Initial Design

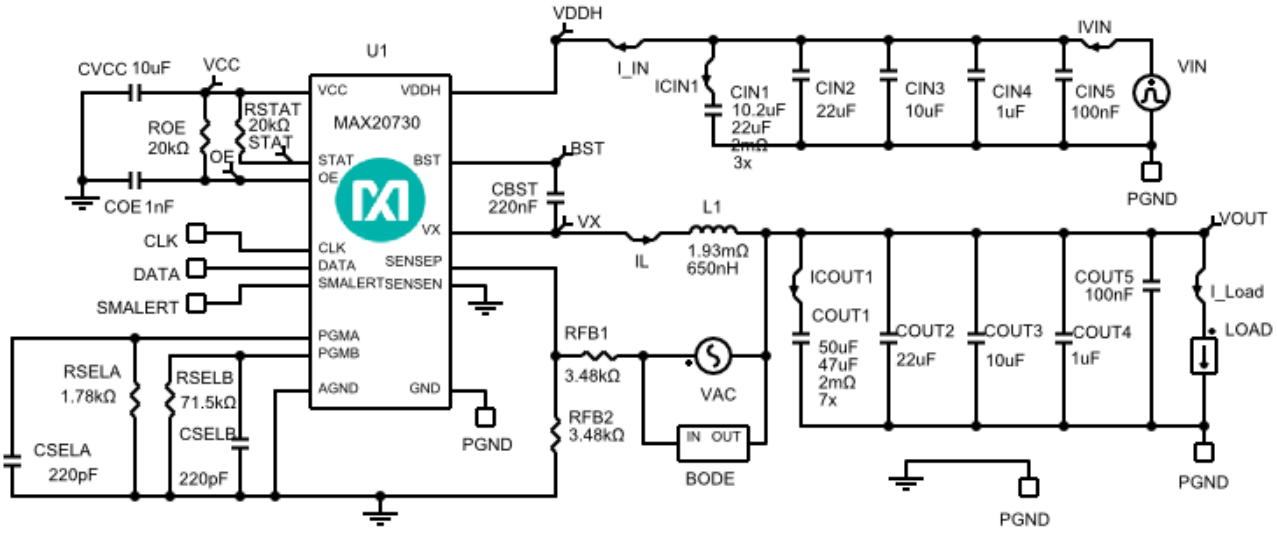
1.0

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	15A
Output Voltage Ripple	1%
Load Step Start Current	7.5A
Load Step Current	15A
Load Step Edge Rate	5A/us
Output Voltage Load Step Over/Undershoot	5%
Performance Priority	Balance Efficiency and Size
BOM Priority	Cost
Ambient Temperature	25°C
Inductor Current Ratio (LIR)	0.3
PMBus Address	1010000
Parameter Programming Method	Boot Components
Vboot Reference Voltage	0.8984 V
PMBus Reference Voltage	0.7V
Switching Frequency	600 KHz
Rgain	1.8 mOhm
Soft Start Ramp Time	3 ms
STAT Blanking Time	125 us

Parameter	Value
OCP Threshold	Setting 1
Overtemerature Protection Threshold	150 °C

Schematic



Over-temperature Protection (OTP) and Over-current 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: RSELA, CSELA, RSELB and CSELB 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

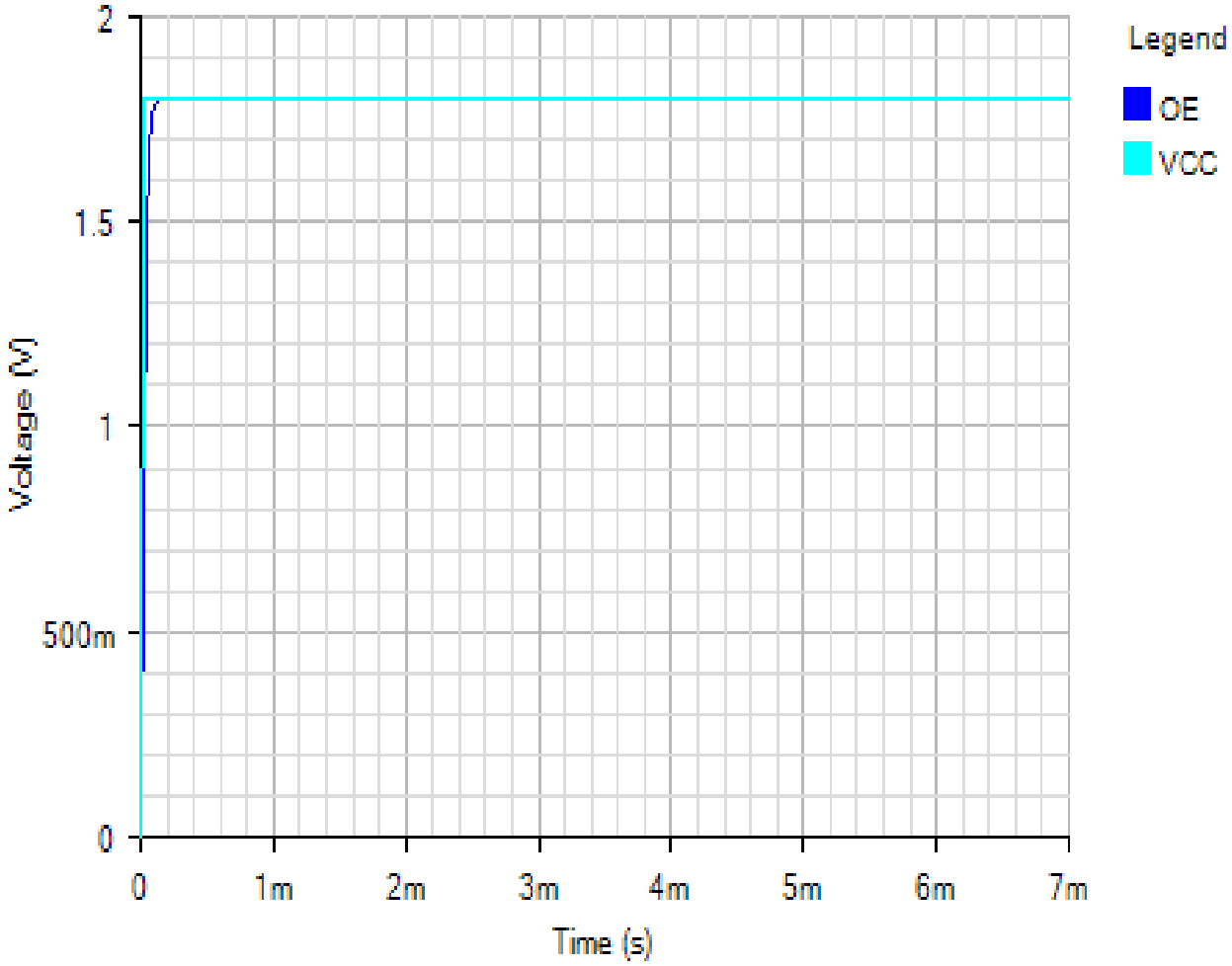
Ref	Qty	Part Number	Manufacturer	Description
U1	1	MAX20730	Maxim Integrated	4.5V to 16V, Integrated Step-Down Switching Regulator 25A, with PMBus
CBST	1	CC0402KRX5R6BB224	Yageo	Cap Ceramic 0.22uF 10V X5R 10% Pad SMD 0402 85°C T/R
CIN1	3	GRM32ER71E226ME15	Murata	Cap Ceramic 22uF 25V 1210 125C
CIN2	1	CL31A226KOHNNNE	Samsung Electro-Mechanics	Cap Ceramic 22uF 16V X5R 10% Pad SMD 1206 85°C T/R
CIN3	1	GRM21BR61C106KE15L	Murata Manufacturing	Cap Ceramic 10uF 16V X5R 10% Pad SMD 0805 85°C T/R
CIN4	1	EMK105BJ105KV-F	Taiyo Yuden	Cap Ceramic 1uF 16V X5R 10% Pad SMD 0402 85°C T/R

CIN5	1	CC0402KRX7R8BB104	Yageo	Cap Ceramic 0.1uF 25V X7R 10% Pad SMD 0402 125°C T/R
COE	1	CC0402KRX7R8BB102	Yageo	Cap Ceramic 0.001uF 25V X7R 10% Pad SMD 0402 125°C T/R
COUT1	7	GRM32ER71A476ME15L	Murata	Cap Ceramic 47uF 10V X7R 20% SMD 1210 125C Embossed T/R
COUT2	1	JMK212BJ226KG-T	Taiyo Yuden	Cap Ceramic 22uF 6.3V X5R 10% Pad SMD 0805 85°C T/R
COUT3	1	C1608X5R1A106K080AC	TDK	Cap Ceramic 10uF 10V X5R 10% Pad SMD 0603 85°C T/R
COUT4	1	EMK105BJ105KV-F	Taiyo Yuden	Cap Ceramic 1uF 16V X5R 10% Pad SMD 0402 85°C T/R
COUT5	1	CC0402KRX7R8BB104	Yageo	Cap Ceramic 0.1uF 25V X7R 10% Pad SMD 0402 125°C T/R
CSELA	1	C0402C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0402 125°C T/R
CSELB	1	C0402C221K4RACTU	KEMET Corporation	Cap Ceramic 220pF 16V X7R 10% Pad SMD 0402 125°C T/R
CVCC	1	NMC0402X5R106K6.3TRPF	NIC Components	Cap Ceramic 10uF 6.3V X5R 10% Pad SMD 0402 85°C T/R
L1	1	XAL7070-651MEB	Coilcraft	Inductor 650nH 20% 1.75mOhm 28.5A Isat 26.5A Irms
RFB1	1	ERJ2RKF3481X	Panasonic	Res Thick Film 0402 3.48K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RFB2	1	ERJ2RKF3481X	Panasonic	Res Thick Film 0402 3.48K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
ROE	1	ERJ2GEJ203X	Panasonic	Res Thick Film 0402 20K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
RSELA	1	ERJ2RKF1781X	Panasonic	Res Thick Film 0402 1.78K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
RSELB	1	ERJ2RKF7152X	Panasonic	Res Thick Film 0402 71.5K 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

Start Up - Tue Nov 20 2018 13:54:57

IC Default



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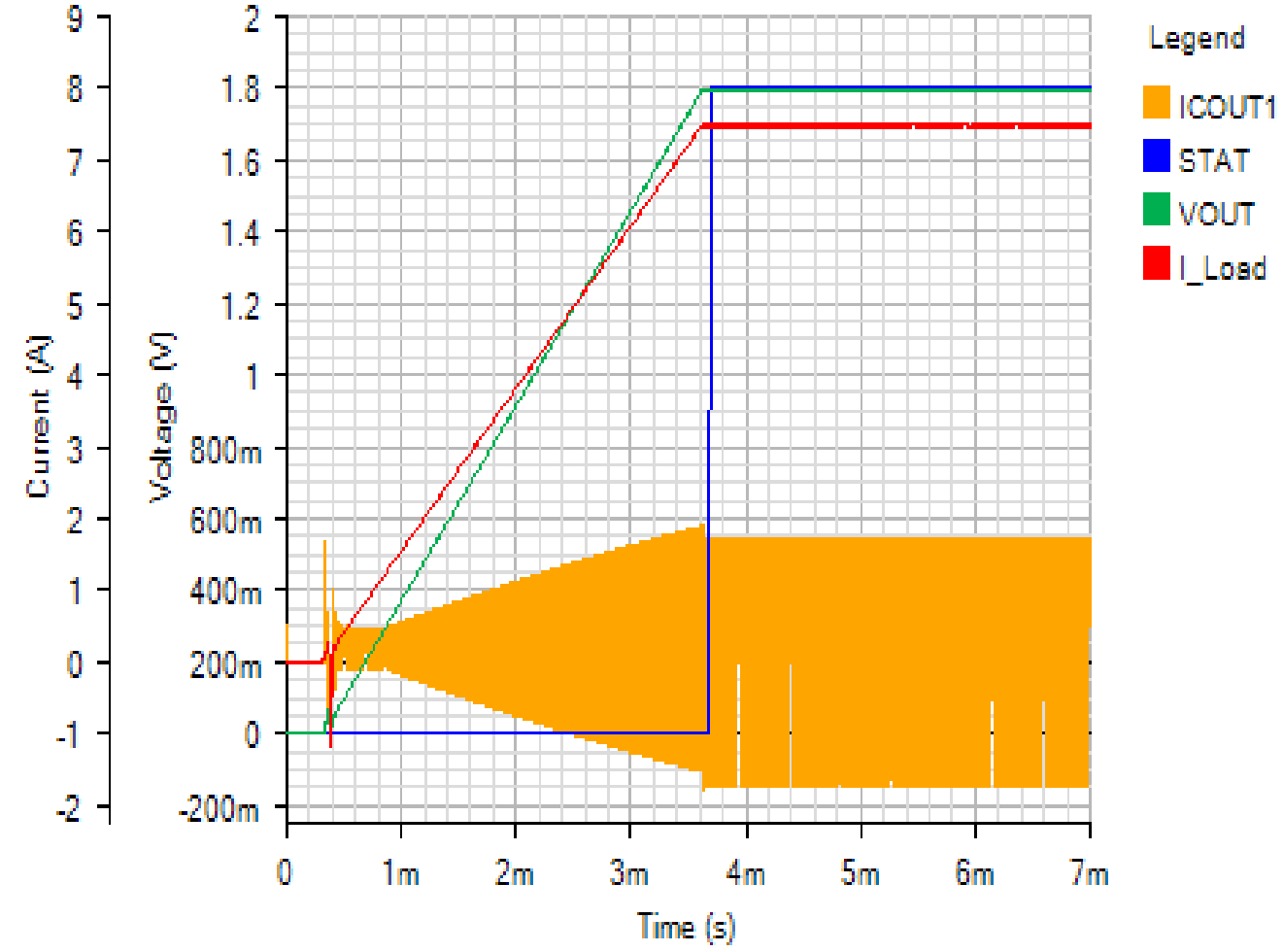

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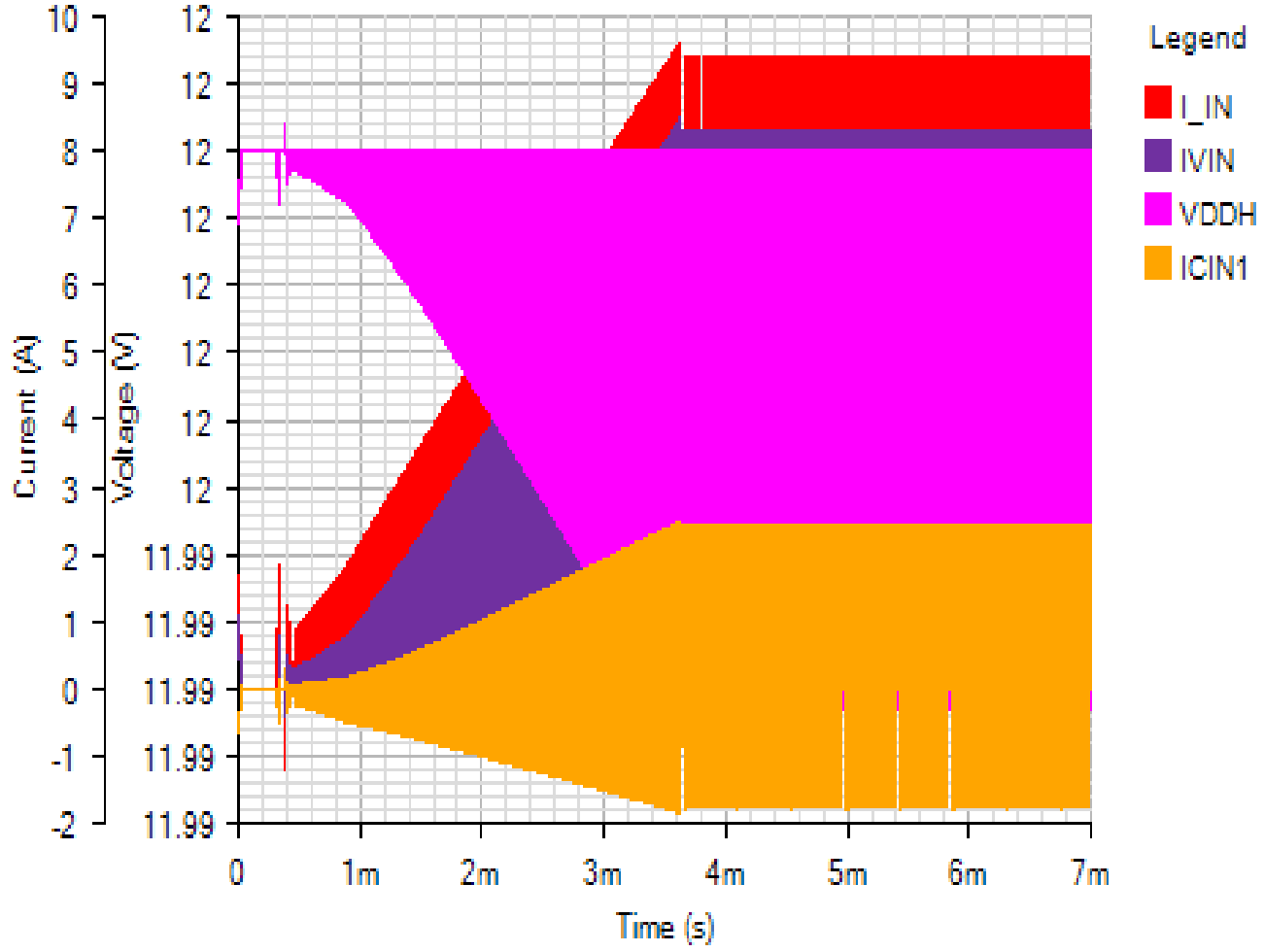

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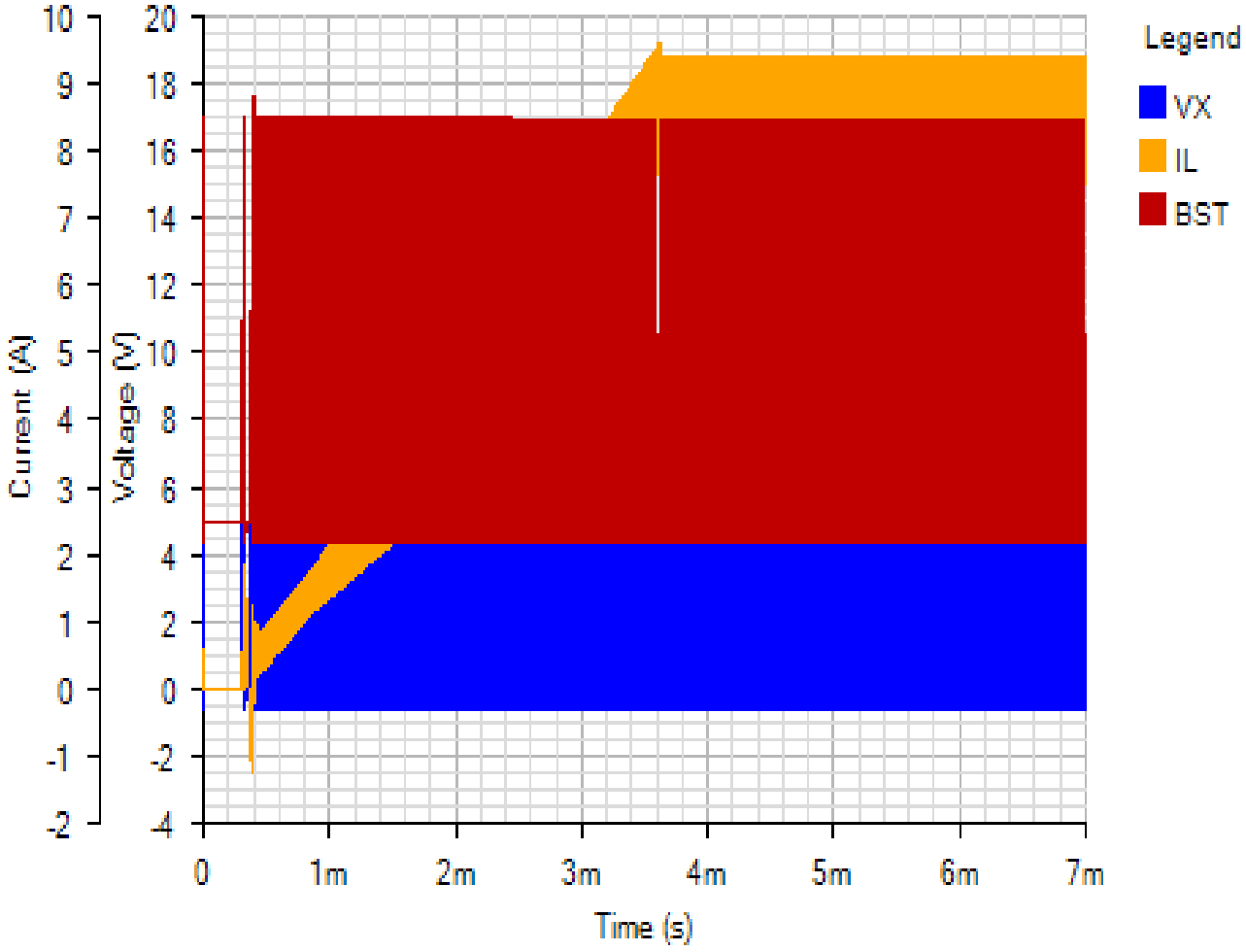

Efficiency - Tue Nov 20 2018 13:54:57

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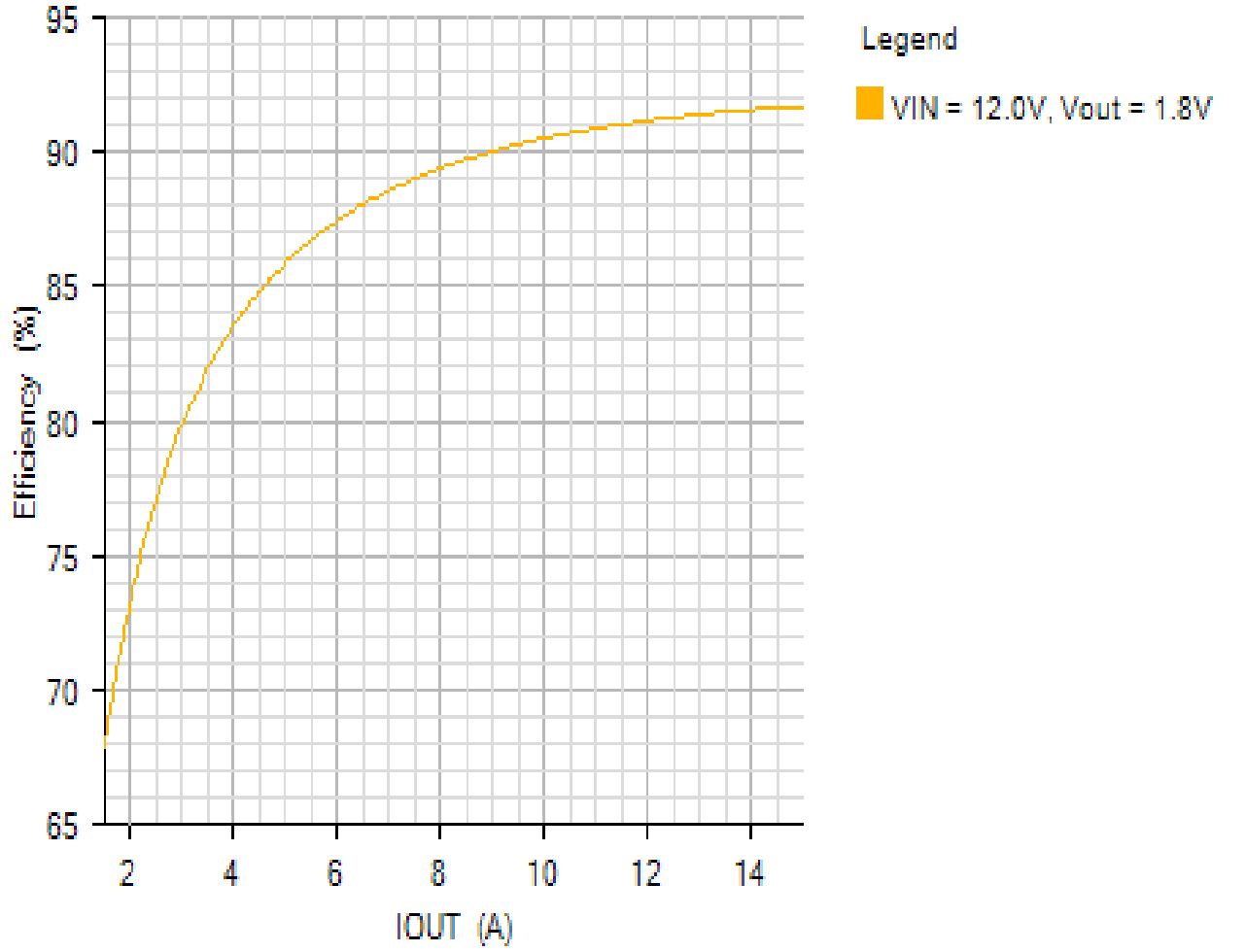
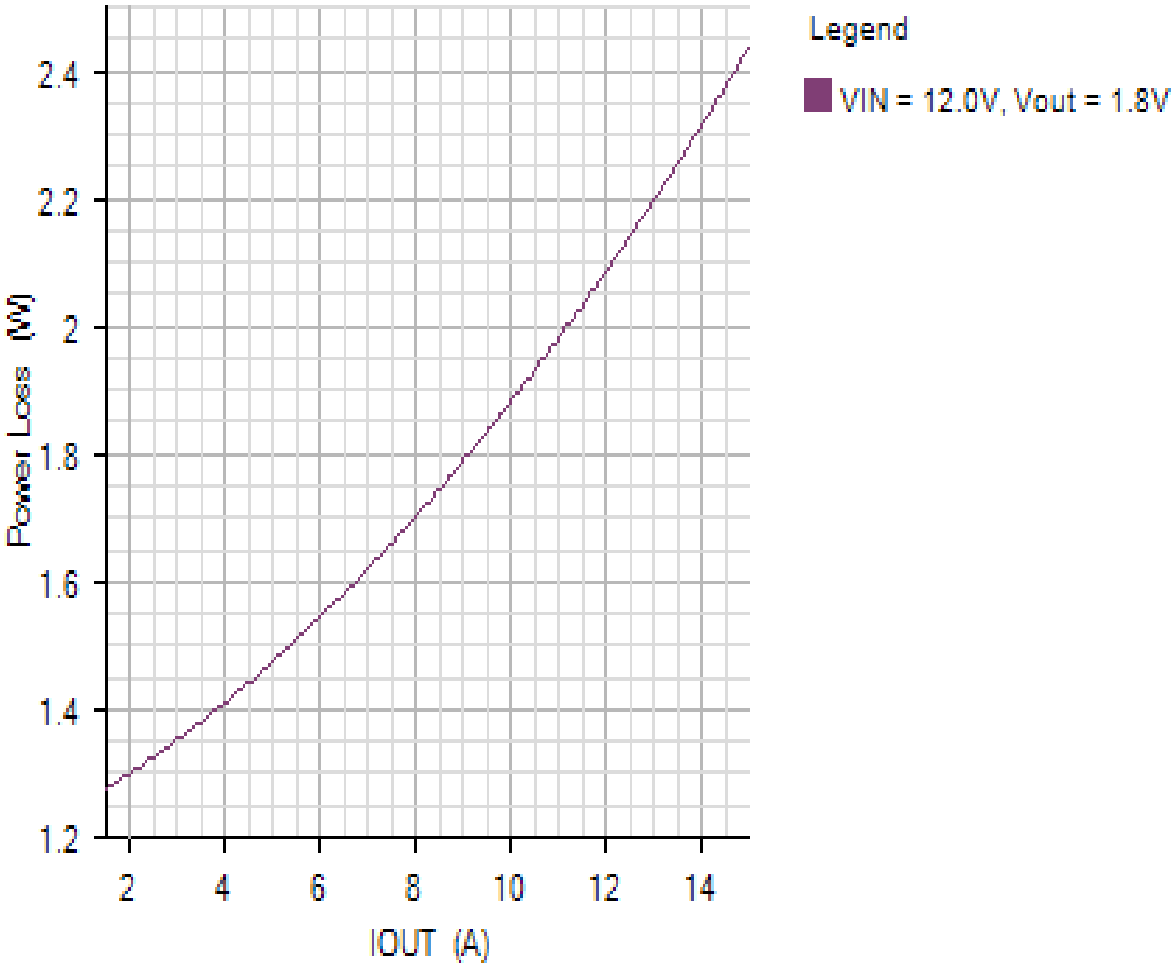
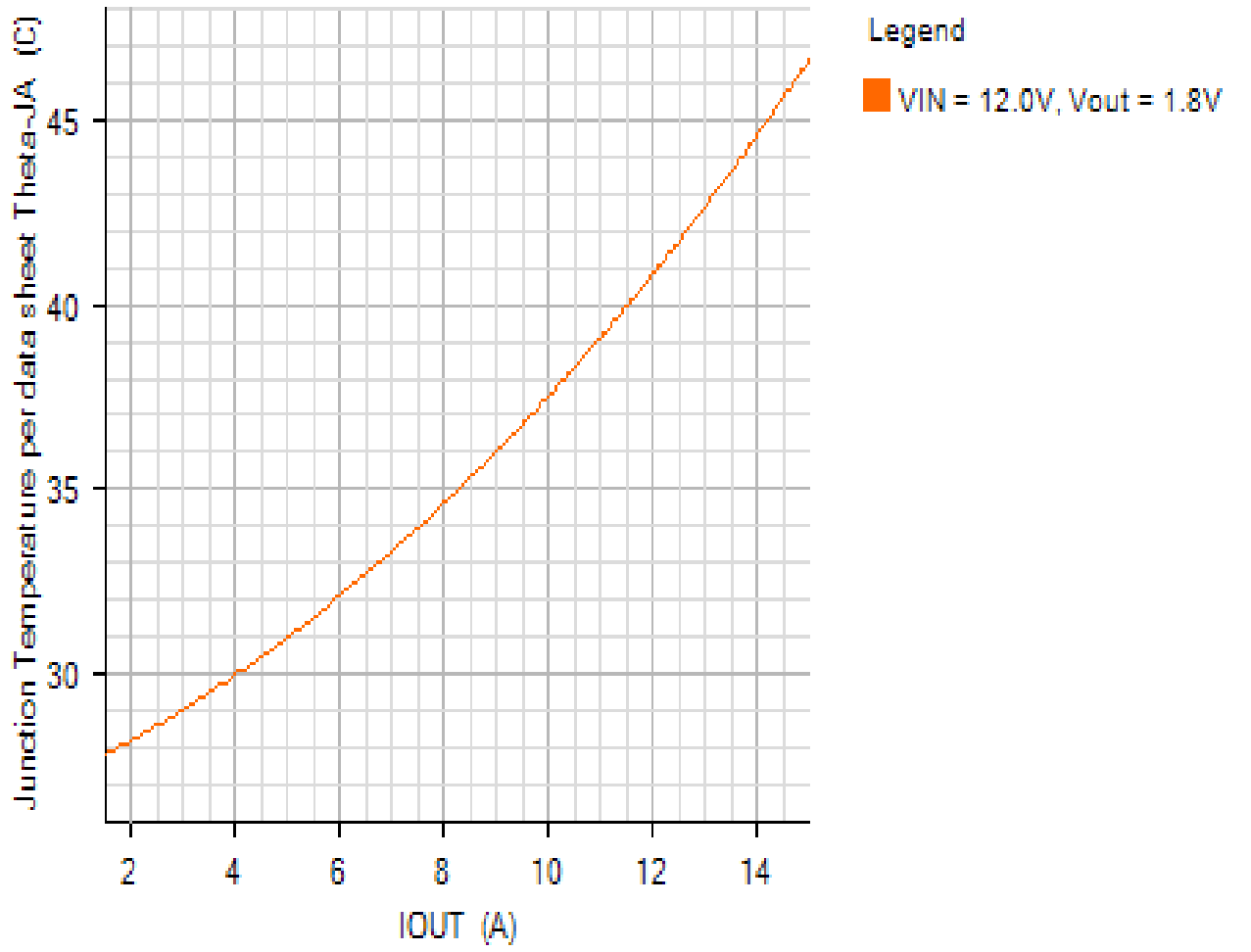


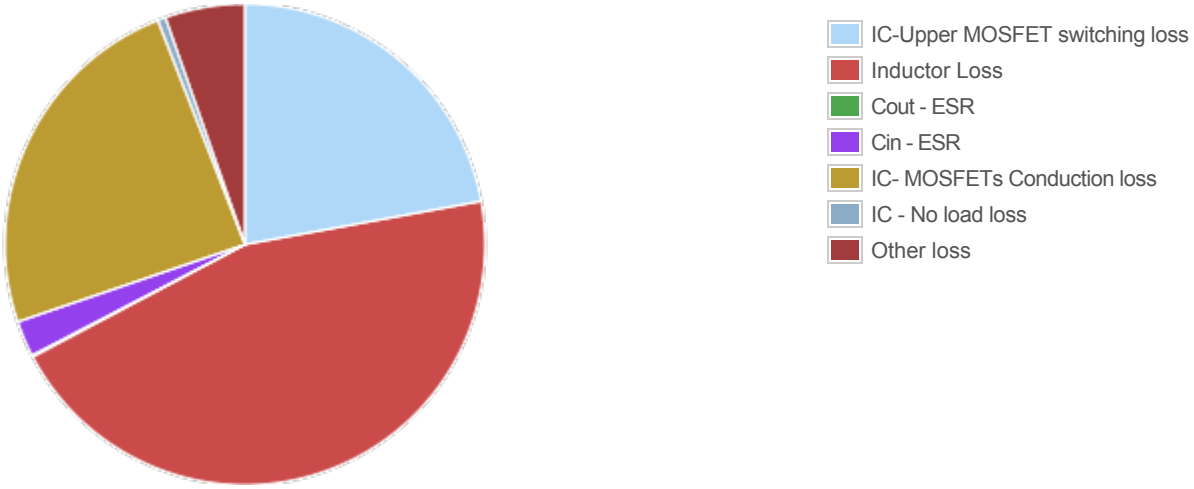
POWER_LOSS_PLOT Default



JUNCTION_TEMPERATURE_PLOT Default



Losses



Component	Loss (W)	% of total

Component	Loss (W)	% of total
IC-Upper MOSFET switching loss	0.539	22.1
Inductor Loss	1.1	45.1
Cout - ESR	0.0025	0.1
Cin - ESR	0.0589	2.4
IC- MOSFETs Conduction loss	0.592	24.3
IC - No load loss	0.0132	0.5
Other loss	0.131	5.4
Total	2.4366	100

Line Transient - Tue Nov 20 2018 13:54:57

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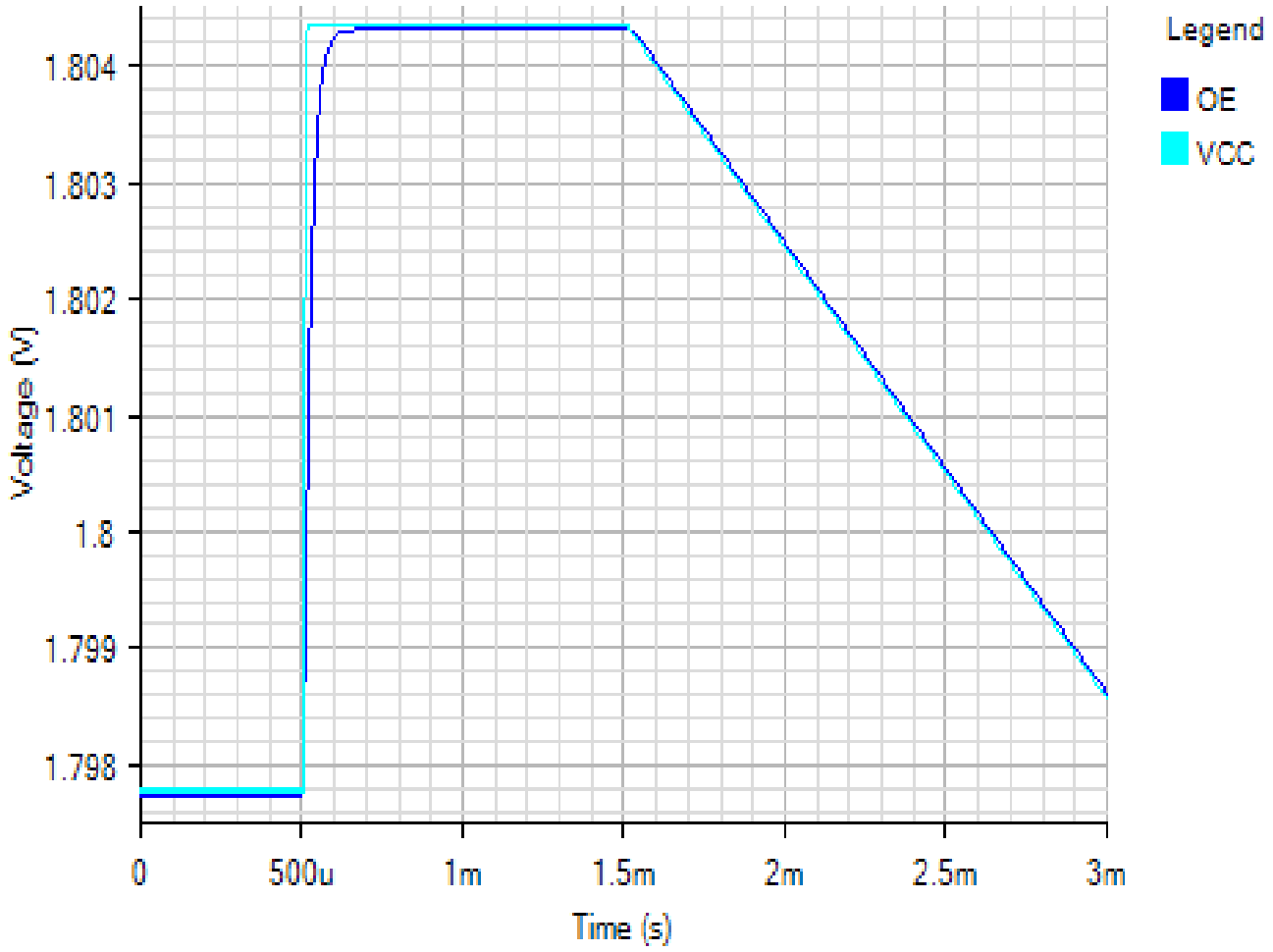

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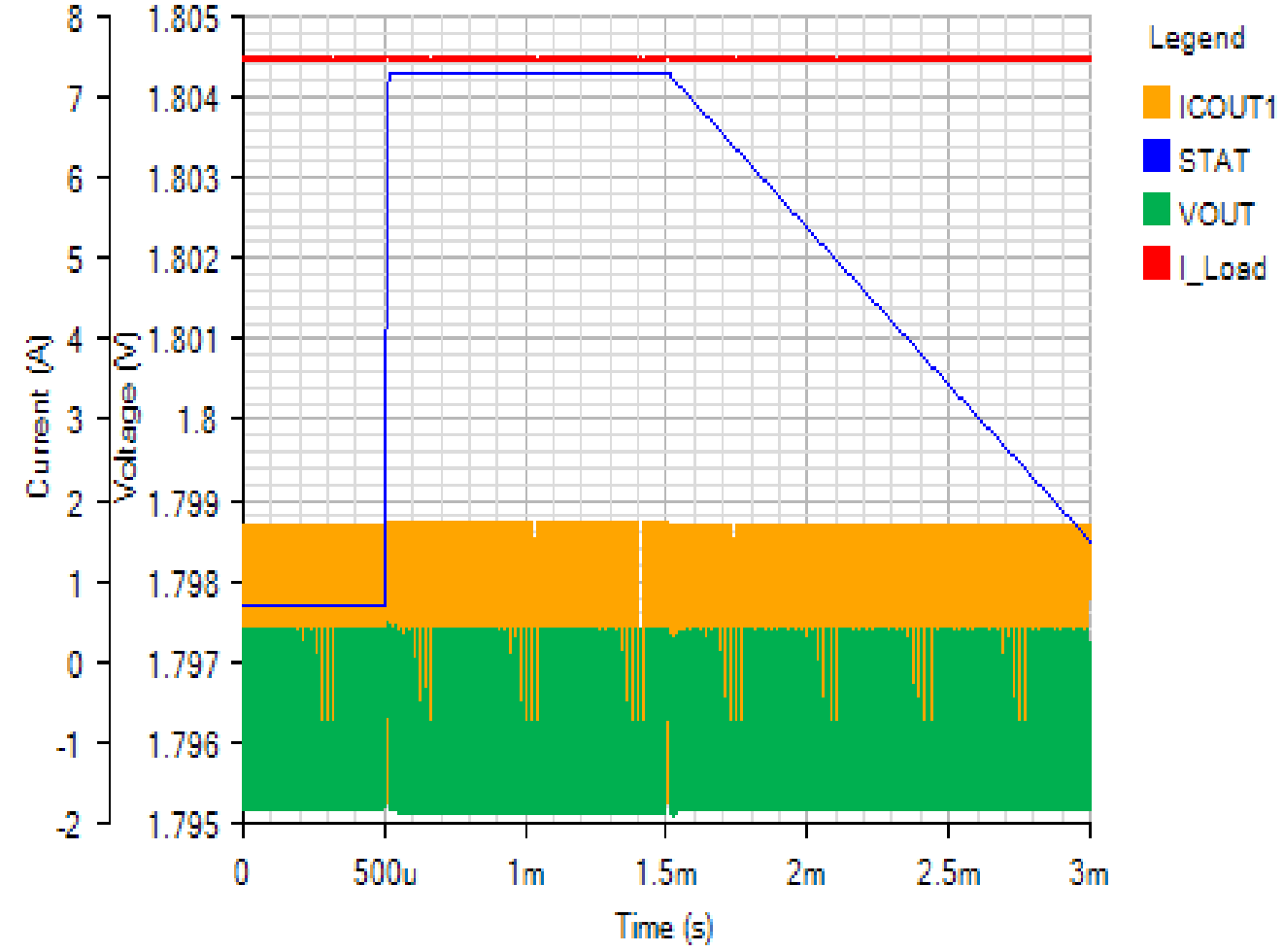

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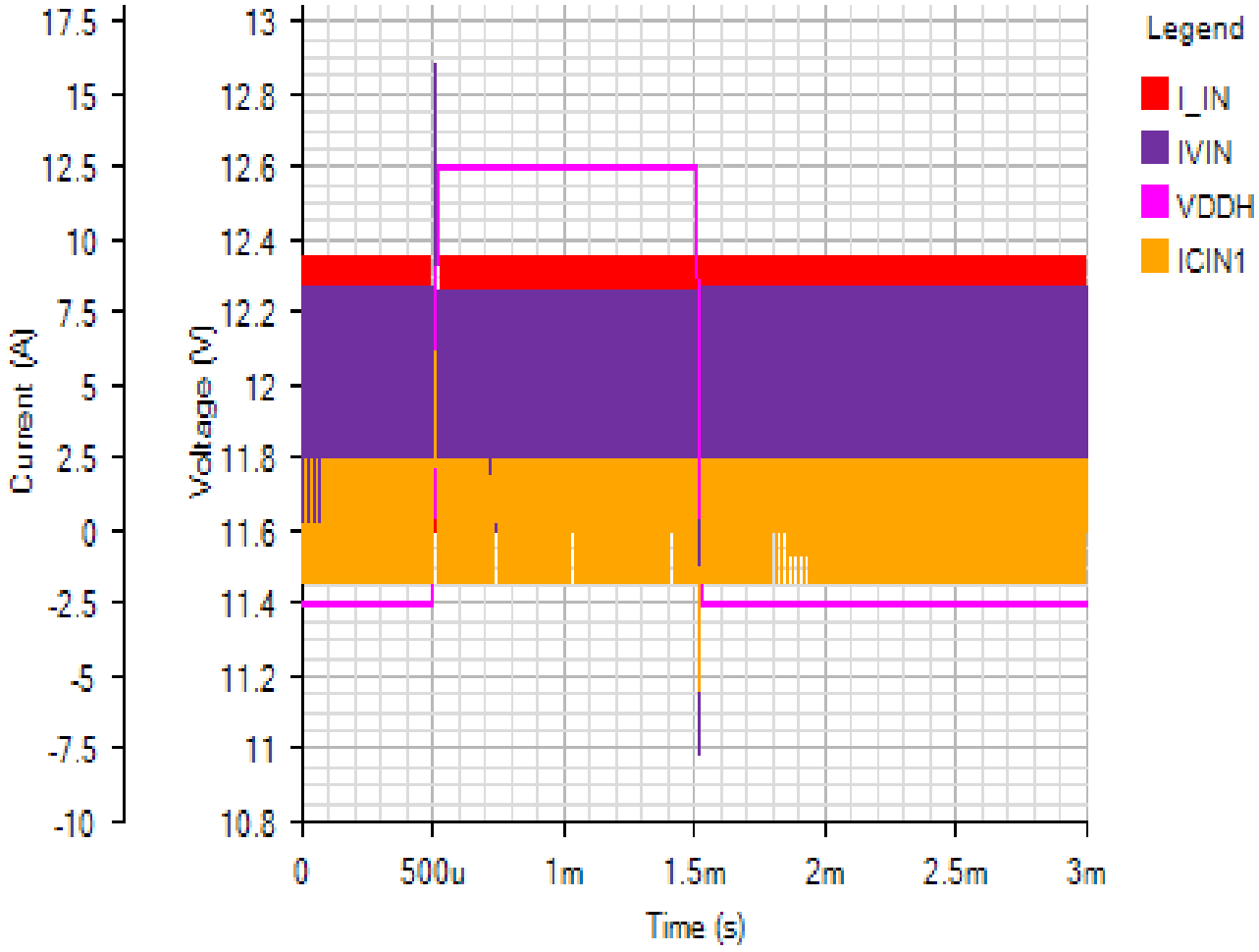

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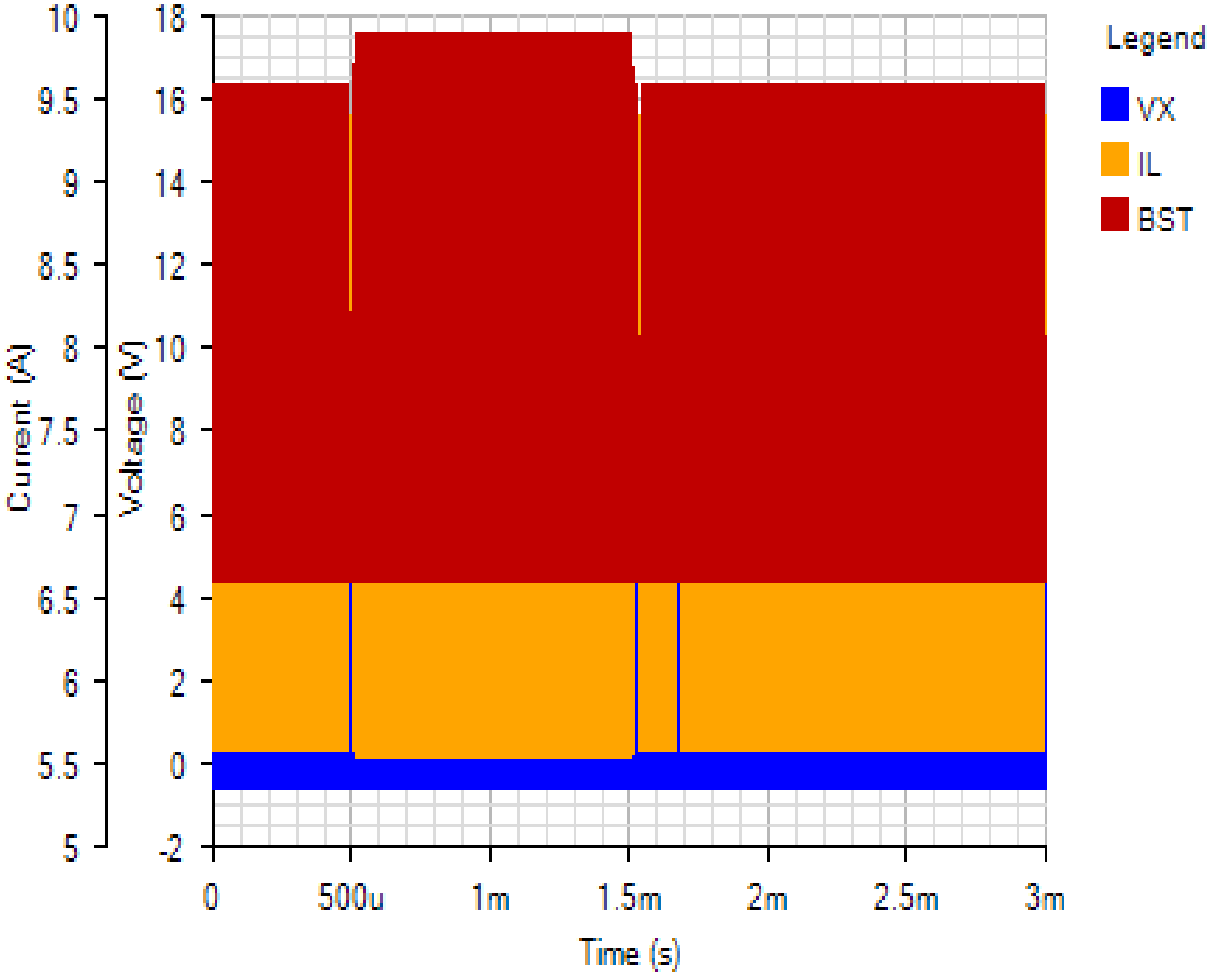
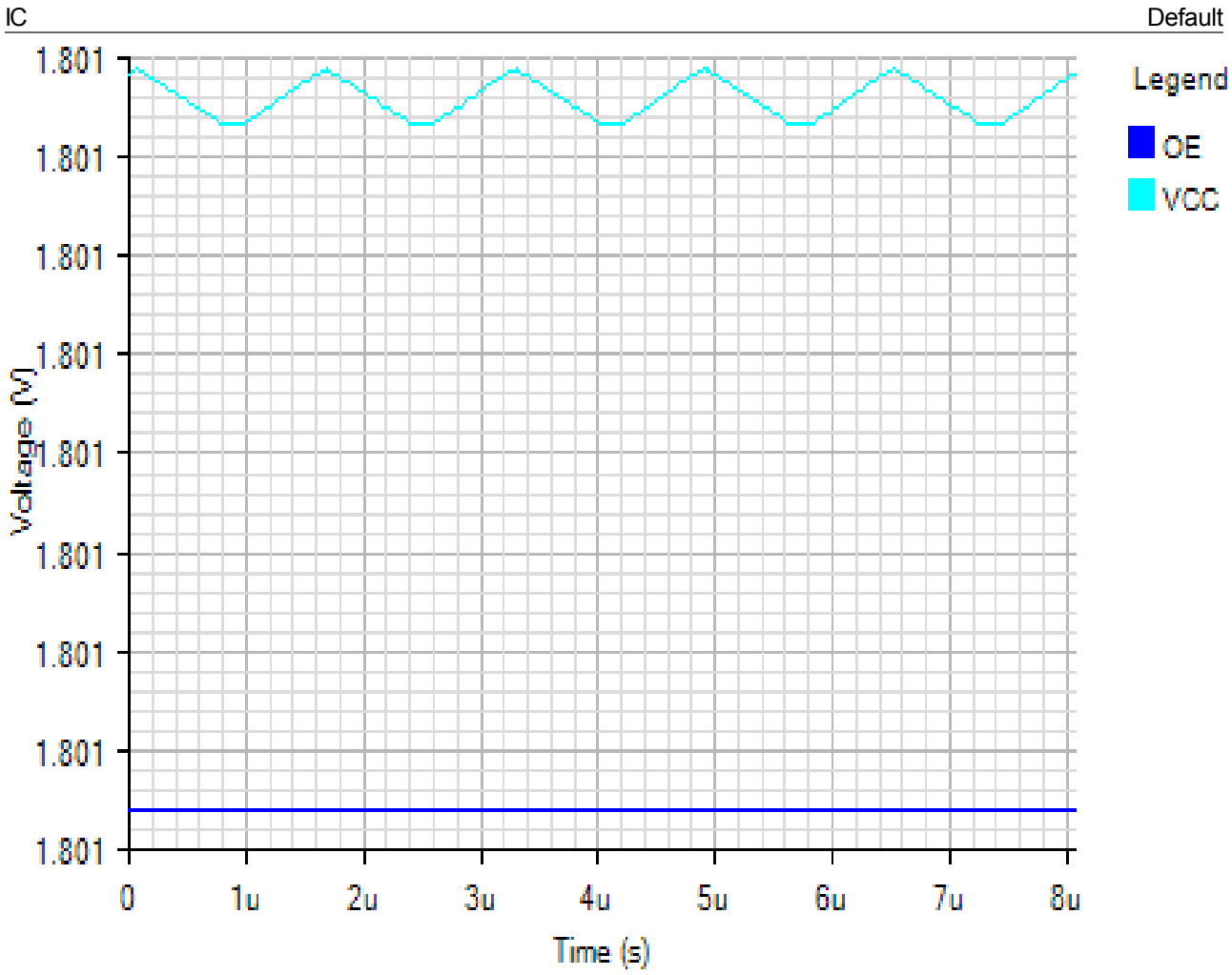


Steady State - Tue Nov 20 2018 13:54:57



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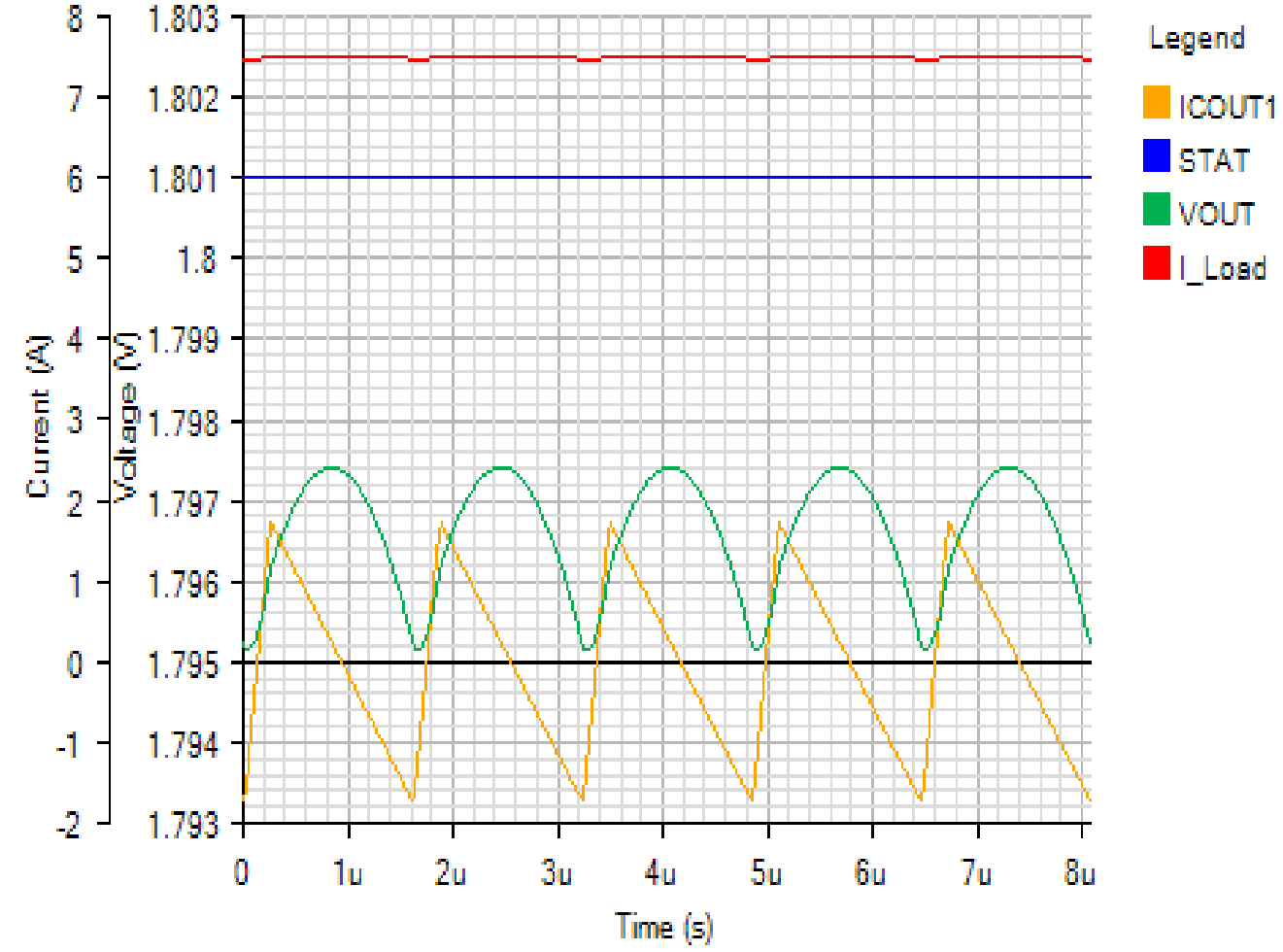

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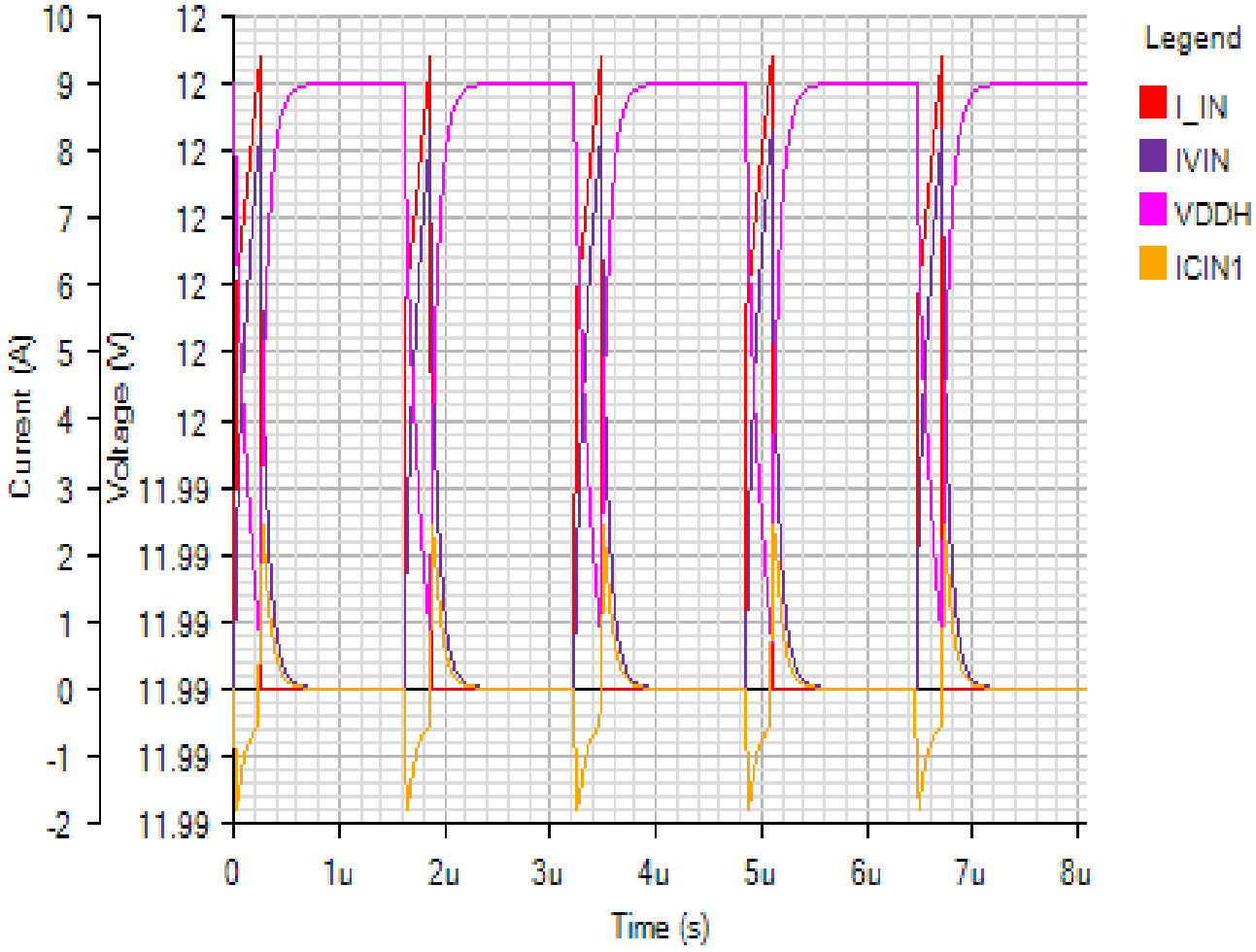

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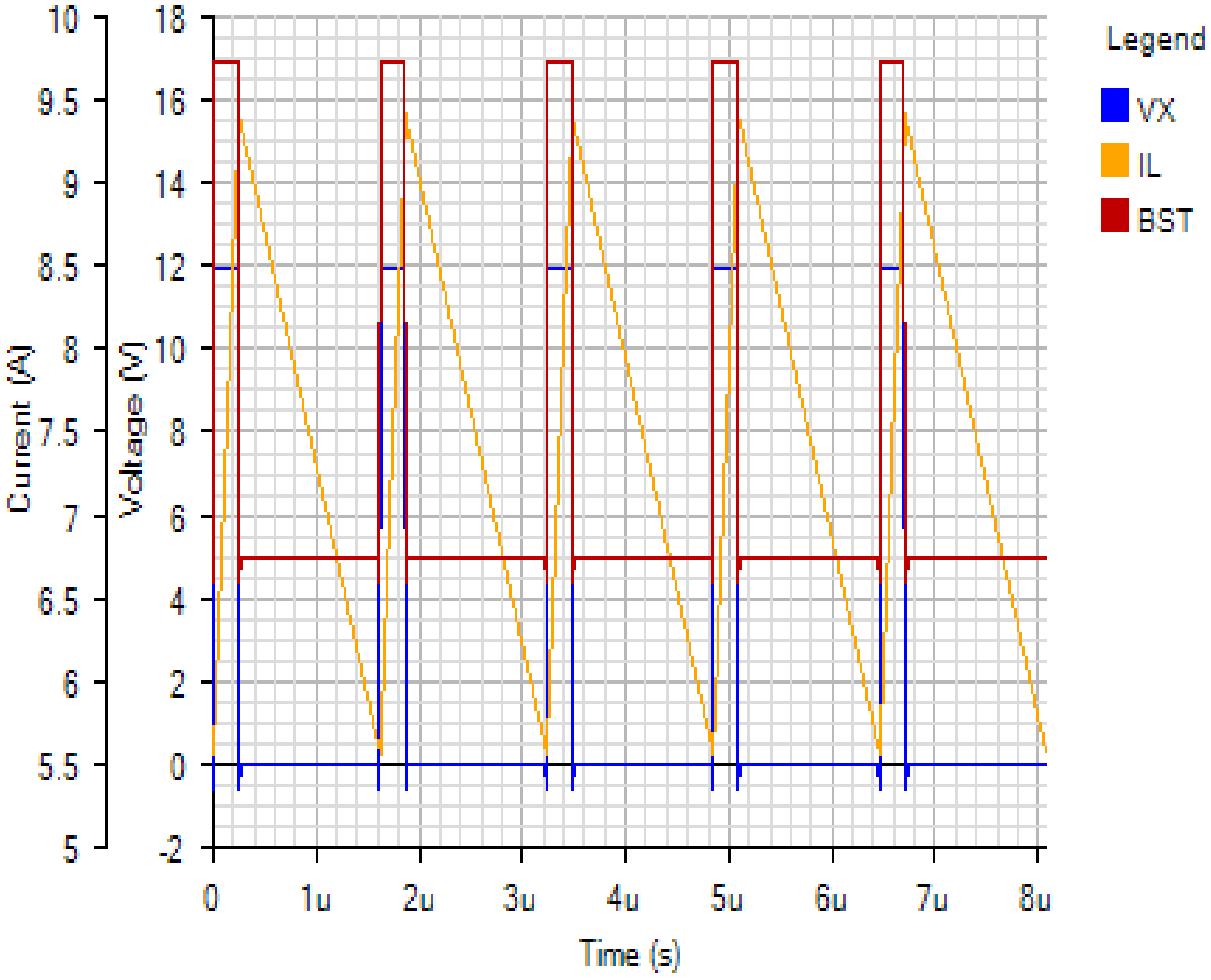
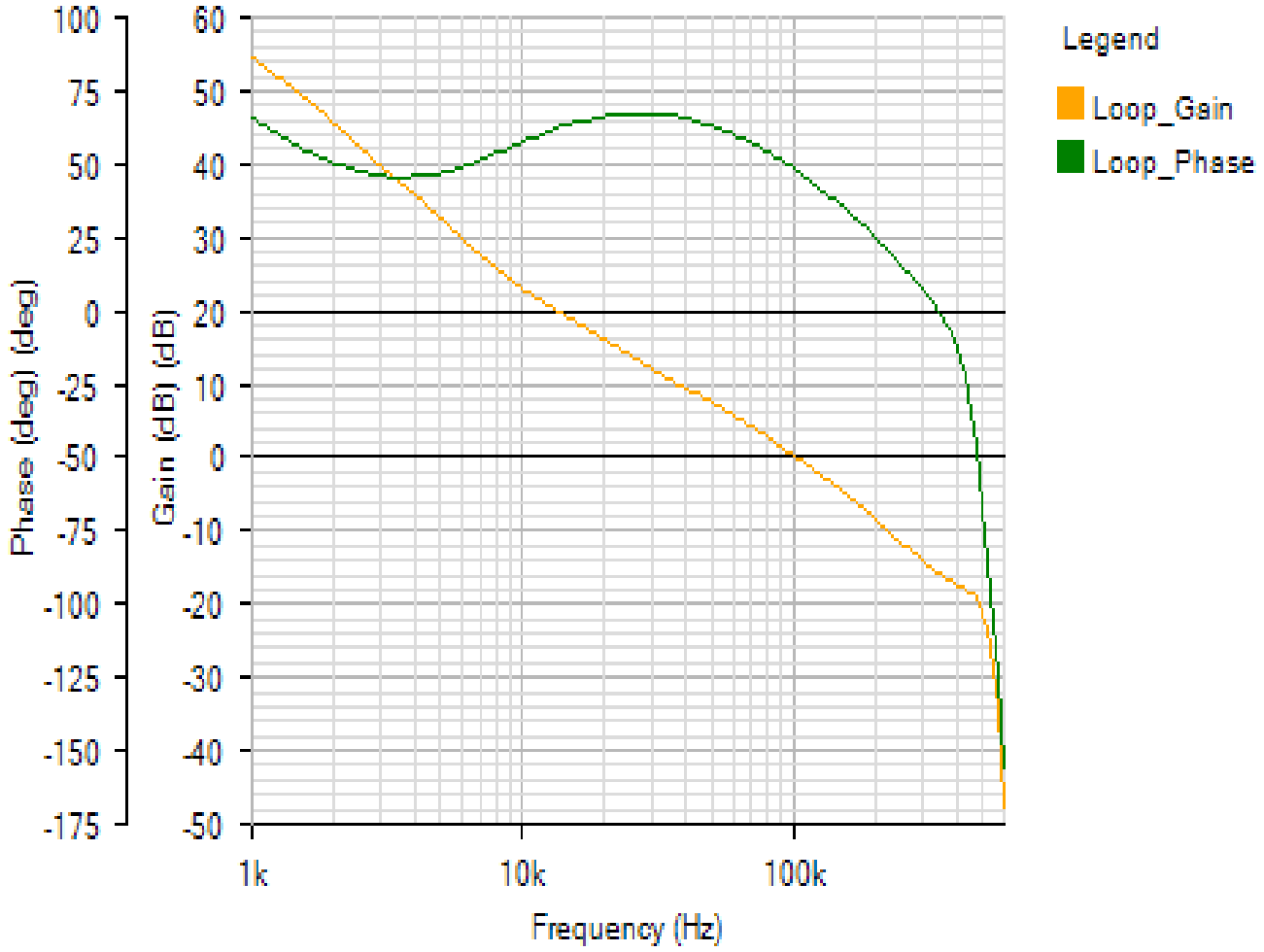
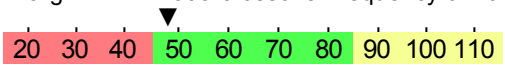


AC Loop - Tue Nov 20 2018 13:54:57

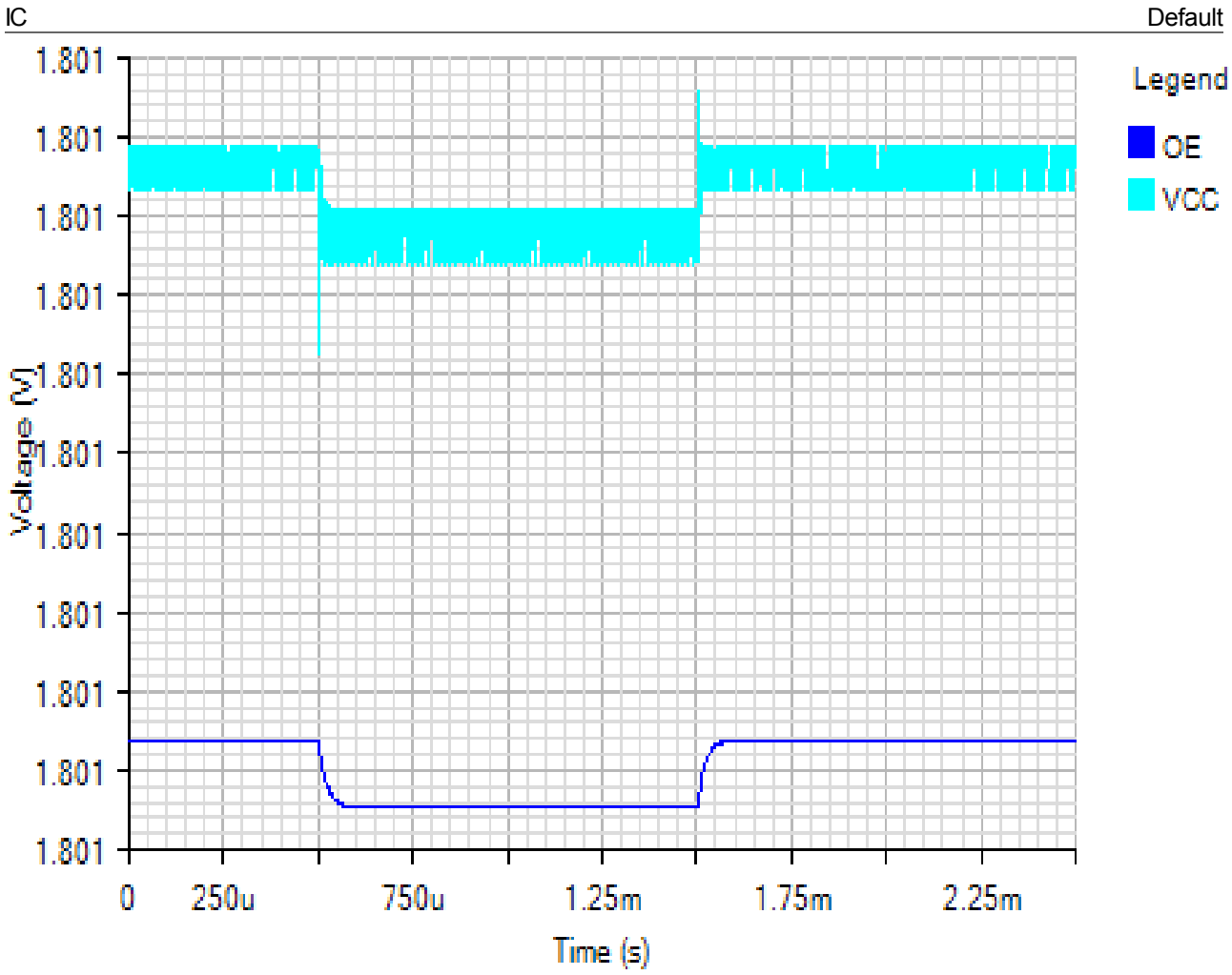
BODE Default



Phase Margin: 47.74° at a crossover frequency of 102.5kHz



Load Step - Tue Nov 20 2018 13:54:57



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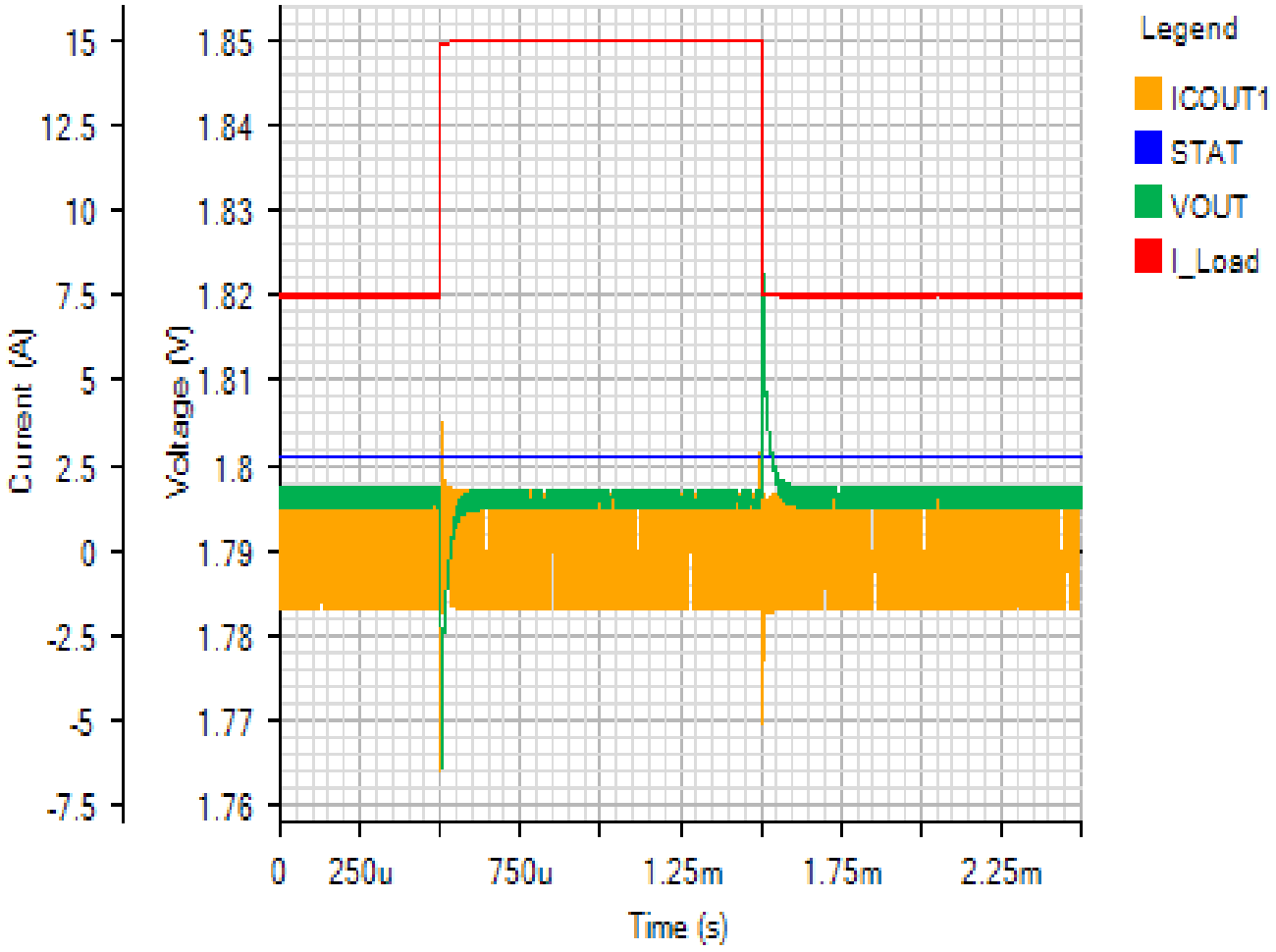

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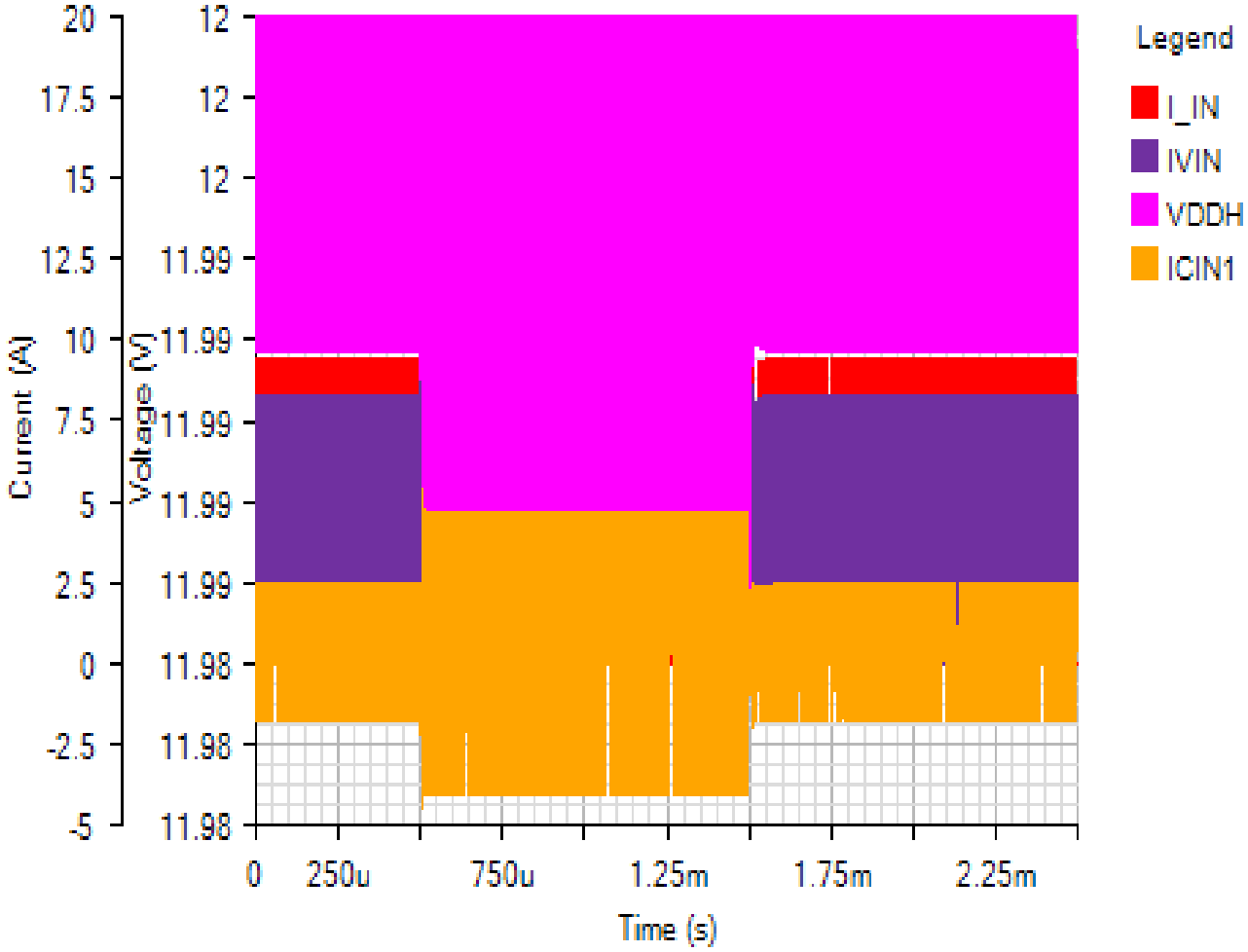

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