

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

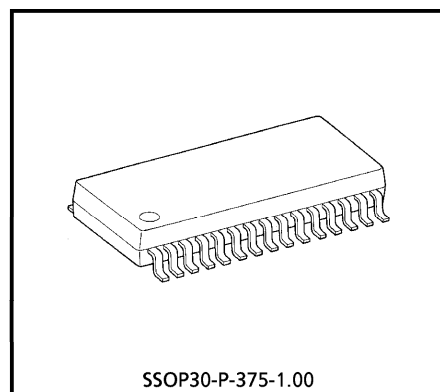
# TA8819FG

## NTSC VIDEO CHROMA SIGNAL PROCESSOR SYNC PLAYBACK IC FOR LCD TV

TA8819FG can be directly driven by battery because it operates on 3.3 to 7.5 V.  
Effect of fluctuations in supply voltage are minimized.  
Built-in automatic contrast limiter (ACL) utilizes LCD panel dynamic range, delivering clear image reproduction.

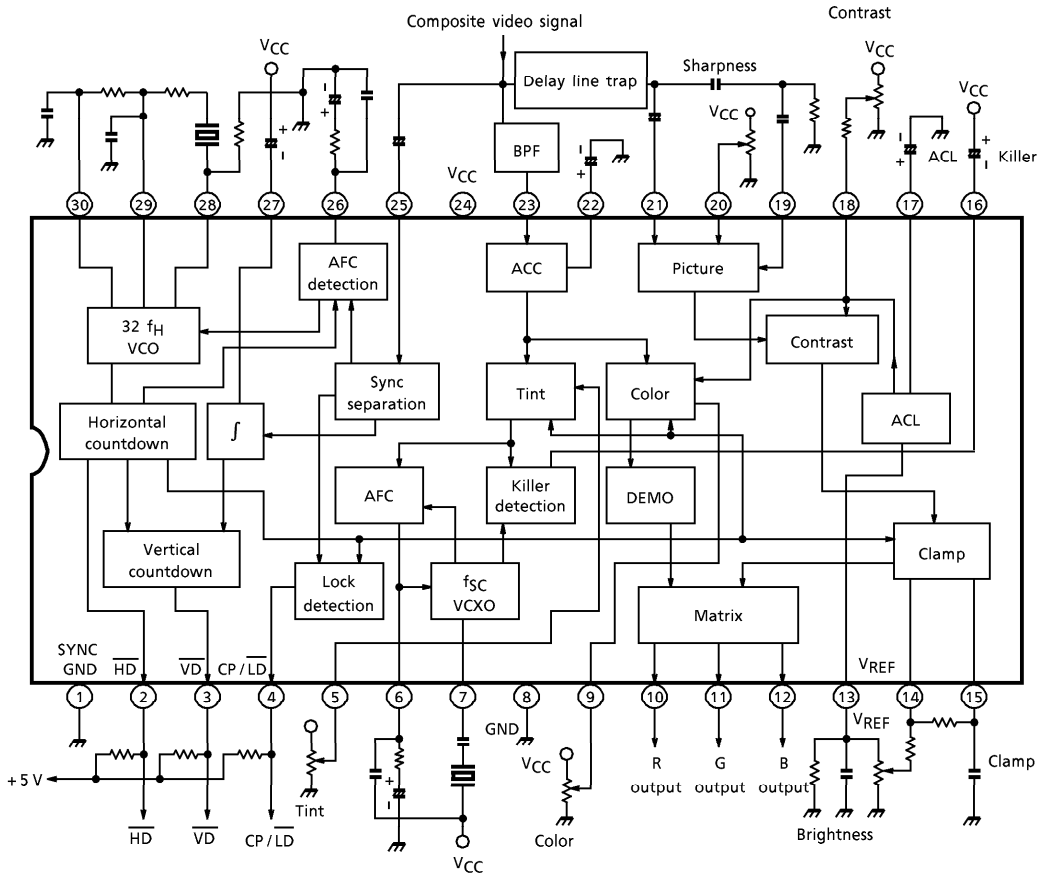
### FEATURES

- Video circuit block
  - Secondary differential sharpness adjustment (DC control)
  - Unicolor contrast control
- Chroma circuit block
  - 2-axis demodulation primary color output
- Sync playback circuit block
  - High-performance sync separation
  - Countdown oscillation frequency adjustment-free
  - Stable vertical sync performance even when synchronization fails



Weight : 0.63 g (Typ.)

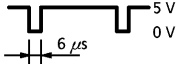
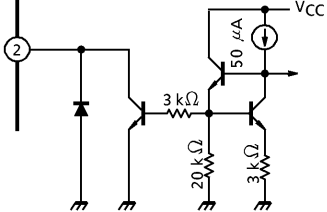
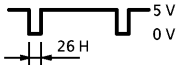
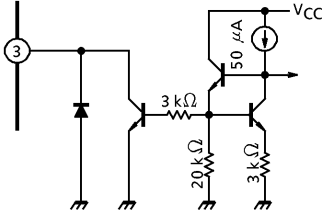
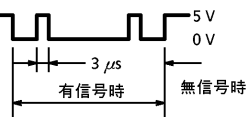
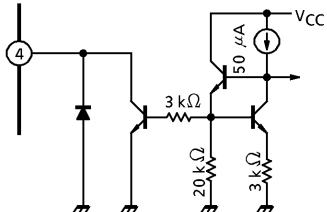
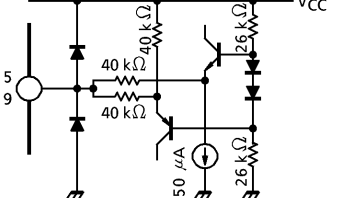
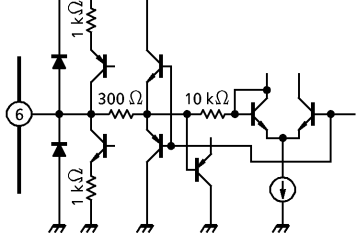
BLOCK DIAGRAM

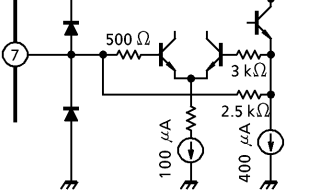
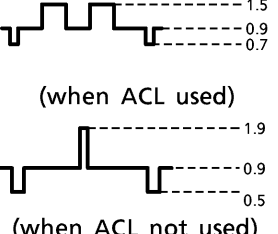
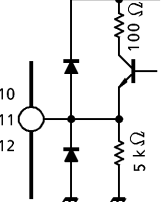
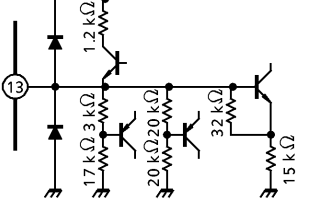
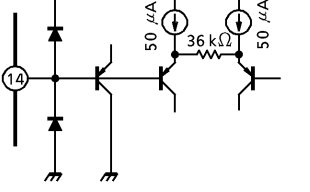
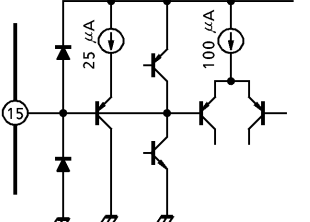


## PIN FUNCTIONS

PIN NUMBER	PIN NAME	FUNCTION
1	SYNC GND	Ground for sync playback circuit
2	$\overline{HD}$ OUT	Horizontal output pulse to controller (open collector)
3	$\overline{VD}$ OUT	Vertical output pulse to controller (open collector)
4	CP/ $\overline{LD}$ OUT	Sync pull-in signal output for selecting channel (open collector)
5	TINT	Tint adjustment pin
6	APC FILTER	Color subcarrier automatic control filter
7	$f_{SC}$ X	$f_{SC}$ resonator
8	V/C GND	Ground for video chroma circuit
9	COLOR	Color adjustment pin
10	R OUT	Primary color output pin (R)
11	G OUT	Primary color output pin (G)
12	B OUT	Primary color output pin (B)
13	VREF/ACL LEVEL	Reference voltage/ACL level adjustment
14	BRIGHTNESS	Brightness adjustment pin
15	CLAMP C	Video DC playback capacitor
16	KILLER FILTER	Color killer filter
17	ACL FILTER	ACL filter
18	CONTRAST	Contrast (unicolor) adjustment pin
19	YH IN	Input of video high-frequency components
20	SHARPNESS	Sharpness adjustment pin
21	Y IN	Video signal input pin
22	ACC FILTER	Chroma automatic amplitude control filter
23	CHROMA IN	Chroma signal input pin
24	VCC	Power supply
25	SYNC IN	Video signal input pin for sync playback
26	AFC FILTER	Horizontal automatic frequency control filter
27	VRET INTEG	Vertical sync integral capacitor
28	$32f_H$ X	$32f_H$ resonator
29	PH1	$32f_H$ oscillation phase pin
30	PH2	$32f_H$ oscillation phase pin

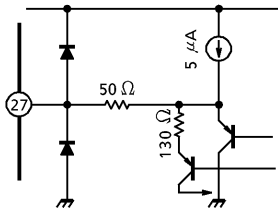
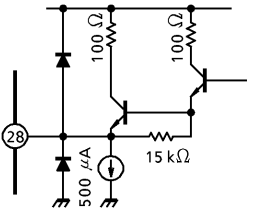
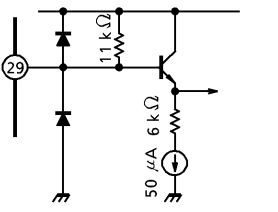
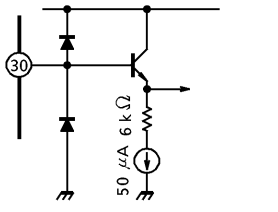
PIN DESCRIPTION

PIN NUMBER	PIN NAME & FUNCTION	TYPICAL SIGNAL LEVEL	INTERNAL CIRCUIT
2	<p><math>\overline{HD}</math> OUT</p> <p>Horizontal drive pulse output</p>	<p>Saturated open collector output</p> <p>Maximum sink current 2 mA</p>  <p><math>V_{OH} = 5\text{ V}</math> (uses separate power supply)</p>	
3	<p><math>\overline{VD}</math> OUT</p> <p>Vertical drive pulse output</p>	<p>Saturated open collector output</p> <p>Maximum sink current 2 mA</p>  <p><math>V_{OH} = 5\text{ V}</math> (uses separate power supply)</p>	
4	<p>CP / <math>\overline{LD}</math></p> <p>Clamp pulse / signal output</p> <p>Pulse output</p>	<p>Saturated open collector output</p> <p>Maximum sink current 2 mA</p>  <p><math>V_{OH} = 5\text{ V}</math> (uses separate power supply)</p>	
5 9	<p>TINT</p> <p>Tint adjustment</p> <p>COLOR</p> <p>Color amplitude adjustment</p>	<p>Internal bias <math>V_{CC}/2</math></p> <p><math>V_{iH} \text{ max} = V_{CC}</math></p> <p><math>V_{iL} \text{ min} = \text{GND}</math></p>	
6	<p>APC DET</p> <p>APC filter connecting pin</p>	<p>Internal bias 2.5 V</p>	

PIN NUMBER	PIN NAME & FUNCTION	TYPICAL SIGNAL LEVEL	INTERNAL CIRCUIT
7	<p><math>f_{SC}</math> VXO</p> <p><math>f_{SC}</math> resonator connecting pin</p>	<p>Internal bias 2.5 V</p> <p><math>V_{OSC} = 50 \text{ mV}_{p-p}</math></p>	
10 11 12	<p>R-OUT</p> <p>G-OUT</p> <p>B-OUT</p> <p>Primary color output pins</p>		
13	<p>V REF</p> <p>Constant voltage supply output pin</p>	<p>Internal bias 1.8 V</p>	
14	<p>BRIGHT</p> <p>Brightness adjustment control pin</p>	<p><math>V_{iH}</math> max V REF (= 1.8 V)</p> <p><math>V_{iL}</math> min GND</p>	
15	<p>CLAMP</p> <p>Clamp capacitor connecting pin</p>	<p>External capacitance <math>2.2 \mu\text{F}</math></p> <p><math>V_{OH} = V_{REF} (= 1.8 \text{ V})</math></p> <p><math>V_{OL} = \text{GND}</math></p>	

PIN NUMBER	PIN NAME & FUNCTION	TYPICAL SIGNAL LEVEL	INTERNAL CIRCUIT
16	<p>KILLER</p> <p>Color killer filter connecting pin</p>	<p>External capacitance <math>0.018 \mu\text{F}</math></p> <p><math>V_{OH} = 3.3 \text{ V}</math></p> <p><math>V_{OL} = 2.6 \text{ V}</math></p>	
17	<p>ACL</p> <p>ACL sample-and-hold capacitor pin</p>	<p>Internal bias <math>0 \text{ V}</math></p>	
18	<p>CONTRAST</p> <p>Contrast (unicolor) adjustment control pin</p>	<p>Internal bias <math>(V_{CC}/2)</math></p> <p><math>V_{iH} = V_{CC}</math></p> <p><math>V_{iL} = \text{GND}</math></p>	
19	<p><math>Y_H \text{ IN}</math></p> <p>Brightness signal (secondary differential) input pin</p>	<p>Internal bias <math>(V_{CC}/2)</math></p> <p>Maximum input level <math>150 \text{ mV}_{\text{p-p}}</math></p>	
20	<p>SHARPNESS</p> <p>Sharpness adjustment control pin</p>	<p>Internal bias <math>(V_{CC}/2)</math></p> <p><math>V_{iH} = V_{CC}</math></p> <p><math>V_{iL} = \text{GND}</math></p>	

PIN NUMBER	PIN NAME & FUNCTION	TYPICAL SIGNAL LEVEL	INTERNAL CIRCUIT
21	YIN Brightness signal input pin	Internal bias 2.5 V Maximum input level 1 V <sub>p-p</sub>	
22	ACC DET ACC sample-and-hold capacitor connecting pin	Permissible load current 0 V <sub>OL</sub> = GND Load capacitance 0.1 μF	
23	C IN Chroma signal input pin	Internal bias V <sub>CC</sub> Burst input 75 mV <sub>p-p</sub> Chroma input 225 mV <sub>p-p</sub>	
25	SYNC IN Composite sync signal input pin	Video signal 1 V <sub>p-p</sub> (sync signal 0.28 V <sub>p-p</sub> ) Internal bias 1.5 V	
26	AFC DET AFC filter connecting pin	Internal bias 1.5 V	

PIN NUMBER	PIN NAME & FUNCTION	TYPICAL SIGNAL LEVEL	INTERNAL CIRCUIT
27	VERT INT Vertical sync signal integral capacitor pin.	Internal bias 3.2 V Load capacitance 1 μF	
28	32f <sub>H</sub> VXO 32f <sub>H</sub> phase shift signal input pin	Internal bias 2.1 V V <sub>OL</sub> = 2.5 V V <sub>OL</sub> = 1.8 V	
29	PS-1 32f <sub>H</sub> phase shift signal input pin 1	Internal bias 4.0 V (V <sub>CC</sub> )	
30	PS-2 32f <sub>H</sub> phase shift signal input pin 2	Further shifts phase of pin 29 signal and inputs.	

**MAXIMUM RATINGS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	8	V
Power Dissipation	P <sub>D</sub> (Note)	890	mW
Power Dissipation Reduction Ratio	θ <sub>ja</sub>	7.2	mW/°C
Input Pin Voltage	V <sub>in</sub>	GND - 0.3~ V <sub>CC</sub> + 0.3	V
Operating Temperature	T <sub>opr</sub>	-20~75	°C
Storage Temperature	T <sub>stg</sub>	-55~150	°C

**RECOMMENDED SUPPLY VOLTAGE**

PIN NUMBER	PIN NAME	MIN	TYP.	MAX	UNIT
24	V <sub>CC</sub>	3.3	5.0	7.5	V



ELECTRICAL CHARACTERISTICS (Unless otherwise specified,  $V_{CC} = 5V$ ,  $T_a = 25^\circ C$ )

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Quiescent Supply Current	$I_{CCQ}$	—		20	27	38	mA

## Video block

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Pin 21 Input Impedance	$R_{i21}$	—	Note V-1	7	10	12.5	$k\Omega$
Pin 19 Input Impedance	$R_{i19}$	—	Note V-2	1.8	2.5	3.25	$k\Omega$
Brightness Adjustment Voltage	$V_{BR}$	—	Note V-3	0.7	0.84	0.98	V
Brightness Adjustment Sensitivity	$G_{BR}$	—	Note V-4	1.0	1.2	1.4	
Brightness Adjustment Range	$\Delta V_{BR}$	—	Note V-5	1.9	2.1	2.3	$V_{p-p}$
Minimum Linear Video Input	$V_{di1}$	—	Note V-6	—	2.6	3.1	V
Maximum Linear Video Input	$V_{di2}$	—	Note V-7	3.3	4	—	V
Video Input Dynamic Range	$V_{di}$	—	Note V-8	0.75	0.88	—	$V_{p-p}$
Minimum Contrast Output	$V_{do1}$	—	Note V-9	—	0.2	0.4	V
Maximum Contrast Output	$V_{do2}$	—	Note V-10	2.6	3.1	—	V
Secondary Differential Input Dynamic Range	$V_{dip}$	—	Note V-11	0.09	0.12	0.15	$V_{p-p}$
AC Gain	$G_V$	—	Note V-12	12	14	15.6	dB
Frequency Characteristic	$G_f$	—	Note V-13	1.8	2.5	—	MHz
Contrast Adjustment Voltage Range	$\Delta V_{ct}$	—	Note V-14	2.2	2.6	—	V
Contrast Adjustment Gain Range	$\Delta G_{ct}$	—	Note V-15	14	15	—	dB
Frequency Characteristic Change Due to Contrast Adjustment	$\Delta G_f$	—	Note V-16	-3	—	3	dB
Gain Change Amount at Minimum Sharpness Adjustment	$G_{p5MIN}$	—	Note V-17	14	—	—	dB
Gain Change Amount at Maximum Sharpness Adjustment	$G_{p5MAX}$	—	Note V-18	3	6	10	dB
Sharpness Adjustment Characteristic	$G_{p5O}$	—	Note V-19	-8	-4	0	dB
Pin 13 Output Voltage	$V_{ref}$	—	Note V-20	1.8	1.9	2.0	V
Pedestal Potential After ACL Adjustment	$A_{on/of}$	—	Note V-21	1.0	1.05	1.1	V
White Amplitude After ACL Adjustment	$A_H1$	—	Note V-22	0.56	0.67	0.80	$V_{p-p}$
3-Axis Output DC Deviation (B/G)	$V_{ofB/G}$	—	Note V-23	-200	—	200	mV

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
3-Axis Output DC Deviation (R/G)	$V_{of R/G}$	—	Note V-24	-200	—	200	mV
3-Axis AC Gain Deviation (B/G)	$\Delta G B/G$	—	Note V-25	-6	—	0.5	dB
3-Axis AC Gain Deviation (R/G)	$\Delta G R/G$	—	Note V-26	-6	—	0.5	dB

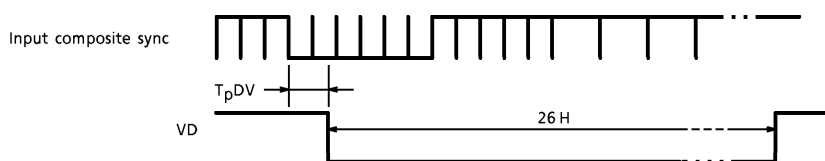
## Chroma block

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Pin 23 Input Resistance	Ri23	—	Note C-1	2.25	3.0	3.75	k $\Omega$
Color Difference Output (R-Y)	eR2	—	Note C-2	0.30	0.43	0.56	V <sub>p-p</sub>
Color Difference Output (G-Y)	eG2	—	Note C-3	0.12	0.18	0.24	V <sub>p-p</sub>
Color Difference Output (B-Y)	eB2	—	Note C-4	0.35	0.50	0.65	V <sub>p-p</sub>
Color Change Amount	eC	—	Note C-5	4	6	—	dB
Unicolor Change Amount	eU	—	Note C-6	14	15	—	dB
Tint Change Amount	$\theta t$	—	Note C-7	80	100	130	°
Tint Center	$\theta tc$	—	Note C-8	-15	—	5	°
Residual Color		—	Note C-9	—	—	-40	dB
Demodulation Relative Amplitude (R-Y/B-Y)	R/B	—	Note C-10	0.72	0.84	0.96	—
Demodulation Relative Amplitude (G-Y/B-Y)	G/B	—	Note C-11	0.27	0.34	0.41	—
Demodulation Relative Phase (R-Y/B-Y)	R-B	—	Note C-12	97	104	111	°
Demodulation Relative Phase (G-Y/B-Y)	G-B	—	Note C-13	225	240	250	°
Demodulation Output Residual Carrier	eCR	—	Note C-14	—	—	15	mV <sub>p-p</sub>
Killer Operation Input Level	eK	—	Note C-15	-58	-50	-44	dB
ACC Characteristic	ACC	—	Note C-16	24	30	—	dB
Control Sensitivity	$\beta fs$	—	Note C-17	0.8	—	2.0	Hz / mV
APC Pull-In Range	fsp	—	Note C-18	± 300	—	—	Hz
APC Hold Range	fsh	—	Note C-19	± 300	—	—	Hz

Sync block

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Horizontal Output Pulse Width	P <sub>WHD</sub>	—	Note D-1	6.0	6.2	6.6	μs
Horizontal Output Pulse Delay Time	T <sub>pdH</sub>	—	Note D-2	0.36	0.52	0.68	μs
Horizontal Output Saturation Level	V <sub>oIH</sub>	—	Note D-3	—	0.2	0.4	V
Vertical Output Pulse Width	P <sub>WVD</sub>	—	Note D-4	—	26	26.5	H
Vertical Output Pulse Delay Time	T <sub>pdV</sub>	—	Note D-5	0.65	0.84	1.03	H
Horizontal Oscillation Frequency	f <sub>H</sub>	—	Note D-6	15655	15734	15813	Hz
Horizontal AFC Pull-In Range	Δf <sub>pul</sub>	—	Note D-7	600	700	—	Hz
Horizontal AFC Hold Range	Δf <sub>hol</sub>	—	Note D-8	600	700	—	Hz
Horizontal AFC Hold Limit Input	V <sub>inPM</sub>	—	Note D-9	—	—	-20	dB
Gate Pulse Width	P <sub>WGP</sub>	—	Note D-10	2.6	3.0	3.45	μs
Gate Pulse Delay Time	T <sub>pdGP</sub>	—	Note D-11	0.65	0.90	1.15	μs
Gate Pulse Generation Limit Input	V <sub>inGM</sub>	—	Note D-12	—	—	-17	dB
Vertical Sync Pull-In Range	f <sub>pv 1</sub>	—	Note D-13	—	—	228	H
	f <sub>pv 2</sub>	—	Note D-14	228	—	—	
Vertical Sync Hold Limit Input	V <sub>inVM</sub>	—	Note D-15	—	—	-15	dB

**VD TIMING PULSE**



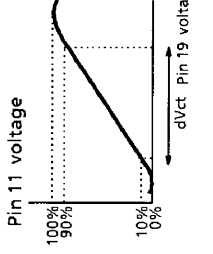
**TEST CONDITIONS**  
Video block

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, VCC = 5V, Ta = 25 ± 3°C)										TEST METHOD
		SW & VR MODE										
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS	BRT			
V-1	Pin 21 input impedance (video input pin)	OPEN	OFF	OFF	INT	OFF	center	center	center	center		(1) Apply 0.2 V <sub>p-p</sub> AC, 1-kHz signal to pin 21 via a 10-kΩ resistor. (2) Measure the AC amplitude voltage of pin 21 (V21). (3) Z21 = V21 × 10 kΩ / (0.2 – V21)
V-2	Pin 19 input impedance (secondary differential signal input pin)	OPEN	OFF	OFF	INT	OFF	center	center	center	center		(1) Apply 0.05 V <sub>p-p</sub> AC, 1-kHz signal to pin 19 via a 10-kΩ resistor. (2) Measure the AC amplitude voltage of pin 19 (V19). (3) Z19 = V19 × 10 kΩ / (0.05 – V19)
V-3	Brightness adjustment voltage	a	OFF	OFF	INT	OFF	center	center	center	specified		(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Measure the DC voltage of pin 14.
V-4	Brightness adjustment sensitivity	a	OFF	OFF	INT	OFF	center	center	center	specified		(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Measure the DC voltage of pin 11 (V11L). (3) Increase BRT VR by 0.1 V. (4) Measure the DC voltage of pin 11 (V11H). (5) Calculate the following formula. GBR = (V11H – V11L) / 0.1
V-5	Brightness adjustment range	a	OFF	OFF	INT	OFF	center	center	center	specified		(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Set BRT VR to the maximum and minimum and measure the DC voltage of pin 11. (3) dVBR = V11max – V11min

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5 V, T <sub>a</sub> = 25 ± 3°C)							TEST METHOD	
		SW & VR MODE								
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS	BRT	
V-6	Minimum linear video input									(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Measure the DC voltage of pin 15 (V <sub>I5</sub> ). (3) Apply DC voltage V <sub>I5</sub> to pin 15 and fix the voltage. (4) Change the DC voltage of pin 21 and set the pin 11 output voltage change width to 100%. (5) Define the DC voltage of pin 21 when the pin 11 output voltage change is 10% as V <sub>d11</sub> ; when 90%, as V <sub>d12</sub> . (6) V <sub>d1</sub> = V <sub>d12</sub> - V <sub>d11</sub>
V-7	Maximum linear video input	a	OFF	OFF	INT	OFF	minimum	center	specified	
V-8	Video input dynamic range									
V-9	Minimum contrast output									
V-10	Maximum contrast output	a	OFF	OFF	INT	OFF	maximum	center	specified	

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 5V$ , $T_a = 25 \pm 3^\circ C$ )							TEST METHOD	
		SW & VR MODE								
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS		BRT
V-11	Secondary differential input dynamic range	a	ON	OFF	INT	OFF	minimum	minimum	specified	<p>(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V.</p> <p>(2) Measure the DC voltage of pin 15 (V15).</p> <p>(3) Apply DC voltage V15 to pin 15 and fix the voltage.</p> <p>(4) Change the DC voltage of pin 19 and set the pin 11 output voltage change width to 100%.</p> <p>(5) Define the DC Pin 11 voltage voltage of pin 19 when the pin 11 output voltage change is 10% as <math>V_{dip1}</math>; when 90%, as <math>V_{dip2}</math>.</p> <p>(6) <math>V_{dip} = V_{dip2} - V_{dip1}</math></p>
V-12	AC gain	OPEN	OFF	OFF	INT	OFF	center	center	specified	<p>(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V.</p> <p>(2) Measure the DC voltage of pin 15 (V15).</p> <p>(3) Apply DC voltage V15 to pin 15 and fix the voltage.</p> <p>(4) Apply a 10-kHz, 0.1-V<sub>p-p</sub> sine wave to pin 21 via a 10-<math>\mu</math>F capacitor.</p> <p>(5) Measure the AC amplitude of pin 11 (V11).  <math>G_v = \text{output amplitude} / \text{input amplitude}</math>                      (<math>\leftarrow 0.1 V_{p-p}</math>)</p>

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 5V$ , $T_a = 25 \pm 3^\circ C$ )							TEST METHOD	
		SW & VR MODE								
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS	BRT	
V-13	Frequency characteristic	OPEN	OFF	OFF	INT	OFF	center	center	specified	<ol style="list-style-type: none"> <li>Adjust BRT VR so that the DC voltage of pin 11 equals 0.9V.</li> <li>Apply a 0.1-V<sub>p-p</sub> sine wave to pin 21 via a 10-<math>\mu</math>F capacitor.</li> <li>Measure the frequency which decreases by 3 dB from the amplitude when pin 11 AC amplitude is at 10 kHz.</li> </ol>
V-14	Contrast adjustment voltage range	b	OFF	OFF	INT	OFF	specified	center	specified	<ol style="list-style-type: none"> <li>Adjust BRT VR so that the DC voltage of pin 11 equals 0.9V.</li> <li>Measure DC voltage V15 or pin 15.</li> <li>Apply DC voltage V15 to pin 15 and fix the voltage.</li> <li>Apply a 10-kHz, 0.1-V<sub>p-p</sub> sine wave to pin 21.</li> <li>Set CONT VR to the maximum and minimum, and measure the AC amplitude of pin 11. Define them as 100% and 10%, respectively.</li> <li>Adjust CONT VR. Measure the CONT pin (pin 18) voltage when the pin 11 amplitude is 90% and 10% (V90%, V10%). <math>\Delta V_{ct} = V90\% - V10\%</math></li> </ol>



NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5 V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD
		SW & VR MODE								SHARPNESS	BRT	
		SV1	SV2	SW2	SW3	SW4	CONT	SV1				
V-15	Contrast adjustment gain range		OFF	OFF	INT	OFF			specified	center	specified	(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Measure the DC voltage of pin 15 (V15). (3) Apply DC voltage V15 to pin 15 and fix the voltage. (4) Apply a 10-kHz, 0.1-V <sub>p-p</sub> sine wave to pin 21. (5) Set CONT VR to the maximum and minimum, and measure the AC amplitude of pin 11. Define them as V <sub>max</sub> and V <sub>min</sub> , respectively. dGct = 20 log (V <sub>max</sub> / V <sub>min</sub> )
V-16	Frequency characteristic change due to contrast adjustment		OFF	OFF	INT	OFF			specified	center	specified	(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Apply a 4-MHz, 0.2-V <sub>p-p</sub> sine wave to pin 21. (3) Set CONT VR to the maximum and minimum, and measure the AC amplitude of pin 11. Define them as V <sub>max</sub> (4M) and V <sub>min</sub> (4M), respectively. (4) Measure the AC amplitude of pin 11 when input signal frequency f = 100 kHz. Define them as V <sub>max</sub> (100k) and V <sub>min</sub> (100k), respectively. (5) Calculate the following formula using the measured values. $dGf = - \frac{20 \log (V_{max} (4M) / V_{max} (100k))}{20 \log (V_{min} (4M) / V_{min} (100k))}$



NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, VCC = 5 V, Ta = 25 ± 3°C)							TEST METHOD	
		SW & VR MODE								
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS	BRT	
V-17	Gain change amount at minimum sharpness adjustment	b	ON	OFF	INT	OFF	center	specified	specified	(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Apply a 2.4-MHz, 0.2-V <sub>pp</sub> sine wave to pins 19 and 21. (3) Set sharpness VR to the maximum and minimum, and measure the AC amplitude of pin 11. Define them as V <sub>max</sub> and V <sub>min</sub> , respectively. (4) Gps <sub>min</sub> = 20 flog (V11 <sub>min</sub> /V11 <sub>max</sub> )
V-18	Gain change amount at maximum sharpness adjustment	a	ON	OFF	INT	OFF	maximum	maximum	specified	(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Apply a 2.4-MHz, 0.2-V <sub>pp</sub> sine wave to pin 19. (3) Measure the AC amplitude of pin 11 and define it as V11 (2.4M). (4) Measure the AC amplitude of pin 11 when input signal frequency f = 100 kHz and define it as V11 (100k). (5) Gps <sub>max</sub> = 20 flog (V11 (2.4M)/V11 (100k))
V-19	Sharpness adjustment characteristic	a	ON	OFF	INT	OFF	maximum	center	specified	(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9 V. (2) Apply a 2.4-MHz, 0.2-V <sub>pp</sub> sine wave to pin 19. (3) Measure the AC amplitude of pin 11 and define it as V11 (2.4M). (4) Measure the AC amplitude of pin 11 when input signal frequency f = 100 kHz and define it as V11 (100k). (5) Gps <sub>o</sub> = 20 flog (V11 (2.4M)/V11 (100k))
V-20	Pin 13 output voltage	a	OFF	OFF	INT	OFF	center	center	specified	(1) Measure the DC voltage of pin 13.

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NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD				
		SW & VR MODE														
		SV1	SV2	SW2	SW3	SW4	CONT	SHARPNESS	BRT							
V-21	Pedestal potential after ACL adjustment														(1) Connect pin 17 (ACL) to GND (SW4 : on). (2) Input 100% white signal of 0.38 V <sub>p-p</sub> to pin 21. (3) Adjust BRT VR so that the pin 11 pedestal level equals 1.0V ; adjust CONT VR so that the pin 11 white level equals 2.1V (pedestal to white : 1.1V <sub>0-p</sub> ). (4) Disconnect pin 17 from GND. Measure the pin 11 pedestal potential and pedestal to white amplitude (SW4 : off).	
V-22	White amplitude after ACL adjustment	b	OFF	OFF	INT	switching	specified	center	specified							
V-23	3-axis output DC deviation (B/G)															(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9V. (2) Measure the DC voltage of pins 10, 11, and 12 (V10, V11, V12). (3) VofB/G = V12 - V11 VofR/G = V10 - V11
V-24	3-axis output DC deviation (R/G)	a	OFF	OFF	INT	OFF	center	center	specified							
V-25	3-axis AC gain deviation (B/G)															(1) Adjust BRT VR so that the DC voltage of pin 11 equals 0.9V. (2) Measure the DC voltage of pin 15 (V15). (3) Apply DC voltage V15 to pin 15 and fix the pin voltage. (4) Apply a 10-kHz, 0.1 V <sub>p-p</sub> sine wave to pin 21. (5) Measure the AC voltage of pins 10, 11, and 12 (V10, V11, V12). dGB/G = 20log (V12 - V11) dGR/G = 20log (V10 - V11) (Note) V11 here is the same as V11 in V-12.
V-26	3-axis AC gain deviation (R/G)	b	OFF	OFF	INT	ON	center	center	specified							

Chroma block

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD		
		SW & VR MODE												
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT				
C-1	Pin 23 input resistance	a	OFF	OFF	ON	OFF	OFF							(1) Turn VCC off. (2) Measure the resistance between pin 23 and VCC. (3) The voltage applied between the pins must be less than 0.5V.
C-2	Color difference output (R-Y)													(1) Input unicolor signal with amplitude 75 mV <sub>p-p</sub> and burst chroma ratio 1:1, or rainbow color bar signal. (2) Adjust (or change chroma tint) TINT VR for pins 10, 11, and 12 separately. When the color difference output is at the maximum, measure the output amplitude (V <sub>0-p</sub> ). (Note) When the unicolor signal is input, measure the red signal on pin 10 ; the green signal on pin 11 ; and the blue signal on pin 12.
C-3	Color difference output (G-Y)	a	OFF	OFF	ON	ON	OFF				specified	center	center	
C-4	Color difference output (B-Y)													
C-5	Color change amount	a	OFF	OFF	ON	ON	OFF				specified	center	center	(1) Input unicolor signal (blue) with amplitude 75 mV <sub>p-p</sub> and burst chroma ratio 1:1, or rainbow color bar signal. (2) Measure the B-Y color difference output amplitudes (V <sub>0max</sub> , V <sub>0sent</sub> ) when COLOR VR is at the maximum and center on pin 12. (3) ec = 20 log (V <sub>0max</sub> /V <sub>0sent</sub> )
C-6	Unicolor change amount	a	OFF	OFF	ON	ON	OFF				specified	center	center	(1) Input unicolor signal (blue) with amplitude 75 mV <sub>p-p</sub> and burst chroma ratio 1:1, or rainbow color bar signal. (2) Measure the B-Y color difference output amplitudes (V <sub>0max</sub> , V <sub>0min</sub> ) when CONT VR is at the maximum and center on pin 12. (3) eu = 20 log (V <sub>0max</sub> /V <sub>0min</sub> )

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NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5 V, T <sub>a</sub> = 25 ± 3°C)									
		SW & VR MODE									
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT	TEST METHOD
C-7	Tint change amount	a	OFF	OFF	ON	ON	OFF	specified	center	center	<p>(1) Input standard color bar signal. (pin 23 signal level)                      Burst : 75 mV<sub>p-p</sub>, R bar : 225 mV<sub>p-p</sub>                      G bar : 210 mV<sub>p-p</sub>, B bar : 160 mV<sub>p-p</sub></p> <p>(2) Change TINT VR, measuring the maximum value of R bar on pin 10, G bar on pin 11, and B bar on pin 12. Define them as V Rmax, V Gmax, and V Bmax.</p> <p>(3) Fix TINT VR to the maximum. Measure the amplitude of R bar on pin 10, G bar on pin 11, and B bar on pin 12. Define them as R Tmax, G Tmax, and B Tmax.</p> <p>(4) Fix TINT VR to minimum. Measure the amplitude of R bar on pin 10, G bar on pin 11, and B bar on pin 12. Define them as R Tmin, G Tmin, and B Tmin.</p> <p><math>R \theta (+) = \cos^{-1} (R \text{ Tmax} / V \text{ Rmax}) + 1.5</math>  <math>G \theta (+) = \cos^{-1} (G \text{ Tmax} / V \text{ Gmax}) + 0.6</math>  <math>B \theta (+) = \cos^{-1} (B \text{ Tmax} / V \text{ Bmax}) - 12.4</math>  <math>R \theta (-) = \cos^{-1} (R \text{ Tmin} / V \text{ Rmax}) - 1.5</math>  <math>G \theta (-) = \cos^{-1} (G \text{ Tmin} / V \text{ Gmax}) - 0.6</math>  <math>B \theta (-) = \cos^{-1} (B \text{ Tmin} / V \text{ Bmax}) + 12.4</math></p>

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5 V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD	
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT			
C-8	Tint center (R θ, G θ, B θ)	a	OFF	OFF	ON	ON	OFF				center	center	<p>(1) Input rainbow color bar signal. (pin 23 signal level). Burst and chroma : 75 mV<sub>p-p</sub></p> <p>(2) Set TINT VR to the center.</p> <p>(3) Measure the amplitude difference between R bar (third bar) on pin 10 and its adjacent bars. Where the difference from the second bar is A and from the fourth bar is B :  <math>R \theta = 90 - \tan^{-1} (2 - \sqrt{3})</math>  <math>(1 - 2A / (A + B))</math></p> <p>(4) Measure the amplitude difference between G bar (fourth bar) on pin 11 and its adjacent bars. Where the difference from the third bar is A and from the fifth bar is B :  <math>G \theta = 240 - \tan^{-1} (2 - \sqrt{3})</math>  <math>(1 - 2A / (A + B))</math></p> <p>(5) Measure the amplitude difference between B bar (sixth bar) on pin 12 and its adjacent bars. Where the difference from the fifth bar is A and from the seventh bar is B :  <math>B \theta = \tan^{-1} (2 - \sqrt{3}) (1 - 2A / (A + B))</math></p>
C-9	Residual color	a	OFF	OFF	ON	ON	OFF				center	center	<p>(1) Input standard color bar signal. (pin 23 signal level)                      Burst : 75 mV<sub>p-p</sub>, R bar : 225 mV<sub>p-p</sub>                      G bar : 210 mV<sub>p-p</sub>, B bar : 160 mV<sub>p-p</sub></p> <p>(2) Set COLOR VR to the center. Use a spectrum analyzer to measure the level of the 15.734-kHz component in the R bar on pin 10, G bar on pin 11, and B bar on pin 12.</p> <p>(3) Set COLOR VR to the minimum, fix pin 16 to 0.5 V (killer off), and measure the levels as in step (2) above.</p> <p>(4) Calculate on each axis the level difference when COLOR VR is set to the center and the minimum.</p>

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NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD
		SW & VR MODE										
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT		
C-10	Demodulation relative amplitude (R-Y/B-Y)	a	OFF	OFF	ON	ON	OFF	specified	center	center	(Note) Calculate the following based on the measured values in C2 to C4 above. R/B = VR/VB G/B = VG/VB	
C-11	Demodulation relative amplitude (G-Y/B-Y)	a	OFF	OFF	ON	ON	OFF	specified	center	center	(Note) Calculate the following based on the measured values in C8 above. R - B = 105 + R θ - B θ G - B = 240 + G θ - B θ	
C-12	Demodulation relative phase (R-Y/B-Y)	a	OFF	OFF	ON	ON	OFF	specified	center	center	(1) Use a spectrum analyzer to measure the level of a sine wave of amplitude 200 mV <sub>p-p</sub> and frequency f <sub>SC</sub> and define it as L200. (2) Use the spectrum analyzer to measure the residual carrier level of the color difference output for pins 10, 11, and 12. Define them as LR, LG, and LB, respectively. (3) Calculate the demodulation output residual carrier for each axis using the following formula. K = (LC - L200) / 20 (CはR、G、Bに置き替える) e CR = 200 · (10 <sup>4</sup> )	
C-13	Demodulation relative phase (G-Y/B-Y)	a	OFF	OFF	ON	ON	OFF	specified	center	center	(1) Input unicolor signal with amplitude 75 mV <sub>p-p</sub> and burst chroma ratio 1:1, or rainbow color bar signal to the chroma input pin via the attenuator. (2) While monitoring the color difference output of pin 10, 11, or 12, decrease the chroma input level. (3) Read the attenuation amount when output stops. (Note) Input, to the sync and video input pins, signals which do not pass the attenuator.	
C-14	Demodulation output residual carrier	a	OFF	OFF	ON	ON	OFF	specified	center	center	(1) Use a spectrum analyzer to measure the level of a sine wave of amplitude 200 mV <sub>p-p</sub> and frequency f <sub>SC</sub> and define it as L200. (2) Use the spectrum analyzer to measure the residual carrier level of the color difference output for pins 10, 11, and 12. Define them as LR, LG, and LB, respectively. (3) Calculate the demodulation output residual carrier for each axis using the following formula. K = (LC - L200) / 20 (CはR、G、Bに置き替える) e CR = 200 · (10 <sup>4</sup> )	
C-15	Killer operation input level	a	OFF	OFF	ON	ON	OFF	center	center	center	(1) Input unicolor signal with amplitude 75 mV <sub>p-p</sub> and burst chroma ratio 1:1, or rainbow color bar signal to the chroma input pin via the attenuator. (2) While monitoring the color difference output of pin 10, 11, or 12, decrease the chroma input level. (3) Read the attenuation amount when output stops. (Note) Input, to the sync and video input pins, signals which do not pass the attenuator.	

NOTE NUM-BER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5 V, T <sub>a</sub> = 25 ± 3°C)										TEST METHOD
		SW & VR MODE										
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT		
C-16	ACC characteristic	a	OFF	OFF	ON	ON	OFF		center	center		<p>(1) Input sine wave with amplitude 75 mV<sub>p-p</sub> and frequency f<sub>SC</sub> to the chroma input pin via the attenuator.</p> <p>(2) Measure the 1-H interval pulse amplitude output on pin 12 (B axis output) and use this as the reference output level.</p> <p>(3) Increase/decrease the attenuation level and determine the attenuation amount when the output level change equals ± 1 dB. (Note) Input, to the sync and video input pins, signals which do not pass the attenuator.</p>
C-17	Control sensitivity	a	OFF	OFF	OFF	OFF	OFF	center	center	center		<p>(1) Provide an electrically floating test pin near pin 7. Use an FET probe to measure the sub carrier frequency induced on the test pin.</p> <p>(2) Connect external power supply to pin 6. Supply voltages of 0.5 V and 1.5 V and measure frequencies f<sub>05</sub> and f<sub>15</sub> and calculate the following. <math display="block">\beta_s = \frac{(f_{05} - f_{15})}{1000 \text{ mV}}</math></p>
C-18	APC pull-in range	a	OFF	OFF	OFF	OFF	OFF	center	center	center		<p>(1) Input to pin 23 a sine wave with a reference frequency of 3.579545 MHz and an amplitude of 75 mV<sub>p-p</sub>.</p> <p>(2) Input composite sync signal to pin 25.</p> <p>(3) Use an oscilloscope to monitor pin 6.</p> <p>(4) Increase or decrease the signal frequency of step (1) above. Unlock the synchronization of the signal in step (1) with the oscillator output signal (out-of-sync when monitor waveform starts fluctuating).</p> <p>(5) Decrease or increase the signal frequency of step (1) above. Measure the difference between the oscillator frequency and the reference frequency (peak and bottom) when the signal in step (1) and the oscillator output signal lock.</p>

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NOTE NUM- BER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5V, Ta = 25 ± 3°C)										TEST METHOD
		SV1	SV2	SW1	SW2	SW3	SW4	TINT	COLOR	CONT		
C-19	APC hold range	a	OFF	OFF	OFF	OFF	OFF	center	center	center		<p>(1) Input a sine wave with a reference frequency of 3.579545 MHz and an amplitude of 75 mV<sub>p-p</sub> to pin 23.</p> <p>(2) Input composite sync signal to pin 25.</p> <p>(3) Use the oscilloscope to monitor pin 6.</p> <p>(4) Increase or decrease the signal frequency of step (1) above. Measure the difference between the oscillator frequency and the reference frequency (peak and bottom) when the signal in step (1) and the oscillator output signal unlock (out-of-sync when monitor waveform starts fluctuating).</p>



Sync block

NOTE NUMBER		CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, VCC = 5V, Ta = 25 ± 3°C)				TEST METHOD
			SW3	SW & VR MODE			
D-1	Horizontal output pulse width						
D-2	Horizontal output pulse delay time				INT		
D-3	Horizontal output saturation level						
D-4	Vertical output pulse width						
D-5	Vertical output pulse delay time				INT		
D-6	Horizontal oscillation frequency				EXT		<p>(1) Connect pin 25 to VCC.                  (2) Measure pin 2 frequency.</p>
D-7	Horizontal AFC pull-in range				INT		<p>(1) Apply a horizontal sync signal (PG) with amplitude 286 mV and pulse width 4.8 μs to pin 25. Set the standard horizontal frequency to 15.734 kHz.                  (2) Use the oscilloscope to monitor the signals on pins 2 and 25. Change the PG frequency, measuring it at the moment when the state changes from out-of-sync to sync.                  (3) Define the frequency when it is pulled in from high as f<sub>HH</sub> ; from low, as f<sub>HL</sub>.                  d f pul = (f<sub>HH</sub> - f<sub>HL</sub>)/2</p>

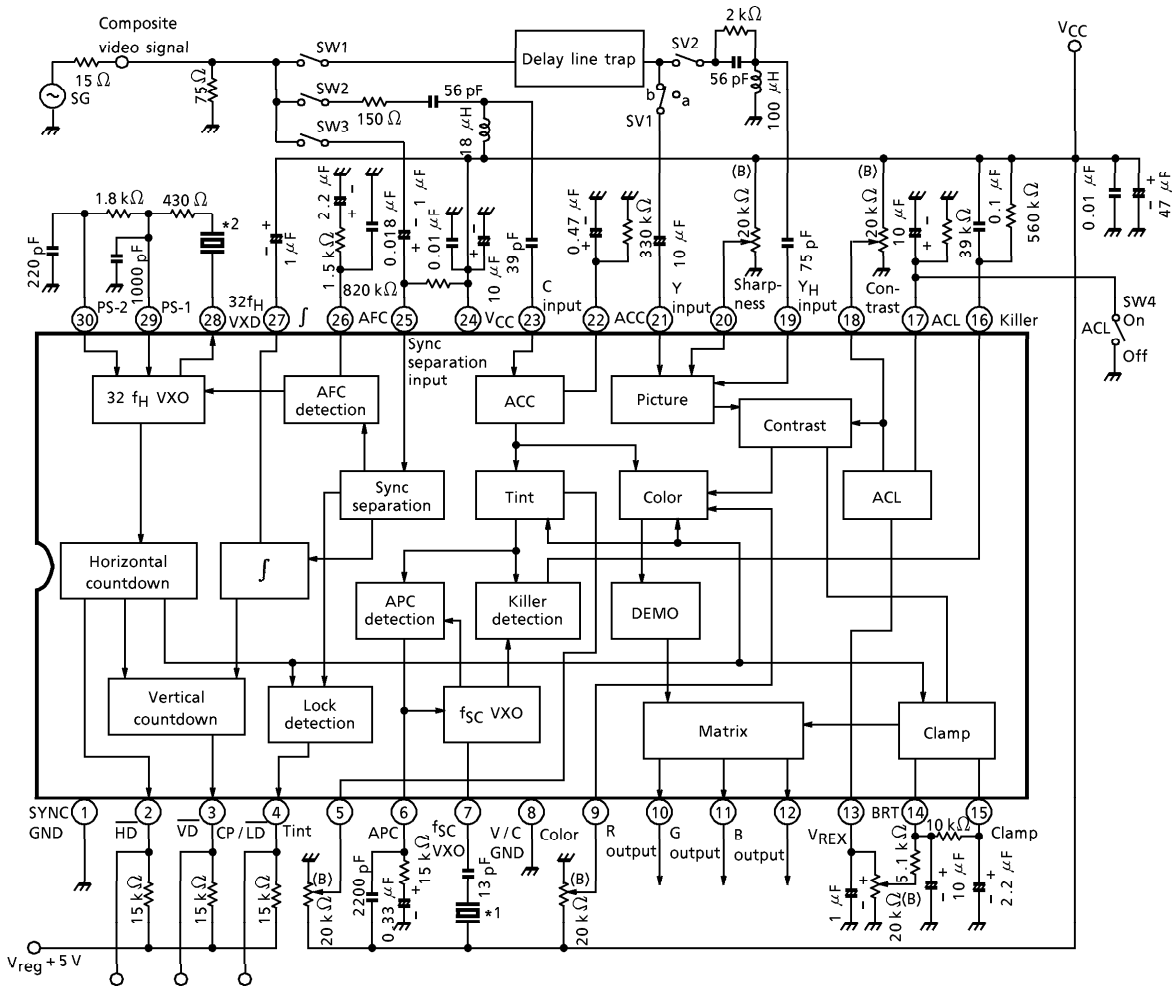
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NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, $V_{CC} = 5V$ , $T_a = 25 \pm 3^\circ C$ )				TEST METHOD
		SW3	SW & VR MODE			
D-8	Horizontal AFC hold range	INT				<p>(1) Apply a horizontal sync signal (PG) with amplitude 286 mV and pulse width 4.8 <math>\mu s</math> to pin 25. Set the standard horizontal frequency to 15.734 kHz.</p> <p>(2) Use the oscilloscope to monitor the signals on pins 2 and 25. Change the PG frequency, measuring it at the moment when the state changes from sync to out-of-sync.</p> <p>(3) Define the frequency when it is out-of-sync to high as <math>f_{HH}</math>; to low, as <math>f_{HL}</math>.  <math>d f_{hol} = (f_{HH} - f_{HL}) / 2</math></p>
D-9	Horizontal AFC hold limit input	EXT				<p>(1) Use an attenuator to apply a horizontal sync signal (PG) with amplitude 286 mV and pulse width 4.8 <math>\mu s</math> to pin 25. Set the standard horizontal frequency to 15.734 kHz.</p> <p>(2) Use the attenuator to change the pin 25 input signal level, reading the attenuation amount at the moment when the state changes from sync to out-of sync.</p>
D-10	Gate pulse width					
D-11	Gate pulse delay time	INT				

NOTE NUMBER	CHARACTERISTIC	TEST CONDITIONS (UNLESS OTHERWISE SPECIFIED, V <sub>CC</sub> = 5V, T <sub>a</sub> = 25 ± 3°C)						TEST METHOD
		SW3	SW & VR MODE					
D-12	Gate pulse generation limit input							<p>(1) Use the attenuator to apply a horizontal sync signal (PG) with amplitude 286 mV and pulse width 4.8 μs to pin 25. Set the standard horizontal frequency to 15.734 kHz.</p> <p>(2) Use the oscilloscope to monitor the pin 4 signal.</p> <p>(3) Use the attenuator to attenuate the pin 25 input signal level, reading the attenuation amount when gate pulse output becomes unstable.</p>
D-13	Vertical sync pull-in range 1							<p>(1) Apply a variable-interval composite sync signal (PG) with amplitude 286 mV to pin 25. Set the standard horizontal frequency to 15.734 kHz, the horizontal sync pulse width to 4.8 μs, the vertical frequency fV to fH/262.5, and the vertical sync pulse width to 3 H.</p>
D-14	Vertical sync pull-in range 2							<p>(2) Use the oscilloscope to monitor pin 3 and 25 signals. Change the PG frequency, measuring the PG frequency at the moment when the state changes from out-of-sync to sync.</p> <p>(3) Define the frequency when it is pulled in from high as fVh ; from low, as fVL.</p>
D-15	Vertical sync hold limit input							<p>(1) Apply a variable-interval composite sync signal (PG) with amplitude 286 mV to pin 25. Set the standard horizontal frequency to 15.734 kHz, the horizontal sync pulse width to 4.8 μs, the vertical frequency fV to fH/262.5, and the vertical sync pulse width to 3 H.</p> <p>(2) Use the oscilloscope to monitor pin 3 and 25 signals.</p> <p>(3) Use the attenuator to attenuate the pin 25 input signal level, reading the attenuation amount just before the state changes from sync to out-of-sync.</p>

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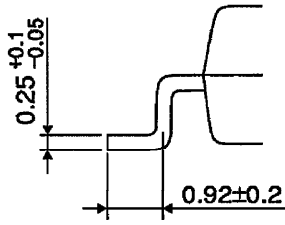
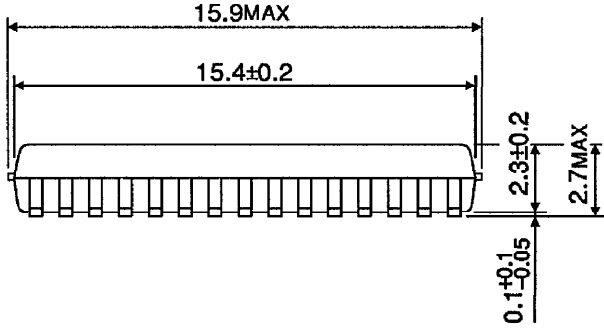
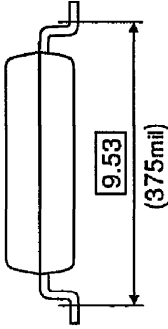
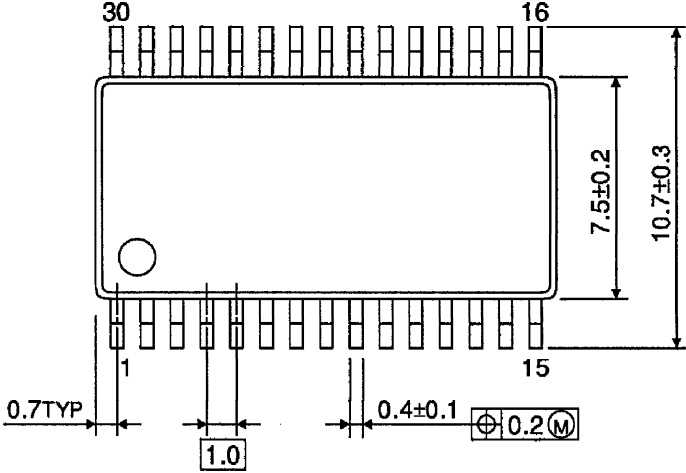
V/C/S IC TEST CIRCUIT



- (\*1) : 3.58 MHz X'tal                      NR-18 (HC-49/U) (made by Nihon Denpa Kogyo Co, Ltd)
- (\*2) : 32-f<sub>H</sub> ceramic oscillator        CSB503F10                      (made by Murata Manufacturing, Co, Ltd)

PACKAGE DIMENSIONS  
SSOP30-P-375-1.00

Unit : mm



Weight : 0.63 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

## RESTRICTIONS ON PRODUCT USE

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