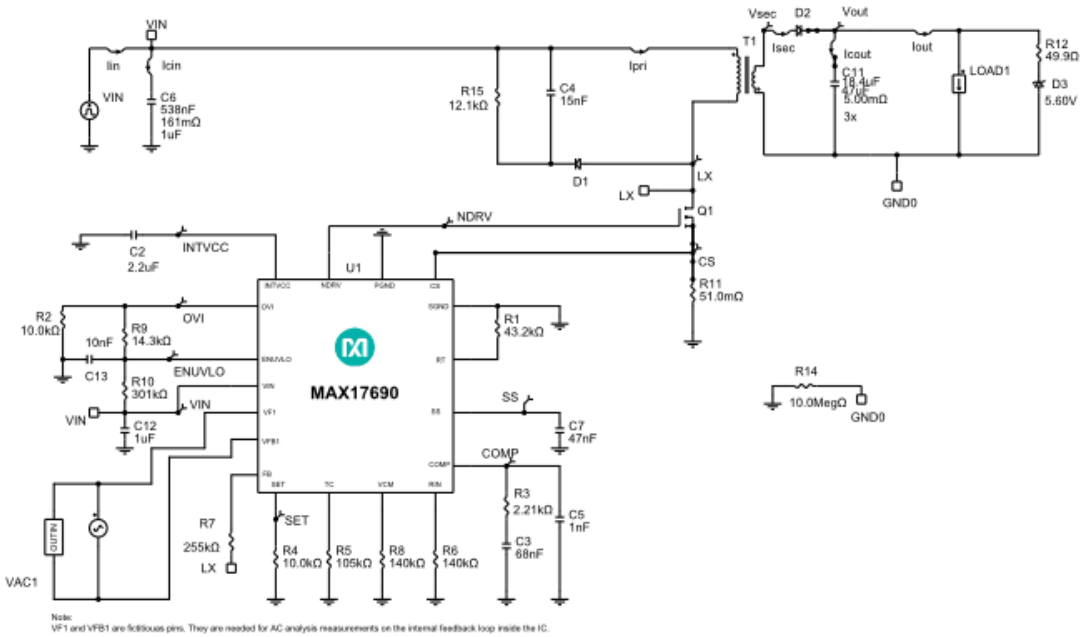
Initial Design

1.0

Design Requirements

Parameter	Value
Minimum Input Voltage	18V
Nominal Input Voltage	24V
Maximum Input Voltage	36V
Input Steady State Ripple	5%
Input Undervoltage Lockout	16.2V
Input Over Voltage	39.6V
Output Voltage	5V
Output Current	1A
Load Step Start Current	0.5A
Load Step Current	1A
Load Step Edge Rate	5A/us
Output Load step Over/Undershoot	3%
Steady State ripple	1%
Performance Priority	Design for Small Solution Size
BOM Priority	Cost
Capacitor Type	Ceramic
Switching Frequency	115kHz
Soft start time	10ms
TA	25°C

Schematic



BOM

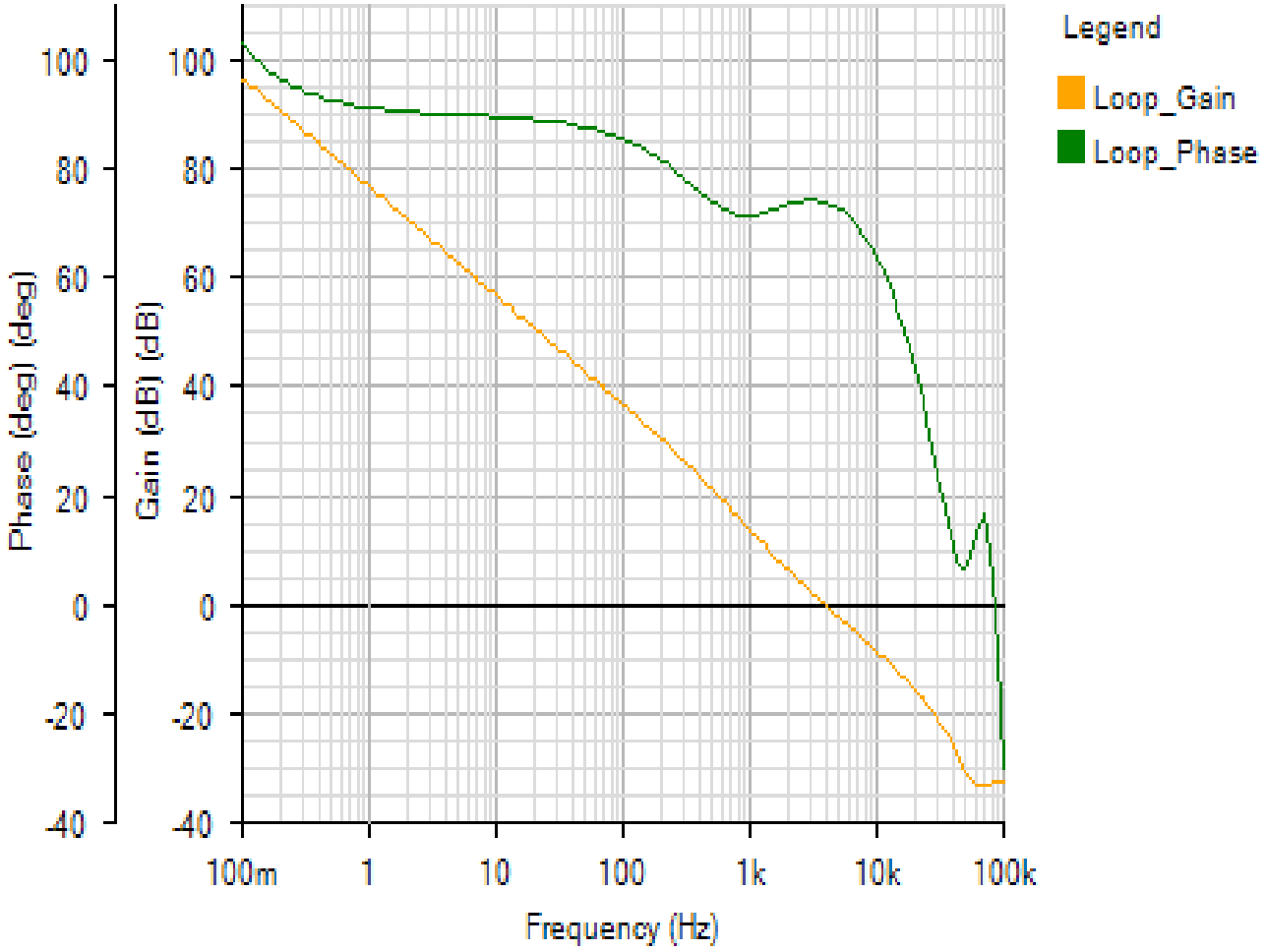
Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX17690	User-Defined	IC
C2	1	LMK105BJ225MV-F	Taiyo Yuden	Cap Ceramic 2.2uF 10V X5R 20% Pad SMD 0402 85°C T/R
C3	1	CL05B683KO5NNNC	Samsung Electro-Mechanics	Cap Ceramic 0.068uF 16V X7R 10% Pad SMD 0402 125°C T/R
C4	1	GC321AD72E153KX01D	Murata Manufacturing	Cap Ceramic 0.015uF 250V X7T 10% Pad SMD 0805 125°C Automotive T/R
C5	1	ECHU1C102GX5	Panasonic	Cap Film 0.001uF 16V PPS 2% (1.6 X 0.8 X 0.7mm) Stacked 125°C T/R
C6	1	C1206C105K5RAC	Kemet	Cap Ceramic 1uF 50V X7R 10% SMD 1206 125C Bulk
C7	1	06033C473JAT2A	AVX	Cap Ceramic 0.047uF 25V X7R 5% Pad SMD 0603 125°C T/R
C11	3	GRM31CR60J476KE19L	Murata	Cap Ceramic 47uF 6.3V X5R 10% SMD 1206 85C Embossed T/R
C12	1	C2012X7S2A105K125AB	TDK	Cap Ceramic 1uF 100V X7S 10% Pad SMD 0805 125°C T/R
C13	1	C1005X7S2A103K050BB	TDK	Cap Ceramic 0.01uF 100V X7S 10% Pad SMD 0402 125°C T/R
D1	1	BAT240AE6327HTSA1	Infineon Technologies AG	Diode Schottky 240V 0.4A Automotive 3-Pin SOT-23 T/R
D2	1	FSV1045V	ON Semiconductor	Diode Schottky 45V 10A 3-Pin(2+Tab) TO-277 T/R

D3	1	BZV55-C5V6,115	Nexperia	Diode Zener Single 5.6V 5% 500mW 2-Pin Mini-MELF T/R
Q1	1	FQT4N20L	Fairchild Semiconductor	Trans MOSFET N-CH 200VDS N.A.mOhm@4.5V 1390mOhm@6V 4nC 2.4nC 0.24nF 0.036nF 150°C 0.85A 2.2W 57°C/W 1.8mm 48.9mm^2 SOT-223 4L
R1	1	ERJ3EKF4322V	Panasonic	Res Thick Film 0603 43.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R2	1	ERJ2RKF1002X	Panasonic	Res Thick Film 0402 10K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R3	1	ERJ2RKF2211X	Panasonic	Res Thick Film 0402 2.21K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R4	1	ERJ2RKF1002X	Panasonic	Res Thick Film 0402 10K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R5	1	ERJ3EKF1053V	Panasonic	Res Thick Film 0603 105K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R6	1	ERJ3EKF1403V	Panasonic	Res Thick Film 0603 140K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R7	1	ERJ3EKF2553V	Panasonic	Res Thick Film 0603 255K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R8	1	ERJ3EKF1403V	Panasonic	Res Thick Film 0603 140K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R9	1	ERJ3EKF1432V	Panasonic	Res Thick Film 0603 14.3K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R10	1	ERJ2RKF3013X	Panasonic	Res Thick Film 0402 301K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R11	1	ERJ3BWFR051V	Panasonic	Res Thick Film 0603 0.051 Ohm 1% 0.33W(1/3W) ±150ppm/°C Pad SMD Automotive T/R
R12	1	ERJ2RKF49R9X	Panasonic	Res Thick Film 0402 49.9 Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R14	1	KTR03EZPF1005	ROHM Semiconductor	Res Thick Film 0603 10M Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R15	1	ERJ6ENF1212V	Panasonic	Res Thick Film 0805 12.1K Ohm 1% 0.125W(1/8W) ±100ppm/°C Pad SMD Automotive T/R
T1	1		User-Defined	IC

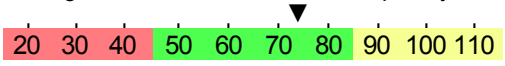
Simulation Results

AC Loop - Mon Nov 19 2018 10:14:56

BODE Default



Phase Margin: 73.92° at a crossover frequency of 3.9kHz



Efficiency - Mon Nov 19 2018 10:14:56

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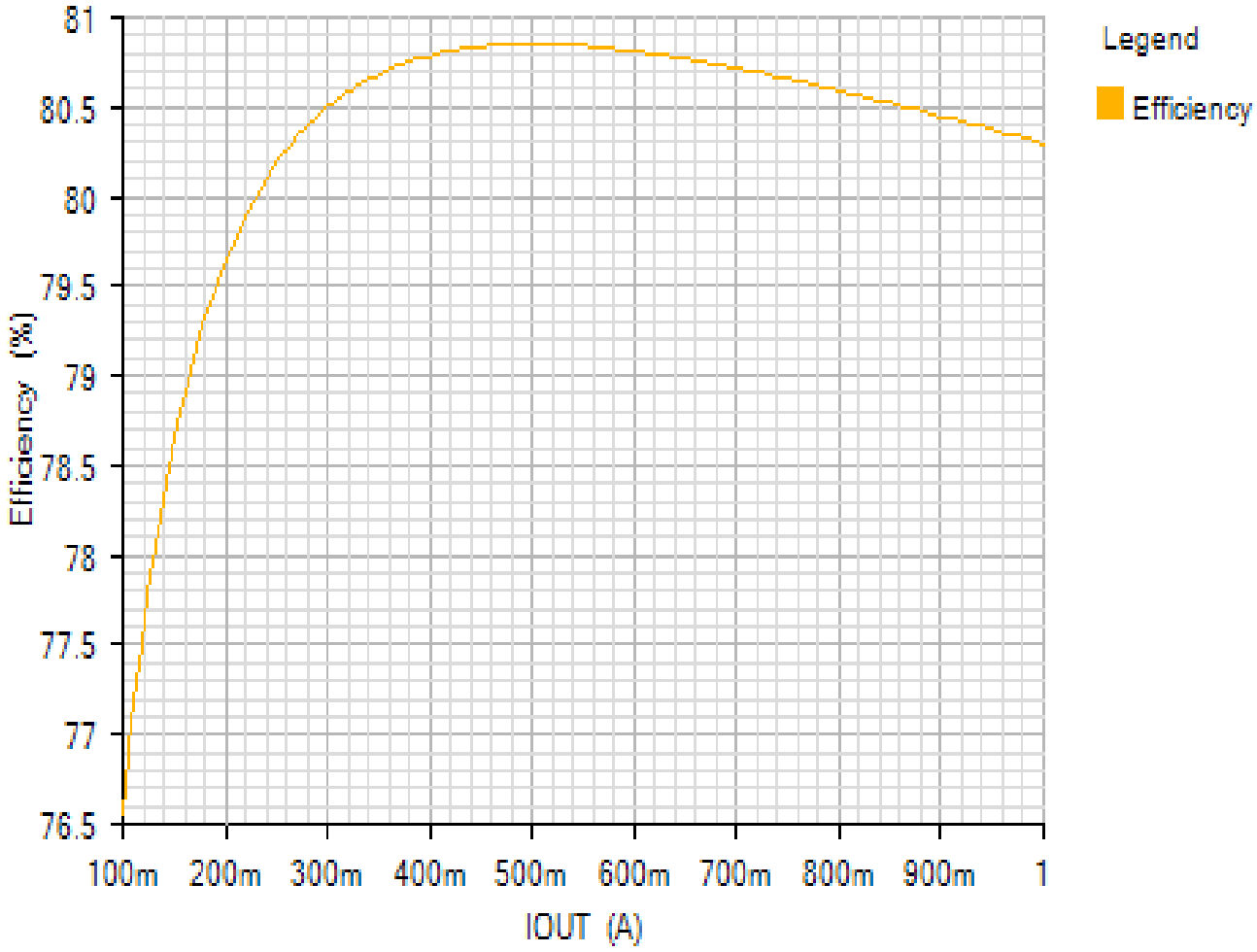

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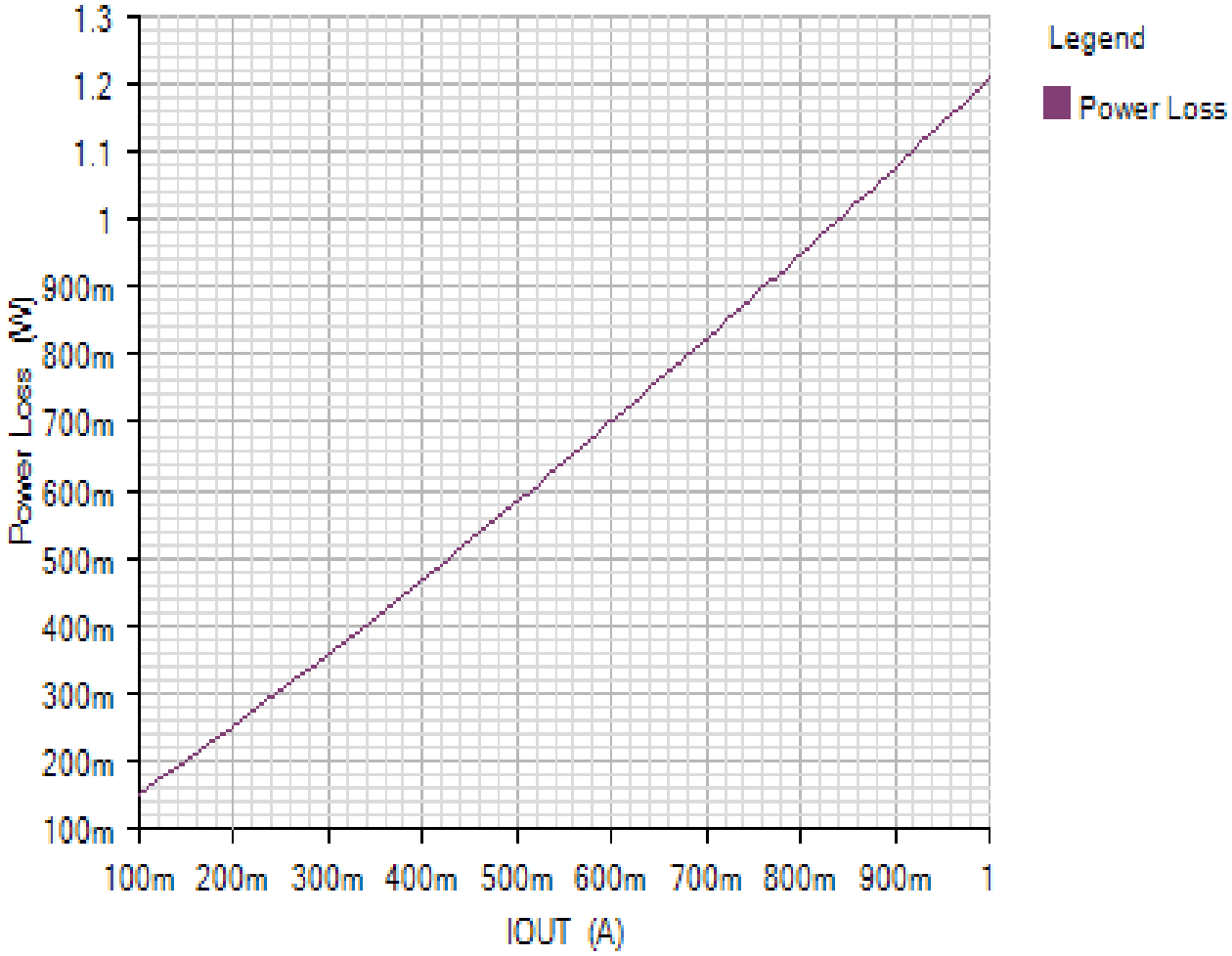
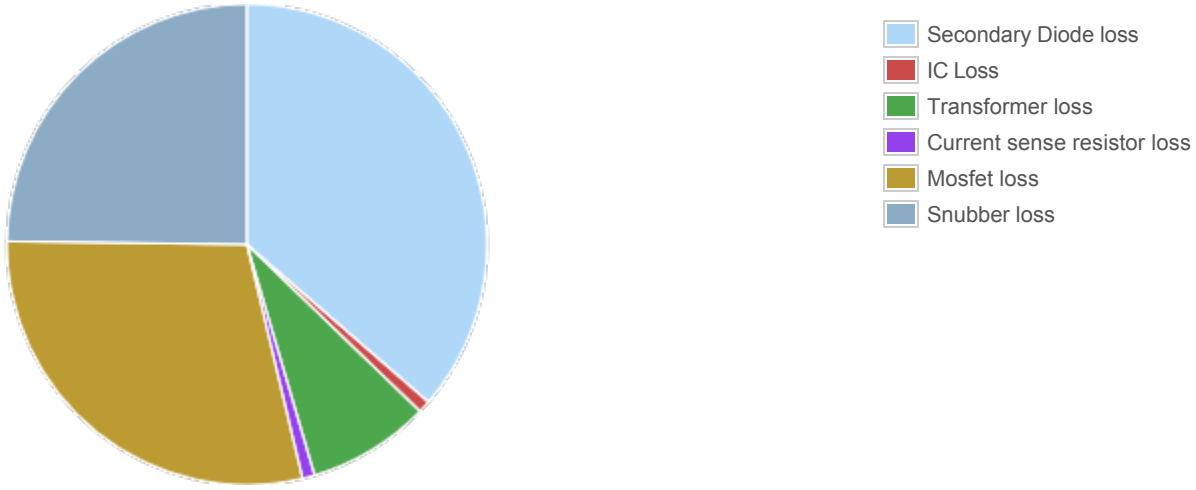


Losses



Component	Loss (W)	% of total

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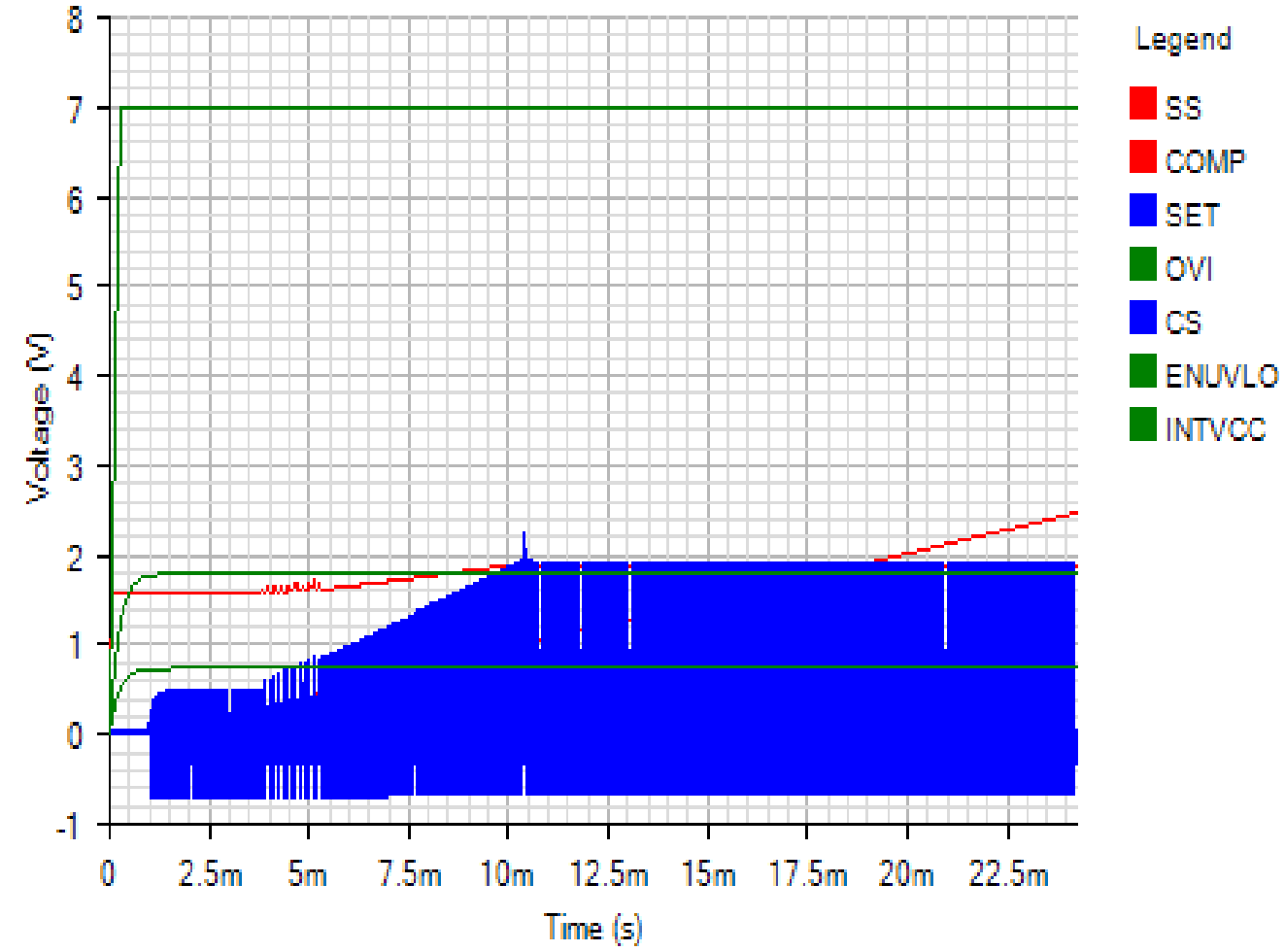
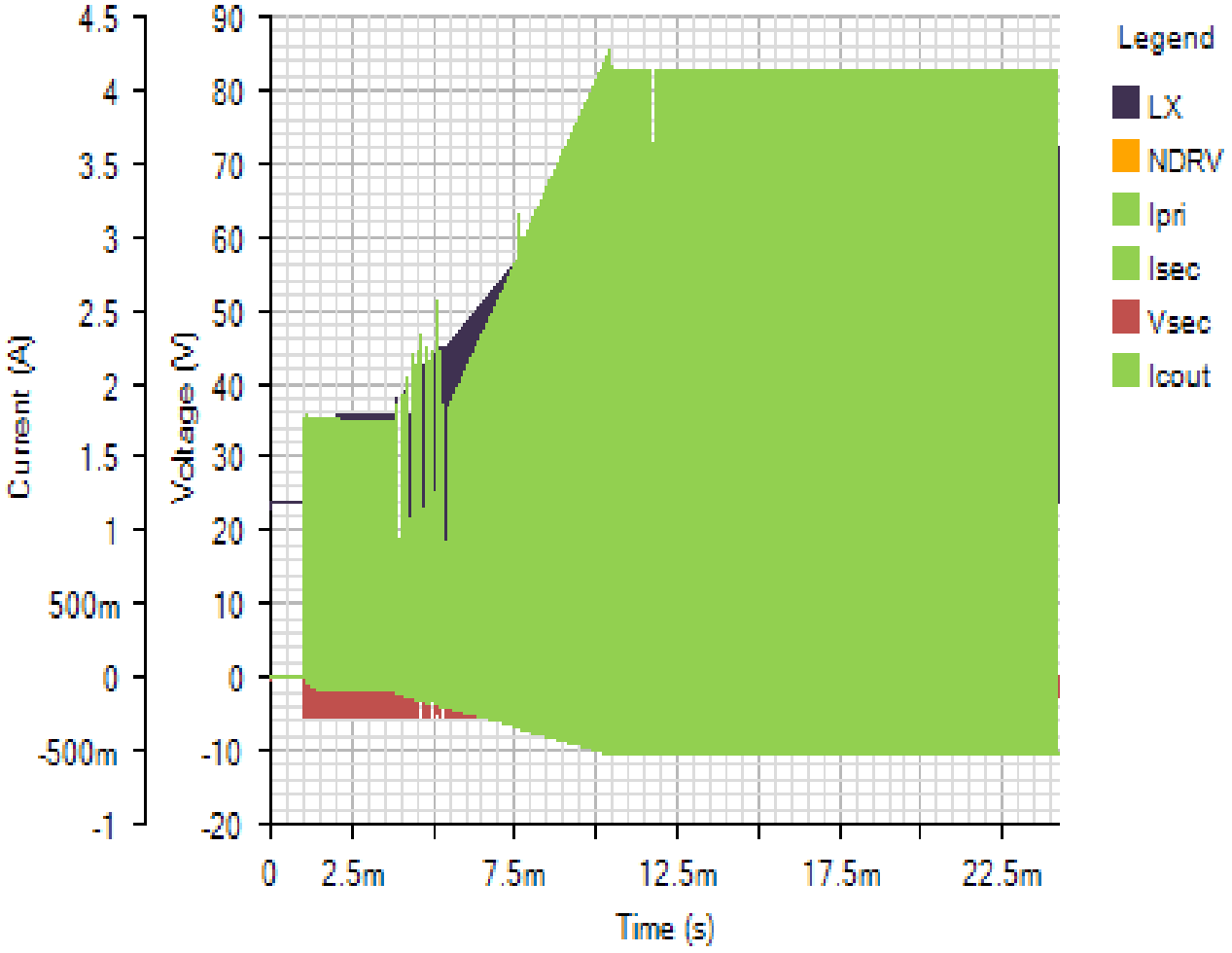
Secondary Diode loss	0.44	36.4
IC Loss	0.01	0.8
Transformer loss	0.1	8.3
Current sense resistor loss	0.01	0.8
Mosfet loss	0.35	28.9
Snubber loss	0.3	24.8
Total	1.21	100

Start Up - Mon Nov 19 2018 10:14:56

IC Default



SWITCHING Default



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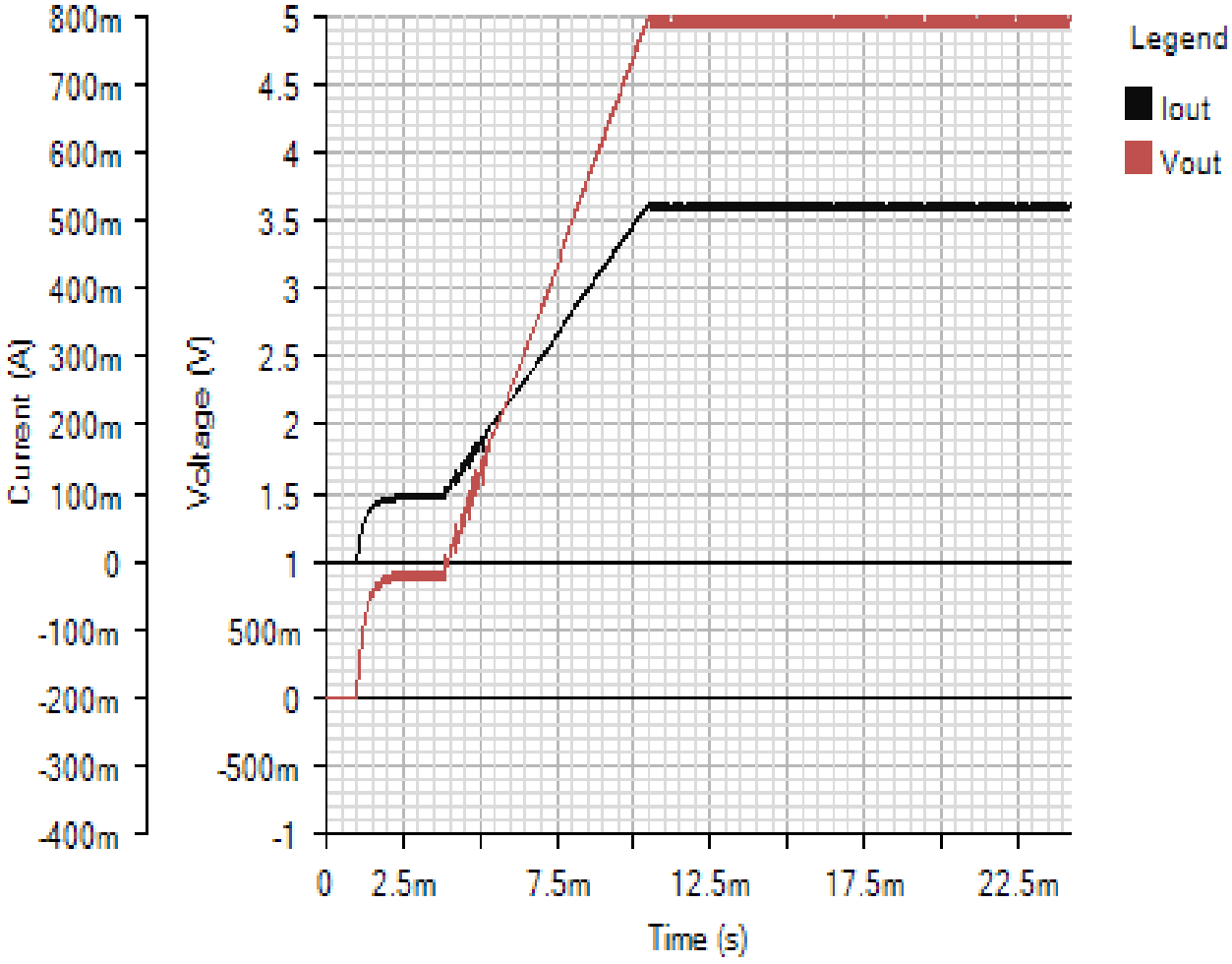

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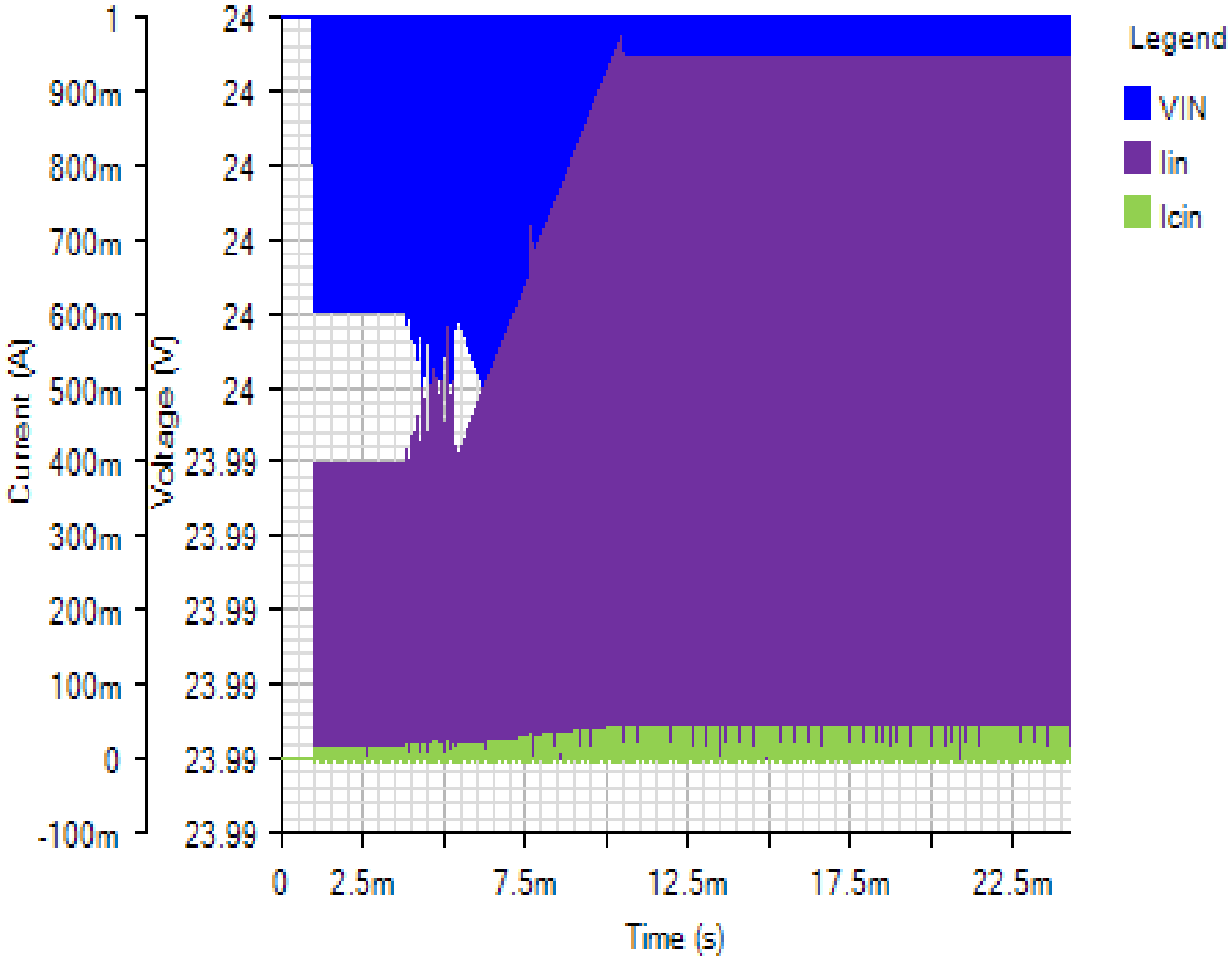
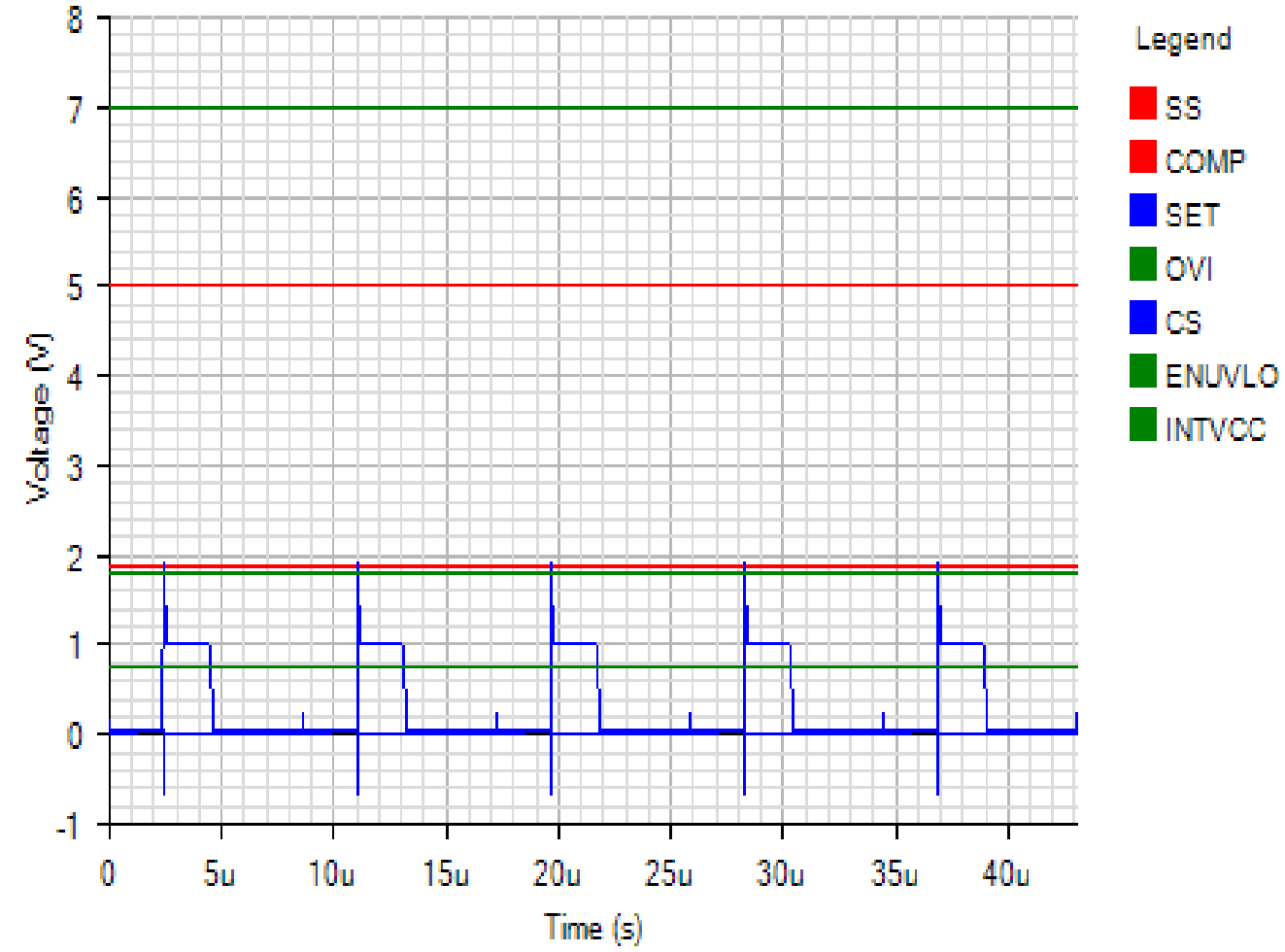


Steady State - Mon Nov 19 2018 10:14:56

IC Default



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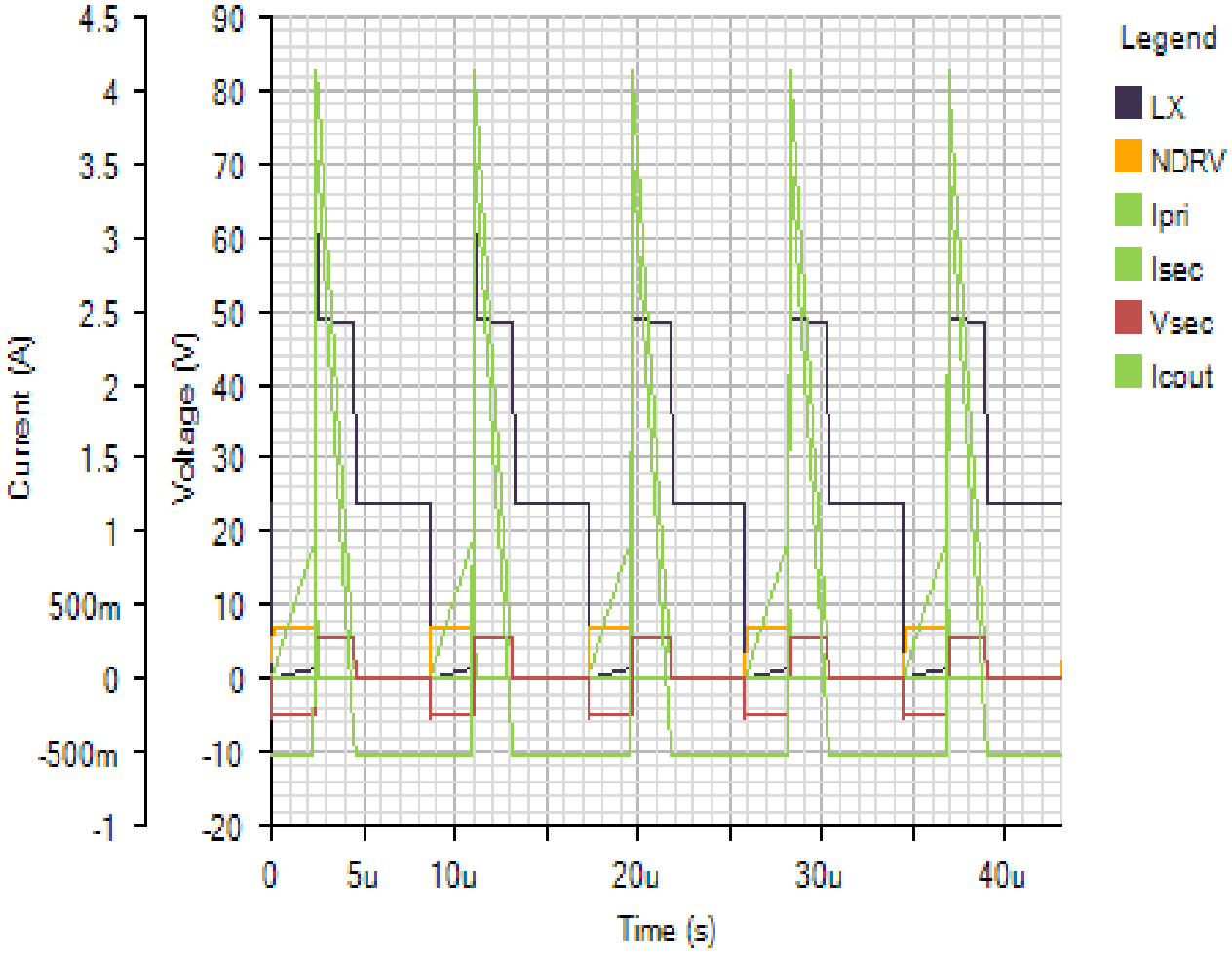

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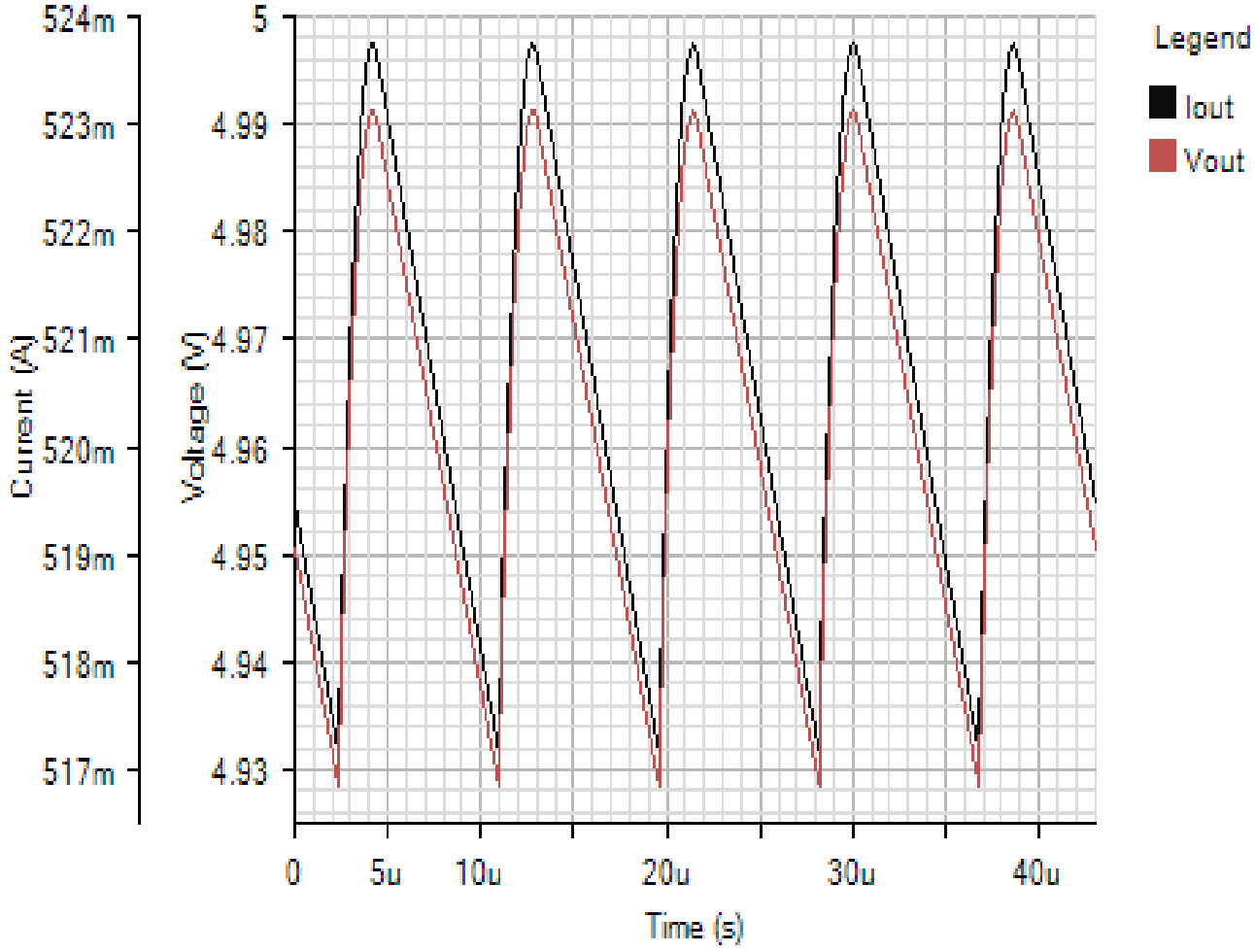

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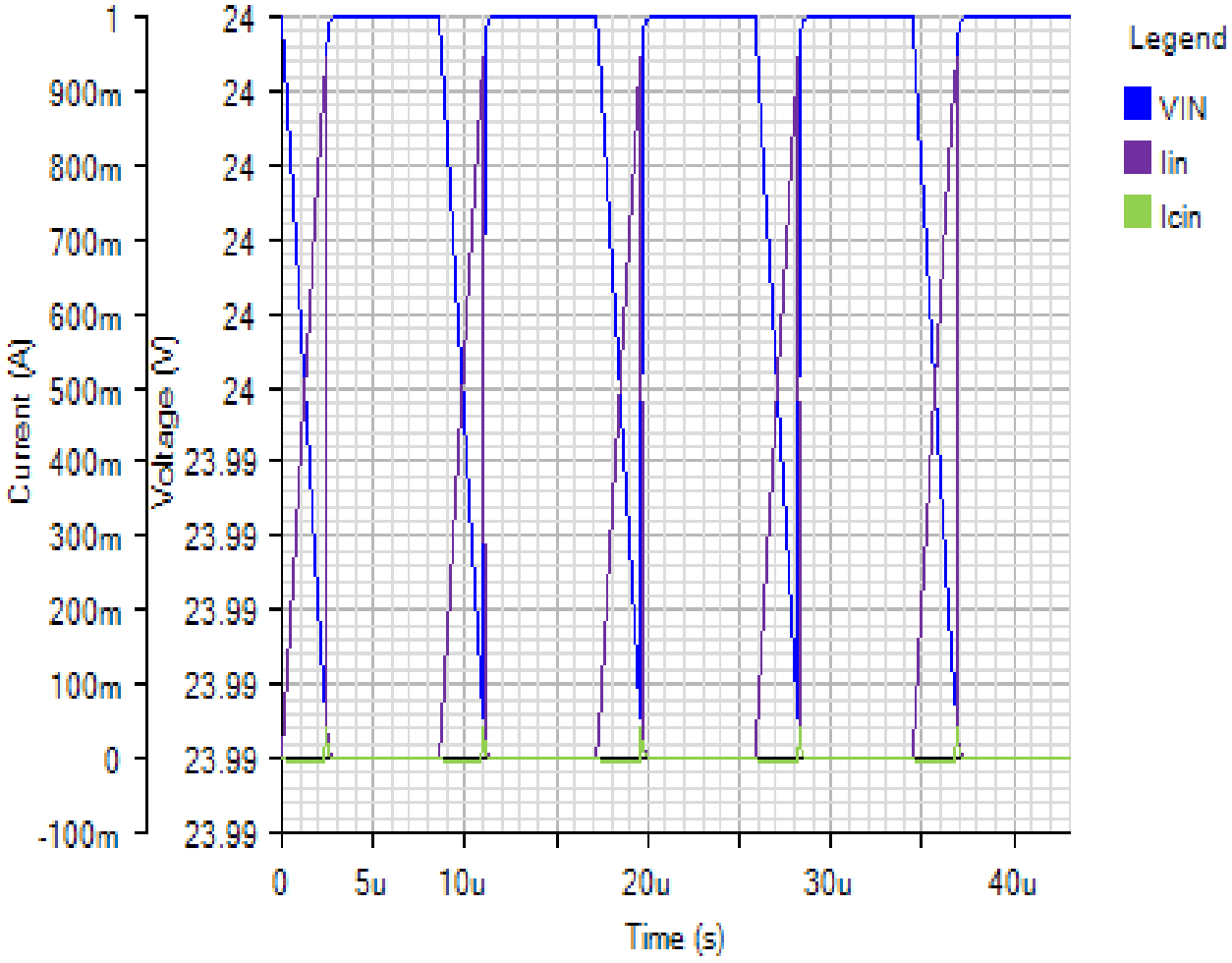

Load Step - Mon Nov 19 2018 10:14:56

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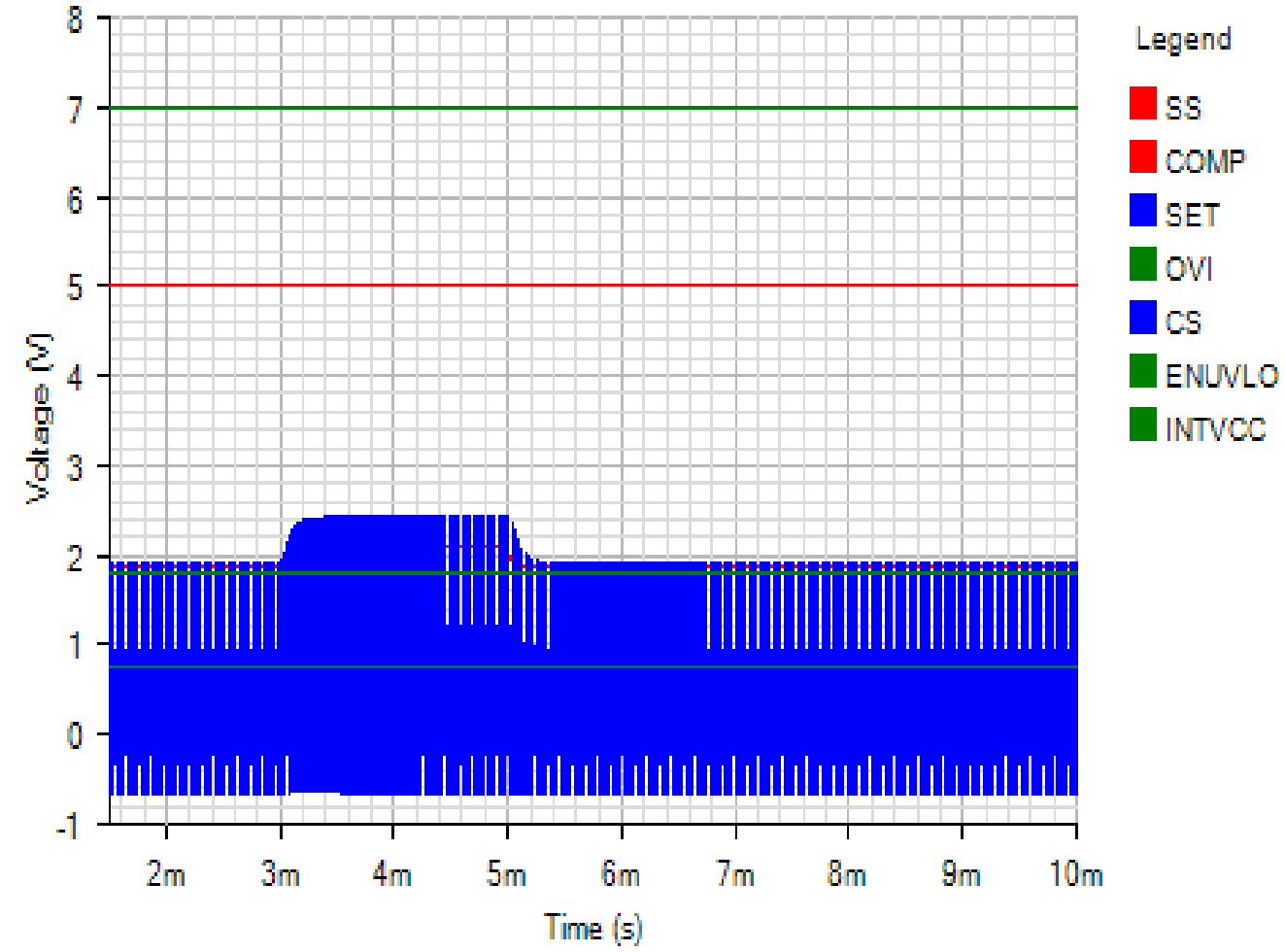

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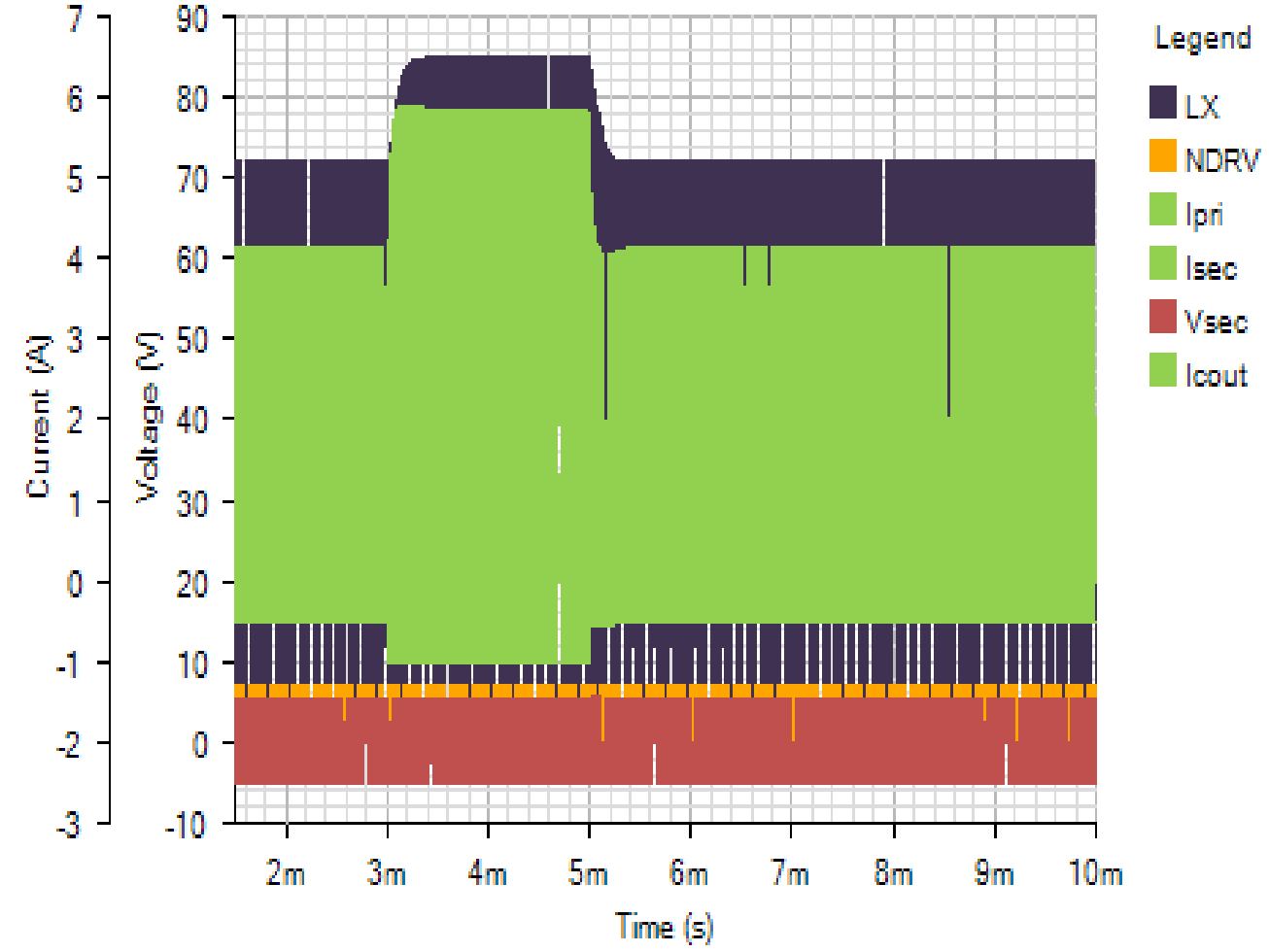

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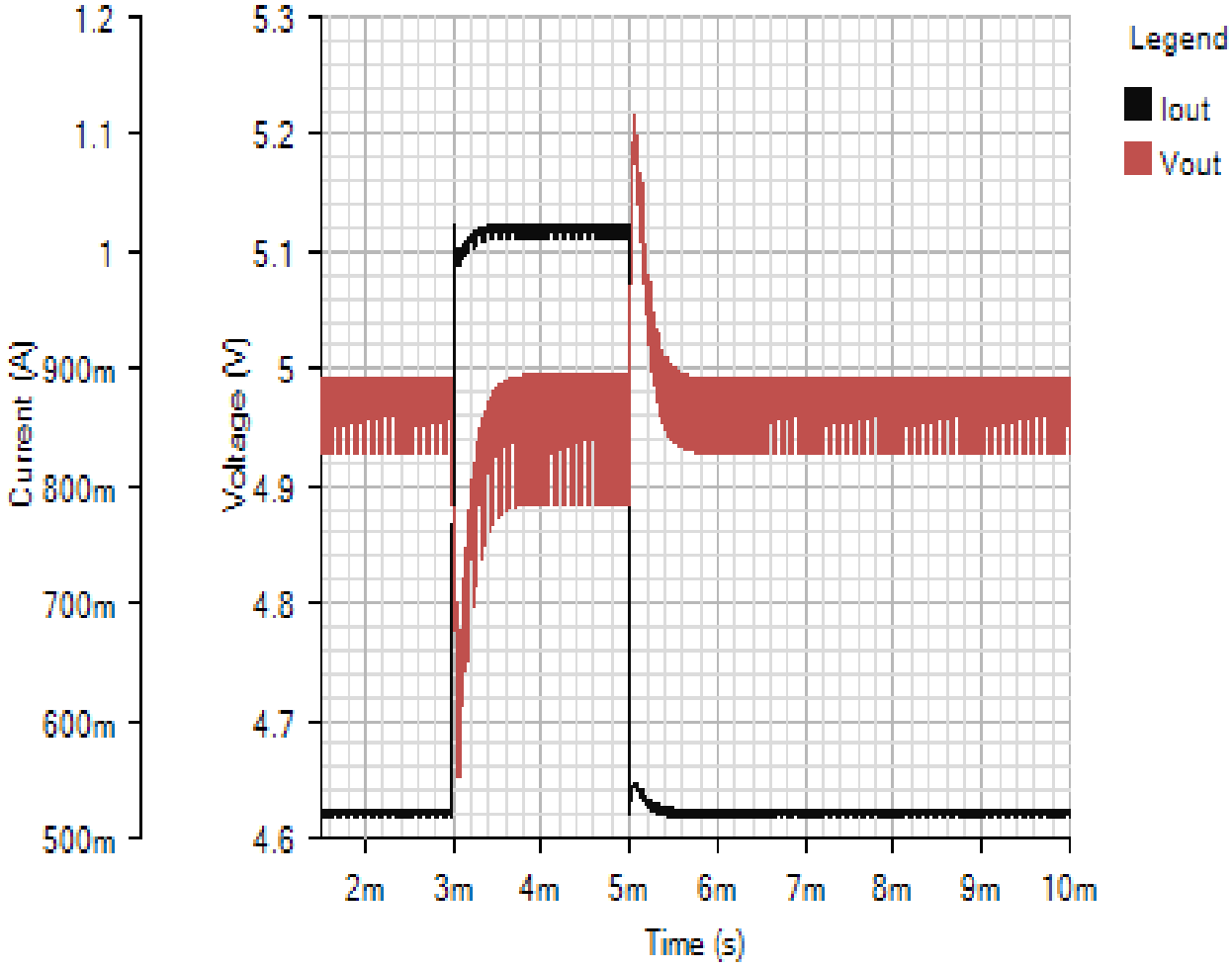

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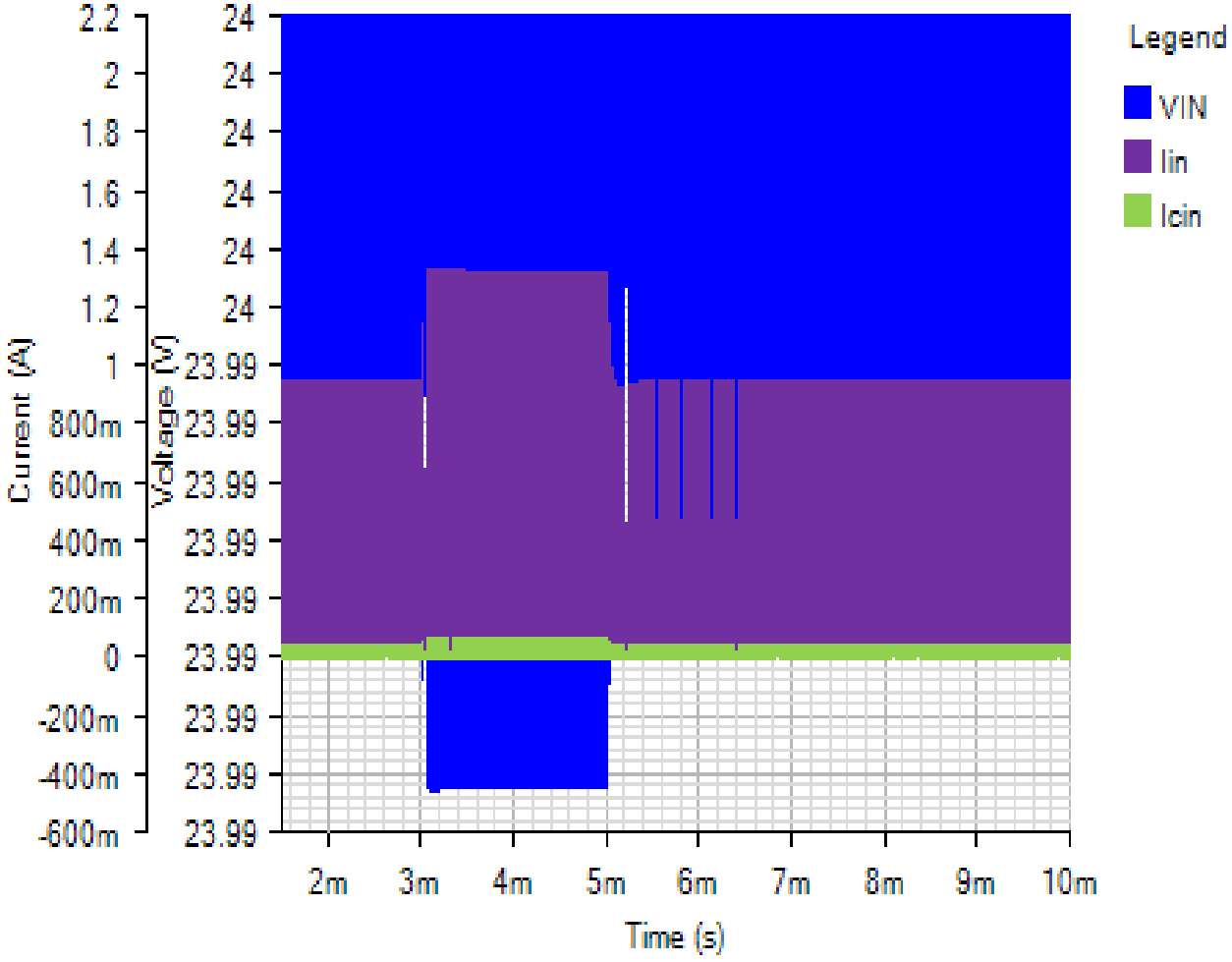

Line Transient - Mon Nov 19 2018 10:14:56

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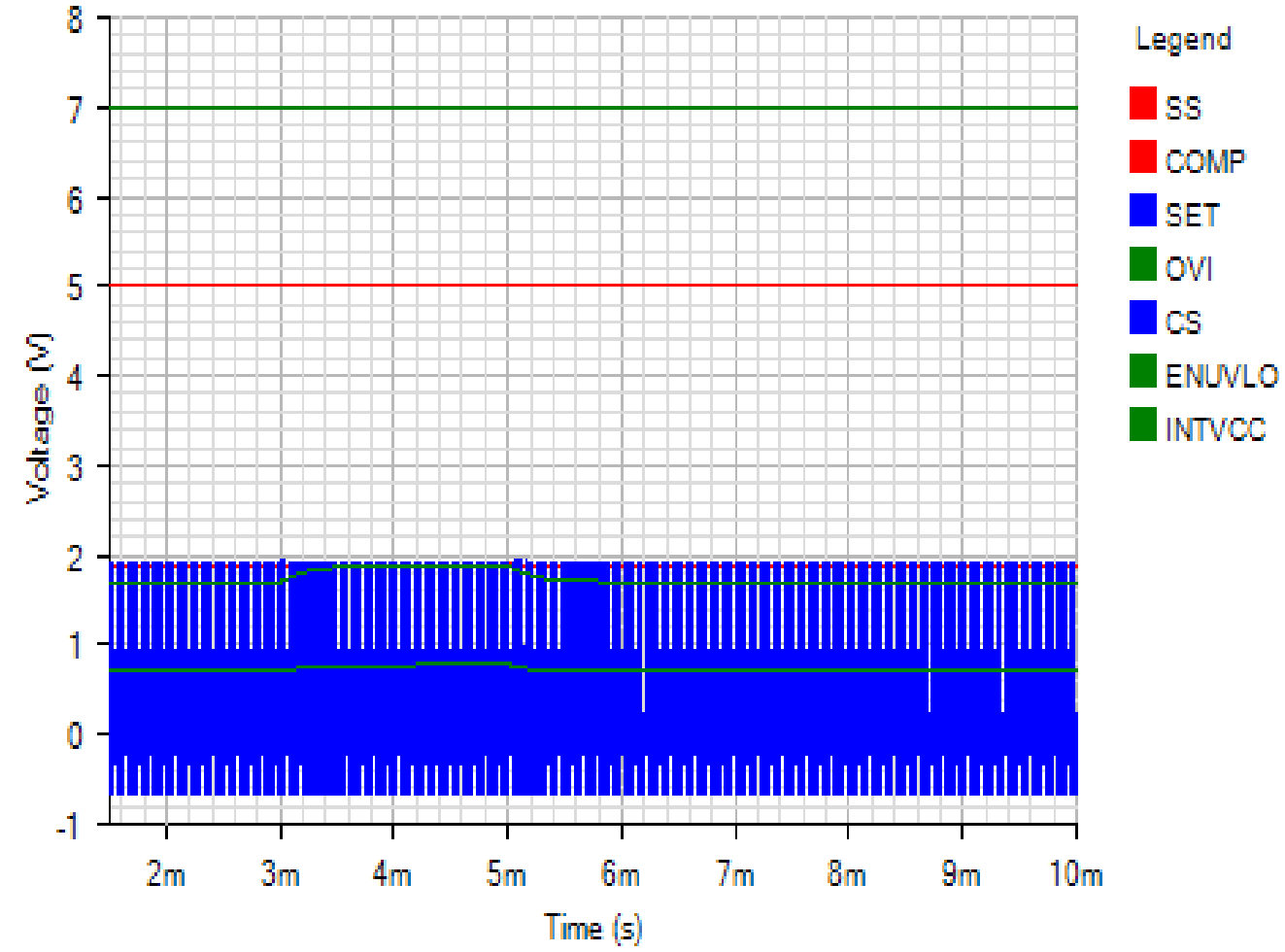

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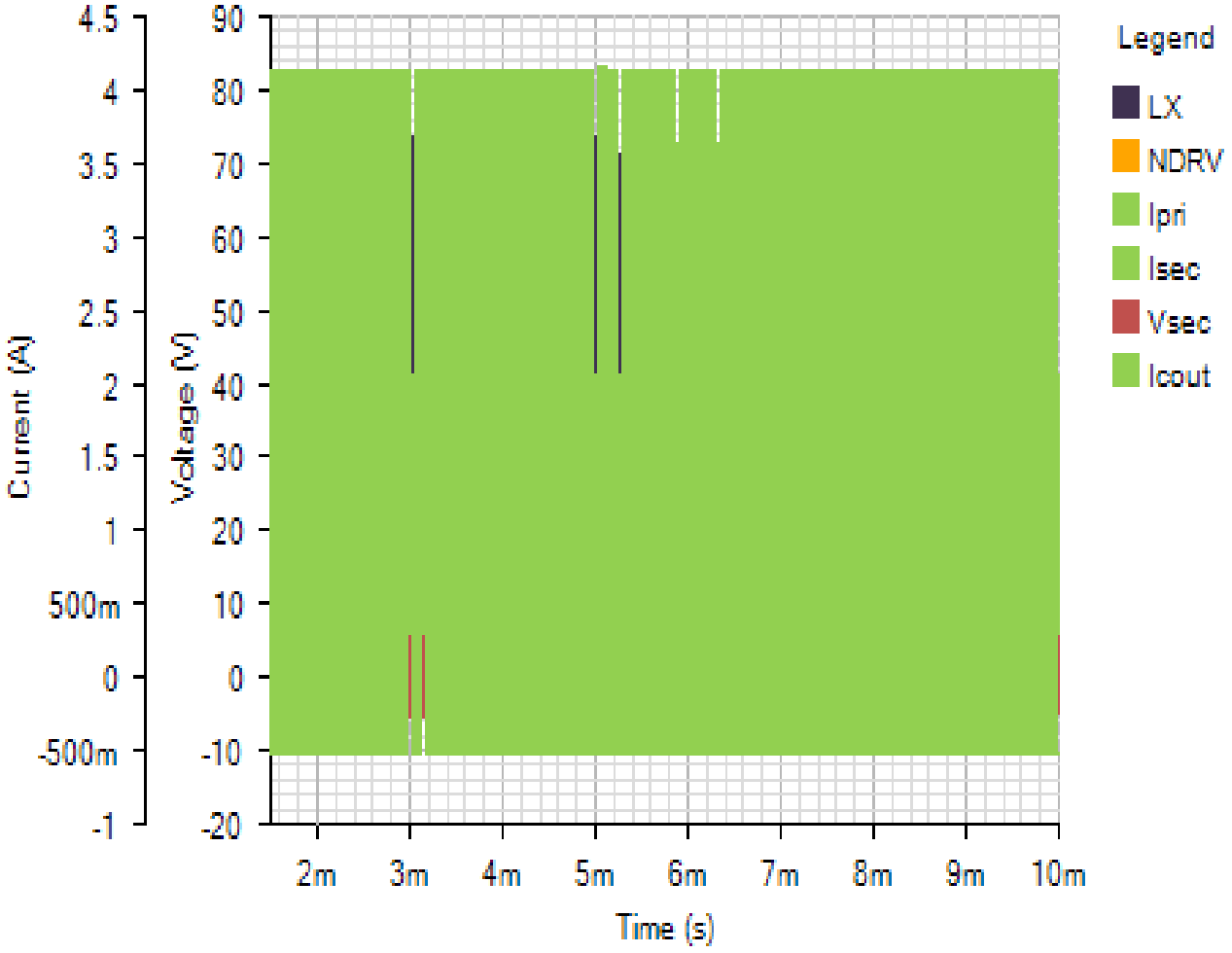

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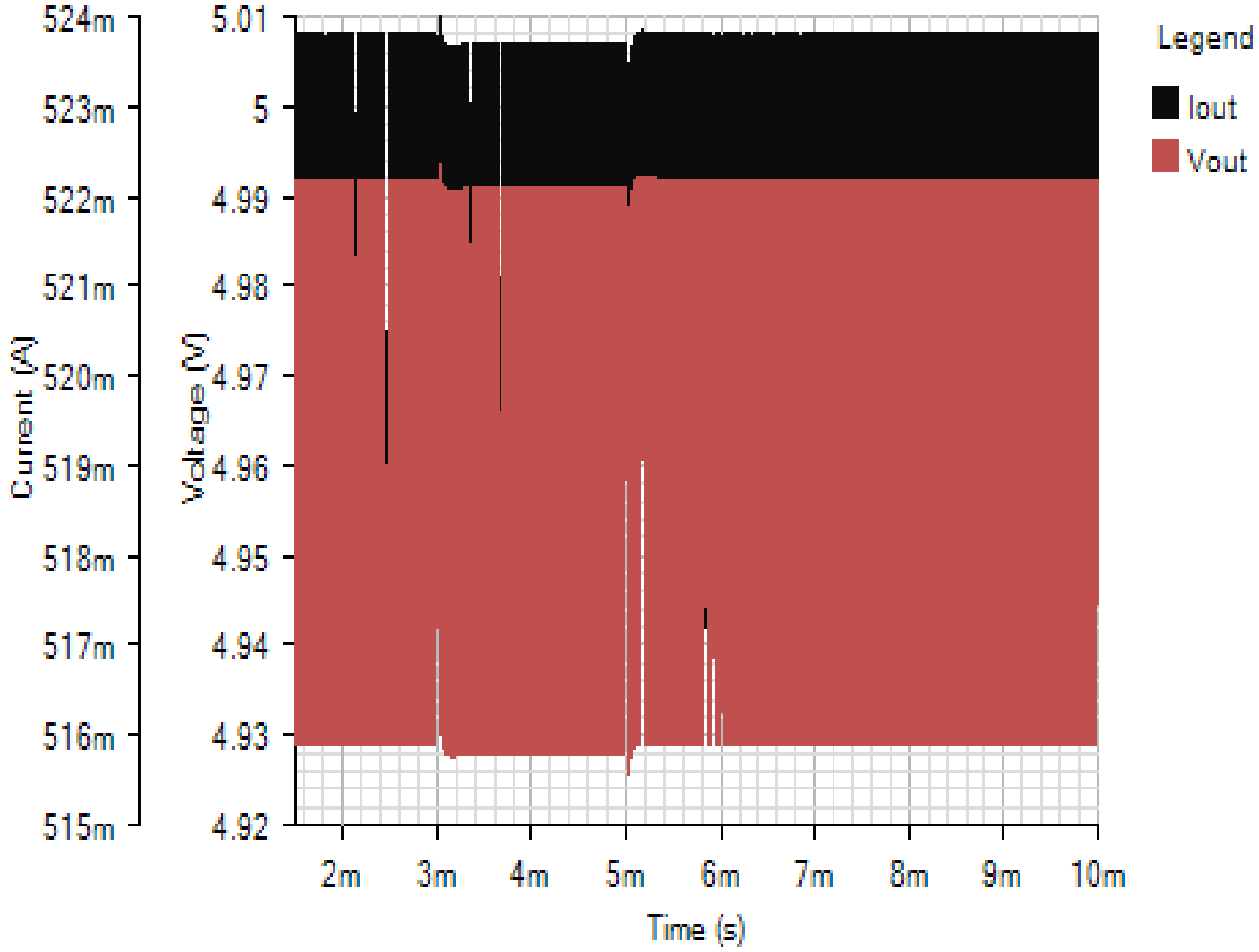

INPUT Default