

PLECS

*DEMO MODEL*

## Buck Converter with Peak Current Control

Last updated in PLECS 4.3.1

[www.plexim.com](http://www.plexim.com)

- ▶ Request a PLECS trial license
- ▶ Check the PLECS documentation

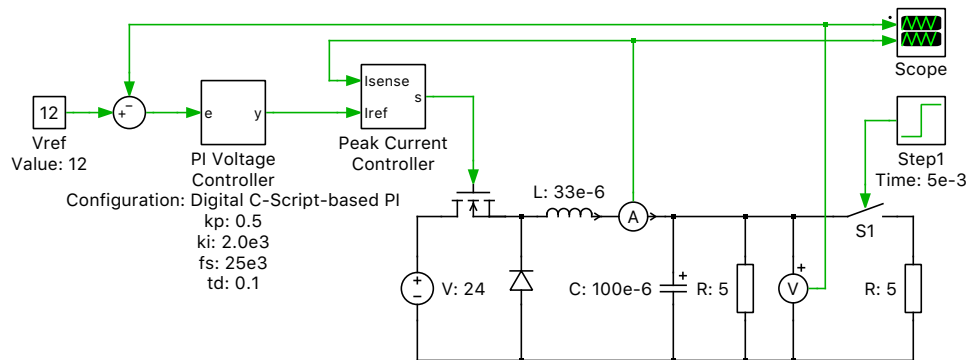
# 1 Overview

This demonstration shows a current-controlled buck converter with a resistive load. The PLECS Peak Current Controller block is used to implement peak current mode control and a voltage control loop is provided in both analog and digital implementations.

## 2 Model

### 2.1 Power circuit

A simple buck converter topology is used to produce 12 V from a 24 V source and demonstrates an output power between  $\sim 25$  and 75 W.



**Figure 1: Buck Converter with Peak Current Control**

### 2.2 Control

The switch modulation is generated by the PLECS Peak Current Controller block. This controls the peak current flowing through the inductor. Slope compensation is used to ensure stability when the duty cycle exceeds 50%. An outer voltage control loop supplies the reference current for the peak current mode control and this is implemented using a masked configurable subsystem. The subsystem contains an analog PI voltage control implementation with discrete s-domain blocks, as well as a digital implementation using a C-Script block. By looking under the mask (**Ctrl+U**) of the PI Voltage Controller block, the two control implementations can be viewed.

The digital PI controller implementation includes an optional calculation delay. In a practical system, a finite delay exists due to the time needed for the controller to read the input(s), perform the control calculation and write to the output(s), and can degrade the stability for certain systems. The parameters for the proportional and integrator gains, as well as the sampling frequency and calculation delay are masked parameters for the controller subsystem. Since they are directly passed to the C-Script block as inputs, the values can be changed at the top level of the schematic for analyzing various effects. Note that for the analog implementation the subsystem mask parameters for switching frequency and calculation delay are not relevant.

## 3 Simulation

The simulation demonstrates the start-up of the converter and a load step half way through the simulation. When the load resistance is halved, the current doubles and the perturbation in the voltage is regulated out in approximately 200  $\mu\text{s}$ .

The voltage control scheme can be toggled between analog and digital implementations. To observe the influence of the calculation delay in the digital voltage controller implementation, set the switching frequency to 10 kHz and run the simulation for a calculation delay of 0.1 and 0.9.

## Revision History:

PLECS 4.3.1      First release

## How to Contact Plexim:

☎	+41 44 533 51 00	Phone
	+41 44 533 51 01	Fax
✉	Plexim GmbH Technoparkstrasse 1 8005 Zurich Switzerland	Mail
@	info@plexim.com	Email
	<a href="http://www.plexim.com">http://www.plexim.com</a>	Web

### *PLECS Demo Model*

© 2002–2021 by Plexim GmbH

The software PLECS described in this document is furnished under a license agreement. The software may be used or copied only under the terms of the license agreement. No part of this manual may be photocopied or reproduced in any form without prior written consent from Plexim GmbH.

PLECS is a registered trademark of Plexim GmbH. MATLAB, Simulink and Simulink Coder are registered trademarks of The MathWorks, Inc. Other product or brand names are trademarks or registered trademarks of their respective holders.