

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8845BN

BUS CONTROL VIDEO, CHROMA, AND SYNC. SIGNAL PROCESSING IC FOR TV

The TA8845BN has various function to be controlled via I²C bus as shown by a table of bus control map in succeeding page. Not only the user control but also various adjustment or compensation are possible via bus. (RGB cut off and drive adjustment etc.)

FEATURES

Video stage

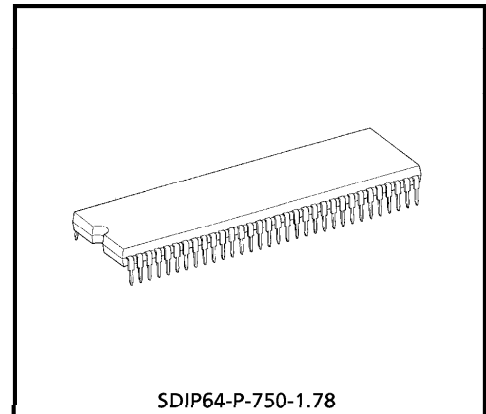
- Black Expansion
- Aperture Compensation (built-in Delay Line)
- Reverse DC Restoration
- Hi-Bright Color
- γ Correction

Chroma stage

- Color Primaries Output
- Cut-off, Drive Adjustment
- Color Detail Enhancer
- Relative Phase, Gain Switch
- IQ Demodulation
- Color γ Correction
- Automatic Flesh Color Correction

RGB stage

- OSD Interface
- Linear RGB Interface
- Fast BLK



SDIP64-P-750-1.78

Weight : 8.85g (Typ.)

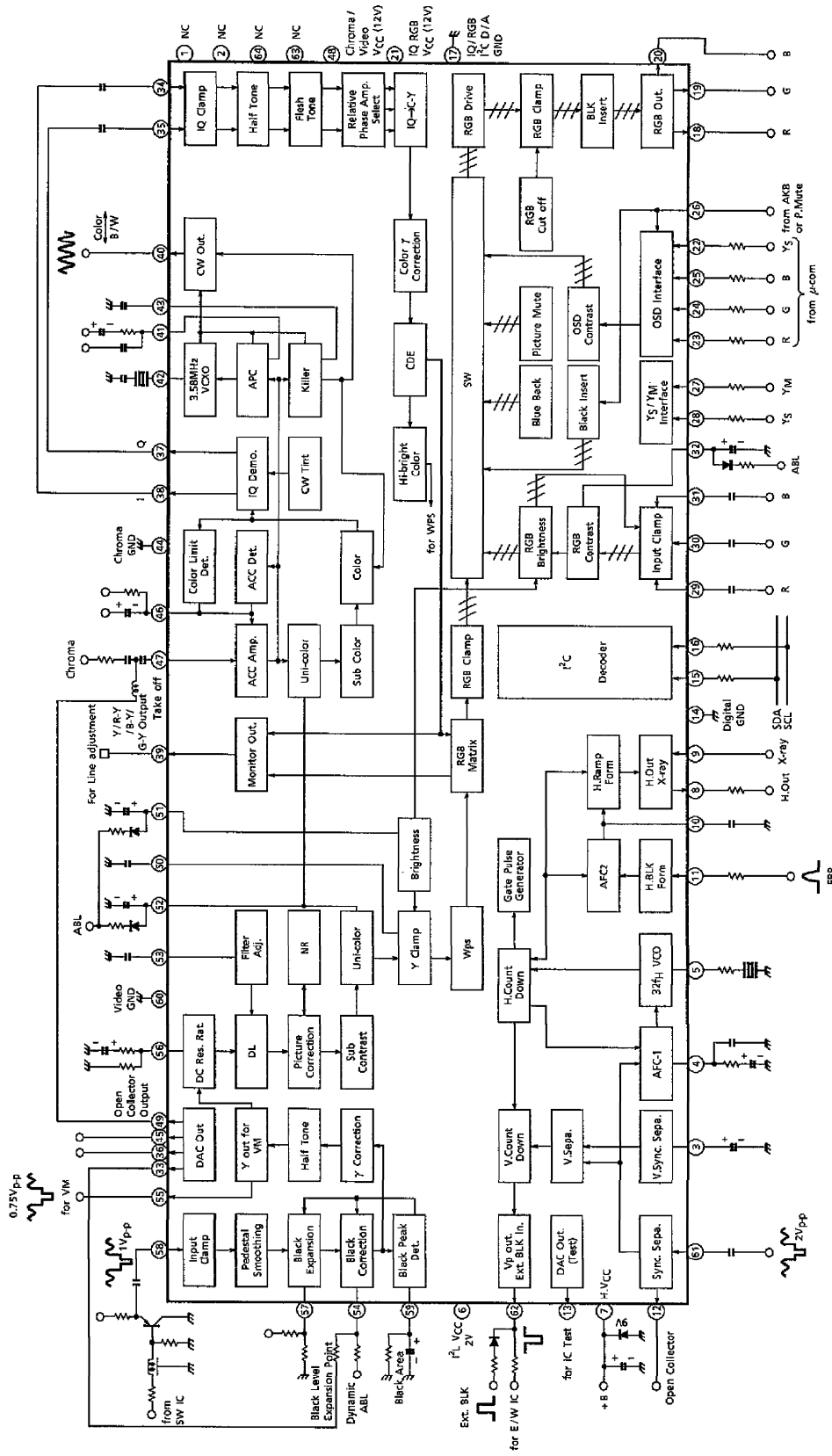
Sync. stage

- High Performance Sync. Separation
- Horizontal, Vertical Oscillation non adjustment by countdown System
- Horizontal Phase Adjustment
- Saw Tooth Wave AFC
- X-ray Protection Circuit

961001EBA2

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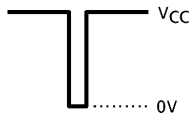
BLOCK DIAGRAM

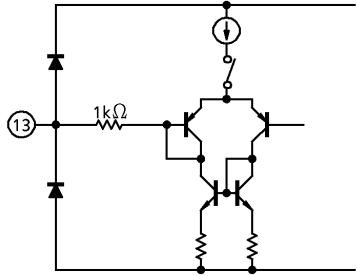
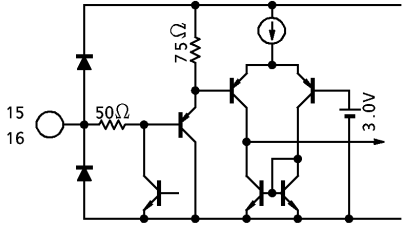
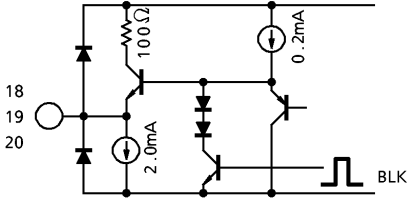
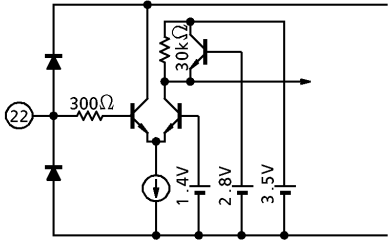


TA8845BN-2

TERMINAL FUNCTION

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
1	N.C.	—	—
2	N.C.	—	—
3	V.Sepa.	Filter for vertical sync. separation is to be connected to this terminal.	
4	AFC1	AFC filter is to be connected to this terminal. AFC1 is to synchronize the horizontal sync. input and horizontal pulse made by 32f _H counting down.	
5	32f _H VCO	Construct 32f _H (503kHz) Osc. circuit with connection of ceramic resonator. The recommendable resonator is Murata CSB503F30.	
6	I ² L V _{CC}	V _{CC} terminal fir I ² L circuit. 2.2V is to be applied.	—
7	DEF V _{CC}	V _{CC} terminal for Def. circuit. 9.0V is to be applied.	—

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
8	H.Out	Horizontal output terminal using emitter follower, to output pulse of 5.0V _{p-p} (Typ.) amplitude with 43% (Typ.) duty.	
9	X-ray	X-ray protection circuit. The threshold is 3.65 (Typ.) i.e., with voltage higher than this voltage. This circuit is to make H out be "low".	
10	AFC2	AFC Filter is to be connected to this terminal. AFC2 is to keep constant phase relation between FBP and horizontal pulse made by 32f _H counting down circuit.	
11	H.BLK Input	FBP input terminal for the horizontal AFC circuit. The threshold level is 2.8V (Typ.).	
12	Sync. Output	Sync. signal is to be separated by the sync. sep. circuit and to be output from this terminal with open collector structure. 	

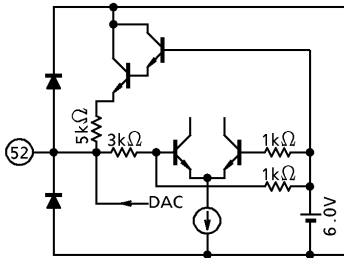
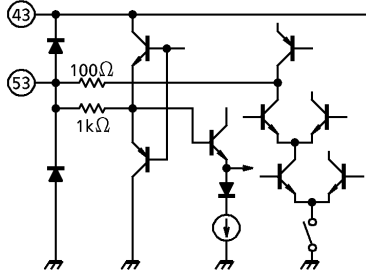
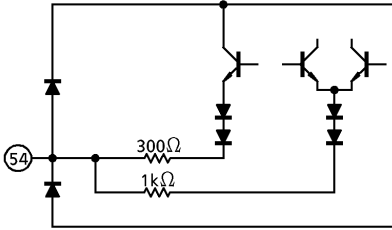
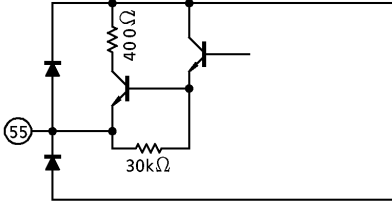
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
13	Test Output	To output internal DAC output. The DAC is to be selected via bus.	
14	I ² L GND	GND for I ² L circuit.	—
15 16	SDA SCL	I ² C bus I/O terminal with threshold voltage of 2.3V (Typ.).	
17	GND2	GND for Def. linear, RGB interface, and IQ demo. stage.	—
18 19 20	R Output G Output B Output	RGB primally color output terminal with emitter follower structure. The output has the H.V.BLK signal.	
21	V _{CC2}	V _{CC} for I/Q demo. stage and RGB interface. 12V.	—
22	OSD Y _S Input	OSD fast blanking signal input terminal. The threshold is 1.4V.	

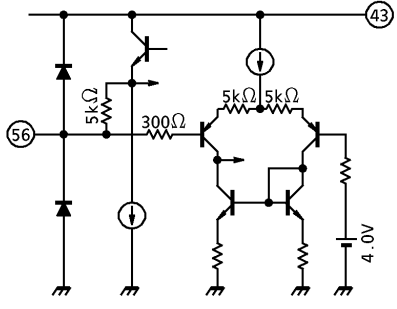
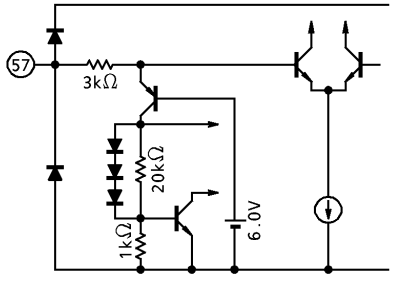
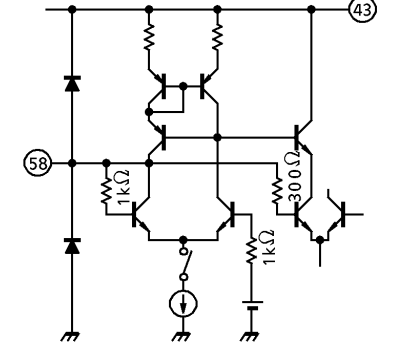
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
23 24 25	OSD R Input OSD G Input OSD B Input	RGB input terminal for OSD with threshold of 1.4V. If this terminal is connected to V _{CC} (threshold V _{CC} - 0.7V) this IC is to be test mode.	
26	Video Mute	Video signal mute signal is to be applied to this terminal. This is for an application with AKB IC. Picture Mute : 3.0V AKB Mute : 9.0V	
27	Analog RGB Y _M	To reduce the contrast of TV signal at the time of super impose in analog RGB signal input. The threshold voltage is 1.4V.	
28	Analog RGB Y _S	Analog RGB fast blanking signal input terminal. The threshold is 1.4V.	
29 30 31	Analog RGB R Input Analog RGB G Input Analog RGB B Input	Analog RGB is to be input and to be clamped by internal clamp circuit. Recommendable input level is 1.0V _{p-p} .	

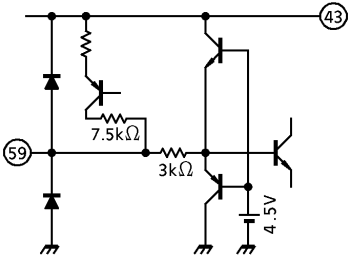
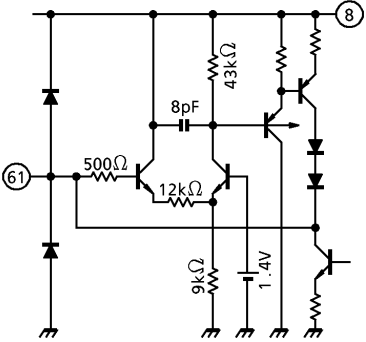
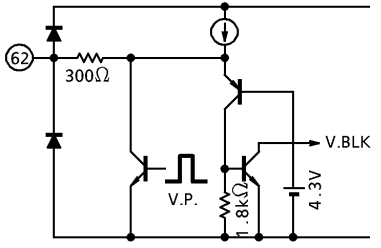
PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
32	RGB Contrast	Analog RGB signal contrast control terminal.	
33 36 45 49	1bit DAC Output	1bit DAC output terminal controlled via I ² C bus with open collector Structure. Terminal voltage is to go to 0V for data of "1".	
34 35	I Input Q Input	Input terminal for I, Q signal. Since internal clamp circuit is to clamp the input to internal reference level, the input is to be the capacitance coupled.	
37 38	Q Output I Output	Output terminal for I, Q signal. Provided internal LPF to reject carrier components.	
39	Monitor Output	To monitor the internal signal. The signal (Y, R-Y, B-Y, G-Y) is selected via bus.	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
40	CW Output	CW of the f_{sc} output terminal. DC level is to be changed up to output ; color or B/W. Color : 3.3V B/W : 0.8V When this pin is connected to V_{CC} , B-Y signal is to be output.	
41	APC Filter	APC filter for f_{sc} Osc is to be connected to this terminal.	
42	X'tal	X'tal resonator for 3.58MHz VCXO circuit is to be connected to this terminal. Recommendable X'tal is MIL HC-49/U.	
43	Killer	Killer filter is to be connected to this terminal. Terminal voltage is ; Color : 8.6V B/W : 7.9V	
44	GND1	GND terminal for chroma stage.	—

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
46	ACC	ACC Filter is to be connected to this terminal.	
47	Chroma Input	Chroma signal input terminal, Typ. input level is 280V _{p-p} (burst).	
48	VCC1	VCC for chroma stage and Video Stage.	—
50	Y Clamp	Filter for Y clamp is to be connected to this terminal. Since pin 56 compensates DC restoration ratio, it is impossible to change DC restoration ratio by brightness circuit. The DC restoration ratio is fixed to 100%.	
51	Brightness	Brightness control DAC output terminal, can be applicable as ABL input terminal.	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
52	Uni-color	Uni-color control DAC output terminal, can be applicable as ACL input terminal.	
53	Filter Adjustment	<p>Filter for internal DL delay time automatic adjustment is to be connected to this terminal.</p> <p>The DL aparature correction peak frequency with capacitance connection only is 4.0MHz.</p> <p>With resistance to GND, the peak frequency is to lower, to VCC, higher.</p>	
54	Dynamic ABL	<p>Terminal to supply control current for Dynamic ABL and black level correction.</p> <p>The dynamic ABL and black level correction are to do level shift the Y signal to black direction subject to outflow current when the black level expanded signal is still whitish.</p>	
55	VM Output	<p>Signal for VM (Velocity modulation) is to be output from this terminal.</p> <p>The Y signal after black level expansion, γ-correction, and uni-color control is to be output.</p> <p>Since the output is the open collector structure, an external resistance is required.</p>	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
56	DC Restoration Ratio Correction	<p>This terminal is for DC restoration ratio correction. The DC restoration ratio (TDC) is subject to the follows ;</p> $T_{DC} = \frac{5k\Omega}{5k\Omega + R\Omega} \times 30 + 100 [\%]$ <p>The smaller the external resistance R, the bigger the correction amount. With open terminal, black level expanded and sync. signal rejected signal can be monitored. This is to check the Black level expansion function.</p>	
57	Black Level Expansion Point	<p>Terminal to define the black level expansion starting point. When the terminal voltage is higher than 6.7V, this IC is to go to Test mode.</p>	
58	Y Input	<p>Y signal input terminal. Recommendable input level is 1.0V_{p-p} (sync. negative) Because of pedestal clamp at the input terminal, the signal source impedance must be low.</p>	

PIN No.	PIN NAME	FUNCTION	INTERFACE CIRCUIT
59	Black Peak Detection	Terminal to control the black level expansion gain and black level shift gain of the dynamic ABL. The black level to be same as that of pedestal level after black level expansion is subject to resistance between this terminal and GND. Smaller resistance increase the black area.	
60	GND3	GND for Video Stage.	—
61	Sync. Input	Input terminal for sync. separation circuit. Video signal of $2V_{p-p}$ sync. negative is to be input. LPF to reject chroma signal components is integrated. Mila capacitance is to be applied for coupling. Since this coupling capacitance is also the one for sync. separation filter, signal source impedance is to be lowered (emitter follower drive).	
62	V.BLK Input, VP Output	V pulse output terminal. V pulse out level is 5.0V (Typ.).	
63	N.C.	—	—
64	N.C.	—	—

BUS CONTROL MAP

(Module address : 88H)

FUNCTION	SUB ADD.	DATA							
		D7	D6	D5	D4	D3	D2	D1	D0
Uni-color (TV)	00	Video Mute (0)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Brightness	01	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Color	02	Color Mute (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Hue	03	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Sharpness	04	DAC1 (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
RGB Brightness	05	DAC2 (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
RGB Contrast	06	DAC3 (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Sub Color	07	Forced TV (1)	Color Limiter Level (1)	(1)	(1)	(0)	(0)	(0)	(0)
Sub Contrast	08	OSD Contrast (1)	VM Y Gain (1)	(1)	(1)	(0)	(0)	(0)	(0)
R Cut off	09	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
G Cut off	0A	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
B Cut off	0B	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
G Drive	0C	Color Temperature (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
B Drive	0D	DAC4 (0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)
Chroma Control	0E	Color γ Correction (1)	R-Y Relative Phase (1)	(0)	R-Y Relative Amp. (1)	G-Y Relative Amp. (0)	G-Y Relative Phase (1)	Auto Flesh ON / OFF (0)	Flesh Pull-in Range (1)
Video Control 1	0F	B / B ON / OFF (0)	Hi-bright Color (0)	(0)	Color Detail Emphasis (0)	(0)	Sharpness Tracking (0)	(1)	WPS (0)
Video Control 2	10	Y-NR Level (1)	(1)	γ Correction Starting Point (1)	(1)	γ Correction Curve (1)	Black Expansion Gain (0)	SRT (1)	Black Expansion Pull-in (1)
Horizontal Picture Phase	11	Service Mode (0)	Monitor Output (0)	(0)	(1)	(0)	(0)	(0)	(0)
DEF Control	12	Compression BLK (0)	H.AFC Sensitivity (0)	(1)	Vertical Frequency (0)	(0)	Vertical Output Pulse Phase (0)	(1)	(1)
Test Mode	13	(0)	(0)	(0)	(0)	(0)	Test Output Selection (0)	(0)	(0)

(Note) (0), (1), Default Value

ITEM	DATA (MIN.~MAX.)	DEFAULT
Uni-color (TV)	- 18dB~0dB	0dB
Brightness (Include Sub)	$\pm 1.3V \cdots 10mV / \text{step}$	$\pm 0V$
Hue (Include Sub)	$\geq \pm 40^\circ \cdots 0.4^\circ / \text{step}$	$\pm 0^\circ$
Color	- 14dB~0dB~ + 4dB	$\pm 0^\circ$
Sub Color	$\pm 3dB \cdots 0.2dB / \text{step}$	$\pm 0dB$
RGB Contrast	- 18dB~0dB (same performance as Uni-color Cont.)	- 5dB
Sub Contrast (TV)	$\pm 4dB \cdots 0.25dB / \text{step}$	$\pm 0dB$
Sharpness Tracking	SRT level at picture : Center, (00) : - 00 / (01) : - 3 / (10) : 0 / (11) : + 3	+ 3dB
Sharpness	- 6dB~ + 6dB~ + 12dB (at 2.4MHz)	+ 6dB
RGB Brightness (Include Sub)	$\pm 0.9V$	$\pm 0V$
Primary Color Output "Cut Off"	+ 0.7V~ - 0.3V (for 3V) 4mV / step	+ 0.2V
Primary color Output "Drive"	Against R $\pm 3dB$	Center
OSD Contrast	(0) : 2.0 / (1) : 2.5V _{p-p}	2.5
Blue Back Contrast	(0) : OFF / (1) : 1.2V _{p-p}	OFF
Hi-bright Color	(00) : OFF / (01) : 0.04 / (10) : 0.08 / (11) : 0.12 times	OFF
Auto Flesh ON/OFF	(1) : ON / (0) : OFF Pull-in axis : I axis (123°)	OFF
Flesh Pull-in Range	(0) : $\pm 34^\circ$ / (1) : $\pm 18^\circ$ (for I axis)	$\pm 18^\circ$
Color Limiter Level	(11) : OFF / (10) : - 1dB / (01) : 0dB / (00) : 1dB	OFF
Forced TV	(1) : Normal / (0) : Forced TV	Normal
VM Y Gain	(00) : $-\infty$ / (01) : - 6 / (10) : - 3 / (11) : 0dB	0dB
Y-NR Level	(11) : OFF / (10) : 25 IRE / (01) : 50 IRE / (00) : 75 IRE (Y-NR = 0)	OFF
γ Correction Starting Point	(00) : 80 / (01) : 90 / (10) : 93 IRE / (11) : OFF	OFF
γ Correction Curve	(1) : - 1 / (0) : - 2dB	- 1
WPS	(1) : 105 / (0) : 95 IRE (Ref. cut off Voltage)	95
DAC1 Output	Open Collector output (0) : OPEN / (1) : ON	OFF
Color Detail Emphasis (CDE)	(00) : OFF / (01) : + 3 / (10) : + 6 / (11) : + 9dB (max. gain) at R-Y	OFF
Super Real Transient (SRT)	(0) : 14 / (1) : 28 IRE	28
Black Expansion Max. Gain	(1) : OFF / (0) : + 3dB	+ 3
Black Expansion Pull-in Point	(1) : 0 / (0) : + 4 IRE	0
DAC2 Output	(0) : OPEN / (1) : ON	OFF
DAC3 Output	(0) : OPEN / (1) : ON	OFF
Color γ Correction	γ -C for R-Y positive side (0) : γ ON / (1) : γ OFF	ON
DAC4 Output	(0) : OPEN / (1) : ON	OFF
R-Y Relative Phase	(11) : 90 / (10) : 93 / (01) : 96 / (00) : 99°	93
R-Y Relative Amp.	(0) : 0.76 / (1) : 0.80 times	0.80

ITEM	DATA (MIN.~MAX.)	DEFAULT
G-Y Relative Phase	(1) : 240 / (0) : 245°	240
G-Y Relative Amp.	(0) : 0.31 / (1) : 0.33 times	0.33
Color Mute	(0) : OFF / (1) : ON Blanking to IQ (C-Y) out for B/W mode etc.	OFF
Monitor Output	Selection between (11) : Y / (10) : R-Y / (01) : B-Y / (00) : G-Y	G-Y
Test Output Selection (for IC Tester)	DAC Out Select to pin. (111) : color / (110) : Hue / (100) : Picture / (101) : Sub Color (011) : Sub Contrast / (010) : G Drive / (001) : B Drive / (000) : H.POS	H.POS
Video Mute	(0) : OFF / (1) : ON Fix RGB Output to OSD low Level (OSD display is possible)	OFF
Color Temperature SW	(0) : OFF / (1) : ON (G : -1dB, B : -2dB)	OFF

SERVICE MODE (1bit)

Vertical output pulse



1	0
Vstop	Normal

Default

When service mode is ON, vertical deflection stops and RGB output turn to cut off voltage.

VERTICAL FREQUENCY (2bit)

Vertical pull-in range (Window) selection

- <Wide> For 50Hz / 60Hz
(Window : 224.5~353H)
- <Normal> For 60Hz
(Window : 224.5~297H)

		MODE	
Default	0	0	Normal
	0	1	Forced 262.5H
	1	0	Wide
	1	1	Forced 312.5H

COMPRESSION BLK (1bit)

Bit for blank upper & bottom side of screen for 16×9 picture display
(Vblk period ; 520H~0H~28H, 257H~291H)

1	0
Compression BLK	Normal

Default

H.AFC SENSITIVITY (2bit)

Selecting phase detector output current ID of H.AFC1

		MODE	
Default	0	0	Detector OFF (f_H Free run)
	0	1	Normal
	1	0	ID×3 during VBLK
	1	1	ID×3 all period

VERTICAL PULSE PHASE (3bit)

Vertical output pulse timing adjustment (Vertical position)

	D ₂	D ₁	D ₀	MODE
Default	0	0	0	Standard
	0	0	1	0.5H~delay
	0	1	0	1.0H~delay
	0	1	1	1.5H~delay
	1	0	0	2.0H~delay
	1	0	1	2.5H~delay
	1	1	0	3.0H~delay
	1	1	1	3.5H~delay

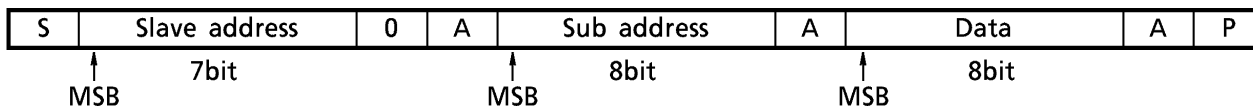
HORIZONTAL PULSE PHASE (5bit)

Picture position control (Horizontal)

I²C BUS CONTROLLED FORMAT SUMMARY

Bus controlled format of TA8845BN is based on I²C Bus Control format of Philips.

Data Transfer Format

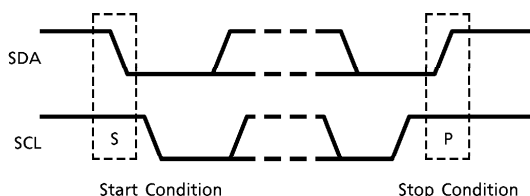


S : Start Condition

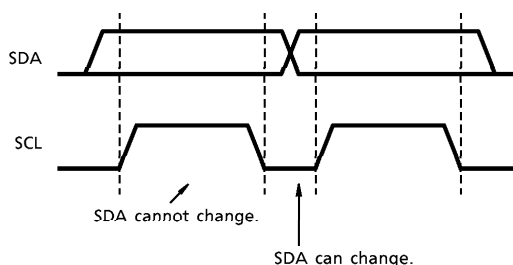
P : Stop Condition

A : Acknowledge

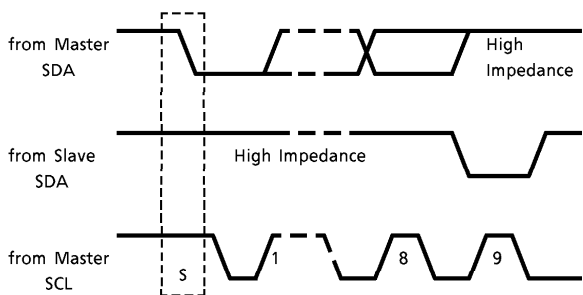
(1) Start condition, stop condition



(2) Bit transfer



(3) Acknowledge



(4) Slave address

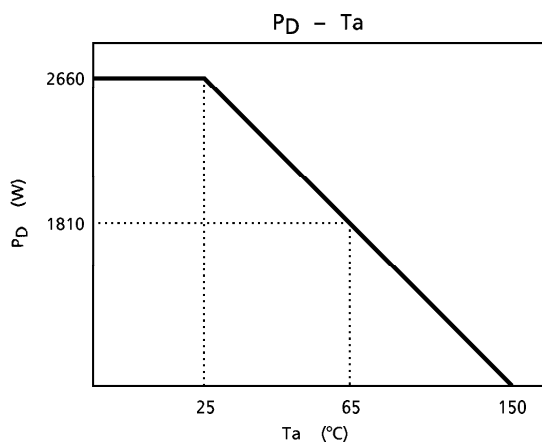
A6	A5	A4	A3	A2	A1	A0	R/W
1	0	0	0	1	0	0	0

Purchase of TOSHIBA I²C components conveys a license under the Philips I²C Patent Rights to use these components in an I²C system, provided that the system conforms to the I²C Standard Specification as defined by Philips.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V _{CC}	13	V
Power Dissipation	P _{Dmax}	2660 (Note)	mW
Input Signal Voltage	e _{in}	3.0	V _{p-p}
Operating Temperature	T _{opr}	- 20~65	°C
Storage Temperature	T _{stg}	- 55~150	°C

(Note) When using the device at above Ta = 25°C, decrease the power dissipation by 21.2mW for each increase of 1°C.



RECOMMENDED SUPPLY VOLTAGE

PIN No.	PIN NAME	MIN.	TYP.	MAX.	UNIT
7	9V V _{CC}	8.5	9.0	9.5	V
6	2.2V V _{CC}	2.0	2.2	2.4	V
48 21	12V V _{CC}	11.0	12.0	13.0	V

ELECTRICAL CHARACTERISTIC

DC CHARACTERISTICS (Unless otherwise specified, $V_{CC} = 9V$, $T_a = 25^{\circ}C$)

DC voltage characteristics

PIN No.	PIN NAME	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
1	N.C.	N.C.	—	—	—	—	—	—
2	N.C.	N.C.	—	—	—	—	—	—
3	V.Sepa.	V_3	—	Pin 61 : 1.5V	3.40	4.14	5.40	V
4	AFC1	V_4	—	OPEN	7.00	7.50	8.00	V
5	32f _H VCO	V_5	—	OPEN	5.40	5.80	6.10	V
6	I ² L V _{CC}	V_{CC}	—	—	—	2.20	—	V
7	DEF V _{CC}	V_{CC}	—	—	—	9.00	—	V
8	H.Out	V_8	—	High Level	4.70	5.00	5.30	V
9	X-ray	V_9	—	—	—	—	—	V
10	AFC2	V_{10}	—	—	4.70	5.20	5.70	V
11	H.BLK Input	V_{11}	—	—	—	—	—	V
12	Sync. Output	V_{12}	—	Low Level	-0.50	0.00	0.50	V
13	Test Output	V_{13}	—	—	2.45	2.78	3.30	V
14	I ² L GND	V_{14}	—	—	—	0.00	—	V
15	SDA	V_{15}	—	High Level	4.80	5.00	5.20	V
16	SCL	V_{16}	—	—	4.50	5.00	5.50	V
17	GND2	GND	—	—	—	0.00	—	V
18	R Output	V_{18}	—	—	3.10	3.30	3.50	V
19	G Output	V_{19}	—	—	3.10	3.30	3.50	V
20	B Output	V_{20}	—	—	3.10	3.30	3.50	V
21	V _{CC} 2	V_{CC}	—	—	—	12.0	—	V
22	OSD Y _S Input	V_{22}	—	—	—	—	—	V
23	OSD R Input	V_{23}	—	—	—	—	—	V
24	OSD G Input	V_{24}	—	—	—	—	—	V
25	OSD B Input	V_{25}	—	—	—	—	—	V
26	AKB Mode / Video Mute	V_{26}	—	—	—	—	—	V
27	Analog RGB Y _M	V_{27}	—	—	—	—	—	V
28	Analog RGB Y _S	V_{28}	—	—	—	—	—	V
29	Analog RGB R Input	V_{29}	—	—	3.80	4.00	4.20	V
30	Analog RGB G Input	V_{30}	—	—	3.80	4.00	4.20	V
31	Analog RGB B Input	V_{31}	—	—	3.80	4.00	4.20	V
32	RGB Contrast	V_{32}	—	OPEN	5.70	6.00	6.30	V
33	DAC1 Output	V_{33}	—	Low Level	0.00	0.07	0.12	V
34	I Input	V_{34}	—	—	4.95	5.25	5.55	V
35	Q Input	V_{35}	—	—	4.95	5.25	5.55	V
36	DAC2 Output	V_{36}	—	Low Level	0.00	0.07	0.12	V
37	Q Output	V_{37}	—	—	8.45	8.70	8.95	V

PIN No.	PIN NAME	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
38	I Output	V ₃₈	—	—	8.45	8.70	8.95	V
39	Monitor Output	V ₃₉	—	—	3.60	3.90	4.20	V
40	CW Output	V ₄₀	—	—	0.80	1.00	1.20	V
41	APC Filter	V ₄₁	—	—	8.60	8.90	9.20	V
42	X'tal	V ₄₂	—	OPEN	5.50	5.95	6.30	V
43	Killer	V ₄₃	—	—	7.80	8.10	8.40	V
44	GND1	GND	—	—	—	0.00	—	V
45	DAC3 Output	V ₄₅	—	Low Level	0.00	0.07	0.12	V
46	ACC	V ₄₆	—	—	11.2	11.6	12.0	V
47	Chroma Input	V ₄₇	—	OPEN	2.70	3.00	3.30	V
48	V _{CC} 1	V _{CC}	—	—	—	12.0	—	V
49	DAC4 Output	V ₄₉	—	Low Level	0.00	0.07	0.12	V
50	Y Clamp	V ₅₀	—	—	5.70	7.20	8.70	V
51	Brightness	V ₅₁	—	—	4.30	4.51	4.72	V
52	Uni-color	V ₅₂	—	—	6.30	6.60	6.90	V
53	Filter Adjustment	V ₅₃	—	—	5.20	6.00	6.80	V
54	Dynamic ABL	V ₅₄	—	—	2.40	2.90	3.40	V
55	VM Output	V ₅₅	—	—	8.30	8.50	8.70	V
56	DC Restoration Ratio Correction	V ₅₆	—	—	4.30	4.50	4.70	V
57	Black Level Expansion Point	V ₅₇	—	—	—	—	—	V
58	Y Input	V ₅₈	—	—	4.25	4.50	4.75	V
59	Black Peak Detection	V ₅₉	—	—	4.60	5.10	5.60	V
60	GND3	GND	—	—	—	0.00	—	V
61	Sync. Input	V ₆₁	—	—	2.00	2.25	2.50	V
62	V.BLK Input, VP Output	V ₆₂	—	High Level	4.50	5.00	5.50	V
63	N.C.	N.C.	—	—	—	—	—	—
64	N.C.	N.C.	—	—	—	—	—	—

DC current

PIN NAME	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
9V V _{CC}	DEF, I _{CC}	—	—	15	23	30	mA
2.2V V _{CC}	I ² L, I _{CC}	—	—	13	19	25	mA
12V V _{CC}	I _{CC}	—	—	59	88	120	mA

AC CHARACTERISTICS (Unless otherwise specified, $V_{CC} = 9V$, $H.V_{CC} = 9V$, $T_a = 25^\circ C$)

Video stage

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Y Input Pedestal Clamp Voltage	V58	—	(Note 1)	4.3	4.5	4.7	V
Y Input Pedestal Clamp Phase	TCL1	—	(Note 2)	0.6	1.0	1.3	μs
	TCL2			2.8	3.0	3.2	
Pin 56 Output Impedance	ZOUT56	—	(Note 3)	4.4	5.5	6.6	$k\Omega$
DC Restoration Ratio Compensation Amp. Gain	AV56	—	(Note 4)	0.28	0.34	0.40	
Dynamic ABL Max. Sensitivity	GV54	—	(Note 5)	3.5	5.0	6.5	$mV / \mu A$
Black Expansion Amp. Max Gain	GVBE	—	(Note 6)	1.30	1.40	1.50	
Y Input Dynamic Range	DR58	—	(Note 7)	0.9	1.0	1.2	V_{p-p}
Picture Control Center Frequency	Fp	—	(Note 8)	4.0	4.3	4.6	MHz
Picture Control Range	GSMAX	—	(Note 9)	10	12	14	dB
	GSMIN			-10	-8	-5.5	
Picture Control Center Characteristics	GsCT	—	(Note 10)	4.0	5.5	7.0	dB
Center Frequency Change Range	FPMAX	—	(Note 11)	4.7	6.3	8.2	MHz
	FPMIN			2.2	3.1	4.0	
Super Real Transient 2T Pulse Response	POS00	—	(Note 12)	190	210	230	ns
	POS01			175	195	215	
	POS10			150	165	180	
	POS11			120	135	150	
Noise Reduce	GNR00	—	(Note 13)	-10	-8	-5.5	dB
	GNR01			-4	-2	± 0	
	GNR10			5	7	9	
Black Expansion Start Point	VST1	—	(Note 14)	250	310	370	mV_{p-p}
	VST2			340	430	520	
Black Peak Detection Inhibit Period (Horizontal)	TBPH	—	(Note 15)	12.5	13.5	14.5	μs
Black Peak Detection Inhibit Period (Vertical)	TBPV	—	(Note 16)	22	23	24	H
VM Output Y Gain	GVM00	—	(Note 17)	-20	-14	-12	dB
	GVM01			-5	-4	-3	
	GVM10			-2	-1	0	
	GVM11			0	1	2	
γ Correction Start Point	V γ 00	—	(Note 18)	530	575	620	mV
	V γ 01			600	645	690	
	V γ 10			620	665	710	
γ Correction Gain	G γ 0	—	(Note 19)	-2.7	-2.0	-1.5	dB
	G γ 1			-1.5	-1.0	-0.5	

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Black Peak Detection Level	VBP ₀	—	(Note 20)	5	20	35	mV
	VBP ₁			-20	-5	+10	
DL Aparature Correction Limiting Range	VAL ₀	—	(Note 21)	65	90	115	mV _{p-p}
	VAL ₁			20	45	70	
Color Detail Emphasis	GCD ₀₀	—	(Note 22)	21	23	25	dB
	GCD ₀₁			18	20	22	
	GCD ₁₀			12	14	16	
	GCD ₁₁			1.5	4	6.5	

Chroma stage

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
ACC Characteristics	F1	—	(Note 23)	0.56	0.80	1.12	V _{p-p}
	ea			0.08	0.16	0.24	
	A			0.9	1.0	1.3	
Color Killer Color Remaining	VK	—	(Note 24)	—	—	3.0	mV _{p-p}
Color Control Characteristics	VC _{MAX}	—	(Note 25)	0.56	0.80	1.12	V _{p-p}
	VC _{CEN}			0.24	0.34	0.47	
	VC _{MIN}			47	67	94	
	ec +			6.0	7.5	9.0	dB
	ec -			-15.5	-14.0	-12.5	
Sub Color Control Characteristics	VS _{MAX}	—	(Note 26)	0.93	1.33	1.86	V _{p-p}
	VS _{CEN}			0.56	0.80	1.12	
	VS _{MIN}			0.40	0.57	0.80	
	es +			3.0	4.4	5.8	dB
	es -			-4.3	-2.9	-1.5	
Contrast Control Characteristics	VU _{MAX}	—	(Note 27)	0.56	0.80	1.12	V _{p-p}
	VU _{CEN}			0.32	0.45	0.63	
	VU _{MIN}			0.07	0.10	0.14	
	eu			-20	-18	-16	dB
Killer Input Level	V _{BK}	—	(Note 28)	0.10	0.20	0.50	mV _{p-p}
	V _{BC}			0.20	1.12	2.82	
Killer Characteristics	VK _{BW}	—	(Note 29)	7.7	8.0	8.3	V
	VK _C			8.45	8.75	9.05	
	ΔVK			0.28	0.75	—	
APC Frequency Control Sensitivity	β	—	(Note 30)	1.0	1.7	2.9	Hz / mV

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
APC Pull-in Range	f _{PH}	—	(Note 31)	250	500	2000	Hz
	f _{PL}			250	500	2000	
APC Hold Range	f _{HH}			250	500	3000	
	f _{HL}			250	500	3000	
f _{sc} Out Amplitude	V _F	—	(Note 32)	0.47	0.54	0.62	V _{p-p}
IQ Color Differential Output Level	V _I	—	(Note 33)	0.56	0.80	1.12	V _{p-p}
IQ Color Differential Out Relative Amplitude	V _I / V _Q	—	(Note 34)	0.9	1.0	1.1	
IQ Color Differential Output Relative Phase	θ _{IQ}	—	(Note 35)	88	93	98	°
IQ Color Differential Tint Control	θ _{MAX}	—	(Note 36)	35	45	55	°
	θ _{CEN}			-10	0	10	
	θ _{MIN}			-55	-45	-35	
	θ _{MM}			80	90	100	
IQ Color Differential Max. Output Level	E _I	—	(Note 37)	2.68	3.35	4.02	V _{p-p}
	E _Q			2.68	3.35	4.02	
Color Limiter Characteristics	V _{L+1}	—	(Note 38)	0.67	0.85	1.02	V _{p-p}
	V _{L0}			0.61	0.76	0.92	
	V _{L-1}			0.54	0.68	0.83	
	V _L			0.80	1.02	1.25	
Color Mute	CM	—	(Note 39)	—	0	—	V _{p-p}
Remained CW Level	V _{Ie}	—	(Note 40)	—	—	15	mV _{p-p}
	V _{Qe}			—	—	15	
Remained Harmonic Level	V _{IHe}	—	(Note 41)	—	—	75	mV _{p-p}
	V _{QHe}			—	—	75	
RGB Color Differential Output Level	V _{R80}	—	(Note 42)	1.14	1.52	1.90	V _{p-p}
	V _{R84}			1.20	1.60	2.00	
	V _{G32}			0.47	0.62	0.78	
	V _{G34}			0.50	0.66	0.83	
	V _B			1.50	2.00	2.50	
RGB Color Differential Output Relative Amplitude	V _{R80} / V _B	—	(Note 43)	0.65	0.76	0.89	
	V _{R84} / V _B			0.68	0.80	0.92	
	V _{G32} / V _B			0.26	0.31	0.36	
	V _{G34} / V _B			0.28	0.33	0.38	
RGB Color Differential Output Relative Phase	θ _{R90}	—	(Note 44)	83	90	97	°
	θ _{R95}			86	93	100	
	θ _{R104}			89	96	103	
	θ _{R109}			92	99	106	
	θ _{G240}			230	240	250	
	θ _{G253}			235	245	255	

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
RGB Color Differential Tint Control Characteristics	θ_{TMAX}	—	(Note 45)	+ 35	+ 45	+ 55	°
	θ_{TMIN}			- 55	- 45	- 35	
IQ Amplitude Characteristics	GRI	—	(Note 46)	4.43	5.54	6.65	—
	GGI			0.90	1.12	1.35	
	GBI			3.48	4.35	5.22	
	GRQ			2.56	3.20	3.84	
	GGQ			1.77	2.21	2.65	
	GBQ			5.37	6.71	8.05	
	ER			1.78	2.22	2.66	V _{p-p}
	EB			2.14	2.68	3.21	
Color γ Characteristics	V γ	—	(Note 47)	0.00	0.40	0.80	V _{p-p}
	$\Delta\gamma$			0.53	0.67	0.81	—
Flesh Color Characteristics	F α_{18}	—	(Note 48)	0.44	0.55	0.66	—
	F α_{33}			0.36	0.45	0.54	
Half Tone Characteristics	V _{HH}	—	(Note 49)	0.8	1.0	1.2	V _{p-p}
	V _{HL}			1.6	2.0	2.4	
	H			1.8	2.0	2.2	
RGB Color Differential Output DC Voltage	V*	—	(Note 50)	3.58	3.90	4.21	V
RGB Color Differential Output DC Difference between Each Axes	ΔV^*	—	(Note 51)	—	0	± 20	mV
Hi-bright Color Gain	HB1	—	(Note 52)	—	0	0.01	—
	HB2			0.02	0.04	0.06	
	HB3			0.06	0.08	0.10	
	HB4			0.10	0.12	0.14	

* : R or G or B

Deflection circuit

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Sync. Sepa. Input Sensitive Current	I _{IN16}	—	(Note 53)	15	25	40	μA
V.Sepa. Filter Terminal Outflow Current	I _{OUT3}	—	(Note 54)	5.6	7.0	8.7	μA
V.Sepa. Level	V _{SEP}	—	(Note 55)	3.4	4.4	5.4	V
H.AFC1 Phase Detection Current	I _{DET1}	—	(Note 56)	230	330	470	μA
H.AFC1 Double Mode Phase Detection Current	2I _{DET1}	—	(Note 57)	420	600	860	μA
Phase Detection Stop Period	T _{CO4}	—	(Note 58)	—	258~6	—	H
Phase Detection Stop Mode	T _{FR8}	—	(Note 59)	15.584	15.734	15.884	kHz
H.AFC2 Phase Detection Current	I _{DET2}	—	(Note 60)	350	500	710	μA
32f _H VCO Oscillation Start Voltage	V _{VCO}	—	(Note 61)	3.5	4.0	4.5	V
Horizontal Output Start Voltage	V _{HON8}	—	(Note 62)	4.0	4.5	5.0	V
Horizontal Output Pulse Duty	T _{H8}	—	(Note 63)	39	41	43	%
Horizontal Free Run Frequency	f _{HO}	—	(Note 64)	15.584	15.734	15.884	kHz
Horizontal OSC Frequency Range	f _{HMAX}	—	(Note 65)	16.500	16.700	16.900	kHz
	f _{HMIN}			14.700	15.000	15.300	
Horizontal OSC Control Sensitivity	β _H	—	(Note 66)	2.0	2.3	2.6	kHz / V
Horizontal Output Voltage	V _{H8}	—	(Note 67)	4.7	5.0	5.3	V
	V _{L8}			—	0	100	mV
X-ray Voltage Protection Detection Voltage	V _{90N}	—	(Note 68)	3.5	3.6	3.7	V
X-ray Voltage Protection Voltage	V _{H7}	—	(Note 69)	—	—	2.5	V
Horizontal Sync. Phase	S _{PH1}	—	(Note 70)	3.1	3.5	3.9	μs
Horizontal Image Position Phase Adjustable Range	ΔH _{SFT}	—	(Note 71)	4.2	5.0	5.9	μs
Vertical OSC Start Voltage	V _{ON}	—	(Note 72)	4.0	4.5	5.0	V
Vertical Free Run Frequency	f _{VO}	—	(Note 73)	48	53	58	Hz
Service Mode Switching Voltage	V _{PNO}	—	(Note 74)	4.5	5.0	5.5	V
Vertical Output Voltage	V _{VH}	—	(Note 75)	4.5	5.0	5.5	V
	V _{VL}			—	0	300	mV
Vertical Output Pulse Width	T _{r1}	—	(Note 76)	—	6.5	—	H
	T _{r2}			—	6.5	—	
Vertical Pulse Width Variable Range	V _{PUN}	—	(Note 77)	—	0.5	—	H
Vertical Output Pulse Width Variable Range	V _{PLI}	—	(Note 78)	—	8.0 ~4.5	—	H
Vertical Pull-in Range (1)	f _{PL1}	—	(Note 79)	—	224.5	—	H
	f _{PH1}			—	296.5	—	
Vertical Pull-in Range (2)	f _{PL2}	—	(Note 80)	—	224.5	—	H
	f _{PH2}			—	352.5	—	

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Vertical Frequency Forced 262.5H (60Hz)	fV60	—	(Note 81)	55	60	65	Hz
Vertical Frequency Forced 312.5H (50Hz)	fV50	—	(Note 82)	45	50	55	Hz

Text stage

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
AC Gain	G*	—	(Note 83)	3.9	4.4	4.9	
Frequency Characteristics	G _f *	—	(Note 84)	- 5.0	- 2.5	0	dB
Uni-color Control Characteristics	V _u MAX	—	(Note 85)	1.15	1.30	1.45	V _{p-p}
	V _u CEN			0.66	0.75	0.84	
	V _u MIN			0.17	0.19	0.21	
	ΔV _u			15.7	16.7	17.7	dB
Uni-color Control Voltage Range	V ₅₂	—	(Note 86)	0.57	0.63	0.69	V
Brightness Control Characteristics	V _{BR} MAX	—	(Note 87)	4.7	5.0	5.3	V
	V _{BR} CEN			3.5	3.8	4.1	
	V _{BR} MIN			2.3	2.6	2.9	
Brightness Data Sensitivity	G _{BR}	—	(Note 88)	0.0088	0.0095	0.0102	V / bit
Brightness Control Voltage Range	V ₅₁	—	(Note 89)	1.0	1.2	1.4	V
White Peak Slice Level	V _{WPS1} *	—	(Note 90)	5.8	6.0	6.2	V
	V _{WPS2} *			5.6	5.8	6.0	
Black Peak Slice Level	V _{BPS} *	—	(Note 91)	2.4	2.6	2.8	mV
DC Restoration Level	TDC*	—	(Note 92)	—	0	50	mV
RGB Output Emitter Follow Drive Current	I _{OUT} *	—	(Note 93)	1.5	2.0	2.5	
Half Tone Characteristics	G _{HT}	—	(Note 94)	0.47	0.50	0.53	V
Half Tone ON Voltage	V _{HT}	—	(Note 95)	1.2	1.5	1.8	V
V-BLK Pulse Output Level	V _V *	—	(Note 96)	0.3	0.8	1.3	V
H-BLK Pulse Output Level	V _H *	—	(Note 97)	0.3	0.8	1.3	V
BLK Pulse Delay Time	td _{ON} *	—	(Note 98)	—	0.1	0.3	μs
	td _{OFF} *			—	0.25	0.45	
Sub Contrast Control Range	ΔV _{SU} (+)	—	(Note 99)	3.3	4.0	4.7	dB
	ΔV _{SU} (-)			- 4.7	- 4.0	- 3.3	
RGB Output Voltage	V _{OUT} *	—	(Note 100)	3.1	3.3	3.5	V
RGB Output Voltage 3 Axes Difference	ΔV _{OUTRG}	—	(Note 101)	—	0	50	mV
	ΔV _{OUTGB}			—	0	50	
	ΔV _{OUTBR}			—	0	50	

* : R or G or B

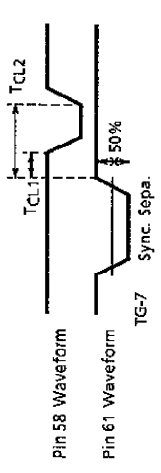
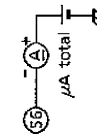
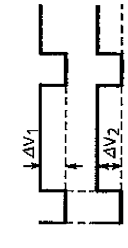
CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Cut off Control Range	CUT* (+)	—	(Note 102)	0.45	0.50	0.55	V
	CUT* (-)			-0.55	-0.50	-0.45	
Drive Control Range	DR _G (+)	—	(Note 103)	2.6	3.1	3.6	dB
	DR _G (-)			-3.6	-3.1	-2.6	
	DR _B (+)			2.6	3.1	3.6	
	DR _B (-)			-3.6	-3.1	-2.6	
Mute Output Voltage	MU* _D	—	(Note 104)	2.4	2.6	2.8	V
	MU* _A			2.4	2.6	2.8	
Mute ON Voltage	V _{MU} *	—	(Note 105)	2.5	3.0	3.5	V
Blue Back Output Voltage	BB _R	—	(Note 106)	2.4	2.6	2.8	V
	BB _G			2.4	2.6	2.8	
	BB _B			4.2	4.4	4.6	
AKB Mode Output Voltage	V _{AKB} *	—	(Note 107)	3.1	3.3	3.5	V
AKB Mode ON Voltage	V ₂₆ *	—	(Note 108)	8.0	9.0	10.0	V
Service Output Voltage	V _{SER} *	—	(Note 109)	3.1	3.3	3.5	V
Analog RGB Gain	G _{TX} *	—	(Note 110)	4.5	5.1	5.7	
Analog RGB Frequency Characteristics	G _{fTX} *	—	(Note 111)	-4.0	-2.0	0	dB
Analog RGB Input Dynamic Range	DR*	—	(Note 112)	1.0	1.5	—	V _{p-p}
Analog RGB White Peak Slice Level	V _{WPTX} *	—	(Note 113)	6.8	7.0	7.2	V
Analog RGB Black Peak Limiter Level	V _{BPTX} *	—	(Note 114)	2.2	2.4	2.6	V
RGB Contrast Control Characteristics	V _{UTXMAX} *	—	(Note 115)	1.36	1.53	1.72	V _{p-p}
	V _{UTXCEN} *			0.76	0.85	0.95	
	V _{UTXMIN} *			0.20	0.22	0.25	
	ΔV _{UTX} *			15.8	16.8	17.8	dB
Analog RGB Brightness Control Characteristics	V _{BRTXMAX} *	—	(Note 116)	4.2	4.5	4.8	V
	V _{BRTXCEN} *			3.4	3.7	4.0	
	V _{BRTXMIN} *			2.6	2.9	3.2	
Analog RGB Brightness Data Sensitivity	G _{TXBR} *	—	(Note 117)	11.7	13.0	14.3	mV
Analog RGB Mode ON Voltage	V _{TXON}	—	(Note 118)	1.2	1.5	1.8	V
Analog RGB Mode Propagation Characteristics	τ _{RYS} *	—	(Note 119)	—	50	100	ns
	t _{PRYS} *			—	25	100	
	Δt _{PRYS}			—	0	20	
	τ _{FYS} *			—	10	100	
	t _{PFYS} *			—	30	100	
	Δt _{PFYS}			—	0	20	

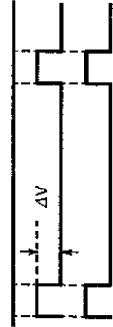
* : R or G or B

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Analog RGB Propagation Characteristics	τ_{RTX}^*	—	(Note 120)	—	50	100	ns
	t_{PRTX}^*			—	20	100	
	Δt_{PRTX}			—	0	20	
	τ_{FTX}^*			—	50	100	
	t_{PFIX}^*			—	20	100	
	Δt_{PFIX}			—	0	20	
OSD Output DC Voltage	V_{OSDDC}^*	—	(Note 121)	2.4	2.6	2.8	V
OSD Mode ON Voltage	V_{OSDON}^*	—	(Note 122)	1.2	1.5	1.8	V
OSD Output Hi Voltage	V_{OSDHI1}^*	—	(Note 123)	5.4	5.7	6.0	V
	V_{OSDHI2}^*			4.9	5.2	5.5	
OSD Hi Mode ON Voltage	$V_{OSDHION}^*$	—	(Note 124)	1.2	1.5	1.8	V
OSD Mode Propagation Characteristics	τ_{ROSD}^*	—	(Note 125)	—	15	100	ns
	t_{PROSD}^*			—	25	100	
	Δt_{PROSD}			—	0	20	
	τ_{FOSD}^*			—	15	100	
	t_{PFOSD}^*			—	25	100	
	Δt_{PFOSD}			—	0	20	
OSD Hi Mode Propagation Characteristics	τ_{ROSD}^*	—	(Note 126)	—	15	100	ns
	t_{PROSD}^*			—	20	100	
	Δt_{PROSD}			—	0	20	
	τ_{FOSD}^*			—	15	100	
	t_{PFOSD}^*			—	20	100	
	Δt_{PFOSD}			—	0	20	
Color Temperature SW	V_{CTG}	—	(Note 127)	-1.5	-1.0	-0.5	dB
	V_{CTB}			-2.5	-2.0	-1.5	

* : R or G or B

TEST CONDITION

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD			
		SW & VR MODE														
		S3	S53	S54	S57	S58	S59	S61	S24	S25						
1	Y Input Pedestal Clamp Voltage	ON	OFF	OFF	OFF	c	b	b	a	↑	↑	↑	↑	↑	↑	Measure the DC voltage of pin 58.
2	Y input Pedestal Clamp Pulse Phase	↑	↑	↑	↑	b	b	↑	a	↑	↑	↑	↑	↑	↑	Monitor pin 58 with Oscilloscope. 
3	Pin 56 Output Impedance	↑	↑	↑	↑	c	c	b	b	↑	↑	↑	↑	↑	↑	(1) Set external voltage supply and micro current measure to get to no current to / from pin 56. (2) Measure current i in (A) for pin 56 voltage change by $+0.1V$.  $Z_{OUT56} = 0.1 (V) / i \text{ input (A)}$.
4	DC Restoration Ratio Compensation Amp.	c	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Same Condition for Note 3. (2) Measure ΔV_1 ; Pin 39 level difference for pin 56 level change by 0.1V. (3) Measure ΔV_2 ; Pin 39 level difference for pin 56 level change by 0.2V.  (4) Calculate $AV_{56} = (\Delta V_2 - \Delta V_1) / 10.1$ (Y gain) (Gu) Pin 39 Waveform [Pin 56 + 0.1V Pin 56 + 0.2V

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V, T_a = \pm 3^\circ C$)										MEASUREMENT METHOD
		SW & VR MODE										
		S3	S53	S54	S57	S58	S59	S61	S24	S25		
5	Dynamic ABL Max. Sensitivity	c	OFF	OFF	OFF	c	a	b	OFF	OFF	(1) Sub address (10) data ; FF (H) (2) Monitor pin 56 Wave form (3) SW54 to "a" and "OFF" (4) Measure pin 56 pulse height ΔV	
				↕							 <p>Pin 56 Wave Form (OFF) Pin 56 Wave Form (a) Pin 11 Wave Form</p>	
6	Black Expansion Amp. Max. Gain	↑	↑	OFF	↑	a	↑	↑	↑	↑	(5) Calculate $GV_{54} = \Delta V / 10 \mu A$ (1) Sub address (10) data ; FF (H) (2) Y γ in Input 0.1V _{p-p} , 500kHz, Sin wave. (3) pin 57 voltage ; 4.5V. (4) Measure pin 56 Wave Amplitude ; V_A (V_{p-p}) (5) Sub address (10) data ; FB (H) (6) Measure pin 56 Wave Amplitude ; V_B (V_{p-p}) (7) Calculate $GV_{BE} = V_B / V_A$	
7	Y Input Dynamic Range	↑	↑	↑	↑	c	b	↑	↑	↑	(1) Connect Power Supply to pin 58. (2) Set the External Voltage to V_{58} at the test Note 1. (3) Raise the External Voltage. (4) Measure the voltage not to change pin 39 monitor out (Y out) voltage ; V (5) Calculate $DR_{58} = V - V_{58}$	
8	Picture Control Center Frequency	↑	↑	b	ON	a	↑	↑	ON	↑	(1) Connect 5G to Y in, input 1 V_{p-p} sinwave (Frequency Sweep). (2) Monitor pin 54, get frequency to minimize the pin 54 wave amplitude ; FP	

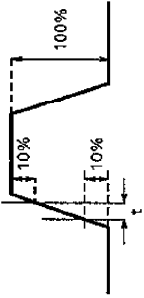
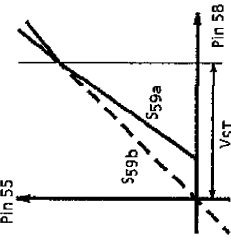
NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, Ta = ±3°C)											MEASUREMENT METHOD
		SW & VR MODE											
		S3	S53	S54	S57	S58	S59	S61	S24	S25			
9	G _S MAX Picture Control Range	c	OFF	OFF	ON	a	b	b	OFF	ON			
	G _S MIN												
10	Picture Control Center Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑			
11	Center Frequency Change Range	↑	a	b	↑	↑	↑	↑	↑	↑			

(1) SG to Y in, input 2.4MHz, 20mV_{p-p}, Sinwave.
 (2) Sub address (04) data ; FF (H)
 (3) Measure pin 39 output amplitude ; V_{PK}
 (4) SG Frequency to 10kHz.
 (5) Measure pin 39 output amplitude ; V_{10K}
 (6) Calculate G_SMAX = 20log (V_{PK}/V_{10K})

(1) SG to Y in, input 2.4MHz, 20mV_{p-p}, Sinwave.
 (2) Sub address (04) data ; 00 (H)
 (3) Measure pin 39 output amplitude ; V_{TP}
 (4) SG Frequency to 10kHz.
 (5) Measure pin 39 output amplitude ; V_{10K}
 (6) Calculate G_SMIN = 20log (V_{TP}/V_{10K})

(1) SG to Y in, input 2.4MHz, 20mV_{p-p}, Sinwave.
 (2) Sub address (04) data ; CO (H)
 (3) Measure pin 39 output amplitude ; V_{PK}
 (4) SG Frequency to 10kHz.
 (5) Measure pin 39 output amplitude ; V_{10K}
 (6) Calculate G_SCT = 20log (V_{PK}/V_{10K})

(1) Connect SG to Y in, input 1V_{p-p} Sinwave.
 (Frequency Sweep)
 (2) Monitor pin 53 wave, get frequency to minimize the pin 53 amplitude ; F_{PMAX}
 (3) SW₅₃ to "b".
 (4) Same as above ; F_{PMIN}

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD
		SW & VR MODE											
		S3	S53	S54	S57	S58	S59	S61	S24	S25			
12	Super Real Transient 2T Pulse Response	c	OFF	OFF	ON	a	b	a	ON	OFF			
													
13	Noise Reduce	↑	↑	↑	↑	↑	↑	b	OFF	ON		<p>(1) Apply 2T pulse to Y in, sync. in. ($0.7V_{pp} = 100IRE$)</p> <p>(2) Monitor pin 39 Wave Form. (Y out)</p> <p>(3) Sub address (04) Data ; CO (H)</p> <p>(4) Sub address (0F) Data ; 00, 01, 10, 11 (H)</p> <p>(5) Get Front Edge rising time (10%, 90%) ; POS</p> <p>(6) POS at sub address (0F) Data ; 00 (H) ; POS00</p> <p>(7) POS at sub address (0F) Data ; 01 (H) ; POS01</p> <p>(8) POS at sub address (0F) Data ; 10 (H) ; POS10</p> <p>(9) POS at sub address (0F) Data ; 11 (H) ; POS11</p> <p>(1) SG to Y in, Input 2.4MHz, 20mV_{pp}, Sinwave</p> <p>(2) Sub address (04) Data ; FF (H)</p> <p>(3) Sub address (10) Data ; FF (H)</p> <p>(4) Measure pin 39 output amplitude ; V_{pK}</p> <p>(5) SG Frequency to 10kHz.</p> <p>(6) Measure pin 39 output amplitude ; V_{10K}</p> <p>(7) Calculate GNR = 20log (V_{pK} / V_{10K})</p> <p>(8) Sub address (10) data ; 3F, 7F, BF (H)</p> <p>(9) GNR at sub address (10) ; 3F (H) ; GNR00</p> <p>(10) GNR at sub address (10) ; 7F (H) ; GNR01</p> <p>(11) GNR at sub address (10) ; BF (H) ; GNR10</p>	
14	Black Expansion Start Point	↑	↑	↑	OFF	c	b	↑	↑	OFF		 <p>(1) External Power Supply to pin 57, 58.</p> <p>(2) Set pin 57 voltage to Note 1 V₅₈, V₅₈ + 0.5V.</p> <p>(3) Set pin 58 voltage to Note 1 V₅₈, and raise.</p> <p>(4) Monitor pin 55 voltage vs. pin 58 voltage for SW_{59a}, b.</p> <p>(5) Get V_{ST} as pin 58 voltage level of transient point.</p> <p>(6) V_{ST} at pin 57 voltage ; V₁ V₅₈ ; V_{ST1}.</p> <p>(7) V_{ST} at pin 57 voltage ; V₁ V₅₈ + 0.5V ; V_{ST2}.</p>	

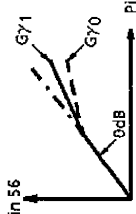
NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)									
		SW & VR MODE									
		S3	S53	S54	S57	S58	S59	S61	S24	S25	
		c	OFF	a	OFF	c	c	b	OFF	OFF	
15	Black Peak Detection Inhibit Period (Horizontal)	↑	↑	OFF	NO	a	b	↑	↑	↑	
16	Black Peak Detection Inhibit Period (Vertical)	↑	↑	OFF	NO	a	b	↑	↑	↑	
17	VM Output Y Gain	↑	↑	OFF	NO	a	b	↑	↑	↑	
18	γ Correction Start Point	↑	↑	OFF	NO	a	b	↑	↑	↑	

MEASUREMENT METHOD	
Monitor pin 59 Wave Form. Measure Horizontal Tip Period.	
Monitor pin 59 Wave Form. Measure Vertical Tip Period.	

(1) Y in Input 0.1V _{p-p} , 500kHz Sinwave.
(2) Sub Address (08) Data ; 10, 30, 50, 70, (H)
(3) Measure pin 55 Wave Form Amplitude ; V_A V _{p-p}
(4) Calculate $GVM = 20 \log (V_A / 0.1)$
(5) GVM at sub address (08) Data ; 10 ; GVM ₀₀
(6) GVM at sub address (08) Data ; 30 ; GVM ₀₁
(7) GVM at sub address (08) Data ; 50 ; GVM ₁₀
(8) GVM at sub address (08) Data ; 70 ; GVM ₁₁
(1) External Power Supply to pin 58.
(2) Sub address (10) Data ; CF, DF, EF (H).
(3) Set pin 58 Voltage to Note 1, V ₅₈ and raise.
(4) Monitor pin 56 Voltage vs. pin 58 voltage.
(5) Get V _y as pin 56 Voltage level of transient point.
(6) V _y at sub address Data CF (H) ; V _{y00}
(7) V _y at sub address Data DF (H) ; V _{y01}
(8) V _y at sub address Data EF (H) ; V _{y10}

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NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD		
		SW & VR MODE													
		S3	S53	S54	S57	S58	S59	S61	S24	S25					
19	γ Correction Gain	c	OFF	OFF	OFF	c	b	b							<p>(1) Same as Note 18, sub address (10) Data ; CF, C7 (H)</p> <p>(2) Get Gain G_γ for γ corrected portion.</p> <p>(3) G_γ at sub address (10) Data ; CF (H) ; $G_{\gamma 1}$</p> <p>(4) G_γ at sub address (10) Data ; C7 (H) ; $G_{\gamma 2}$</p>
20	Black Peak Detection Level	↑	↑	↑	↑	↑	c	↑	↑	↑	↑	↑	↑	<p>(1) External Power Supply to pin 58.</p> <p>(2) Monitor pin 59.</p> <p>(3) Sub address (10) Data ; FA, FB (H)</p> <p>(4) Get pin 58 Voltage when pin 59 Voltage goes to "H" from "L" ; VBP (V).</p> <p>(5) VBP at sub address (10) Data ; FA (H) ; VBPA</p> <p>(6) VBP at sub address (10) Data ; FB (H) ; VBPB</p> <p>(7) Calculate $VBP_0 = VBP - V_{58}$</p> <p>(8) Calculate $VBP_1 = VBP - V_{58}$</p>	
21	DL Aparature Correction Limiting Range	↑	↑	b	ON	a	b	↑	↑	ON	↑	ON	<p>(1) SG connect to Y in.</p> <p>(2) Set SG Frequency to FP of Note 8.</p> <p>(3) Monitor pin 39 monitor output (Y out).</p> <p>(4) Sub address (04) Data ; FF (H)</p> <p>(5) Sub address (10) Data ; FD, FF (H)</p> <p>(6) Raise Input Amplitude, get Input Amplitude with which the pin 39 Wave Form starts to be distorted.</p> <p>(7) Amplitude at sub address (10) Data ; FF (H) ; VAL₀</p> <p>(8) Amplitude at sub address (10) Data ; FD (H) ; VAL₁</p>		



NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)												MEASUREMENT METHOD
		SW & VR MODE												
		S3	S53	S54	S57	S58	S59	S61	S24	S25				
22	Color Detail Emphasis	c	OFF	b	ON	a	b	b	OFF	NO			(1) SG to Y in. 5.7V to pin 34. (2) Set SG Frequency to Fp of test Vg. (3) Sub address (11) Data D6, D5 ; 10. (4) Sub address (0F) Data ; 00, 08, 10, 18 (H) (5) Monitor pin 39 monitor output (R-Y) (6) Input Amplitude ; 20mV _{p-p} (7) Measure pin 39 Amplitude ; VCD mV _{p-p} . (8) Calculate GCD = 20log (VCD / 20) (9) GCD at sub address (0F) Data ; 00 (H) ; GCD11 (10) GCD at sub address (0F) Data ; 08 (H) ; GCD10 (11) GCD at sub address (0F) Data ; 10 (H) ; GCD01 (12) GCD at sub address (0F) Data ; 18 (H) ; GCD00	

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)										MEASUREMENT METHOD	
		SW & VR MODE											
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35
23	ACC Characteristics	7F	7F	ADJ	70	—	—	—	a	OPEN	a		
									/				
									a				
24	Color Killer Color Remaining	↑	↑	↑	↑	↑	↑	↑	↑	b	↑	↑	↑
25	Color Control Characteristics	↑	00 / 40 / 7F	↑	↑	↑	↑	↑	↑	OPEN	↑	↑	↑

Chroma Input Terminal [mV_{p-p}]

U47

F1 F3

ea

5 100 300

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)												MEASUREMENT METHOD			
		SW & VR MODE															
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35				
26	Sub Color Control Characteristics	7F	7F	ADJ	60 / 70 / 7F	—	—	—	a	OPEN	a	OPEN					(1) Rainbow Signal 100mV _{p-p} Input. (2) Adjust pin 38 Iout to 8 Bar Bottom with Tint (hue) Control. (3) Sub Color Control ; Max ; (7F), Center ; (70), Min ; (60) (4) Measure Iout Amplitude. (5) Iout Amplitude at Color Control ; Max ; VSMAX (6) Iout Amplitude at Color Control ; Center ; VSCEN (7) Iout Amplitude at Color Control ; Max ; VSMIN (8) Calculate es + = 20log (VSMAX / VSCEN) (9) Calculate es - = 20log (VSMIN / VSCEN)
27	Contrast Control Characteristics	00 / 40 / 7F	↑	↑	70	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Rainbow Signal 100mV _{p-p} Input. (2) Adjust pin 38 Iout to 8 Bar Bottom with Tint (hue) Control. (3) Contrast Control ; Max ; (7F), Center ; (40), Min ; (00) (4) Measure Iout Amplitude. (5) Iout Amplitude at Color Control ; Max ; VUMAX (6) Iout Amplitude at Color Control ; Center ; VUCEN (7) Iout Amplitude at Color Control ; Max ; VUMIN (8) Calculate es = 20log (VUMAX / VUMIN).

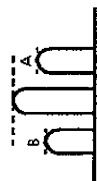
MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^{\circ}C$)													
NOTE No.	ITEM	SW & VR MODE											
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35
28	Killer Input Level	40	40	—	70	—	—	—	a	OPEN	a	OPEN	OPEN
29	Killer Characteristics	—	—	↑	—	↑	↑	↑	b	↑	↑	↑	↑
30	APC Frequency Control Sensitivity	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑

MEASUREMENT METHOD	
28	(1) Rainbow Signal 100mV _{p-p} Input. (2) Probe OFF at TP47B. (3) Reduce Input Level from 100mV _{p-p} . (4) Measure VBK ; Input Level to make no Amplitude of Iout. (5) Raise Input Level. (6) Measure VBC ; Input Level to make an Amplitude of Iout.
29	(1) No input. (2) Measure the pin 43 Killer Filter Terminal Voltage with high impedance digital volt meter ; VKBW (3) External Power Supply to this terminal. (4) Get Voltage Level to Change the DC Voltage level of pin 40 FSC out terminal ; VKC (5) Calculate $\Delta VK = VK_C - VK_{BW}$
30	(1) No Input. (2) Monitor the pin 40 FSC out terminal Frequency with counter. (3) External Power Supply (8.9 ± 0.7V) to pin 41 APC Filter Terminal, and vary. (4) V41 ; Voltage to get FSC out equals (nearly equals) to $f_c = 3.579545MHz$. (5) Vary External Power Supply to pin 41 as $V_{41} \pm 0.1V$. (6) Get free run sensitivity of FSC out ; β

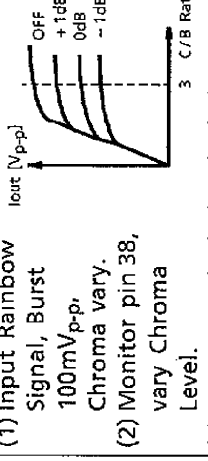
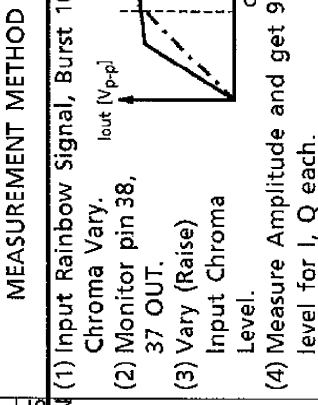
f_{40} [Hz]

FSC out terminal Frequency with counter.

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD				
		SW & VR MODES															
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34		SW35			
31	APC Pull-in, Hold Range	—	40	—	—	—	—	—	—	—	—	—	—	—	—	—	(1) Input $f_c = 3.579545MHz$, $100mV_{p-p}$ CW (2) Monitor pin 38 Iout. (3) Vary Input Frequency $\pm 3kHz$ Range by 10Hz Step. (4) Raise Frequency. (5) fPH ; Frequency to get color mode $\rightarrow f_c$. (6) fHH ; Frequency to get BW mode $\rightarrow f_c$. (7) Reduce Frequency. (8) fPL ; $f_c \rightarrow$ Frequency to get color mode. (9) fHL ; $f_c \rightarrow$ Frequency to get BW mode.
32	f_{sc} OUT Amplitude	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input 3.579545MHz, $100mV_{p-p}$. (2) Measure pin 40 FSC out Amplitude ; VFC (3) Input no Input. (4) Measure pin 40 FSC out Amplitude ; VFBW
33	IQ Color Differential Output Level	7F	7F	ADJ	70	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Rainbow Signal $100mV_{p-p}$. (2) Adjust Tint Control to 8 Bar Bottom. (3) Measure pin 38 Iout Amplitude. (4) Adjust Tint Control to 5 Bar Peak. (5) Measure pin 37 Q out Amplitude.
34	IQ Color Differential Out Relative Amplitude	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Calculate VI/VQ of Note 33.

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)										MEASUREMENT METHOD				
		00	02	03	07	0E	0F	11	SW47	SW43	SW40		SW34	SW35		
35	IQ Color Differential Output Relative Phase	7F	7F	ADJ	70	—	—	a	OPEN	a	OPEN	a	OPEN	OPEN	OPEN	<p>(1) Input Red only signal 100mV_{pp}. [B : C Amplitude = 1.1, B Phase ; 180°, C Phase ; 95°]</p> <p>(2) Monitor Q out Terminal. (3) Adjust Tint Control to get Flat Amplitude of Qout. (4) Monitor Iout Terminal. (5) Reduce the Input Signal Burst Phase (Keep C ; 95°), get Burst Phase to make Flat Iout Amplitude ; θ (6) Calculate θ_{IQ} = 180° - θ</p>
36	IQ Color Differential Tint Control	↑	↑	00 / 80 / FF	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	<p>(1) Input Rainbow signal 100mV_{pp}. (2) Tint Cont. Max (FF), Center (80), Min (00). (3) Get Phase Difference Iθ from 5 Bar Peak state. (4) Get Phase Difference Qθ from 8 Bar Bottom state. (5) Calculate</p> $\theta = \tan^{-1} \left[\frac{1}{2 \frac{A}{B} + 3} \right] - 15^\circ$ <p>(6) Iθ at Tint Max (FF) ; Iθ_{MAX}. (7) Qθ at Tint Max (FF) ; Qθ_{MAX}. (8) Iθ at Tint Cen (80) ; Iθ_{CEN}. (9) Qθ at Tint Cen (80) ; Qθ_{CEN}. (10) Iθ at Tint Min (00) ; Iθ_{MIN}. (11) Qθ at Tint Min (00) ; Qθ_{MIN}.</p> 

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^{\circ}C$)											MEASUREMENT METHOD
		SW & VR MODE											
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35
37	IQ Color Differential Max Output Level	7F	7F	ADJ	70	—	—	—	a	OPEN	a	OPEN	OPEN
		↑	40	↑	70 / 50 / 30 / 10	↑	↑	↑	↑	↑	↑	↑	
38	Color Limiter Characteristics	↑	40	↑	70 / 50 / 30 / 10	↑	↑	↑	↑	↑	↑	↑	
		↑	40	↑	70 / 50 / 30 / 10	↑	↑	↑	↑	↑	↑	↑	
39	Color Mute	↑	40 / C0	—	70	↑	↑	↑	↑	↑	↑	↑	
40	Remained CW Level	↑	7F	ADJ	↑	D4	↑	↑	b	↑	↑	↑	



(1) Input Rainbow Signal 100mVp-p.
 (2) Sub Address 02 Data to 40 (H) from C0 (H). (Mute ON.)
 (3) Measure I, Q Out level
 (1) No Input
 (2) Monitor pin 37, 38.
 (3) Vary Tint Control.
 (4) Measure Max. Color Sub Carrier Leakage for each ; V_{Ie} , V_{Qa} .

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD			
		SW & VR MODE														
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34		SW35		
41	Remained Harmonic Level	7F	7F	ADJ	70	D4	—	—	a	OPEN	a	OPEN	a	OPEN	OPEN	(1) Input Rainbow Signal 100mV _{p-p} . (2) Monitor pin 37, 38. (3) Vary Tint Control. (4) Measure Max Harmonics Level for each ; V _{IHe} , V _{QHe} .
42	RGB Color Differential Output Level	↑	ADJ	↑	↑	C4 / D4 / D4 / DC / D4	↑	↑	↑	↑	↑	↑	↑	↑	a	(1) Input Rainbow Signal 100mV _{p-p} . (2) Adjust Pin 38, 37 out Amplitude to 0.25V _{p-p} with Color Control. (3) Monitor Out (Sub address 11 data (H) ; R-Y (50), G-Y (10), B-Y (30)). (4) R-Y, G-Y relative Amp (Sub address 0E data (H)) ; 0.80, 0.32 (C4), 0.84, 0.32 (D4), 0.84, 0.34 (DC) (5) Tint Cont. ; 3 Bar Peak for R-Y (6) Tint Cont. ; 4 Bar Bottom for G-Y (7) Tint Cont. ; 6 Bar Peak for B-Y (8) Measure Output Level for each color Differential OUT.
43	RGB Color Differential OUT Relative Amplitude	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Calculate VR80 / VB, VR84 / VB, VG32 / VB, VB34 / VB of Note 42.

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^{\circ}C$)											MEASUREMENT METHOD	
		SW & VR MODE												
		00	02	03	07	0E	0F	11	SW ₄₇	SW ₄₃	SW ₄₀	SW ₃₄		SW ₃₅
44	RGB Color Differential Output Relative Phase	7F	ADJ	ADJ	70	F4 / D4 / B4 / 94 / D4 / D0	—	10 / 30 / 50	a	OPEN	a	a	a	(1) Input Rainbow Signal 100mV _{pp} . (2) Adjust Pin 38, 37 Out Amplitude to 0.25V _{pp} with color with Tint Control. (3) Input Relative Phase Measuring Bar 100mV _{pp} (fig. C-1). (4) Monitor B-Y OUT, Adjust B-Y OUT to get flat first Color with Tint Control. (5) Measure Amplitude Ratio ; R-Y OUT ; with 2, 3, 4, 5, th Color. (6) Measure Amplitude Ratio ; G-Y OUT ; with 6, 7, 8 th Color. (7) Get Phase Differential θ subject to the calculation of Note 36. (8) $\theta_R = 95^{\circ} \pm \theta$ (9) $\theta_G = 240^{\circ} \pm \theta$
45	RGB Color Differential Tint Control Characteristics	↑	↑	00 / FF	↑	D4	↑	30	↑	↑	↑	↑	(1) Input Rainbow Signal 100mV _{pp} . (2) Adjust Pin 38, 37 Out Amplitude to 0.25V _{pp} with Color Control. (3) Tint Cont. ; MAX (FF), MIN (00). (4) Measure B-Y OUT Amplitude, convert to Phase ; θ_{TMAX} , MIN.	

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)										MEASUREMENT METHOD	
		SW & VR MODE											
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35
46	IQ Amplitude Characteristics	—	—	—	—	D4	—	10	b	OPEN	a	b	c
								/	/			/	b
								30				c	
								/					
								50					

(1) I in Input 500kHz, Q input AC GND, I, Q same DC Bias.

(2) Monitor R-Y, G-Y, B-Y OUT vs. I in input voltage. (Sub address 11 data ; 10, 00. 01)

(3) Measure Output Level at I input ; $0.1V_{p-p}$; eRI, eGI, eBI.

RGB Color Differential Output

Left Graph: $R-Y \text{ GRI} = eRI \times 10$, $B-Y \text{ GRI} = eRI \times 10$, $R-Y \text{ GGI} = eGI \times 10$, $B-Y \text{ GGI} = eGI \times 10$, $R-Y \text{ GBI} = eBI \times 10$, $B-Y \text{ GBI} = eBI \times 10$

Right Graph: $B-Y \text{ GRQ} = eRQ \times 10$, $R-Y \text{ GRQ} = eRQ \times 10$, $R-Y \text{ GQG} = eGQ \times 10$, $B-Y \text{ GQG} = eGQ \times 10$, $R-Y \text{ GBQ} = eBQ \times 10$, $B-Y \text{ GBQ} = eBQ \times 10$

(4) Calculate $GRI = 10 \times eRI$.

(5) Calculate $GGI = 10 \times eGI$.

(6) Calculate $GBI = 10 \times eBI$.

(7) Measure R-Y Output Level at I input ; $0.4V_{p-p}$; ER

(8) Q in input 500kHz, I input AC GND, I, Q same DC bias.

(9) Monitor R-Y, G-Y, B-Y OUT vs in input voltage.

(10) Measure Output Level at Q input ; $0.1V_{p-p}$; eRQ, eGQ, eBQ.

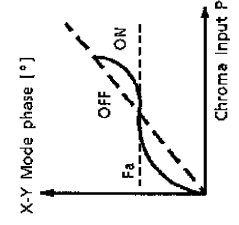
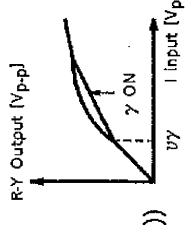
(11) Calculate $GRQ = 10 \times eRQ$.

(12) Calculate $GQG = 10 \times eGQ$.

(13) Calculate $GBQ = 10 \times eBQ$.

(14) Measure B-Y Output Level at Q input ; $0.4V_{p-p}$; EB

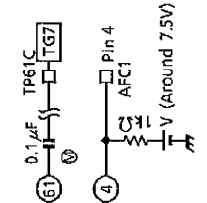
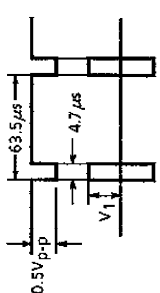
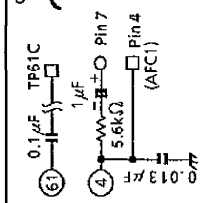
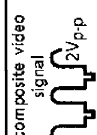
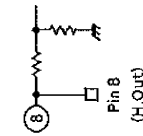
NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD	
		SW & VR MODE												
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35	
47	Color γ Characteristics	—	—	—	—	54 / D4	—	50	b	OPEN	a	b	c	<p>(1) I in input 500kHz, Q input AC GND, I, Q same DC bias.</p> <p>(2) Vary I in input level, get R-Y out vs. I in for both of color γ on (Sub address 0E data ; D4 (H)) and OFF (54).</p> <p>(3) I in to start γ correction ; V_γ.</p> <p>(4) R-Y out change vs. I in change at γ correction on against that at γ correction OFF ; $\Delta\gamma$</p>
48	Flesh Color Characteristics	7F	ADJ	ADJ	70	D4 / D6 / D7	↑	↑	a	↑	a	a	<p>(1) Input Rainbow Signal 100mV_{p-p}.</p> <p>(2) Adjust pin 38, 37 out to 0.25V_{p-p} with color control (Sub address ; 02)</p> <p>(3) Change Input Signal to Flesh Bar (Rainbow Signal by 15° step for - 30° ~ + 240° range)</p> <p>(4) Vector Monitor on B-Y out Amplitude with X-Y mode of Synchroscope.</p> <p>(5) Flesh OFF/ON, Flesh pull in range 18°, 33° (Sub address 0E data (H) ; D4 (OFF), D6 (ON, 33°), D7 (ON, 18°))</p> <p>(6) Fa18, Fa33 ; X-Y mode phase change vs. Chroma Input Phase change for I axes.</p>	



NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)											MEASUREMENT METHOD		
		SW & VR MODE													
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34		SW35	
49	Half Tone Characteristics	7F	ADJ	ADJ	70	D4	—	50	a	OPEN	a	a	a	a	(1) Input Rainbow Signal 100mV _{p-p} . (2) Adjust pin 38, 37 out to 0.25V _{p-p} with color control (Sub address ; 02) (3) Monitor B-Y OUT and adjust it to 6 Bar Peak with Tint Control (Sub Address 03) (4) Supply 5V to pin 27 YM terminal. (5) Measure B-Y OUT Amplitude V _H H. (6) No voltage Supply to pin 27. (7) Measure B-Y OUT Amplitude ; V _H L. (8) Calculate $H = V_{H}L / V_{H}H$.
50	RGB Color Differential Output DC Voltage	↑	7F	↑	↑	↑	↑	10 / 30 / 50	c	↑	↑	↑	↑	c	(1) Input Rainbow Signal 100mV _{p-p} . (2) No Input IQ in Terminal. (3) Measure Monitor OUT ; R-Y (Sub address 11 data ; 50 (H)), G-Y (10), B-Y (10), B-Y (30) DC Voltage.
51	RGB Color Differential Output DC Difference between each Axes	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) $VRG = V_R - V_G$ of Note 50. (2) $VGB = V_G - V_B$ of Note 50. (3) $VBR = V_B - V_R$ of Note 50.

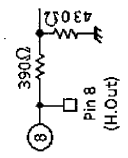
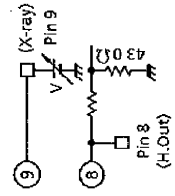
NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^{\circ}C$)												MEASUREMENT METHOD
		SW & VR MODE												
		00	02	03	07	0E	0F	11	SW47	SW43	SW40	SW34	SW35	
52	Hi-bright Color Gain	7F	ADJ	ADJ	70	35	00	30	a	OPEN	a	a	a	(1) Input Rainbow Signal 100mV _{p-p} . (2) Adjust pin 38, 37 Out to 0.25V _{p-p} with color Control. (3) Sub address 11 data ; 30 (H) ; Monitor OUT B-Y OUT. (4) Adjust B-Y OUT to 6 Bar Peak with Tint Control. (5) Measure Amplitude ; V _B (6) Sub address 11 data ; 70 (H) ; Monitor OUT Y OUT (7) Sub address 0F data ; 00, 20, 40, 60 (H) (8) Measure Y OUT 6 Bar Amplitude ; VY1, 2, 3, 4. (9) Calculate HB1 = VY1/V _B (Sub address 0F data : 00) (10) Calculate HB2 = VY2/V _B (Sub address 0F data : 20) (11) Calculate HB3 = VY3/V _B (Sub address 0F data : 40) (12) Calculate HB4 = VY4/V _B (Sub address 0F data : 60)

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, Ta = ±3°C)										MEASUREMENT METHOD
		SW & VR MODE										
		SW3	SW4	SW8	SW9	SW10	SW11	SW12	SW61			
53	Sync. Sepa. Input Sensitive Current	d	ON	ON	a	a	ON	ON	c		<p>(1) Reduce V from 3V. (2) Monitor pin 62 (Vp Out) Frequency. (3) Measure Δ when the frequency goes to 250H from 297H.</p>	
54	V.Sepa. Filter Terminal Outflow Current	↑	↑	↑	↑	↑	↑	↑	b		<p>Measure Δ.</p>	
55	V.Sepa. Level	↑	↑	↑	↑	↑	↑	↑	OFF		<p>(1) Ground pin 61 (Sync. in). (2) Measure pin 3 (V.sepa.) Voltage.</p>	
56	H.AFC1 Phase Detection Current	↑	OFF	↑	↑	↑	↑	↑	a		<p>(1) Adjust V to pin 4 opened voltage (Around 7.5V). (2) Input signal shown in the fig. to TP61C from 5G. (3) Monitor Pin 4 terminal waveform. (4) Get V₁, V₂. (5) Calculate $\Delta \text{DET1} = V_1 / 1k\Omega$ (μA) (6) $\Delta \text{DET1} = (V_1 / V_2 - 1) \times 100$ (%)</p>	

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)											
		SW & VR MODE											
		SW3	SW4	SW8	SW9	SW10	SW11	SW12	SW61				
57	H-AFC1 Double Made Phase Detection Current	d	OFF	ON	a	a	ON	OFF	a				
		<p>MEASUREMENT METHOD</p> <p>(1) Adjust V to pin 4 opened voltage (Around 7.5V). (2) Input signal shown in the fig. to TP61C from SG. (3) Monitor pin 4 terminal waveform. (4) Sub address 12 data 63 (H) (5) Get V₁. (6) Calculate $3 DET1 = V_1 / 1k\Omega (\mu A)$ $4 DET1 = (V_1 / V_2 - 1) \times 100 (\%)$</p>  											
58	Phase Detection Stop Period	↑	ON	↑	↑	↑	↑	↑	↑				
		<p>MEASUREMENT METHOD</p> <p>(1) Input 60Hz Composite Video Signal to TP61C. (2) Monitor pin 4 terminal waveform. (3) Measure the V mask Period.</p>  											
59	Phase Detection Stop Mode	↑	↑	↑	↑	↑	↑	↑	↑				
		<p>MEASUREMENT METHOD</p> <p>(1) Sub address (H) ; 12 data ; 03 (2) Input 60Hz Composite Video Signal to TP61C. (3) Measure pin 8 (H.Out) Frequency.</p> 											

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)							MEASUREMENT METHOD	
		SW & VR MODE								
		SW ₃	SW ₄	SW ₈	SW ₉	SW ₁₀	SW ₁₁	SW ₁₂	SW ₆₁	
60	H-AFC2 Phase Detection Current	d	ON	OFF	a	b	OFF	OFF	a	<p>Pin 10 Waveform. (AFC2)</p> <p>(1) No V_{CC}1, No V_{CC}2. (2) Calculate I_{DET2} = V₄ / 5.1kΩ (μA)</p>
61	32fH VCO Oscillation Start Voltage	↑	↑	↑	↑	a	↑	↑	b	<p>(1) Raise V from 3.5V. (2) Measure V to start OSC at Pin 5 B. (3) Check Pin 8 of no Output. (No V_{CC}1, NO V_{CC}2)</p>
62	Horizontal Output Start Voltage	↑	↑	↑	↑	↑	ON	↑	↑	<p>(1) Raise V. (2) Measure V to generate H Pulse at Pin 8. (3) Check H OSC Frequency around f_{HO} (15.7 ± 1kHz), (No V_{CC}1, NO V_{CC}2)</p>
63	Horizontal Output Pulse Duty	↑	↑	↑	↑	↑	ON	↑	↑	<p>(1) Monitor Pin 8 Waveform. (2) Measure t₁ and t₂.</p> <p>(3) Calculate TH8 = $\frac{t_1}{t_1 + t_2} \times 100$ [%]</p>

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)										MEASUREMENT METHOD
		SW & VR MODE										
		SW ₃	SW ₄	SW ₈	SW ₉	SW ₁₀	SW ₁₁	SW ₁₂	SW ₆₁			
64	Horizontal Free Run Frequency	d	ON	OFF	a	ON	OFF	b				(1) Measure Pin 8 (H.Out) OSC Frequency.
65	Horizontal OSC Frequency Range	↑	↑	↑	↑	↑	↑	↑	↑			(1) Connect Pin 4 to Def V _{CC} via 10kΩ. (2) Measure Pin 8 OSC Frequency, f _{HMAX} . (3) Release Pin 4. (1) Connect Pin 4 to GND via 68kΩ. (2) Measure Pin 8 OSC Frequency, f _{HMIN} .
66	Horizontal OSC Control Sensitivity	↑	OFF	↑	↑	↑	ON	↑				(1) Vary Pin 4 Voltage. (2) Get Pin 4 Voltage to make H OSC of 15.734kHz. (3) Vary Pin 4 Voltage with ±0.05V. (4) Get Pin 8 (H.Out) Frequency Change Ratio vs. Voltage Change.
67	Horizontal OUT Voltage	↑	ON	↑	↑	↑	↑	↑	↑			Measure "H" Voltage of pin 8 Output Waveform, V _{H8} . Measure "L" Voltage of Pin 8 Output Waveform, V _{L8} .
68	X-ray Voltage Protection Detection Voltage	↑	↑	↑	OFF	↑	↑	↑				(1) Connect Power Supply to Pin 9 (X-ray pin). (2) Monitor Pin 8 Pin out. (3) Raise Supply Voltage to Pin 9. (4) Measure Supply Voltage V to stop pin 8 out. (Make "L")
69	X-ray Voltage Protection Voltage	↑	↑	↑	↑	↑	OFF	↑				(1) Supply 4V to Pin 9 to make Pin 8 "L". (2) Release Power Supply to pin 4 after check of pin 8 "L". (3) Vary Pin 7 (Def V _{CC}) Voltage 9V→2.5V→9V. (4) Check Pin 8 "L". (No V _{CC1} , No V _{CC2})



NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, Ta = ± 3°C)									
		SW & VR MODE									
		SW3	SW4	SW8	SW9	SW10	SW11	SW12	SW13	SW61	
70	Horizontal Sync. Phase	d	ON	ON	a	a	ON	ON	a	ON	<p>MEASUREMENT METHOD</p> <p>(1) Input signal as shown in ref. fig. from SG to TP61C.</p> <p>(2) Measure Phase Difference SpH1 of Pin 11 (H.BLK in) Waveform against Pin 61 (Sync. in) Waveform.</p>
71	Horizontal Image Position Phase Adjustable Range	↑	↑	↑	↑	↑	↑	↑	↑	↑	<p>(1) Same as above.</p> <p>(2) Vary sub address (11) data from (00) to (1F) (H).</p> <p>(3) Measure Phase change amount of Pin 11 (H.BLK IN) Waveform for the data change, ΔHSFT.</p>
72	Vertical OSC Start Voltage	↑	↑	OFF	↑	OFF	OFF	b	↑	<p>(1) Raise V from 0V.</p> <p>(2) Measure V to generate pulse Out at pin 62 (VP Out). (No V_{CC}1, No V_{CC}2)</p>	
73	Vertical Free Run Frequency	↑	↑	ON	↑	ON	↑	a	↑	<p>Measure pin 62 (Vp Out) Oscillation Frequency.</p>	
74	Survive Mode Switching Voltage	↑	↑	↑	↑	↑	ON	↑	↑	<p>(1) Sub address (11) data ; (80).</p> <p>(2) Check pin 62 (Vp Out) keep High (DC 5V), VPNO.</p>	

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)									
		SW & VR MODE									
		SW3	SW4	SW8	SW9	SW10	SW11	SW12	SW61		
75	Vertical Output Voltage	d	ON	ON	a	a	ON	OFF	a		
76	Vertical Output Pulse Width	↑	↑	↑	↑	↑	ON	OFF			
77	Vertical Pulse Width Variable Range	↑	↑	↑	↑	↑	↑	↑	↑		
78	Vertical Output Pulse Width Variable Range	↑	↑	↑	↑	↑	↑	↑	↑		
79	Vertical Pull-in Range (1)	↑	↑	↑	↑	↑	↑	↑	a		
80	Vertical Pull-in Range (2)	↑	↑	↑	↑	↑	↑	↑	↑		
81	Vertical Frequency Focused 262.5H (60Hz)	↑	↑	↑	↑	↑	↑	OFF	↑		
82	Vertical Frequency Focused 312.5H (50Hz)	↑	↑	↑	↑	↑	↑	↑	↑		

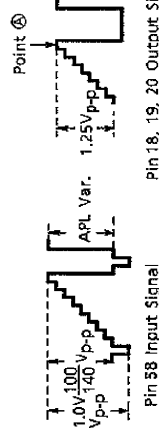
MEASUREMENT METHOD	MEASUREMENT METHOD
Measure the "H" voltage of pin 62 (Vp Out) Output, V _{VH} . Measure the "L" voltage of pin 62 (Vp Out) Output, V _{VL} .	<p>Pin 62 Waveform</p> <p>(1) Monitor Pin 62 (Vp Out) Output Waveform. (2) Measure Tr1.</p>
<p>(1) Ground Tp 61. (2) Measure Tr2.</p>	<p>(1) Vary sub address (12) data ; from (20) to (27). (2) Monitor Tr2. (3) Measure Tr2 change step / 1bit, VPUN. (4) Measure Tr2 variable range, VPLI.</p>
<p>(1) Input 60Hz Comp. Video Signal to TP61C. (2) Vary V Frequency by 0.5H Step. (3) Measure Pull in Range.</p>	<p>(1) Sub address (12) data ; (3B) (2) Input 50Hz Comp. Video Signal to TP61C. (3) Vary V Frequency by 0.5H Step. (4) Measure pull in Range.</p>
<p>(1) Sub address (12) data ; (2B) (2) Measure pin 62 (Vp Out) Osc Frequency, fv60.</p>	<p>(1) Sub address (12) data ; (3B) (2) Measure pin 62 (Vp Out) Osc Frequency, fv50.</p>

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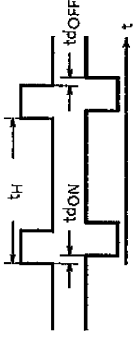
NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)												MEASUREMENT METHOD			
		SW & VR MODE															
83	AC Gain	SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	a	a	a	a	a	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Measure Picture Period Amplitude of Output at pin 18, 19, 20 ; V18, 19, 20. (3) Calculate GR = V18/0.3 (4) Calculate GG = V19/0.3 (5) Calculate GB = V20/0.3
84	Frequency Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal 1 ; f ₀ = 8MHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Measure Picture Period Amplitude of Output at pin 18, 19, 20 ; V18MHz, 19MHz, 20MHz. (3) Calculate Gfr = 20log (V18MHz / V18) (4) Calculate Gfg = 20log (V19MHz / V19) (5) Calculate Gfb = 20log (V20MHz / V20)
85	Uni-color Control Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Sub address (11) Data ; (70). (3) Uni-color Data ; max (7F), Center (40), Min (00). (4) Measure pin 39 Amplitude during picture Period, V _{uMAX} , V _{uCEN} , V _{uMIN} . (5) Calculate $\Delta V_u = 20\log (V_{uMAX} / V_{uMIN})$.
86	Uni-color Control Voltage Range	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	c	↑	↑	↑	(1) Uni-color Data ; Max (7F), Center (40), Min (00). (2) Measure pin 52 Terminal Voltage, V52MAX, V52CEN, V52MIN. (3) Calculate V52 (+) = V52MAX - V52CEN. (4) Calculate V52 (-) = V52CEN - V52MIN.
87	Brightness Control Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Sub address (11) Data ; (70). (2) Brightness data ; Max (FF), Center (80), Min (00). (3) Measure pin 39 Picture Period Amplitude VBRMAX, VBRCEIN, VBRMIN.

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NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)													MEASUREMENT METHOD
		SW & VR MODE													
88	Brightness Data Sensitivity	SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	a	a	a	(1) Same as above. (2) Calculate $G_{BR} = (V_{BRMAX} - V_{BRMIN}) / 255$
89	Brightness Control Voltage Range	a	b	b	a	a	a	a	↑	↑	↑	↑	↑	↑	(1) Brightness Data ; Max (FF), Center (80). Min (00). (2) Measure pin 51 Terminal Voltage, V51MAX, V51CEN, V51MIN. (3) Calculate $V51 (+) = V51MAX - V51CEN$. (4) Calculate $V51 (-) = V51CEN - V51MIN$.
90	White Peak Slice Level	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Sub Contrast Max. (2) Apply Power Supply to pin 58. (3) Raise Voltage to pin 58 from DC 4V. (4) Measure the Voltage to Clip pin 18, 19, 20 Picture Period Amplitude, V _{WPS1} . (5) Sub address (0F) Data ; (00). (6) Same as above, V _{SPW2} *. * : R or G or B
91	Black Peak Slice Level	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Sub contrast Max. (2) Apply Power Supply to pin 58. (3) Reduce Voltage to pin 58 from DC 4V. (4) Measure the Voltage to Clip pin 18, 19, 20 Picture period Amplitude, V _{BPS} *. * : R or G or B
92	DC Restoration Level	↑	↑	↑	↑	↑	↑	↑	a	↑	↑	↑	↑	↑	(1) Input SG step up Signal. (2) Adjust uni-color data to make step up signal out from pin 18 be 1.25V _{p-p} . (3) Monitor Point A Voltage. (4) Vary the APL of the step up signal from 10 to 90%. (5) Measure the Voltage change of point A. (6) Same as above for pin 19, 20.



NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)											MEASUREMENT METHOD
		SW & VR MODE											
93	RGB Output Emitter Follow Drive Current	a	b	b	a	a	a	a	a	a	a	a	(1) Adjust Brightness Data to make pin 18 Picture Period Voltage be 3.2V. (2) Connect 4.2V Power Supply to pin 18 via 100Ω. (3) Measure flow in current to pin 18, (IOUTR). (4) Same as above for pin 19, 20 ; (IOUTG, IOUTB).
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61		
94	Half Tone Characteristics	↑	↑	↑	OFF	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Measure pin 18 Picture Period Amplitude, (V18A). (3) Supply 5V External Power Supply to pin 27. (4) Measure pin 18 Picture Period Amplitude, (V18B). (5) Calculate GHT = V18B / V18A
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61		
95	Half Tone ON Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Connect Power Supply to pin 27. (3) Raise External Power from 0V. (4) Monitor the pin 18 picture Period Amplitude. (5) Measure the pin 27 Voltage to change the pin 18 picture Period Amplitude, (VHT).
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61		
96	V.BLK Pulse Output Level	↑	↑	↑	a	↑	↑	↑	↑	↑	↑	d	Measure pin 18, 19, 20 V.BLK Period Voltage, (Vv*). * : R or G or B
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61		
97	H.BLK Pulse Output Level	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	Measure pin 18, 19, 20 H.BLK Period Voltage, (VH*). * : R or G or B
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61		

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)										MEASUREMENT METHOD	
		SW & VR MODE											
98	BLK Pulse Delay Time	a	b	b	a	a	a	a	a	a	a	d	(1) Input Signal A to pin 11 (H:BLK IN). (2) Monitor Output Signal B from pin 18, 19, 20. (3) Measure t _{ON} *, OFF*. (A) Pin 11 Apply Signal  (B) Pin 18, 19, 20 Output Signal * : R or G or B
99	Sub Contrast Control Range	↑	↑	↑	↑	↑	↑	↑	↑	a	↑	↑	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Sub Contrast (Sub address (08)) Data ; max (IF), center (10), min (00), V18max, center, min. (3) Calculate $\Delta V_{SU} (+) = 20\%og (V18max / V18center)$ (4) Calculate $\Delta V_{SU} (-) = 20\%og (V18min / V18center)$
100	RGB Output Voltage	↑	↑	↑	↑	↑	↑	↑	↑	c	↑	↑	Measure pin 18, 19, 20 Picture Period Voltage, V _{OUT} *. * : R or G or B
101	RGB OUT Voltage 3 Axes Difference	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	$\Delta V_{out} = \max \left(\frac{ V_{OUTR} - V_{OUTG} }{V_{OUTB}}, \frac{ V_{OUTG} - V_{OUTB} }{V_{OUTR}}, \frac{ V_{OUTB} - V_{OUTR} }{V_{OUTG}} \right)$
102	Cut Off Control Range	↑	↑	↑	↑	↑	↑	↑	↑	a	c	a	(1) Supply 12V Power Supply to pin 26. (2) Cut off (Sub address (09, 0A, 0B)) Data ; max (FF), center (80), min (00). (3) Measure pin 18, 19, 20 Voltage. (4) CUT* (+) = V (max) - V (center) (5) CUT* (-) = V (min) - V (center) * : R or G or B

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NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)												MEASUREMENT METHOD
		SW & VR MODE												
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61			
103	Drive Control Range	a	b	b	a	a	a	a	a	a	a	a	a	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Drive (Sub address (0C, 0D) Data ; max (7F), center (40), min (00). (3) Measure pin 19, 20 Voltage. (4) (+) ; 20log (volt. max / volt. center) (5) (-) ; 20log (volt. min / volt. center)
104	Mute Output Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	c	↑	(1) Bus Mute ; Sub address (00) Data ; (FF) (2) Measure R, G, B OUT (pin 18, 19, 20) Picture period Output Voltage, (MURD, GD BD). (3) Pin mute ; Supply 5V External Power Supply to pin 26. (4) Measure R, G, B OUT (pin 18, 19, 20) Picture Period Output Voltage, (MU*A). * : R or G or B
105	Mute ON Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Connect External Power Supply to pin 26. (2) Raise the External Supply Voltage from 0V. (3) Measure the voltage to change the pin 18, 19, 20 voltage each, (VMU*). * : R or G or B
106	Blue Back Output Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Sub address (0F) Data ; (80). (2) Measure R, G, B Out (pin 18, 19, 20) Picture Period Output Voltage, (BB*). * : R or G or B
107	AKB Mode Output Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Connect pin 26 to 12 VCC. (2) Measure R, G, B out (pin 18, 19, 20) Picture Period Output Voltage, (VAKB*). * : R or G or B
108	AKB Mode ON Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Apply 5V External Voltage to pin 26. (2) Raise the External Supply Voltage. (3) Measure the Voltage to change the pin 18, 19, 20 Voltage each, (V _{26R} , V _{26B})

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ± 3°C)										
		SW & VR MODE										
109	Service Output Voltage	SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	MEASUREMENT METHOD (1) Apply 5V External Voltage to pin 26. (2) Sub address (11) Data ; (80). (3) Measure R, G, B out (pin 18 19, 20) picture Period Output Voltage, (V _{SER} *). * : R or G or B
110	Analog RGB Gain	↑	↑	↑	a or b	a or b	a or b	a or b	↑	a or c	↑	(1) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{pp} to pin 58. (2) Adjust Drive Control data to equalize the pin 19 and 20 picture Period Voltage to that of pin 18. (3) Supply 5V External Voltage to pin 28. (4) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{pp} to pin 29/20/31. (5) Measure the pin 18/19/20 Picture period Output Voltage (V18R/19G/20B). (6) Calculate GTXR = V18R/0.3, GTXG = V19G/0.3, GTXB = V20B/0.3.
111	Analog RGB Frequency Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{pp} to pin 58. (2) Adjust Drive Control Data to equalize the pin 19 and 20 Picture Period Voltage to that of pin 18. (3) Supply 5V External Voltage to pin 28. (4) Input Signal ; f ₀ = 8MHz, Picture period Amplitude 0.3V _{pp} to pin 29/30/31. (5) Measure the pin 18/19/20 Picture Period Output Voltage, (V18R8MHz/19G8MHz/20B8MHz). (6) Calculate GfTXR = 20log (V18R8MHz / V18R) (7) Calculate GfTXG = 20log (V19R8MHz / V19G) (8) Calculate GfTXB = 20log (V20R8MHz / V20B)

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)										MEASUREMENT METHOD
		SW & VR MODE										
112	Analog RGB Input Dynamic Range	SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	(1) Supply 5V External Power Supply to pin 28. (2) RGB Contrast Data ; min (00). (3) Input Signal 2 ; to pin 29/30/31. (4) Raise Picture Period Amplitude from 0V. (5) Measure the Amplitude A to stop changing the pin 18/19/20 Output Voltage, (DRG, DRB).
113	Analog RGB White Peak Slice Level	↑	↑	↑	↑	a	a or b	a or b	↑	↑	↑	(1) Supply 5V External Voltage to pin 28. (2) RGB Contrast Data ; max (7F). (3) Supply External Power Supply to pin 29/30/31. (4) Raise the voltage from DC 4.5V. (5) Measure the Voltage to Clip pin 18/19/20 Output, (VWPSTXG, VWPSTXB).
114	Analog RGB Black Peak Limiter Level	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Supply 5V External Voltage to pin 28. (2) RGB Contrast Data ; max (7F). (3) Supply External Power Supply to pin 29/30/31. (4) Reduce the Voltage from DC 4.5. (5) Measure the Voltage to Clip pin 18/19/20 output, (VBPSTXG, VBPSTXB).

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, T _a = ±3°C)												MEASUREMENT METHOD
		SW & VR MODE												
115	RGB Contrast Control Characteristics	SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	a	c	(1) Input Signal ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Adjust Drive Control Data to equalize the pin 19 and 20 Picture Period Voltage to that of pin 18. (3) Supply 5V External Voltage to pin 28. (4) Input Signal 1 ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} . (5) RGB Contrast Data ; max (7F), center (40), min (00). (6) Measure pin 18 Picture Period Amplitude, (VUTXRMAX*, VUTXCEN*, VUTXRMIN*). (7) ΔVUTXR = 20log (VUTXRMAX / VUTXRMIN) (8) Same as above for pin 30, 19, G, pin 31, 20, B. * : R or G or B
116	Analog RGB Brightness Control Characteristics	↑	↑	↑	↑	a	a	a	↑	↑	↑	↑	↑	(1) Input Signal ; f ₀ = 100kHz, Picture Period Amplitude 0.3V _{p-p} to pin 58. (2) Adjust Drive Control Data to equalize the pin 19 and 20 Picture Period Voltage to that of pin 18. (3) Supply 5V External Voltage to pin 28. (4) Input Signal 2 ; to pin 29, 30, 31. (5) Adjust the Amplitude A to get pin 18 Picture Period Out of 0.5V _{p-p} . (6) RGB Brightness Data ; max (7F), center (40), min (00). (7) Measure pin 18, 19, 20 Picture Period Voltage for each. (VBRTXMAX*, VBRTXCEN*, VBRTXMIN*) * : R or G or B
117	Analog RGB Brightness Data Sensitivity	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) for pin 18, 19, 20, calculate GT _{XBR} * = (VBRTXMAX* - VBRTXMIN*) / 127. * : R or G or B

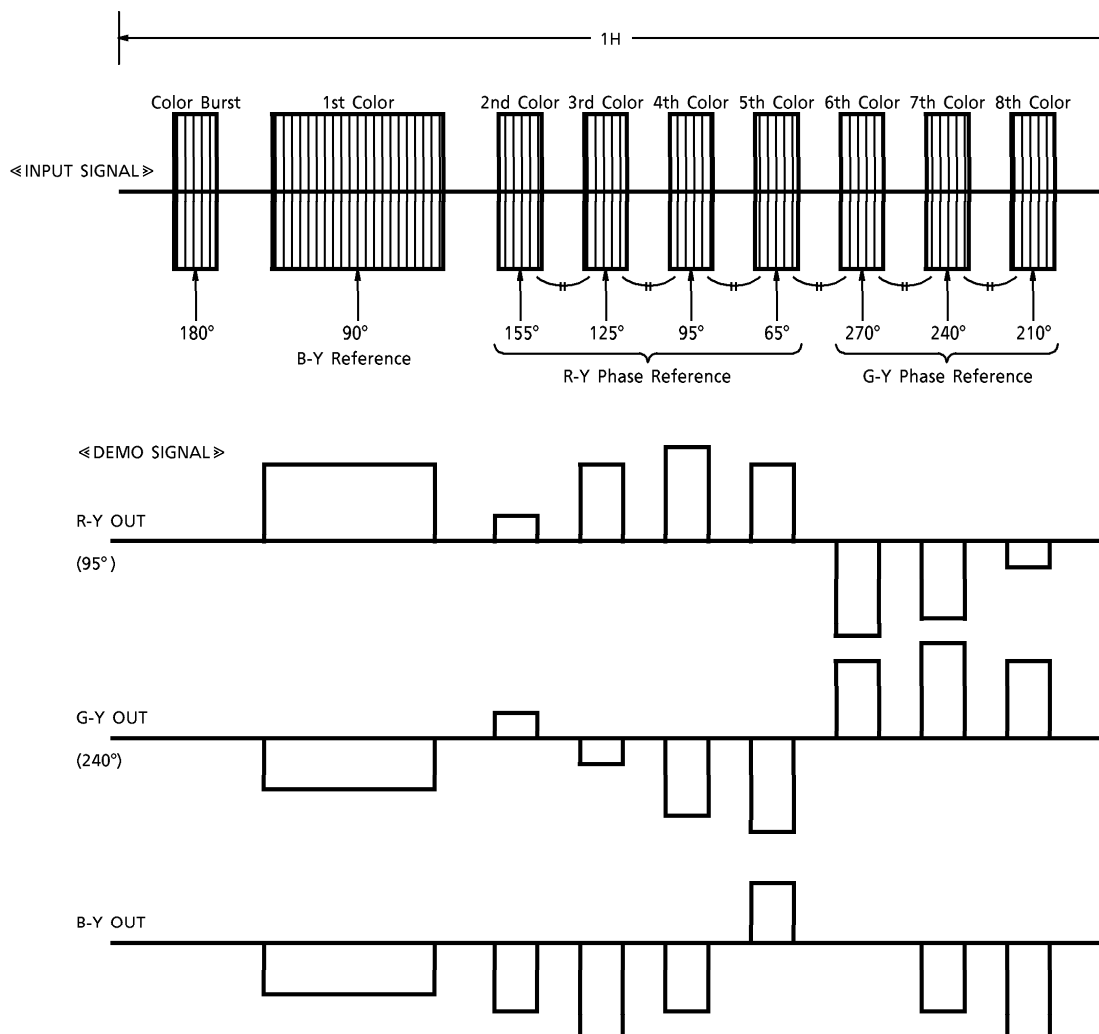
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NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^\circ C$)														
		SW & VR MODE														
		SW23	SW24	SW25	SW27	SW29	SW30	SW31	SW03	SW58	SW61	MEASUREMENT METHOD				
118	Analog RGB Mode ON Voltage	a	b	b	a	b	a	a	a	a	c	a	(1) Input Signal 1 ; $f_0 = 100kHz$, Picture period Amplitude $0.3V_{pp}$ to pin 29. (2) Supply External Power Supply to pin 28. (3) Raise the External Voltage from 0V. (4) Measure the External Voltage to generate signal 1 from pin 18. (V_{TXON})			
119	Analog RGB Mode Propagation Characteristics	↑	↑	↑	↑	a	↑	↑	↑	↑	↑	↑	(1) RGB Brightness Data ; Max (7F). (2) Input Signal 3 ; Amplitude $3V_{pp}$ to pin 28. (3) Ref. Fig. (4) Measure the τ_R , t_{PR} , τ_F , t_{PF} , for each pin 18, 19 and 20. (5) Calculate t_{PR} max difference between each axis, (Δt_{PRs}). (6) Calculate t_{PF} max difference between each axis, (Δt_{PFs}).			
120	Analog RGB Propagation Characteristics	↑	↑	↑	↑	a or b	a or b	a or b	↑	↑	↑	↑	(1) Apply External 5V Voltage to pin 28. (2) Input Signal 3 ; Amplitude $0.5V_{pp}$ to pin 29 / 30 / 31. (3) Ref. Fig. (4) Monitor pin 18 / 19 / 20. (5) Measure the τ_R , t_{PR} , τ_F , t_{PF} , for each pin 18, 19, 20. (6) Calculate t_{PR} max difference between each axis, (Δt_{PRTx}). (7) Calculate t_{PF} max difference between each axis, (Δt_{PFTx}).			

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, V _{CC} = 9V, Ta = ±3°C)											MEASUREMENT METHOD
		SW & VR MODE											
121	OSD Output DC Voltage	SW ₂₃ OFF	SW ₂₄ OFF	SW ₂₅ OFF	SW ₂₇ a	SW ₂₉ a	SW ₃₀ a	SW ₃₁ a	SW ₀₃ a	SW ₅₈ c	SW ₆₁ a		(1) Apply 5V External Voltage to pin 22. (2) Measure the pin 18, 19, 20 Picture Period Voltage. (VOSDDC*) * : R or G or B
122	OSD Mode ON Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Apply External Power Supply to pin 22. (2) Monitor the pin 18, 19, 20. (3) Raise the External Voltage from 0V. (4) Measure the Voltage to change pin 18, 19, 20 Picture Period Voltage. (VOSDON*) * : R or G or B
123	OSD OUT Hi Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Apply 5V External Voltage to pin 22. (2) Apply 5V External Voltage to pin 23, 24 and 25. (3) Measure the pin 18 / 19 / 20 Picture Period Voltage, (VOSDH1*). (4) Sub address (08) Data ; (70). (5) Measure the pin 18 / 19 / 20 Picture Period Voltage, (VOSDH2*). * : R or G or B
124	OSD Hi Mode ON Voltage	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Apply 5V External Voltage to pin 22. (2) Apply External Power Supply to pin 23, 24 and 25. (3) Monitor the pin 18 / 19 / 20. (4) Raise the External Voltage from 0V. (5) Measure the Voltage to change pin 18 / 19 / 20 Picture Period Voltage, (VOSDHIONG, VOSDHIONB).

NOTE No.	ITEM	MEASUREMENT CONDITION (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 9V$, $T_a = \pm 3^{\circ}C$)											MEASUREMENT METHOD	
		SW & VR MODE												
125	OSD Mode Propagation Characteristics	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	(1) Input Signal 3 ; Amplitude 3V _{p-p} to pin 22. (2) Ref. fig. (3) Measure the τ_R , t _{PR} , τ_F , t _{PF} , for each axis, (Δt_{PROSDH}). (4) Calculate t _{PF} max difference between each axis, (Δt_{PFOSD}).
126	OSD Hi Mode Propagation Characteristics	a or b	a or b	a or b	a	a	a	a	a	a	a	c	a	(1) Apply 5V External Voltage to pin 21. (2) Input Signal 3 ; Amplitude 3V _{p-p} to pin 23/24/25. (3) Ref. fig. (4) Measure the τ_R , t _{PR} , τ_F , t _{PF} , for each pin 18, 19, 20. (5) Calculate t _{PR} max difference between each axis, $\Delta t_{PROSDHI}$. (6) Calculate t _{PF} max difference between each axis, $\Delta t_{PFOSDHI}$.
127	Color Temperature SW	a	b	b	b	↑	↑	↑	↑	↑	↑	a	d	(1) Input Signal 1 ; f ₀ = 100kHz, Signal amplitude of Picture Period is 0.3V _{p-p} . (2) Set sub address (OC) Data ; (OC). (3) Measure pin 19, 20 Amplitude of Picture Period, (V19ct, V20ct). (4) Calculate VCTG = 20log (V19ct / V19) VCTB = 20log (V20ct / V20)

Fig.1 RGB relative phase measuring bar



(*) Wave form at B-Y ref setting Bar to flat in B-Y monitoring.

Fig.2 Text measuring signal

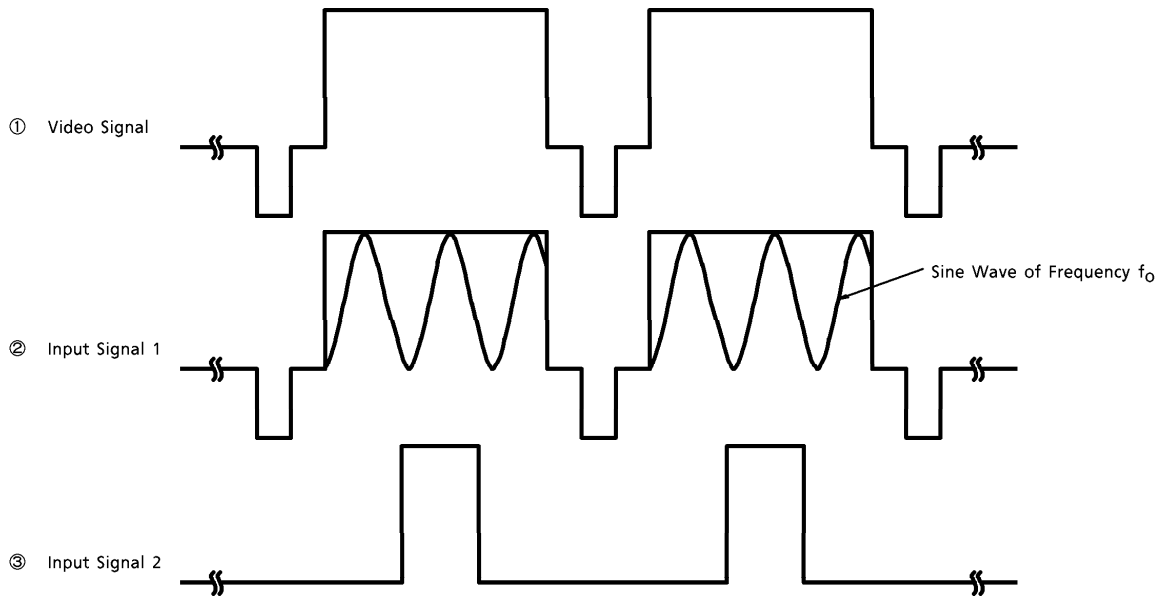
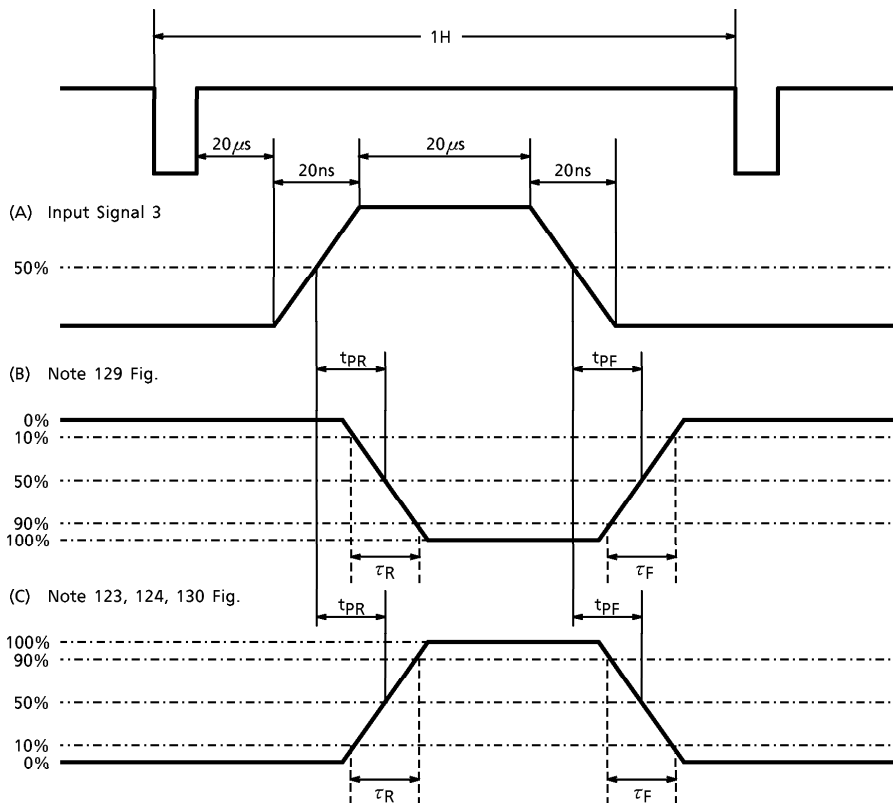
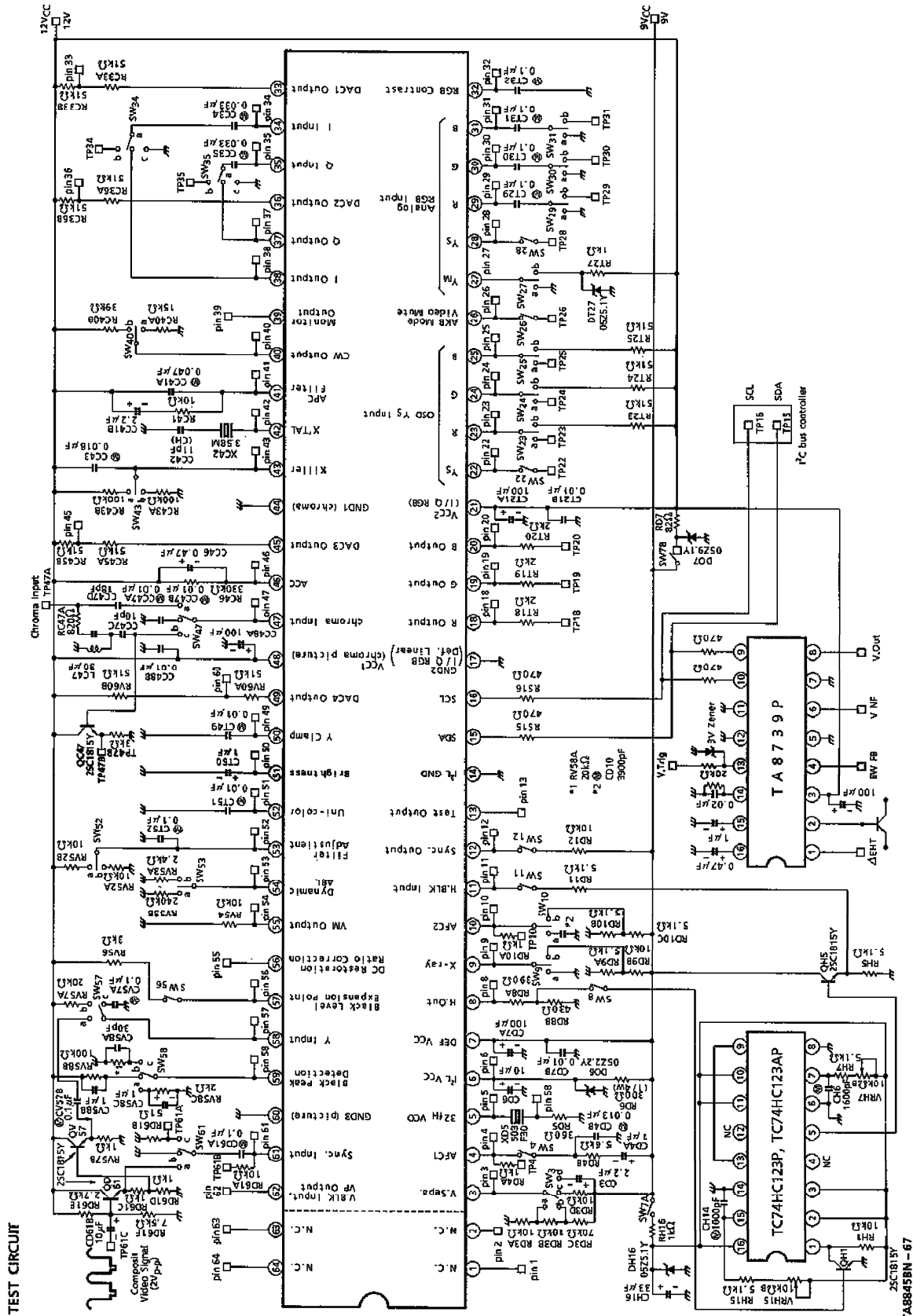


Fig.3 Text test pulse



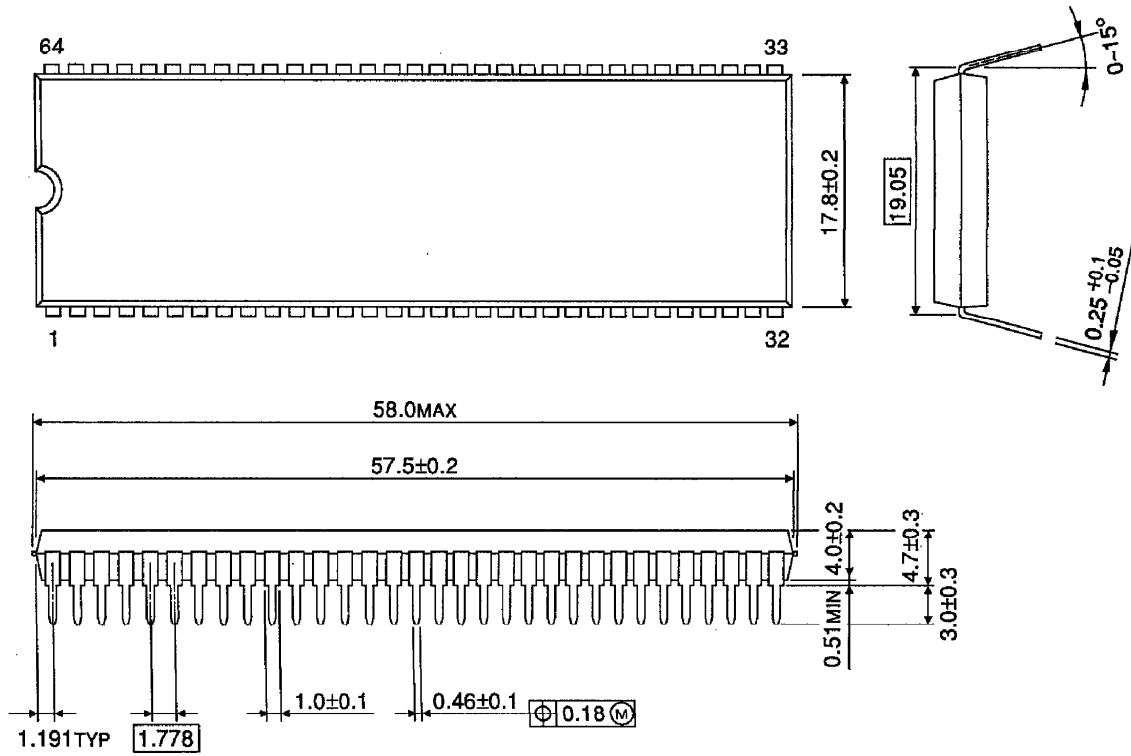


TEST CIRCUIT

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OUTLINE DRAWING
SDIP64-P-750-1.78

Unit : mm



Weight : 8.85g (Typ.)