# ASSP Image Control

# RGB Encoder

# **MB3516A**

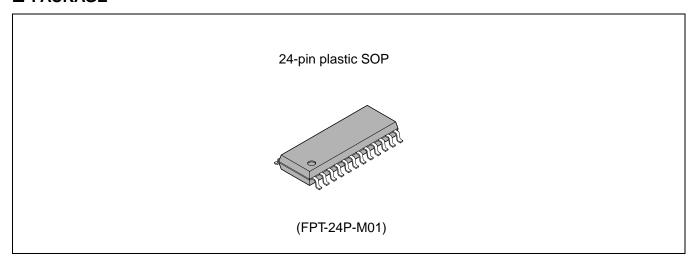
#### **■ DESCRIPTION**

The MB3516A is an RGB encoder containing an RGB signal matrix circuit, balanced modulator circuits, and a luminance signal/color-difference signal mixing circuit. This device inputs analog RGB and composite sync signals and outputs a composite video signal in the NTSC or PAL format. Also, it has Y/C separate output pins and RGB signal output pins.

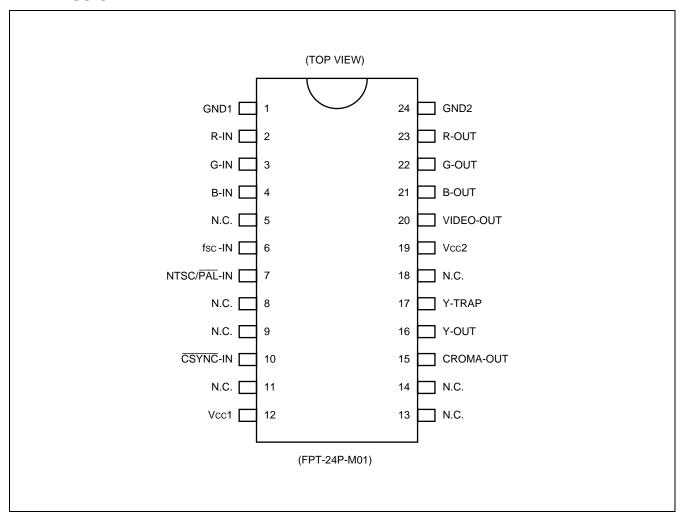
#### **■ FEATURES**

- Supporting for both of the NTSC and PAL formats
- Containing Y/C separate output and RGB output pins as well as a composite video signal output pin
- On-chip 75  $\Omega$  driver (Composite video output, Y/C separate outputs, RGB outputs)
- Half H-killer circuit integrated
- Burst flag generator integrated
- PAL alternate circuit integrated
- · Built-in filters
- Operation with a +5 volt single power supply
- Low power consumption: 280 mW (typical)

### **■ PACKAGE**



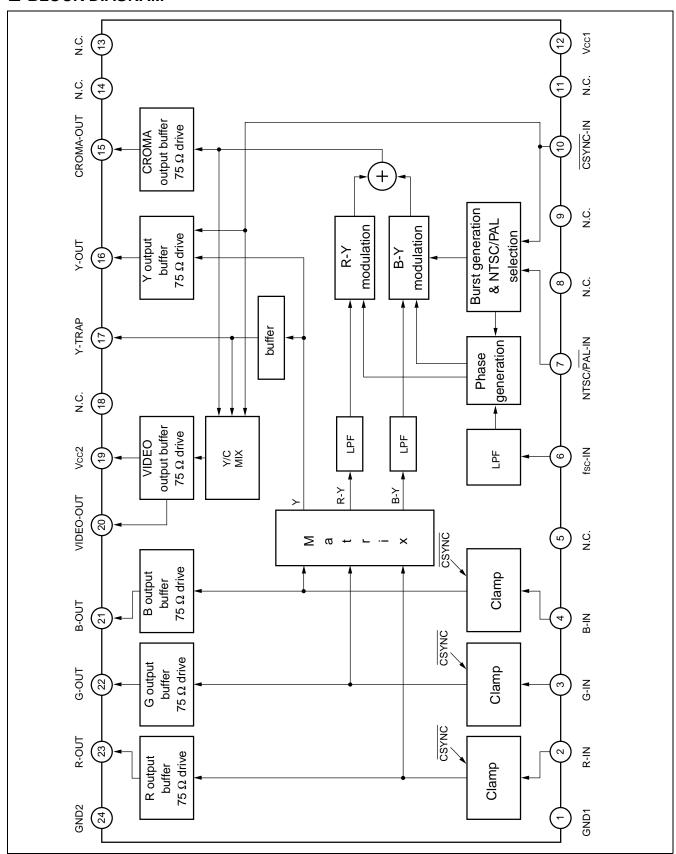
## **■ PIN ASSIGNMENT**



## **■ PIN DESCRIPTION**

5 N.C. — Unused pin — Inputs a sine wave of 1.0 to 5.0 Vp-p or a pulse carrier.  7 NTSC/PAL-IN I Subcarrier input pin Inputs a sine wave of 1.0 to 5.0 Vp-p or a pulse carrier.  7 NTSC/PAL-IN I NTSC/PAL selector pin "H" level : Selects the NTSC mode.  8 N.C. — Unused pin — —  9 N.C. — Unused pin — —  10 CSYNC-IN I Composite sync signal input pin while clamping R-IN, G-IN, and B-IN.  11 N.C. — Unused pin — —  12 Vcc1 — Power-supply pin Power-supply pin for circuits other than 75 Ω output driver.  13 N.C. — Unused pin — —  14 N.C. — Unused pin — —  15 CROMA-OUT O Chroma signal output pin Capable of directly driving a 75 Ω load.  16 Y-OUT O Y-signal output pin Capable of adjusting the frequency characteristic of the	Pin No.	Symbol	I/O	Pin name	Function	
G-IN   Harland Robb Input   Pins   Pins	1	GND 1	_	GND I pin	Ground pin for circuits other than 75 $\Omega$ output driver	
Sc-IN   I   Subcarrier input pin   Inputs a sine wave of 1.0 to 5.0 Vp-p or a pulse carrier.	3	G-IN	I			
NTSC/PAL-IN   NTSC/PAL selector pin   "H" level : Selects the NTSC mode. selector pin   "H" level : Selects the NTSC mode.   "L" level : Selects the PAL mode.   "L" level : Selects the PAL mode.   "L" level : Selects the PAL mode.	5	N.C.	_	Unused pin	_	
NISC/PAL-IN   I   selector pin   "L" level : Selects the PAL mode.	6	fsc-IN	I	Subcarrier input pin	Inputs a sine wave of 1.0 to 5.0 Vp-p or a pulse carrier.	
9 N.C. — Unused pin — CSYNC-IN I Composite sync signal input pin while clamping R-IN, G-IN, and B-IN.  11 N.C. — Unused pin — Power-supply pin Power-supply pin for circuits other than 75 Ω output driver.  13 N.C. — Unused pin — CROMA-OUT O Chroma signal output pin output pin Capable of directly driving a 75 Ω load.  15 CROMA-OUT O Y-signal output pin Capable of adjusting the frequency characteristic of the luminance signal band control pin series to GND1.  18 N.C. — Unused pin — Capable of directly driving a 75 Ω load.  19 Vcc2 — Power-supply pin Power-supply pin for the 75 Ω output driver circuit capable of directly driving a 75 Ω load.  20 VIDEO-OUT O Composite video signal output pin capable of directly driving a 75 Ω load.  21 B-OUT O Analog RGB signal output pin Capable of directly driving a 75 Ω load.	7	NTSC/PAL-IN	I			
10 CSYNC-IN  I Composite sync signal input pin while clamping R-IN, G-IN, and B-IN.  11 N.C.  Unused pin  Power-supply pin Power-supply pin for circuits other than 75 Ω output driver.  13 N.C.  Unused pin  Unused pin  CROMA-OUT  O Chroma signal output pin  Capable of directly driving a 75 Ω load.  Capable of adjusting the frequency characteristic of the luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.  N.C.  Unused pin  Capable of directly driving a 75 Ω load.  Capable of adjusting the frequency characteristic of the luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.  N.C.  Unused pin  Vcc2  Power-supply pin  Power-supply pin for the 75 Ω output driver circuit  Capable of directly driving a 75 Ω load.	8	N.C.	—	Unused pin	_	
Signal input pin   while clamping R-IN, G-IN, and B-IN.	9	N.C.	_	Unused pin	_	
12 Vcc1 — Power-supply pin Power-supply pin for circuits other than 75 Ω output driver.  13 N.C. — Unused pin —  14 N.C. — Unused pin —  15 CROMA-OUT O Chroma signal output pin Capable of directly driving a 75 Ω load.  16 Y-OUT O Y-signal output pin Capable of directly driving a 75 Ω load.  17 Y-TRAP — Luminance signal band control pin band control pin band control pin connecting a capacitor or a capacitor and an inductor in series to GND1.  18 N.C. — Unused pin —  19 Vcc2 — Power-supply pin Power-supply pin for the 75 Ω output driver circuit  20 VIDEO-OUT O Composite video signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT O Analog RGB signal output pins  Capable of directly driving a 75 Ω load.	10	CSYNC-IN	I			
13 N.C. — Unused pin —  14 N.C. — Unused pin —  15 CROMA-OUT O Chroma signal output pin Capable of directly driving a 75 Ω load.  16 Y-OUT O Y-signal output pin Capable of directly driving a 75 Ω load.  17 Y-TRAP — Luminance signal band control pin band control pin connecting a capacitor or a capacitor and an inductor in series to GND1.  18 N.C. — Unused pin — Power-supply pin Power-supply pin for the 75 Ω output driver circuit  20 VIDEO-OUT O Composite video signal output pin Signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT O Analog RGB signal output pins  Capable of directly driving a 75 Ω load.  Capable of directly driving a 75 Ω load.	11	N.C.	_	Unused pin	_	
14 N.C. — Unused pin — Capable of directly driving a 75 Ω load.  15 CROMA-OUT O Chroma signal output pin Capable of directly driving a 75 Ω load.  16 Y-OUT O Y-signal output pin Capable of directly driving a 75 Ω load.  17 Y-TRAP — Luminance signal band control pin Capable of adjusting the frequency characteristic of the luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.  18 N.C. — Unused pin — Power-supply pin Power-supply pin for the 75 Ω output driver circuit  20 VIDEO-OUT O Composite video signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT O Analog RGB signal output pins Capable of directly driving a 75 Ω load.	12	Vcc1	_	Power-supply pin	Power-supply pin for circuits other than 75 $\Omega$ output driver.	
15 CROMA-OUT O Chroma signal output pin Capable of directly driving a 75 Ω load.  16 Y-OUT O Y-signal output pin Capable of directly driving a 75 Ω load.  17 Y-TRAP	13	N.C.	_	Unused pin	_	
16 Y-OUT O Y-signal output pin Capable of directly driving a 75 Ω load.  17 Y-TRAP  Luminance signal band control pin  18 N.C.  Unused pin  Power-supply pin  Capable of directly driving a 75 Ω load.  Capable of adjusting the frequency characteristic of the luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.  N.C.  Power-supply pin  Power-supply pin for the 75 Ω output driver circuit  Capable of directly driving a 75 Ω load.	14	N.C.	_	Unused pin	_	
The result of the luminance signal band control pin  Y-TRAP  Luminance signal band control pin  Capable of adjusting the frequency characteristic of the luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.  N.C. — Unused pin — —  Power-supply pin Power-supply pin for the 75 Ω output driver circuit  VIDEO-OUT O Composite video signal output pin  Power-supply pin for the 75 Ω load.  Analog RGB signal output pins  Capable of directly driving a 75 Ω load.  Capable of directly driving a 75 Ω load.	15	CROMA-OUT	0	_	Capable of directly driving a 75 $\Omega$ load.	
<ul> <li>Y-TRAP</li> <li>Luminance signal band control pin</li> <li>Iluminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in series to GND1.</li> <li>N.C.</li> <li>Unused pin</li> <li>Power-supply pin</li> <li>Power-supply pin for the 75 Ω output driver circuit</li> <li>VIDEO-OUT</li> <li>Composite video signal output pin</li> <li>Capable of directly driving a 75 Ω load.</li> <li>B-OUT G-OUT G-OUT R-OUT</li> <li>Analog RGB signal output pins</li> <li>Capable of directly driving a 75 Ω load.</li> </ul>	16	Y-OUT	0	Y-signal output pin	Capable of directly driving a 75 $\Omega$ load.	
19 Vcc2 — Power-supply pin Power-supply pin for the 75 Ω output driver circuit  20 VIDEO-OUT O Composite video signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT G-OUT R-OUT O Analog RGB signal output pins Capable of directly driving a 75 Ω load.	17	Y-TRAP	_		luminance signal at the composite video signal output pin by connecting a capacitor or a capacitor and an inductor in	
20 VIDEO-OUT O Composite video signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT O Analog RGB signal output pins Capable of directly driving a 75 Ω load.	18	N.C.	_	Unused pin	_	
20 VIDEO-001 O signal output pin Capable of directly driving a 75 Ω load.  21 B-OUT G-OUT O Analog RGB signal output pins Capable of directly driving a 75 Ω load.	19	Vcc2	_	Power-supply pin	Power-supply pin for the 75 $\Omega$ output driver circuit	
22 G-OUT O Analog RGB signal output pins Capable of directly driving a 75 Ω load.	20	VIDEO-OUT	0		Capable of directly driving a 75 $\Omega$ load.	
24 GND2 — GND2 pin Ground pin for 75 Ω output driver circuit	22	G-OUT	0		Capable of directly driving a 75 $\Omega$ load.	
	24	GND2	_	GND2 pin	Ground pin for 75 $\Omega$ output driver circuit	

### **■ BLOCK DIAGRAM**



### ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ra	Unit		
raiametei	Symbol	Min.	Max.		
Power supply voltage	Vcc	_	7	V	
Digital signal input voltage	VID	0	Vcc	V	
Subcarrier input voltage	Vfsc	0	Vcc	V	
Storage temperature	Tstg	-55	+125	°C	

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

#### ■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit	
Faranietei	Symbol	Min.	Тур.	Max.	Oille	
Power supply voltage	Vcc	4.75	5.00	5.25	V	
Subcarrier input voltage	Vfsc	1.0	_	5.0	V <sub>P-P</sub>	
RGB input voltage	V <sub>R</sub> , G, B	0	_	1.0	V <sub>P-P</sub>	
Digital "L" level input voltage	VıL	_	_	0.8	V	
Digital "H" level input voltage	VIH	2.0	_	_	V	
Operating temperature	Та	-20	_	+75	°C	

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

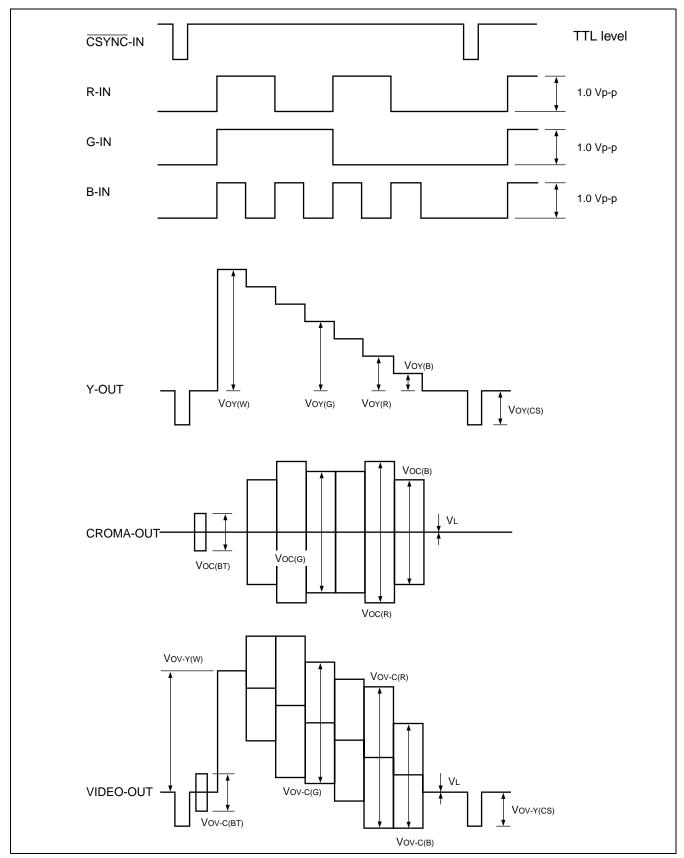
No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

## **■ ELECTRICAL CHARACTERISTICS**

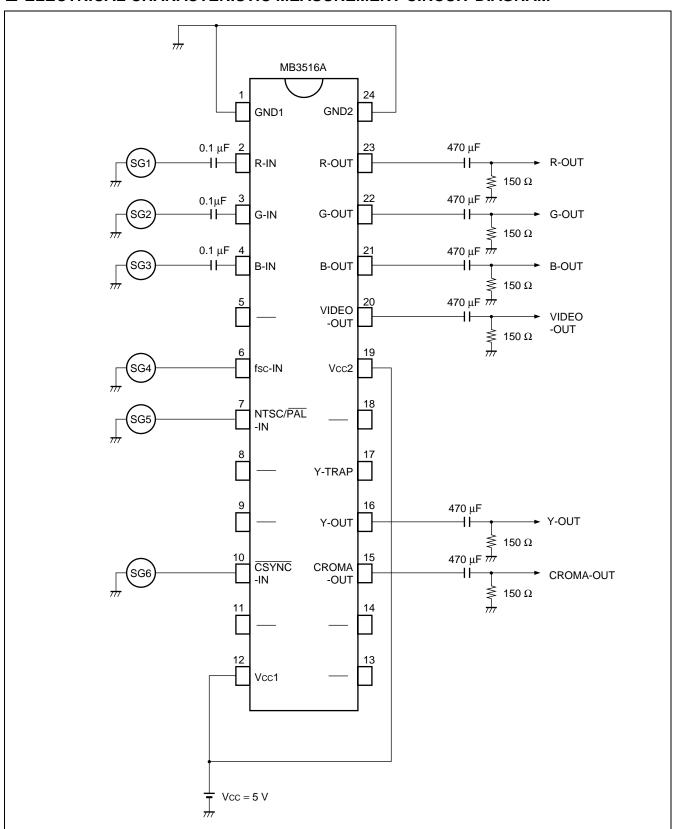
 $(Vcc1, 2 = 5 V, Ta = 25^{\circ}C)$ 

Doromotor	Symbol	O and Petronia	Value			11:4
Parameter		Conditions	Min.	Тур.	Max.	Unit
	Vo-R	R-IN = 1 V <sub>P-P</sub>				
RGB output voltage	Vo-G	G-IN = 1 V <sub>P-P</sub>	1.28	1.43	1.58	V <sub>P-P</sub>
	V <sub>O-В</sub>	B-IN = 1 V <sub>P-P</sub>				
Sync signal level	Voy (CS)	Y-OUT	0.48	0.57	0.66	V <sub>P-P</sub>
Y-signal level at R 100%	Voy (R)	Y-OUT	0.365	0.43	0.495	V
Y-signal level at G 100%	Voy (G)	Y-OUT	0.714	0.84	0.966	V
Y-signal level at B 100%	Voy (B)	Y-OUT	0.136	0.16	0.184	V
Y-signal level at White 100%	Voy (W)	Y-OUT	1.21	1.43	1.65	V
Sync signal level	Vov-y (CS)	VIDEO-OUT	0.48	0.57	0.66	V <sub>P-P</sub>
Y-signal level at R 100%	Vov-y (R)	VIDEO-OUT	0.365	0.43	0.495	V
Y-signal level at G 100%	Vov-y (G)	VIDEO-OUT	0.714	0.84	0.966	V
Y-signal level at B 100%	Vov-y (B)	VIDEO-OUT	0.136	0.16	0.184	V
Y-signal level at White 100%	Vov-y (w)	VIDEO-OUT	1.21	1.43	1.65	V
Durat laval	Voc (BT)	CROMA-OUT	0.45	0.57	0.69	V <sub>P-P</sub>
Burst level	Vov-c (BT)	VIDEO-OUT	0.45	0.57	0.69	V <sub>P-P</sub>
R chroma ratio	R/BT	CROMA-OUT, VIDEO-OUT	2.84	3.16	3.48	
R phase	$\theta$ R	CROMA-OUT, VIDEO-OUT	94	104	114	deg
G chroma ratio	G/BT	CROMA-OUT, VIDEO-OUT	2.65	2.95	3.25	
G phase	$\theta$ G	CROMA-OUT, VIDEO-OUT	231	241	251	deg
B chroma ratio	B/BT	CROMA-OUT, VIDEO-OUT	2.01	2.24	2.47	
B phase	θв	CROMA-OUT, VIDEO-OUT	337	347	357	deg
PAL burst level ratio	K (BT)	CROMA-OUT, VIDEO-OUT	0.9	1.0	1.1	
DAI hurat phage	hetaPAL	CROMA-OUT, VIDEO-OUT	125	135	145	deg
PAL burst phase	θ/PAL	CROMA-OUT, VIDEO-OUT	215	225	235	deg
Burst count	<b>N</b> вт	CROMA-OUT, VIDEO-OUT	8	10	12	Count
Burst position	t <sub>d-BT</sub>	CROMA-OUT, VIDEO-OUT	0.4	0.5	0.7	μs
Carrier leak	VL	CROMA-OUT, VIDEO-OUT	0	_	40	mV <sub>P-P</sub>
Current consumption 1	Icc 1	_		40	58	mA
Current consumption 2	Icc 2	_		16	23	mA

### ■ VIDEO SIGNAL WAVEFORMS AND MAJOR MEASUREMENT ITEMS



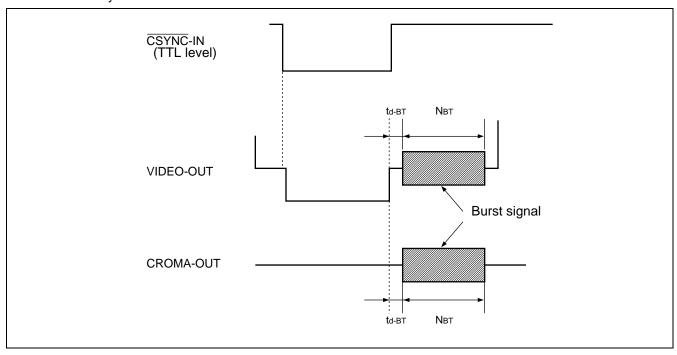
### ■ ELECTRICAL CHARACTERISTIC MEASUREMENT CIRCUIT DIAGRAM



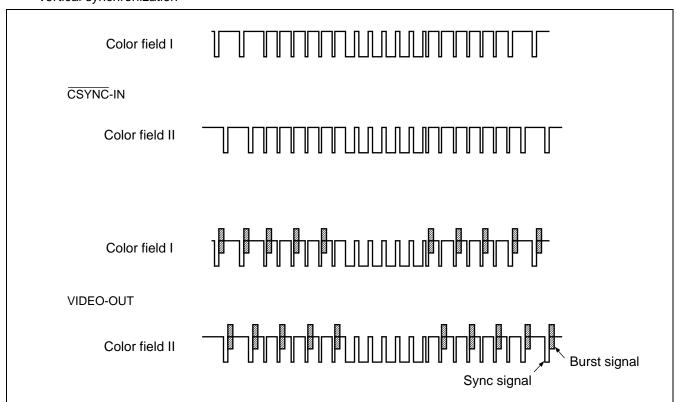
#### **■ BURST SIGNAL**

The MB3516A generates a burst signal at the timings shown below based on the composite sync signal.

· Horizontal synchronization

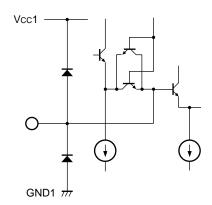


· Vertical synchronization

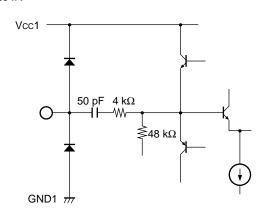


### **■ EQUIVALENT CIRCUIT DIAGRAMS**

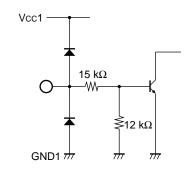




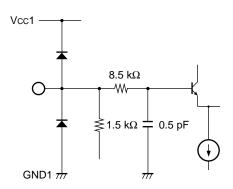
### · fsc-IN



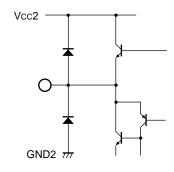
### $\cdot \, \mathsf{NTSC}/\overline{\mathsf{PAL}}\text{-}\mathsf{IN}, \, \overline{\mathsf{CSYNC}}\text{-}\mathsf{IN}$



### · Y-TRAP



· CROMA-OUT, VIDEO-OUT, Y-OUT, B-OUT, G-OUT, R-OUT



### **■ USAGE PRECAUTIONS**

### 1. Analog RGB signal input

The analog RGB signal must be input with 1.0 Vp-p or lower at a sufficiently low impedance.

### 2. Subcarrier input

The subcarrier input to the MB3516A supports both of a sine wave from 1.0 to 5.0 Vp-p and a pulse.

### 3. Board pattern design

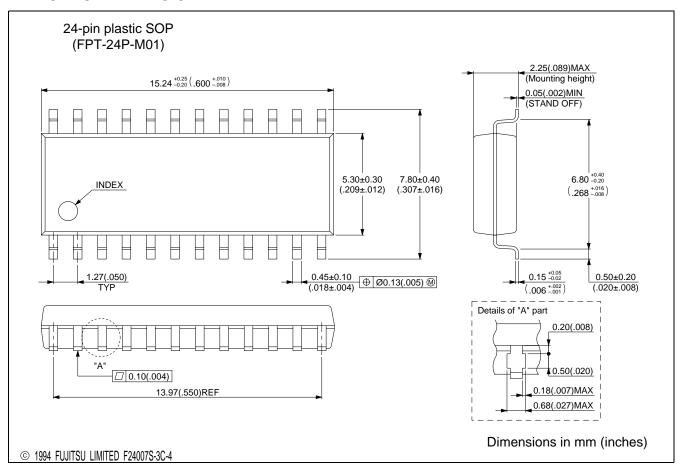
The noise limiting capacitors to be inserted to the Vcc1 and Vcc2 pins must be connected to the GND1 and GND2 pins as closely to the pins as possible.

The patterns to be connected to the GND1 and GND2 pins must be as wide as possible to reduce parasitic impedance.

### **■** ORDERING INFORMATION

Part number	Package	Remarks		
MB3516APF	24-pin plastic SOP (FPT-24P-M01)			

### **■ PACKAGE DIMENSION**



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