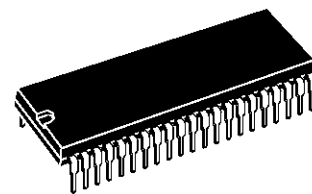


## BUS CONTROLLED PAL/NTSC TV PROCESSOR

- I<sup>2</sup>C BUS CONTROL OF ALL FUNCTIONS
- INTEGRATED FILTERS (TRAP, BANDPASS)
- INTEGRATED LUMINANCE DELAY LINE
- PAL/NTSC CHROMA DEMODULATORS
- NTSC AUTOMATIC FLESH TONE CONTROL
- AUTOMATIC CUT-OFF CURRENT LOOP
- TWO RGB INPUTS
- SVHS SWITCH
- TWO PLLs HORIZONTAL DEFLECTION
- VERTICAL COUNT DOWN
- 3 CRYSTALS APPLICATION CAPABILITY
- BLUE SCREEN
- VERY FEW EXTERNAL COMPONENTS

Used with STV8223 (PIF/SIF/switches), TDA1771 or TDA8174 (frame booster), STV2180 (delay line), it allows to design a PAL/NTSC (BGDKIMN) set with very few external components and no adjustment.



**SHRINK42**  
(Plastic Package)

**ORDER CODE : STV2116A**

### DESCRIPTION

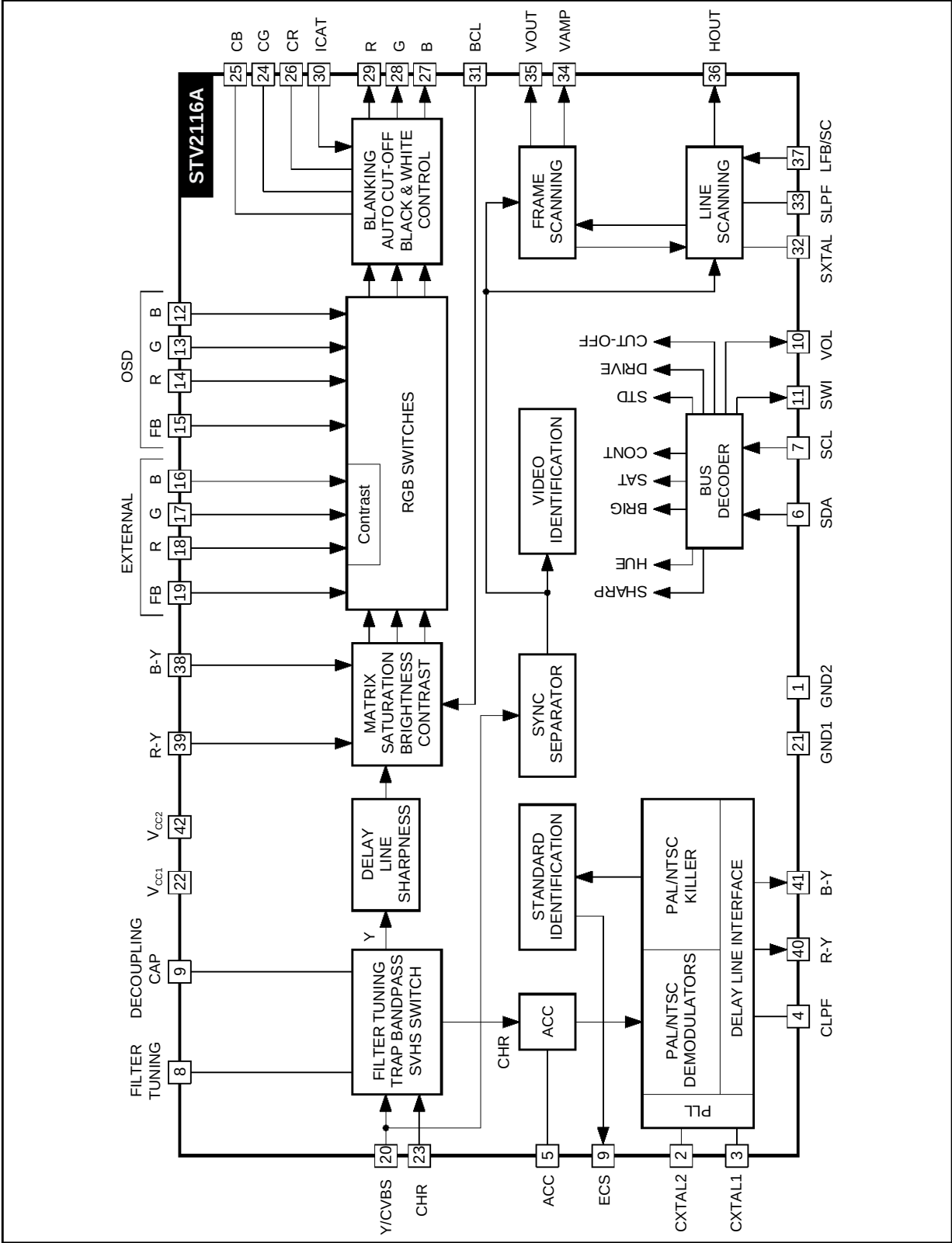
The STV2116A is a fully bus controlled IC for TV luma, chroma and deflection processing.

### PIN CONNECTIONS

|                                  |        |    |    |                  |                                      |
|----------------------------------|--------|----|----|------------------|--------------------------------------|
| CHROMA/SCANNING GROUND           | GND2   | 1  | 42 | V <sub>CC2</sub> | CHROMA/SCANNING/BUS SUPPLY           |
| 3.58MHz XTAL                     | CXTL2  | 2  | 41 | BYO              | B-Y OUTPUT                           |
| 4.43MHz XTAL                     | CXTL1  | 3  | 40 | RYO              | R-Y OUTPUT                           |
| CHROMA LOOP FILTER               | CLPF   | 4  | 39 | RYI              | R-Y INPUT                            |
| ACC CONTROL CAPACITOR            | ACC    | 5  | 38 | BYI              | B-Y INPUT                            |
| DATA WIRE I <sup>2</sup> C BUS   | SDA    | 6  | 37 | LFB/SC           | LINE FLYBACK INPUT/SANDCASTLE OUTPUT |
| CLOCK WIRE I <sup>2</sup> C BUS  | SCL    | 7  | 36 | HOUT             | HORIZONTAL OUTPUT                    |
| FILTER TUNING                    | FTUN1  | 8  | 35 | VOUT             | VERTICAL OUTPUT                      |
| EXTERNAL CRYSTAL SELECTION       | ECS    | 9  | 34 | VAMP             | AMPLITUDE CONTROL VOLTAGE            |
| VOLUME AND MUTE CONTROL VOLTAGE  | VOL    | 10 | 33 | SLPF             | SCANNING LOOP FILTER                 |
| IF STANDARD AND SWITCH SELECTION | SWI    | 11 | 32 | SXTL             | 503kHz CERAMIC                       |
| OSD BLUE INPUT                   | BOSD   | 12 | 31 | BCL              | BEAM CURRENT LIMITER                 |
| OSD GREEN INPUT                  | GOSD   | 13 | 30 | ICAT             | CATHODE CURRENT MEASUREMENT          |
| OSD RED INPUT                    | ROS    | 14 | 29 | RO               | RED OUTPUT                           |
| OSD RGB INSERTION                | FBOSD  | 15 | 28 | GO               | GREEN OUTPUT                         |
| EXTERNAL BLUE INPUT              | BEXT   | 16 | 27 | BO               | BLUE OUTPUT                          |
| EXTERNAL GREEN INPUT             | GEXT   | 17 | 26 | CR               | RED CUT-OFF CAPACITOR                |
| EXTERNAL RED INPUT               | REXT   | 18 | 25 | CB               | BLUE CUT-OFF CAPACITOR               |
| EXTERNAL RGB INSERTION           | FBEXT  | 19 | 24 | CG               | GREEN CUT-OFF CAPACITOR              |
| CVBS OR LUMINANCE INPUT          | Y/CVBS | 20 | 23 | CHR/SVHS         | CHROMINANCE INPUT/SVHS SELECTION     |
| BUS/VIDEO GROUND                 | GND1   | 21 | 22 | V <sub>CC1</sub> | VIDEO SUPPLY                         |

2116A-01 EPS

BLOCK DIAGRAM



2116A-02 EPS

## FUNCTIONAL DESCRIPTION

### 1 - DEFLECTION CIRCUIT

**Note :** [X,Y] : line number referred to the internal line counter numbering

- Fully integrated synch. separator, with a low pass filter, a black level alignment of the Y/CVBS input, a slicing level at 2/3,1/3 of the sync. pulse amplitude.
- Frame sync. pulse locked on  $2 f_H$  frequency to perfect interlace.
- 500kHz VCO with an external ceramic resonator.
- Two phase locked loops
  - the first PLL locks the VCO on the video signal frequency,
  - the second PLL compensates the line transistor storage time.
- Three time constants for the first PLL.
  - the long time constant is used for normal operation
  - the short time constant is automatically used during the frame retrace and in search mode of VCR when the frame pulse is outside [258,264] and [309,314].
  - very long time constant when no video recognition

Time constants in normal operation

(automatic selection of time constants) :

50Hz input signal :

- short time constant : [306, 21]
- long time constant : the rest of the field

60Hz input signal :

- short time constant : [0, 16]
- long time constant : the rest of the field

- inhibition of the first PLL :  
the first locked loop is opened from line 309 to line 4.5 (or 314) in 50Hz mode. It is opened from line 258 to line 5.5 (or 264) in 60Hz mode.
- the time constants values are chosen by means of external components.
- possibility to force the short time constant through the bus.
- possibility to force the very long time constant through the bus.
- Video identification : coincidence detector between the line synchro top and a line frequency window from the first PLL. The video identification status is available in the output register of the I<sup>2</sup>C bus decoder.
- Generation of burst gate pulses and line frequency signals from the first PLL to drive the chroma and video circuits. The burst gate pulse is also sent to the sandcastle generator.
- Frame synchro window : [248, 352] catching
- Field frequency selection windows :  
[248, 288] 60Hz mode selection if two consecutive frame pulses occur inside this window, otherwise 50Hz mode selection.  
[288, 352] 50Hz mode selection window

- frame blanking pulse :  
from line 0 to 21 in 50Hz mode  
from line 0 to 16 in 60Hz mode
- Vertical output pulse is 10.5 lines long.
- Horizontal output pulse : 28μs line pulse on an open collector output;
- Start up circuit : the horizontal output is at a high level when V<sub>CC</sub> increases from 0 to 6.8V. On shutting down, horizontal pulses are disabled when V<sub>CC</sub> is below 6.2V.
- Soft-start circuit : the duty cycle of the horizontal output is 78 % (Thigh/(Thigh + TLow)) when V<sub>CC1</sub> is lower than (0.75 x V<sub>CC2</sub>), during the rising time. During the falling time, a 78% duty cycle HOUT pulse is provided when V<sub>CC1</sub> is lower than (0.60 x V<sub>CC2</sub>).
- Possibility to disable the horizontal output pulse through the bus (force a high level on HOUT).
- Horizontal position adjustment controlled by bus.
- Bus controlled output voltage to adjust the vertical amplitude; this voltage permits to adjust the slope of the vertical sawtooth generated by the external frame booster.
- Bus controlled vertical position ; the high level of the vertical pulse permits to adjust the vertical position.
- Bus controlled 4/3-16/9 selection : the low level of the vertical pulse is 0.1V when 16/9 is selected, 2V when 4/3 is selected.
- Combined flyback input and sandcastle output (Pin 37). Two thresholds on LFB/SCO Pin : The lowest threshold (0.7V) permits to extract the line blanking pulse; the highest threshold (2V) permits to extract the line pulse for PLL2. The sandcastle signal at Pin 37 is used to control the external baseband chroma delay line.

### 2 - FILTERS

- Integrated trap filter :

$$Q = \frac{1}{\frac{f_o}{f_{-3dB}} - \frac{f_{-3dB}}{f_o}}$$

Q = 1.7 at sharp. min

Q = 3.0 at sharp. max

Center frequency : - 4.43MHz,  
3.58MHz for PAL, NTSC

- Integrated chroma bandpass : Q = 3.5  
Center frequency : 4.43MHz, 3.58MHz
- Integrated delay line : Bandwidth = 8MHz
- Integrated low pass filter for deflection part.
- All filters are tuned with a reference phase locked loop. The PLL consists of a lowpass filter, a phase comparator, a loop filter (an external capacitor). The reference signal is the continuous carrier wave from the VCO (4.43MHz or 3.58MHz). The PLL adjusts the center frequency of the lowpass so that it is equal to the reference signal. The tuning voltage of the PLL is used to adjust all other filters.

**FUNCTIONAL DESCRIPTION (continued)****3 - VIDEO CIRCUIT**

- 2 RGB inputs : RGB (OSD) input has priority against the RGBext. Maximum contrast on RGB (OSD). -10dB range contrast control on RGBext. Possibility to disable the RGBext insertion through the bus.
- Oversize blanking capability on FB(OSD)(Pin15) input. The RGB outputs will be blanked when the voltage on Pin 15 will exceed the second threshold at 1.9V (blanking threshold) : the whole field is blanked but not the inserted cut-off pulses. The OSD insertion threshold is 0.7V.
- Automatic cut-off current loop : 2V cut-off range. Sequential cut-off current measurement during the three lines after the frame blanking signal. Leakage current measurement during the frame blanking, memorization on an internal capacitor.
- Possibility to force through the bus the inserted cut-off pulses on lines 23/24/25(CCIR) in 50Hz and 60Hz mode.
- Warm up detector.
- Beam current limiter DC voltage input. The beam current limiter control voltage will act on contrast first, then the brightness will be decreased when contrast attenuation reaches -5dB.
- Bus control of the red, green and blue channel gain (White point adjustment)
- Bus control of the red and green DC levels (black point adjustment)
- PAL matrix, specific NTSC matrix when demodulation angles are (0°, 104°).
- Switch-off of the trap filter in SVHS mode.
- Bus controlled contrast on luminance (20dB range)
- Bus controlled saturation (50dB range)
- Bus controlled brightness : 40% range at maximum contrast.
- Bus controlled sharpness (peaking).
- Noise coring function on sharpness.
- Bus controlled blue screen feature

**4 - CHROMA CIRCUIT****4.1 - PAL/NTSC Decoders**

- SVHS inputs ; bus controlled SVHS mode.
- 30dB range ACC.
- Use of an external base band delay line (STV2180 recommended).
- Automatic standard identification, with possibility to force the standard through the bus.
- ACC done by peak detector on synchronous demodulation of the burst.
- Fully integrated killer functions.
- VCO using two standard crystals : 4.43MHz and 3.58MHz. One crystal is internally selected de-

pending on the standard selection.

- 3 crystals application capability : one crystal on Pin XTAL1 (4.43MHz or 3.58MHz), two crystals on Pin XTAL 2 (3.58MHz only) which can be selected by Pin 9 out signal.

**XTAL SPECIFICATION :**

Frequency : 4.433619MHz (PAL)  
 3.579545MHz (NTSC M)  
 3.575611MHz (PAL M)  
 3.582056MHz (PAL N)

Vibration mode : Fondamental, series resonance (no serial capacitor)

Motional capacity : 13fF ±3fF

Resonance resistance : < 70Ω

Shunt capacitance : < 7pF

Spurious response : No resonance at  $3 \cdot f_0 \pm 3\text{kHz}$

- 0° and ±90° demodulation angles for PAL
- (0°, 90°) or (0°, 104°) = demodulation angles for NTSC. The selection of 90° or 104° is made through the bus.
- Bus control Hue adjustment in NTSC mode.
- NTSC automatic flesh control. Bus controlled disable.
- Switchable chroma demodulator gain (+6dB) for NTSC only application, when no external chroma delay line is used.

**4.2 - Standard Identification**

- Sequential identification.
- 3 identification sequences : XTAL1 (4.43MHz) mode to identify either PAL or NTSC, XTAL2 (3.58MHz) mode to identify either PAL or NTSC, no SECAM signal checking. In case of single standard operation, we recommend to force this standard by the bus which permits the use of only one crystal.
- Blanking of the (R-Y) and (B-Y) outputs during color search mode.

**5 - OTHER FUNCTIONS : IF CONTROLS****5.1 - Volume Control and Mute**

The volume control voltage range on Pin 10 is from 0.5V to 5V. A low voltage on Pin 10 (below 0.1V) will mute the FM demodulator of the IF circuit (STV8223). Thus there will be no sound either on the speaker or an audio output plug.

The volume control voltage and the mute level are controlled by the bus.

**5.2 - TV/SCART Mode Selection**

The selection of the TV/External (AV) mode is controlled by the bus. The selection is converted in two voltages on Pin 11.

The lowest voltage selects the TV mode.

The highest voltage (open collector output with internal pull-up resistor to V<sub>CC</sub>) selects the External (AV) mode.

## I<sup>2</sup>C BUS SPECIFICATION

### General Comments

Slave Address : 8A (HEX) (1000101X)

### WRITE MODE DATA FORMAT

| Slave Address     | Register Address                | Data                                   |
|-------------------|---------------------------------|----------------------------------------|
| 1000 1010<br>(8A) | XXXS SSSS<br>(from 00 to 11HEX) | XXSS SSSS<br>(6 significant bits Max.) |

The not used bits in data byte must be put to "0".

### READ MODE DATA FORMAT

| Slave Address     | Data                              |
|-------------------|-----------------------------------|
| 1000 1011<br>(8B) | SSSS SSSS<br>(8 significant bits) |

MSB on the left, LSB on the Right.

MSB

LSB

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| X | X | X | X | X | X | X | X |
|---|---|---|---|---|---|---|---|

X : not significant bit - S : significant bit

### Input Signals (Write Mode)

#### VIDEO

| Address<br>Dec (HEX) | Description                                                                                                                | Data<br>(Bits) | Comments                                                                 |
|----------------------|----------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------|
| 0 (00)               | Contrast                                                                                                                   | 5              | XXX0 0000 = -20dB<br>XXX1 1111 = 0dB                                     |
| 0 (00)               | External Fast Blanking Enable                                                                                              | 1              | XXSX XXXX<br>0 = RGBext insertion enable<br>1 = RGBext insertion disable |
| 1 (01)               | Saturation                                                                                                                 | 6              | XX00 0000 = -44dB<br>XX11 1111 = +6dB                                    |
| 2 (02)               | Brightness                                                                                                                 | 5              | XXX0 0000 = -20%<br>XXX1 1111 = +20%                                     |
| 2 (02)               | RGB Outputs Blanking                                                                                                       | 1              | XXSX XXXX<br>0 = Normal mode<br>1 = Blanking active                      |
| 3 (03)               | Red Drive Adjust (white point red adjust)                                                                                  | 6              | XX00 0000 = -6dB<br>XX11 1111 = 0dB                                      |
| 4 (04)               | Red Cut-off Adjust                                                                                                         | 6              | XX00 0000 = +150mV<br>XX11 1111 = -150mV                                 |
| 5 (05)               | Green Drive Adjust (white point green adjust)                                                                              | 6              | XX00 0000 = -6dB<br>XX11 1111 = 0dB                                      |
| 6 (06)               | Green Cut-off Adjust                                                                                                       | 6              | XX00 0000 = +150mV<br>XX11 1111 = -150mV                                 |
| 7 (07)               | Blue Drive Adjust (white point blue adjust)                                                                                | 6              | XX00 0000 = -6dB<br>XX11 1111 = 0dB                                      |
| 8 (08)               | Sharpness                                                                                                                  | 3              | XXXX X000 = Peaking Min.<br>XXXX X111 = Peaking Max.                     |
| 8 (08)               | Blue Screen                                                                                                                | 1              | XXXX SXXX 0 = blue screen disable<br>1 = blue screen enable              |
| 8 (08)               | Third Crystal Selection<br>(This bit is not significant in automatic color standard mode - data = 06Hex in register 0AHex) | 1              | XXXS XXXX 0 = low level on Pin 9<br>1 = high level on Pin 9              |

I<sup>2</sup>C BUS SPECIFICATION (continued)

## Input Signals (Write Mode) (continued)

## CHROMA

| Address Dec (HEX) | Description              | Data (Bits) | Comments                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|--------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 (09)            | Hue                      | 6           | XX00 0000 = -45°<br>XX11 1111 = +45°                                                                                                                                                                                                                                                                                                                       |
| 10 (0A)           | Standard Selection       | 4           | XXXX SSSS<br>0000 = PAL/XTAL1 (4.43MHz)<br>0001 = PAL/XTAL2 (3.58MHz)<br>0010 = NTSC/XTAL1/90°<br>0011 = NTSC/XTAL2/90°<br>1010 = NTSC/XTAL1/104°<br>1011 = NTSC/XTAL2/104°<br>011X = Auto/90°<br>111X = Auto/104°<br><br>0100 = Not allowed<br>0101 = Not allowed<br>1000 = Not allowed<br>1001 = Not allowed<br>1100 = Not allowed<br>1101 = Not allowed |
| 10 (0A)           | SVHS Selection           | 1           | XXXS XXXX 0 = No SVHS (CVBS mode)<br>1 = SVHS mode                                                                                                                                                                                                                                                                                                         |
| 10 (0A)           | XTAL1 (Pin 3) Indication | 1           | XXSX XXX 0 = 4.43MHz Crystal on Pin 3<br>1 = 3.58MHz Crystal on Pin 3                                                                                                                                                                                                                                                                                      |
| 14 (0E)           | Chroma Demodulation Gain | 1           | XXXS XXXX 0 = 0dB<br>1 = +6dB                                                                                                                                                                                                                                                                                                                              |
| 14 (0E)           | Flesh Control            | 1           | XXSX XXXX 0 = Flesh control disable<br>1 = Flesh control enable                                                                                                                                                                                                                                                                                            |

## DEFLECTION

| Address Dec (HEX) | Description                     | Data (Bits) | Comments                                                                                                                          |
|-------------------|---------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 11 (0B)           | Horizontal Shift                | 6           | XX00 0000 = -2.5μs<br>XX11 1111 = +2.5μs                                                                                          |
| 12 (0C)           | Vertical Amplitude              | 6           | XX00 0000 = 1.2V<br>XX11 1111 = 6.2V                                                                                              |
| 13 (0D)           | Vertical Position               | 3           | XXXX X000 = 3.8V<br>XXXX X111 = 6.3V                                                                                              |
| 13 (0D)           | 50/60Hz Selection               | 2           | XXXS SXXX 00 = Auto<br>01 = 60Hz<br>10 = 50Hz<br>11 = Auto                                                                        |
| 13 (0D)           | Horizontal Output (HOUT) Safety | 1           | XXSX XXXX 0 = Normal mode<br>1 = HOUT disabled (high level)                                                                       |
| 14 (0E)           | PLL1 Time Constant              | 2           | XXXX XXSS 00 = Normal mode (Auto)<br>01 = Short time constant<br>10 = Very long time constant<br>11 = PLL1 inhibition (open loop) |
| 14 (0E)           | Interlace                       | 1           | XXXX XSXX 0 = Interlace<br>1 = DE-Interlace                                                                                       |
| 14 (0E)           | 4/3 16/9 Selection              | 1           | XXXX SXXX 0 = 4/3 (V <sub>OUT-Low</sub> = 2V)<br>1 = 16/9 (V <sub>OUT-Low</sub> = 0.1V)                                           |

**I<sup>2</sup>C BUS SPECIFICATION** (continued)**Input Signals** (Write Mode) (continued)**OTHERS**

| Address Dec (HEX) | Description            | Data (Bits) | Comments                                                                                                   |
|-------------------|------------------------|-------------|------------------------------------------------------------------------------------------------------------|
| 15 (0F)           | Volume                 | 6           | XX00 0000 = 0.5V<br>XX11 1111 = 5V                                                                         |
| 16 (10)           | Mute                   | 1           | XXXX XXS<br>0 = Mute not active<br>1 = Mute active                                                         |
| 16 (10)           | AV Switch Selection    | 2           | XXXX XSSX<br>00 = TV mode<br>01 = not allowed<br>10 = not allowed<br>11 = External (AV) mode               |
| 16 (10)           | Not Used               | 1           | XXXX SXXX<br>S = 0 default value                                                                           |
| 16 (10)           | Cut-off Pulse Position | 1           | XXS XXXX<br>0 = lines 23/24/25 in 50Hz, lines 18/19/20 in 60Hz<br>1 = lines 23/24/25 both in 50Hz and 60Hz |
| 17 (11)           | Only for Test          | 6           | XXSS SSSS<br>00 0000 = Test mode not active                                                                |

**Output Signals** (Read Mode)**READ REGISTER**

| Description            | Data (Bits) | Comments                                                                                                                                               |
|------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field Frequency        | 1           | XXXX XXS<br>1 = 50Hz<br>0 = 60Hz                                                                                                                       |
| Video Identification   | 1           | XXXX XXSX<br>1 = No Identification<br>0 = Video Identification                                                                                         |
| SVHS Status            | 1           | XXXX XSXX<br>1 = No SVHS<br>0 = SVHS                                                                                                                   |
| Standard Status        | 3           | XXSS SXXX<br>111 = PAL/XTAL1 (4.43MHz)<br>110 = NTSC/XTAL1<br>101 = not to be used<br>011 = PAL/XTAL2 (3.58MHz)<br>010 = NTSC/XTAL2<br>X00 = Color off |
| Circuit Identification | 2           | SSXX XXXX<br>11 = STV2118B/2116/2112<br>10 = STV2116A<br>01 = STV2112B<br>00 = STV2216                                                                 |

**I<sup>2</sup>C BUS SPECIFICATION** (continued)**Bus Register Initial Conditions**

Not used bits are preset to "0".

| Address<br>Dec (HEX) | Data Initial<br>Value | Comments                                                                                                     |
|----------------------|-----------------------|--------------------------------------------------------------------------------------------------------------|
| 0 (00)               | XX01 0000             | Mid. contrast ; RGBext insertion enable                                                                      |
| 1 (01)               | XX10 0000             | Mid. saturation                                                                                              |
| 2 (02)               | XX01 0000             | Mid. brightness ; Blanking : normal mode                                                                     |
| 3 (03)               | XX10 0000             | Mid. RED drive adjust                                                                                        |
| 4 (04)               | XX10 0000             | Mid. RED cut-off adjust                                                                                      |
| 5 (05)               | XX10 0000             | Mid. GREEN drive adjust                                                                                      |
| 6 (06)               | XX10 0000             | Mid. GREEN cut-off adjust                                                                                    |
| 7 (07)               | XX10 0000             | Mid. BLUE drive adjust                                                                                       |
| 8 (08)               | XX00 0100             | Mid. sharpness ; Blue screen not active, External crystal selection in auto mode                             |
| 9 (09)               | XX10 0000             | Mid. hue                                                                                                     |
| 10 (0A)              | XX00 0110             | Auto search color standard ; no SVHS                                                                         |
| 11 (0B)              | XX10 0000             | Mid. horizontal shift                                                                                        |
| 12 (0C)              | XX10 0000             | Mid. vertical amplitude                                                                                      |
| 13 (0D)              | XX00 0100             | Mid. vertical position ; Auto search field frequency ; HOUT : normal mode                                    |
| 14 (0E)              | XX00 0000             | PLL1 time constant : normal mode ; Interlace ; 4/3 selection ; chroma gain = +0dB ; no flesh                 |
| 15 (0F)              | XX10 0000             | Mid. volume                                                                                                  |
| 16 (10)              | XX00 0000             | Mute not active ; TV mode ; Not used ;<br>Cut-off pulses on lines 23/24/25 in 50Hz or lines 18/19/20 in 60Hz |
| 17 (11)              | XX00 0000             | Test mode not active                                                                                         |

## ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter                                                      | Value     | Unit |
|------------|----------------------------------------------------------------|-----------|------|
| $V_{CC}$   | Supply Voltage (Pins 22-42) ( $V_{CC1(22)} \leq V_{CC2(42)}$ ) | 12        | V    |
| $T_{oper}$ | Operating Temperature                                          | 0, +70    | °C   |
| $T_{stg}$  | Storage Temperature                                            | -55, +150 | °C   |

2116A-01.TBL

## THERMAL DATA

| Symbol        | Parameter                                                 | Value | Unit |
|---------------|-----------------------------------------------------------|-------|------|
| $R_{th(j-a)}$ | Junction-ambient Thermal Resistance ( $P_D = 1.3W$ ) Typ. | 40    | °C/W |

2116A-02.TBL

ELECTRICAL CHARACTERISTICS ( $V_{CC} = 9V$ ,  $T_{amb} = 25^\circ C$ , unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

## SUPPLY

|           |                                                 |               |     |      |      |    |
|-----------|-------------------------------------------------|---------------|-----|------|------|----|
| $V_{CC1}$ | Video Supply Voltage ( $V_{CC1} \leq V_{CC2}$ ) |               | 8.1 | 9    | 9.9  | V  |
| $V_{CC2}$ | Chroma & Scanning & Bus Supply Voltage          |               | 8.1 | 9    | 9.9  | V  |
| $I_{CC1}$ | $V_{CC1}$ Current Consumption                   |               | 55  | 75   | 95   | mA |
| $I_{CC2}$ | $V_{CC2}$ Current Consumption                   | PAL/NTSC mode | 40  | 60   | 80   | mA |
| $P_{tot}$ | Power Total Dissipation                         |               |     | 1215 | 1600 | mW |

## LUMINANCE /CVBS INPUT (Pin 20)

|            |                           |                           |      |     |      |          |
|------------|---------------------------|---------------------------|------|-----|------|----------|
| $DC_{20}$  | DC Operating Voltage      | No input signal           | 3.55 | 3.7 | 3.95 | V        |
| $V_{20PP}$ | CVBS or Y Input Voltage   |                           |      | 1   | 1.41 | $V_{PP}$ |
| GY         | Luma Gain                 | Contrast Max., Drive Max. |      | 4.1 |      | -        |
| CTRY       | Luma Contrast Range       |                           | 18   | 20  | 22   | dB       |
| $-I_{20}$  | Negative Clamping Current | During sync. pulse        | -20  | -25 | -35  | $\mu A$  |
| $I_{20}$   | Clamping Current          |                           | 3    | 5   | 10   | $\mu A$  |

## COMBINED CHROMINANCE AND SVHS SELECTION INPUT (Pin 23)

|              |                                                             |                                                             |     |     |     |            |
|--------------|-------------------------------------------------------------|-------------------------------------------------------------|-----|-----|-----|------------|
| $V_{23}$     | Chrominance Input Voltage                                   | Burst Amplitude, 100/75 colour bar                          |     | 0.3 |     | $V_{PP}$   |
| $V_{CLIP23}$ | Input Amplitude before Clipping                             |                                                             | 1.0 |     |     | $V_{PP}$   |
| $V_{DC23}$   | DC Voltage                                                  | SVHS mode                                                   | 1.4 | 1.6 | 1.8 | V          |
| $V_{TH23}$   | SVHS Threshold Voltage                                      |                                                             | 0.5 | 0.7 | 1   | V          |
| $I_{low23}$  | Output Current                                              | 0V at Pin 23                                                | 70  | 120 | 170 | $\mu A$    |
| $V_{min23}$  | Minimum Burst Signal Amplitude within the ACC Control Range |                                                             |     | 30  |     | mV $_{PP}$ |
| $G_{ACC}$    | ACC Control Range                                           | Change of Burst over whole ACC control range < 2dB          |     | 30  |     | dB         |
| Killer       | Color Killer on Threshold                                   | Burst amplitude on Pin 20 or Pin 12, S/N > 40dB<br>PAL Mode |     | 4   |     | mV $_{PP}$ |
|              | Color Killer off Hysteresis                                 | NTSC Mode                                                   |     | 1   |     | mV $_{PP}$ |
|              |                                                             | PAL & NTSC Mode                                             |     | 2   |     | mV $_{PP}$ |

## RGB INPUTS (Pins 12-13-14-16-17-18)

|                |                                                                           |                            |     |      |      |          |
|----------------|---------------------------------------------------------------------------|----------------------------|-----|------|------|----------|
| $V_{CLAMP}$    | Clamp Level                                                               | Contrast Max., Drive Nom.  | 1.4 | 1.8  | 2.2  | V        |
| $V_{RGB}$      | RGB Input Voltage                                                         |                            |     | 0.7  | 1    | $V_{PP}$ |
| $G_{RGB}$      | RGB Gain                                                                  | Contrast Max., Drive Max.  |     | 4.2  |      | -        |
| $CTR_{RGB}$    | RGB Contrast Range                                                        | On external RGB (16-17-18) | 8.5 | 10.5 | 12.5 | dB       |
| $\Delta Black$ | Difference of Black Level of Internal and External signals at the Outputs |                            |     |      | 200  | mV       |
| $I_{RGB}$      | Clamping Current                                                          |                            | 50  | 100  | 150  | $\mu A$  |

2116A-03.TBL

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 9V$ ,  $T_{amb} = 25^{\circ}C$ , unless otherwise specified) (continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

## OSD FAST BLANKING INPUT (Pin 15)

|                |                             |              |     |     |      |         |
|----------------|-----------------------------|--------------|-----|-----|------|---------|
| $V_{THFB1-15}$ | Insertion Threshold Voltage |              | 0.5 | 0.7 | 0.85 | V       |
| $V_{THFB2-15}$ | Blanking Threshold Voltage  |              | 1.6 | 2.0 | 2.4  | V       |
| $T_{sw1-15}$   | Insertion Switching Delay   |              |     | 30  |      | ns      |
| $T_{sw2-15}$   | Blanking Switching Delay    |              |     | 50  |      | ns      |
| $I_{FB-15}$    | Input Current               | 0V at Pin 15 |     |     | 50   | $\mu A$ |

## EXTERNAL FAST BLANKING INPUT (Pin 19)

|               |                   |              |     |     |      |         |
|---------------|-------------------|--------------|-----|-----|------|---------|
| $V_{THFB-19}$ | Threshold Voltage |              | 0.5 | 0.7 | 0.85 | V       |
| $I_{FB-19}$   | Input Current     | 0V at Pin 19 |     |     | 50   | $\mu A$ |
| $T_{swi-19}$  | Switching Delay   |              |     | 30  |      | ns      |

## CATHODE CURRENT INPUT (Pin 30)

|              |                                                                         |  |     |      |     |         |
|--------------|-------------------------------------------------------------------------|--|-----|------|-----|---------|
| $V_{LEAK}$   | Leakage Current Reference Voltage                                       |  |     | 1.80 | 2.0 | V       |
| $V_{Coff}$   | Cut-off Current Reference Voltage referred to Leakage Current Reference |  |     | 250  |     | mV      |
| $V_{SB}$     | Start Beam Current Detection Reference Voltage                          |  | 2.1 | 2.3  |     | V       |
| $I_{Low-30}$ | Source current                                                          |  | 150 | 250  |     | $\mu A$ |

## AUTOMATIC CUT-OFF CAPACITORS (Pins 24-25-26)

|                |                 |  |    |     |     |         |
|----------------|-----------------|--|----|-----|-----|---------|
| $I_{24-25-26}$ | Control Current |  | 70 | 100 | 130 | $\mu A$ |
|----------------|-----------------|--|----|-----|-----|---------|

## BEAM CURRENT LIMITER VOLTAGE (Pin 31)

|              |                                               |  |     |      |  |    |
|--------------|-----------------------------------------------|--|-----|------|--|----|
| $V_{TH1-31}$ | Contrast Attenuation Starting                 |  |     | 6.0  |  | V  |
| $V_{TH2-31}$ | Brightness Attenuation Starting               |  |     | 5.5  |  | V  |
| $V_{TH3-31}$ | Contrast Attenuation Ending                   |  |     | 5.0  |  | V  |
| CTR-BCL      | Contrast Attenuation at $V_{31}=V_{TH3-31}$   |  |     | 14.0 |  | dB |
| $V_{TH4-31}$ | Brightness Attenuation Ending                 |  |     | 4.5  |  | V  |
| BRIG-BCL     | Brightness Attenuation at $V_{31}=V_{TH4-31}$ |  | 100 |      |  | %  |
| $CLP_{31}$   | High Clamping Voltage                         |  | 6.5 |      |  | V  |

## RGB OUTPUTS (Pins 27-28-29)

|                     |                                          |                                                                                 |     |      |     |    |
|---------------------|------------------------------------------|---------------------------------------------------------------------------------|-----|------|-----|----|
| $V_{BW}$            | Output Signal Amplitude (B to W)         | 0.7V B/W at Pin 20, Drive Max., Contrast Max., Brightness Typ., Saturation Typ. |     | 2.85 |     | V  |
| $I_{S27-28-29}$     | Output Sinking Current                   |                                                                                 | 1.5 | 2    |     | mA |
| $V_{M27-28-29}$     | Maximum Peak White Level                 |                                                                                 |     | 7.8  |     | V  |
| $V_{Black27-28-29}$ | Blanking Level                           | No load                                                                         | 0.3 | 0.45 | 0.6 | V  |
| RCO                 | Cut-off Output Range                     |                                                                                 | 2   | 2.6  |     | V  |
| Lev CO              | Cut-off Pulse Level                      | Middle position of cut-off range                                                |     | 3.8  |     | V  |
| DCCO                | Cut-off Adjustment Range                 | On Red and Green outputs Pins 29 and 28, Drive Max.                             |     | 300  |     | mV |
| DRIV                | Drive Adjustment Range                   |                                                                                 |     | 6.5  |     | dB |
| R BRIG              | Brightness Range                         | Relative to B/W amplitude on R,G,B outputs at Contrast Max.                     | 30  | 40   | 50  | %  |
| $\Delta V_{CTR}$    | Variation of Black Level with Contrast   |                                                                                 |     |      | 100 | mV |
| $\Delta V_{SAT}$    | Variation of Black Level with Saturation |                                                                                 |     |      | 50  | mV |

2116A04.TBL

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 9V$ ,  $T_{amb} = 25^{\circ}C$ , unless otherwise specified) (continued)

| Symbol                                  | Parameter                                                                                                                                                                                    | Test Conditions                                                                                        | Min.                 | Typ.            | Max.     | Unit                     |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------|-----------------|----------|--------------------------|
| RGB OUTPUTS (Pins 27-28-29) (continued) |                                                                                                                                                                                              |                                                                                                        |                      |                 |          |                          |
| $\Delta V_{REL}$                        | Relative Variation in Black Level between the three Channels<br>- during Variation of Contrast(20dB)<br>- during Variation of Brightness (total range)<br>- during Variation of Vcc (+/-10%) | Drive Max.                                                                                             |                      | 5               | 10<br>10 | mV<br>mV<br>mV           |
| $\Delta V_{Temp}$                       | Black Level Thermal Drift                                                                                                                                                                    |                                                                                                        |                      | 1               |          | mV/ $^{\circ}C$          |
| Track                                   | Tracking between Luminance and Chrominance Signals                                                                                                                                           | From Max. contrast (0dB) to -10dB contrast                                                             |                      |                 | 2        | dB                       |
| Bwidth                                  | Bandwidth of Output Signals at -3dB<br>- CVBS Input (no SVHS)<br>- CVBS Input (no SVHS)<br>- Y Input SVHS Mode<br>- RGB Inputs                                                               | $f_{OSC} = 3.58MHz$ , Sharp Typ.<br>$f_{OSC} = 4.43MHz$ , Sharp Typ.<br>No trap Filter, Sharp Typ.     | 2.5<br>2.7<br>6<br>8 | 3.0<br>3.6<br>8 |          | MHz<br>MHz<br>MHz<br>MHz |
| S/N                                     | Signal to Noise Ratio of Output ( $V_{PP}/V_{RMS}$ )<br>4.43MHz on Y/CVBS Input                                                                                                              | No signal on R-Y, B-Y inputs<br>Contrast Max., Drive Max., Saturation Typ., Sharp Typ., Bandwidth 5MHz |                      | 50              |          | dB                       |
| Res                                     | Residual Frequency at 2 $f_{OSC}$ and Higher Harmonics                                                                                                                                       | PAL                                                                                                    |                      | 10              | 50       | mV <sub>PP</sub>         |

**FILTERS TUNING VOLTAGE**

|            |                              |  |  |            |  |   |
|------------|------------------------------|--|--|------------|--|---|
| $V_{TUN1}$ | Tuning Voltage Range (Pin 8) |  |  | 3.2 to 4.8 |  | V |
|------------|------------------------------|--|--|------------|--|---|

**EXTERNAL CRYSTAL SELECTION (Pin 9)**

|             |                                     |                             |     |      |     |         |
|-------------|-------------------------------------|-----------------------------|-----|------|-----|---------|
| $V_{LOW9}$  | Low Level Voltage                   | No load                     |     | 0.02 | 0.1 | V       |
| $I_{LOW9}$  | Low Level Current (input current)   | Low level voltage on Pin 9  | 70  | 100  |     | $\mu A$ |
| $V_{HIGH9}$ | High Level Voltage                  | No load                     | 3.0 | 3.5  | 4.0 | V       |
| $I_{HIGH9}$ | High Level Current (output current) | High level voltage on Pin 9 | 70  | 100  |     | $\mu A$ |

**Y DELAY LINE**

|           |                         |           |     |     |     |    |
|-----------|-------------------------|-----------|-----|-----|-----|----|
| $t_{d1p}$ | Delay Time PAL 4.43MHz  | SVHS mode | 330 | 370 | 410 | ns |
| $t_{d1n}$ | Delay Time NTSC 3.58MHz | SVHS mode | 370 | 410 | 450 | ns |
| $t_{d3p}$ | Delay Time PAL 4.43MHz  | CVBS mode | 380 | 420 | 460 | ns |
| $t_{d3}$  | Delay Time NTSC 3.58MHz | CVBS mode | 435 | 475 | 515 | ns |

**SHARPNESS CIRCUIT**

|             |                                        |                      |  |     |  |     |
|-------------|----------------------------------------|----------------------|--|-----|--|-----|
| $f_{Sharp}$ | Center Frequency                       | SVHS mode            |  | 2.5 |  | MHz |
| $G_{Sharp}$ | Gain Variation from Min. to Max. Sharp | at $f_{Sharp}$       |  | 6   |  | dB  |
| Overshoot   | Amplitude Variation compared to B/W    | 2T pulse, Sharp Max. |  | 150 |  | %   |
| Pre-shoot   | Amplitude Variation compared to B/W    | 2T pulse, Sharp Max. |  | -15 |  | %   |
| After-shoot | Amplitude Variation compared to B/W    | 2T pulse, Sharp Max. |  | -40 |  | %   |
| Coring      | Coring Range compared to B/W           |                      |  | 10  |  | %   |

**Y TRAP FILTER**

|                    |                                                       |                                                       |          |           |      |          |
|--------------------|-------------------------------------------------------|-------------------------------------------------------|----------|-----------|------|----------|
| $f_{Trap}$         | Trap Frequency                                        |                                                       | -0.2     | $f_{OSC}$ | +0.2 | MHz      |
| $Q_{Trap}$         | Trap Quality Factor ( $Q=1/(f_o/f-3dB - f-3dB/f_o)$ ) | Sharpness Min.<br>Sharpness Max.                      |          | 1.7<br>3  |      | -<br>-   |
| CR <sub>ejPN</sub> | Color Subcarrier Rejection                            | PAL mode, Sharpness Min.<br>NTSC mode, Sharpness Min. | 18<br>18 |           |      | dB<br>dB |

**CHROMINANCE BANDPASS**

|          |                         |  |      |           |      |     |
|----------|-------------------------|--|------|-----------|------|-----|
| $f_C$    | Center Frequency        |  | -0.2 | $f_{OSC}$ | +0.4 | MHz |
| $Q_{BP}$ | Bandpass Quality Factor |  | 3.0  | 3.8       | 4.7  | -   |

2116A-05.TBL

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 9V$ ,  $T_{amb} = 25^{\circ}C$ , unless otherwise specified) (continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

## ACC CAPACITOR (Pin 5)

|          |                  |                          |  |     |   |         |
|----------|------------------|--------------------------|--|-----|---|---------|
| $I_{C5}$ | Charging Current | During burst gate window |  | 250 |   | $\mu A$ |
| $I_{L5}$ | Leakage Current  |                          |  | 0.2 | 1 | $\mu A$ |

## CHROMA PLL (Pins 2-3)

|            |                |                                                |  |                        |  |          |
|------------|----------------|------------------------------------------------|--|------------------------|--|----------|
| $CR_{2-3}$ | Catching Range | $Q = 4.43MHz$ (Pin 3)<br>$Q = 3.58MHz$ (Pin 2) |  | $\pm 600$<br>$\pm 500$ |  | Hz<br>Hz |
|------------|----------------|------------------------------------------------|--|------------------------|--|----------|

## PLL LOOP FILTER (Pin 4)

|          |                 |                          |  |     |   |         |
|----------|-----------------|--------------------------|--|-----|---|---------|
| $I_{C4}$ | Control Current | During burst gate window |  | 400 |   | $\mu A$ |
| $I_{L4}$ | Leakage Current |                          |  |     | 5 | $\mu A$ |

## HUE CONTROL (in NTSC mode only)

|            |                   |  |          |          |          |     |
|------------|-------------------|--|----------|----------|----------|-----|
| $CR_{HUE}$ | HUE Control Range |  | $\pm 25$ | $\pm 45$ | $\pm 65$ | Deg |
|------------|-------------------|--|----------|----------|----------|-----|

## COLOR DIFFERENCE OUTPUT SIGNALS (Pins 40-41)

| PAL /NTSC DEMODULATORS           |                                             |                                                                |       |       |       |          |
|----------------------------------|---------------------------------------------|----------------------------------------------------------------|-------|-------|-------|----------|
| $V_{P40}$                        | R-Y Output signal Amplitude (Pin 40)        | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, PAL mode   | 0.40  | 0.50  | 0.60  | $V_{PP}$ |
| $V_{P41}$                        | B-Y Output Signal Amplitude (Pin 41)        | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, PAL mode   | 0.48  | 0.58  | 0.70  | $V_{PP}$ |
| $G_{PAL}$                        | Gain Ratio of both Demodulators (B-Y)/(R-Y) | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, PAL mode   | 1.0   | 1.15  | 1.30  | -        |
| $V_{N40}$                        | R-Y Output signal Amplitude (Pin 40)        | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, NTSC mode  | 0.35  | 0.47  | 0.60  | $V_{PP}$ |
| $V_{N41}$                        | B-Y Output Signal Amplitude (Pin 41)        | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, NTSC mode  | 0.48  | 0.58  | 0.70  | $V_{PP}$ |
| $G_{NTSC90}$                     | Gain Ratio of both Demodulators (B-Y)/(R-Y) | RED-BLUE  axes = $90^{\circ}$<br>100/75 colour bar, NTSC mode  | 1.0   | 1.25  | 1.45  | -        |
| $G_{NTSC104}$                    | Gain Ratio of both Demodulators (B-Y)/(R-Y) | RED-BLUE  axes = $104^{\circ}$<br>100/75 colour bar, NTSC mode | 1.0   | 1.15  | 1.30  | -        |
| $V_{PNDC}$                       | Output Voltage when colour killed           |                                                                | 5.2   | 5.4   | 5.6   | V        |
| PAL/NTSC ( $90^{\circ}$ ) MATRIX |                                             |                                                                |       |       |       |          |
| G/R                              | (G-Y)/(R-Y)                                 |                                                                | -0.6  | -0.51 | -0.4  | -        |
| G/B                              | (G-Y)/(B-Y)                                 |                                                                | -0.30 | -0.19 | -0.15 | -        |
| NTSC ( $104^{\circ}$ ) MATRIX    |                                             |                                                                |       |       |       |          |
| NG/R                             | (G-Y)/(R-Y)                                 |                                                                |       | -0.29 |       | -        |
| NG/B                             | (G-Y)/(B-Y)                                 |                                                                |       | -0.22 |       | -        |

## AUTOMATIC FLESH CONTROL (see Figure 8)

|                  |                                       |                   |  |          |  |     |
|------------------|---------------------------------------|-------------------|--|----------|--|-----|
| $Flesh_{Nom.}$   | Nominal Flesh Tint Phase              |                   |  | 118      |  | Deg |
| $Flesh_{Dv1}$    | Phase Shift when Auto Flesh on        | At $Flesh_{Nom.}$ |  | 0        |  | Deg |
| $Flesh_{Dev2A}$  | Maximum Phase Correction              |                   |  | $\pm 12$ |  | Deg |
| $Flesh_{Max.A}$  | Chroma Input Phase at Max. Correction |                   |  | $\pm 30$ |  | Deg |
| $Flesh_{RangeA}$ | Auto Flesh Control Range              |                   |  | $\pm 60$ |  | Deg |

## SATURATION CONTROL

|              |                                 |                          |   |      |   |    |
|--------------|---------------------------------|--------------------------|---|------|---|----|
| $SAT_{Max.}$ | Maximum Saturation Control (3F) | $1V_{PP}$ CVBS on Pin 20 | 5 | +6.5 | 8 | dB |
| $SAT_{Nom.}$ | Nominal Saturation Control (20) | $1V_{PP}$ CVBS on Pin 20 |   | 0    |   | dB |
| $SAT_{Min.}$ | Minimum Saturation Control(00)  | $1V_{PP}$ CVBS on Pin 20 |   | -44  |   | dB |

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 9V$ ,  $T_{amb} = 25^{\circ}C$ , unless otherwise specified) (continued)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

## COLOUR DIFFERENCE INPUT SIGNALS (Pins 38-39)

|               |                               |                  |     |      |     |          |
|---------------|-------------------------------|------------------|-----|------|-----|----------|
| DCRYI         | DC Voltage Pin 39             | No colour        | 2.6 | 2.8  | 3.0 | V        |
| DCBYI         | DC Voltage Pin 38             | No colour        | 2.6 | 2.8  | 3.0 | V        |
| VRyI          | Input Signal Amplitude Pin 39 | 100/75 color bar |     | 1.05 |     | $V_{PP}$ |
| VBvI          | Input Signal Amplitude Pin 38 | 100/75 color bar |     | 1.33 |     | $V_{PP}$ |
| $I_{CL38-39}$ | Clamping Current              | During burst key |     | 150  |     | $\mu A$  |

## SYNC. SEPARATOR

|       |                       |           |    |     |  |    |
|-------|-----------------------|-----------|----|-----|--|----|
| VSync | Sync. Pulse Amplitude | On Pin 20 | 50 | 300 |  | mV |
|-------|-----------------------|-----------|----|-----|--|----|

## HORIZONTAL OSCILLATOR

|            |                                       |                                 |                |                |                |          |
|------------|---------------------------------------|---------------------------------|----------------|----------------|----------------|----------|
| $f_{H50}$  | Frequency after Divider               | 50Hz input signal               |                | 15625          |                | Hz       |
| $f_{H60}$  | Frequency after Divider               | 60Hz input signal               |                | 15750          |                | Hz       |
| $f_{Rang}$ | Frequency Control Range               | Low Frequency<br>High Frequency | 14500<br>16100 | 14850<br>16300 | 15200<br>16500 | Hz<br>Hz |
| $f_{free}$ | Free Running Frequency when PLL1 open | Value 03hex in register 0Ehex   | 15000          | 15800          |                | Hz       |

## FIRST LOOP FILTER (Pin 33)

|              |                                    |  |      |      |      |    |
|--------------|------------------------------------|--|------|------|------|----|
| $I_{LOW-33}$ | Long Time Constant Output Current  |  | 0.12 | 0.15 | 0.20 | mA |
| $I_{HIGH}$   | Short Time Constant Output Current |  | 0.35 | 0.45 | 0.55 | mA |
| $I_{VLOW}$   | Very Long Time Constant            |  | 0.02 | 0.03 | 0.05 | mA |

## SECOND CONTROL LOOP

|                  |                                                          |                              |   |         |  |         |
|------------------|----------------------------------------------------------|------------------------------|---|---------|--|---------|
| CRQ <sub>2</sub> | Control Range from Start of Horizontal Output to Flyback | Horizontal position centered |   | 2 to 14 |  | $\mu s$ |
| $t_{shift}$      | Horizontal Shift Range                                   |                              | 4 |         |  | $\mu s$ |

## LINE FLYBACK INPUT/SANDCASTLE OUTPUT (Pin 37)

|              |                                                          |                       |     |     |     |         |
|--------------|----------------------------------------------------------|-----------------------|-----|-----|-----|---------|
| $V_{SCO}$    | Output Voltage during Burst Key                          |                       | 4.0 | 5.0 |     | V       |
| $V_{CL37}$   | Clamped Input Voltage during Flyback                     |                       |     | 2.5 | 3.1 | V       |
| $t_{WBG}$    | Burst Key Pulse Width                                    |                       | 3.7 | 3.8 | 3.9 | $\mu s$ |
| $t_{DBG}$    | Delay of Start of Burst Key to Start of Sync.            |                       |     | 5.2 |     | $\mu s$ |
| $V_{TH1-37}$ | Blanking Threshold Voltage                               |                       | 0.5 | 0.7 | 0.9 | V       |
| $V_{TH2-37}$ | PLL2 Threshold Voltage referred to Line Level $V_{CL37}$ | $PLL2V_{TH}/V_{CL37}$ |     | 80  |     | %       |
| $I_{37}$     | Input Current                                            | During flyback pulse  | 0.1 |     | 1   | mA      |

## HORIZONTAL OUTPUT (Pin 36)

|                 |                                                                   |                                                          |    |      |     |         |
|-----------------|-------------------------------------------------------------------|----------------------------------------------------------|----|------|-----|---------|
| $T_{W36}$       | Output Pulse Width                                                | Normal operation                                         | 26 | 28   | 30  | $\mu s$ |
| $V_{Low36}$     | Voltage Output Low                                                | R pull-up = 1k $\Omega$                                  |    | 1.1  | 2.0 | V       |
| $V_{CC\ Start}$ | $V_{CC}$ Start Level                                              | Voltage on Pin 42                                        |    | 6.7  | 7.2 | V       |
| $V_{CC\ Stop}$  | $V_{CC}$ Stop Level : hysteresis                                  | Voltage on Pin 42,<br>$V_{CCstart} - V_{CCstop}$         |    | 0.60 |     | V       |
| $I_{36\ Max.}$  | Maximum Allowed Output Current                                    |                                                          |    |      | 10  | mA      |
| $V_{36\ Max.}$  | Maximum Allowed Output Voltage (open collector)                   |                                                          |    |      | 12  | V       |
| $T_{ss}$        | Output Pulse Duty Cycle in soft-start mode (Thigh/(Thigh + Tlow)) | $V_{CC2} = 9V$ , $V_{CC1} < 6.0V$<br>( $V_{CC1}$ rising) |    | 78   |     | %       |

2116A-07.TBL

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 9V$ ,  $T_{amb} = 25^{\circ}C$  unless otherwise specified) (continued)

| Symbol                   | Parameter                                                     | Test Conditions                                              | Min.       | Typ.       | Max.       | Unit     |
|--------------------------|---------------------------------------------------------------|--------------------------------------------------------------|------------|------------|------------|----------|
| VERTICAL OUTPUT (Pin 35) |                                                               |                                                              |            |            |            |          |
| $T_{W35}$                | Output Pulse Width                                            |                                                              |            | 10.5       |            | Lines    |
| $V_{Low35}$              | Low Level Output Voltage 4/3<br>Low Level Output Voltage 16/9 | XXXX0XXX (bin) in Reg. 0Ehex<br>XXXX1XXX (bin) in Reg. 0Ehex | 1.5        | 2<br>0.1   | 2.5<br>0.5 | V<br>V   |
| FR35                     | Locking Range                                                 |                                                              | 248        |            | 352        | Lines    |
| $f_{FR-50}$              | Free Frequency (no Video Signal)                              | 50Hz or Auto Mode                                            |            | 314        |            | Lines    |
| $f_{FR-60}$              | Free Frequency (no Video Signal)                              | 60Hz Mode                                                    |            | 264        |            | Lines    |
| $V_{HIGH35}$             | High Level Range<br>(vertical position control)               | XXXXX000(bin) in Reg. 0Dhex<br>XXXXX111(bin) in Reg. 0Dhex   | 3.5<br>5.7 | 3.8<br>6.3 | 4.2<br>7.0 | V<br>V   |
| $I_{sink}$               | Output Sinking Current                                        | 4/3<br>16/9                                                  |            | 0.2<br>0.5 |            | mA<br>mA |

## VERTICAL AMPLITUDE CONTROL (Pin 34)

|           |                      |                                                            |            |            |            |        |
|-----------|----------------------|------------------------------------------------------------|------------|------------|------------|--------|
| $V_{34R}$ | Output Voltage Range | XX000000(bin) in Reg. 0Chex<br>XX111111(bin) in Reg. 0Chex | 1.0<br>5.6 | 1.2<br>6.2 | 1.5<br>6.7 | V<br>V |
|-----------|----------------------|------------------------------------------------------------|------------|------------|------------|--------|

## VOLUME CONTROL AND MUTE (Pin 10)

|           |                                       |                                                            |             |            |            |        |
|-----------|---------------------------------------|------------------------------------------------------------|-------------|------------|------------|--------|
| $V_{R10}$ | Output Voltage Range (volume control) | XX000000(bin) in Reg. 0Fhex<br>XX111111(bin) in Reg. 0Fhex | 0.30<br>4.2 | 0.5<br>4.7 | 0.7<br>5.2 | V<br>V |
| MUT       | Output Voltage when MUTE              |                                                            |             | 0.02       | 0.1        | V      |

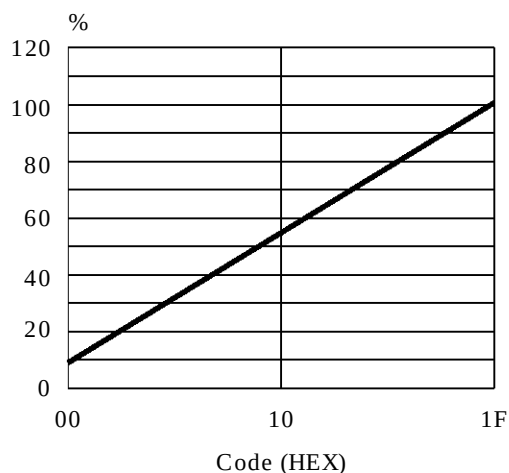
## SWITCH SELECTION (Pin 11)

|                 |                                                                    |               |      |     |     |            |
|-----------------|--------------------------------------------------------------------|---------------|------|-----|-----|------------|
| $V_{TV/NEG}$    | Output Voltage in TV Mode                                          | $V_{CC} = 9V$ |      | 0.1 | 0.7 | V          |
| $V_{Start/Neg}$ | Output Voltage in SCART Mode<br>(open collector mode)              | $V_{CC} = 9V$ | 7.88 | 9   |     | V          |
| $R_{TV/Neg}$    | Output Resistance in TV Mode                                       |               |      | 200 |     | $\Omega$   |
| $R_{Scart/Neg}$ | Output Resistance in Scart Mode<br>(pull-up resistor to $V_{CC}$ ) |               |      | 18  |     | k $\Omega$ |

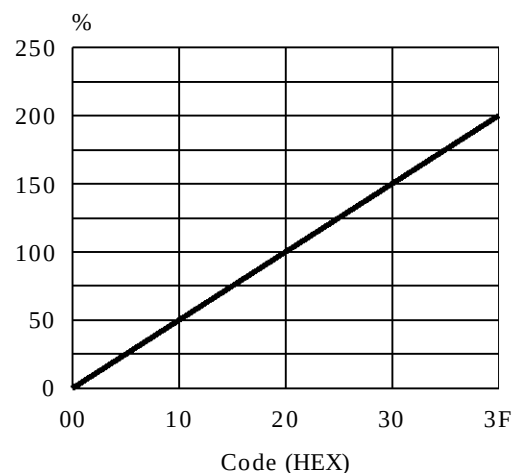
 $I^2C$  BUS INPUTS (Pins 6-7)

|               |                         |                                   |     |      |    |         |
|---------------|-------------------------|-----------------------------------|-----|------|----|---------|
| $V_{TH6-7}$   | Threshold Voltage       |                                   | 1.5 | 2.25 | 3  | V       |
| $CL_{6-7}$    | Capacitance of each Pin |                                   |     | 5    | 10 | pF      |
| $I_{Leak6-7}$ | Leakage Current         | Write Mode, 0 level on SDA or SCL |     |      | 10 | $\mu A$ |

2116A-08.TBL

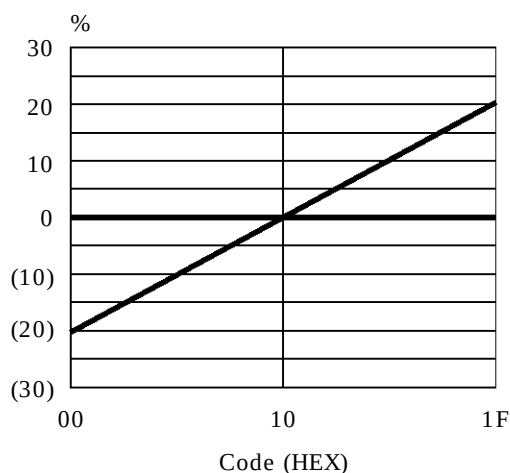
**USER CONTROLS****Figure 1 : Contrast Control Curve**

2116A-03.EPS

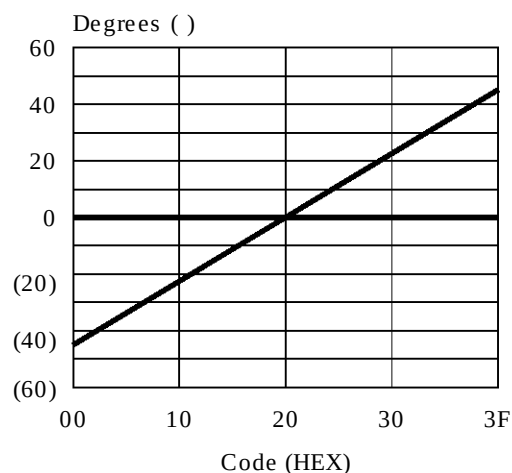
**Figure 2 : Saturation Control Curve**

2116A-04.EPS

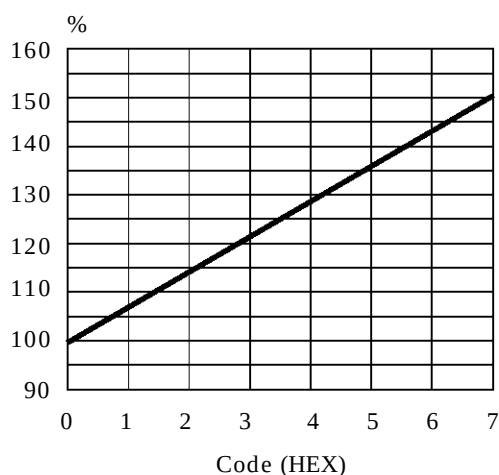
## USER CONTROLS (continued)

**Figure 3 : Brightness Control Curve**

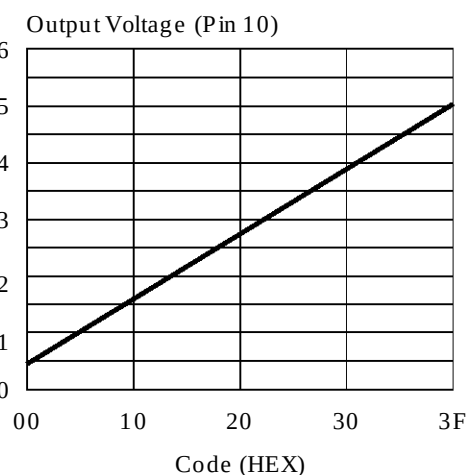
2116A-06.EPS

**Figure 4 : Hue Control Curve**

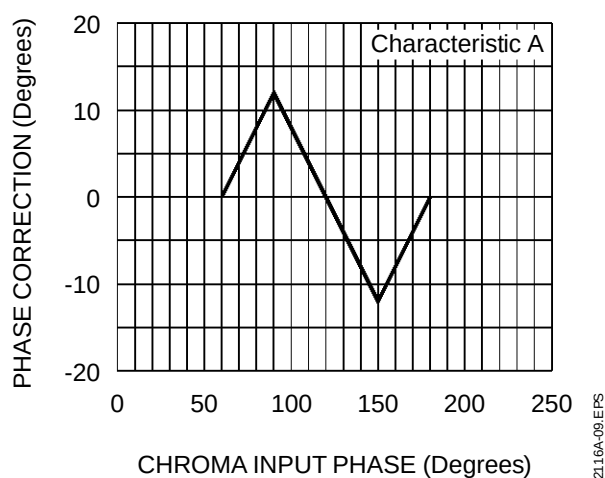
2116A-06.EPS

**Figure 5 : Peaking Control (2T overshoot)**

2116A-07.EPS

**Figure 6 : Volume Control Curve**

2116A-08.EPS

**Figure 7 : Automatic Flesh Tint Control**

2116A-09.EPS

INPUT/OUTPUT PIN CONFIGURATION

Figure 8 : Pins 2, 3 - CXTL1, CXTL2

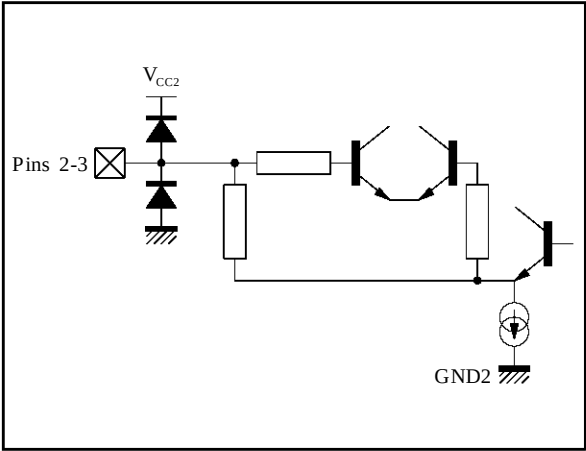


Figure 9 : Pin 4 - CLPF

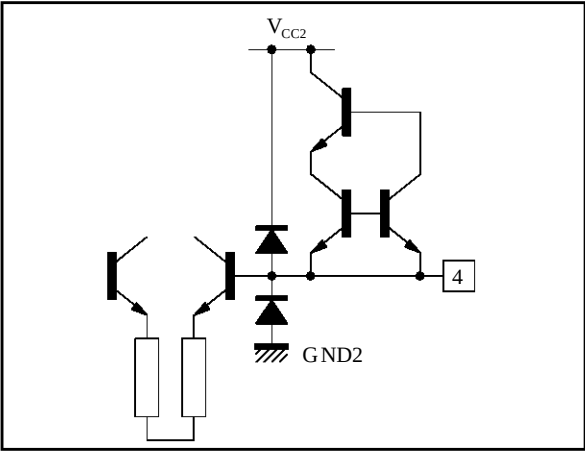


Figure 10 : Pin 5 - ACC

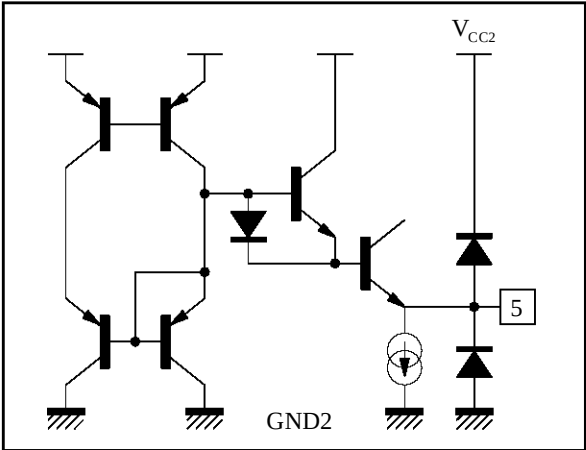


Figure 11 : Pin 6 - SDA

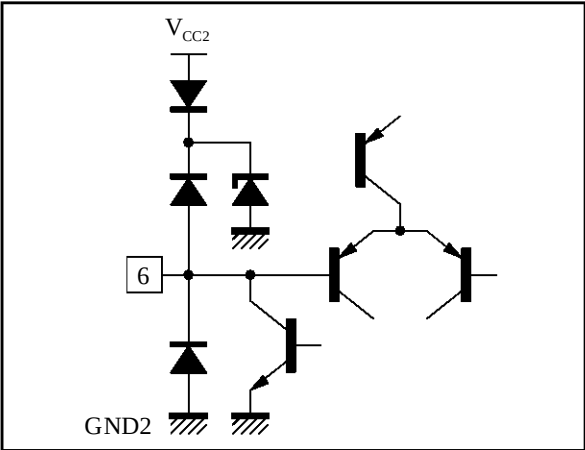


Figure 12 : Pin 7 - SCL

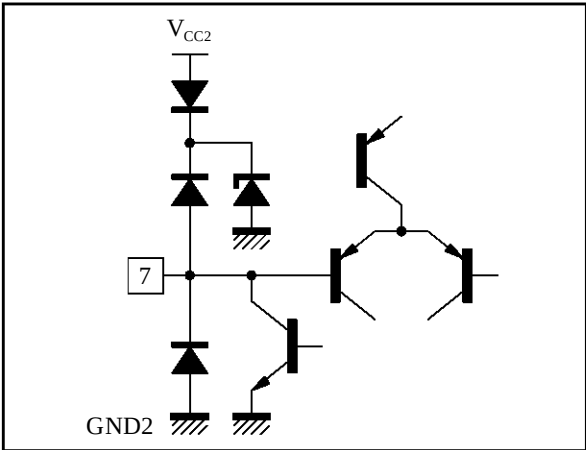
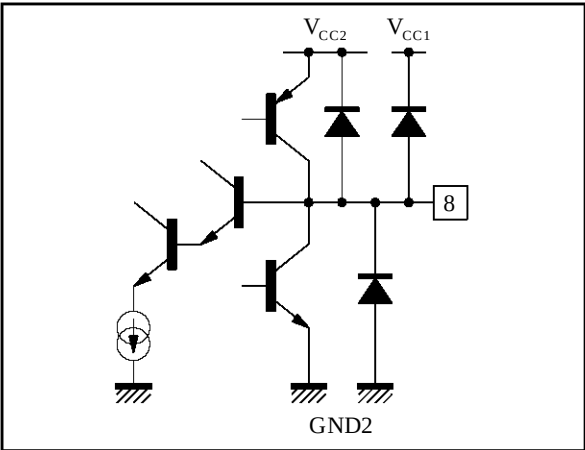
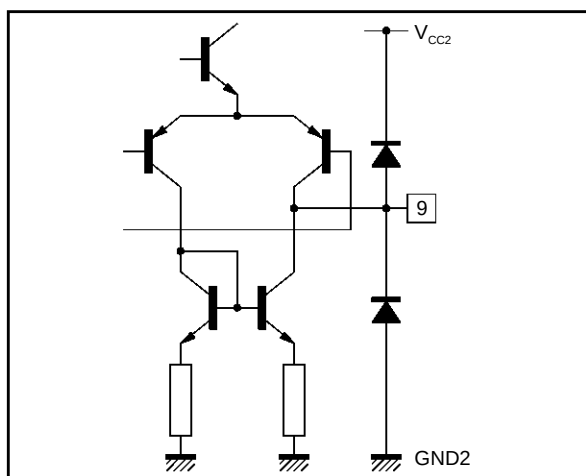


Figure 13 : Pin 8 - FTUN1



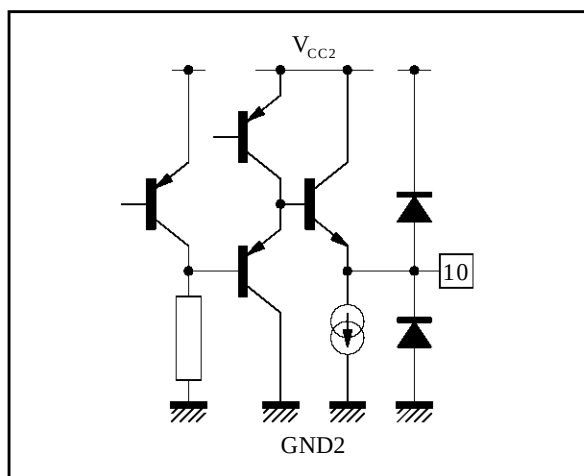
## INPUT/OUTPUT PIN CONFIGURATION (continued)

Figure 14 : Pin 9 - CRYSTAL SWITCH



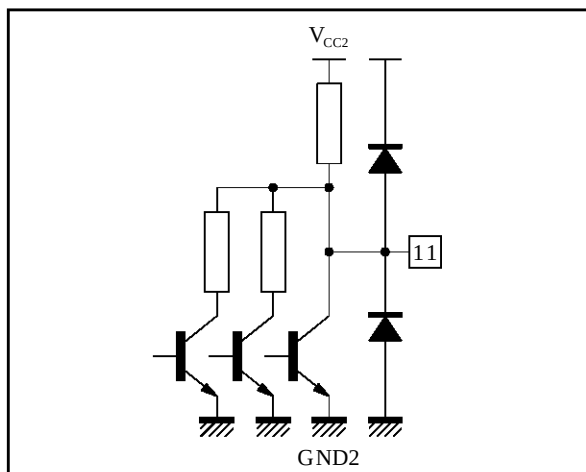
2116A-16.EPS

Figure 15 : Pin 10 - Volume



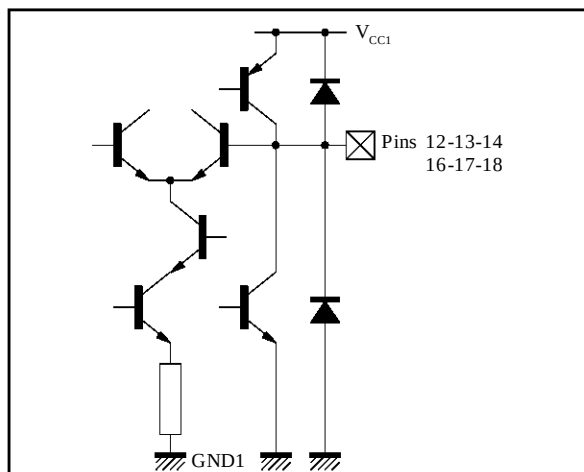
2116A-17.EPS

Figure 16 : Pin 11 - SWI



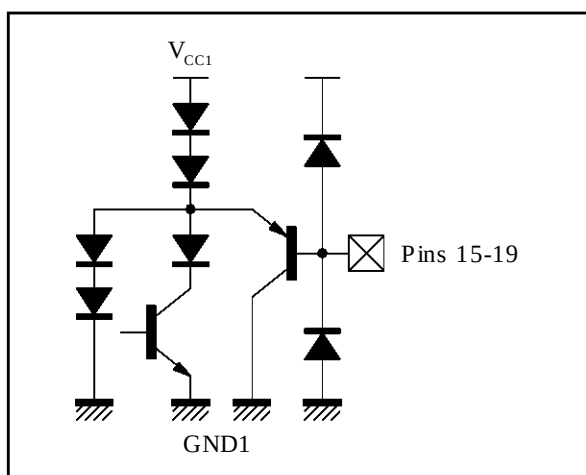
2116A-18.EPS

Figure 17 : Pins 12,13,14,16,17,18- RGB Inputs



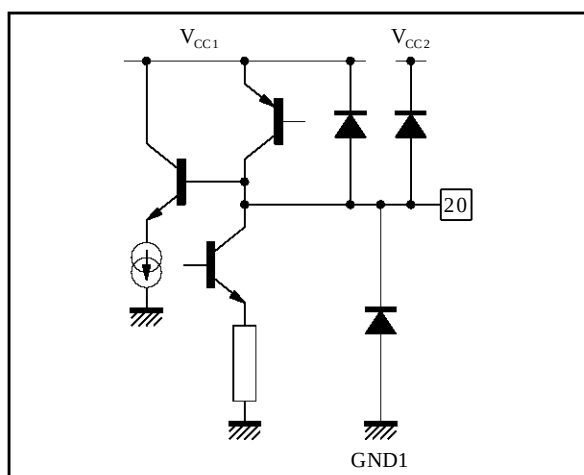
2116A-19.EPS

Figure 18 : Pins 15,19 - FBOSD, FBEXT



2116A-20.EPS

Figure 19 : Pin 20 - Y/CVBS



2116A-21.EPS

INPUT/OUTPUT PIN CONFIGURATION (continued)

Figure 20 : Pin 23 - CHR/SVHS

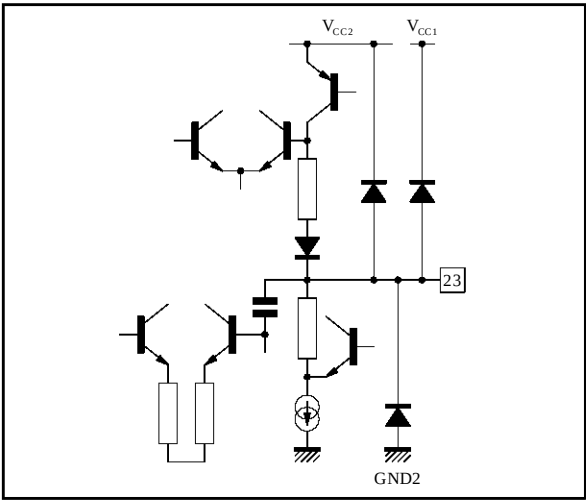


Figure 21 : Pins 24, 25, 26 - CG, CR, CB

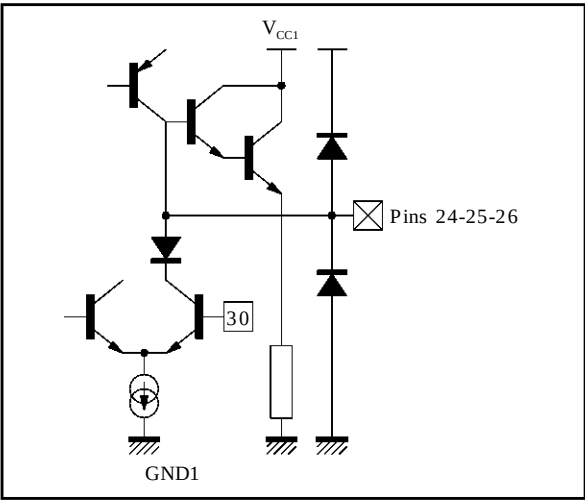


Figure 22 : Pins 27, 28, 29 - BO, GO, RO

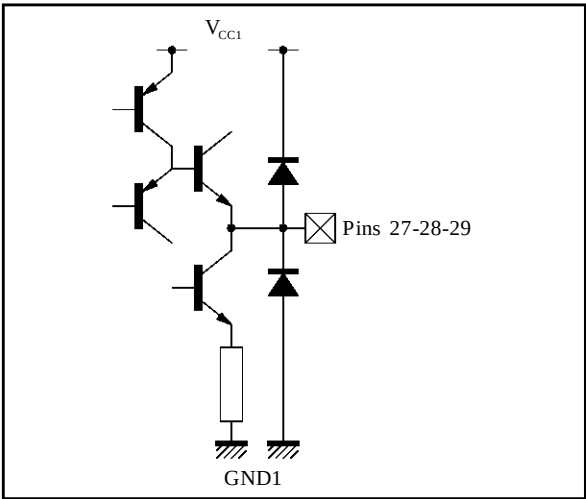


Figure 23 : Pin 30 - ICAT

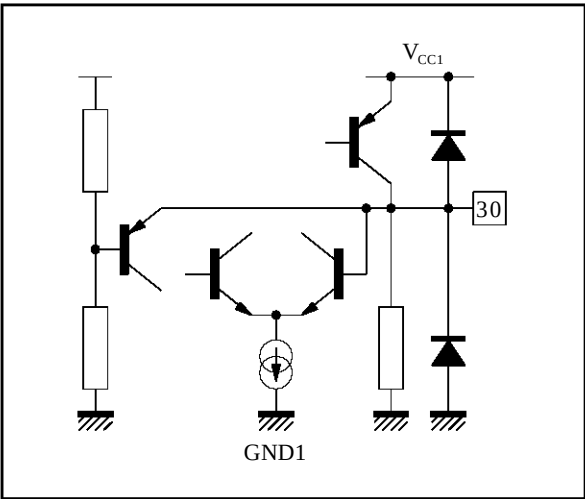


Figure 24 : Pin 31 - BCL

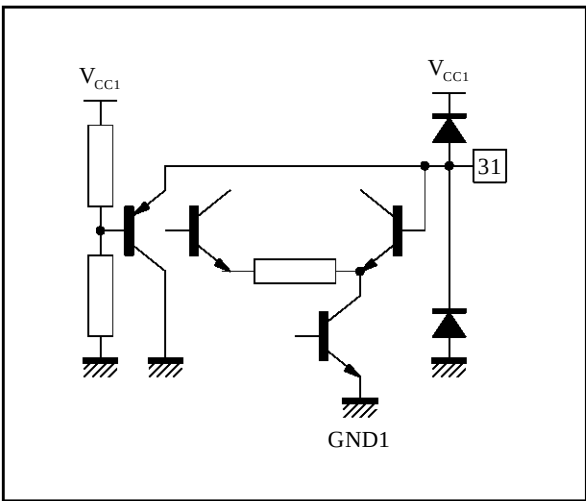
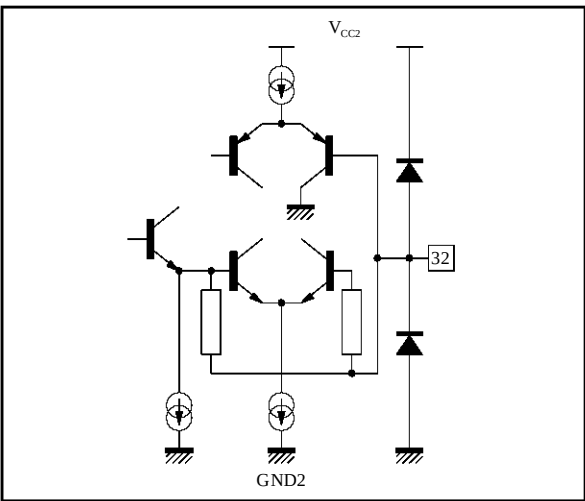


Figure 25 : Pin 32 - SXTL



## INPUT/OUTPUT PIN CONFIGURATION (continued)

Figure 26 : Pin 33 - SLPF

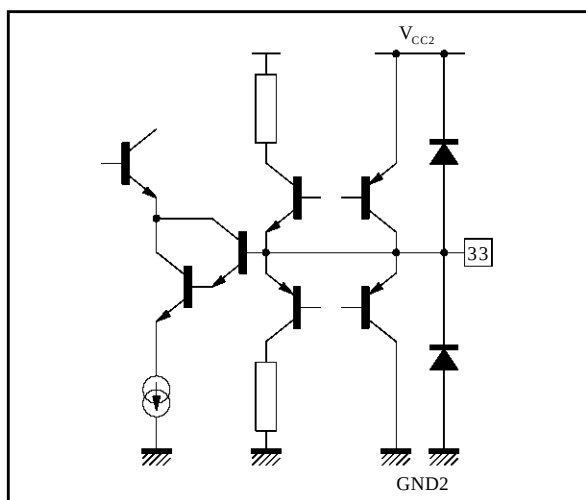


Figure 27 : Pin 34 - VAMP

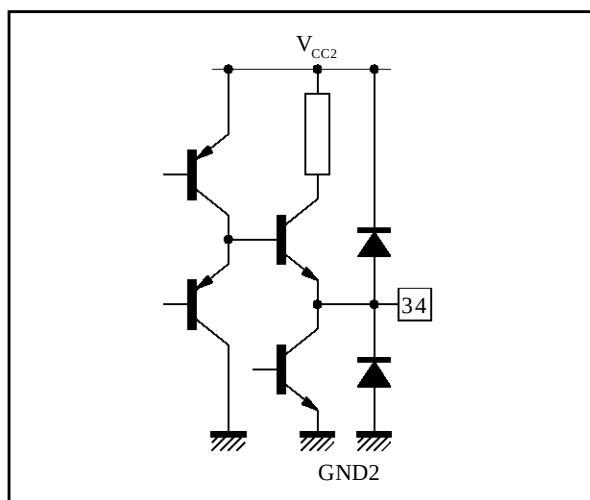


Figure 28 : Pin 35 - VOUT

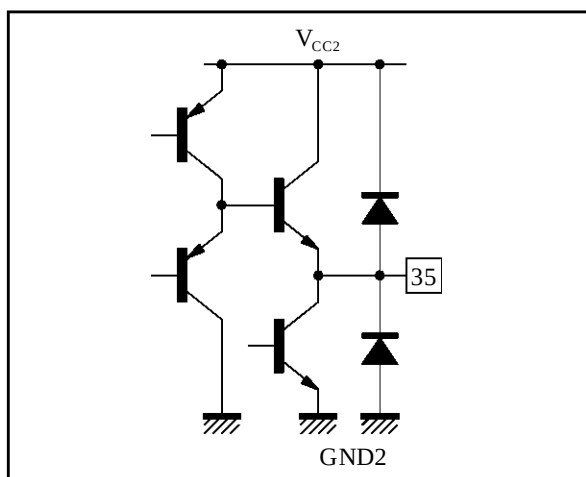


Figure 29 : Pin 36 - HOUT

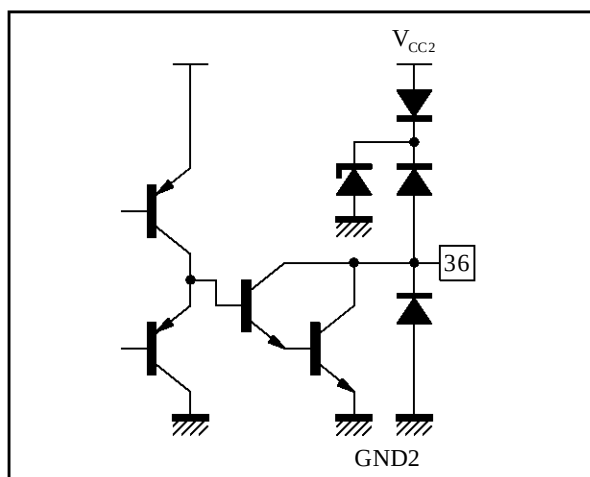


Figure 30 : Pin 37 - LFB/SC

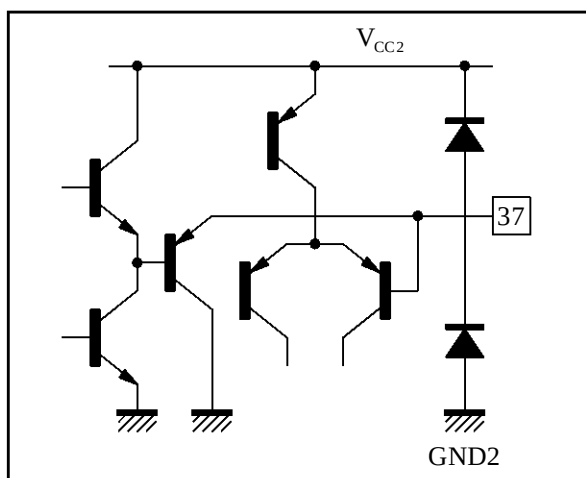
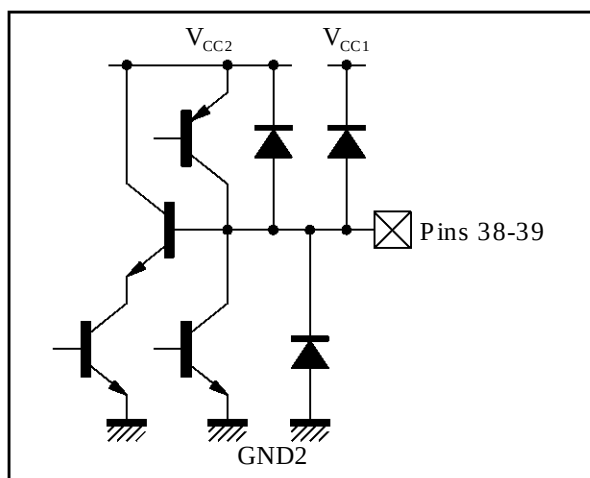


Figure 31 : Pins 38, 39 - BYI, RYI



INPUT/OUTPUT PIN CONFIGURATION (continued)

Figure 32 : Pins 40, 41 - RYO, BYO

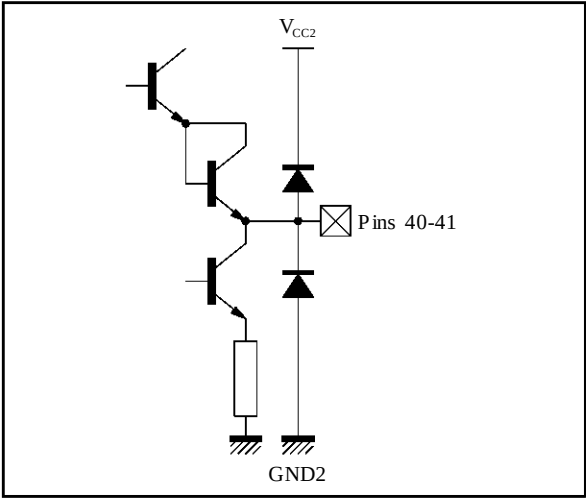
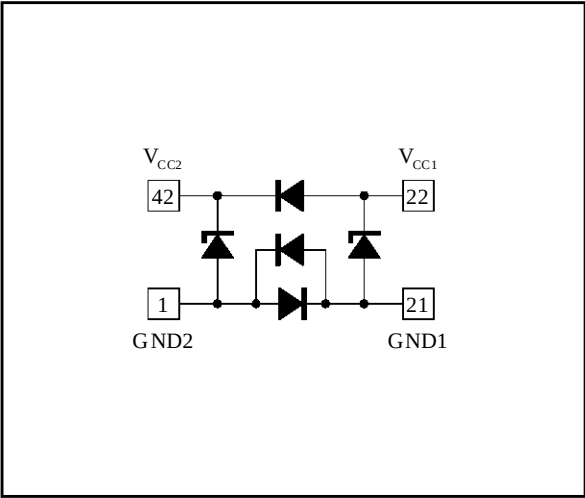
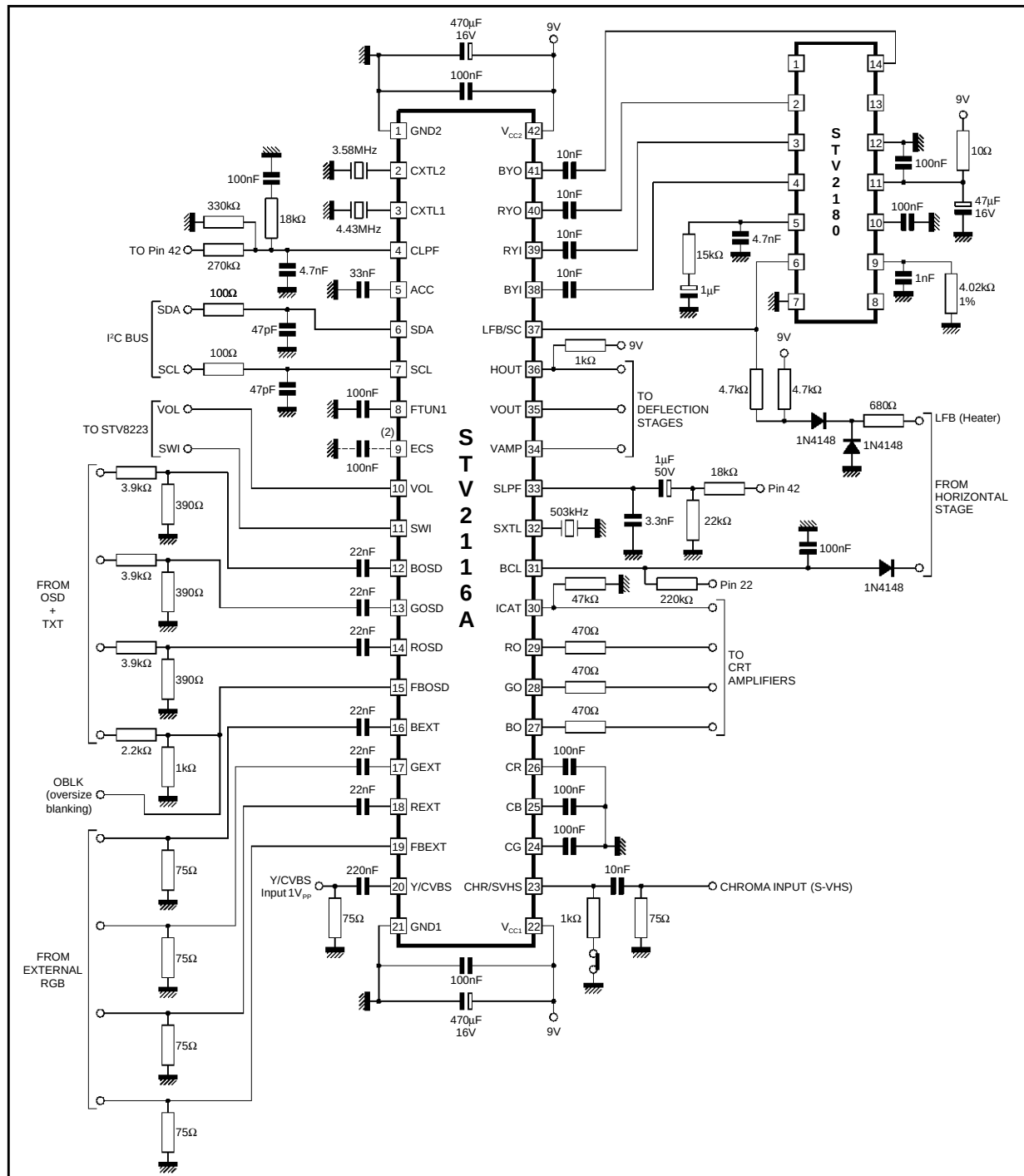


Figure 33 : Pins 42, 22 -  $V_{CC2}$ ,  $V_{CC1}$



## APPLICATION DIAGRAM (compatible with STV2116 &amp; STV2118B)

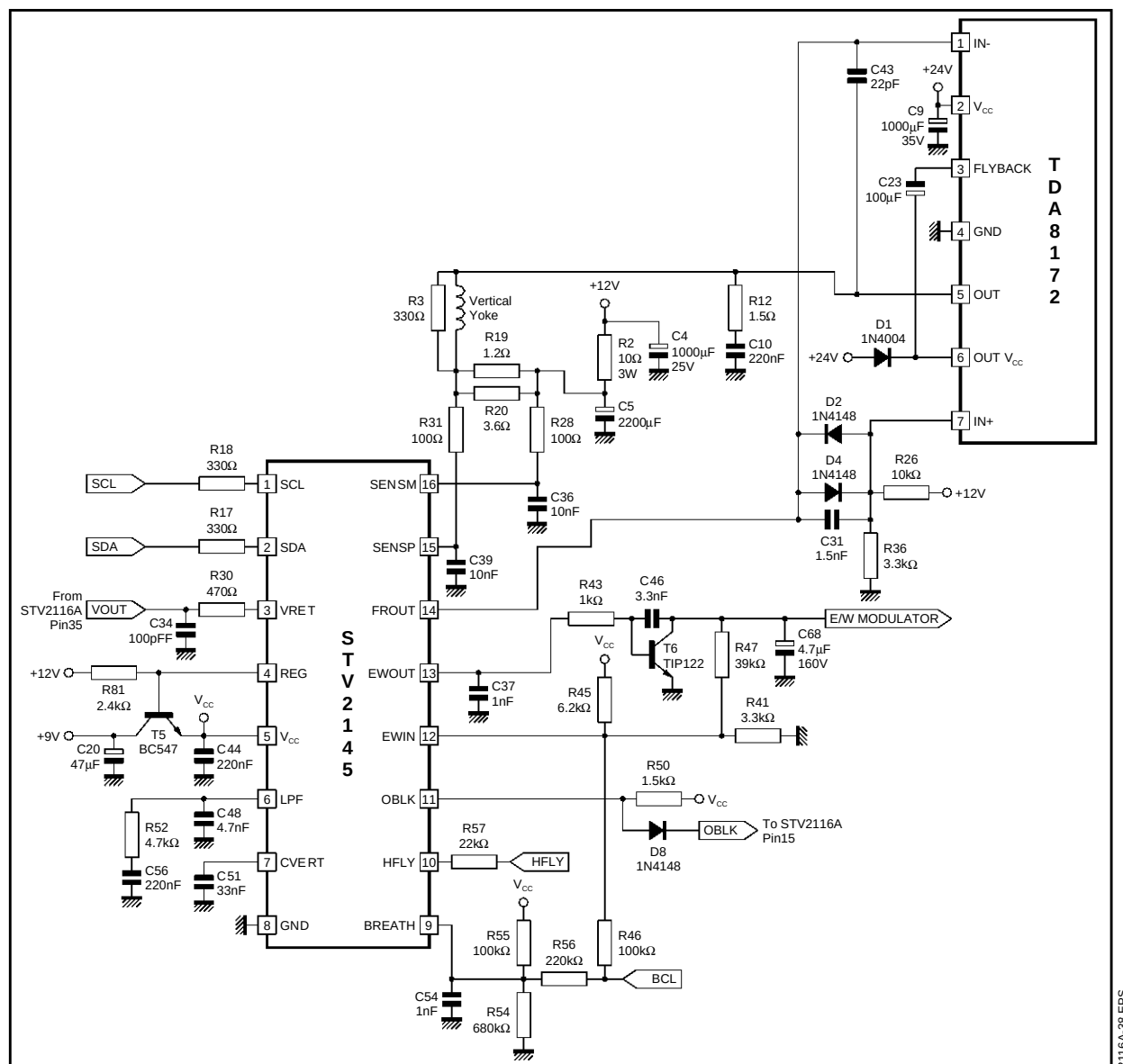


- Notes :**
- STV2116A requires 2 XTALS (4.43MHz and 3.58MHz) for all operations in auto mode. We recommend to force the standard when only one.
  - If ECS is not used, Pin 9 can be not connected.

## 22/24

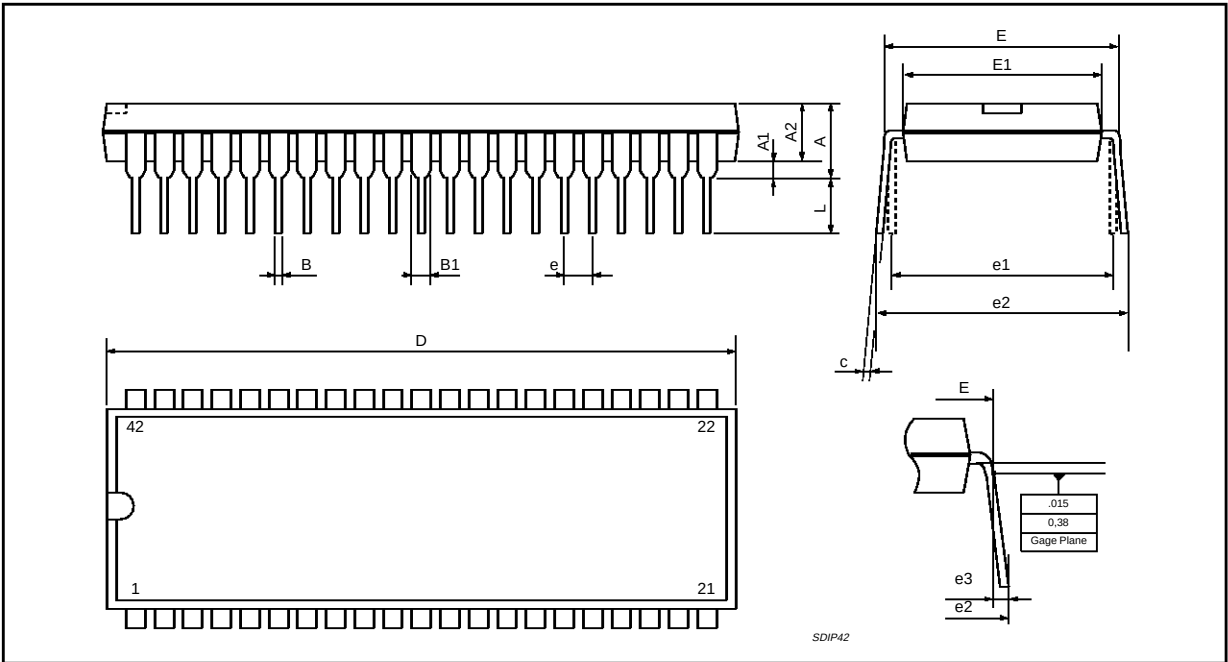


## 110° CRT APPLICATIONS : Vertical System with East-West



2116A-38.EPS

PACKAGE MECHANICAL DATA  
42 PINS - PLASTIC SHRINK DIP



| Dimensions | Millimeters |       |       | Inches |        |        |
|------------|-------------|-------|-------|--------|--------|--------|
|            | Min.        | Typ.  | Max.  | Min.   | Typ.   | Max.   |
| A          |             |       | 5.08  |        |        | 0.200  |
| A1         | 0.51        |       |       | 0.020  |        |        |
| A2         | 3.05        | 3.81  | 4.57  | 0.120  | 0.150  | 0.180  |
| B          | 0.36        | 0.46  | 0.56  | 0.0142 | 0.0181 | 0.0220 |
| B1         | 0.76        | 1.02  | 1.14  | 0.030  | 0.040  | 0.045  |
| c          | 0.23        | 0.25  | 0.38  | 0.0090 | 0.0098 | 0.0150 |
| D          | 37.85       | 38.10 | 38.35 | 1.490  | 1.5    | 1.510  |
| E          | 15.24       |       | 16.00 | 0.60   |        | 0.629  |
| E1         | 12.70       | 13.72 | 14.48 | 0.50   | 0.540  | 0.570  |
| e          |             | 1.778 |       |        | 0.070  |        |
| e1         |             | 15.24 |       |        | 0.60   |        |
| e2         |             |       | 18.54 |        |        | 0.730  |
| e3         |             |       | 1.52  |        |        | 0.060  |
| L          | 2.54        | 3.30  | 3.56  | 0.10   | 0.130  | 0.140  |

Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No licence is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1997 SGS-THOMSON Microelectronics - All Rights Reserved

Purchase of I<sup>2</sup>C Components of SGS-THOMSON Microelectronics, conveys a license under the Philips I<sup>2</sup>C Patent. Rights to use these components in a I<sup>2</sup>C system, is granted provided that the system conforms to the I<sup>2</sup>C Standard Specifications as defined by Philips.

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco  
The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.