Initial Design

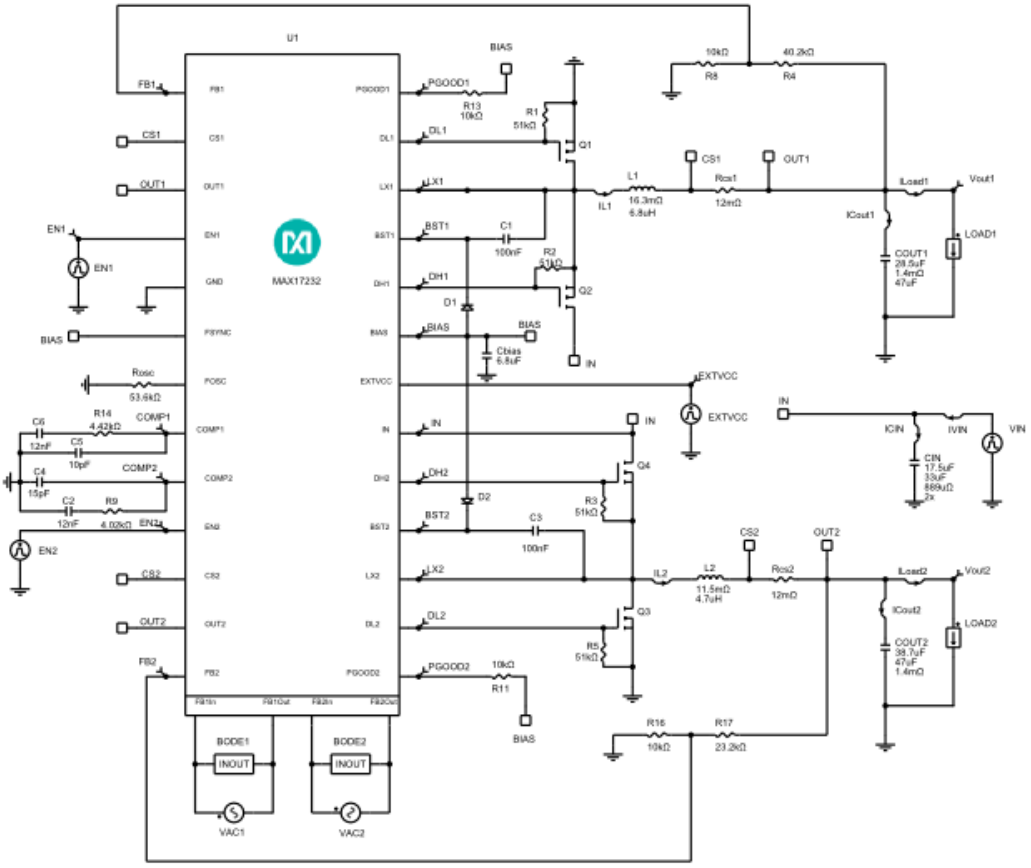
1.0

Design Requirements

Parameter	Value
Output Configuration	Adjustable Output Voltage
Minimum Input Voltage	10V
Maximum Input Voltage	14V
Nominal Input Voltage	12V
Input Voltage Ripple	0.5%
Output 1 Voltage	5V
Output 1 Current	3
Output 2 Voltage	3.3
Output 2 Current	3
Output 1 Voltage Rippple	1%
Load 1 Start Current	1.5A
Load 1 Step Current	3A
Load 1 Step Edge Rate	1A/us
Output 1 Voltage Load Step Over/Undershoot	5%
Output 2 Voltage Rippple	1%
Load 2 Step Current	3A
Load 2 Start Current	1.5A
Load 2 Step Edge Rate	1A/us
Output 2 Voltage Load Step Over/Undershoot	5%
Performance Priority	Balance Efficiency and Size
BOM Priority	yes
Mode	PWM
Switching Frequency	600000Hz

Parameter	Value
Ambient Temperature	25
Inductor 1 Current Ratio (LIR 1)	0.3
Inductor 1 Current Ratio (LIR 2)	0.3
Peak Current Limit Output 1	5.175A
Peak Current Limit Output 2	5.175A

Schematic



Notes:

- FB1in, FB1Out, FB2In, and FB2Out are fictitious pins. They are needed for AC analysis measurements on the internal Feedback loop inside the IC.
- 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.

BOM

Ref	Qty	Part Number	Manufacturer	Description

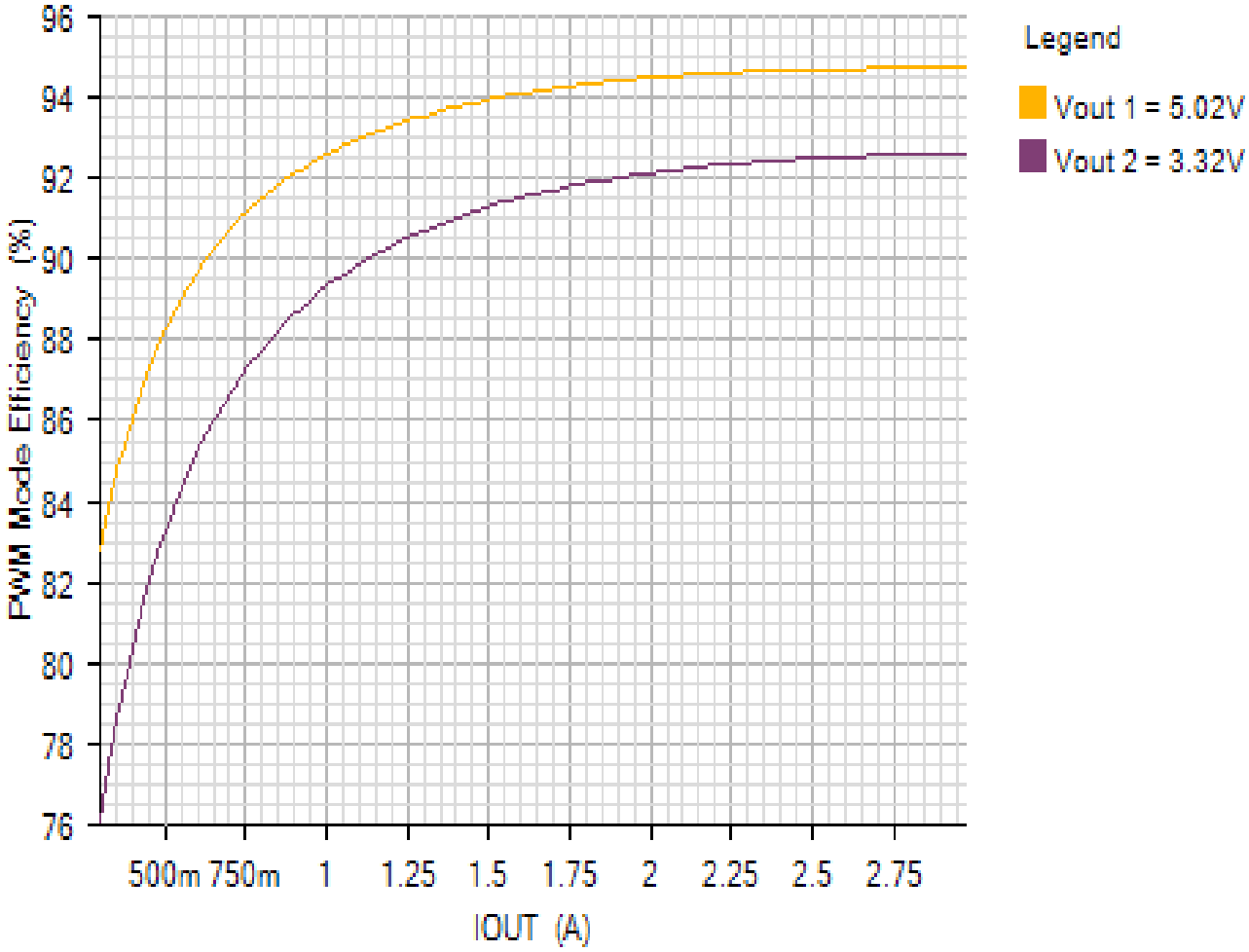
U1	1	MAX17232	Maxim Integrated	3.5V - 36V, 2.2MHz, Synchronous Dual Buck Controller with 20µA Quiescent Current
C1	1	06035C104KAT2A	AVX	Cap Ceramic 0.1uF 50V X7R 10% Pad SMD 0603 125°C T/R
C2	1	0402YC123KAT2A	AVX	Cap Ceramic 0.012uF 16V X7R 10% Pad SMD 0402 125°C T/R
C3	1	06035C104KAT2A	AVX	Cap Ceramic 0.1uF 50V X7R 10% Pad SMD 0603 125°C T/R
C4	1	C0402C150K5GACTU	KEMET Corporation	Cap Ceramic 15pF 50V C0G 10% Pad SMD 0402 125°C T/R
C5	1	06035C100KAT2A	AVX	Cap Ceramic 10pF 50V X7R 10% Pad SMD 0603 125°C T/R
C6	1	0402YC123KAT2A	AVX	Cap Ceramic 0.012uF 16V X7R 10% Pad SMD 0402 125°C T/R
CIN	2	C4532X5R1C336M250KA	TDK	Cap Ceramic 33uF 16V 1812 85C
COUT1	1	GRM32EC81A476KE19L	Murata	Cap Ceramic 47uF 10V X6S 10% SMD 1210 105C Embossed T/R
COUT2	1	GRM32EE70J476ME20L	Murata	Cap Ceramic 47uF 6.3V 1210 125C
Cbias	1	C2012X5R1E685K125AC	TDK	Cap Ceramic 6.8uF 25V X5R 10% Pad SMD 0805 85°C T/R
D1	1	MBR0520L	ON Semiconductor	Diode Schottky 20V 0.5A 2-Pin SOD-123 T/R
D2	1	1N914	ON Semiconductor	Diode Small Signal Switching 100V 0.3A 2-Pin DO-35 Bag
L1	1	MSS1048-682NLB	Coilcraft	Inductor 6.8uH 30% 14.67mOhm 5.6A Isat 6.01A Irms
L2	1	MSS1048-472NLB	Coilcraft	Inductor 4.7uH 30% 10.35mOhm 6A Isat 6.9A Irms
Q1	1	FDMS0310AS	Fairchild Semiconductor	Trans MOSFET N-CH 30VDS 5.2mOhm@4.5V 5mOhm@6V 13nC 5.8nC 1.72nF 0.655nF 150°C 22A 41W 3°C/W 1.1mm 32.5mm^2 PQFN 5x6 8L (Power 56)
Q2	1	FDMS0310AS	Fairchild Semiconductor	Trans MOSFET N-CH 30VDS 5.2mOhm@4.5V 5mOhm@6V 13nC 5.8nC 1.72nF 0.655nF 150°C 22A 41W 3°C/W 1.1mm 32.5mm^2 PQFN 5x6 8L (Power 56)
Q3	1	FDMS0310AS	Fairchild Semiconductor	Trans MOSFET N-CH 30VDS 5.2mOhm@4.5V 5mOhm@6V 13nC 5.8nC 1.72nF 0.655nF 150°C 22A 41W 3°C/W 1.1mm 32.5mm^2 PQFN 5x6 8L (Power 56)
Q4	1	FDMS0310AS	Fairchild Semiconductor	Trans MOSFET N-CH 30VDS 5.2mOhm@4.5V 5mOhm@6V 13nC 5.8nC 1.72nF 0.655nF 150°C 22A 41W 3°C/W 1.1mm 32.5mm^2 PQFN 5x6 8L (Power 56)
R1	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
				Res Thick Film 0402 51K Ohm 5%

R2	1	ERJ2GEJ513X	Panasonic	0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R3	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R4	1	ERJ3EKF4022V	Panasonic	Res Thick Film 0603 40.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R5	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R8	1	ERJ3EKF1002V	Panasonic	Res Thick Film 0603 10K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R9	1	ERJ3EKF4021V	Panasonic	Res Thick Film 0603 4.02K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R11	1	ERJ3GEYJ103V	Panasonic	Res Thick Film 0603 10K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R13	1	ERJ3GEYJ103V	Panasonic	Res Thick Film 0603 10K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R14	1	ERJ3EKF4421V	Panasonic	Res Thick Film 0603 4.42K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R16	1	ERJ3EKF1002V	Panasonic	Res Thick Film 0603 10K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
R17	1	ERJ3EKF2322V	Panasonic	Res Thick Film 0603 23.2K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R
Rcs1	1	NCSS12AFR012TRF	NIC Components	Res Metal Strip 1206 0.012 Ohm 1% 0.25W(1/4W) ±75ppm/°C Pad SMD T/R
Rcs2	1	NCSS12AFR012TRF	NIC Components	Res Metal Strip 1206 0.012 Ohm 1% 0.25W(1/4W) ±75ppm/°C Pad SMD T/R
Rosc	1	ERJ3EKF5362V	Panasonic	Res Thick Film 0603 53.6K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R

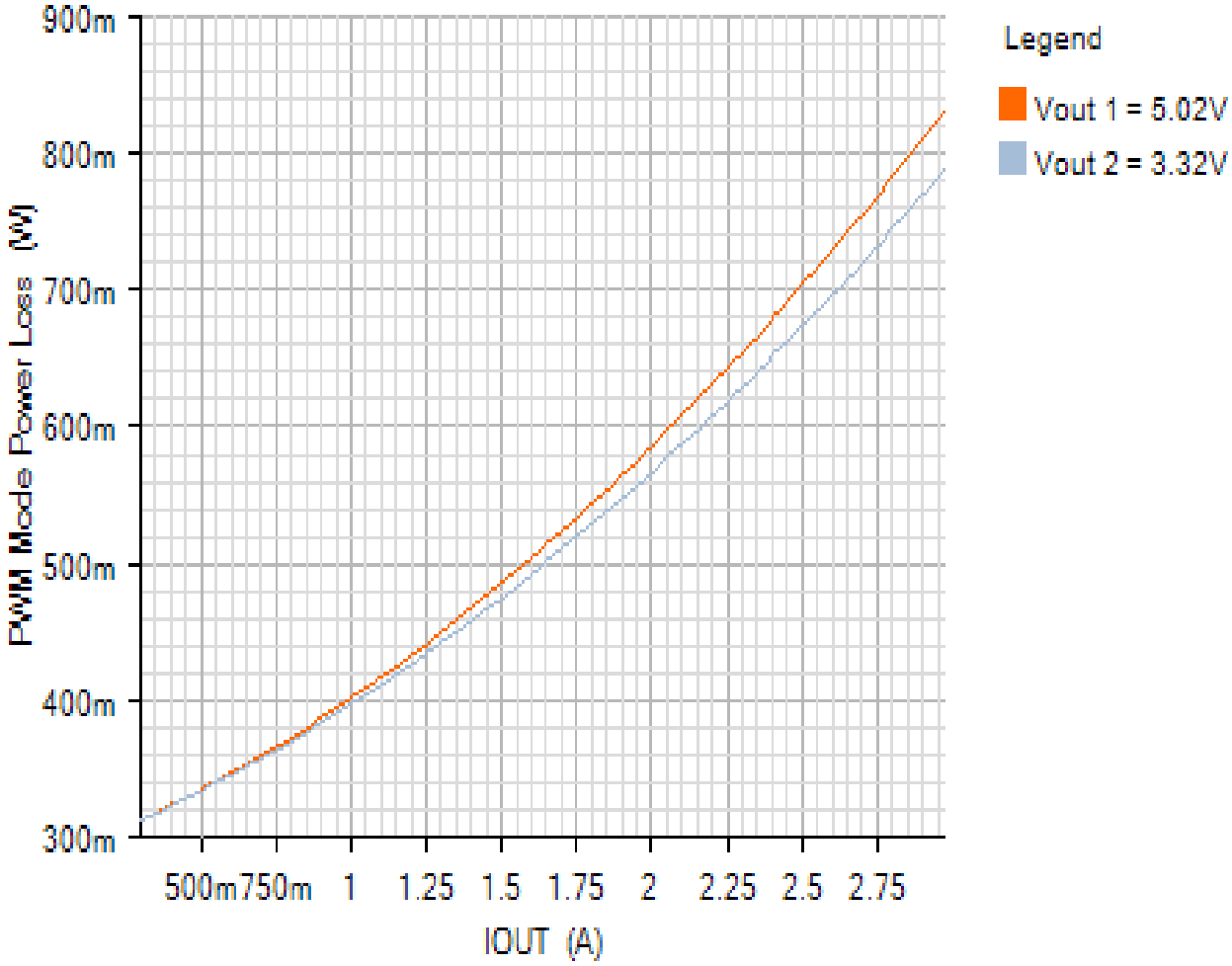
Simulation Results

Efficiency - Thu Nov 15 2018 15:20:01

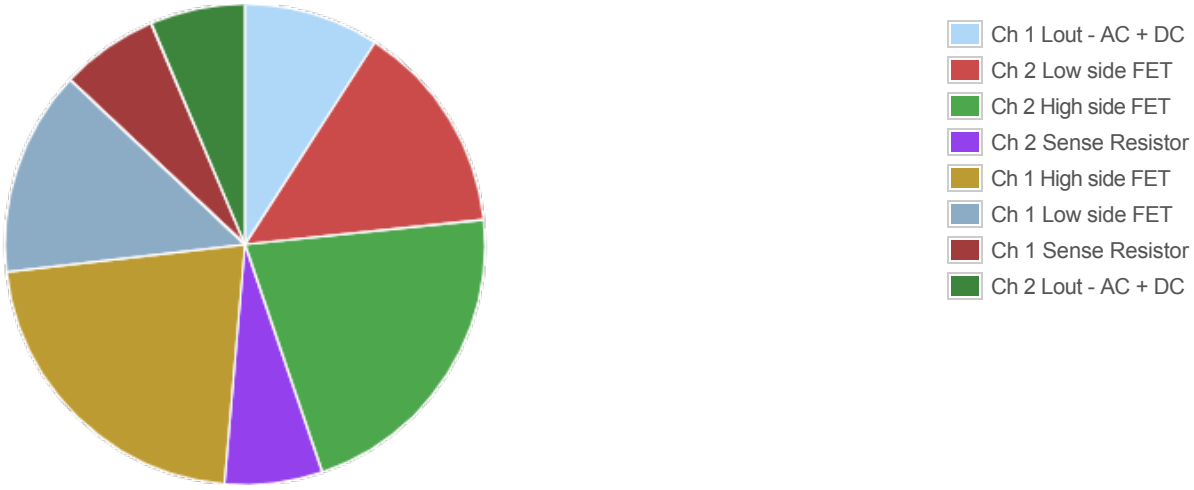
EFFICIENCY Default



POWER_LOSS Default



Losses

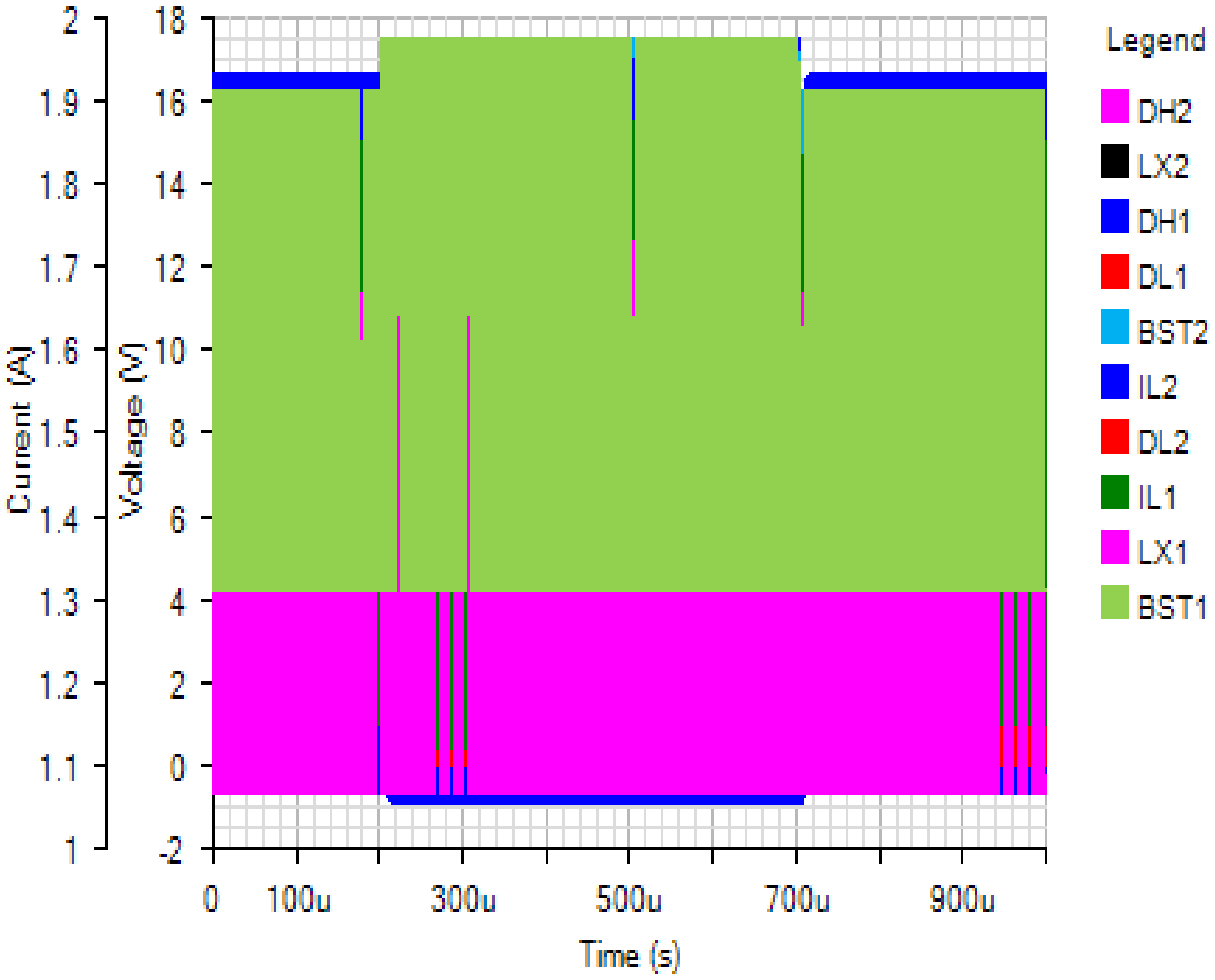


Component	Loss (W)	% of total

Component	Loss (W)	% of total
Ch 1 Lout - AC + DC	0.147555	9.1
Ch 2 Low side FET	0.230839	14.3
Ch 2 High side FET	0.3466	21.4
Ch 2 Sense Resistor	0.106789	6.6
Ch 1 High side FET	0.353242	21.8
Ch 1 Low side FET	0.224123	13.8
Ch 1 Sense Resistor	0.106572	6.6
Ch 2 Lout - AC + DC	0.103729	6.4
Total	1.619448	100

Line Transient - Thu Nov 15 2018 15:20:01

SWITCHING Default



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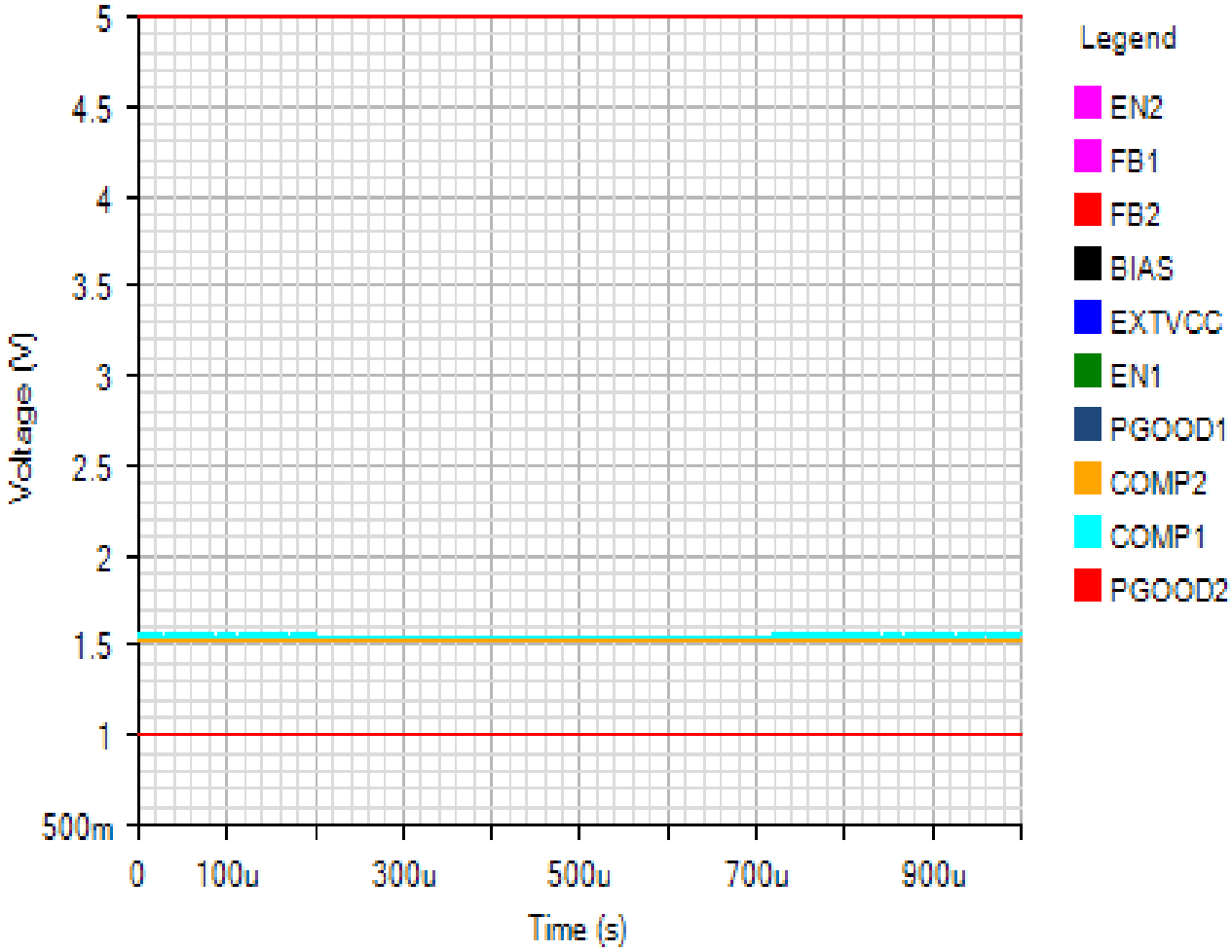

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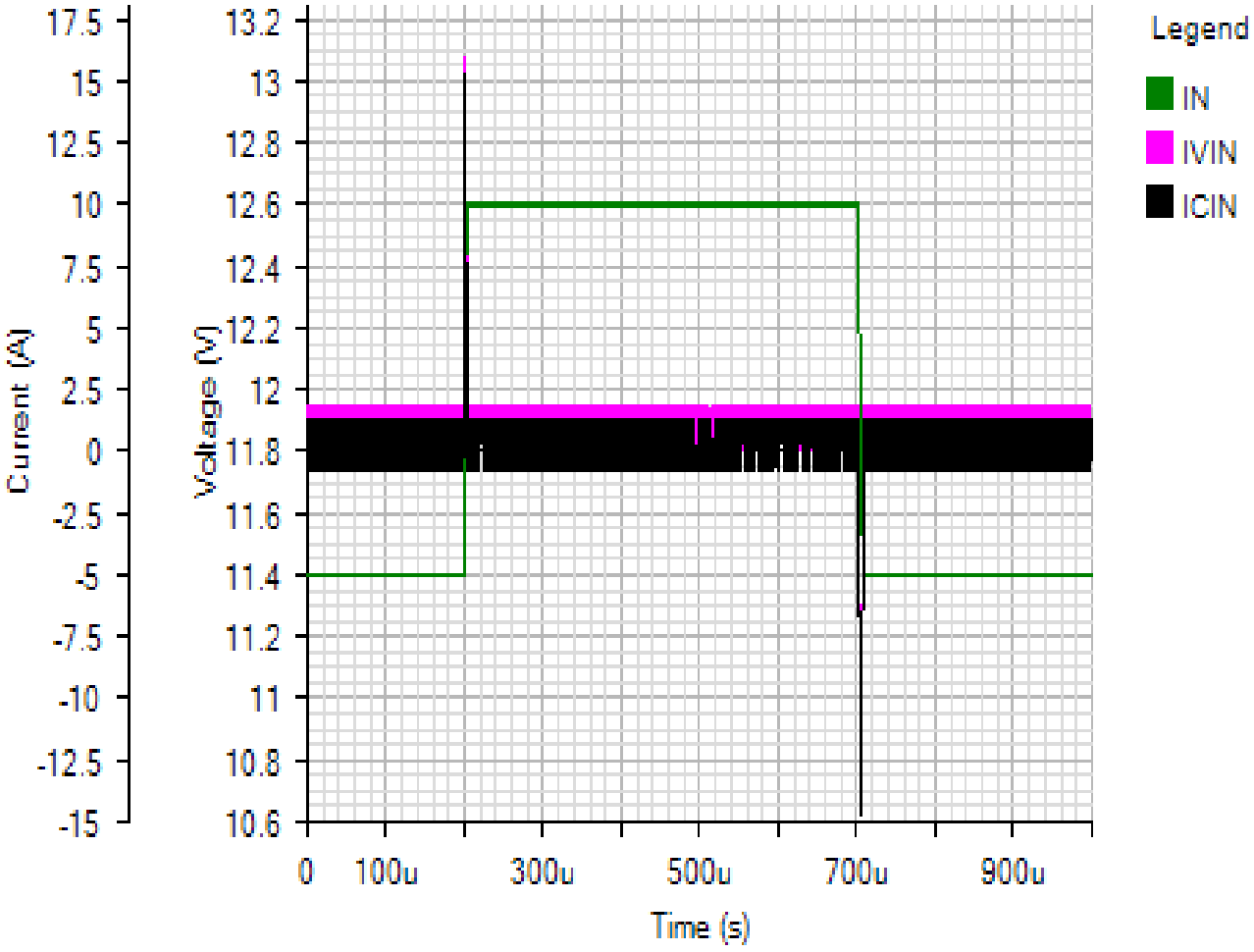

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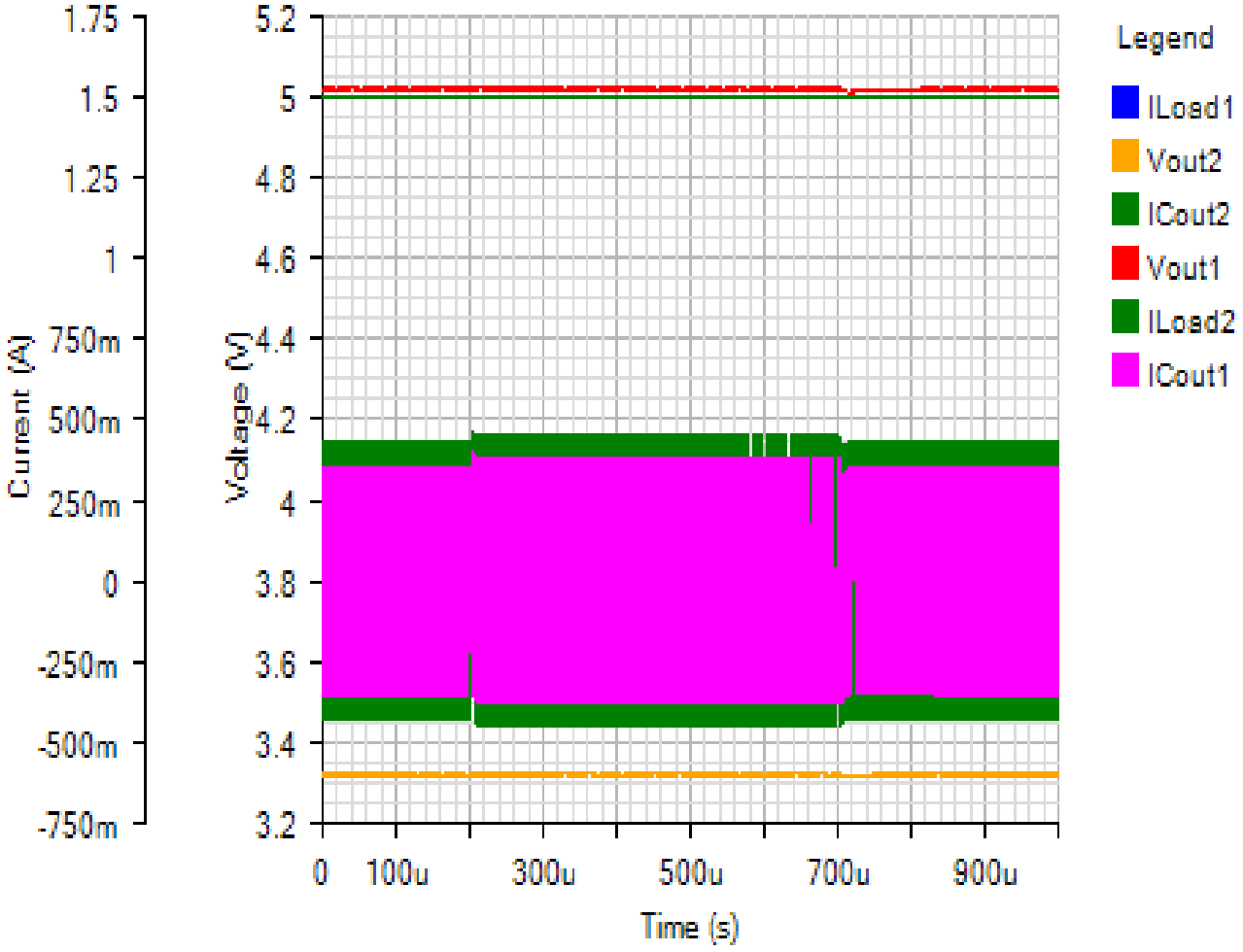
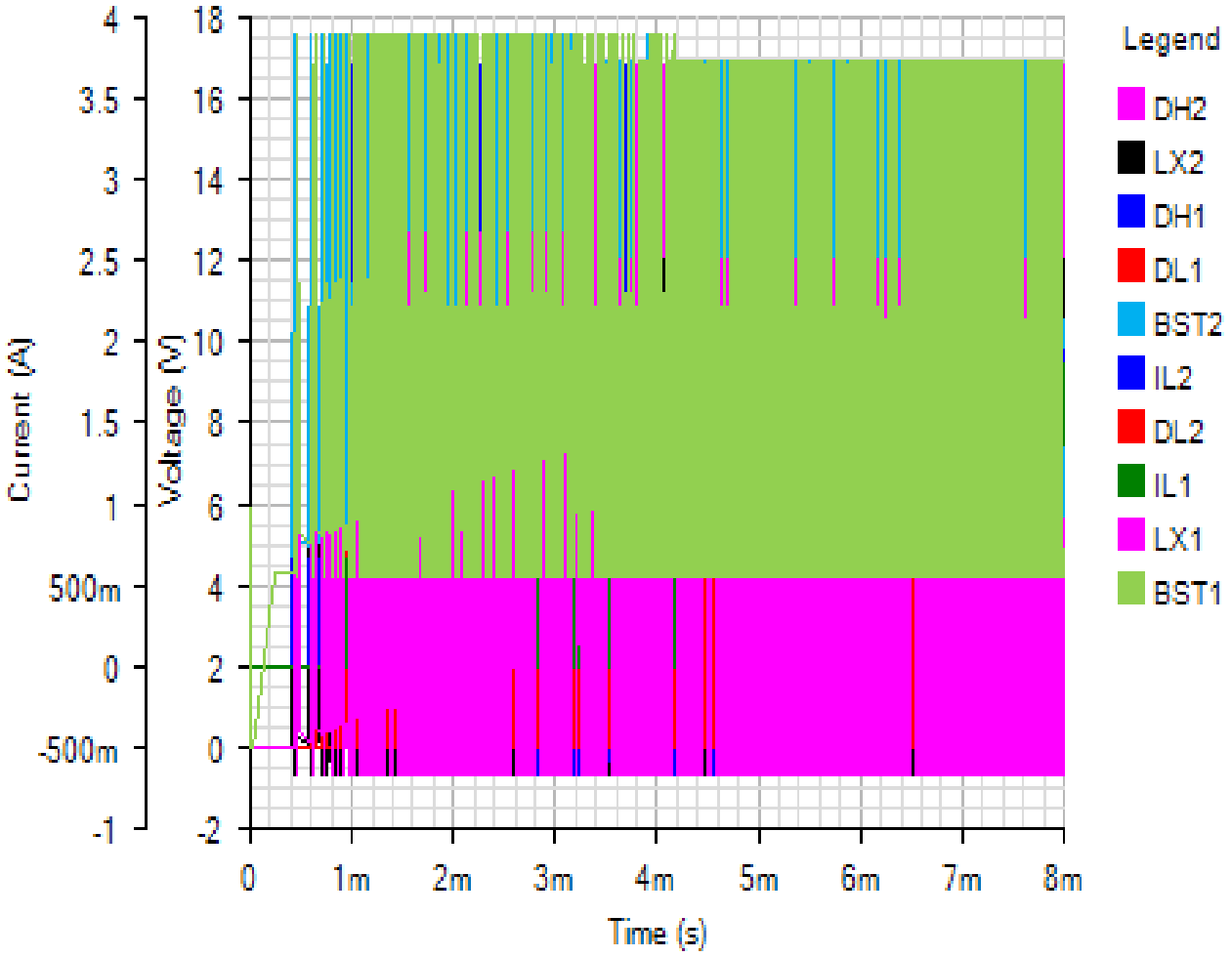


Start Up - Thu Nov 15 2018 15:20:01

SWITCHING Default



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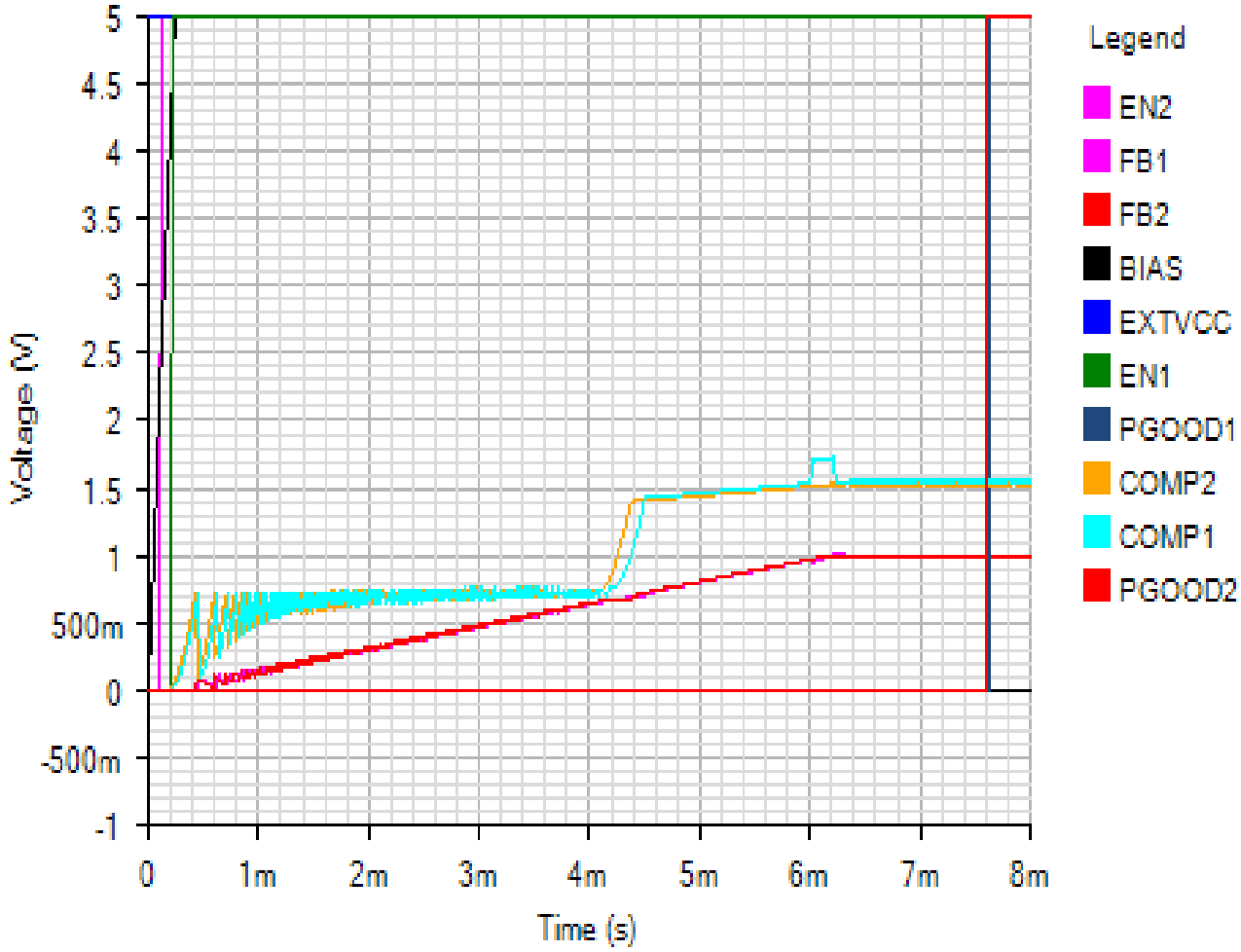

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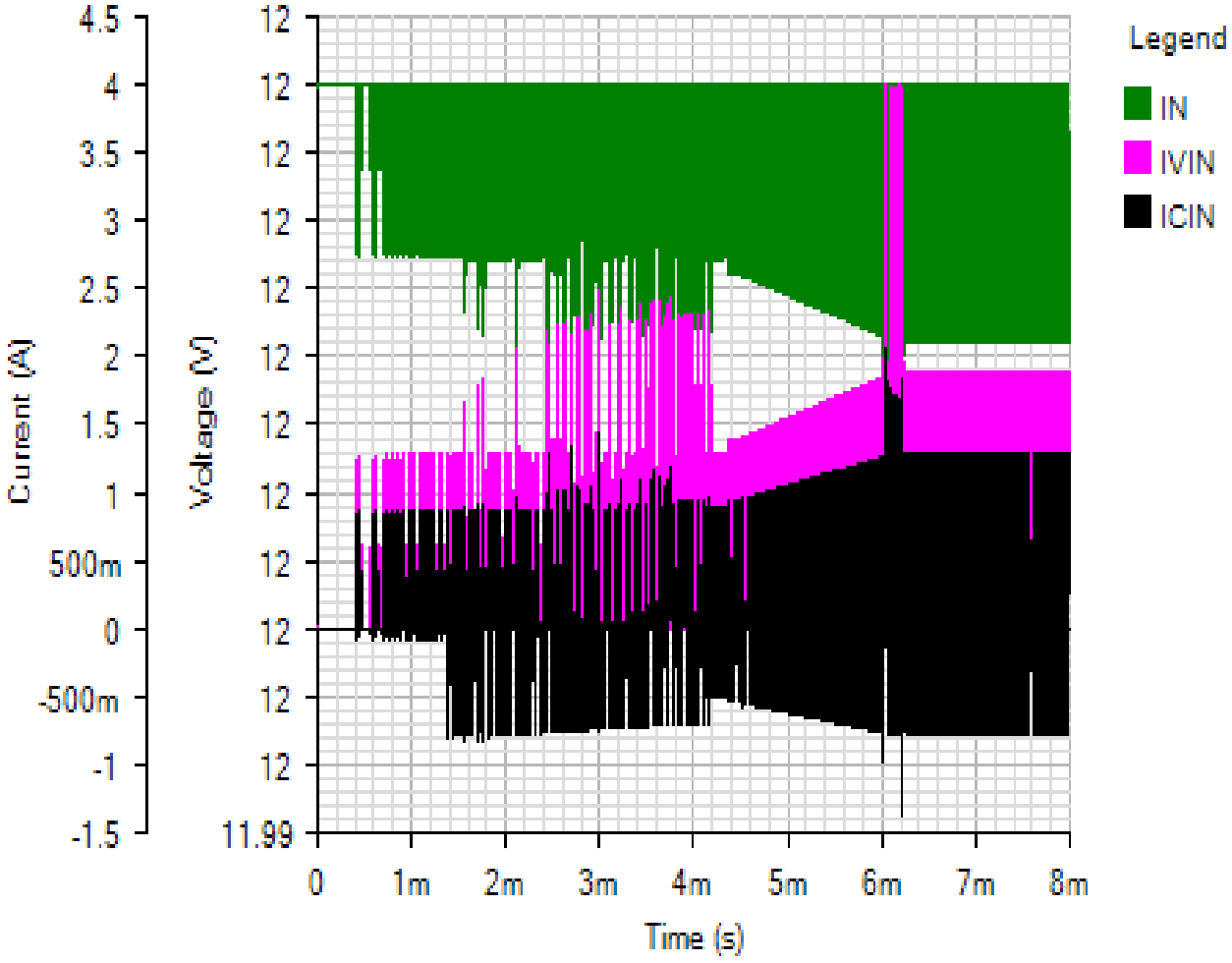

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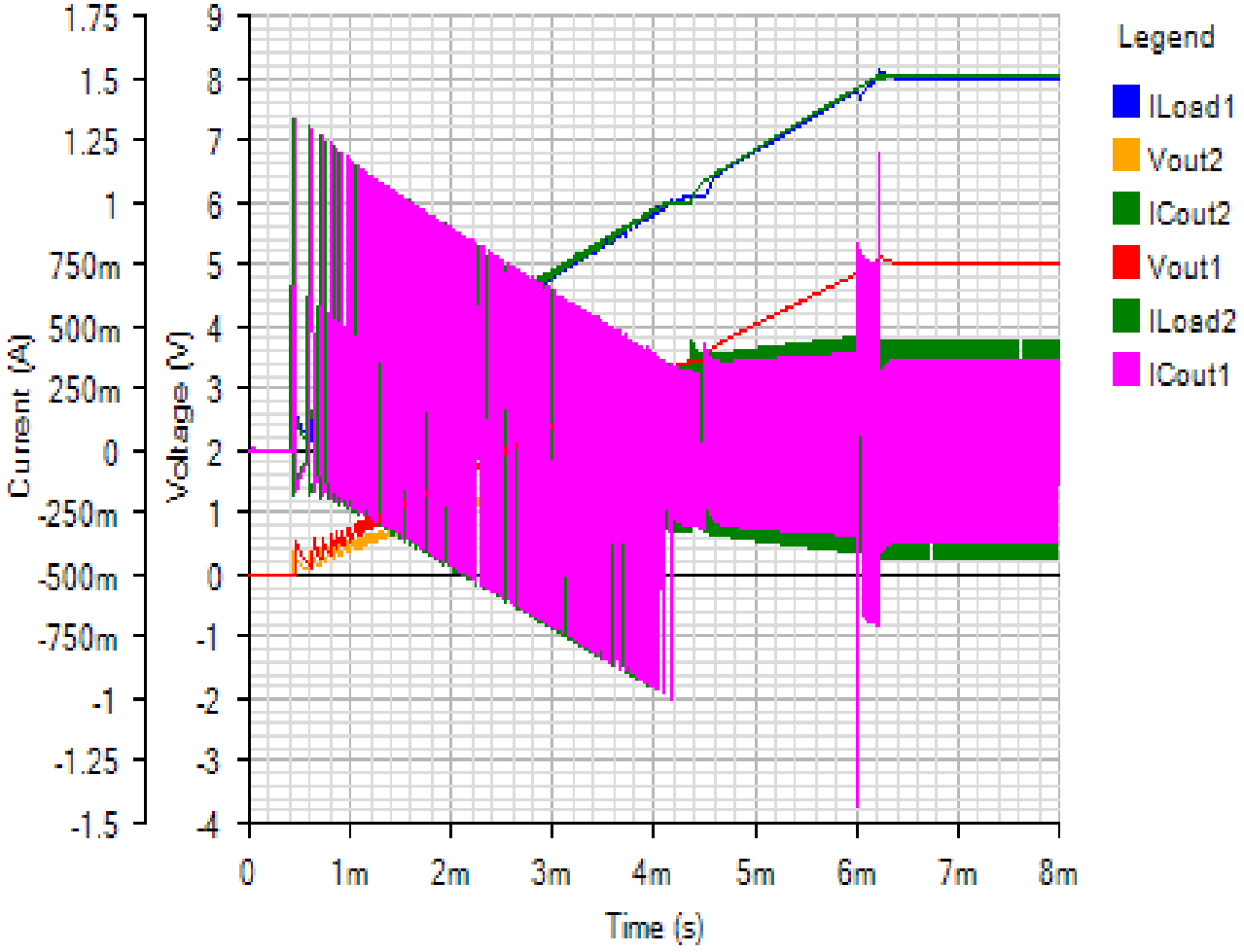
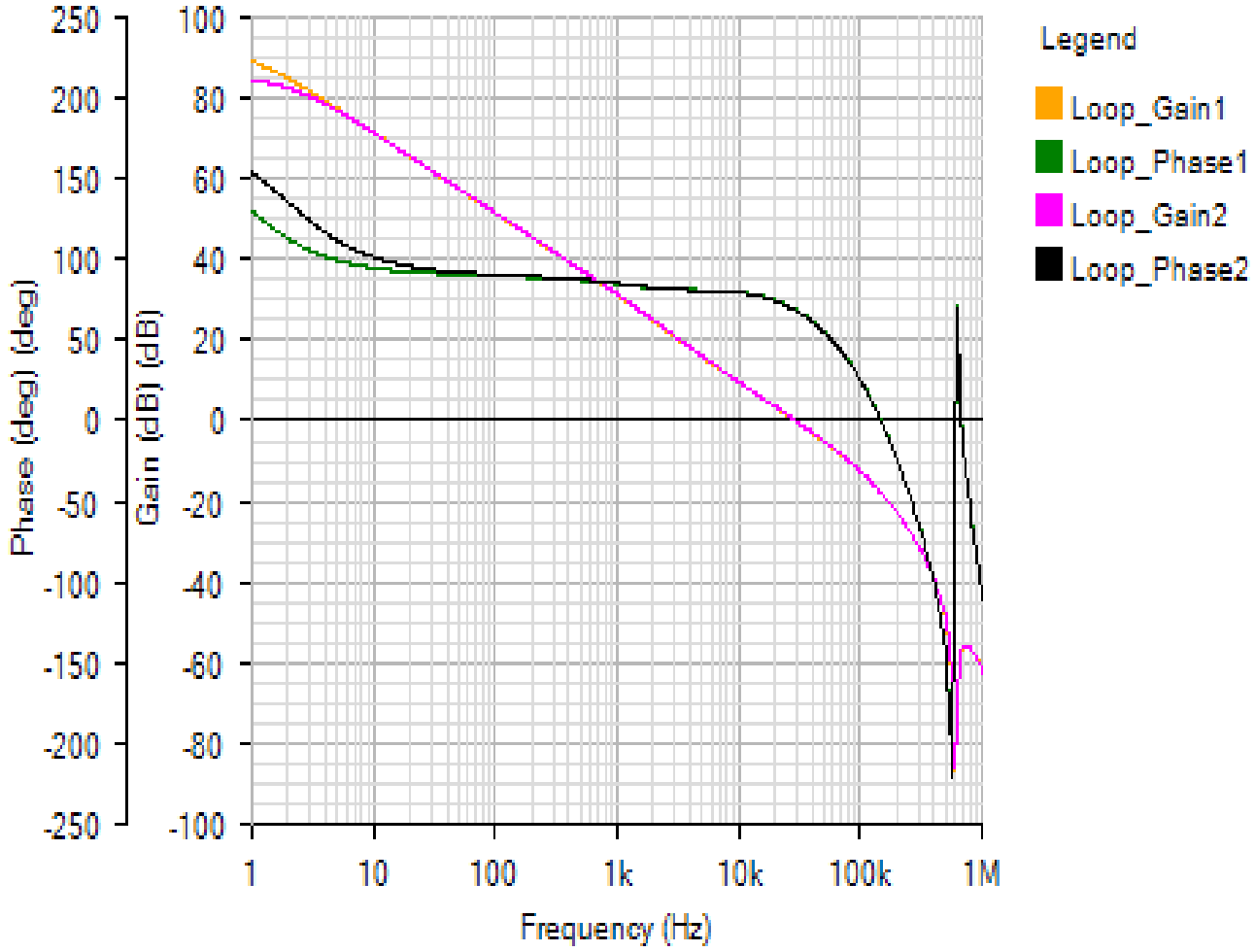
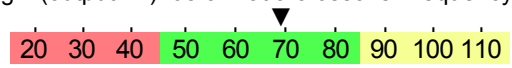


AC Loop - Thu Nov 15 2018 15:20:01

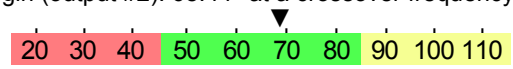
BODE Default



Phase Margin (output #1): 68.91° at a crossover frequency of 29.1kHz

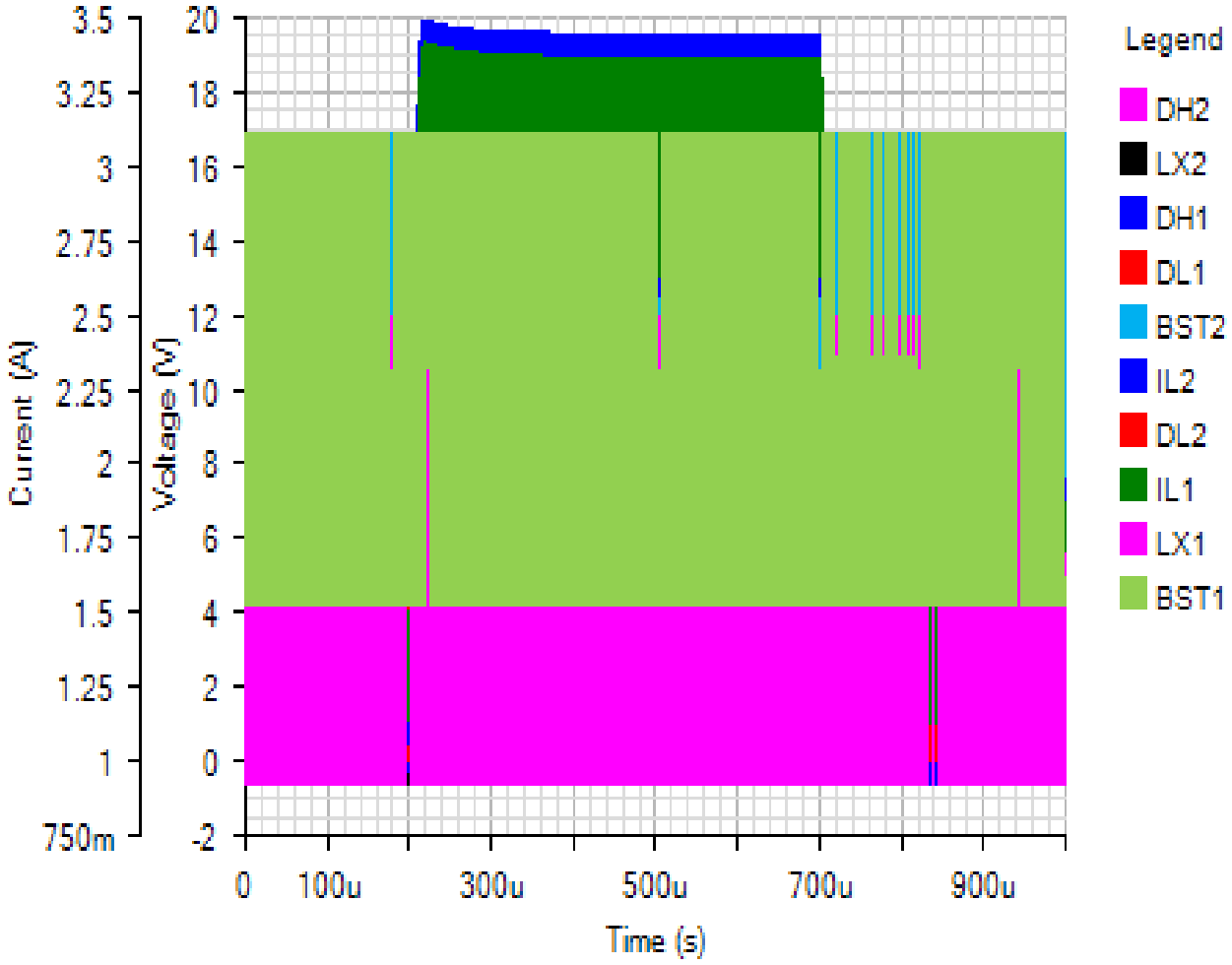


Phase Margin (output #2): 68.44° at a crossover frequency of 29.5kHz



Load Step - Thu Nov 15 2018 15:20:01

SWITCHING Default



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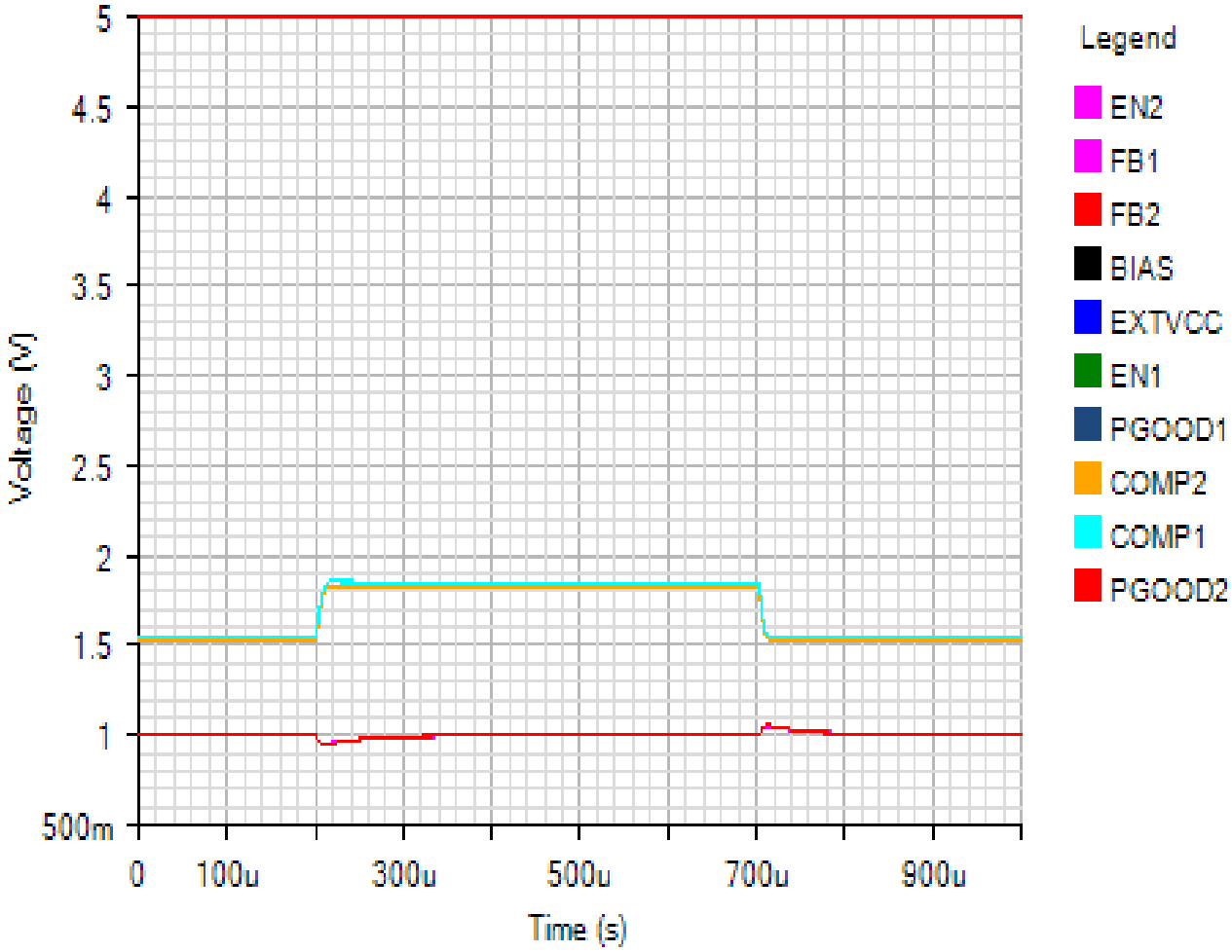

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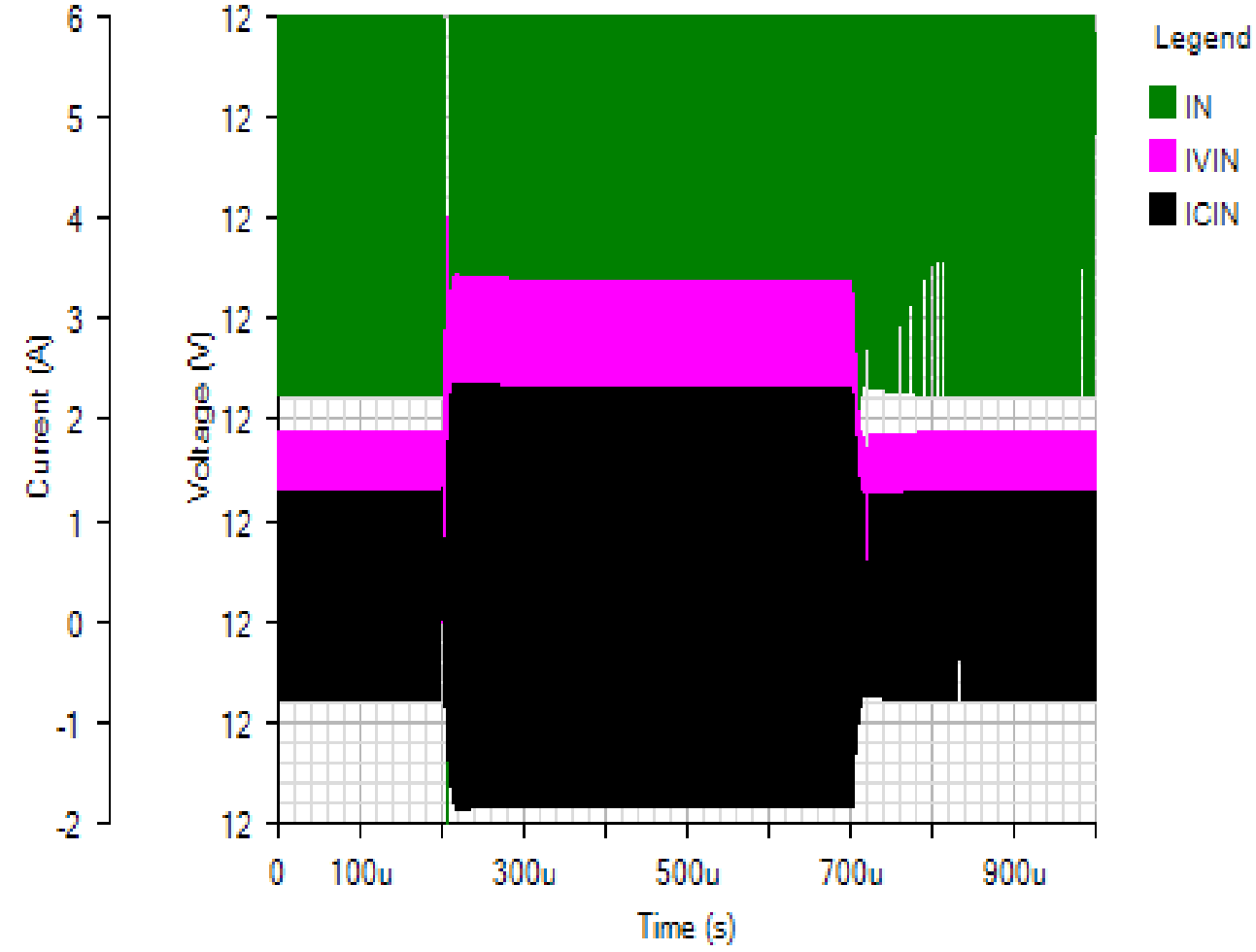
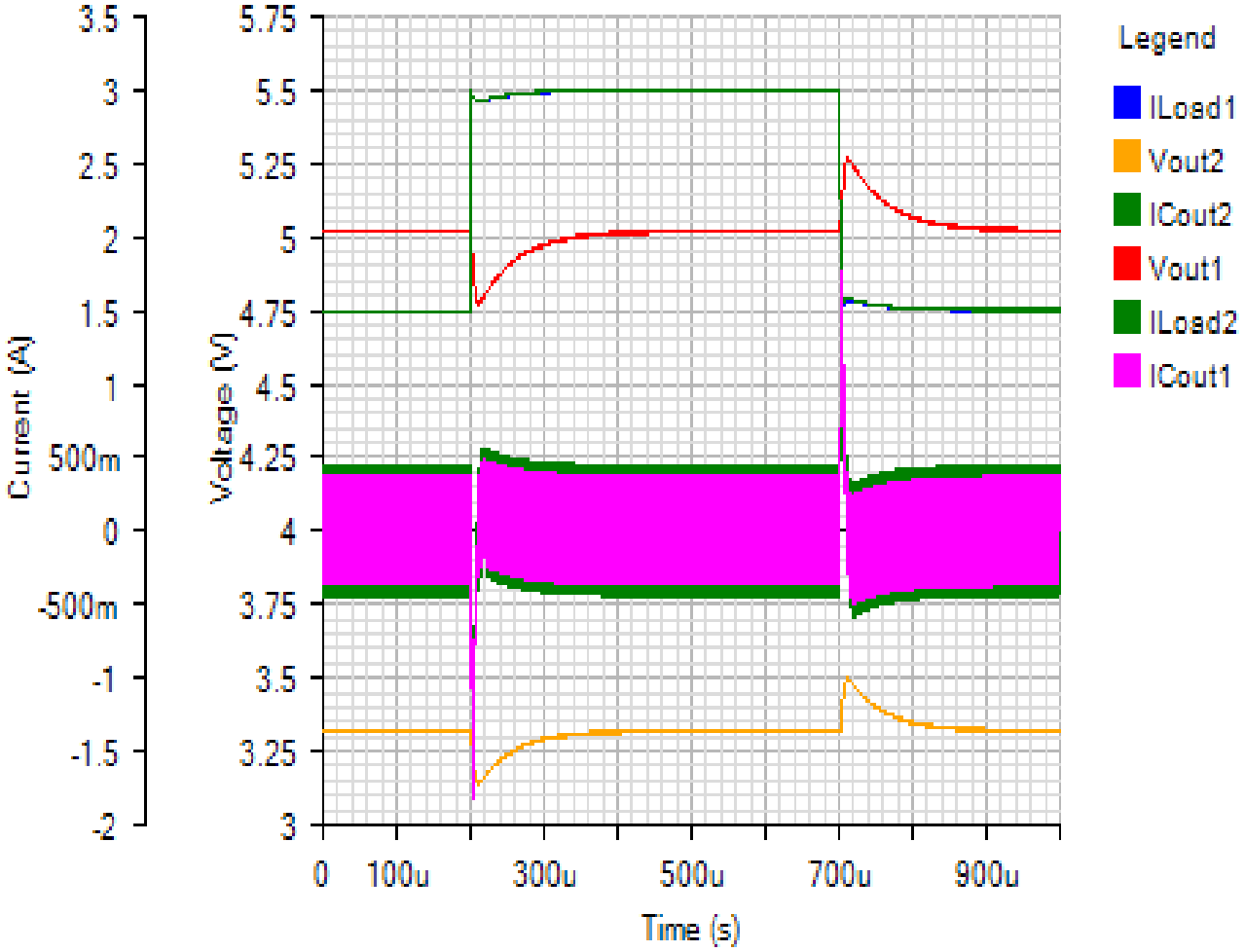
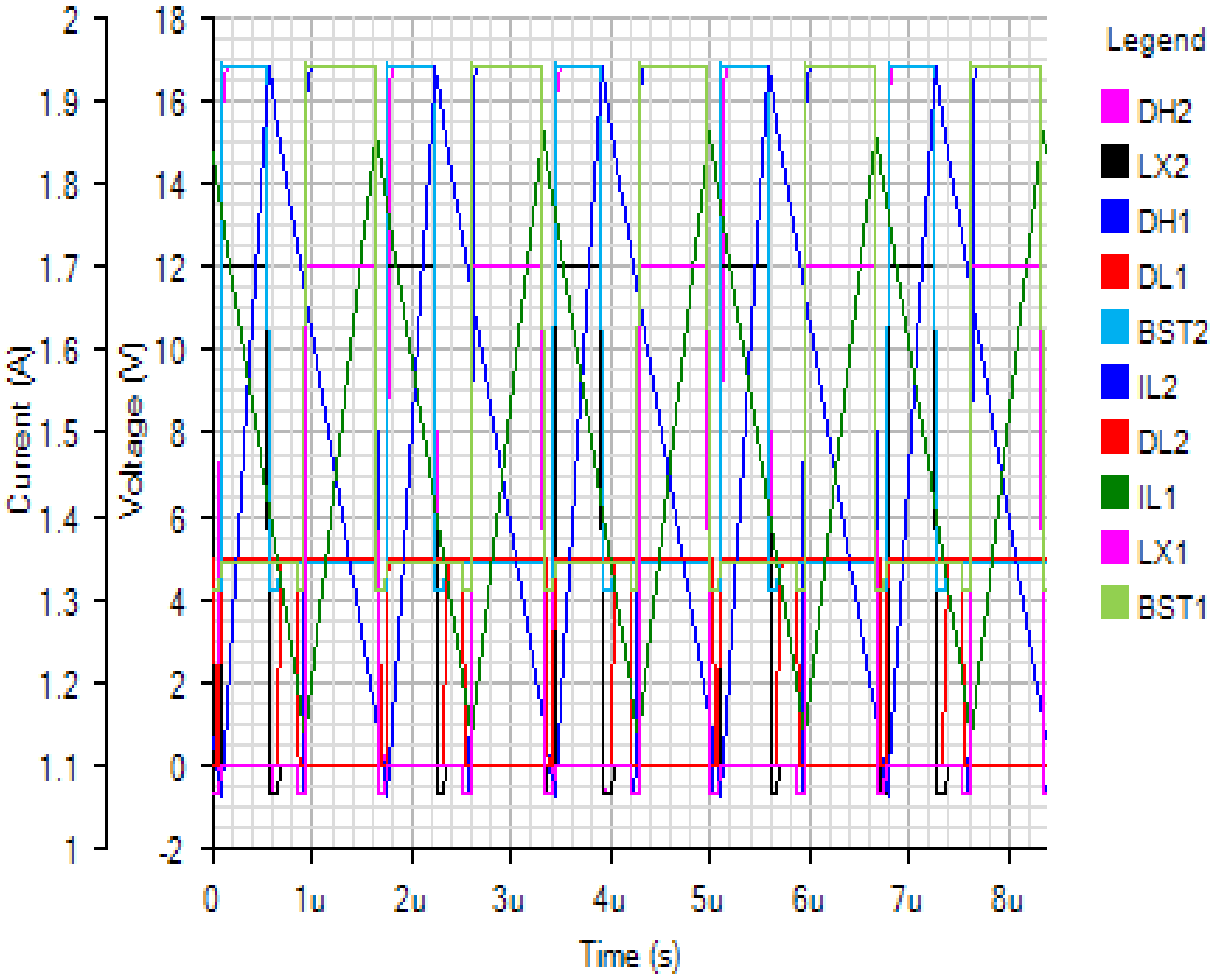


OUTPUT Default



Steady State - Thu Nov 15 2018 15:20:01

SWITCHING Default



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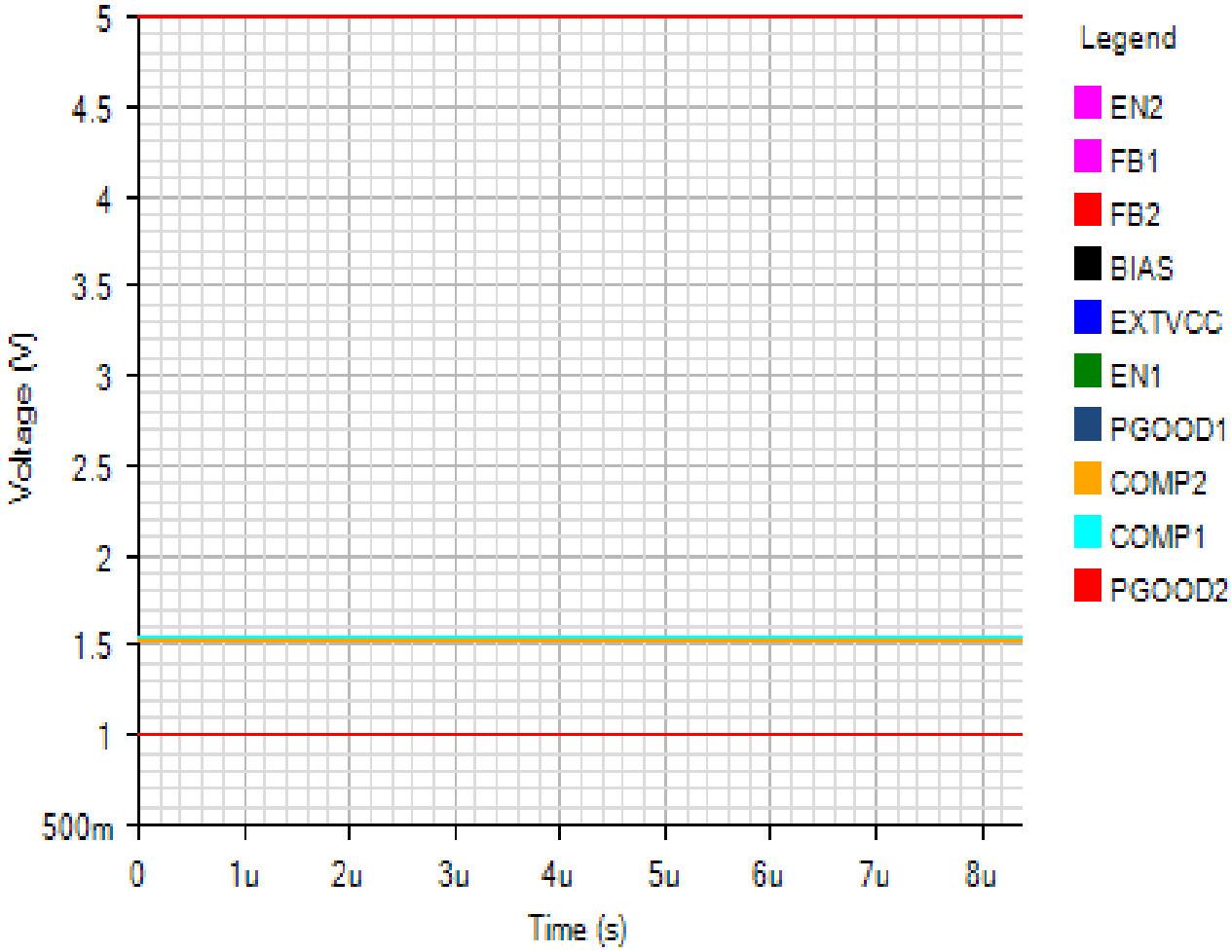

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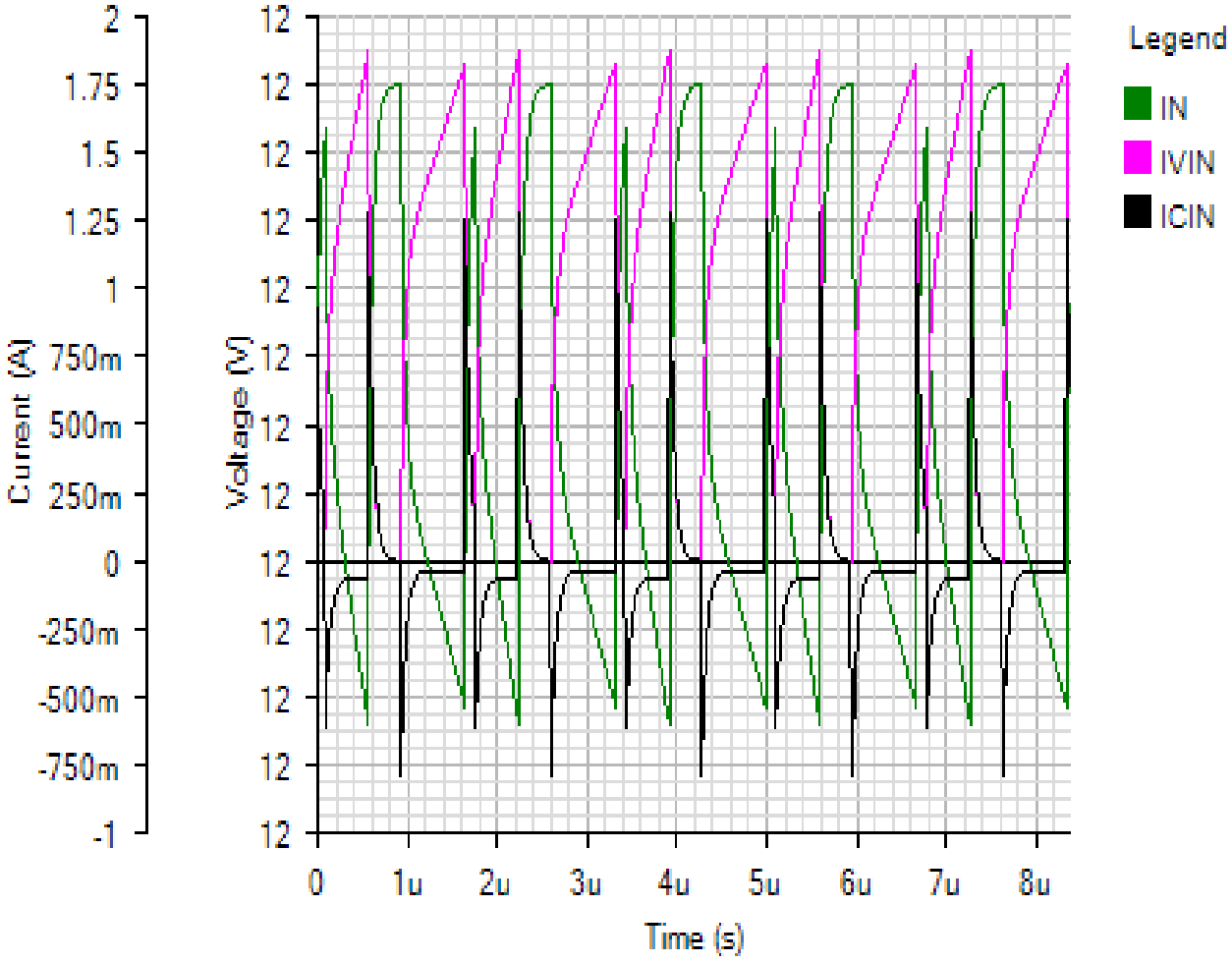

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