

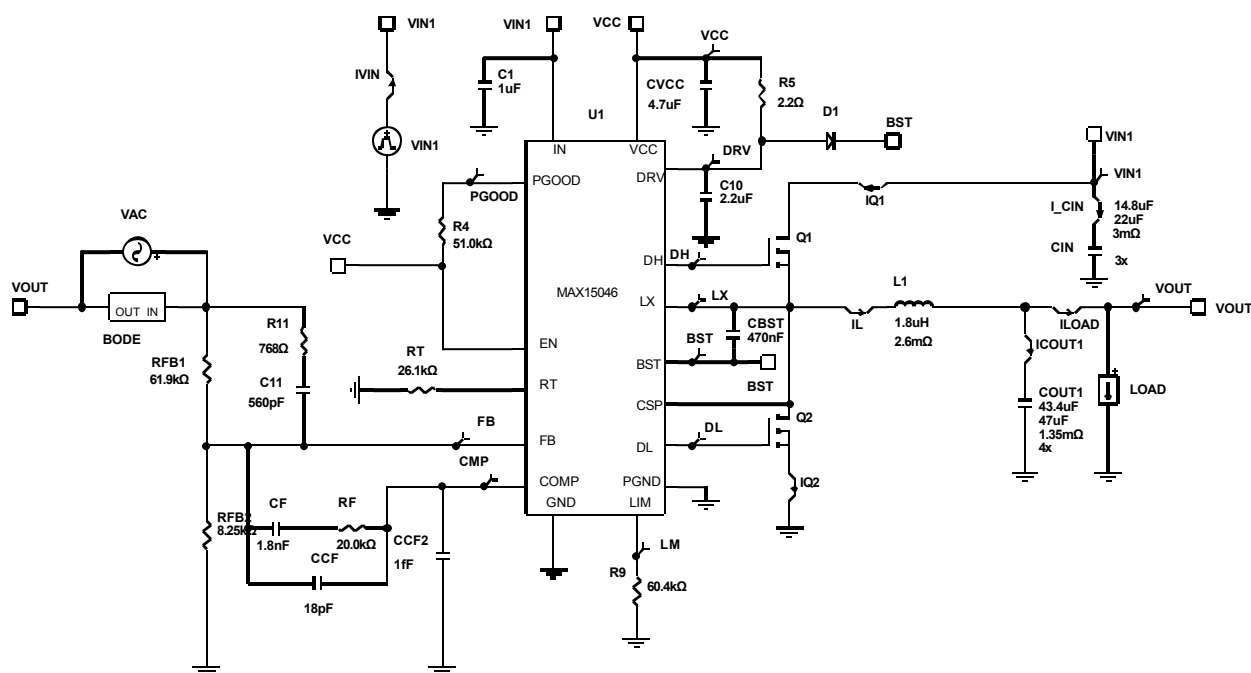
Initial Design

1.0

Design Requirements

| Parameter | Value |
|--|-----------------------------|
| Minimum Input Voltage | 10.8V |
| Maximum Input Voltage | 13.2V |
| Nominal Input Voltage | 12V |
| Input Voltage Ripple | 1% |
| Output Voltage | 5V |
| Output Current | 10A |
| Output Voltage Ripple | 1% |
| Load Step Start Current | 10A |
| Load Step Current | 5A |
| Load Step Edge Rate | 5A/us |
| Output Voltage Load Step Over/Undershoot | 3% |
| Performance Priority | Balance Efficiency and Size |
| BOM Priority | Cost |
| Switching Frequency | 550kHz |
| Lock Switching Frequency | Not locked |
| Output Capacitor Type | Ceramic |
| Ambient Temperature | 25°C |
| Inductor Current Ratio(LIR) | 0.3 |
| Soft Stop Enable | No |
| Enable High Power Design | No |

Schematic



Note : Thermal Shutdown and Soft Stop are not modeled in EE-Sim.

BOM

| Ref | Qty | Part Number | Manufacturer | Description |
|-------|-----|-------------------------------------|---------------------|---|
| C1 | 1 | 0603YC105KAT2A | AVX | Cap Ceramic 1uF 16V X7R 10% Pad SMD 0603 125°C T/R |
| C10 | 1 | LMK212B7225KGHT | Taiyo Yuden | Cap Ceramic 2.2uF 10V X7R 10% Pad SMD 0805 125°C Automotive T/R |
| C11 | 1 | CC0402KRX7R9BB561 | Yageo | Cap Ceramic 560pF 50V X7R 10% Pad SMD 0402 125°C T/R |
| CBST | 1 | 0805YC474KAT2A | AVX | Cap Ceramic 0.47uF 16V X7R 10% Pad SMD 0805 125°C T/R |
| CCF | 1 | 06033A180KAT2A | AVX | Cap Ceramic 18pF 25V C0G 10% Pad SMD 0603 125°C T/R |
| CF | 1 | 04025C182KAT2A | AVX | Cap Ceramic 0.0018uF 50V X7R 10% Pad SMD 0402 125°C T/R |
| CIN | 3 | C4532X7R1E226M250KC | TDK | Cap Ceramic 22uF 25V X7R 20% SMD 1812 125C Plastic T/R |
| COUT1 | 4 | C5750X7R1C476M230KB | TDK | Cap Ceramic 47uF 16V X7R 20% SMD 2220 125C Plastic T/R |
| CVCC | 1 | C2012X7R1A475K125AC | TDK | Cap Ceramic 4.7uF 10V X7R 10% Pad SMD 0805 125°C T/R |
| D1 | 1 | ZHCS506TA | Diodes Incorporated | Diode Schottky 60V 0.5A Automotive 3-Pin SOT-23 T/R |
| L1 | 1 | SER1360-182KLB | Coilcraft | Inductor 1.8uH 10% 2.36mOhm 19.6A Isat 13A Irms |

Trans MOSFET N-CH 30VDS

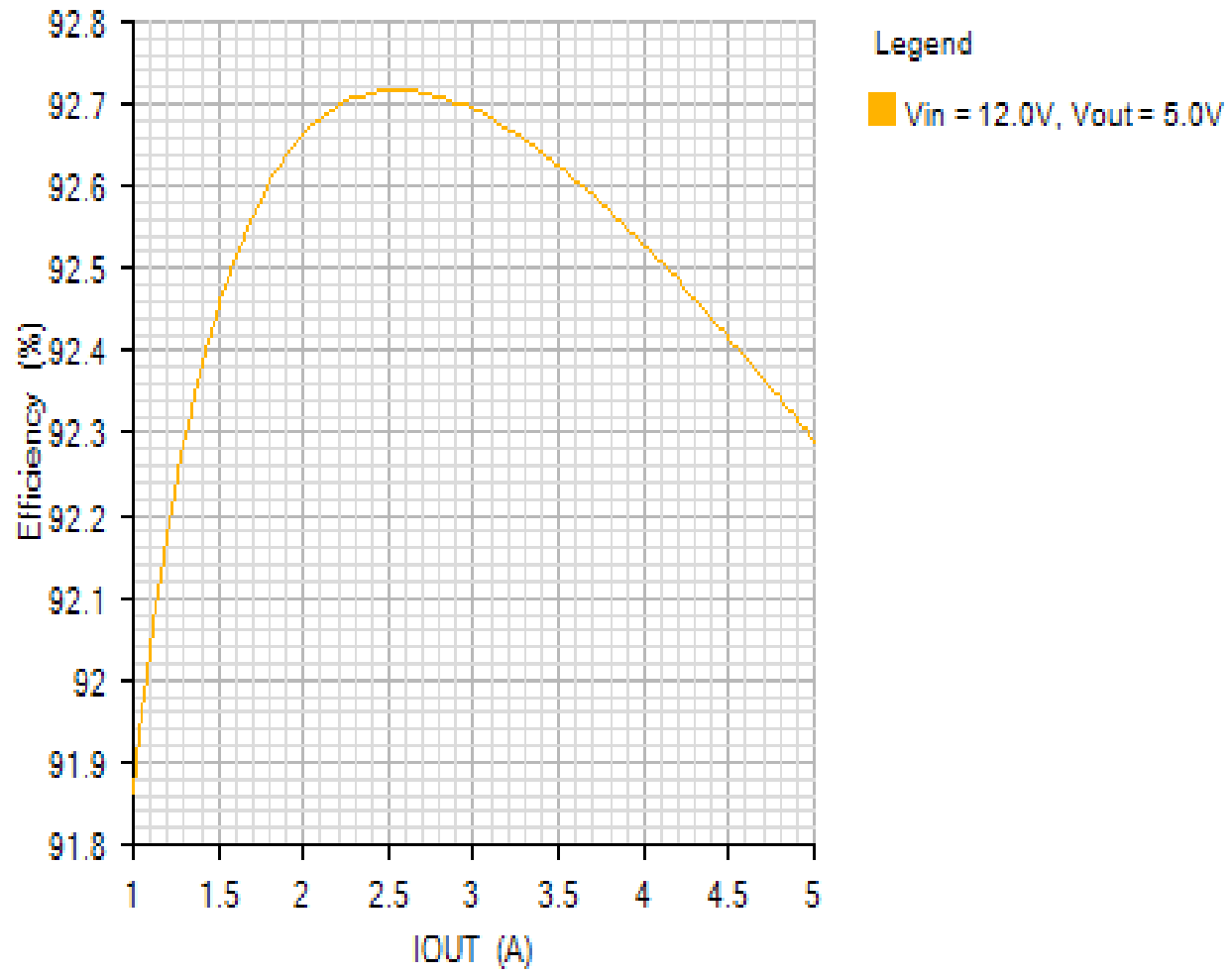
| | | | | |
|------|---|------------------------------|-------------------------|--|
| Q1 | 1 | FDMS0310AS | Fairchild Semiconductor | 5.2mOhm@4.5V 5mOhm@6V 13nC 5.8nC 1.72nF 0.655nF 150°C 22A 41W 3°C/W 1.1mm 32.5mm ² PQFN 5x6 8L (Power 56) |
| Q2 | 1 | FDMC8296 | Fairchild Semiconductor | Trans MOSFET N-CH 30VDS 13mOhm@4.5V 12mOhm@6V 7.6nC 4nC 1.04nF 0.513nF 150°C 18A 27.2W 4.6°C/W 0.8mm 11.2mm ² MLP 3.3x3.3 8L (Power 33) |
| R4 | 1 | ERJ3GEYJ513V | Panasonic | Res Thick Film 0603 51K Ohm 5% 0.1W(1/10W) ±200ppm/°C Pad SMD Automotive T/R |
| R5 | 1 | ERJ3GEYJ2R2V | Panasonic | Res Thick Film 0603 2.2 Ohm 5% 0.1W(1/10W) -100ppm/°C to 600ppm/°C Pad SMD Automotive T/R |
| R9 | 1 | ERJ2RKF6042X | Panasonic | Res Thick Film 0402 60.4K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |
| R11 | 1 | ERJ2RKF7680X | Panasonic | Res Thick Film 0402 768 Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |
| RF | 1 | ERJ3EKF2002V | Panasonic | Res Thick Film 0603 20K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |
| RFB1 | 1 | ERJ3EKF6192V | Panasonic | Res Thick Film 0603 61.9K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |
| RFB2 | 1 | ERJ3EKF8251V | Panasonic | Res Thick Film 0603 8.25K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |
| RT | 1 | ERJ3EKF2612V | Panasonic | Res Thick Film 0603 26.1K Ohm 1% 0.1W(1/10W) ±100ppm/°C Pad SMD Automotive T/R |

Simulation Results

Efficiency - Wed Feb 13 2019 10:50:14

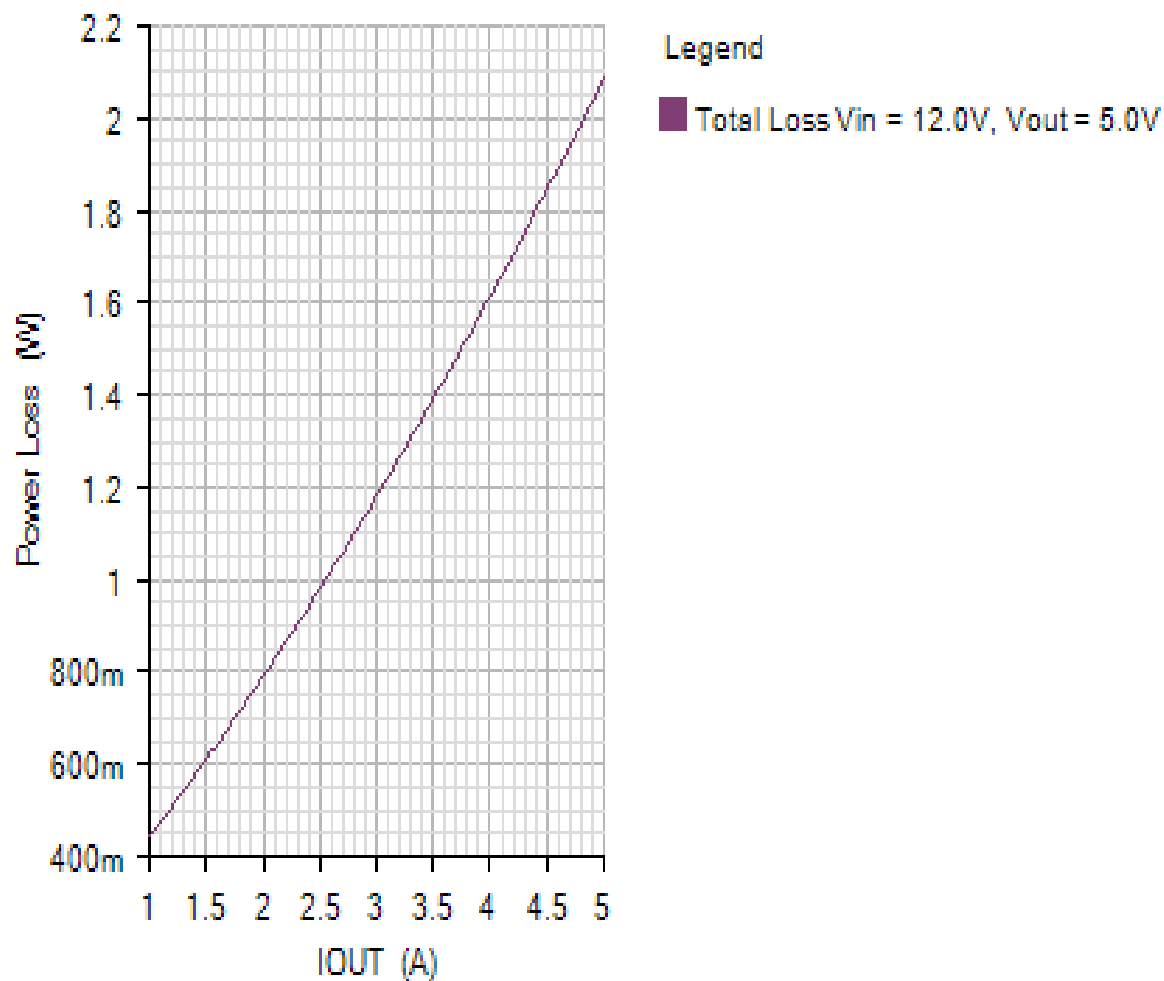
EFFICIENCY

Default

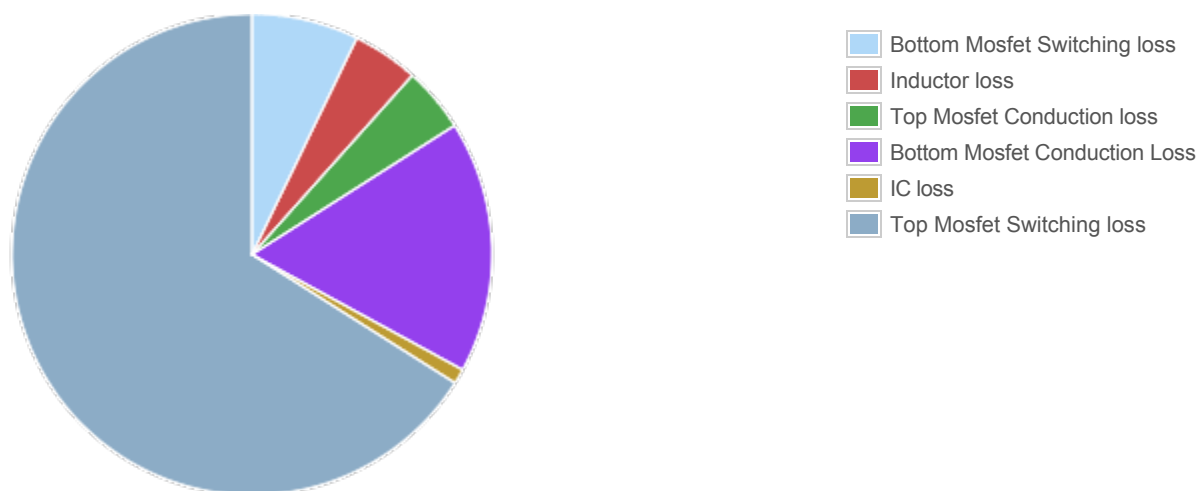


POWER_LOSS

Default



Losses



Component

Loss (W)

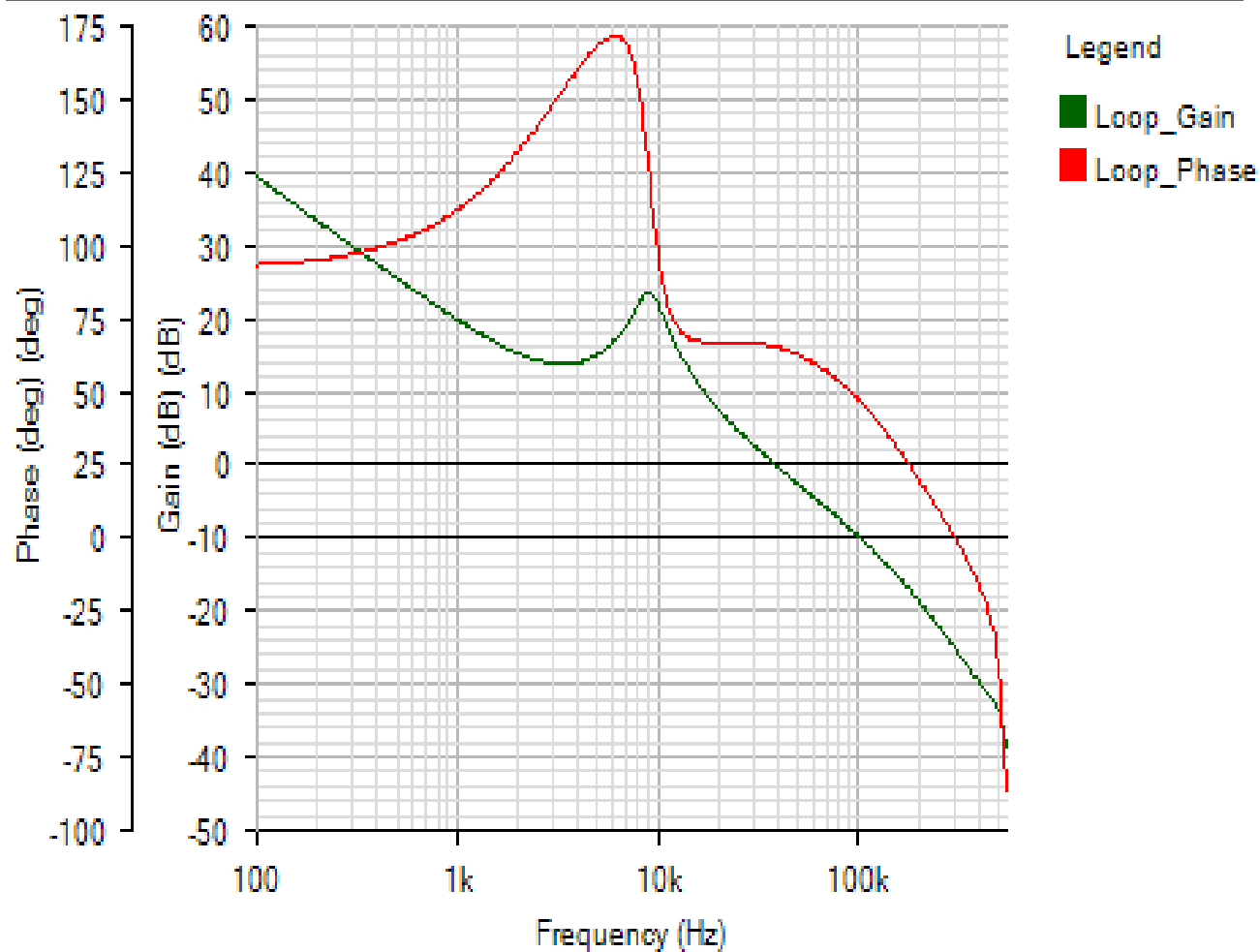
% of total

| Component | Loss (W) | % of total |
|-------------------------------|----------|------------|
| Bottom Mosfet Switching loss | 0.150376 | 7.2 |
| Inductor loss | 0.092619 | 4.4 |
| Top Mosfet Conduction loss | 0.090977 | 4.4 |
| Bottom Mosfet Conduction Loss | 0.354408 | 17 |
| IC loss | 0.021 | 1 |
| Top Mosfet Switching loss | 1.379276 | 66 |
| Total | 2.088655 | 100 |

AC Loop - Wed Feb 13 2019 10:50:14

BODE

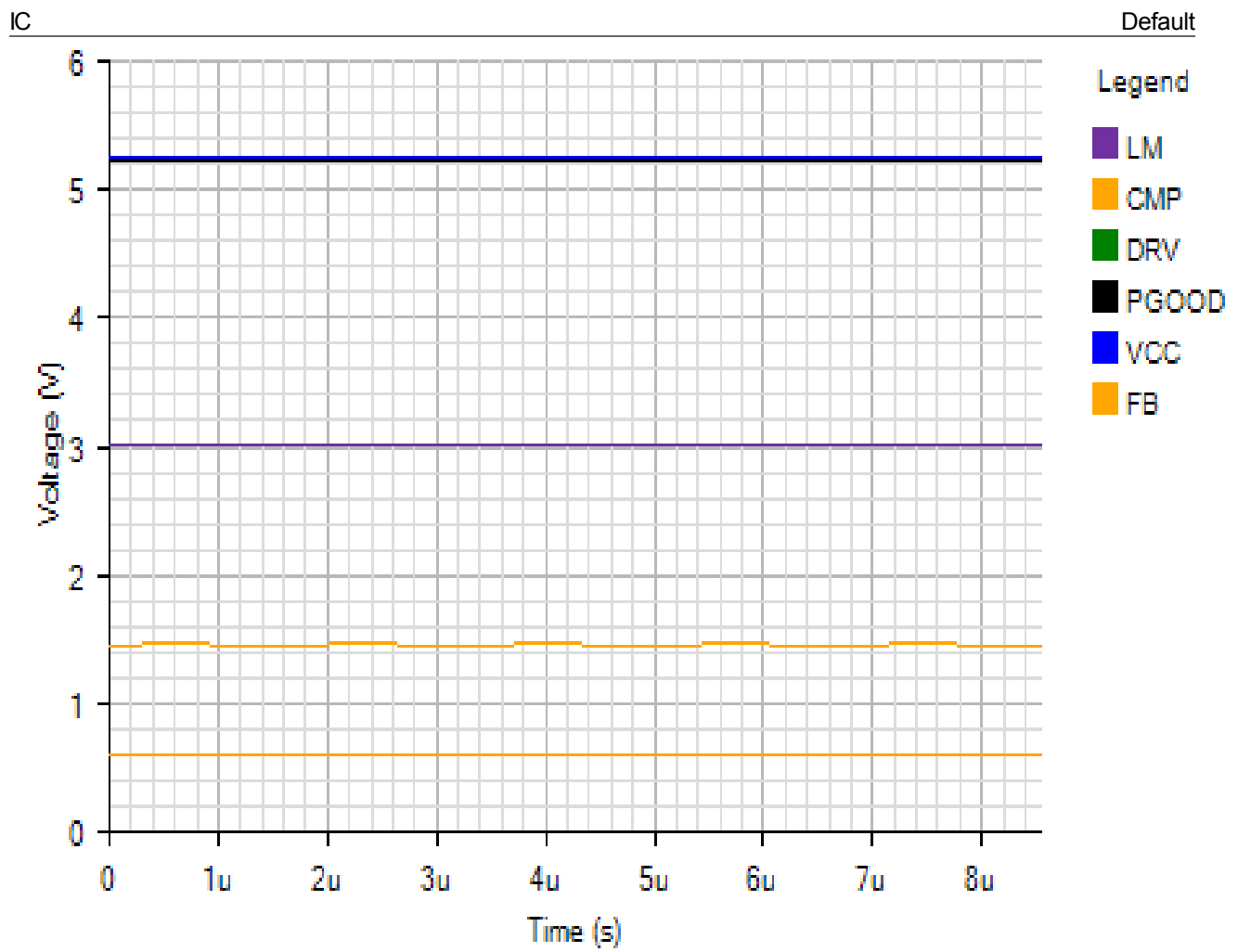
Default



Phase Margin: 65.31° at a crossover frequency of 38.7kHz

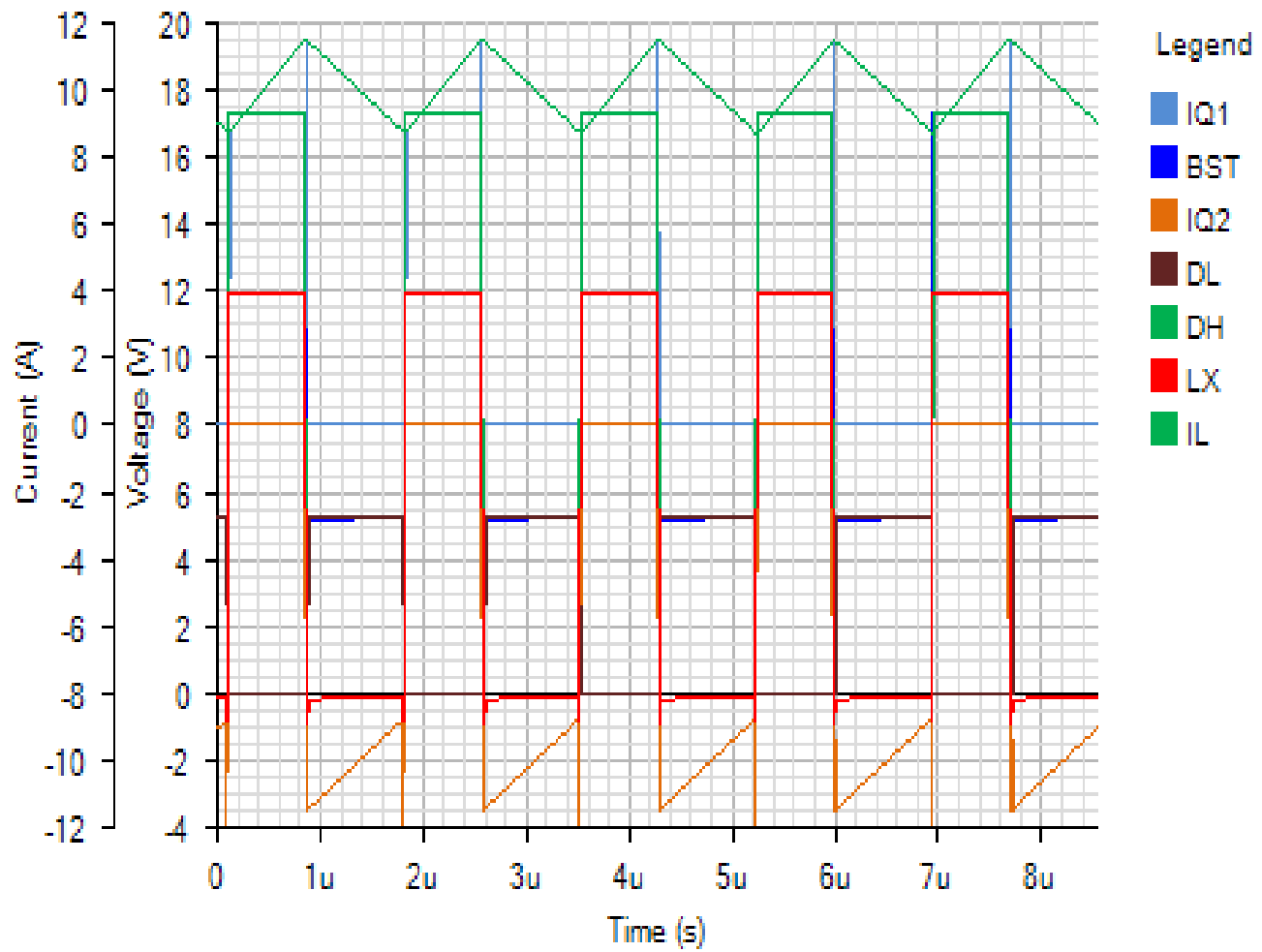


Steady State - Wed Feb 13 2019 10:50:14



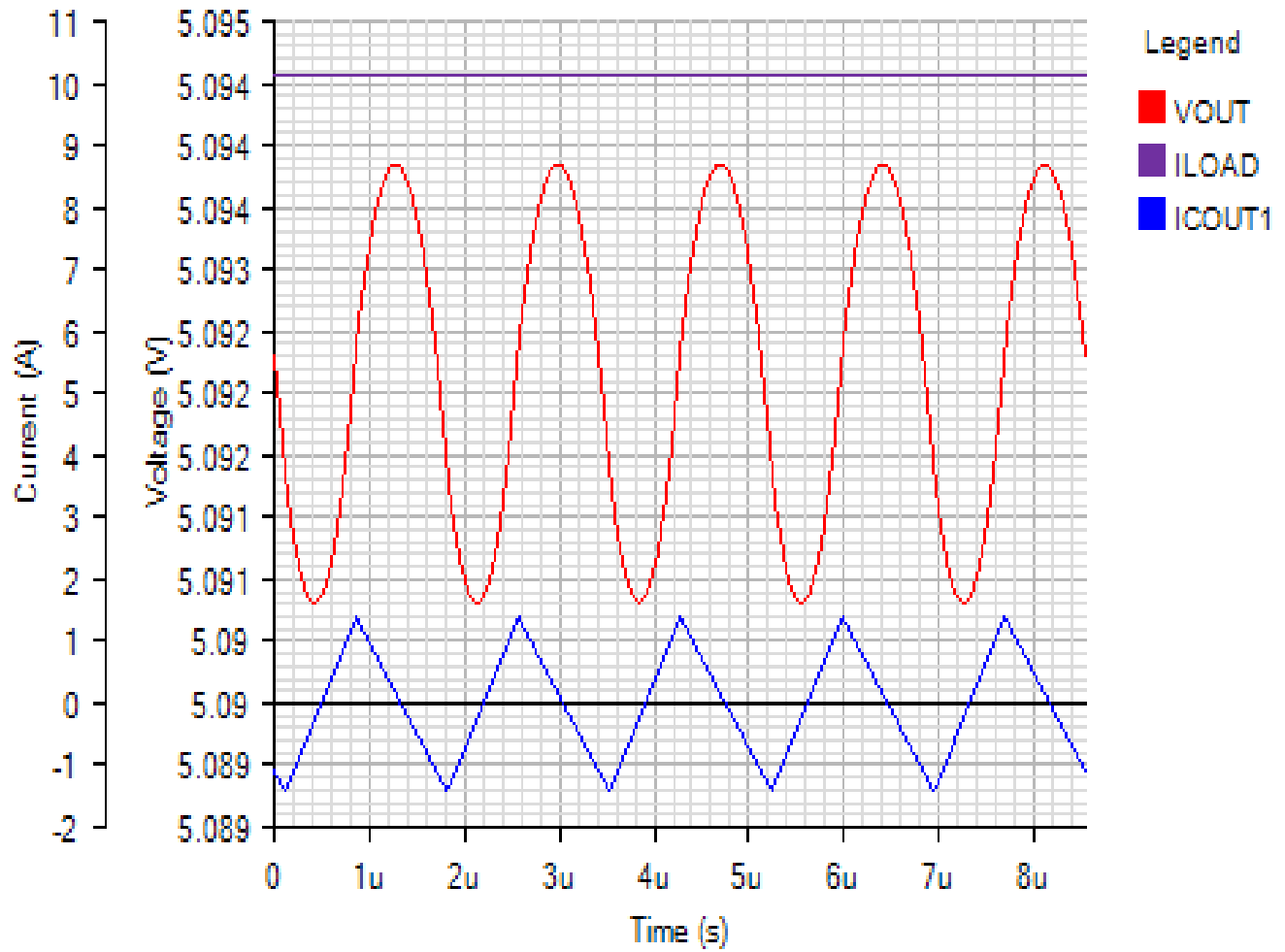
SW

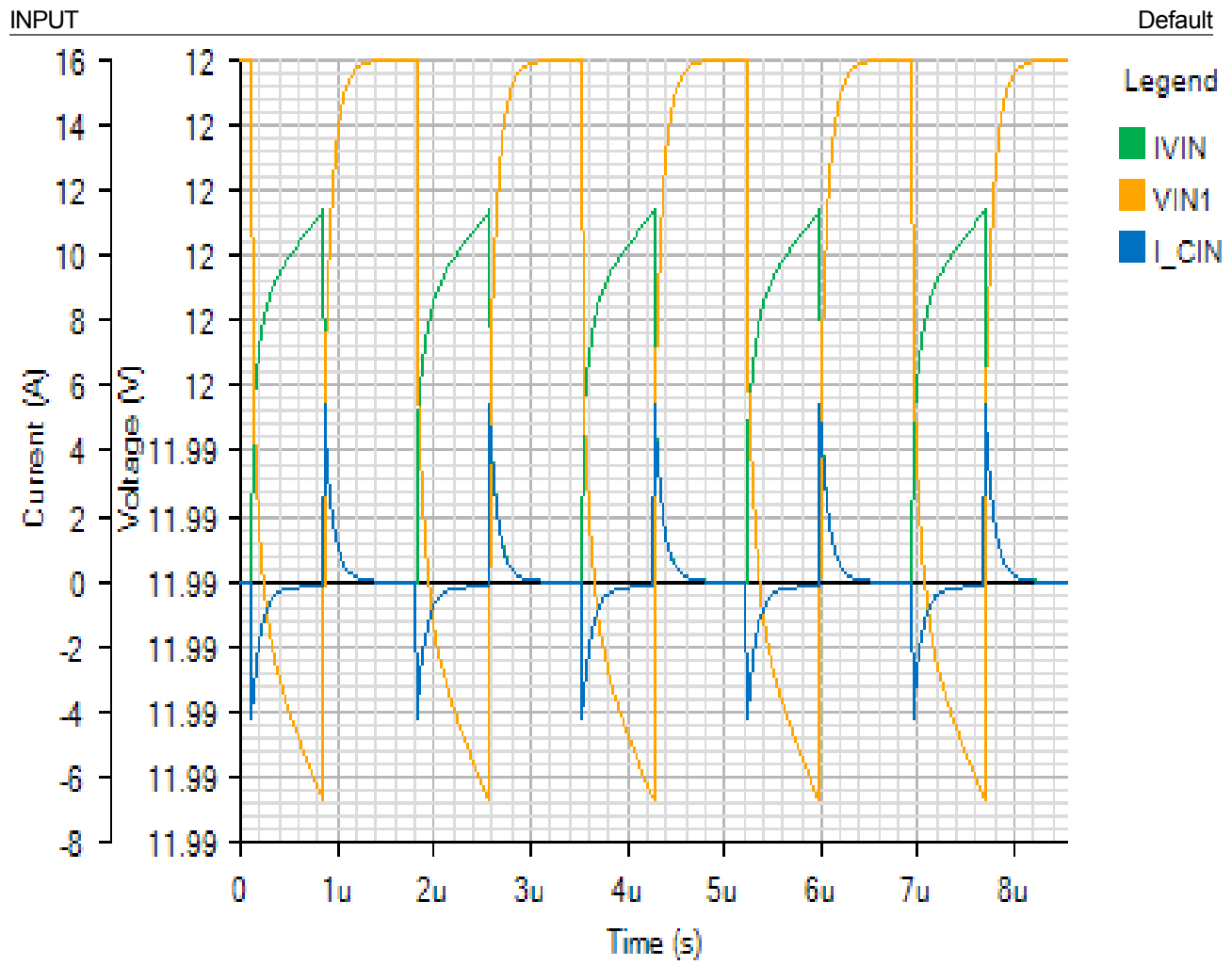
Default



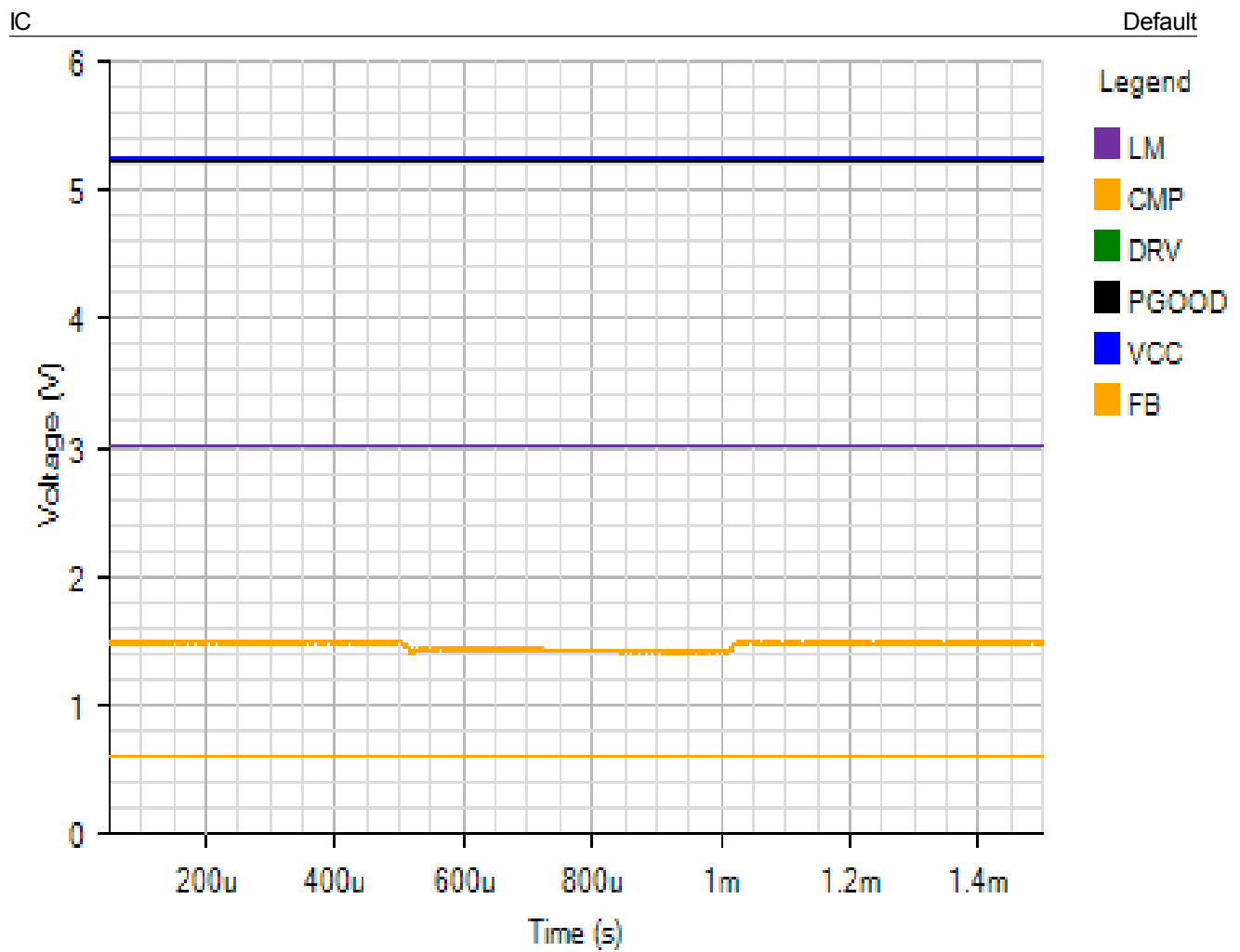
OUT

Default



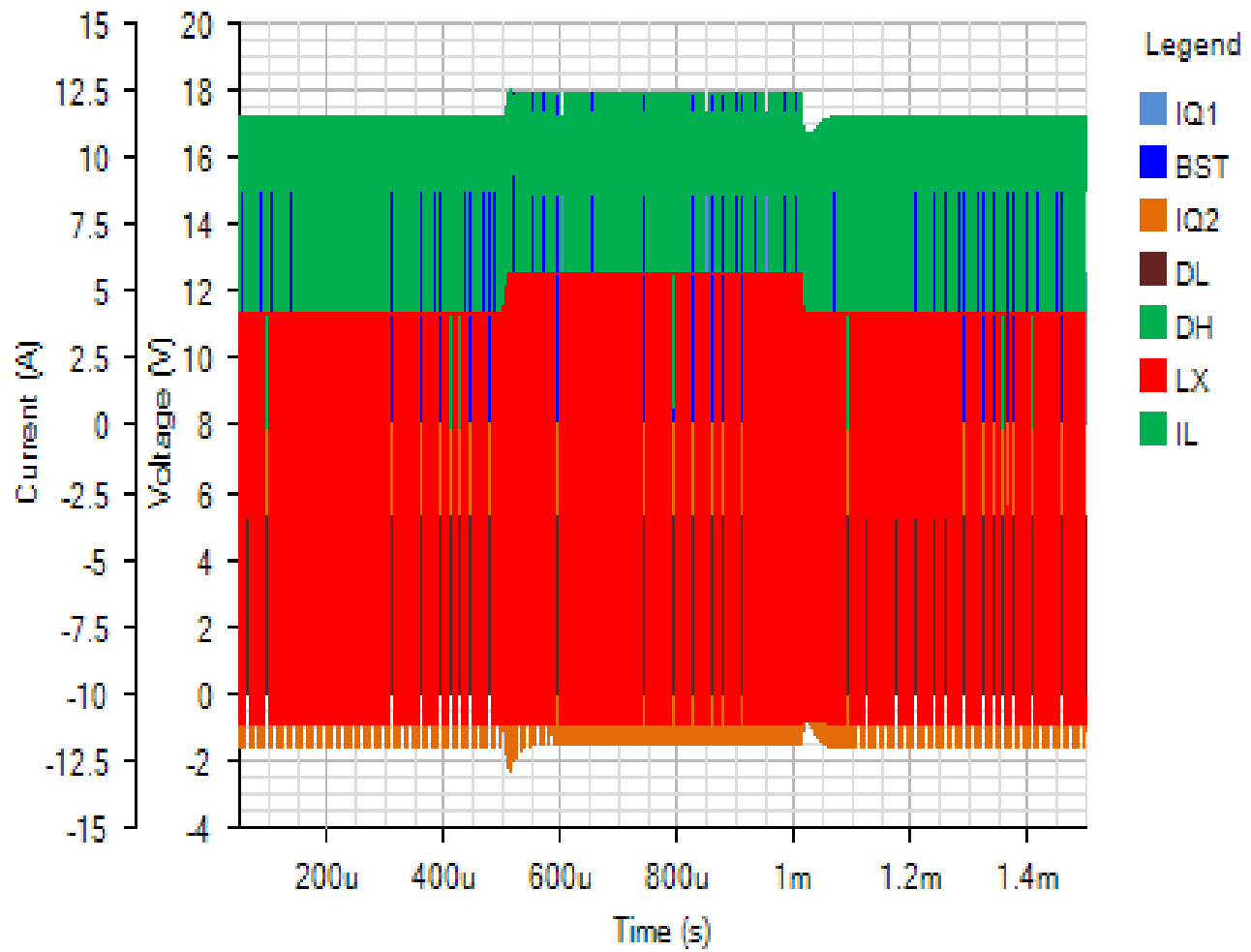


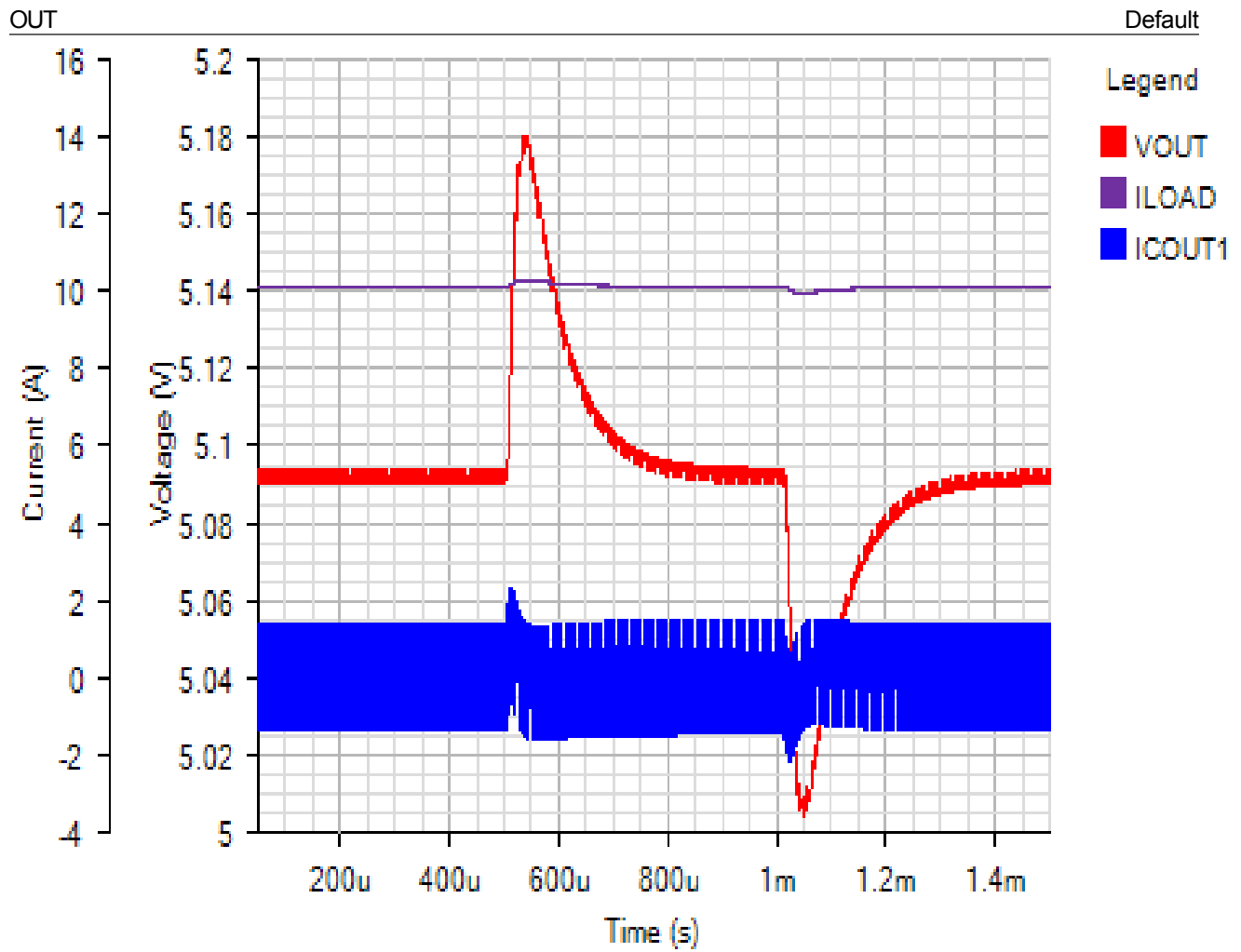
Line Transient - Wed Feb 13 2019 10:50:14



SW

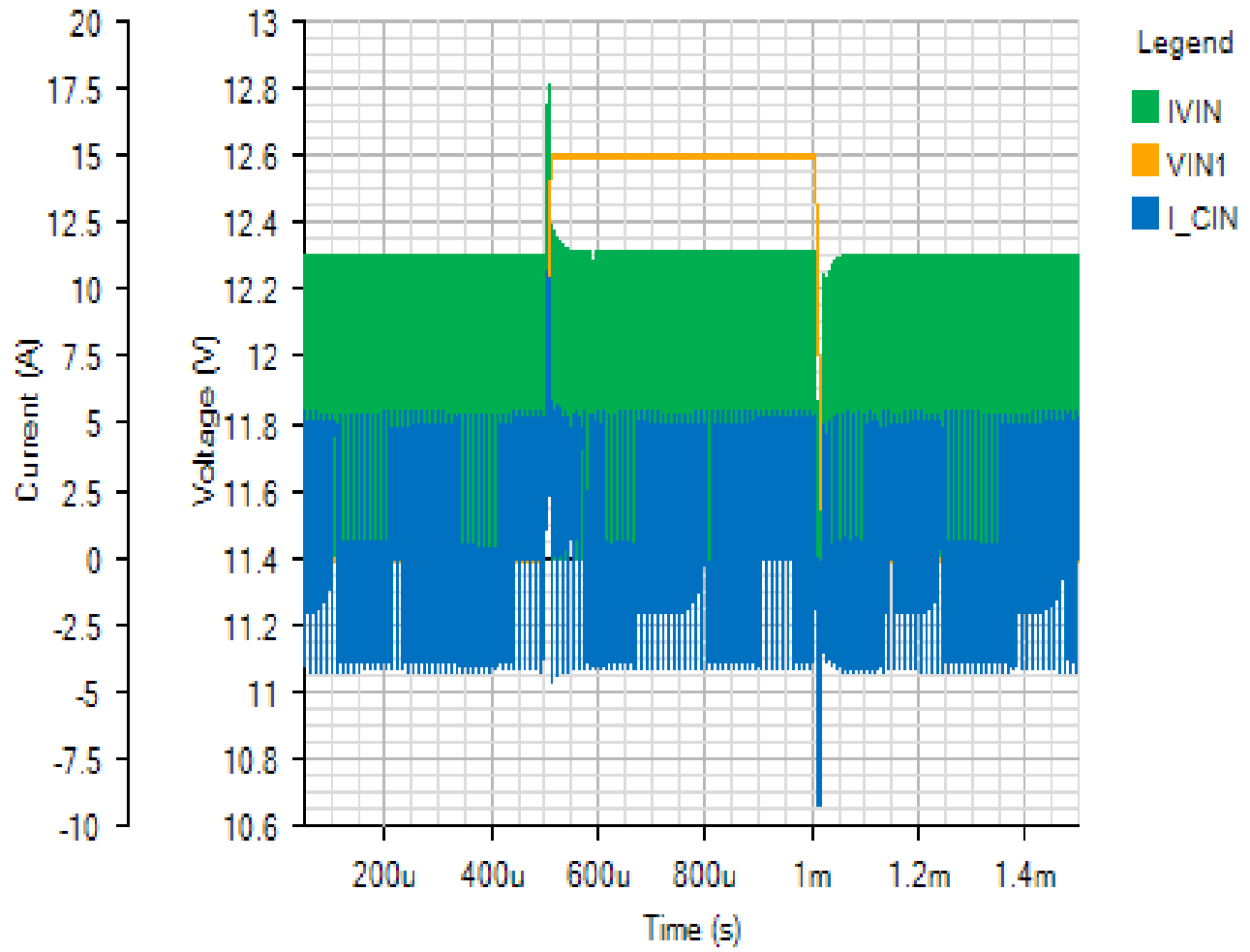
Default



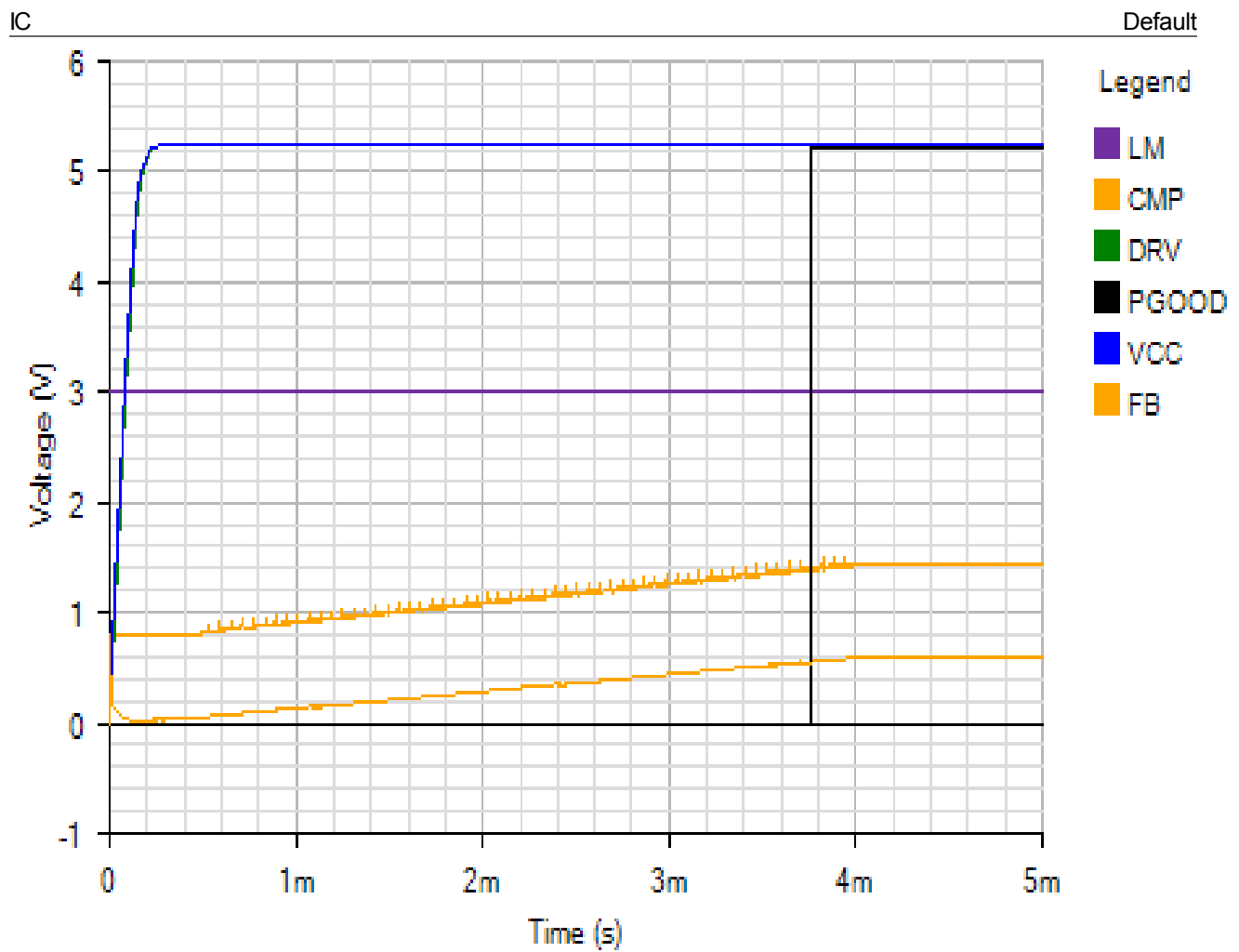


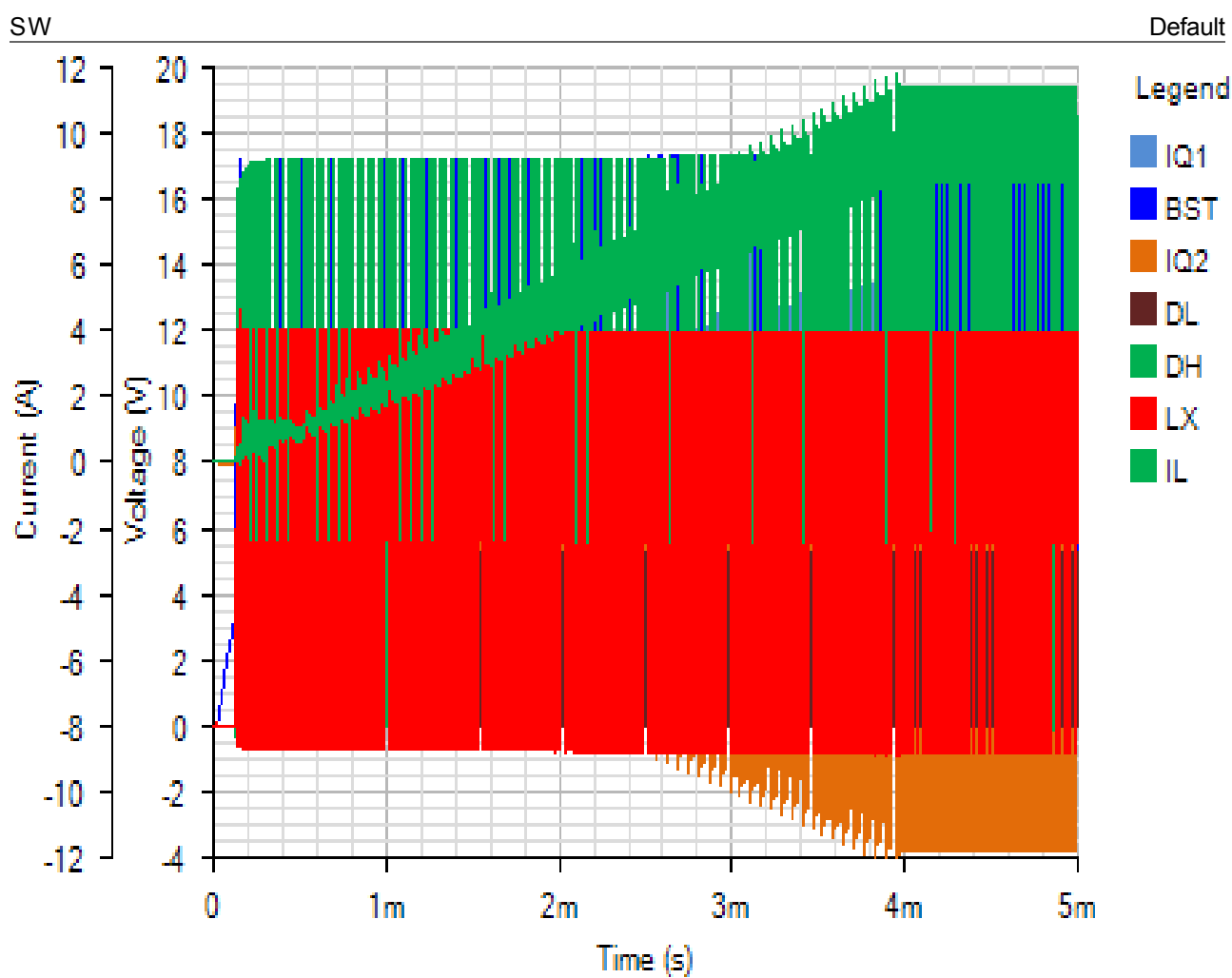
INPUT

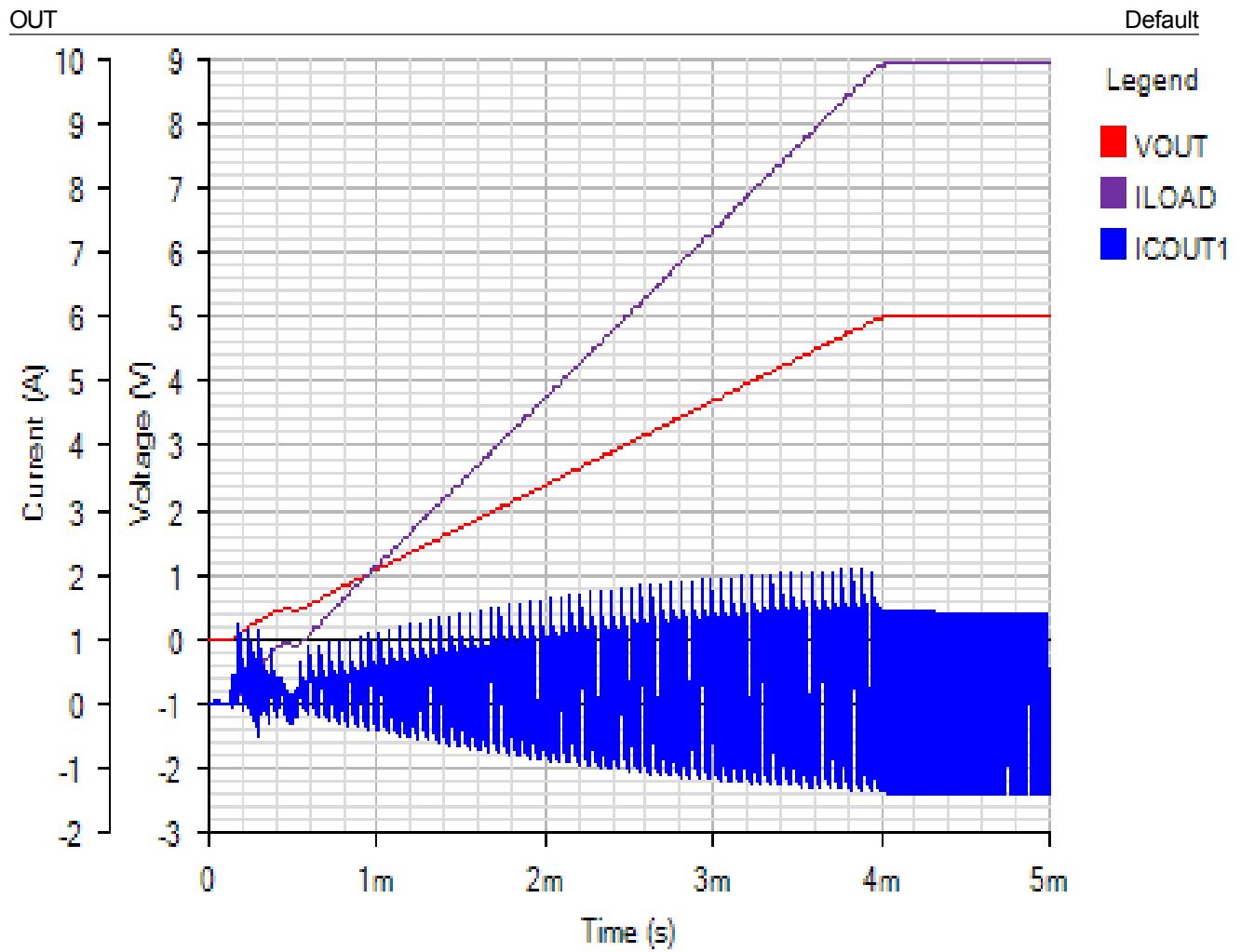
Default

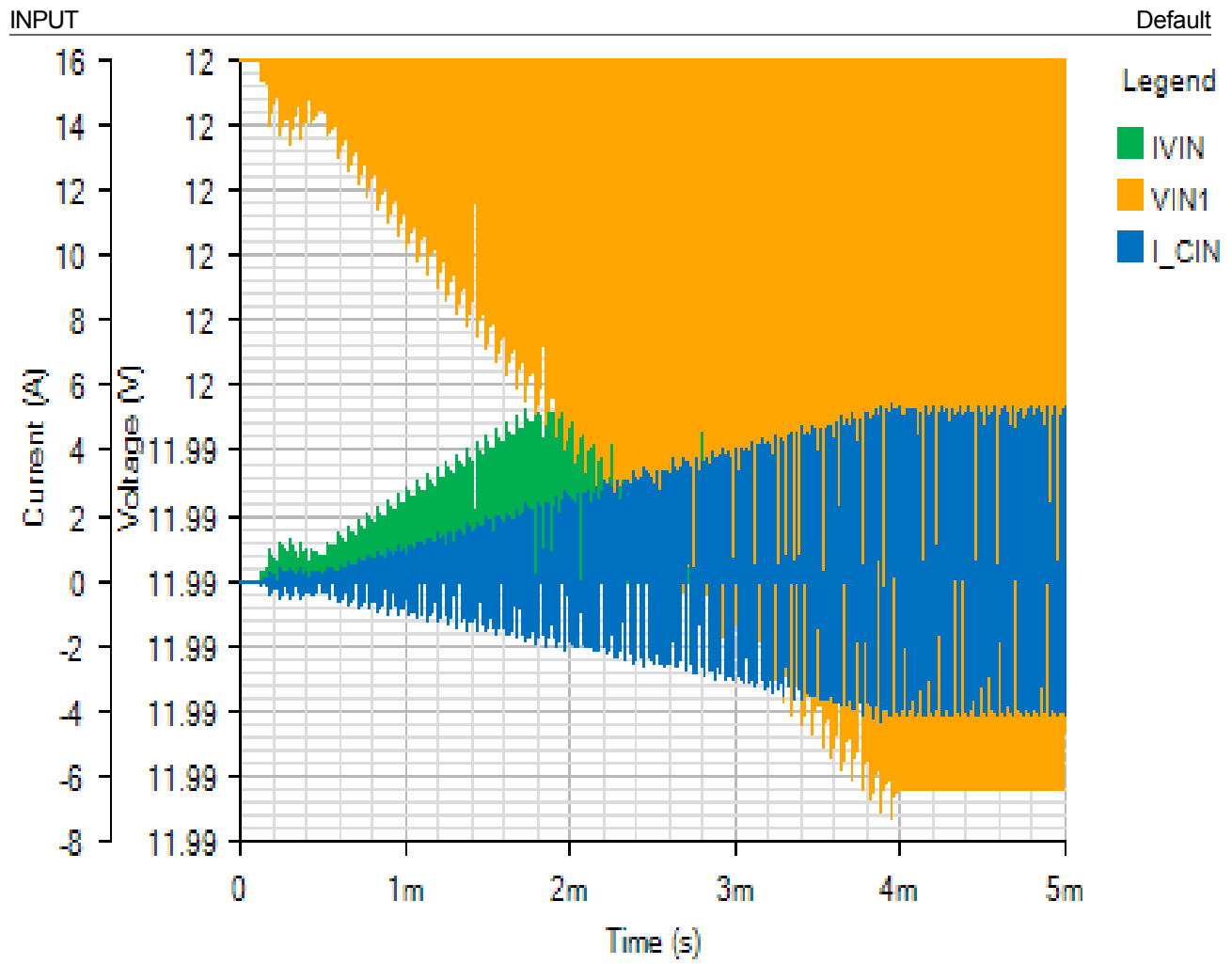


Start Up - Wed Feb 13 2019 10:50:14

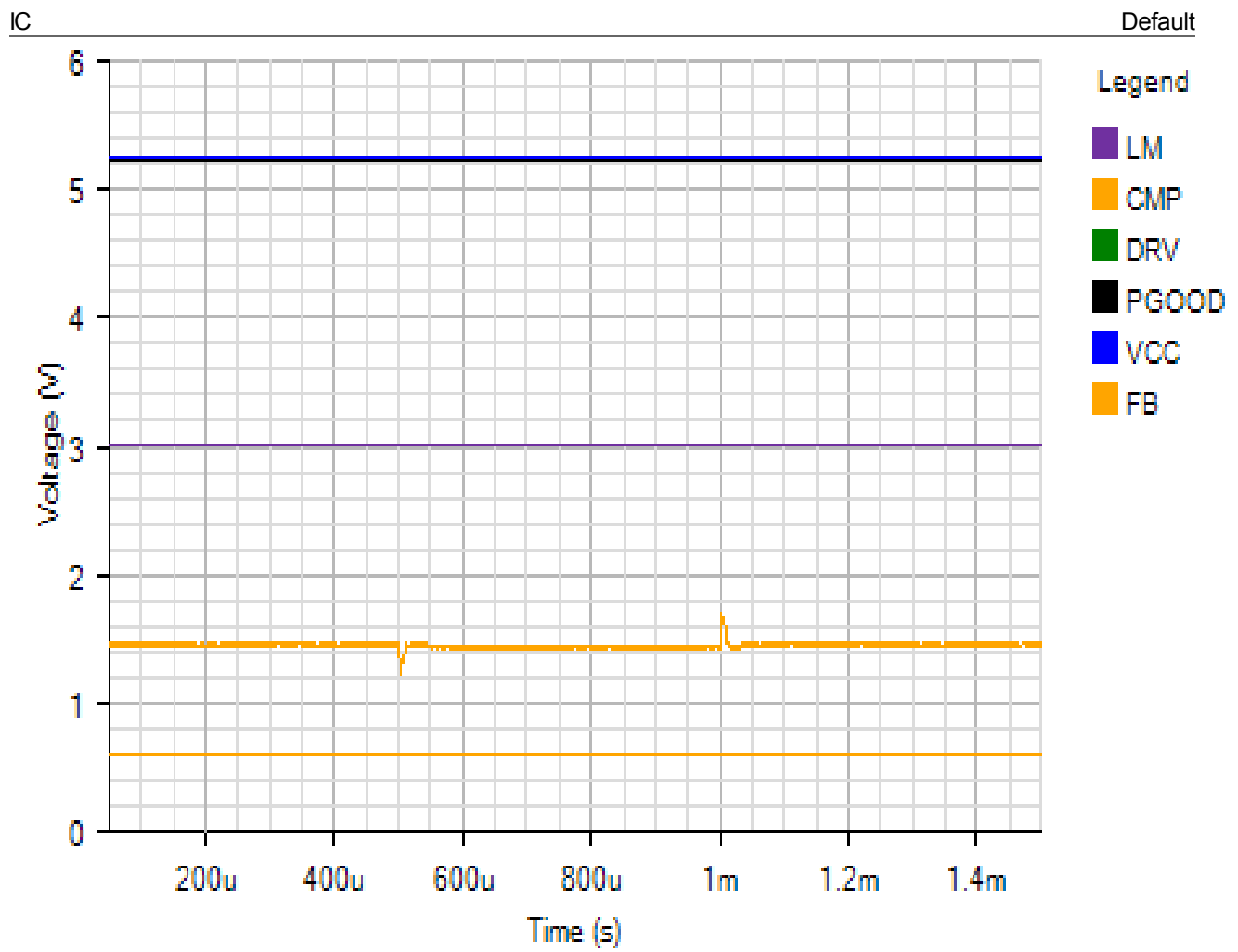








Load Step - Wed Feb 13 2019 10:50:14



SW

Default

