SGS-THOMSON MICROELECTRONICS

TECHNICAL NOTE

STV5730
OSD CHIP EVALUATION GUIDE

SUMMARY **Page**

I - OVERVIEW OF THIS DOCUMENT

The objective of this evaluation guide is to provide a quick and easy instruction manual for displaying OSD text with the STV5730 and its demonstration software. Six basic demonstration pages of text have been created which are intended to show some of the main features of the STV5730. These pages (context files) can be used as a basis for further detailed evaluation of the device by entering the "modify RAM registers" mode.

II - SUMMARY OF STV5730 FUNCTIONS

- 11 rows consisting of 28 characters ; thus 308 characters per page maximum.
- 128 different user definable characters can be stored in ROM.
- Output signals :
  - Composite video :
    Video IN+text(translucent)-All standards
    Video IN+text(opaque)-PAL/NTSC
  - RGB+Fb-corresponding to entire text page
  - Co-digital output corresponding to text info
- Csync- currently active sync(extracted from video IN or internally generated)
- MUTE-monitors quality of video IN sync signal
- Character Attributes
  - one of 8 colours
  - character border and backround
  - character blinking
- Line (row) Attributes
  - line horizontal offset
  - line vertical offset
  - line hide/show
  - background ON/OFF
  - character border ON/OFF
  - line zoom (x1, x2, x3, x4 for both X and Y coordinates)
    3 different zoom factors for lines 1, 2 to 10 and 11
- Page Attributes
  - horizontal and vertical offsets
  - screen color
    background color
    character border color
  - clean color encoding (CCE)
  - blinking frequency and duty cycle

- Three Basic Operating Modes
  - Mixed mode : text page is displayed over the incoming video signal either in B/W or transparently (some Video IN visible behind text). Alternatively, coloured OSD is available from the RGB outputs for external insertion by the fast blanking signal.
  - Full page mode : The STV5730 outputs an entire frame with internally generated vertical/horizontal synchronisation. In this mode, the CVBS outputs the screen, background and text in colour (PAL or NTSC encoded).
  - Video full page mode : color (CVBS) text is superimposed on unsynchronized Video IN background. This mode is useful for manual/automatic channel search functions.

In both the above cases, character positions are referenced to an internal line blanking pulse. The stability of this pulse (and hence text stability) in mixed mode, is guaranteed by the use of a digitally controled line PLL.

III - GETTING STARTED

For the OSD demo/evaluation, the following equipment is required :

- STV5730 evaluation board (supplied)
- STV5730 PC control software diskette (supplied)
- PC parallel port interface cable (male to female)
- PC or compatible
- Television monitor (multistandard)
- SCART type connection to TV
- Video signal pattern generator or video source (VCR, Sat Receiver, etc...)
- +5V power supply

The connection diagram (see Figure 1) shows how the evaluation board must be connected.
Please ensure that the evaluation board switches are set to the positions given in Figure 2.

Figure 1 : STV5730 Evaluation Connection Diagram

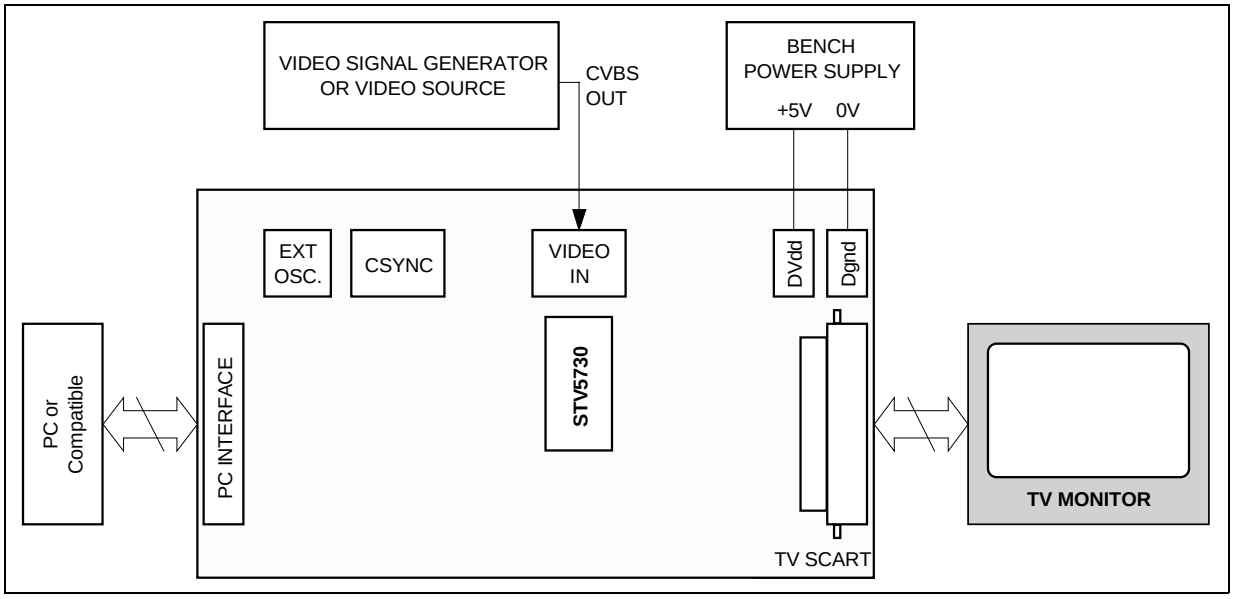
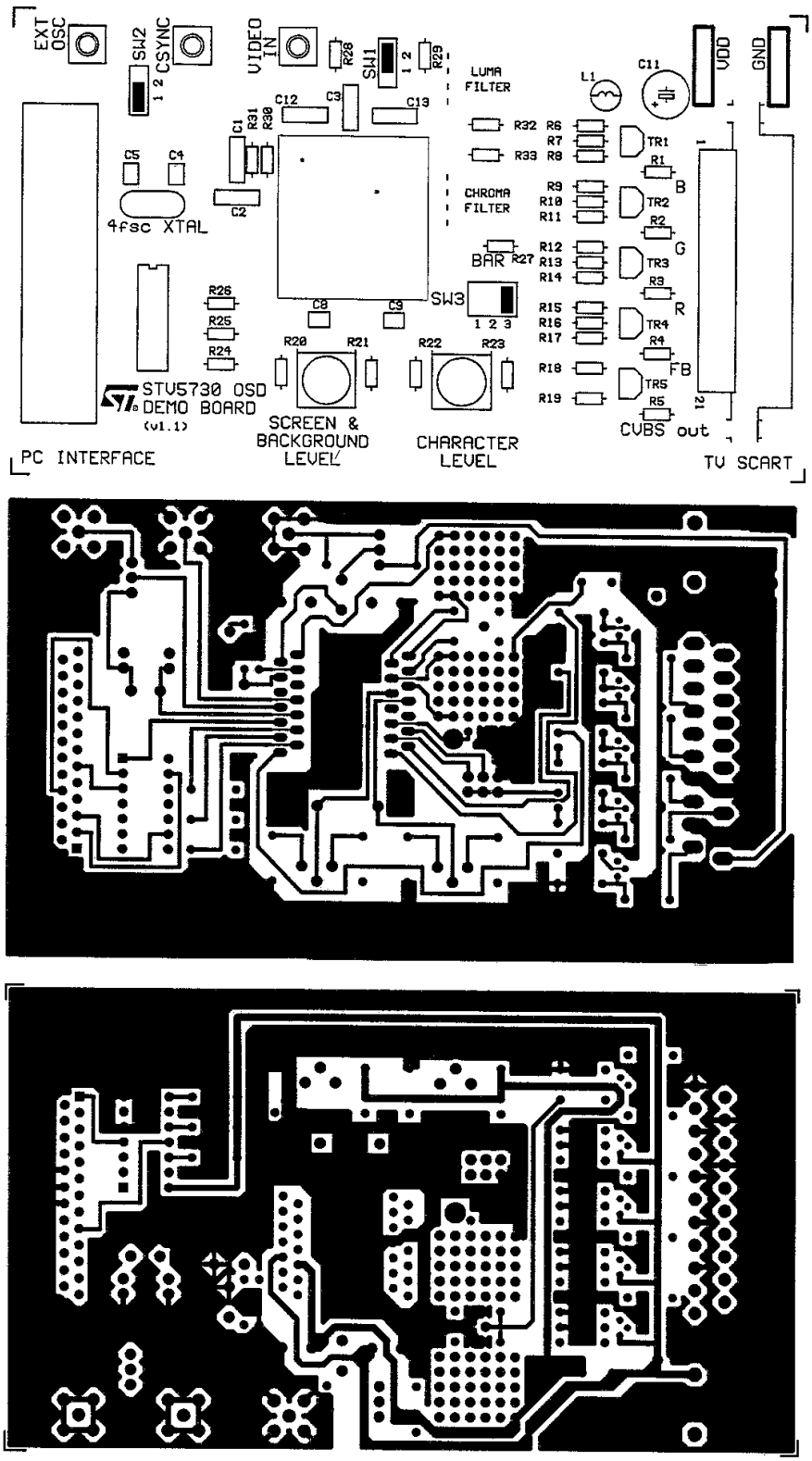


Figure 2 : STV5730 Evaluation Board Diagram



Installing the Software

After all the interconnections have been made, the +5V to the pcb can be switched ON, and all other equipment turned ON.

1. Insert the STV5730 demo program diskette, and using the DOS command, set the PC to the relevant disk drive. Eg. [B:] + **RTN**
2. Type [cd STV5730] + **RTN**,
   then type [STV5730] + **RTN**
   This will locate the appropriate directory and load the STV5730 PC control executable file .EXE. At this point, if any PC interface connection errors are encountered, (or the evaluation board supplies have not been set), the program will fail to load since a connection test is performed at the beginning of the program. If this occurs, please check the interface and retry.

   A main menu consisting of 10 different choices will be displayed on the PC monitor, and the program will prompt for a number (1 to 10) to be entered to perform one of the menu functions : see Figure 3.
3. STV5730 Initialization
   In order that the STV5730 registers be cleared and set to a given condition, an initialisation sequence is required. A specific context file has been written to perform this function, and is loaded as follows :
   a. Type [5] + **RTN**. This resets registers to 0
   b. Type [3] + **RTN**. This enters the "load context" function
   c. Type [INIT.DAT] + **RTN**. This loads the context file INIT.DAT, and sets the STV5730 registers.

Now, The Video IN signal (from the pattern generator or video source) should be displayed on the TV monitor. We can now proceed with the demo, which summarizes most of the STV5730 features and operation modes combined in 6 pages of text.

Figure 3 : Menu Functions

```
1 : Modify RAM - to change character attributes or create text page
2 : Modify Registers - to change operation modes, page and row attributes, etc.
3 : Load Context - to display .DAT text page files
4 : Save Context - to save modified .DAT files (or new text pages)
5 : Reset - to reset the STV5730 registers (see 3. STV5730 initialization)
6 : Stop Quartz - to stop on-board crystal oscillator (to reduce polution when OSD is not displayed)
7 : Setup - to select data entry possibilities (HEX or binary), etc.
8 : Application Example - a simulation of a typical OSD menu system controlled from a remote control
9 : Mute Test - to simulate the Mute signal controlling the mode full page or mixed
10 : Quit - to exit program.
```

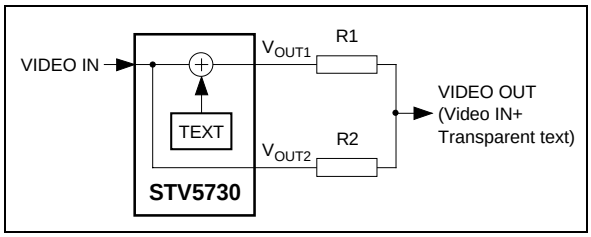
IV - PC SOFTWARE STEP BY STEP STV5730 FEATURES DEMO

1. Type [3] + **RTN**, then type [DEMO1.DAT] + **RTN**
   This will display a demo title page in mixed-mode (i.e. superimposed on the Video IN signal).
2. Type [3] + **RTN**, then type [DEMO2.DAT] + **RTN**
   This will display a message showing the 128 different characters stored in the default character set - This time in full-page mode.
3. Type [3] + **RTN**, then type [DEMO3.DAT] + **RTN**
   This page shows the horizontal line offset capability of the STV5730 (this time in transparent mixed mode).
4. Type [3] + **RTN**, then type [DEMO4.DAT] + **RTN**
   This page shows the vertical line offset feature, and could be used to create a scrolling effect. This page is displayed in video full page mode, where the video IN signal can be seen (unsynchronized) behind the text.
5. Type [3] + **RTN**, then type [DEMO5.DAT] + **RTN**
   This page shows the STV5730 zoom feature in full-page mode. The screen is now replaced by an uniform colour
6. Type [3] + **RTN**, then type [DEMO6.DAT] + **RTN**
   This page shows the use of character backround and "blinking" characters.
7. Type [3] + **RTN**, then type [CBAR1.DAT] + **RTN**
   This page shows a colour bar pattern generated by the STV5730 in CVBS.

V - MODES/FUNCTIONS DESCRIPTION

1. Transparent mode operation
   (in mixed-mode only) :
   This feature allows the viewer to display the text but with an amount of the Video IN signal slightly visible behind the text page. This feature apart from giving a pleasing visual effect, allows SECAM mode operation by providing the necessary chrominance reinsertion during the text periods (see Figure 4).
   This feature is performed by connecting ratioed resistors between the two CVBS outputs as shown in Figure 4. The resistor ratio can control the degree of transparency.

Figure 4



   This mode can be bus controlled simply by setting the VOUT2 Pin to either "low Z" for "transparent" mode, or to "high Z" for normal (black/white) mixed mode text.

2. RGB Mode Operation :
   So far, we have looked at only the CVBS output signals. Now we can display the text full-page in RGB simply by switching the Fb signal output of the STV5730 to the scart connector output (using SWITCH 3).
   Obviously, this feature will require a TV that has an external RGB input capability.
   In full-page mode, the page (screen) backround is provided by the CVBS output, and its colour is encoded in PAL/NTSC.
   The RGB mode is performed on the evaluation board by replacing the SWITCH 3 jumper to position 1, shown in Figure 2.
   A further possibility can be viewed on the evaluation board, by replacing the SWITCH 1 jumper to position 2. In this position, the Co (character output) digital signal controls the text insertion (fast blanking signal). This gives a "three dimentional" type display where each character has its information output in RGB, and simultaneously in CVBS, which has a delay assosiated with its encoding, and subsequent decoding in the TV receiver.
   This effect works best on expanded characters (particularly in the X direction) and could be useful for main title type text applications.
   To best view this effect, a dedicated text context file page has been created :
   Type [3] + **RTN**, then Type [3D.DAT] + **RTN**
   Remember : This effect can only be viewed if the TV receiver has an external RGB insertion capability. Also, check that SWITCH 3 is in position 2.

3. External Character and
   Background Level Control :
   In CVBS mode (i.e. SWITCH 3 returned to position 3) the character and background levels can be controlled independantly by the two potentiometers. Adjusting these potentiometers allow the text and text background to be set from black through to white, allowing "negative" text display if prefered.
   Caution : Extremes of potentiometers settings could cause problems with the TV receivers synchronization operation, since these levels can be reduced to less than black level.

VI - REGISTER MODIFICATION

After a given context file page has been displayed, we can perform many modifications on the text display or system operation simply by entering the second menu item - MODIFY REGISTERS :
Type [2] + **RTN**
A sub-menu will now be displayed which allows the user to select the required RAM register for modification simply by entering the appropriate letter :
eg. Video register : Type [V] + **RTN**

The current data will now be displayed, and the program will prompt for new data (three digits in hexadecimal form) to be entered. After the required data has been input ; eg. [020] + **RTN**, the RAM register is updated (in this case +6dB output gain is selected).

When this is complete, before new data can be written, the relevant register selection must be performed (even if writing to the same register).

This part of the program may be exit (i.e. returned to main menu) simply by pressing **RTN** when asked to make a register selection.

When returning to the main menu, it may be useful to save the modified text page. This can be performed by selecting the "SAVE CONTEXT" function as follows : Type [4] + **RTN**

*At this point, the program will prompt for a file name, date and comment (if required).

When this is completed, the program will save the data in the allocated context file.

Register Menu

The following registers can be modified using the STV5730 PC control program :

0 to 10 : Row attributes
Z : Zoom register
C : Color register
R : Raster (control) register
P : Position register
M : Mode register

For easy register content modification, a description of the 12 bit word content for each register is given.

VII - REGISTER DESCRIPTION

VII.1 - Row attributes (rows 0 to 10)

Write to addresses : 0000 1100 0000 to 0000 1100 1010 for each respectively

11	10	9	8	7	6	5	4	3	2	1	0
HPOS OFFSET				RE	FBE			VPOS OFFSET			
First hex digit				Second hex digit				Third hex digit			

VPOS OFFSET : the MSB is the sign bit (0 : positive, 1 : negative). If the offset is positive (from 0 to +17), then the corresponding number of lines are added on top of the row (i.e. it moves downwards). These extra lines are colored according to the character background rules. If the offset is negative (from -1 to -17), then the corresponding number of lines are subtracted from the display of the row.

FBE : FBE = 0 : the characters are displayed without border
FBE = 1 : the characters are displayed with border

RE : RE = 0 : the characters of the row are not displayed.
RE = 1 : They are replaced by the page background color.
the characters of the row are displayed.

HPOS OFFSET : The display of the row is shifted to the right by the corresponding number of pixels (from 0 to 15).

Example : Please load DEMO1.DAT ; Enter menu item 2 (modify registers).
To access the row to be modified, enter a digit 0 to 10.

Eg1.Type [0] + **RTN**, the [080] + **RTN**
This will set the FBE bit to 0 and the display will show the first line of text without border.

Eg2.Type [10] + **RTN**, the [000] + **RTN**
Now the last line of text will disappear.

Eg3.Type [0] + **RTN**, the [2F0] + **RTN**
This time, the first line of text will move horizontally and vertically.

* Type **RTN** to exit to main menu

VII.2 - Zoom register

Write to addresses : 0000 1100 1100

11	10	9	8
VZb1	VZb0	HZb1	HZb0
First hex digit			

7	6	5	4
VZm1	VZm0	HZm1	HZm0
Second hex digit			

3	2	1	0
VZt1	VZt0	HZt1	HZt0
Third hex digit			

HZt[1:0] : Top row horizontal zoom factor (ie row 0)
HZt[1:0] = 00 : 1 pixel per character dot
01 : 2 pixels per character dot
10 : 3 pixels per character dot
11 : 4 pixels per character dot

VZt[1:0] : Top row vertical zoom factor
VZt[1:0] = 00 : 1 pixel per character line
01 : 2 pixels per character line
10 : 3 pixels per character line
11 : 4 pixels per character line

HZm[1:0] : Same as HZt[1:0], for middle rows (ie rows 1 to 9)

VZm[1:0] : Same as VZt[1:0], for middle rows

HZb[1:0] : Same as HZt[1:0], for bottom row (ie row 10)

VZb[1:0] : Same as VZt[1:0], for bottom row

This register is validated by the first line sync pulse immediately after it is written.

Example : Please load DEMO5.DAT ; Enter menu item 2 (modify registers)
Eg.Now press [Z] + **RTN**, the [00F] + **RTN**
The display will shows the top row of text expanded to the maximum (X4,Y4) whilst the other two lines return to the minimum size.

VII.3 - Color register

Write to addresses : 0000 1100 1101

11	10	9	8
R	G	B	R
First hex digit			

7	6	5	4
G	B	//	//
Second hex digit			

3	2	1	0
//	R	G	B
Third hex digit			

SBC : Screen background color

FBC : Character border color

BCC : Character background color

This register is validated by the first line sync pulse immediately after it is written.

* Note : The character foreground color is defined in the RAM register.

Example : Please load DEMO2.DAT ; Type [2] + **RTN** to acess the modify register program.
Eg.Type [C] + **RTN**, the [601] + **RTN**
The Text color will remain unchanged, but the screen will now become green, and the character background will be blue.

VII.4 - Control register (raster register)

Write to addresses : 0000 1100 1110

11	10	9	8	7	6	5	4	3	2	1	0
C11	C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	C0
First hex digit				Second hex digit				Third hex digit			

C0 : C0 = 0 : mixed mode
C0 = 1 : full page mode

C1 : C1 = 0 : the character background is controlled by BE (see character word description)
C1 = 1 : all displayed character backgrounds are disabled

C2 : C2 = 0 : display off
C2 = 1 : display on

C3 : C3 = 0 : the characters are colored according to the character attribute and the color register values (i.e. CBACKG and CBORD)
C3 = 1 : the character foreground, border and background colors are all set to the character attribute value (see paragraph 1.2). This option is mainly intended for full page mode, CVBS or Y/C output (clean color encoding CCE)

C4 : C4 = 0 : 1.0 second blinking period
C4 = 1 : 0.5 second blinking period

C[6:5] : C[6:5] = 00 : blinking off
01 : 0.75 blinking duty cycle
10 : 0.5 blinking duty cycle
11 : 0.25 blinking duty cycle

C7 : C7 = 0 an external input composite sync is taken from the CSYNC pin
C7 = 1 the sync is extracted by the STV5730.The currently active sync is output on the CSYNC pin

C8 : C8 = 0 : the standard is NTSC, 60Hz
C8 = 1 : the standard is PAL or SECAM with M6 = 0, 50Hz

C9 : C9 = 0 : character color encoding is disabled
C9 = 1 : character color encoding is enabled

C10 : C10 = 0 : the luminance levels are generated internally
C10 = 1 : the luminance levels are provided by the LESCREEN and LECHAR input pins.

C11 : C11 = 0 : Video Full Page Mode. A stable full page mode text is displayed while the screen background is the unlocked video input signal.
C11 = 1 : Normal full page mode is active.

The output of this register is synchronized by the horizontal sync (except C7). The RESET message clears this register.

Example : Please load DEMO1.DAT ; Type [2] + **RTN** to modify registers

Eg1.Type [R] + **RTN**, the [F85] + **RTN**
The page will now be displayed in full page mode, and the "STV5730" will not blink.

Eg2.Type [R] + **RTN**, the [FFD] + **RTN**
Now the display will have the clear color encoding (CCE) function active, in which the character background and border become that of the programmed color of each character. This effectively limits the color transitions, to give a more pleasing CVBS picture. Also, the blinking frequency is doubled, and the duty cycle inverted.

Eg3.Type [R] + **RTN**, the [1A5] + **RTN**
This time the Text will be displayed in video full page mode, in which the screen background is replaced by an unsynchronized video IN signal. Also the character color encoding is disabled, and the internal levels (LECHAR/LESCREEN) are programmed (external potentiometers have no effect).

VII.5 - Position register

Write to addresses : 0000 1100 1111

11	10	9	8	7	6	5	4	3	2	1	0
VERTCAL POSITION				HORIZONTAL POSITION							
First hex digit				Second hex digit				Third hex digit			

HORIZONTAL POSITION Any value from 6 to 63
VERTICAL POSITION Any value from 1 to 63
This register is validated as it is written.

Example : Please load DEMO3.DAT ; Type [2] + **RTN** to access the modify register menu
Eg1.Type [P] + **RTN**, the [000] + **RTN**
The text will be displayed at its normal position on the screen (no-offset).
Eg2.Type [P] + **RTN**, the [FFF] + **RTN**
The text will now be displaced to the maximum position both horizontally and vertically.
This register is used to optimize text position on the TV monitor.

VII.6 - Mode register

Write to addresses : 0000 1101 0000

11	10	9	8	7	6	5	4	3	2	1	0
M11	M10	M9	M8	M7	M6	M5	M4	M3	M2	M1	M0
First hex digit				Second hex digit				Third hex digit			

M0 : M0 = 0 : the BAR pin is disabled
M0 = 1 : the BAR pin has an action on the line PLL
M1 : M1 = 0 : the missing sync pulses are not detected
M1 = 1 : the missing sync pulses are detected
M2 : M2 = 0 : the MUTE pin is forced to 0
M2 = 1 : the MUTE pin delivers the internal MUTE signal
M3 : M3 = 0 : the MUTE time constant is 8 lines
M3 = 1 : the MUTE time constant is 32 lines
M4 : M4 = 0 : the sync is not re-inserted
M4 = 1 : the sync is re-inserted for improved text stability
M5 : M5 = 0 : the gain of pins VIDEO OUT1 & VIDEO OUT2 is 0dB.
M5 = 1 : the gain of pins VIDEO OUT1 & VIDEO OUT2 is 6dB.
M6 : M6 = 0 : the color encoder is enabled (PAL or NTSC)
M6 = 1 : the color encoder is disabled (B&W or SECAM)
M7 : M7 = 0 : the VIDEO OUT2 pin outputs the VIDEO IN signal
M7 = 1 : the VIDEO OUT2 pin outputs the composite sync
M8 : M8 = 0 : the VIDEO OUT2 pin is in high impedance state
M8 = 1 : the VIDEO OUT2 pin is in low impedance state
M9 : This Mode bit has to be kept at a low level.
M10 : M10 = 0 : No delay compensation
M10 = 1 : It enables the delay compensation of the internal sync extractor.
M11 : M11 = 0 : The mute signal output is synchronized on vertical sync in order to limit its transitions.
M11 = 1 : The mute signal is not synchronized on vertical sync thus accelerating the VIDEO IN presence detection (useful in full page mode).

This register is validated as it is written.

Example : Please load DEMO3.DAT ; Type [2] + **RTN** to display modify register menu
Eg.Type [M] + **RTN**, then [180] + **RTN**
Now the Text will change to B/W mixed mode with 0dB gain.

*** Note :** A majority of the bit Functions in this register are dedicated to the analog signal processing functions, such as sync extraction/reinsertion or "MUTE" output optimization. They can not be easily demonstrated, since they are intended to optimize the STV5730 performance in noisy environments (off-channel tunning) or VCR applications, for example.

VIII - RAM MODIFICATION

After a given context file page has been displayed, it is possible to modify the RAM context by entering the second menu item - MODIFY RAM : Type [1] + **RTN**.
A submenu will be displayed allowing easy selection of the character requiring modification.

Firstly, the modify RAM program will ask for the OSD line number . This is the actual row 0 to 10 (11 rows per page !) that the character is to be displayed on : Enter → 0 x 0 to 0 x A.

Then the program prompts for the horizontal number. This is the actual character position on a given line location from 0 to 27 (28 characters per row !) : Enter → 0 x 0 to 01B.

Following this data input, the current RAM contents are displayed :
- RAM : XXX. This gives the write pointer data (see datasheet 2.2).
- Current value : XXX. This gives the current character attributes data.
- Enter new data : -
  The new data must be entered using three hex digits, conforming to :

11	10	9	8	7	6	5	4	3	2	1	0
BE	R	G	B	BK	CHARACTER CODE						
First hex digit				Second hex digit				Third hex digit			

CHARACTER CODE : 1 character out of 128 from the character ROM

BK : BK=0 : character blink disabled
BK=1 : character blink enabled

R/G/B : Character color :

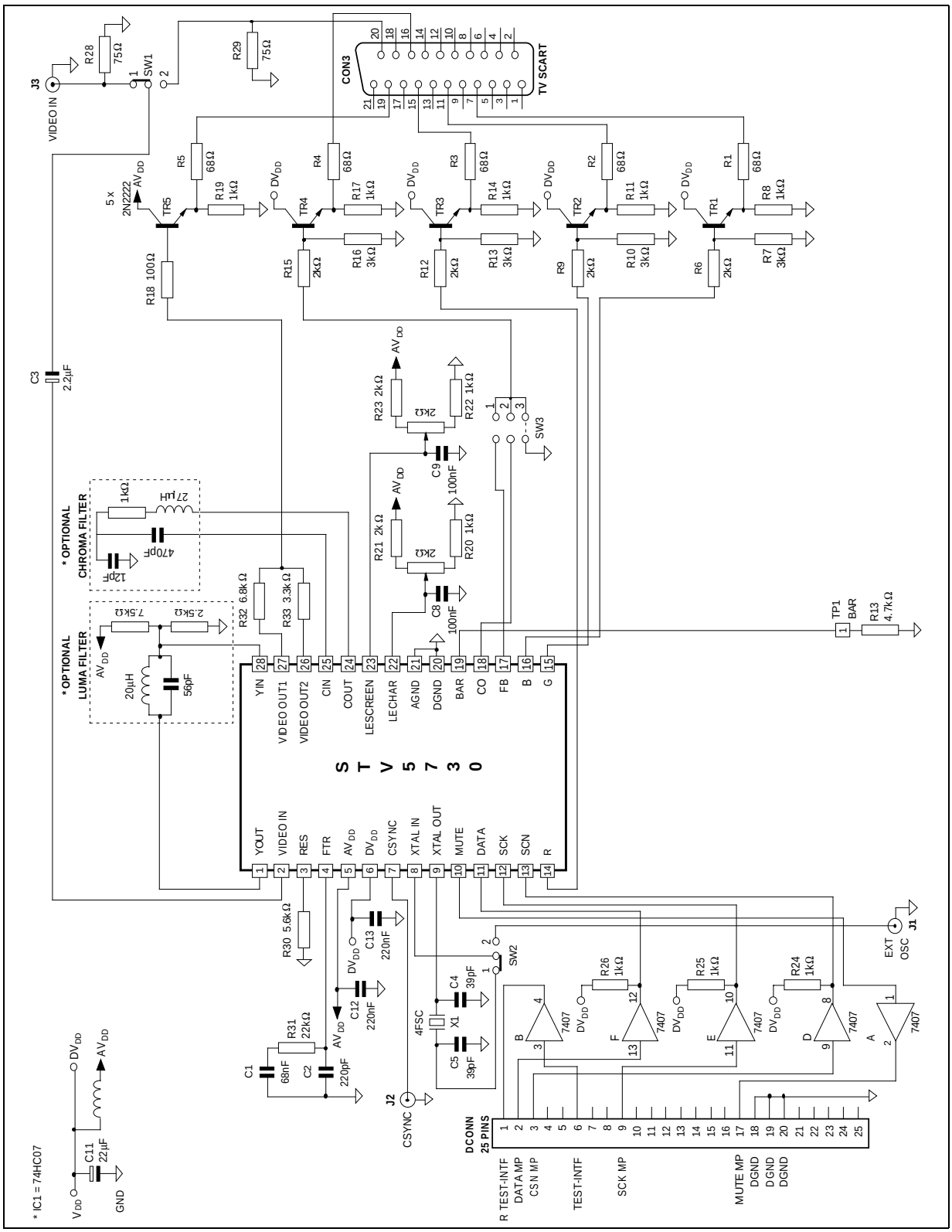
000	black
001	blue
010	green
011	cyan
100	red
101	magenta
110	yellow
111	white

BE : BE=0 : the character background is disabled
BE=1 : the character background is enabled

In the appendix there is the table of the standard ROM characters with the character code value expressed in hexadecimal (see Figure 6).

IX - ELECTRICAL SCHEMATIC

Figure 5



X - APPENDIX

Figure 6

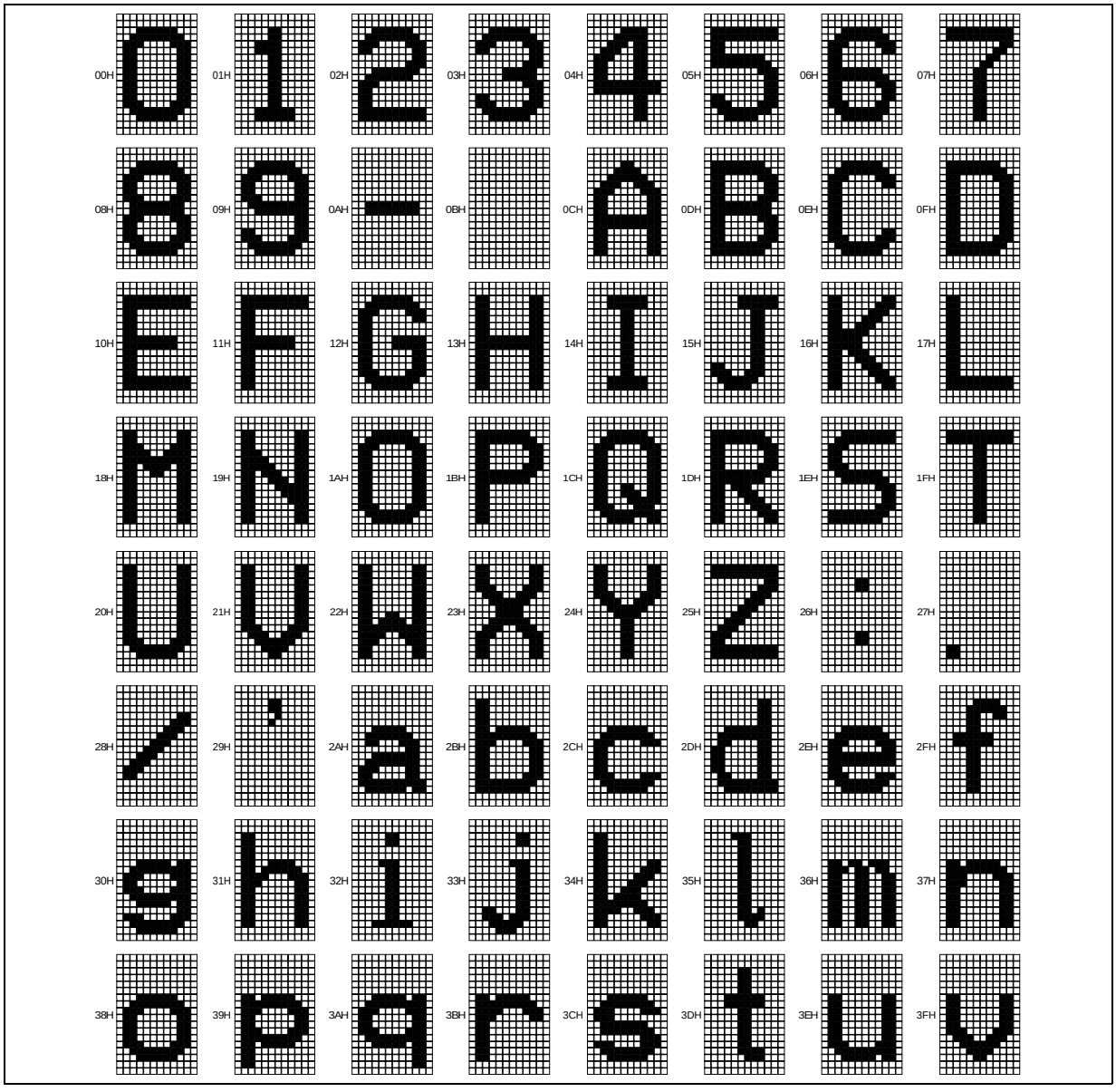


Figure 6 (continued)