

DESIGN IDEAS

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8-CHANNEL AUDIO/VIDEO SWITCH (PHILIPS COMPONENTS)

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General description

The TDA8440 from Philips Components is a versatile video/audio switch intended to be used in colour TV receivers equipped with an auxiliary video/audio (SCART) input

The IC provides two 3-state switches for audio channels, and one 3-state switch for the video channel and a video amplifier with selectable gain (unity gain or 2 times)

The TDA8440 can be used in conjunction with a microcontroller from the MAB8400 family, and is then controlled via

a bidirectional I²C bus. Sufficient sub-addressing is provided for the I²C bus mode. The IC can also be controlled directly by d.c. switching signals. This option is worked out in the present application note

Functional description

The block diagram of the TDA8440 is given in Fig. 1. The IC incorporates three 3-state switches with the following functions:

- one video switch with selectable gain (unity gain or 2 times) for switching between an internal video signal (from the TV's IC amplifier/demodulator) and an AUXILIARY input signal;
- two electronic audio switches for two sound channels (stereo or dual language) for switching between internal audio sources and signals from the AUXILIARY VIDEO/AUDIO connector.

Each switch on board the TDA8440 allows a selection to be made between two input signals and a high-impedance 'off' state. The 'off' state is necessary if more than one TDA8440 is used.

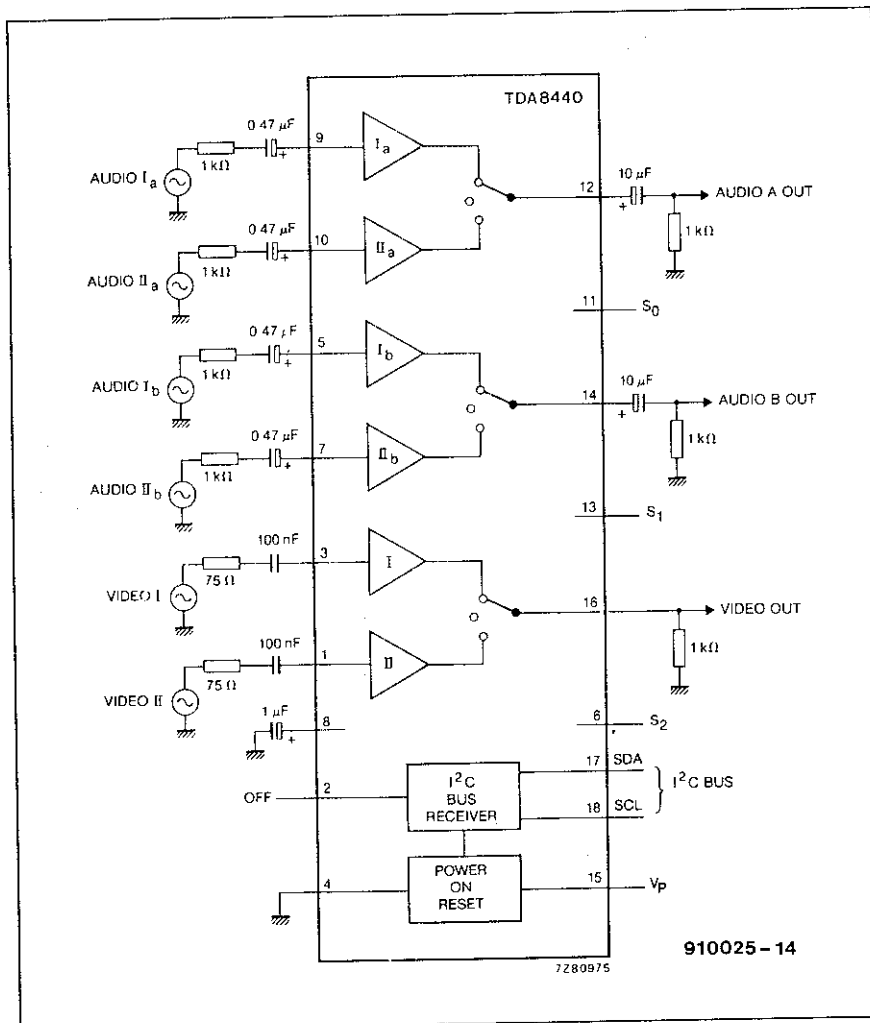


Fig. 1. Block diagram of the TDA8440 audio/video switch IC (illustration reproduced by courtesy of Philips Components).

TDA8440 MAIN SPECIFICATIONS

- Combined analogue and digital circuitry gives maximum flexibility in channel switching
- 3-state switches for all channels
- Selectable gain for the video channel
- Sub-addressing facility for I²C bus
- I²C bus or non-I²C bus mode (controlled by d.c. voltages)
- Slave receiver in the I²C bus mode
- External OFF command
- System expansion possible up to 7 devices (for 14 signal sources)
- Static short-circuit resistant outputs

The SDA and SCL pins can be connected to the I²C bus, or to d.c. switching voltages. Inputs S0 (pin 11), S1 (pin 13) and S2 (pin 6) are used for selection of sub-addressing or switching to the non-I²C bus mode.

The non-I²C bus mode is selected by making S0, S1 and S2 permanently logic high (+12 V). In this mode the sources (internal and external), and the gain of the video amplifier can be selected via the SDA and SCL pins, by means of the switching voltage from the AUXILIARY VIDEO/AUDIO connector. The four available functions are controlled as follows:

- sources 1 are selected if SDA = 12 V (external source);
- sources 2 are selected if SDA = 0 V (TV mode);
- video amplifier gain is 2 times if SCL = 12 V (external source);
- video amplifier gain is unity if SCL = 0 V (TV mode)

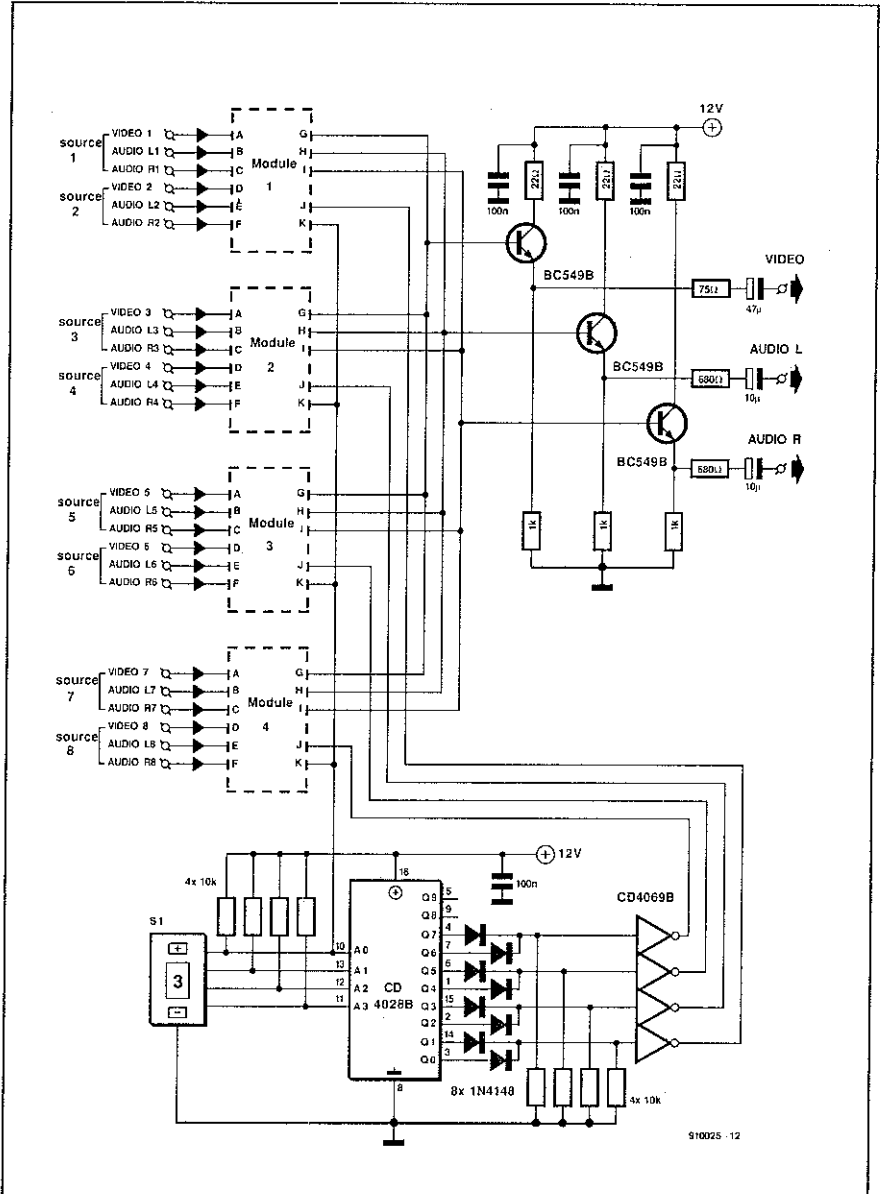
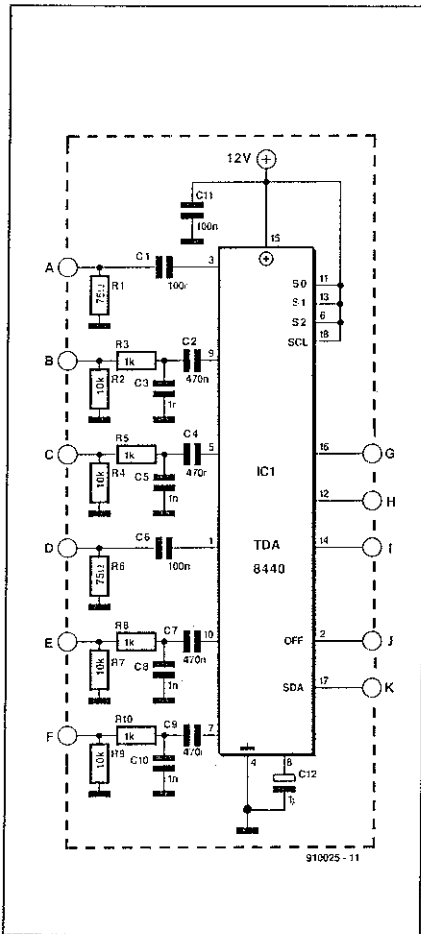


Fig. 2. Circuit diagram of the basic audio/video switching module

Fig. 3. Four modules as shown in Fig. 2 and a BCD thumbwheel switch interface together make a versatile eight-way electronic audio/video switch.

switch position	BCD				CD4028 decoder outputs								SDA	OFF OFF OFF OFF				Selection
	3	2	1	0	1	2	3	4	5	6	7	8		1	2	3	4	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	-
1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	1	source 1
2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	source 2
3	0	0	1	1	0	0	1	0	0	0	0	0	1	1	0	1	1	source 3
4	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	source 4
5	0	1	0	1	0	0	0	0	1	0	0	0	1	1	1	0	1	source 5
6	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	source 6
7	0	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	source 7
8	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	source 8

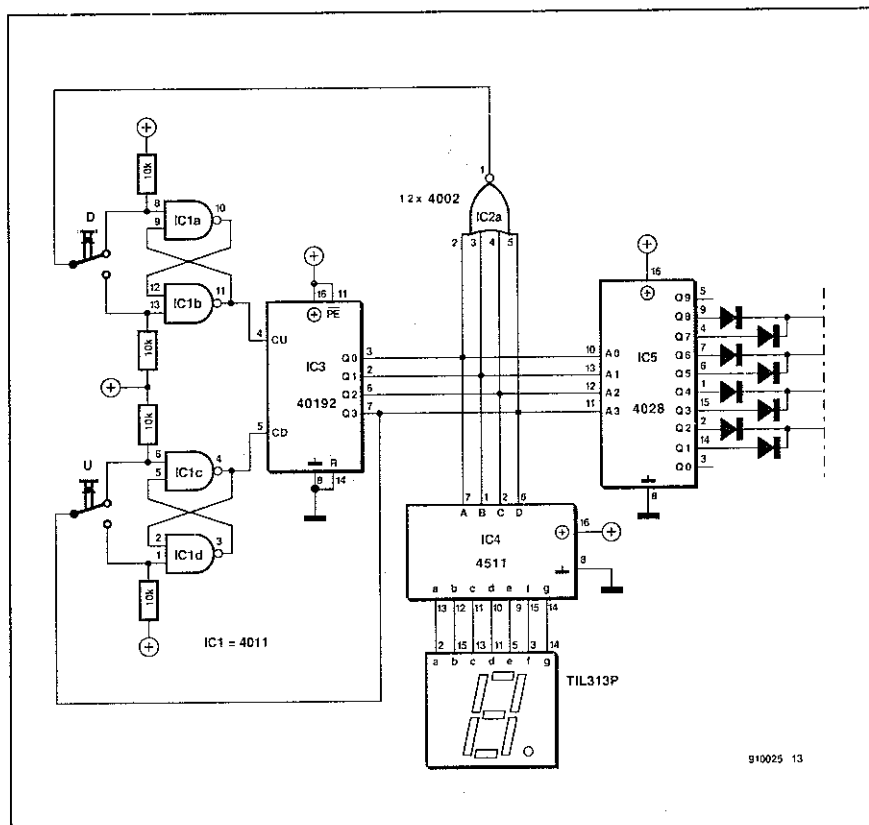


Fig. 4 A possible substitute for the BCD thumbwheel switch in the circuit of Fig. 3.

If more than one TDA8440 device is used in the non- I^2C bus system, the OFF pin (pin 2) can be used to switch off the desired devices. This can be done via the 12-V switching voltage of the AUXILIARY VIDEO/AUDIO connector:

- all switches are in the high-Z (off) position if OFF = 12 V;
- all switches are in the position selected with SDA if OFF = 0 V.

Application circuits

The circuit shown in Fig. 2 is one of four identical switching modules based on the TDA8440. The two video inputs, A and D, are terminated with 75- Ω resistors, while the two stereo audio inputs (pairs B-C and E-F) are terminated with 10-k Ω resistors. The audio signals are filtered with R-C networks to suppress noise. The amplification of the video switch is set to 2 times here by the permanently high level at the SCL input. The voltage at the SDA input determines the source selection as discussed above.

The final 8-way audio/video switcher (Fig. 3) contains four modules of the type shown in Fig. 2. A thumbwheel switch with BCD-coded outputs is used to select one of eight AV channels. The LSB (least-significant bit) of the BCD switch is connected to the SDA inputs of the four modules.

The four 'module select' lines are created with a CD4028 BCD-to-decimal decoder. The eight decoded outputs of this IC are connected in pairs. Each of the four signals so obtained is inverted by a CD4069

gate to ensure the correct control of the OFF input of the relevant AV switching module. The channel selection of the 8-way switching unit is shown in the Table below Fig. 3. All channels are switched off by setting the thumbwheel switch to 0.

The audio and video outputs of the four modules are connected in parallel and buf-

fered with the aid of emitter follower stages that provide the appropriate source impedance (75 Ω for the video output and about 600 Ω for the audio outputs). The gain of the video channel is set to two times here to compensate the 6 dB voltage attenuation introduced by the series resistor at the video output and the input resistance of the load.

Connectors for the inputs and outputs are not specified here since they depend on the practical use of the switching unit. BNC sockets, phono sockets or SCART sockets may be used as required. Likewise, the switcher can be built to handle fewer or more than eight AV channels as proposed here. A simple AV switcher for two video and two audio channels, for instance, requires only one module controlled by a much simpler selection circuit than the BCD switch plus the 4028.

One application of the AV switching unit is the connection of a video recorder, a home computer and a CD player to the SCART input of the TV set, eliminating the need of changing lots of cables any time a different source is selected.

Finally, a 'discrete' replacement for the (expensive) BCD switch is given in Fig. 4. The channel selection is effected by pressing the U (up) and D (down) keys. The number of the selected channel appears on a 7-segment LED display.

Reference:

TDA8440 Development Data. Philips Components

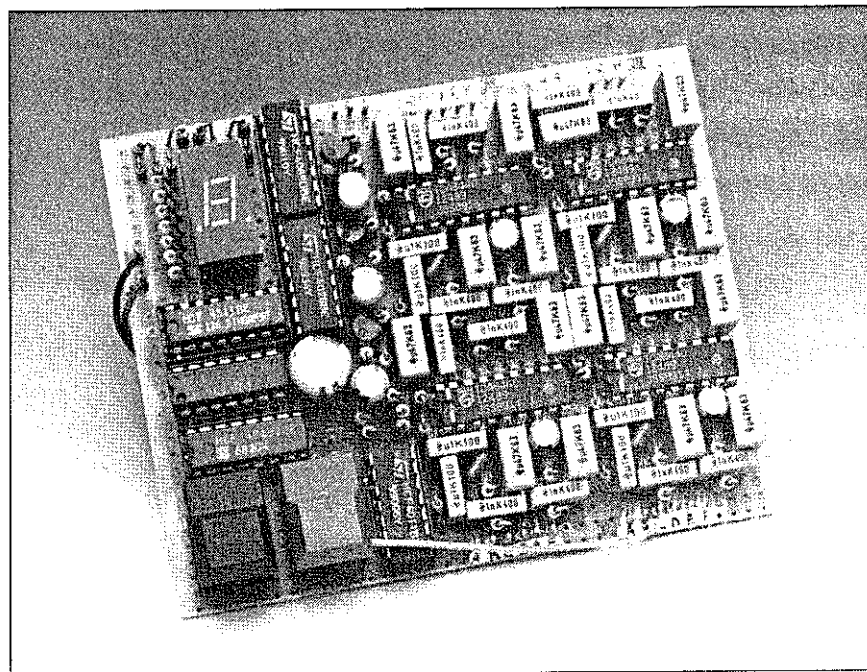


Fig. 5 Prototype of the eight-way audio/video switch built on a small piece of Vero stripboard. In this version, the unit has the up/down keys and the 7-segment LED display shown in Fig. 4 to set and visualize the selected AV channel.