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Software S/PDIF audio output for Raspberry Pi using the I2S interface

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 kiffie add module parameter to enable continuous SPDIF signal output (#5) 2b18c39 · last year		
 doc	added images for documentation	10 years ago
 .gitignore	initial commit	10 years ago
 LICENSE	Initial commit	10 years ago
 Makefile	add module parameter to enable continuous ...	last year
 README.md	add module parameter to enable continuous ...	last year
 bcm2708-i2s-spdif-driver.c	add module parameter to enable continuous ...	last year
 bcm2708-i2s-spdif.conf	add module parameter to enable continuous ...	last year
 dkms.conf	adapt for kernel 6.1 (first commit after almost ...	2 years ago
 spdif-encoder.c	generate channel status bits; add support for ...	2 years ago
 spdif-encoder.h	add module parameter to enable continuous ...	last year

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Software S/PDIF audio output for Raspberry Pi

Description

This is a Linux kernel module that outputs an audio stream in the S/PDIF format. The module is an ALSA sound card driver. It includes a software encoder to generate the S/PDIF stream and uses the I2S interface present in the BCM2708 SOC to transmit the S/PDIF stream.

The driver supports multiple sampling rates: 44100, 48000, 96000 and 192000. The channel status bits in the S/PDIF blocks are set according to the sampling rate.

The driver has been successfully tried on a Raspberry Pi Model B (with P5 header), Raspberry Pi Zero W and Raspberry Pi 3 Model B when connected to a simple audio DAC with an S/PDIF input. The driver has been reported to work on a Raspberry Pi 1 Model B combined with a SONY STR-DB840 AV receiver.

Installation

Manual compiling and installing

The module can be compiled (either on the PC or on the RPI) using the Makefile after adapting the path to the kernel headers.

The compiled module `bcm2708-i2s-spdif.ko` may be copied e.g. to `/lib/modules/$(uname -r)/updates/bcm2708-i2s-spdif.ko`. The original driver must be blacklisted. The Makefile has targets for both installing and blacklisting.

In `/boot/config.txt`, the i2s part of the device tree must be enabled.

```
dtparam=i2s=on
```

The above steps can be done like so:

```
sudo apt install raspberrypi-kernel-headers
make
sudo make install
sudo make blacklist
sudo vi /boot/config.txt # edit to enable i2s
sudo reboot
```

DKMS

The module can be intalled with DKMS, too. The following commands must be executed from a root shell.

```

apt install dkms raspberrypi-kernel-headers
cd /usr/src
git clone https://github.com/kiffie/rpi-i2s-spdif.git rpi_i2s_spdif-1
dkms install rpi_i2s_spdif/1
vi /boot/config.txt # edit to enable i2s
# blacklist the original driver
echo "blacklist snd_soc_bcm2835_i2s" > /etc/modprobe.d/blacklist-snd_soc_bcm2835_i2s.conf

```



Pinout

Since the S/PDIF stream is generated in software, no special encoder chip is needed. Just connect an S/PDIF transmitter (electrical or optical) to the PCM_DOUT pin.

Model	SPDIF output pin
Raspberry Pi 1 Model B (28-pin header + P5 header)	header P5, pin 6: GPIO 31
Raspberry Pi 1 Model B+ and later (40-pin header)	pin 40: GPIO 21

Continuous SPDIF signal output

There are module parameters to control whether an SPDIF signal containing zero samples (silence) is outputted when there is no ALSA audio stream (continuous SPDIF signal).

Parameter	Default	Description
continuous	N	Enable continuous SPDIF signal output. Modifications of this parameter via the /sys file system will have an effect the next time when an ALSA stream is stopped.
initial_rate	44100	Sample rate of the continuous SPDIF signal after loading the module before the first ALSA stream is outputted. Modification of this parameter via the /sys filesystem does not have an effect.

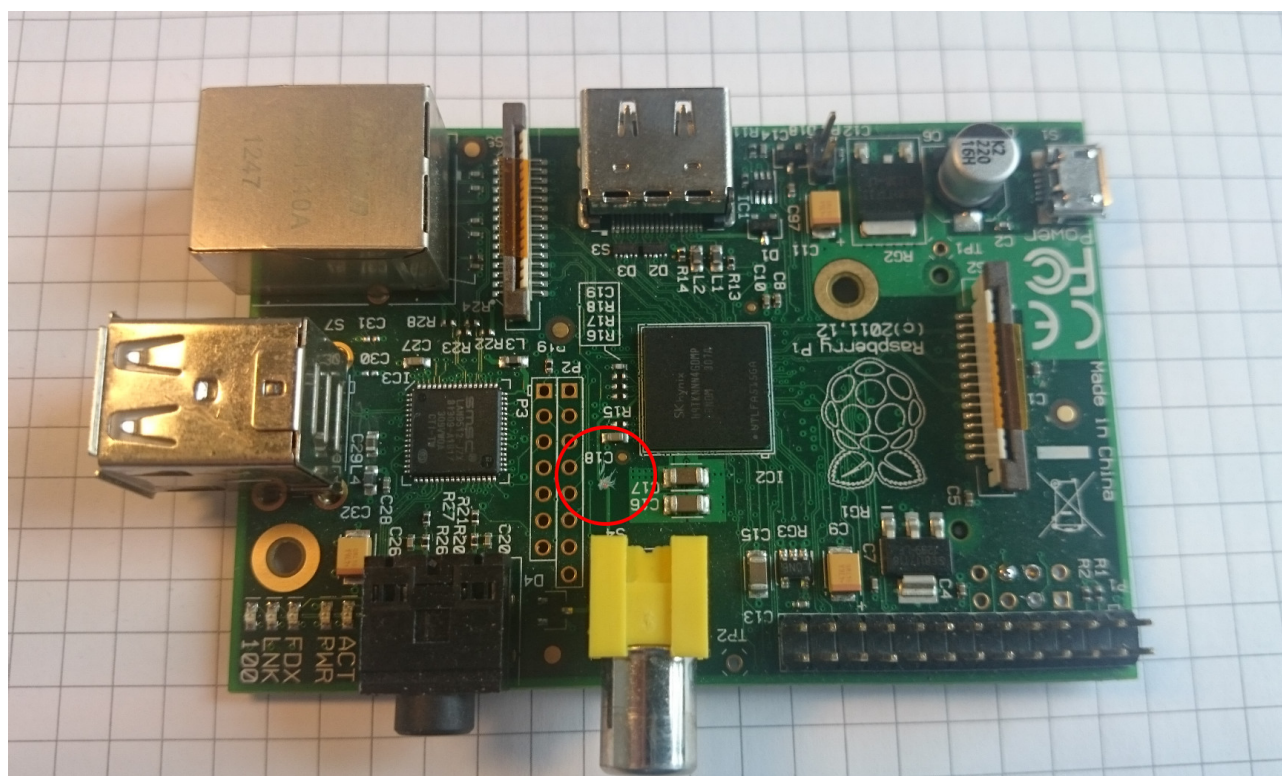
The sample rate of the continuous SPDIF signal corresponds to the sample rate of the previously outputted ALSA stream.

An example configuration is in file `bcm2708-i2s-spdif.conf`, which can be copied to `/etc/modprobe.d`.

Hardware hack for Pi 1 Model B: using the analog video output RCA connector

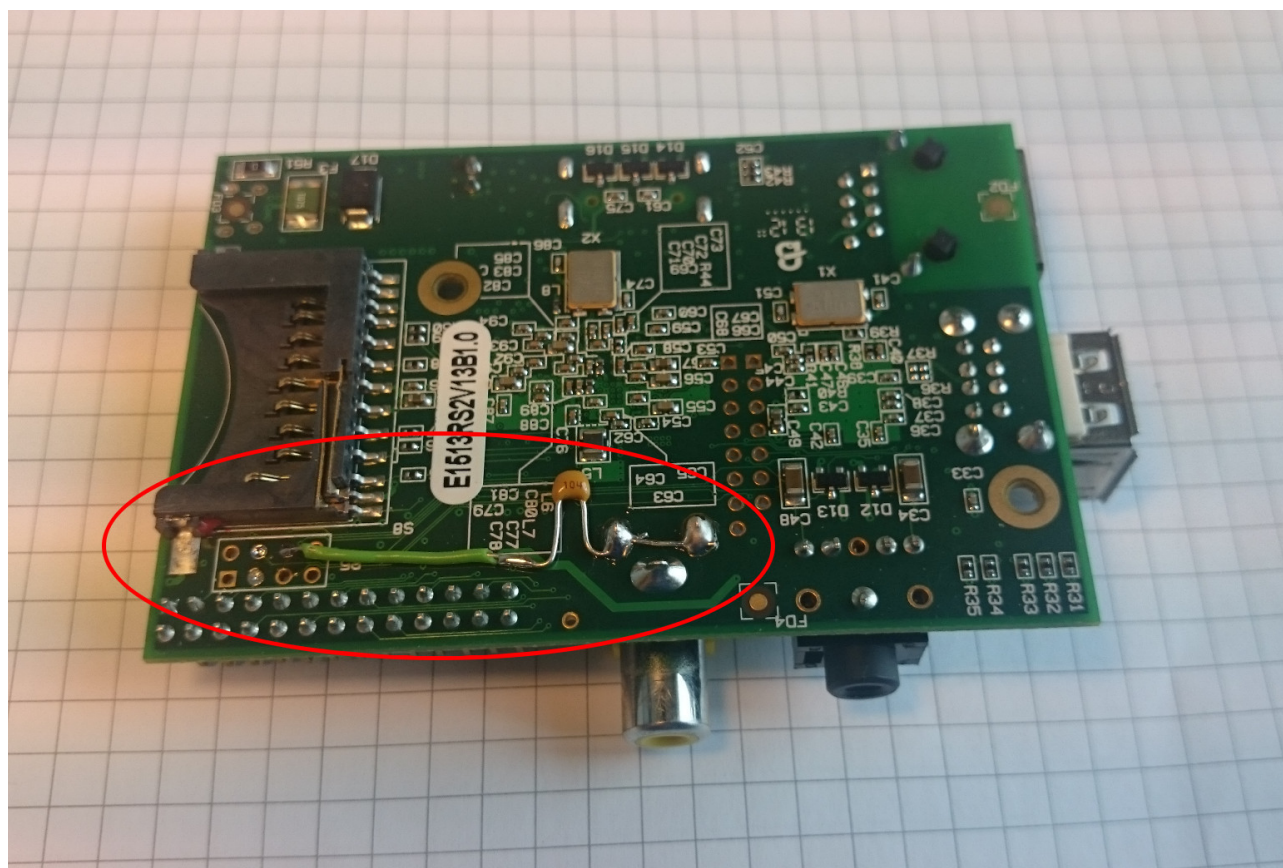
As shown below, old models of the Raspberry Pi can be modified to reuse the analog video connector as an electrical S/PDIF output.

First, I cut off the PCB track between the center connector and the Soc.



Maybe, cutting of this PCB track is not needed. However, I do not know how the inactive analog video output behaves.

Second, a 100 nF capacitor should be connected between the PCM_DOUT pin and the center connector of the video RCA connector. This is shown in the image below.



Instead of performing this modification, an optical transmitter module can be connected to the PCM_DOUT pin in order connect the Raspberry Pi to an optical fiber.

Releases

No releases published

Packages

No packages published

Languages

● C 97.8% ● Makefile 2.2%