

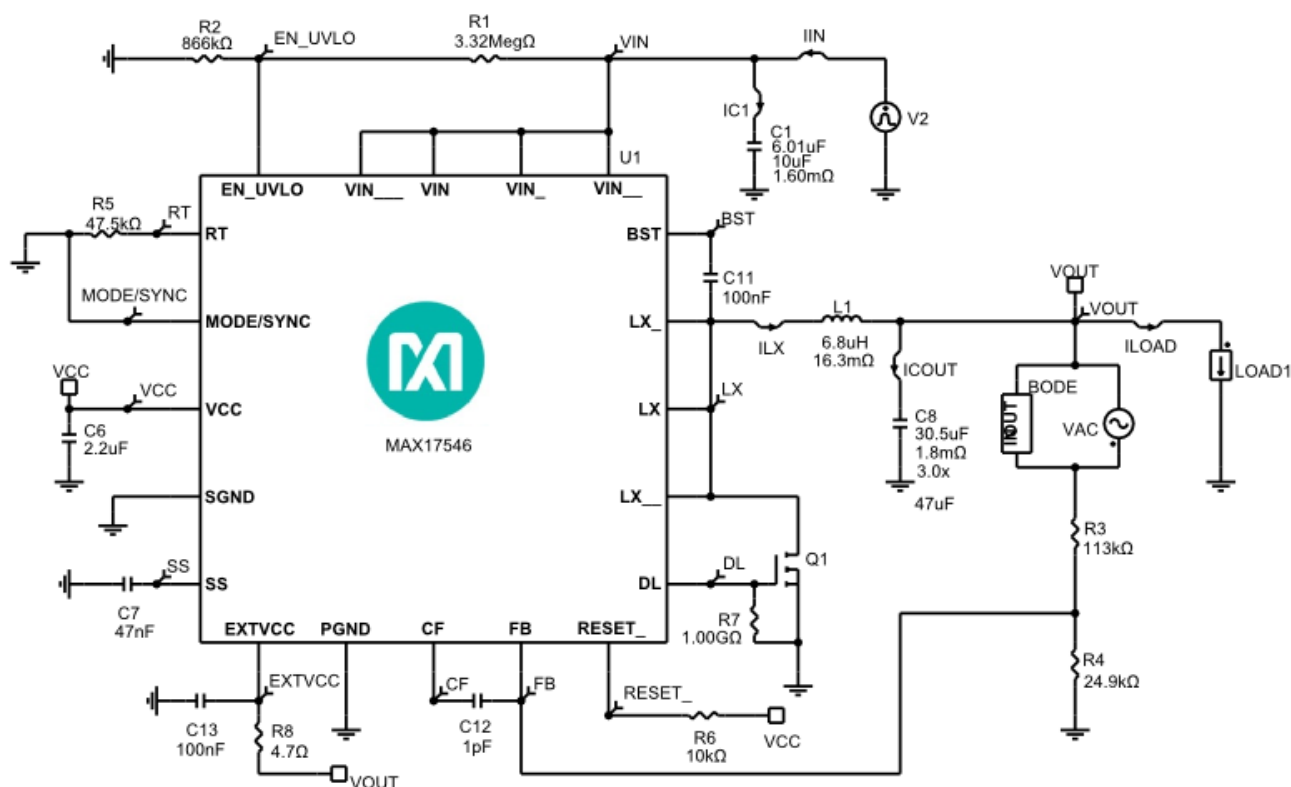
Initial Design

1.0

Design Requirements

Parameter	Value
Minimum Input Voltage	7.5V
Maximum Input Voltage	42V
Nominal Input Voltage	24V
Input Undervoltage Lockout	5.9V
Input Ripple Voltage	0.5V
Output Voltage	5V
Load Current	5A
Output Voltage Load Step Over/Undershoot	0.15V
Performance Priority	Balance Efficiency and Size
BOM Priority	Cost
Switching Frequency	390KHz
Mode of Operation	PWM
Soft-Start Time	0.007s
Ambient Temperature	25°C
Overload Protection Method	HICCUP
Current Limit	7.8A

Schematic



***** Notes *****

- Decreasing the output capacitance below recommended value might degrade the transient response or loop stability.
- If the current level (starting current for Load Steps) is too low, AC, Steady State and Load Step analyses may fail when PFM mode is selected.

BOM

Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX17546	Maxim Integrated	Voltage Regulators - Switching Regulators 42V, 5A Synchronous Buck Regulator
C1	1	GRM32ER71H106KA12	Murata	Cap Ceramic 10uF 50V 1210 125C
C6	1	CGA4J3X7R1C225K125AB	TDK	Cap Ceramic 2.2uF 16V X7R 10% Pad SMD 0805 125°C Automotive T/R
C7	1	C2012X7R2A473K125AA	TDK	Cap Ceramic 0.047uF 100V X7R 10% Pad SMD 0805 125°C T/R
C8	3.0	GRM32ER71A476ME15L	Murata	Cap Ceramic 47uF 10V X7R 20% SMD 1210 125C Embossed T/R
C11	1	GCM155R71C104KA55D	Murata Manufacturing	Cap Ceramic 0.1uF 16V X7R 10% Pad SMD 0402 125°C Automotive T/R
C12	1	C0603H109M5GACTU	KEMET Corporation	Cap Ceramic 1pF 50V COG 20% Pad SMD 0603 200°C T/R
C13	1	C0402C104K8RACTU	KEMET Corporation	Cap Ceramic 0.1uF 10V X7R 10% Pad SMD 0402 125°C T/R

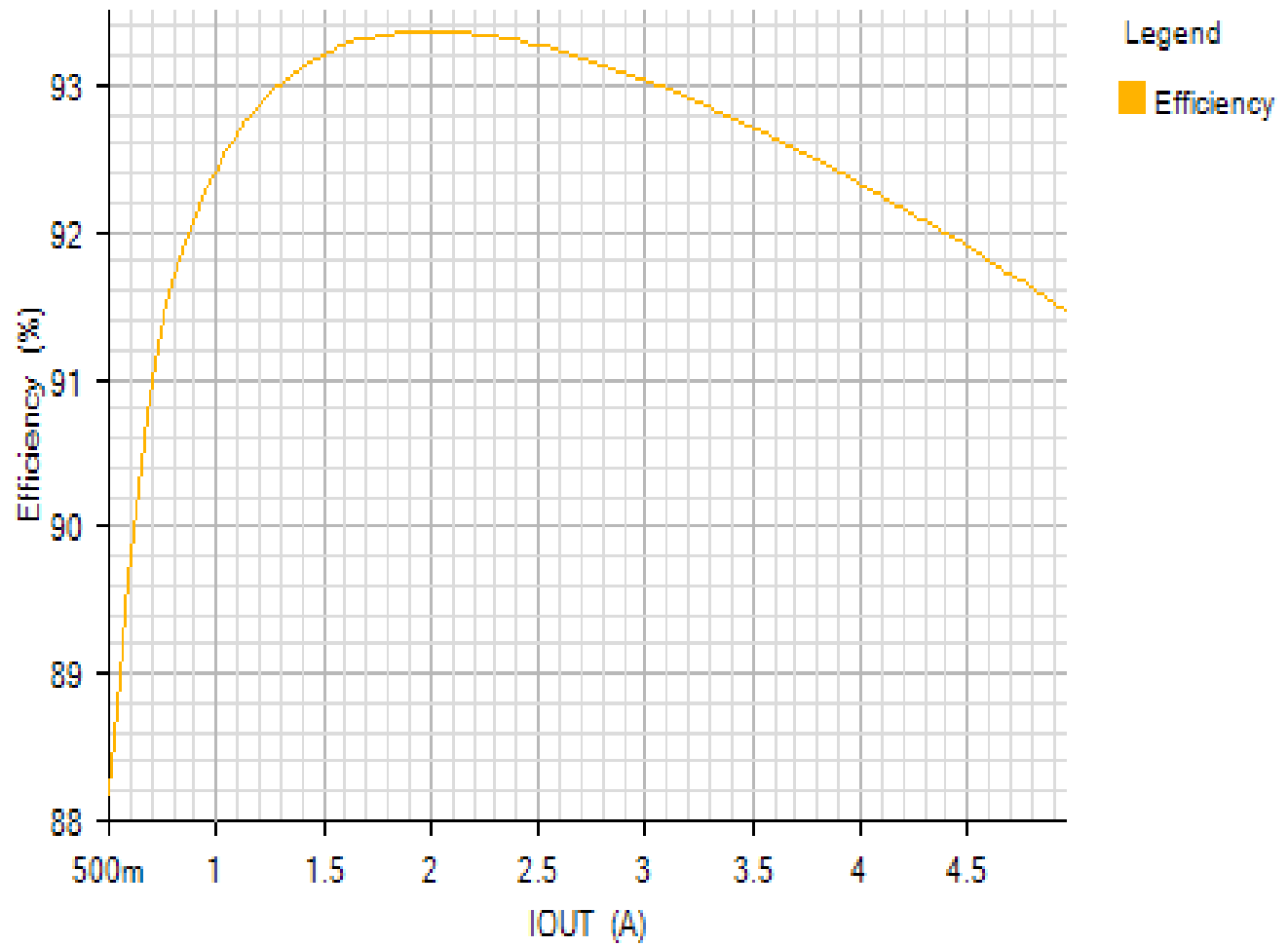
L1	1	MSS1048-682NLB	Coilcraft	Inductor 6.8uH 30% 14.67mOhm 5.6A Isat 6.01A Irms
Q1	1	FDD5810_F085	Fairchild Semiconductor	Trans MOSFET N-CH 60VDS N.A.mOhm@4.5V 26mOhm@6V 13nC 7nC 1.42nF 0.15nF 175°C 33A 88W 2.1°C/W 2.39mm 70.1mm^2 TO-252 3L (DPAK)
R1	1	RC0603FR-073M32L	Yageo	Res Thick Film 0603 3.32M Ohm 1% 0.1W(1/10W) ±100ppm/°C Epoxy Pad SMD T/R
R2	1	ERJ2RKF8663X	Panasonic	Res Thick Film 0402 866K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R3	1	ERJ2RKF1133X	Panasonic	Res Thick Film 0402 113K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R4	1	ERJ2RKF2492X	Panasonic	Res Thick Film 0402 24.9K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R5	1	ERJ2RKF4752X	Panasonic	Res Thick Film 0402 47.5K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R6	1	ERJ2RKF1002X	Panasonic	Res Thick Film 0402 10K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R8	1	CRCW04024R70FKEDHP	Vishay	Res Thick Film 0402 4.7 Ohm 1% 0.2W(1/5W) ±100ppm/°C Pad SMD Automotive T/R

Simulation Results

Efficiency - Tue Nov 20 2018 16:40:04

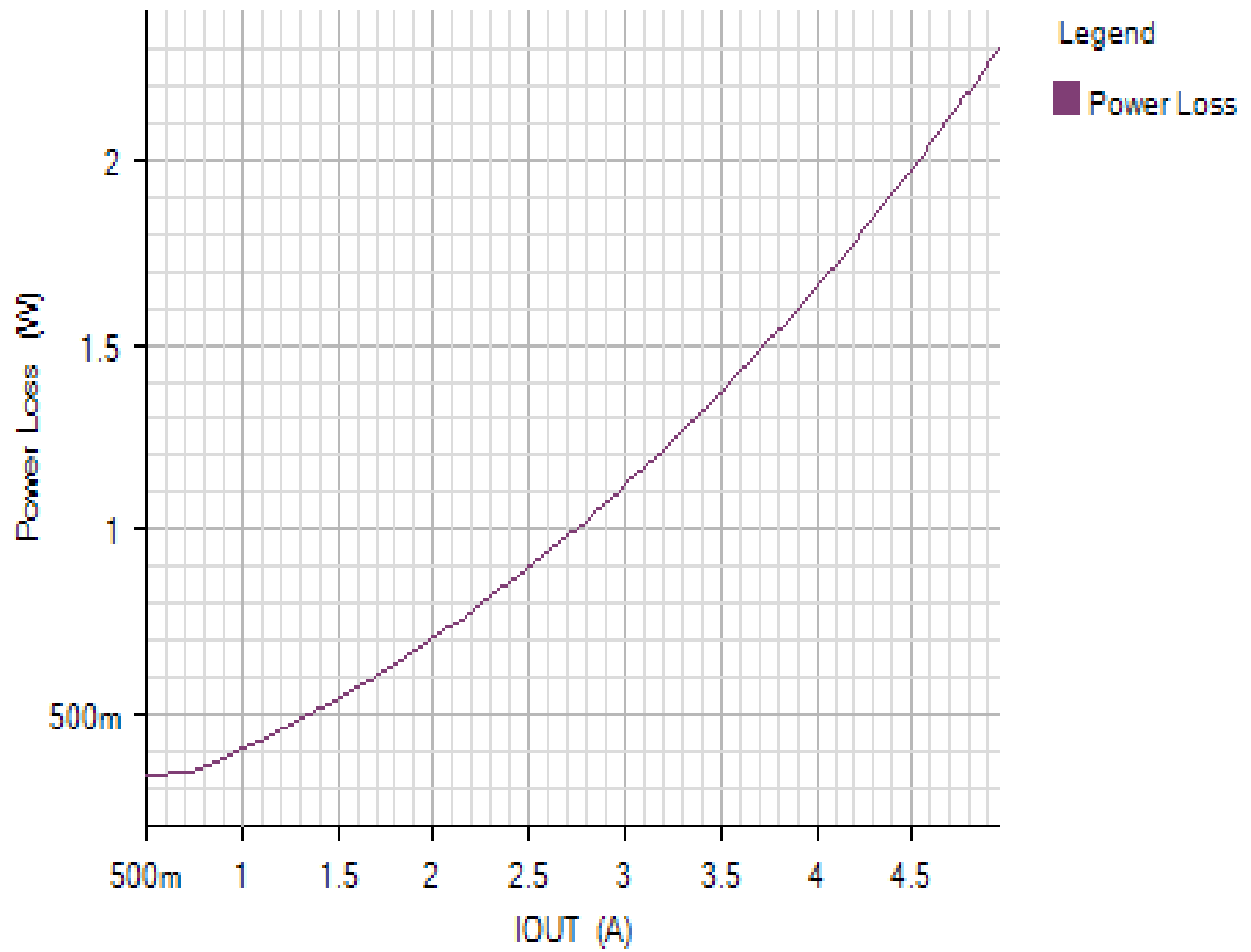
EFFICIENCY_PLOT

Default



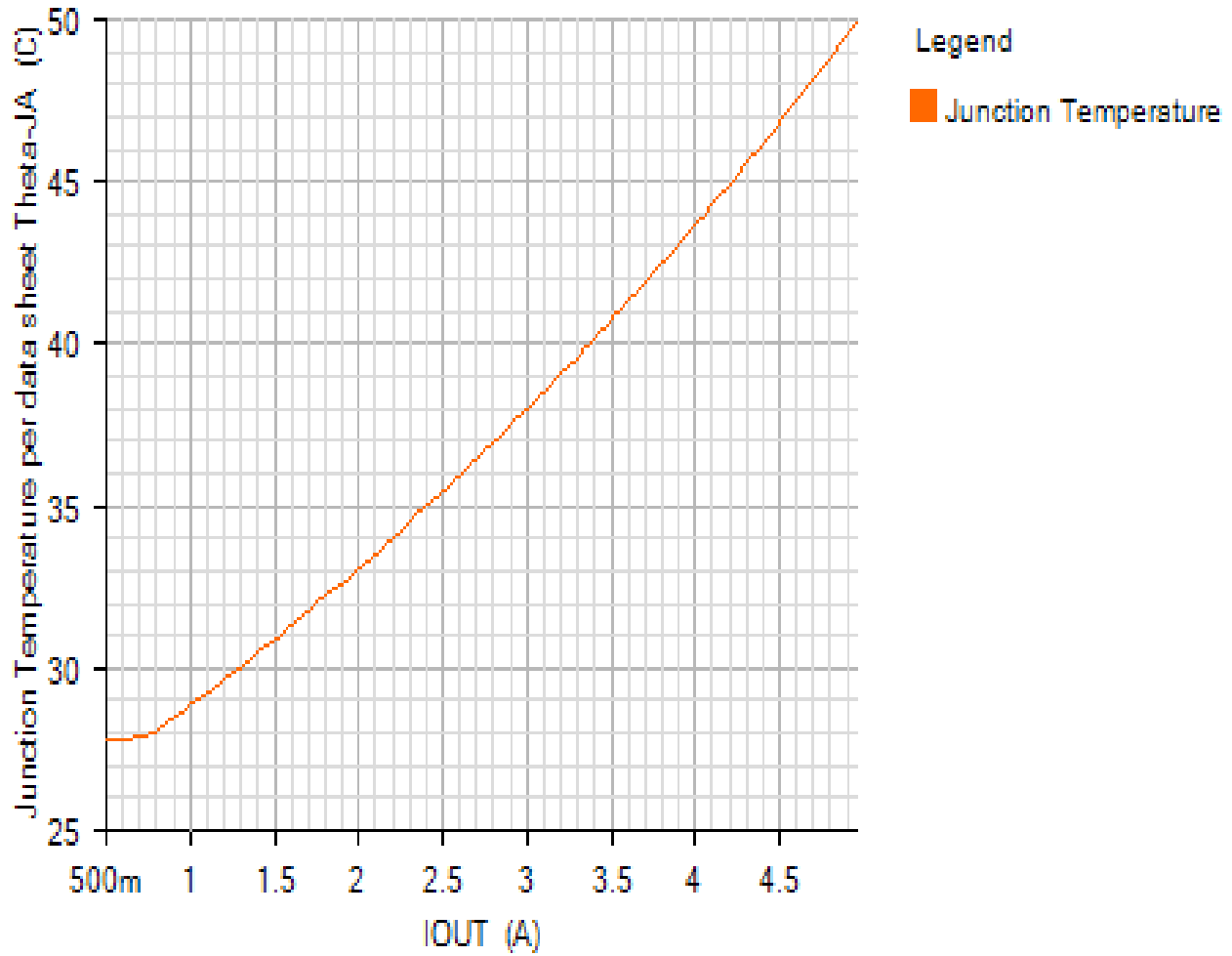
POWER_LOSS_PLOT

Default

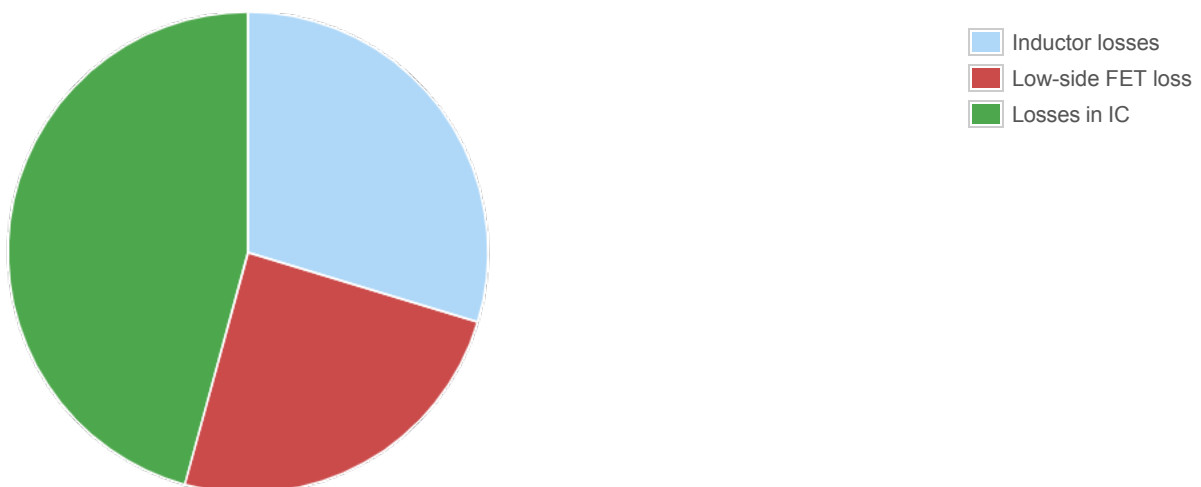


JUNCTION_TEMPERATURE_PLOT

Default



Losses



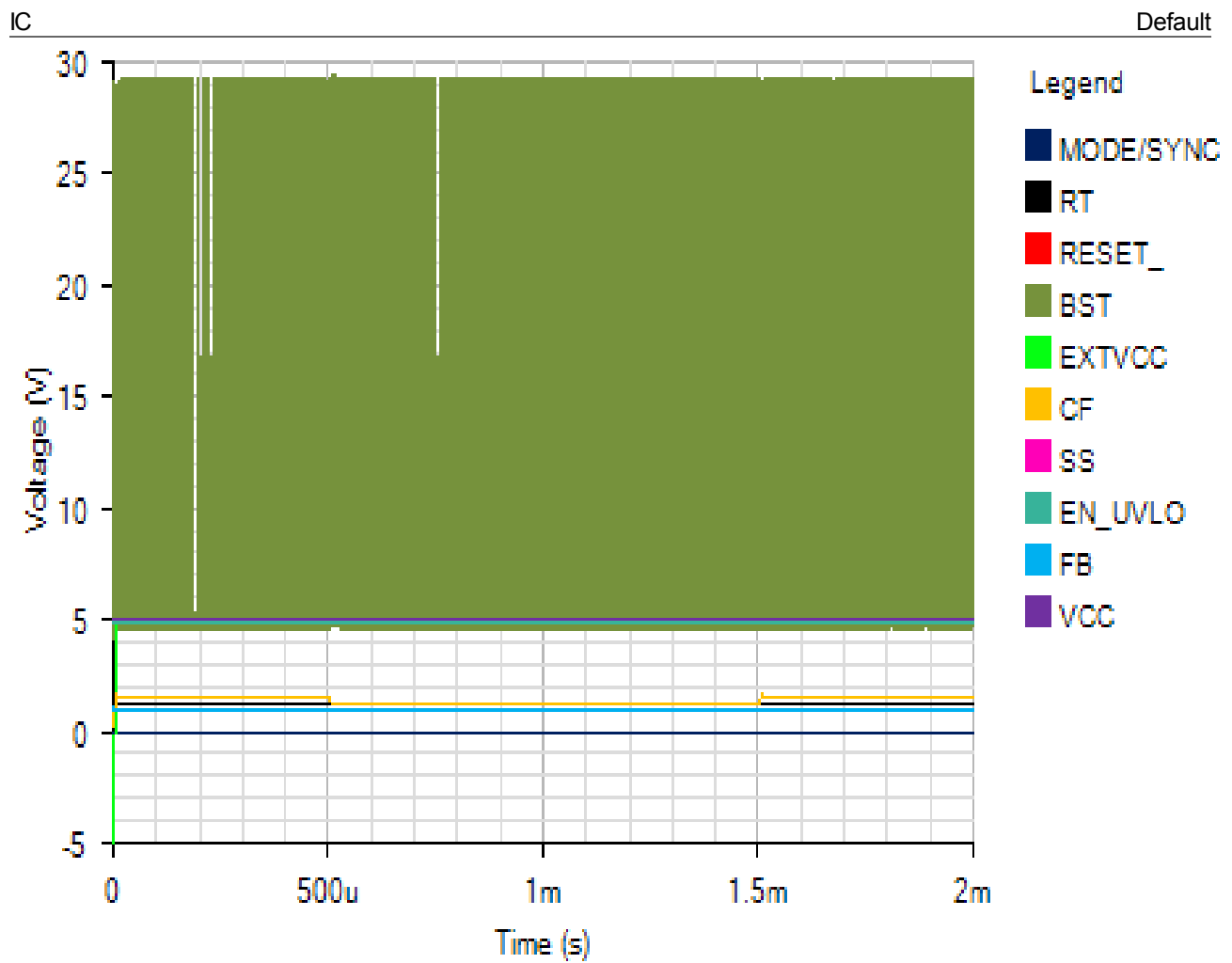
Component

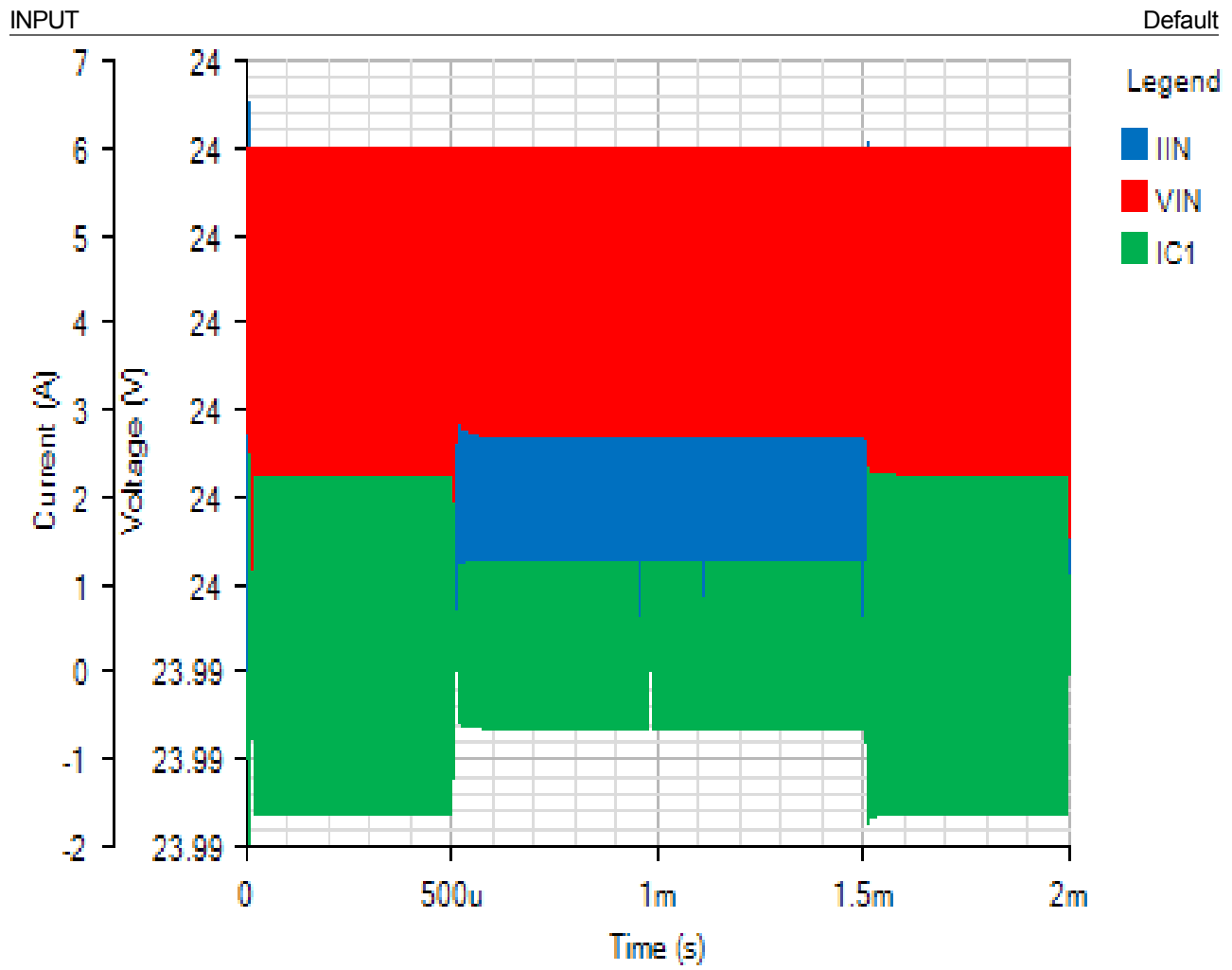
Loss (W)

% of total

Component	Loss (W)	% of total
Inductor losses	0.7	29.7
Low-side FET loss	0.58	24.6
Losses in IC	1.08	45.8
Total	2.36	100

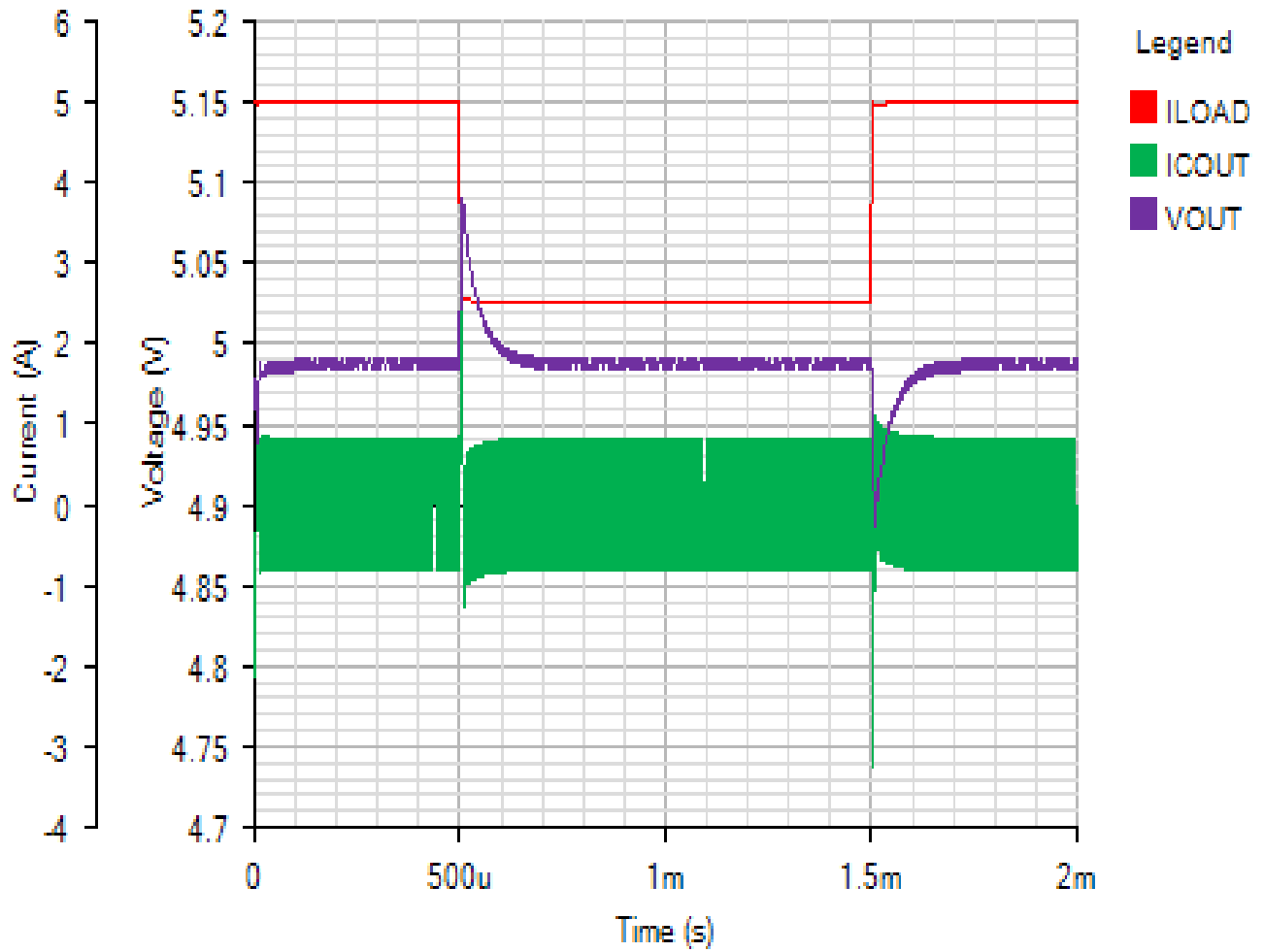
Load Step - Tue Nov 20 2018 16:40:04





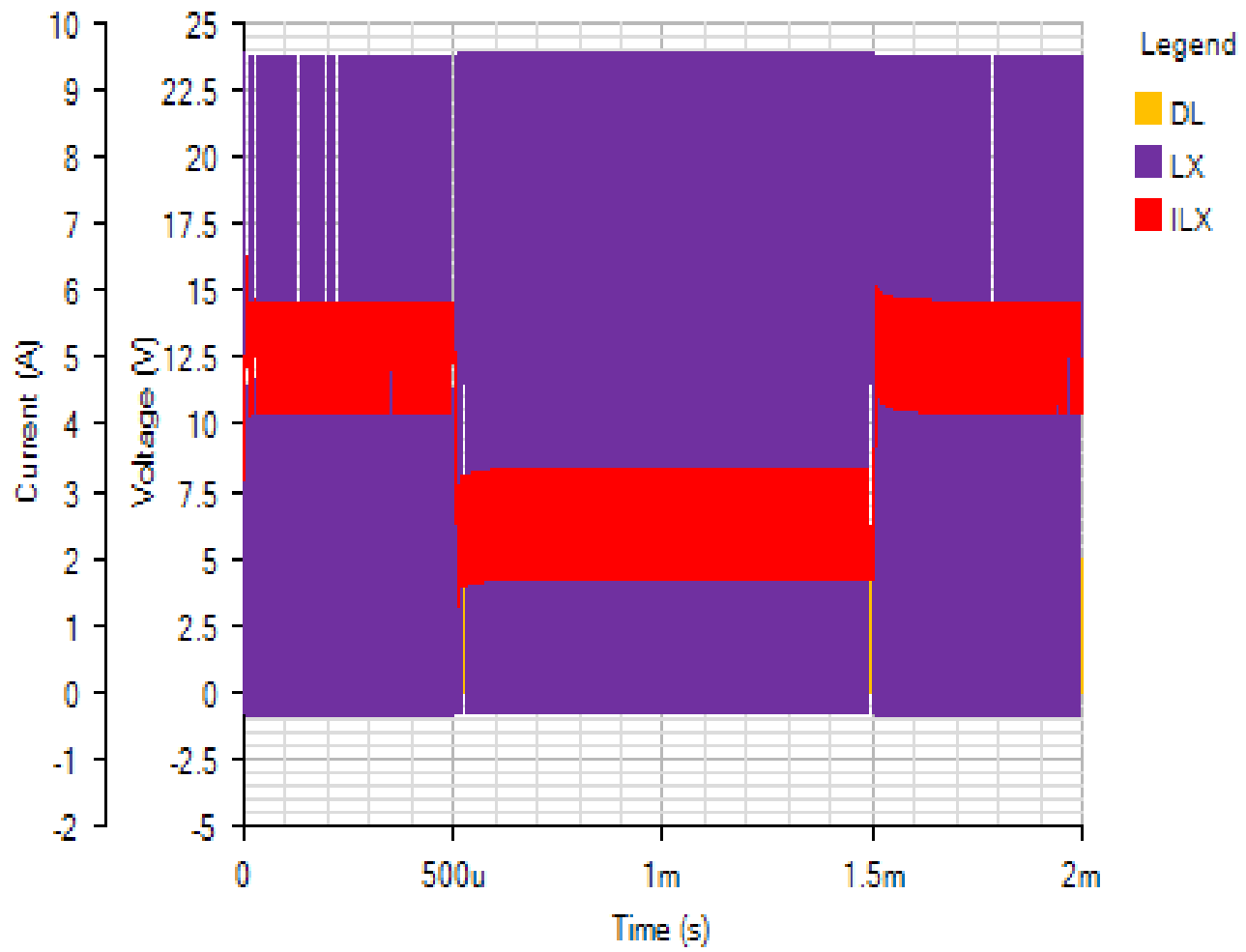
OUTPUT

Default

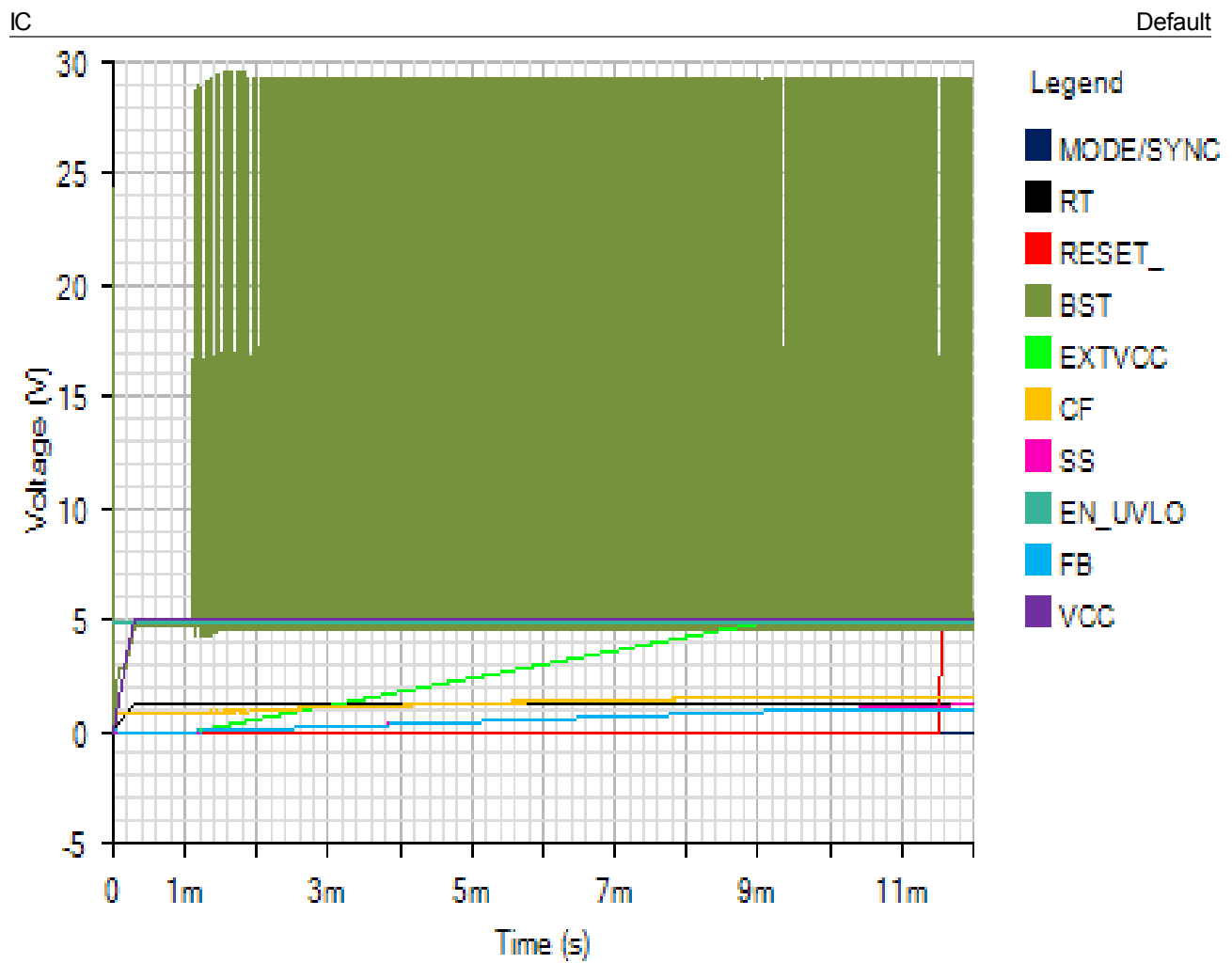


SWITCHING

Default

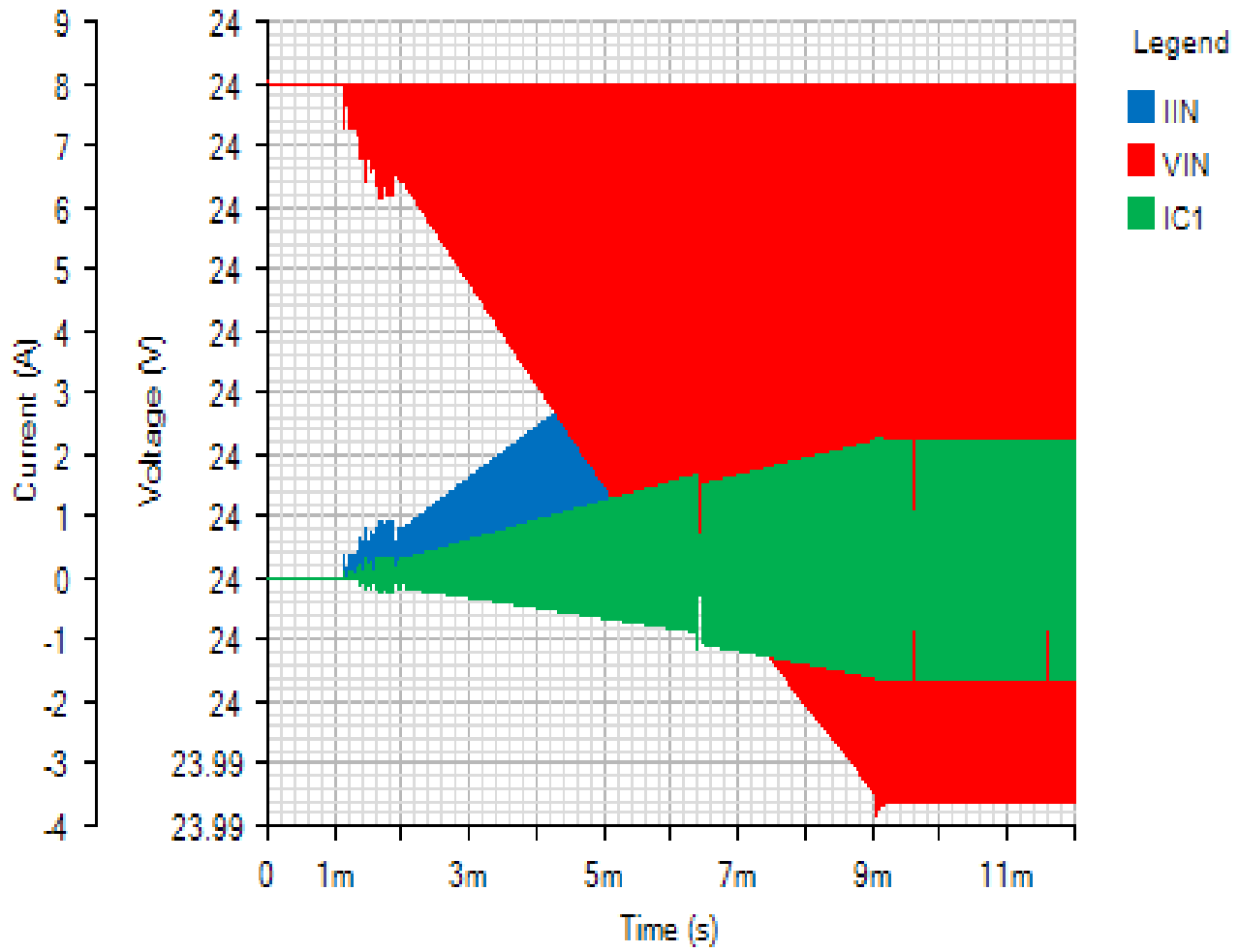


Start Up - Tue Nov 20 2018 16:40:04



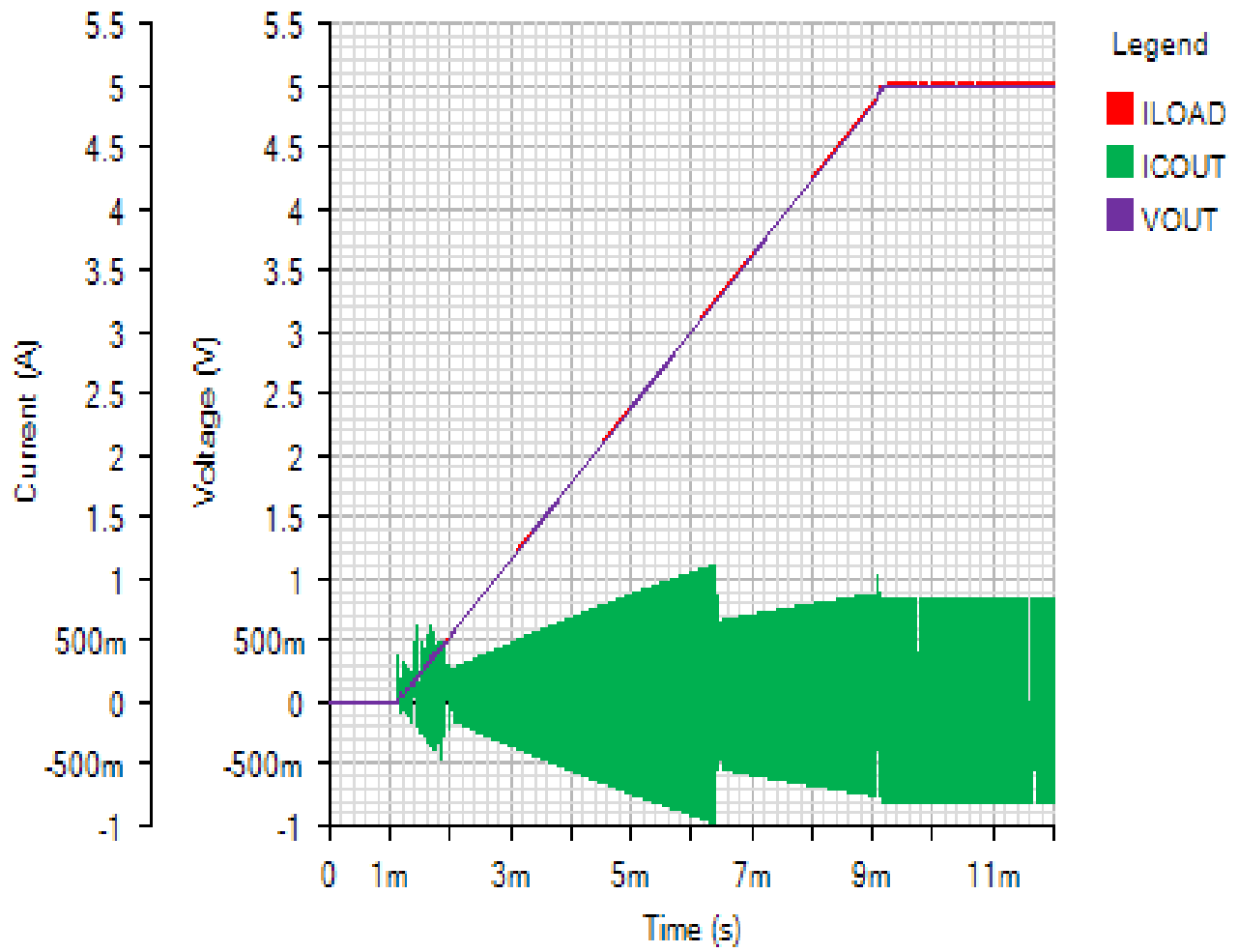
INPUT

Default



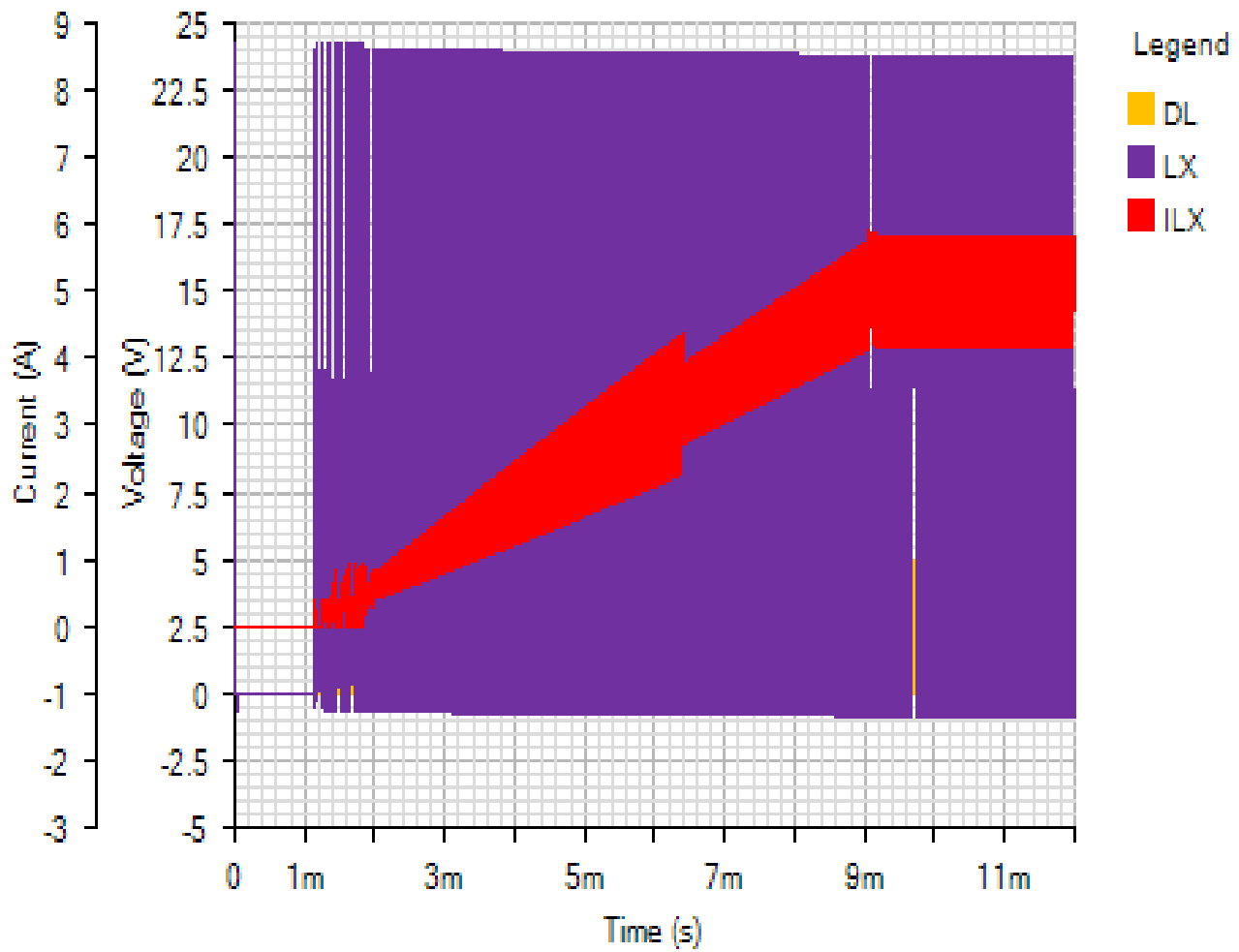
OUTPUT

Default



SWITCHING

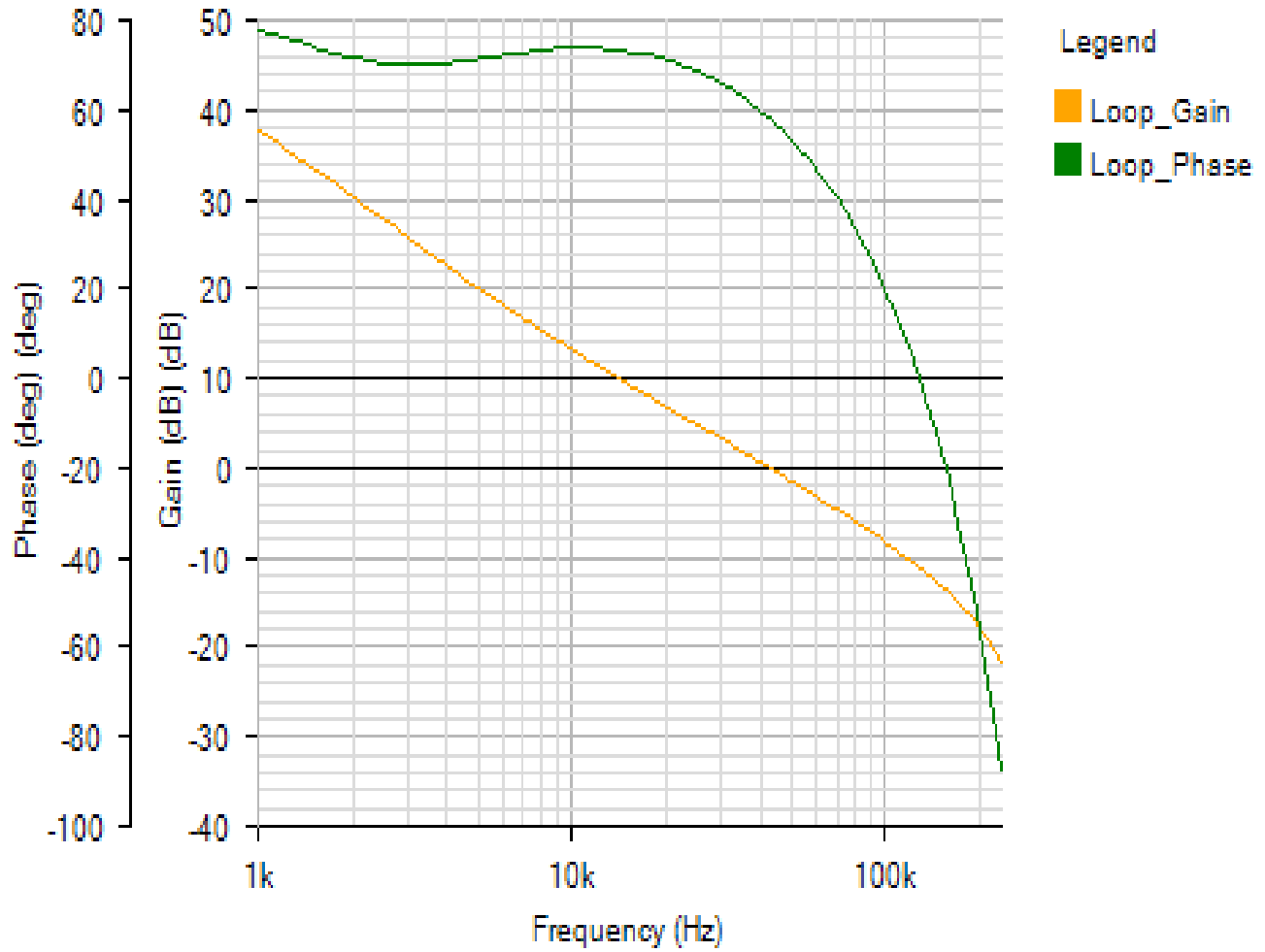
Default



AC Loop - Tue Nov 20 2018 16:40:04

BODE

Default



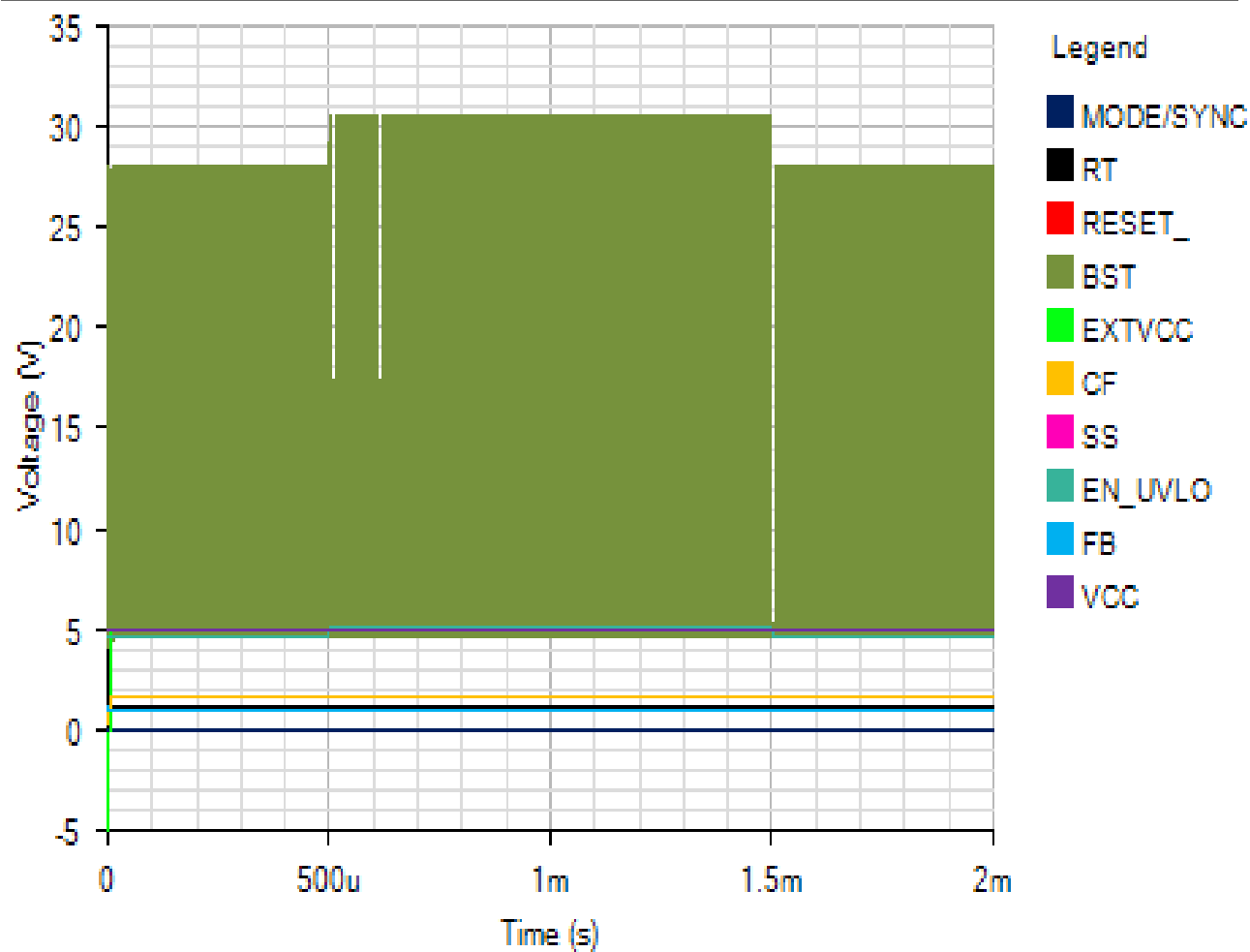
Phase Margin: 58.03° at a crossover frequency of 42.9kHz



Line Transient - Tue Nov 20 2018 16:40:04

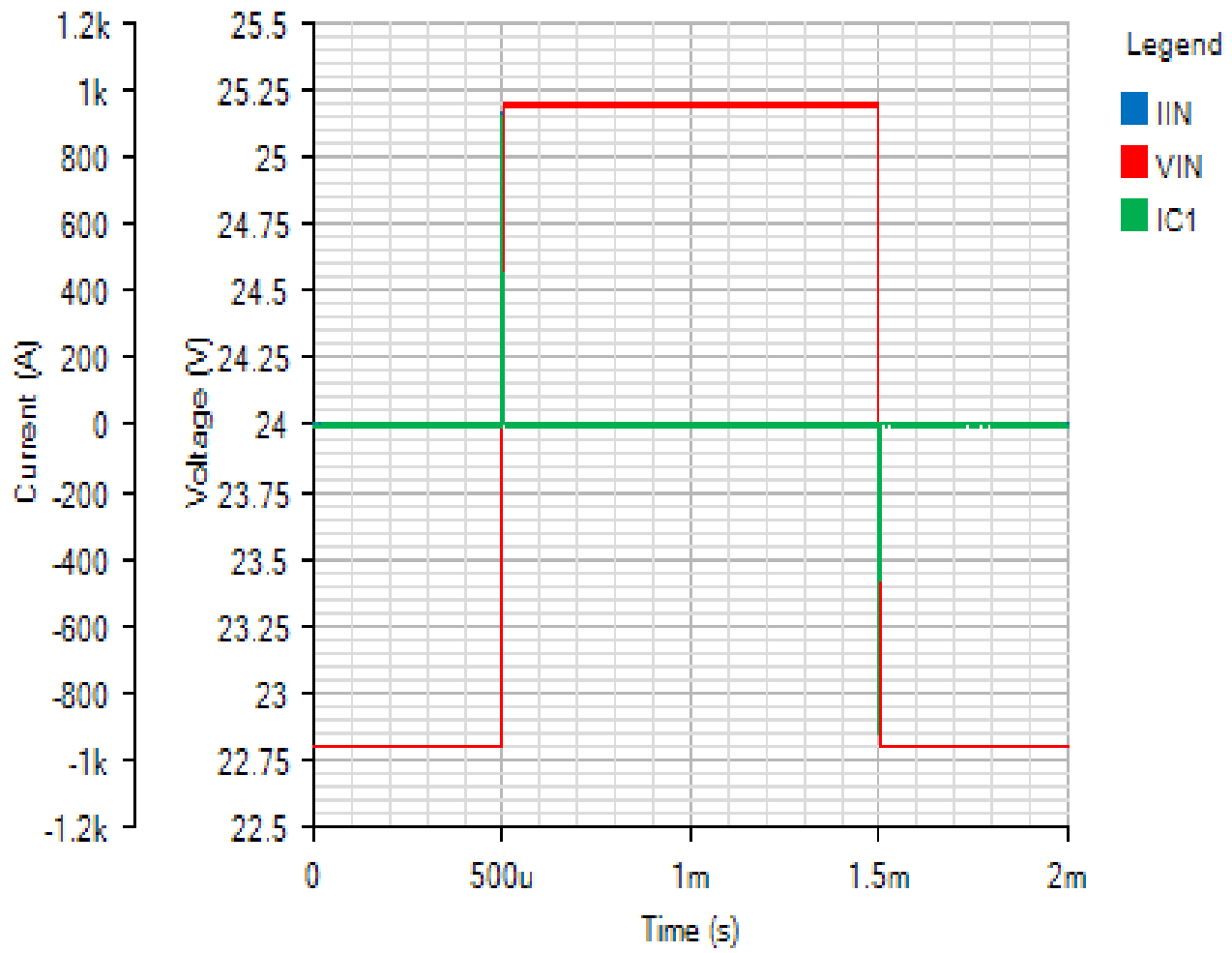
IC

Default



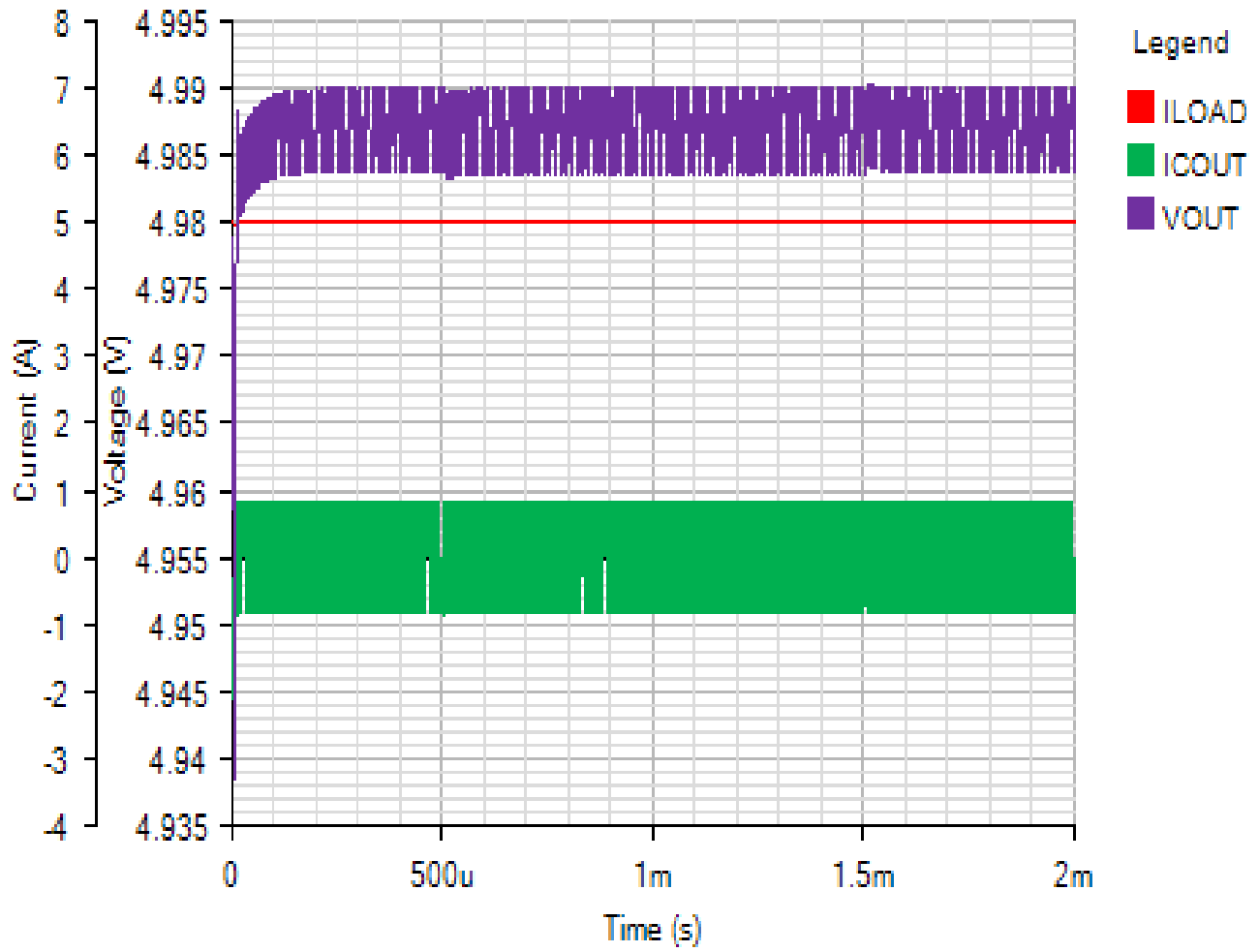
INPUT

Default



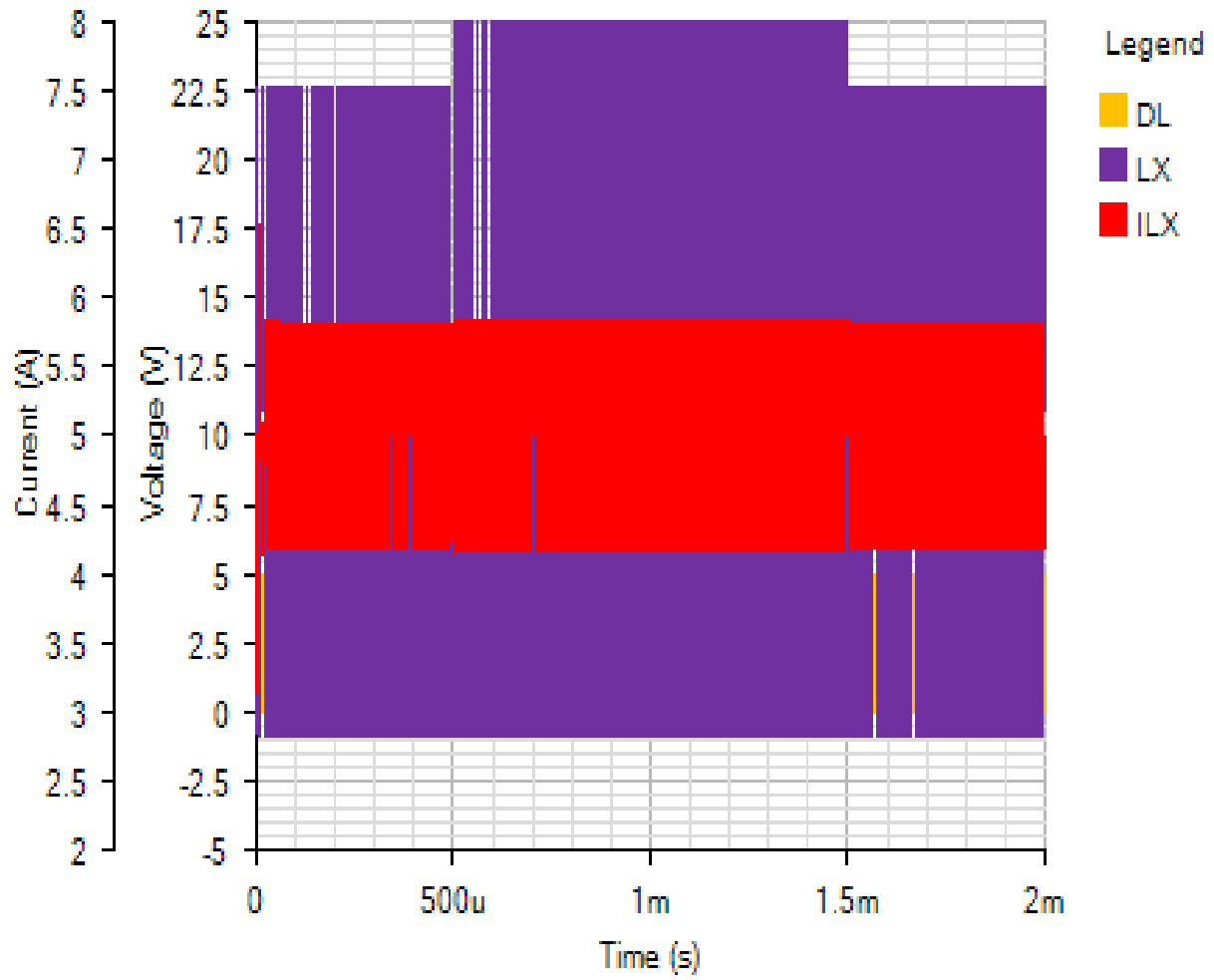
OUTPUT

Default



SWITCHING

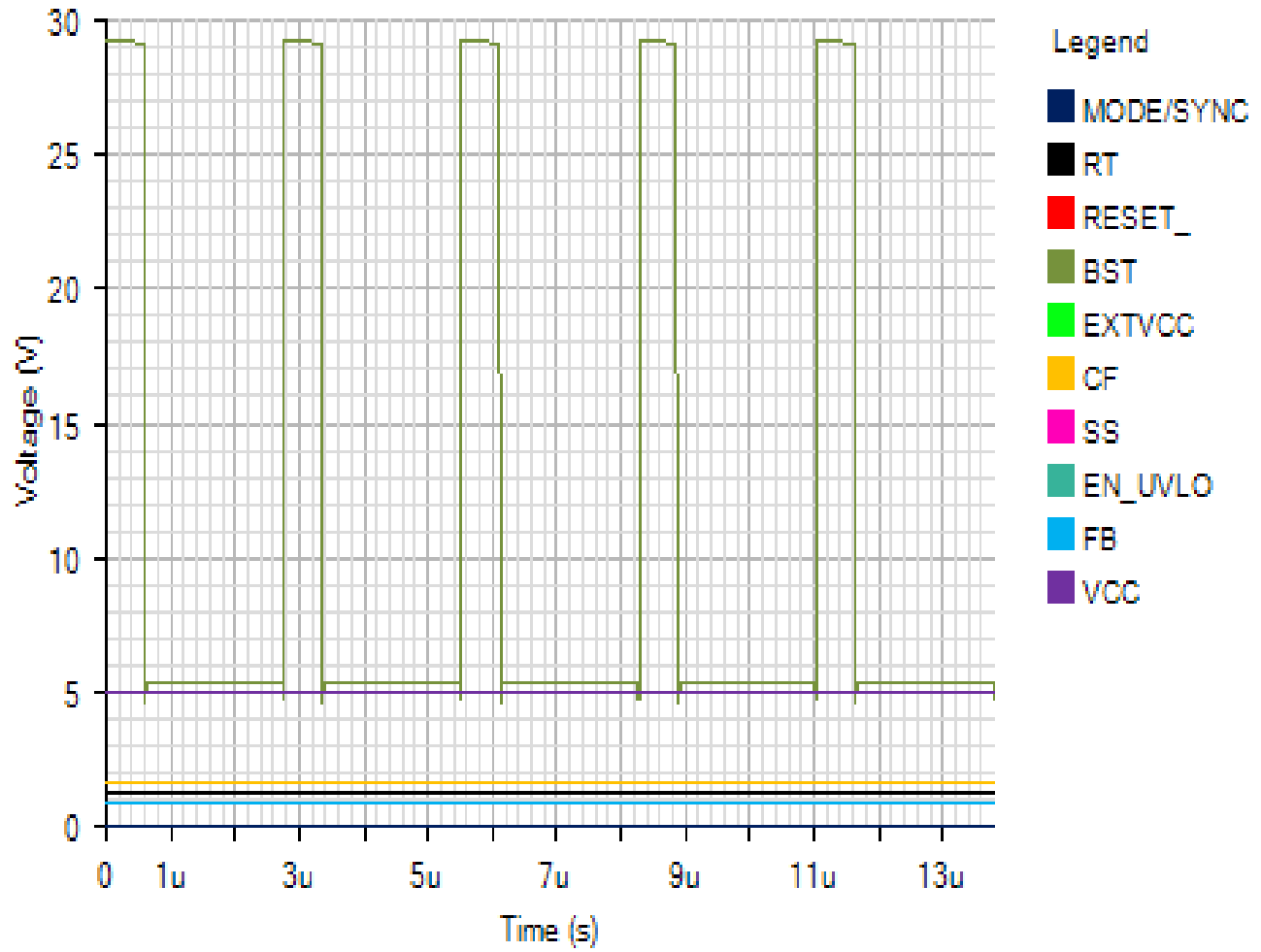
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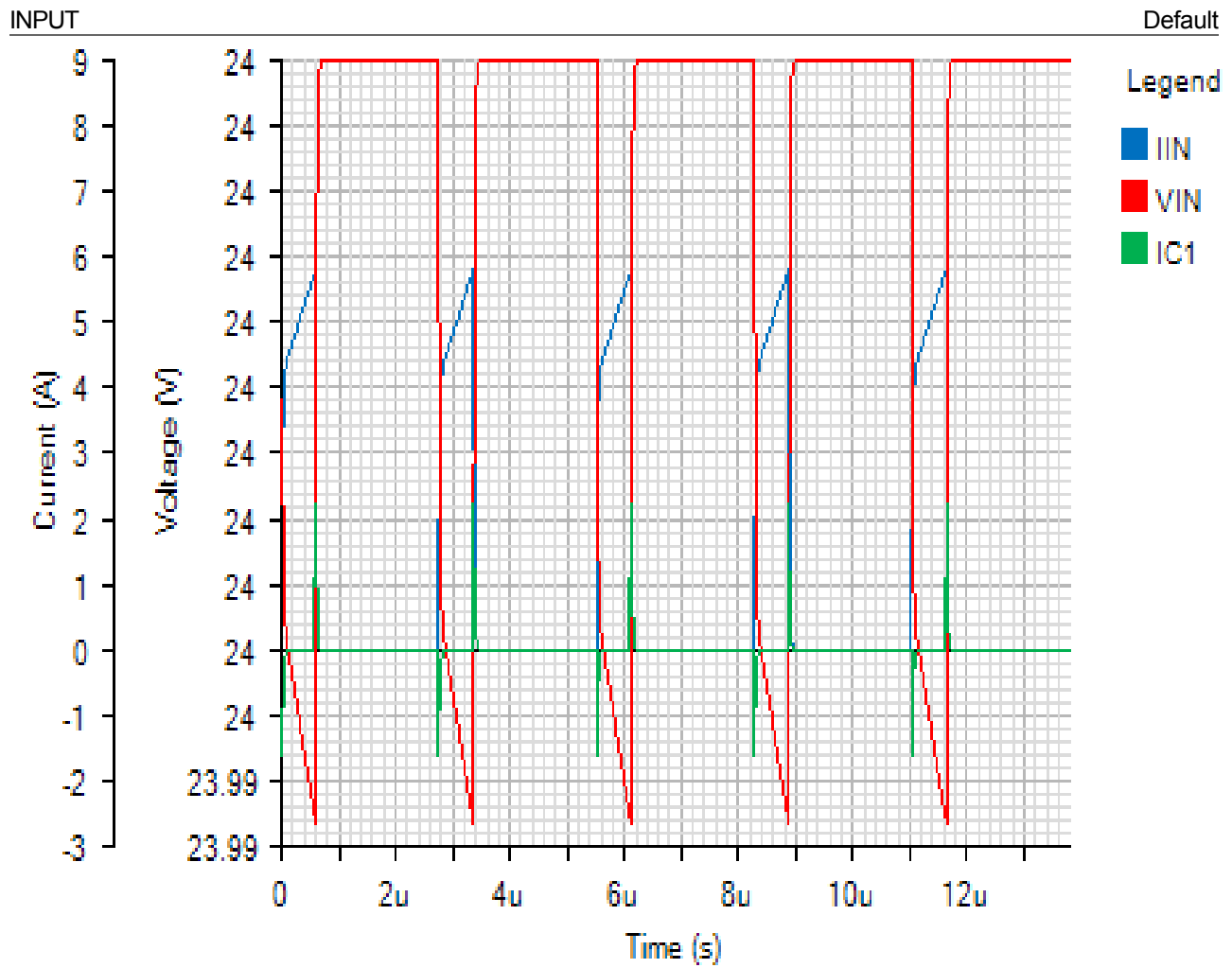


Steady State - Tue Nov 20 2018 16:40:04

IC

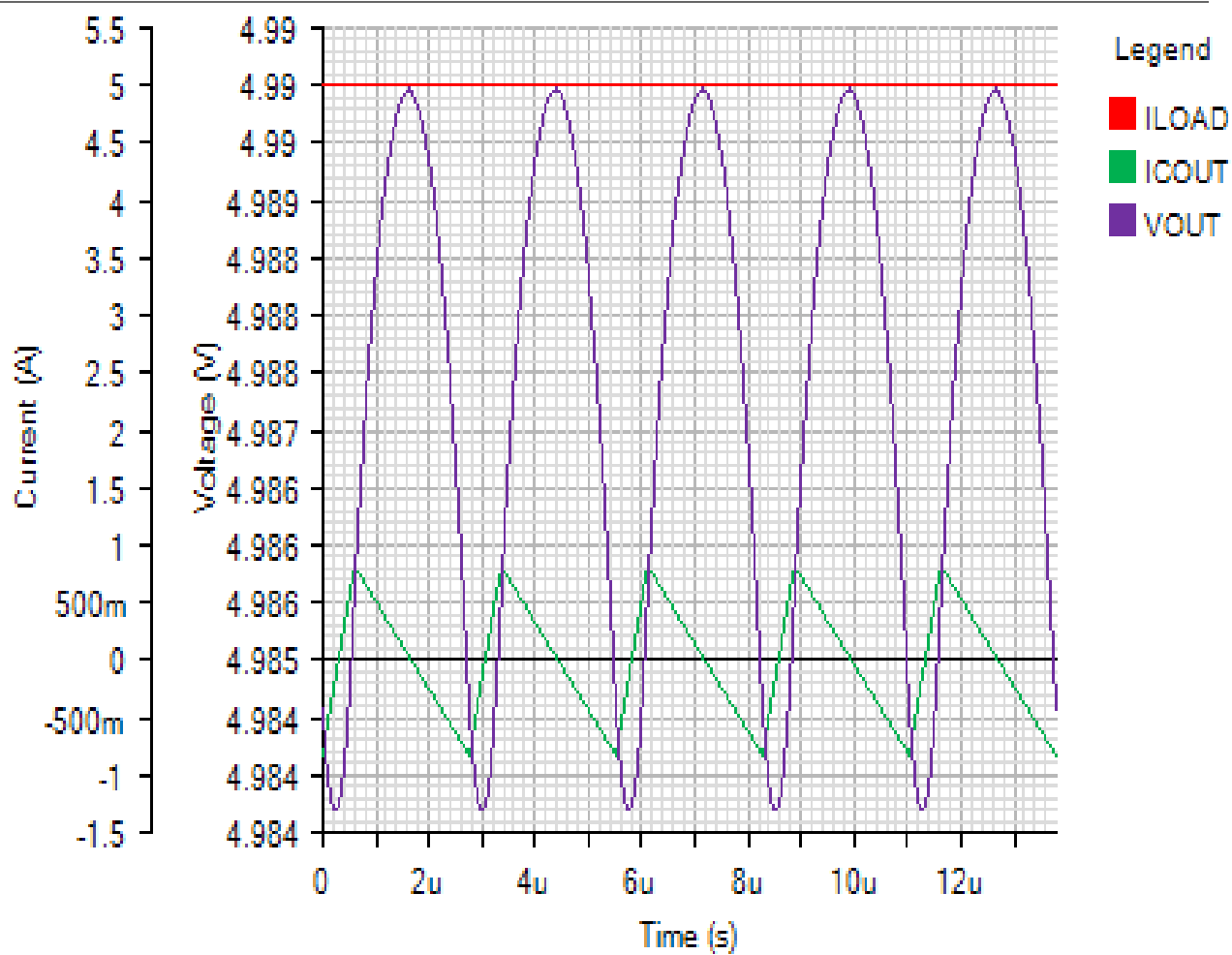
Default





OUTPUT

Default



SWITCHING

Default

