

## Initial Design

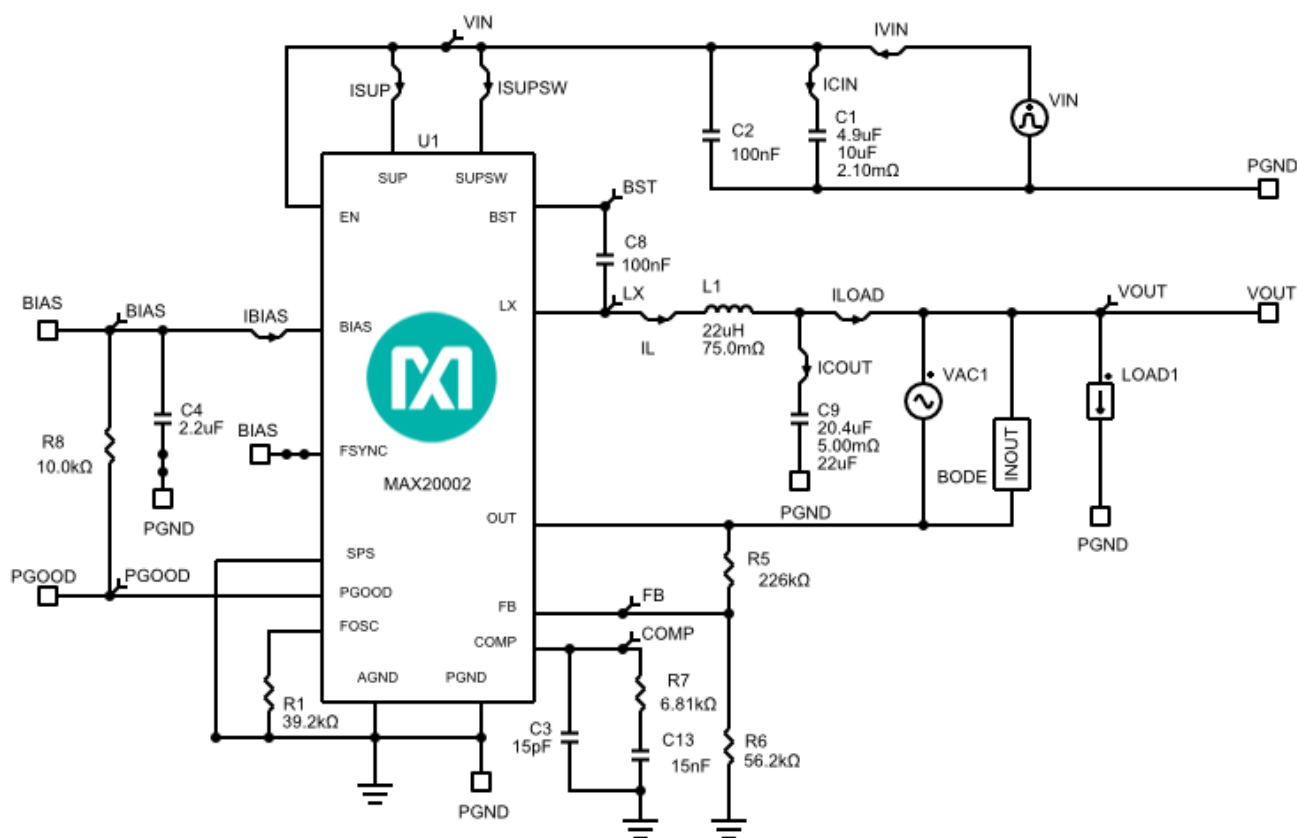
1.0

**Design Requirements**

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Parameter	Value
Minimum Input Voltage	13V
Maximum Input Voltage	15V
Nominal Input Voltage	14V
Input Voltage Ripple	1%
Output Voltage Programming	Externally Resistor Adjustable
Output Voltage	5V
Output Current	1A
Output Voltage Ripple	1%
Load Step Start Current	0.5A
Load Step Current	1A
Load Step Edge Rate	5A/us
Output Voltage Load Step Over/Undershoot	3%
Performance Priority	Balance Efficiency and Size
BOM Priority	Cost
Switching Frequency	695kHz
Mode of Operation	PWM
Inductor Current Ratio (LIR)	0.3
Ambient Temperature	25°C

## Schematic



If the current level (starting current for Load Steps) is too low, AC, Steady State and Load Step analyses may fail when SKIP mode is selected.

The following features described in the data sheet have not been modeled in EE-SIM :

1. A mode for Maximum Duty Cycle Operation which is engaged when Vout is within a few percent of Vin.
2. Spread Spectrum - the model will always operate with Spread Spectrum turned off, regardless of whether the SPS pin is pulled high or low.

## BOM

Ref	Qty	Part Number	Manufacturer	Description
U1	1	<a href="#">MAX20002</a>	Maxim Integrated	36V, 220kHz to 2.2MHz, 2A/3A Fully Integrated Step-Down Converters with 15μA Operating Current
C1	1	<a href="#">C3216X7R1V106K160AC</a>	TDK	Cap Ceramic 10uF 35V 1206 125C
C2	1	<a href="#">VJ0603Y104KXAAC</a>	Vishay	Cap Ceramic 0.1uF 50V X7R 10% Pad SMD 0603 150°C T/R
C3	1	<a href="#">C0402C150K5GACTU</a>	KEMET Corporation	Cap Ceramic 15pF 50V C0G 10% Pad SMD 0402 125°C T/R
C4	1	<a href="#">C1608X7R1A225K080AC</a>	TDK	Cap Ceramic 2.2uF 10V X7R 10% Pad SMD 0603 125°C T/R
C8	1	<a href="#">VJ0603Y104KXAAC</a>	Vishay	Cap Ceramic 0.1uF 50V X7R 10% Pad SMD 0603 150°C T/R

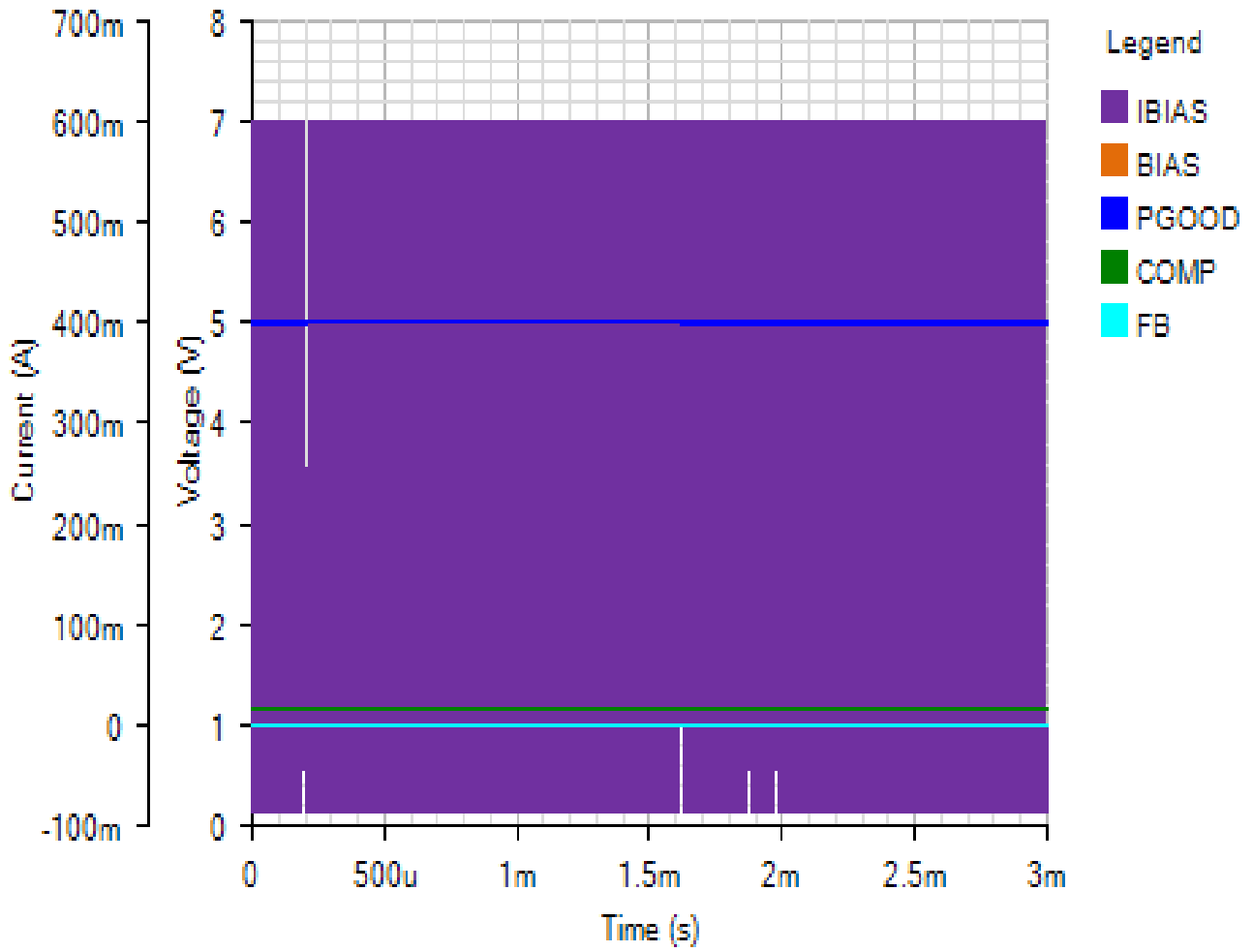
C9	1	<a href="#">C3225X7R1C226K250AC</a>	TDK	Cap Ceramic 22uF 16V X7R 10% SMD 1210 125C Plastic T/R
C13	1	<a href="#">GRT155R71H153KE01D</a>	Murata Manufacturing	Cap Ceramic 0.015uF 50V X7R 10% Pad SMD 0402 125°C Automotive T/R
L1	1	<a href="#">VLP8040T-220M</a>	TDK	Inductor Power Shielded Wirewound 22uH 20% 100KHz Ferrite 2.5A 75mOhm DCR Embossed Carrier T/R
R1	1	<a href="#">ERJ2RKF3922X</a>	Panasonic	Res Thick Film 0402 39.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R5	1	<a href="#">ERJ2RKF2263X</a>	Panasonic	Res Thick Film 0402 226K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R6	1	<a href="#">ERJ2RKF5622X</a>	Panasonic	Res Thick Film 0402 56.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R7	1	<a href="#">ERJ2RKF6811X</a>	Panasonic	Res Thick Film 0402 6.81K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R8	1	<a href="#">ERJ2GEJ103X</a>	Panasonic	Res Thick Film 0402 10K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R

## Simulation Results

Line Transient - Tue Nov 20 2018 11:05:36

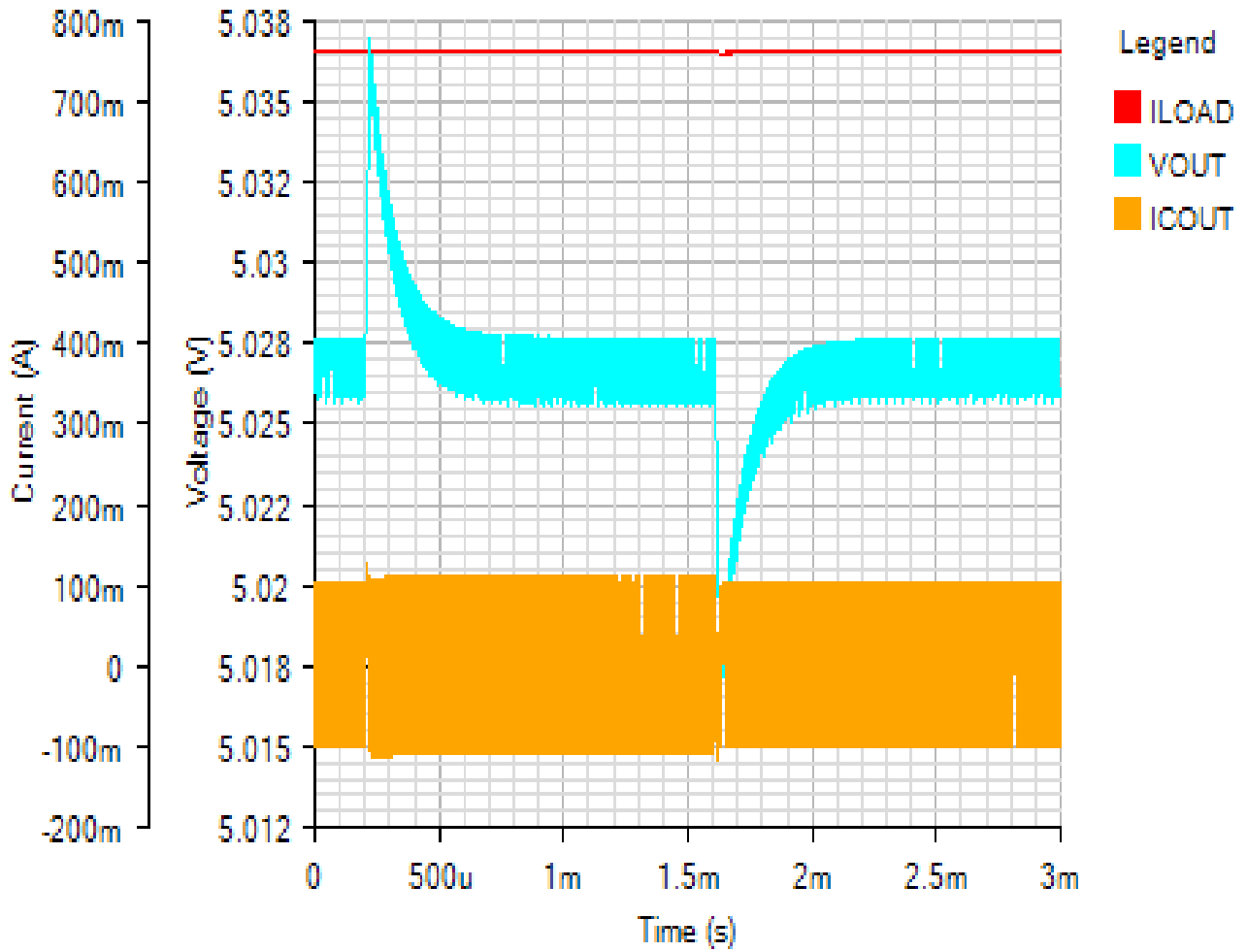
IC

Default



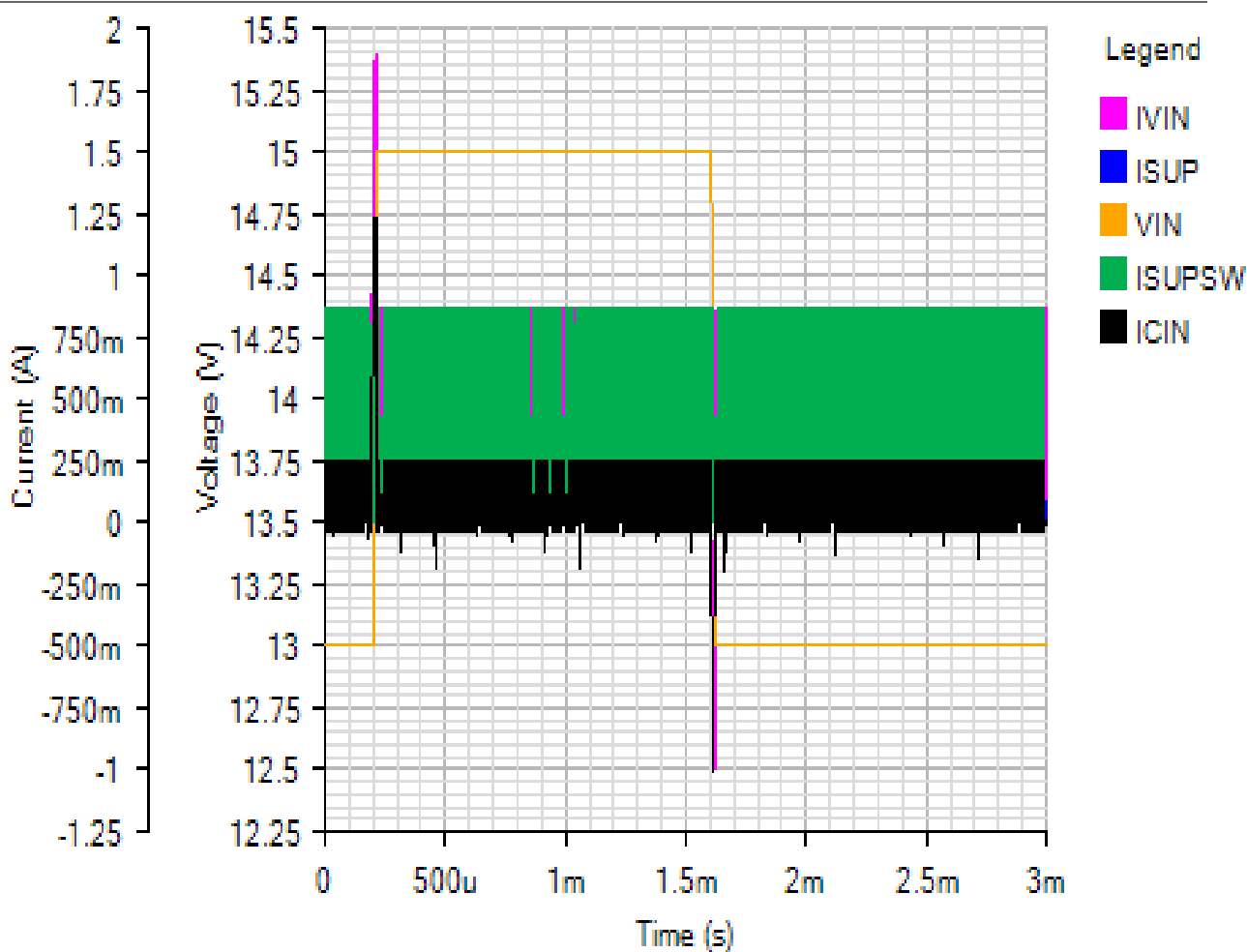
OUTPUT

Default



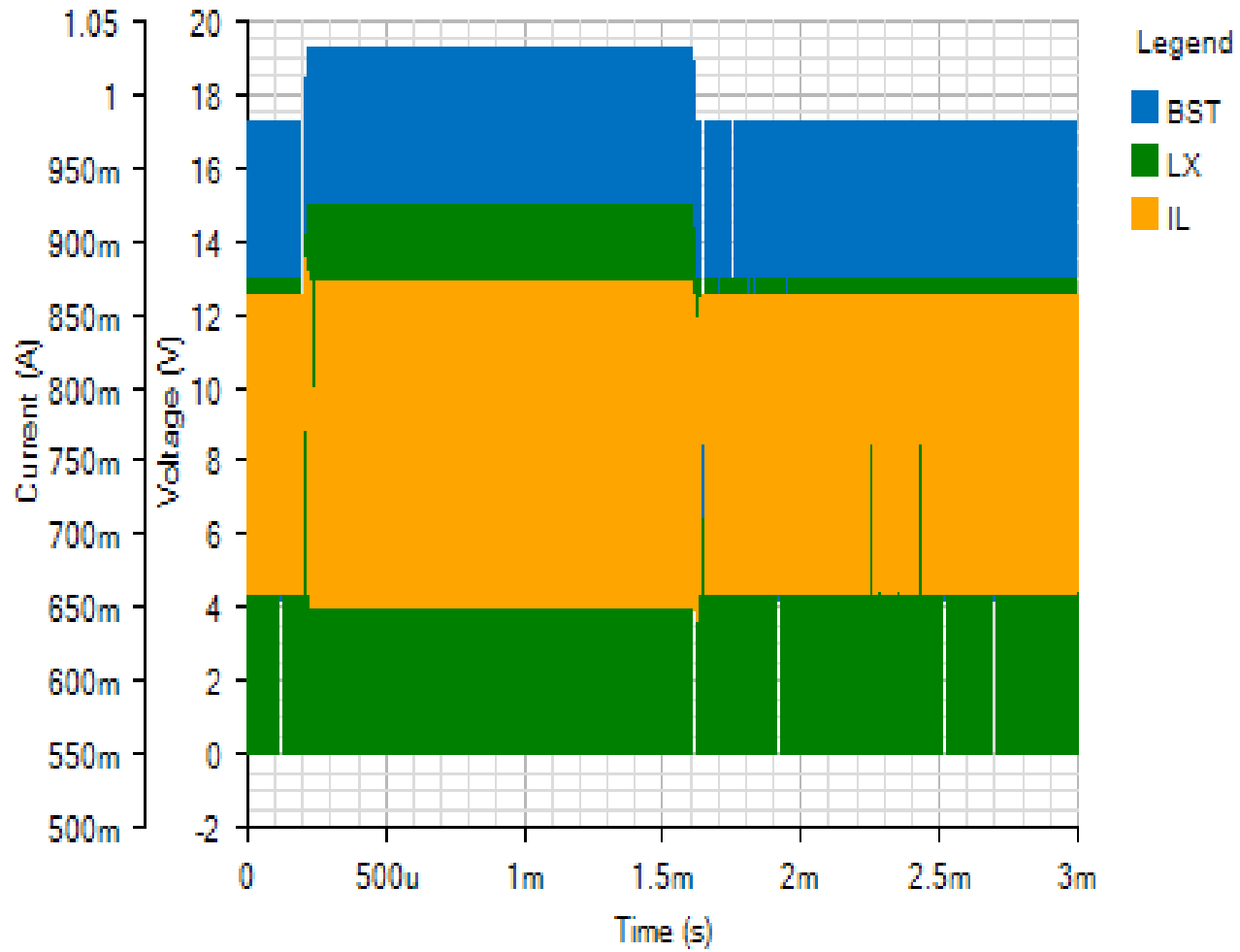
INPUT

Default

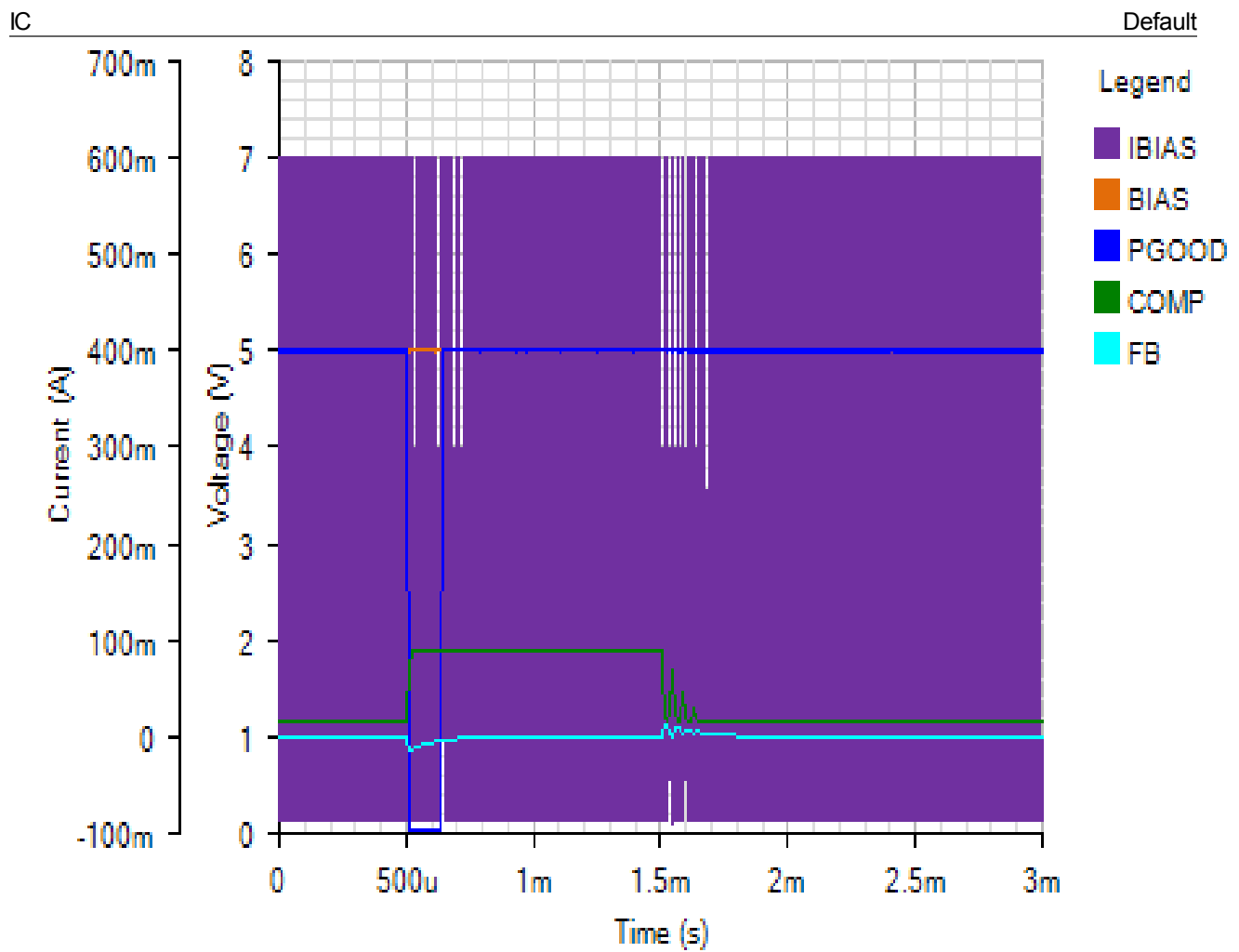


SWITCHING

Default



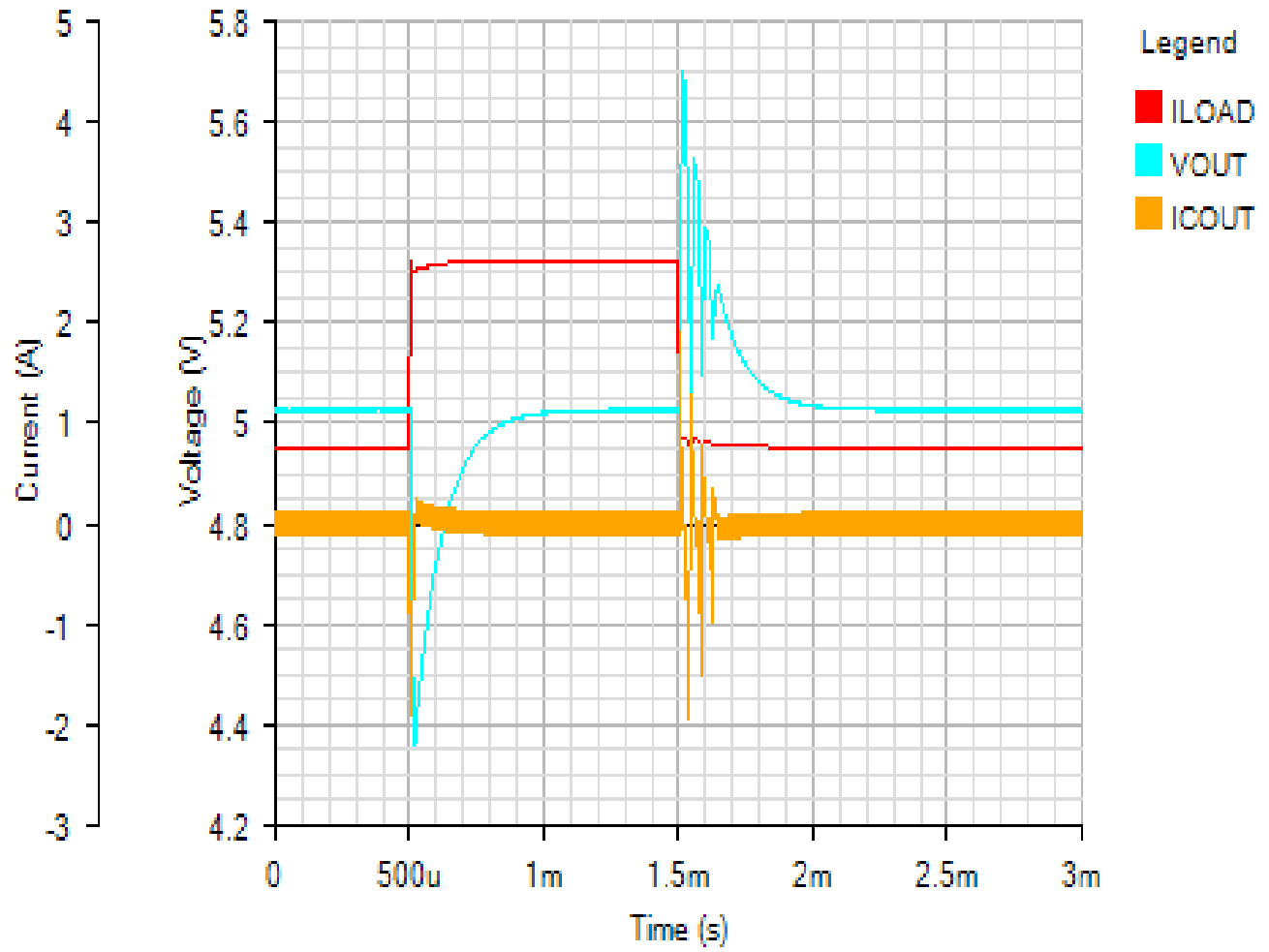
Load Step - Tue Nov 20 2018 11:05:36





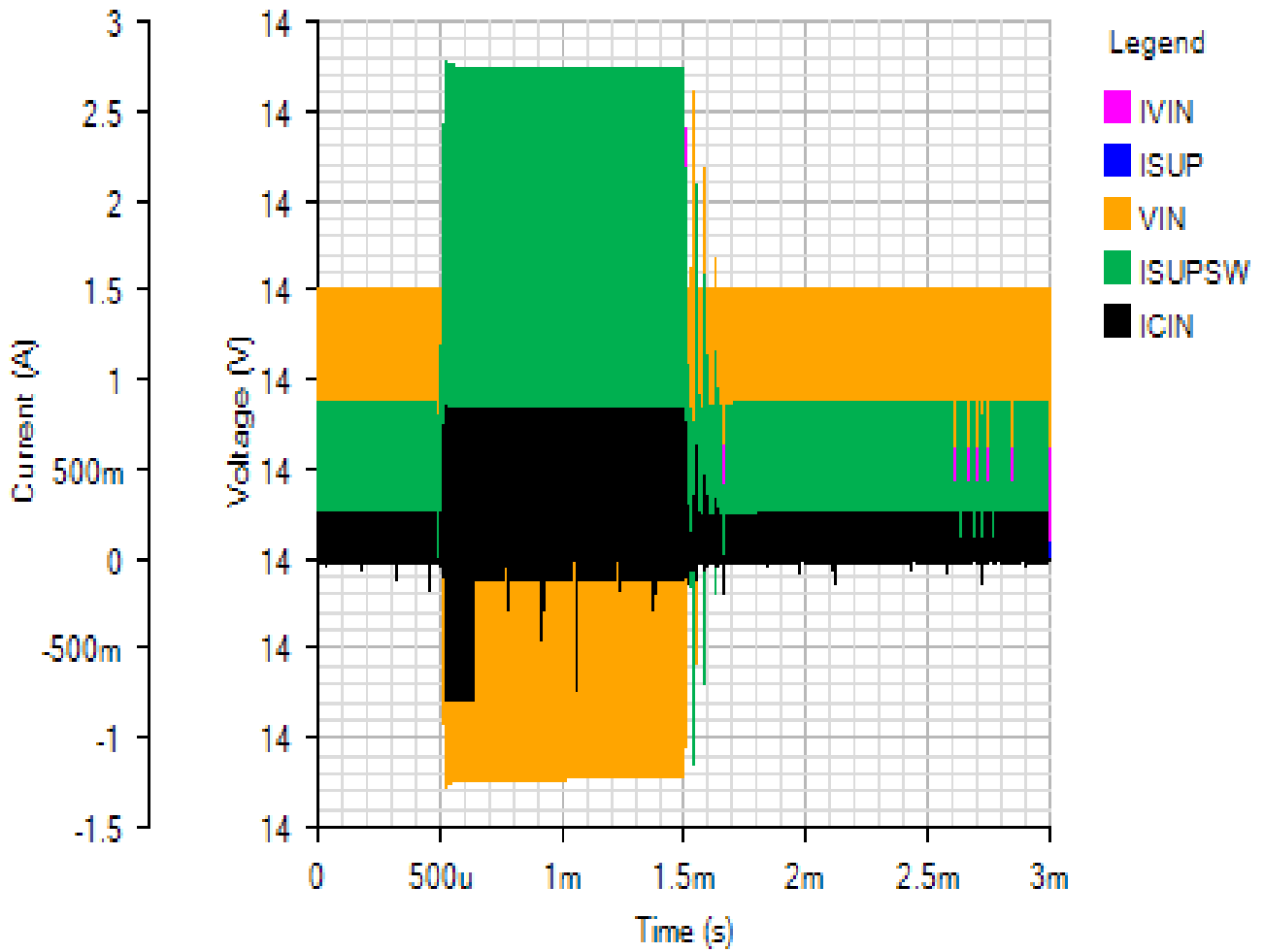
OUTPUT

Default



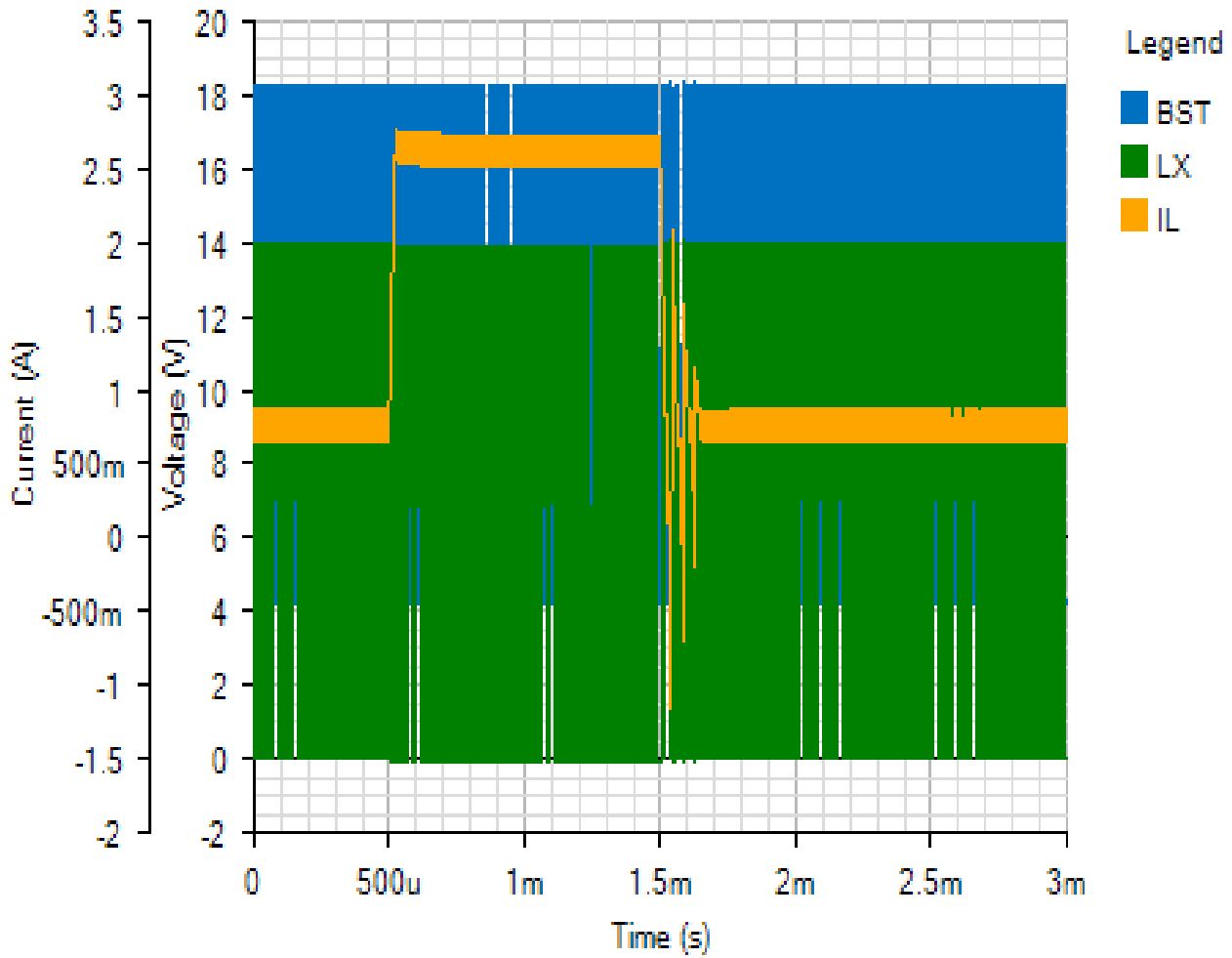
INPUT

Default



SWITCHING

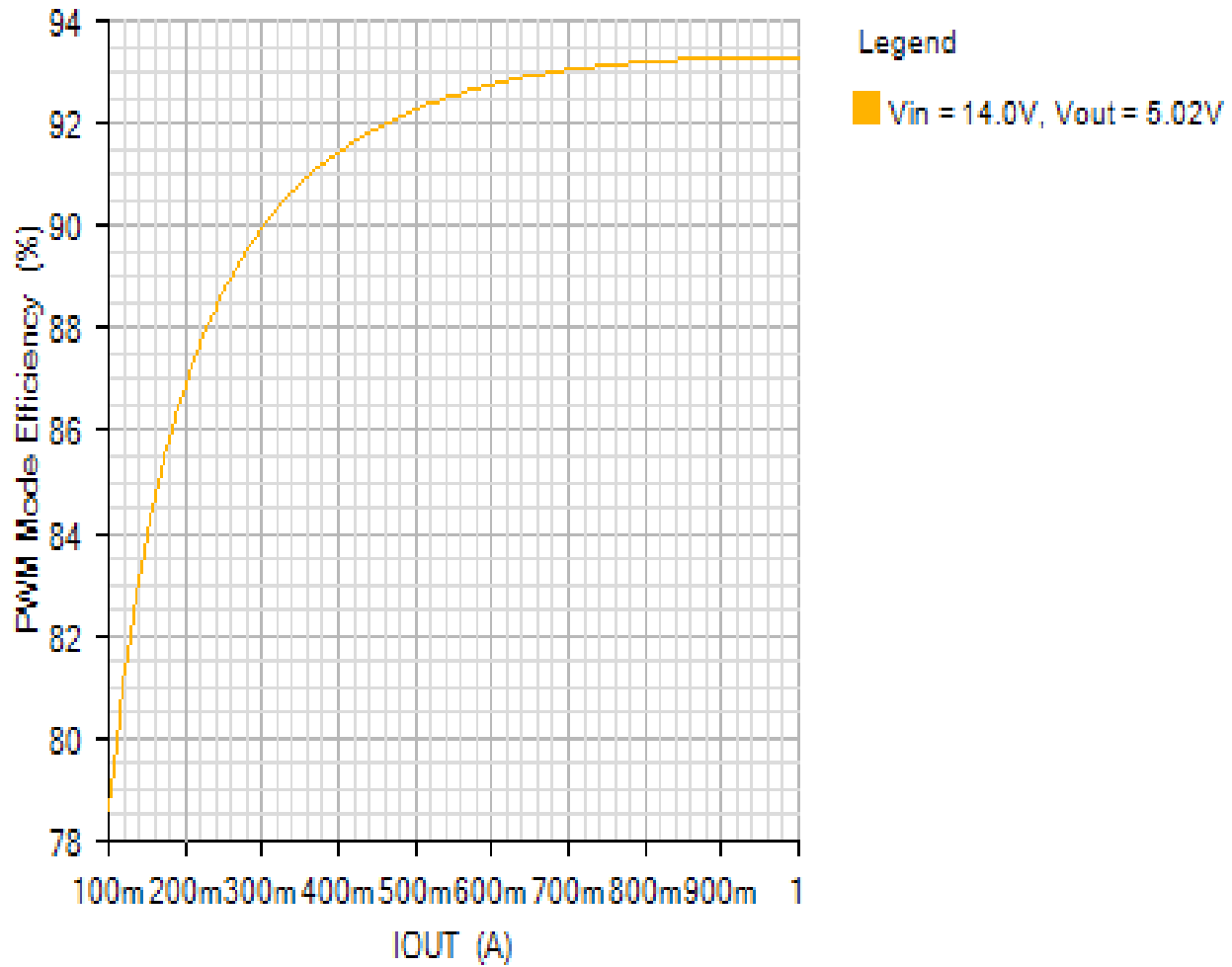
Default



Efficiency - Tue Nov 20 2018 11:05:36

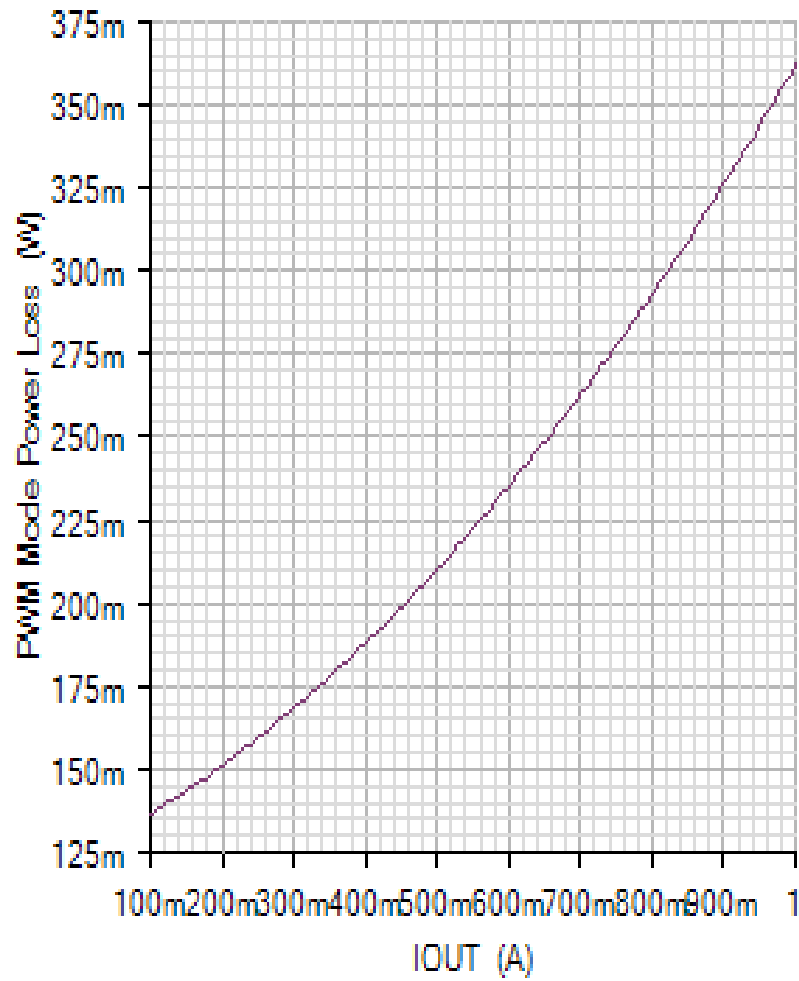
EFFICIENCY

Default



POWER\_LOSS

Default

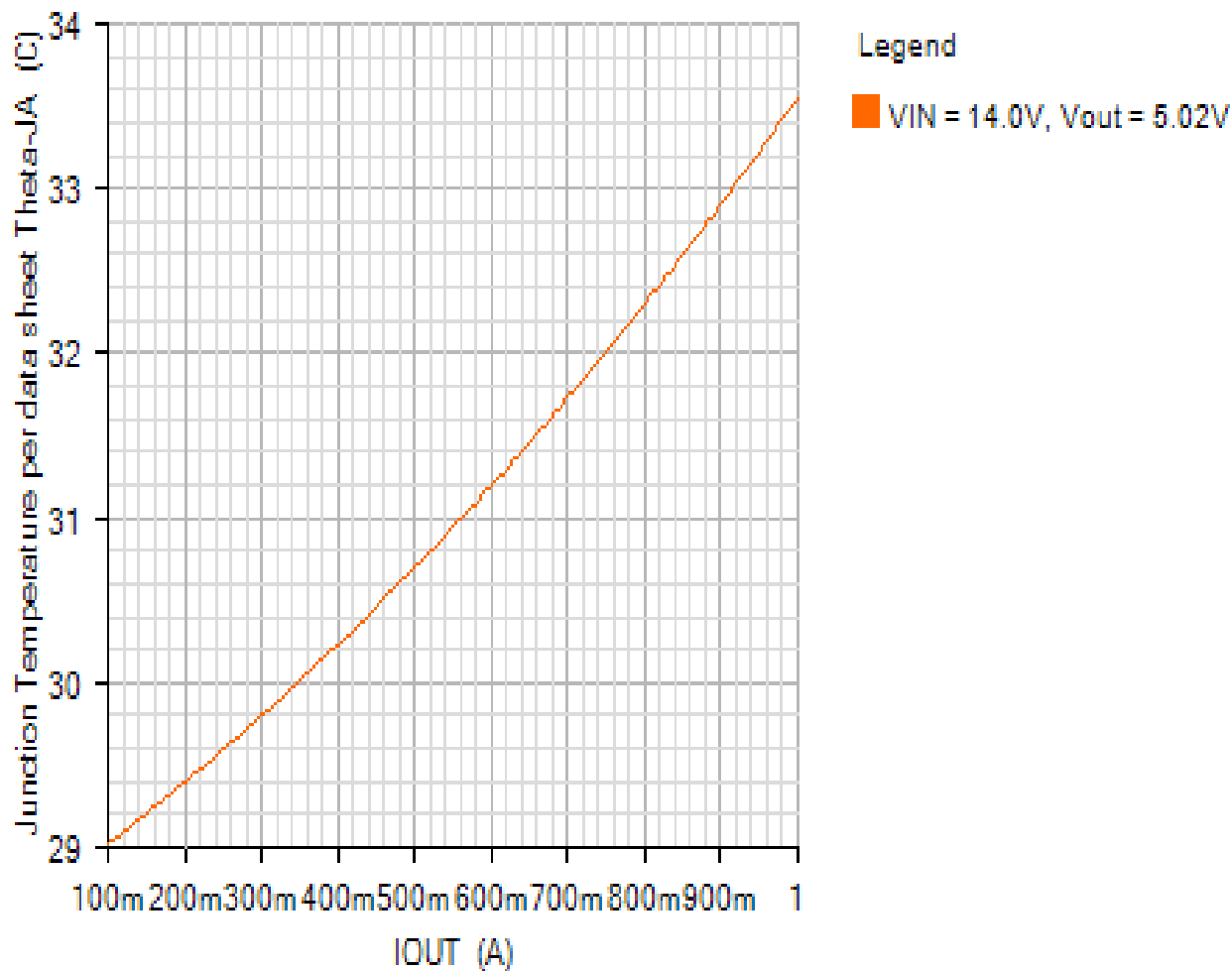


Legend

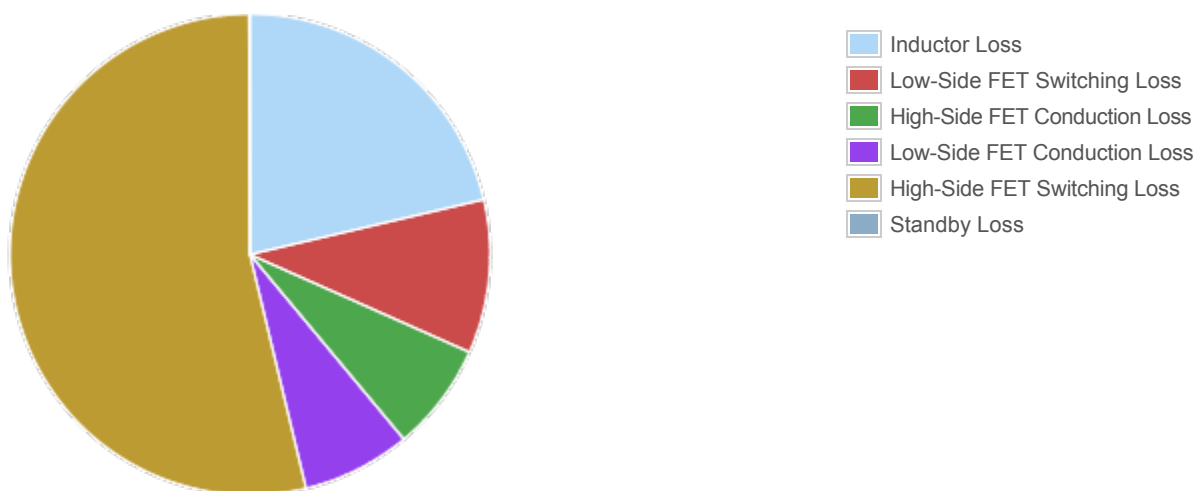
■ Vin = 14.0V, Vout = 5.02V

# JUNCTION\_TEMPERATURE

Default



## Losses



Component

Loss (W)

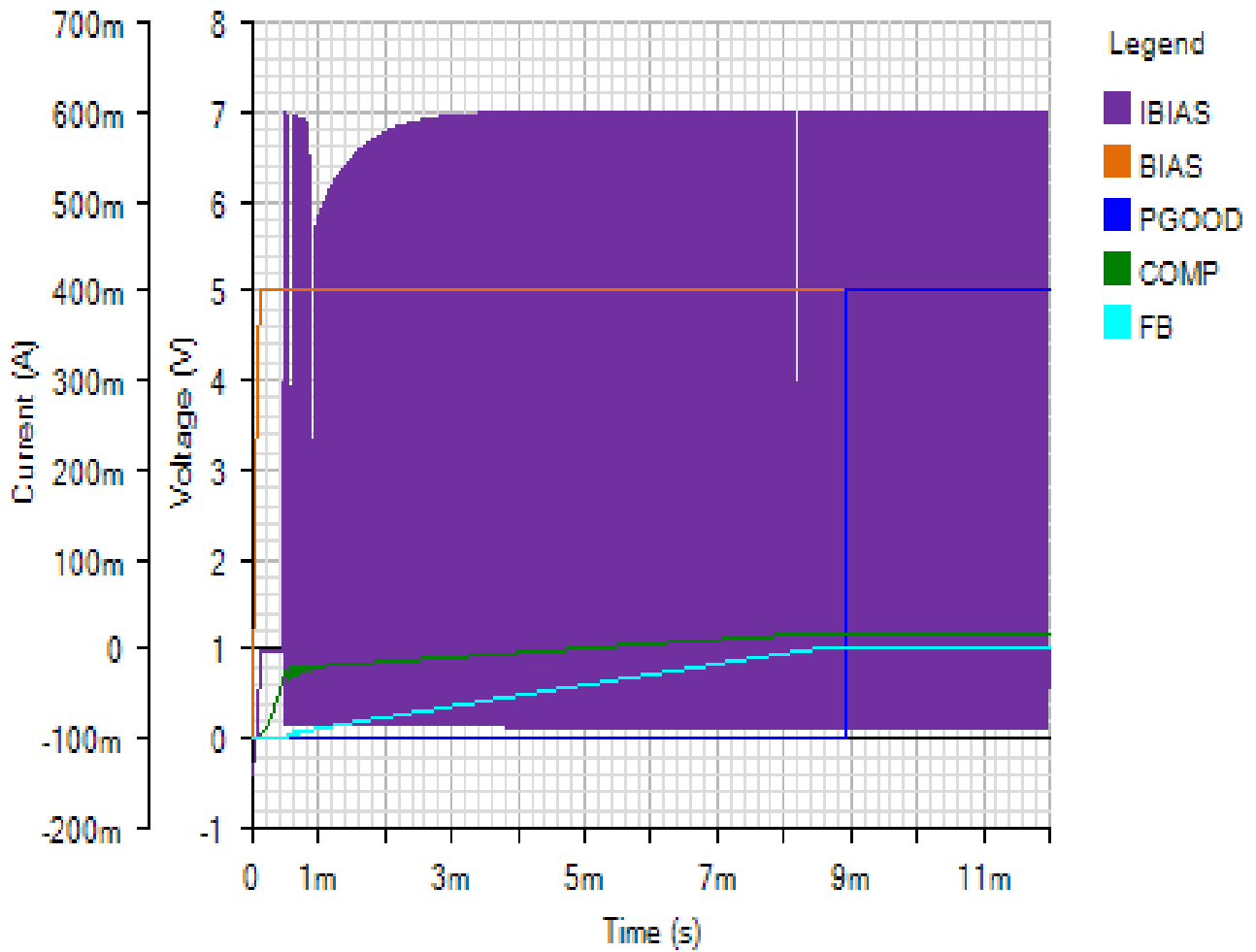
% of total

Component	Loss (W)	% of total
Inductor Loss	0.213325	21.3
Low-Side FET Switching Loss	0.103212	10.3
High-Side FET Conduction Loss	0.072767	7.3
Low-Side FET Conduction Loss	0.073161	7.3
High-Side FET Switching Loss	0.536762	53.7
Standby Loss	0.000773	0.1
Total	1	100

Start Up - Tue Nov 20 2018 11:05:36

IC

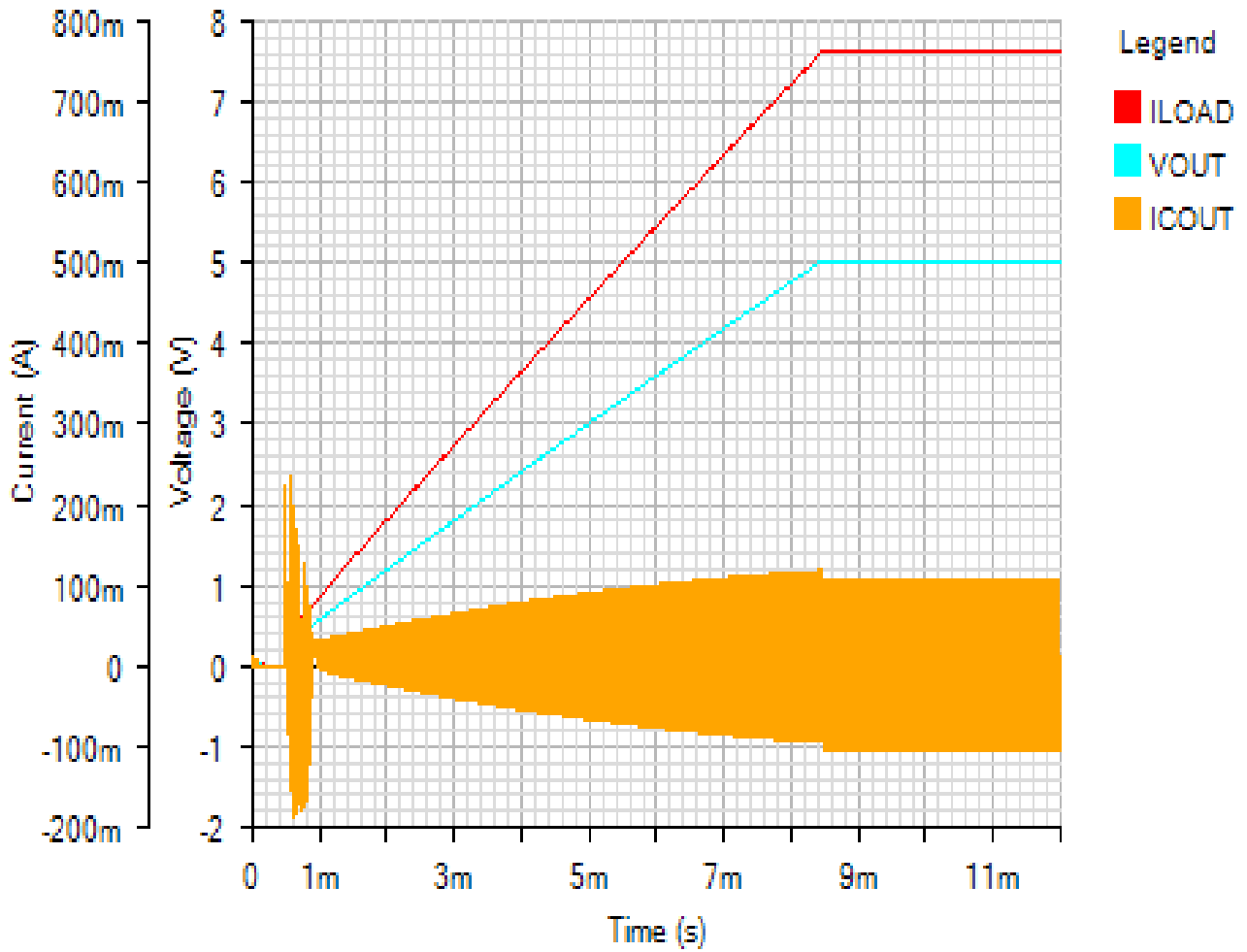
Default





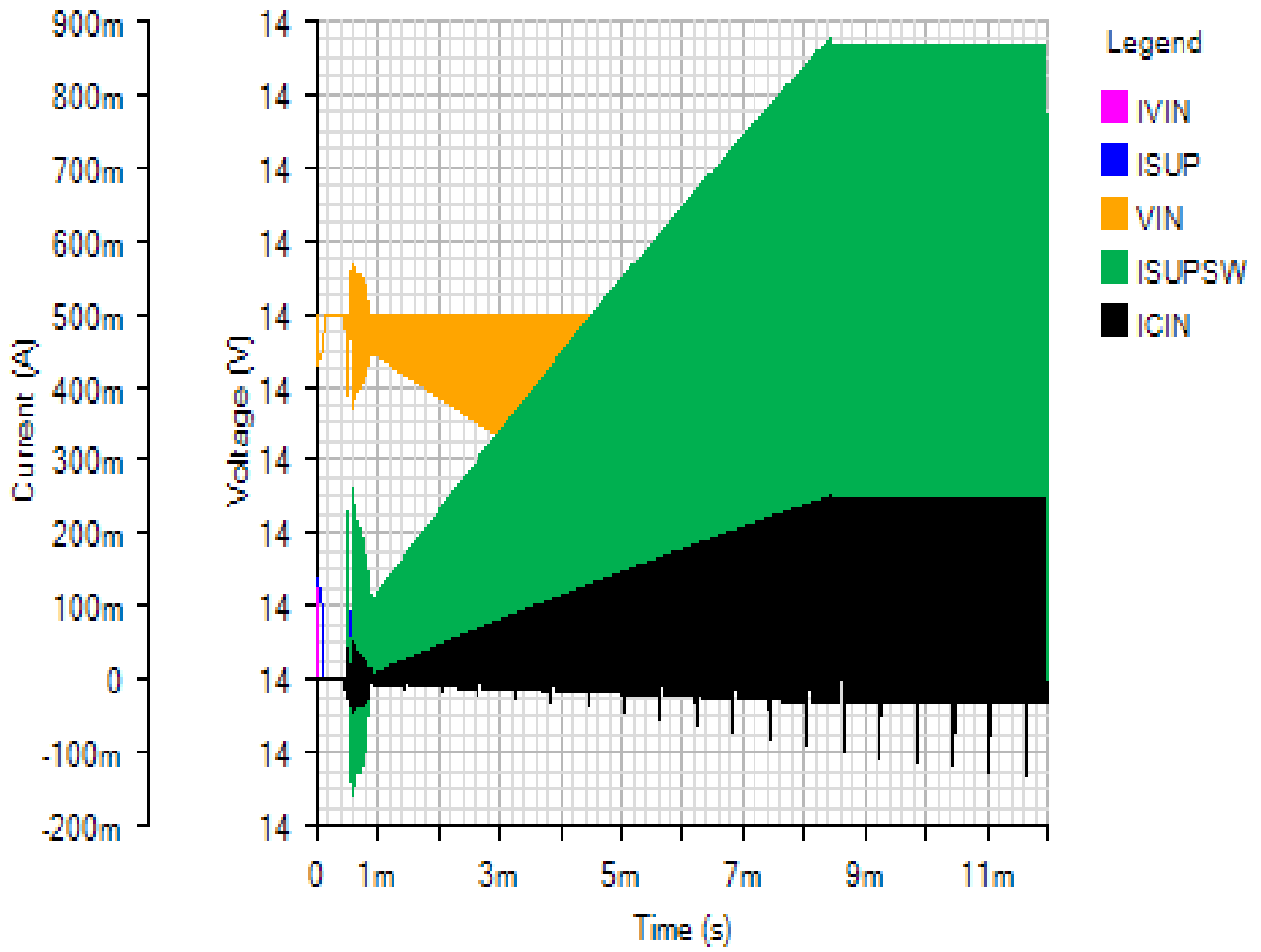
OUTPUT

Default



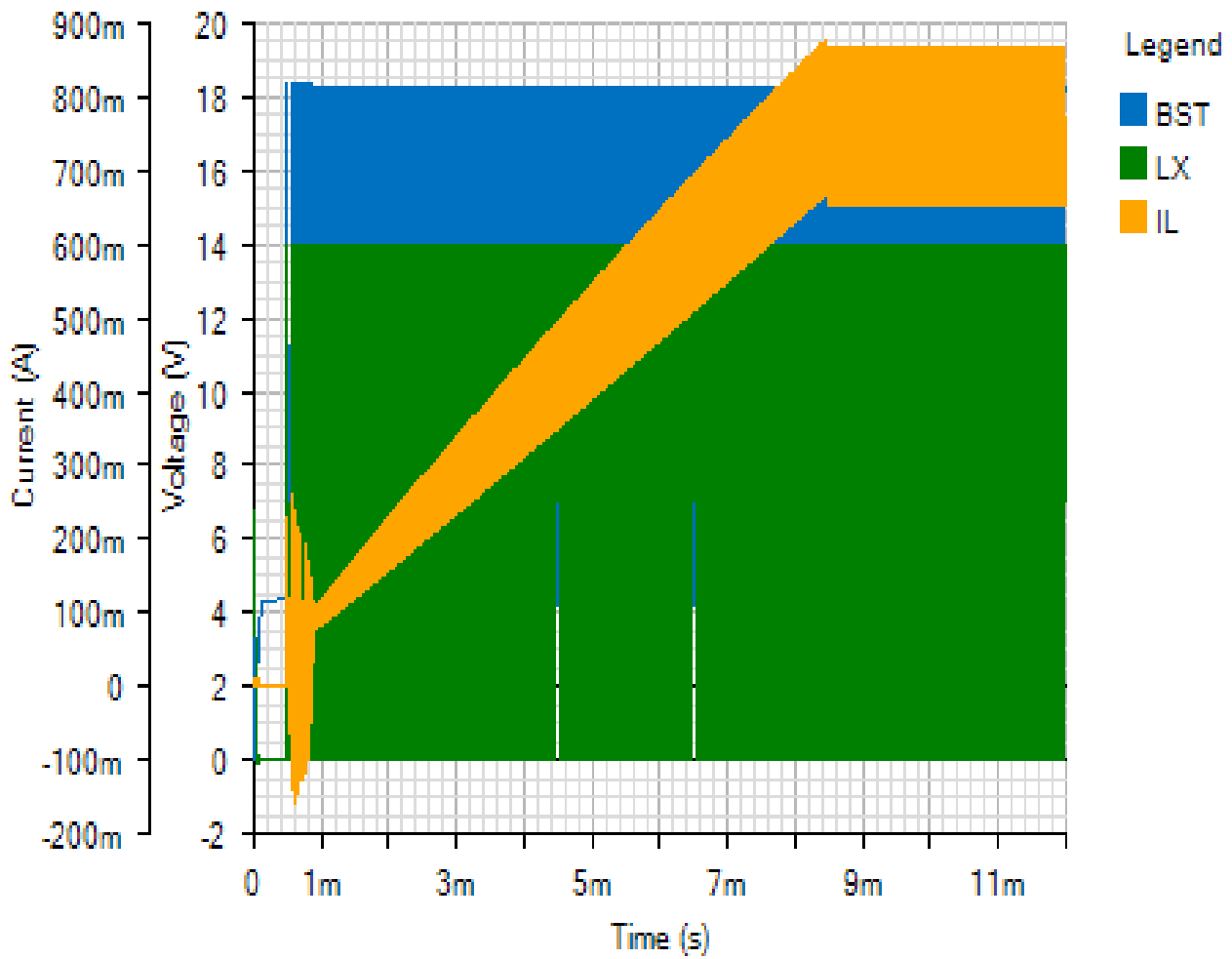
INPUT

Default



SWITCHING

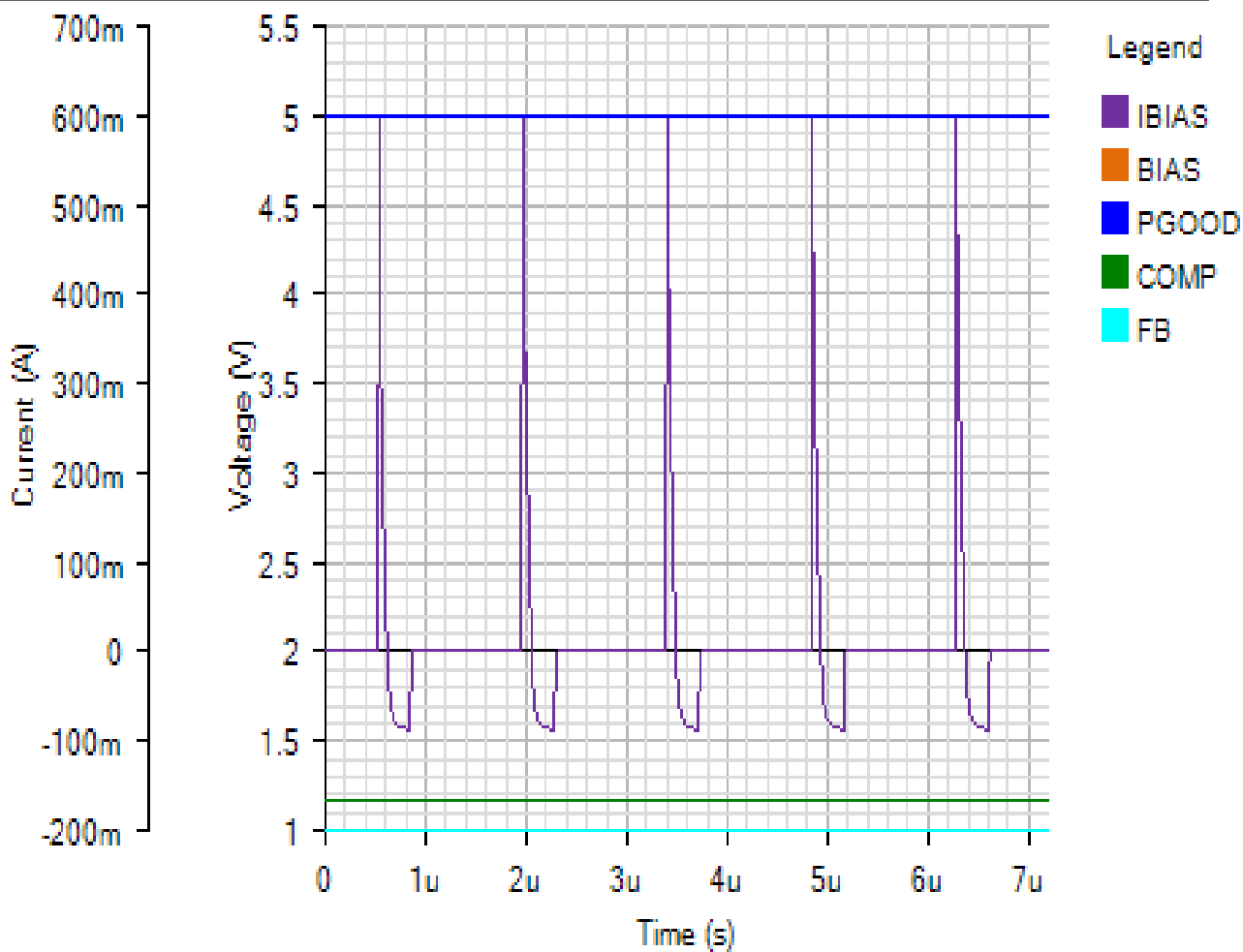
Default



Steady State - Tue Nov 20 2018 11:05:36

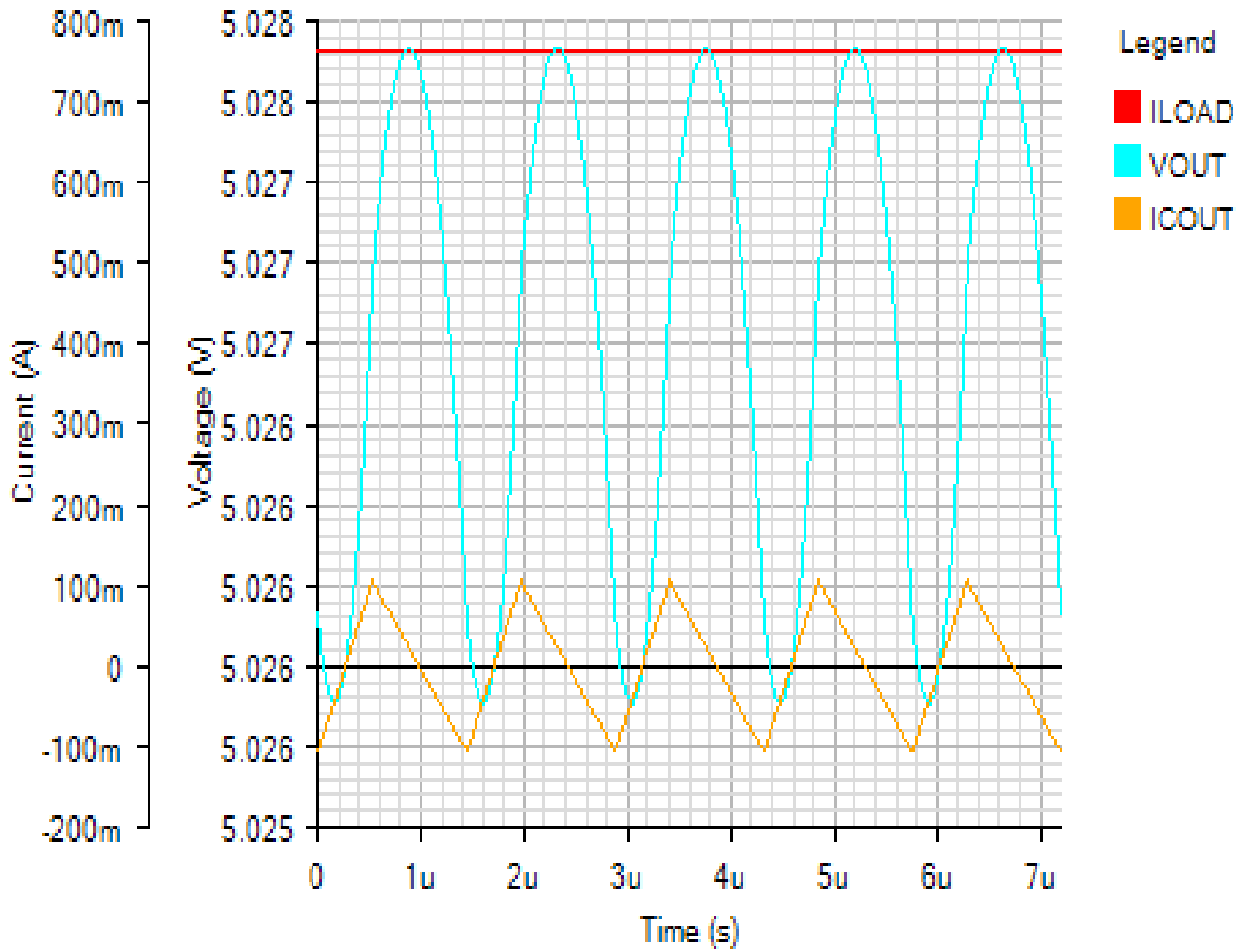
IC

Default



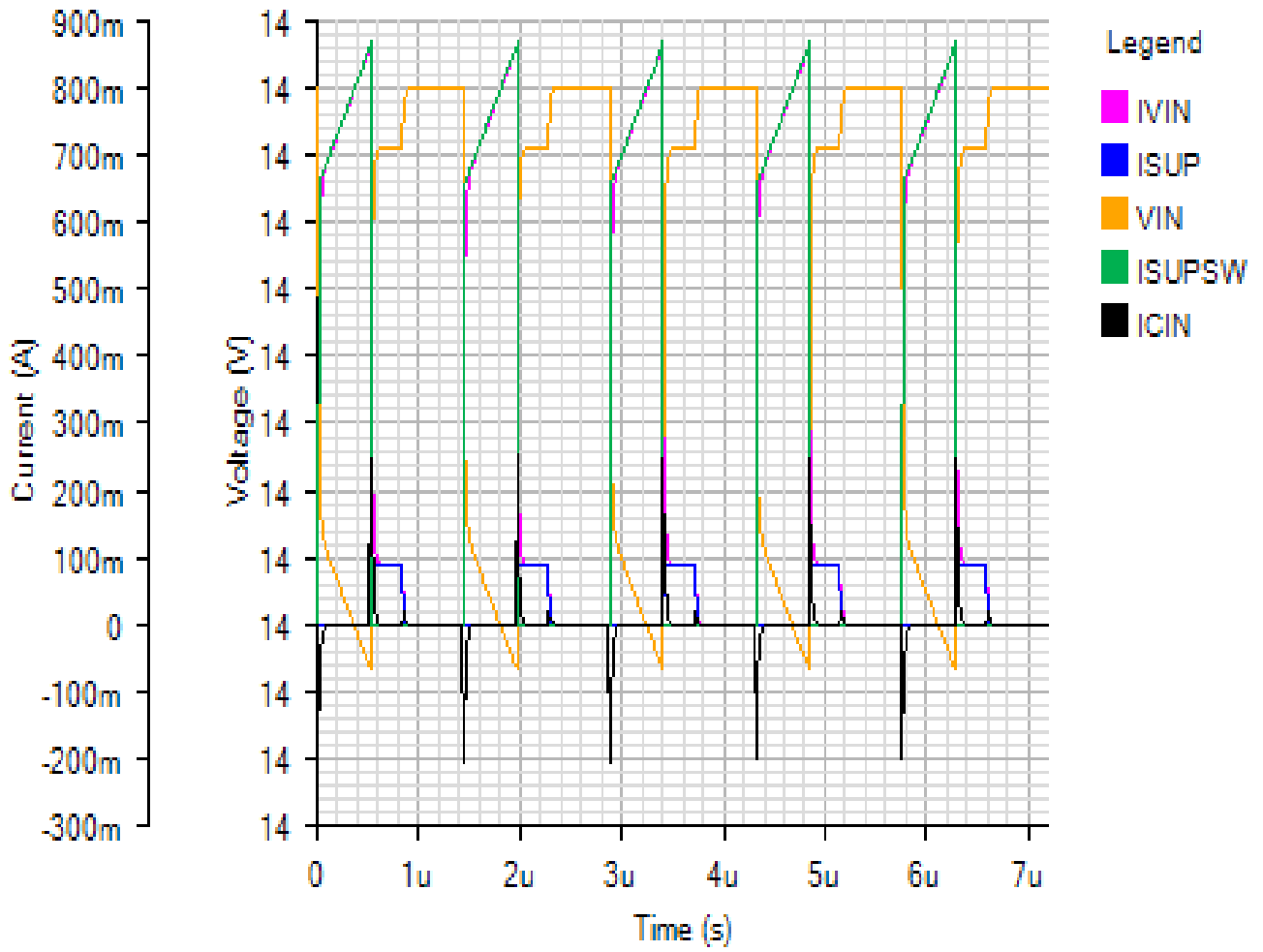
OUTPUT

Default



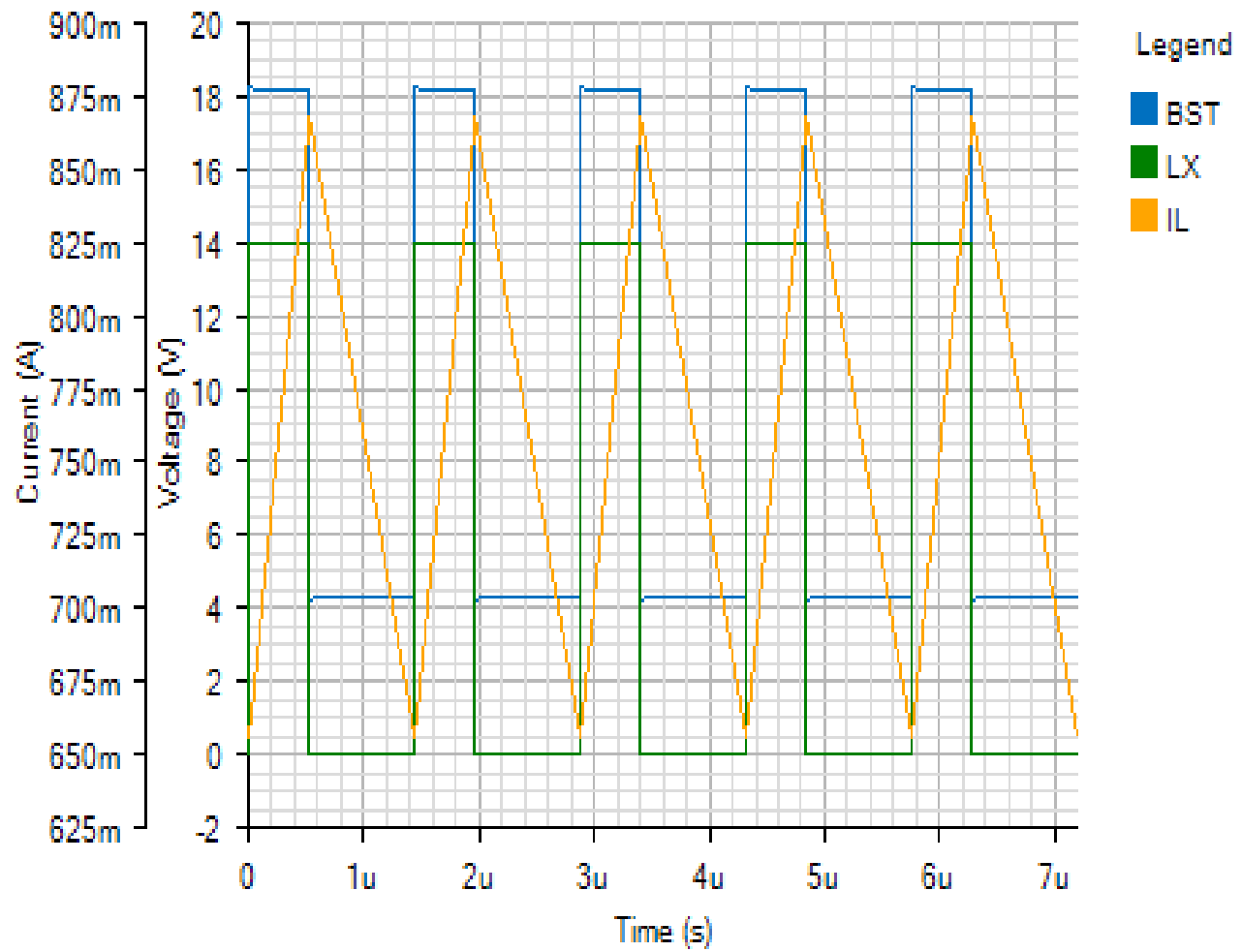
INPUT

Default



SWITCHING

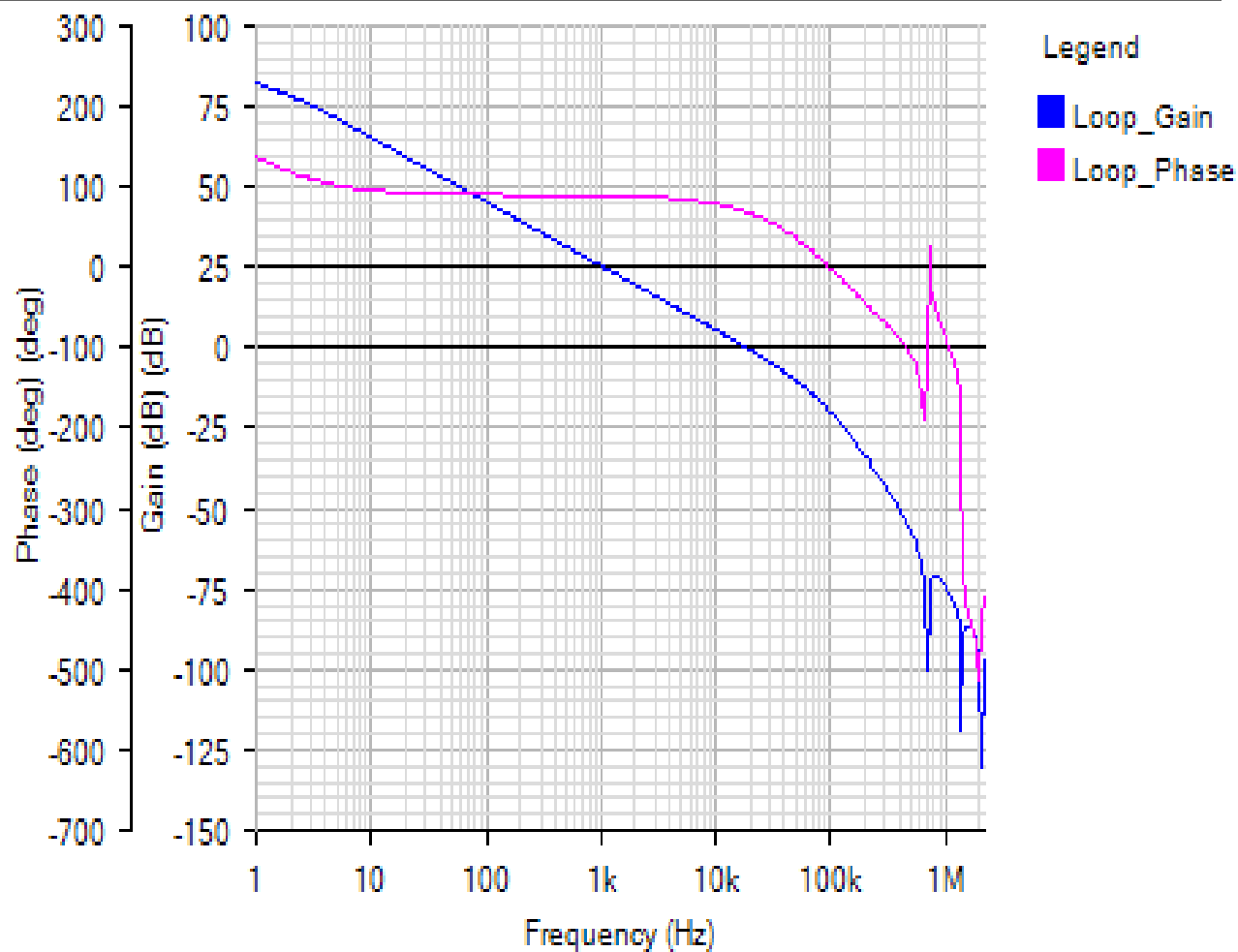
Default



AC Loop - Tue Nov 20 2018 11:05:36

BODE

Default



Phase Margin: 68.8° at a crossover frequency of 18.7kHz

