



JAN. 1998

SPECIFICATION

for KS5514B-XX

**SYSTEM LSI BUSINESS
SAMSUNG ELECTRONICS CO.**



SPECIFICATION for KS5514B-XX

Important Notice

Copyright 1998 by SAMSUNG

The information in this publication has been carefully checked and is believed to be accurate at the time of publication. Samsung assumes no responsibility, however, for possible errors or omissions, or for any consequences resulting from the use of the information contained herein.

Samsung reserves the right to make changes in its products or product specifications with the intent to improve function or design at any time and without notice and is not required to update this documentation to reflect such changes.

This publication does not convey to a purchaser of semiconductor devices described herein any license under the patent rights of Samsung or others.

Samsung makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does Samsung assume any liability arising out of the application or use of any product or circuit and specifically disclaims any liability, including without limitation any consequence or incidental damages.

Typical parameters can and do vary in different applications. All operating parameters, including *Typicals,* must be validated for each customer application by the customer's technical experts.

Samsung products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, for other applications intended to support or sustain life, or for any other application in which the failure of the Samsung product could cause personal injury or death.

Should the buyer purchase or use a Samsung product for any such unintended or unauthorized application, the buyer shall indemnify and hold Samsung and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, expenses, and reasonable attorney fees arising out of, either directly or indirectly, any claim of personal injury or death that may be associated with such unintended or unauthorized use, even if such claim alleges that Samsung was negligent regarding the design or manufacture or manufacture of said product.

CONTENTS

• FUNCTIONS -----	3
• FEATURES -----	3
• BLOCK DIAGRAM -----	3
• PIN DESCRIPTION -----	4
• ABSOLUTE MAXIMUM RATINGS --	5
• ELECTRICAL CHARACTERISTICS -	6
• OPERATION DESCRIPTION -----	7
• TEST CIRCUIT -----	13
• APPLICATION CIRCUIT -----	14
• PACKAGE DIMENSIONS -----	16

ON SCREEN DISPLAY PROCESSOR

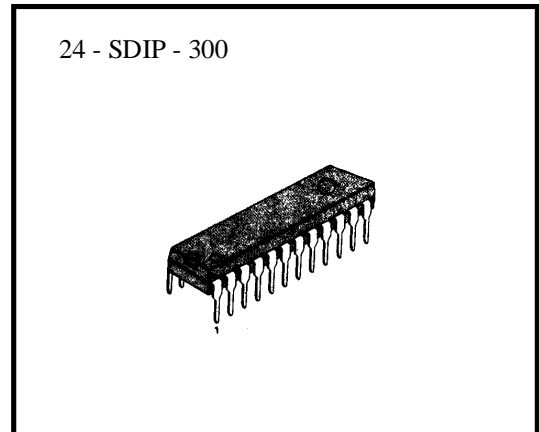
The KS5514B is a BICMOS LSI with on screen display function, sync separator & expander function.

FUNCTIONS

- On screen display
- Sync separator and sync detector
- General expander

FEATURES

- Character capacity : 240 (24 column × 10 row)
- Construction of character : 12 × 18 dots
- 128 kinds of character
- Display position : 62 horizontal position
: 64 vertical position
- Character size : 4 × 4 times of normal
- Blinking : character unit
- Background coloring : 8 colors
- Synchronous ways : automatic selection internal
or external synchronization via MICOM control
- General output : 3 ports (by serial data)
- Built-in sync separator & sync detector
- NTSC / PAL / SECAM mode
- Clamp circuit



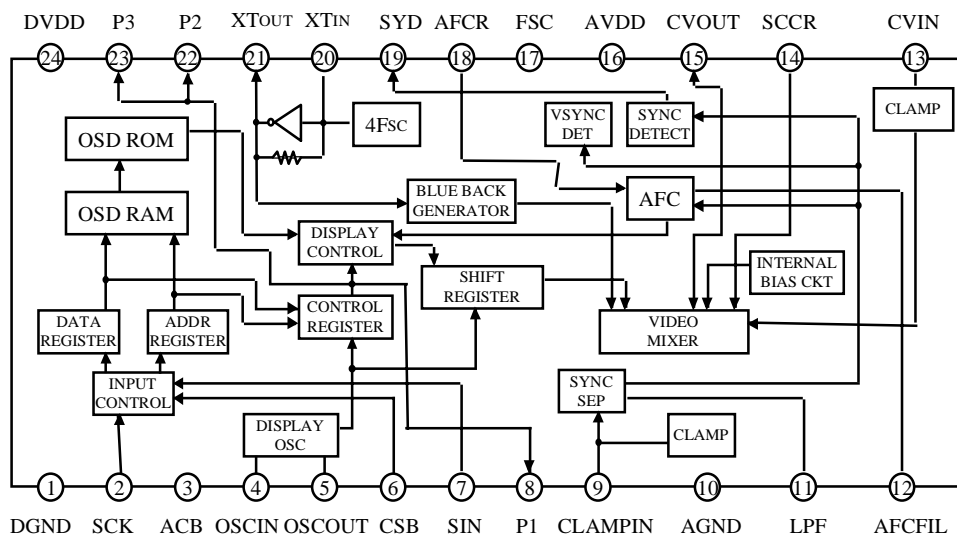
ORDERING INFORMATION

Device	Package	Operating Temperature
KS5514B-XX	24-SDIP-300	- 20 ~ + 70°C

OPTION CODE INFORMATION

Code No.	Remark
- 02	English
- 03	English, Russian
- 06	English
- 07	Korean
- 09	Korean, English
- 10	English, German
- 12	English, Arabic
- 13	English
- 14	Korean, English
- 15	English, Chinese
- 16	English, Russian, Arabic

BLOCK DIAGRAM



PIN DESCRIPTION

Pin No.	Symbol	I/O	Function
1	DGND	-	Digital Ground
2	SCK	I	Serial clock input. When CSB pin is `L` then serial data is inputted by micom. Hysteresis input.
3	ACB	I	Auto clear pin. If `L`, then all circuit is reset. Built-in pull up resistor. Hysteresis input.
4	OSCIN	I	LC oscillation pin. Standard frequency is 7MHz & the horizontal start position is controlled by the clock of oscillation block.
5	OSCOUT	O	
6	CSB	I	While pin 6 is low, serial data input is active. Built - in pull up resistor
7	SIN	I	Serial data input pin. Built-in pull up resistor
8	P1	O	General output port 1
9	CLAMPIN	I	Clamp input pin of composite video signal
10	AGND	-	Analog ground
11	LPF	-	Low pass filter
12	AFCFIL	-	AFC filter output
13	CVIN	I	Composite video signal input
14	SCCR	I	SECAM chroma input
15	CVOUT	O	Composite video output : 2 Vp-p
16	AVDD	-	Analog VDD
17	FSC	I	FSC input (Not use)
18	AFCR	I	VCO oscillation frequency control
19	SYD	O	When sync signal is inputted, then SYD is high.

PIN DESCRIPTION (Continued)

Pin No.	Symbol	I/O	Function
20	XT _{IN}	I	X-TAL
21	XT _{OUT}	O	X-TAL
22	P2	O	General output port 2
23	P3	O	General output port 3
24	DVDD	-	Digital VDD

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Supply Voltage	V _{DD}	- 0.3 ~ 6.0	V
Input Voltage	V _{IN}	$V_{SS} - 0.3 \leq V_{IN} \leq V_{DD} + 0.3$	V
Power Dissipation	P _d	300	mW
Operating Temperature	T _{opr}	- 20 ~ + 70	°C
Storage Temperature	T _{stg}	- 40 ~ + 125	°C

ELECTRICAL CHARACTERISTICS (Ta = 25 °C, AVDD = DVDD = 5V)

Characteristics	Symbol	Min	Typ	Max	Unit
Operating Voltage	DVDD	3.5	5.0	5.5	V
Operating Voltage	AVDD	4.5	5.0	5.5	V
Operating Current	Icc	10	20	25	mA
Pin 12 DC Voltage	Vpi2	2.3	2.5	2.7	V
Pin 13 DC Voltage	Vpi3	1.3	1.45	1.6	V
AFC Freerun Frequency	Ffr	15.5	15.7	15.9	KHz
AFC Pulse Width	twd	3.7	4.0	4.3	usec
AFC Delay Time	td	1.0	2.5	4.0	usec
AFC Lock Range H	Falh	+600	-	-	Hz
AFC Lock Range L	Fall	-	-	-900	Hz
AFC Capture Range H	Fach	+400	-	-	Hz
AFC Capture Range L	Fac1	-	-	-700	Hz
SYNC DET. Lock Range H	Flh	143	153	163	KHz
SYNC DET. Lock Range L	Fll	6.7	7.7	8.7	KHz
SYNC DET. Capture Range H	Fch	100	107	114	KHz
SYNC DET. Capture Range L	Fc1	14.3	15.3	16.3	KHz
V - SYNC Delay Time	tvd	10	14	-	usec
Oscillation Level	Vosc	4.0	4.5	5.0	Vpp
Oscillation Frequency	Fosc	6.3	7.0	7.7	MHz
Blueback Sync Tip Level	Vbst	1.85	2.05	2.25	V
Blueback Pedestal Level	Vbpd	2.5	2.7	2.9	V
Blueback Color Burst Level H	Vbbh	2.75	2.95	3.15	V
Blueback Color Level H	Vbch	3.1	3.3	3.5	V

OPERATION DESCRIPTION

MEMORY STRUCTURE

After KS5514B records, in DATA RAM and CONTROL REGISTER, the serial DATA that is inputted from MICOM, in recording to the V-SYNC and H-SYNC signal, mix the COMPOSITE VIDEO signal and the font ROM data that is mapped to data RAM.

In case that there is no composite video signal that is inputted to KS5514B, the SYNC detector becomes low, KS5514B makes the blue back signal in dividing the 4fsc signal and the blue back signal is outputted.

The following table is the data structure that is inputted from MICOM.

- Memory address consists of 16 bit
- The data of address 0 ~ 239 are character data which are display on the screen.
- The address 240 ~ 244 are the control registers.
- Don't care bit : the upper 8 bits (DA8 ~ DAF) in address 0 ~ address 239, the upper 5bits (DAB ~ DAF) in address 240 ~ address 244

Bit Addr	DAF	DAE	DAD	DAC	DAB	DAA	DA9	DA8	DA7	DA6	DA5	DA4	DA3	DA2	DA1	DA0
0	*	*	*	*	*	*	*	*	BLI	C6	C5	C4	C3	C2	C1	C0
.			.				.						.			
.			.				.						.			
.			.				.						.			
239	*	*	*	*	*	*	*	*	BLI	C6	C5	C4	C3	C2	C1	C0
240	*	*	*	*	*	INT/ NON	HSZ 21	HSZ 20	HSZ 11	HSZ 10	HP5	HP4	HP3	HP2	HP1	HP0
241	*	*	*	*	*	BLI2	VSZ 21	VSZ 20	VSZ 11	VSZ 10	VP5	VP4	VP3	VP2	VP1	VP0
242	*	*	*	*	*	DSP 3	DSP 2	DSP 1	RAM ERS	TEST	TC	LEV 1	LEV 0	PH2	PH1	PH0
243	*	*	*	*	*	-	LE BK	LE CHA	DSP ON	BLK 1	BLK 0	BLI 1	BLI 0	EX	YM	BCO
244	*	*	*	*	*	SECAM PAL	NT/ PAL	-	PD3	PD2	-	PD0	PC3	PC2	PC1	PC0

CONTROL REGISTER

1) Register 240

DA0 ~ DAA	Register	Content		Remark																	
		State	Function																		
0	HP0	0	HS is horizontal display start position $HS = Tc * \{ 4 * \sum_{n=0}^5 (HPn * 2^n) + N \}$	Horizontal Start Position																	
		1																			
1	HP1	0	Tc : osc. period (1 / 7MHz = 143 nsec)																		
		1																			
2	HP2	0	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>HSZ11</td> <td>HSZ10</td> <td rowspan="2">N</td> </tr> <tr> <td>HSZ21</td> <td>HSZ20</td> </tr> <tr> <td>0</td> <td>0</td> <td>9</td> </tr> <tr> <td>0</td> <td>1</td> <td>10</td> </tr> <tr> <td>1</td> <td>0</td> <td>11</td> </tr> <tr> <td>1</td> <td>1</td> <td>12</td> </tr> </table>		HSZ11	HSZ10	N	HSZ21	HSZ20	0	0	9	0	1	10	1	0	11	1	1	12
		HSZ11			HSZ10	N															
HSZ21	HSZ20																				
0	0	9																			
0	1	10																			
1	0	11																			
1	1	12																			
3	HP3	0																			
		1																			
4	HP4	0																			
		1																			
5	HP5	0																			
		1																			
6	HSZ10	0	1st line	1st line character size control to horizontal-direction																	
		1																			
7	HSZ11	0	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>HSZ10</td> <td>0</td> <td>1</td> </tr> <tr> <td>HSZ11</td> <td>0</td> <td>1X</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>		HSZ10	0	1	HSZ11	0	1X	0	1X	2X	1	3X	4X					
		HSZ10			0	1															
HSZ11	0	1X																			
0	1X	2X																			
1	3X	4X																			
8	HSZ20	0	2nd ~ 10 th line		2nd ~ 10th line character size control to horizontal-direction																
		1																			
9	HSZ21	0	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>HSZ20</td> <td>0</td> <td>1</td> </tr> <tr> <td>HSZ21</td> <td>0</td> <td>1X</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>			HSZ20	0	1	HSZ21	0	1X	0	1X	2X	1	3X	4X				
		HSZ20		0		1															
HSZ21	0	1X																			
0	1X	2X																			
1	3X	4X																			
A	INT/ NON	0	Interlace Mode																		
		1	Non-interlace Mode																		

2) Register 241

DA0 ~ DAA	Register	Content		Remark										
		State	Function											
0	VP0	0	VS is vertical start position $VS = H * \{ 4 * \sum_{n=0}^5 (VPn * 2^n) + 3 \}$	Vertical Start Position										
		1												
1	VP1	0	H : horizontal synchronous pulse time											
		1												
2	VP2	0												
		1												
3	VP3	0												
		1												
4	VP4	0												
		1												
5	VP5	0												
		1												
6	VSZ10	0		<table border="1"> <tr> <td>VSZ11 \ VSZ10</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>	VSZ11 \ VSZ10	0	1	0	1X	2X	1	3X	4X	1st line character size control to vertical direction
		VSZ11 \ VSZ10			0	1								
0	1X	2X												
1	3X	4X												
1														
7	VSZ11	0	<table border="1"> <tr> <td>VSZ21 \ VSZ20</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>	VSZ21 \ VSZ20	0	1	0	1X	2X	1	3X	4X	2nd ~ 10th line character size control to vertical direction	
		VSZ21 \ VSZ20		0	1									
0	1X	2X												
1	3X	4X												
1														
8	VSZ20	0	<table border="1"> <tr> <td>VSZ21 \ VSZ20</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>	VSZ21 \ VSZ20	0	1	0	1X	2X	1	3X	4X	2nd ~ 10th line character size control to vertical direction	
		VSZ21 \ VSZ20		0	1									
0	1X	2X												
1	3X	4X												
1														
9	VSZ21	0	<table border="1"> <tr> <td>VSZ21 \ VSZ20</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1X</td> <td>2X</td> </tr> <tr> <td>1</td> <td>3X</td> <td>4X</td> </tr> </table>	VSZ21 \ VSZ20	0	1	0	1X	2X	1	3X	4X	2nd ~ 10th line character size control to vertical direction	
		VSZ21 \ VSZ20		0	1									
0	1X	2X												
1	3X	4X												
1														
A	BLI2	0	V - SYNC 64 divide (= 1 sec)	Control the blink period										
		1	V - SYNC 32 divide (= 0.5 sec)											

3) Register 242

DA0 ~ DAA	Register	Content			Remark							
		State	Function									
0	PH0	0	<table border="1"> <tr> <td>P2 P1 P0</td> <td>NTSC</td> <td>PAL</td> </tr> <tr> <td>0 0 0</td> <td>$\pi/4$</td> <td>$\pi/4$</td> </tr> </table>			P2 P1 P0	NTSC	PAL	0 0 0	$\pi/4$	$\pi/4$	Back ground color control bit
		P2 P1 P0				NTSC	PAL					
0 0 0	$\pi/4$	$\pi/4$										
1	0 0 1	$\pi/2$	$\pi/2$									
1	PH1	0	<table border="1"> <tr> <td>P2 P1 P0</td> <td>NTSC</td> <td>PAL</td> </tr> <tr> <td>0 1 0</td> <td>$7\pi/4$</td> <td>$-\pi/4$</td> </tr> </table>			P2 P1 P0	NTSC	PAL	0 1 0	$7\pi/4$	$-\pi/4$	Back ground color control bit
		P2 P1 P0				NTSC	PAL					
0 1 0	$7\pi/4$	$-\pi/4$										
1	0 1 1	0	0									
2	PH2	0	<table border="1"> <tr> <td>P2 P1 P0</td> <td>NTSC</td> <td>PAL</td> </tr> <tr> <td>1 0 0</td> <td>π</td> <td>$\pm\pi$</td> </tr> </table>			P2 P1 P0	NTSC	PAL	1 0 0	π	$\pm\pi$	Back ground color control bit
		P2 P1 P0				NTSC	PAL					
1 0 0	π	$\pm\pi$										
1	1 0 1	$3\pi/4$	$3\pi/4$									
		0	<table border="1"> <tr> <td>P2 P1 P0</td> <td>NTSC</td> <td>PAL</td> </tr> <tr> <td>1 1 0</td> <td>$3\pi/2$</td> <td>$3\pi/2$</td> </tr> </table>			P2 P1 P0	NTSC	PAL	1 1 0	$3\pi/2$	$3\pi/2$	Back ground color control bit
		P2 P1 P0				NTSC	PAL					
1 1 0	$3\pi/2$	$3\pi/2$										
1	1 1 1	$5\pi/4$	$5\pi/4$									
3	LEVEL0	0	<table border="1"> <tr> <td>level 0 / level 1</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>Internal bias 1</td> <td>Internal bias 2</td> </tr> </table>			level 0 / level 1	0	1	0	Internal bias 1	Internal bias 2	Color level control
		level 0 / level 1				0	1					
0	Internal bias 1	Internal bias 2										
1	1	Internal bias 3										
4	LEVEL1	0	<table border="1"> <tr> <td>0</td> <td>Internal bias 1</td> <td>Internal bias 2</td> </tr> <tr> <td>1</td> <td>-</td> <td>Internal bias 3</td> </tr> </table>			0	Internal bias 1	Internal bias 2	1	-	Internal bias 3	Color level control
		0				Internal bias 1	Internal bias 2					
1	-	Internal bias 3										
1	1	Internal bias 3										
5	TC	0	1H = 454Tc Tc = 2 / fosc									
		1	1H = 455Tc									
6	TEST	0	Active mode									
		1	Test mode									
7	RAM ERS	0	RAM no erase									
		1	RAM erase									
8	DSP1	0	Display method of the 1st is fixed by BLK0 & BLK1									
		1	Display method of the 1st is variable									
9	DSP2	0	Display method of 2nd - 9th is fixed by BLK0 & BLK1									
		1	Display method of 2nd - 9th is variable									
A	DSP3	0	Display method of 10th is fixed by BLK0 & BLK1									
		1	Display method of 10th is variable									

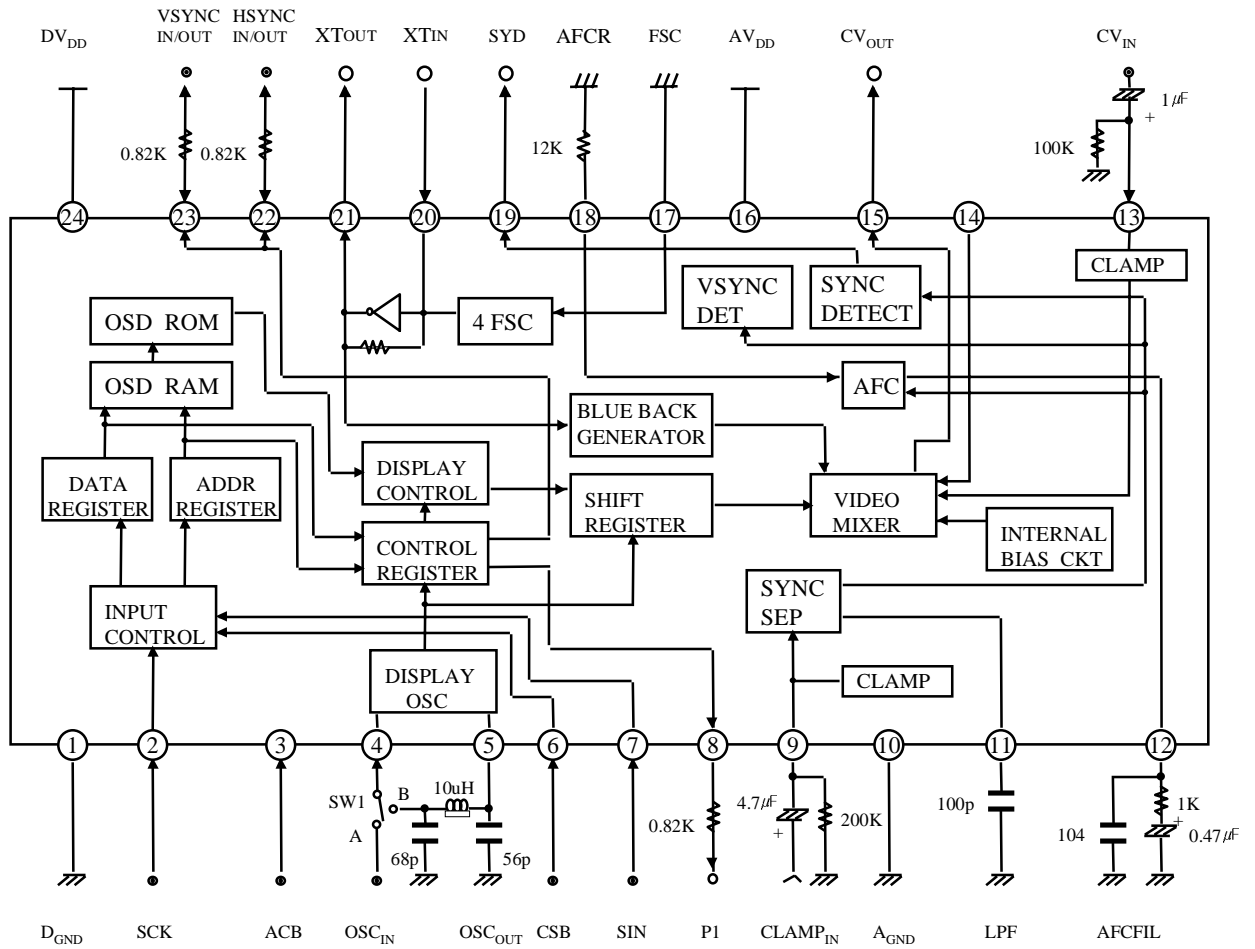
4) Register 243

DA0 ~ DAA	Register	Content		Remark									
		State	Function										
0	BCO	0	Blanking area coloring	Determined by BLK0 & BLK1									
		1	Full TV screen coloring										
1	YM	0	The same luminance level character and back ground	Determined by BCO, BLK0 & BLK1									
		1	Variable background luminance level available										
2	EX	0	External mode available	-									
		1	Internal mode available										
3	BLI0	0	Blanking mode control <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>BLI0 \ BLI1</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>OFF</td> <td>DUTY 25%</td> </tr> <tr> <td>1</td> <td>DUTY 50%</td> <td>DUTY 75%</td> </tr> </table>	BLI0 \ BLI1	0	1	0	OFF	DUTY 25%	1	DUTY 50%	DUTY 75%	Blinking duty control
BLI0 \ BLI1	0	1											
0	OFF	DUTY 25%											
1	DUTY 50%	DUTY 75%											
4	BLI1	0											
		1											
5	BLK0	0	Blanking mode control <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>BLK0 \ BLK1</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>OFF</td> <td>C</td> </tr> <tr> <td>1</td> <td>O</td> <td>R</td> </tr> </table>	BLK0 \ BLK1	0	1	0	OFF	C	1	O	R	C : character O : outline R : raster
BLK0 \ BLK1	0	1											
0	OFF	C											
1	O	R											
6	BLK1	0											
		1											
7	DSP ON	0	Display off										
		1	Display on										
8	LECHA	0	Character luminance level 1										
		1	Character luminance level 2										
9	LEBLK	0	Blank luminance level 1										
		1	Blank luminance level 2										
A	-	0	-										
		1	-										

5) Register 244

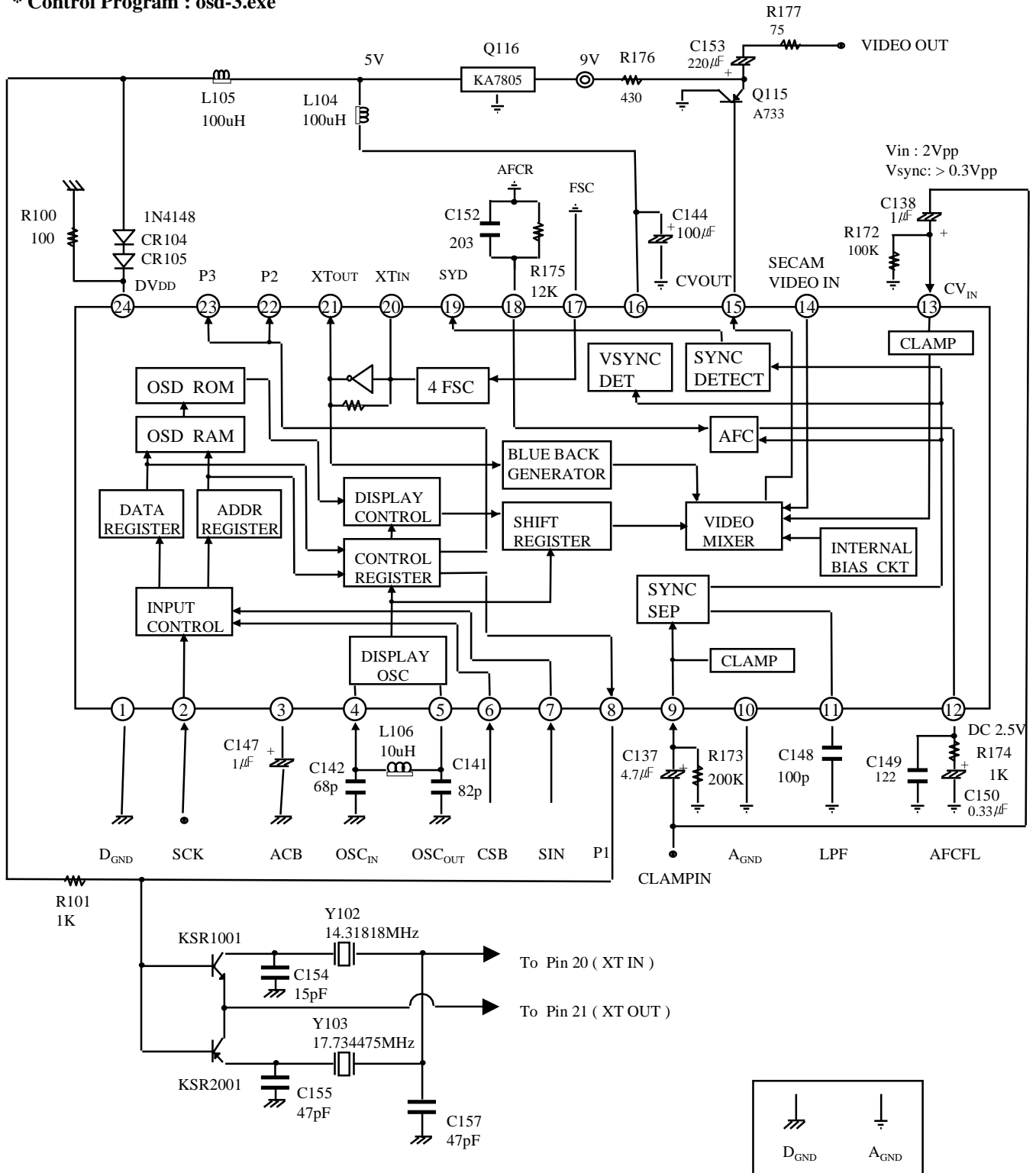
DA0 ~ DAA	Register	Content			Remark									
		State	Function											
0	PC0	0	<table border="1"> <tr> <td>PC1 \ PC0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>Hsync+Vsync output</td> <td>-</td> </tr> <tr> <td>1</td> <td>Port(PD0) output</td> <td>Character1 output</td> </tr> </table>		PC1 \ PC0	0	1	0	Hsync+Vsync output	-	1	Port(PD0) output	Character1 output	Pin 8 output mode setting
		PC1 \ PC0			0	1								
0	Hsync+Vsync output	-												
1	Port(PD0) output	Character1 output												
1														
1	PC1	0	<table border="1"> <tr> <td>PC3 \ PC2</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>Hsync(pin22) & Vsync(pin23) output</td> <td>Test mode</td> </tr> <tr> <td>1</td> <td>Port(PD2/PD3) output</td> <td>Character2, BLK2 output</td> </tr> </table>		PC3 \ PC2	0	1	0	Hsync(pin22) & Vsync(pin23) output	Test mode	1	Port(PD2/PD3) output	Character2, BLK2 output	Pin 22/23 output mode setting
		PC3 \ PC2			0	1								
0	Hsync(pin22) & Vsync(pin23) output	Test mode												
1	Port(PD2/PD3) output	Character2, BLK2 output												
1														
2	PC2	0	<table border="1"> <tr> <td>PC3 \ PC2</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>Hsync(pin22) & Vsync(pin23) output</td> <td>Test mode</td> </tr> <tr> <td>1</td> <td>Port(PD2/PD3) output</td> <td>Character2, BLK2 output</td> </tr> </table>		PC3 \ PC2	0	1	0	Hsync(pin22) & Vsync(pin23) output	Test mode	1	Port(PD2/PD3) output	Character2, BLK2 output	Pin 22/23 output mode setting
		PC3 \ PC2			0	1								
0	Hsync(pin22) & Vsync(pin23) output	Test mode												
1	Port(PD2/PD3) output	Character2, BLK2 output												
1														
3	PC3	0	<table border="1"> <tr> <td>PC3 \ PC2</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>Hsync(pin22) & Vsync(pin23) output</td> <td>Test mode</td> </tr> <tr> <td>1</td> <td>Port(PD2/PD3) output</td> <td>Character2, BLK2 output</td> </tr> </table>		PC3 \ PC2	0	1	0	Hsync(pin22) & Vsync(pin23) output	Test mode	1	Port(PD2/PD3) output	Character2, BLK2 output	Pin 22/23 output mode setting
		PC3 \ PC2			0	1								
0	Hsync(pin22) & Vsync(pin23) output	Test mode												
1	Port(PD2/PD3) output	Character2, BLK2 output												
1														
4	PD0	0	L output		Pin 8 output data setting									
		1	H output											
5	-	0	-		-									
		1	-											
6	PD2	0	L output		Pin 22 output data setting									
		1	H output											
7	PD3	0	L output		Pin 23 output data setting									
		1	H output											
8	-	0	-											
		1	-											
9	NT/ PAL	0	NTSC mode											
		1	PAL mode											
A	SECAM	0	NTSC or PAL mode											
		1	SECAM mode											

TEST CIRCUIT



APPLICATION CIRCUIT (APP-306)

* Control Program : osd-3.exe



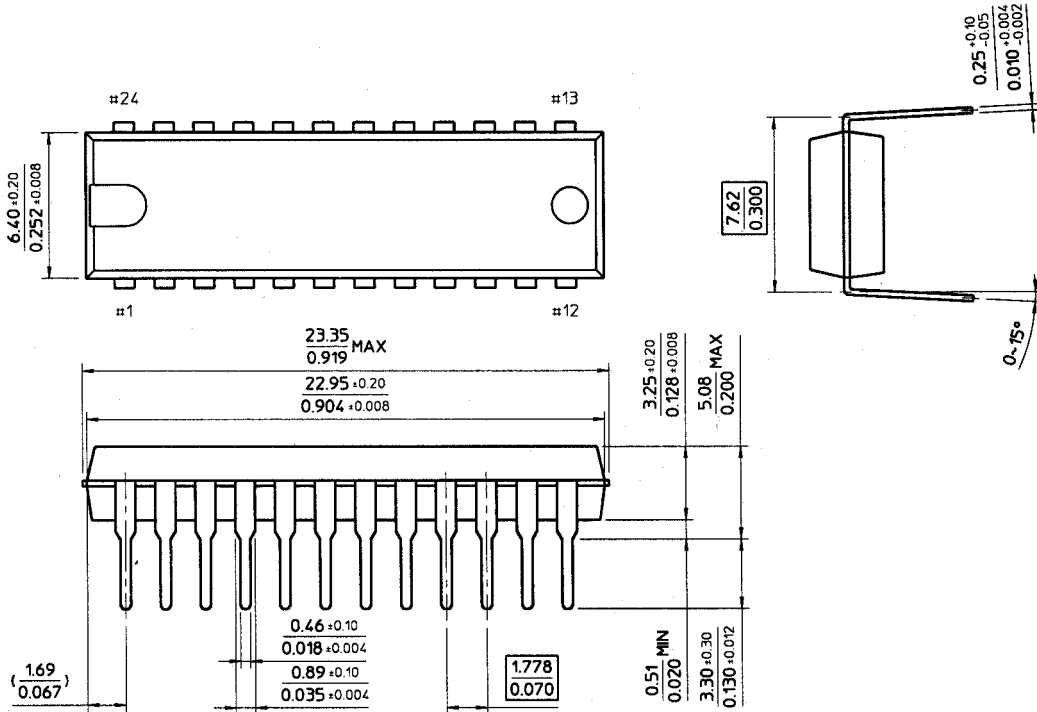
The circuit drawn above is for Demo Board.

- Y102 (4fsc X-TAL) → NTSC : 14.31818MHz
- Y103 (4fsc X-TAL) → PAL : 17.734475MHz

PACKAGE DIMENSIONS

24-SDIP-300

Dimensions in Millimeters/Inches



MEMO

SAMSUNG ELECTRONICS CO., LTD.
SEMICONDUCTOR BUSINESS BEIJING OFFICE
15FL., BRIGHT CHINA CHANG AN BLDG.,
NO.7, JIANGUOMEN, NEI AVENUE,
BEIJING, CHINA 100005
TEL 8610 - 6510 - 1234(0)
FAX 8610 - 6510 - 1545

HEAD OFFICE :
8/11FL., SAMSUNG MAIN BLDG.
250, 2 - KA. TAEPYUNG - RO,
CHUNG - KU, SEOUL, KOREA
TEL 2 - 727 - 7114
FAX 2 - 753 - 0967

SEMICONDUCTOR BUSINESS
SALES & MARKETING DIVISION :
15/16 FL., SEVERANCE BLDG., 84 - 11,
5 - KA, NAMDAEMOON - RO, CHUNG - KU
SEOUL, KOREA
TEL 2 - 259 - 1114
FAX 2 - 259 - 2468

SAMSUNG SEMICONDUCTOR INC.
3655 NORTH FIRST STREET,
SAN JOSE, CA 95134, U.S.A
TEL 408 - 954 - 7000
FAX 408 - 954 - 7873

SAMSUNG SEMICONDUCTOR EUROPE GMBH
SAMSUNG HOUSE,
AM KRONBERGER HANG 6,
65824 SCHWALBACH/TS
TEL 49 - 6196 - 663300
FAX 49 - 6196 - 663311

SAMSUNG SEMICONDUCTOR EUROPE LTD.
GREAT WEST HOUSE
GREAT WEST ROAD, BRENTFORD,
MIDDLESEX TW8 9DQ
TEL 181 - 380 - 7132
FAX 181 - 380 - 7220

SAMSUNG ELECTRONICS JAPAN CO., LTD.
HAMACHO CENTER BLDG.,
31 - 1, NIHONBASHI - HAMACHO, 2 - CHOME,
CHUO - KU, TOKYO 103, JAPAN
TEL 3 - 5641 - 9850
FAX 3 - 5641 - 9851

SAMSUNG ELECTRONICS HONGKONG CO., LTD.
65TH FL., CENTRAL PLAZA,
18 HARBOUR ROAD,
WANCHAI, HONG KONG
TEL 852 - 2862 - 6900
FAX 852 - 2866 - 1343

SAMSUNG ELECTRONICS TAIWAN CO., LTD.
30FL., NO.333, KEELUNG RD.,
SEC1, TAIPEI, TAIWAN, R.O.C
TEL 886 - 2 - 757 - 7292
FAX 886 - 2 - 757-7311

SAMSUNG ASIA PRIVATE LIMITED
80. ROBINSON ROAD, #20 - 01
SINGAPORE 068898
TEL 65 - 535 - 2808
FAX 65 - 227 - 2792

SAMSUNG ELECTRONICS CO., LTD.
SHANGHAI OFFICE
9F, SHANGHAI INTERNATIONAL TRADE CENTRE,
NO.2200 YANAN(W) RD.,
SHANGHAI, CHINA 200335
TEL 8621 - 6270 - 4168
FAX 8621 - 6275 - 2975