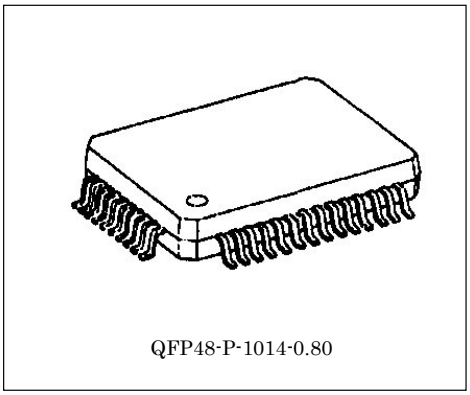
TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

TB1274BFG

LUMINANCE, CHROMA AND SYNCHRONIZING SIGNALS PROCESSOR IC FOR PAL / NTSC / SECAM COLOR TV



QFP48-P-1014-0.80

Weight : 0.83 g (Typ.)

TB1274BFG integrates luminance, chroma and synchronizing signals processing circuits for PAL / NTSC / SECAM color TV system.

TB1274BFG incorporates high performance picture quality compensation circuits in luminance section, an automatic PAL / NTSC / SECAM discrimination and decode circuits in chroma section, and an automatic 50 / 60 Hz discrimination circuit in synchronizing section.

Besides a crystal oscillator generates 4.43MHz, 3.58MHz and M/N-PAL clock signals internally for color demodulation. A horizontal PLL circuit is also built in this IC.

PAL / SECAM demodulation circuits which are adjustment-free circuits incorporates a 1H DL circuit inside for operating the base band signal processing system.

Also, TB1274BFG makes it possible to set and to control various functions through the built-in I^2C BUS line.

FEATURES

LUMINANCE SECTION

- Built-in chroma trap filter
- Y delay line
- Sharpness control
- Sub-Contrast control (-/+ 2dB)
- Black set-up

CHROMA SECTION

- Built-in 1H delay circuit (PAL / SECAM base band demodulation system)
- One crystal color demodulation circuit (4.43MHz, 3.58MHz, M/N-PAL)
- Automatic system discrimination system and forced system mode
- 1H delay line also serves as comb filter in NTSC demodulation
- Built-in band-pass and take-off filter, SECAM bell filter
- Sub-Color control (-/+2dB)

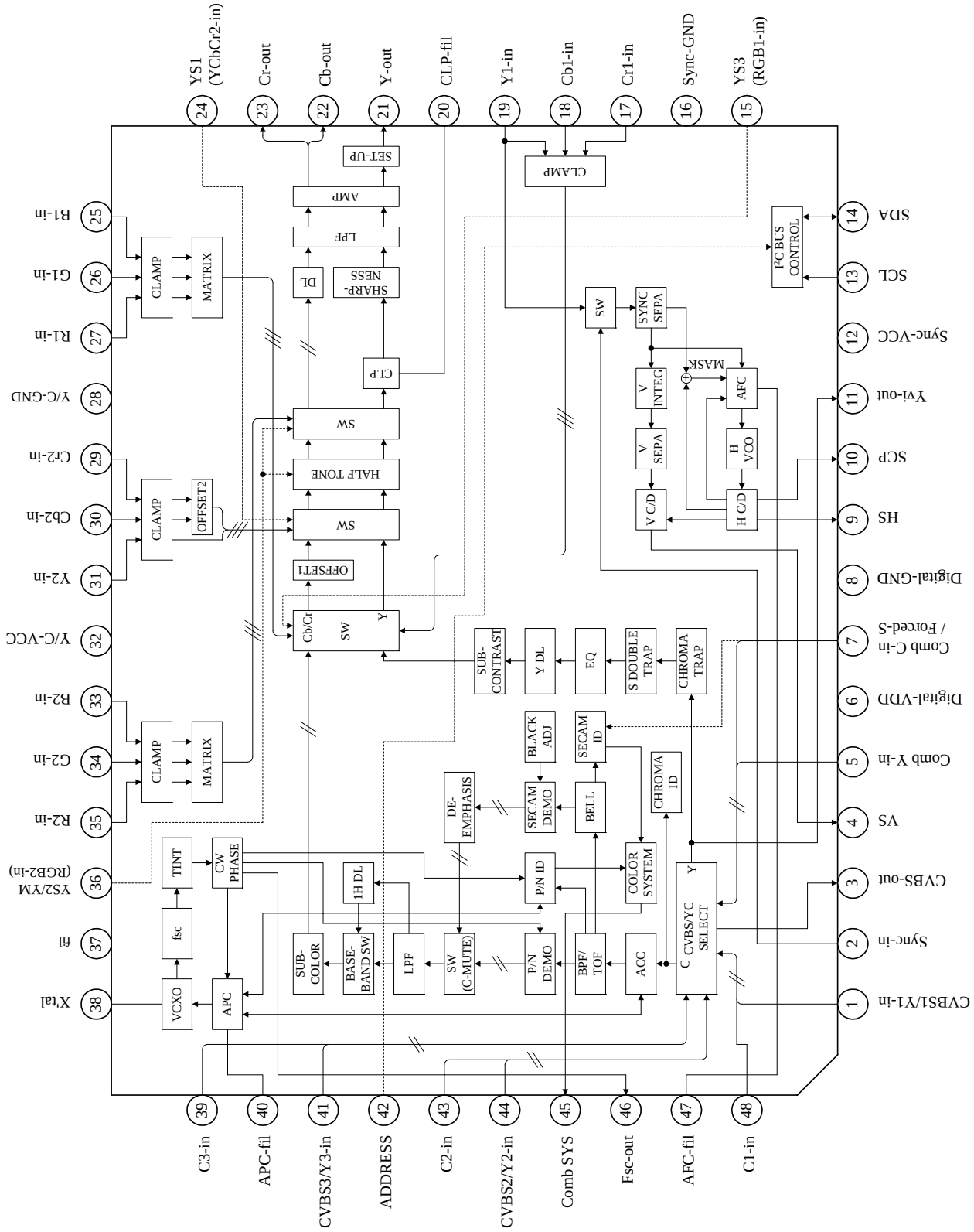
SYNCHRONIZING SECTION

- Built-in horizontal VCO resonator
- Adjustment-free horizontal and vertical oscillation by count-down circuit
- Automatic vertical frequency discrimination circuit
- Noise detection circuit

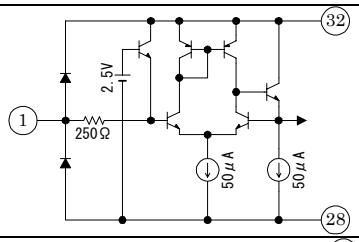
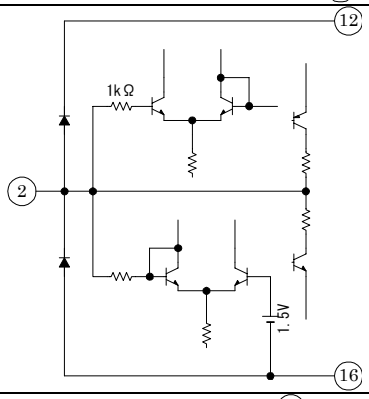
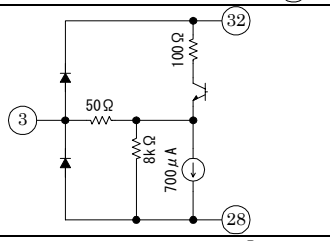
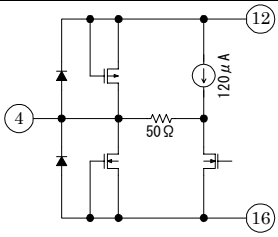
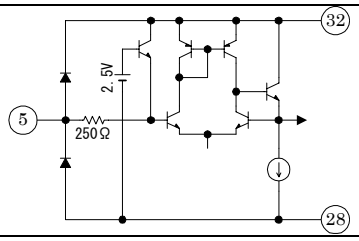
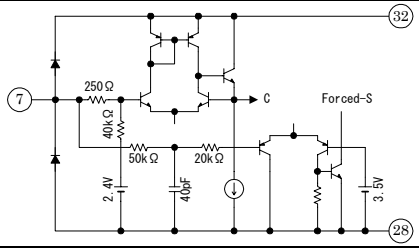
OTHERS

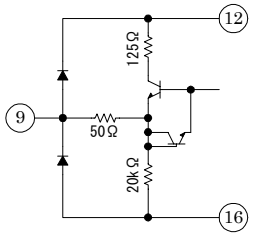
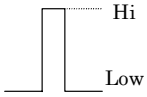
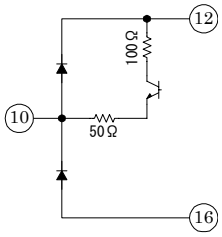
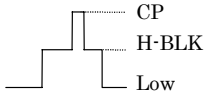
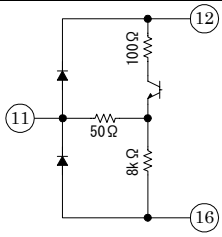
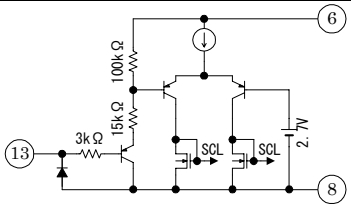
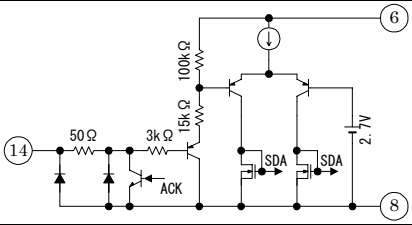
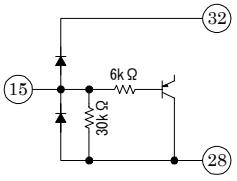
- Y/C out level control
- 4-channels inputs switching
- 2-input circuit for RGB
- 2-input circuit for Y/Cb/Cr
- Y/Cb/Cr outputs
- Cb/Cr offset adjustment
- Built-in pre filters for A/D converter

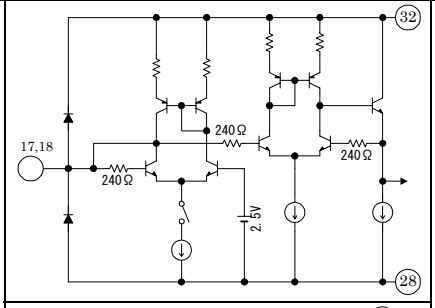
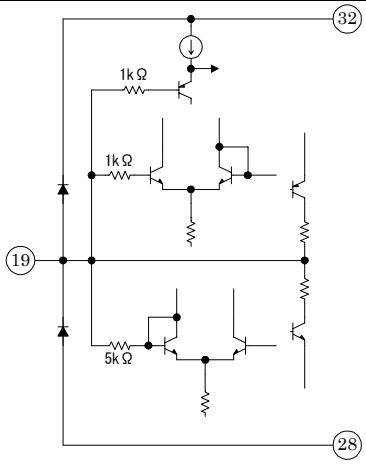
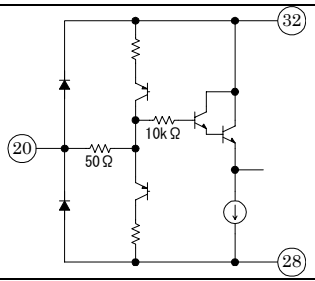
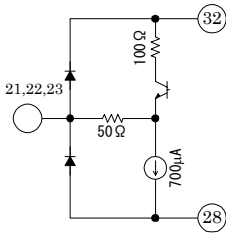
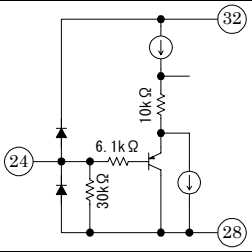
BLOCK DIAGRAM

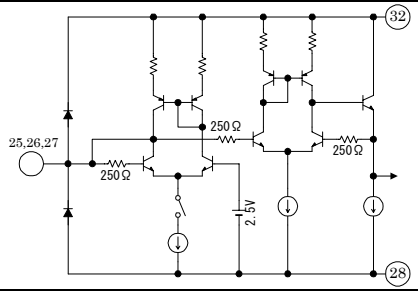
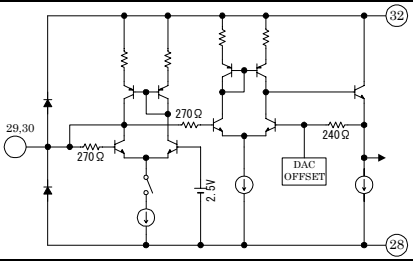
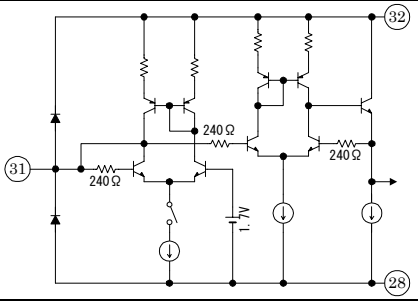
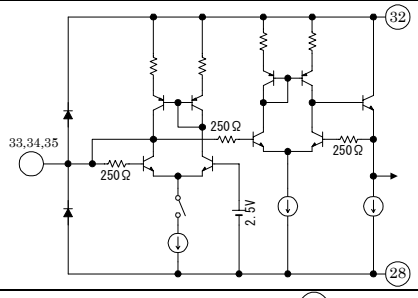
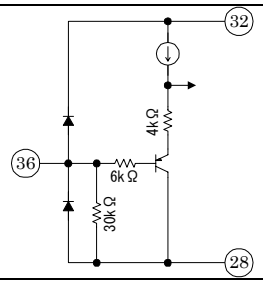


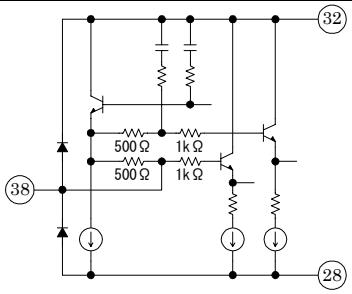
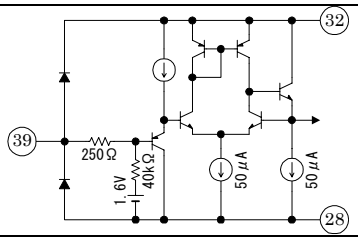
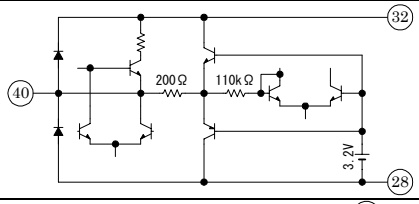
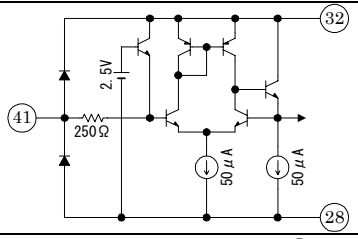
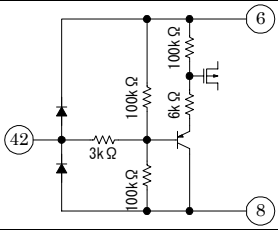
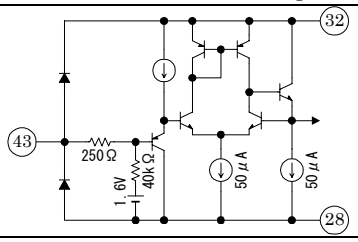
TERMINAL DESCRIPTIONS (YC-VCC/SYNC-VCC/D-VDD=5V and Ta=25℃, unless otherwise specified)

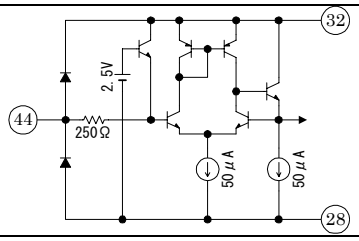
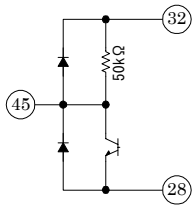
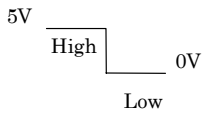
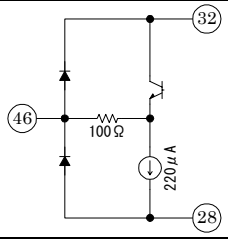
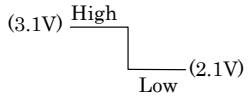
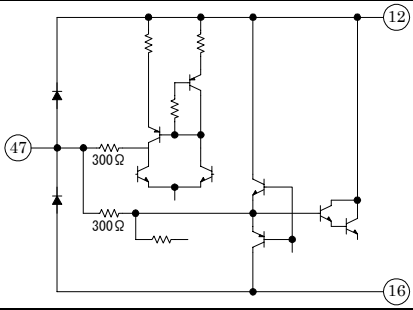
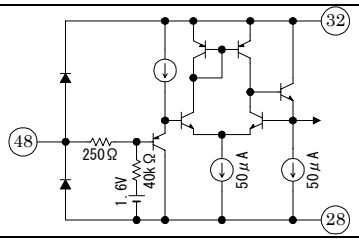
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
1	CVBS1/Y1-IN	Input CVBS1/Y1 signal through a clamping capacitor.		CVBS : 1Vp-p Y : 1Vp-p(with sync) DC : 1.8V
2	SYNC-IN	Input signal to synchronize.		1Vp-p (with sync) DC : 1.7V
3	CVBS-OUT	CVBS or Y+C signal output pin.		2Vp-p(with sync) DC : 0.6V
4	VS	Output pin of vertical synchronizing signal. Minimum pull-up resister is 6.8kΩ.		Hi Low 4.7V≦Hi≦5.2V 0V≦Low≦0.8V
5	COMB Y-IN	Input luminance signal from Comb filter through a clamping capacitor.		1Vp-p(with sync) DC : 1.8V
6	D-VDD	Power supply pin for DDS/BUS/V-CD/H-CD sections.	—	DC 5V
7	COMB C-IN / FORCED-S	Input chroma signal from Comb filter through a clamping capacitor. When this pin is connected to Vcc, color killer is OFF and SECAM ID is ON forcibly. (Forced SECAM mode) Refer to FUNCTION DESCRIPTION.		0.3Vp-p(Burst) DC : 2.4V 4.0V≦Forced-S≦5.0V (Th : 3.5V)

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
8	D-GND	GND pin for DDS/BUS/V-CD/H-CD sections.	—	
9	HS	Output pin of horizontal synchronizing signal. Minimum pull-down resister is 2.7kΩ.		 3.8V≦Hi≦4.6V 0≦Low≦1.0V
10	SCP	Sand Castle Pulse output pin. The clamping pulse and the horizontal blanking pulse are outputted.		 3.6V≦CP≦4.4V 1.6V≦H-BLK≦2.4V 0.0V≦Low≦0.8V with pull-down resister (7.5kΩ)
11	Yvi-OUT	Output pin to synchronize inputs. Y signal from video-SW is outputted.		1Vp-p(with sync) DC : 2.1V
12	SYNC-VCC	Power supply pin for liner SYNC/HVCO sections.	—	DC 5V
13	SCL	SCL pin for I²CBUS.		
14	SDA	SDA pin for I²CBUS.		
15	YS3 (RGB1-in)	Pin to switch main signals and RGB1 signals. If the voltage of this pin is HI and the RGB1-ENB data is “enable” via I²C BUS, RGB1-IN is selected. And its status is responded to the Read Bus data.		1.0V≦RGB1≦5.0V (Th : 0.7V)
16	SYNC-GND	GND pin for liner SYNC/HVCO sections.	—	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
17	Cr1-IN	Input Y1/Cb1/Cr1 signal through a clamping capacitor. (Selected by I²C BUS.) When Y/Cb/Cr1-IN is active, Y1 signal is synchronized.		Y : 1Vp-p(with sync) DC : 1.7V Cb/Cr : 0.7Vp-p(100% color bar) DC : 2.5V
18	Cb1-IN			
19	Y1-IN			
20	CLP-FIL	Connect a filter for clamping Y signal.		
21	Y-OUT	Y/Cb/Cr output pins. The output's amplitudes is variable from 0.5 to 1.6Vp-p by I²C BUS.		DC ; Y : 1.3V, Cb/Cr : 1.8V AC ; Y : 0.7Vp-p(0dB,non-sync) Cb/Cr : 0.7Vp-p(0dB)
22	Cb-OUT			
23	Cr-OUT			
24	YS1 (YCbCr2-in)	Pin to switch main signals and YCbCr2 signals.		1.0V≦YCbCr2≦5.0V (Th : 0.7V)

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
25	B1-IN	Input RGB1 signal through a clamping capacitor.(Selected by YS3 and I²C BUS.)		0.7Vp-p DC : 2.5V
26	G1-IN			
27	R1-IN			
28	Y/C-GND	GND pin for Y/C/Text/Video-SW/1HDL sections.	—	
29	Cr2-IN	Input Y2/Cb2/Cr2 signal through a clamping capacitor. (Selected by YS1.)		Y : 1Vp-p(with sync) DC : 1.7V
30	Cb2-IN			
31	Y2-IN			Cb/Cr : 0.7Vp-p(100% color bar) DC : 2.5V
32	Y/C-VCC	Power supply pin for Y/C/Text/ Video-SW/1HDL sections.	—	DC 5V
33	B2-IN	Input RGB2 signal through a clamping capacitor. (Selected by YS2.)		0.7Vp-p DC : 2.5V
34	G2-IN			
35	R2-IN			
36	YS2/YM (RGB2-in)	Pin to switch main signals and RGB2 inputs. Half-tone ON/OFF SW is also included. Half tone gain is selected by I²C BUS.		1.0V≦YM≦1.5V 2.5V≦RGB2≦5.0V (Th1 : 0.7V, Th2 : 2.0V)

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
37	FIL	Connect this terminal to Y/C VCC.	–	–
38	X'TAL	Pin to connect a 16.2MHz crystal. Recommended crystal : NR-18 NT162020A, made by NIHON DENPA KOGYO CO, LTD.		16.2MHz wave
39	C3-IN	Input C3 signal through a clamping capacitor.		0.3Vp-p(Burst) DC : 1.6V
40	APC-FIL	Connect APC filer.		
41	CVBS3/Y3-IN	Input CVBS3/Y3 signal through a clamping capacitor.		CVBS : 1Vp-p Y : 1Vp-p(with sync) DC : 1.8V
42	ADDRESS	Slave address setting pin. Select slave address. When this pin is open, 8A/8B$_H$ is selected. W: 88$_H$ 8A$_H$ 8E$_H$ R: 89$_H$ 8B$_H$ 8F$_H$		88/89$_H$≦1.3V 3.9V≦8E/8F$_H$ (Th1 : 1.5V, Th2 : 3.2V)
43	C2-IN	Input C2 signal through a clamping capacitor.		0.3Vp-p(Burst) DC : 1.6V

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT	INPUT / OUTPUT SIGNALS
44	CVBS2/Y2-IN	Input CVBS2/Y2 signal through a clamping capacitor.		CVBS : 1Vp-p Y : 1Vp-p(with sync) DC : 1.8V
45	COMB SYS	The status of color system is responded to pin 45 and pin 46. It is the same as Read BUS status. Refer to FUNCTION DESCRIPTION.		
46	Fsc-OUT	Sub-carrier output pin. Refer to FUNCTION DESCRIPTION.		AC : 0.84Vp-p DC : as blow fig. 
47	AFC-FIL	Connect AFC filter.		
48	C1-IN	Input C1 signal through a clamping capacitor.		0.3Vp-p(Burst) DC : 1.6V

Color system	Pin 45	Pin 46
M-PAL	Low	Low
4.43PAL, SECAM, B/W	High	Low
3.58/4.43NTSC	Low	High
N-PAL	High	High

WRITE MODE

SLAVE ADDRESS : 88_H / $8A_H$ / $8E_H$

SUB ADDRESS	MSB D7	D6	D5	D4	D3	D2	D1	LSB D0	PRESET	
80	P/N ID	P/N GW	TINT						0010	0000
81	SUB-CONTRAST				SUB-COLOR				1000	1000
82	SHARPNESS GAIN				SHARPNESS EQ		SHARPNESS f_0		1000	0000
83	0	0	Y-OUT LEVEL						0010	0000
84	0	0	C-OUT LEVEL						0010	0000
85	LPF	S-D TRAP	C-TRAP SW	FILTER SW	BPF Q		BPF f_0		0000	0000
86	N-COMB	Y-DL				COLOR SYSTEM			0010	1000
87	Cb/Cr-MUTE	HALF TONE	RGB SELECT		VIDEO SELECT				0000	0000
88	Cb OFFSET1				Cr OFFSET1				1000	1000
89	Cb OFFSET2				Cr OFFSET2				1000	1000
8A	MVM	AFC GAIN		V C/D MODE		V-FREQ			0000	0000
8B	S B-Y ADJ				S R-Y ADJ				1000	1000
8C	S-INHBT	S ID	S GP		S V-ID	BELL f_0	BELL/HPF		0000	0000
8D	AUTO-SW	0	0	0	HS-PH	0	SETUP-SW	RGB1 ENB	1000	0000
8E	0	VP-PH	1	0	0	0	0	0	0010	0000
8F	TEST MODE								0000	0000

READ MODE

SLAVE ADDRESS : 89_H / $8B_H$ / $8F_H$

SUB ADDRESS	MSB D7	D6	D5	D4	D3	D2	D1	LSB D0
00	POR	COLOR SYSTEM		X'TAL		N-DET		H-LOCK
01	V-FREQ	V-STD	C ID	V-SIG	V15	*	*	1

Note) * ; don't care

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BUS CONTROL FUNCTION

WRITE MODE

SLAVE ADDRESS : 88_H / $8A_H$ / $8E_H$

ITEM / Number of bits	FUNCTION	VARIABLE RANGE	PRESET
TINT / ⑥	TINT adjustment for NTSC	00H : -33deg～3F H : +33deg (1LSB=1.1deg)	0deg
P/N GW / ①	PAL/NTSC gate width	0 : 2.0 μ s, 1 : 3.2 μ s	2.0 μ s
P/N ID / ①	PAL/NTSC sensitivity SW	0 : Normal, 1 : Low	Normal
SUB-COLOR / ④	Sub-color control	0 H : -2dB ～ F H : 2dB	0dB
SUB-CONTRAST / ④	Sub-contrast control	0 H : -2dB ～ F H : 2dB	0dB
SHARPNESS f_0 / ②	Sharpness center frequency changing	00 : 2.5MHz, 01 : 3.2MHz 10 : 4.0MHz, 11 : OFF	2.5MHz
SHARPNESS EQ / ②	Sharpness equalizer characteristic (Evaluation with 2T-pulse)	00 : 1 : 1.2, 01 : 1 : 1 10 : 1.2 : 1, 11 : 1.4 : 1	1 : 1.2
SHARPNESS GAIN / ④	Sharpness gain control	0 H : -6dB ～ F H : 6dB	0dB
Y-OUT LEVEL / ⑥	Y output level control (pin 21)	00 H : 0.5 ～ 3F H : 1.6Vp-p	1.05Vp-p
C-OUT LEVEL / ⑥	Cb/Cr output level control (pin 22/23)	00 H : 0.5 ～ 3F H : 1.6Vp-p	1.05Vp-p
BPF f_0 / ②	BPF/TOF f_0 adjustment	00 : -400kHz, 01 : +0kHz, 10 : +400kHz, 11 : OFF(by-pass)	-400kHz
BPF Q / ②	BPF/TOF Q adjustment	00 : 1.0, 01 : 1.5 10 : 2.0, 11 : 2.5	1.0
FILTER SW / ①	BPF/TOF switch	0 : BPF, 1 : TOF	BPF
C-TRAP SW / ①	Chroma trap switch This function is controlled automatically by setting of "VIDEO SELECT" and "Y/C-AUTO". Refer to FUNCTION DESCRIPTION.	0 : ON, 1 : OFF	ON
S-D TRAP / ①	SECAM double trap switch This function is controlled automatically by setting of "VIDEO SELECT" and "Y/C-AUTO". Refer to FUNCTION DESCRIPTION.	0 : OFF, 1 : ON	OFF
LPF / ①	Y/Cb/Cr LPF switch	0 : ON, 1 : OFF(by-pass)	ON
COLOR SYSTEM / ③	Color system switching Europe automatic mode ; 4.43PAL, 4.43NTSC, 3.58NTSC, SECAM South America automatic mode ; 3.58NTSC, M-PAL, N-PAL Refer to FUNCTION DESCRIPTION.	000 : Europe automatic 001 : South America automatic 010 : 3.58NTSC 011 : 4.43NTSC 100 : 4.43PAL 101 : SECAM 110 : M-PAL, 111 : N-PAL	Europe automatic
Y-DL / ④	Y-DL time adjustment (1LSB=40ns) Refer to FUNCTION DESCRIPTION.	0000 : 120 ～ 1010 : 520ns 1011 ～ 1111 : don't use	320ns

ITEM / Number of bits	FUNCTION	VARIABLE RANGE	PRESET
N-COMB / ①	1H addition switch, when NTCS.	0 : OFF, 1 : ADD	OFF
VIDEO SELECT / ④	Selection of input video signals	Refer to FUNCTION DESCRIPTION.	0000
RGB SELECT / ②	Selection of input sources. Refer to FUNCTION DESCRIPTION.	00 : Main, 01 : YCbCr1 10 : RGB1, 11 : don't use	Main
HALF TONE / ①	Half tone gain switch	0 : -10dB, 1 : -6dB	-10dB
Cb/Cr-MUTE / ①	Cb/Cr output mute switch	0 : OFF, 1 : ON	OFF
Cb/Cr OFFSET1 / ④/④	Cb/Cr offset adjustment (main route)	0 H : -12 ～ F H : +10.5mV	0mV
Cb/Cr OFFSET2 / ④/④	Cb/Cr offset adjustment (YCbCr2 input)	0 H : -12 ～ F H : +10.5mV	0mV
V-FREQ / ③	V count down frequency switch. Automatic mode 1 ; 50/60Hz automatic distinction. At no-signal, the last statement is kept. Right after power-on, 50Hz mode is run. Automatic mode 2 ; 50/60Hz automatic distinction. And 50Hz mode is run at no-signal. Refer to FUNCTION DESCRIPTION.	000 : Automatic mode 1, 001 : 50Hz, 010 : 60Hz, 011 : Automatic mode 2, 100 : Forced 312.5H (AFC free-run), 101 : Forced 262.5H (AFC free-run), 110 : Forced 313H (AFC free-run), 111 : Forced 263H (AFC free-run)	Automatic mode 1
V C/D MODE / ②	V count down judge switch. Refer to FUNCTION DESCRIPTION.	00 :Normal 1, 01 : Teletext, 10 : Fast, 11 : Normal 2 note) Normal 1 : One time detection Normal 2 : Continuously detection	Normal 1
AFC SENS / ②	AFC sensitivity switch	00 : +6dB, 01 : 0dB, 10 : -6dB, 11 : -17dB	+6dB (data : 00)
MVM / ①	Macrovision Mask + AFC Mask	0 : Narrow, 1 : Always masked	Narrow
S R-Y ADJ / ④	SECAM R-Y black adjustment	0 H : -10 ～ F H : 8.8mV	0mV
S B-Y ADJ / ④	SECAM B-Y black adjustment	0 H : -10 ～ F H : 8.8mV	0mV
BELL/HPF / ②	SECAM bell/HPF switching. Or the high frequency side on SECAM bell filter is boosted. Refer to FUNCTION DESCRIPTION.	00 : Bell, 01 : Boost 1, 10 : Boost 2, 11 : HPF	Bell
BELL f_0 / ①	BELL f_0 adjustment	0 : Normal, 1 : +15kHz	Normal
S V-ID SW / ①	SECAM V-ID switch	0 : OFF, 1 : ON	OFF
S GP / ②	SECAM gate position adjustment (Its width is same)	00 : Normal, 01 : 0.4 μ s delay, 10 : Normal, 11 : 0.4 μ s forward	Normal
S ID / ①	SECAM sensitivity switch	0 : Normal, 1 : Low	Normal
S-INHBT / ①	SECAM inhibition switch	0 : Normal, 1 : Inhibited	Normal
RGB1 ENB / ①	Enable YS3 to switch to RGB1-IN. Refer to FUNCTION DESCRIPTION.	0 : Disable, 1 : Enable	Disable

ITEM / Number of bits	FUNCTION	VARIABLE RANGE	PRESET
AUTO SW / ①	Auto Video select mode SW Select automatically for CVBS, Y/C and Comb mode by setting of "AUTO-SW" and "VIDEO SELECT". And also select automatically for C-Trap and S-D Trap. Refer to FUNCTION DESCRIPTION.	0 : Auto select Data of SA 07H D3 0 : Auto Y/C select mode 1 : Auto Comb select mode 1 : Manual select	Manual Select
VP-PH / ①	Switching for VP output phase	0 : +0.75H, 1 : +0.6875H	+0.75H
SETUP-SW / ①	Y black level set-up	0 : Normal, 1 : Set-up	Normal
HS-PH / ①	HS Output phase switch	0 : H-Sync(4.7 μ s), 1 : GP(3.2 μ s)	H-Sync
TEST MODE / ⑧	Factory test mode. Set all zero.	—	00_H

READ MODE

SLAVE ADDRESS : 89_H / $8B_H$ / $8F_H$

ITEM / Number of bits	FUNCTION	VARIABLE RANGE
H-LOCK / ①	H. Lock detection	0 : Un-lock, 1 : Lock
N-DET / ②	Noise judgment	00 : SN > 40dB, 01 : 10dB > SN, 10 : 40dB > SN > 20dB, 11 : 20dB > SN > 10dB
X'TAL / ②	Crystal mode judgment	00 : 4.433619MHz(PAL) 01 : 3.579545MHz(NTSC) 10 : 3.575611MHz(M-PAL) 11 : 3.582056MHz(N-PAL)
COLOR SYSTEM / ②	Color system judgment	00 : B/W, 01 : PAL 10 : NTSC, 11 : SECAM
POR / ①	Power On Reset	0 : Normal, 1 : Resistor preset
V15 / ①	Status of pin 15 voltage Refer to FUNCTION DESCRIPTION.	0 : Low, 1 : High
V-SIG / ①	Internal V. pulse detection for V. lock	0 : Existing, 1 : Not existing
C ID / ①	Input signal condition (Detection of burst signal on C-IN pins) Refer to FUNCTION DESCRIPTION.	0 : Not detected (CVBS), 1 : Detected (Y/C)
V-STD / ①	Decision on the standard of the vertical frequency. When no-signal, 1 : STD is responded.	0 : Non-STD, 1 : STD
V-FREQ / ①	Vertical frequency judgment. Right after power-on, 0 : 50Hz is responded. At no-signal, the last statement is kept.	0 : 50Hz, 1 : 60Hz
SA 01 D0 / ①	The bit for product ident	0 : TB1239**, 1 : TB1274**

I²C BUS START-UP PROCEDURE

Just after power-on, TB1274BFG starts tuning automatically. Initially, I²C-BUS decoder works, and then H-VCO alignment circuit works. The following figure describes the start-up status. While Vcc is lower than 3.4V, Power-On-Reset flag indicates 1. To make TB1274BFG functioning properly, verify that POR bit is 0 by reading the I²C BUS status data before writing data. POR is released by reading status data. Please refer the following figure and optimize the software on the set.

1. Power on the device.
2. Read the I²C BUS status bytes until POR bit indicates 0.
3. Write all bytes.

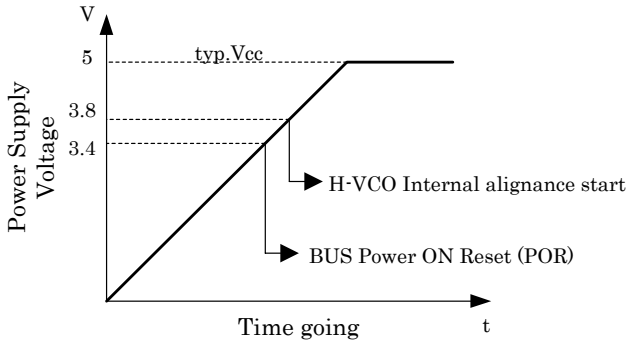


Fig. Start-up status in the IC

DATA TRANSFER FORMAT VIA I^2C BUS

Slave address : select slave address for setting voltage of pin 42.

Pin42–GND(<1.3V) : 88H

A6	A5	A4	A3	A2	A1	A0	W / R
1	0	0	0	1	0	0	0 / 1

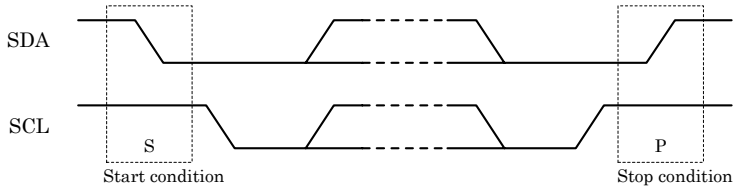
Pin42–Open : 8AH

A6	A5	A4	A3	A2	A1	A0	W / R
1	0	0	0	1	0	1	0 / 1

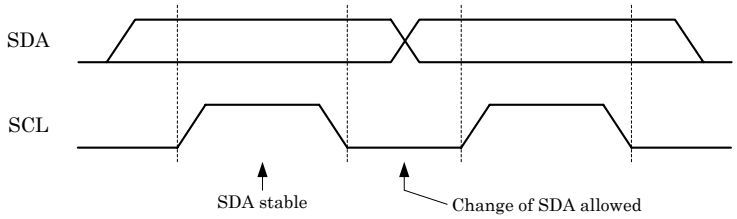
Pin42–VDD(>3.9V) : 8EH

A6	A5	A4	A3	A2	A1	A0	W / R
1	0	0	0	1	1	1	0 / 1

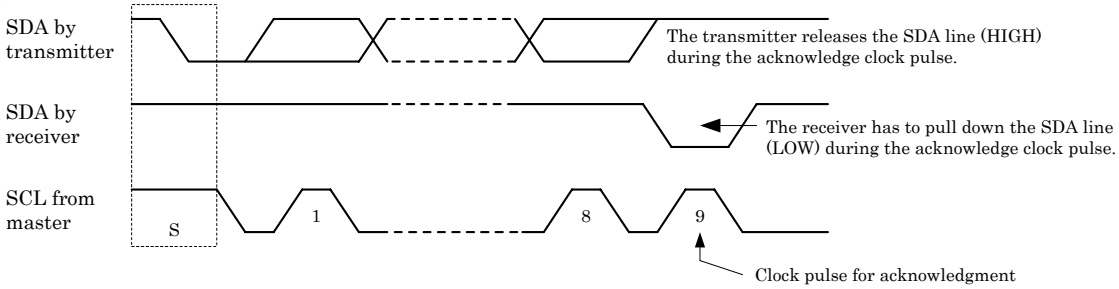
Start and stop condition



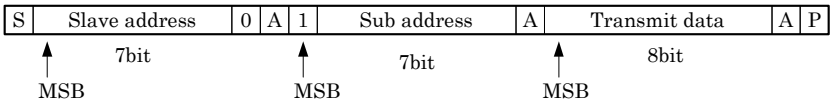
Bit transfer



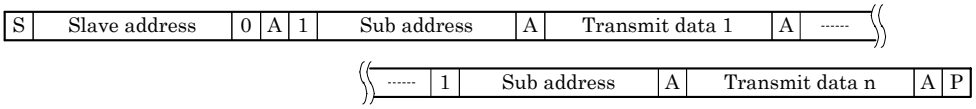
Acknowledge



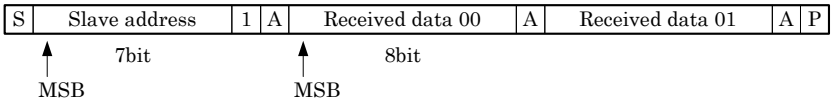
Data transmit format 1



Data transmit format 2



Data receive format

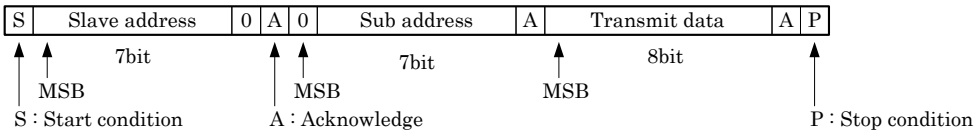


At the moment of the first acknowledge, the master transmitter becomes a master receiver and the slave receiver becomes a slave transmitter. This acknowledge is still generated by the slave.

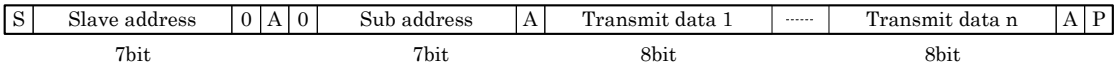
The Stop condition is generated by the master.

Option Data transmit format

Automatic increment mode 1



Automatic increment mode 2



In this transmission method, data is set on automatically incremented sub-address from the specified sub-address.

I^2C BUS Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Low level input voltage	V_{IL}	0	—	1.3	V
High level input voltage	V_{IH}	3.8	—	Vcc	V
Low level output voltage at 3 mA sink current	V_{OL1}	0	—	0.4	V
Input current each I/O pin with an input voltage between 0.1 VDD and 0.9 VDD	I_i	−10	—	10	μA
Capacitance for each I/O pin	C_i	—	—	10	pF
SCL clock frequency	f_{SCL}	0	—	100	kHz
Hold time START condition	$t_{HD;STA}$	4.0	—	—	μs
Low period of SCL clock	t_{LOW}	4.7	—	—	μs
High period of SCL clock	t_{HIGH}	4.0	—	—	μs
Set-up time for a repeated START condition	$t_{SU;STA}$	4.7	—	—	μs
Data hold time	$t_{HD;DAT}$	50	—	—	ns
Data set-up time	$t_{SU;DAT}$	250	—	—	ns
Set-up time for STOP condition	$t_{SU;STO}$	4.0	—	—	μs
Bus free time between a STOP and START condition	t_{BUF}	4.7	—	—	μs

FUNCTION DESCRIPTION

VIDEO SELECT, AUTO-SW

1) "AUTO-SW" = (1) Manual select

When "AUTO-SW" is (1) Manual select, input signal is selected by the BUS as Fig. 1 and Table 1. Mainly, CVBS-OUT(pin 3) is used for the comb filter input, and Yvi-OUT(pin 11) is used for synchronization(pin 2). Besides, on chroma line from video SW to main route, the peak detection is done during the burst period. The result is responded to the Read BUS data, C ID.

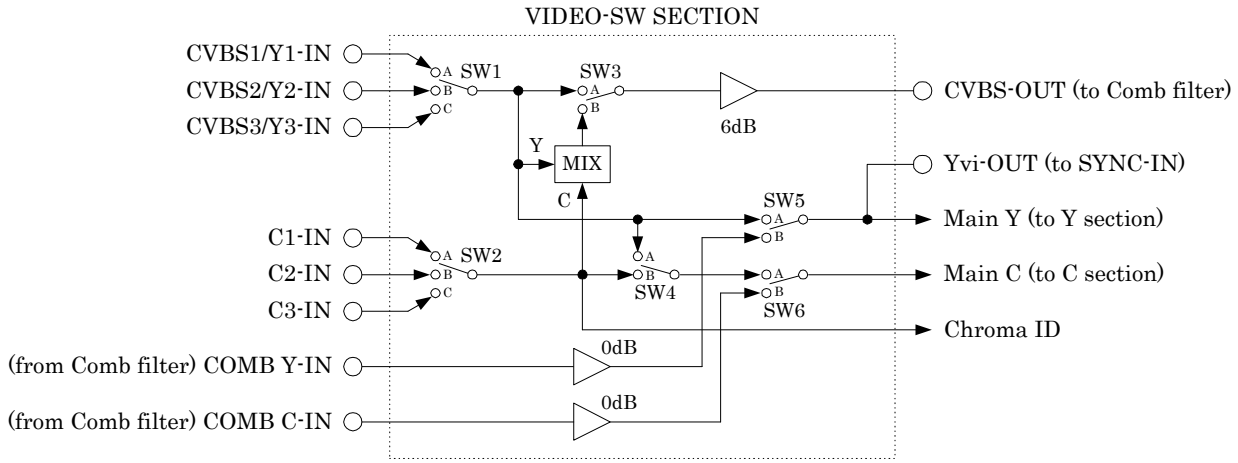


Fig. 1 Signal route at Video SW section

Table 1 Selected input and pin 3/11 output from Video SW section

BUS DATA	SW mode						To Y/C section		Output from V-SW	
	1	2	3	4	5	6	Main Y	Main C	CVBS-out	Yvi-out
0000	A		A	A	A	A	CVBS1	CVBS1	CVBS1	CVBS1
0001	B		A	A	A	A	CVBS2	CVBS2	CVBS2	CVBS2
0010	C		A	A	A	A	CVBS3	CVBS3	CVBS3	CVBS3
0100	A	A	B	B	A	A	Y1	C1	Y1+C1	Y1
0101	B	B	B	B	A	A	Y2	C2	Y2+C2	Y2
0110	C	C	B	B	A	A	Y3	C3	Y3+C3	Y3
1000	A		A		B	B	COMB Y	COMB C	CVBS1	COMB Y
1001	B		A		B	B	COMB Y	COMB C	CVBS2	COMB Y
1010	C		A		B	B	COMB Y	COMB C	CVBS3	COMB Y
others	—	—	—	—	—	—	Don't use.			

2) "AUTO-SW" = (0) Auto select

Depending on this function and VIDEO SELECT, can select Auto Y/C select mode or Auto Comb select mode (Table 2). The input system chose automatically by the sate of color system detection and C-ID (Chroma ident detection). And C-TRAP and S-D TRAP selected also automatically.

Table 2 The changing Selective Mode

SA07H D3	Selective Mode	Content
0	Auto Y/C select	Automatic input select CVBS input or Y/C input
1	Auto Comb select	Automatic input select Y/C-input and comb Y/C-input

Table 3 The changing input system

SA07H D1	SA07H D0	Input system
0	0	CVBS1 system
0	1	CVBS2 system
1	0	CVBS3 system
1	1	Don't use.

Table 4 The changing input system and The changing TRAP

Selective Mode	The state of detection		The changing input system			The changing TRAP	
	C-ID	Color System	Y	C	CVBS-out	C-TRAP	S-D TRAP
Auto Y/C Select	Detected	4.43PAL, M/N-PAL, 3.58/4.43NTSC	Y	C	Y + C	OFF	OFF
		SECAM					
		B/W					
	Not detected	4.43PAL, M/N-PAL, 3.58/4.43NTSC	CVBS	CVBS	CVBS	ON	
		SECAM					ON
		B/W				OFF	OFF
Auto Comb Select	Detected	4.43PAL, M/N-PAL, 3.58/4.43NTSC	Y	C	Y + C		
		SECAM					
		B/W					
	Not detected	4.43PAL, M/N-PAL, 3.58/4.43NTSC	Comb-Y	Comb-C	CVBS		
		SECAM	CVBS	CVBS	CVBS	ON	ON
		B/W				OFF	OFF

Table 5 The neglecting control items

Item	Content
SA07H D2 (: VIDEO SELECT)	Neglecting date setting
SA05H D5 : C-TRAP	
SA05H D6 : S-D TRAP	

Note) Depending on the input signal state, this function may malfunction.

EXTERNAL INPUT SWs

External inputs are selected by the BUS data and fast SWs. Final outputs from pin 21/22/23 are shown in Table 6. RGB1-IN interface complies with SCART connector. Therefore it is active, when RGB1-IN is enable by the BUS data and when YS3(pin 15) is also high. The status of YS3(pin 15) is responded to the Read BUS data, V15.

Table 6 Outputs from pin 21/22/23

RGB SELECT	RGB1 ENB	YS3 (RGB1)	YS1 (YCbCR2)	YS2 (RGB2)	Output
00	0	L	L	L	Main (from V-SW)
		H			
	1	L			
		H			RGB1
01	0	L			YCbCr1
		H			
	1	L			
		H			RGB1
10	0	L			RGB1
		H			
	1	L			
		H			
11	—	—			—
—	—	—	H		YCbCr2
—	—	—	L	H	RGB2
—	—	—	H		

RGB SELECT/RGB1 ENB : I²C BUS data, YS1/2/3 : Fast SW

COLOR SYSTEM

Distinguishable color systems are selected by the write BUS data, COLOR SYSTEM. The demodulated color system is responded to the read BUS data, COLOR SYSTEM and X'TAL. (Refer to BUS CONTROL FUNCTION) The system data is also responded to Comb SYS(pin 45) and fsc-OUT(pin 46) as Table 7. If distinguishable color system signal is not received, the system data is responded with B/W.

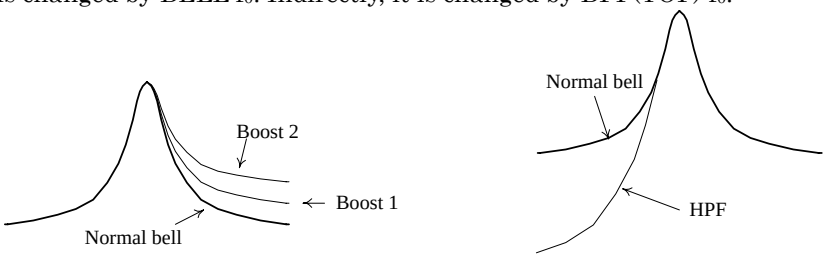
Table 7 DC level of pin 45 and 46 on each color system

COLOR SYSTEM	Pin 45	Pin46
M-PAL	Low	Low
4.43PAL, SECAM, B/W	High	Low
3.58/4.43NTSC	Low	High
N-PAL	High	High

Besides, if pin 7 is connected to V_{CC}(more than 3.5V), Forced SECAM mode is active. In this mode, SECAM system is identified forcibly. It has priority over the BUS selection.

SECAM BELL FILTER

SECAM bell filter characteristics can be changed by the BUS data, BELL/HPF. The group delay near chroma band is corrected by changing filter characteristic. As a result, S/N looks better. Besides, center frequency f_0 of bell is changed by BELL f_0. Indirectly, it is changed by BPF(TOF) f_0.



(a) Boost mode (b) HPF mode

Fig.2 SECAM bell filter characteristics

VERTICAL COUNT-DOWN

In Automatic of V C/D MODE, the vertical synchronization is controlled by internal PLL. In Fast mode, it is synchronized with the inputted synchronizing signal and the pull-in time is short. Furthermore the time is shorter in Very fast mode by the expanded pull-in range. Pull-in range of vertical count-down is determined by the BUS data, V C/D MODE and V-FREQ as Table 8.

Table 8 V C/D pull-in range

V C/D MODE / V FREQ		Normal 1, 2	Teletext	Fast
		00, 11	01	10
000	Automatic 1	224-353H		32-353H
001	50Hz	274-353H		32-353H
010	60Hz	224-297H		32-297H
011	Automatic 2	224-353H		32-353H
100	312.5H	Forced 312.5H mode & AFC free-run		
101	262.5H	Forced 262.5H mode & AFC free-run		
110	313H	Forced 313H mode & AFC free-run		
111	263H	Forced 263H mode & AFC free-run		

00 ; Normal 1 Normal vertical input mode 1. It is good performance of vertical phase keeping for standard TV signal sync. And vertical output phase that is detected first time is kept always. And this mode can detect teletext or VCR skew sync (non-standard sync).

01 ; Teletext This mode is less performance of vertical phase keeping for standard TV signal sync against “Normal”. However, pull-in speed is faster few vertical periods than “Normal”. Therefore this mode is recommended for tesetext sync.
On the other hand, this mode can detect standard TV signal sync in the state of stability but it is less performance of vertical phase keeping in week signal as about –3dB against “Normal”.

10 ; Fast This mode is same performance of vertical phase keeping for standard TV signal sync of “Teletext”. But it is faster pull-in speed faster than “Teletext” because pull-in ranges wider than “Teletext”. (refer to Table 8)
Therefore, this mode is better to use when channel changing, but is not recommended to use in the state of stability or in week signal due to too wide pull-in range and incorrect actions of vertical keeping appearing.

11 ; Normal 2 Basic detecting function is same as “Normal 1”. And in “Normal 1” mode, the vertical output phase that is detected first time is kept, however, in this mode, the vertical output phase is detected always.

Y-DL ADJUSTMENT

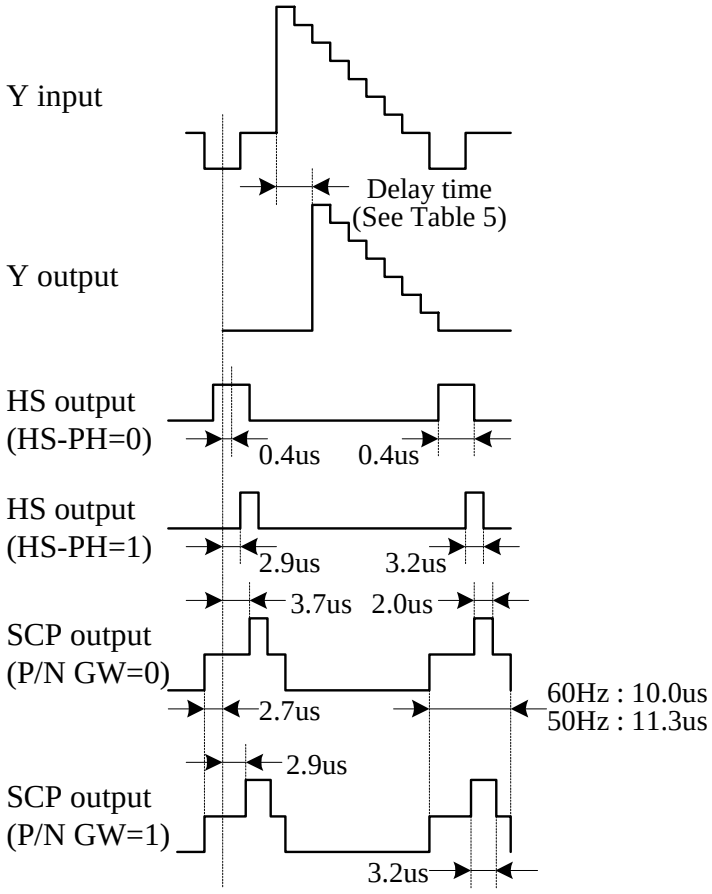
Table 9 shows Y output delays against Y input on condition with BPF=f_0, Q=2.0, Y-DL=Min and LPF=ON. Y-out signal can be delayed by the BUS data, Y-DL. The adjustment time of one step is 40ns.

Table 9 Y delays according to the color system

Color system	Y delay (ns)
PAL	450
NTSC	450
SECAM	650

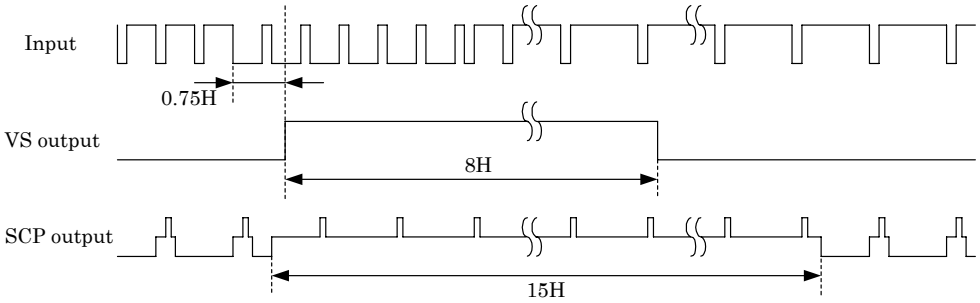
PULSES TIMMING

HORIZONTAL PERIOD (Typical output phase of horizontal pulses)

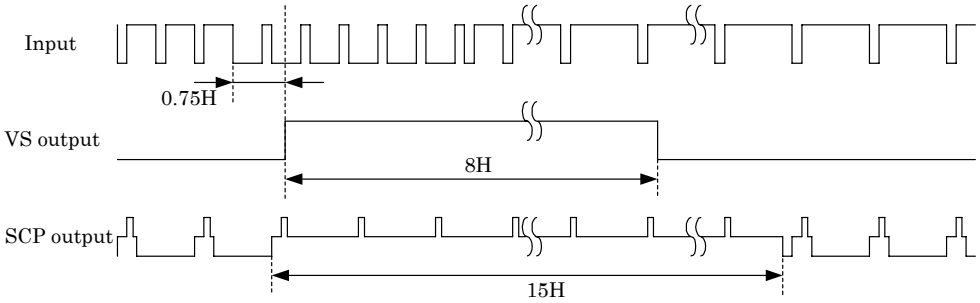


VERTICAL PERIOD (Typical output phase of vertical pulse)

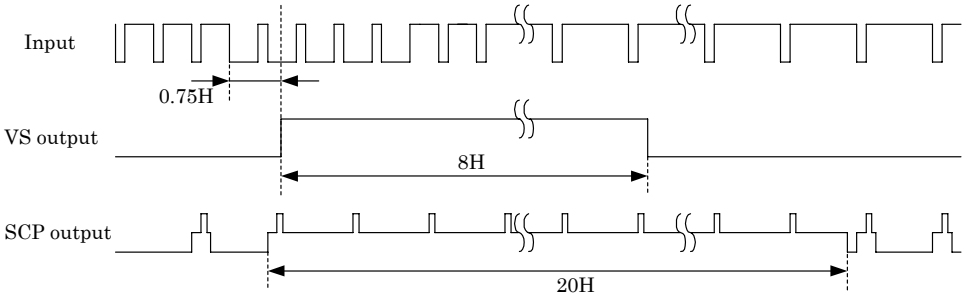
60Hz ODD



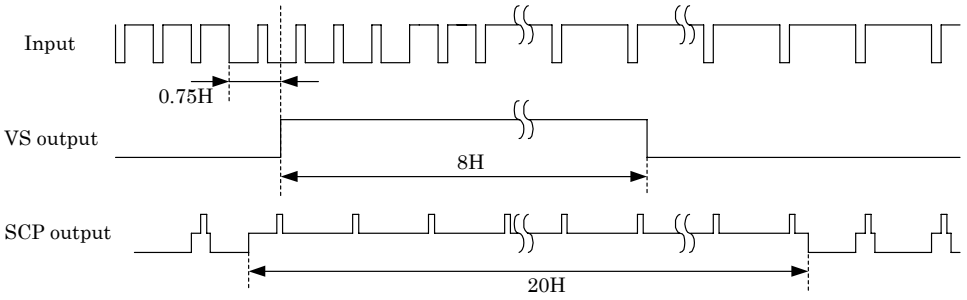
60Hz EVEN



50Hz ODD



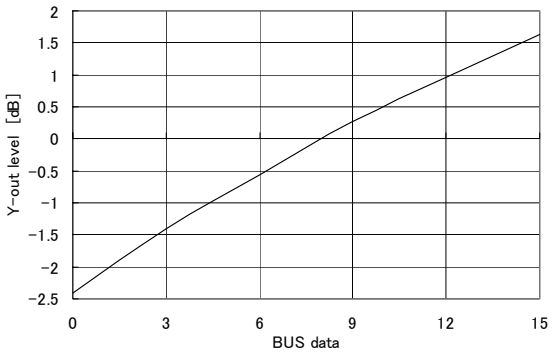
50Hz EVEN



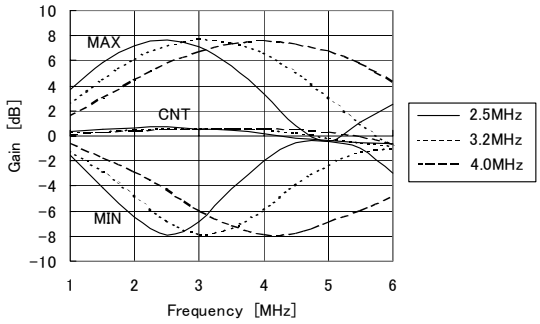
MISCELLANEOUS CHARACTERISTICS

SHARPNESS=OFF, LPF=OFF. Other BUS data is preset, unless otherwise specially.

Sub-contrast characteristic

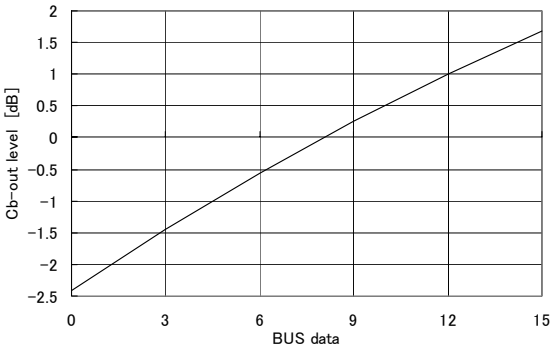


Sharpness characteristics

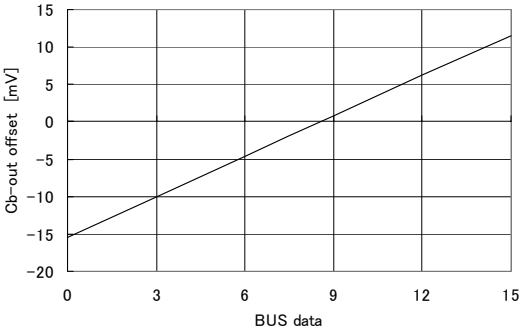


INPUT : RAMP 0.7Vp-p

Sub-color characteristic

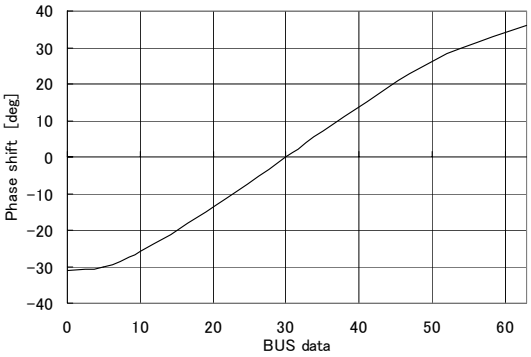


Cb/Cr offset1 characteristic

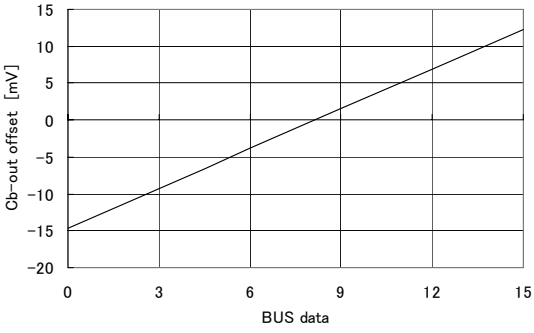


INPUT : 4.43PAL 75% color bar (CVBS1-IN)

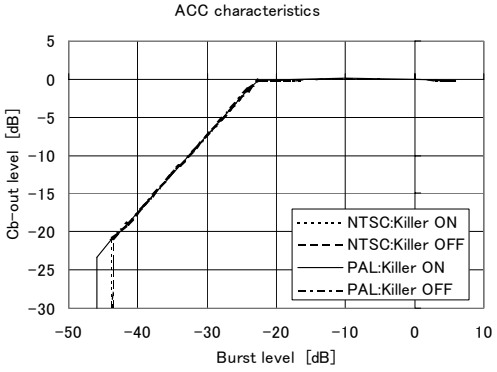
TINT characteristic

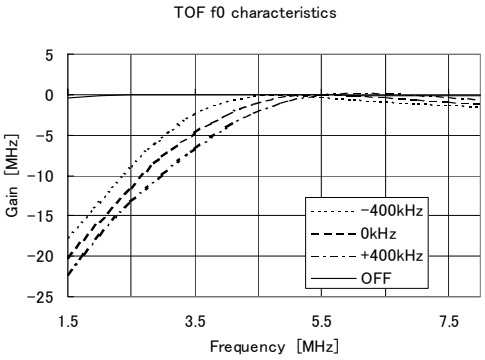


Cb/Cr offset2 characteristic



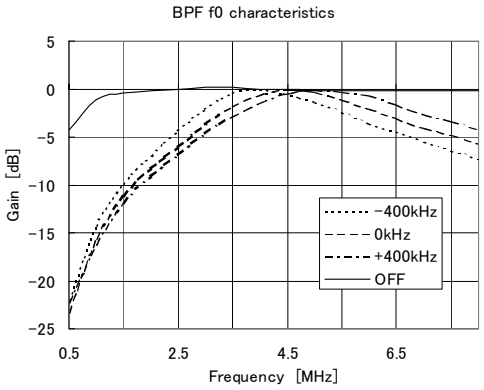
INPUT : 3.58NTSC rainbow color bar (CVBS1-IN)

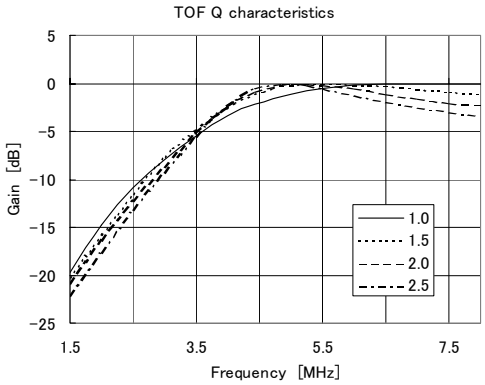




INPUT : 75% color bar
BUS : C-out level=12, Sub-color=0,
BPF=f0, Q=1.5

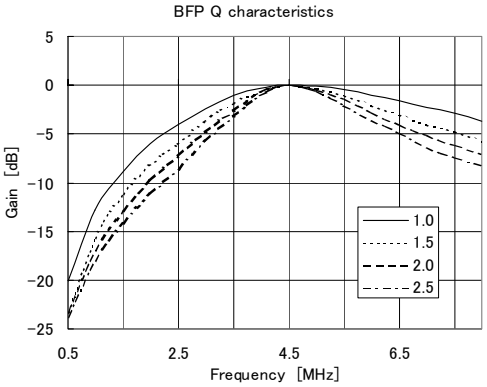
BUS : Q=1.5

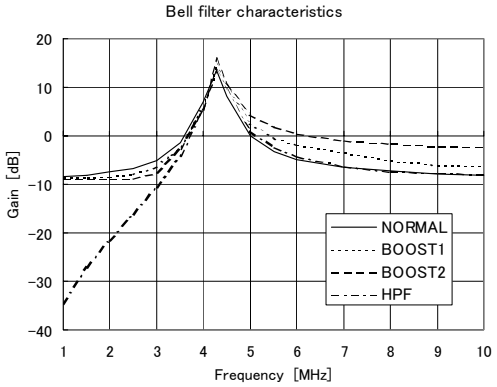




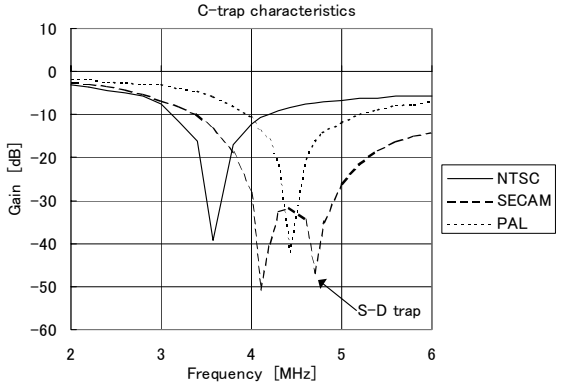
BUS : Q=1.5

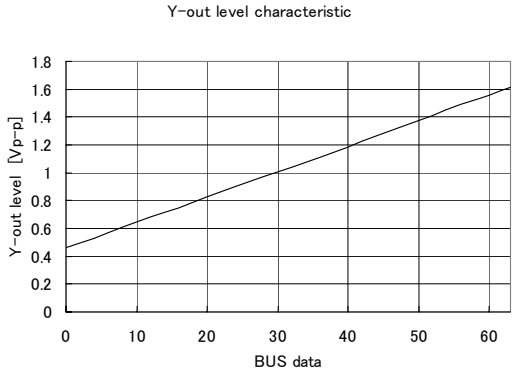
BUS : BPF=f0



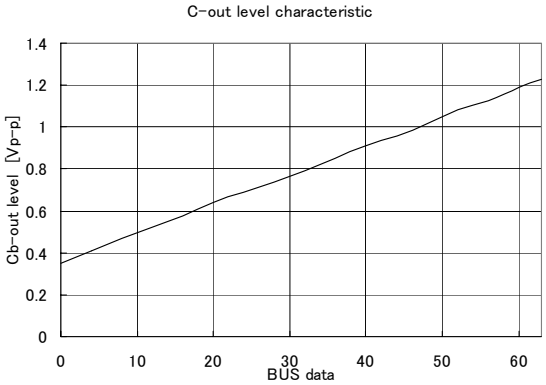


BUS : BFP=f0

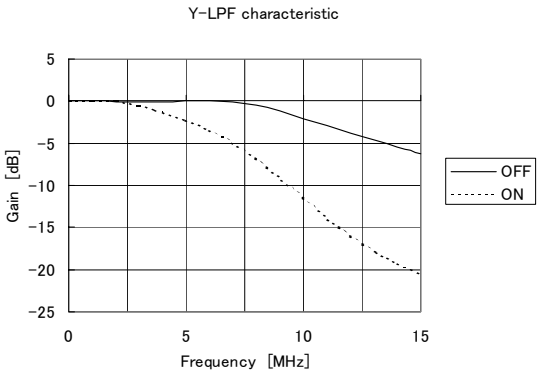




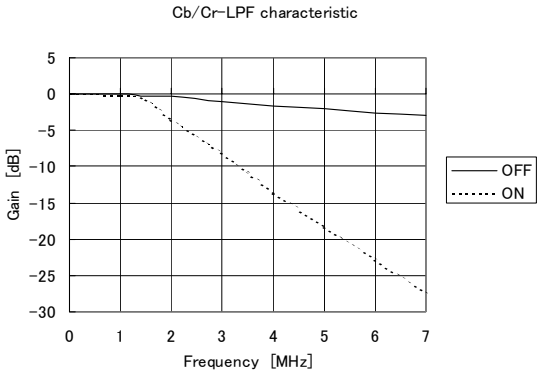
INPUT : RAMP 1.0Vp-p with sync(Y1-IN)



INPUT : 4.43PAL 75% color bar (Cb2-IN)



INPUT : Y1-IN



INPUT : Cb1-IN

MAXIMUM RATINGS (Ta＝25℃)

ITEM	SYMBOL	RATING	UNIT
Supply voltage	$V_{CC/DDmax}$	5.5	V
Signal voltage at each input pin	e_{inmax}	5	Vp-p
Power consumption	P_D (Note1)	1644	mW
Power consumption reduction ratio	$1/\theta_{ja}$	13.16	mW/℃
Operating temperature	T_{opr}	-20～65	℃
Storage temperature	T_{stg}	-55～150	℃

(Note1) Put on the circuit board. Refer to the figure below.

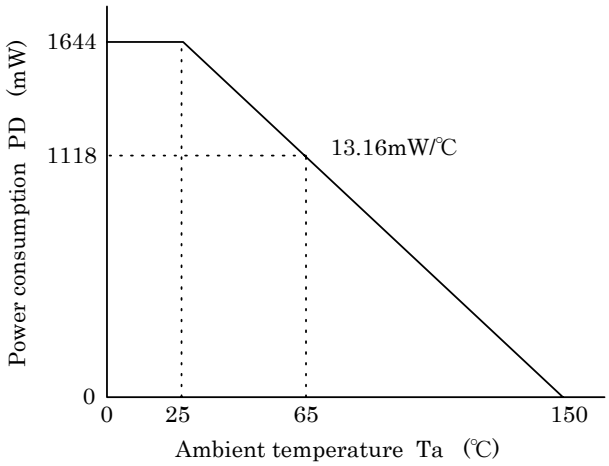


Fig. Power consumption reduction against ambient temperature.

(Note2)CAUTION

1. Since this device is susceptible to surge, handle with care. Especially, pin 39 is most weak to surge.
2. Confirm that pins connection is correct. Don't connect plus pins and minus pins to be opposite polarity. Refer to *Handling Guide* to handle ICs properly.
3. This device is not proof enough against a strong E-M field by CRT which may cause function errors and / or poor characteristics. Keeping the distance from CRT to the device longer than 20cm, or if cannot, placing shield metal over the device, is recommended in an application.
4. APC characteristics is sensitive to external conditions, please care floating capacitor by patterning and stray capacitor to X'tal.

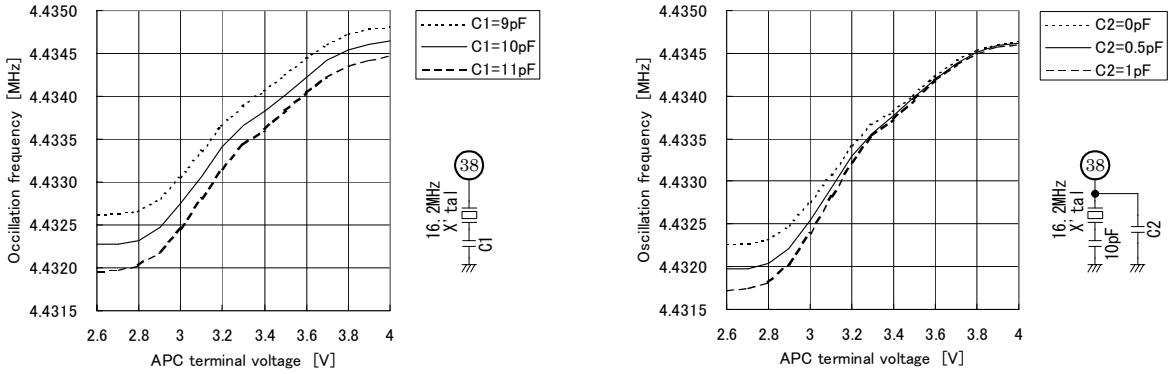


Fig. APC characteristics according to stray capacitor

SUPPLY VOLTAGE

ITEM	DESCRIPTION	MIN	TYP	MAX	UNIT
Supply voltage	Pin 6, 12, 32	4.75	5.0	5.25	V

ELECTRICAL CHARACTERISTICS

(YC-VCC/SYNC-VCC/D-VDD=5V and Ta=25℃, unless otherwise specified)

CURRENT CONSUMPTION

PIN No.	PIN NAME	SYMBOL	MIN	TYP	MAX	UNIT
6	D VDD	I_{DD}	4	7	15	mA
12	SYNC VCC	I_{CC1}	9	13.5	20	
32	Y/C VCC	I_{CC2}	75	100	130	

AC CHARACTERISTICS

VIDEO SWITCH SECTION

ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Maximum video input range	Vdrvi	(NOTE V1)	1.4	—	—	Vp-p
CVBS-OUT amplitude gain	Gcv	(NOTE V2)	—	6.0	—	dB
Frequency bandwidth	Gfv1	(NOTE V3)	—	12	—	MHz
Crosstalk between each input	CTvsw	(NOTE V4)	—	-55	—	dB
Y-OUT maximum output range	Vdryo	(NOTE V5)	—	2.2	—	Vp-p
Cb-OUT maximum output range	Vdrcbo		—	2.2	—	
Cr-OUT maximum output range	Vdrcro		—	2.2	—	

LUMINANCE SECTION

ITEM		SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Chroma trap attenuation	3.58MHz	Gtr3	(NOTE Y1)	25	36	—	dB
	4.43MHz	Gtr4		25	36	—	
	SECAM	GtrS		25	36	—	
	S double	GtrSD		25	36	—	
Y S/N ratio		Ysn	Trap off	—	60	—	
Cb/Cr offset level 1	MAIN	Offs1MAIN	(NOTE Y2)	-5	—	5	mV
	YCbCr1	Offs1YCbCr1		-5	—	5	
	RGB1	Offs1RGB1		-5	—	5	
Cb/Cr offset level 2		Offs2	(NOTE Y3)	-5	—	5	
Black set-up		BSETUP	—	180	200	220	mV

CHROMA SECTION

ITEM		SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
TINT center		T θ 3NCT	3N,CNT	-10	0	10	deg
APC pull-in range (4.43MHz PAL)		APCp	(NOTE C1)	-400	—	400	Hz
Killer operation input level	3N,NORMAL ON→OFF	KilNNoff	(NOTE C2)	—	-42.5	—	dB
	3N,LOW, ON→OFF	KilNLoff		—	-38	—	
	4P,NORMAL, ON→OFF	KilPNoff		—	-45	—	
	4P,LOW, ON→OFF	KilPLoff		—	-40.5	—	
Demodulated Cb and Cr output level Difference (PAL 75% color ber)		ldNTSC	$Cr_{(x)}/Cr_{(PAL)}$	-1.5	0	1.5	dB
		ldSECAM	$Cb_{(x)}/Cb_{(PAL)}$	-1.5	0	1.5	dB
Demodulation relative amplitude (Cb/Cr)		V3Nbr	PAL : Cr/Cb	-1	—	1	dB
		V4Nbr	NTSC : Cr/Cb	-1	—	1	
		V4Pbr	SECAM : Cr/Cb	-1	—	1	
Cb and Cr output level difference (PAL 75% color ber)		ldYCbCr1	$Cr_{(x)}/Cr_{(PAL)}$、 $Cb_{(x)}/Cb_{(PAL)}$	-2	—	2	dB
		ldRGB1		-2	—	2	
		ldYCbCr2		-2	—	2	
		ldRGB2		-2	—	2	
Demodulation output residual carrier		ResiCarr	(NOTE C3)	—	—	20	mVp-p
Demodulation output residual higher harmonic		ResiHarm	(NOTE C4)	—	—	40	mVp-p
fsc free-run frequency	3.58N	3fr	(NOTE C5)	3578700	3579640	3580000	Hz
	4.43P	4fr		4432600	4433700	4434100	

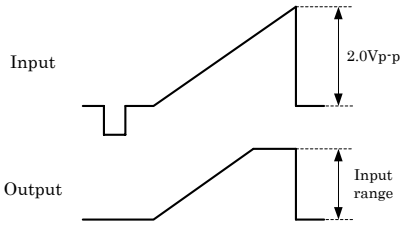
SECAM SECTION

ITEM		SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
SECAM black level adjustment	Cb,CNT	SBCbCT	—	-9	—	9	—
	Cr,CNT	SBCrCT		-9	—	9	
Linearity		LinCb	(NOTE S1)	—	100	—	%
		LinCr		—	100	—	
Transient characteristic		trCb	(NOTE S2)	—	0.8	—	μs
		trCr		—	1.2	—	
Killer operation input level	VID OFF	eSK	(NOTE S3)	—	-42	—	dB
		eSC		—	-39	—	
1H DL gain ratio between direct and delay		gDL	—	—	—	5	%

SYNCHRONIZING SECTION

ITEM		SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
HS output start voltage		VSHVCO	Vcc voltage	—	3.6	—	V
HS output frequency	50Hz	fHD50	—	15.4	15.625	15.9	kHz
	60Hz	fHD60		15.4	15.734	15.9	
H AFC pull-in range	50Hz	AFCp50	—	14.625	15.625	16.625	kHz
	60Hz	AFCp60		14.734	15.734	16.734	
H AFC hold range	50Hz	AFCh50	—	14.625	15.625	16.625	kHz
	60Hz	AFCh60		14.734	15.734	16.734	

TEST CONDITION （Unless otherwise specified, YC-VCC/SYNC-VCC/D-VDD=5V and Ta=25±3℃ ）

NOTE	ITEM	MEASURING METHOD
		COMMON TEST CONDITION ① Unless otherwise specified,- Y/C VCC, Sync-VCC and Digital VDD=5V, Ta=25±3℃. ② Set the BUS data preset, unless otherwise specified. ③ Unless otherwise specified, SW33/34/35/39/41=A, ADD SW=B, Y1 SW=A, SYNC SW=A.
	VIDEO SWITCH SECTION	COMMON TEST CONDITION FOR LUMINANCE SECTION ① Set the BUS data as Sharpness f_0 is.
V1	Maximum video input range	① Set the BUS data as CVBS1 input is selected. ② Minimize Y-OUT LEVEL via I²C BUS. ③ Input ramp-signal to CVBS1/Y1-IN(pin 1). ④ Measure input range on the right figure at pin21(Y-OUT). 
V2	CVBS-OUT amplitude gain	① Set the BUS data as CVBS1 input is selected. ② Input video signal (1.0Vp-p) to CVBS1/Y1-IN(pin 1). ③ Calculate the gain between input signal's amplitude and amplitude of CVBS-OUT(pin 3).
V3	Frequency bandwidth	① Set the BUS data as CVBS1 input is selected. ② Input sweep-signal to pin 1(CVBS1/Y1-IN). ③ Measure the frequency where the ratio between the amplitude of pin 3(CVBS-OUT) and that of pin 1(CVBS1/Y1-IN) is -3dB by network analyzer .
V4	Crosstalk between each input	① Input Signal 1(f_0=4MHz, V_0=0.7V, V_S=0V) to pin 1(CVBS1/Y1-IN). ② Set the BUS data as CVBS1 input is selected. ③ Short other input pins with AC coupling. Measure the amplitude of pin 3(CVBS-OUT). (V1) ④ Set the BUS data as CVBS2 input is selected via I²C BUS. ⑤ Measure the amplitude of pin 3(CVBS-OUT). (V2) ⑥ Crosstalk level from pin 1 to pin 3 is calculated by the following equation. CT= 20log(V2 / V1) ⑦ Calculate leak levels on other cases as well.
V5	Y-OUT maximum output range Cb-OUT maximum output range Cr-OUT maximum output range	① Set the BUS data as CVBS1 input is selected. ② Maximize Y-OUT LEVEL via I²C BUS. ③ Measure Y output range at Y-OUT(pin 21) in the same as NOTE V1. ④ Measure Cb/Cr output range as well.

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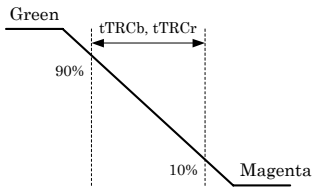
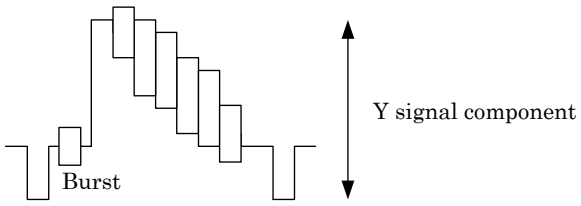
NOTE	ITEM	MEASURING METHOD
	LUMINANCE SECTION	COMMON TEST CONDITION FOR LUMINANCE SECTION ① Set the BUS data as Y1/C1 input is selected.
Y1	Chroma trap attenuation	① Set the BUS data as C TRAP is ON. ② Input signal 1(f_0=3.58MHz(NTSC), V_0=0.5V, V_S=0V) to pin 1(CVBS1/Y1-IN). ③ Measure the amplitude at pin 21(Y-OUT) with the chroma trap being turned on(VTon) and off(VTOff). Calculate the attenuation value as following equation. Gtr3=20log(VToff / VTon) ④ Calculate the following value in the same way as② to ③. Gtr4 : f_0=4.43MHz(PAL) GtrS : f_0=4.43MHz(SECAM) GtrSD : f_0=5.0MHz(SECAM, S-D TRAP = ON)
Y2	Cb, Cr offset level 1	① Input PAL Black Burst signal to pin 1(CVBS1/Y1-IN). ② Monitor Cb or Cr out (pin 22 or 23), and measure voltage between blanking period and picture period as Offs1MAIN. ③ Set the BUS data as RGB SELECT is YcbCr1 (or RGB1), and measure Offs1YcbCr1(or OffsRGB1) in the same way as ②.
Y3	Cb, Cr offset level 2	① Set YS1(pin 24)=2V and Cb2, Cr2-in : no-signal input. ② Monitor Cb or Cr-OUT(pin 22 or 23), and measure voltage between blanking period and picture period as Offs2.

NOTE	ITEM	MEASURING METHOD
	CHROMA SECTION	COMMON TEST CONDITION FOR CHROMA SECTION ① Set the BUS data as Y1/C1 input is selected via I²C BUS. ② Set the BUS data as BPF f_0 is through, Color system is Europe mode and P/N GW is 2.0 μ s.
C1	APC pull-in/hold range	① Input color signal(4.43PAL, 100mVp-p) to pin 48(C1-IN). ② Increase its frequency until Cb-OUT at pin 22 is discolored(upper hold range), and decrease its frequency until Cb-OUT is colored(upper pull-in range). ③ In the same way, decrease its frequency until Cb-OUT is discolored(lower hold range), and increase its frequency until Cb-OUT is colored(lower pull-in range). ④ Calculate the differences between the frequencies and center frequency(4.43MHz).
C2	Killer operation input level	① Set the BUS data as P/N ID is Normal. ② Input color signal(3.58NTSC) to pin 48(C1-IN). ③ While attenuating the burst signal, measure the burst amplitude when Cb-OUT(pin 22) is discolored. ④ Set P/N ID Low, and measure killer level as well. ⑤ Input 4.43PAL color signal to pin 48, and measure items in the same way as①to④.
C3	Demodulation output residual carrier	① Input 3.58NTSC or 4.43NTSC rainbow color bar signal(burst=100mVp-p) to pin 48(C1-IN). ② Measure sub-carrier leak's amplitude in Cb signal of pin 22 and Cr signal of pin 23 respectively.
C4	Demodulation output residual higher harmonic	① Input 3.58NTSC or 4.43NTSC rainbow color bar signal(burst=100mVp-p) to pin 48(C1-IN). ② Measure higher harmonic's amplitude (2fc=7.16MHz or 8.86MHz) in Cb signal of pin 22 and Cr signal of pin 23 respectively.
C5	fsc free-run frequency	① Input nothing into pin 48(C1-IN). ② Change setting of Color system according to respective frequency modes. ③ Measure frequency of fsc signal of pin 46 respectively.

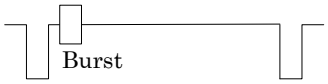
NOTE	ITEM	MEASURING METHOD
	SECAM SECTION	COMMON TEST CONDITION FOR SECAM SECTION ① Set the BUS data as Y1/C1 input is selected. ② Input SECAM 75% color bar(R-Y ID=214mVp-p) to pin 48(C1-IN), unless otherwise specified.
S1	Linearity	① Measure the amplitude from black bar levels in output of pin 22 and 23. ② Calculate items by the following equation. LinCb= V[yellow] / V[blue]×100 (%) LinCr= V[cyan] / V[red]×100 (%)
S2	Transient characteristic	① Measure the period shown in the following figure at pin 22(Cb-OUT) and pin 23(Cr-OUT). 
S3	Killer operation input level	① Set the BUS data as S-ID is Normal and S V-ID SW is OFF. ② While attenuating the ID signal, measure its R-Y ID amplitude when the killer is ON/OFF as eSK and eSC.

TEST SIGNAL

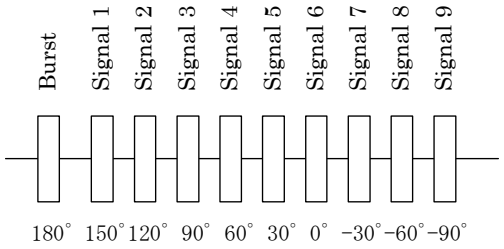
Color bar



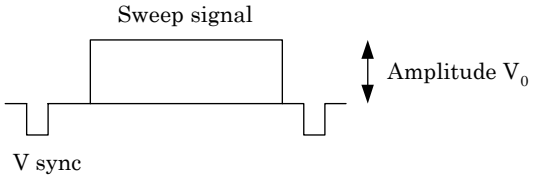
Black Burst



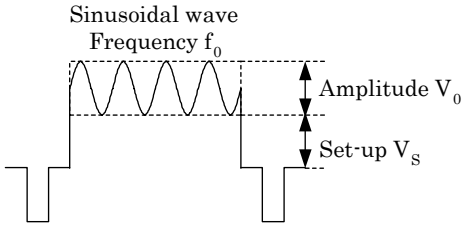
Rainbow color bar



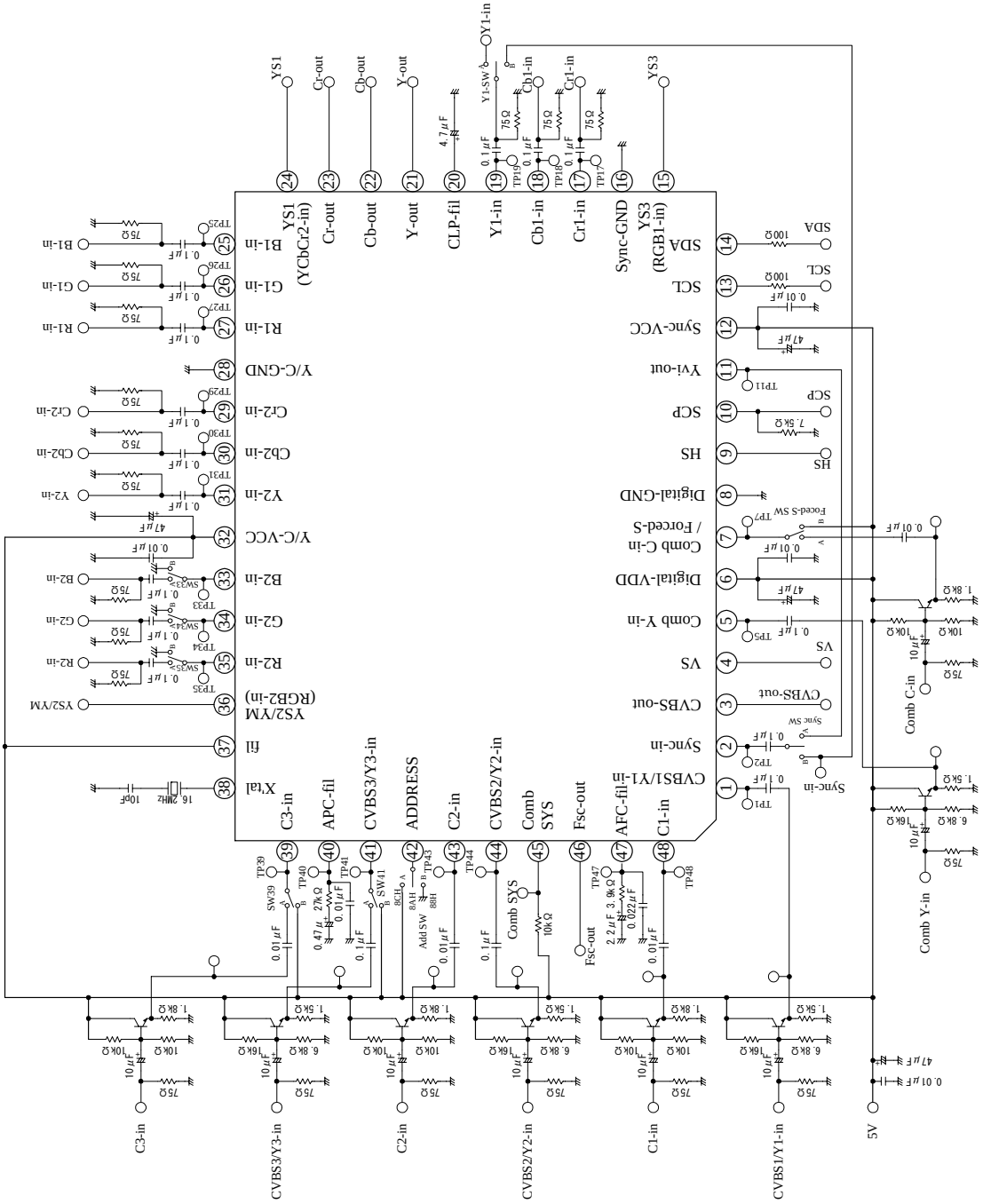
Sweep signal



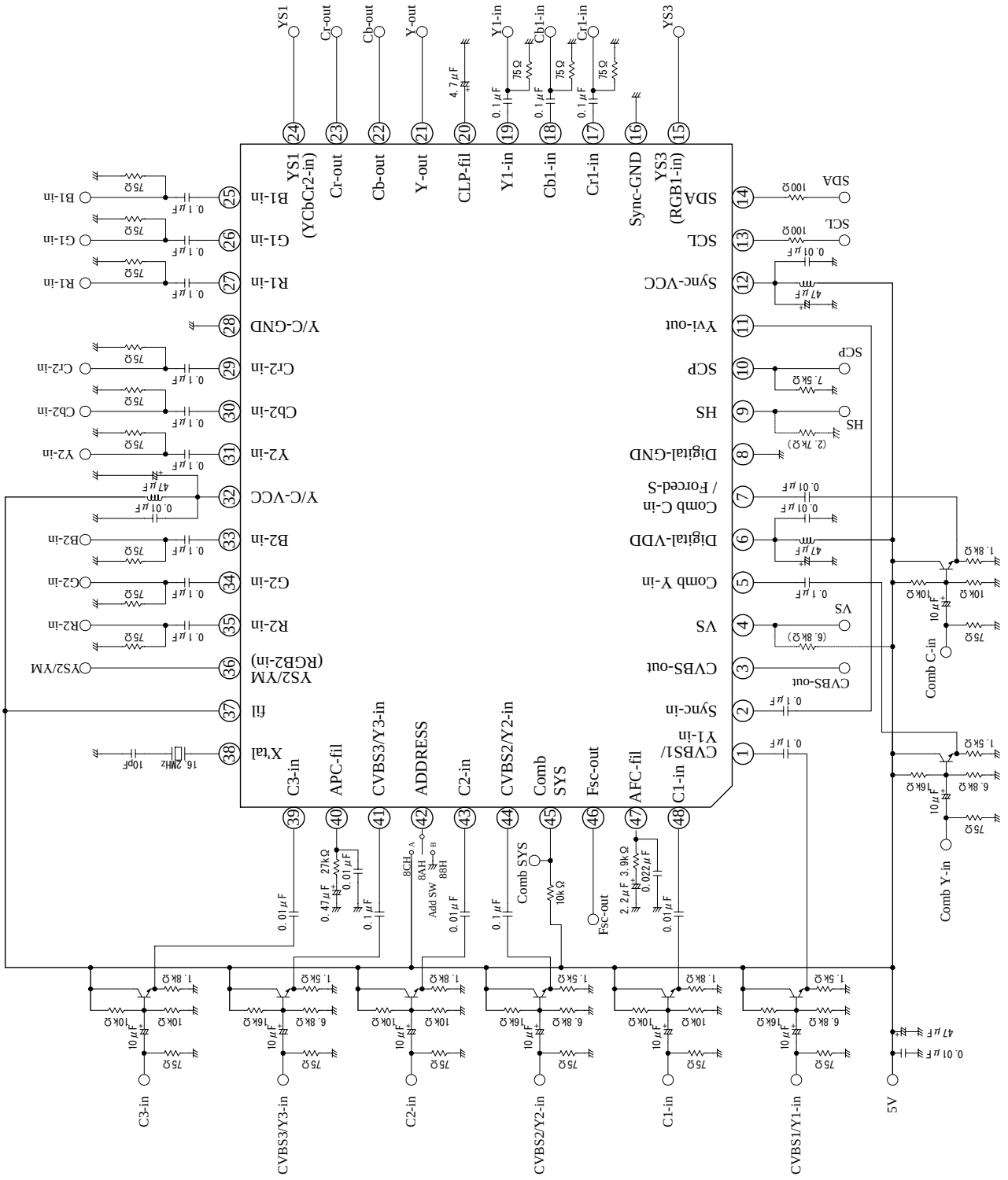
Signal 1



TEST CIRCUIT



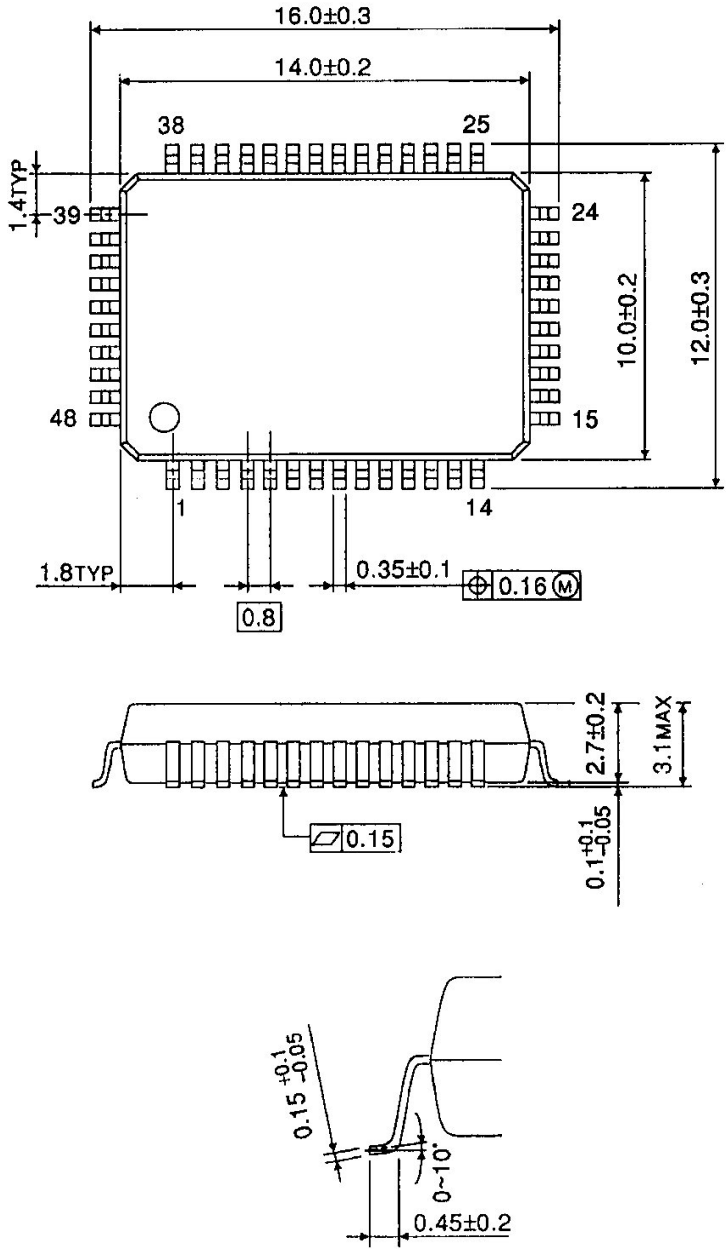
APPLICATION CIRCUIT



OUTLINE DRAWING

Unit : mm

QFP48--P-1014-0.80



Weight : 0.83 g (Typ.)

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-63Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

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030619EBA

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