

## Initial Design

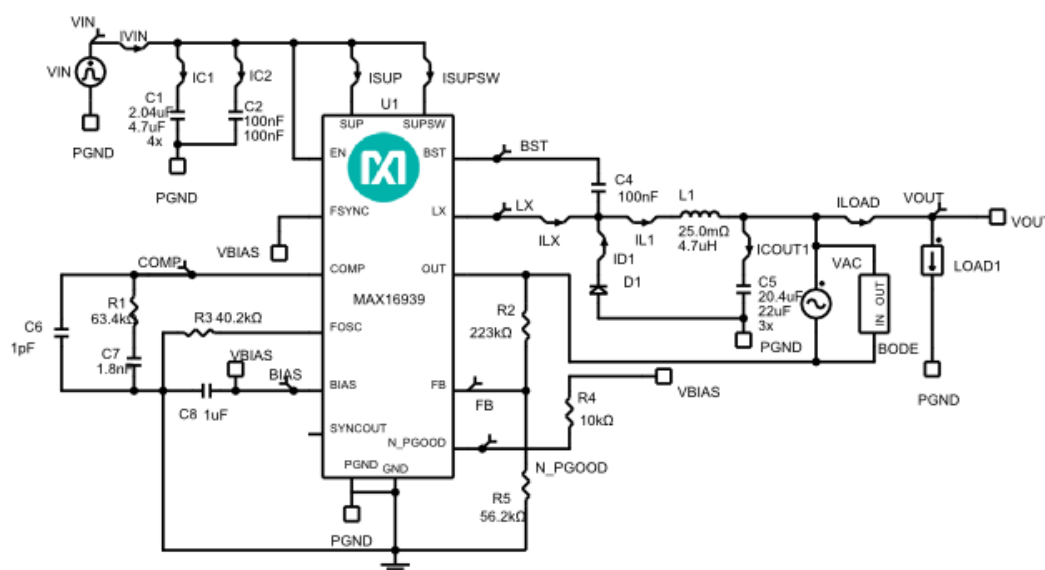
1.0

**Design Requirements**

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Parameter	Value
Minimum Input Voltage	10V
Maximum Input Voltage	14V
Nominal Input Voltage	12V
Input Voltage Ripple	1%
Output Voltage Programming	External Resistive Divider
Output Voltage	5 V
Output Current	2.5A
Load Step Start Current	1.25A
Load Step Current	2.5A
Output Voltage Ripple	2%
Output Voltage Load Step Over/Undershoot	5%
Performance Priority	Balance Efficiency and Size
BOM Priority	Cost
Inductor Current Ratio (LIR)	0.3
Mode of operation	PWM
Switching Frequency	700000Hz
Ambient Temperature	25°C

## Schematic



- The data sheet describes a mode for Maximum Duty Cycle Operation which is engaged when  $V_{out}$  is within a few percent of  $V_{in}$ . This feature is not yet modeled in EE-Sim.

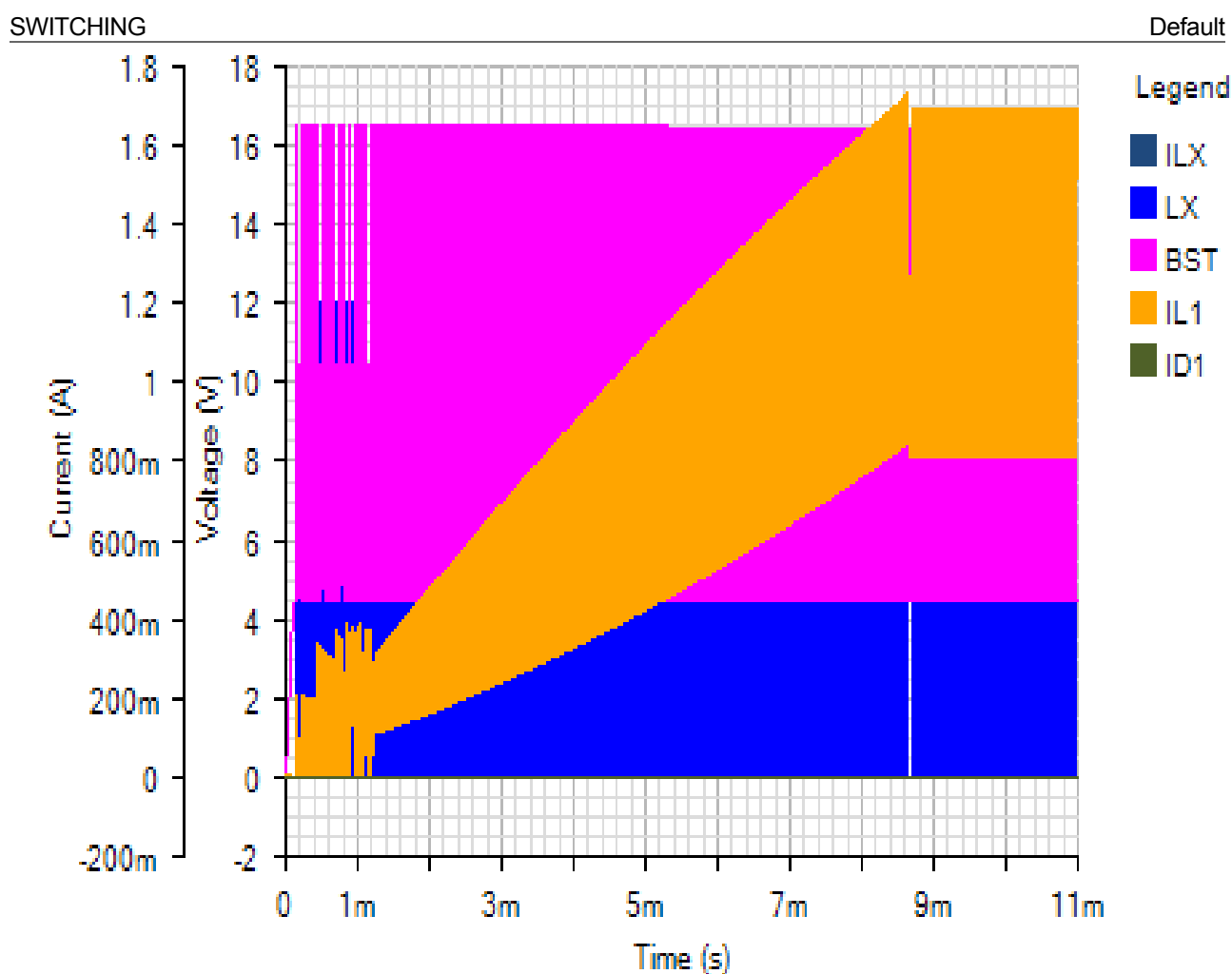
## BOM

Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX16939	Maxim Integrated	36V, 3.5A, 2.2MHz Step-Down Converters with 28µA Quiescent Current
C1	4	GRM21BC71H475KE11	Murata	Cap Ceramic 4.7uF 50V 0805 125C
C2	1	0603YC104K4T4A	AVX	Cap Ceramic 0.1uF 16V X7R 10% Pad SMD 0603 125°C Automotive T/R
C4	1	0603YC104K4T4A	AVX	Cap Ceramic 0.1uF 16V X7R 10% Pad SMD 0603 125°C Automotive T/R
C5	3	GRM32ER71E226ME15	Murata	Cap Ceramic 22uF 25V 1210 125C
C6	1	06031A1R0KAT2A	AVX	Cap Ceramic 1pF 100V C0G 10% Pad SMD 0603 125°C T/R
C7	1	CC0603KRX7R9BB182	Yageo	Cap Ceramic 0.0018uF 50V X7R 10% Pad SMD 0603 125°C T/R
C8	1	CC0603KRX7R6BB105	Yageo	Cap Ceramic 1uF 10V X7R 10% Pad SMD 0603 125°C T/R
D1	1	B360B-E3/52T	Vishay	Diode Schottky 60V 3A 2-Pin SMB T/R
L1	1	VLP8040T-4R7M	TDK	Inductor Power Shielded Wirewound 4.7uH 20% 100KHz Ferrite 4.5A 25mOhm DCR Embossed Carrier T/R
R1	1	ERJ3EKF6342V	Panasonic	Res Thick Film 0603 63.4K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R

R2	1	<a href="#">TFCR0603-10W-E-2233FT-1K</a>	Venkel	Res Thin Film 0603 223K Ohm 1% 0.1W(1/10W) ±25ppm/°C Pad SMD T/R
R3	1	<a href="#">ERJ3EKF4022V</a>	Panasonic	Res Thick Film 0603 40.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R4	1	<a href="#">ERJ2GEJ103X</a>	Panasonic	Res Thick Film 0402 10K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R5	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

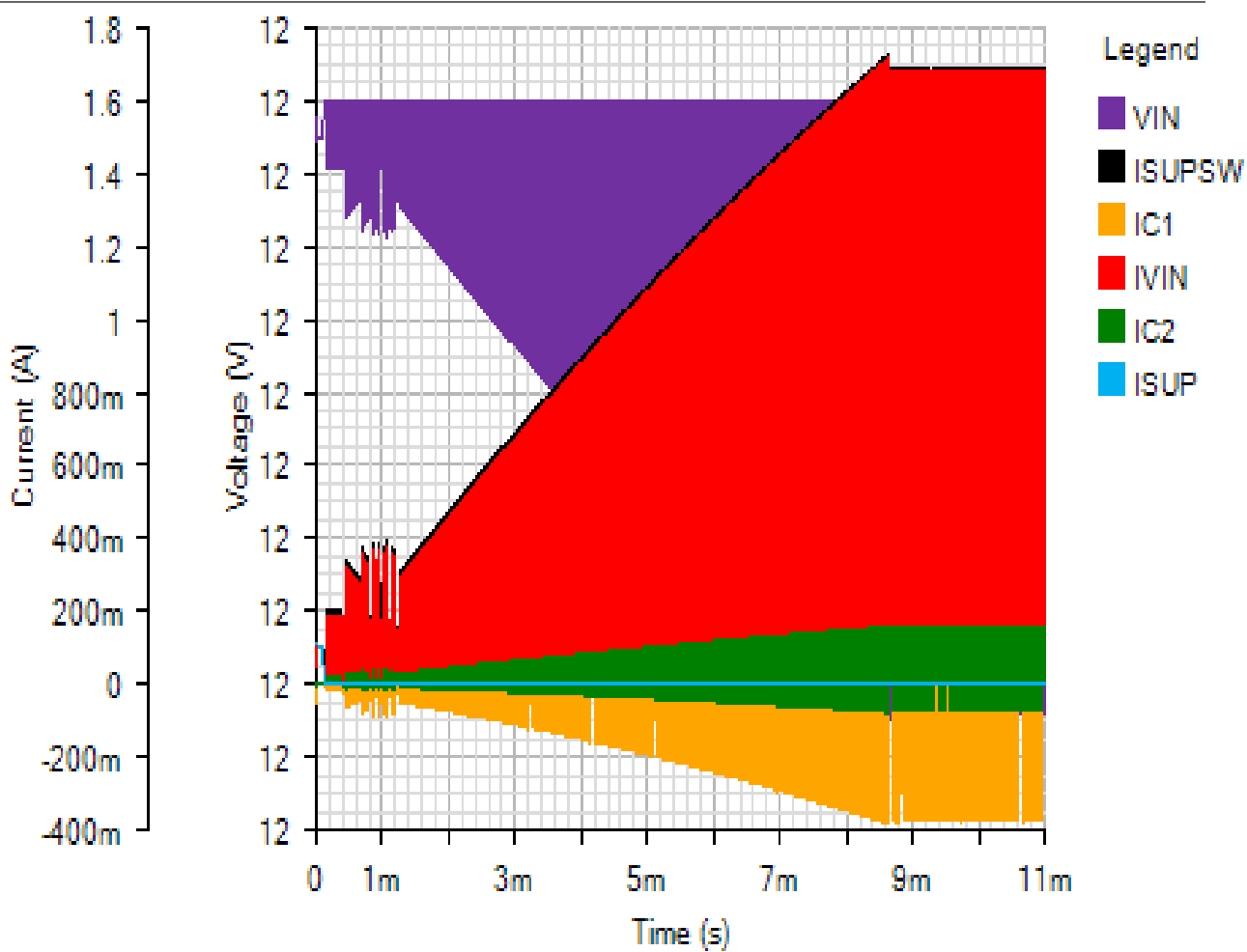
## Simulation Results

Start Up - Mon Nov 19 2018 18:58:17



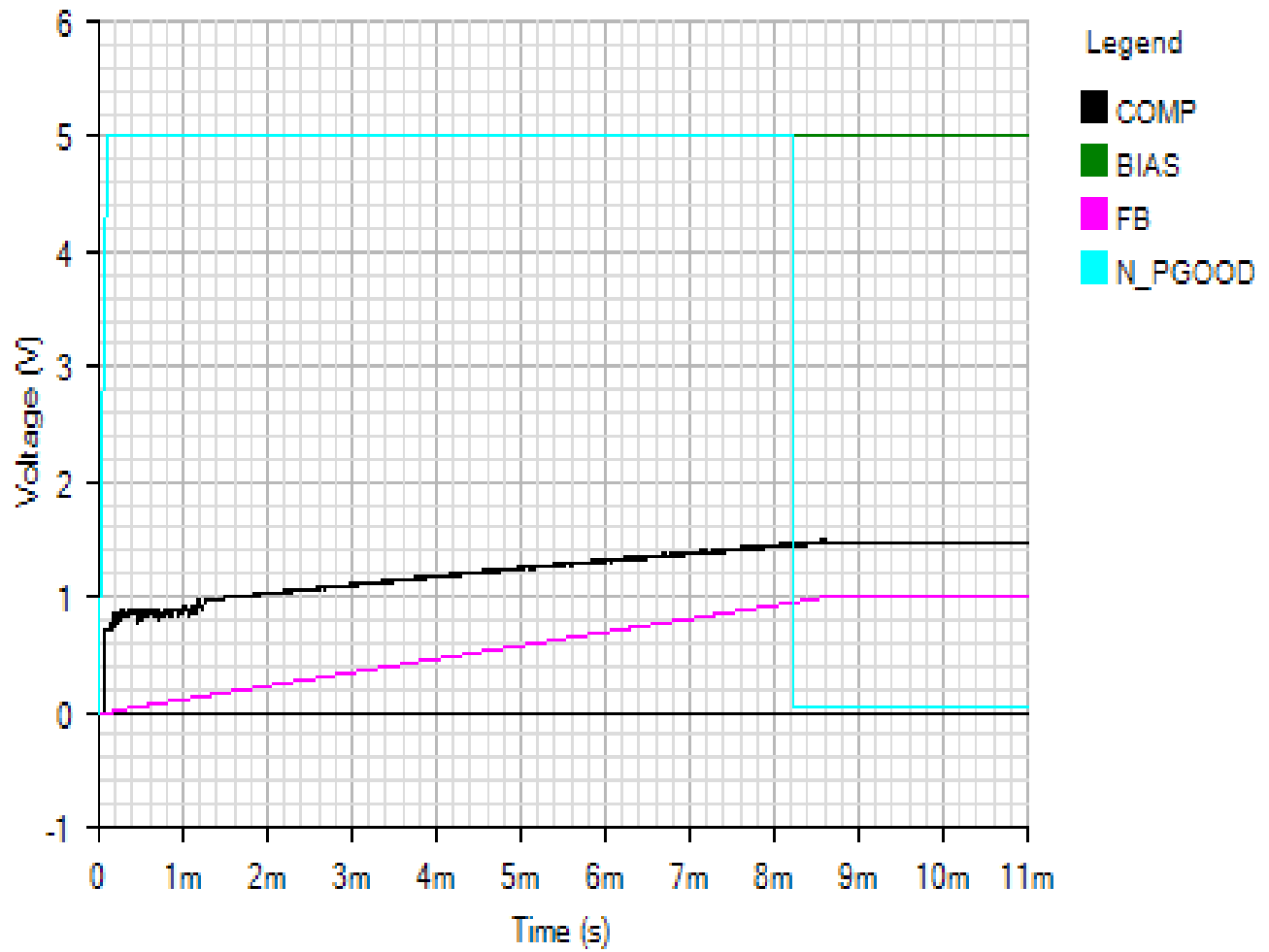
INPUT

Default



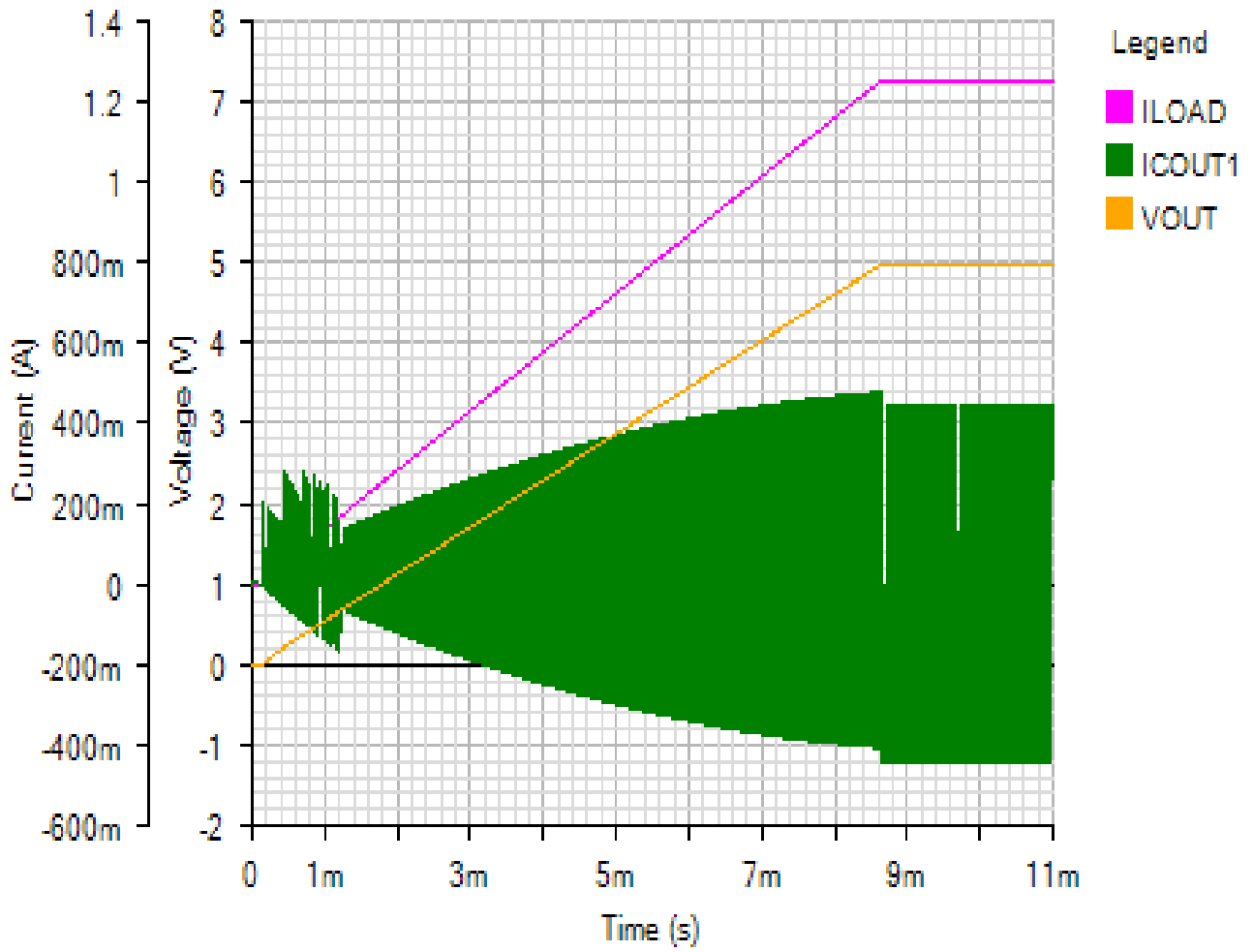
IC

Default



OUTPUT

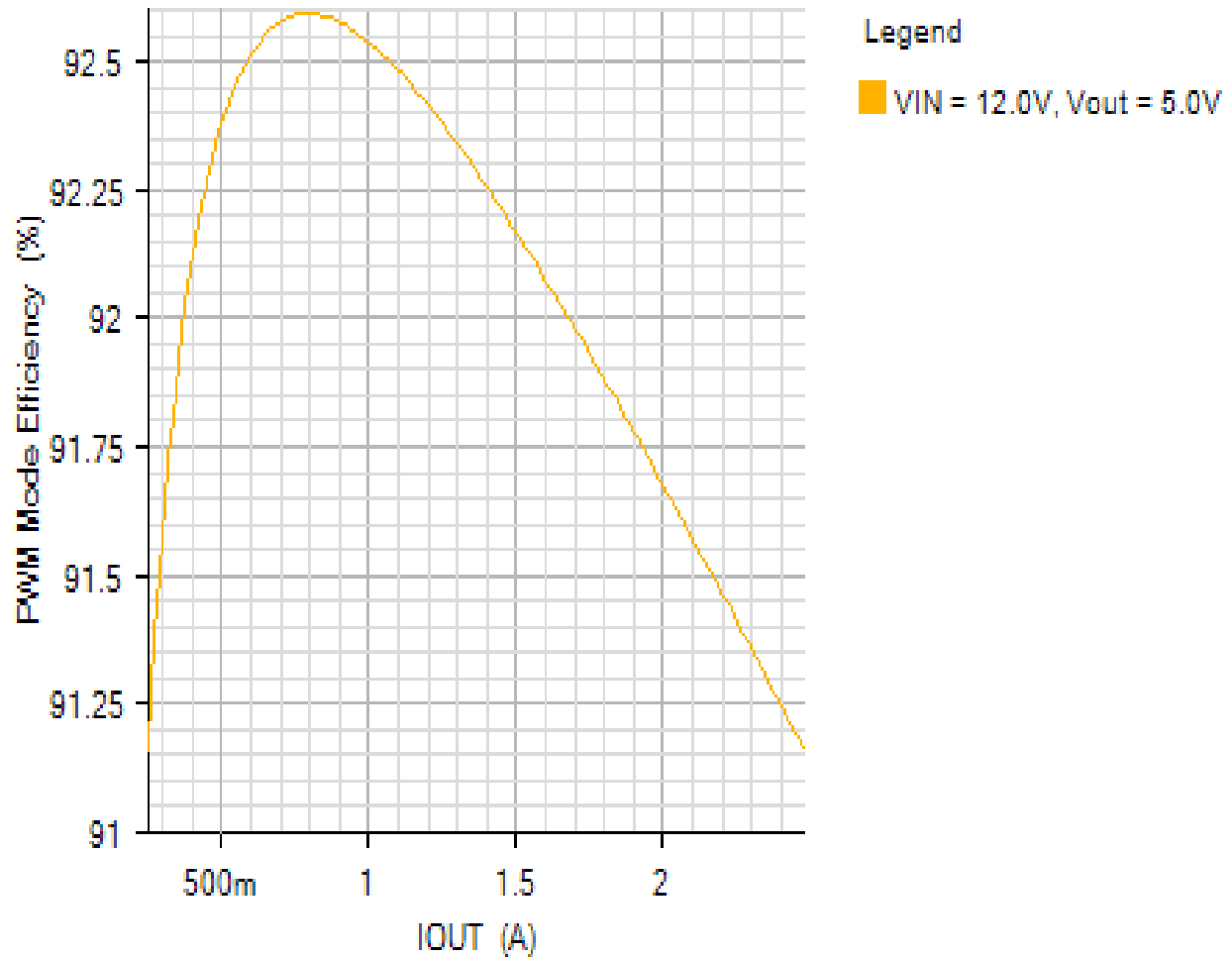
Default



Efficiency - Mon Nov 19 2018 18:58:17

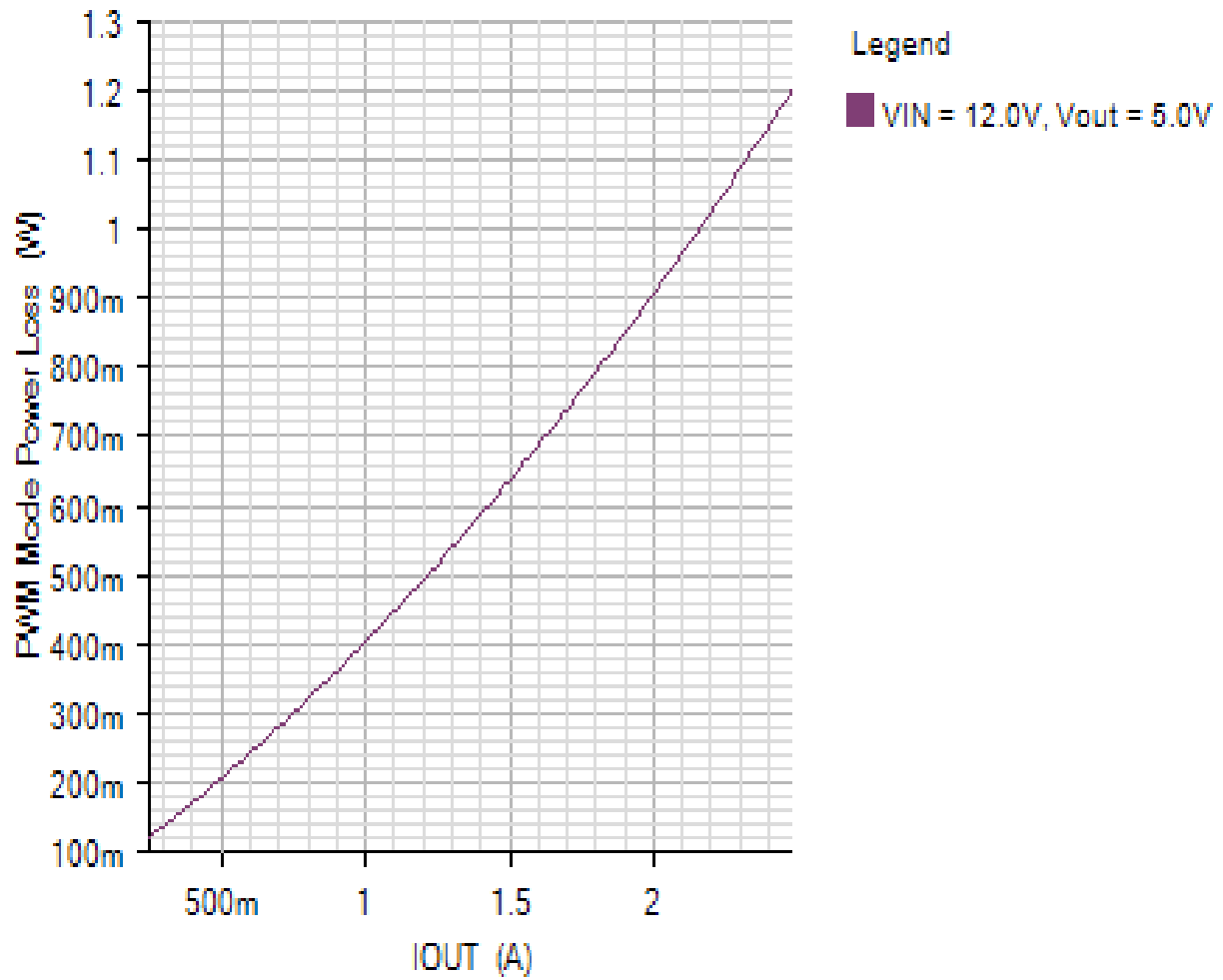
EFFICIENCY\_PLOT

Default



POWER\_LOSS\_PLOT

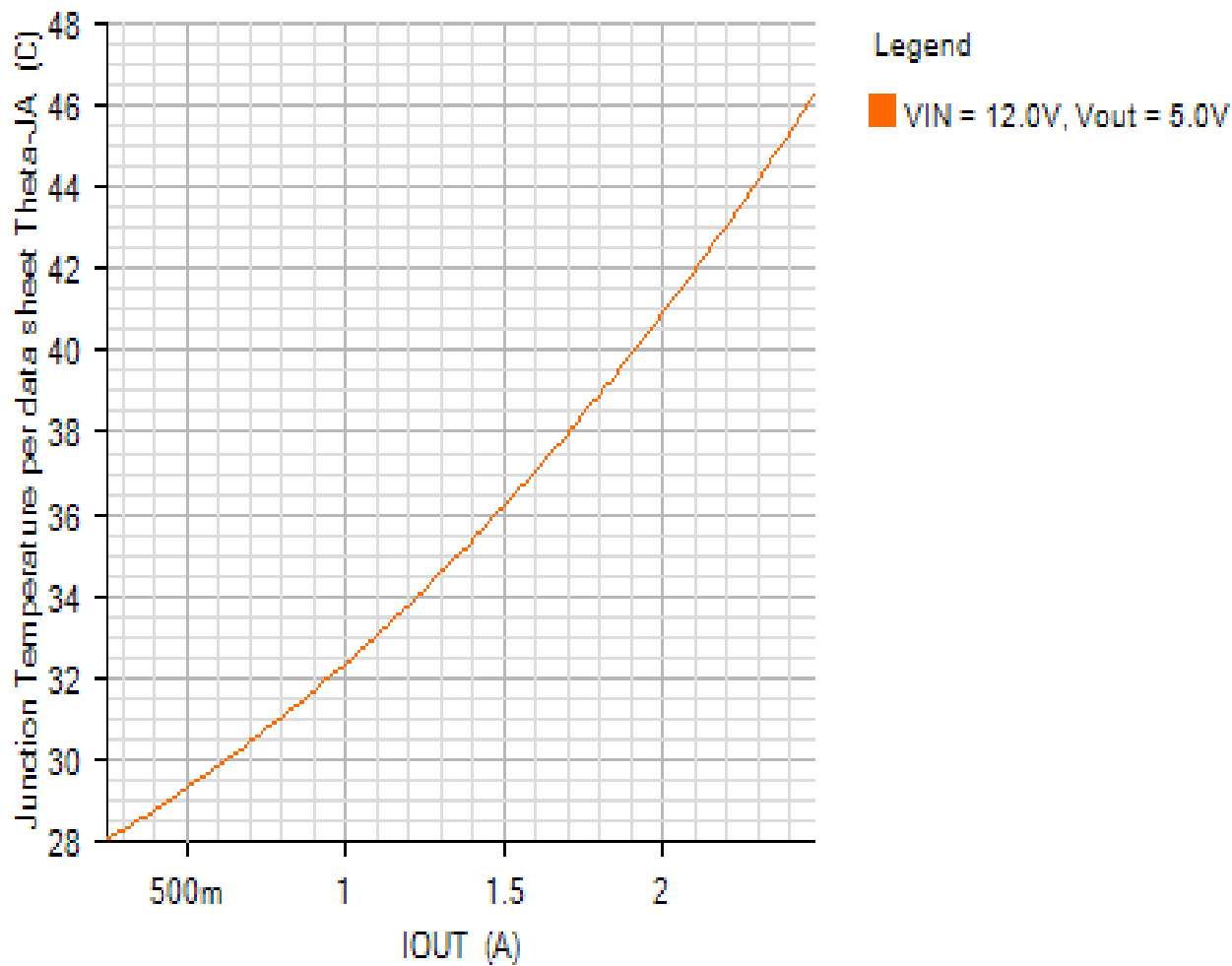
Default



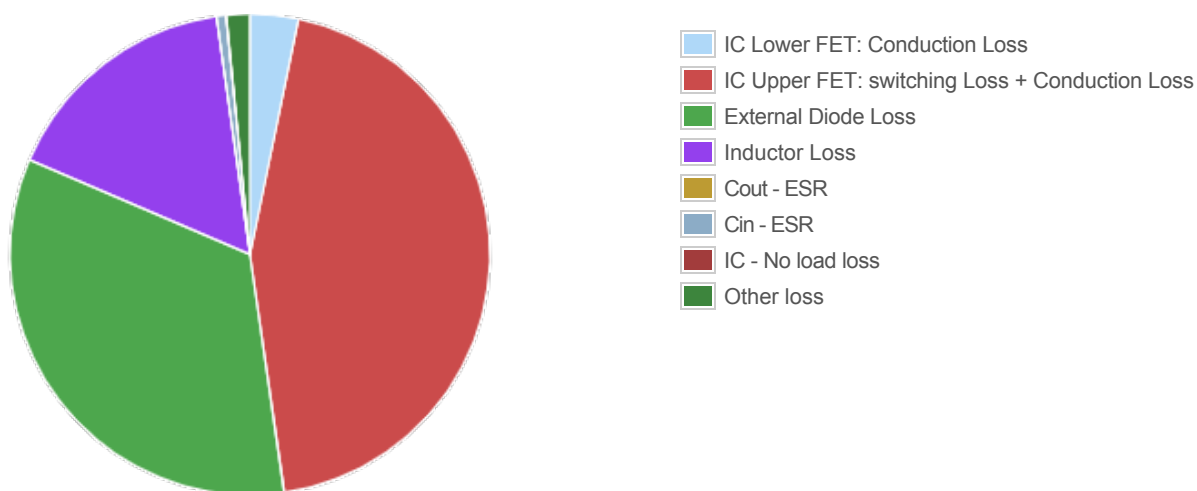


JUNCTION\_TEMPERATURE\_PLOT

Default



Losses



Component

Loss (W)

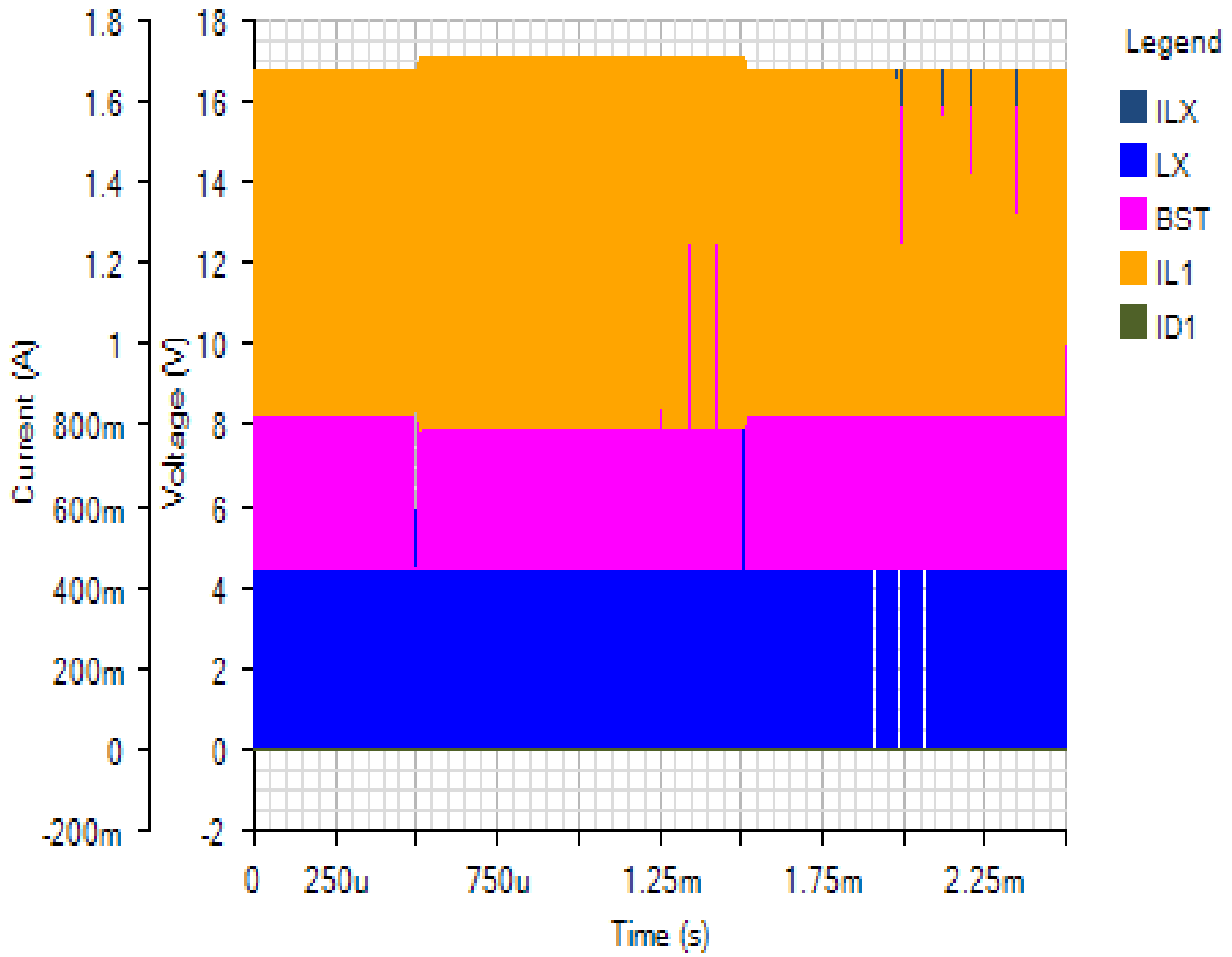
% of total

Component	Loss (W)	% of total
IC Lower FET: Conduction Loss	0.039	3.2
IC Upper FET: switching Loss + Conduction Loss	0.534	44.5
External Diode Loss	0.405	33.7
Inductor Loss	0.196	16.3
Cout - ESR	0.0001	0
Cin - ESR	0.0075	0.6
IC - No load loss	0.0003	0
Other loss	0.019	1.6
Total	1.2009	100

Line Transient - Mon Nov 19 2018 18:58:17

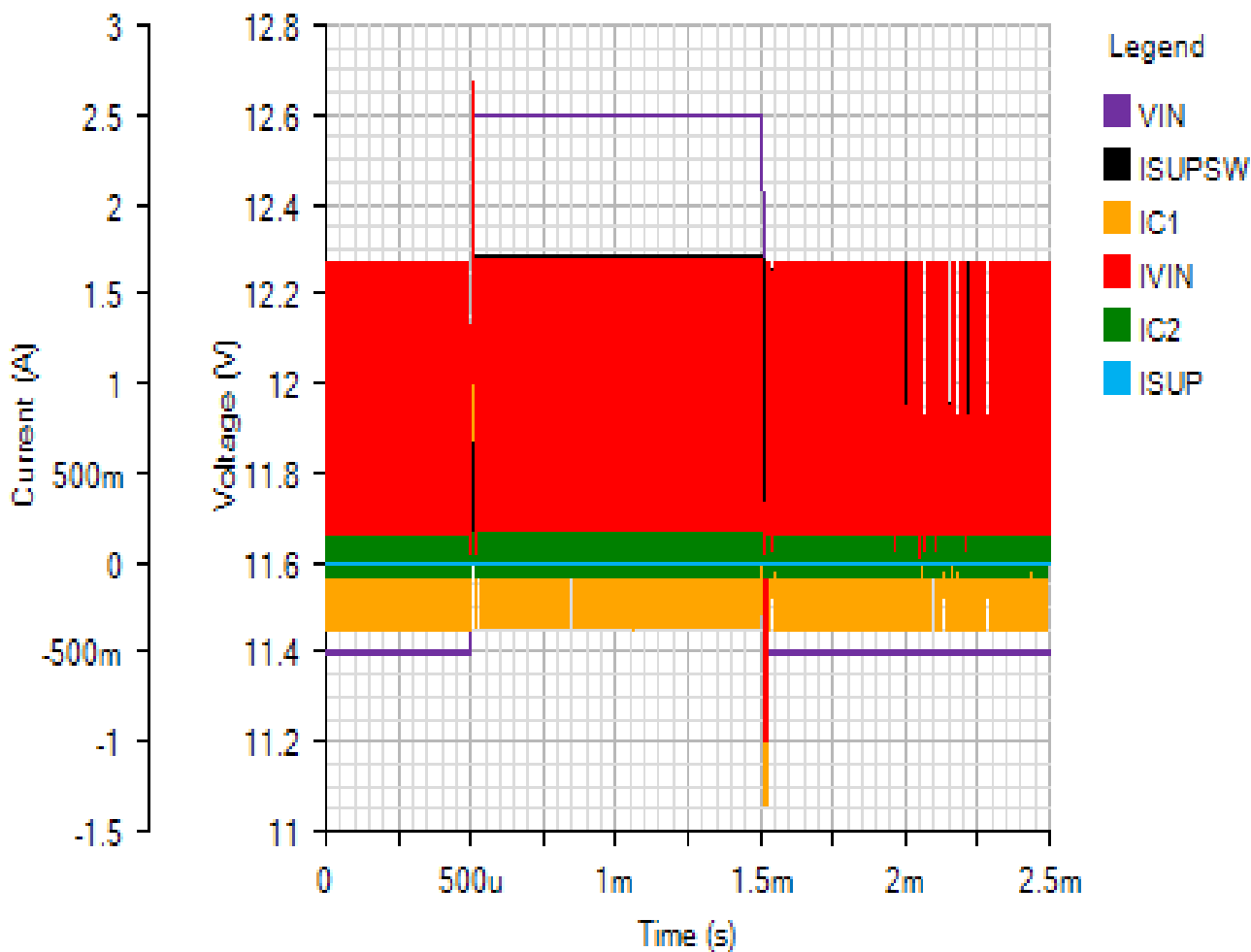
SWITCHING

Default



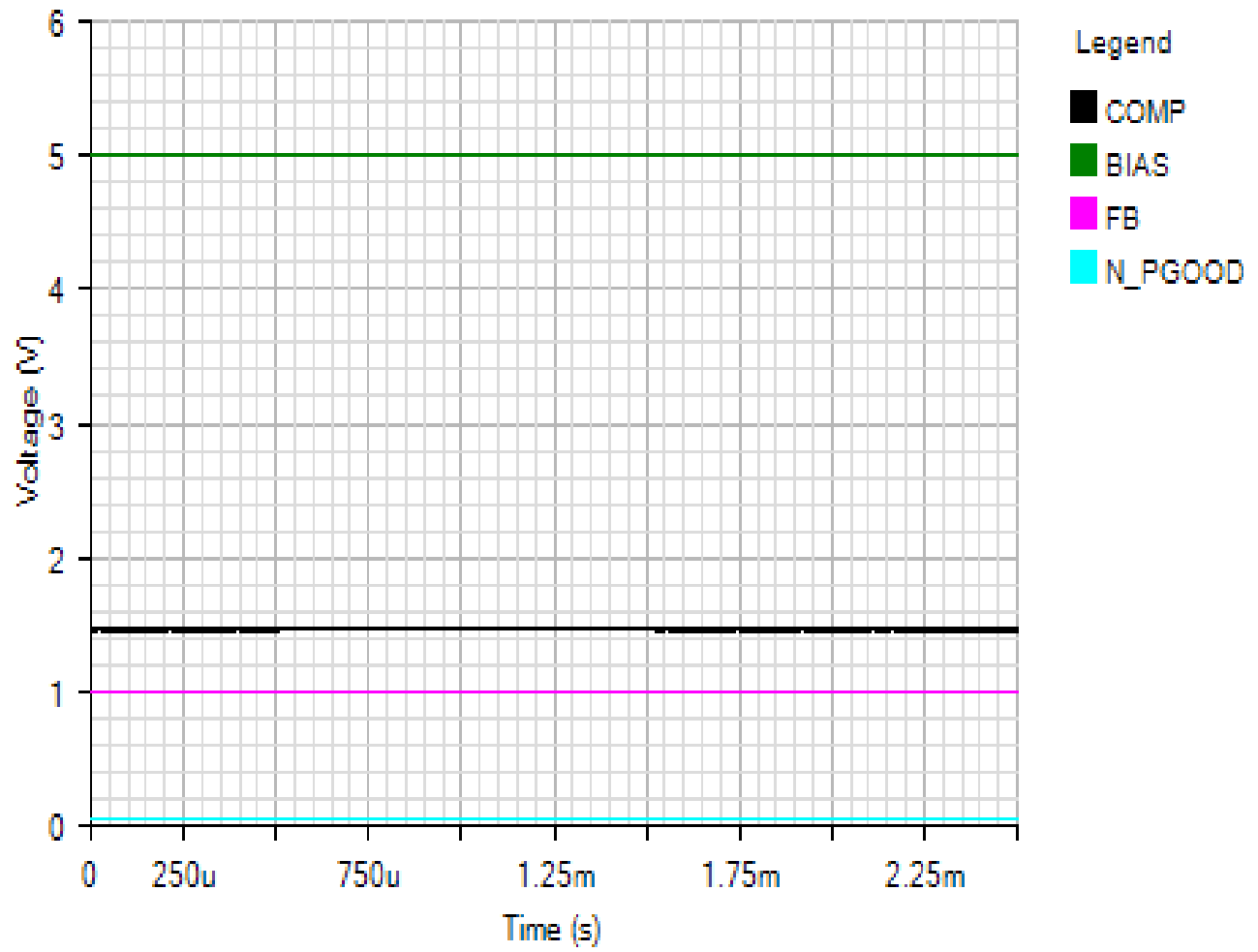
INPUT

Default



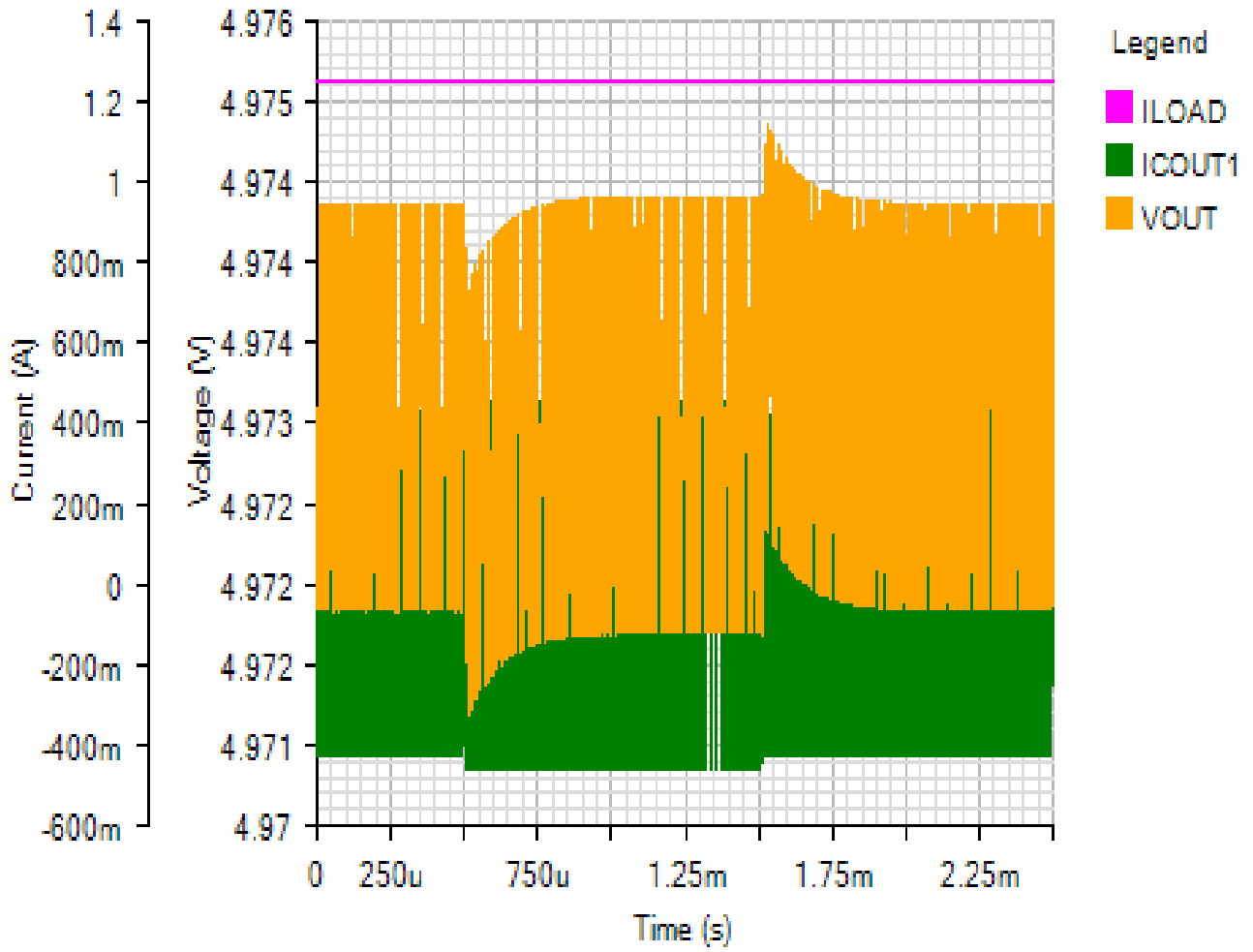
IC

Default



OUTPUT

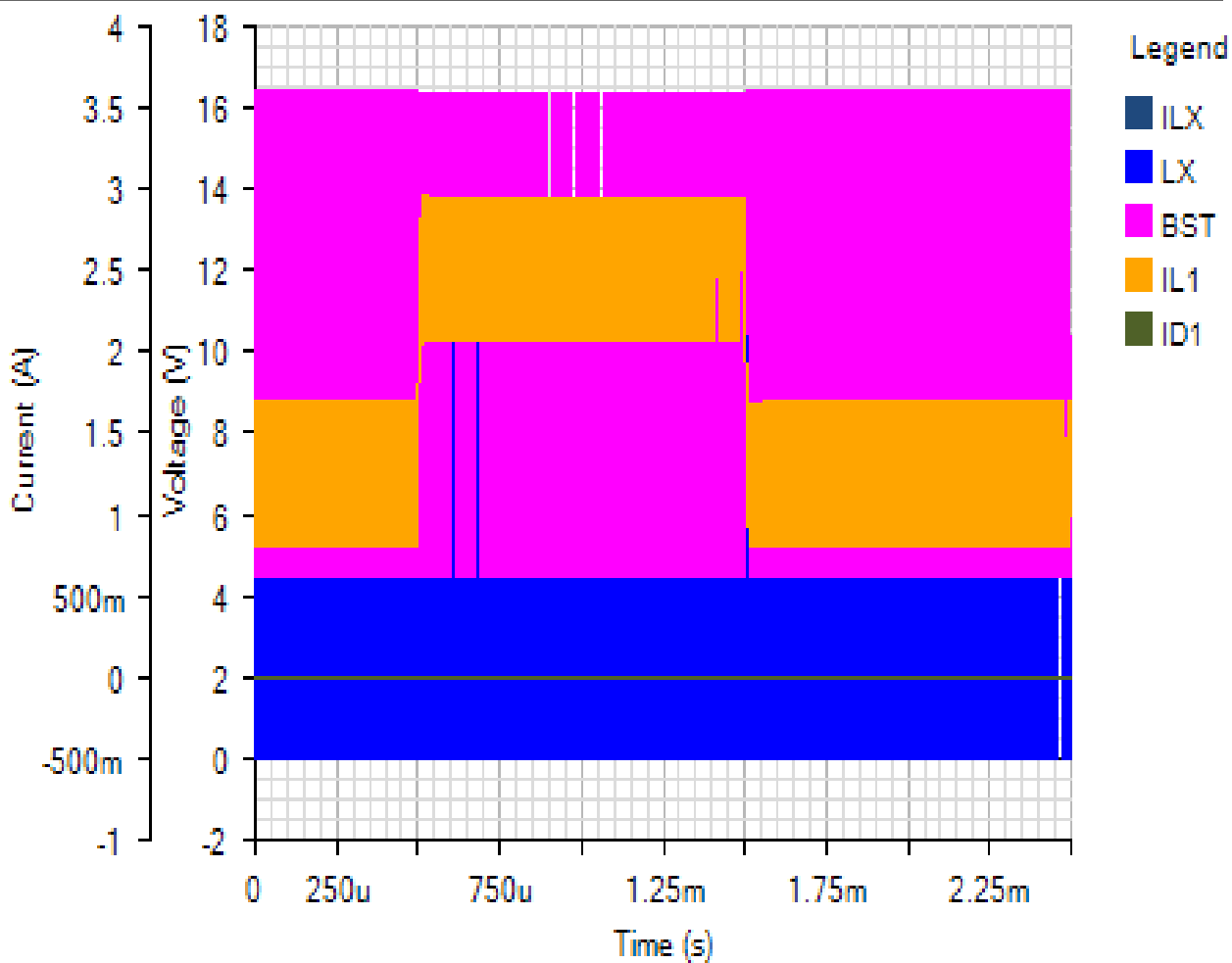
Default



Load Step - Mon Nov 19 2018 18:58:17

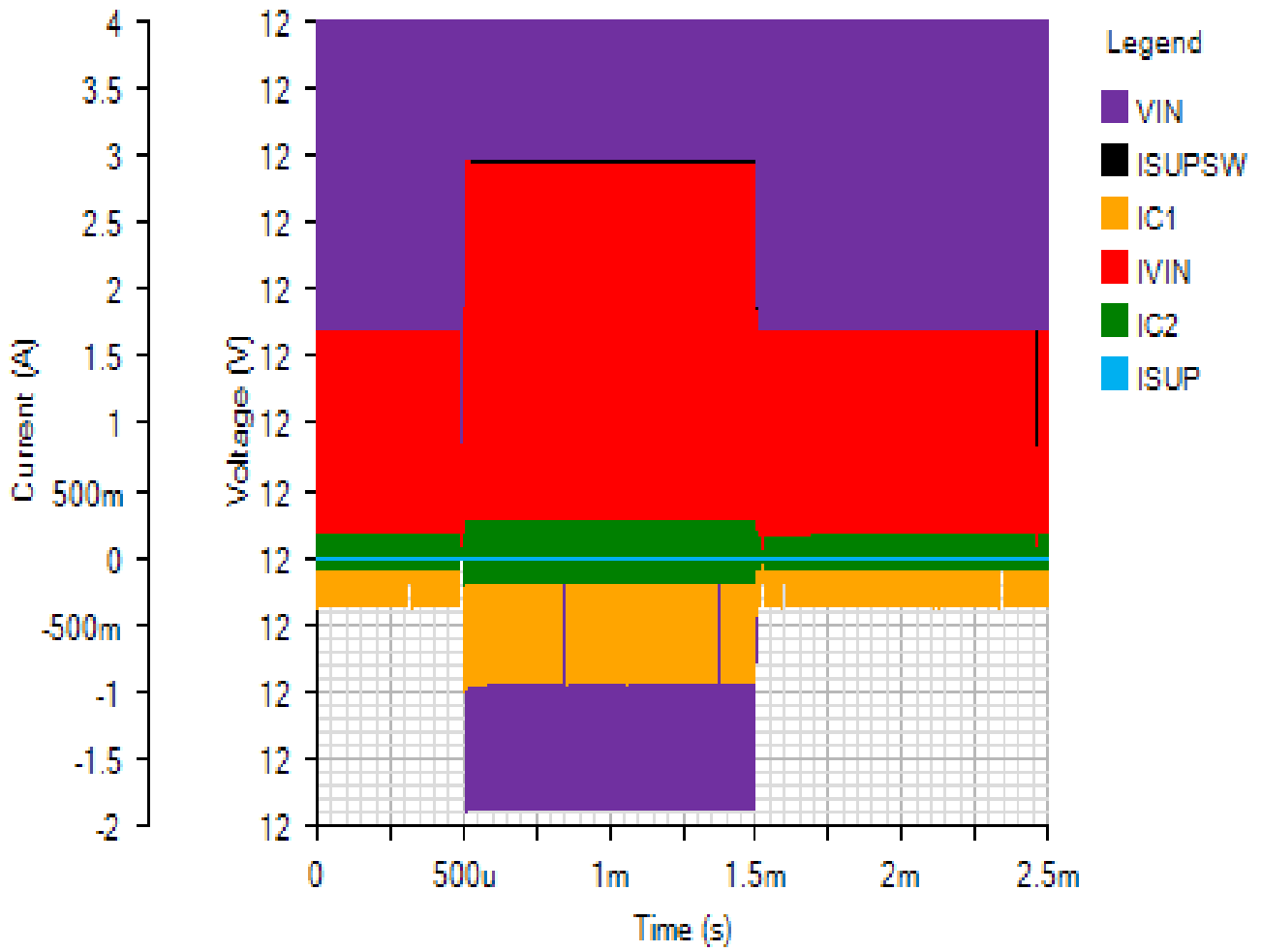
SWITCHING

Default



INPUT

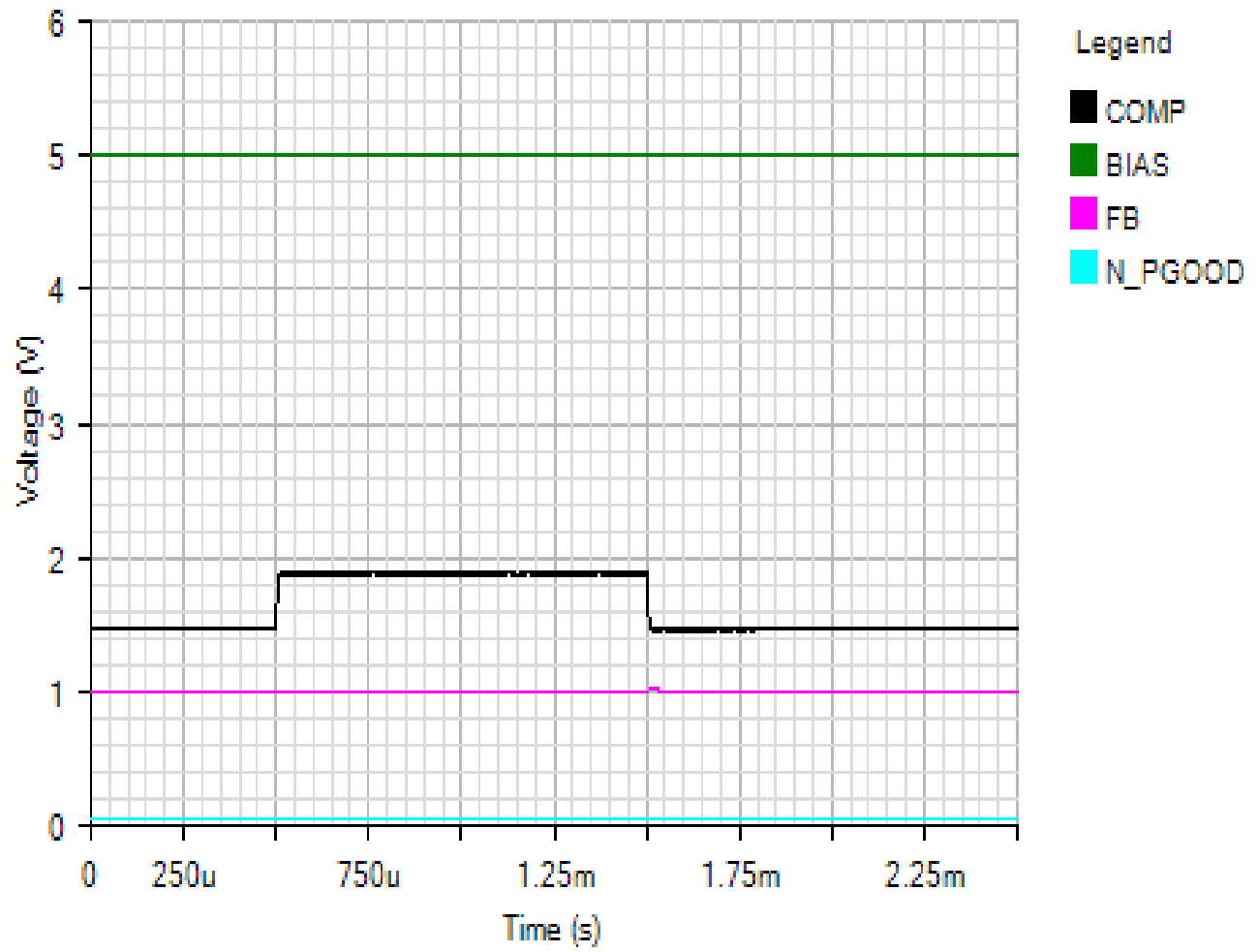
Default





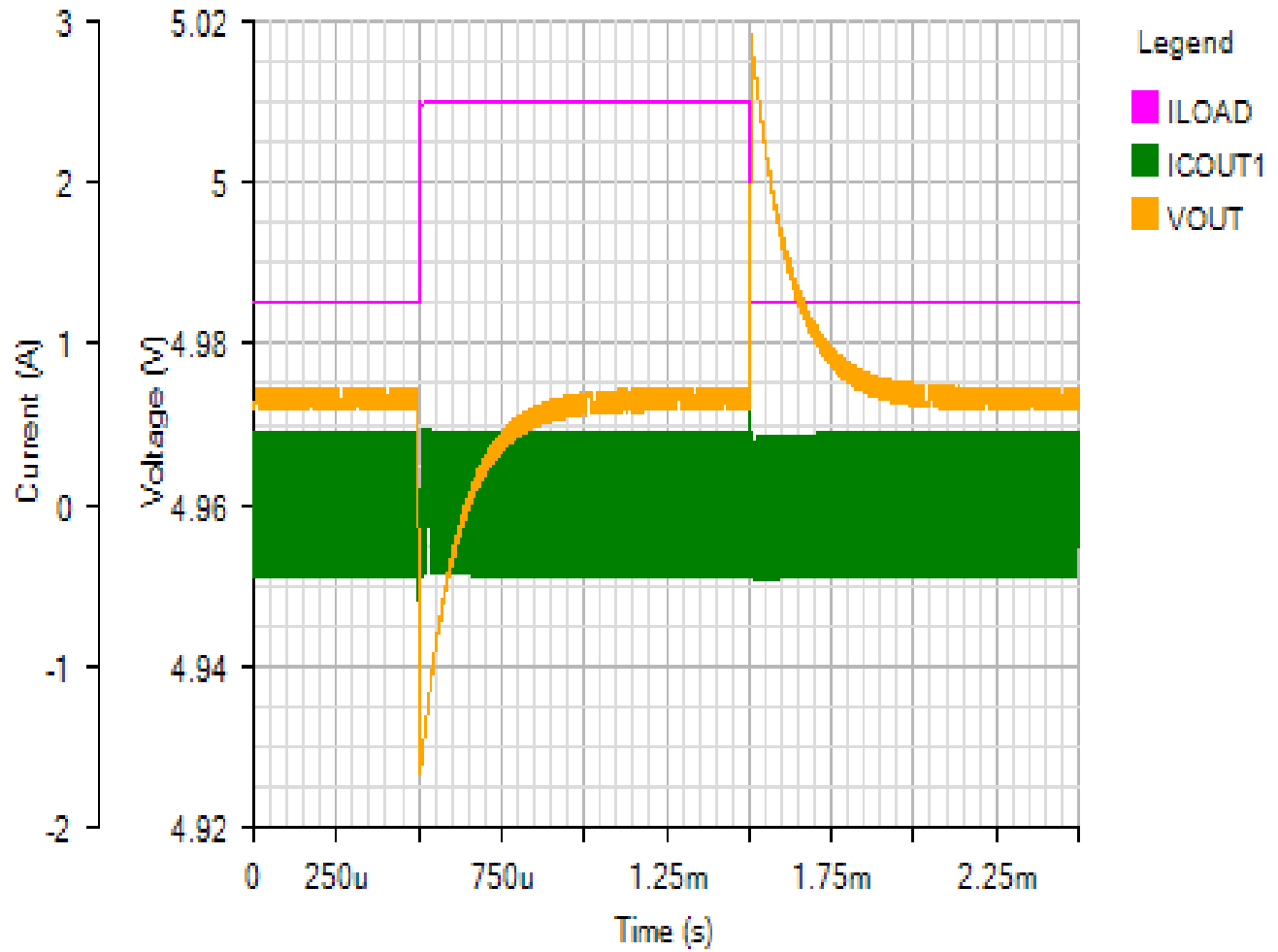
IC

Default



OUTPUT

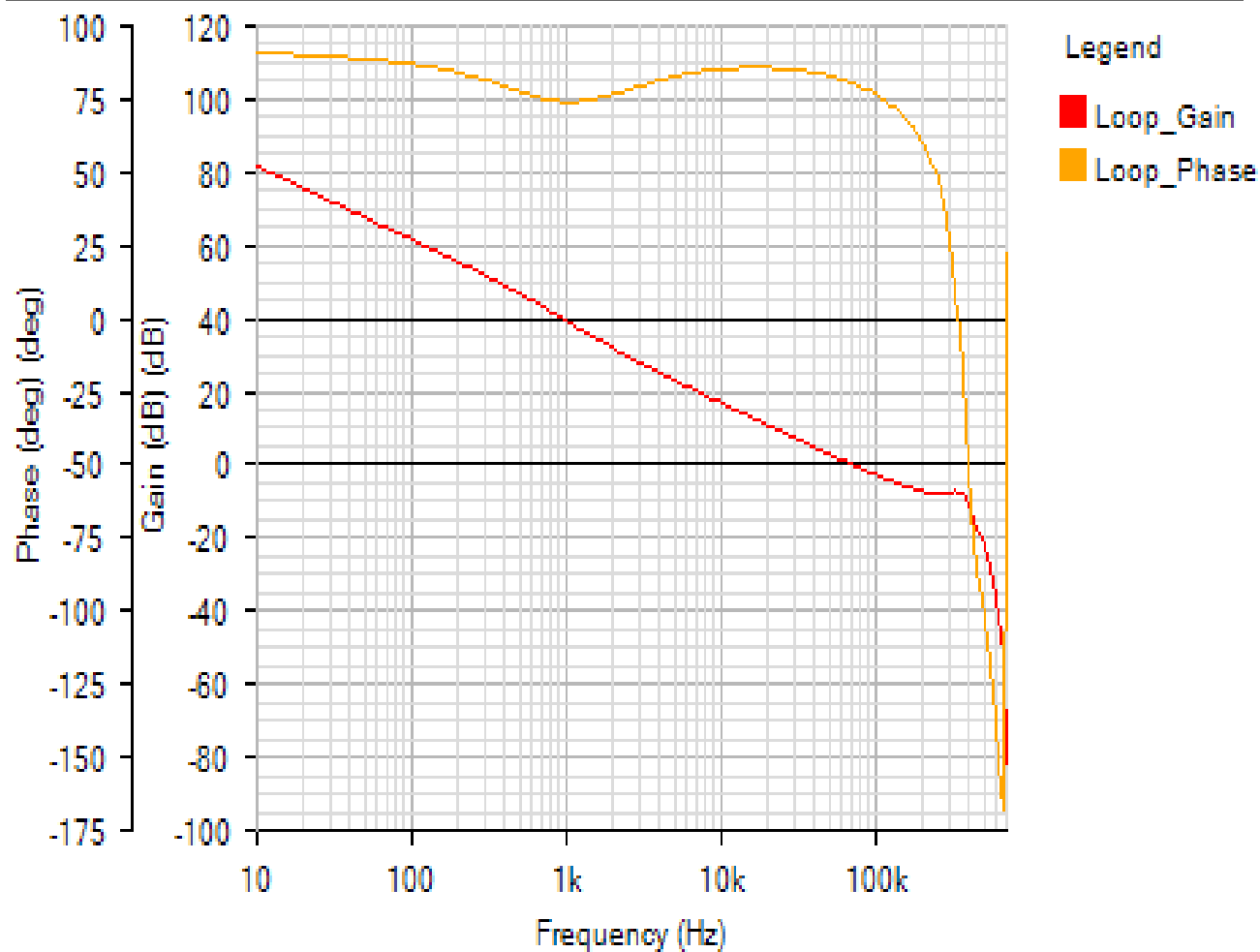
Default



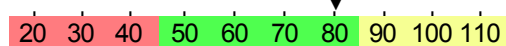
AC Loop - Mon Nov 19 2018 18:58:17

BODE

Default



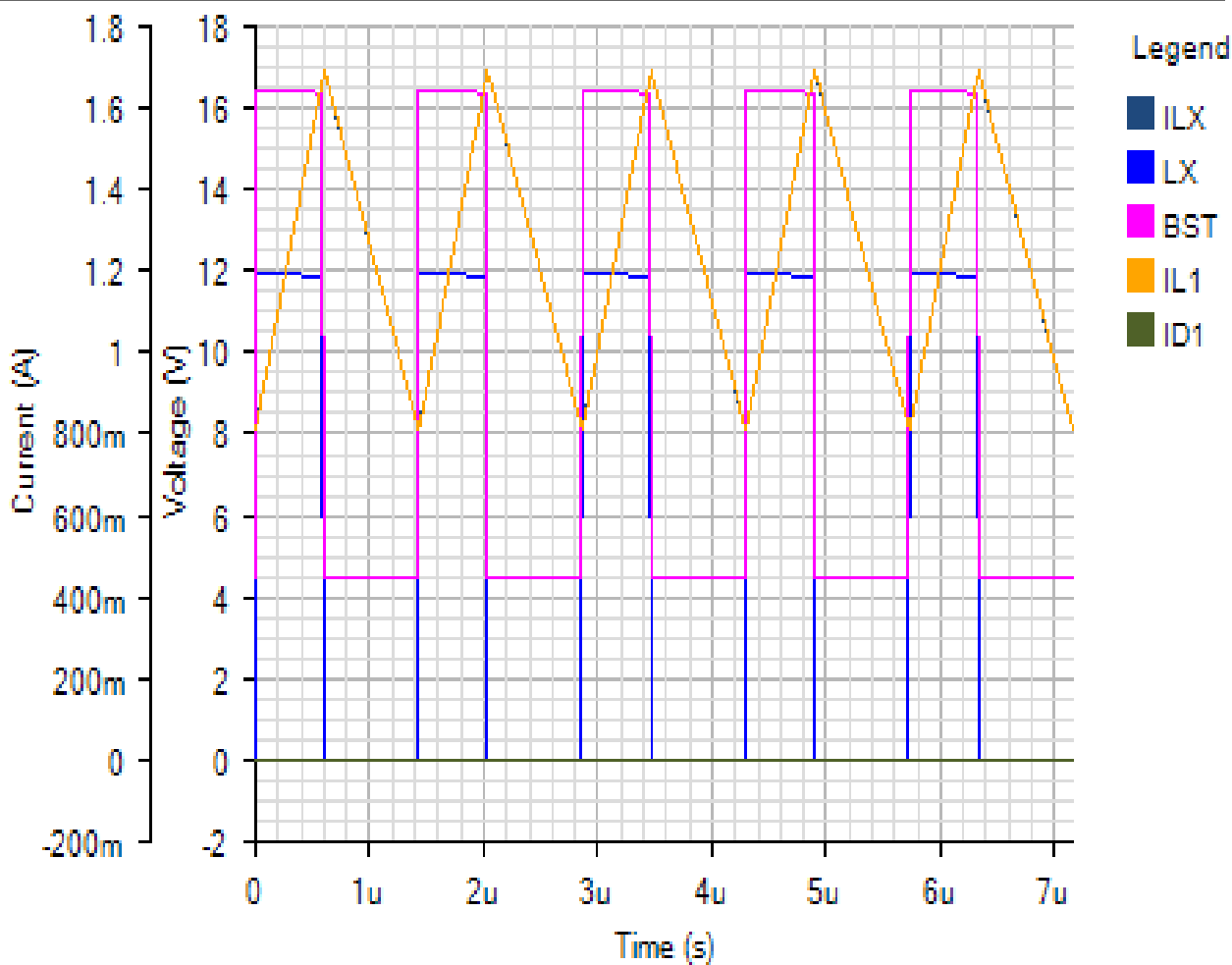
Phase Margin: 80.39° at a crossover frequency of 71.3kHz



Steady State - Mon Nov 19 2018 18:58:17

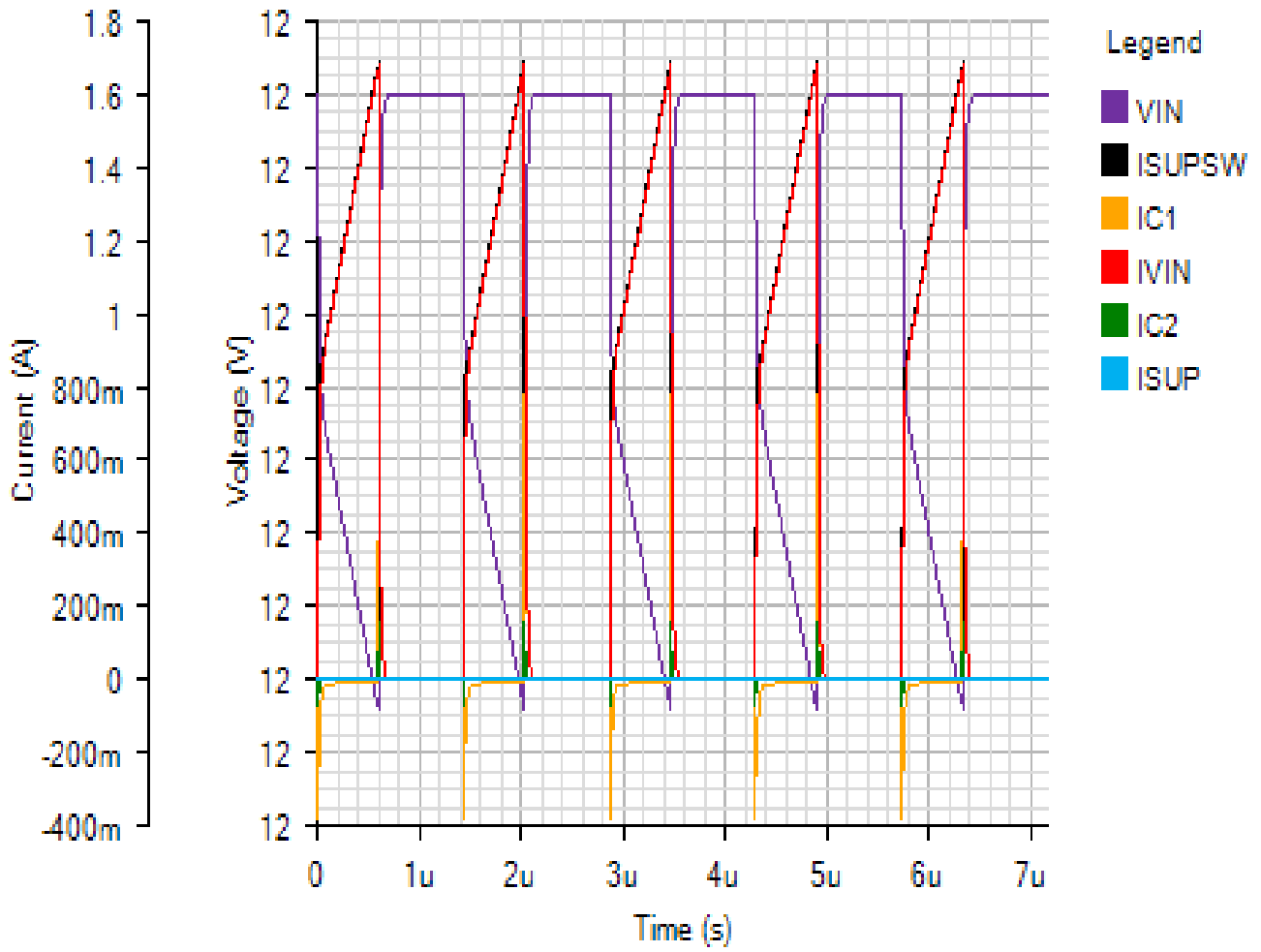
SWITCHING

Default



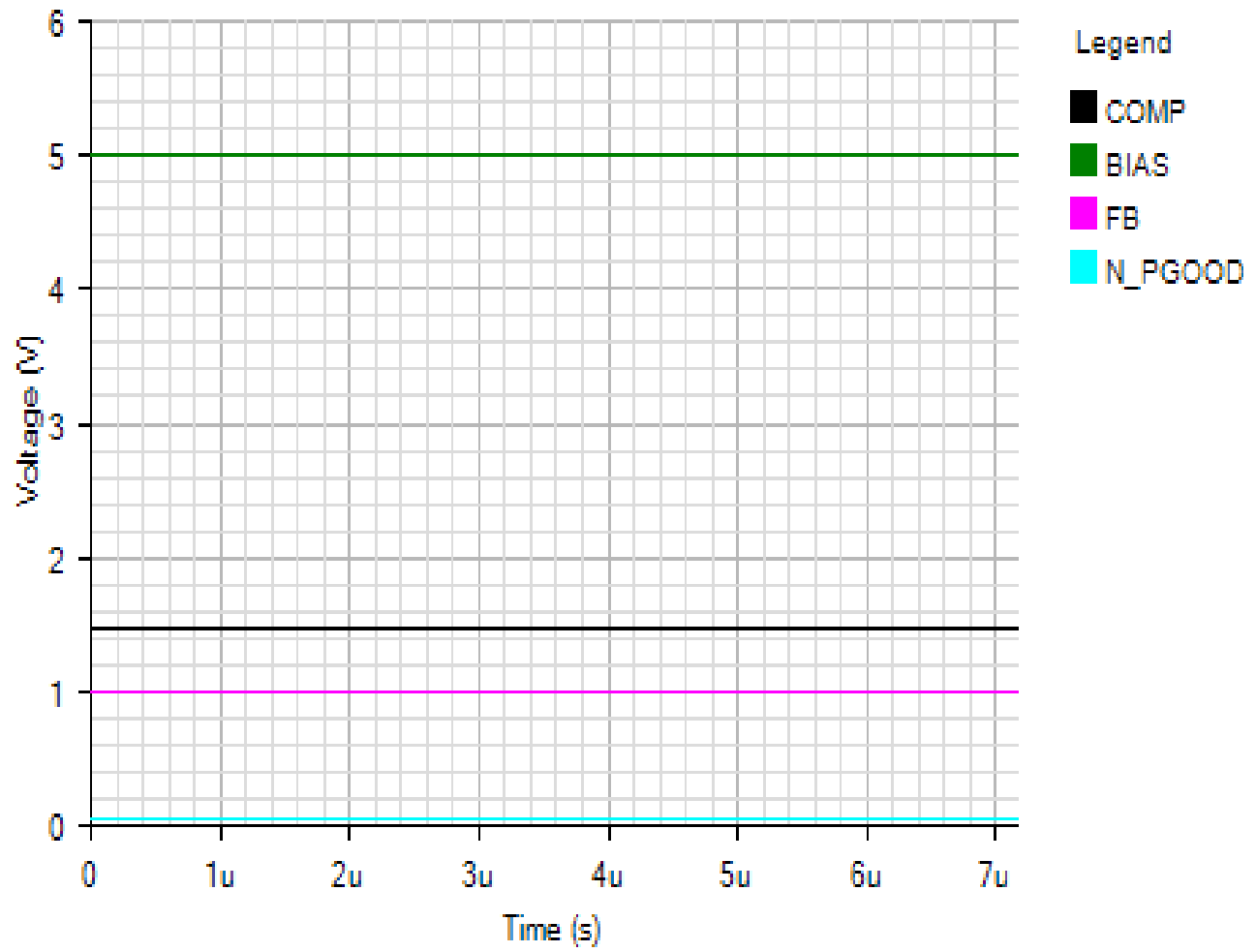
INPUT

Default



IC

Default



OUTPUT

Default

