	Yageo	Cap Ceramic 1uF 10V X7R 10% Pad SMD 0603 125°C T/R
COUT4	1	GCM155R71C104KA55D	Murata Manufacturing	Cap Ceramic 0.1uF 16V X7R 10% Pad SMD 0402 125°C Automotive T/R
CSEL1	1	C0805C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0805 125°C T/R
CSEL2	1	C0805C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0805 125°C T/R

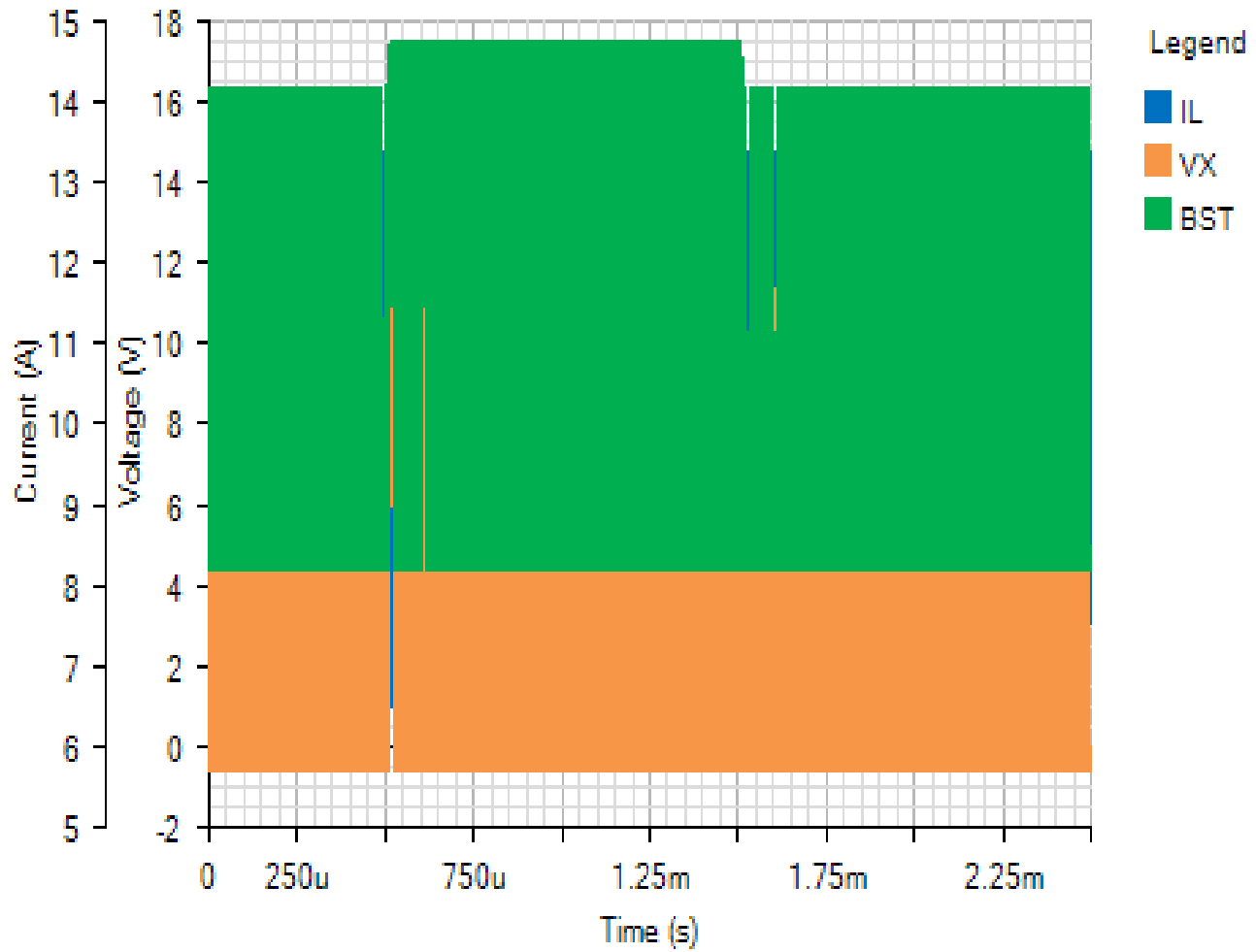
CVCC	1	GCJ31CR71A106KA13L	Murata Manufacturing	Cap Ceramic 10uF 10V X7R 10% Pad SMD 1206 Soft Termination 125°C Automotive T/R
L1	1	SLC1480-441MLB	Coilcraft	Inductor 440nH 20% 0.18mOhm 32A Isat 55A Irms
RFB1	1	ERJ2RKF4991X	Panasonic	Res Thick Film 0402 4.99K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RFB2	1	ERJ2RKF4991X	Panasonic	Res Thick Film 0402 4.99K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
ROE	1	ERJ3GEYJ203V	Panasonic	Res Thick Film 0603 20K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
RSEL1	1	ERJ2RKF4642X	Panasonic	Res Thick Film 0402 46.4K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RSEL2	1	ERJ2RKF2671X	Panasonic	Res Thick Film 0402 2.67K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RSEL3	1	ERJ2RKF1073X	Panasonic	Res Thick Film 0402 107K 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

Line Transient - Sun Nov 18 2018 15:40:36

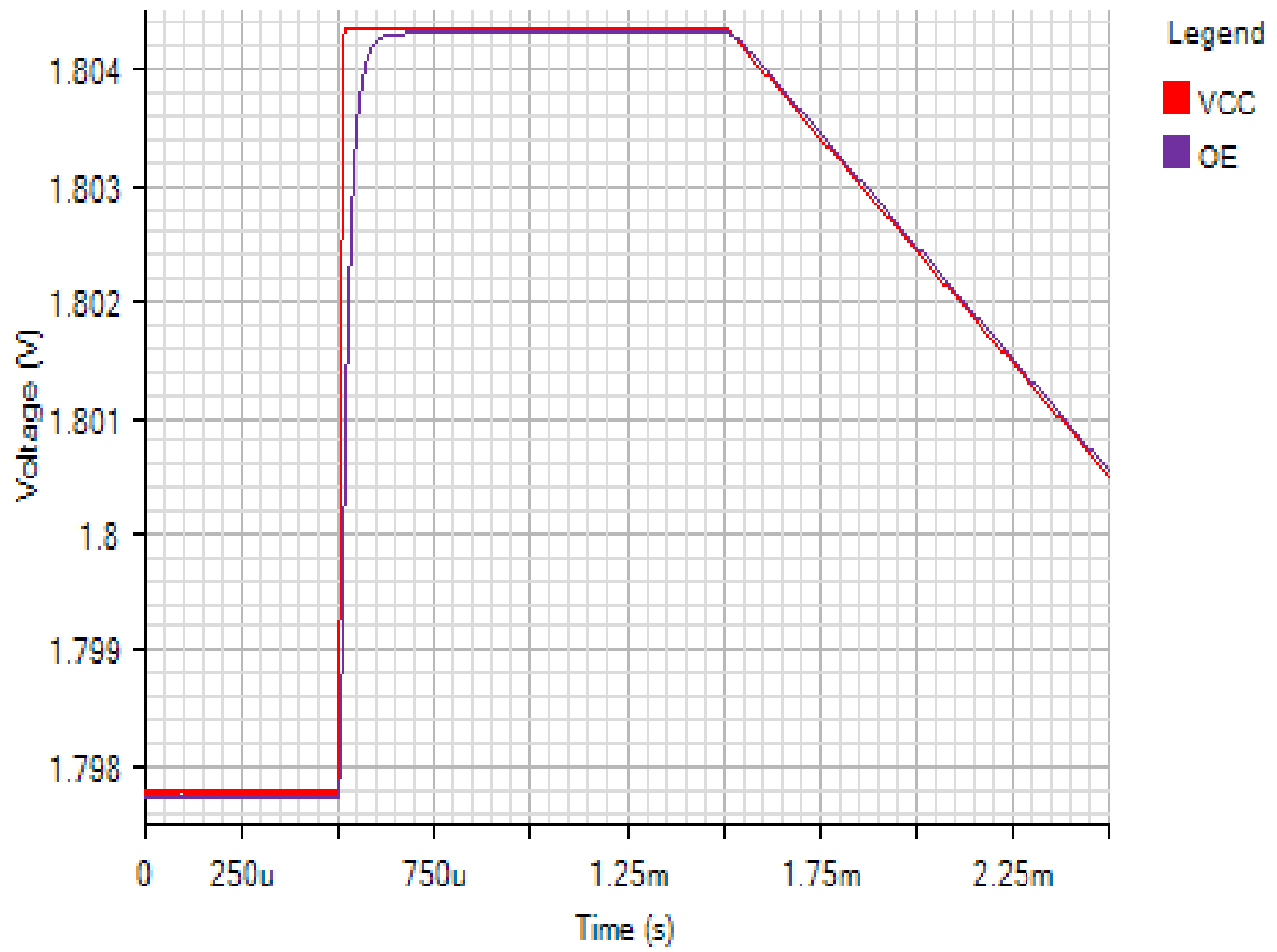
SWITCHING

Default



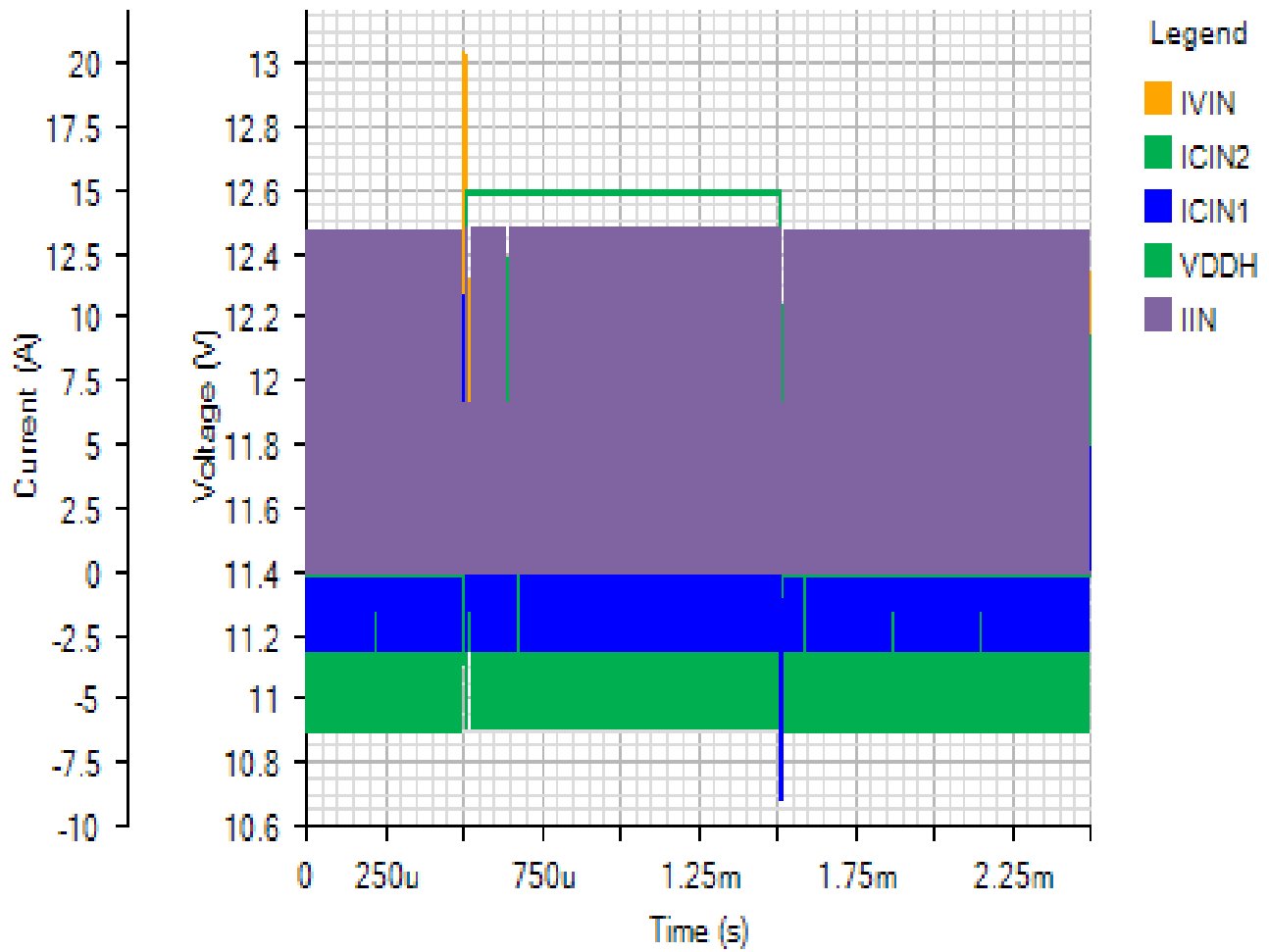
IC

Default



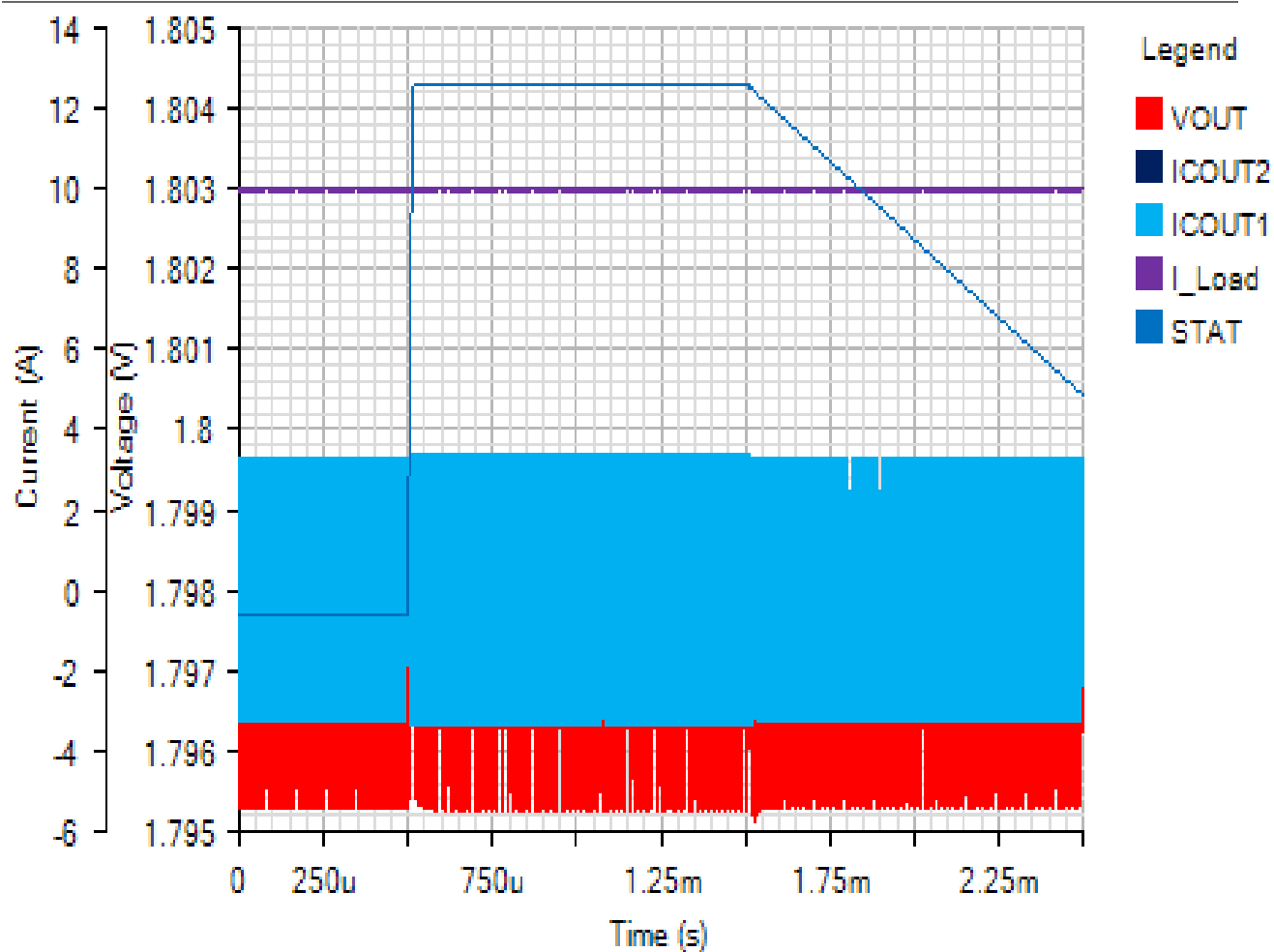
INPUT

Default



OUTPUT

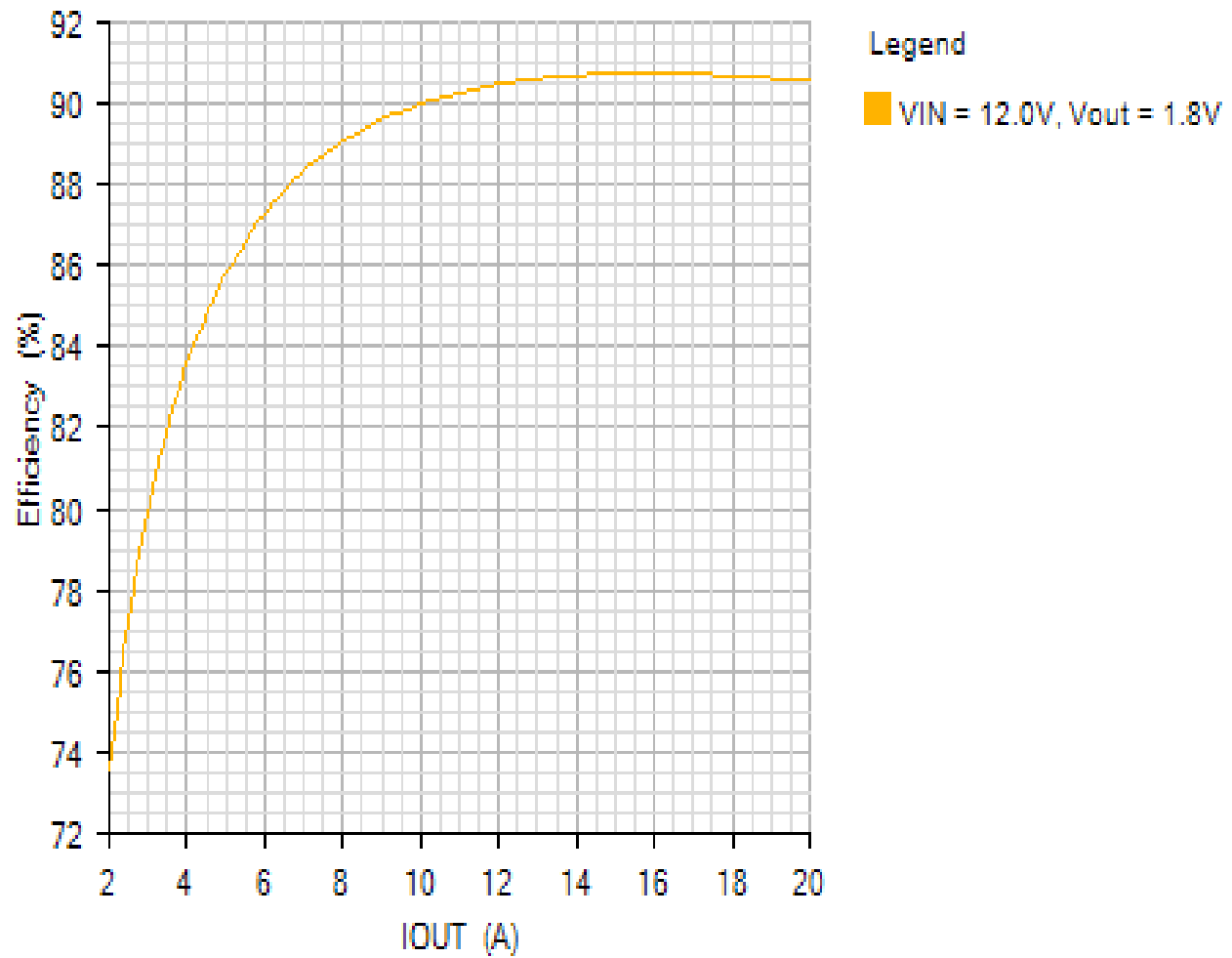
Default



Efficiency - Sun Nov 18 2018 15:40:36

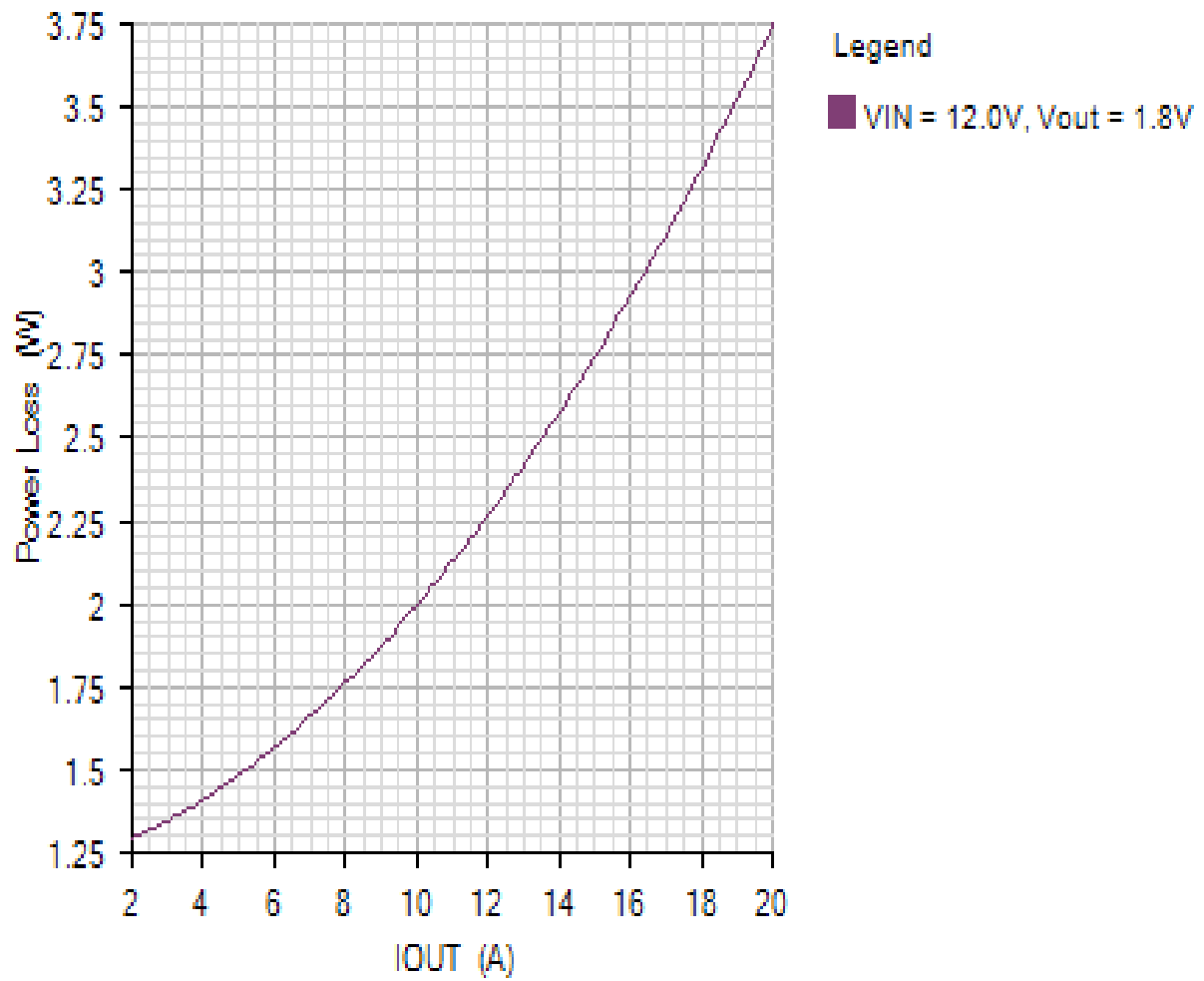
EFFICIENCY_PLOT

Default



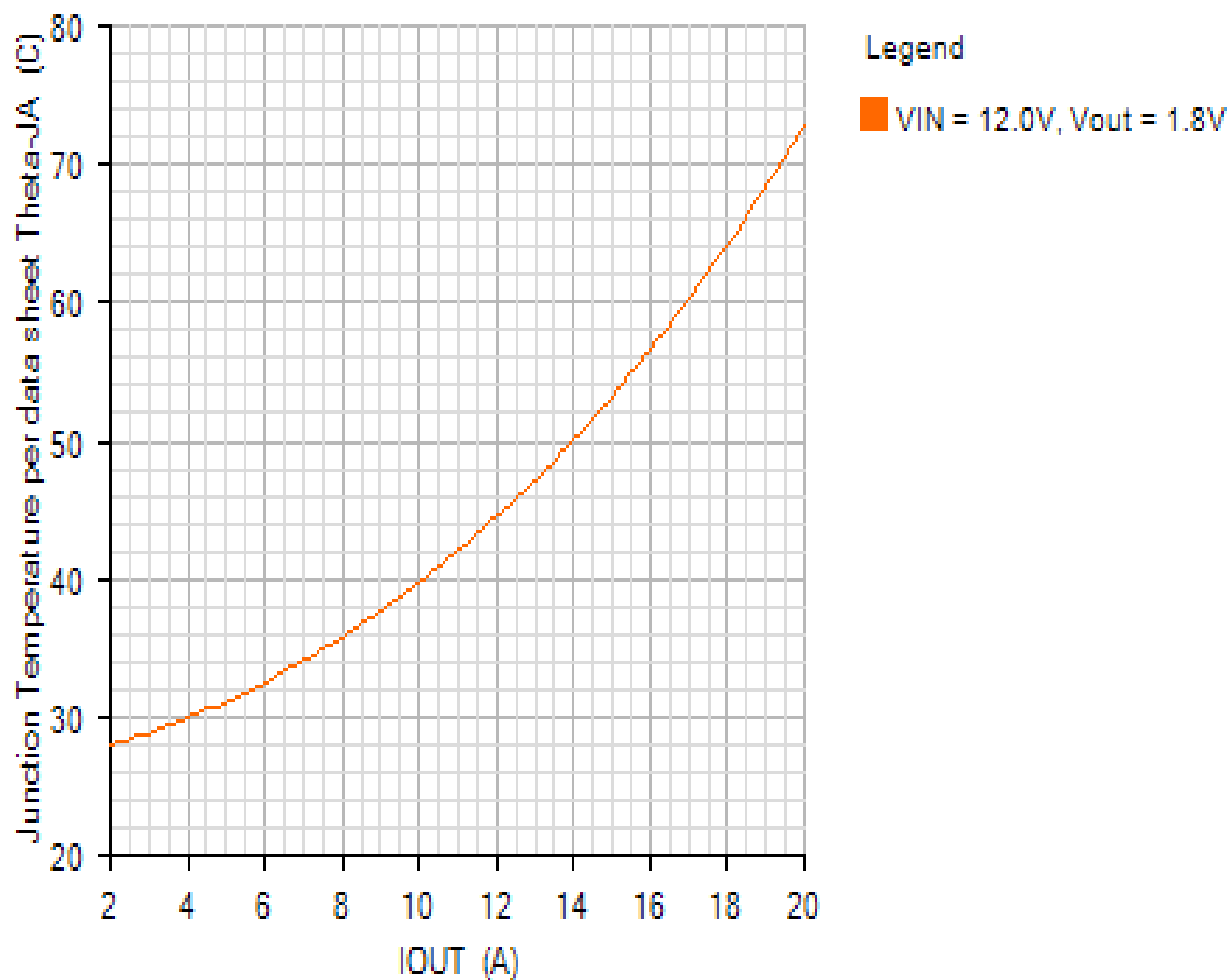
POWER_LOSS_PLOT

Default

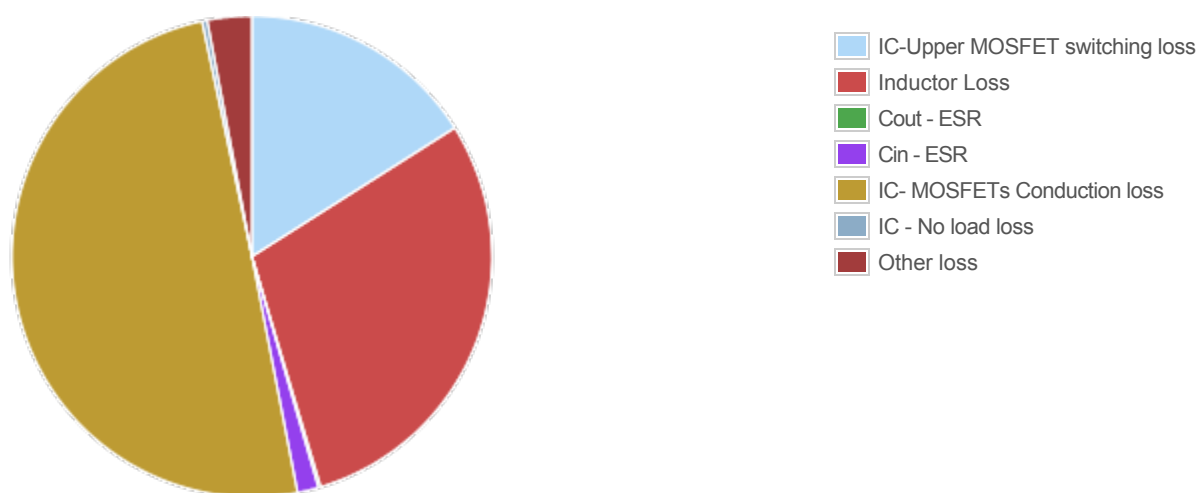


JUNCTION_TEMPERATURE_PLOT

Default



Losses



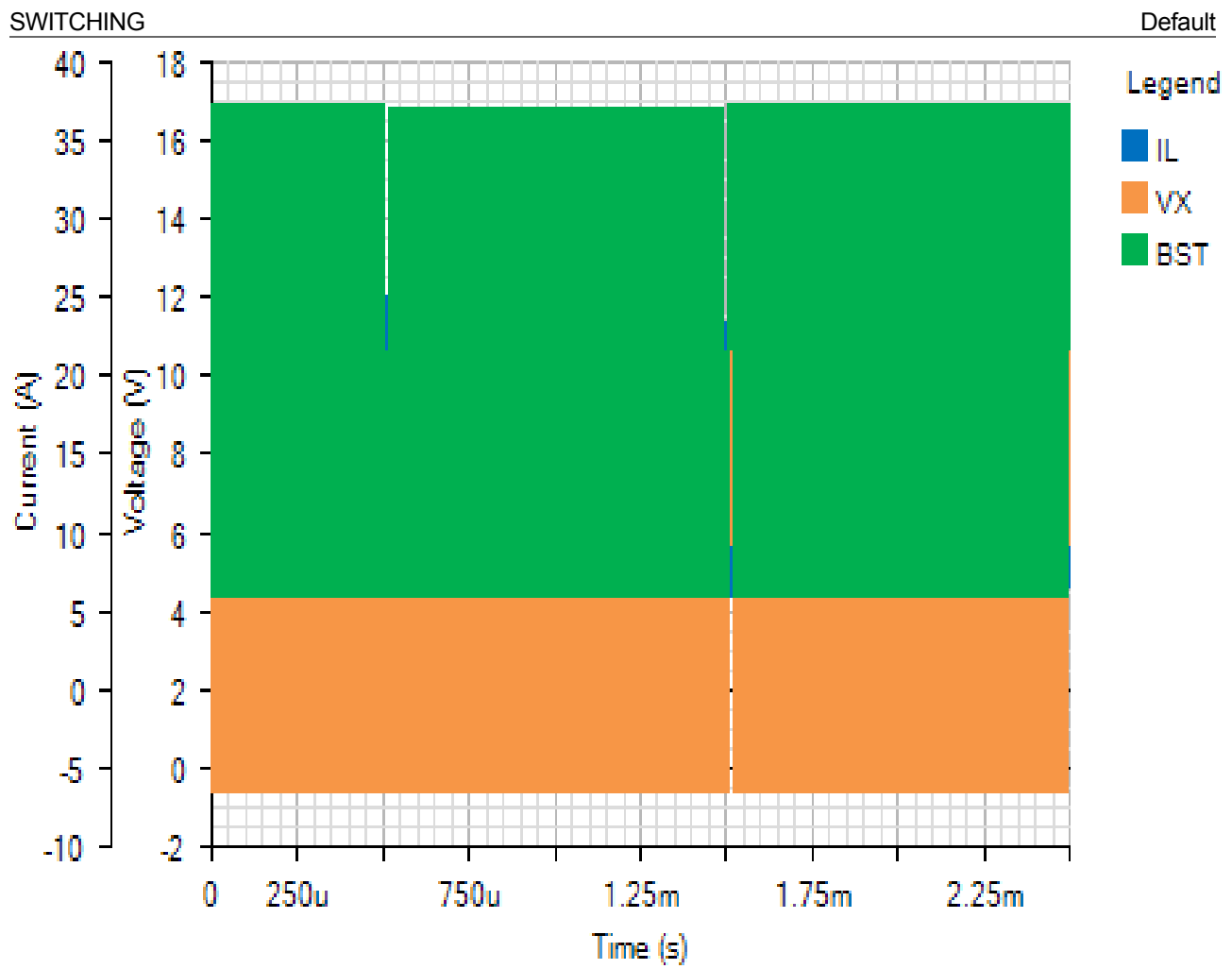
Component

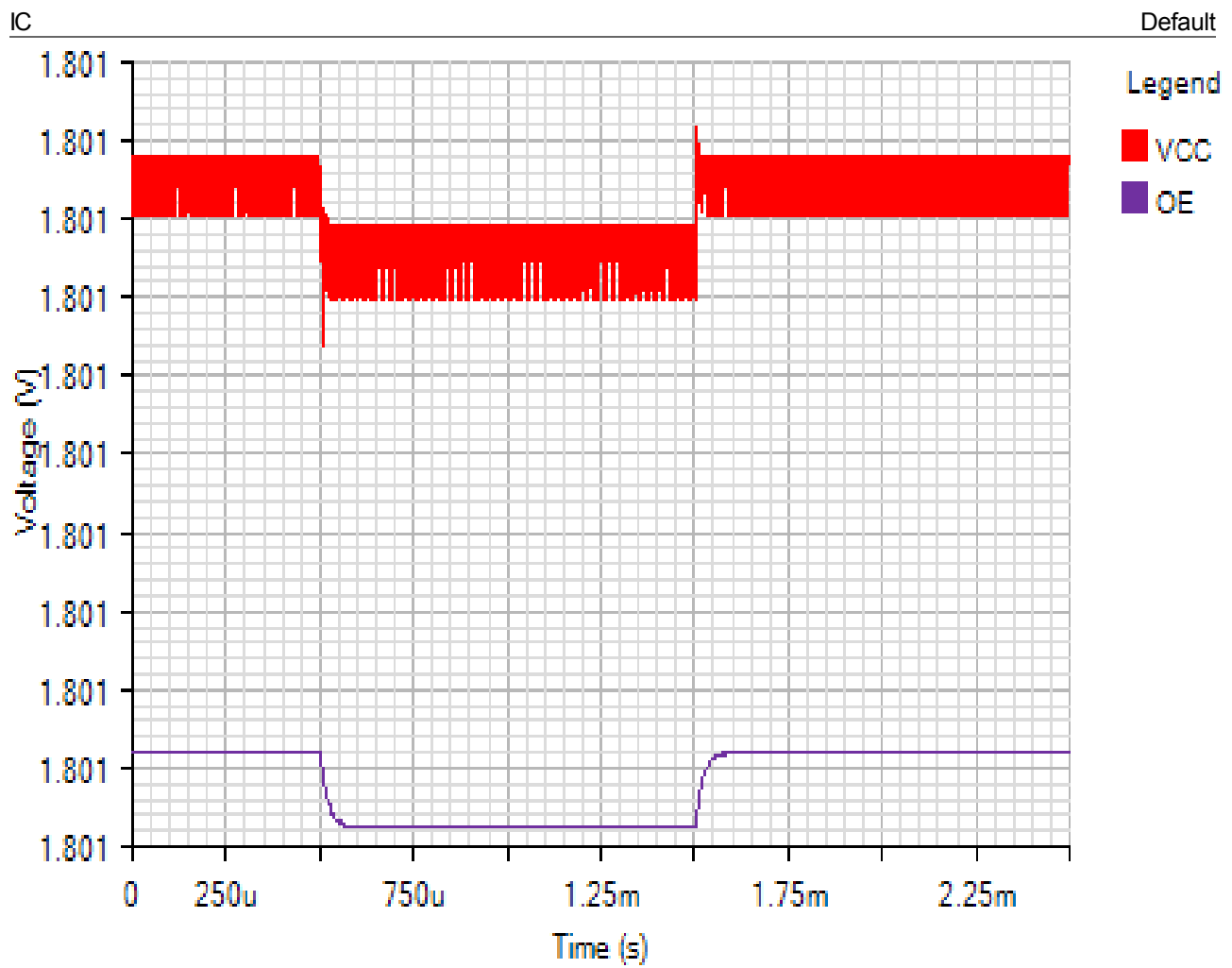
Loss (W)

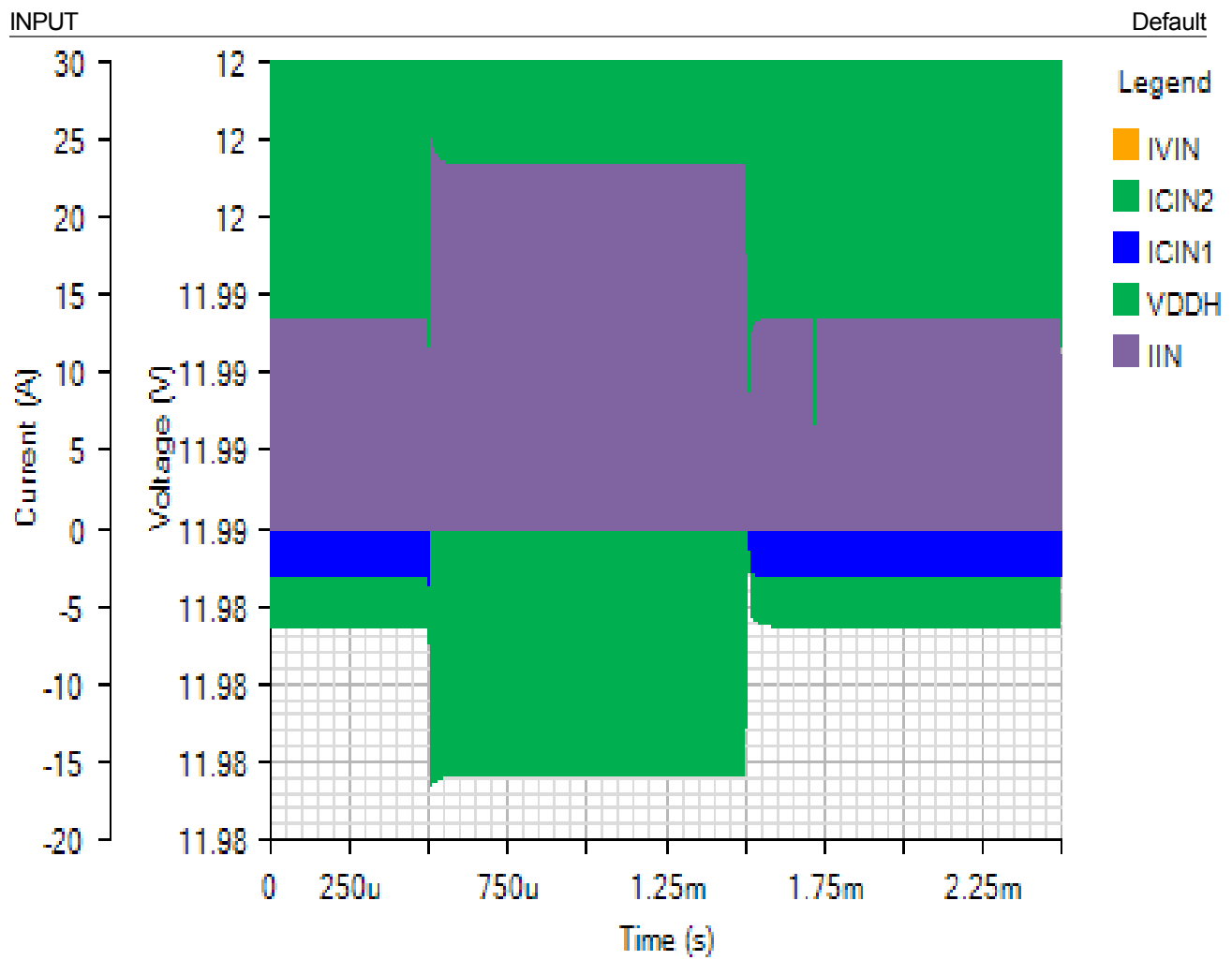
% of total

Component	Loss (W)	% of total
IC-Upper MOSFET switching loss	0.6	16
Inductor Loss	1.1	29.4
Cout - ESR	0.0059	0.2
Cin - ESR	0.0532	1.4
IC- MOSFETs Conduction loss	1.862	49.7
IC - No load loss	0.0132	0.4
Other loss	0.112	3
Total	3.7463	100

Load Step - Sun Nov 18 2018 15:40:36

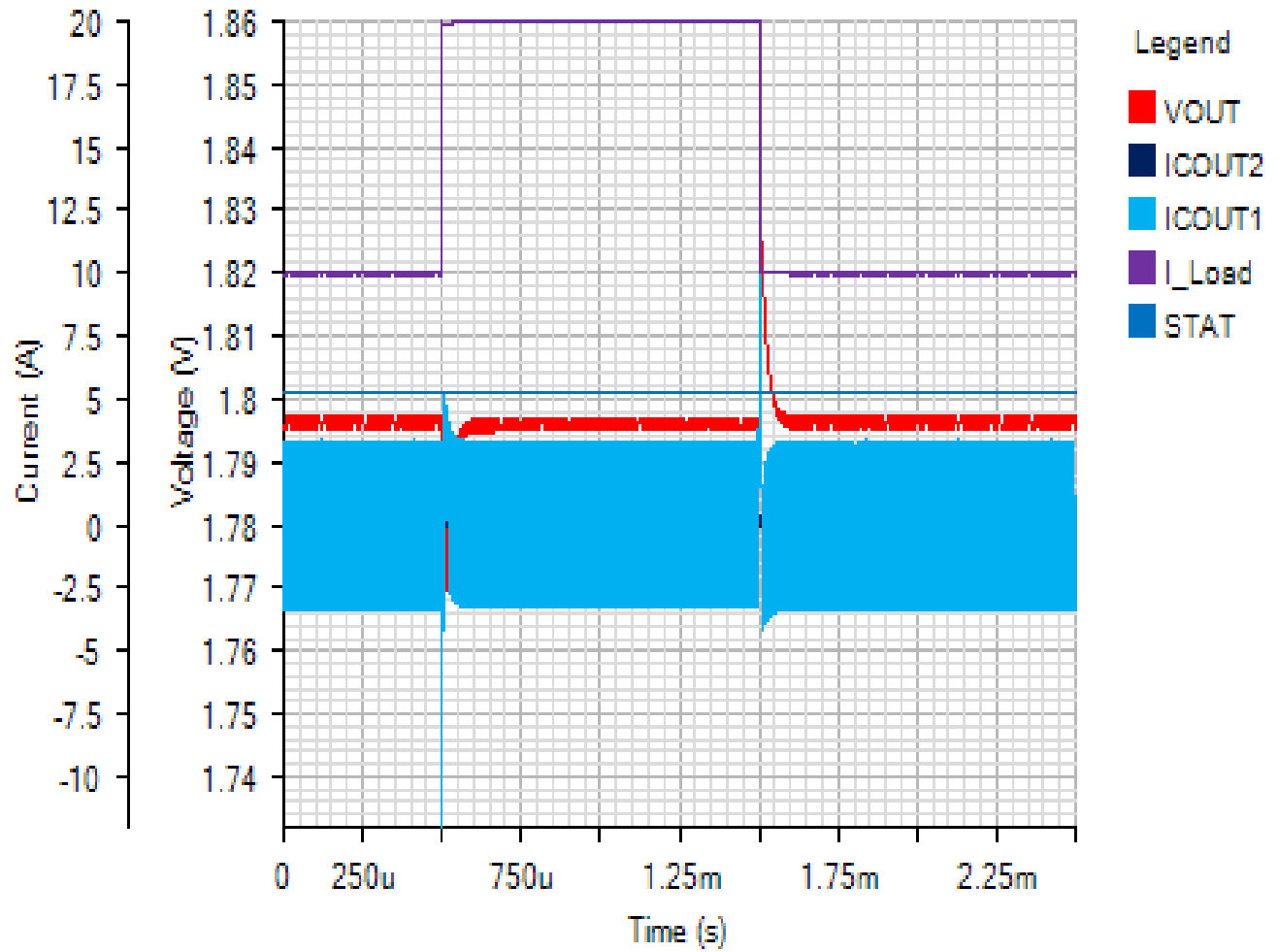






OUTPUT

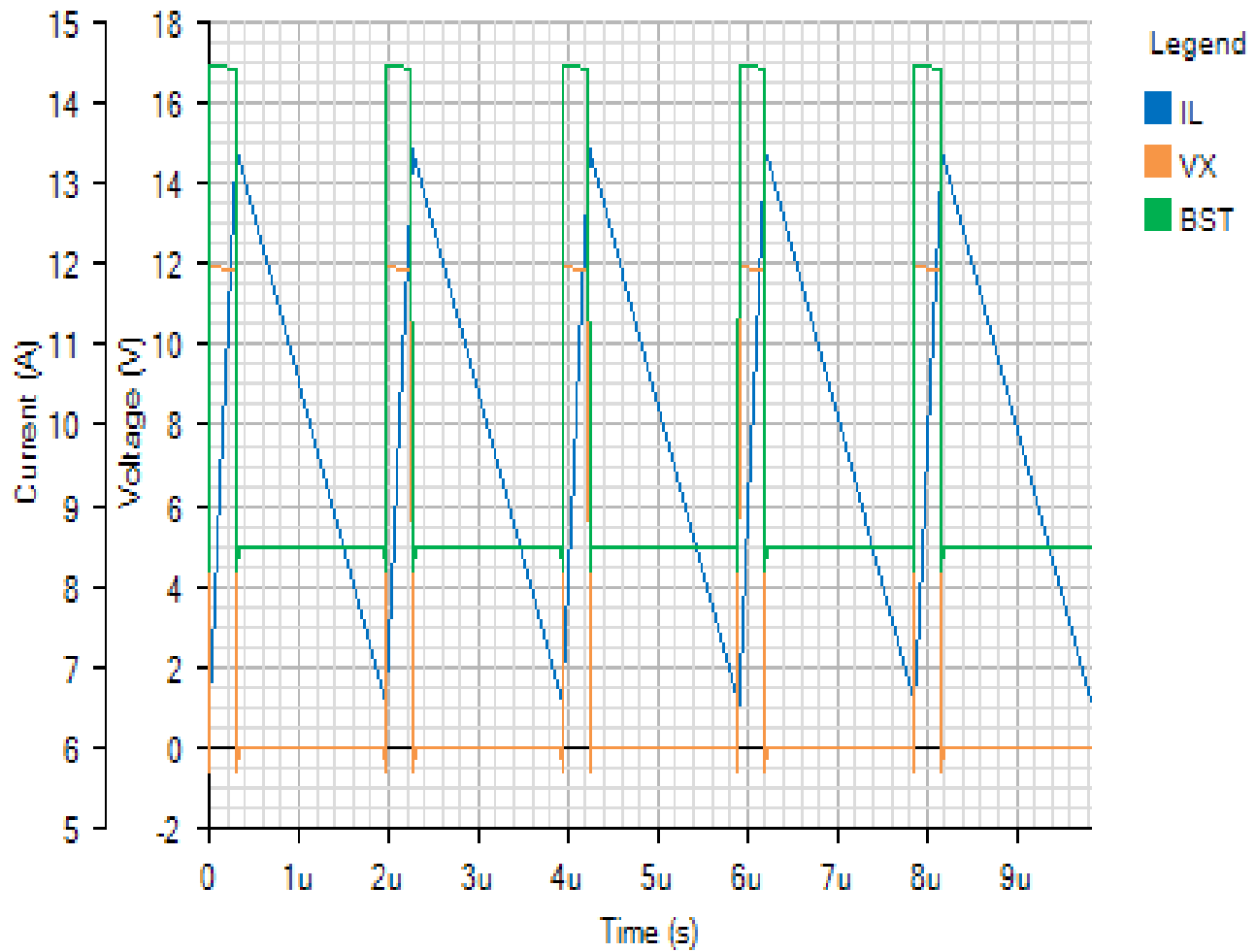
Default

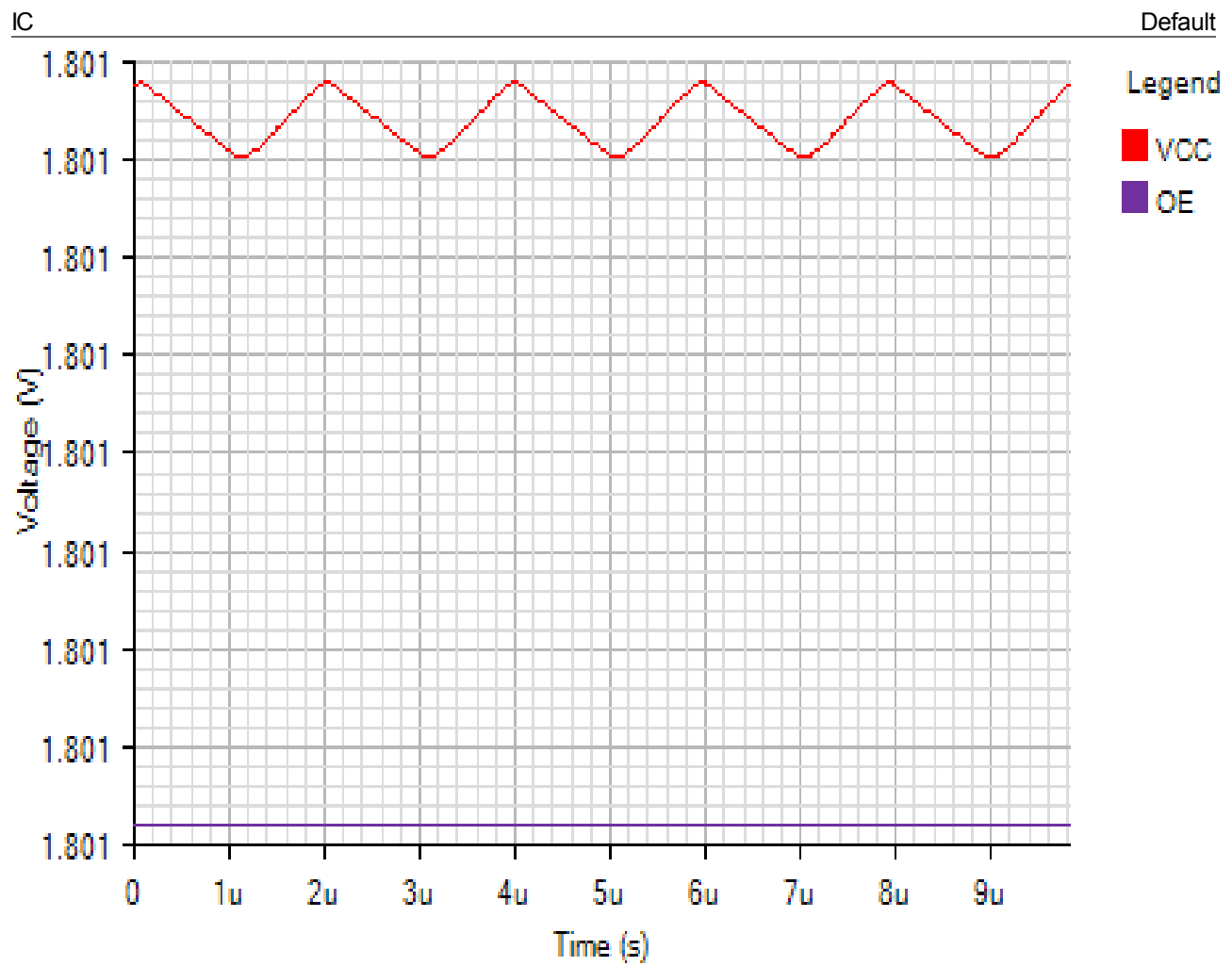


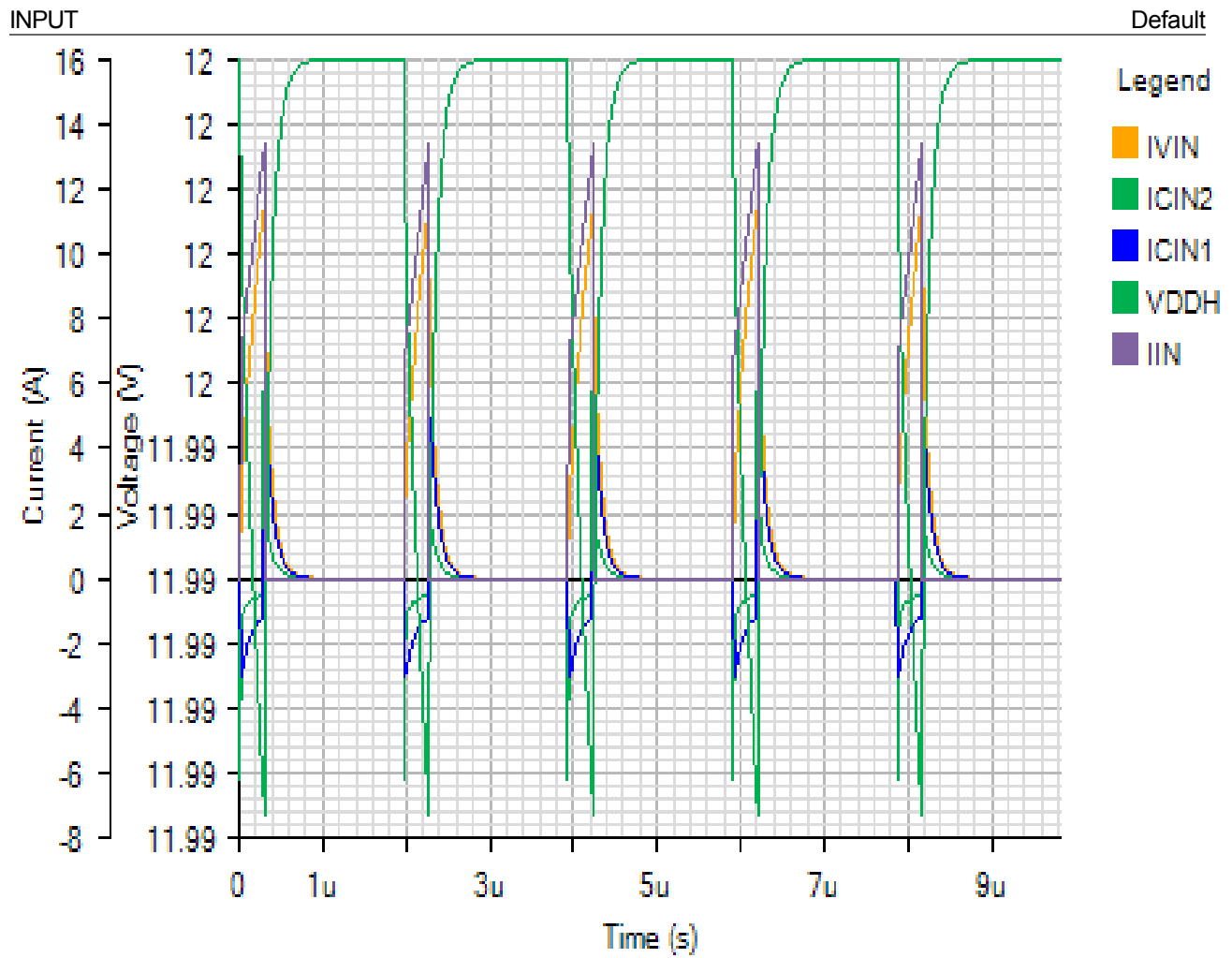
Steady State - Sun Nov 18 2018 15:40:36

SWITCHING

Default

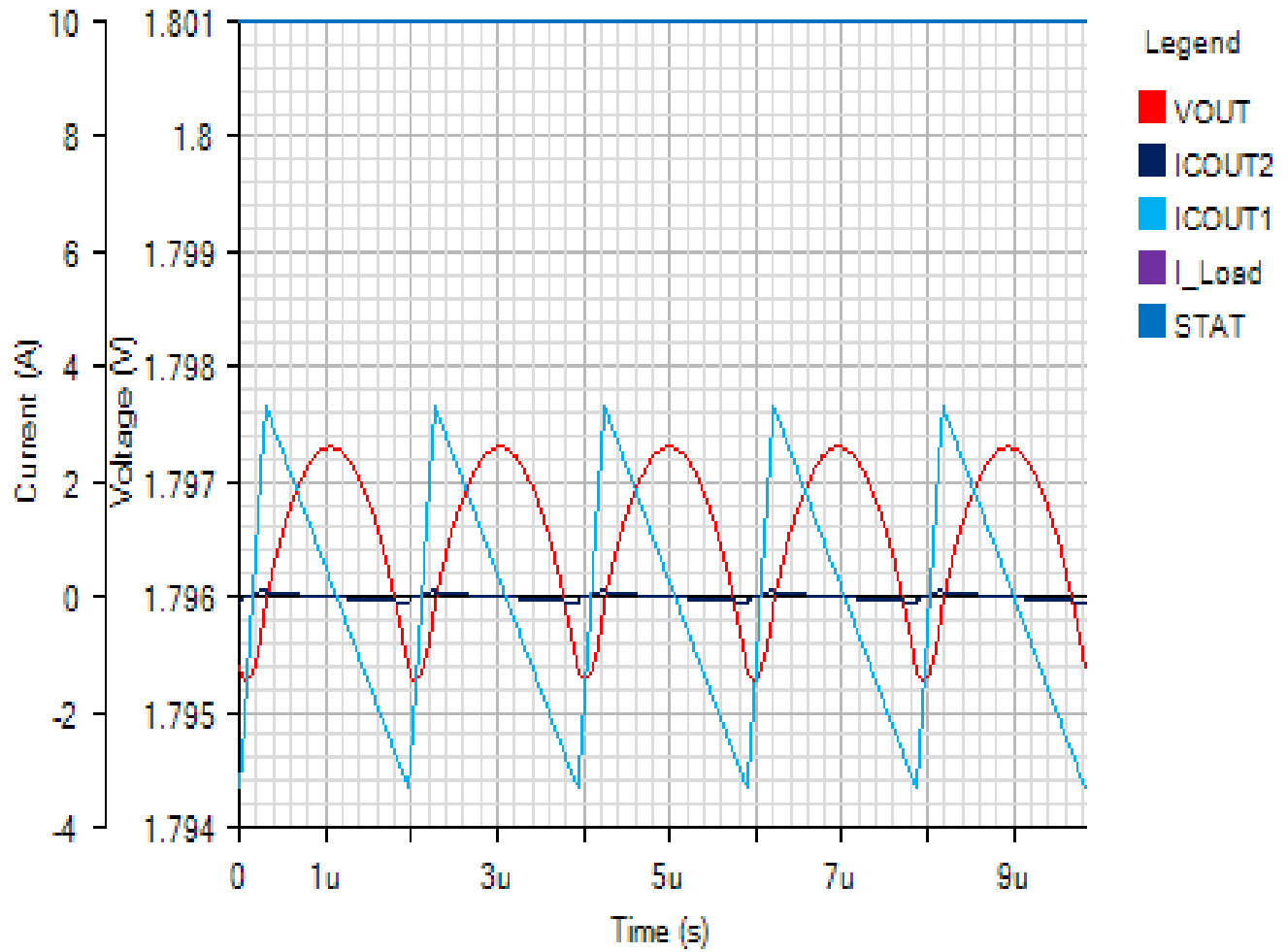






OUTPUT

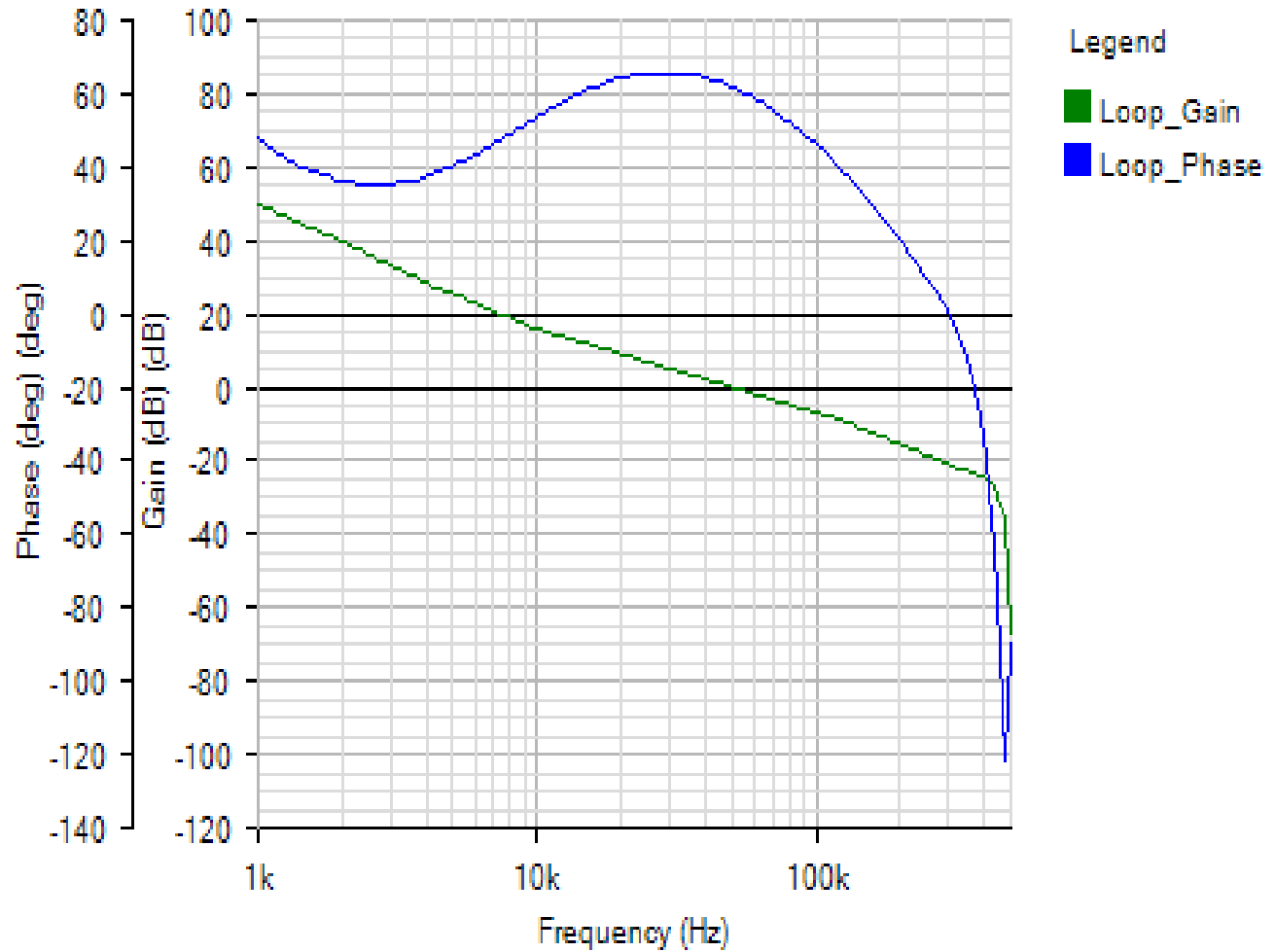
Default



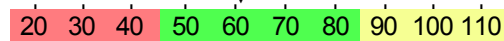
AC Loop - Sun Nov 18 2018 15:40:36

BODE

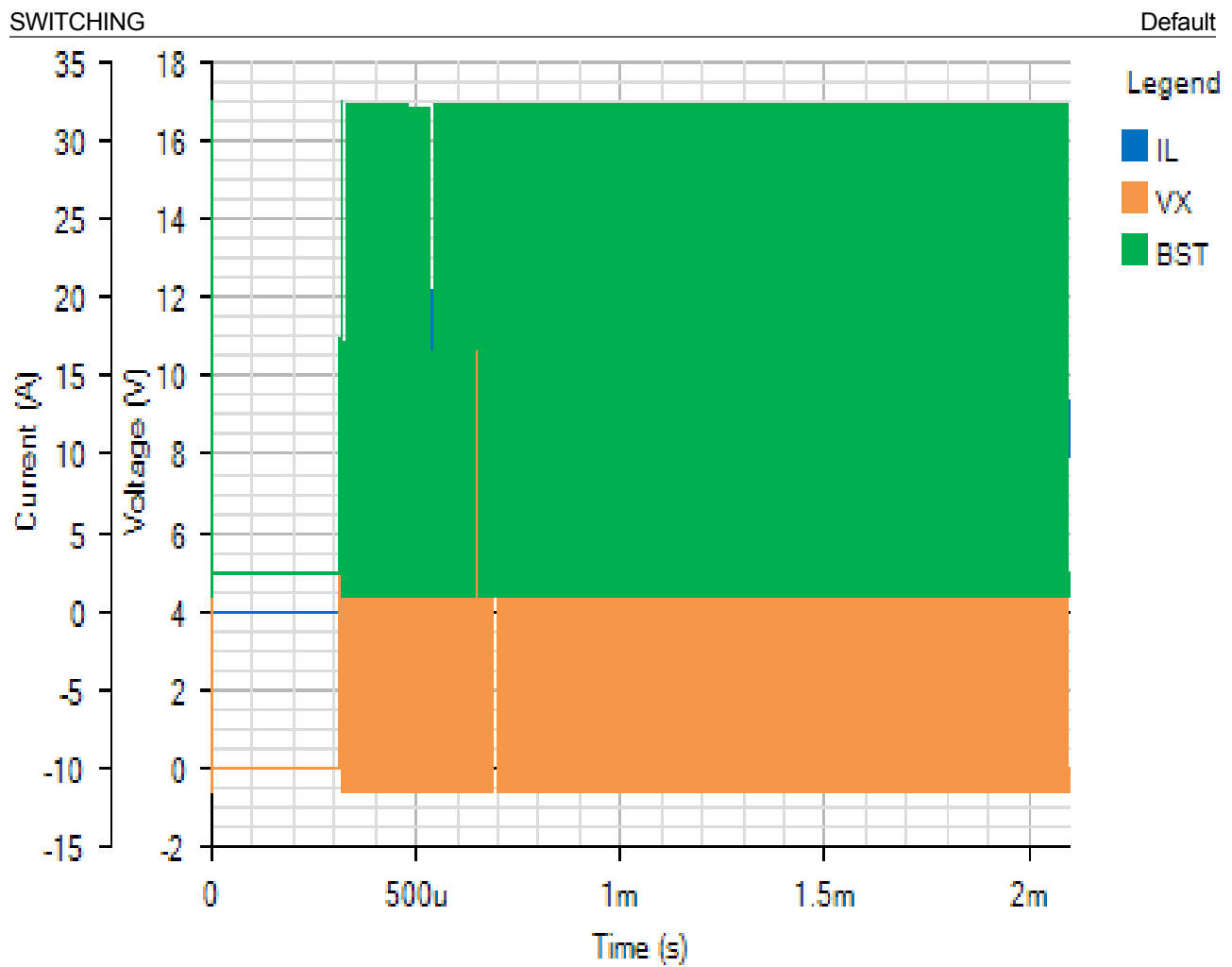
Default



Phase Margin: 61.15° at a crossover frequency of 52kHz

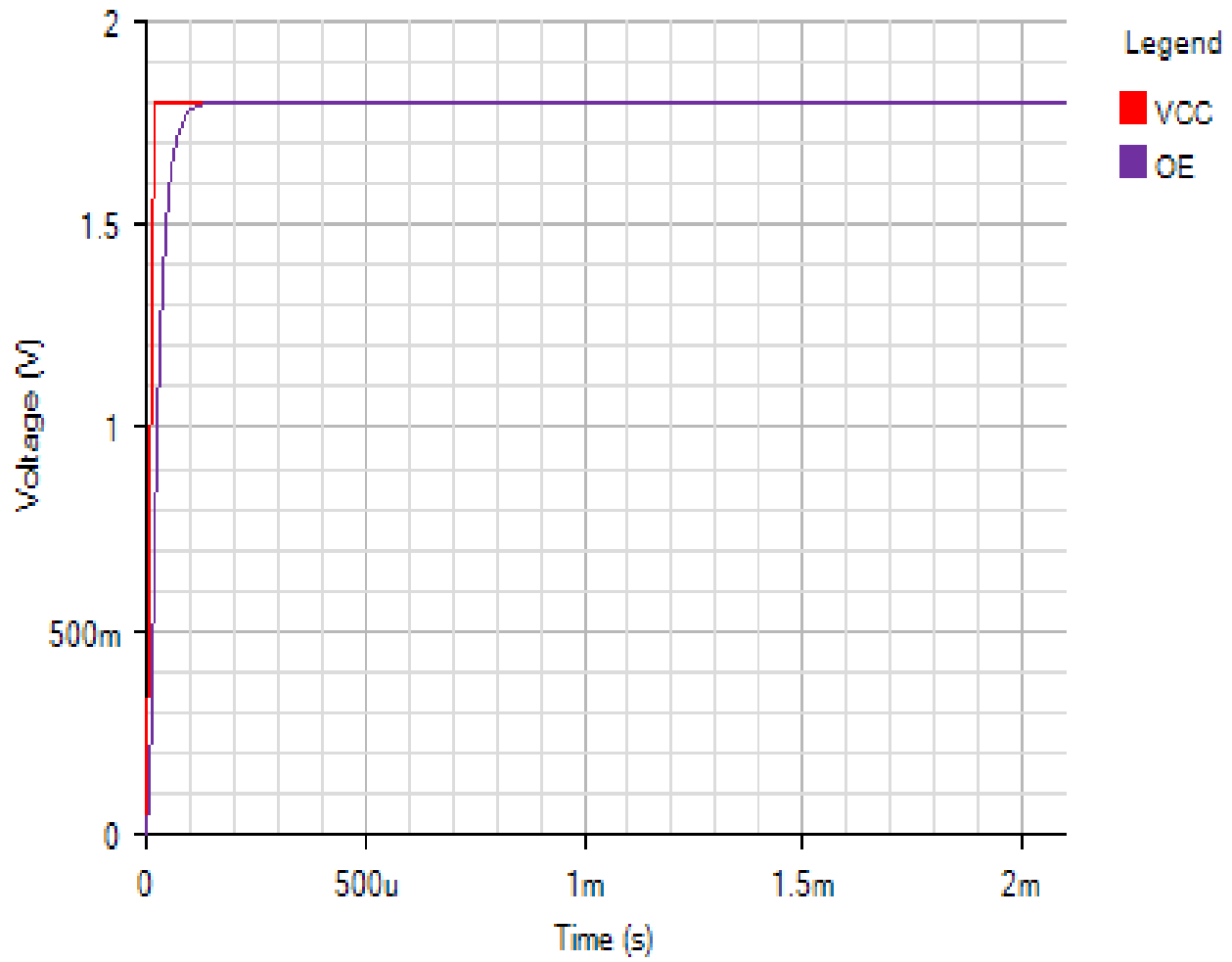


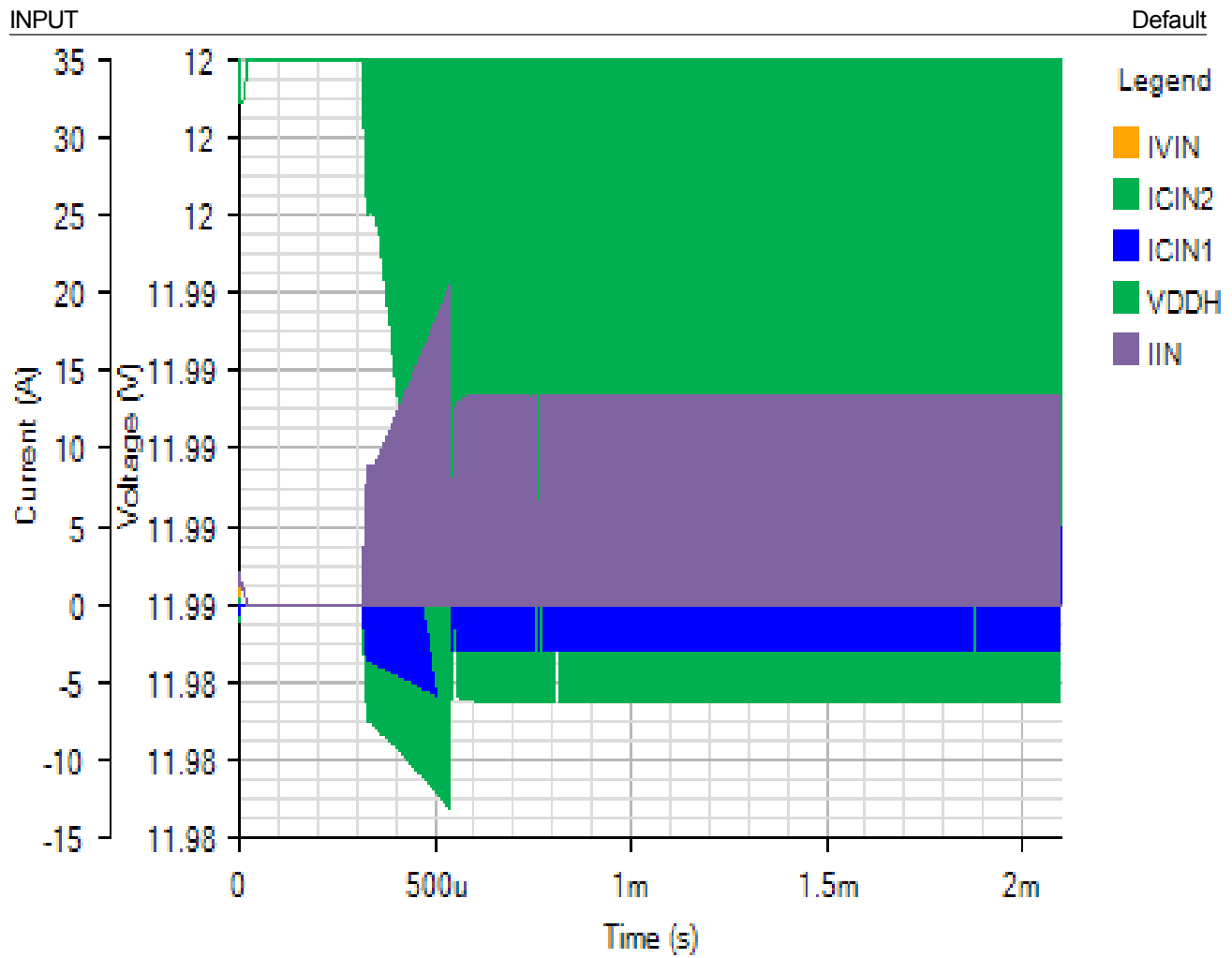
Start Up - Sun Nov 18 2018 15:40:36



IC

Default





OUTPUT

Default

