

WAN-0129

Decoupling and Layout Methodology for Wolfson DACs, ADCs and CODECs

INTRODUCTION

This application note looks at the general decoupling and layout practice required for Wolfson converters to achieve maximum performance in a typical high-speed mixed-signal circuit.

APPLICATION

Wolfson DACs, ADCs and CODECs have both digital and analogue interfaces. It is important that noise is minimised to get the maximum converter performance. In our datasheets there are a number of supply pins on each chip. They are labelled according to their internal connection, not necessarily how they should be connected externally. The datasheets show typical supply connections and decoupling arrangements and this report goes into further details.

GROUNDING

First consider the grounding of the IC. Ideally the circuit board will have a single continuous ground plane, with all ground pins connected to it. The components will be located so that high-speed digital devices are kept away from analogue devices, so that noise currents do not stray where they are not wanted.

In some cases a cut between analogue and digital planes is required, because the component positions cannot be optimised. In this case the analogue and digital grounds must be connected under the converter with a wide copper track. Just using a zero-ohm link may not provide a good enough connection in some circumstances. Ensure any tracks going from the board's analogue section to the digital section (e.g. data lines and clocks) are tracked over the ground connection, not the cut, to minimise loop area for the return currents. Wolfson converters are designed with a pin-out which ensures tracks need only go over the appropriate ground plane. If you have other high-speed currents (including ESD currents) flowing between analogue and digital grounds, make sure this is not the only connection between them, or you will make the converter performance worse.

DIGITAL SUPPLY

Digital supply pins can be connected to the main digital supply rail if the noise levels are not too high. If there is no nearby digital supply, or it is too noisy, then one can be made from the analogue supply using an LC filter like below: this will make sure the noise does not go back to the analogue supply.

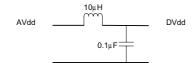


Figure 1 Converter Digital Supply from Analogue Supply

We name the digital pins like this: DVDD, DCVDD. Be sure to place a 0.1μ F multi-layer ceramic capacitor close to each of these pins (within 3mm) to decouple it properly to DGND. If there is no large-value capacitor within 50mm, then also add one 10μ F low-ESR capacitor per rail. This can be multi-layer ceramic, low-ESR tantalum or low-ESR organic semiconductor electrolytic type. Check the datasheet shows the part has less than $200m\Omega$ ESR for best performance.

January 2003, Rev 1.0

ANALOGUE SUPPLY

Analogue supply pins must be connected to a low-noise analogue supply rail, which ideally comes from a low-noise linear regulator. We name these pins like this: AVDD, HPVDD, SPKVDD. Be sure to place a 0.1μ F multi-layer ceramic capacitor close to each of these pins (within 3mm) to decouple it properly to AGND. If there is no large-value capacitor within 50mm, then also add one 10μ F low-ESR capacitor per rail. This can be multi-layer ceramic, low-ESR tantalum or low-ESR organic semiconductor electrolytic type. Check the datasheet shows the part has less than $200m\Omega$ ESR for best performance.

On some of our devices there are internal supplies or references which require external decoupling. We names these pins like: VMID, VREF, VREFOUT, CAP2. The pins connect just to a capacitor, not to an external supply. Be sure to place a 0.1µF multi-layer ceramic capacitor close to each of these pins (within 3mm) to decouple it properly to AGND. Also add one 10µF low-ESR capacitor per pin. This can be multi-layer ceramic, low-ESR tantalum or low-ESR organic semiconductor electrolytic type. Check the datasheet shows the part has less than 200m Ω ESR for best performance.

SUPPLY LAYOUT

Ideally the supply connections will be made with planes on a multi-layer circuit board. If these planes are on adjacent layers, the parasitic capacitance of these layers will further improve high-frequency decoupling. Where this is not possible, use tracks much wider than the current rating requires.

SOLUTION

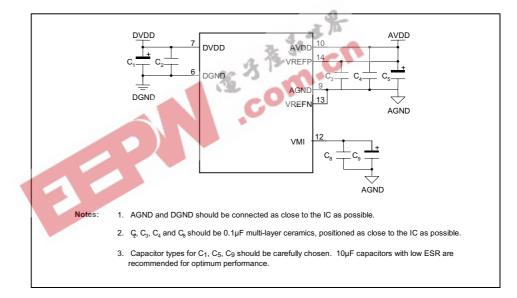


Figure 2 Decoupling Example

..

CONCLUSION

With careful consideration of layout and provision of low-noise supplies, the performance specified in our datasheets should be achieved.

APPLICATION SUPPORT

If you require more information or require technical support please contact Wolfson Microelectronics Applications group through the following channels:

apps@woifsonmicro.com
+44 (0)131 272 7070
+44 (0)131 272 7001
Applications at the address on last page.

~ "

or contact your local Wolfson representative.

Additional information may be made available from time to time on our web site at http://www.wolfsonmicro.com



January 2003, Rev 1.0

WAN_0129

IMPORTANT NOTICE

Wolfson Microelectronics plc (WM) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current. All products are sold subject to the WM terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

WM warrants performance of its products to the specifications applicable at the time of sale in accordance with WM's standard warranty. Testing and other quality control techniques are utilised to the extent WM deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

In order to minimise risks associated with customer applications, adequate design and operating safeguards must be used by the customer to minimise inherent or procedural hazards. Wolfson products are not authorised for use as critical components in life support devices or systems without the express written approval of an officer of the company. Life support devices or systems are devices or systems that are intended for surgical implant into the body, or support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided, can be reasonably expected to result in a significant injury to the user. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

WM assumes no liability for applications assistance or customer product design. WM does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of WM covering or relating to any combination, machine, or process in which such products or services might be or are used. WM's publication of information regarding any third party's products or services does not constitute WM's approval, license, warranty or endorsement thereof.

Reproduction of information from the WM web site or datasheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations and notices. Representation or reproduction of this information with alteration voids all warranties provided for an associated WM product or service, is an unfair and deceptive business practice, and WM is not responsible nor liable for any such use.

Resale of WM's products or services with <u>statements different from or beyond the parameters</u> stated by WM for that product or service voids all express and any implied warranties for the associated WM product or service, is an unfair and deceptive business practice, and WM is not responsible nor liable for any such use.

ADDRESS:

Wolfson Microelectronics plc Westfield House 26 Westfield Road Edinburgh EH11 2QW United Kingdom

Tel :: +44 (0)131 272 7000 Fax :: +44 (0)131 272 7001 Email :: apps@wolfsonmicro.com

