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## VS1011 to VS1063 Migration Guide

### Description

This document describes how to migrate from VS1011 to VS1063. It lists hardware and software differences and other considerations.

This document applies to all versions of VS1011 and VS1063.

Revision History			
Rev	Date	Author	Description
1.13	2025-03-14	POj	(old) sine test requires 12 zeroes.
1.12	2023-12-22	POj	Clarifications to CLOCKF and CVDD.
1.11	2019-02-04	POj	MP3 patents expired in 2017.
1.00	2012-11-28	HH	Initial revision.

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## 1 General

VS1063 has been vastly expanded from the VS1011. The most significant differences are:

- VS1011 and VS1063 have different operating voltage ranges.  
**VS1063 has an additional supply voltage pin CVDD.**
- VS1063 is only available in LQFP-48 packaging.
- Added HiFi stereo line input / mono microphone input.
- New decoder formats: Ogg Vorbis, AAC and HE-AAC, WMA, FLAC, G.722, 24-bit and 32-bit floating point WAV.
- Added MP3, Ogg Vorbis,  $\mu$ -law, A-law, G.722, PCM WAV and IMA ADPCM WAV encoding.
- MPEG layers II (MP2) and III (MP3): new, more robust and accurate decoding. MP3 is now full accuracy compliant.
- Removed MP1 decoder.
- Added codec mode (both encoder and decoder work at the same time) that works with  $\mu$ -law, A-law G.722, IMA ADPCM, PCM WAV.
- The highest allowed internal clock speed has increased from 26.0 MHz to 67.6 MHz.
- VS1063 has a UART so it can be connected to VSIDE.
- VS1063 has an internal PLL and a control register for it.
- VS1063 has an I2S interface for external DACs.
- VS1063 has GPIO pins.
- CRC checking added for MP3 files that contain CRC. CRC checking can be disabled.
- Keeps track of the valid data in MP3 bit reservoir, which allows noiseless start of decoding in the middle of an MP3 file.
- Reading of stream and audio buffer fill states possible.
- Proportional and fixed-width font in data ROM for standalone applications.
- RIFF-WAV header is generated automatically in WAV encoding (and codec) modes. The user still needs to fix the RIFF size and data size fields to make them valid WAV files.
- Sample-exact samplerate and volume change.
- A new parametric data structure contains lots of new functionality
  - Mono mode and pause mode for player
  - 5-channel equalizer
  - VU meter
  - AD mixer
  - PCM mixer
  - Samplerate finetuning.
  - Speed shifter
  - EarSpeaker spatial processing.
  - Potential to individually disable AAC, WMA, MP3 and FLAC decoders.
- Added I2C memory boot option.

Due to these new features the pinout and register interface has been changed accordingly.

## 2 Hardware

VS1011 and VS1063 have a few hardware differences which are listed in this chapter.

### 2.1 Changed: Voltages

VS1063 requires three separate voltages instead of two for VS1011.

Analog voltage AVDD has stayed at 2.5...3.6 V (3.3...3.6 V in VS1063 if you use the higher 1.65 V reference voltage REF).

VS1011's DVDD which was 2.3...3.6 V has been replaced with IOVDD, which is 1.8...3.6 V in VS1063.

VS1063 also requires another power input CVDD 1.7...1.85 V for the processor core.

In other words, with VS1063 you need at least two supply voltages: one for CVDD and another for AVDD and IOVDD.

### 2.2 Changed: Clocking

VS1011 is clocked with a 24...26 MHz, fundamental frequency clock, or 12...13 MHz if the internal clock doubler is active.

VS1063 is clocked with either a 12...13 MHz or 24...26 MHz crystal. In the latter case an internal clock divider needs to be activated in register SCI\_MODE for playback and recording, and another in SCI\_STATUS for recording. An internal PLL can be used to increase the clock to a speed up to 67.6 MHz. The recommended crystal for vs1063 is 12.288 MHz.

### 2.3 New: HiFi Stereo Line Input

VS1063 features a differential microphone and one-sided HiFi stereo line-level input. It can encode that analog input into a multitude of formats, including MP3, Ogg Vorbis, and PCM.

### 2.4 Changed: LQFP-48 Pin Descriptions

LQFP-48 is a lead (Pb) free and RoHS compliant package. RoHS is a short name of *Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment*. See dimensions for the LQFP package from <http://www.vlsi.fi/>

The table on the following page describes the new pins and functions for VS1063 in LQFP-49.

Pin description changes:

Pad Name	LQFP Pin	Pin Type	New Function For VS1063
MICP / LINE1	1	AI	Microphone / line input left, new for VS1063
MICN	2	AI	Microphone input, new for VS1063
XRESET	3	DI	
DGND0	4	DGND	
CVDD0	5	CPWR	Core power, new for VS1063
IOVDD0	6	IOPWR	Only I/O Power in VS1063
CVDD1	7	CPWR	Core power, new for VS1063
DREQ	8	DO	
GPIO2 / DCLK	9	DIO	
GPIO3 / SDATA	10	DIO	
GPIO6 / I2S_SCLK	11	DIO	Both functions new for VS1063
GPIO7 / I2S_SDATA	12	DIO	Both functions new for VS1063
XDCS / BSYNC	13	DI	
IOVDD1	14	IOPWR	Only I/O Power in VS1063
VCO	15	DO	For testing purposes (don't connect), new for VS1063
DGND1	16	DGND	
XTALO	17	AO	
XTALI	18	AI	
IOVDD2	19	IOPWR	Only I/O Power in VS1063
DGND2	20	DGND	
DGND3	21	DGND	
DGND4	22	DGND	
XCS	23	DI	
CVDD2	24	CPWR	Core power, new for VS1063
GPIO5 / I2S_MCLK	25	DIO	Both functions new for VS1063
RX	26	DI	UART receive, new for VS1063
TX	27	DO	UART transmit, new for VS1063
SCLK	28	DI	
SI	29	DI	
SO	30	DO3	
CVDD3	31	CPWR	Core power, new for VS1063
TEST	32	DI	Connect to IOVDD instead of VDD on VS1063
GPIO0 / SPIBOOT	33	DIO	
GPIO1	34	DIO	
GND	35	DGND	I/O ground, new for VS1063
GPIO4 / I2S_LROUT	36	DIO	Both functions new for VS1063
AGND0	37	APWR	
AVDD0	38	APWR	
RIGHT	39	AO	
AGND1	40	APWR	
AGND2	41	APWR	
GBUF	42	AO	
AVDD1	43	APWR	
RCAP	44	AIO	
AVDD2	45	APWR	
LEFT	46	AO	
AGND3	47	APWR	
LINE2	48	AI	Line input right, new for VS1063

Pin types:

Type	Description	Type	Description
DI	Digital input, CMOS Input Pad	AO	Analog output
DO	Digital output, CMOS Input Pad	AIO	Analog input/output
DIO	Digital input/output	APWR	Analog power supply pin
DO3	Digital output, CMOS Tri-stated Output Pad	DGND	Core or I/O ground pin
AI	Analog input	CPWR	Core power supply pin
		IOPWR	I/O power supply pin

### 3 Application Considerations

This chapter gives general info on applications using VS1063.

#### 3.1 Hardware Design

VS1063 requires 10 nF capacitors near the ADC pins as well as series resistors to cut the capacitive load for the other device that drives the inputs. See figure *Typical Connection Diagram Using LQFP-48* in the *VS1063 Datasheet* for details.

PCB traces from analog connections (particularly mic and line inputs) should be kept as short as possible.

Outputs of the DACs need RC filters when connecting them to an external power amplifier. The DAC type for VS1063 has been changed for improved distortion but with a cost of some additional high frequency noise outside of the hearing band. Without the filters there may be excessive noise with some audio amplifiers, particularly digital ones. See figure *Typical Connection Diagram Using LQFP-48* in the *VS1063 Datasheet* for details.

#### 3.2 Software Considerations

VS1063 has a set of extra parameters to give the user additional control over the chips functions. For example fast forward and rewind for WMA and AAC is supported through the extra parameters interface. See *VS1063 Datasheet* Chapter *Extra Parameters* for more info.

If you don't want the product to play certain formats, you can use SCI\_HDAT1 register to determine the currently playing file type. You can then skip the file if the format is something you don't want played. See the *VS1063 Datasheet* for detailed info.

When using VS1063, it is highly recommended that the latest version of VS1063a Patches is loaded and running. This package corrects several bugs in the VS1063 ROM firmware and also adds some new features. The package can be downloaded from <http://www.vlsi.fi/en/support/software/vs10xxpatches.html>

There is a whole new interface for recording which you will have to study.

If you use the (old) sine test, send 12 zero bytes (instead of 4) after the sine test start and exit sequences (i.e. 16 bytes each). The same applies to other tests started through SDI.

## 4 SCI Registers

VS1011 and VS1063 have a few differences in registers that are not compatible with each other. Care should be taken when porting VS1011 microcontroller software to VS1063. The following chapters list some of these differences. For more info on the registers, see *VS1011 Datasheet* and *VS1063 Datasheet*.

### 4.1 Changed: SCI\_MODE

SM\_OUTOFWAV has been renamed SM\_CANCEL because it is used as a general playback or recording cancellation bit regardless of the format being played / recorded.

SM\_STREAM has been removed from VS1063. To sync streams using VS1063, use samplerate finetuning.

SM\_ENCODE is used to activate encoding on VS1063. See, however, for alternative ways in the *VS1063 Datasheet*.

SM\_CLK\_RANGE has been added to VS1063. This should be activated if the input clock XTALI is 24...26 MHz.

## 4.2 Changed: SCI\_STATUS

SS\_DO\_NOT\_JUMP has been added to VS1063. This instructs the user that it is not allowed to fast forward or rewind in a file. Typically this bit is set when decoding important headers, e.g. the first 4 KiB headers of an Ogg Vorbis file, or if the file type doesn't allow random access, like MIDI files.

SS\_SWING bits have been added to VS1063. Typical users will not need to touch these bits. The same is true for new bits SS\_VCM\_OVERLOAD and SS\_VCM\_DISABLE.

SS\_VER is 1 for VS1011 and 6 for VS1063. The field has also been expanded to four bits in VS1063 (bits 6:4 on VS1011, bits 7:4 on VS1063). Note that bit 7 is 0 in all earlier VS10XX IC's, so all four bits can be read regardless of IC version.

SS\_AD\_CLOCK can be set to divide the Analog-to-Digital modulator frequency by 2 if XTALI is in the 24...26 MHz range.

SS\_REFERENCE\_SEL has been added to VS1063. If AVDD  $\geq$  3.3 V, setting this bit will set reference voltage to 1.65 V instead of the default 1.25 V and increases analog output and input swing accordingly.

## 4.3 Changed: SCI\_CLOCKF

Bits in register SCI\_CLOCKF has changed. See the datasheets for details.

The suggested crystal for VS1063 is 12.288 MHz. With vs1063 a good default for SCI\_CLOCKF is 0x8000 (for  $3.5\times$  clock), which is the same value that vs1011 uses with a 12.288 MHz crystal and clock doubler.

## 4.4 Changed: SCI\_HDAT0 and SCI\_HDAT1

These registers give info on the supported audio formats. These registers contain new info for new codecs supported by VS1063.

You can use SCI\_HDAT1 register to determine the currently playing file type. You can then skip the file if the format is something you don't want played. See the *VS1063 Datasheet* for detailed info.



## 5 User Applications

Because the memory addresses have changed the user applications, plugins and patches are different between VS1011 and VS1063.

## 6 Licenses

If the end product plays formats that require licenses, refer to the *Licenses* chapter of the VS1063 Datasheet. As of year 2017 patents related to MP3 have expired and MP3 does not require licenses.

See section 4.4 on how to detect file formats.

## 7 Microcontroller Examples

Examples on how to control VS1063 using a microcontroller are available at <http://www.vlsi.fi/en/support/software/microcontrollersoftware.html>

## 8 Latest Document Version Changes

This chapter describes the most important changes to this document.

### Version 1.13, 2025-03-14

- Tests started through SDI require 12 zero bytes to start.

### Version 1.12, 2023-12-22

- Clarifications for CLOCKF and CVDD.

### Version 1.11, 2019-02-04

- MP3 patents expired in 2017.

## 9 Contact Information

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