

Pin Connections

The average model is an equation based model, which needs the operating conditions of the buck regulator in order to properly compute the response of the ISL70003SEH. In order to feed the necessary inputs, the model has been modified to accept the values for LOUT and VOUT.

Inductor - LOUT

The model library, isl70003seh_avg.lib, contains the sub circuit file vc_inductor.subckt. This four terminal inductor must be used to appropriately set the output inductance value used within the model. The IN pin of the inductor must be connected to the LX pin of the ISL70003_AVG model and the OUT pin connects to the output capacitors. A series resistor may be added in line with any of these pins to mimic the DCR of the inductor. The "+" pin should connect the LOUT pin of the ISL70003_AVG model and the "-" pin connects to ground, see [Figure 2](#).

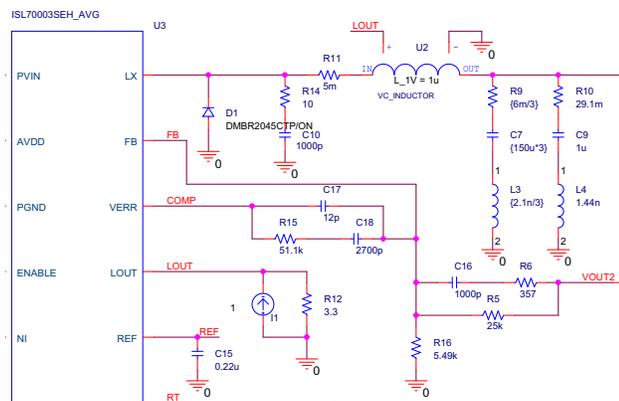


FIGURE 2. VC_INDUCTOR.SUBCKT CONNECTION WITH DCR

To set the output inductor value, a voltage source must be added to the LOUT pin of the ISL70003_AVG model. This voltage is then converted to an inductance value by the equation within the vc_inductor.subckt. The equation is $L_{1V} = 1\mu$, which translates to 1V is equal to $1\mu\text{H}$ of inductance. As an example, a 3.3V voltage source connected to the LOUT pin would equal to $3.3\mu\text{H}$ of the output inductance. In [Figure 1](#), a DC current source and resistor R_{12} are used to create the voltage on the LOUT pin. This allows the user to easily analyze the effects of the inductor's tolerance by setting R_{12} as a parameter and performing a parametric sweep simulation.

Output Voltage - VOUT

Another pin added to the ISL70003SEH_AVG model is the VOUT pin. This pin is used to sense the output voltage of the regulator and pass the information down into model to compute the operating point. VOUT must be connected to the output voltage of the regulator for the model to work properly.

Sawtooth Ramp - RT/CT

On the ISL70003SEH the RT/CT pin is connected to a resistor and capacitor, which generates the sawtooth ramp that is the input to the comparator that creates the PWM pulse train driving the LX node. In the model, this pin is broken up into two pins (RT and CT) in order to accurately model the feed-forward affect of the regulator. A voltage source is needed at these two pins to set the value for RT and CT. For the RT pin, 1V is equivalent to a resistor of $1\text{k}\Omega$ and for the CT pin, 1V is equivalent to a capacitor of 1nF . [Figure 3](#) demonstrates the connection to the RT and CT pins. Note that a current source and resistor are used to generate the voltage on these pins. This allows for easy parametric sweep analysis as PSPICE does not allow tolerances on fixed DC voltage sources.

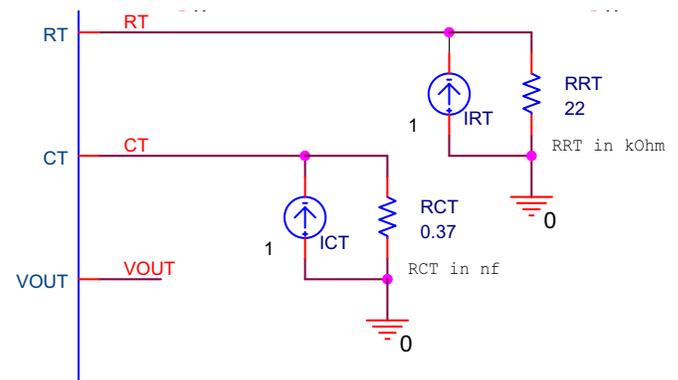


FIGURE 3. RT AND CT PIN CONNECTION

Simulation Performance Curves

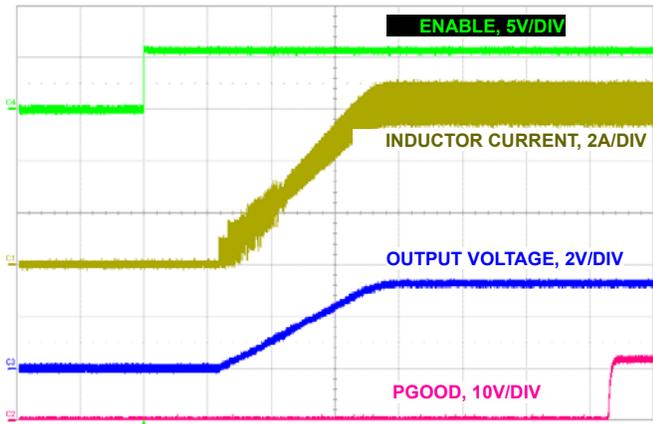


FIGURE 4. CHARACTERIZED SOFT-START WITH 6A LOAD

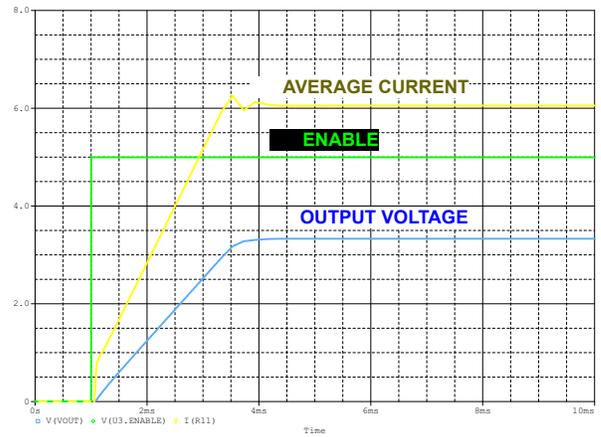


FIGURE 5. SIMULATED SOFT-START WITH 6A LOAD

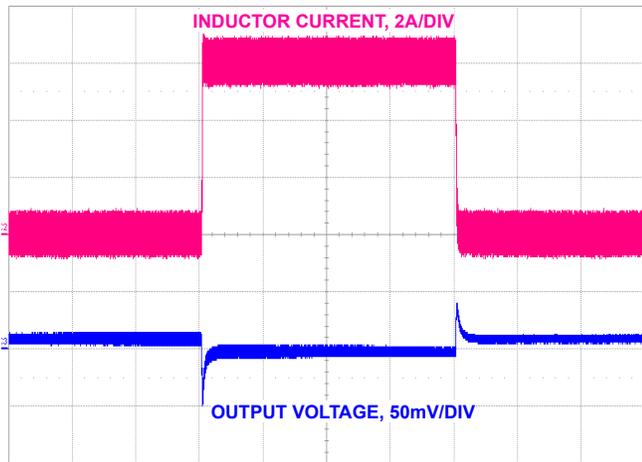


FIGURE 6. CHARACTERIZED 6A LOAD TRANSIENT RESPONSE

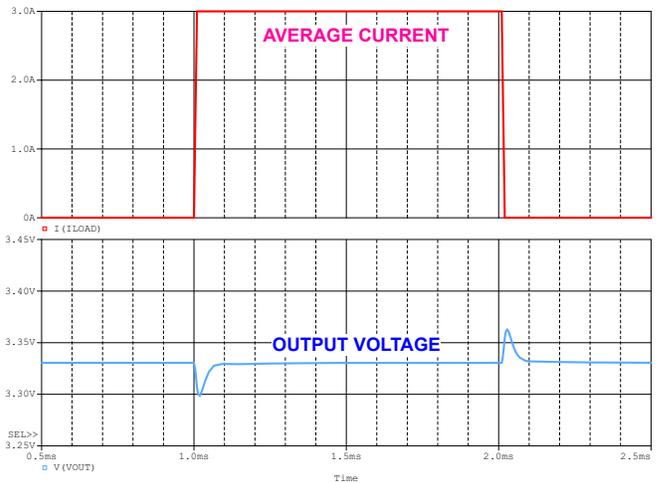


FIGURE 7. SIMULATED 6A LOAD TRANSIENT RESPONSE

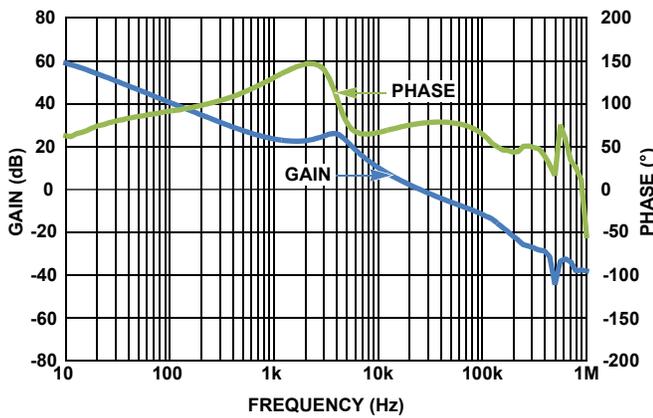


FIGURE 8. CHARACTERIZED LOOP RESPONSE

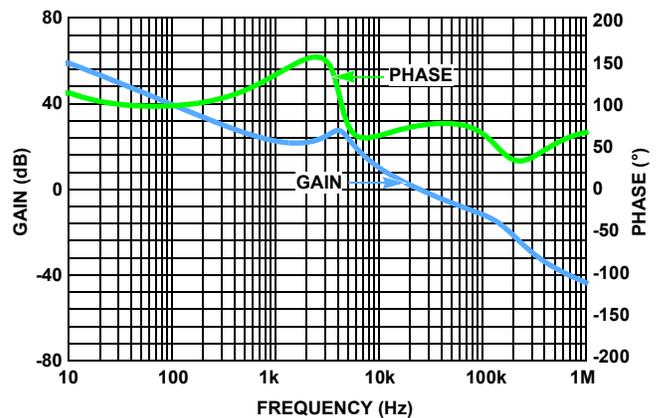


FIGURE 9. SIMULATED LOOP RESPONSE

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Renesas Electronics America Inc.
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.
Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004

Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-651-700, Fax: +44-1628-651-804

Renesas Electronics Europe GmbH
Arcadiastrasse 10, 40472 Düsseldorf, Germany
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong
Tel: +852-2265-6688, Fax: +852-2886-9022

Renesas Electronics Taiwan Co., Ltd.
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan
Tel: +886-2-8175-9600, Fax: +886-2-8175-9670

Renesas Electronics Singapore Pte. Ltd.
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India
Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5338