OnTV-21
or
Stay in touch while watching TV

Abstract

OnTV-21 is a small and relatively simple device that allows its owner to stay in touch while watching TV. *OnTV-21* includes a wireless link to a PC that can collect information about incoming E-mails and chat requests. *OnTV-21* is also coupled to a telephone line so it can collect Caller ID information. *OnTV-21* displays the information it gets in the TV using the Closed Caption decoder. *OnTV-21* gets its name from the fact that Closed Caption information is broadcasted on the 21st line of the video frame.

OnTV-21 is inserted in the video link between a TV receiver (Tuner) and a TV that has been set to accept an external video input. The information collected by *OnTV-21* is displayed seamlessly using the Closed Caption decoder that every modern TV set includes (mandated by law since 1993). Despite the relatively high bit rate of the Closed Caption information (503.5 KHz), the Closed Caption bit stream is generated in software by *OnTV-21*. To stay in touch, the TV has to be set to permanently decode the Closed Caption information. *OnTV-21* automatically strips the Closed Caption information generated by the network or cable operator.

OnTV-21 is based on a Cypress PsoC™ 26443 microcontroller that handles the following tasks:

- Interface to a small wireless receiver
- Decode frames from the wireless receiver
- Analog interface to the telephone line
- Caller ID demodulation
- Maintain the synchronization with the incoming video
- Filter unwanted Closed Caption data
- Generate the Closed Caption bit stream

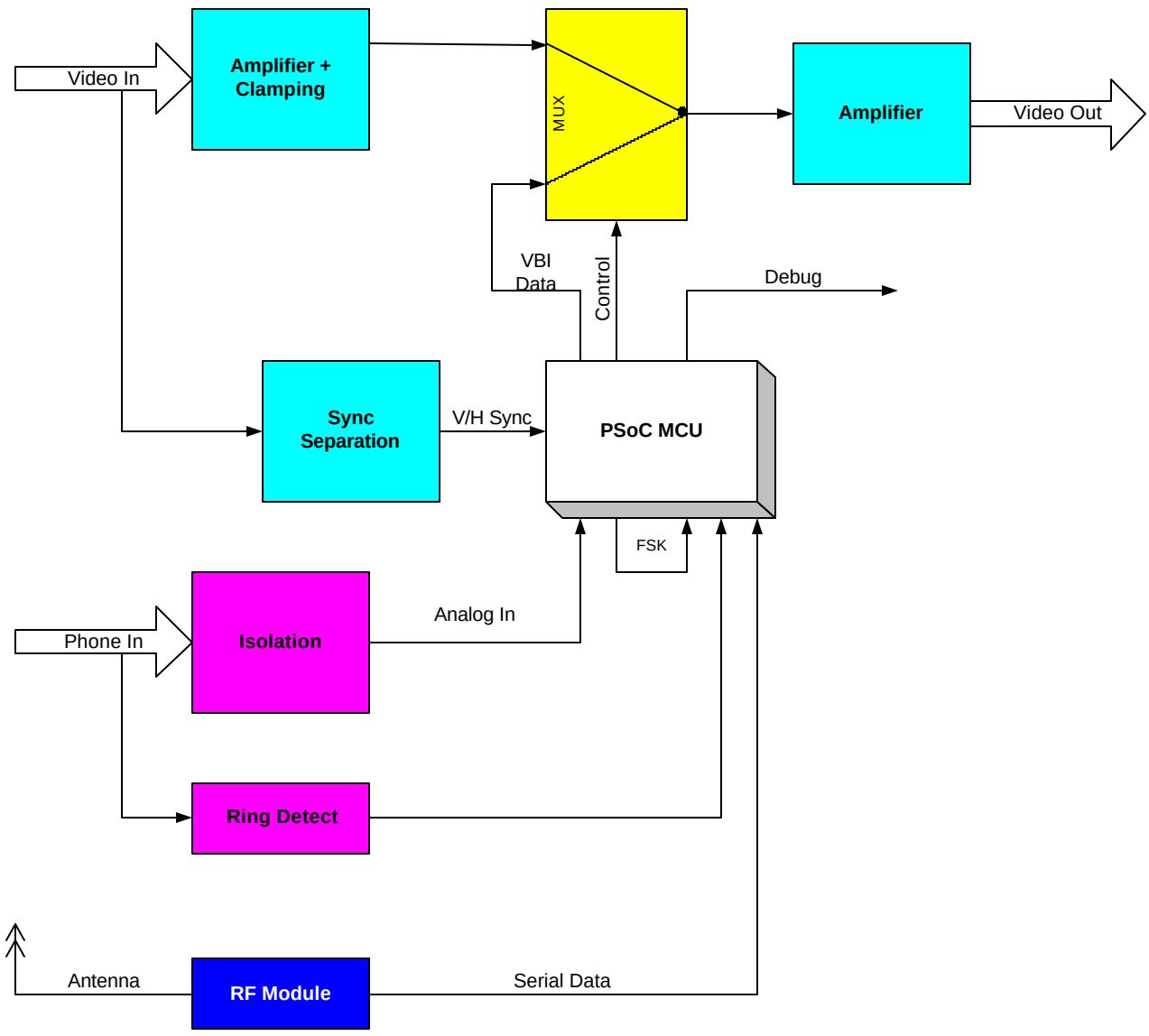
OnTV-21 is enclosed in a small plastic box. The front panel has 2 LED's and a push button. The rear panel has 2 RCA connectors (Video In and Video Out) and an RJ 11 connector for the telephone line. The first LED labeled STATUS shows the status of *OnTV-21* (Steady off: OFF, Steady on: ON, Blinking: Closed Caption pass through mode). The second LED labeled LINK shows the status of the wireless link (the LED stays on for 2 seconds every time a valid frame is received). The push button allows the user to select the mode of operation.

Inside the plastic enclosure, a small PCB (4.1" x 4.7") includes the input and output video buffers. In order for the Closed Caption generated by the TV network to be removed, the video must be switched off the video input during the time Closed Caption information can be broadcasted. A CD4066, a veteran in the analog switch world, performs this function. A dedicated IC (LM1881) extracts the synchronization pulses from the incoming video stream and presents the pulses to the microcontroller.

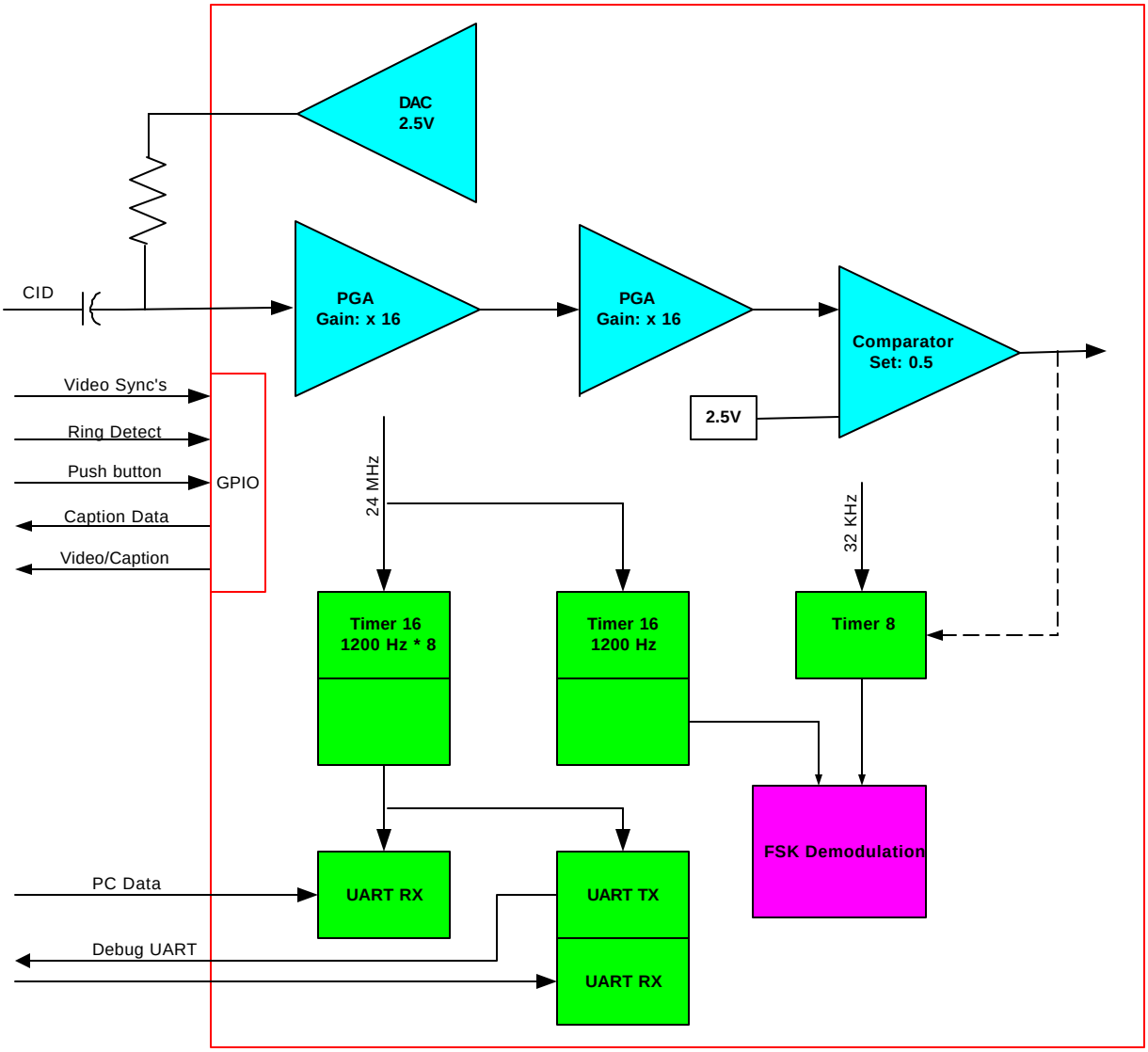
An optocoupler-based ring detector and a transformer-based telephone line pick up are connected to the telephone line on one side and to the microcontroller on other side. Finally, a standalone RF receiver operating at 418 MHz provides a link from the house Personal Computer.

With *OnTV-21,* the “couch potato” will be able to stay in touch, without having to check for a potential new E-Mail every 5 minutes. When the telephone rings, a concise message will give the name and phone number of the caller. Will *OnTV-21* return the family TV set to the role it had before the PC?

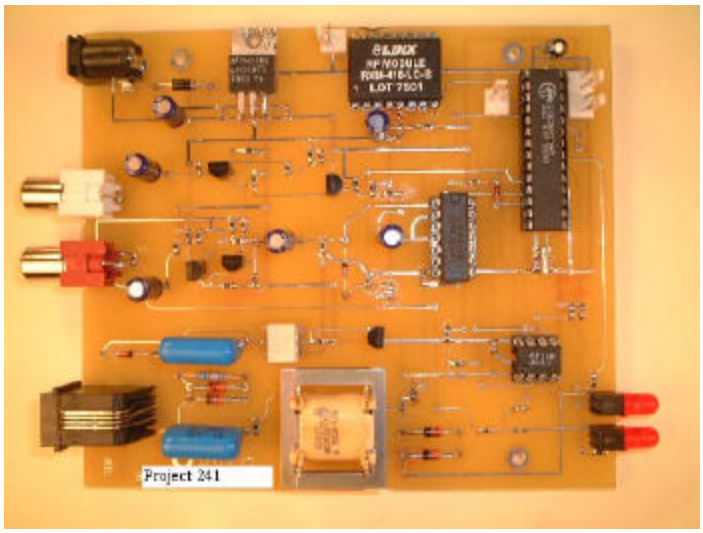
Block Diagrams



OnTV-21 Block Diagram

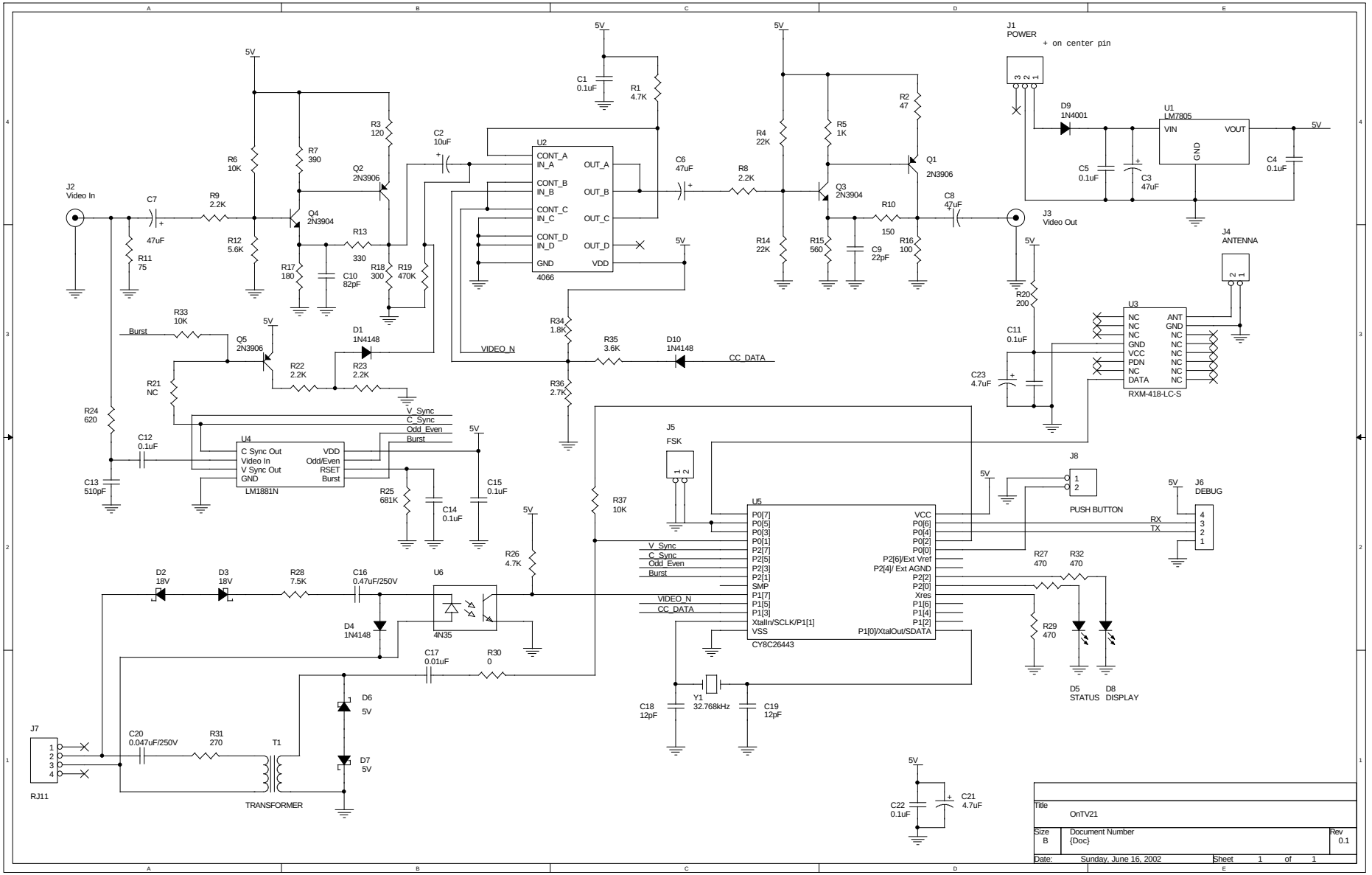


PsoC Blocks Usage



The board

OnTV-21 at work


J1
POWER
+ on center pin
D9
1N4001
U1
LM7805
VIN
VOUT
GND
C5
0.1uF
C3
47uF
C4
0.1uF
J2
Video In
C7
47uF
R9
2.2K
R6
10K
R7
390
R3
120
Q2
2N3906
Q4
2N3904
R12
5.6K
R11
75
R13
330
R17
180
C10
82pF
R18
300
R19
470K
C2
10uF
U2
CONT_A
IN_A
OUT_A
CONT_B
IN_B
OUT_B
CONT_C
IN_C
OUT_C
CONT_D
IN_D
OUT_D
GND
VDD
4066
C1
0.1uF
R1
4.7K
C6
47uF
R8
2.2K
R4
22K
R5
1K
R2
47
Q1
2N3906
Q3
2N3904
R14
22K
R15
560
C9
22pF
R10
150
R16
100
C8
47uF
J3
Video Out
R20
200
C11
0.1uF
C23
4.7uF
J4
ANTENNA
U3
NC
NC
NC
GND
VCC
PDN
NC
DATA
ANT
GND
NC
NC
NC
NC
NC
NC
RXM-418-LC-S
Burst
R33
10K
Q5
2N3906
D1
1N4148
R22
2.2K
R23
2.2K
R21
NC
VIDEO_N
R34
1.8K
R35
3.6K
D10
1N4148
CC_DATA
R36
2.7K
R24
620
C12
0.1uF
C13
510pF
U4
C Sync Out
Video In
V Sync Out
GND
VDD
Odd/Even
RSET
Burst
LM1881N
V_Sync
C_Sync
Odd_Even
Burst
R25
681K
C14
0.1uF
C15
0.1uF
R26
4.7K
R37
10K
J5
FSK
J8
PUSH BUTTON
J6
DEBUG
RX
TX
U5
P0[7]
P0[5]
P0[3]
P0[1]
P2[7]
P2[5]
P2[3]
P2[1]
SMP
P1[7]
P1[5]
P1[3]
XtalIn/SCLK/P1[1]
VSS
VCC
P0[6]
P0[4]
P0[2]
P0[0]
P2[6]/Ext Vref
P2[4]/ Ext AGND
P2[2]
P2[0]
Xres
P1[6]
P1[4]
P1[2]
P1[0]/XtalOut/SDATA
CY8C26443
R27
470
R32
470
R29
470
D5
STATUS
D8
DISPLAY
D2
18V
D3
18V
R28
7.5K
C16
0.47uF/250V
U6
4N35
D4
1N4148
C17
0.01uF
R30
0
Y1
32.768kHz
C18
12pF
C19
12pF
J7
RJ11
C20
0.047uF/250V
R31
270
T1
TRANSFORMER
D6
5V
D7
5V
C22
0.1uF
C21
4.7uF
Title
OnTV21
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