I2S/TDM Library

A software library that allows you to control an I²S or TDM (time division multiplexed) bus via xCORE ports. I²S and TDM are digital data streaming interfaces particularly appropriate for transmission of audio data. The components in the library are controlled via C using the XMOS multicore extensions (xC) and can either act as I²S master, TDM master or I²S slave.

Features

- I²S master, TDM master and I²S slave modes.
- Handles multiple input and output data lines.
- Support for standard I²S, left justified or right justified data modes for I²S.
- Support for multiple formats of TDM synchronization signal.
- Efficient "frame-based" versions of I²S master and slave allowing use of processor cycles in between I2S signal handling.
- Sample rate support up to 192kHz or 768kHz for "frame-based" versions.
- Up to 32 channels in/32 channels out (depending on sample rate and protocol).

Resource Usage

This following table shows typical resource usage in some different configurations. Exact resource usage will depend on the particular use of the library by the application.

Configuration	Pins	Ports	Clocks	Ram	Logical cores
I2S Master (frame-based)	3 + data lines	3 x (1-bit) + data lines	2	~1.6K	1
I2S Master	3 + data lines	3 x (1-bit) + data lines	2	~2.1K	1
I2S Slave (frame-based)	2 + data lines	2 x (1-bit) + data lines	1	~1.6K	1
I2S Slave	2 + data lines	2 x (1-bit) + data lines	1	~1.6K	1
TDM Master	2 + data lines	2 x (1-bit) + data lines	1	~1.8K	1

Software version and dependencies

This document pertains to version 3.0.0 of this library. It is known to work on version 14.3.3 of the xTIMEcomposer tools suite, it may work on other versions.

This library depends on the following other libraries:

- lib_xassert (>=3.0.0)
- lib_logging (>=2.1.0)

Notes on "frame-based" I²S implementations

The library supports both "sample-based" and "frame-based" versions of I²S master and slave. The "frame-based" versions are recommended for new designs and support higher I²S channel counts and rates. In

addition, the number of callbacks to pass data to and from the I^{2}S handler task are reduced. "Frame-based" I^{2}S pass an array of channels per sample period whereas "sample-based" versions make a callback per channel within a sample period. The "Frame-based" callbacks are all grouped together allowing the user side to make maximum use of the MIPS between I^{2}S frames. For example, a 48kHz (20.83us) I^{2}S interface supports a total of 19us processing per sample period, in any order, across the callbacks. The older "channel-based" versions are currently maintained to provide compatibility with existing code examples.

Related application notes

The following application notes use this library:

- AN00162 - Using the I^{2}S library