

Automatic Generation of State Diagrams for the ADM1062 to ADM1069 Using Graphviz

by Michael Bradley

GENERAL DESCRIPTION

The ADM1062, ADM1063, ADM1064, ADM1065, ADM1066, ADM1067, ADM1068, and ADM1069, hereafter referred to as ADM1062 to ADM1069, are fully programmable supply sequencers that can be used as complete supply management solutions in systems utilizing multiple voltage supplies. Applications include line cards in telecommunications infrastructure equipment (for central offices and base stations) and blade cards in servers.

One of the most powerful features of the ADM1062 to ADM1069 devices is their 63-state sequencing engine (SE). The SE is used to control the power-up and power-down of supplies and can implement application-specific fault handling.

The evaluation software GUI for the ADM1062 to ADM1069 is used to define the behavior of the state machine. The definition of the state machine is presented in a tabular form in the GUI. This is not always the most natural method of understanding the operation of the state machine; a more graphical state diagram is the usual representation.

With the release of Version 4.0.5 of the ADM1062 to ADM1069 evaluation software, it is now possible to quickly and easily generate state diagrams using an external graph visualization software tool called Graphviz. These diagrams can be generated in a number of different formats, and viewed, printed, and, in some cases, edited, if required. This application note describes Graphviz and how to use the new graphical output function in the ADM1062 to ADM1069 evaluation software.

For more details on the ADM1062 to ADM1069 devices, and to download the evaluation software, visit www.analog.com.

WHAT IS GRAPHVIZ?

Graphviz is an open-source visualization tool. It is capable of reading a state diagram definition provided in the form of a specially formatted text file, and creating a graphical output file showing each state and the relationships it has with other states. A simple example of the type of output possible is shown in Figure 1. A more complex example is shown in Figure 4.

The position and layout of the states, the relationship lines, and all text labels are handled automatically by the Graphviz tool. Graphviz attempts to optimize the layout to minimize the crossing of lines, and tries to group related states close together.

Because the Graphviz installer is included as part of the ADM1062 to ADM1069 software installation, a separate download is not necessary.

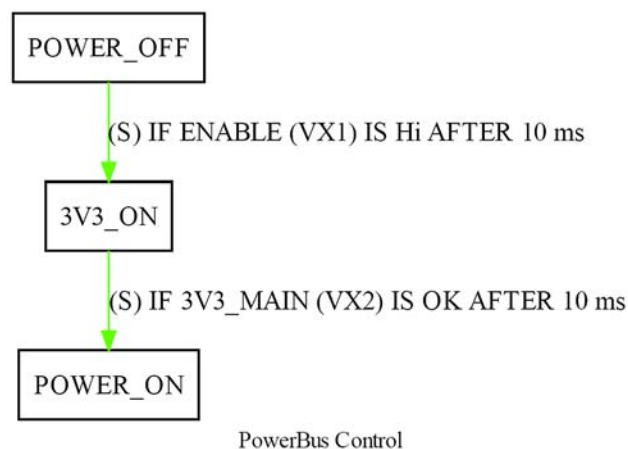


Figure 1. Example of Graphviz Output

Additional documentation, tools, and examples of other ways that Graphviz can be used can be found online.

USING THE STATE DIAGRAMS

The graphical state diagrams can be used to easily visualize the different steps performed during a sequencing operation. The diagrams can be used to check that the state machine is doing what the designer intended. Viewing the state machine in graphical form can help spot any unexpected or incorrect transitions between different states.

When a comparison between two versions of a state machine needs to be made, it can be useful to compare the versions graphically, instead of attempting to compare them in the text form provided in the GUI. It is possible to quickly find any additional or missing states and get an idea of the nature of the changes and their impact upon the sequencing operation.

The state diagram output is a useful and more meaningful method of documenting the state machine and sequencing behavior than the tabular view provided by the software. This is particularly true if the graphical form of the state machine is printed out and referred to during the debugging of a given state machine. The Graphviz software is used by the ADM1062 to ADM1069 software to create graphical forms of the tabular sequencing engine configuration. The ADM1062 to ADM1069 software creates an intermediate text file that Graphviz processes to produce the state diagram.

Editing the state diagram or the intermediate text file and then loading the modified file back into the ADM1062 to ADM1069 evaluation software is not supported.

INSTALLING GRAPHVIZ

The ADM1062 to ADM1069 software installer runs the Graphviz installer once the ADM1062 to ADM1069 software is installed. The Graphviz software should be installed at the default path, but can be installed at a different location, if necessary. If the ADM1062 to ADM1069 software cannot locate the required Graphviz executable file when creating the state machine diagrams, the user is prompted for the location.

GENERATING A SEQUENCE ENGINE DIAGRAM

The basic operation of the ADM1062 to ADM1069 software remains unchanged. To access the new graphical output functionality, click the **Create State Diagram** button on the **Sequence Engine** tab (see Figure 2) to display a settings window.

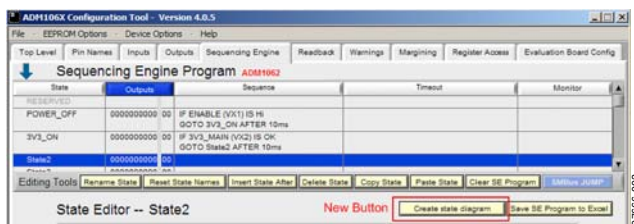


Figure 2. Configuration Tool, Sequence Engine Tab

The **State Diagram Settings** window (see Figure 3) provides control over the format and nature of the diagram generated. The configuration options are listed and described in this section.

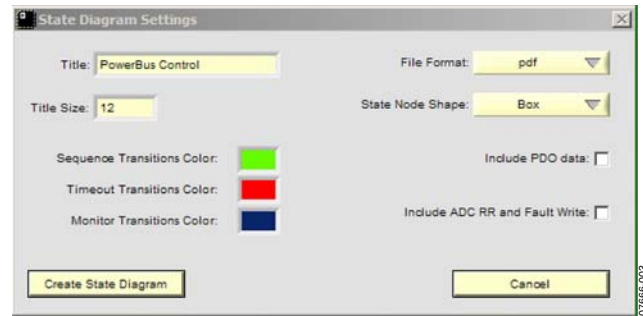


Figure 3. State Diagram Settings Window

Title: A user can give the state machine a title that appears at the bottom of the diagram.

Title Size: This is the font size used for the title text.

Sequence/Timeout/Monitor Transitions Color: There are three possible exit routes from any given ADM1062 to ADM1069 state. These color boxes allow each type of transition to be color-coded.

File Format: Various graphical file formats are supported. The best format to use depends on how a user intends to use the file. Some guidance on the choice of file formats is given.

State Node Shape: States can be shown enclosed in one of several different shapes.

Include PDO Data: This checkbox, when enabled, includes an extra line in each state node showing how the programmable digital outputs (PDOs) are configured in that state.

Include ADC RR and Fault Write: This checkbox, when enabled, includes an extra line in each state node showing if the ADC round robin (RR) is active, or if the user enabled writing to the fault registers.

Clicking **Create State Diagram** prompts the user for a file name and location. When the name and location are set, click **Save** to begin generating the state diagram.

The file name, with a .txt suffix, is used to create a Graphviz format text file containing the state machine definition in the location specified by the user. If a file already exists in the location with the same name, a software prompt inquires if you want to replace the existing file. The same file name with a suffix appropriate to the selected file format, for example, a .jpg suffix for a JPEG file, is created by Graphviz as the output graphical file in the same location.

Note: If a file already exists in the location with the same name, the software overwrites the existing file without inquiring.

FILE FORMAT CHOICES

Version 4.0.5 of the ADM106x evaluation software supports four different output file formats: .jpg, .png, .pdf, and .svg. The joint photographic experts group (JPEG or .jpg) and portable network graphics (PNG or .png) formats are both bit-mapped formats, which can be easily viewed directly from Windows® Explorer.

Because these are bit-mapped files, they do not print at high resolutions, and print with jaggies if scaled up to larger sizes. They can, however, be edited easily in most software paint programs.

The portable document format (PDF or .pdf) can be viewed using any PDF viewer application, such as Adobe Acrobat® Reader. Because this is a vector format, a PDF file can print at high resolutions, can be scaled up, and remains free of jaggies. Few applications can directly edit a PDF file; Adobe Illustrator® is a notable exception. In general, if the diagram only needs to be viewed and printed, then PDF is the best option.

The final format is scalable vector graphics (SVG or .svg). As the name suggests, this is another vector format, so printing at high resolutions and large sizes is not a problem. This format can also be edited easily, using either commercial tools, such as Adobe Illustrator, or other free SVG editor tools, such as Inkscape.

PRINTING STATE DIAGRAMS

The typical approach used when printing a state diagram is to select the **Fit to Page** option so that the state diagram prints on a single page. Unless a large format printer is available, this means that as the number of states increases, the diagram text becomes very small and illegible.

In order to print a complex state diagram with legible text, it is necessary to print the state diagram output file using software that supports **Tiling** or **Poster** output options. The **Tiling** and **Poster** options allow a single page in a document to be scaled up to a larger size and printed across multiple single printer pages, which can be joined together, effectively providing a large format output.

To facilitate tiled or poster output, the state diagram should be generated using the PDF file format output option. This is the best choice because it offers the best quality printed output and software is readily available to support the tiling function. Using suitable software, it is possible to scale the state machine PDF file such that it prints across two, three, or more pages.

In some cases, the tiling or poster function may be available as part of the printer driver software for a given printer. In this case, the user can use software, such as Adobe Acrobat Reader, to print the state diagram PDF file, selecting the required settings in the printer driver.

Alternatively, if the printer driver does not support the tiling or poster function, another solution is to use a PDF viewer application, such as PDF-XChange Viewer from Tracker Software, which is capable of performing the tiling function to create the larger format when printing.

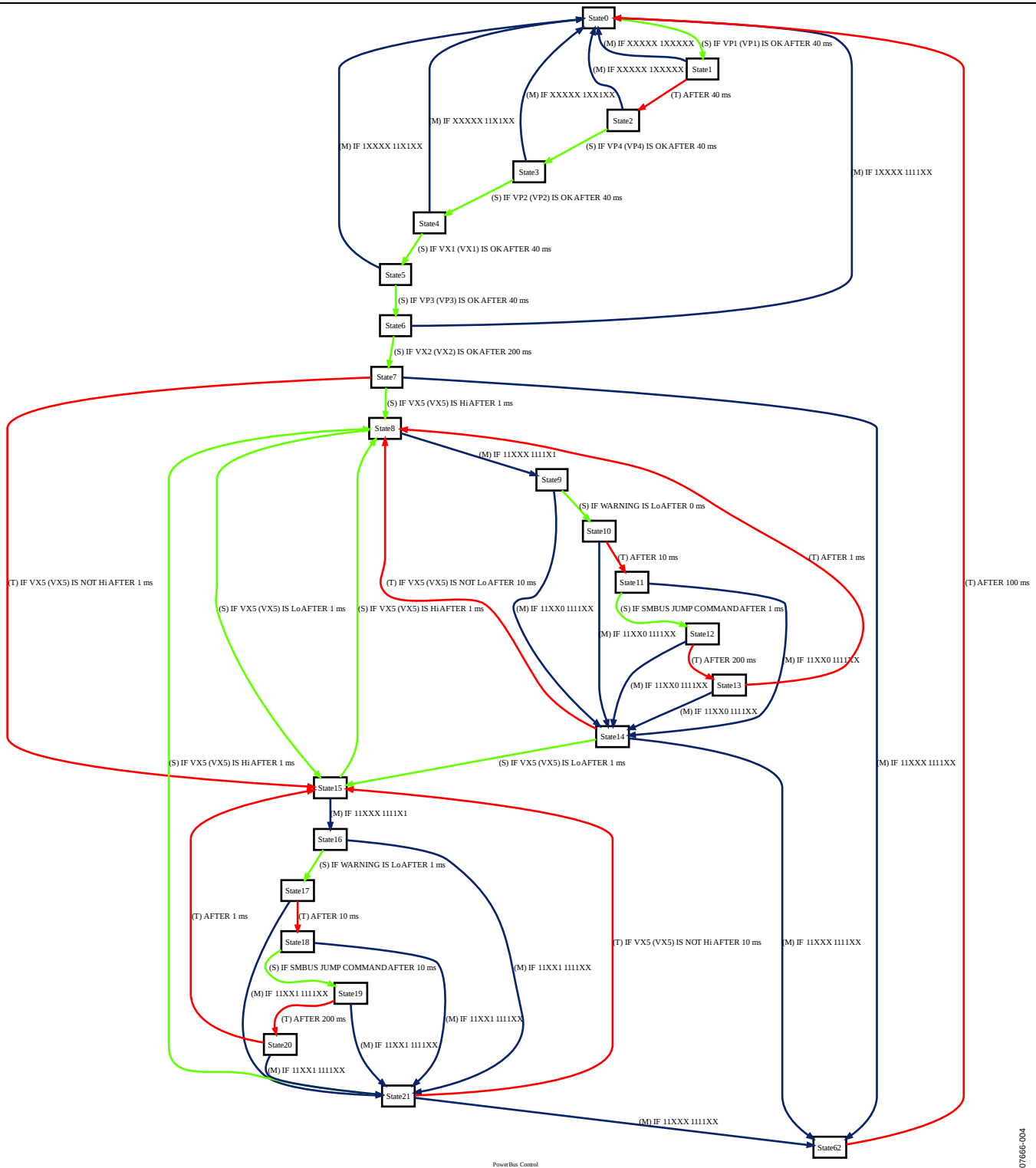


Figure 4. Example of Graphviz Output for a Typical ADM1062 to ADM1069 State Machine