
BlueTiger™ Connected Optical Drive Family
CD-100 CD/MP3/WMA/FLAC Player
APPLICATION NOTE EXTERNAL INPUT
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General

CD100 is capable to receive I2S data via its external input, apply upsampling and output the enhanced signal via I2S and SPDIF. If desired, SONIC2 scrambling can be applied to the audio data for I2S output.

All output modes working for internal source (CD playback) are also supported for external input.

Clocking scheme

CD100 can either be clocked by internal oscillator or external source. Depending on the use case the clock of the external I2S source may not be synchronized to the clock CD100 is running at or may even be unreliable. This is especially the case when the I2S source is a SPDIF receiver which connects to a source external to the product. Therefore, even when running inputs and outputs at the same frequency sample rate conversion is normally required to compensate small deviations between input and output data rate. This all is handled by CD100 internally without any specific configurations other than desired output mode and output sampling frequency.

Detection of incoming sampling frequency, error handling

CD100 will auto-detect incoming sampling frequency and configure the internal sample rate converter accordingly. Special care has been taken to minimize frequency drift by following method:

- when detecting incoming data, CD100 first determines incoming sampling frequency accurately with its outputs muted. Then the audio outputs are enabled. The incoming datarate is still measured and the sample rate converter ratio will be adapted very slowly if needed to compensate differences of temperature drift of the oscillator driving I2S source and the one driving CD100.
- To avoid artefacts in case the external I2S source is not continuously delivering data or may deliver data at changing sampling frequency, following method is provided:

- **CD100 provides a trigger input which resets the audio processing.** Connecting this input to the Error Output of a SPDIF receiver used as I2S source will ensure, that whenever the I2S input is unstable (as is the case when unplugging or replugging the SPDIF cable) CD100 will mute its outputs and wait for the input to become stable again. **Note, that this input is edge sensitive, so the implementation is INDEPENDENT on whether the output of the SPDIF receiver is high or low active.** Any transition of this pin will cause a reset, leaving this pin

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*Blue***Tiger**[™]

static will enable external audio input processing. internal pullup to 3V3. Longer periods of wrong or missing input clocks are detected by the internal audio processing and don't require this pin.

Pin assignment of connector CON505 when using external input option

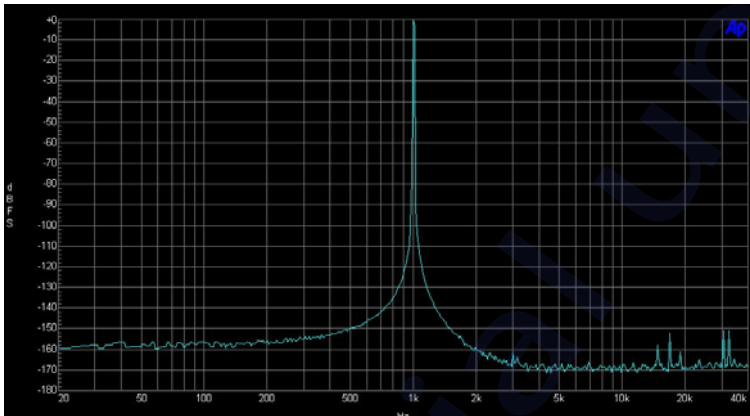
Pin	Signal	Direction	Type	Description
1	MCLK DIR	Input	LVTTTL	Masterclock direction (if connected to GND, MCLK is output)
2	provisional			do not connect (or use 1nF to GND)
3	Reset	Input	LVTTTL/OD	Reset Pin of B;ackfin. Must be open drain.
4	GND	-	-	Ground
5	SPDIF OUT	Output	LVTTTL	SPDIF out from the CD-100 module
6	GND	-	-	Ground
7	PCM LRCK	Output	I ² S	Digital audio out I ² S – word clock
8	PCM MCLK	IO	I ² S	Audio Masterclock
9	GND	-	-	Ground
10	PCM LTRT	Output	I ² S	Digital audio out I ² S – channel data. Connected to pin 23
11	PCM SCLK	Output	I ² S	Digital audio I ² S out – bit clock
12	GND	-	-	Ground
13	EXT SDLR	Input	I ² S	Digital audio in I ² S – channel data
14	EXT LRCK	Input	I ² S	Digital audio in I ² S – word clock
15	EXT SCLK	Input	I ² S	Digital audio I ² S in – bit clock
16	GND	-	-	Ground
17	provisional			do not connect (or use 1nF to GND)
18	GND	-	-	Ground
19	provisional			do not connect (or use 1nF to GND)
20	GND	-	-	Ground
21	SDATA1	Output	I ² S	Digital audio I ² S out – right channel differential data (for Sonic2)
22	GND			
23	SDATA0	Output	I ² S	Digital audio I ² S out – left channel differential data (for Sonic2)
24	GND	IO	LVTTTL	
25	MUTE	Output	LVTTTL	Indicates to the set to mute Audio outputs when set to low
26	provisional			do not connect (or use 1nF to GND)
27	ERROR INPUT	input	LVTTTL	input from e.g. SPDIF receiver to trigger reset of audio processing in case of unreliable data; edge triggered; internal pullup to 3V3
28	RX	Input	LVTTTL	UART Data Input
29	TX	Output	LVTTTL	UART Data Output
30	provisional			do not connect (or use 1nF to GND)

Results of spectral measurements

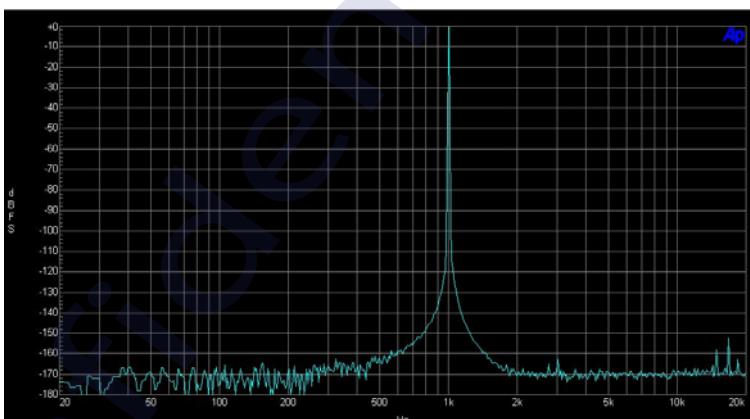
As CD100 is able to resample signals originating from a source which has a lower quality or unreliable master clock, the effects of re-sampling have been studied in detail. Note, that following measurements were taken on SPDIF output to be able to analyze the signal directly in digital domain. SONIC2 scrambling will not broaden the spectrum but just reduce noisefloor. The benefits of SONIC2 are independent on whether the signal is from the CD or external input.

input: 1kHz 0dB, fs=96kHz

a) spectrum on SPDIF output with output fs set to 88.2kHz

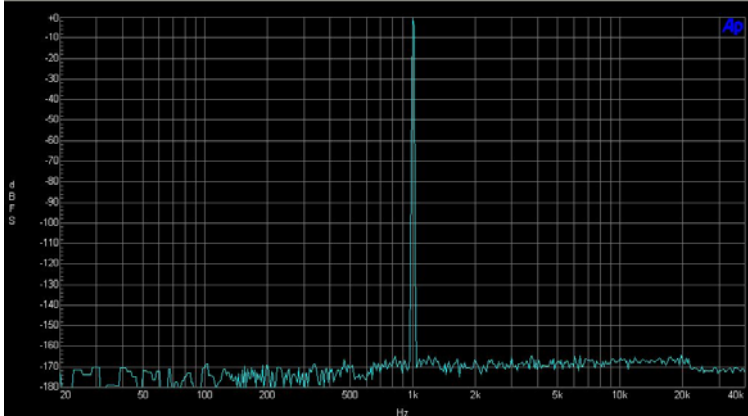


b) spectrum on SPDIF output with output fs set to 44.1kHz

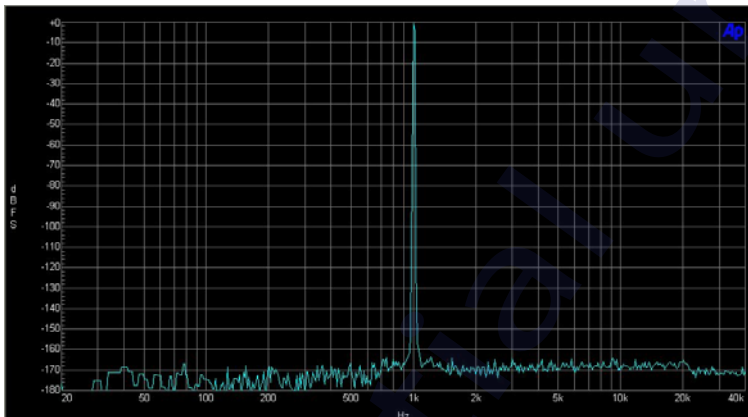


input: 1kHz 0dB, fs=44.1kHz

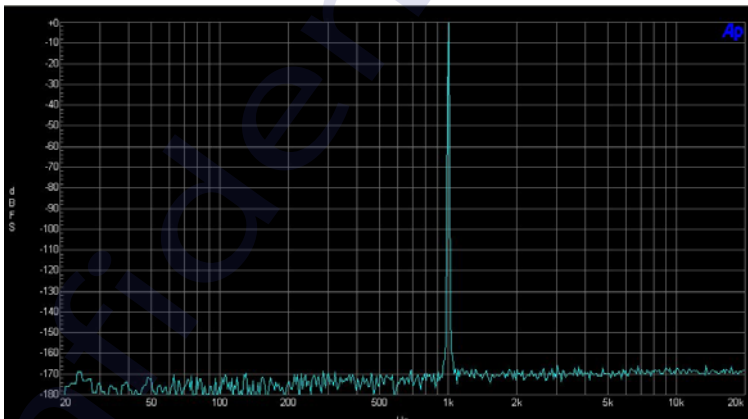
a) spectrum of source signal



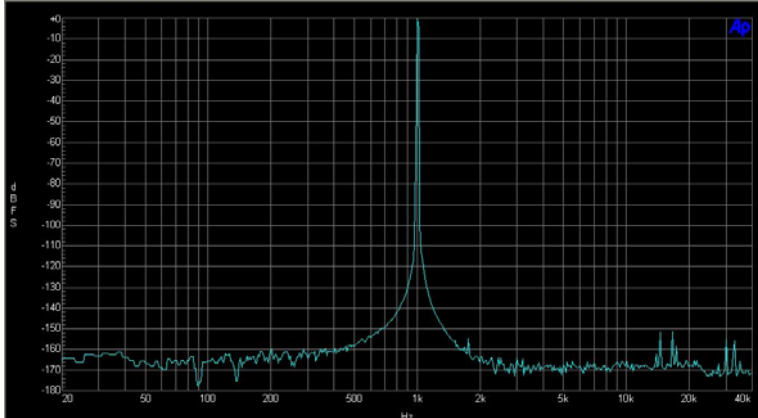
b) spectrum on SPDIF output with output fs set to 88.2kHz



c) spectrum on SPDIF output with output fs set to 44.1kHz



input: 1kHz 0dB, fs=48kHz



Conclusion

when input and output sampling frequencies are integer fractions, the spectrum of the signal does not broaden, the noise floor is not influenced by CD100
when converting 48kHz and 96kHz which do not perfectly match to the system clock of 16.9344MHz that drives the PLLs inside CD100, the spectrum is still very well.