

Initial Design

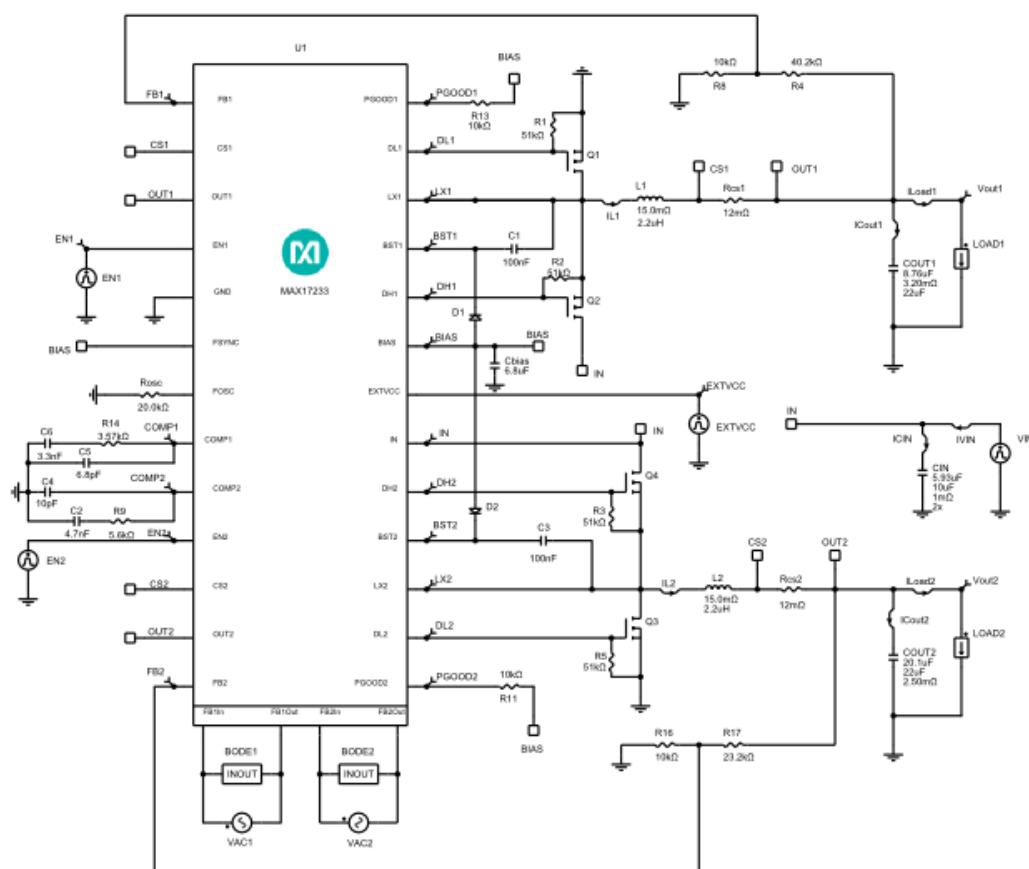
1.0

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 Ripple	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 Ripple	1%
Load 2 Start Current	1.5A
Load 2 Step Current	3A
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 Output 1	1600000Hz

Parameter	Value
Switching Frequency Output 2	Equal to Switching Frequency of Output 1
Ambient Temperature	25°C
Inductor 1 Current Ratio	0.3
Inductor 1 Current Ratio	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 analysis may fail when SKIP mode is selected.

BOM

Ref	Qty	Part Number	Manufacturer	Description
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U1	1	MAX17233	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	CGA3E2X7R1H472K080AA	TDK	Cap Ceramic 0.0047uF 50V X7R 10% Pad SMD 0603 125°C Automotive T/R
C3	1	06035C104KAT2A	AVX	Cap Ceramic 0.1uF 50V X7R 10% Pad SMD 0603 125°C T/R
C4	1	06035C100KAT2A	AVX	Cap Ceramic 10pF 50V X7R 10% Pad SMD 0603 125°C T/R
C5	1	C0603C689K5GACTU	KEMET Corporation	Cap Ceramic 6.8pF 50V C0G 10% Pad SMD 0603 125°C T/R
C6	1	04025C332KAT2A	AVX	Cap Ceramic 0.0033uF 50V X7R 10% Pad SMD 0402 125°C T/R
CIN	2	C1206C106K4PAC	Kemet	Cap Ceramic 10uF 16V X5R 10% SMD 1206 85C Bulk
COUT1	1	GRM21BR61A226ME51L	Murata	Cap Ceramic 22uF 10V X5R 20% SMD 0805 85C Embossed T/R
COUT2	1	GRM32DR61C226KE18L	Murata	Cap Ceramic 22uF 16V X5R 10% SMD 1210 85C Embossed T/R
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	VLP8040T-2R2N	TDK	Inductor Power Shielded Wirewound 2.2uH 30% 100KHz Ferrite 6.2A 15mOhm DCR Embossed Carrier T/R
L2	1	VLP8040T-2R2N	TDK	Inductor Power Shielded Wirewound 2.2uH 30% 100KHz Ferrite 6.2A 15mOhm DCR Embossed Carrier T/R
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	SiR474DP	Vishay	Trans MOSFET N-CH 30VDS 12mOhm@4.5V 11.3mOhm@6V 8nC 3.5nC 0.99nF 0.205nF 150°C 20A 29.8W 4.2°C/W 1.12mm

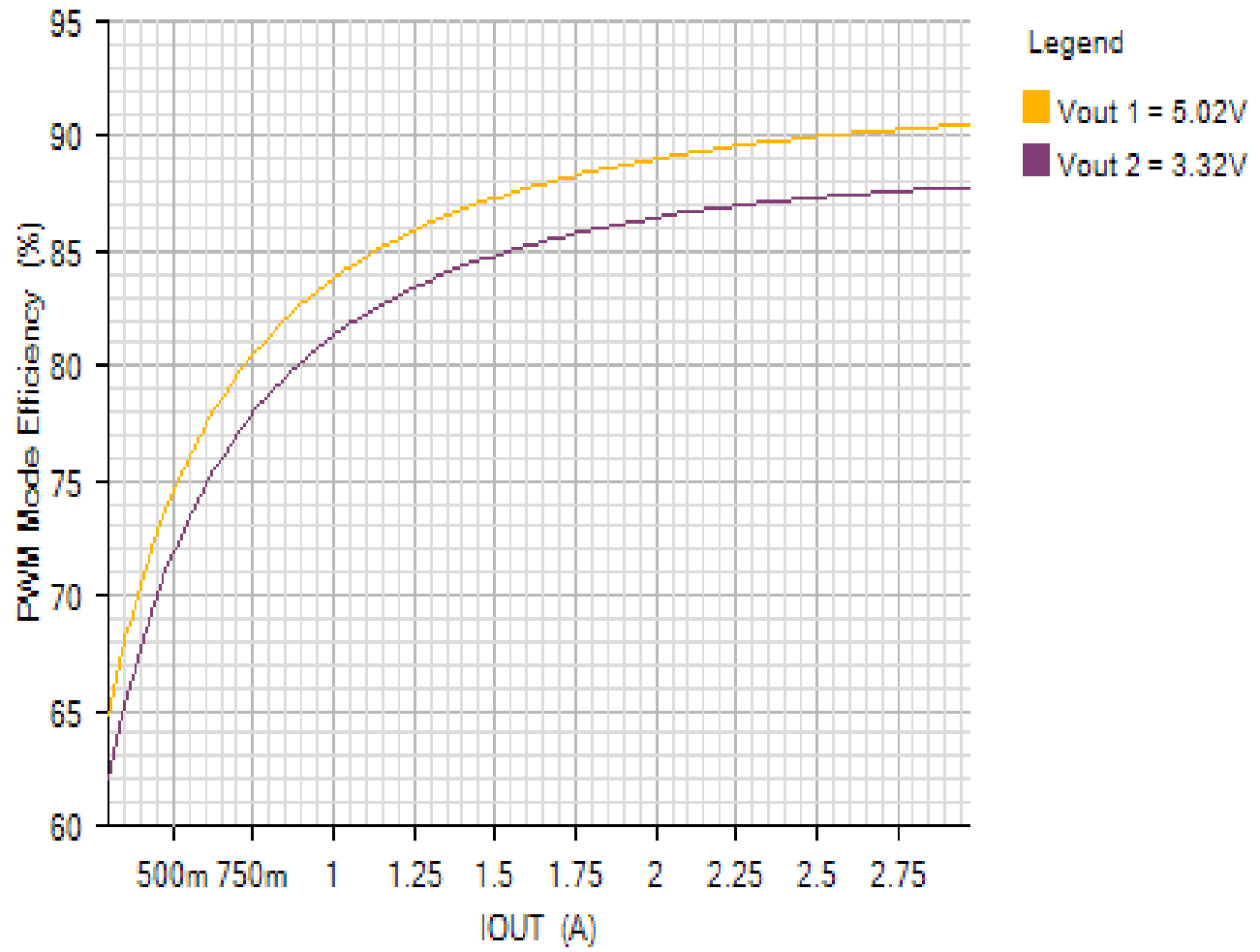
				32.9mm ² PowerPAK SO-8
R1	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R2	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R
R3	1	ERJ2GEJ513X	Panasonic	Res Thick Film 0402 51K Ohm 5% 0.1W(1/10W) ±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	ERJ2RKF5601X	Panasonic	Res Thick Film 0402 5.6K 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	ERJ2RKF3571X	Panasonic	Res Thick Film 0402 3.57K 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	ERJ3EKF2002V	Panasonic	Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R

Simulation Results

Efficiency - Thu Nov 15 2018 15:35:08

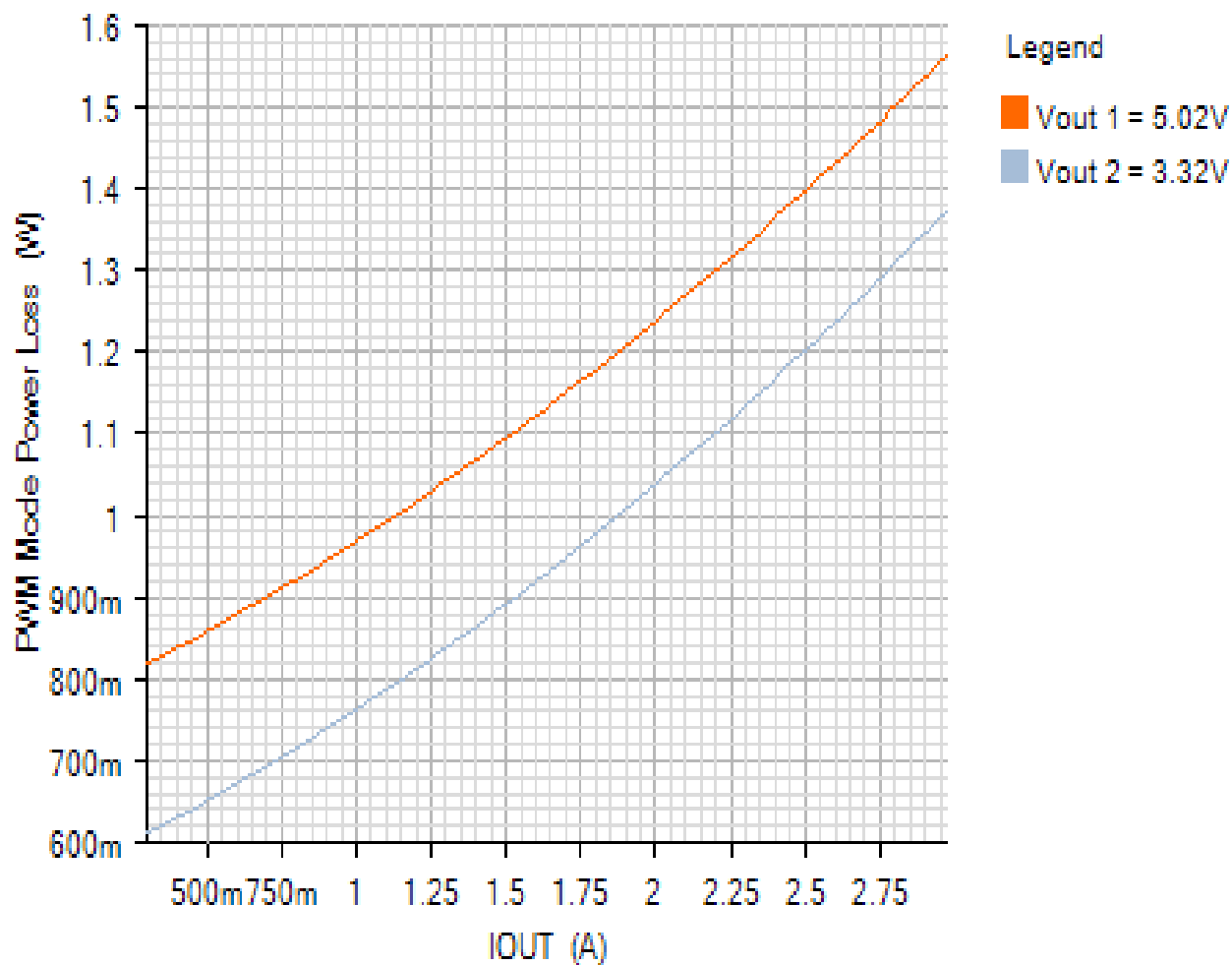
EFFICIENCY

Default

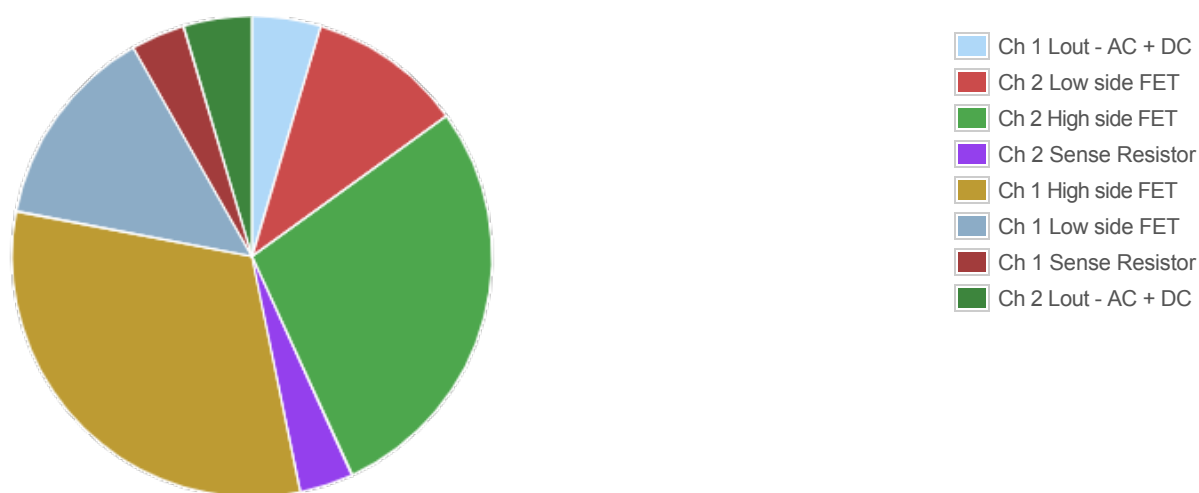


POWER_LOSS

Default



Losses



Component

Loss (W)

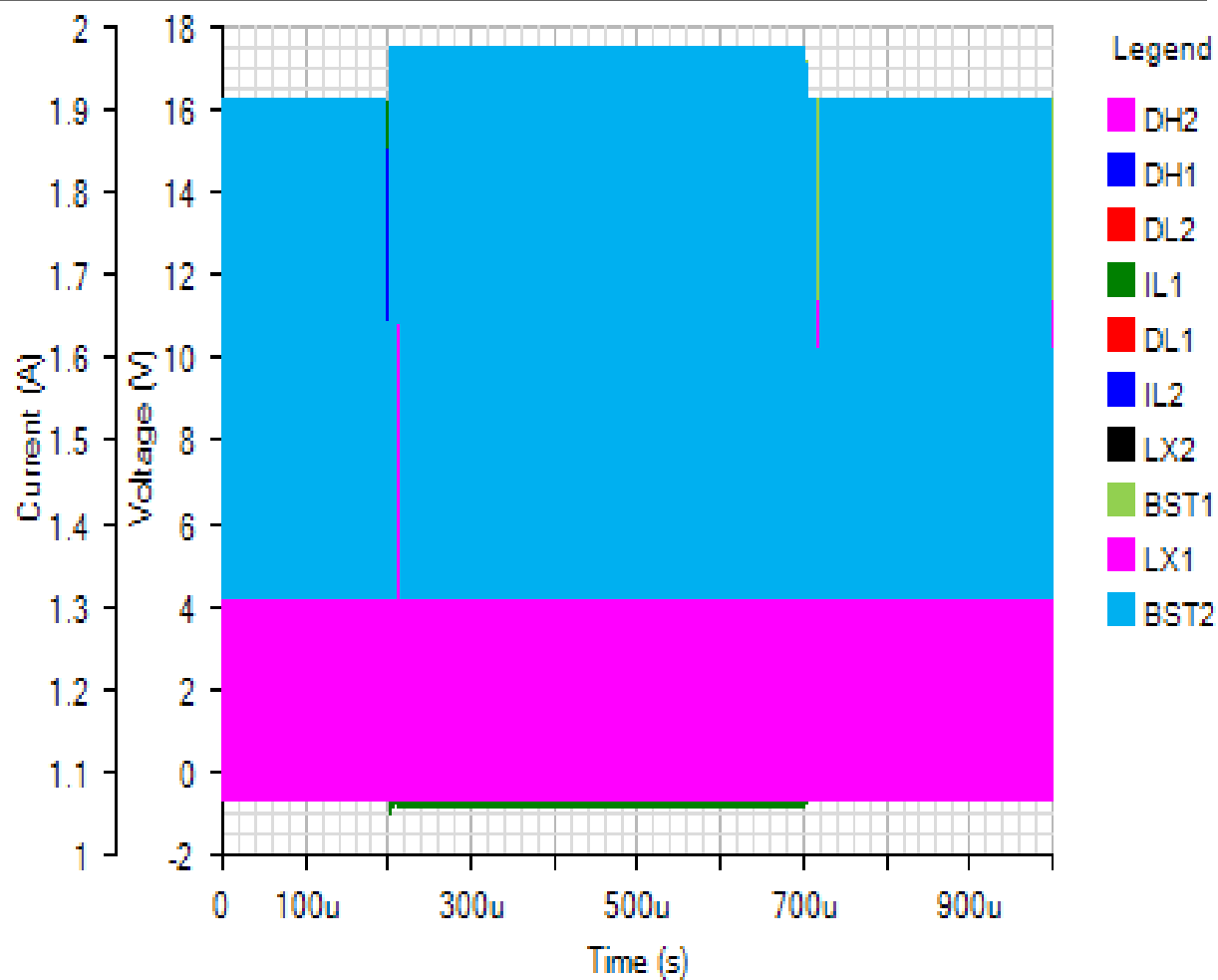
% of total

Component	Loss (W)	% of total
Ch 1 Lout - AC + DC	0.135788	4.6
Ch 2 Low side FET	0.306482	10.4
Ch 2 High side FET	0.824862	28.1
Ch 2 Sense Resistor	0.106519	3.6
Ch 1 High side FET	0.917381	31.2
Ch 1 Low side FET	0.403716	13.7
Ch 1 Sense Resistor	0.106734	3.6
Ch 2 Lout - AC + DC	0.13551	4.6
Total	2.936992	100

Line Transient - Thu Nov 15 2018 15:35:08

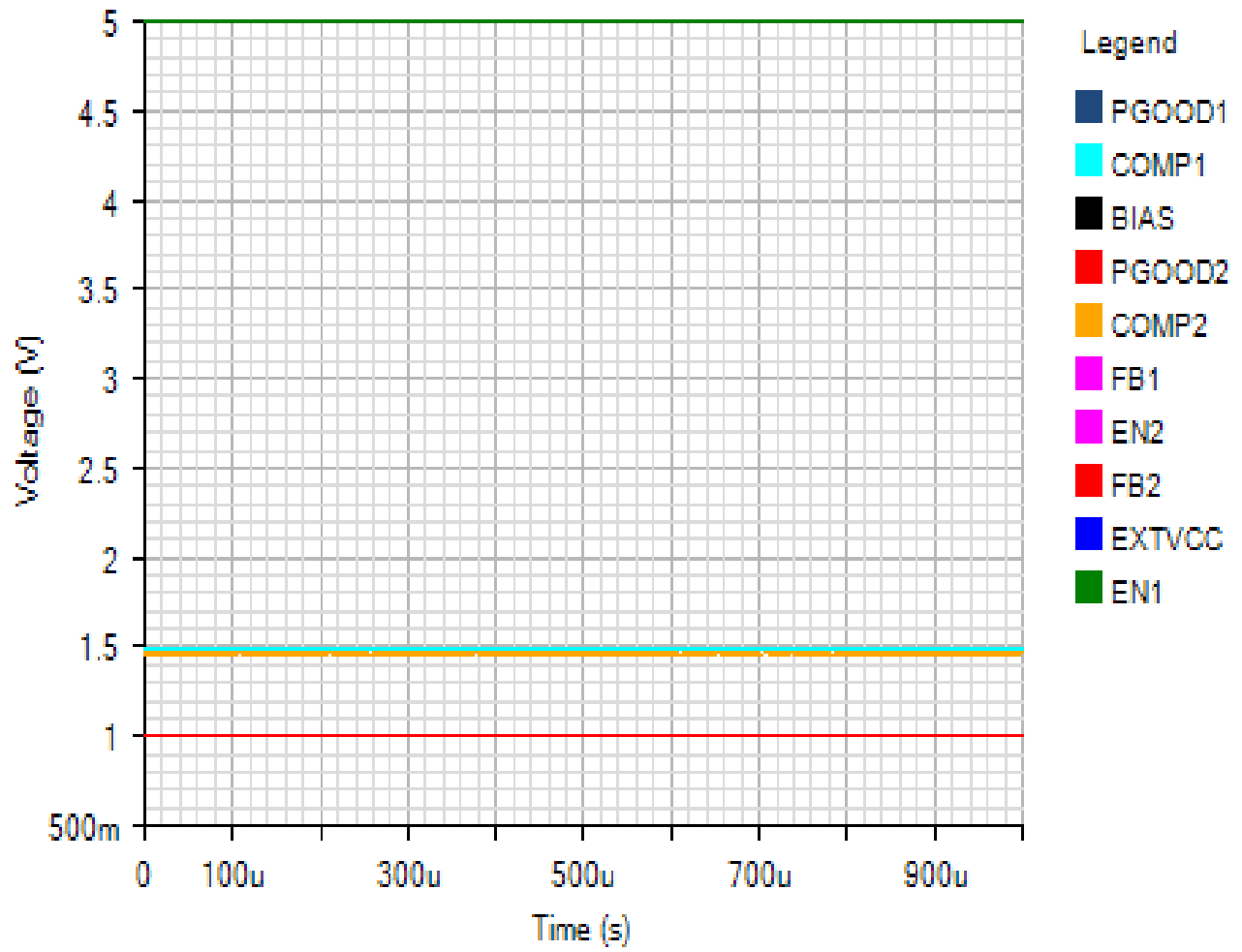
SWITCHING

Default



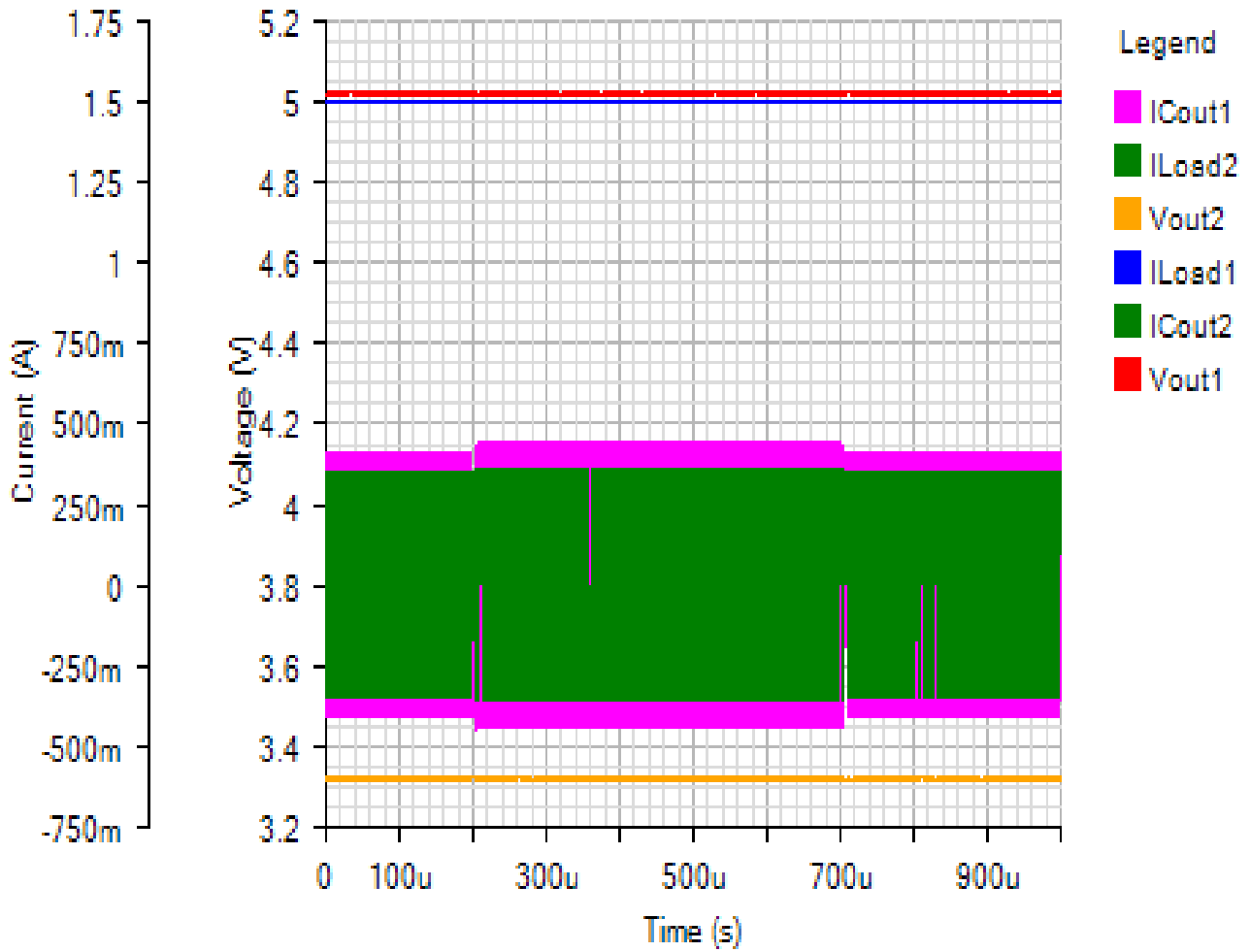
IC

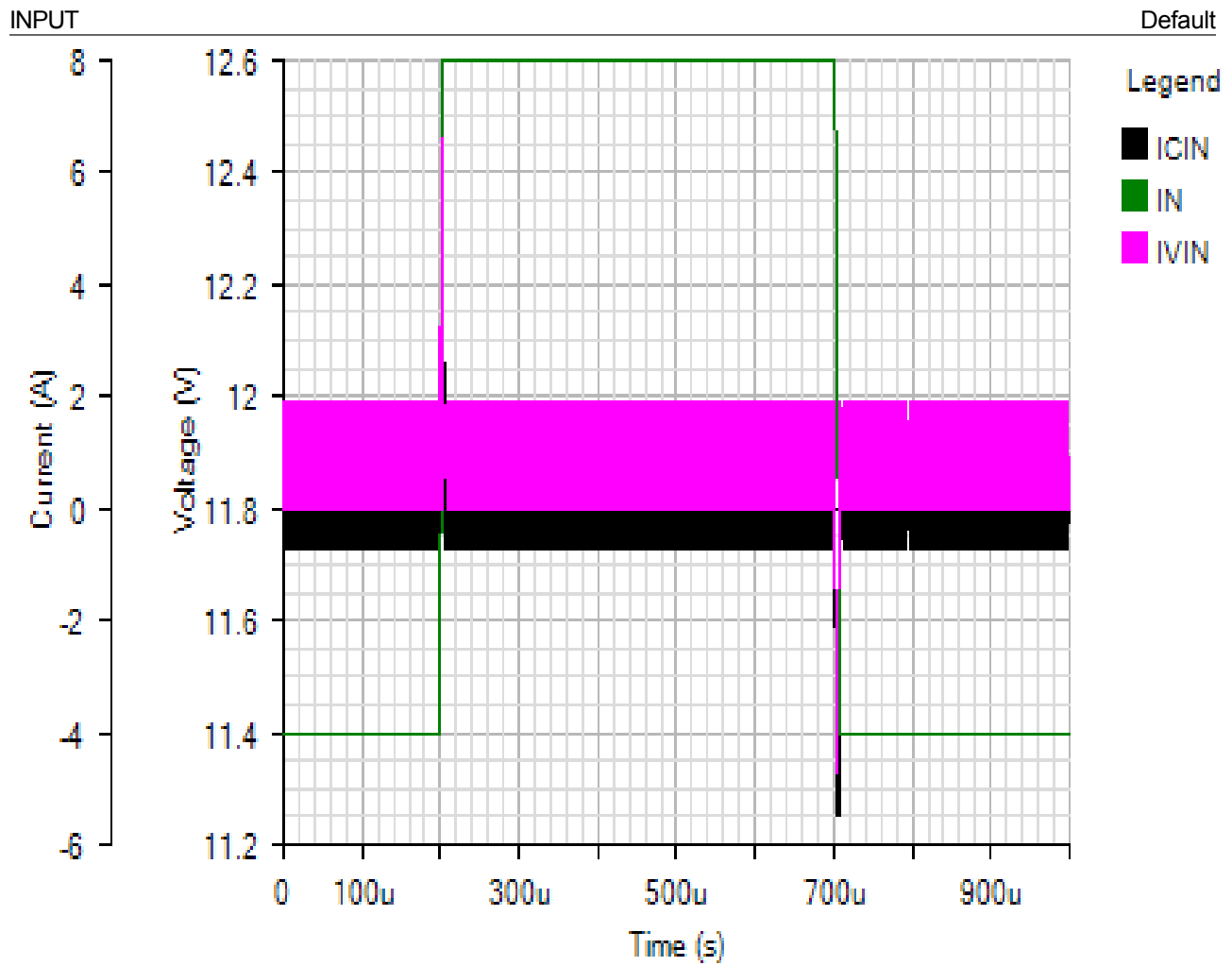
Default



OUTPUT

Default

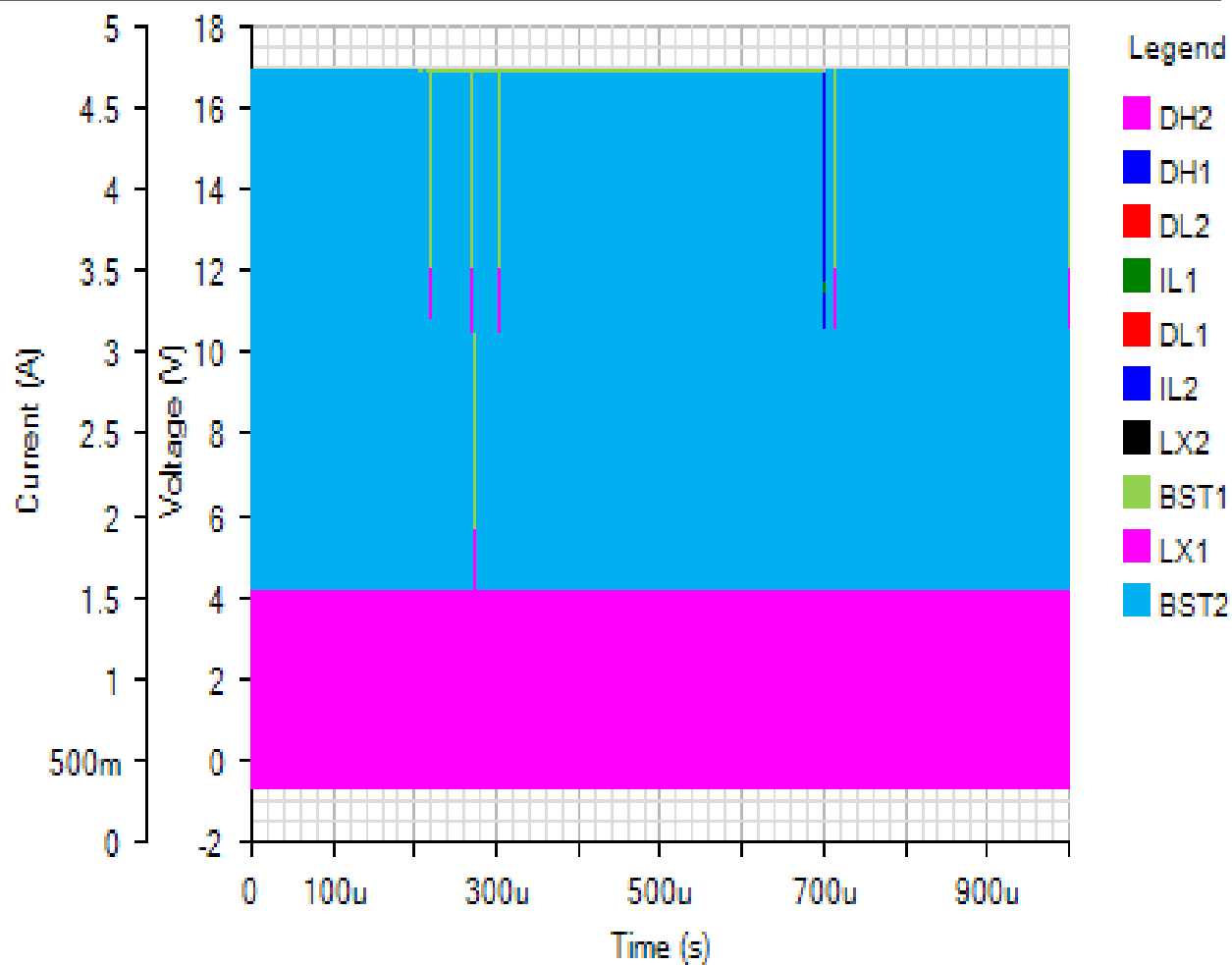




Load Step - Thu Nov 15 2018 15:35:08

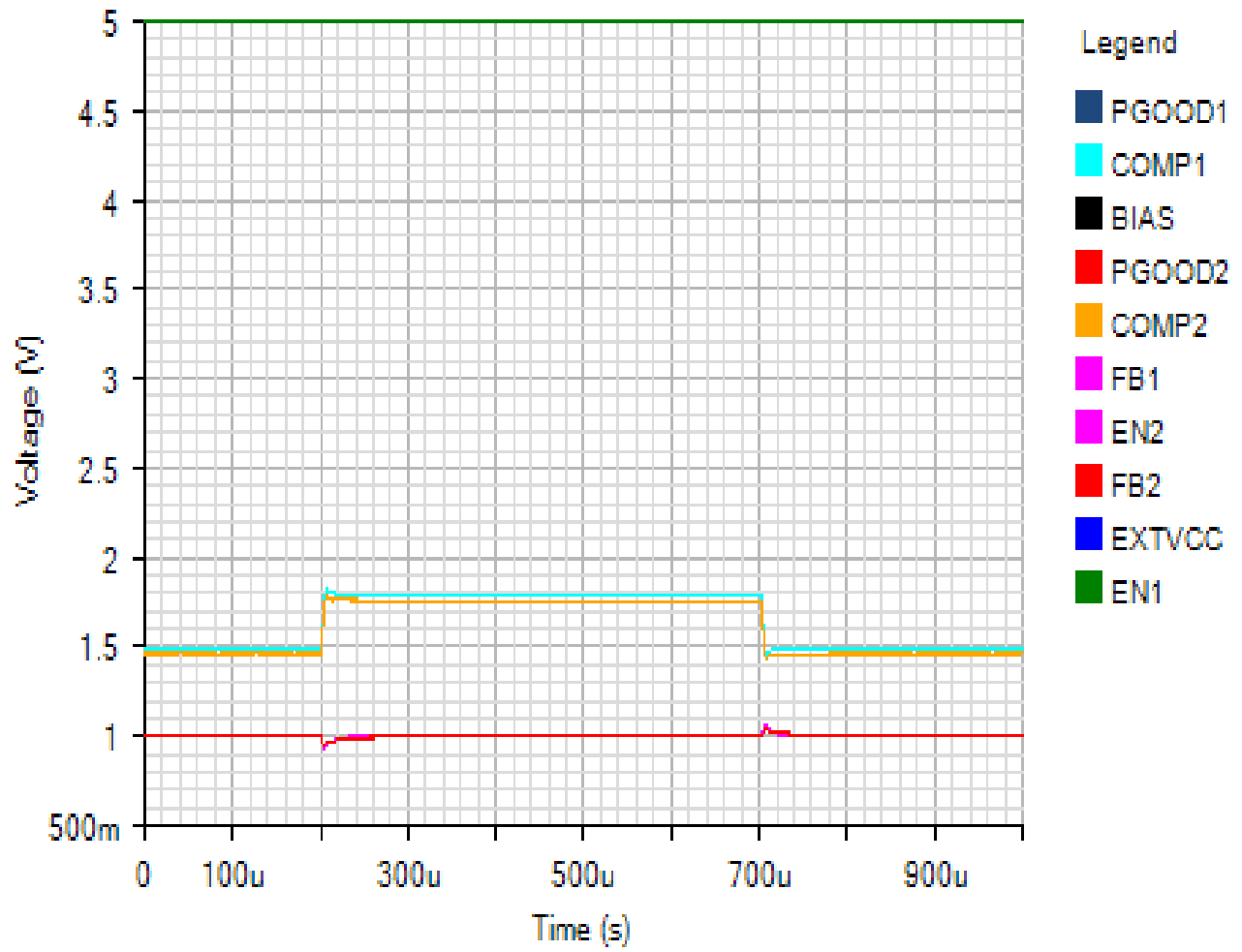
SWITCHING

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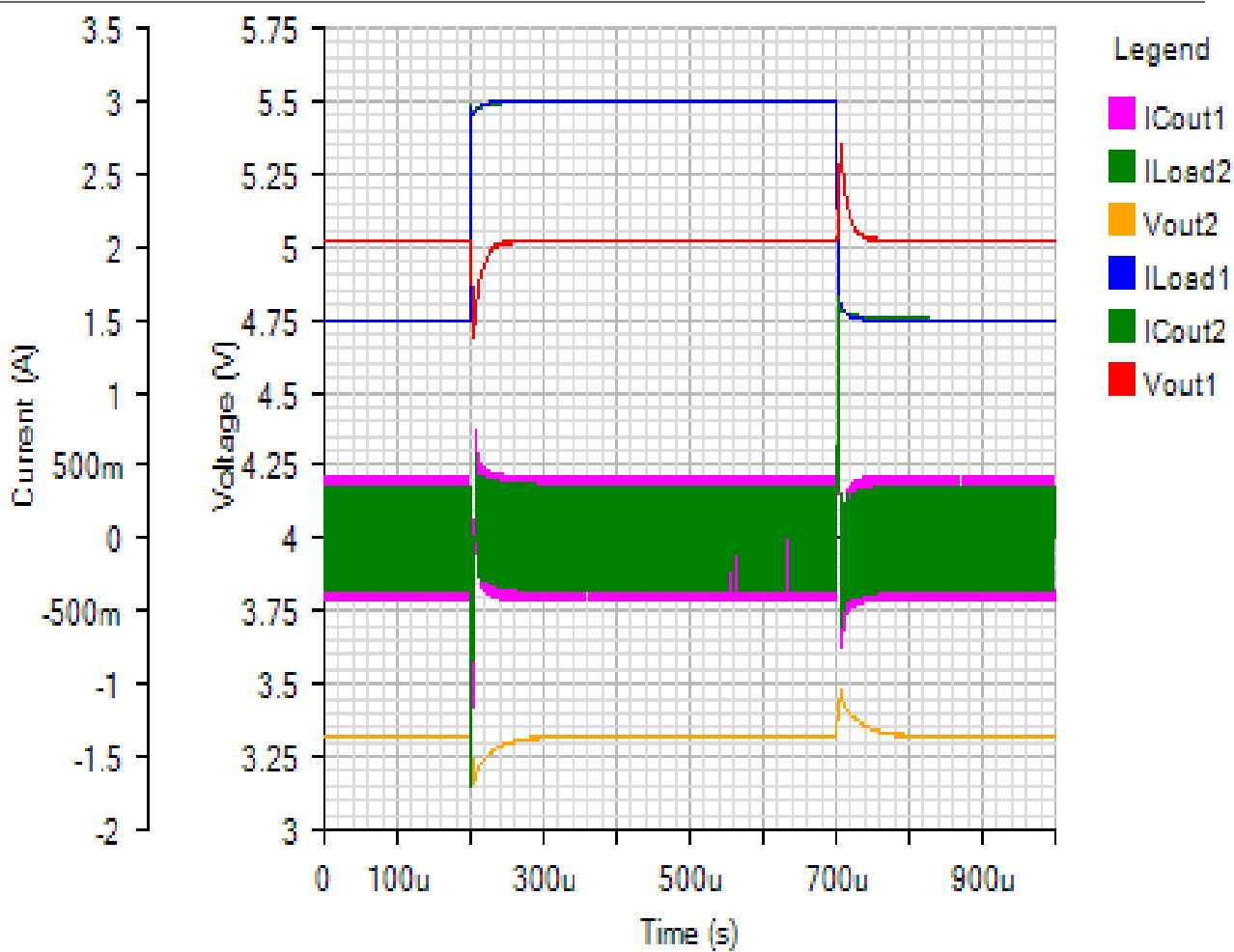
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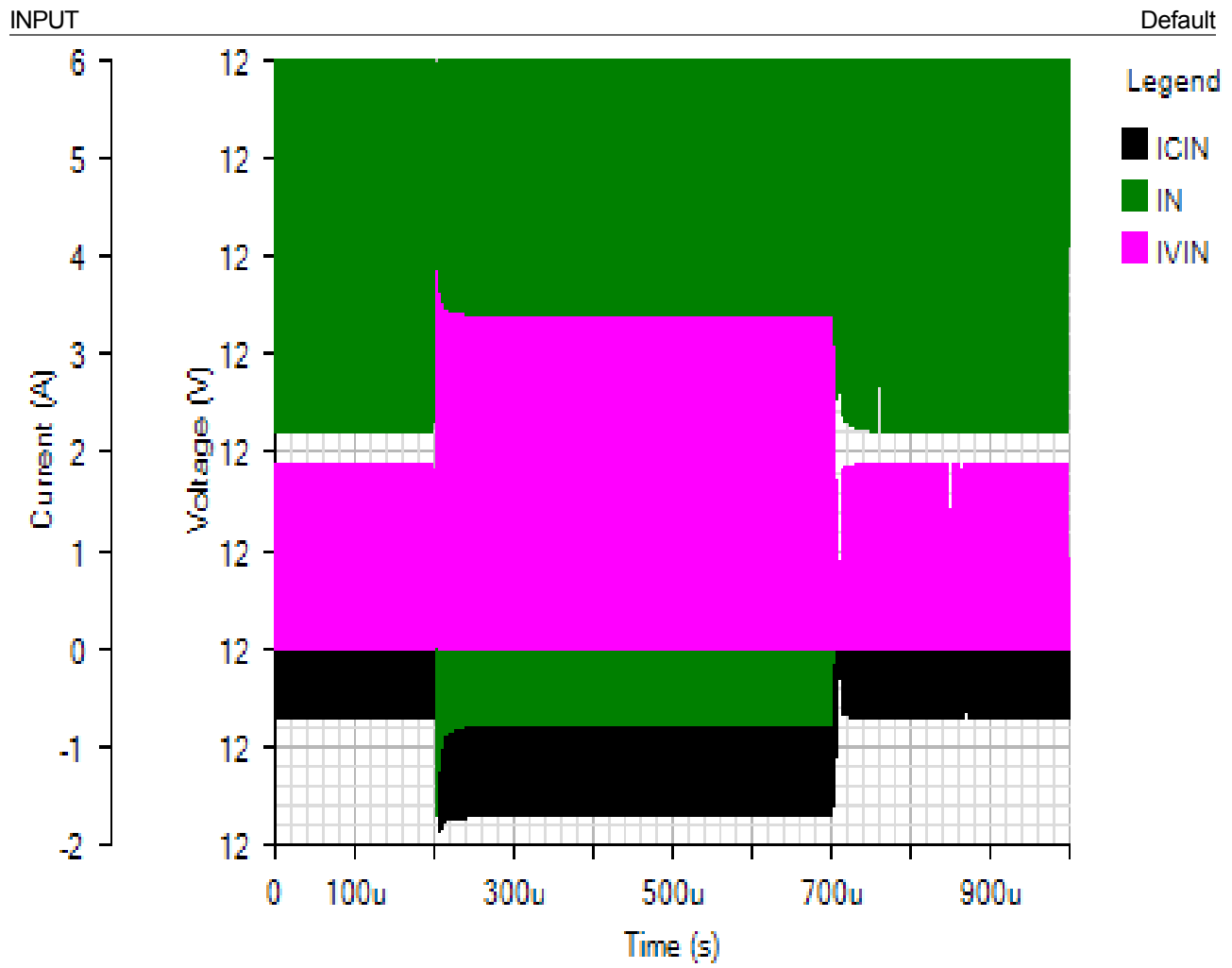
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OUTPUT

Default

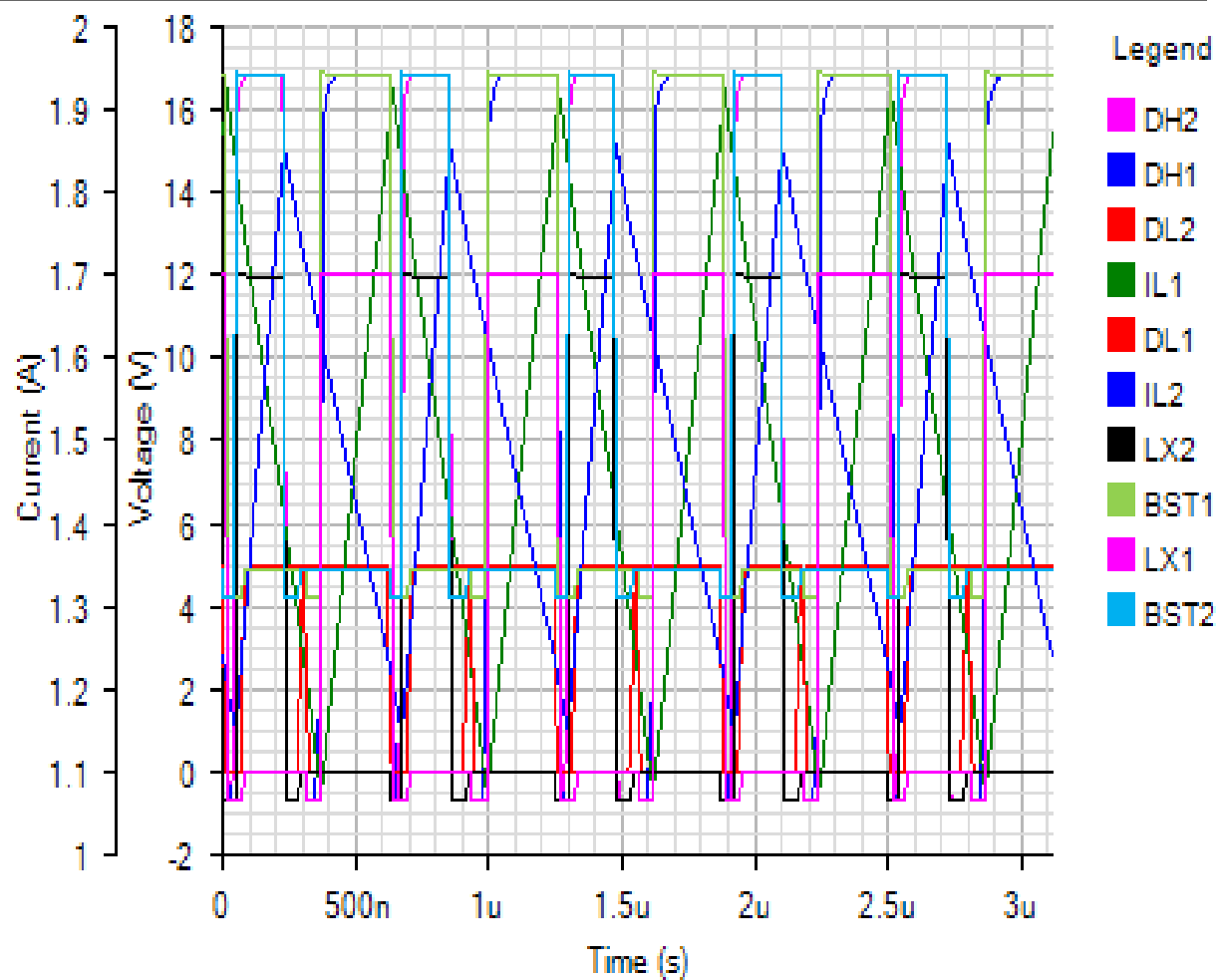




Steady State - Thu Nov 15 2018 15:35:08

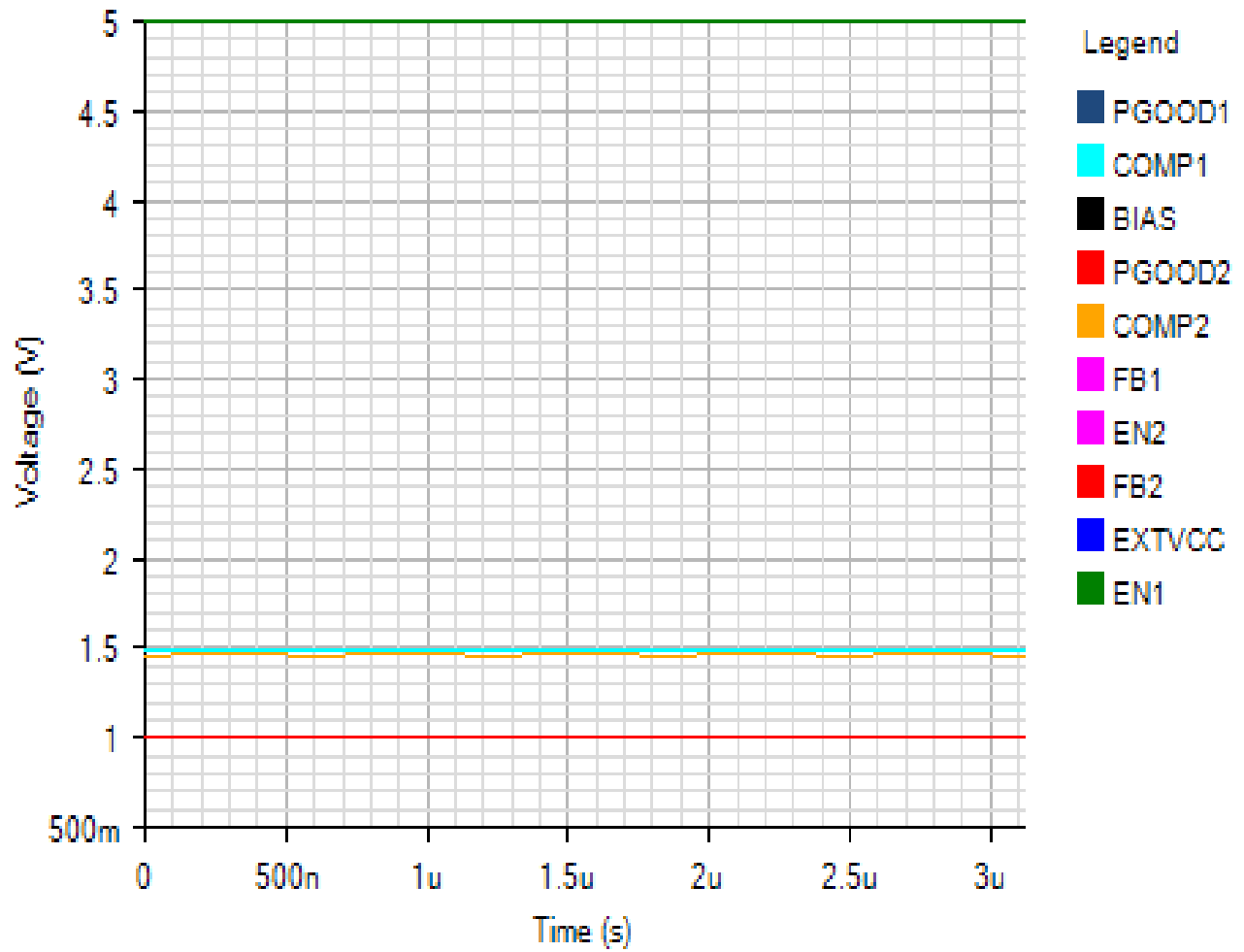
SWITCHING

Default



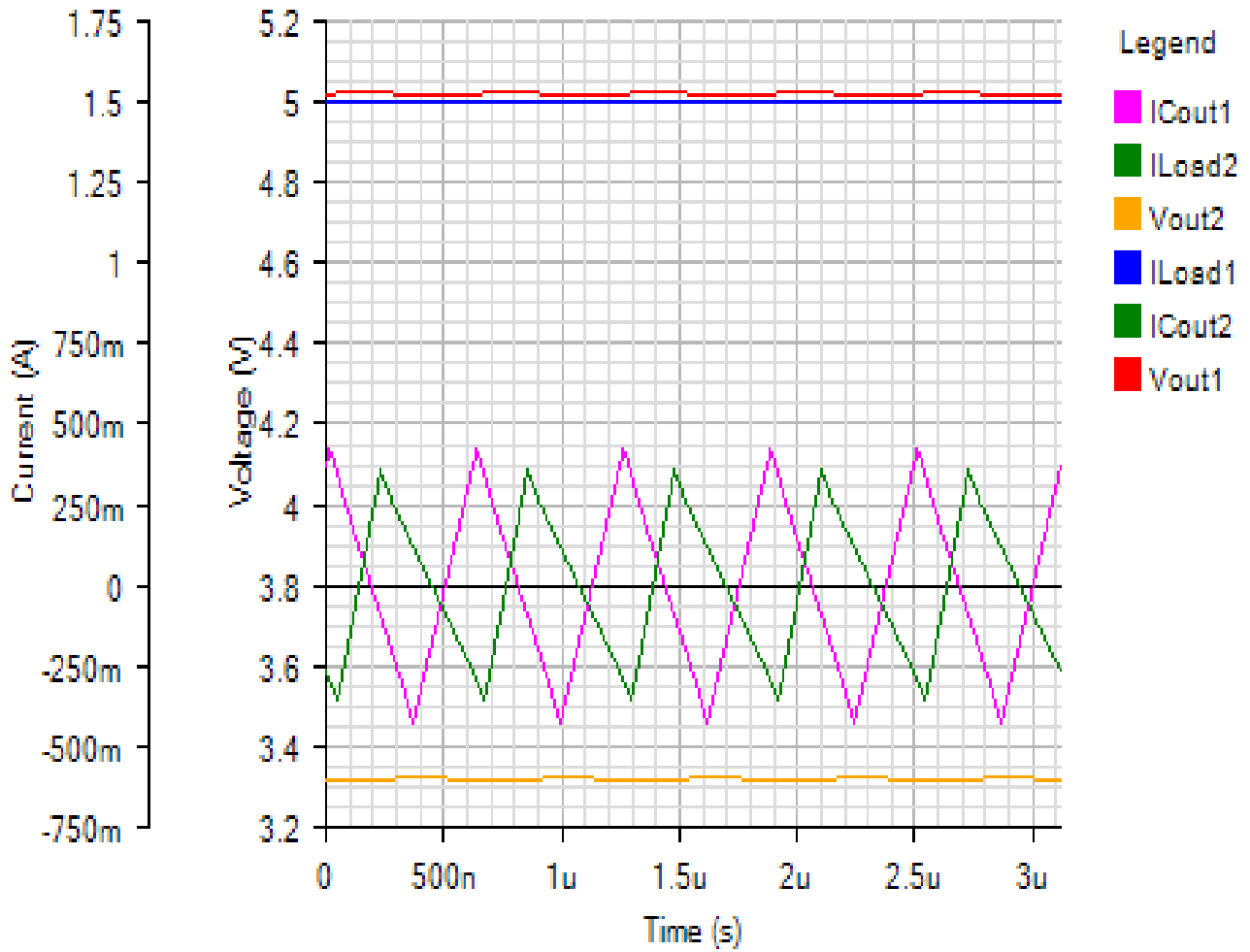
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Default



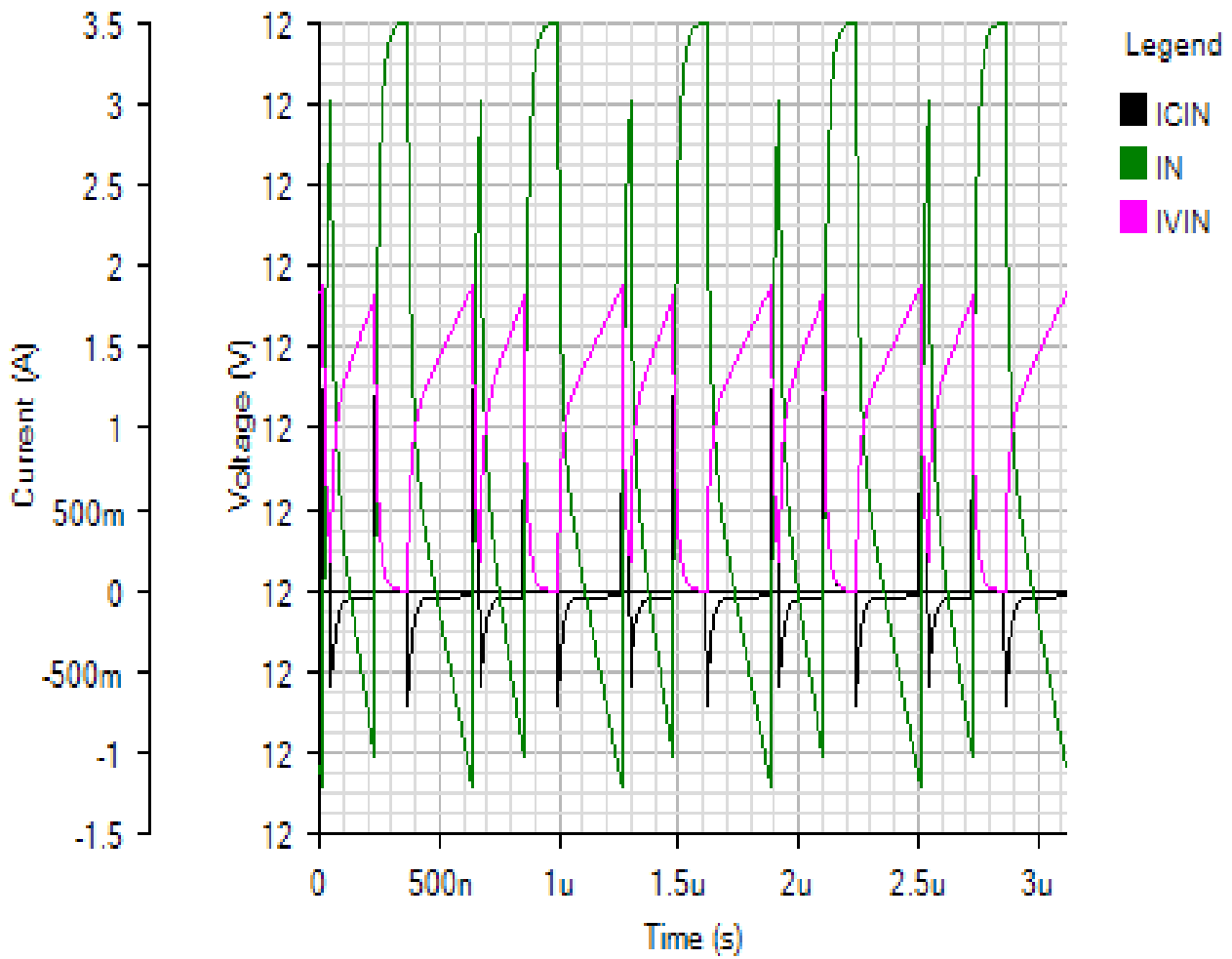
OUTPUT

Default



INPUT

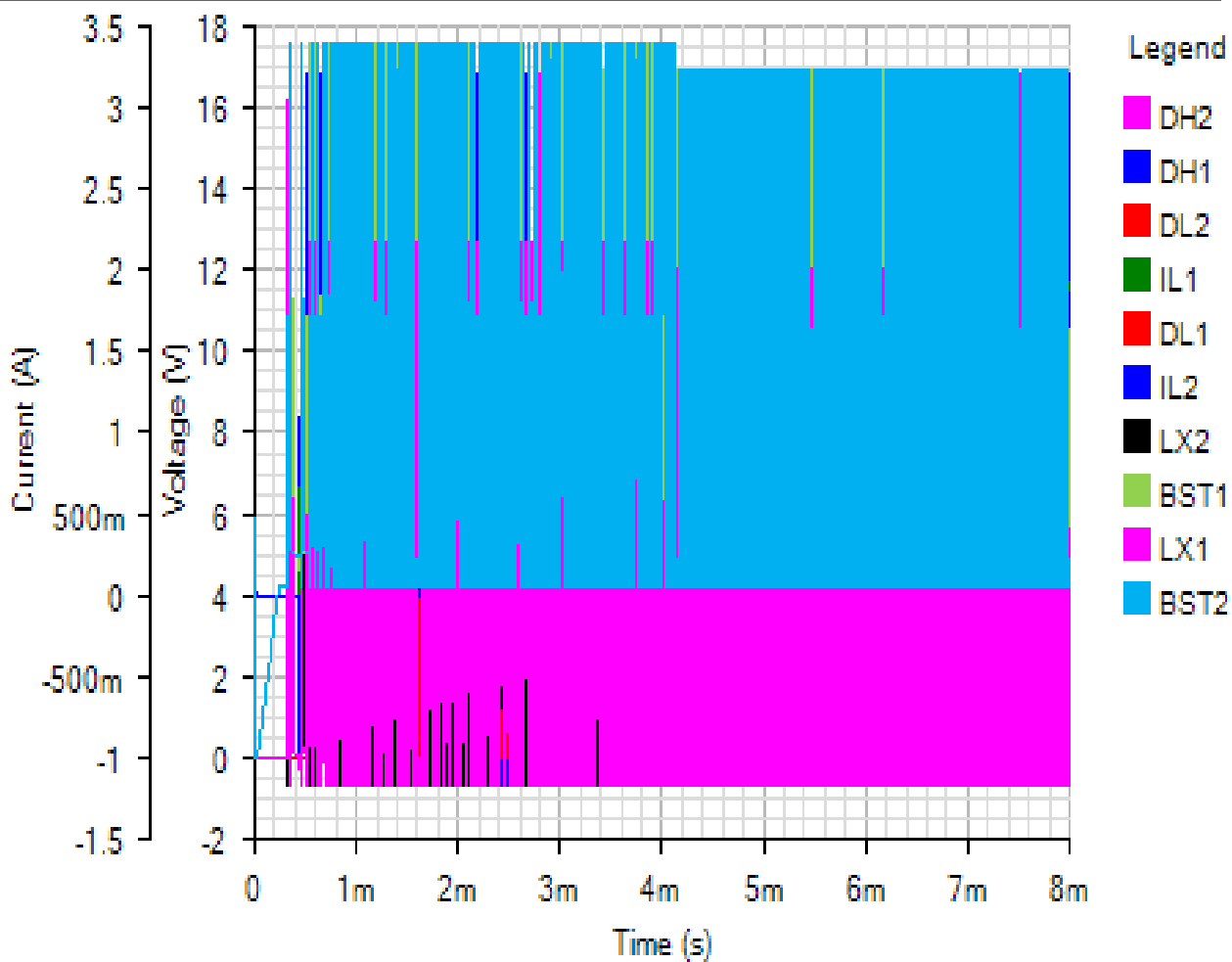
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Start Up - Thu Nov 15 2018 15:35:08

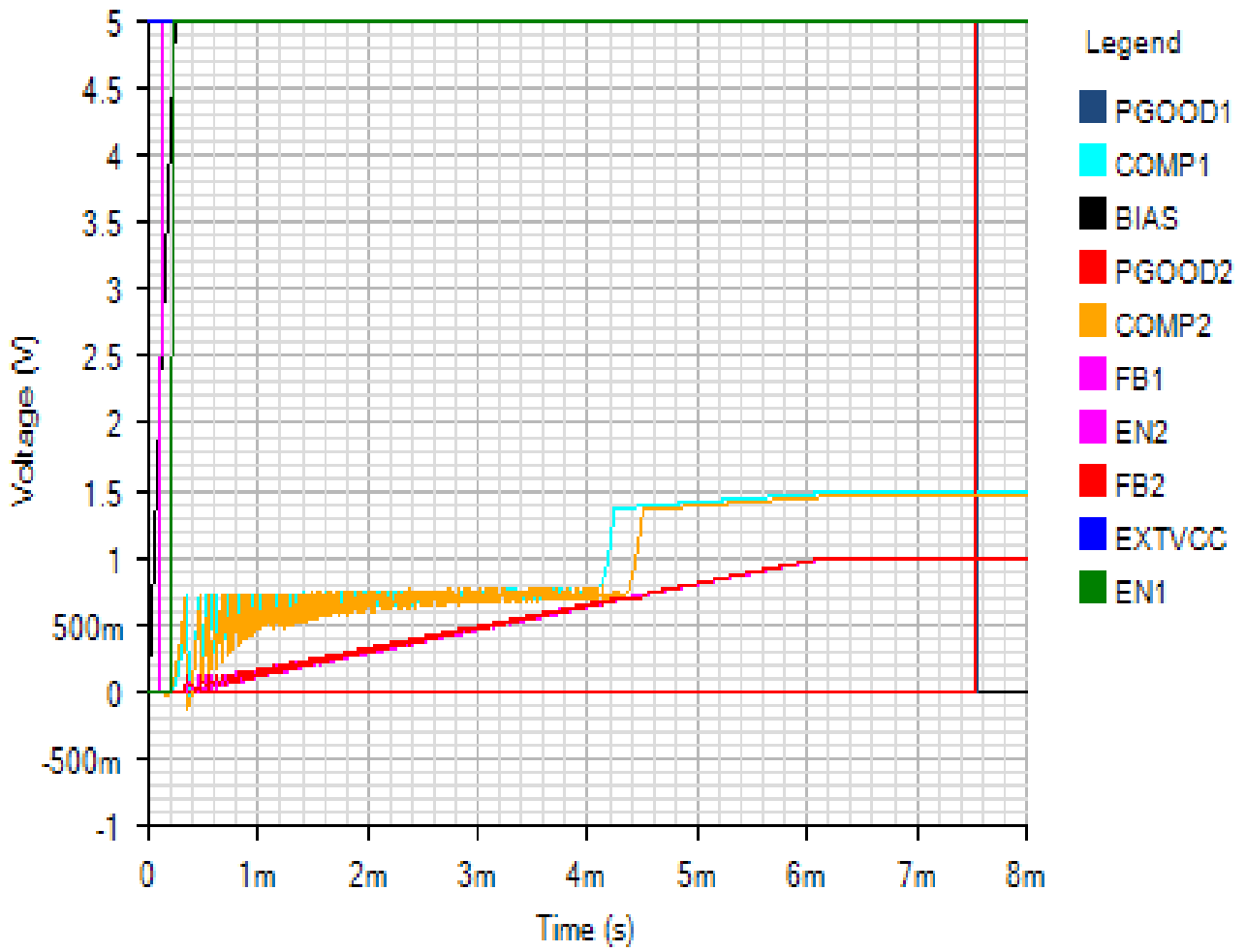
SWITCHING

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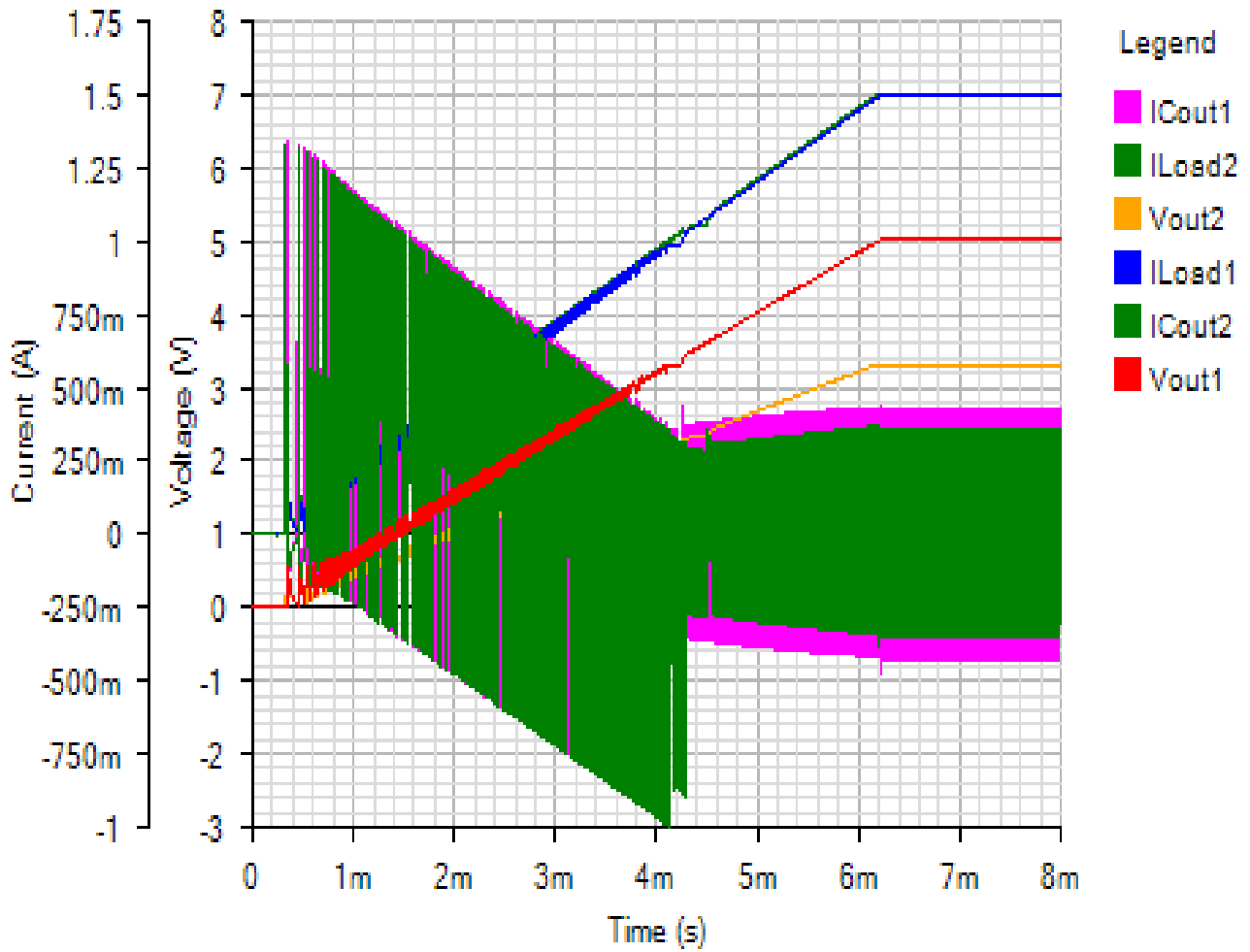
IC

Default



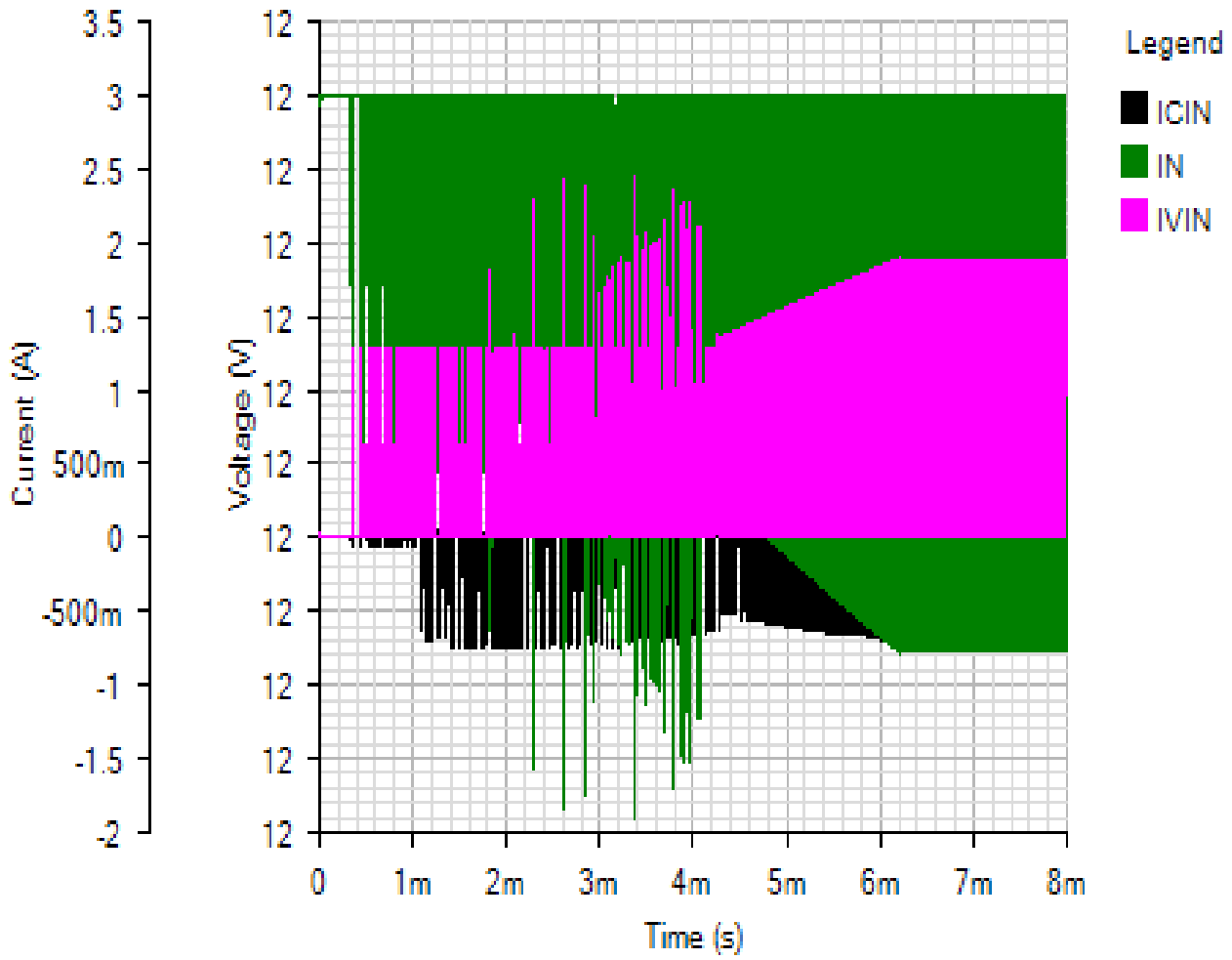
OUTPUT

Default



INPUT

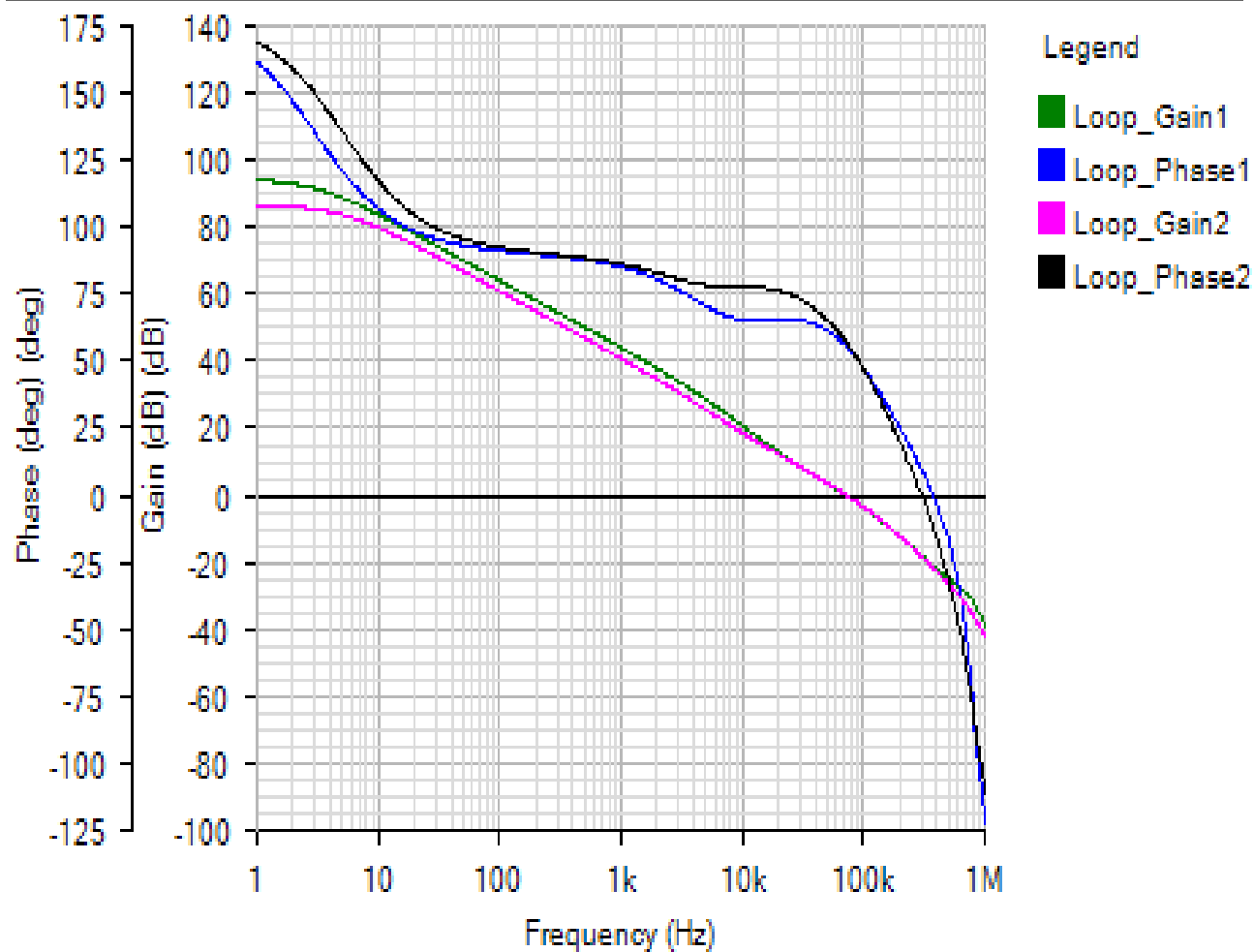
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AC Loop - Thu Nov 15 2018 15:35:08

BODE

Default



Phase Margin (output #1): 55.66° at a crossover frequency of 71.6kHz



Phase Margin (output #2): 56.89° at a crossover frequency of 72.8kHz

