

Preliminary

Bi-CMOS Integrated Circuit Silicon Monolithic

TB1239BF

Luminance, Chroma and Synchronizing Signals Processor IC for PAL/NTSC/SECAM
COLOR TV

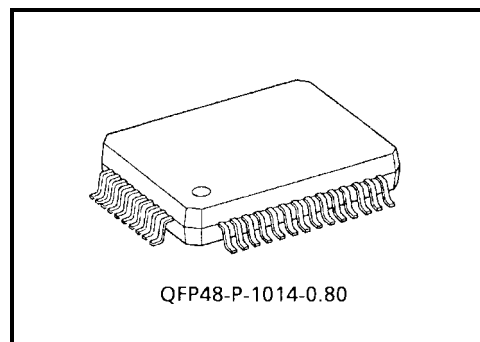
TB1239BF integrates luminance, chroma and synchronizing signals processing circuits for PAL/NTSC/SECAM color TV system.

TB1239BF incorporates high performance picture quality compensation circuits in luminance section, an automatic PAL/NTSC/SECAM discrimination and decode circuits in chroma section, and an automatic 50/60 Hz discrimination circuit in synchronizing section.

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

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

Also, TB1239BF makes it possible to set and to control various functions through the built-in I²C BUS line.



Weight: 0.83 g (typ.)

Features

Luminance Section

- Built-in chroma trap filter
- Black stretch circuit
- DC restoration circuit
- Y delay line
- Sharpness control
- Sub-Contrast control (-/+2dB)
- Black set-up for PAL plus

Chroma Section

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

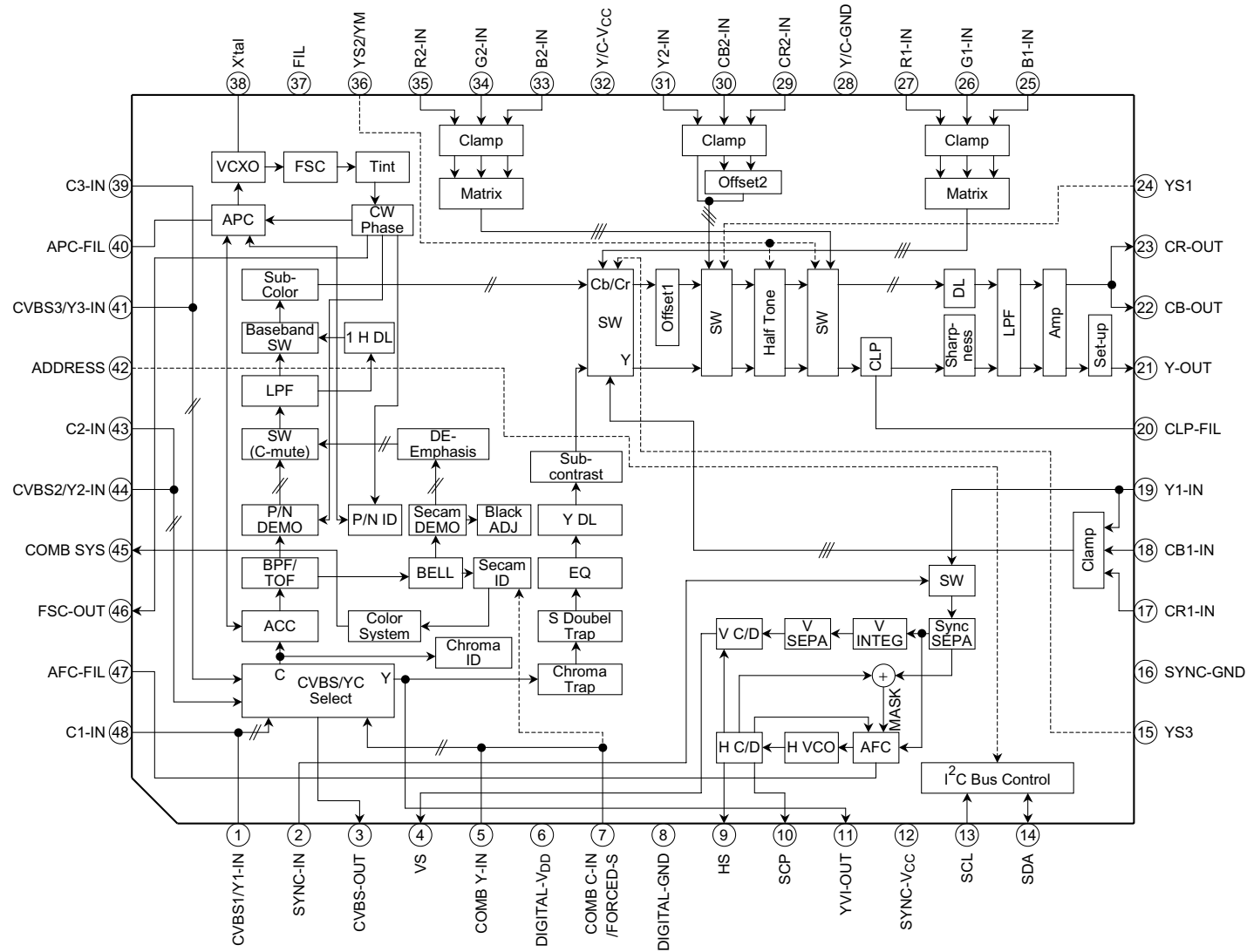
Synchronizing Section

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

Others

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

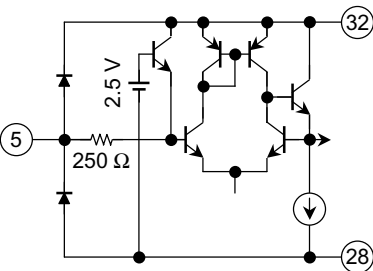
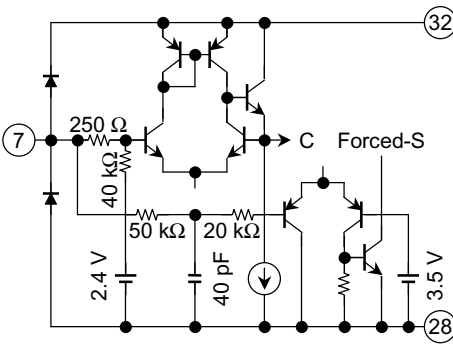
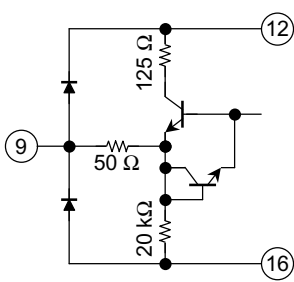
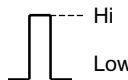
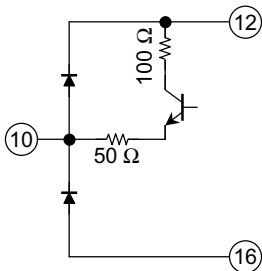
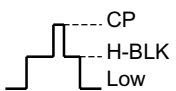
Block Diagram



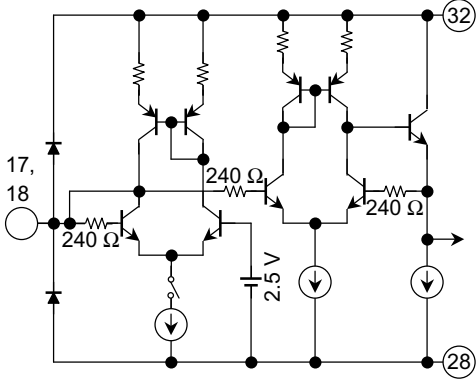
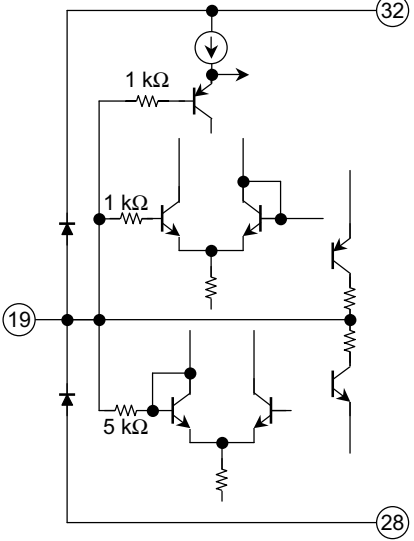
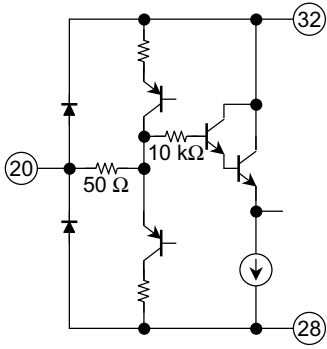
Terminal Descriptions

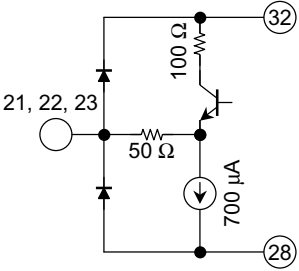
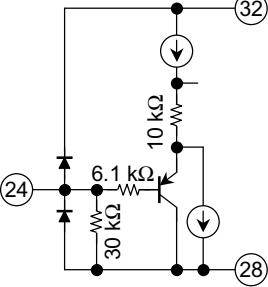
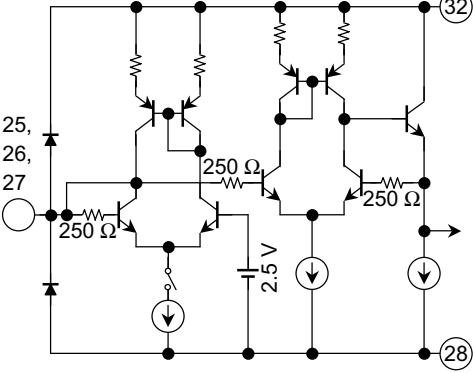
(YC – V_{CC}/SYNC – V_{CC}/D – V_{DD} = 5 V and Ta = 25°C, unless otherwise specified)

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|-------------|---|-------------------|--|
| 1 | CVBS1/Y1-IN | Input CVBS1/Y1 signal through a clamping capacitor. | | CVBS: 1 V _{p-p} Y: 1 V _{p-p} (with sync) DC: 1.8 V |
| 2 | SYNC-IN | Input signal to synchronize. | | 1 V _{p-p} (with sync) DC: 1.7 V |
| 3 | CVBS-OUT | CVBS or Y + C signal output pin. | | 2 V _{p-p} (with sync) DC: 0.6 V |
| 4 | VS | Output pin of vertical synchronizing signal. Minimum pull-up resistor is 6.8 kΩ. | | 4.7 V ≤ Hi ≤ 5.2 V 0 V ≤ Low ≤ 0.8 V |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|---------------------|---|--|---|
| 5 | COMB Y-IN | Input luminance signal from Comb filter through a clamping capacitor. |  | 1 V _{p-p} (with sync) DC: 1.8 V |
| 6 | D-V _{DD} | Power supply pin for DDS/BUS/V-CD/H-CD sections. | — | DC 5 V |
| 7 | COMB C-IN /FORCED-S | Input chroma signal from Comb filter through a clamping capacitor. When this pin is connected to V _{CC} , color killer is OFF and SECAM ID is ON forcibly. (forced SECAM mode) Refer to FUNCTION DESCRIPTION. |  | 0.3 V _{p-p} (burst) DC: 2.4 V 4.0 V ≤ Forced-S ≤ 5.0 V (Th: 3.5 V) |
| 8 | D-GND | GND pin for DDS/BUS/V-CD/H-CD sections. | — | |
| 9 | HS | Output pin of horizontal synchronizing signal. Minimum pull-down resistor is 2.7 kΩ. |  |  3.8 V ≤ Hi ≤ 4.6 V 0 ≤ Low ≤ 1.0 V |
| 10 | SCP | Sand Castle Pulse output pin. The clamping pulse and the horizontal blanking pulse are outputted. |  |  3.6 V ≤ CP ≤ 4.4 V 1.6 V ≤ H-BLK ≤ 2.4 V 0.0 V ≤ Low ≤ 0.8 V with pull-down resistor (7.5 kΩ) |

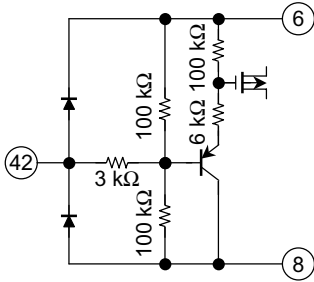
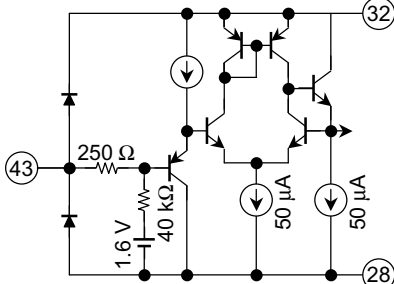
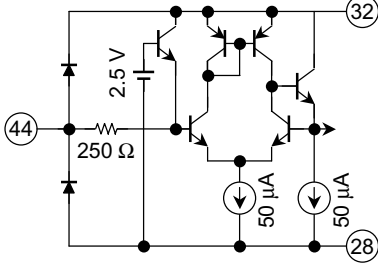
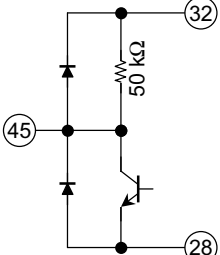
| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|----------------------|---|-------------------|---|
| 11 | Yvi-OUT | Output pin to synchronize inputs. Y signal from video-SW is outputted. | | 1 V _{p-p} (with sync) DC: 2.1 V |
| 12 | SYNC-V _{CC} | Power supply pin for liner SYNC/HVCO sections. | — | DC 5 V |
| 13 | SCL | SCL pin for I ² C BUS. | | |
| 14 | SDA | SDA pin for I ² C BUS. | | |
| 15 | YS3 (RGB1-in) | Pin to switch main signals and RGB1 signals. If the voltage of this pin is HI and the RGB1-ENB data is "enable" via I ² C BUS, RGB1-IN is selected. And its status is responded to the Read Bus data. | | 1.0 V ≤ RGB1 ≤ 5.0 V (Th: 0.7 V) |
| 16 | SYNC-GND | GND pin for liner SYNC/HVCO sections. | — | |

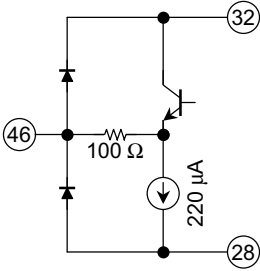
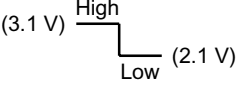
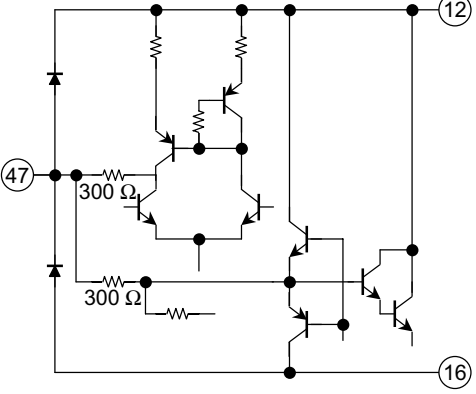
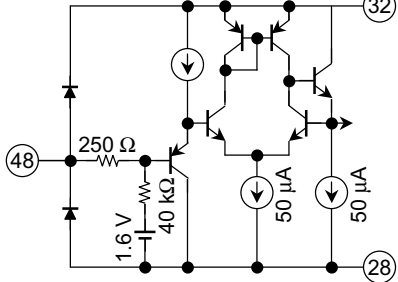
| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|----------|---|--|--|
| 17 | Cr1-IN | Input Y/Cb1/Cr1 signal through a clamping capacitor. (selected by I ² C BUS.) When Y/Cb/Cr1-IN is active, Y1 signal is synchronized. |  | Y: 1 V _{p-p} (with sync) DC: 1.7 V Cb/Cr: 0.7 V _{p-p} (100% color bar) DC: 2.5 V |
| 18 | Cb1-IN | | | |
| 19 | Y1-IN | |  | |
| 20 | CLP-FIL | Connect a filter for clamping Y signal. |  | |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|--------------------|---|---|--|
| 21 | Y-OUT | Y/Cb/Cr output pins. The output's amplitudes is variable from 0.5 to 1.6 V _{p-p} by I ² C BUS. |  | DC; Y: 1.3 V, Cb/Cr: 1.8 V AC; Y: 0.7 V _{p-p} (0 dB, non-sync) Cb/Cr: 0.7 V _{p-p} (0 dB) |
| 22 | Cb-OUT | | | |
| 23 | Cr-OUT | | | |
| 24 | YS1 (YCbCr2-in) | Pin to switch main signals and YCbCr2 signals. |  | $1.0\text{ V} \leq \text{YCbCr2} \leq 5.0\text{ V}$ (Th: 0.7 V) |
| 25 | B1-IN | Input RGB1 signal through a clamping capacitor. (selected by YS3 and I ² C BUS.) |  | 0.7 V _{p-p} DC: 2.5 V |
| 26 | G1-IN | | | |
| 27 | R1-IN | | | |
| 28 | Y/C-GND | GND pin for Y/C/Text/Video-SW/ 1 H DL sections. | — | |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|---------------------|--|-------------------|--|
| 29 | Cr2-IN | Input Y2/Cb2/Cr2 signal through a clamping capacitor. (selected by YS1.) | | Y: 1 V _{p-p} (with sync) DC: 1.7 V Cb/Cr: 0.7 V _{p-p} (100% color bar) DC: 2.5 V |
| 30 | Cb2-IN | | | |
| 31 | Y2-IN | | | |
| 32 | Y/C-V _{CC} | Power supply pin for Y/C/Text/Video-SW/1HDL sections. | — | DC 5 V |
| 33 | B2-IN | Input RGB2 signal through a clamping capacitor. (selected by YS2.) | | 0.7 V _{p-p} DC: 2.5 V |
| 34 | G2-IN | | | |
| 35 | R2-IN | | | |
| 36 | YS2/YM (RGB2-in) | Pin to switch main signals and RGB2 inputs. Half-tone ON/OFF SW is also included. Half tone gain is selected by I ² C BUS. | | 1.0 V ≤ YM ≤ 1.5 V 2.5 V ≤ RGB2 ≤ 5.0 V (Th1: 0.7 V, Th2: 2.0 V) |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|-------------|--|-------------------|--|
| 37 | FIL | Connect this terminal to Y/C V _{CC} . | — | — |
| 38 | X'TAL | Pin to connect a 16.2 MHz crystal. Recommended crystal: NR-18 NT162020A, made by NIHON DENPA KOGYO CO, LTD. | | 16.2 MHz wave |
| 39 | C3-IN | Input C3 signal through a clamping capacitor. | | 0.3 V _{p-p} (burst) DC: 1.6 V |
| 40 | APC-FIL | Connect APC filer. | | |
| 41 | CVBS3/Y3-IN | Input CVBS3/Y3 signal through a clamping capacitor. | | CVBS: 1 V _{p-p} Y: 1 V _{p-p} (with sync) DC: 1.8 V |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals | | | | | | | | | | | | | | | |
|---------------------|-----------------|---|--|---|-----------------|-----------------|-----|-----------------|---------------------|-----------------|--|---|-----|------|-------|------|------|--|-----------------------------|
| 42 | ADDRESS | <p>Slave address setting pin. Select slave address. When this pin is open, 8A/8B_H is selected.</p> <table border="1"><tr><td>W</td><td>88_H</td><td>8A_H</td><td>8E_H</td></tr><tr><td>R</td><td>89_H</td><td>8B_H</td><td>8F_H</td></tr></table> | W | 88 _H | 8A _H | 8E _H | R | 89 _H | 8B _H | 8F _H |  | <p>88/89_H ≤ 1.3 V 3.9 V ≤ 8E/8F_H (Th1: 1.5 V, Th2: 3.2 V)</p> | | | | | | | |
| W | 88 _H | 8A _H | 8E _H | | | | | | | | | | | | | | | | |
| R | 89 _H | 8B _H | 8F _H | | | | | | | | | | | | | | | | |
| 43 | C2-IN | Input C2 signal through a clamping capacitor. |  | <p>0.3 V_{p-p} (burst) DC: 1.6 V</p> | | | | | | | | | | | | | | | |
| 44 | CVBS2/Y2-IN | Input CVBS2/Y2 signal through a clamping capacitor. |  | <p>CVBS: 1 V_{p-p} Y: 1 V_{p-p} (with sync) DC: 1.8 V</p> | | | | | | | | | | | | | | | |
| 45 | COMB SYS | <p>The status of color system is responded to pin 45 and pin 46. It is the same as Read BUS status.</p> <table border="1"><tr><th>Color System</th><th>Pin 45</th><th>Pin 46</th></tr><tr><td>M-PAL</td><td>Low</td><td>Low</td></tr><tr><td>4.43PAL, SECAM, B/W</td><td>High</td><td>Low</td></tr><tr><td>3.58/4.43 NTSC</td><td>Low</td><td>High</td></tr><tr><td>N-PAL</td><td>High</td><td>High</td></tr></table> <p>Refer to FUNCTION DESCRIPTION.</p> | Color System | Pin 45 | Pin 46 | M-PAL | Low | Low | 4.43PAL, SECAM, B/W | High | Low | 3.58/4.43 NTSC | Low | High | N-PAL | High | High |  | <p>5 V High Low 0 V</p> |
| Color System | Pin 45 | Pin 46 | | | | | | | | | | | | | | | | | |
| M-PAL | Low | Low | | | | | | | | | | | | | | | | | |
| 4.43PAL, SECAM, B/W | High | Low | | | | | | | | | | | | | | | | | |
| 3.58/4.43 NTSC | Low | High | | | | | | | | | | | | | | | | | |
| N-PAL | High | High | | | | | | | | | | | | | | | | | |

| Pin No. | Pin Name | Function | Interface Circuit | Input/Output Signals |
|---------|----------|---|--|--|
| 46 | Fsc-OUT | Sub-carrier output pin. Refer to FUNCTION DESCRIPTION. |  | AC: $0.84 V_{p-p}$ DC: as blow figure.  |
| 47 | AFC-FIL | Connect AFC filter. |  | |
| 48 | C1-IN | Input C1 signal through a clamping capacitor. |  | $0.3 V_{p-p}$ (burst) DC: 1.6 V |

Write Mode

Slave Address: 88_H/8A_H/8E_H

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

Read Mode

Slave Address: 89_H/8B_H/8F_H

| Sub Address | MSB D7 | D6 | D5 | D4 | D3 | D2 | D1 | LSB D0 |
|-------------|-----------|--------------|------|-------|-----|---------|---------|-----------|
| 00 | POR | COLOR SYSTEM | | X'TAL | | N-DET | | H-LOCK |
| 01 | V-FREQ | V-STD | C ID | V-SIG | V15 | (note1) | (note1) | 0 |

Note1: Don't care

Bus Control Function
Write Mode
Slave Address: 88_H/8A_H/8E_H

| Item/Number of Bits | Function | Variable Range | Preset |
|----------------------------|--|--|-----------------------|
| TINT/ | TINT adjustment for NTSC | 00H: -33 deg to 3F H: +33 deg (1LSB = 1.1 deg) | 0 deg |
| P/N GW/ | PAL/NTSC gate width | 0: 2.0 μ s, 1: 3.2 μ s | 2.0 μ s |
| P/N ID/ | PAL/NTSC sensitivity SW | 0: Normal, 1: Low | Normal |
| SUB-COLOR/ | Sub-color control | 0 H: -2 dB to F H: 2 dB | 0 dB |
| SUB-CONTRAST/ | Sub-contrast control | 0 H: -2 dB to F H: 2 dB | 0 dB |
| SHARPNESS f ₀ / | Sharpness center frequency changing | 00: 2.5 MHz, 01: 3.2 MHz 10: 4.0 MHz, 11: OFF | 2.5 MHz |
| SHARPNESS EQ/ | Sharpness equalizer characteristic (evaluation with 2T-pulse) | 00: 1: 1.2, 01: 1: 1 10: 1.2: 1, 11: 1.4: 1 | 1: 1.2 |
| SHARPNESS GAIN/ | Sharpness gain control | 0 H: -6 dB to F H: 6 dB | 0 dB |
| Y-OUT LEVEL/ | Y output level control (pin 21) | 00 H: 0.5 to 3 F H: 1.6 V _{p-p} | 1.05 V _{p-p} |
| BS POINT/ | Black Stretch start point changing | 00: OFF (by-pass), 01: 20 IRE 10: 30 IRE, 11: 40 IRE | OFF |
| C-OUT LEVEL/ | Cb/Cr output level control (pin 22/23) | 00 H: 0.5 to 3 F H: 1.6 V _{p-p} | 1.05 V _{p-p} |
| DC REST/ | DC restoration ratio adjustment | 00: 100%, 01: 95% 10: 90%, 11: 85% | 100% |
| BPF f ₀ / | BPF/TOF f ₀ adjustment | 00: -400 kHz, 01: +0 kHz, 10: +400 kHz, 11: OFF (by-pass) | -400 kHz |
| BPF Q/ | BPF/TOF Q adjustment | 00: 1.0, 01: 1.5 10: 2.0, 11: 2.5 | 1.0 |
| FILTER SW/ | BPF/TOF switch | 0: BPF, 1: TOF | BPF |
| C-TRAP SW/ | Chroma trap switch | 0: ON, 1: OFF | ON |
| S-D TRAP/ | SECAM double trap switch | 0: OFF, 1: ON | OFF |
| LPF/ | Y/Cb/Cr LPF switch | 0: ON, 1: OFF (by-pass) | ON |
| COLOR SYSTEM/ | Color system switching Europe automatic mode; 4.43PAL, 4.43NTSC, 3.58NTSC, SECAM South America automatic mode; 3.58NTSC, M-PAL, N-PAL Refer to FUNCTION DESCRIPTION. | 000: Europe automatic 001: South America automatic 010: 3.58 NTSC 011: 4.43 NTSC 100: 4.43 PAL 101: SECAM 110: M-PAL, 111: N-PAL | Europe automatic |
| Y-DL/ | Y-DL time adjustment (1LSB = 40 ns) Refer to FUNCTION DESCRIPTION. | 0000: 120 to 1010: 520 ns 1011 to 1111: don't use | 320 ns |
| N-COMB/ | 1 H addition switch, when NTCS. | 0: OFF, 1: ADD | OFF |
| VIDEO SELECT/ | Selection of input video signals | Refer to FUNCTION DESCRIPTION. | 0000 |
| RGB SELECT/ | Selection of input sources. Refer to FUNCTION DESCRIPTION. | 00: Main, 01: YCbCr1 10: RGB1, 11: don't use | Main |
| HALF TONE/ | Half tone gain switch | 0: -10 dB, 1: -6 dB | -10 dB |

| Item/Number of Bits | Function | Variable Range | Preset |
|-----------------------|---|--|---------------------|
| Cb/Cr-MUTE/ | Cb/Cr output mute switch | 0: OFF, 1: ON | OFF |
| Cb/Cr OFFSET1/ / | Cb/Cr offset adjustment (main route) | 0 H: -12 to F H: +10.5 mV | 0 mV |
| Cb/Cr OFFSET2/ / | Cb/Cr offset adjustment (YCbCr2 input) | 0 H: -12 to F H: +10.5 mV | 0 mV |
| V-FREQ/ | V count down frequency switch. Automatic mode 1; 50/60 Hz automatic distinction. At no-signal, the last statement is kept. Right after power-on, 50 Hz mode is run. Automatic mode 2; 50/60 Hz automatic distinction. And 50 Hz mode is run at no-signal. Refer to FUNCTION DESCRIPTION. | 000: Automatic mode 1, 001: 50 Hz, 010: 60 Hz, 011: Automatic mode 2, 100: Forced 312.5 H (AFC free-run), 101: Forced 262.5 H (AFC free-run), 110: Forced 313 H (AFC free-run), 111: Forced 263 H (AFC free-run) | Automatic mode 1 |
| V C/D MODE/ | V count down judge switch. Refer to FUNCTION DESCRIPTION. | 00: Normal, 01: Teletext, 10: Fast, 11: Normal | Normal |
| AFC GAIN/ | AFC sensitivity switch | 00: +6 dB, 01: 0 dB, 10: -6 dB, 11: -17 dB | +6 dB (data: 00) |
| MVM/ | Macrovision Mask + AFC Mask | 0: Narrow, 1: Always masked | Narrow |
| S R-Y ADJ/ | SECAM R-Y black adjustment | 0 H: -10 to F H: 8.8 mV | 0 mV |
| S B-Y ADJ/ | SECAM B-Y black adjustment | 0 H: -10 to F H: 8.8 mV | 0 mV |
| BELL/HPF/ | SECAM bell/HPF switching. Or the high frequency side on SECAM bell filter is boosted. Refer to FUNCTION DESCRIPTION. | 00: Bell, 01: Boost 1, 10: Boost 2, 11: HPF | Bell |
| BELL f ₀ / | BELL f ₀ adjustment | 0: Normal, 1: +15 kHz | Normal |
| S V-ID SW/ | SECAM V-ID switch | 0: OFF, 1: ON | OFF |
| S GP/ | SECAM gate position adjustment (its width is same) | 00: Normal, 01: 0.4 μs delay, 10: Normal, 11: 0.4 μs forward | Normal |
| S ID/ | SECAM sensitivity switch | 0: Normal, 1: Low | Normal |
| S-INHBT/ | SECAM inhibition switch | 0: Normal, 1: Inhibited | Normal |
| RGB1 ENB/ | Enable YS3 to switch to RGB1-IN. Refer to FUNCTION DESCRIPTION. | 0: Disable, 1: Enable | Disable |
| SETUP-SW/ | Y black level set-up | 0: Normal, 1: Set-up | Normal |
| HS-PH/ | HS Output phase switch | 0: H-Sync (4.7 μs), 1: GP (3.2 μs) | H-Sync |
| TEST MODE/ | Factory test mode. Set all zero. | — | 00H |

Read Mode

Slave Address: 89_H/8B_H/8F_H

| Item/Number of Bits | Function | Variable Range |
|---------------------|---|---|
| H-LOCK/ | H.Lock detection | 0: Un-lock, 1: Lock |
| N-DET/ | Noise judgment | 00: SN > 30 dB, 01: —, 10: 30 dB > SN > 20 dB, 11: 20 dB > SN |
| X'TAL/ | Crystal mode judgment | 00: 4.433619 MHz (PAL) 01: 3.579545 MHz (NTSC) 10: 3.575611 MHz (M-PAL) 11: 3.582056 MHz (N-PAL) |
| COLOR SYSTEM/ | Color system judgment | 00: B/W, 01: PAL 10: NTSC, 11: SECAM |
| POR/ | Power On Reset | 0: Normal, 1: Resistor preset |
| V15/ | Status of pin 15 voltage Refer to FUNCTION DESCRIPTION. | 0: Low, 1: High |
| V-SIG/ | Internal V.pulse detection for V.lock | 0: Existing, 1: Not existing |
| C ID/ | Input signal condition (detection of burst signal on C-IN pins) Refer to FUNCTION DESCRIPTION. | 0: Not detected (CVBS), 1: Detected (Y/C) |
| V-STD/ | Decision on the standard of the vertical frequency. When no-signal, 1: STD is responded. | 0: Non-STD, 1: STD |
| V-FREQ/ | Vertical frequency judgment. Right after power-on, 0: 50 Hz is responded. At no-signal, the last statement is kept. | 0: 50 Hz, 1: 60 Hz |

Function Description

Video Select, Auto-SW

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

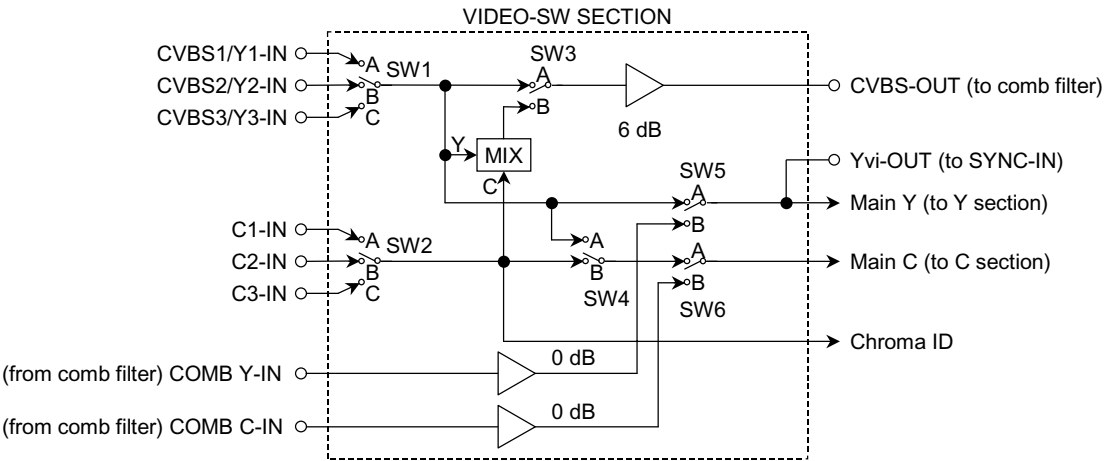


Figure 1 Signal Route at Video SW Section

Table 1 Selected Input and Pin 3/11 Output from Video SW Section

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

External Input SWs

External inputs are selected by the BUS data and fast SWs. Final outputs from pin 21/22/23 are shown in Table 2. RGB1-IN interface complies with SCART connector. Therefore it is active, when RGB1-IN is enable by the BUS data and when YS3 (pin 15) is also high. The status of YS3 (pin 15) is responded to the Read BUS data, V15.

Table 2 Outputs from Pin 21/22/23

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

Note2: RGB SELECT/RGB1 ENB: I²C BUS data, YS1/2/3: Fast SW

Color System

Distinguishable color systems are selected by the write BUS data, COLOR SYSTEM. The demodulated color system is responded to the read BUS data, COLOR SYSTEM and X'TAL. (refer to BUS CONTROL FUNCTION) The system data is also responded to Comb SYS (pin 45) and fsc-OUT (pin 46) as Table 3. If distinguishable color system signal is not received, the system data is responded with B/W.

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

Table 3 DC Level of Pin 45 and 46 on Each Color System

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

Secam Bell Filter

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

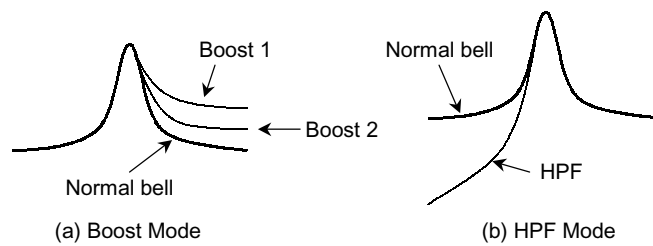


Figure 2 SECAM Bell Filter Characteristics

Vertical Count-Down

In Automatic of V C/D MODE, the vertical synchronization is controlled by internal PLL. In Fast mode, it is synchronized with the inputted synchronizing signal and the pull-in time is short. Furthermore the time is shorter in Very fast mode by the expanded pull-in range. Pull-in range of vertical count-down is determined by the BUS data, V C/D MODE and V-FREQ as Table 4.

Table 4 V C/D Pull-In Range

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

Note 3: 00, 11; Normal

Normal vertical input mode. It is good performance of vertical phase keeping for standard TV signal sync. This mode is recommended in the state of stability. And this mode can detect teletext or VCR skew sync.

Note 4: 01; Teletext

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

Note 5: 10; Fast

This mode is same performance of vertical phase keeping for standard TV signal sync of "Teletext". But it is faster pull-in speed faster than "Teletext" because pull-in ranges wider than "Teletext". (refer to Table 5) Therefore, this mode is better to use when channel changing, but is not recommended to use in the state of stability or in week signal due to too wide pull-in range and incorrect actions of vertical keeping appearing.

Y-DL Adjustment

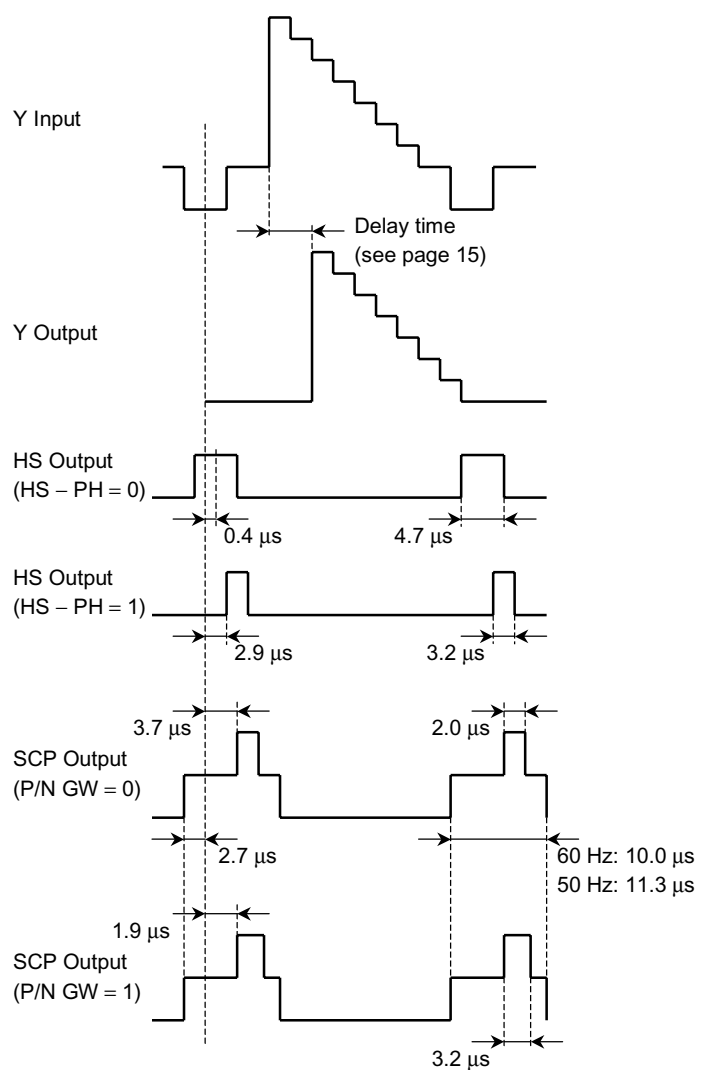
Table 5 shows Y output delays against Y input on condition with BPF = f_0 , Q = 2.0, Y-DL = Min and LPF = ON. Y-out signal can be delayed by the BUS data, Y-DL. The adjustment time of one step is 40 ns.

Table 5 Y Ddelays According to the Color System

| Color System | Y Delay (ns) |
|--------------|--------------|
| PAL | 420 |
| NTSC | 460 |
| SECAM | 645 |

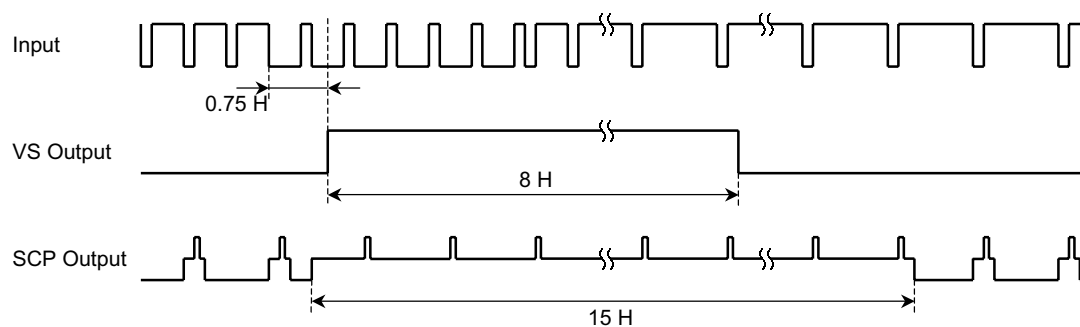
Pulses Timming

Horizontal Period (typical output phase of horizontal pulses)

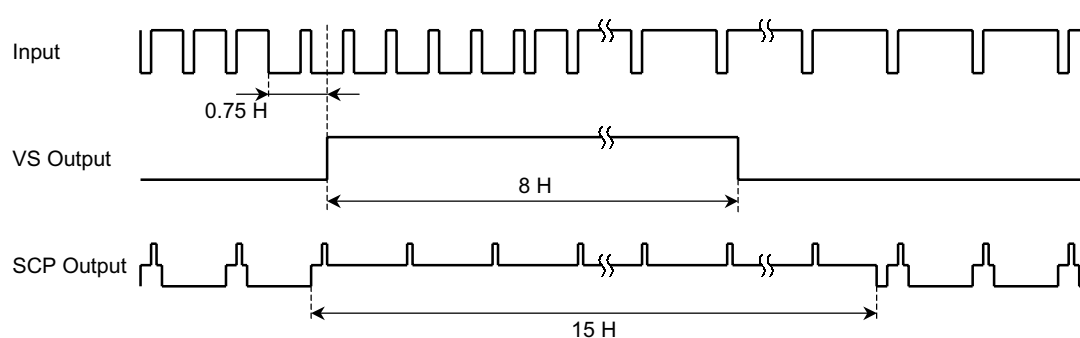


Vertical Period (typical output phase of vertical pulse)

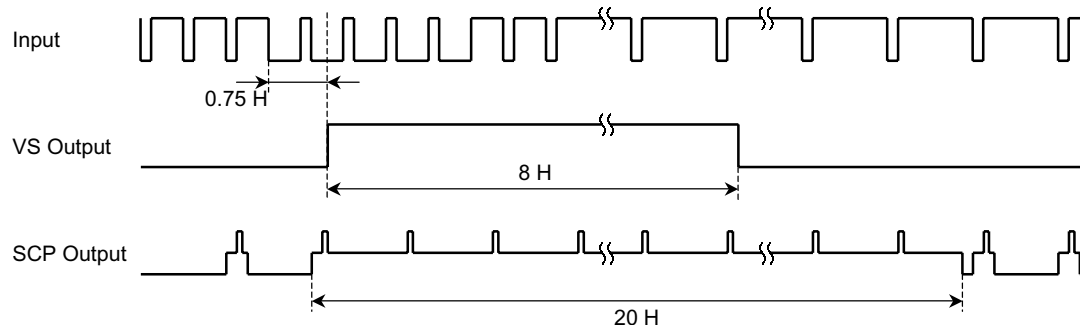
60 Hz ODD



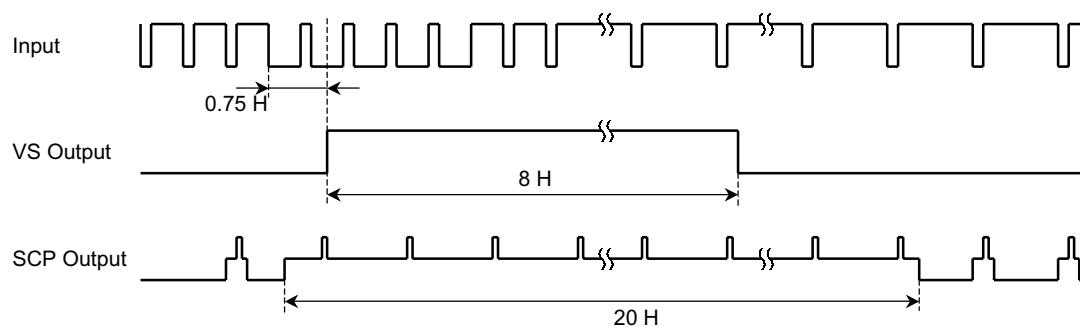
60 Hz EVEN



50 Hz ODD



50 Hz EVEN



Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------------|------------------------|------------|------------------|
| Supply voltage | V _{CC/DDmax} | 5.5 | V |
| Signal voltage at each input pin | e _{inmax} | 5 | V _{p-p} |
| Power consumption | P _D (Note6) | 1644 | mW |
| Power consumption reduction ratio | 1/θ _{ja} | 13.16 | mW/°C |
| Operating temperature | T _{opr} | –25 to 65 | °C |
| Storage temperature | T _{stg} | –55 to 150 | °C |

Note 6: Put on the circuit board. Refer to the figure below.

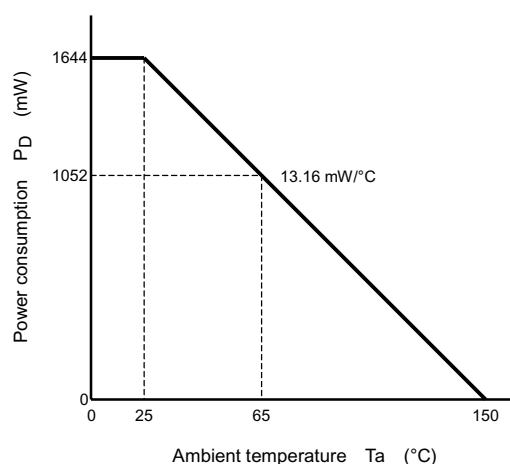


Figure 3 Power Consumption Reduction Against Ambient Temperature

Supply Voltage

| Characteristics | Description | Min | Typ. | Max | Unit |
|-----------------|---------------|------|------|------|------|
| Supply voltage | Pin 6, 12, 32 | 4.75 | 5.0 | 5.25 | V |

Electrical Characteristics

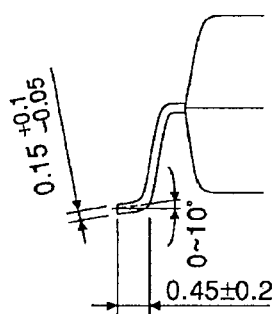
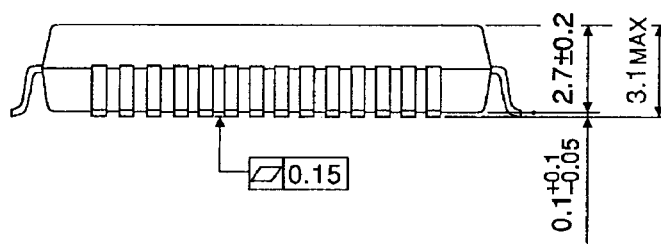
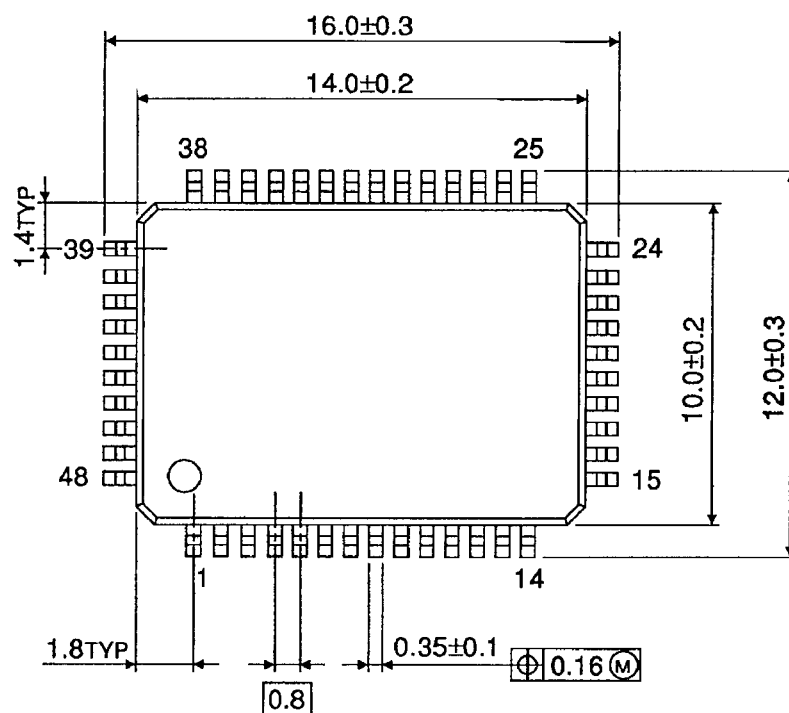
(YC – V_{CC}/SYNC – V_{CC}/D – V_{DD} = 5 V and Ta = 25°C, unless otherwise specified)

Current Consumption

| Pin No. | Pin Name | Symbol | Min | Typ. | Max | Unit |
|---------|----------------------|------------------|-----|------|-----|------|
| 6 | D V _{DD} | I _{DD} | 4 | 7 | 15 | mA |
| 12 | SYNC V _{CC} | I _{CC1} | 9 | 13.5 | 20 | |
| 32 | Y/C V _{CC} | I _{CC2} | 75 | 100 | 130 | |

QFP48-P-1014-0.80

Unit : mm



Weight: 0.83 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.