

USER GUIDE

UG021 | Using the WPME-VDLM LTspice Models



Timur Uludag

1. INTRODUCTION

The VDLM series MagI³C power module provides a fully integrated DC-DC power supply including the switching regulator with integrated MOSFETs, controller and compensation, as well as the shielded inductor in one package.

The Spread Spectrum feature enables the modules to actively reduce EMI. The extremely wide input voltage range now makes it possible to cover bus voltages from 5 V up to and including 24 V. Thus applications from PoL, USB up to direct connection to the 24 V bus can be realized. Due to their small size and high efficiency (up to 94%), they are particularly suitable for use in mobile and battery-powered devices. To save energy, the power module can be set to an idle state via an additional PIN (EN). The Power Good feature indicates whether the output voltage of the module is in the nominal range. The integrated sync feature makes it possible to synchronize several VDLMs to an external frequency.

2. TYPES OF MODULES

Article number	171013801	171023801	17133801
V _{IN}	3.5 – 38 V	3.5 – 38 V	3.5 – 38 V
V _{OUT}	0.85 – 13 V	0.85 – 13 V	0.85 – 6 V
I _{OUT}	1 A	2 A	3 A

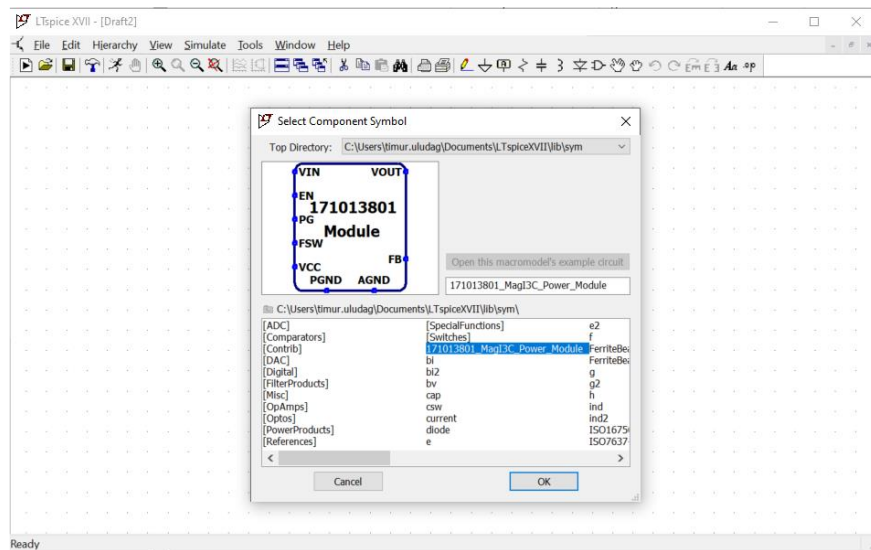
Table 1: Types of Modules.

3. HOW TO USE THE MODEL

3.1 Insert the Symbol / Part Number

- Note: The model installation locations below pertain to LTspice version 17.1 or greater.
- If installing the models yourself, save the *.lib files in the user folder ...\\AppData\\Local\\LTspiceXVII\\lib\\sub.
- Save the *.asy files in the user folder ...\\AppData\\Local\\LTspiceXVII\\lib\\sub or a subfolder thereof. If LTspice is open, it must be closed and re-opened to view the new models in the component directory.
- To use the model of the 1710 x 3801, add the symbol 171013801_MagI3C_Power_Module to the schematic.

Inserting the WPME-VDLM **171013801** is shown in Figure 1.



Press OK.

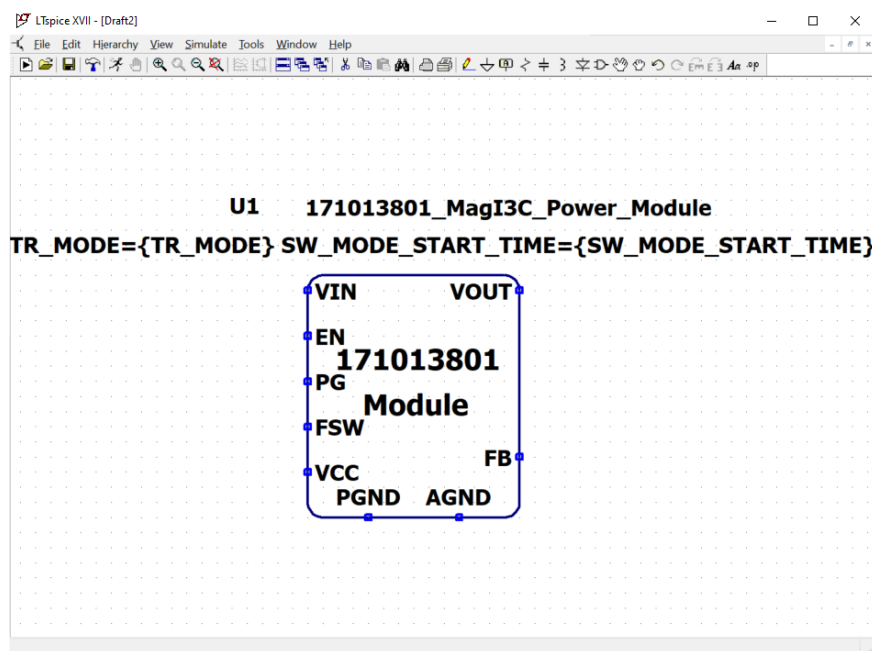


Figure 1: Insert the WPME-VDLM **171013801**.

3.2 Configure the Model

The models provided for the 1710 x 3801 have two modes of operation, which can be selected using the TR_Mode parameter: average mode and switching mode.

- **Average Mode:** This mode is ideal for characterizing functional checks such as UVLO, PG, soft start, etc., as it calculates average values instead of switching ones. This results in faster simulations and shorter conversion times.
- **Switching Mode:** This mode is used to accurately calculate and display switching parameters, such as switching node or input/output voltage ripples. However, it results in longer simulation times.

To enable average mode, set the TR_Mode parameter to 1, and to enable switching mode, set it to 0.

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As an example, we set the TR_MODE to 1 (Figure 2).

Open the SPICE Directive window and type in:

```
.PARAM TR_MODE = {1}
```

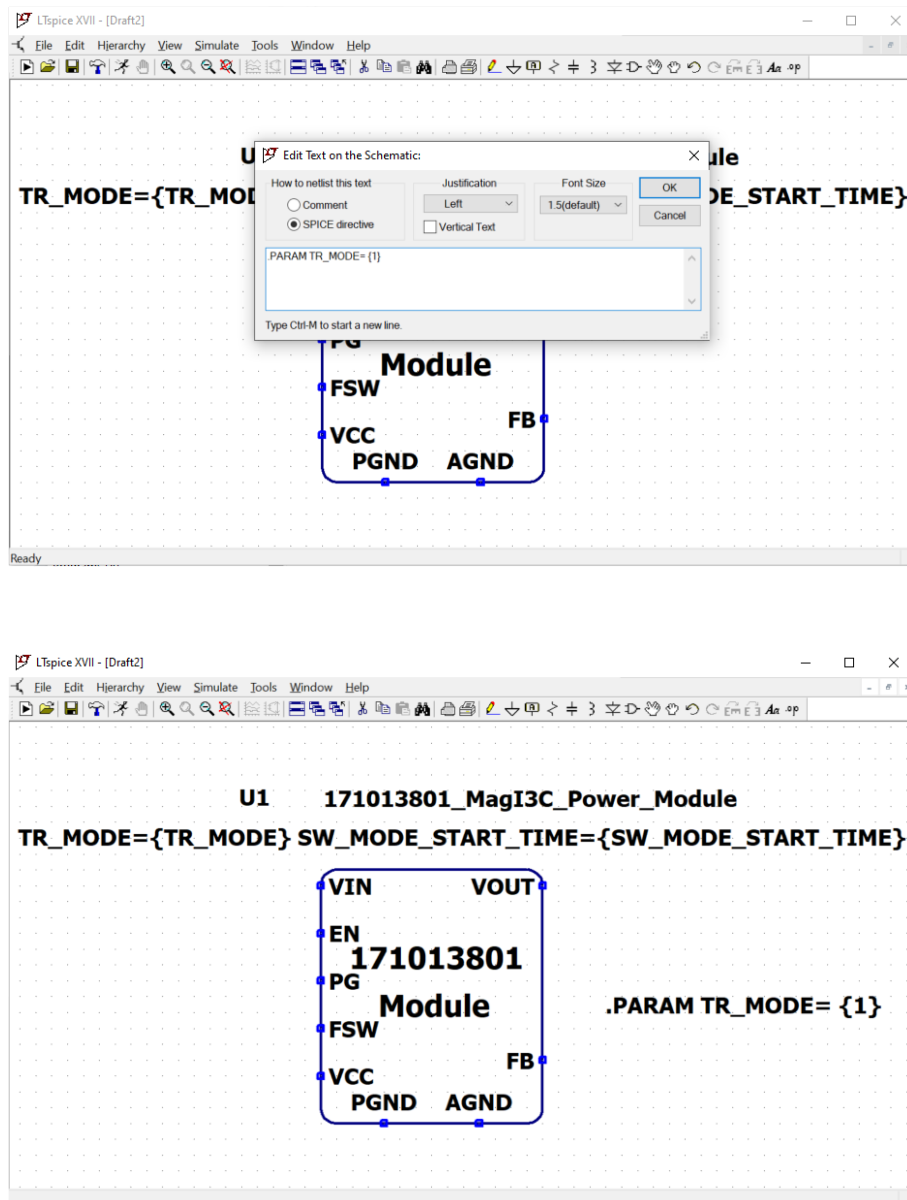


Figure 2: TR_MODE set to "1".

Another feature of the provided models is SW_MODE_START_TIME, which combines the benefits of both average and switching modes. By using this feature, the simulation model starts in average mode to quickly reach a stable point, then switches to switching mode when the time stamp allows for greater accuracy.

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As an example, we set the SW_MODE_START_TIME to 2.4 ms (Figure 3).

Open the SPICE Directive window and type in:

```
.param SW_MODE_START_TIME = {2.4 m}
```

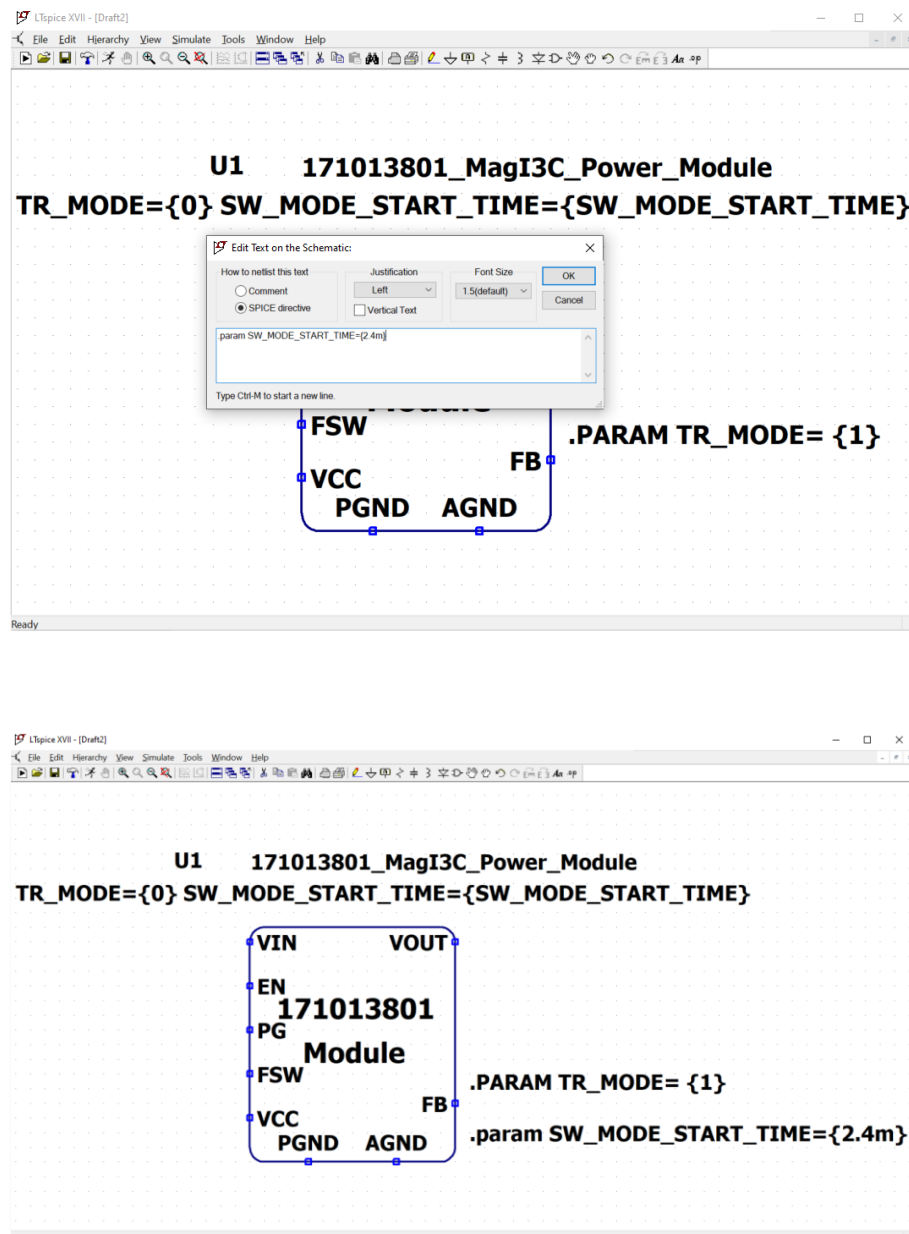


Figure 3: Setting SW_MODE_START_TIME.

It is recommended to use the UIC (Use Initial Condition) option in transient analysis when incorporating the model into a schematic. For other settings related to time step, solver, or other transient analysis parameters, please refer to the provided schematics.

NOTE: The simulation time is strongly dependent on the performance of your simulating device.

4. EXAMPLE CIRCUIT

For a first start to get more familiar with the LTspice capabilities of the provided model of the [171013801](#)-power module an example circuit with load jumps from 0 A to 3 A is shown in Figure 4.

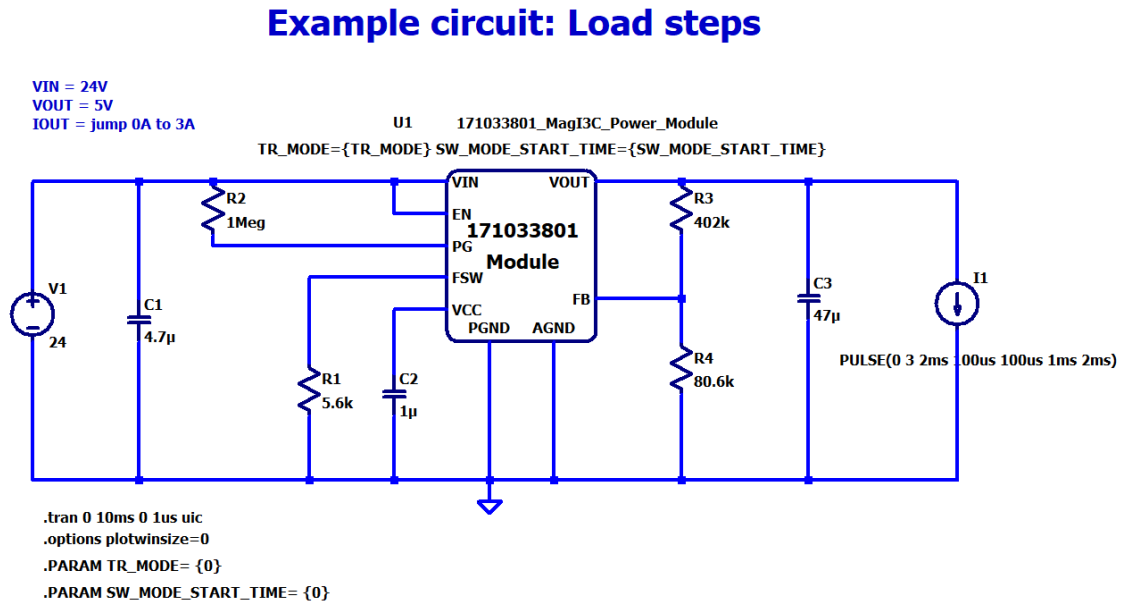


Figure 4: Simple example circuit for load jumps.

5. ADDITIONAL PREDEFINED CIRCUIT MODELS

In addition, there are following predefined circuits available (Fehler! Verweisquelle konnte nicht gefunden werden.).

File name	Description
Efficiency	This predefined model can be used to measure the efficiency of the power module. The user can adjust input voltage, output voltages, and output current to check efficiency at different conditions.
Enable	This predefined model can be used to enable feature of the power module.
Feedback	This predefined model can be used to check the accuracy of the voltage reference integrated inside the power module. The user can change temperature to see the impact on the voltage reference.
Internal LDO	This predefined model can be used to measure the output voltage of the V _{CC} pin of the power module.
Overcurrent	This predefined model can be used to verify the overcurrent protection limit.
PFM	This predefined model can be used to verify behaviour of the power module during PFM.
Power Good	This predefined model can be used to verify the power good feature.
Quiescent Current	This predefined model can be used to measure the quiescent current of the power module.
Startup	This predefined model can be used to verify the startup behaviour of the power module.
Thermal shutdown	This predefined model verifies the operation of the thermal shutdown feature.
UVLO	This predefined model verifies the operation of the UVLO feature.

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CONTACT INFORMATION



appnotes@we-online.com
Tel. +49 7942 945 - 0



Würth Elektronik eiSos GmbH & Co. KG
Max-Eyth-Str. 1 74638 Waldenburg Germany
www.we-online.com