Application Report
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Dual-Channel VCAs: Methods for Powering Down One Channel

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ABSTRACT

Texas Instruments offers several product groups of highly-integrated voltage-controlled amplifiers (VCAs), originally designed for ultrasound applications. These product families include the VCA2611/12/13/16, with an integrated Low-Noise Preamplifier (LNP), and the VCA2614/18/19, without an LNP. Both the VCA2611 and the VCA2614 families feature two channels. Recently, a question has arisen regarding whether it is possible to power only one channel of the VCA while powering down the other. This application note outlines two possible approaches to this question and describes the steps needed to assure the greatest chance of success. Additional methods to accomplish this task are also suggested. Unless otherwise specified, this application report applies to any member of the VCA2611 and VCA2614 families.

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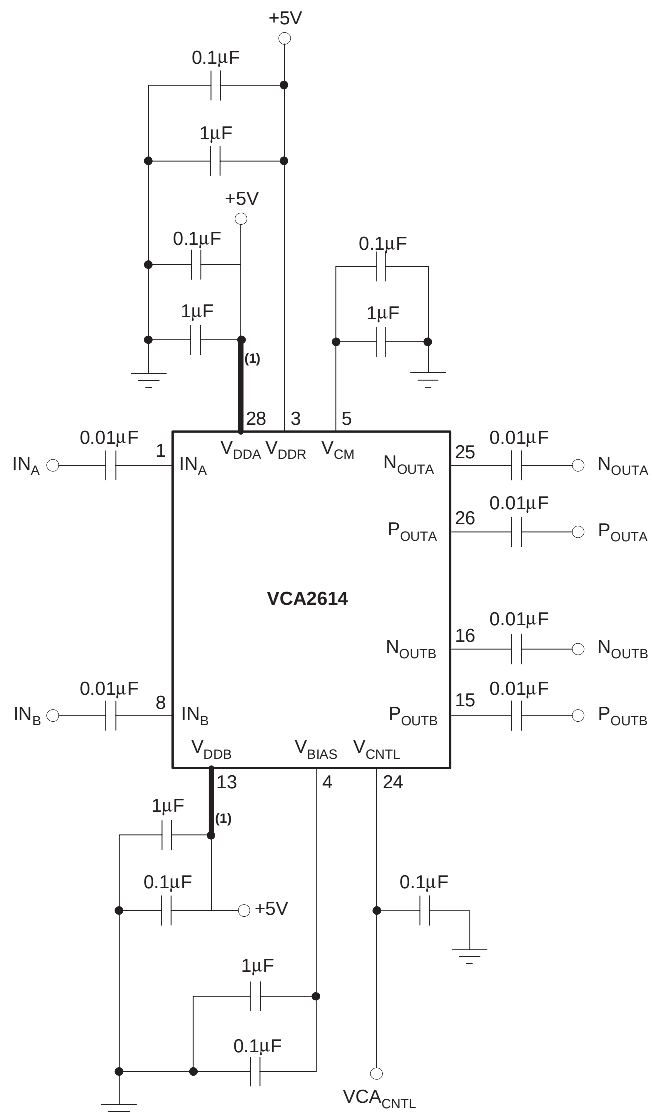
Powering Down A Single Channel

This report addresses the fundamental issue of whether or not it is possible to power only one channel of a VCA while powering down the other. The VCA2614 family features a dedicated power-down pin that powers down the entire device. However, this report will show that it is possible to power-down one channel of either family of VCAs.

The VCA2614 and VCA2611 families are dual-channel devices with separate power-supply pins for each channel. Separate supply pins make it possible for a user to apply power to one channel and not the other. The two channels of the device share some internal functions (such as the MGS settings) because of the internal circuitry of the VCAs.

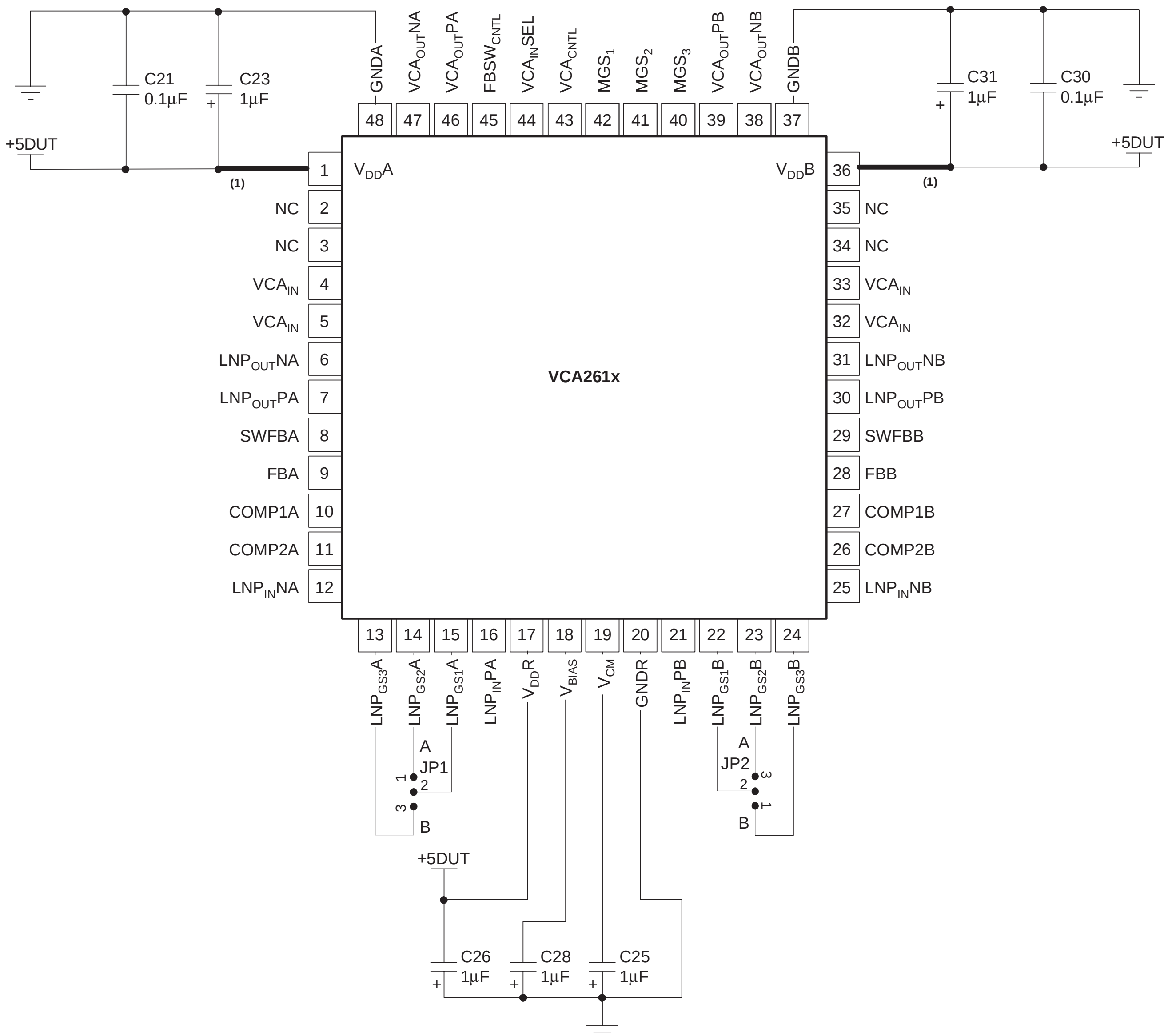
NOTE: *Powering down one channel will reduce the overall power consumed by the VCA, but it will not reduce the power consumption by half. This limited power consumption is a result of the shared circuitry architecture.*

Once the user has determined which channel will not be powered, the V_{DD} supply pin can be left disconnected from the power-supply. Figure 1 and Figure 2 show the locations of the connection to the supplies, with respect to each channel.



NOTE: (1) When powering down a single channel, one or the other supply pins (V_{DDX}) must be disconnected.

Figure 1. Typical Power Supply Connection of the VCA2614 Family



NOTE: (1) When powering down a single channel, one or the other supply pins (V_{DDX}) must be disconnected.

Figure 2. Typical Power Supply Connection of the VCA2611 Family

The ground pin (GNDA or GNDB) for the selected channel that will be powered down must be connected to ground. This requirement is a consequence of the shared internal circuitry. The reference supply pin and its associated ground pin (V_{DDR} and GNDR) must be connected, as well. Even though the reference circuit is shared, it is still important to connect these pins. These are all that is necessary to power down a single channel of the VCA.

Alternate Power-Down Methods

There are several alternate methods of powering-down an unused channel, including the use of an active device to disconnect the power supply dynamically. An example of this type of active device would be a Low Drop-Out regulator (LDO) with an enable (EN) pin, such as the REG101 from the REG10x family of LDOs from Texas Instruments.

The enable pin allows a logic level signal to enable or disable the supply voltage of one channel of the VCA. When the channel is needed, the LDO is enabled; when the channel is not necessary, the LDO is disabled.

NOTE: *There will be delay times associated with this method that are not discussed in detail in this application note. For additional information, please consult the particular LDO datasheet for turn-on delays needed for determining the delays.*

By using LDOs with enable pins and a large enough current capacity, you can dynamically control entire banks of VCA channels to help conserve power when needed. Figure 3 shows a detailed description of an LDO connection to the VCA using the REG101 as an example.

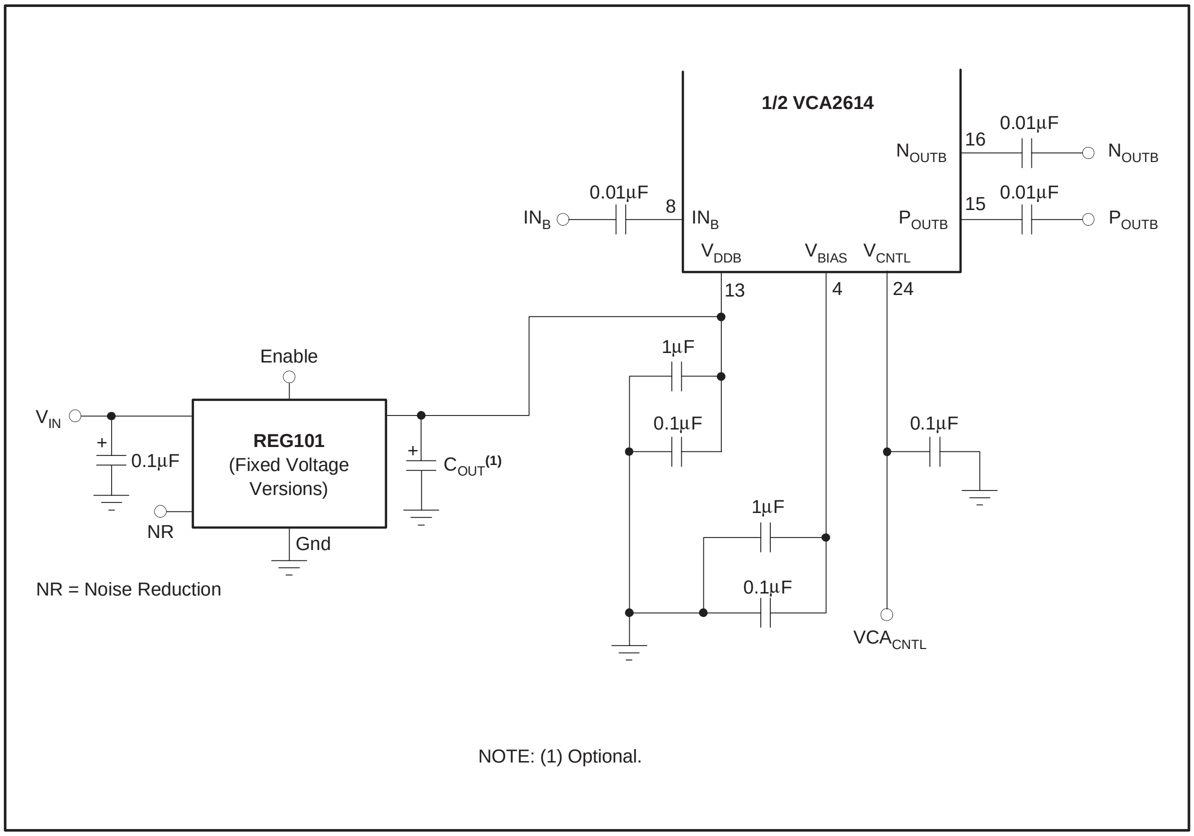


Figure 3. Example LDO Connection to the VCA261x

Other possible methods of powering down a VCA channel include the use a of relay, as shown in Figure 4, or a transistor switch, as shown in Figure 5 (both a FET and a BJT are shown as examples). As noted earlier, turn-on delays will be associated with each setup; these characteristics would have to be considered for the actual devices used in either case. Other factors to be evaluated in the turn-on delay would also be the amount of capacitance on the power supply, the on-resistance of the device used, and the resistance and inductance of the printed circuit board trace connecting to the VCA.

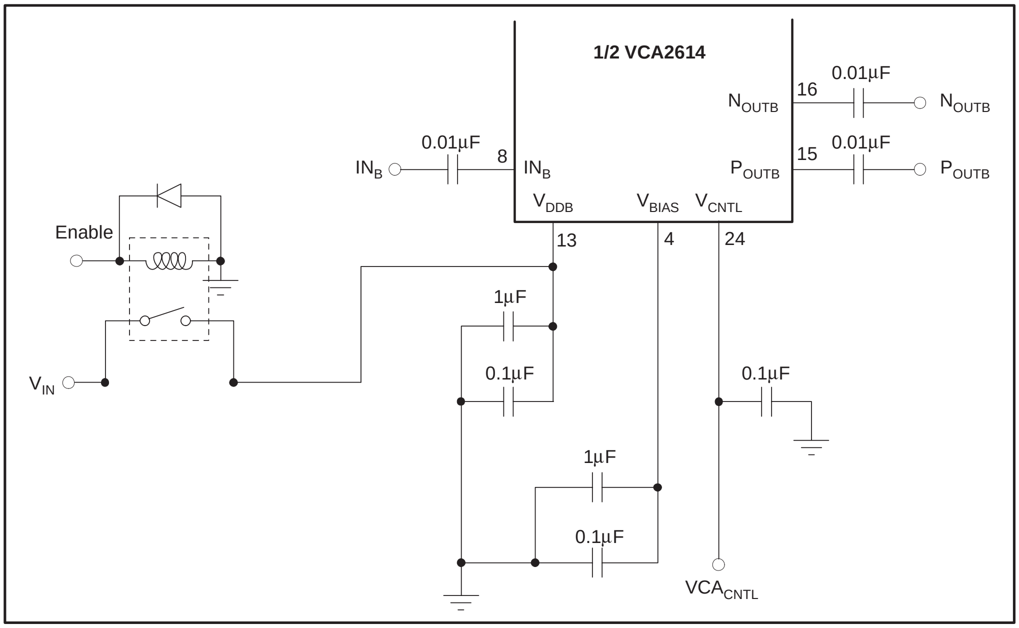


Figure 4. Example Relay Connection to the VCA261x

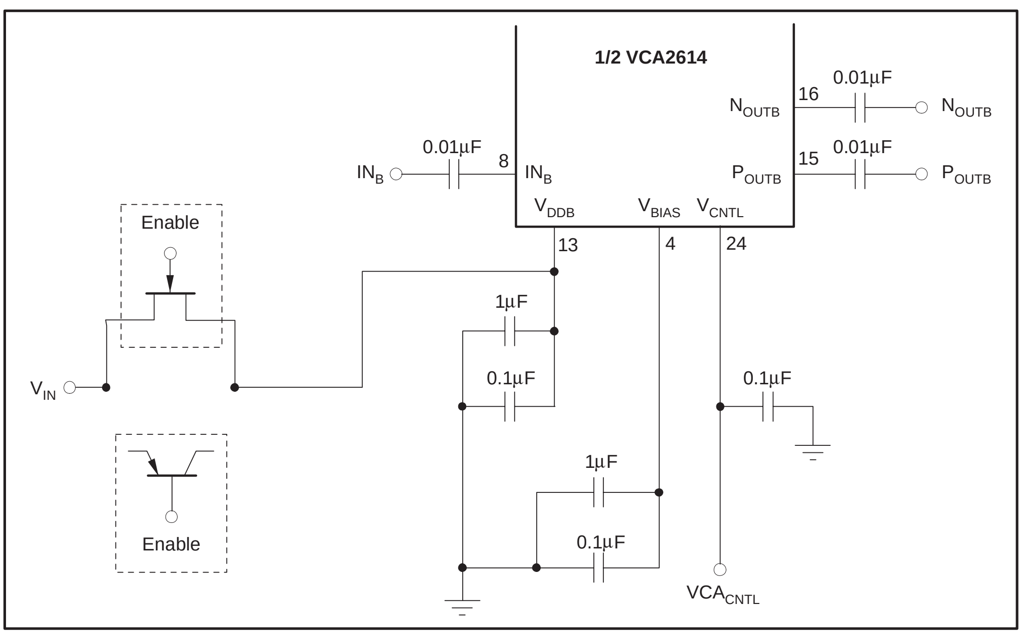


Figure 5. Example Transistor Connection to the VCA261x

Conclusion

Several different methods were presented here to accomplish the powering down of one channel of a VCA device. The concept of this process is simple if the power-down state is to be static; when the power-down state becomes dynamic, however, one must take into account additional variables, such as power-on delay and on-resistance.

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