

Abstract

This application note describes how to use the SPICE model for the [ISL70001SRH](#), [ISL70001SEH](#) Radiation Hardened and SEE Hardened 6A Synchronous Buck Regulator. This SPICE model was developed to help system designers evaluate the operation of this IC prior or in conjunction with prototyping a system design. This model accurately simulates typical performance characteristics at room temperature (+25 °C) such as loop analysis, transient analysis and start-up. Functionality has been tested on CADENCE ORCAD 16.3. Other SPICE simulators may be used, however, the model may require translation.

Table of Contents

Introduction	2
Reference Documents	2
License Statement.	2
Project Files	2
Power Blocks	3
Inductor Value	3
V _{OUT} Value	3
Simulation Performance Curves	3

List of Figures

FIGURE 1. Basic Noninverting Gain Configuration in Orcad Spice for AC Analysis	2
FIGURE 2. Simulated Start-Up	3
FIGURE 3. Simulated 3A Transient Response	3
FIGURE 4. Simulated Loop Response	3

Introduction

The ISL70001SRH, ISL70001SEH are radiation hardened and SEE hardened high efficiency monolithic synchronous buck regulators with integrated MOSFETs, which operate over an input voltage range of 3.0V to 5.5V. Utilizing peak current-mode control with integrated compensation and a switching frequency of 1MHz, this Point-of-Load (POL) provides excellent dynamic response in a small form factor. High integration and class leading radiation tolerance makes the ISL70001SRH, ISL70001SEH the ideal POL solution for many space applications.

Reference Documents

- [ISL70001SEH, ISL70001SRH](#) Datasheet
- SMD [5962-09225](#)

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Project Files

The zip file: [isl70001srh-pspice-average-model.zip](#) contains the project file ISL70001SRH.opj to be used in an ORCAD simulator. The project file has the model definition file (.lib), symbol file (.olb) and the schematic page as shown in [Figure 1](#). Three simulation profiles are included in the project to simulate start-up, loop analysis and transient response. [Figures 2](#) through [4](#) show the results of the three preset simulation profiles.

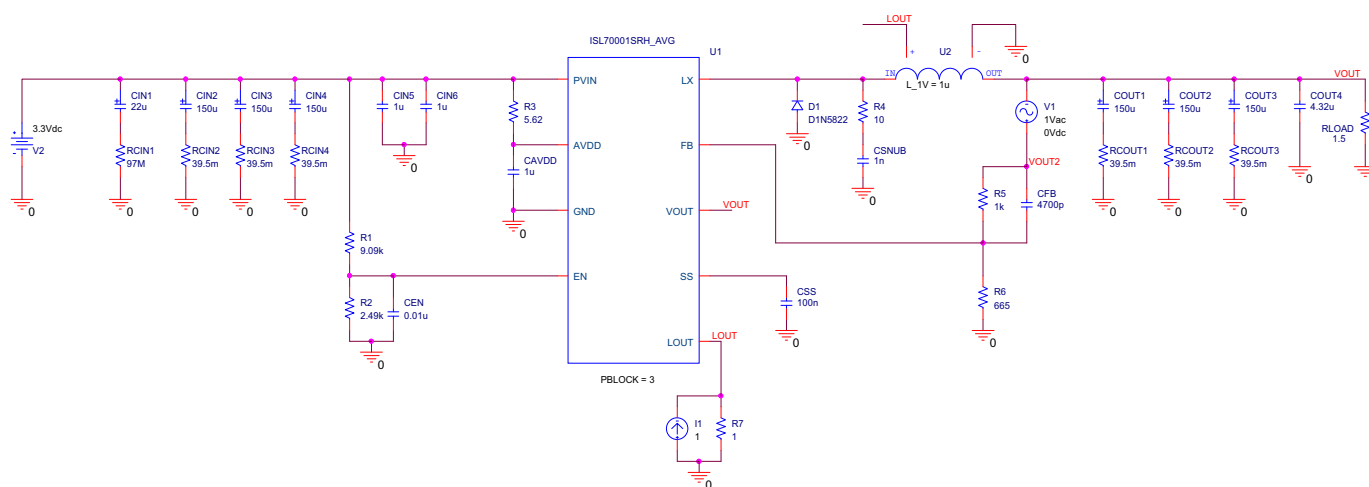


FIGURE 1. BASIC NONINVERTING GAIN CONFIGURATION IN ORCAD SPICE FOR AC ANALYSIS

Power Blocks

The model has a parameter named PBLOCK, which is equivalent to the number of LX nodes connected on the ISL70001SRH in a given application. By double clicking the text you can modify the number of blocks to match the prototype board.

Inductor Value

The average model is based on a mathematical representation of the ISL70001SRH. The value of the inductor is needed for the model to accurately simulate the regulator. The model has an added pin LOUT, which is connected to a current source I1 and resistor R7. These create a voltage that is fed into the pin and into

the inductor U2. U2 translates the voltage into inductance by the equation $L_{1V} = 1\mu$, for every volt on LOUT the inductor value is $1\mu\text{H}$. To change the inductor value to say for example 500nH , one must change R7 to 0.5Ω .

VOUT Value

The output voltage must also be known for the average model to work correctly. The VOUT pin is added to read the output voltage and feed into the internal equations within the ISL70001SRH model. For proper simulation of the model VOUT must be connected to the output voltage of the ISL70001SRH application schematic.

Simulation Performance Curves

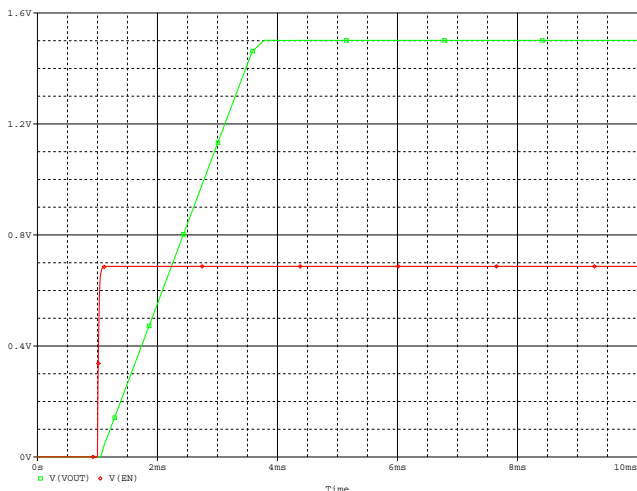


FIGURE 2. SIMULATED START-UP

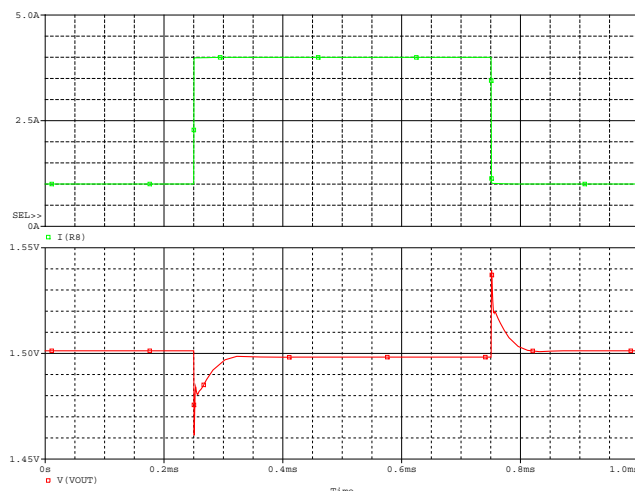


FIGURE 3. SIMULATED 3A TRANSIENT RESPONSE

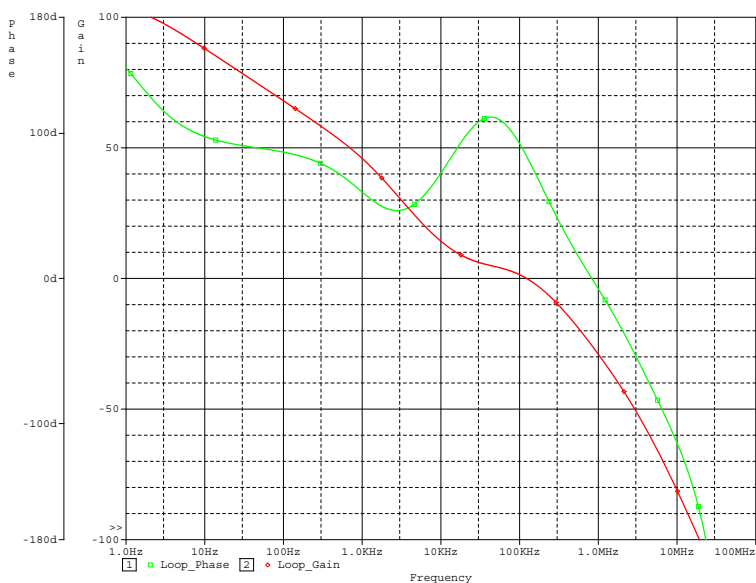


FIGURE 4. SIMULATED LOOP RESPONSE

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