

# NTSC/PAL Encoder Monolithic IC MM1394

## Outline

This is an encoder IC that converts luminance signal Y, color difference signals R-Y and B-Y to composite video signals and RGB signals.

## Features

1. Operates on 5V single power supply
2. Low power consumption (265mW : video output ON)  
(165mW : video output OFF)
3. Supports both NTSC and PAL formats
4. Built-in 75Ω drive output (RGB output, composite output)
5. BPF and DELAY filters built-in
6. Built-in oscillator for subcarrier
7. Built-in video output ON/OFF circuit

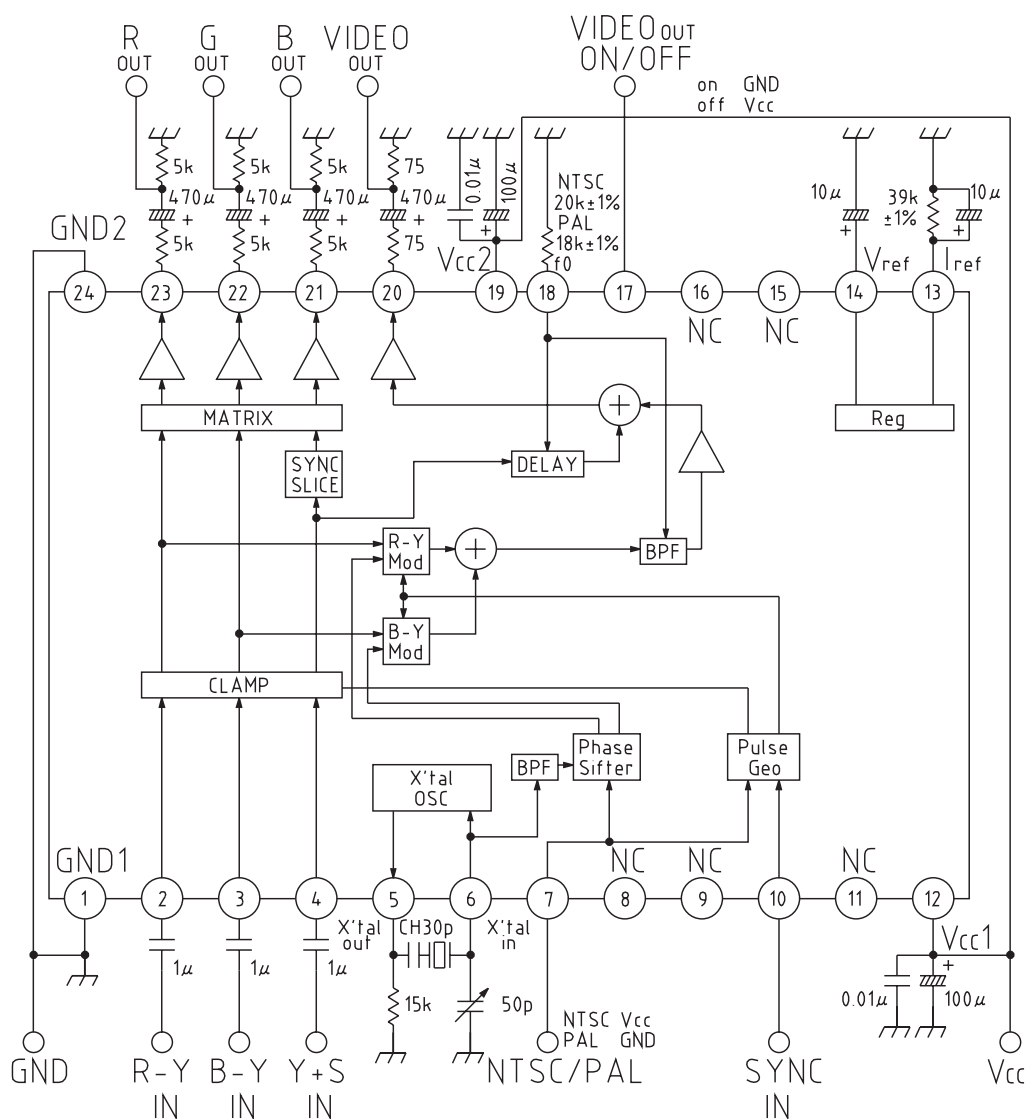
## Package

SOP-24

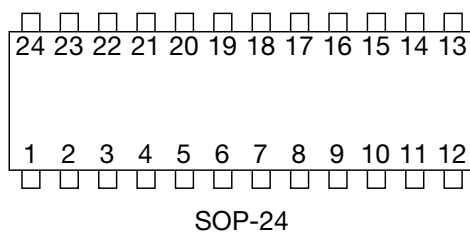
## Applications

1. Game equipment
2. Digital cameras
3. Other video equipment

# Block Diagram



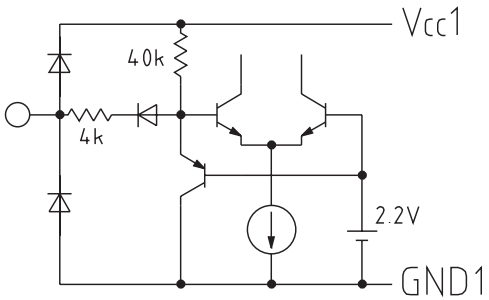
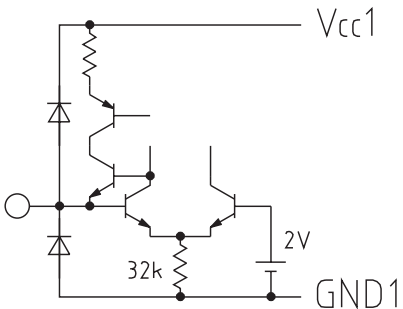
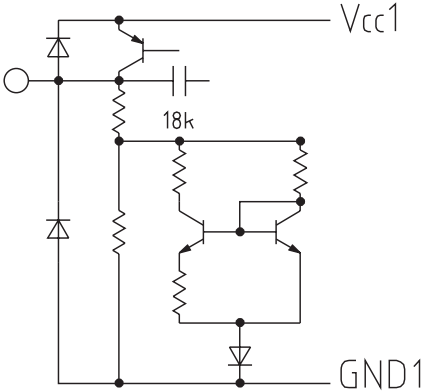
# Pin Assignment



|   |            |    |         |    |                  |
|---|------------|----|---------|----|------------------|
| 1 | GND1       | 9  | NC      | 17 | VIDEO OUT ON/OFF |
| 2 | R-Y IN     | 10 | SYNC IN | 18 | f0               |
| 3 | B-Y IN     | 11 | NC      | 19 | Vcc2             |
| 4 | Y+S IN     | 12 | Vcc1    | 20 | VIDEO OUT        |
| 5 | X' tal OUT | 13 | Iref    | 21 | B OUT            |
| 6 | X' tal IN  | 14 | Vref    | 22 | G OUT            |
| 7 | NTSC/PAL   | 15 | NC      | 23 | R OUT            |
| 8 | NC         | 16 | NC      | 24 | GND2             |

# Pin Description

| Pin no. | Pin name          | Function                                                                                                                                                                                      | Internal equivalent circuit diagram |
|---------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1       | GND1              |                                                                                                                                                                                               |                                     |
| 2       | R-Y <sub>IN</sub> | Input pins.<br>Maximum input voltage :<br>R-Y 1.00V <sub>P-P</sub><br>B-Y 1.27V <sub>P-P</sub><br>Y+S 1.00V <sub>P-P</sub><br>(SYNC is 0.286V <sub>P-P</sub> )<br>DC level for clamp is 2.2V. |                                     |
| 3       | B-Y <sub>IN</sub> |                                                                                                                                                                                               |                                     |
| 4       | Y+S <sub>IN</sub> |                                                                                                                                                                                               |                                     |
| 5       | X' tal out        | Oscillator circuit output pin                                                                                                                                                                 |                                     |
| 6       | X' tal in         | Subcarrier input pin<br>Input a 0.4~1.0V <sub>P-P</sub> sine wave.                                                                                                                            |                                     |
| 7       | NTSC/PAL          | Mode setting pin<br>NTSC : Vcc<br>PAL : PAL                                                                                                                                                   |                                     |

| Pin no.  | Pin name           | Function                                                                                                       | Internal equivalent circuit diagram                                                  |
|----------|--------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 8<br>9   | NC                 | OPEN                                                                                                           |                                                                                      |
| 10       | SYNC <sub>IN</sub> | Composite sync signal input pin                                                                                |    |
| 11       | NC                 | OPEN                                                                                                           |                                                                                      |
| 12       | Vcc1               |                                                                                                                |                                                                                      |
| 13       | Iref               | Determines internal reference current.<br>Connect a 47kΩ resistor between this pin and GND.                    |  |
| 14       | Vref               | Internal reference voltage pin<br>Reference voltage : 4V<br>Connect a 10μF capacitor between this pin and GND. |  |
| 15<br>16 | NC                 | OPEN                                                                                                           |                                                                                      |

| Pin no.        | Pin name                                                 | Function                                                                            | Internal equivalent circuit diagram |
|----------------|----------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|
| 17             | VIDEO OUT<br>ON/OFF                                      | Turns VIDEO output ON/OFF<br>VIDEO output ON : GND<br>OFF : V <sub>CC</sub>         |                                     |
| 18             | f <sub>0</sub>                                           | Determines f <sub>0</sub> for filter and delay circuits.<br>NTSC : 20k<br>PAL : 16k |                                     |
| 19             | V <sub>CC2</sub>                                         | Output stage power supply                                                           |                                     |
| 20             | VIDEO OUT                                                | Composite video signal output pin<br>Can drive 75Ω load.                            |                                     |
| 21<br>22<br>23 | B <sub>OUT</sub><br>G <sub>OUT</sub><br>B <sub>OUT</sub> | RGB signal output pin                                                               |                                     |
| 24             | GND2                                                     | Output stage GND                                                                    |                                     |

## Absolute Maximum Ratings (Ta=25°C)

| Item                  | Symbol               | Ratings  | Units |
|-----------------------|----------------------|----------|-------|
| Storage temperature   | T <sub>STG</sub>     | -40~+125 | °C    |
| Operating temperature | T <sub>OPR</sub>     | -20~+75  | °C    |
| Power supply voltage  | V <sub>CC</sub> max. | +7       | V     |
| Allowable loss        | P <sub>d</sub>       | 450      | mW    |

## Recommended Operating Conditions

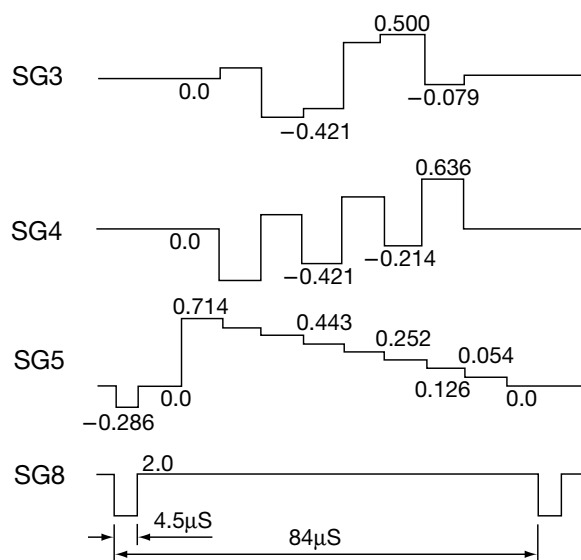
| Item                   | Symbol           | Ratings   | Units |
|------------------------|------------------|-----------|-------|
| Operating temperature  | T <sub>OPR</sub> | -20~+75   | °C    |
| Operating power supply | V <sub>OPR</sub> | 4.75~5.25 | V     |

## Electrical Characteristics (Except where noted otherwise, Ta=25°C, V<sub>CC</sub>=5.0V)

| Item                       | Symbol  | Measurement pin | Measurement conditions<br>SW conditions<br>SW (S1,S2,S3,S4,S5,S6,S7)                                                 | Min.       | Typ. | Max. | Units             |
|----------------------------|---------|-----------------|----------------------------------------------------------------------------------------------------------------------|------------|------|------|-------------------|
| Consumption current 1      | Icc1    |                 | V4 : SG6 V5 : SG8<br>SW (0, 0, 0, 0, 0, 0, 0)                                                                        | 23         | 33   | 43   | mA                |
| Consumption current 2      | Icc2    |                 | V4 : SG6 V5 : SG8<br>SW (0, 0, 0, 0, 0, 1, 0)                                                                        | 14         | 20   | 26   | mA                |
| RGB output characteristics |         |                 |                                                                                                                      |            |      |      |                   |
| R output voltage           | VR      | D               | V1 : SG3 V2 : SG4 V3 : SG5<br>SW (1, 0, 0, 0, 0, 0, 0)                                                               | 0.64       | 0.71 | 0.78 | V <sub>P-P</sub>  |
| G output voltage           | VG      | C               |                                                                                                                      |            |      |      |                   |
| B output voltage           | VB      | B               |                                                                                                                      |            |      |      |                   |
| Rf characteristic          | fR      | D               | V3 : SG2/SG1 V4 : SG6<br>SW (1, 1, 0, 0, 1, 0, 0)<br>R, B frequency response Va=2.0V<br>G frequency response Va=2.9V | -3.0<br>★1 |      |      | dB                |
| Gf characteristic          | fG      | C               |                                                                                                                      |            |      |      |                   |
| Bf characteristic          | fB      | B               |                                                                                                                      |            |      |      |                   |
| Red-1 level ratio          | CL (R1) | A               |                                                                                                                      | 2.62       | 2.92 | 3.21 |                   |
| Red-1 phase                | CP (R1) |                 |                                                                                                                      | 94         | 104  | 114  | deg               |
| Red-2 level ratio          | CL (R2) |                 |                                                                                                                      | 2.62       | 2.92 | 3.21 |                   |
| Red-2 phase                | CP (R2) |                 |                                                                                                                      | 2.46       | 2.56 | 2.66 | deg               |
| Green-1 level ratio        | CL (G1) |                 |                                                                                                                      | 2.46       | 2.74 | 3.02 |                   |
| Green-1 phase              | CP (G1) |                 |                                                                                                                      | 231        | 241  | 251  | deg               |
| Green-2 level ratio        | CL (G2) |                 |                                                                                                                      | 2.46       | 2.74 | 3.02 |                   |
| Green-2 phase              | CP (G2) |                 |                                                                                                                      | 109        | 119  | 129  | deg               |
| Blue-1 level ratio         | CL (B1) |                 |                                                                                                                      | 1.87       | 2.08 | 2.29 |                   |
| Blue-1 phase               | CP (B1) |                 |                                                                                                                      | 337        | 347  | 357  | deg               |
| Blue-2 level ratio         | CL (B2) |                 |                                                                                                                      | 1.87       | 2.08 | 2.29 |                   |
| Blue-2 phase               | CP (B2) |                 |                                                                                                                      | 3          | 13   | 23   | deg               |
| NTSC / PAL                 |         |                 |                                                                                                                      |            |      |      |                   |
| Burst position             | td      | A               | V1 : SG3 V2 : SG4 V3 : SG5<br>V4 : SG6 V5 : SG8<br>SW (1, 0, 0, 0, 0, 0, 0) ★6                                       | 0.4        | 0.6  | 0.75 | μS                |
| Burst width                | tw      |                 |                                                                                                                      | 2.3        | 2.55 | 3.0  | μS                |
| Carrier leak               | VL      | A               | V1, 2, 3 : no signal<br>V4 : SG6 V5 : SG8<br>SW (1, 0, 0, 0, 0, 0, 0) ★7                                             |            |      | 30   | mV <sub>P-P</sub> |
| Oscillation circuit        |         |                 |                                                                                                                      |            |      |      |                   |
| Gain                       | Gain    | E               | V1, 2, 3 : no signal<br>V4 : SG9 V5 : SG8<br>SW (1, 0, 0, 0, 0, 0, 0)                                                | 8.5        | 9.5  | 10.5 | dB                |
| Phase                      |         | P               |                                                                                                                      |            | 65   |      | deg               |

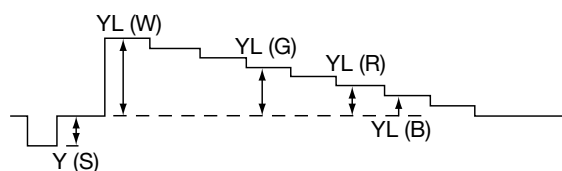
# Input Conditions

| Symbol | Signal                                    |
|--------|-------------------------------------------|
| SG1    | sine wave 0.7V <sub>P-P</sub> f=200kHz    |
| SG2    | sine wave 0.7V <sub>P-P</sub> f=5kHz      |
| SG3    | color bar R-Y signal 1V <sub>P-P</sub>    |
| SG4    | color bar B-Y signal 1.27V <sub>P-P</sub> |
| SG5    | color bar Y+S signal 1V <sub>P-P</sub>    |
| SG6    | sine wave 0.5V <sub>P-P</sub> f=3.58MHz   |
| SG7    | sine wave 0.5V <sub>P-P</sub> f=4.43MHz   |
| SG8    | 0.8V-2.0V composite sync signal           |
| SG9    | sine wave 30mV <sub>P-P</sub> f=4.43MHz   |
| SG10   | white signal 1161RE                       |



Note 1 : \*1 Frequency response is calculated at 20Log (5MHz output voltage/200kHz output 5MHz).

Note 2 : \*2 Luminance level measurement

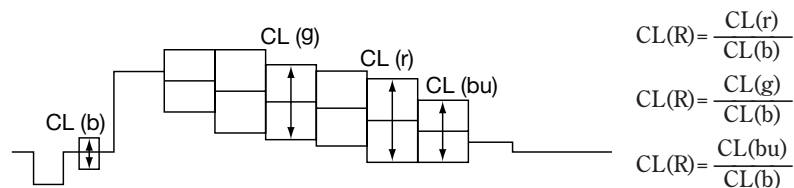


Note 3 : \*3 Frequency response is calculated at 20Log (5MHz output voltage/200kHz output 5MHz).

Note 4 : \*4 Chroma signal measurement (NTSC mode)

Chroma level ratio is the ratio between each color signal level and burst signal level.

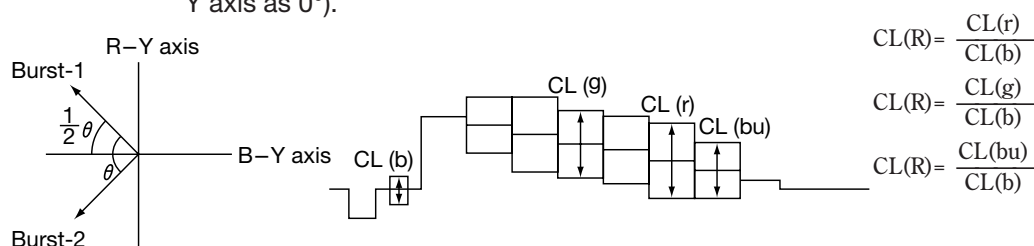
Each color phase is 180° from burst signal phase (given B-Y axis as 0°).



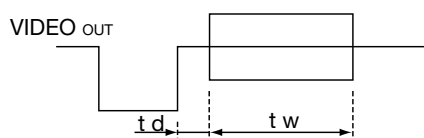
Note 5 : \*5 Chroma signal measurement (PAL mode)

Assume burst 135° side signal as color-1, and burst 225° side signal as color-2.

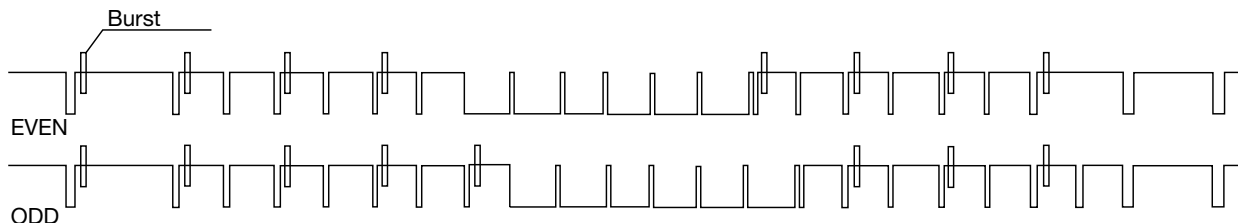
Phase measurement is done assuming the middle of burst-1 and burst-2 phase as 180° (given B-Y axis as 0°).



Note 6 : \*6 Burst signal

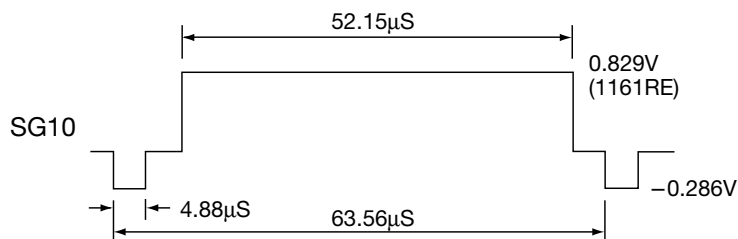


Note 7 : \*7 3.58MHz component level for RGB input no signal.



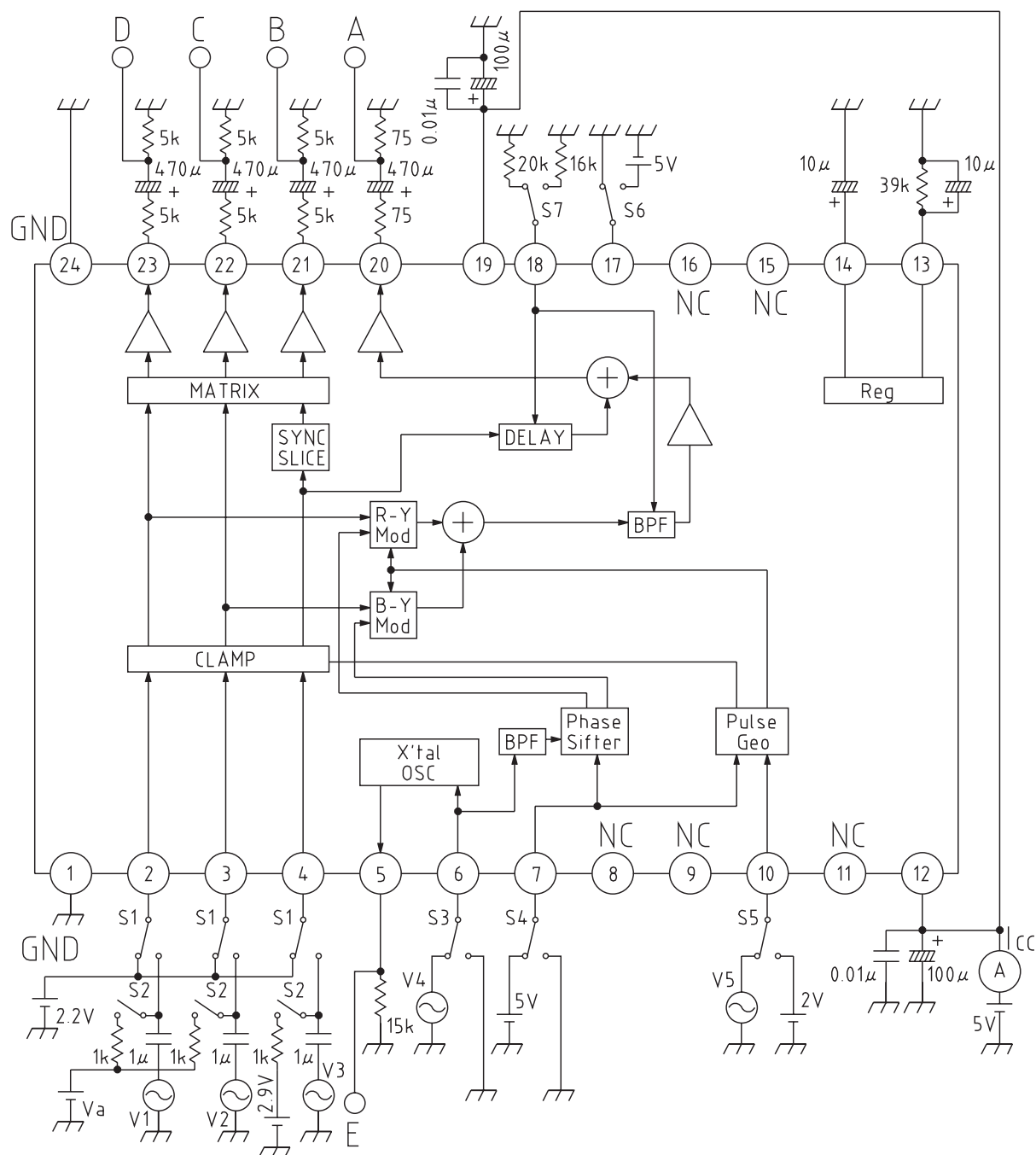
Note 8 : \*8 Input dynamic range measurement

Input the signal shown below and measure video output sync level. Sync level between 0.26~0.33V is acceptable.

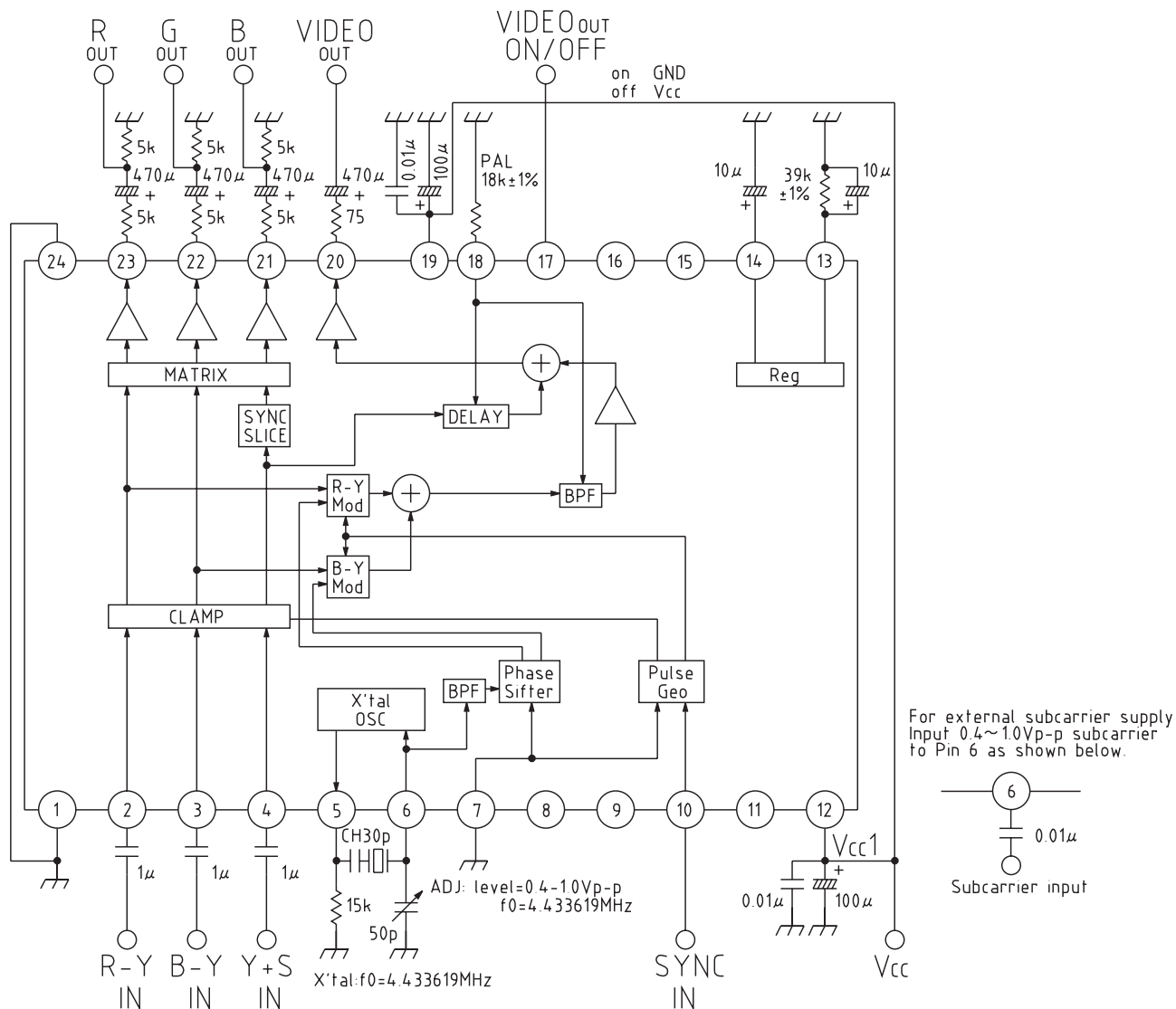




**Measuring Circuit** SW conditions : SW status in the circuit diagram below is SW (0,0,0,0,0,0).



■ NTSC mode



■ PAL mode

