

TENTATIVE

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA1310ANG

NTSC VIDEO, CHROMA, DEFLECTION, AND DISTORTION COMPENSATION IC
(WITH YUV INTERFACE AND ACB)

TA1310ANG is Video Chroma and deflection signal. Processing IC for NTSC. On a 56-pin shrink DIP package. TA1310ANG has deflection distortion compensation.
TA1310ANG uses an I²C Bus controls for controllings and settings.

FEATURES

Video Signal Processing

- Built-in Y delay line
- Black stretch
- DC restoration ratio compensation
- Aperture controlled sharpness
- Output for velocity scan modulation (VSM)
- White peak suppression (WPS)

Chroma Signal Processing

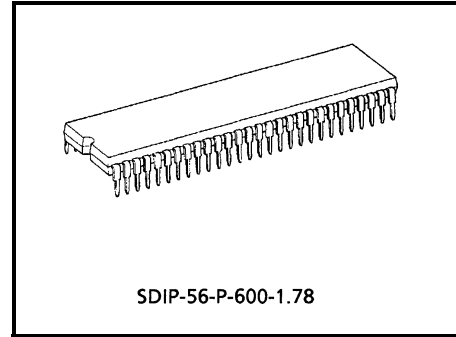
- Built-in chroma BPF / TOF
- R-Y and B-Y outputs
- Color / BW situation output by read bus

Sync Signal Processing

- Counts down 32 fH
- Dual AFC
- Vertical AGC
- HD and VD outputs
- Vertical frequency fixed mode
- Horizontal and Vertical position alignment
- DC outputs for vertical centering

Text Signal Processing

- Analog RGB inputs
- Digital RGB inputs
- Halftone switch (Y_M)
- Cutoff and drive alignment
- YUV inputs
- ACB

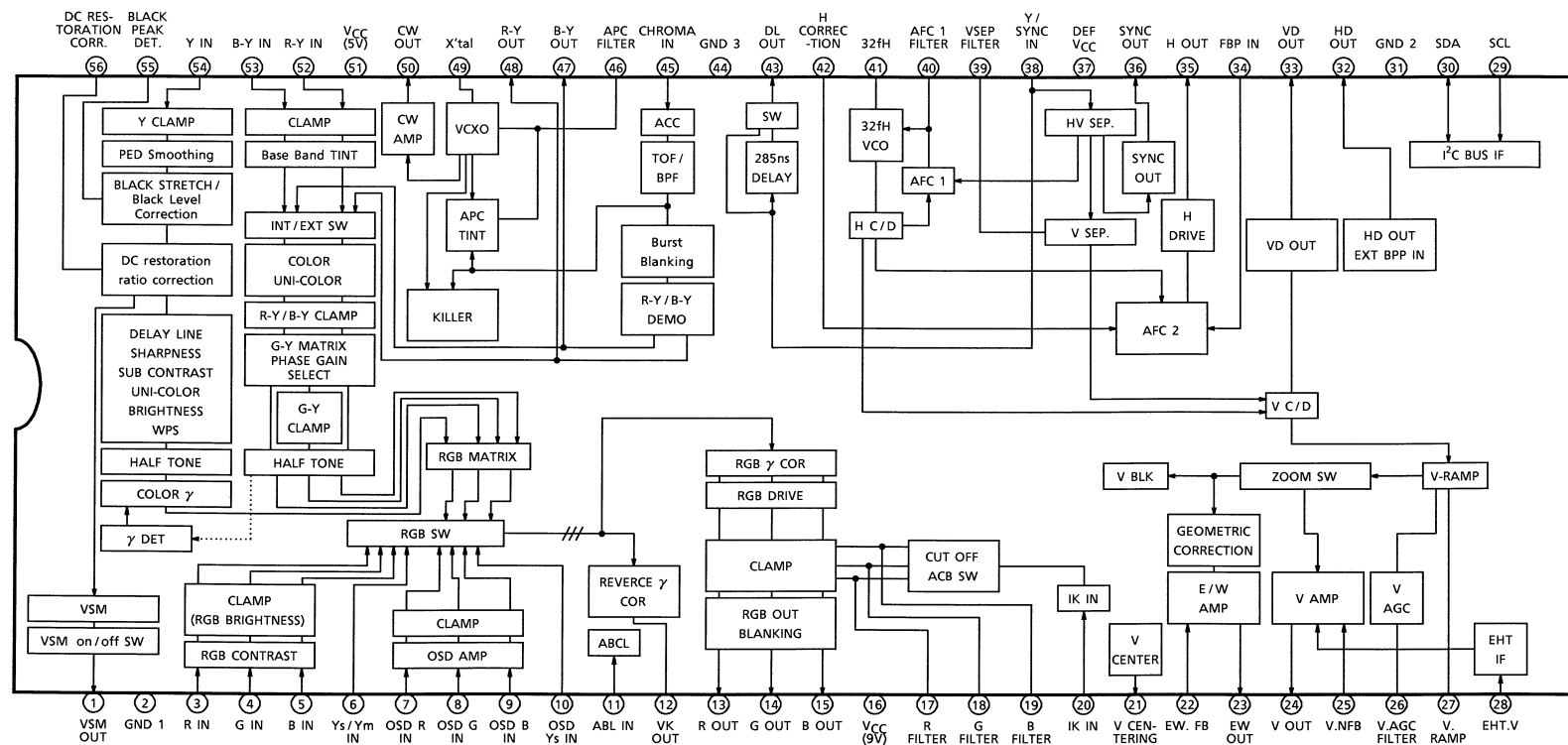


Weight: 5.55 g (Typ.)

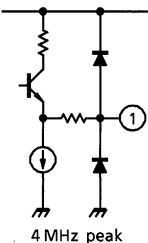
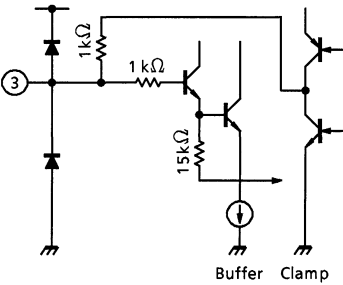
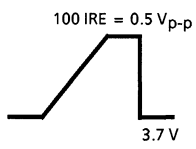
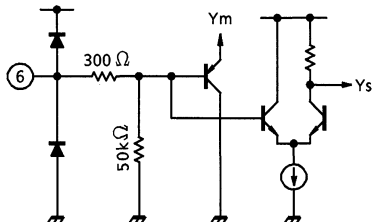
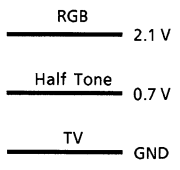
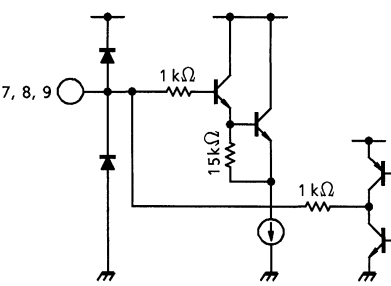
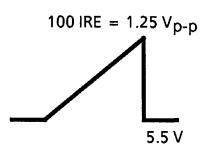
Deflection Correction Function

- Horizontal and Vertical amplitude adjustment
- Vertical linearity correction
- Vertical S correction
- Vertical EHT correction
- E / W parabola correction
- E / W corner correction
- E / W trapezium correction

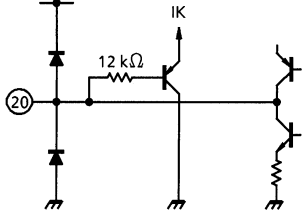

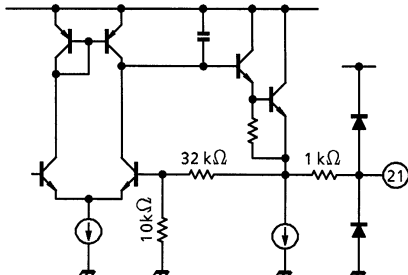
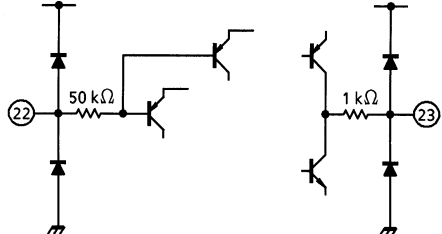

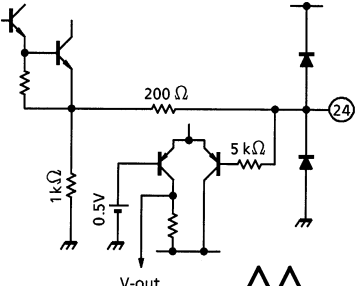
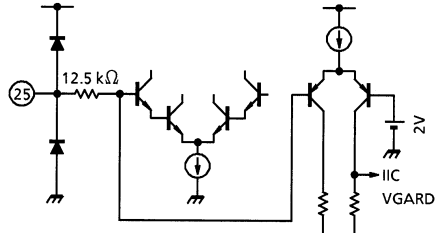
BLOCK DIAGRAM

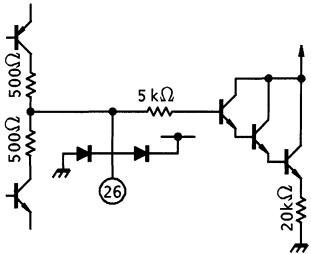
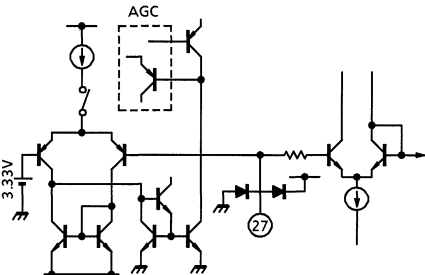

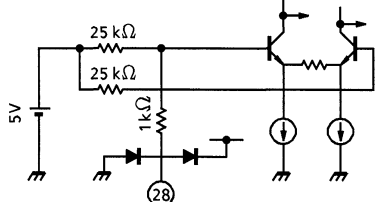
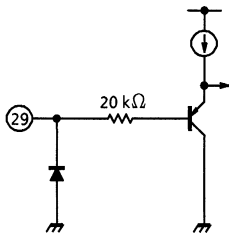
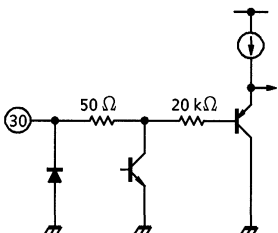


PIN FUNCTION

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|-------------|---|--|--|---|
| 1 | VSM OUT | VSM means Verocity Scanning Modulation. |  | |
| 2 | GND I | The terminal for GND of Video / Y / TEXT circuits. | — | |
| 3 4 5 | R _{IN} G _{IN} B _{IN} | The terminals for Analog RGB signal input. Input signals clamped by coupling capacitors. (*) : Even when not in use, connect to GND with a coupling capacitor. |  |  |
| 6 | Y _S / Y _M IN | The terminal for switching of Analog RGB Mode and Half tone. |  |  |
| 7 8 9 | OSD R IN OSD G IN OSD B IN | The terminals for Analog OSD RGB signal input. Input signals clamped by coupling capacitors. (*) : Even when not in use, connect to GND with a coupling capacitor. |  |  |

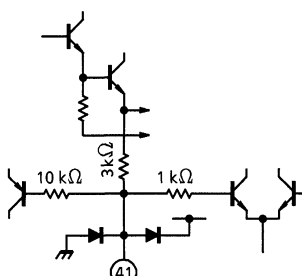
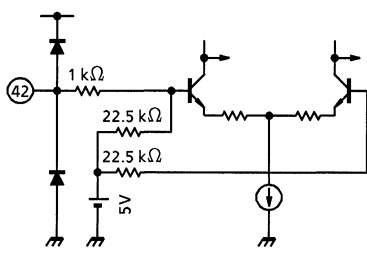
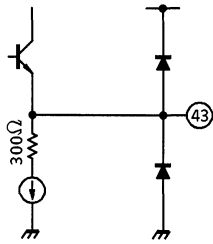
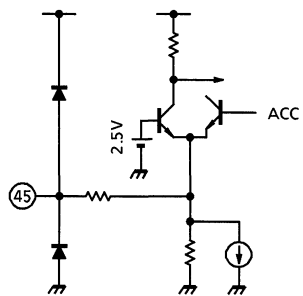
| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|----------------|----------------------------------|--|-----------|---|
| 10 | OSD Y _s IN | The terminal for switching of internal RGB signals and Analog OSD RGB signals (Pin 7, 8, 9). | | <p>Analog RGB 2.8 V</p> <p>Main GND</p> |
| 11 | ABL IN | The terminal for the external unicolor and brightness control. ABL Gain and ABL start point can be set by using BUS. | | OPEN 6.0 V |
| 12 | VK OUT | The terminal outputs signal in order to input in H-correction (Pin 42). The signal corresponds to RGB signal. | | |
| 13 14 15 | R OUT G OUT B OUT | The terminals for RGB signal output. | | |
| 16 | V _{CC} (9 V) | The terminal for V _{CC} supply 9 V. The terminals is connected to 9 V (typ.). | — | |
| 17 18 19 | R Filter G Filter B Filter | Control the RGB output cutoff voltage, holding the standard pulse period comparator output to one vertical period. At ACB ON, the filters operate so that the IK IN (pin 20) voltage equals the value determined by the bus (when RBG cutoff : center, 1 V _{p-p} .) The filters must be low leakage current filters. | | |

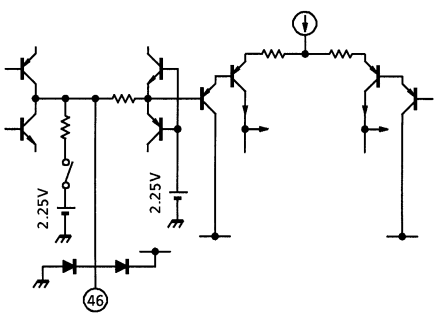
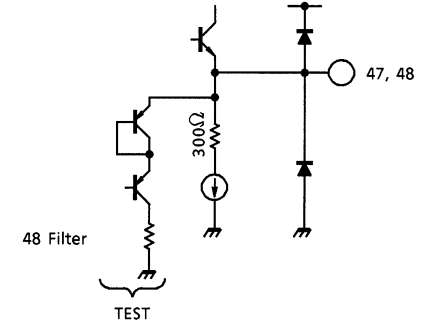
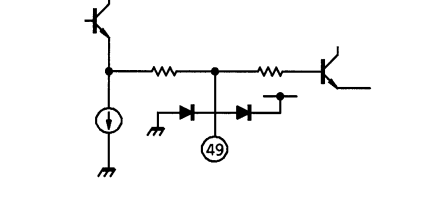
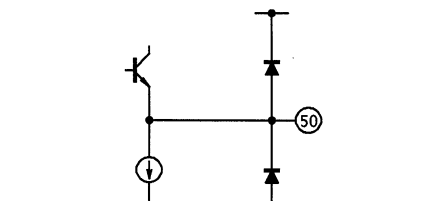
| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|-------------|--|--|---|
| 20 | IK IN | Terminal for detection of IK feedback signal. Leakage canceller incorporated. |  |  |
| 21 | V Centering | The terminal for the DAC output that controlled by BUS (V-center). |  | |
| 22 | EW FB | The terminal for E / W feedback. |  |  |
| 23 | EW OUT | The terminal for output of E / W drive signal. | | |
| 24 | V OUT | The terminal for output of Vertical drive signal. |  | |
| 25 | V NFB | The terminal for input of Vertical negative feedback. If input voltage is less than 2 V, V-Guard function works and blanks RGB signal output. |  | |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|--------------|--|--|---|
| 26 | V AGC Filter | The terminal to be connected a capacitor for Automatic gain control of Vertical RAMP signal. |  | |
| 27 | V RAMP | The terminal to be connected a capacitor to generate Vertical RAMP signal. |  |  |
| 28 | EHT V | The terminal for the Vertical EHT input. |  | |
| 29 | SCL | The terminal for input of I ² C BUS clock. |  | |
| 30 | SDA | The terminal for input / output of I ² C BUS data. |  | |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|--------|---|-----------|--------------|
| 31 | GND II | The terminal for the GND of DEF / I ² C / EW. | — | |
| 32 | HD OUT | The terminal for the HD pulse. The suspension period of the Black peak stretching is extended by inputting the external pulse. | | |
| 33 | VD OUT | The terminal for the VD pulse. | | |
| 34 | FBP IN | The terminal for the flyback pulse to control H-BLK and H-AFC. | | |
| 35 | H OUT | The terminal for the Horizontal output. | | |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|---------------------|---|---|--------------|
| 36 | SYNC OUT | <p>The terminal for output of the synchronizing signal that was separated in the synchronous separation circuit.</p> <p>This terminal is of the open collector system.</p> <p>Connect the pull-up resistor.</p> | | |
| 37 | DEF V _{CC} | The terminal for V _{CC} supply 9 V of DEF. | (Caution) Be sure to design the power supply so that when the power is Off, DEF V _{CC} is below 1.9 V. | |
| 38 | Y / SYNC IN | <p>The terminal for input of the synchronous separation circuit.</p> <p>Input via clamp capacitor.</p> | | |
| 39 | V SEP Filter | The terminal to be connected a capacitor for the Vertical synchronous separation circuit. | | |
| 40 | AFC I Filter | <p>Connect the filter for horizontal AFC I detection.</p> <p>The frequency of the horizontal output varies depending on the voltage at this pin.</p> | | |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|--------------|--|--|---|
| 41 | 32 fh VCO | Connect the ceramic oscillator for horizontal oscillation. The oscillator to be used is CSBLA503KECZF30, made by Murata electronics. |  | |
| 42 | H Correction | The terminal to correct distortion of picture in the case of high-tension fluctuation. Input the AC component of high tension fluctuation. This terminal can be inputted VK output (Pin 12). |  | |
| 43 | DL OUT | The terminal outputs delayed Y signal. Input this signal to Y IN (Pin 54) via a capacitor. |  | |
| 44 | GND III | The terminal for GND of DEF linear / Chroma circuits. | — | |
| 45 | CHROMA IN | The terminal for the chroma input. |  | DC : 1.77 V AC : Burst 286 mV _{p-p} |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|---------|---------|---|--|---|
| 46 | APC | The terminal to be connected APC filter. The oscillation frequency of VCXO varies depending on the voltage at this pin. |  | |
| 47 | B-Y OUT | The terminal outputs the B-Y signal. |  | DC : 2.2 V AC : 300m V _{p-p} (Rainbow color bar) |
| 48 | R-Y OUT | The terminal outputs the R-Y signal. | | DC : 2.2 V AC : 300 mV _{p-p} (Rainbow color bar) |
| 49 | X'tal | The terminal to be connected with a 3.579545 MHz X'tal oscillator. The oscillated frequency, f_0 , is controlled by series capacitors, and frequency adjustment range can be expanded by putting capacitors in parallel. |  | |
| 50 | CW OUT | The terminal for CW output generated in VCXO. |  | |

| PIN No. | SYMBOL | FUNCTION | INTERFACE | I / O SIGNAL |
|----------|-----------------------|--|-----------|--------------|
| 51 | V _{CC} (5 V) | The terminal for V _{CC} supply 5 V. | — | |
| 52 53 | R-Y IN B-Y IN | The terminals for the R-Y / B-Y signal input. Input signals clamped by coupling capacitors. (*) : Even when not in use, connect to GND with a coupling capacitor. | | |
| 54 | Y IN | The terminal for the Y signal input. Input the Y signals clamped by coupling capacitors. | | |
| 55 | BLACK PEAK DET | The terminal to be connected the filter controlling the black stretching gain of the black stretching circuit. The black stretching gain varies depending on the voltage at this pin. | | |
| 56 | DC RESTORATION CORR. | The terminal to be connected capacitor for DC restoration correction control. Open this pin if not use the DC restoration correction. | | |

BUS CONTROL MAP

Slave address : 88H (WRITE) / 89H (READ)

| | D ₇ | D ₆ | D ₅ | D ₄ | D ₃ | D ₂ | D ₁ | D ₀ |
|----|-------------------------|----------------|----------------|-------------------|-------------------|----------------|----------------|----------------|
| 00 | ABL POINT | | UNI-COLOR | | | | | |
| 01 | TEST | BRIGHTNESS | | | | | | |
| 02 | Y-MUTE | COLOR | | | | | | |
| 03 | TINT | | | | | | | TOF-SW |
| 04 | SHARPNESS | | | | | | ABL GAIN | |
| 05 | RGB BRIGHTNESS | | | | VERTICAL POSITION | | | UV-SW |
| 06 | G DRIVE GAIN | | | | | | | V-AGC |
| 07 | B DRIVE GAIN | | | | | | | VSM-G |
| 08 | R CUT OFF | | | | | | | |
| 09 | G CUT OFF | | | | | | | |
| 0A | B CUT OFF | | | | | | | |
| 0B | HORIZONTAL POSITION | | | | | B. S. POINT | | |
| 0C | VERTICAL SIZE | | | | | | ZOOM | SERVICE |
| 0D | HORIZONTAL SIZE | | | | | | HV-FIX | |
| 0E | E / W PARABOLA | | | | | V-S CORRECTION | | |
| 0F | V-LIN CORRECTION | | | | SUB CONTRAST | | | |
| 10 | E / W TRAPEZIUM | | | | E / W CORNER | | | |
| 11 | COL-γ | ACB MODE | | V-BLK START PHASE | | | | |
| 12 | RY / GY PHASE / GAIN | | DL- MODE | V-BLK STOP PHASE | | | | |
| 13 | VERTICAL CENTERING | | | | | | | RGB-γ |
| 14 | V CENTERING DAC SW | BASE BAND TINT | | | | | | |

READ MODE

| | PORES | Y-IN | RGB-OUT | H-OUT | V-OUT | EW-OUT | COLOR | ED2 |
|--|-------|------|---------|-------|-------|--------|-------|-----|
|--|-------|------|---------|-------|-------|--------|-------|-----|

The preset value for D₇ is 1. The preset values for D₀ to D₆ are 0.

BUS CONTROL CHARACTERISTICS BY FUNCTION

Write mode

| ITEM | DATA | No. OF BITS | PRESET VALUE |
|--|--|-------------|----------------------------|
| Unicolor (UNI-COLOR) / RGB Contrast | 000000 ; -18dB 111111 ; 0 dB | 6 | -18 dB (000000) |
| Brightness (sub-brightness included) (BRIGHTNESS) | 0000000 ; -40 (IRE) 1111111 ; +40 (IRE) | 7 | -40 (IRE) (0000000) |
| Color (sub-color included) (COLOR) | 0000000 ; -∞ 1111111 ; +6 dB | 7 | -∞ (0000000) |
| Tint (sub-tint included) (TINT) | 0000000 ; -32° 1111111 ; +32° | 7 | ±0° (1000000) |
| Picture Sharpness (PICTURE-SHARPNESS) | 000000 ; -6 dB 111111 ; +12 dB (at 2.4 MHz) | 6 | +6 dB (100000) |
| Sub Contrast (SUB-CONTRAST) | 0000 ; -3 dB 1111 ; +3 dB | 4 | -3 dB (0000) |
| DC Output for Vertical Centering (VERTICAL CENTERING) | 0000000 ; 1.0 V 1111111 ; 4.0 V | 7 | Center (1000000) |
| External / Internal Color Difference Switching (UV-SW) | 0 ; INT 1 ; EXT | 1 | INT (0) |
| RGB Brightness (RGB-BRIGHTNESS) | 0000 ; -20 (IRE) 1111 ; +20 (IRE) | 4 | Center (1000) |
| RGB Cut Off (RGB-CUTOFF) | 00000000 ; -0.5 V 11111111 ; +0.5 V -At bus control- 00000000 ; 0.5 Vp-p 11111111 ; 1.5 Vp-p -IK input amplitude in ACB mode- | 8×3 | -0.5 V (00000000) |
| G / B Drive Gain (GB-DRIVE GAIN) | 0000000 ; -5 dB 1111111 ; +3 dB | 7×2 | Center (1000000) |
| VSM Gain (VSM-G) | 0 ; ON 1 ; OFF | 1 | ON (0) |
| Zoom Mode Switching (ZOOM) | 0 ; Normal 1 ; ZOOM | 1 | Normal (0) |
| Black Stretching Start Point (B.S. POINT) | 000; Min / black stretch off (black correction on) 111; MAX / 50 (IRE) | 3 | Black stretch OFF (000) |
| ABL Detection Voltage (ABL POINT) | 00 ; MIN 11 ; MAX | 2 | Center (10) |
| ABL Sensitivity (ABL GAIN) | 00 ; MIN 11 ; MAX | 2 | MIN (00) |
| Horizontal Position (HORIZONTAL POSITION) | 00000 ; -3 μs (left shift) 11111 ; +3 μs | 5 | Center (10000) |
| Horizontal and Vertical Frequency Fixed Mode (HV-FIX) | 00 / 01 ; normal 10 ; AFC OFF (Free run) & V = 263 (H) 11 ; AFC OFF (Free run) & V = 262.5 (H) | 2 | Normal (00) |
| Vertical Pulse Phase (VERTICAL-PULSE PHASE) | 000 ; 0H 111 ; 7H DELAY | 3 | 0 (H) (000) |
| Service Mode (SERVICE) | 0 ; normal 1 ; Service mode(V-Stop) | 1 | Normal (0) |
| Test Mode (TEST MODE) | 1 ; normal 0 ; RGB BLK OFF | 1 | Normal (1) |

| ITEM | DATA | No. OF BITS | PRESET VALUE |
|---|--|-------------|----------------------|
| TOF Switching (TOF-SW) | 0 ; BPF mode 1; TOF mode | 1 | BPF (0) |
| V-AGC Time Constant (V-AGC) | 0 ; fast 1 ; slow | 1 | Fast (0) |
| Vertical Amplitude (VERTICAL SIZE) | 000000 ; MIN 111111 ; MAX | 6 | Center (100000) |
| Vertical Linearity Correction (V-LIN CORRECTION) | 0000 ; Lower stretch 1111 ; Upper stretch | 4 | Center (1000) |
| Vertical S Correction (V-S CORRECTION) | 000 ; Reverse S MAX 111 ; S MAX | 3 | (000) |
| Horizontal Amplitude (HORIZONTAL SIZE) | 000000 ; MAX 111111 ; MIN | 6 | Center (100000) |
| E / W Parabola Correction (E / W PARABOLA) | 00000 ; MIN 11111 ; MAX | 5 | Center (10000) |
| E/W Corner Correction (E / W CORNER) | 0000 ; Vertical expansion 1111 ; Vertical compression | 4 | (0000) |
| E / W Trapezium Correction (E / W TRAPEZIUM) | 0000 ; Expansion upward 1111 ; Expansion downward | 4 | Center (1000) |
| Color γ Correction (COL- γ) | 0 ; ON 1 ; OFF | 1 | OFF (1) |
| Y Mute (Y MUTE) | 0 ; OFF 1 ; ON | 1 | ON (1) |
| RGB γ Correction (RGB- γ) | 0 ; OFF 1 ; ON | 1 | OFF (0) |
| DL Mode Switching (DL-MODE) | 0 ; Through 1 ; ON | 1 | Through (0) |
| ACB Mode Switching (ACB-MODE) | 00 ; ACB OFF & S / H LOW 01 ; ACB OFF (Bus control) 10 ; ACB ON & I-DET normal 11 ; ACB ON & I-DET \times 3 | 2 | S / H LOW (00) |
| Relative Phase Amplitude Switching (RY / GY PHASE / GAIN) | 00 ; NTSC STD 01 ; DVD STD 10 ; NTSC (T) 11; A-TV STD | 2 | TSB STD (10) |
| Vertical Blanking Start Phase (V-BLK START PHASE) | 00000 ; Vth (Hi) 11111 ; Vth (Lo) | 5 | (00000) |
| Vertical Blanking Stop Phase (V-BLK STOP PHASE) | 00000 ; Vth (Lo) 11111 ; Vth (Hi) | 5 | (00000) |
| Base Band Tint | 0000000 ; +60 deg 1111111 ; -40 deg *1000000 (Center) :+6 deg | 7 | Center (1000000) |
| V CenteringDAC Output switch(V Centering DAC SW) | 0 ; Interlocking E / W trapezium correction (E / W trapezium correction : \pm 12.5%) 1; Non-interlocking E / W trapezium correction (E / W trapezium correction : \pm 4.5%) | 1 | Non-Interlocking (1) |

READ MODE

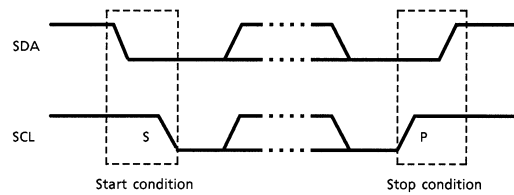
Slave address : 89H

| D ₇ | D ₆ | D ₅ | D ₄ | D ₃ | D ₂ | D ₁ | D ₀ |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| PONRES | Y-IN | RGB-OUT | H-OUT | V-OUT | EW-OUT | COLOR | ED2 |

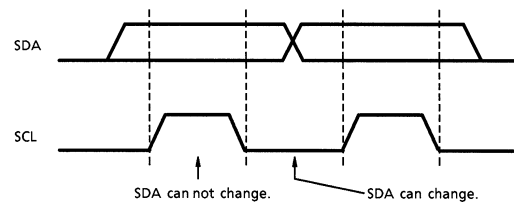
| ITEM | DATA | |
|---|-------------|---------------------|
| Power On Reset (PORES) | 0 ; Normal | 1 ; Resister preset |
| Color Mode (COLOR) | 0 ; B / W | 1 ; NTSC |
| Self Diagnosis Result Output (RGB-OUT / Y-IN / H-OUT / V-OUT / E-W OUT / UV-IN) | 0 ; NG | 1 ; OK |
| ED2 Identification | 0 ; non-ED2 | 1 ; ED2 |

I²C BUS COMMUNICATIONS, RECEIVE METHOD

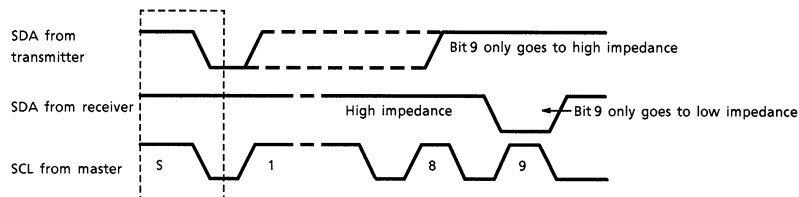
Start and stop condition



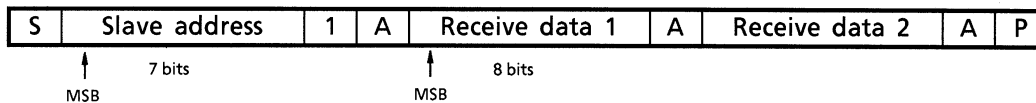
Bit transfer



Acknowledgement



Data receive format

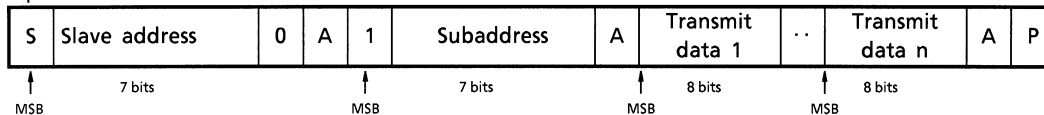


When data are received, the master transmitter changes to a receiver immediately after the first acknowledgement and the slave receiver changes to a transmitter.

The master always creates the stop condition.

Details are provided in the Philips I²C specifications.

Option data transmit format



In the above method, the subaddresses are automatically incremented from the specified subaddress and data are set.

Purchase of TOSHIBA I²C components conveys 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)

| CHARACTERISTICS | SYMBOL | RATING | UNIT |
|-----------------------------------|--------------------|---------|------------------|
| Power Supply Voltage (5 V / 9 V) | V _{CCmax} | 7 / 12 | V |
| Input Signal Voltage (5 V / 9 V) | einmax | 5 / 9 | V _{p-p} |
| Power Dissipation (Note) | P _D | 1920 | mW |
| Power Dissipation Reduction Rate | 1 / Qja | 15.4 | mW / °C |
| Operating Temperature | T _{opr} | -20~65 | °C |
| Storage Temperature | T _{stg} | -55~150 | °C |

Note: See the figure below.

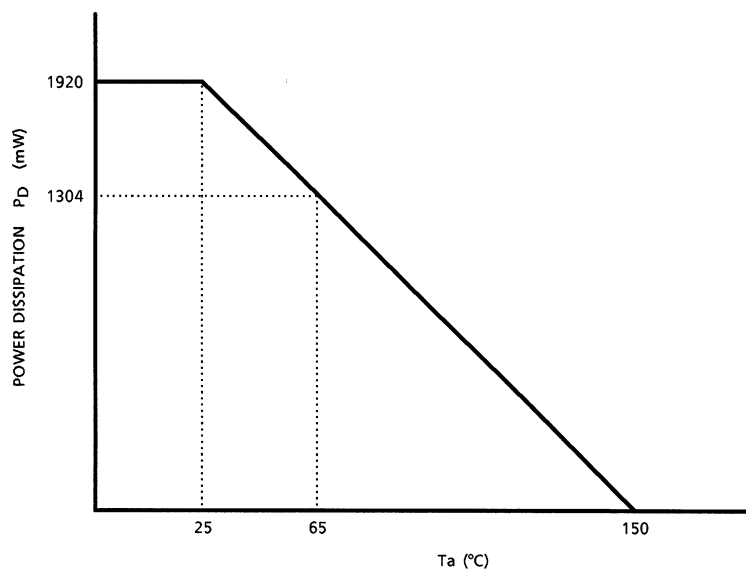


Fig. Temperature reduction curve for power dissipation

OPERATING CONDITION

| ITEM | DATA AND CONDITIONS | MIN | TYP. | MAX | UNIT |
|----------------------------------|---------------------------------------|-----|------|-----|-------------------|
| Power Supply Voltage | Pin 16, Pin 37 | 8.7 | 9.0 | 9.3 | V |
| | Pin 51 | 4.8 | 5.0 | 5.2 | |
| Pin 54 Y Input Signal Level | 100% white, including synchronization | 0.9 | 1.0 | 1.1 | V _{p-p} |
| Pin 45 Chroma Input Signal Level | TOF : off, burst level | 100 | 300 | 400 | mV _{p-p} |
| | TOF : on, burst level | 100 | 300 | 400 | |
| Pin 38 Sync Signal Input Level | 100% white, including synchronization | 0.9 | 1.0 | 1.1 | V _{p-p} |

Note: Be sure to design the power supply so that when the power is Off, DEF V_{CC} is below 1.9 V.

ELECTRICAL CHARACTERISTICS

(V_{CC} = 5 V / 9 V, DEF V_{CC} = 9 V, Ta = 25°C ± 3°C, unless otherwise specified)

Current dissipation

| PIN NAME | SYMBOL | TEST CIR-CUIT | CURRENT DISSIPATION | | | UNIT | REMARKS |
|---------------------|------------------|---------------|---------------------|-------|-------|------|---------|
| | | | MIN | TYP. | MAX | | |
| 5 V V _{CC} | I _{CC1} | — | 32.50 | 38.34 | 45.30 | mA | — |
| 9 V V _{CC} | I _{CC2} | — | 48.54 | 57.44 | 67.78 | mA | — |
| DEF V _{CC} | I _{CC3} | — | 19.70 | 23.31 | 27.50 | mA | — |

DC CHARACTERISTICS

Pin voltage

| PIN | PIN NAME | SYM-BOL | MIN | TYP. | MAX | UNIT | PIN | PIN NAME | SYM-BOL | MIN | TYP. | MAX | UNIT |
|-----|----------------------|-----------------|------|------|------|------|-----|---------------------------|-----------------|------|------|------|------|
| 1 | VSM out | V ₁ | 4.10 | 4.30 | 4.50 | V | 29 | SCL | V ₂₉ | 4.90 | 5.00 | — | V |
| 2 | GND1 | V ₂ | — | 0.00 | — | | 30 | SDA | V ₃₀ | 4.90 | 5.00 | — | |
| 3 | R in | V ₃ | 3.40 | 3.70 | 4.00 | | 31 | D. GND GND2 | V ₃₁ | — | 0.00 | — | |
| 4 | G in | V ₄ | 3.40 | 3.70 | 4.00 | | 32 | HD out | V ₃₂ | 0.15 | 0.20 | 0.25 | |
| 5 | B in | V ₅ | 3.40 | 3.70 | 4.00 | | 33 | VD out | V ₃₃ | 4.90 | 5.00 | 5.10 | |
| 6 | Ys / Ym in | V ₆ | — | 0.00 | 0.20 | | 34 | FBP in | V ₃₄ | 1.30 | 1.60 | 1.90 | |
| 7 | OSD R in | V ₇ | 5.00 | 5.50 | 6.00 | | 35 | H out | V ₃₅ | 1.50 | 1.80 | 2.10 | |
| 8 | OSD G in | V ₈ | 5.00 | 5.50 | 6.00 | | 36 | Sync out | V ₃₆ | 8.80 | 9.00 | — | |
| 9 | OSD B in | V ₉ | 5.00 | 5.50 | 6.00 | | 37 | DEF V _{CC} | V ₃₇ | — | 9.00 | — | |
| 10 | OSD Ys in | V ₁₀ | — | 0.00 | 0.20 | | 38 | Sync in | V ₃₈ | 2.80 | 3.00 | 3.20 | |
| 11 | ABL in | V ₁₁ | 5.70 | 6.00 | 6.30 | | 39 | V Sep | V ₃₉ | 6.00 | 6.40 | 6.80 | |
| 12 | VK out | V ₁₂ | 4.85 | 5.00 | — | | 40 | AFC1 | V ₄₀ | 7.20 | 7.50 | 7.80 | |
| 13 | R out | V ₁₃ | 1.20 | 1.60 | 2.00 | | 41 | 32fh VCO | V ₄₁ | 5.70 | 5.90 | 6.10 | |
| 14 | G out | V ₁₄ | 1.20 | 1.60 | 2.00 | | 42 | Curve correction | V ₄₂ | 4.60 | 4.80 | 5.00 | |
| 15 | B out | V ₁₅ | 1.20 | 1.60 | 2.00 | | 43 | DL out | V ₄₃ | 0.30 | 0.80 | 1.00 | |
| 16 | V _{CC} (9V) | V ₁₆ | — | 9.00 | — | | 44 | GND3 | V ₄₄ | — | 0.00 | — | |
| 17 | R Filter | V ₁₇ | 2.1 | 2.5 | 2.9 | | 45 | Chroma in | V ₄₅ | 1.59 | 1.77 | 1.95 | |
| 18 | G Filter | V ₁₈ | 2.1 | 2.5 | 2.9 | | 46 | APC | V ₄₆ | 1.39 | 1.72 | 2.05 | |
| 19 | B Filter | V ₁₉ | 2.1 | 2.5 | 2.9 | | 47 | B-Y out | V ₄₇ | 1.91 | 2.22 | 2.53 | |
| 20 | IK in | V ₂₀ | 0.95 | 1.00 | 1.05 | | 48 | R-Y out | V ₄₈ | 1.91 | 2.22 | 2.53 | |
| 21 | V Centering | V ₂₁ | 2.20 | 2.30 | 2.40 | | 49 | X'tal | V ₄₉ | 3.80 | 4.00 | 4.20 | |
| 22 | EW FB | V ₂₂ | 3.90 | 4.30 | 4.70 | | 50 | CW out | V ₅₀ | 3.00 | 3.50 | 4.00 | |
| 23 | EW out | V ₂₃ | 0.60 | 0.70 | 0.80 | | 51 | V _{CC} (5V) | V ₅₁ | — | 5.00 | — | |
| 24 | V out | V ₂₄ | 0.60 | 0.70 | 0.80 | | 52 | R-Y in | V ₅₂ | 2.85 | 3.00 | 3.15 | |
| 25 | V NFB | V ₂₅ | 4.60 | 5.00 | 5.40 | | 53 | B-Y in | V ₅₃ | 2.85 | 3.00 | 3.15 | |
| 26 | V AGC | V ₂₆ | 1.80 | 2.00 | 2.20 | | 54 | Y in | V ₅₄ | 3.50 | 3.65 | 3.90 | |
| 27 | V RAMP | V ₂₇ | 4.00 | 4.20 | 4.40 | | 55 | Black peak detect | V ₅₅ | 3.20 | 3.70 | 3.80 | |
| 28 | EHT, V i n | V ₂₈ | 4.80 | 4.90 | 5.00 | | 56 | DC restoration correction | V ₅₆ | 2.90 | 3.00 | 3.10 | |

AC CHARACTERISTICS

Video stage

| CHARACTERISTIC | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|--|---------------|--------------|----------------|-----------|---------|------|------------|
| #54 Voltage (Y Input Pedestal Clamp Voltage) | V54 | — | (Note P1) | 3.5 | 3.65 | 3.9 | V |
| #55 Voltage | V55 | — | (Note P2) | 3.2 | 3.7 | 3.8 | V |
| #56 Voltage | V56 | — | (Note P3) | 2.93 | 3.03 | 3.13 | V |
| #1 Voltage | V1 | — | (Note P4) | 4.1 | 4.25 | 4.4 | V |
| Y Input Pedestal Clamp Error Voltage | $\Delta VPC0$ | — | (Note P5) | -7 | ± 0 | +7 | mV |
| | $\Delta VPC1$ | — | | | | | |
| Y Input Pedestal Clamp Pulse Phase | TCL1 | — | (Note P6) | 2.8 | 2.9 | 3.0 | μs |
| | TCL2 | — | | 4.8 | 4.9 | 5.0 | |
| Y Input Dynamic Range | DR54 | — | (Note P7) | 1.0 | 1.25 | 1.4 | V_{p-p} |
| #56 Output Impedance | Z56 | — | (Note P8) | 4 | 5 | 6 | k Ω |
| Black Stretching Amplifier Maximum Gain | GBS | — | (Note P9) | 1.3 | 1.4 | 1.5 | (Times) |
| Black Level Compensation | BLC | — | (Note P10) | 6 | 7 | 8 | (IRE) |
| Black Peak Detection Level | ΔVBP | — | (Note P11) | -15 | 0 | +15 | mV |
| Black Stretching Start Point | PB001 | — | (Note P12) | 34 | 36 | 42 | (IRE) |
| | PB111 | — | | 51 | 54 | 61 | |
| DC Restoration Rate | GDTC | — | (Note P13) | 1.45 | 1.55 | 1.65 | (Times) |
| Compensation Amp. Gain | GDTR | — | | 1.3 | 1.4 | 1.5 | |
| Self-Diagnosis Y IN | SCDC | — | (Note P14) | — | OK | — | — |
| | SCAC | — | | | | | |
| Y Mute | GYM | — | (Note P15) | $-\infty$ | -50 | -45 | dB |
| Sharpness Peak Frequency | FAP | — | (Note P16) | 3.35 | 4.2 | 5.05 | MHz |
| Sharpness Control Range | GMAX | — | (Note P17) | 8 | 11 | 14 | dB |
| | GMIN | — | | -12 | -7.5 | -3 | |
| Sharpness Control Center Characteristics | GCEN | — | (Note P18) | 2 | 5 | 8 | dB |
| Between Y IN and R OUT Delay Time | TY | — | (Note P19) | 120 | 150 | 180 | ns |
| VSM Peak Frequency | FVSM | — | (Note P20) | 3 | 4 | 5 | MHz |
| VSM Gain | GVSM0 | — | (Note P21) | 9 | 11 | 13 | dB |
| | GVSM1 | — | | $-\infty$ | -30 | -20 | |
| VSM Muting Threshold Voltage | VVM10 | — | (Note P22) | 0.7 | 0.8 | 0.9 | V |
| | VVM6 | — | | 2.15 | 2.25 | 2.35 | |
| VSM High Speed Muting Response Time | THM1 | — | (Note P23) | 0 | +50 | +100 | ns |
| | THM2 | — | | | | | |
| | THM3 | — | | | | | |
| | THM4 | — | | | | | |
| VSM Phase | TVM24 | — | (Note P24) | 64 | 80 | 94 | ns |
| | TVMFP | — | | 59 | 73 | 87 | |
| | TVM2T | — | | 64 | 80 | 94 | |

Note 1: For testng, see the picture sharpness test circuit diagrams.

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

Chroma stage

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|-----------------|---------------|----------------|----------|----------|----------|-------------------|
| ACC Characteristic | va10 | — | (Note C1) | 93.5 | 110 | 127 | mV _{p-p} |
| | va30 | — | | 272 | 320 | 368 | |
| | va300 | — | | 276 | 325 | 374 | |
| | va600 | — | | 276 | 325 | 374 | |
| | A | — | | 0.80 | 1.00 | 1.10 | — |
| Color Difference Output Level | vB | — | (Note C2) | 276 | 325 | 374 | mV _{p-p} |
| | vR | — | | 276 | 325 | 374 | |
| Color Difference Output Relative Amplitude | vRB | — | (Note C3) | 0.90 | 1.00 | 1.10 | — |
| Color Difference Output Demodulation Angle | θ_{Bcnt} | — | (Note C4) | 3.0 | 6.0 | 11.0 | ° |
| | θ_{Rcnt} | — | | 91.0 | 94.0 | 99.0 | |
| Color Difference Output Relative Phase | θ_{RB} | — | (Note C5) | 85.0 | 89.0 | 91.0 | ° |
| Color Difference Output Tint Adjustment Characteristics | θ_{Bmax} | — | (Note C6) | -35.0 | -40.0 | -46.5 | ° |
| | θ_{Bmin} | — | | 35.0 | 38.0 | 44.0 | |
| | θ_{Rmax} | — | | -35.0 | -40.0 | -46.5 | |
| | θ_{Rmin} | — | | 35.0 | 38.0 | 46.0 | |
| Supply Voltage Dependence of Color Difference Output | BVp | — | (Note C7) | 5.00 | 8.00 | 11.00 | % |
| | RVp | — | | 5.00 | 8.00 | 11.00 | |
| | BVn | — | | -11.00 | -8.00 | -5.00 | |
| | RVn | — | | -11.00 | -8.00 | -5.00 | |
| Identification Sensitivity | vCB | — | (Note C8) | 3.00 | 4.10 | 6.00 | mV _{p-p} |
| | vBC | — | | 3.00 | 4.40 | 6.00 | |
| Bus Read Identification | bCB | — | (Note C9) | — | 0 | — | — |
| | bBC | — | | — | 1 | — | |
| Color Difference Output Voltage Difference in 1H Period | vBH | — | (Note C10) | — | 0 | 4.00 | mV _{p-p} |
| | vRH | — | | — | 0 | 4.00 | |
| Color Difference Output Voltage Difference Every 1H Period | vBG | — | (Note C11) | — | 0 | 2.00 | mV _{p-p} |
| | vRG | — | | — | 0 | 2.00 | |
| Color Difference Output DC Voltage | VB | — | (Note C12) | 1.91 | 2.22 | 2.53 | V |
| | VR | — | | 1.91 | 2.22 | 2.53 | |
| Difference between DC Voltage Axes of Color Difference Output | VRB | — | (Note C13) | -0.1 | 0 | +0.1 | V |
| X'tal Free-Run Frequency | Xf | — | (Note C14) | 3.579345 | 3.579545 | 3.579745 | MHz |
| APC Frequency Control Sensitivity | βf | — | (Note C15) | 0.45 | 0.90 | 1.20 | $\frac{Hz}{mV}$ |
| APC Pull-In / Hold Range | fh+ | — | (Note C16) | +250 | +500 | +2000 | Hz |
| | fh- | — | | -250 | -500 | -2000 | |
| | fp+ | — | | +250 | +500 | +2000 | |
| | fp- | — | | -250 | -500 | -2000 | |
| Residual Carrier Level | vBNo | — | (Note C17) | — | 2.0 | 4.00 | mV _{p-p} |
| | vRNo | — | | — | 2.0 | 4.00 | |
| Residual Higher Harmonics Level | vBHn | — | (Note C18) | — | 2.0 | 4.0 | mV _{p-p} |
| | vRHn | — | | — | 2.0 | 4.0 | |

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|------------------------|--------|---------------|----------------|------|------|------|-------------------|
| TOF-BPF Characteristic | GBL | — | (Note C19) | 17.5 | 21.0 | 24.5 | dB |
| | GBH | — | | 21.5 | 25.0 | 28.5 | |
| | GTL | — | | 14.0 | 17.5 | 21.0 | |
| | GTH | — | | 21.5 | 25.0 | 28.5 | |
| CW Output Amplitude | vCW | — | (Note C20) | 420 | 700 | 980 | mV _{p-p} |

Color difference stage

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|--|--------|---------------|----------------|------|------|------|------------------|
| Color Difference Input Clamp Voltage | VRY | — | (Note A1) | 2.85 | 3.00 | 3.15 | V |
| | VBY | — | | 2.85 | 3.00 | 3.15 | |
| Color Difference Input / Output Delay Time | DLRY | — | (Note A2) | 115 | 150 | 185 | ns |
| | DLBY | — | | 115 | 150 | 185 | |
| Unicolor Adjustment Characteristics | uR | — | (Note A3) | -17 | -19 | -21 | dB |
| | uB | — | | -17 | -19 | -21 | |
| Color Adjustment Characteristics | cRmax | — | (Note A4) | 6.5 | 8.0 | 9.5 | dB |
| | cRmin | — | | — | — | -20 | |
| | cBmax | — | | 6.5 | 8.0 | 9.5 | |
| | cBmin | — | | — | — | -20 | |
| RGB Output Half-Tone Characteristics | vRHo | — | (Note A5) | -5.5 | -6 | -6.5 | dB |
| | vGHo | — | | -5.5 | -6 | -6.5 | |
| | vBHo | — | | -5.5 | -6 | -6.5 | |
| RGB Output Amplitude | vRSTD | — | (Note A6) | 0.64 | 1.13 | 0.87 | V _{p-p} |
| | vGSTD | — | | 0.39 | 0.50 | 0.53 | |
| | vBSTD | — | | 1.14 | 1.35 | 1.56 | |
| | vRDVD | — | | 0.90 | 1.07 | 1.23 | |
| | vGDVD | — | | 0.51 | 0.61 | 0.70 | |
| | vBDVD | — | | 1.14 | 1.35 | 1.56 | |
| | vRTSB | — | | 0.78 | 0.92 | 1.06 | |
| | vGTSB | — | | 0.34 | 0.41 | 0.47 | |
| | vBTSB | — | | 1.14 | 1.35 | 1.56 | |
| | vRDTV | — | | 0.98 | 1.13 | 1.34 | |
| | vGDTV | — | | 0.34 | 0.41 | 0.47 | |
| | vBDTV | — | | 1.14 | 1.35 | 1.56 | |
| RGB Output Relative Amplitude | vRBSTD | — | (Note A7) | 0.78 | 0.87 | 0.96 | — |
| | vGBSTD | — | | 0.31 | 0.35 | 0.39 | |
| | vRBDVD | — | | 0.72 | 0.80 | 0.88 | |
| | vGBDVD | — | | 0.37 | 0.42 | 0.47 | |
| | vRBTSB | — | | 0.62 | 0.69 | 0.76 | |
| | vGBTSB | — | | 0.25 | 0.28 | 0.31 | |
| | vRBDTV | — | | 0.78 | 0.87 | 0.96 | |
| | vGBDTV | — | | 0.24 | 0.27 | 0.30 | |

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|--------------------------------------|----------------|---------------|----------------|-------|------|-------|------|
| RGB Output Demodulation Angle | θ RSTD | — | (Note A8) | 86.0 | 90 | 94 | ° |
| | θ GSTD | — | | 232.0 | 236 | 240.0 | |
| | θ BSTD | — | | -4 | 0 | 4 | |
| | θ RDVD | — | | 86.0 | 90 | 94.0 | |
| | θ GDVD | — | | 240 | 244 | 248 | |
| | θ BDVD | — | | -4 | 0 | 4 | |
| | θ RTSB | — | | 88.0 | 92 | 96.0 | |
| | θ GTSB | — | | 236.0 | 240 | 244.0 | |
| | θ BTSB | — | | -4 | 0 | 4 | |
| | θ RDTV | — | | 86.0 | 90 | 94.0 | |
| | θ GDTV | — | | 240.0 | 244 | 248.0 | |
| | θ BDTV | — | | -4 | 0 | 4 | |
| RGB Output Relative Phase | θ RBSTD | — | (Note A9) | 92 | 96 | 100 | ° |
| | θ GBSTD | — | | 236 | 240 | 244 | |
| | θ RBDVD | — | | 88 | 92 | 96 | |
| | θ GBDVD | — | | 240 | 244 | 248 | |
| | θ RBTSB | — | | 90 | 94 | 98 | |
| | θ GBTSB | — | | 235 | 239 | 243 | |
| | θ RBDTV | — | | 103 | 107 | 111 | |
| | θ GBDTV | — | | 239 | 243 | 247 | |
| Color Difference EXT → INT Crosstalk | XEIR | — | (Note A10) | — | -50 | -45 | dB |
| | XEIG | — | | — | -50 | -45 | |
| | XEIB | — | | — | -50 | -45 | |
| Color Difference INT → EXT Crosstalk | XIER | — | (Note A11) | — | -50 | -45 | dB |
| | XIEG | — | | — | -50 | -45 | |
| | XIEB | — | | — | -50 | -45 | |
| Color γ Characteristic | C γ sp | — | (Note A12) | 1.80 | 2.07 | 2.20 | V |

Y stage

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|--------|---------------|----------------|-------|-------|------|------------------|
| Sync Input~DL Output AC Gain | Gyoff | — | (Note Y1) | -0.30 | -0.20 | 0.01 | dB |
| | Gyon | — | | -0.45 | -0.35 | 0.01 | |
| Sync Input~DL Output Frequency Gain | Gfyoff | — | (Note Y2) | -0.20 | 0.00 | 0.20 | dB |
| | Gfyon | | | -3.00 | -1.60 | 0.20 | |
| Sync Input~DL Output Dynamic Range | VDoff | — | (Note Y3) | 1.30 | 1.60 | — | V _{p-p} |
| | VDon | | | 1.30 | 1.60 | — | |
| Sync Input~DL Output Transfer Characteristics | TYDL | — | (Note Y4) | 300 | 350 | 410 | ns |

Text stage

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|--------|-------------------|-------------------|-------|-------|-------|------------------|
| AC Gain | GR | — | (Note T1) | 3.2 | 3.80 | 4.55 | Times |
| | GG | — | | 3.2 | 3.80 | 4.55 | |
| | GB | — | | 3.2 | 3.80 | 4.55 | |
| Frequency Characteristics | GfR | — | (Note T2) | — | −3.0 | −6.0 | dB |
| | GfG | — | | — | −3.0 | −6.0 | |
| | GfB | — | | — | −3.0 | −6.0 | |
| Unicolor Adjustment Characteristic | vuMAX | — | (Note T3) | 0.59 | 0.74 | 0.88 | V _{p-p} |
| | vuCNT | — | | 0.31 | 0.39 | 0.47 | dB |
| | vuMIN | — | | 0.06 | 0.08 | 0.10 | |
| | Δvu | — | | 17 | 18.5 | 20 | |
| Brightness Adjustment Characteristic | VbrMAX | — | (Note T4) | 4.3 | 4.6 | 4.9 | V |
| | VbrCNT | — | | 3.3 | 3.6 | 3.9 | |
| | VbrMIN | — | | 2.3 | 2.6 | 2.9 | |
| Brightness Control Sensitivity | Gbr | — | (Note T5) | 14.2 | 16.3 | 18.7 | mV |
| White Peak Slice Level | VWPS | — | (Note T6) | 2.600 | 2.825 | 3.100 | V _{p-p} |
| Black Peak Slice Level | VBPSR | — | (Note T7) | 1.95 | 2.15 | 2.35 | V |
| | VBPSG | — | | | | | |
| | VBPSB | — | | | | | |
| DC Restoration | TDCR | — | (Note T8) | — | 0.0 | 50 | mV |
| | TDCG | — | | | | | |
| | TDCB | — | | | | | |
| RGB Output S / N | N13 | — | (Note T9) | — | −50 | −45 | dB |
| | N14 | — | | | | | |
| | N15 | — | | | | | |
| RGB Output Emitter-Follower Drive Current | I#13 | — | (Note T10) | 1.1 | 1.5 | 1.9 | mA |
| | I#14 | — | | | | | |
| | I#15 | — | | | | | |
| RGB Output Temperature Coefficient | Δt13 | — | (Note T11) | −2.0 | 0.0 | 2.0 | mV / °C |
| | Δt14 | — | | | | | |
| | Δt15 | — | | | | | |
| Half-Tone Characteristics | GHT | — | (Note T12) | 0.45 | 0.5 | 0.55 | Times |
| Half-Tone ON Voltage | VHT | — | (Note T13) | 0.6 | 0.8 | 1.0 | V |
| V-BLK Pulse Output Level | VVR | — | (Note T14) | 0.5 | 1.0 | 1.5 | V |
| | VVG | — | | | | | |
| | VVB | — | | | | | |
| H-BLK Pulse Output Level | VHR | — | (Note T15) | 0.5 | 1.0 | 1.5 | V |
| | VHG | — | | | | | |
| | VHB | — | | | | | |
| Blanking Pulse Delay Time | tdONR | — | (Note T16) | — | 0.0 | 0.3 | μs |
| | tdONG | — | | | | | |
| | tdONB | — | | | | | |
| | tdOFFR | — | | — | 0.0 | 0.3 | |
| | tdOFFG | — | | | | | |
| | tdOFFB | — | | | | | |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|--------------------------------------|---------------|-------------------|-------------------|--------|----------------|--------|------------------|
| Sub-Contrast Control Range | $\Delta vsu+$ | — | (Note T17) | 1.8 | 2.3 | 2.8 | dB |
| | $\Delta vsu-$ | — | | -3.0 | -3.5 | -4.0 | |
| RGB Output Voltage | V#13 | — | (Note T18) | 2.35 | 2.6 | 2.85 | V |
| | V#14 | — | | | | | |
| | V#15 | — | | | | | |
| Cut-Off Voltage Control Range | CUT+R | — | (Note T19) | 0.45 | 0.5 | 0.55 | V |
| | CUT+G | — | | | | | |
| | CUT+B | — | | | | | |
| | CUT-R | — | | -0.45 | -0.5 | -0.55 | |
| | CUT-G | — | | | | | |
| | CUT-B | — | | | | | |
| Drive Adjustment Range | DRG+ | — | (Note T20) | 2.35 | 2.85 | 3.35 | dB |
| | DRG- | — | | -4.25 | -5.0 | -5.75 | |
| | DRB+ | — | | 2.35 | 2.85 | 3.35 | |
| | DRB- | — | | -4.25 | -5.0 | -5.75 | |
| #11 Input Impedance | Zin11 | — | (Note T21) | 24 | 30 | 36 | k Ω |
| ACL Characteristic | ACL1 | — | (Note T22) | -1.5 | -3.5 | -5.5 | dB |
| | ACL2 | — | | -12 | -15 | -18 | |
| ABL Point | ABLP1 | — | (Note T23) | 0.04 | -0.01 | -0.06 | V |
| | ABLP2 | — | | -0.09 | -0.14 | -0.19 | |
| | ABLP3 | — | | -0.24 | -0.29 | -0.34 | |
| | ABLP4 | — | | -0.37 | -0.42 | -0.47 | |
| ABL Gain | ABLG1 | — | (Note T24) | -0.119 | -0.095 | -0.072 | V |
| | ABLG2 | — | | -0.400 | -0.320 | -0.240 | |
| | ABLG3 | — | | -0.750 | -0.600 | -0.450 | |
| | ABLG4 | — | | -0.925 | -0.740 | -0.555 | |
| BLK Off Mode | BLK | — | (Note T25) | — | Oper- ating | — | — |
| Analog RGB Gain | GTXR | — | (Note T26) | 4.2 | 5.0 | 6.0 | Times |
| | GTXG | — | | | | | |
| | GTXB | — | | | | | |
| Analog RGB Frequency Characteristics | GfTXR | — | (Note T27) | — | -1.0 | -3.0 | dB |
| | GfTXG | — | | | | | |
| | GfTXB | — | | | | | |
| Analog RGB Input Dynamic Lange | GR13 | — | (Note T28) | 0.47 | 0.55 | — | V _{p-p} |
| | GR14 | — | | | | | |
| | GR15 | — | | | | | |
| Analog RGB White Peak Slice Level | VTXMAXR | — | (Note T29) | 3.5 | 3.8 | 4.1 | V _{p-p} |
| | VTXMAXG | — | | | | | |
| | VTXMAXB | — | | | | | |
| Analog RGB Black Peak Limiter Level | VTXMINR | — | (Note T30) | 1.9 | 2.1 | 2.3 | V |
| | VTXMING | — | | | | | |
| | VTXMINB | — | | | | | |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|--|--------------------|-------------------|-------------------|------|------|------|------------------|
| Analog RGB Contrast Adjustment Characteristics | vuTXR1 | — | (Note T31) | 0.85 | 1.0 | 1.2 | V _{p-p} |
| | vuTXG1 | — | | | | | |
| | vuTXB1 | — | | | | | |
| | vuTXR2 | — | | 0.50 | 0.59 | 0.71 | |
| | vuTXG2 | — | | | | | |
| | vuTXB2 | — | | | | | |
| | vuTXR3 | — | | 0.11 | 0.13 | 0.15 | |
| | vuTXG3 | — | | | | | |
| | vuTXB3 | — | | | | | |
| | ΔvuTXR | — | | 17.0 | 18.5 | 20 | dB |
| | ΔvuTXG | — | | | | | |
| | ΔvuTXB | — | | | | | |
| Analog RGB Brightness Adjustment Characteristics | VbrTX1R | — | (Note T32) | 3.3 | 3.6 | 3.9 | V |
| | VbrTX1G | — | | | | | |
| | VbrTX1B | — | | | | | |
| | VbrTX2R | — | | 2.8 | 3.1 | 3.4 | |
| | VbrTX2G | — | | | | | |
| | VbrTX2B | — | | | | | |
| | VbrTX3R | — | | 2.2 | 2.5 | 2.8 | |
| | VbrTX3G | — | | | | | |
| | VbrTX3B | — | | | | | |
| Analog RGB Mode On Voltage | VTXON | — | (Note T33) | 2.0 | 2.25 | 2.5 | V |
| Analog RGB Mode Transfer Characteristics | τRYSR | — | (Note T34) | — | 25 | 100 | ns |
| | τRYSG | — | | | | | |
| | τRYSB | — | | | | | |
| | tPRYSR | — | | — | 30 | 100 | |
| | tPRYSG | — | | | | | |
| | tPRYSB | — | | | | | |
| | ΔtPRYS | — | | — | 0 | 20 | |
| | τFYSR | — | | — | 10 | 100 | |
| | τFYSG | — | | | | | |
| | τFYSB | — | | | | | |
| | tpFYSR | — | | — | 25 | 100 | |
| | tpFYSG | — | | | | | |
| | tpFYSB | — | | | | | |
| | ΔtPFYS | — | | — | 0 | 20 | |
| Crosstalk from Video to Analog RGB | V _v →aR | — | (Note T35) | — | -50 | -45 | dB |
| | V _v →aG | — | | | | | |
| | V _v →aB | — | | | | | |
| Crosstalk from Analog RGB to Video | V _a →vR | — | (Note T36) | — | -55 | -50 | dB |
| | V _a →vG | — | | | | | |
| | V _a →vB | — | | | | | |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|-----------|-------------------|-------------------|-------|----------------|-------|------------------|
| Analog OSD Gain | GOSDR | — | (Note T37) | 1.8 | 2.0 | 2.2 | (Times) |
| | GOSDG | — | | | | | |
| | GOSDB | — | | | | | |
| Analog OSD Frequency Characteristics | GfOSDR | — | (Note T38) | — | −1.0 | −3.0 | dB |
| | GfOSDG | — | | | | | |
| | GfOSDB | — | | | | | |
| Analog OSD Output Level | VOSD1R | — | (Note T39) | 2.25 | 2.5 | 2.75 | V |
| | VOSD1G | — | | | | | |
| | VOSD1B | — | | | | | |
| | VOSD2R | — | | 1.98 | 2.20 | 2.42 | |
| | VOSD2G | — | | | | | |
| | VOSD2B | — | | | | | |
| | VOSD3R | — | | 5.0 | 5.5 | 6.0 | |
| | VOSD3G | — | | | | | |
| | VOSD3B | — | | | | | |
| Analog OSD Mode On Voltage | VOSDON | — | (Note T40) | 2.00 | 2.25 | 2.50 | V |
| Analog OSD Mode Transfer Characteristic | τROSDYSR | — | (Note T41) | — | 20 | 100 | ns |
| | τROSDYSG | — | | | | | |
| | τROSDYSB | — | | | | | |
| | tPROSDYSR | — | | — | 30 | 100 | |
| | tPROSDYSG | — | | | | | |
| | tPROSDYSB | — | | | | | |
| | ΔtPROSDYS | — | | — | 0 | 20 | |
| | τFOSDYSR | — | | — | 15 | 100 | |
| | τFOSDYSG | — | | | | | |
| | τFOSDYSB | — | | | | | |
| | tPFOSDYSR | — | | — | 30 | 100 | |
| | tPFOSDYSG | — | | | | | |
| | tPFOSDYSB | — | | | | | |
| | ΔtPFOSDYS | — | | — | 0 | 20 | |
| RGB Output Self-Diagnosis | SCRGB | — | (Note T42) | — | Oper- ating | — | — |
| ACB Input Pulse Phase, Amplitude | θACBR | — | (Note T43) | — | 1 | — | (H) |
| | θACBG | — | | — | 2 | — | |
| | θACBB | — | | — | 3 | — | |
| | VACBR | — | | 0.200 | 0.250 | 0.300 | V _{p-p} |
| | VACBG | — | | 0.200 | 0.250 | 0.300 | |
| | VACBB | — | | 0.200 | 0.250 | 0.300 | |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|-------------|-------------------|-------------------|-------|-------|-------|-----------|
| ACB Clamp Current | I17a | — | (Note T44) | 0.08 | 0.1 | 0.125 | mA |
| | I17b | — | | 0.08 | 0.1 | 0.125 | |
| | I17c | — | | 0.8 | 1.0 | 1.3 | |
| | I17d | — | | 2.0 | 2.5 | 3.2 | |
| | I18a | — | | 0.08 | 0.1 | 0.125 | |
| | I18b | — | | 0.08 | 0.1 | 0.125 | |
| | I18c | — | | 0.8 | 1.0 | 1.3 | |
| | I18d | — | | 2.0 | 2.5 | 3.2 | |
| | I19a | — | | 0.08 | 0.1 | 0.125 | |
| | I19b | — | | 0.08 | 0.1 | 0.125 | |
| | I19c | — | | 0.8 | 1.0 | 1.3 | |
| | I19d | — | | 2.0 | 2.5 | 3.2 | |
| IK Input Amplitude | IKR | — | (Note T45) | 0.8 | 1.0 | 1.2 | V_{p-p} |
| | IKG | — | | 0.8 | 1.0 | 1.2 | |
| | IKB | — | | 0.8 | 1.0 | 1.2 | |
| RGB γ Correction Characteristics | γ 1R | — | (Note T46) | 40 | 50 | 60 | (IRE) |
| | γ 2R | — | | 60 | 70 | 80 | dB |
| | Δ 1R | — | | 0.75 | 1.5 | 2.25 | |
| | Δ 2R | — | | -0.75 | 0.0 | 0.75 | |
| | Δ 3R | — | | -2.55 | -3.3 | -4.05 | (IRE) |
| | γ 1G | — | | 40 | 50 | 60 | |
| | γ 2G | — | | 60 | 70 | 80 | |
| | Δ 1G | — | | 0.75 | 1.5 | 2.25 | dB |
| | Δ 2G | — | | -0.75 | 0.0 | 0.75 | |
| | Δ 3G | — | | -2.55 | -3.3 | -4.05 | |
| | γ 1B | — | | 40 | 50 | 60 | (IRE) |
| | γ 2B | — | | 60 | 70 | 80 | |
| | Δ 1B | — | | 0.75 | 1.5 | 2.25 | |
| | Δ 2B | — | | -0.75 | 0.0 | 0.75 | dB |
| | Δ 3B | — | | -2.55 | -3.3 | -4.05 | |
| VK Output Characteristic | VKA | — | (Note T47) | 1.90 | 2.00 | 2.10 | V_{p-p} |
| | VK1 | — | | 25.0 | 35.00 | 45.0 | |
| | VK2 | — | | 60.0 | 70.00 | 80.0 | (IRE) |
| ACB Protector Circuit Operation Check 1 | ACBPR | — | (Note T48) | — | — | — | — |
| | ACBPG | — | | — | — | — | — |
| ACB Protector Circuit Operation Check 2 | ACBBRAR | — | (Note T49) | — | — | — | — |
| | ACBBRAG | — | | — | — | — | — |
| ACB Protector Circuit Operation Check 3 | ACBBRLO | — | (Note T50) | — | — | — | — |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|----------|-------------------|-------------------|-------|-------|-------|------|
| Base Band TINT Adjustment Characteristics | ANG RMIN | — | (Note T51) | 47.0 | 53.0 | 59.0 | ° |
| | ANG BMIN | — | | 47.0 | 53.0 | 59.0 | |
| | ANG RMAX | — | | -51.0 | -45.0 | -39.0 | |
| | ANG BMAX | — | | -51.0 | -45.0 | -39.0 | |
| Base Band TINT Adjustment Position | BUS BO | — | (Note T52) | C2 | C6 | CA | HEX |

Deflection stage

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|------------------|---------------|----------------|-------|-----------|-------|-----------|
| Sync. Separation Input Sensitivity Current | I_{IN38} | — | (Note D1) | 12 | 20 | 30 | μA |
| V Separation Filter Pin Source Current | I_{OUT39} | — | (Note D2) | 3.2 | 4.2 | 5.2 | μA |
| V Separation Level | V_{SEP} | — | (Note D3) | 5.0 | 5.5 | 6.0 | V |
| H AFC Phase Detection Current Ratio | I_{DET} | — | (Note D4) | 210 | 300 | 420 | μA |
| | ΔI_{DET} | — | | -5 | 0 | +5 | % |
| Phase Detection Stop Period | T_{CO40} | — | (Note D5) | — | 262 10 | — | (H) |
| 32* f_H VCO Oscillation Start Voltage | V_{VCO} | — | (Note D6) | 3.7 | 4.0 | 4.3 | V |
| Horizontal Output Start Voltage | V_{HON35} | — | (Note D7) | 4.7 | 5.0 | 5.3 | V |
| | $V_{BUS HON}$ | — | | — | 1 | — | — |
| | $V_{BUS HOFF}$ | — | | — | 0 | — | |
| Horizontal Output Pulse Duty | T_{H35} | — | (Note D8) | 38.5 | 40.5 | 42.5 | % |
| Phase Detection Stop Mode | f_{FR} | — | (Note D9) | 15585 | 15734 | 15885 | Hz |
| Horizontal Output Free-Run Frequency | f_{HO} | — | (Note D10) | 15585 | 15734 | 15885 | Hz |
| Horizontal Oscillation Frequency Range | f_{HMIN} | — | (Note D11) | 14700 | 15000 | 15300 | Hz |
| | f_{HMAX} | — | | 16500 | 16700 | 16900 | |
| Horizontal Oscillation Control Sensitivity | β_H | — | (Note D12) | 250 | 300 | 350 | Hz / 0.1V |
| Horizontal Output Voltage | V_{H35} | — | (Note D13) | 4.2 | 4.6 | 5.0 | V |
| | V_{L35} | — | | — | 0.15 | 0.3 | |
| Power Supply Voltage Dependence of Horizontal Oscillation Frequency | Δf_{HV} | — | (Note D14) | -20 | 0 | +20 | Hz / V |
| Temperature Dependence of Horizontal Oscillation Frequency | Δf_{HT} | — | (Note D15) | — | 60 | 70 | Hz |
| Horizontal Sync. Phase | $SPH1$ | — | (Note D16) | 2.3 | 2.5 | 2.7 | μs |
| | $SPH2$ | — | | 0.2 | 0.3 | 0.4 | |
| Horizontal Picture Phase Adjustment Range | ΔH_{SFT} | — | (Note D17) | 5.5 | 6.0 | 6.5 | μs |
| Horizontal Blanking Pulse Threshold | V_{HBLK1} | — | (Note D18) | 4.7 | 5.0 | 5.3 | V |
| | V_{HBLK2} | — | | 0.8 | 1.1 | 1.4 | |
| Curve Correction Characteristic | ΔH_{42} | — | (Note D19) | 2.3 | 2.5 | 2.7 | μs |
| H Cycle Black Peak Detection Disable Pulse | HBP_S | — | (Note D20) | 7.5 | 8.0 | 8.5 | μs |
| | HBP_W | — | | 13.0 | 13.5 | 14.0 | |
| External Black Peak Detection Disable Pulse Threshold | BP_{V32} | — | (Note D21) | 0.9 | 1.1 | 1.3 | V |

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|-----------------------|-------------------|-------------------|-----|----------------|-----|------|
| Clamp Pulse Start Phase | CP _S | — | (Note D22) | 2.8 | 3.0 | 3.2 | μs |
| Clamp Pulse Width | CP _W | — | (Note D22) | 5.6 | 5.8 | 6.0 | μs |
| HD Output Start Phase | HD _S | — | (Note D23) | 0.7 | 0.9 | 1.1 | μs |
| HD Output Pulse Width | HD _W | — | (Note D23) | 0.7 | 0.9 | 1.1 | μs |
| HD Output Amplitude | V _{HD} | — | (Note D23) | 4.7 | 5.0 | 5.3 | V |
| Gate Pulse Start Phase | GP _S | — | (Note D24) | 2.7 | 2.9 | 3.1 | μs |
| Gate Pulse Width | GP _W | — | (Note D24) | 1.8 | 2.0 | 2.2 | μs |
| Gate Pulse V Mask Period | T _{CO34} | — | (Note D25) | — | 261 ± 10 | — | (H) |
| Sync. Out Low Level | V _{SY} | — | (Note D26) | 0.0 | 0.3 | 0.5 | V |
| Vertical Output Oscillation Start Voltage | V _{ON} | — | (Note D27) | 4.1 | 4.4 | 4.7 | V |
| Vertical Free-Run Frequency | f _{VO} | — | (Note D28) | — | 53 | — | Hz |
| Vertical Output Voltage | V _{VH} | — | (Note D29) | 4.9 | 5.2 | 5.5 | V |
| | V _{VL} | — | | — | 0 | 0.3 | |
| Service Mode Switching | VD _{NO} | — | (Note D30) | 3.1 | 3.4 | 3.7 | V |
| Vertical Pull-In Range | f _{PL} | — | (Note D31) | — | 225 | — | (H) |
| | f _{PH} | — | | — | 297 | — | |
| Vertical Frequency Forced 263H | f _{V1} | — | (Note D32) | — | 263 | — | (H) |
| Vertical Frequency Forced 262.5H | f _{V2} | — | (Note D32) | — | 262.5 | — | (H) |
| Vertical Blanking Off Mode | V _{OFF} | — | (Note D33) | — | Check | — | — |
| Vertical Output Pulse Width | T _D | — | (Note D34) | 44 | 46 | 48 | μs |
| | T _W | — | | — | 8 | — | |
| RGB Output Vertical Blanking Pulse Start Phase | VR _{S1} | — | (Note D35) | 44 | 46 | 48 | μs |
| | VG _{S1} | — | | | | | |
| | VB _{S1} | — | | | | | |
| RGB Output Vertical Blanking Pulse Stop Phase | VR _{S2} | — | (Note D35) | — | 22 | — | (H) |
| | VG _{S2} | — | | — | 22 | — | |
| | VB _{S2} | — | | — | 22 | — | |
| V Cycle Black Peak Detection Disable Pulse (Normal) | VBP _{NORMAL} | — | (Note D36) | — | 257 ± 28 | — | (H) |
| V Cycle Black Peak Detection Disable Pulse (Zoom) | VBP _{zoom} | — | (Note D37) | — | 229 ± 56 | — | (H) |

Deflection correction stage

| CHARACTERISTIC | SYMBOL | TEST CIR- CUIT | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|-------------------------------------|-------------------|-------------------|------|-------|------|------------------|
| Vertical Ramp Amplitude | V _{P27} | — | (Note G1) | 1.50 | 1.67 | 1.83 | V _{p-p} |
| Vertical Amplification | G _V | — | (Note G2) | 22 | 25 | 28 | dB |
| Vertical Amp Maximum Output Voltage | V _{H24} | — | (Note G3) | 2.5 | 3.0 | 3.5 | V |
| Vertical Amp Minimum Output Voltage | V _{L24} | — | (Note G4) | — | 0.0 | 0.3 | V |
| Vertical Amp Maximum Output Current | I _{MAX1} | — | (Note G5) | 11 | 14 | 17 | mA |
| Vertical NF Sawtooth Wave Amplitude | V _{P25} | — | (Note G6) | 1.50 | 1.67 | 1.83 | V _{p-p} |
| Vertical Amplitude Range | V _{PH} | — | (Note G7) | ±36 | ±40 | ±44 | % |
| Vertical Linearity Correction Maximum Value | V _ℓ | — | (Note G8) | ±12 | ±15 | ±18 | % |
| Vertical S Correction Maximum Value | V _S | — | (Note G9) | 20 | 25 | 30 | % |
| Vertical NF Center Voltage | V _C | — | (Note G10) | 4.8 | 5.0 | 5.2 | V |
| Vertical NF DC Change | V _{DC} | — | (Note G11) | ±100 | ±120 | ±140 | mV |
| Vertical Amplitude EHT Correction | V _{EHT} | — | (Note G12) | 8 | 9 | 10 | % |
| E-W NF Maximum DC Value (Picture Width) | V _{H22} | — | (Note G13) | 5.3 | 5.8 | 6.3 | V |
| E-W NF Minimum DC Value (Picture Width) | V _{L22} | — | (Note G14) | 1.75 | 1.90 | 2.05 | V |
| E-W NF Parabola Maximum Value (Parabola) | V _{PB} | — | (Note G15) | 2.1 | 2.5 | 2.9 | V _{p-p} |
| E-W NF Corner Correction (Corner) | V _{CR} | — | (Note G16) | 1.0 | 1.2 | 1.4 | V _{p-p} |
| Parabola Symmetry Correction | V _{TR} | — | (Note G17) | ±4.5 | ±5.5 | ±6.5 | % |
| E-W Amp Maximum Output Current | I _{MAX2} | — | (Note G18) | 0.14 | 0.20 | 0.28 | mA |
| AGC Operating Current 1 | V _{AGC0} | — | (Note G19) | 470 | 590 | 710 | μA |
| AGC Operating Current 2 | V _{AGC1} | — | (Note G20) | 100 | 130 | 160 | μA |
| Vertical Guard Voltage | V _{VG} | — | (Note G21) | 1.80 | 2.00 | 2.20 | V |
| E / W Output Self-Diagnosis | V _{BUS} E _W OFF | — | (Note G22) | — | 0 | — | — |
| | V _{BUS} E _W ON | — | | — | 1 | — | |
| V-Out Output Self-Diagnosis | V _{BUS} V _{OFF} | — | (Note G23) | — | 0 | — | — |
| | V _{BUS} V _{ON} | — | | — | 1 | — | |
| Vertical Blanking Check | V _{BLK1} V _{BLK2} | — | (Note G24) | — | Check | — | — |
| V Centering DAC Output | V _{21L} | — | (Note G25) | 0.20 | 0.25 | 0.30 | V |
| | V _{21M} | — | | 2.20 | 2.30 | 2.35 | |
| | V _{21H} | — | | 4.20 | 4.30 | 4.35 | |
| V NFB Pin Input Current | I ₂₀ | — | (Note G26) | — | 10 | 900 | nA |

TEST CONDITIONS

Video stage

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|----------------|---|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁ | #54 Voltage (Y Input Pedestal Clamp Voltage) | C | OPEN | OPEN | 1) Set the bus control data to the preset value. 2) Measure the #54 DC voltage V_{54} . |
| P ₂ | #55 Voltage | C | OPEN | OPEN | 1) Set the bus control data to the preset value. 2) Measure the #55 DC voltage V_{55} . |
| P ₃ | #56 Voltage | C | OPEN | OPEN | 1) Set the bus control data to the preset value. 2) Measure the #56 DC voltage V_{56} . |
| P ₄ | #1 Voltage | C | OPEN | ON | 1) Set the bus control data to the preset value. 2) Measure the #1 DC voltage V_1 . |
| P ₅ | Y Input Pedestal Clamp Error Voltage | C | OPEN | OPEN | 1) Set the bus control data to the preset value. 2) Set SW ₅₄ to C (connect the Y input to AC-GND). 3) Measure #56 with an oscilloscope as shown in the diagram and calculate ΔVPC . 4) Calculate the voltage differences ΔVPC1 and ΔVPC0 when the Y mute is on (1) and off (0). <div><div>#56 (DC transfer rate correction)</div><div>#34 (FBP input)</div></div> |

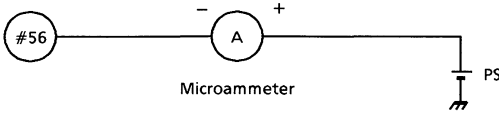
Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | |
|----------------|------------------------------------|--|------------------|------------------|--|
| | | SW MODE | | | MEASUREMENT METHOD |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₆ | Y Input Pedestal Clamp Pulse Phase | B | B | OPEN | <div><div><div><div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><di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|

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$) | | | |
|----------------|---|--|--------------------------|------------------|---|
| | | SW MODE | | | MEASUREMENT METHOD |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₈ | #56 Output Impedance | C | B | OPEN | <div><div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set SW₅₄ to C (connect the Y input to AC-GND).</div><div>3) Connect the external power supply to #56 via ammeter A as shown in the diagram below.</div><div>4) Adjust the power supply until the ammeter reads 0 amperes.</div><div>5) Measure the ammeter current I₅₆ when the power supply is increased by 0.1 V.</div><div>6) Calculate Z₅₆ from the following formula. Z₅₆ = 0.1 [V] ÷ I₅₆ [A]</div></div></div><div></div></div> |
| P ₉ | Black Stretching Amplifier Maximum Gain | A | <div>B ↓ A</div> | OPEN | <div><div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set the black stretch start point to 001, turn the Y mute off (0), set SW₅₄ to A, and input a 500-kHz sine wave to TP54A.</div><div>3) Use #54 to adjust the signal amplitude to 0.1 V_{p-p}.</div><div>4) Set SW₅₅ to B (minimum gain) and measure the amplitude V_A of #56.</div><div>5) Set SW₅₅ to A (maximum gain) and measure the amplitude V_B of #56.</div><div>6) Calculate G_{BS} from the following formula. G_{BS} = V_B ÷ V_A</div></div></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

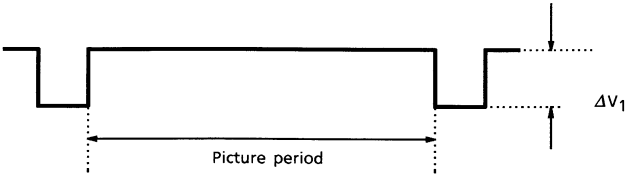
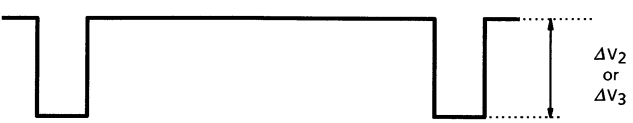
| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | |
|-----------------|--------------------------|--|------------------|------------------|--|
| | | SW MODE | | | MEASUREMENT METHOD |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₀ | Black Level Compensation | C | A | OPEN | <div><div><div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div></div></div> 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Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

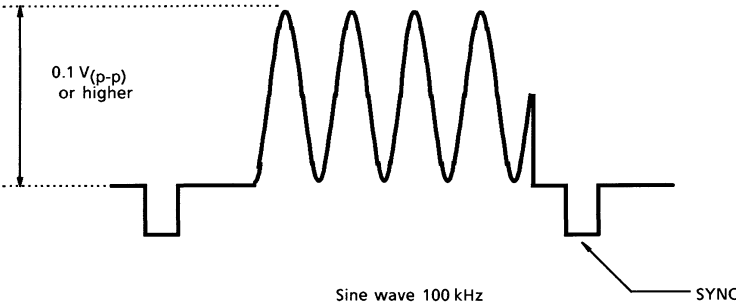
| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|------------------------------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₂ | Black Stretching Start Point | C | B ↓ A | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set SW₅₄ to C (connect the Y input to AC-GND), set SW₅₅ to B (minimum gain), turn the Y mute off (0), and set the black stretch start point to 001.</div><div>3) Connect #54 to an external power supply (PS), increase the voltage from V₅₄, and plot the resulting change in voltage S₁ of #56.</div><div>4) Next, set SW₅₅ to A (maximum gain). Then, increase the voltage from V₅₄ as in 3) above and plot the resulting change in voltage S₂ of #56.</div><div>5) Now set the black stretch point to 111 and plot S₃ as in 3) above.</div><div>6) Use the diagram below to calculate the intersection V_{B001} of S₁ and S₂, and the intersection V_{B111} of S₁ and S₃. Use the following formalts to calculate P_{B001} and P_{B111}, and calculate P_{B001} and P_{B111} from the formulas below. P_{B001} [(IRE)] = ((V_{B001} [V] - V₅₆ [V] ÷ 0.7 [V]) × 100 [(IRE)]) P_{B111} [(IRE)] = ((V_{B111} [V] - V₅₆ [V] ÷ 0.7 [V]) × 100 [(IRE)])</div><div></div></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).
Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|---|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₃ | DC Restoration Rate Compensation Amp Gain | C | B | OPEN ↓ ON | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Connect #54 to an external power supply (PS).</div><div>3) Turn the Y mute off (0), set the unicolor to the center (100000), set the brightness to the center (1000000), set RGB cutoff to the center (10000000), and observe #13 (R_{OUT}).</div><div>4) Use unicolor to adjust the difference in the #13 picture period DC level to 0.7 V when the power supply is set to V_{54} and $V_{54}+0.7\text{ V}$.</div><div>5) Applying $V_{54}+0.7\text{ V}$ to #54 as shown in the diagram below, calculate ΔV_1 of #13, then calculate ΔV_2 of #13 when SW₅₆ is on.</div><div>6) Connect a 2-kΩ resistor between #56 and C56 (1 μF) and calculate ΔV_3 of #13.</div><div>7) Calculate GDTC and GDTR from the following formula.</div></div><div>$\text{GDTC} = ((\Delta V_2 [\text{V}] - \Delta V_1 [\text{V}]) + 0.7 [\text{V}]) \div 0.7 [\text{V}]$$\text{GDTR} = ((\Delta V_3 [\text{V}] - \Delta V_1 [\text{V}]) + 0.7 [\text{V}]) \div 0.7 [\text{V}]$</div><div><div><div><div><div>$V_{54} + 0.7\text{ V}$ & SW56 OPEN</div><div></div></div><div><div><div>$V_{54} + 0.7\text{ V}$ & SW56 ON or 2 kΩ resistor inserted</div><div></div></div></div><div>#13 waveform</div></div></div></div></div> |

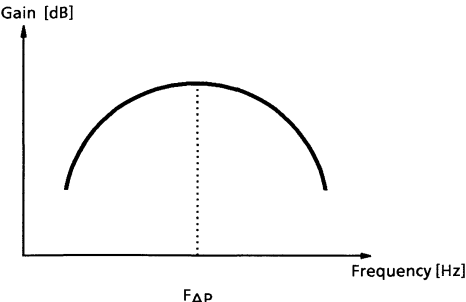
Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|---------------------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₄ | Self-Diagnosis Y-IN | C ↓ A | B | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set SW₅₄ to C (connect the Y input to AC-GND), connect #54 to an external power supply (PS), and turn read mode on.</div><div>3) When the power supply is increased from V_{54} to $V_{54} + 0.7\text{ V}$, check that in read mode Y-IN changes from error to OK to error.<div>SCDC</div></div><div>4) Next, set SW₅₄ to A and input a sine wave from TG-7 to TP54. Apply a signal on #54 as shown in the diagram. Check that there is no problem with the Y IN in read mode.<div>SCAC</div></div></div><div></div></div> |
| P ₁₅ | Y Mute | A | B | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Input a 100-kHz sine wave to TP54 and adjust #54 to 0.7 V_{p-p}.</div><div>3) Turn the Y mute on (1) and measure the #56 amplitude V_{YM1}.</div><div>4) Turn the Y mute off (0) and measure the #56 amplitude V_{YM0}.</div><div>5) Calculate the following formula.<div>$G_{YM} [\text{dB}] = 20 \times \log (V_{YM1} / V_{YM0})$</div></div></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | |
|-----------------|--------------------------|--|------------------|------------------|--|
| | | SW MODE | | | MEASUREMENT METHOD |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₆ | Sharpness Peak Frequency | A | B | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set SW₅₄ to A and input a sweep signal to TP54.</div><div>3) Set the amplitude of #54 to 20 mV_{p-p}.</div><div>4) Set the unicolor to the maximum (111111), set the brightness to the center (1000000), set the RGB cutoff to the center (10000000), turn the Y mute off (0), turn test mode on (0), and set the picture sharpness to the maximum (111111).</div><div>5) Connect an emitter-follower to TP13 (R OUT) and use a spectrum analyzer to observe TP13 (R OUT).</div><div>6) Seek the peak point frequency F_{AP} as shown in the diagram.</div></div><div></div></div> |

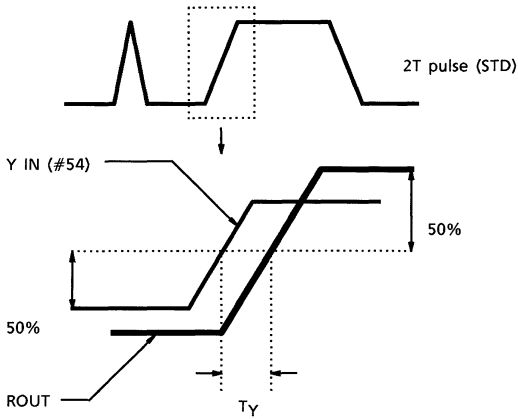
Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS V _{CC} = 9 V / 5 V, Ta = 25 ± 3°C) | | | |
|-----------------|--|--|------------------|------------------|---|
| | | SW MODE | | | MEASUREMENT METHOD |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₁₇ | Sharpness Control Range | A | B | OPEN | 1) Set the bus control data to the preset value. 2) Set SW ₅₄ to A and input a sine wave to TP54A. 3) Set the amplitude of #54 to 20 mV _{p-p} . 4) Set the unicolor to the maximum (111111), the brightness to the center (1000000), RGB cutoff to the center (10000000), and turn the Y mute off (0). 5) Set the picture sharpness to the maximum (111111). Connect an emitter-follower to TP13 (R OUT). When the frequencies are 100 kHz and 2.4 MHz, measure the respective V ₁₀₀ and V ₂₄ amplitudes. 6) Next, set the picture sharpness to the minimum (000000). As in 5), when the frequencies are 100 kHz and 2.4 MHz, measure the V ₁₀₀ and V ₂₄ amplitudes respectively. 7) Calculate G _{MAX} and G _{MIN} from the following formula. G _{MAX} , G _{MIN} [dB] = 20 × log (V ₂₄ ÷ V ₁₀₀) |
| P ₁₈ | Sharpness Control Center Characteristics | A | B | OPEN | 1) Repeat steps 1) to 4) of P ₁₇ . 2) Set the picture sharpness to the center (100000) 3) Connect an emitter-follower to TP13 (R OUT). When the frequencies are 100 kHz and 2.4 MHz, measure the V ₁₀₀ and V ₂₄ amplitudes respectively. 4) Calculate G _{CEN} from the following formula. G _{CEN} [dB] = 20 × log (V ₂₄ ÷ V ₁₀₀) |

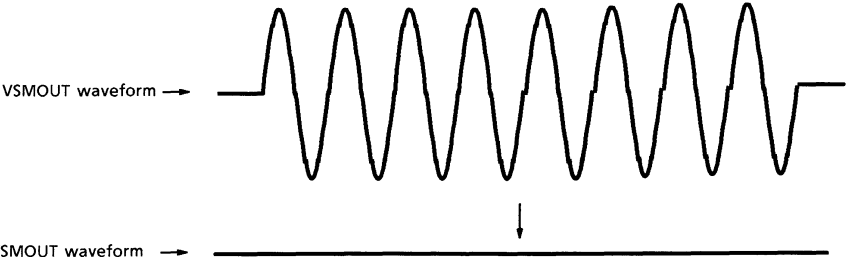
Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|------|-----------------------------------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P19 | Between Y IN and R OUT Delay Time | A | B | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Set SW₅₄ to A and input a 2T pulse (STD) signal from TG-7 to TP54A.</div><div>3) Set the unicolor to the maximum (111111), the brightness to the center (1000000), the RGB cutoff to the center (10000000), turn the Y mute off (0), and set the picture sharpness to the center (1000000).</div><div>4) Connect an emitter-follower to TP13 (R OUT) to observe TP13 (R OUT).</div><div>5) Calculate T_Y from the following diagram.</div></div><div></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|------------------------------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₂₀ | VSM Peak Frequency | A | B | OPEN | 1) Set the bus control data to the preset value. 2) Set SW ₅₄ to A, turn the Y mute off, and input a sweep signal to TP54. 3) Set the #54 amplitude to 100 mV _{p-p} . 4) Observe TP1 (VSMOUT) with a spectrum analyzer and seek the peak point frequency FVSM. |
| P ₂₁ | VSM Gain | A | B | OPEN | 1) Set the bus control data to the preset value. 2) Set SW ₅₄ to A, turn the Y mute off (0), and input the FVSM sine wave (see P ₂₀ above) to TP54. 3) Set the amplitude of #54 to 100 mV _{p-p} . 4) When the VSM gain is on (0), measure the TP1 (VSMOUT) amplitude V_{VSM0} (V_{p-p}). 5) Next, measure the TP1 (VSMOUT) amplitude V_{VSM1} (V_{p-p}) when the VSM gain is off (1). 6) Calculate G_{VSM0} and G_{VSM1} by the following formulas. $G_{VSM0} [\text{dB}] = 20 \times \log (V_{VSM0} \div 0.1)$ $G_{VSM1} [\text{dB}] = 20 \times \log (V_{VSM1} \div 0.1)$ |
| P ₂₂ | VSM Muting Threshold Voltage | A | B | OPEN | 1) Repeat steps 1) to 3) of P ₂₁ . 2) Connect the external power supply (PS) to #10 and increase the voltage from 0.5 V. Read the PS voltage V_{VM10} when the TP1 (VSMOUT) amplitude disappears, as shown in the following diagram. 3) Set SW ₆ to open, connect #6 to an external power supply, increase the voltage from 1.5 V. When the TP1 (VSMOUT) amplitude disappears as shown in the following diagram, read the PS voltage V_{VM6} . <div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|-------------------------------------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₂₃ | VSM High Speed Muting Response Time | A | B | OPEN | <div><div><div>1) Repeat steps 1) to 3) of P₂₁ above.</div><div>2) Set SW₆ to open, input a pulse as shown below to #6 (Ys / Ym IN), and measure the response times T_{HM1} and T_{HM2} at that input.</div><div>3) Similarly, input the pulse to #10 (OSD Ys IN) and measure the response times T_{HM3} and T_{HM4} at that input.</div></div><div><p>$V_{VM10} [V]$ or $V_{VM6} [V]$</p><p>Square wave (50 kHz, 3 V_{p-p})</p><p>3 [V]</p><p>0 [V]</p><p>$T_{HM1} (3)$</p><p>$T_{HM2} (4)$</p><p>VSMOUT</p><p>Mute period</p></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

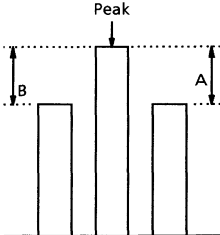
Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 9\text{ V} / 5\text{ V}$, $T_a = 25 \pm 3^{\circ}\text{C}$) | | | MEASUREMENT METHOD |
|-----------------|-----------|--|------------------|------------------|---|
| | | SW MODE | | | |
| | | SW ₅₄ | SW ₅₅ | SW ₅₆ | |
| P ₂₄ | VSM Phase | A | B | OPEN | <div><div><div>1) Set the bus control data to the preset value.</div><div>2) Input a signal like that shown in the diagram below to TP54, turn the Y mute off (0), and adjust the amplitude of #54 to 0.7 V_{p-p}.</div><div>3) Set the unicolor to the maximum (111111), increase the picture sharpness from the minimum to a level where the R OUT waveform is not distorted.</div><div>4) Measure the phase differences T_{VM24}, T_{VMFP}, and T_{VM2T} between TP1 (VSMOUT) and TP13 (R OUT) when the signal is an FVSM sine wave, a 2T pulse, and a 2.4-MHz signal, as shown in the diagram below. (To make a waveform at TP1, reverse the waveform at TP13 using an oscilloscope.)</div></div><div><div><div><div><div>TP1</div><div>TP13</div></div><div><div><div><div><div><div>T_{VM24}, T_{VMFP}</div><div>Sine wave</div><div>50%</div></div></div></div></div></div></div><div><div><div><div><div>TP1</div><div>TP13</div></div><div><div><div><div><div><div>T_{VM2T}</div><div>2T pulse</div><div>50%</div></div></div></div></div></div></div></div></div></div></div></div> |

Note 1: When testing, see the picture sharpness test circuit diagram. First turn ACB mode off (bus control).

Note 2: Ensure the composite signal is always input to pin 38 (SYNC IN).

Chroma stage

| NOTE | ITEM | SW MODE | | MEASUREMENT METHOD |
|--|--|---------|------|--|
| | | SW45 | SW46 | |
| | | | | |
| #16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C | | | | |
| C ₁ | ACC Characteristics | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45).Burst : chroma = 1 : 1 2) When the chroma input amplitude levels are set to 10, 30, 300, and 600 mV _{p-p} , measure the output amplitudes va10, va30, va300, and va600 of the R-Y output pin (TP48). 3) Calculate A = va30 / va600. |
| C ₂ | Color Difference Output Level | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV _{p-p} : 300 mV _{p-p} 2) Change the burst phase so that bar 2 of the B-Y output pin (TP47) output waveform is the bottom peak and bar 7 is the top peak. 3) Measure the amplitude (v _B) of the B-Y output pin (TP47). 4) Set the burst phase to 180°. 5) Measure the amplitude (v _R) of the R-Y output pin (TP48) |
| C ₃ | Color Difference Output Relative Amplitude | B | ON | 1) Calculate the relative amplitude v _{RB} from the following formula using the values obtained in steps 3) and 5) of C ₂ above. v _{RB} = v _R / v _B |
| C ₄ | Color Difference Output Demodulation Angle | B | ON | 1) Input a rainbow signal (C-1) to the chroma input pin (TP45). Burst : chroma = 200 mV _{p-p} : 200 mV _{p-p} 2) Calculate the demodulation angles θ _{Bcnt} and θ _{Rcnt} of the B-Y output pin (TP47) and the R-Y output pin (TP48) using the formulas and diagram below. <div style="text-align: center;"><div style="display: flex; justify-content: space-around; align-items: center;"><div>$\theta_{Bcnt} = 0^\circ - \tan^{-1} \left[\frac{1}{\frac{2A}{B} + \sqrt{3}} \right] - 15^\circ$<p>(Bar 6 is the peak at B-Y)</p></div><div>$\theta_{Rcnt} = 90^\circ - \tan^{-1} \left[\frac{1}{\frac{2A}{B} + \sqrt{3}} \right] - 15^\circ$<p>(Bar 3 is the peak at R-Y)</p></div></div></div> |
| C ₅ | Color Difference Output Relative Phase | B | ON | ① Calculate the relative phase θ _{RB} from the following formula using the values obtained in C ₄ above. θ _{RB} = θ _{Rcnt} - θ _{Bcnt} |

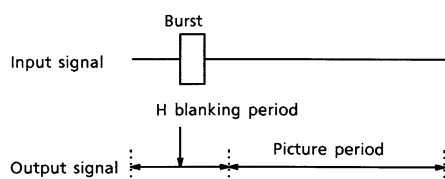
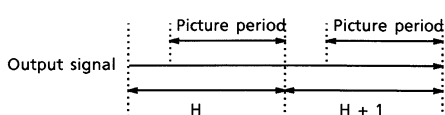
Note 1: Where the bus data are not specified, set the preset values.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | | | |
|----------------|---|--|------------------|--|--|
| | | SW MODE | | MEASUREMENT METHOD | |
| | | SW ₄₅ | SW ₄₆ | | |
| C ₆ | Color Difference Output Tint Adjustment Characteristics | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV _{p-p} : 300 mV _{p-p} 2) Measure the demodulation angles $\theta_{B'}$ and $\theta_{R'}$ in the outputs with the tint set to the maximum (subaddress (03H), data (FE)). Calculate θ_{Bmax} and θ_{Rmax} by the following formulas. $\theta_{Bmax} = \theta_{B'} - \theta_{Bcnt}$ $\theta_{Rmax} = \theta_{R'} - \theta_{Rcnt}$ 3) Measure the demodulation angles $\theta_{B''}$ and $\theta_{R''}$ in the outputs with the tint set to the minimum (subaddress (03H), data (00)). Calculate θ_{Bmin} and θ_{Rmin} by the following formulas $\theta_{Bmin} = \theta_{B''} - \theta_{Bcnt}$ $\theta_{Rmin} = \theta_{R''} - \theta_{Rcnt}$ | |
| C ₇ | Supply Voltage Dependence of Color Difference Output | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV _{p-p} : 300 mV _{p-p} 2) As in C ₂ , measure the amplitudes ΔVBp and ΔVRp of the B-Y output pin (TP47) and R-Y output pin (TP48) when the 5-V V _{CC} is set to 5 V + 0.3 V. Calculate the amplitude ratios BVp and RVp when the 5-V V _{CC} is set to 5 V. $BVp = \frac{\Delta VBp - vB}{vB} \times 100$ $RVp = \frac{\Delta VRp - vR}{vR} \times 100$ 3) Using the same tests as above, calculate BVn and RVn when the 5-V VCC is set to 5 V - 0.3 V $BVn = \frac{\Delta VBn - vB}{vB} \times 100$ $RVn = \frac{\Delta VRn - vR}{vR} \times 100$ | |
| C ₈ | Identification Sensitivity | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 1 : 1 2) Gradually reduce the input signal amplitude from 100 mV _{p-p} . When the B-Y output pin (TP47) signal disappears (when the current is DC), measure the input signal amplitude v _{CB} . 3) Gradually increase the input signal amplitude from 0 mV _{p-p} . When a demodulation signal appears on the B-Y output pin (TP47), measure the input signal amplitude v _{BC} . | |
| C ₉ | Bus Read Identification | B | ON | 1) Perform the same tests as above while observing the bus read : When the input signal amplitude is v _{CB} , check that the first bit is set to 0 (bCB). When the input signal amplitude is v _{BC} , check that the first bit is set to 1 (bBC). | |

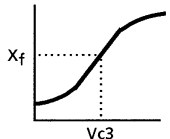
Note 1: Where the bus data are not specified, set the preset values.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | #16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C |
|-----------------|---|--------------------|------------------|--|
| | | SW ₄₅ | SW ₄₆ | |
| | | MEASUREMENT METHOD | | |
| C ₁₀ | Color Difference Output Voltage Difference in 1H Period | B | ON | <div><div><div>1) Input no more than 300-mV_{p-p} as a burst signal to chroma input pin (TP45).</div><div>2) Measure the DC voltage difference (vBH) between the H blanking period and picture period of the B-Y output pin (TP47).</div><div>3) Measure the DC voltage difference (vRH) between the H blanking period and picture period of the R-Y output pin (TP48).</div></div><div></div></div> |
| C ₁₁ | Color Difference Output Voltage Difference Every 1H Period | B | ON | <div><div><div>1) Input no more than 300-mV_{p-p} as a burst signal to chroma input pin (TP45).</div><div>2) Measure the DC voltage difference (vBG) between the H picture period and H + 1 picture period of the B-Y output pin (TP47).</div><div>3) Measure the DC voltage difference (vRG) between the H picture period and H + 1 picture period of the R-Y output pin (TP48).</div></div><div></div></div> |
| C ₁₂ | Color Difference Output DC Voltage | B | ON | <div><div><div>1) Input no more than 300-mV_{p-p} as a burst signal to chroma input pin (TP45).</div><div>2) Measure the picture period DC voltage V_B of the B-Y output pin (TP47).</div><div>3) Measure the picture period DC voltage V_R of the R-Y output pin (TP48).</div></div></div> |
| C ₁₃ | Difference between DC Voltage Axes of Color Difference Output | B | ON | <div><div>1) Use the following formula to calculate the difference (V_{RB}) between the voltage axes from the following formula using the values obtained in C₁₂ above.</div><div>V_{RB} = V_R - V_B</div></div> |
| C ₁₄ | X'tal Free-Run Frequency | A | ON | <div><div><div>1) No signal input to the chroma input pin (TP45) (set SW₄₅ to A).</div><div>2) Observe the CW output pin (TP50) and measure the output frequency X_f.</div></div></div> |

Note 1: Where the bus data are not specified, set the preset values.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | MEASUREMENT METHOD |
|-----------------|-----------------------------------|--|------------------|--|
| | | #16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C | | |
| | | SW ₄₅ | SW ₄₆ | |
| C ₁₅ | APC Frequency Control Sensitivity | A | OFF | <div><div><div>1) No signal input to the chroma input pin (TP45) (set SW₄₅ to A).</div><div>2) Set SW₄₆ to open and connect an external power supply to the APC filter pin (#46).</div><div>3) Change the voltage of external power supply to a value regarded as Vc3, where the output frequency of the CW output pin (TP50) is 3.579545 MHz (X_f).</div><div>4) Measure the CW output frequencies X_f (+100) and X_f (−100) for Vc3 + ΔVc3 (±100 mV). Calculate the free-run sensitivity β_f from the following formula.</div></div><div><div></div><div>$\beta_f = \frac{X_f(+100) - X_f(-100)}{200}$</div></div></div> |
| C ₁₆ | APC Pull-In / Hold Range | B | ON | <div><div><div>1) Input a 3.579545-MHz sine wave (300 mV_{p-p}) to the chroma input pin (TP45).</div><div>2) Vary the input sine wave frequency in ±10-Hz steps from 3.579545 MHz. When the B-Y output pin (TP47) picture period amplitude changes, measure the difference between 3.579545 MHz and the varied sine wave frequencies : on the plus side, f_{h+}, and on the minus side, f_{h−} (hold).</div><div>3) Increase and decrease the above measured values by 1 kHz : (f_{h+}) +1 kHz and (f_{h−}) −1 kHz. Adjust to approximately 3.579545 MHz in ±10-Hz steps. When the B-Y output pin (TP47) picture period amplitude changes, measure the difference from 3.579545 MHz : on the plus side, f_{p+}, and on the minus side, f_{p−} (pull-in).</div></div></div> |
| C ₁₇ | Residual Carrier Level | B | ON | <div><div><div>1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV_{p-p} : 300 mV_{p-p}</div><div>2) Measure the color subcarrier leak levels v_{BN0} and v_{RN0} of the B-Y output pin (TP47) and the R-Y output pin (TP48).</div></div></div> |
| C ₁₈ | Residual Higher Harmonic Level | B | ON | <div><div><div>1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV_{p-p} : 300 mV_{p-p}</div><div>2) Measure the higher harmonic levels v_{BHN} and v_{RHN} of the B-Y output pin (TP47) and the R-Y output pin (TP48).</div></div></div> |

Note 1: Where the bus data are not specified, set the preset values.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | (#16 $V_{CC} = 9\text{ V}$, #37 $V_{CC} = 9\text{ V}$, #51 $V_{CC} = 5\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$) | | | |
|-----------------|-------------------------|---|------------------|--|--|
| | | SW MODE | | MEASUREMENT METHOD | |
| | | SW ₄₅ | SW ₄₆ | | |
| C ₁₉ | TOF-BPF Characteristics | B | ON | 1) Connect the V_{CC} (5 V) via a 750 Ω resistor to the R-Y output pin (TP48). 2) Input a 3.579545-MHz sine wave (50 mV _{p-p}) to the chroma input pin (TP45). 3) Set to BPF mode (subaddress (03H), data (80)). 4) Set f_0 of the sine wave to (3.579545 M – 1 M) Hz, measure the output amplitude of TP48, and calculate the gain from the input (GB _L). 5) Set f_0 of the sine wave to (3.579545 M+1 M) Hz, measure the output amplitude of TP48, and calculate the gain from the input (GB _H). 6) Set to TOF mode (subaddress (03H), data (81)). 7) Set f_0 of the sine wave to (3.579545 M – 1 M) Hz, measure the output amplitude of TP48, and calculate the gain from the input (GT _L). 8) Set f_0 of the sine wave to (3.579545 M + 1 M) Hz, measure the output amplitude of TP48, and calculate the gain from the input (GT _H). | |
| C ₂₀ | CW Output Amplitude | B | ON | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 300 mV _{p-p} : 300 mV _{p-p} 2) Measure the amplitude vCW of the CW output pin. | |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

Color difference stage

| NOTE | ITEM | SW MODE | | | | MEASUREMENT METHOD |
|----------------|--|--|------------------|------------------|------------------|---|
| | | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | | | | |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | |
| A ₁ | Color Difference Input Clamp Voltage | C | A | A | A | 1) Connect the color difference input pin to AC-GND. (Set SW _{52A} and SW _{53A} to A.) 2) Measure the voltage V _{RY} of the R-Y input pin (#52) and the voltage V _{BY} of the B-Y input pin (#53). |
| A ₂ | Color Difference Input / Output Delay Time | C | A | B | B | 1) Set to external color difference input mode (subaddress (05H), data (81)). 2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Color : center (subaddress (02H), data (40)). 3) Set SW _{52A} and SW _{53A} to B. Input signal C-2 to the R-Y input pin (TP52) and the B-Y input pin (TP53) f ₀ = 100 kHz, picture period amplitude = 0.2 V _{p-p} . 4) Measure the signal delay time (DLRY) from the R-Y input pin (TP52) to the R output (TP13). 5) Measure the signal delay time (DLBY) from the B-Y input pin (TP53) to the B output (TP15). |
| A ₃ | Unicolor Adjustment Characteristics | C | A | B | B | 1) Set to external color difference input mode (subaddress (05H), data (81)) 2) Now set as follows : Brightness : maximum (subaddress (01H), data (7F)) Color : center (subaddress (02H), data (40)) Relative phase amplitude : standard (subaddress (12H), data (00)). 3) Set SW _{52A} and SW _{53A} to B. Input signal C-2 to the R-Y input pin (TP52) and the B-Y input pin (TP53). f ₀ = 100 kHz, picture period amplitude = 0.2 V _{p-p} . 4) Set unicolor to the maximum (subaddress (00H), data (3F)). Measure the RU _{max} , the amplitude of the R output (TP13) and BU _{max} , the amplitude of B output (TP15). 5) Set unicolor to the minimum (subaddress (00H), data (00)). Measure the RU _{min} , the amplitude of the R output (TP13) and BU _{min} , the amplitude of B output (TP15). 6) Calculate the unicolor adjustment characteristics uR and uB by the following formulas. <div>$uR = 20\text{Log} \frac{RU_{\min}}{RU_{\max}} \quad uB = 20\text{Log} \frac{BU_{\min}}{BU_{\max}}$</div> |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | | | MEASUREMENT METHOD | |
|----------------|----------------------------------|-----------------|------------------|------------------|------------------|---|--|
| | | | | | | | |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | | |
| A ₄ | Color Adjustment Characteristics | C | A | B | B | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | |
| | | | | | | 1) Set to external color difference input mode (subaddress (05H), data (81)) | |
| | | | | | | 2) Now set as follows : | |
| | | | | | | Unicolor : maximum (subaddress (00H), data (3F)) | |
| | | | | | | Brightness : maximum (subaddress (01H), data (7F)) | |
| | | | | | | Relative phase amplitude : standard (subaddress (12H), data (00)). | |
| | | | | | | 3) Set SW _{52A} and SW _{53A} to B. Input signal C-2 to the R-Y input pin (TP52) and the B-Y input pin (TP53). f ₀ = 100 kHz, picture period amplitude = 0.2 V _{p-p} . | |
| | | C | A | B | B | 4) Set the color to the maximum (subaddress (02H), data (7F)). Measure RC _{max} , the amplitude of the R output (TP13), and BC _{max} , and the amplitude of the B output (TP15). | |
| | | | | | | 5) Set the color to the center (subaddress (02H), data (40)). Measure RC _{cnt} , the amplitude of the R output (TP13), and BC _{cnt} , the amplitude of the B output (TP15). | |
| | | | | | | 6) Set the color to the minimum (subaddress (02H), data (00)). Measure RC _{min} , the amplitude of the R output (TP13), and BC _{min} , the amplitude of the B output (TP15). | |
| | | | | | | 7) Calculate the color adjustment characteristics cR _{max} , cR _{min} , cB _{max} , and cB _{min} by the following formulas. | |
| | | | | | | $cR_{max} = 20\text{Log} \frac{RC_{MAX}}{RC_{CNT}} \qquad cR_{min} = 20\text{Log} \frac{RC_{MIN}}{RC_{CNT}}$ $cB_{max} = 20\text{Log} \frac{BC_{MAX}}{BC_{CNT}} \qquad cB_{min} = 20\text{Log} \frac{BC_{MIN}}{BC_{CNT}}$ | |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | | | MEASUREMENT METHOD | | | | | | | | | | | | | | | | | | | | |
|-----------------------|--------------------------------------|--|------------------|------------------|------------------|--|-----------------------|------|------|------|----------|-------|-------|-------|----------|-------|-------|-------|----------|-------|-------|-------|----------|-------|-------|-------|
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | | | | | | | | | | | | | | | | | | | | | |
| | | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | | | | | | | | | | | | | | | | | | | | | | | | |
| A ₅ | RGB Output Half-Tone Characteristics | C or B | B | A | A | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 200 mV _{p-p} : 200 mV _{p-p} . 2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Color : center (subaddress (02H), data (40)) Relative phase amplitude : standard (subaddress (12H), data (00)). 3) Measure the amplitudes v _{Ro} , v _{Go} , and v _{Bo} of the R output pin (TP13), the G output pin (TP14), and the B output pin (TP15). 4) Set SW ₆ to B and repeat the test in 3) above. Measure the amplitudes v _{RH} , v _{GH} , and v _{BH} . 5) Calculate the half-tone characteristics v _{RHo} , v _{GHo} , and v _{BHo} by the following formulas. $v_{RH0}=20\text{Log}\frac{v_{RH}}{v_{Ro}} \quad v_{GH0}=20\text{Log}\frac{v_{GH}}{v_{Go}} \quad v_{BH0}=20\text{Log}\frac{v_{BH}}{v_{Bo}}$ | | | | | | | | | | | | | | | | | | | | |
| A ₆ | RGB Output Amplitude | C | B | A | A | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 200 mV _{p-p} : 200 mV _{p-p} . 2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Color : center (subaddress (02H), data (40)). 3) Switch the relative phase amplitude (subaddress (12H)) and measure the amplitudes (peak values) of the RGB outputs (TP13, TP14, TP15) according to the table below. <table><tr><td>Subaddress (12H) data</td><td>TP13</td><td>TP14</td><td>TP15</td></tr><tr><td>STD (00)</td><td>vRSTD</td><td>vGSTD</td><td>vBSTD</td></tr><tr><td>DVD (40)</td><td>vRDVD</td><td>vGDVD</td><td>vBDVD</td></tr><tr><td>TSB (80)</td><td>vRTSB</td><td>vGTSB</td><td>vBTSB</td></tr><tr><td>DTV (C0)</td><td>vRDTV</td><td>vGDTV</td><td>vBDTV</td></tr></table> | Subaddress (12H) data | TP13 | TP14 | TP15 | STD (00) | vRSTD | vGSTD | vBSTD | DVD (40) | vRDVD | vGDVD | vBDVD | TSB (80) | vRTSB | vGTSB | vBTSB | DTV (C0) | vRDTV | vGDTV | vBDTV |
| Subaddress (12H) data | TP13 | TP14 | TP15 | | | | | | | | | | | | | | | | | | | | | | | |
| STD (00) | vRSTD | vGSTD | vBSTD | | | | | | | | | | | | | | | | | | | | | | | |
| DVD (40) | vRDVD | vGDVD | vBDVD | | | | | | | | | | | | | | | | | | | | | | | |
| TSB (80) | vRTSB | vGTSB | vBTSB | | | | | | | | | | | | | | | | | | | | | | | |
| DTV (C0) | vRDTV | vGDTV | vBDTV | | | | | | | | | | | | | | | | | | | | | | | |
| A ₇ | RGB Output Relative Amplitude | C | B | A | A | 1) Using the values obtained in A ₀₆ above, calculate the relative amplitudes by the following formulas. $v_{RB***}=\frac{v_{R***}}{v_{B***}} \quad v_{GB}=\frac{v_{G***}}{v_{B***}}$ | | | | | | | | | | | | | | | | | | | | |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | | | | | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | | | |
|--|--|-----------------|------------------|------------------|------------------|--|---------------------------|-------------------|-------------------|
| | | SW MODE | | | | MEASUREMENT METHOD | | | |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | | | | |
| A ₈ | RGB Output Demodulation Angle | C | B | A | A | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 200 mV _{p-p} : 200 mV _{p-p} . | | | |
| | | | | | | 2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Color : center (subaddress (02H), data (40)). Adjust the tint so that the waveform angle of the B-Y output pin (TP47) is 0°. | | | |
| | | | | | | 3) Switch the relative phase amplitude (subaddress (12H)) and measure the phase of the RGB outputs (TP13, TP14, TP15) according to the table below. | | | |
| | | | | | | Subaddress (12H) data | TP13 | TP14 | TP15 |
| | | | | | | STD (00) | θ _{RSTD} | θ _{GSTD} | θ _{BSTD} |
| | | | | | | DVD (40) | θ _{RDVD} | θ _{GDVD} | θ _{BDVD} |
| | | | | | | TSB (80) | θ _{RTSB} | θ _{GTSB} | θ _{BTSB} |
| | | | | | | DTV (C0) | θ _{RDTV} | θ _{GDTV} | θ _{BDTV} |
| | | | | | | (*)The test method is the same as those for C ₄ in Chroma stage. (Measure bar 2 of the G axis.) | | | |
| | | | | | | A ₉ | RGB Output Relative Phase | C | B |
| θ _{RB***} = θ _{R***} - θ _{B***} | θ _{GB***} = θ _{G***} - θ _{B***} | | | | | | | | |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | #16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C | | | | |
|-----------------|--|--|------------------|------------------|------------------|--|
| | | SW MODE | | | | MEASUREMENT METHOD |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | |
| A ₁₀ | Color Difference EXT → INT Crosstalk | C | A | B | B | <p>1) No signal input to the chroma input pin (TP45) (set SW₄₅ to A).</p> <p>2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Relative phase amplitude : standard (subaddress (12H), data (00)).</p> <p>3) Set SW_{52A} and SW_{53A} to B. Input signal C-2 to the R-Y input pin (TP52) and the B-Y input pin (TP53). f₀ = 4 MHz, picture period amplitude = 0.2 V_{p-p}</p> <p>4) Set to external color difference input mode (subaddress (05H), data (81)).</p> <p>5) Adjust the color data so that the amplitude of the R output pin (TP13) is 2 V_{p-p}.</p> <p>6) Set to internal color difference input mode (subaddress (05H), data (80)).</p> <p>7) Measure the amplitude v_{XER} of the R output pin (TP13) and calculate the amount of crosstalk.</p> $XEIR = 20\text{Log} \frac{v_{XER}}{2}$ <p>8) Repeat steps 4) to 7) above for the G and B axes and calculate the amount of crosstalk on those axes.</p> $XEIG = 20\text{Log} \frac{v_{XEG}}{2} \quad XEIB = 20\text{Log} \frac{v_{XEB}}{2}$ |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | | | MEASUREMENT METHOD | |
|-----------------|----------------------|-----------------|------------------|------------------|------------------|--|--|
| | | | | | | | |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | | |
| A ₁₁ | Color Difference | C | B | A | A | 1) Input a rainbow signal (signal C-1) to the chroma input pin (TP45). Burst : chroma = 200 mV _{p-p} : 200 mV _{p-p} . 2) Now set as follows : Unicolor : maximum (subaddress (00H), data (3F)) Brightness : maximum (subaddress (01H), data (7F)) Relative phase amplitude : standard (subaddress (12H), data (00)). 3) Set SW _{52A} and SW _{53A} to A. 4) Set to internal color difference input mode (subaddress (05H), data (80)). 5) Adjust the color data so that the amplitude of the R output pin (TP13) is 2 V _{p-p} . 6) Set to external color difference input mode (subaddress (05H), data (81)). 7) Measure the amplitude v_{XIR} of the R output pin (TP13) and calculate the amount of crosstalk. $XIER = 20\text{Log} \frac{v_{XIR}}{2}$ 8) Repeat steps 4) to 7) above for the G and B axes and calculate the amount of crosstalk on those axes. $XIEG = 20\text{Log} \frac{v_{XIG}}{2} \quad XIEB = 20\text{Log} \frac{v_{XIB}}{2}$ | |
| | INT→EXT Crosstalk | | | | | | |

Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

| NOTE | ITEM | SW MODE | | | | MEASUREMENT METHOD | |
|-----------------|-------------------------|-----------------|------------------|------------------|------------------|---|--|
| | | | | | | | |
| | | SW ₆ | SW ₄₅ | SW ₅₂ | SW ₅₃ | | |
| A ₁₂ | Color γ Characteristics | C | B | A | A | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | |
| | | | | | | 1) Set to external color difference input mode (subaddress (05H), data (81)). | |
| | | | | | | 2) Now set as follows : | |
| | | | | | | Unicolor : maximum (subaddress (00H), data (3F)) | |
| | | | | | | Brightness : maximum (subaddress (01H), data (7F)) | |
| | | | | | | Relative phase amplitude : standard (subaddress (12H), data (00)) | |
| | | | | | | Y mute : on (set D ₇ of subaddress (02H) to 1). | |
| | | | | | | 3) Set SW _{52a} to a, set SW _{53a} to b, and input the signal shown in Fig.1) below to the B-Y input pin (TP53). | |
| | | | | | | 4) Set the color to the minimum and measure the picture period DC voltage v _{By0} of the B output pin (TP15). | |
| | | | | | | 5) Increase the color from the minimum. When the picture period DC voltage of the R output pin (TP13) changes, measure the picture period DC voltage v _{By1} of the B output pin (TP15). | |
| | | | | | | 6) Using the values obtained above, calculate the color γ start point C _{γsp} by the following formula. | |
| | | | | | | $C_{\gamma sp} = v_{By1} - v_{By0}$ | |



Note 1: Where the bus data are not specified, set the preset value.

Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

Y stage

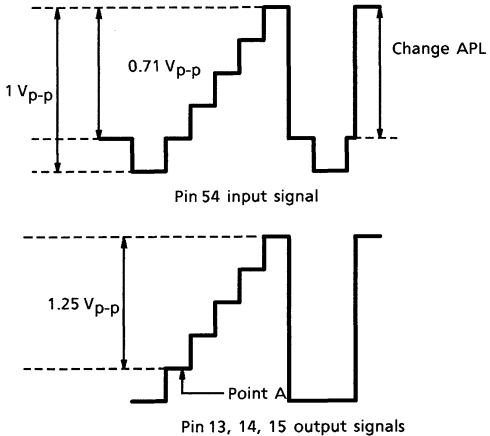
| NOTE | ITEM | (#16 V _{CC} = 9 V, #37 V _{CC} = 9 V, #51 V _{CC} = 5 V, Ta = 25 ± 3°C) | |
|----------------|---|--|--|
| | | SW MODE | MEASUREMENT METHOD |
| | | SW45 | |
| Y ₁ | Sync Input~DL Output AC Gain | A | <ol style="list-style-type: none"> 1) Input signal C-2 to the Sync Input pin (TP38). f₀ = 100 kHz, picture period amplitude = 0.2 V_{p-p} 2) Turn DL mode off (subaddress (12), data (80)) and measure the picture period amplitude v_{43off} of the DL output (TP43). Calculate the gain from the input (GYoff) by the formula shown below. 3) Turn DL mode on (subaddress (12), data (A0)) and measure the picture period amplitude v_{43on} of the DL output (TP43). Calculate the gain from the input (GYon) by the formula shown below. $GYoff = 20\text{Log} \frac{v_{43off}}{0.2} \qquad GYon = 20\text{Log} \frac{v_{43on}}{0.2}$ |
| Y ₂ | Sync Input~DL Output Frequency Gain | A | <ol style="list-style-type: none"> 1) Input signal C-2 to the Sync Input pin (TP38). f₀ = 8 MHz, picture period amplitude = 0.2 V_{p-p} 2) Turn DL mode off (subaddress (12), data (80)) and measure the picture period amplitude v_{438Moff} of the DL output (TP43). Calculate the gain from the input (GfYoff) by the formula shown below. 3) Turn DL mode on (subaddress (12), data (A0)) and measure the picture period amplitude v_{438Mon} of the DL output (TP43). Calculate the gain from the input (GfYon) by the formula shown below. $GfYoff = 20\text{Log} \frac{v_{438Moff}}{v_{43off}} \qquad GfYon = 20\text{Log} \frac{v_{438Mon}}{v_{43on}}$ |
| Y ₃ | Sync Input~DL Output Dynamic Range | A | <ol style="list-style-type: none"> 1) Input signal C-3 to the Sync Input pin (TP38). 2) When the amplitude A of signal C-3 is increased from 0, observe the change in the picture period amplitude of the DL output (TP43). With DL mode turned on and off, when the output amplitude stops changing in a linear direction, measure the input signal amplitude A. |
| Y ₄ | Sync Input~DL Output Transfer Characteristics | A | <ol style="list-style-type: none"> 1) Input signal C-2 to the Sync Input pin (TP38). f₀ = 100 kHz, picture period amplitude = 0.2 V_{p-p} 2) Turn DL mode on (subaddress (12H), data (20)) and measure the amount of delay TYLD from the Sync Input (#38) to the DL output (TP43). |

Note 1: Where the bus data are not specified, set the preset value.

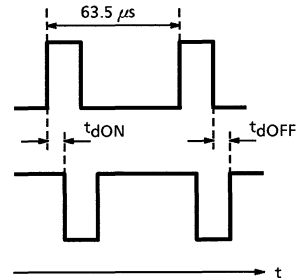
Note 2: Ensure the sync signal is always input to TP38 (SYNC IN).

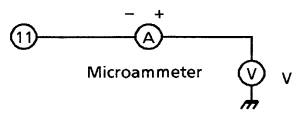
Text stage

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | |
|----------------|---------------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | MEASUREMENT METHOD |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | |
| T ₁ | AC Gain | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) Measure the picture period amplitudes of pins 13, 14, and 15. (v_{13} , v_{14} , v_{15}) 3) $G_R = v_{13} / 0.2$ $G_G = v_{14} / 0.2$ $G_B = v_{15} / 0.2$ |
| T ₂ | Frequency Characteristics | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 8\text{ MHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) Measure the picture period amplitudes of pins 13, 14, and 15. (v_{13} 8 MHz, v_{14} 8 MHz, and v_{15} 8 MHz). 3) Using the values obtained in T ₀₁ above, calculate the frequency characteristics from the following formulas. 4) $G_{fR} = 20 \times \log (v_{13} \text{ 8 MHz} / v_{13})$ $G_{fG} = 20 \times \log (v_{14} \text{ 8 MHz} / v_{14})$ $G_{fB} = 20 \times \log (v_{15} \text{ 8 MHz} / v_{15})$ |
| T ₃ | Unicolor Adjustment Characteristics | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) When the subaddress (00, unicolor) data are changed to the maximum (3F), the center (20), and the minimum (00), measure the picture period amplitude of pin 13. $(v_u^{MAX}, v_u^{CNT}, v_u^{MIN})$ 3) Calculate the maximum, minimum amplitude ratio for unicolor in decibels. (Δv_u) |
| T ₄ | Brightness Adjustment Characteristics | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 2 to pin 54 and adjust the picture period amplitude input of pin 13 to 1 V_{p-p} . 2) When the subaddress (01, brightness) data are changed to the maximum (FF), the center (C0), and the minimum (80), measure the picture period DC voltage of pin 13. $(v_{br}^{MAX}, v_{br}^{CNT}, v_{br}^{MIN})$ |
| T ₅ | Brightness Control Sensitivity | A | A | A | OFF | A | A | A | OFF | A | 1) Using the values obtained in T ₄ above, calculate the brightness sensitivity from the following formula. 2) $G_{br} = (v_{br}^{MAX} - v_{br}^{MIN}) / 128$ |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|----------------|------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₆ | White Peak Slice Level | A | A | A | OFF | A | A | A | OFF | A | 1) Change the bus data and set the sub-contrast to the maximum. 2) Input signal 2 to pin 54 and gradually increase the amplitude. 3) When pin 13's picture period is clipped, measure the picture period amplitude of pin 13 | |
| T ₇ | Black Peak Slice Level | A | A | A | OFF | A | A | A | OFF | C | 1) Apply an external power supply to pin 54 and gradually decrease the voltage from 3.7 V. 2) When their picture periods are clipped, measure the picture period amplitudes of pins 13, 14, and 15. | |
| T ₈ | DC Restoration | A | A | A | OFF | A | A | A | OFF | A | 1) Input the TG7 stair-step signal to pin 54. 2) Adjust the unicolor data so that the pin 13 stair-step output signal is 1.25 V _{p-p} . 3) When the stair-step signal APL is changed from 10% to 90%, measure the voltage change at point A in the diagram below. 4) Repeat steps 1) to 3) above on pins 14 and 15. <div></div> | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|---|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₉ | RGB Output S / N | A | A | A | OFF | A | A | A | OFF | C | 1) Measure the picture period noise levels of pins 13, 14, and 15 with an oscilloscope. (n_{13} , n_{14} , n_{15} (V_{p-p})) 2) Calculate the S / N for each pin. $N_{13} = -20 \times \text{Log} (2.5 / (0.2 \times n_{13}))$ $N_{14} = -20 \times \text{Log} (2.5 / (0.2 \times n_{14}))$ $N_{15} = -20 \times \text{Log} (2.5 / (0.2 \times n_{15}))$ | |
| T ₁₀ | RGB Output Emitter-Follower Drive Current | A | A | A | OFF | A | A | A | OFF | C | 1) Connect a 3.5-V external power supply to pin 13 via a 100-Ω resistor (I#13) and measure the sink current on pin 13. 2) Perform the same test on pins 14 and 15. (I#14, I#15) | |
| T ₁₁ | RGB Output Temperature Coefficient | A | A | A | OFF | A | A | A | OFF | C | 1) When the temperature changes through the range -20°C to $+65^\circ\text{C}$, measure the changes in the picture period amplitudes of pins 13, 14, and 15. 2) Calculate the voltage changes per degree of temperature. (Δt_{13} , Δt_{14} , Δt_{15}) | |
| T ₁₂ | Half-Tone Characteristics | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) Measure the picture period amplitude of pin 13. (v_{13A}) 3) Apply 1.5 V DC to pin 6. 4) Measure the picture period amplitude of pin 13. (v_{13B}) 5) $G_{HT} = v_{13B} / v_{13A}$ | |
| T ₁₃ | Half-Tone ON Voltage | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) Connect an external power supply to pin 6 and gradually increase the voltage from 0 V. 3) When the picture period amplitude of pin 13 changes, measure the pin 3 voltage. (V_{HT}) | |
| T ₁₄ | V-BLK Pulse Output Level | A | A | A | OFF | A | A | A | OFF | C | 1) Measure the voltages of pins 13, 14, and 15 during the vertical blanking period. (V_{VR} , V_{VG} , V_{VB}) | |
| T ₁₅ | H-BLK Pulse Output Level | A | A | A | OFF | A | A | A | OFF | C | 1) Measure the voltages of pins 13, 14, and 15 during the horizontal blanking period. (V_{HR} , V_{HG} , V_{HB}) | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|-------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₁₆ | Blanking Pulse Delay Time | A | A | A | OFF | A | A | A | OFF | C | <div>1) Measure t_{dON} and t_{dOFF} using the signal input to pin 34 (FBN-IN) (A below) and the signals output from pins 13, 14, and 15 (B below). (A) Signal input to pin 34</div> <div></div> <div>(B) Signals output from pins 13, 14, and 15</div> | |
| T ₁₇ | Sub-Contrast Control Range | A | A | A | OFF | A | A | A | OFF | A | <div>1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54.</div> <div>2) When the subaddress (0F, sub-contrast) data are changed to the maximum (8F), the center (88), and the minimum (80), measure the picture period amplitude of pin 13.</div> <div>3) Calculate the maximum and minimum amplitude ratios in relation to the sub-contrast center in decibels. ($\Delta v_{su+}, \Delta v_{su-}$)</div> | |
| T ₁₈ | RGB Output Voltage | A | A | A | OFF | A | A | A | OFF | C | <div>1) Measure the picture period amplitudes of pins 13, 14, and 15.</div> | |
| T ₁₉ | Cut-Off Voltage Control Range | A | A | A | OFF | A | A | A | OFF | C | <div>1) When the R cutoff (subaddress (08)) data are changed to the maximum (FF), the center (80), and the minimum (00), measure the picture period amplitude of pin 13 and calculate the change in maximum and minimum from the center. (CUT+, CUT-)</div> <div>2) Make the following changes in steps (1) and (2) above and measure : Change the subaddress (09) data and measure pin 14. Change the subaddress (0A) data and measure pin 15.</div> | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₂₀ | Drive Adjustment Range | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) When the G drive subaddress (06) data are changed to the maximum (FE), the center (80), and the minimum (00), measure the picture period amplitude of pin 14. 3) Calculate the maximum and minimum amplitude ratios in relation to the drive center in decibels. (DRG+, DRG-) 4) Repeat steps 1) to 3) above with the subaddress (07) data and pin 15 instead of 14. (DRB+, DRB-) | |
| T ₂₁ | #11 Input Impedance | A | A | A | OFF | A | A | A | OFF | C | 1) Adjust the external power supply voltage until the ammeter reads 0. 2) When the pin 11 voltage is increased by 0.2 V , measure the ammeter current. (i) $Z_{in11}(\Omega) = 0.2(\text{V}) \div i(\text{A})$  | |
| T ₂₂ | ACL Characteristics | A | A | A | OFF | A | A | A | OFF | A | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 54. 2) Measure the picture period amplitude of pin 13 (v_{ACL1}). 3) Apply -0.5 V DC to pin 11 from an external power supply and measure the picture period amplitude of pin 13. (v_{ACL2}) 4) Apply -1 V DC to pin 11 from an external power supply and measure the picture period amplitude of pin 13. (v_{ACL3}) 5) $ACL1 = -20 \times \log(v_{ACL2} / v_{ACL1})$ $ACL2 = -20 \times \log(v_{ACL3} / v_{ACL1})$ | |

| NOTE | ITEM | (TEST CONDITIONS V _{CC} = 5 V and 9 V, Ta = 25 ± 3°C) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₂₃ | ABL Point | A | A | A | OFF | A | A | A | OFF | C | 1) Measure the DC voltage of pin 11 (V _{ABL1}) 2) Set the subaddress (04) data to (83). 3) Set the subaddress (00) data to (3F). Apply external voltage to pin 11, decrease the pin voltage from 6.5 V. When the voltage of pin 13 starts to change, measure the voltage of pin 11. (V _{ABL2}) 4) Change the subaddress (00) data to (7F), (BF), and (FF), and repeat step 3) for each of these data. (V _{ABL3} , V _{ABL4} , V _{ABL5}) 5) ABL _{P1} = V _{ABL2} - V _{ABL1} ABL _{P2} = V _{ABL3} - V _{ABL1} ABL _{P3} = V _{ABL4} - V _{ABL1} ABL _{P4} = V _{ABL5} - V _{ABL1} | |
| T ₂₄ | ABL Gain | A | A | A | OFF | A | A | A | OFF | C | 1) Apply 6.5 V from an external power supply to pin 11. 2) Set the subaddress (00) data to (3F). 3) Set the brightness to the maximum. 4) Measure the voltage of pin 13 (V _{ABL6}) 5) Apply 5 V from the external power supply to pin 11. 6) Change the subaddress (04) data to (80), (81), (82), and (83), and repeat step 4 for each of these data. (V _{ABL7} , V _{ABL8} , V _{ABL9} , V _{ABL10}) 7) ABL _{G1} = V _{ABL7} - V _{ABL6} ABL _{G2} = V _{ABL8} - V _{ABL6} ABL _{G3} = V _{ABL9} - V _{ABL6} ABL _{G4} = V _{ABL10} - V _{ABL6} | |
| T ₂₅ | BLK Off Mode | A | A | A | OFF | A | A | A | OFF | C | 1) Set the subaddress (01) data to (40) and check that the blanking of pins 13, 14, and 15 is turned off. | |

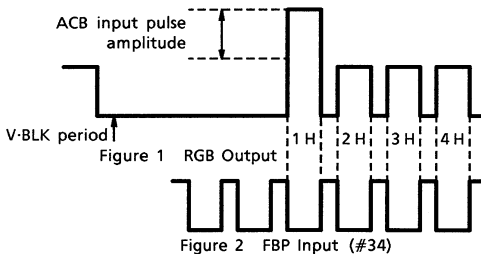
| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--------------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₂₆ | Analog RGB Gain | B | B | B | ON | A | A | A | OFF | C | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 3. 2) Measure the picture period amplitude of pin 13 (v_{13R}). 3) As in steps 1) and 2) above, input to pin 4 and measure pin 14 (v_{14G}), then input to pin 5 and measure pin 15 (v_{15B}). 4) $G_{TXR} = v_{13R} / 0.2$ $G_{TXG} = v_{14G} / 0.2$ $G_{TXB} = v_{15B} / 0.2$ | |
| T ₂₇ | Analog RGB Frequency Characteristics | B | B | B | ON | A | A | A | OFF | C | 1) Input signal 1 ($f = 8\text{ MHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 3. 2) Measure the picture period amplitude of pin 13. ($v_{13R}\ 8\text{ MHz}$) 3) As in steps 1) and 2) above, input to pin 4 and measure pin 14, then input to pin 5 and measure pin 15. ($v_{14G}\ 8\text{ MHz}$, $v_{15B}\ 8\text{ MHz}$) 4) Calculate the frequency characteristics from the above results and the results obtained in T ₂₆ . $G_{fTXR} = 20 \times \log (v_{13R}\ 8\text{ MHz} / v_{13R})$ $G_{fTXG} = 20 \times \log (v_{14G}\ 8\text{ MHz} / v_{14G})$ $G_{fTXB} = 20 \times \log (v_{15B}\ 8\text{ MHz} / v_{15B})$ | |
| T ₂₈ | Analog RGB Input D Range | B | B | B | ON | A | A | A | OFF | C | 1) Set the subaddress (00 : unicolor) data to min (00). 2) Input signal 2 to pin 3 and gradually increase picture amplitude A. 3) When the voltage during the picture period of pin 13 stops changing, measure picture amplitude A (DR13). 4) Repeat steps 2) and 3) above under the following conditions : Input to pin 4, measure the voltage during the picture period of pin 14 (DR14). Input to pin 5, measure the voltage during the picture period of pin 15 (DR15). | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₂₉ | Analog RGB White Peak Slice Level | B | B | B | ON | A | A | A | OFF | C | 1) Input signal 2 to pin 3. Gradually increase the picture period amplitude A. 2) When pin 13 is clipped, measure the picture period amplitude of pin 13. 3) As in steps 1) and 2) above, input to pin 4 and measure pin 14, then input to pin 5 and measure pin 15. | |
| T ₃₀ | Analog RGB Black Peak Limiter Level | A | A | A | ON | A | A | A | OFF | C | 1) Apply an external power supply to pin 3. Gradually decrease the voltage from 5V DC. When pin 13 is clipped, measure the voltage of pin 13. 2) As in step 1) above, apply to pin 4 and measure pin 14, then apply to pin 5 and measure pin 15. | |
| T ₃₁ | Analog RGB Contrast Adjustment Characteristics | B | B | B | ON | A | A | A | OFF | C | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 3. 2) When the subaddress (00, unicolor) data are changed to the maximum (3F), the center (20), and the minimum (00), measure the picture period amplitude of pin 13. (vuTXR1, vuTXR2, vuTXR3) 3) Calculate the maximum and minimum amplitude ratios in decibels. 4) As in steps 1), 2) and 3) above, input signal 1 to pin 4 and measure pin 14, then input signal 1 to pin 5 and measure pin 15. | |
| T ₃₂ | Analog RGB Brightness Adjustment Characteristics | B | B | B | ON | A | A | A | OFF | C | 1) Input signal 2 to pins 3, 4, and 5. 2) Adjust the signal 2 amplitude A so that the picture period amplitude of pin 13 is 0.5 V_{p-p} . 3) When the subaddress (05, RGB brightness) data are changed to the maximum (F8), the center (88), and the minimum (08), measure the picture period amplitudes of pins 13, 14, and 15. (vbrTX1, vbrTX2, vbrTX3) | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₃₃ | Analog RGB Mode On Voltage | B | A | A | OFF | A | A | A | OFF | C | 1) Input signal 1 ($f = 100\text{ kHz}$, picture period amplitude = 0.2 V_{p-p}) to pin 3. 2) Apply an external power supply to pin 6. Gradually increase the voltage from 0 V. 3) When signal 1 is output to pin 13, measure the voltage of pin 6. | |
| T ₃₄ | Analog RGB Mode Transfer Characteristics | A | A | A | OFF | A | A | A | OFF | C | 1) Set the subaddress (05, RGB brightness) data to the maximum (F8). 2) Input signal 3 (signal amplitude 4.5 V_{p-p}) to pin 6. 3) Measure the switching transfer characteristics of pins 13, 14, and 15 according to diagram T-2. 4) Using the data obtained from the above measurements, calculate the maximum axis difference between the rising and falling edges of transfer delay time. | |
| T ₃₅ | Crosstalk from Video to Analog RGB | A | A | A | OFF or ON | A | A | A | OFF | A | 1) Input signal 1 ($f = 4\text{ MHz}$, picture period amplitude = 0.5 V_{p-p}) to pin 54. 2) Adjust the input amplitude so that the picture period amplitude of pin 13 is 2 V_{p-p} . 3) Turn SW ₆ on. 4) Measure the picture period amplitude (V_{p-p}) of pin 13. (v_{13A}) 5) Calculate by the following formula the amount of crosstalk from the video to the analog RGB. $V_v \rightarrow AR = -20 \times \log (v_{13A} / 2)$ 6) Repeat steps 4) and 5) above on pins 14 and 15. | |

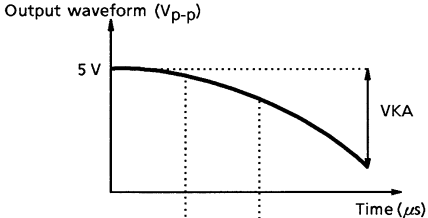
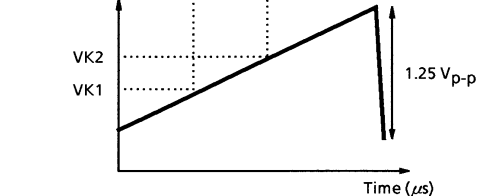
| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--------------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₃₆ | Crosstalk from Analog RGB to Video | B | B | B | ON or OFF | A | A | A | OFF | C | 1) Turn SW ₆ on. 2) Input signal 1 (f = 4MHz, picture period amplitude = 0.5 V _{p-p}) to pin 3. 3) Adjust the input amplitude so that the picture period amplitude of pin 13 is 2 V _{p-p} . 4) Turn SW ₆ off. 5) Measure the picture period amplitude (V _{p-p}) of pin 13. (v _{13B}) 6) Calculate by the following formula the amount of crosstalk from the analog RGB to the video. vA → AR = -20 × log (v _{13B} / 2) 7) As in steps 2) to 6) above, input to pin 4 and measure pin 14, then input to pin 5 and measure pin 15 | |
| T ₃₇ | Analog OSD Gain | A | A | A | OFF | B | B | B | ON | C | 1) Input signal 1 (f = 100 kHz, picture period amplitude = 0.2 V _{p-p}) to pin 7. 2) Measure the picture period amplitude of pin 13. (v _{13R}) 3) As in steps 1) and 2) above, input to pin 8 and measure pin 14, then input to pin 9 and measure pin 15. (v _{14G} , v _{15B}) 4) $G_{OSDR} = v_{13R} / 0.2$ $G_{OSDG} = v_{14G} / 0.2$ $G_{OSDB} = v_{15B} / 0.2$ | |
| T ₃₈ | Analog OSD Frequency Characteristics | A | A | A | OFF | B | B | B | ON | C | 1) Input signal 1 (f = 8 MHz, picture period amplitude = 0.2 V _{p-p}) to pin 7. 2) Measure the picture period amplitude of pin 13. (v _{13R} 8MHz) 3) As in steps 1) and 2) above, input to pin 8 and measure pin 14, then input to pin 9 and pin 15. (v _{14G} 8 MHz, v _{15B} 8 MHz) 4) Calculate the frequency characteristics from the above results and the results in T ₃₇ . 5) $G_{fOSDR} = 20 \times \log (v_{13R} \text{ 8 MHz} / v_{13R})$ $G_{fOSDG} = 20 \times \log (v_{14G} \text{ 8 MHz} / v_{14G})$ $G_{fOSDB} = 20 \times \log (v_{15B} \text{ 8 MHz} / v_{15B})$ | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₃₉ | Analog OSD Output Level | A | A | A | OFF | A | A | A | OFF | C | 1) When 0V (DC) is input from an external power supply to pin 7, when 7.5 V is input to pin 7, and when no external voltage is applied to pin 7, measure the picture period amplitude of pin 13. (V _{OSD1R} , V _{OSD2R} , V _{OSD3R}) 2) As in step 1) above, input to pin 8 and measure pin 14, then input to pin 9 and measure pin 15. (V _{OSD1G} , V _{OSD2G} , V _{OSD3G}) (V _{OSD1B} , V _{OSD2B} , V _{OSD3B}) | |
| T ₄₀ | Analog OSD Mode On Voltage | A | A | A | OFF | B | A | A | OFF | C | 1) Input signal 1 (f = 100 kHz, picture period amplitude = 0.2 V _{p-p}) to pin 7. 2) Apply an external power supply to pin 10. Gradually increase the voltage from 0 V. 3) When signal 1 is output to pin 13, measure the pin 10 voltage. | |
| T ₄₁ | Analog OSD Mode Transfer Characteristics | A | A | A | OFF | A | A | A | OFF | C | 1) Apply 2.5 V from an external power supply to pins 7, 8, and 9. 2) Input signal 4 (signal amplitude = 4.5 V _{p-p}) to pin 10. 3) Measure the switching transfer characteristics of pins 13, 14, and 15 according to diagram T-2. 4) Using the data obtained from the above measurements, calculate the maximum axis difference between the rising and falling edge of the transfer delay time. | |
| T ₄₂ | RGB Output Self-Diagnosis | A | A | A | OFF | A | A | A | OFF | A | 1) Set the bus control data to read mode and reset. 2) Set to read mode again. 3) Check that the read mode parameter (RGB-OUT) is 0 (error). 4) Measure the voltage of pin 54 and apply that voltage +0.7 V to pin 53 using an external power supply. 5) Set to read mode again. 6) Check that the read mode parameter (RGB-OUT) is 1 (OK). | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|----------------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₄₃ | ACB Input Pulse Phase, Amplitude | A | A | A | OFF | A | A | A | OFF | A or C | <div>1) Input signal 1 ($f = 100\text{ kHz}$, picture amplitude 0.2 V_{p-p}) to pin 53 and adjust drive data so that the picture period amplitude of pins 14 and 15 equals that of pin 13.</div> <div>2) Set SW₅₄ to C.</div> <div>3) Measure the voltages on pins 17, 18, and 19 and apply the measured voltages to the pins from an external power supply.</div> <div>4) Set the subaddress (11) data to (50).</div> <div>5) According to the voltage on pins 13, 14, and 15 in Figure 1 below, determine the phase of ACB input pulse.</div> <div>Note : The phase starts after the V-BLK period. The picture period after the falling edge of FBP input is 1 H ; then, every time H-BLK ends, the period is 2 H, 3 H, and so on.</div> <div>6) According to pins 13, 14, and 15 the voltage on, determine the ACB input pulse amplitude (amplitude from the BLK level at RGB-BLK OFF).</div> <div></div> | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|--------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₄₄ | ACB Clamp Current | A | A | A | OFF | A | A | A | OFF | C | 1) Set pin 17 to open, connect a 1-kΩ resistor to the pin, and apply 3V to the pin from the power supply. 2) When the subaddress (11) data are set to (10), (30), (50), and (70), measure from the waveform of pin 17 the current flowing to GND during the clamp period. (I17a, I17b, I17c I17d) 3) Repeat the measurements in steps 1) and 2) above on pins 18 and 19. (I18a, I18b, I18c I18d) (I19a, I19b, I19c I19d) | |
| T ₄₅ | IK Input Amplitude | A | A | A | OFF | A | A | A | OFF | C | 1) Connect TP13 to TP13b ; TP14 to TP14b ; TP15 to TP15b. 2) Set SW ₂₀ to b. 3) Set the subaddress (11) data to (50). 4) By referring to Figure 1 of T ₄₃ , determine the voltage output from pins 13, 14, and 15 (IKR, IKG, IKB) during the ACB pulse input to the signal input to pin 20. | |

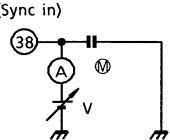
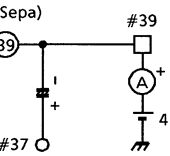
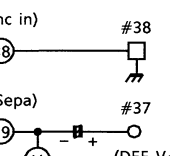
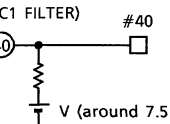
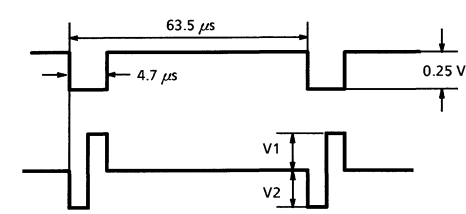
| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^{\circ}\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|---|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₄₆ | RGB γ Correction Characteristics | A | A | A | OFF | A | A | A | OFF | A | <div><div>1) Input a ramp waveform to pin 54 (Y IN) and adjust the input amplitude so that the picture period amplitude of pin 13 is 2.5 V_{p-p}.</div><div>2) Adjust the drive adjustment data so that the picture period amplitudes of pins 14 and 15 are equal to that of pin 13.</div><div>3) Set the subaddress (13) data to (81).</div><div>4) Using pins 13, 14, and 15, calculate the RGBγ start point and its gradient (in decibels) in relation to the off point, using Fig.1 below.</div><div></div></div> | |

| NOTE | ITEM | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | | | | | | | | | | MEASUREMENT METHOD |
|-----------------|---------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|--------------------|
| | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | | |
| | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | | |
| T ₄₇ | VK Output Characteristics | A | A | A | ON | B | B | B | OFF | C | <div>1) Input a sync signal to pin 38.</div> <div>2) Input a ramp waveform (1.25 V_{p-p}) to pins 7, 8, and 9 during the picture period.</div> <div>3) Acquire VK1 and VK2 of the input level, by means of monitoring the VKA and the inflection points of the output waveform for pin #12.</div> <div><div><p>Output waveform (V_{p-p})</p></div><div><p>Input waveform (V_{p-p})</p></div></div> | |

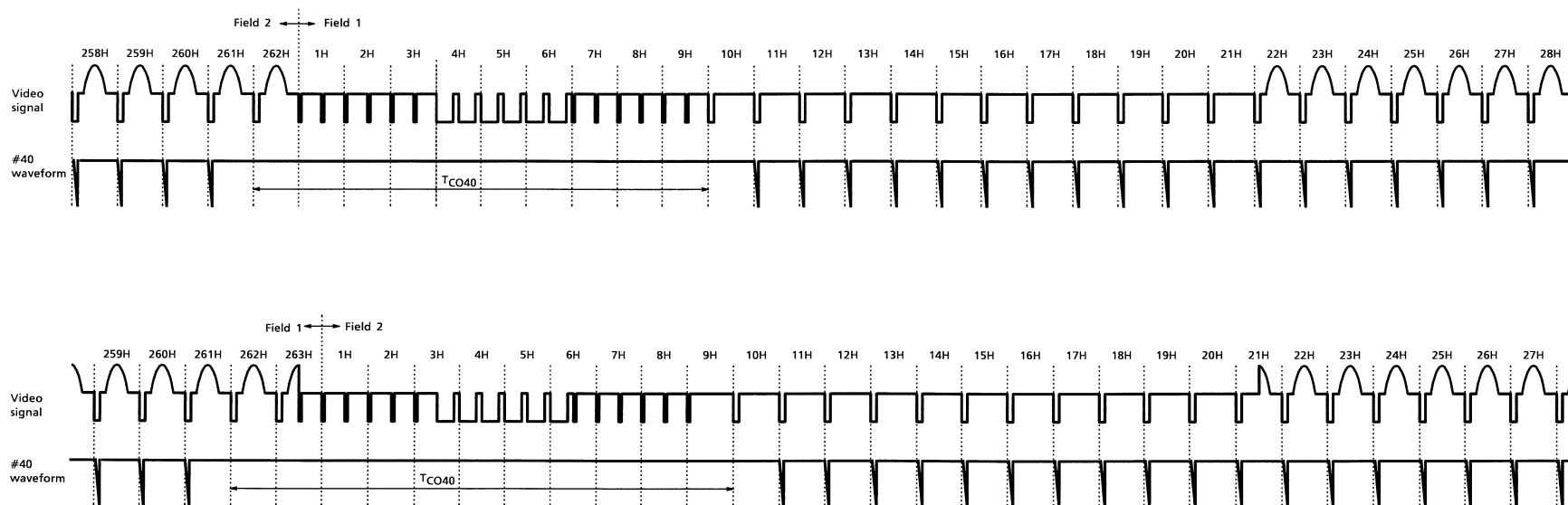
| NOTE | ITEM | SYMBOL | SW MODE & SUB ADDRESS & DATA | | | | | | | | | (TEST CONDITIONS $V_{CC} = 5\text{ V}$ and 9 V , $T_a = 25 \pm 3^\circ\text{C}$) | |
|-----------------|--|--|------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---|--|
| | | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | MEASUREMENT METHOD | |
| T ₄₈ | ACB Protection Circuit Operating monitor 1 | ACBPR ACBPG | A | A | A | OFF | A | A | A | OFF | C | 1) Set the subaddress (11) data to (A0). 2) Apply 8.0 V to pin 17. 3) Monitor pin 13 and confirm that the picture period has not dropped to the BLK level (ACBPR). 4) Monitor pin 14 and confirm that the picture period has not dropped to the BLK level (ACBPG) | |
| T ₄₉ | ACB Protection Circuit Operating monitor 2 | ACBBRAR ACBBRAG | A | A | A | OFF | A | A | A | OFF | C | 1) Set the subaddress (11) data to (C0). 2) Apply 8.0 V to pin 17. 3) Monitor pin 13 and confirm that the picture period is at the BLK level (ACBBRAR). 4) Monitor pin 14 and confirm that the picture period is at the BLK level (ACBBRAG) | |
| T ₅₀ | ACB Protection Circuit Operating monitor 3 | ACBBRLO | A | A | A | OFF | A | A | A | OFF | C | 1) Set the subaddress (11) data to (C0). 2) Apply 6.8 V to 9 V V_{CC} (pin 16). 3) Apply 6.8 V to pin 17. 4) Monitor pin 13 and confirm that the picture period has not dropped to the BLK level (ACBBRLO) | |
| T ₅₁ | Base BandTint Adjustment Characteristics | ANG RMIN ANG BMIN ANG RMAX ANG BMAX | A | A | A | OFF | ON | ON | - | OFF | C | 1) Change subaddress (05) H to (81) H. 2) Set unicolor = max ; bright = max ; color = center. 3) Input signal 1 ($f_0 = 100\text{ kHz}$, 100 mV_{p-p}) to pin 53. 4) To pin 52, input a signal with the same amplitude but 90°C phase advanced compared to the signal input to pin 53. 5) When subaddress (14) H is changed to (C0) H \rightarrow (80) H, measure the amount of change in the output phase of pin 13. (ANG RMIN) 6) Under the same conditions as 5) above, measure the amount of change in the output phase of pin 15. (ANG BMIN) 7) When subaddress (14) H is changed to (C0) H \rightarrow (FF), measure the amount of change in the output phase of pin 13. (ANG RMAX) 8) Under the same conditions as 7) above, measure the amount of change in the output phase of pin 15. (ANG BMAX) | |

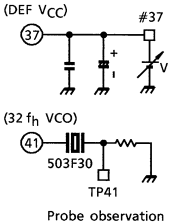
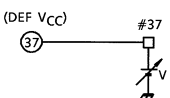
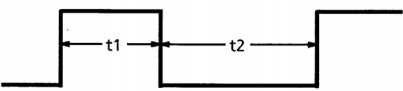
| NOTE | ITEM | SYMBOL | (TEST CONDITIONS V _{CC} = 5 V and 9 V, Ta = 25 ± 3°C) | | | | | | | | | |
|-----------------|-----------------------------------|--------|--|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
| | | | SW MODE & SUB ADDRESS & DATA | | | | | | | | | MEASUREMENT METHOD |
| | | | S ₀₃ | S ₀₄ | S ₀₅ | S ₀₆ | S ₀₇ | S ₀₈ | S ₀₉ | S ₁₀ | S ₅₄ | |
| T ₅₂ | Base BandTint Adjustment Position | BUS B0 | A | A | A | OFF | ON | ON | - | OFF | C | 1) Change subaddress (05) H to (81) H. 2) Set unicolor = max ; bright = max ; color = center.Relative amplitude, phase switching: Change subaddress (12) H to (00). 3) Input signal 1 (f ₀ = 100 kHz, 100 mV _{p-p}) to pin 53. 4) To pin 52, input a signal with the same amplitude but 90°C phase advanced compared to the signal input to pin 53. 5) Changing subaddress (14) H from (C0) H, read the transmission data at subaddress (14) H when the output phase of the pin 15 signal is the same as the input phase of the pin 53 signal. (BUS B0) |

Deflection stage


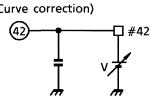
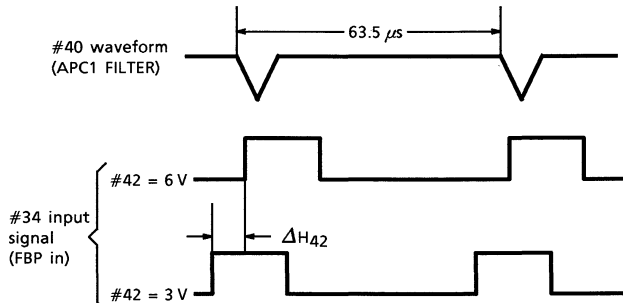
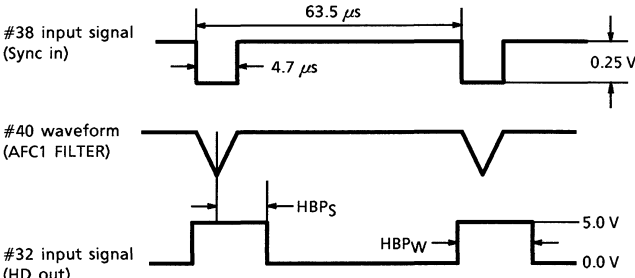
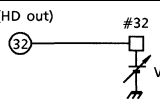
| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF V _{CC} = 9 V, Ta = 25 ± 3°C, BUS DATA = POWER-ON RESET) | |
|----------------|---|------------------|------------------|--|---|
| | | SW ₃₄ | SW ₃₈ | MEASUREMENT METHOD | |
| D ₁ | Sync separation Input Sensitivity Current | OFF | B |  | When the number of H periods in the #33 (VD out) waveform changes from 297 to 225, increase the voltage from 3 V and measure the value at ㉔ in the diagram. |
| D ₂ | V separation Filter Pin Source Current | OFF | B |  | When the subaddress (0D) D ₁ is set to (1), measure the value at ㉔ in the diagram. |
| D ₃ | V Separation Level | OFF | B |  | When #38 (Sync in) is connected to GND, measure the #39 (VSEP FILTER) voltage. |
| D ₄ | H AFC Phase Detection Current H AFC Phase Detection Current Ratio | OFF | A |  | <p>Set the voltage to around 7.5 V, equivalent to when #40 (AFC1 FILTER) has no load. When a signal as shown in the diagram below is input to #38 (Sync in) from TG7, calculate V₁ and V₂ using the #40 waveform.</p> <p>$I_{DET} = V_1 \div 1 \text{ k}\Omega \text{ (}\mu\text{A)}$</p> <p>$\Delta I_{DET} = (V_1 / V_2 - 1) \times 100 \text{ (\%)}$</p>  |
| D ₅ | Phase Detection Stop Period | OFF | A | Input a composite video signal to #38 and measure the V mask period of the #40 (AFC1 FILTER) waveform. | |


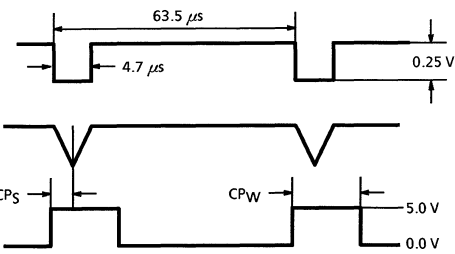
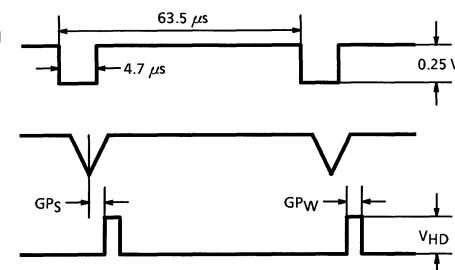
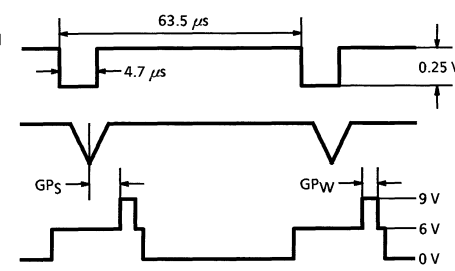
Note D5 : Phase detection stop period



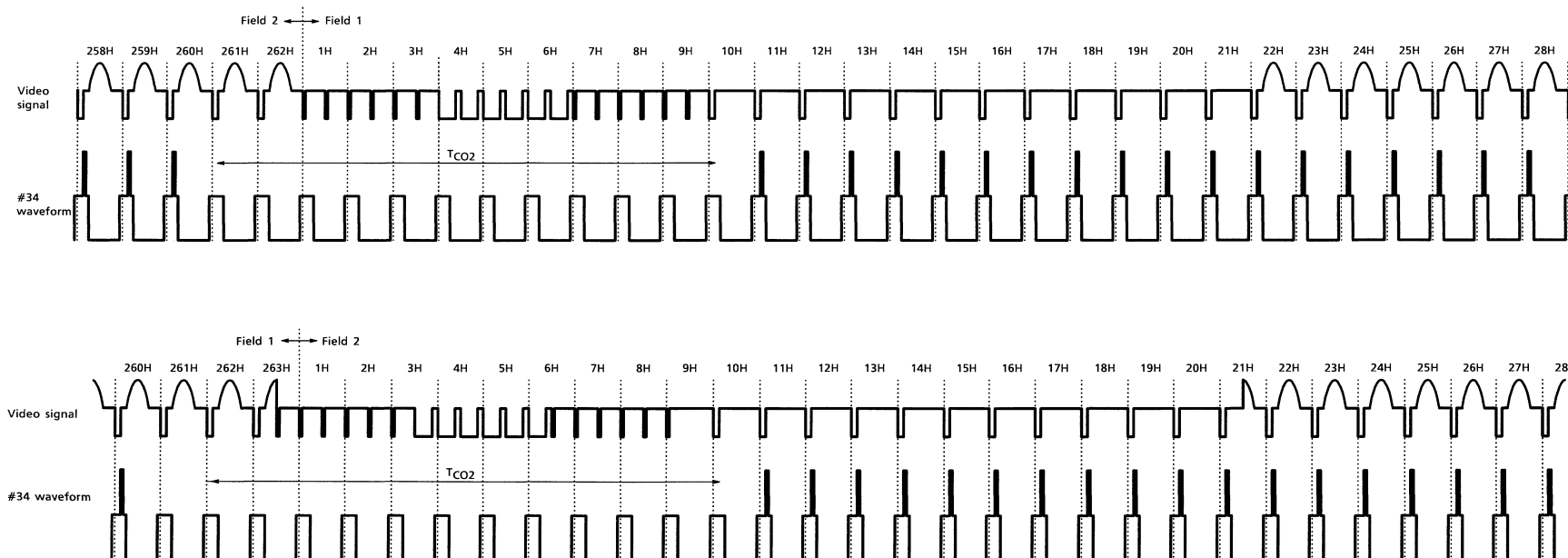
| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF V _{CC} = 9 V, Ta = 25 ± 3°C, BUS DATA = POWER-ON RESET) | |
|-----------------|---|------------------|------------------|--|--|
| | | SW ₃₄ | SW ₃₈ | MEASUREMENT METHOD | |
| D ₆ | 32*f _H VCO Oscillation Start Voltage | OFF | B |  <p>Probe observation</p> | <p>Increase the voltage from 2.5 V.</p> <p>When an oscillation waveform appears on TP41, measure the voltage. At the same time, check that no waveform is output (0V DC) to #35 (H out). (Apply only DEF V_{CC}.)</p> |
| D ₇ | Horizontal Output Start Voltage | OFF | B |  | <p>Increase the voltage. When a horizontal pulse appears on #35 (H out), measure the voltage. Note that the horizontal oscillation frequency at this time is near f_{HO} (15.7 kHz ± 1 kHz).</p> <p>(Apply only DEF V_{CC}.)</p> <p>1) Under the above conditions, when no horizontal pulse is output on #35, read D₄ in bus read mode. (Apply also the chroma V_{CC}.) (VBUS HOFF)</p> <p>2) Under the above conditions, when a horizontal pulse is output on #35, read D₄ in bus read mode. (Apply also the chroma V_{CC}.) (VBUS HON)</p> |
| D ₈ | Horizontal Output Pulse Duty | OFF | B |  | <p>Observe the #35 (H out) waveform and measure t1 and t2.</p> $T_{H35} = \frac{t1}{t1 + t2} \times 100(\%)$ |
| D ₉ | Phase Detection Stop Mode | OFF | B | Input a composite video signal to TP38. When the subaddress (0D) D ₁ is set to (1), measure the oscillation frequency of the #35 (H out) waveform. | |
| D ₁₀ | Horizontal Free-Run Frequency | OFF | B | Measure the oscillation frequency of #35 (H out). | |
| D ₁₁ | Horizontal Oscillation Frequency Range | OFF | B | <p>1) When #40 (AFC1 FILTER) is connected to DEF V_{CC} via a 10-kΩ resistor, measure the #35 (H out) oscillation frequency. (V_{HMIN})</p> <p>2) When #40 (AFC1 FILTER) is connected to GND via a 68-kΩ resistor, measure the #35 (H out) oscillation frequency. (V_{HMAX})</p> | |
| D ₁₂ | Horizontal Oscillation Control Sensitivity | OFF | B | When the voltage on #40 (AFC1 FILTER) is varied by ±0.05 V with a horizontal oscillation frequency of 15.734 kHz, calculate the #35 (H out) frequency variation rate. | |

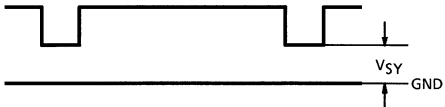
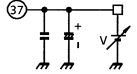
| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) |
|-----------------|---|------------------|------------------|---|
| | | SW ₃₄ | SW ₃₈ | |
| | | | | MEASUREMENT METHOD |
| D ₁₃ | Horizontal Output Voltage | OFF | B | 1) Measure the high-level voltage of #35 (H out) (when #35 is connected to GND via a 481-Ω resistor). (V_{H35}) 2) Measure the low-level voltage of #35 (H out) (when #35 is connected to GND via a 481-Ω resistor). (V_{L35}) |
| D ₁₄ | Supply Voltage Dependence of Horizontal Oscillation Frequency | OFF | B | When the #37 (DEF V_{CC}) voltage is varied from 8.5 V to 9.5 V, measure the variation in the #35 (H out) oscillation frequency. |
| D ₁₅ | Temperature Dependence of Horizontal Oscillation Frequency | OFF | B | When the temperature is varied through the range -20°C to $+60^\circ\text{C}$, measure the variation in the #35 (H out) oscillation frequency. |
| D ₁₆ | Horizontal Sync Phase | OFF | A | <div> <div> <p>#38 input signal (Sync in)</p> </div> <div> <p>When a signal as shown at left is input to TP38 from TG7, measure the phase difference of the #34 (FBP in) waveform in relation to the #40 (AFC1 FILTER) waveform (S_{PH1}). Also measure the phase difference of the #40 waveform in relation to the center of the input horizontal sync signal (S_{PH2}).</p> </div> </div> |
| D ₁₇ | Horizontal Picture Phase Adjustment Range | OFF | A | <div> <div> <p>#40 waveform</p> </div> <div> <p>Under the above conditions, when the subaddress (0B) D₇ to D₃ are varied from (00000) to (11111), measure the phase variation in the #34 (FBP in) waveform.</p> </div> </div> |

| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | |
|-----------------|--|------------------|------------------|---|---|
| | | SW ₃₄ | SW ₃₈ | MEASUREMENT METHOD | |
| D ₁₈ | Horizontal Blanking Pulse Threshold | ON | A |  | <p>Decrease the amplitude of #34 (FBP in) from 9 V_{p-p}. When AFC2 stops locking, measure the amplitude. (V_{HBLK1})</p> <p>Increase the amplitude of #34 (FBP in) from 0 V_{p-p}. When horizontal blanking is applied to #13 (R in), measure the amplitude. (V_{HBLK2})</p> |
| D ₁₉ | Curve Correction Range | OFF | A | <p>(Curve correction)</p>  <p>Input a signal as shown below to TP38 from TG7. When the voltage is varied from 3 V to 6 V, measure the phase variation in the #34 (FBP in) waveform.</p>  | |
| D ₂₀ | H Cycle Black Peak Detection Disable Pulse | OFF | A |  | <p>Set the subaddress (01) D₇ to (0), set the subaddress (05) D₃~D₁ to (010), and set the subaddress (0C) D₀ to (1).</p> <p>When a signal as shown at left is input to TP38 from TG7, measure the #32 (HD out) waveform phase difference HBP_S and pulse width HBP_W in relation to the #40 (AFC1 FILTER) waveform.</p> |
| D ₂₁ | Threshold of External Black Peak Detection Disable Pulse | OFF | A | <p>(HD out)</p>  <p>Set the subaddress (02) D₇ to (1).</p> <p>Increase the voltage from 0 V. When #52 reaches 3.4 V DC, measure the voltage.</p> | |

| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | |
|-----------------|---|------------------|------------------|--|--|
| | | SW ₃₄ | SW ₃₈ | MEASUREMENT METHOD | |
| D ₂₂ | Clamp Pulse Start Phase Clamp Pulse Width | OFF | A | <p>(R in)  #13 Set the subaddress (01) D₇ to (0), set the subaddress (05) D₃~D₁ to (001), and set the subaddress (0C) D₀ to (1).</p>  <p>Input a signal as shown at left to TP38 from TG7, then measure the #32 (HD out) waveform phase difference CP_S and pulse width CP_W in relation to the #40 (AFC1 FILTER) waveform.</p> | |
| D ₂₃ | HD Output Start Phase HD Output Pulse Width HD Output Amplitude | OFF | A |  <p>Input a signal as shown at left to TP38 from TG7, then measure the #32 (HD out) waveform phase difference HD_S and pulse width HD_W and V_{HD} in relation to the #40 (AFC1 FILTER) waveform.</p> | |
| D ₂₄ | Gate Pulse Start Phase Gate Pulse Width | OFF | A |  <p>Input a signal as shown at left to TP38 from TG7, then measure the #34 (FBP in) waveform phase difference GP_S and pulse width GP_W in relation to the #40 (AFC1 FILTER) waveform.</p> | |

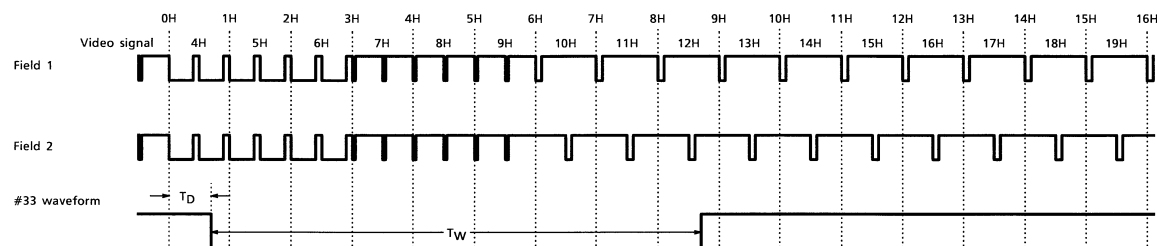
Note D24 : Gate pulse V mask period



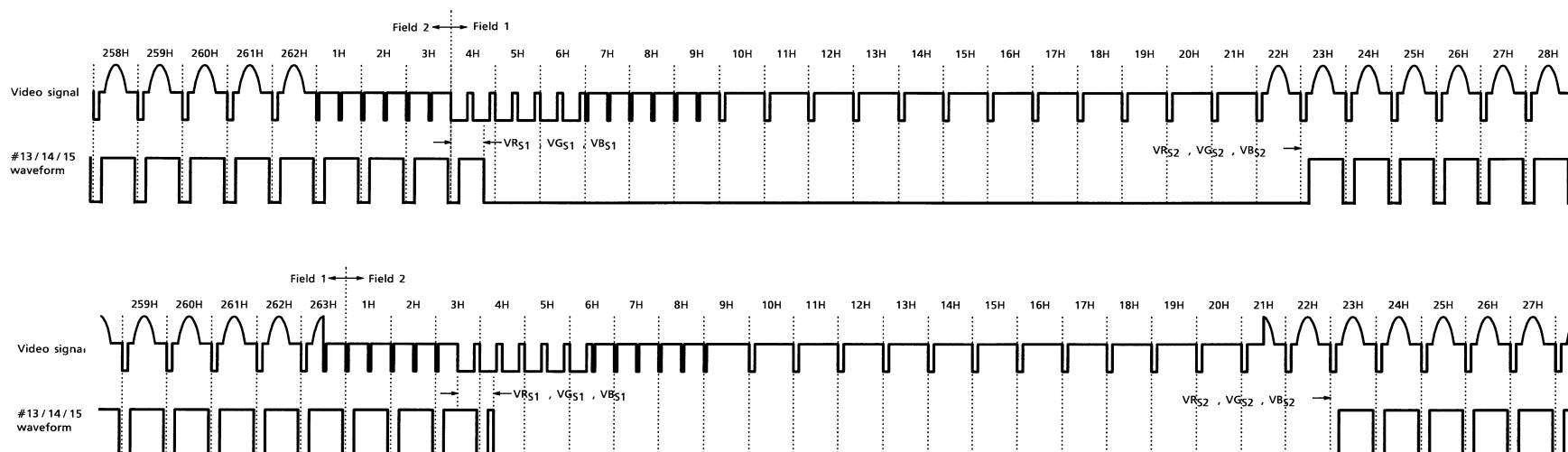
| NOTE | ITEM | SW MODE | | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) |
|-----------------|--|------------------|------------------|--|
| | | SW ₃₄ | SW ₃₈ | |
| | | | | MEASUREMENT METHOD |
| D ₂₅ | Gate Pulse V Mask Period | OFF | A | Input a composite video signal to TP38, observe the #34 (FBP in) waveform, and measure the V mask period. |
| D ₂₆ | Sync Out Low Level | OFF | A | <div> <div>#36 waveform (Sync out)</div>  <div>Input a composition video signal to TP38, observe the #36 (Sync out) waveform, and measure the low level of the sync period.</div> </div> |
| D ₂₇ | Vertical Oscillation Start Voltage | OFF | B | <div> <div>(DEF V_{CC})</div>  <div>Increase the voltage from 0 V. When a pulse is output from #33 (VD out), measure the voltage. (Apply only DEF V_{CC}.)</div> </div> |
| D ₂₈ | Vertical Free-Run Frequency | OFF | B | Measure the frequency of #33 (VD out). |
| D ₂₉ | Vertical Output Voltage | OFF | B | 1) Measure the high level voltage of the #33 (VD out) waveform. (V_{VH}) 2) Measure the low level voltage of the #33 (VD out) waveform. (V_{VL}) |
| D ₃₀ | Service Mode Switching | OFF | B | When the subaddress (0C) D ₀ is set to (1), check that the #27 (V.Ramp) waveform is low (3.4 V DC). |
| D ₃₁ | Vertical Pull-In Range | OFF | C | Input a composite video signal to TP38, vary the vertical frequency of this signal in 0.5-H steps, and measure the vertical pull-in range. |
| D ₃₂ | Vertical Frequency Forced 263H Vertical Frequency Forced 262.5H | OFF | B | 1) Measure the number of H periods of #33 (HD out) when the subaddress (0D) D ₁ and D ₀ are set to (10). (f_{V1}) 2) Measure the number of H periods of #33 (HD out) when the subaddress (0D) D ₁ and D ₀ are set to (11). (f_{V2}) |
| D ₃₃ | Vertical Blanking Off Mode | OFF | B | Set the subaddress (01) D ₇ to (1) and check that no vertical or horizontal blanking pulse is applied to #13 (R out), #14 (G out), or #15 (B out). |

| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | | |
|-----------------|---|--|------------------|---|
| | | SW MODE | | MEASUREMENT METHOD |
| | | SW ₃₄ | SW ₃₈ | |
| D ₃₄ | Vertical Output Pulse Width | OFF | C | Input a composite video signal to TP38, then measure the #33 (VD out) vertical pulse delay T_D and pulse width T_W in relation to the vertical sync signal of #38 (Sync in). |
| D ₃₅ | RGB Output Vertical Blanking Pulse Start Phase RGB Output Vertical Blanking Pulse Stop Phase | OFF | C | Input a composite video signal to TP38, then measure the #13 (R out) waveform phase difference VR_{S1} and pulse width VR_{S2} in relation to the #38 (Sync in) waveform. Repeat measurement on #14 and #15. Set the subaddress (11) D ₄ ~D ₁ to (1111) and the subaddress (12) D ₄ ~D ₁ to (1111). |
| D ₃₆ | V Cycle Black Peak Detection Disable Pulse (Normal) | OFF | C | Input a composite video signal to TP38 and measure the V cycle black peak detection disable pulse period of #55 (BLACK PEAK DET). |
| D ₃₇ | V Cycle Black Peak Detection Disable Pulse (Zoom) | OFF | C | Under the conditions in D ₃₈ above, set the subaddress (0C) D1 to (1) and measure the V cycle black peak detection disable period of #55. |

Note D34 : Vertical output pulse width, vertical output pulse phase variation, and vertical output pulse phase range

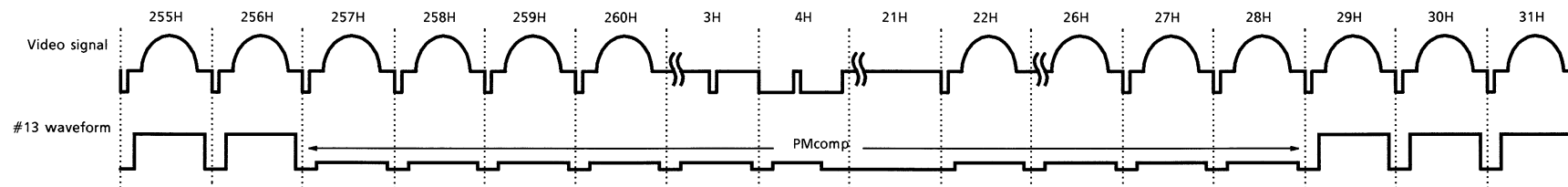


Note D35 : RGB output vertical blanking pulse start and stop phases

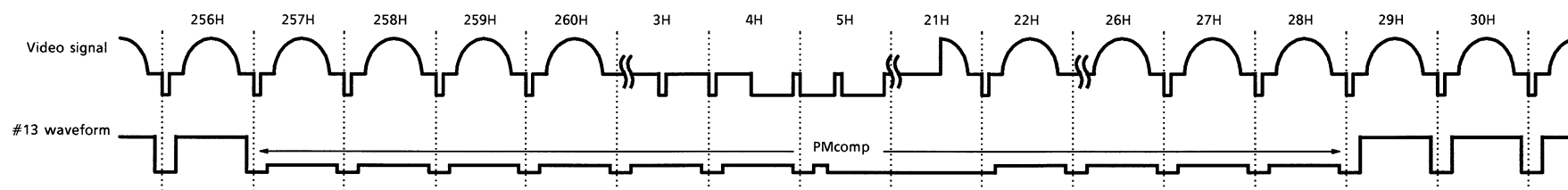


Note D36 : Video mute period (normal)

Field 2 to field 1

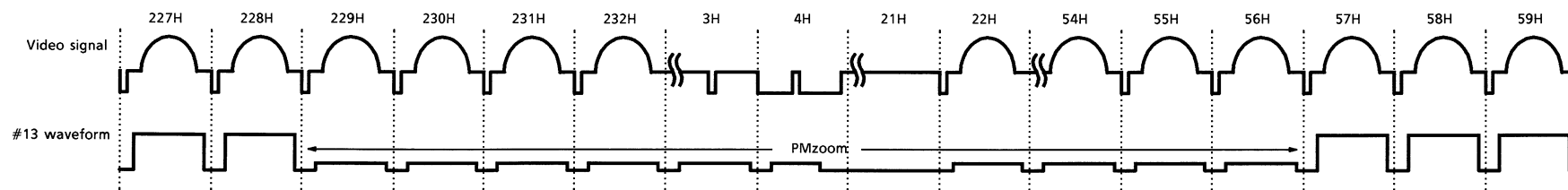


Field 1 to field 2

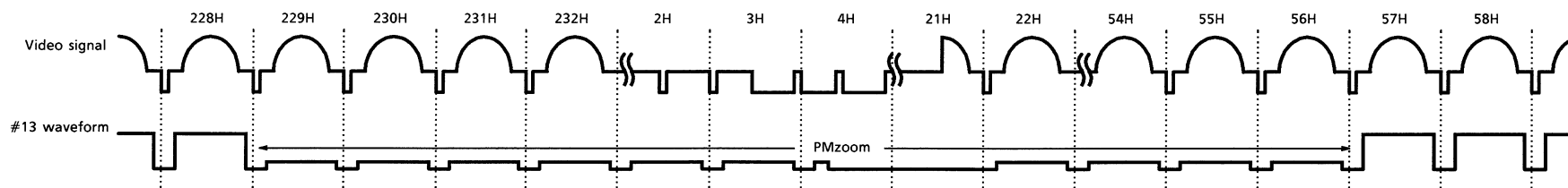


D37 : Video mute period (zoom)

Field 2 to field 1

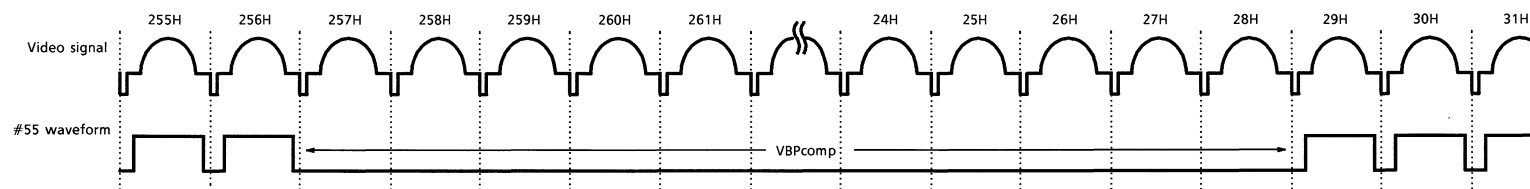


Field 1 to field 2

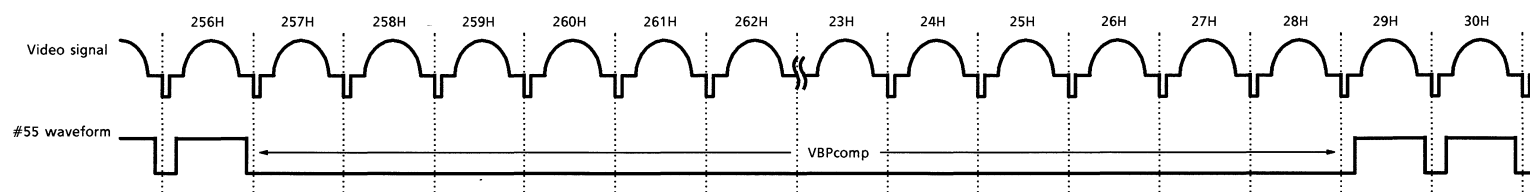


Note D38 : V cycle black peak detection disable pulse (normal)

Field 2 to field 1

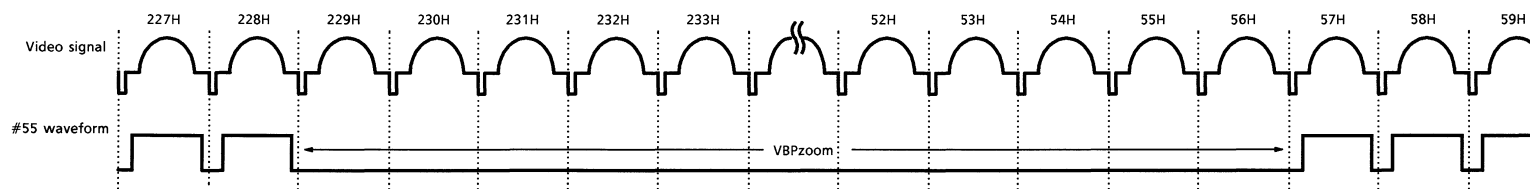


Field 1 to field 2

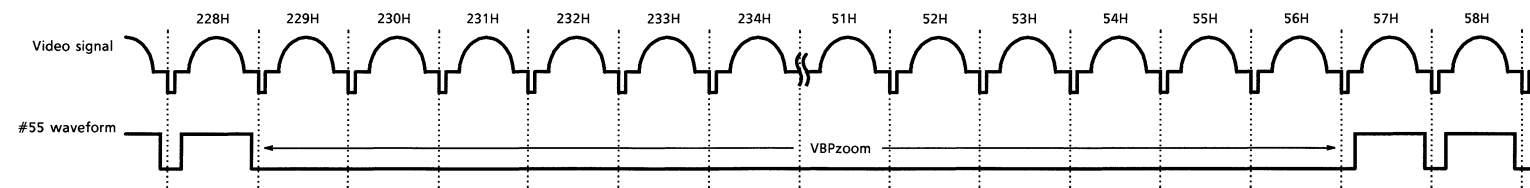


Note D39 : V cycle black peak detection disable pulse (zoom)

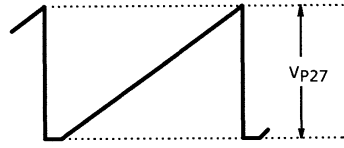
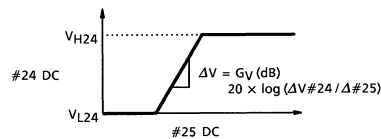
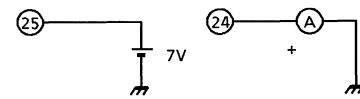
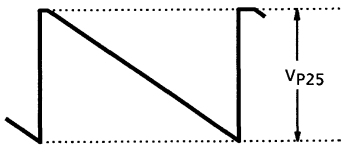
Field 2 to field 1

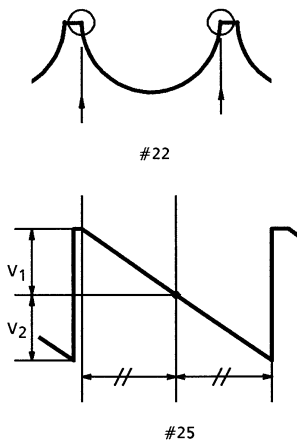
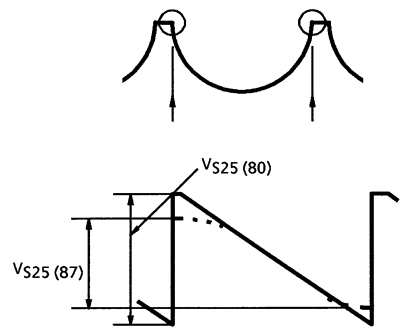


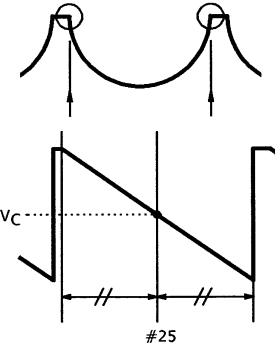

Field 1 to field 2


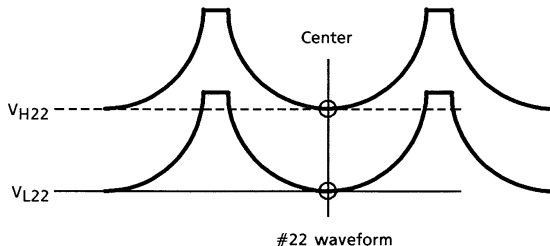
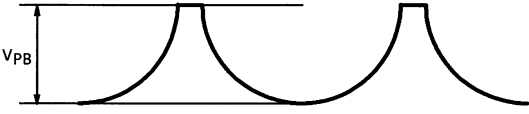


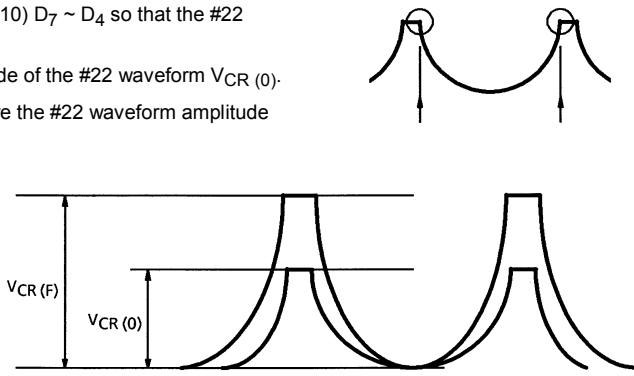
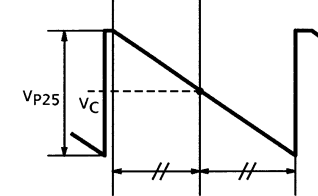
Deflection correction stage

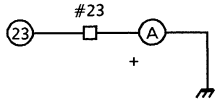
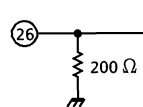
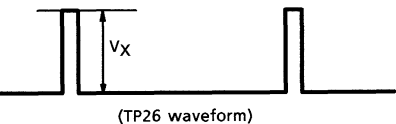
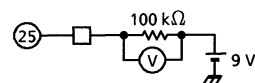
| NOTE | ITEM | SW MODE | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | |
|----------------|-------------------------------------|------------------|---|--|
| | | SW ₂₈ | MEASUREMENT METHOD | |
| G ₁ | Vertical Ramp Amplitude | A | Measure the amplitude of the vertical ramp wave on #27. |  <p>#27 waveform</p> |
| G ₂ | Vertical Amplification | A | Set #24 and #25 to open. Set the subaddress (0C) data to (81). |  |
| G ₃ | Vertical Amp Maximum Output Voltage | A | Connect #25 to an external power supply. When the voltage is varied from 5.5 V to 6.5 V, measure the vertical amplification on the #24 voltage. | |
| G ₄ | Vertical Amp Minimum Output Voltage | A | (G _V) (V _{H24}) (V _{L24}) | |
| G ₅ | Vertical Amp Maximum Output Current | A | Set #24 and #25 to open. Apply 7 V to #25 from an external source. Insert an ammeter between #24 and GND, and measure the current. |  |
| G ₆ | Vertical NF Sawtooth Wave Amplitude | A | Measure the amplitude of the #25 waveform (vertical sawtooth waveform). |  <p>#25 waveform</p> |
| G ₇ | Vertical Amplitude Range | A | When the subaddress (0C) data are set to (00) and (FC), measure the amplitudes of the #25 waveform (vertical sawtooth waveform) V _{P25} (00) and V _{P25} (FC). $V_{PH} = \pm \frac{V_{P25}(FC) - V_{P25}(00)}{V_{P25}(FC) + V_{P25}(00)} \times 100(\%)$ | |

| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9V$, $T_a = 25 \pm 3^\circ C$, BUS DATA = POWER-ON RESET) | |
|------|--|--|---|
| | | SW MODE SW ₂₈ | MEASUREMENT METHOD |
| G8 | Vertical Linearity Correction Maximum Value | A | <p>Set the subaddress (0E) data to (F8). Change the subaddress (10) D₇~D₄ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress (0E) data to (00). When the subaddress (0F) data are (80), measure the #25 waveform V_1 (80) and V_2 (80).</p> <p>Likewise, when the subaddress (0F) data are (00) and (F0), measure V_1 (00), V_2 (00), V_1 (F0), and V_2 (F0).</p> $V_I = \pm \frac{V_1(00) - V_1(F0) + V_2(F0) - V_2(00)}{2 \times (V_1(80) + V_2(80))}$  |
| | | | <p>Set the subaddress (0E) data to (F8). Change the subaddress (10) D₇~D₄ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress (0E) data to (00).</p> <p>When the subaddress (0E) data are (80), measure the amplitude of the #25 waveform V_{S25} (80).</p> <p>Likewise, when the subaddress (0E) data are (87), measure the amplitude of the #25 waveform V_{S25} (87).</p> $V_S = \pm \frac{V_{S25}(80) - V_{S25}(87)}{V_{S25}(80)} \times 100(\%)$  |

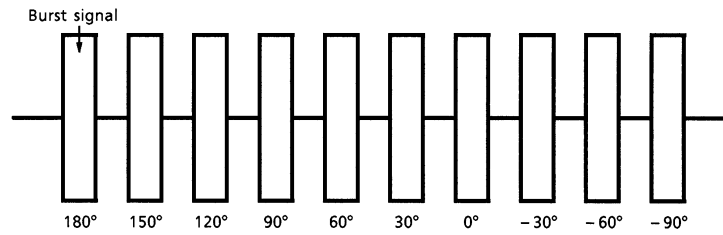
| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9V$, $T_a = 25 \pm 3^\circ C$, BUS DATA = POWER-ON RESET) | |
|-----------------|-----------------------------------|--|--|
| | | SW MODE SW ₂₈ | MEASUREMENT METHOD |
| G ₁₀ | Vertical NF Center Voltage | A | <p>Set the subaddress data (0E) to (F8). Change the subaddress (10) D₇~D₄ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress data (0E) to (00). Measure the center voltage V_C of the #25 waveform.</p>  |
| G ₁₁ | Vertical NF DC Change | A | <p>Under the conditions in G₁₀ above, set the subaddress (13) data to (80) and measure the vertical NF center voltage V_C (80).</p> <p>Next, set the subaddress (13) data to (00) and measure the vertical NF center voltage V_C (00).</p> $V_{DC} = \pm V_C(00) - V_C(80) \quad (V)$ |
| G ₁₂ | Vertical Amplitude EHT Correction | A | <p>Set the subaddress (0E) data to (F8). Change the subaddress (10) D₇~D₄ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress (0E) data to (00).</p> <p>Connect #28 to GND and measure the amplitude of the #25 waveform $V_{EHT}(0V)$.</p> <p>Connect #28 to a 5-V power supply and measure the amplitude of the #25 waveform $V_{EHT}(5V)$.</p> $V_{EHT} = \frac{V_{EHT}(5V) - V_{EHT}(0V)}{V_{EHT}(5V)} \times 100(\%)$  |

| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | |
|------|--|--|--|
| | | SW MODE SW ₂₈ | MEASUREMENT METHOD |
| G13 | E-W NF Maximum DC Value (Picture Width) | A | <p>Set the subaddress (0E) data to (F8). Change the subaddress (10) D₇~D₄ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress (0E) data to (00).</p> <p>Set the subaddress (0D) data to (00) and measure the #22 voltage V_{L22}.</p> <p>Set the subaddress (0D) data to (FC) and measure the #22 voltage V_{H22}.</p>  |
| G14 | E-W NF Minimum DC Value (Picture Width) | |  <p>#22 waveform</p> |
| G15 | E-W NF Parabola Maximum Value (Parabola) | A | <p>Set the subaddress (0D) data to (00) and the subaddress (0E) data to (F8).</p> <p>Measure the amplitude of the #22 waveform (parabola waveform) V_{PB}.</p>  <p>#22 waveform</p> |

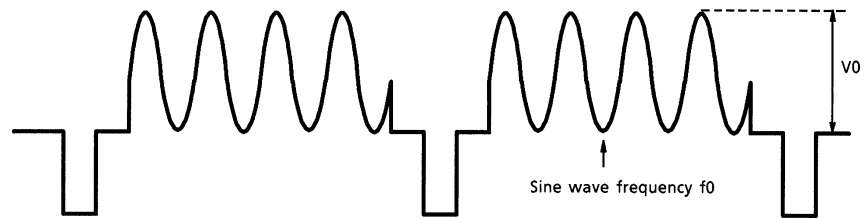
| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9V$, $T_a = 25 \pm 3^\circ C$, BUS DATA = POWER-ON RESET) | |
|------|-----------------------------------|--|---|
| | | SW MODE SW ₂₈ | MEASUREMENT METHOD |
| G16 | E-W NF Corner Correction (Corner) | A | <p>Set the subaddress (0E) data to (F8). Change the subaddress (10) $D_7 \sim D_4$ so that the #22 parabola waveform is symmetrical.</p> <p>Set the subaddress (10) $D_3 \sim D_0$ to (0) and measure the amplitude of the #22 waveform $V_{CR(0)}$. Likewise, when the subaddress (10) data are set to (F), measure the #22 waveform amplitude $V_{CR(F)}$.</p> $V_{CR} = V_{CR(F)} - V_{CR(0)}$  |
| G17 | Parabola Symmetry Correction | A | <p>Set the subaddress (14) data to (7F).</p> <p>Set the subaddress (10) data to (00) and measure the vertical NF center voltage of the #25 waveform $V_C(00)$. Likewise, when the subaddress (10) data are set to (FC), measure the #25 voltage $V_C(FC)$.</p> $V_{TR} = \pm \frac{V_C(00) - V_C(FC)}{2 \times V_{P25}} \times 100(\%)$  |

| NOTE | ITEM | TEST CONDITIONS (DEF $V_{CC} = 9\text{ V}$, $T_a = 25 \pm 3^\circ\text{C}$, BUS DATA = POWER-ON RESET) | |
|-----------------|--------------------------------|--|--|
| | | SW MODE SW ₂₈ | MEASUREMENT METHOD |
| G ₁₈ | E-W Amp Maximum Output Current | A | <p>Connect an ammeter between #23 and GND. Measure the current.</p>  |
| G ₁₉ | AGC Operating Current 1 | A | <p>Measure the TP26 waveform peak value. (V_{AGC0}) Set the subaddress (06) D₀ to (1) and repeat the measurement. (V_{AGC1})</p>  |
| G ₂₀ | AGC Operating Current 2 | A | <p>$I_{AGC0} = V_X \div 200\ (\mu\text{A})$ (I_{AGC1})</p>  |
| G ₂₁ | Vertical Guard Voltage | A | Set #25 to open. Connect an external power supply to #25. Decrease the voltage from 5 V. When full blanking is applied to #13, measure the voltage. |
| G ₂₂ | E / W Output Self-Diagnosis | A | <p>Connect a 5-V external power supply to #23. Read D₂ in bus read mode. ($V_{BUS\ EW_{OFF}}$) When the external power supply connected to #23 is disconnected, read D₂ in bus read mode. Ensure that an E / W waveform is output from #22. ($V_{BUS\ EW_{ON}}$)</p> |
| G ₂₃ | V-Out Output Self-Diagnosis | A | <p>Connect a 9-V external power supply to #24. Read D₃ in bus read mode. ($V_{BUS\ V_{OFF}}$) When the external power supply connected to #24 is disconnected, read D₃ in bus read mode. Ensure that a V-out waveform is output from #25. ($V_{BUS\ V_{ON}}$)</p> |
| G ₂₄ | Vertical Blanking Check | A | <ol style="list-style-type: none"> Set the subaddress (0C) data to (81). When the subaddress (11) D₄~D₀ are changed from 0000 to 1111, check that the #13 blanking stop phase begins. (V_{BLK1}) When the subaddress (12) D₄~D₀ are changed from 0000 to 1111, check that the #13 blanking start phase begins. (V_{BLK2}) |
| G ₂₅ | V Centering DAC Output | A | <ol style="list-style-type: none"> Set the subaddress (13) data to (00) and measure the #21 voltage V_{21L}. Set the subaddress (13) data to (80) and measure the #21 voltage V_{21M}. Set the subaddress (13) data to (FE) and measure the #21 voltage V_{21H}. |
| G ₂₆ | V NFB Pin Input Current | A | <p>Connect a 9-V V_{CC} via a 100-kΩ resistor to #25. Measure the sink current on #25 according to the voltage difference of the 100-kΩ resistance. $I_{25} = V / 100\text{ k}\Omega$</p>  |

1) Input signal C-1



2) Input signal C-2

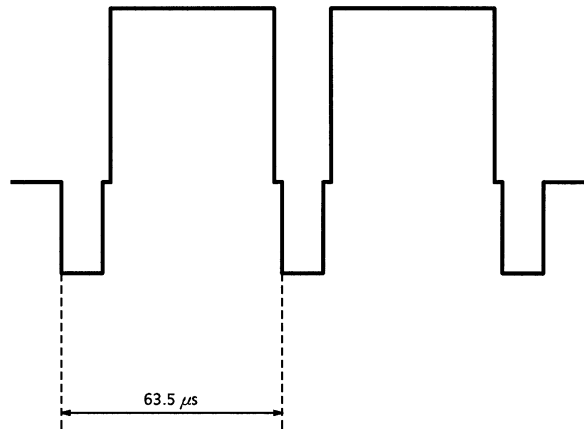


3) Input signal C-3

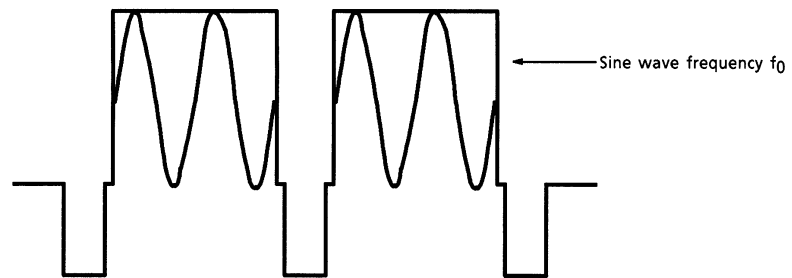


Fig.C Test signals for TA1310ANG chroma, color difference, and Y stage

1) Video signal



2) Input signal 1



3) Input signal 2

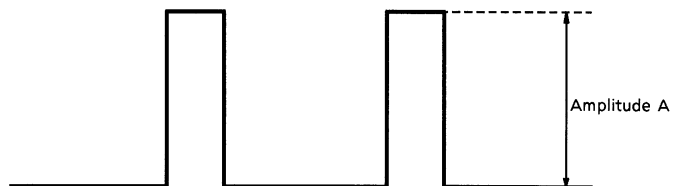


Fig.T-1 Test signals for TA1310ANG text stage

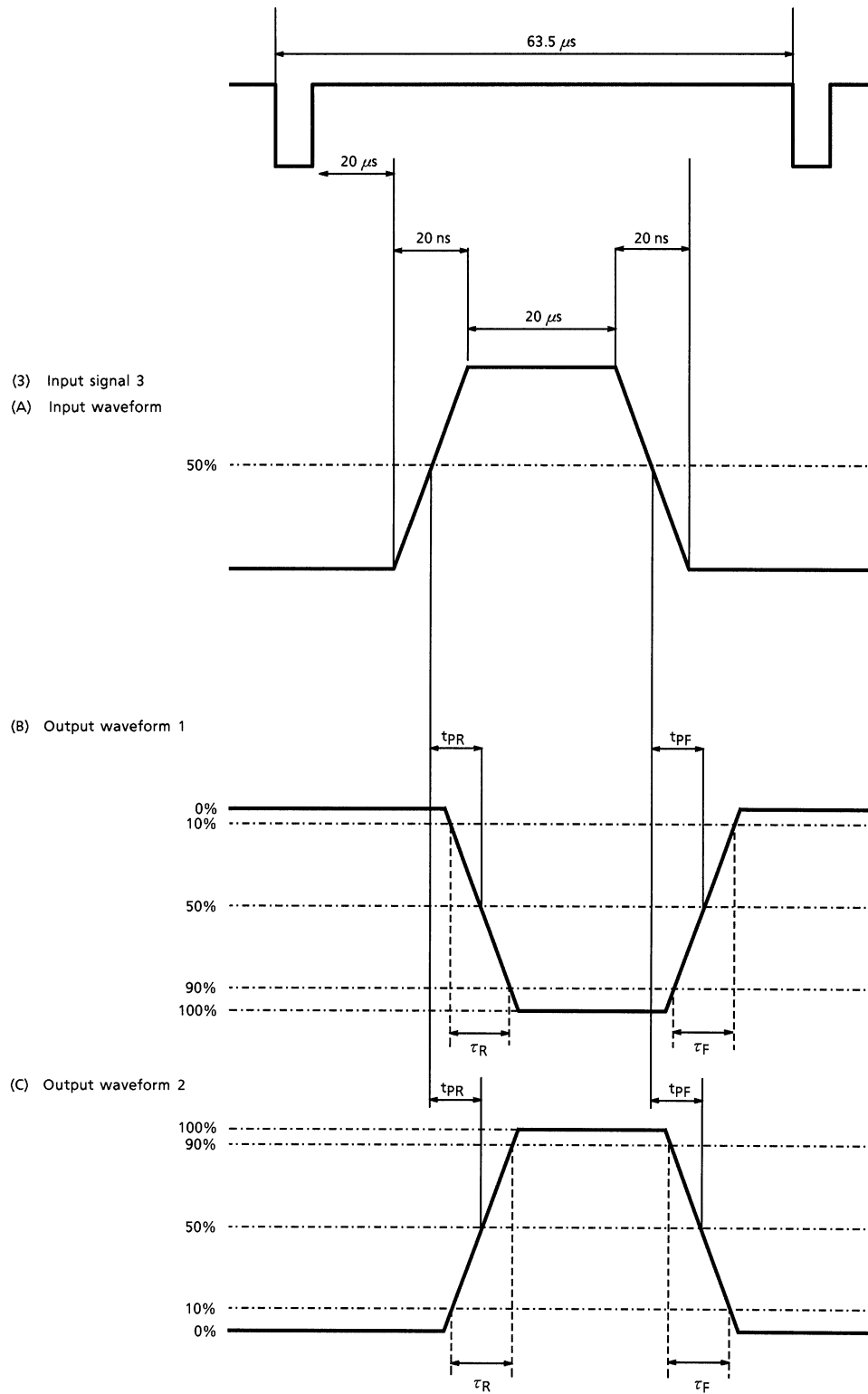
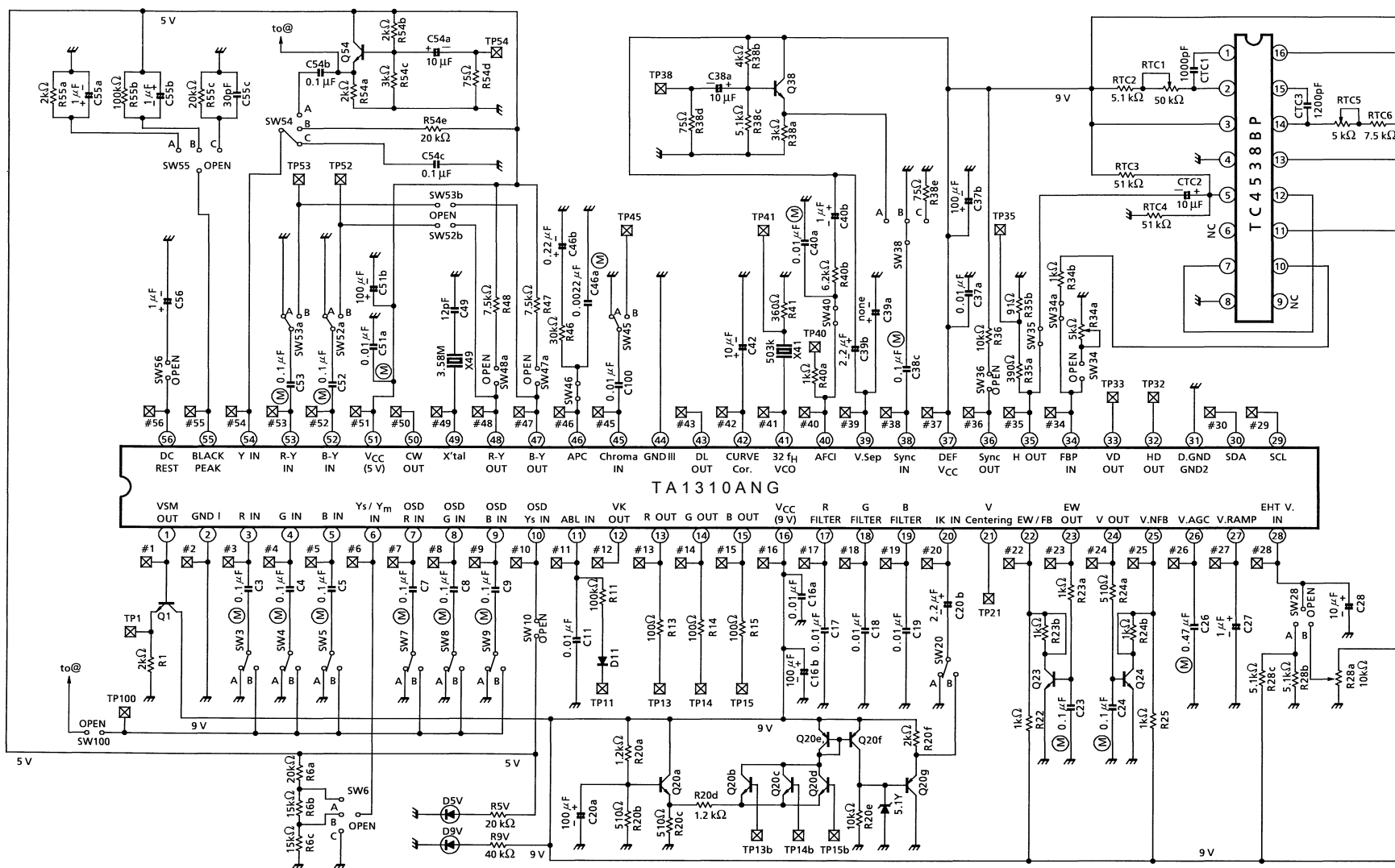


Fig.T-2 Test pulses for TA1310ANG text stage

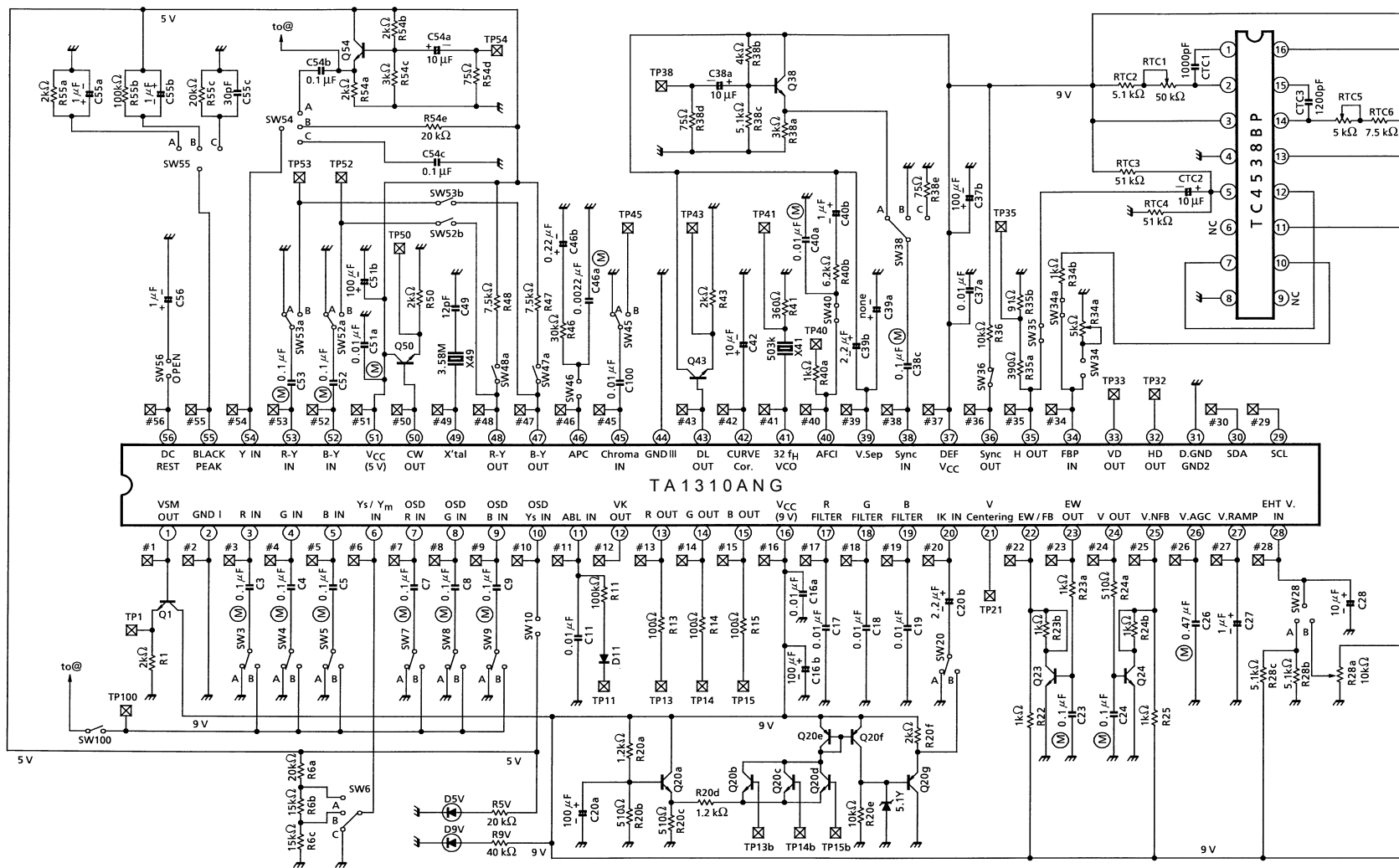
TEST CIRCUIT

DC



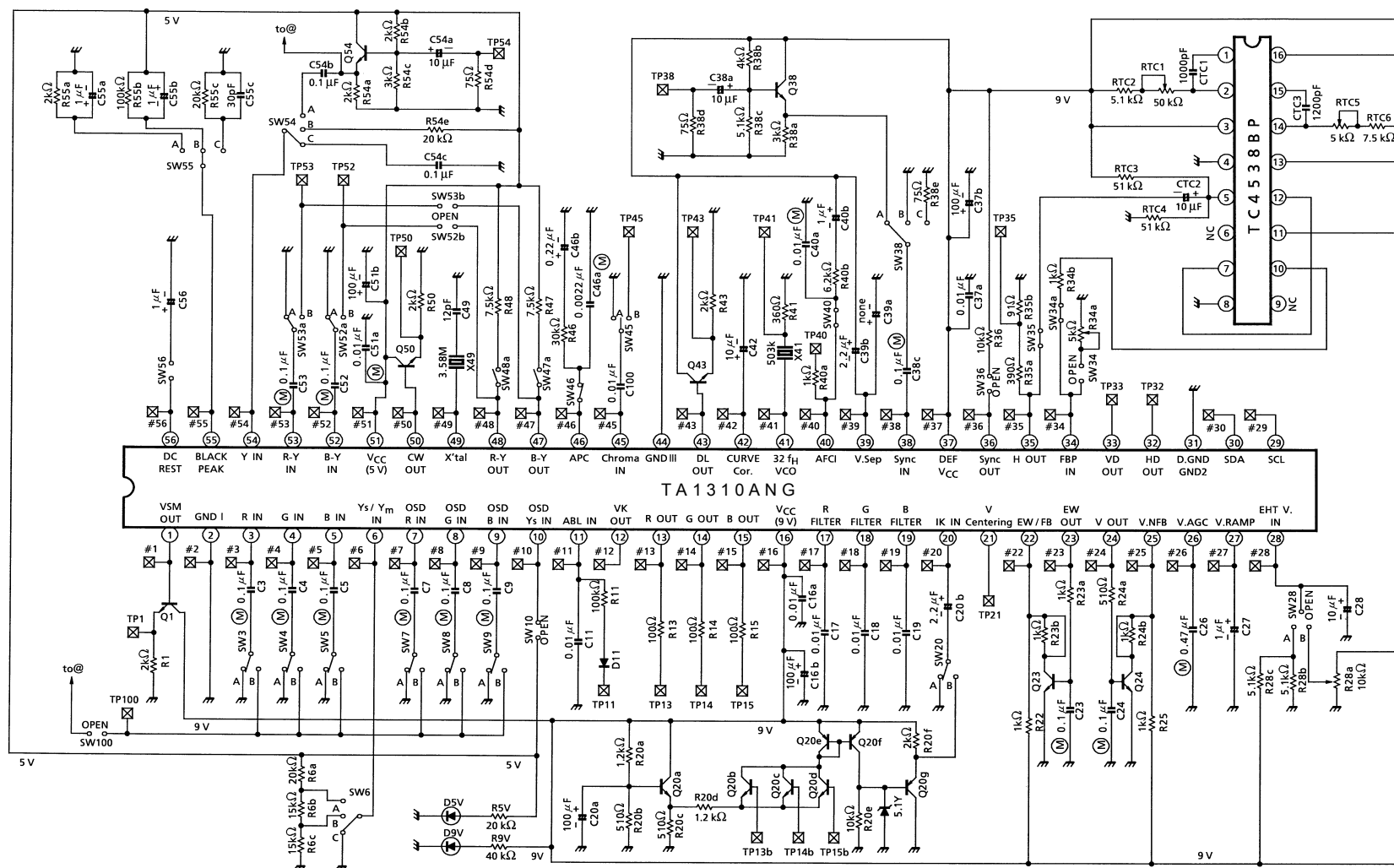
TEST CIRCUIT

AC characteristics for picture sharpness stage



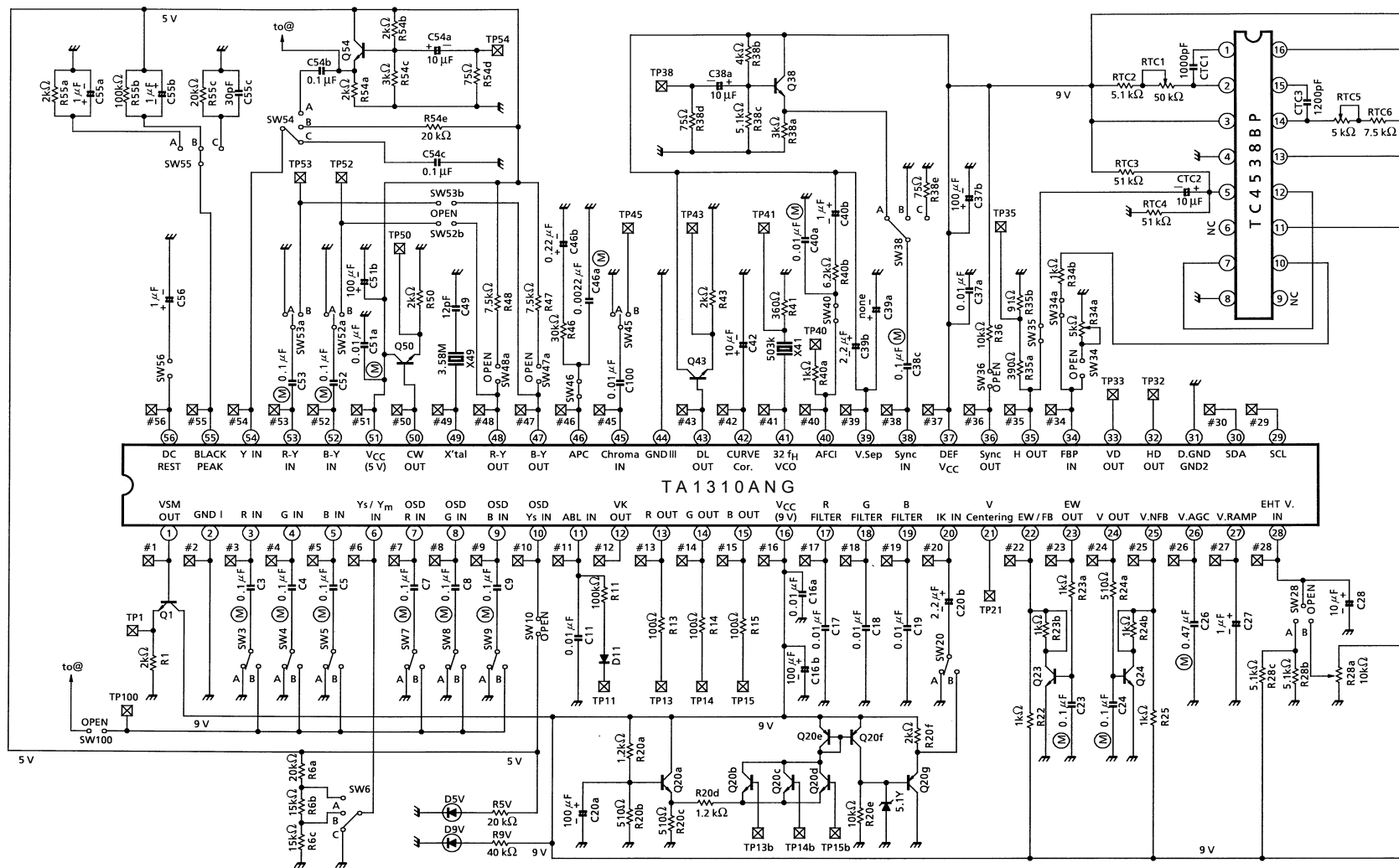
TEST CIRCUIT

Chroma stage



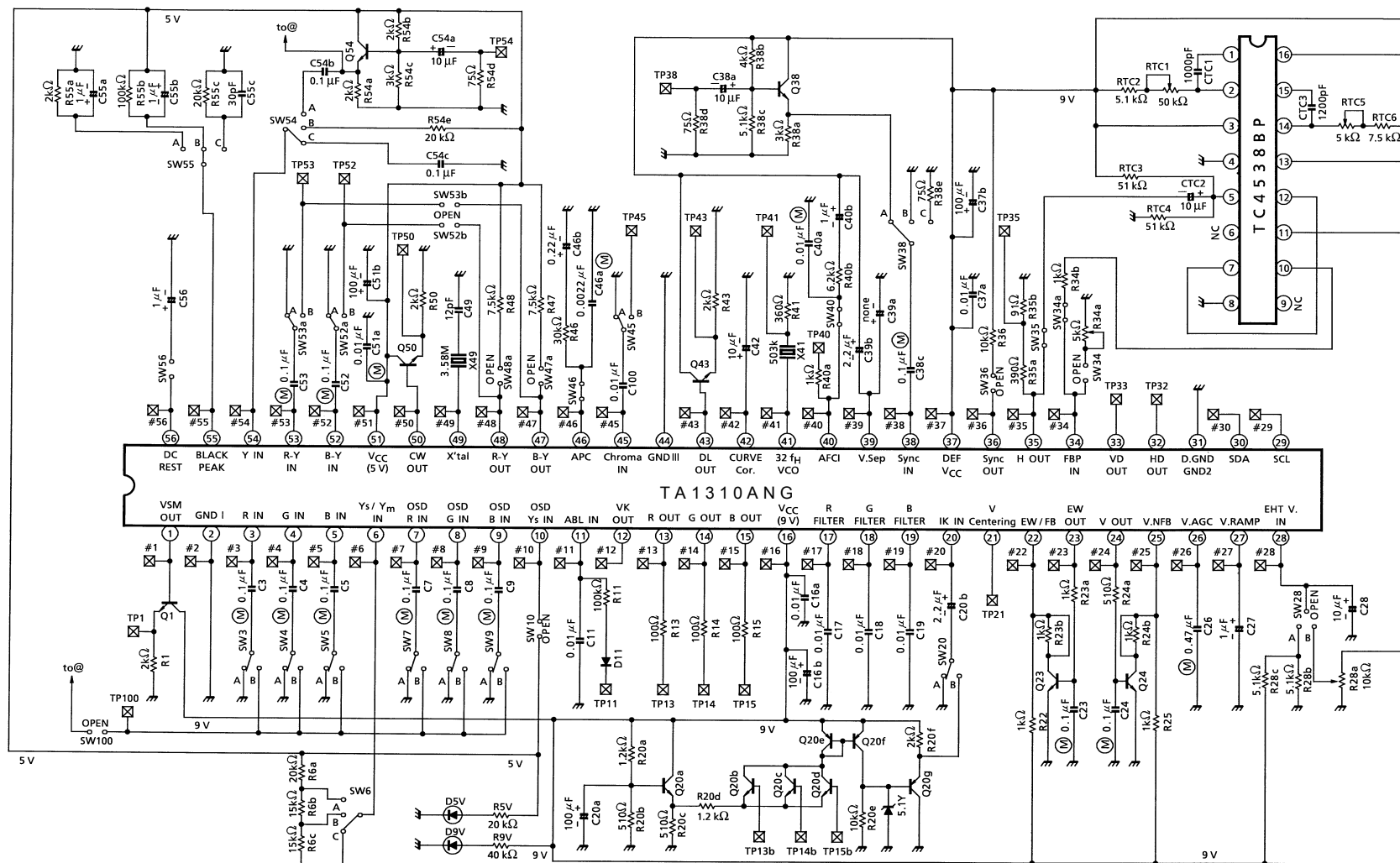
TEST CIRCUIT

Color difference stage



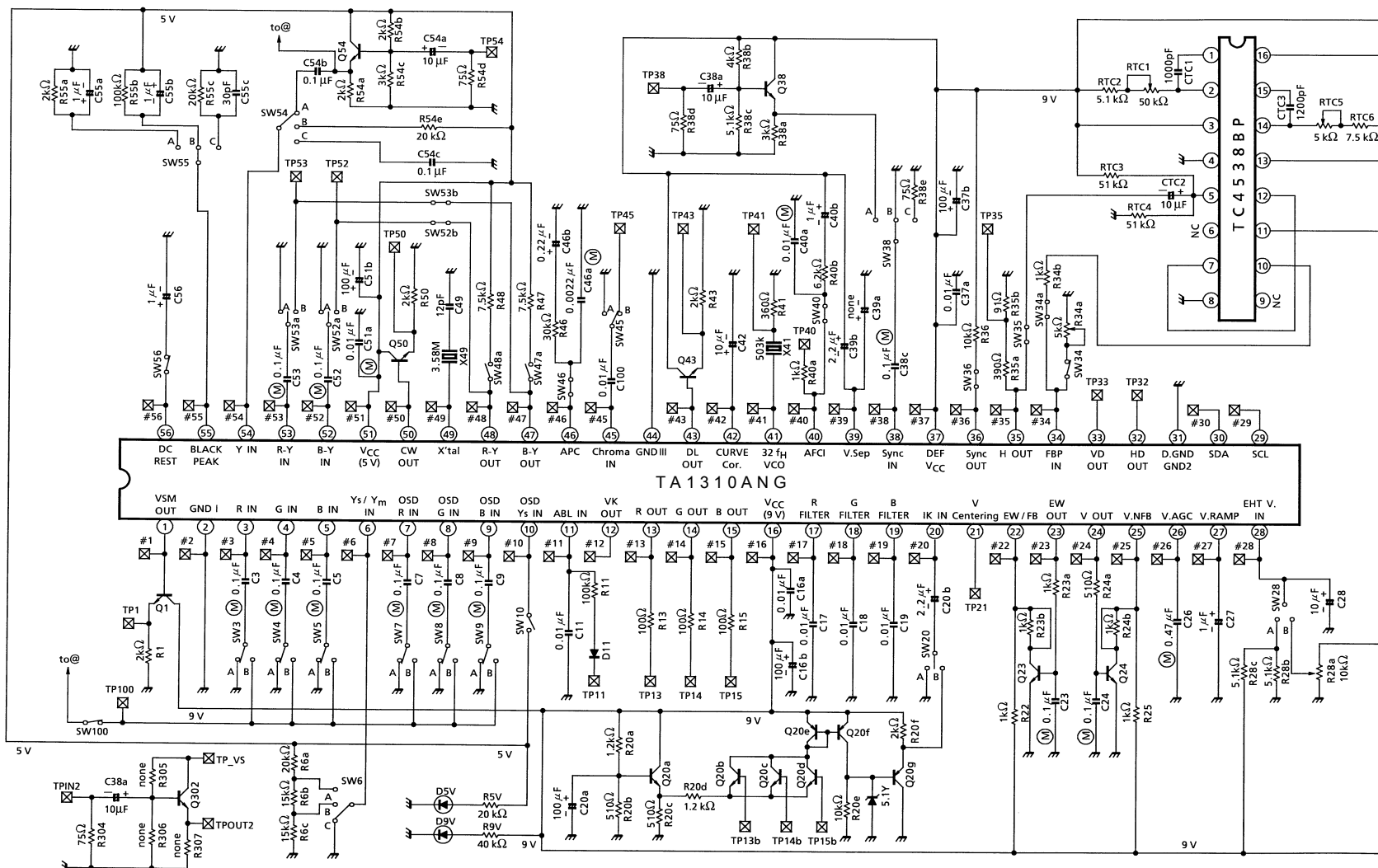
TEST CIRCUIT

Y stage

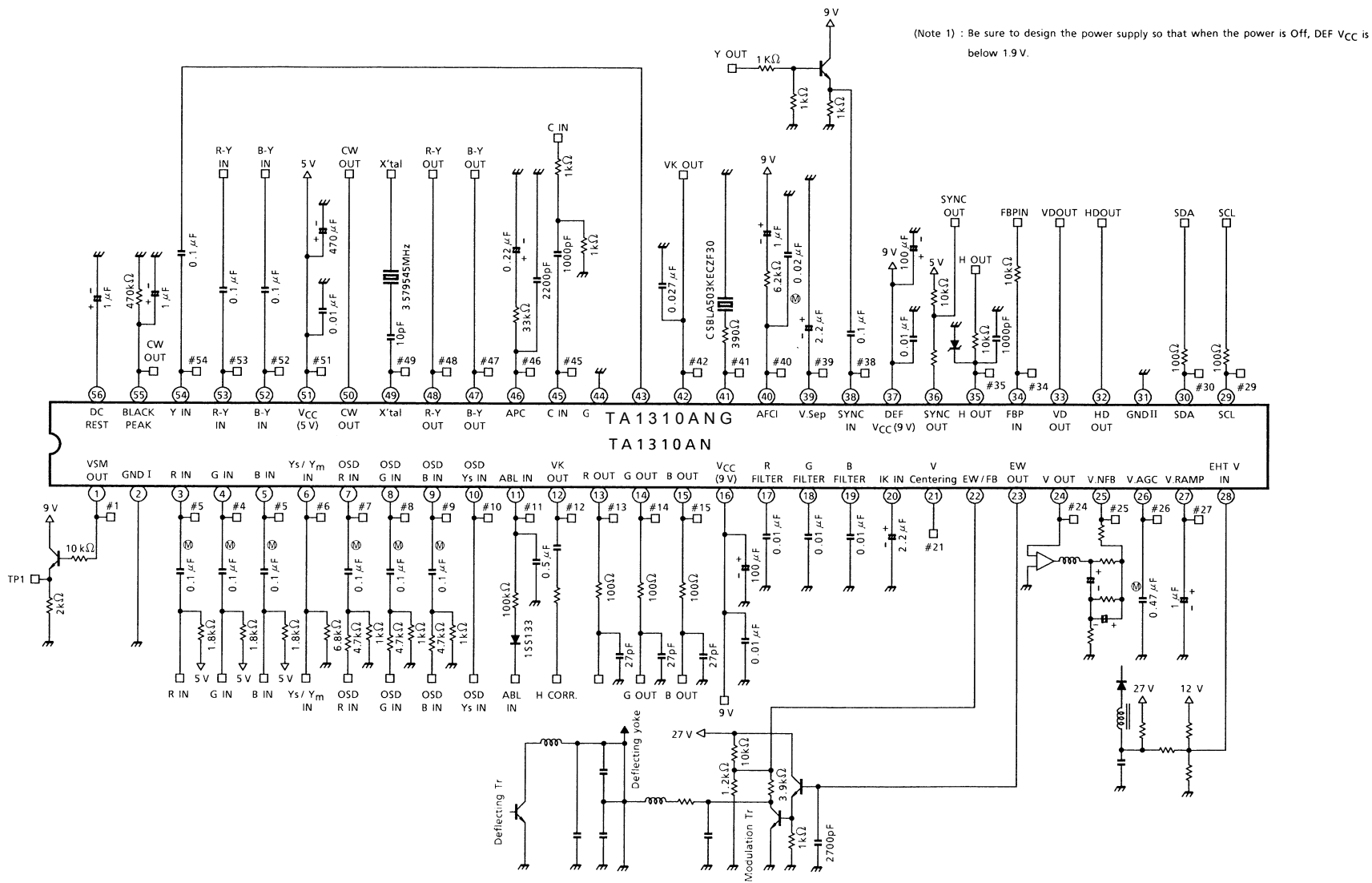


TEST CIRCUIT

Deflection stage and deflection correction stage



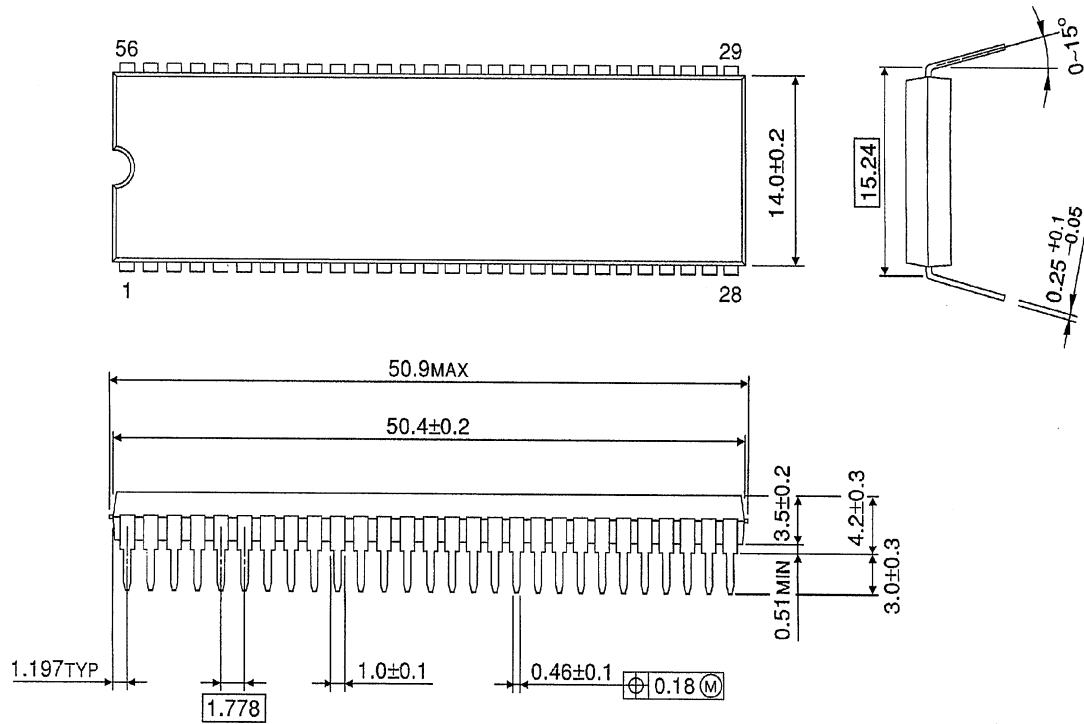
APPLICATION CIRCUIT



PACKAGE DIMENSIONS

SDIP56-P-600-1.78

Unit : mm



Weight: 5.55 g (Typ.)

About solderability, following conditions were confirmed

- Solderability

- (1) Use of Sn-63Pb solder Bath

- solder bath temperature = 230°C
 - dipping time = 5 seconds
 - the number of times = once
 - use of R-type flux

- (2) Use of Sn-3.0Ag-0.5Cu solder Bath

- solder bath temperature = 245°C
 - dipping time = 5 seconds
 - the number of times = once
 - use of R-type flux

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030619EBA

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