Transitioning from the CS4362 to the CS4362A or CS4365

David Olivenbaum
Applications Engineer

1. Introduction

This application note describes how to transition easily to the CS4365 or CS4362A from an existing design that uses the CS4362. The CS4362A was designed to give a simple upgrade path from the CS4362, whereas the CS4365 adds some additional features. Please refer to the CS4362A and CS4365 data sheets for supplemental information and specifications concerning operation of the device. A brief comparison between the product families is shown in Table 1.

1.1 What the CS4362A offers over the CS4362:

- Sixth order multi-bit delta-sigma modulator for lower out of band noise
- Increased full-scale output level for ease of board level noise management
- Improved lower latency PCM digital filter
- Non-decimating DSD processor with on chip 50 kHz filtering
- Uses identical register mapping

1.2 Changes from the CS4362 that the CS4362A requires:

- The VD supply must be changed to 2.5 V from either the 3.3 V or 5 V of the CS4362.
- Depending on the desired output voltage requirements, attenuation may need to be added to the off-chip filter.
- Loss of simultaneous support for two synchronous sample rates mode which was available in the CS4362. This mode provided for dual sample rates such as 192 kHz front channels with 96 kHz surrounds for DVD audio and required the use of LRCK2 and SCLK2. This mode is not offered in the CS4362A or CS4365.

1.3 What the CS4365 offers over the CS4362A:

- Additional DSD functions of Volume control, Mute pattern detect, support for phase modulation mode, and offers a direct to switched capacitor path
- 1/2 dB volume control steps (vs. 1 dB in CS4362/62A)
- One-Line and TDM modes
- Auto-mute polarity detection
- Auto-speed mode detection

1.4 Changes from the CS4362 that the CS4365 requires:

- The VD supply must be changed to 2.5 V from the either 3.3 V or 5 V of the CS4362.
- Depending on the desired output voltage requirements, attenuation may need to be added to the off-chip filter.
- Simultaneous support for two synchronous sample rates is no longer available.
- Additional resistors on MUTEC pins.
- Four pins change location or function for hardware mode. The changes aren't necessary for software mode.
- Requires different register mapping from the CS4362.

		CS4365	CS4362A	CS4362
Dynamic Range	dB	**114**	114	114
THD+N	dB	**-100**	-100	-100
Resolution	bits	**24**	24	24
Sample Rate	kHz	**192**	192	192
Power Supply	VA	**5**	5	5
	VD	**2.5**	2.5	3.3 to 5
Volume Control		**0.5 dB**	1 dB	1 dB
Auto Fs Detect		**Yes**	No	No
Package		**48-LQFP**	48-LQFP	48-LQFP

Table 1. Product Comparison

For users of the CS4362, the CS4365 is a simple, yet affordable, upgrade to a richer feature set and lower out-of-band noise performance.

2. The Design Transition

2.1 Transitioning from the CS4362 to CS4362A

2.1.1 Hardware changes

The CS4362A pinout was primarily based on the CS4362 with only 2 pins changing function. Other pins have new recommended components but the circuit topologies remain the same and thus do not require modification to the PCB. The most significant change is that the VD core of the CS4362A requires 2.5 V for operation, whereas the CS4362 was able to run from 3.3 V to 5 V. The CS4362A will NOT operate off of a VD supply of 3.3 V or 5 V.

Figure 1 and Figure 2 show the CS4362 and CS4362A pinouts respectively. The changes to the two pinouts are highlighted. Figure 1 highlights the pins which have changed function and which may require a PCB change. Figure 2 highlights the pins which have new recommended components.

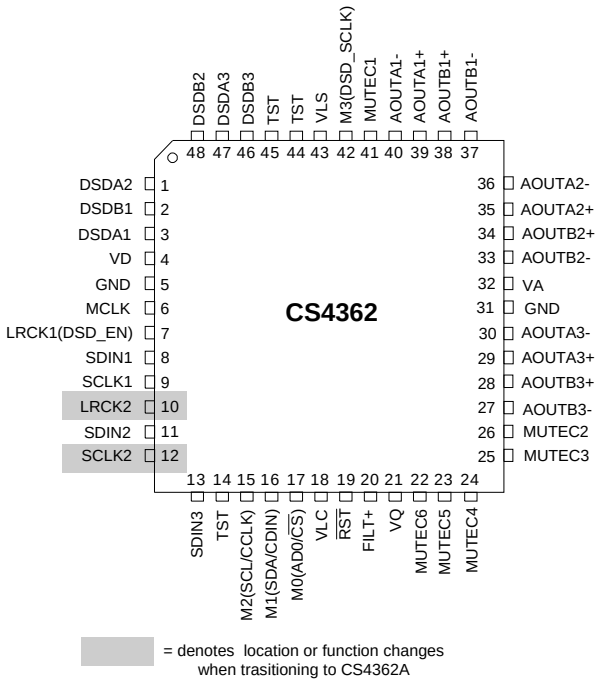

Figure 1. CS4362 pinout

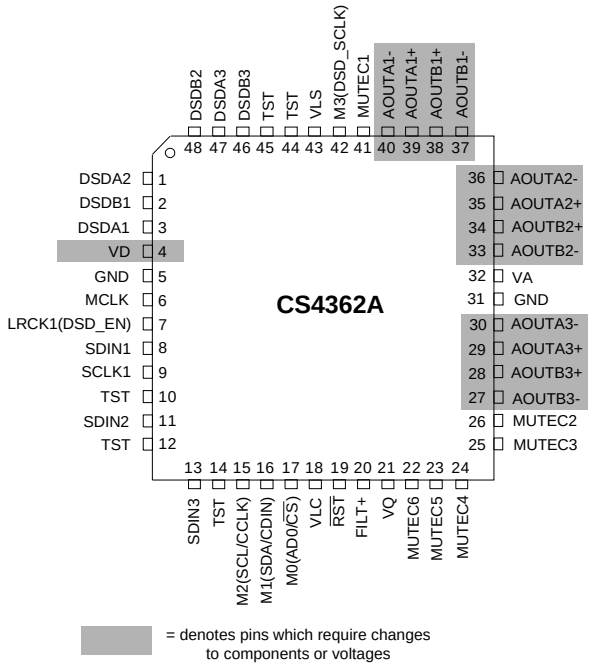

Figure 2. CS4362A pinout

Location or function changes as denoted in Figure 1 are as follows:

- The CS4365 does not support the simultaneous synchronous sample rate function of the CS4362. Pins 10 and 12 are now Test inputs.

Pins which require changes to external components or voltages as denoted in Figure 2 are as follows:

- Pin 4 (VD) requires 2.5 V for recommended operation. The CS4362 used either 3.3 V or 5 V, which, if left unchanged, would damage the CS4362A.

- Pins 27 - 30, 33 - 40 (AOUTs) have a new recommended filter circuit. This filter uses the same filter topology as the CS4362. The component values have been changed to account for the extra output level from the CS4362A and still provide 2 Vrms on the output. A general optimization was also made in order to reduce the thermal noise contribution of the resistances (using smaller resistances where possible). Please refer to the CS4362A datasheet for details on the new recommended filter.

2.1.2 Functional changes

- With the addition of the non-decimating DSD processor mode comes the added benefits of matched PCM and DSD output levels and an on chip 50 kHz filter.
- The CS4362A uses a new multi-bit Delta-Sigma modulator core with mis-match shaping which allows for lower over-all out-of-band noise and improved audio quality.
- The CS4362A gained new digital filters with improved stop-band performance and lower latency.
- The full-scale differential output voltage has increased which needs to be accounted for in the analog filter gain (if similar output level to the CS4362 is desired).
- The dual serial port function of the CS4362 which accepted two simultaneous synchronous sample rates (such as 192 kHz front and 96 kHz surrounds) is not supported.

2.2 Transitioning from the CS4362 to CS4365

2.2.1 Hardware changes

The CS4365 pinout was primarily based on the CS4362 with only 3 pins changing function. Other pins have new recommended components but the circuit topologies remain the same and thus do not require modification to the PCB. The most significant change is that the VD core of the CS4365 requires 2.5 V for operation, whereas the CS4362 was able to run from 3.3 V to 5 V. The CS4365 will NOT operate off of a VD supply of 3.3 V or 5 V.

Figure 3 and Figure 4 show the CS4362 and CS4365 pinouts respectively. The changes to the two pinouts are highlighted. Figure 3 highlights the pins which have changed function and which may require a PCB change. Figure 4 highlights the pins which have new recommended components.

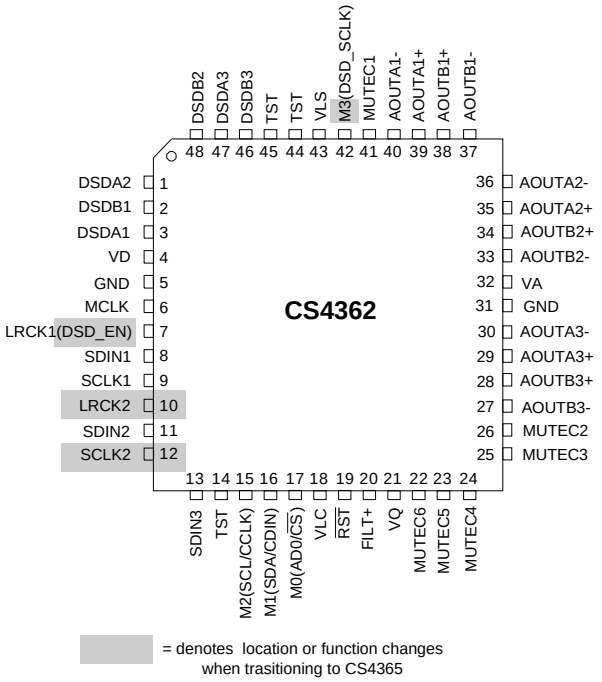

Figure 3. CS4362 pinout

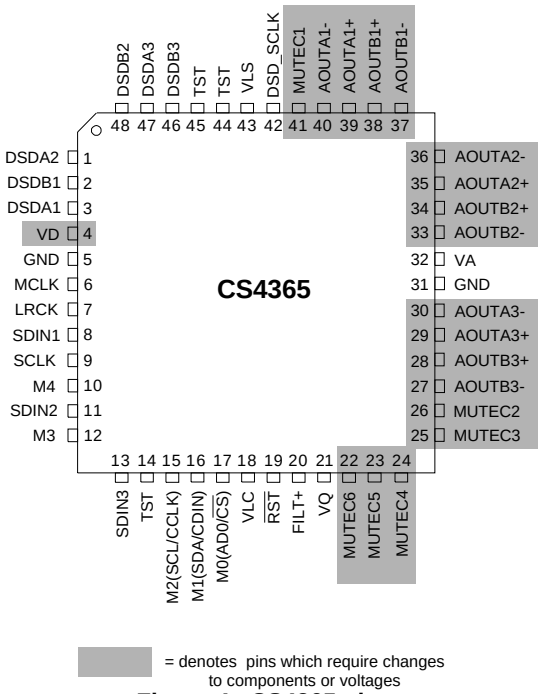

Figure 4. CS4365 pinout

Location or function changes as denoted in Figure 3 are as follows:

- Pin 7 is no longer DSD_EN in hardware mode. In order to enter DSD mode on the CS4365 you must either set the M4 and M3 pins accordingly or use SPI™ or I^2C configuration.
- The CS4365 does not support the simultaneous synchronous sample rate function of the CS4362. Pins 10 and 12 are now dedicated for stand-alone configuration (voltage input on these pins are still referenced to VLS).
- Pin 42 no longer functions as M3 in stand-alone PCM modes. It is now a dedicated DSD_SCLK pin.

Pins which require changes to external components or voltages as denoted in Figure 4 are as follows:

- Pin 4 (VD) requires 2.5 V for recommended operation. The CS4362 used either 3.3 V or 5 V, which, if left unchanged, would damage the CS4365.

- Pins 22-26 and pin 41 (MUTEC#) require an additional pull-up or down in order to indicate the desired direction of mute polarity. While reset is asserted these pins are high impedance and will not drive the mute circuitry. It is recommended that the pull-up/down resistance properly biases the off-chip mute circuit into muting.

- Pins 27 - 30, 33 - 40 (AOUTs) have a new recommended filter circuit. This filter uses the same filter topology as the CS4362. The component values have been changed to account for the extra output level from the CS4365 and still provide 2 Vrms on the output. A general optimization was also made in order to reduce the thermal noise contribution of the resistances (using smaller resistances where possible). Please refer to the CS4365 datasheet for details on the new recommended filter.

2.2.2 Functional changes

- The CS4365 uses a new register mapping in order to accommodate the additional features which it provides over the CS4362. Please refer to the CS4365 datasheet for the new mapping
- With the addition of the non-decimating DSD processor mode comes the added benefits of matched PCM and DSD output levels, DSD volume control, an on chip 50 kHz filter, Phase Modulation input mode, and DSD mute pattern detection. A direct DSD path to the switched capacitor array is also offered. All of the features are accessed through the configuration registers.
- The CS4365 supports a setting for auto-selection of the speed mode to set what sample rate range the DAC is to expect. This allows the CS4365 to operate at sample rates from 4 kHz on up to 192 kHz without intervention (Note: there are a few reserved frequencies, see datasheet for details). This setting is available in both stand-alone and control-port operation.
- The volume control in the CS4365 offers 0.5 dB step sizes for more volume setting resolution.
- The CS4365 offers TDM and One-Line modes for compatibility with various multi-channel surround sound DSPs which helps reduce board real-estate from the additional data lines. These modes are not available in stand-alone mode.
- The CS4365 uses a new multi-bit Delta-Sigma modulator core with mis-match shaping which allows for lower over-all out-of-band noise and improved audio quality.
- The CS4365 gained new digital filters with improved stop-band performance and lower latency.
- The full-scale differential output voltage has increased which needs to be accounted for in the analog filter gain (if similar output level to the CS4362 is desired).
- The mute control pins now support auto polarity detection. This allows for selection of active high or low mute circuitry without the need to set registers. An external pull-up or down is required to set the mute polarity.
- The MCLK divide by 2 bit is no longer necessary to access the 1024x MCLK/LRCK ratio (SSM), 512x MCLK/LRCK ratio (DSM) and 256x MCLK/LRCK ratio. A new ratio of 1152x has been added for 32 kHz operation.
- The dual serial port function of the CS4362 which accepted two simultaneous synchronous sample rates (such as 192 kHz front and 96 kHz surrounds) is not supported.

Table 2. Revision History

Release	Date	Changes
REV1	FEB 2005	Initial Release

Contacting Cirrus Logic Support

For a complete listing of Direct Sales, Distributor, and Sales Representative contacts, visit the Cirrus Logic web site at:
http://www.cirrus.com/corporate/contacts