M51403FP/GP

PAL VIDEO CHROMA SIGNAL PROCESSOR

DESCRIPTION

The M51403FP/GP is a semiconductor integrated circuit for processing video signals in a PAL system color liquid crystal (LC) television set.
This IC incorporates ACC, APC, VCXO, RGB matrix amplifier, color signal demodulator, picture quality control, killer circuit and ID circuit.

FEATURES

- Low power dissipation
- PAL/SECAM dual system can be configured by combination with M51404AFP (SECAM chroma IC)
- 32-pin flat package

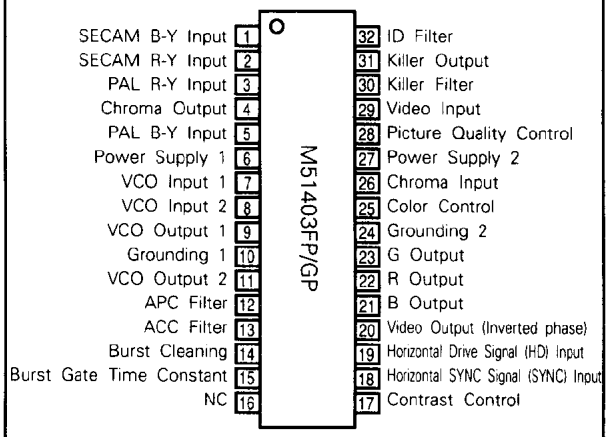
APPLICATION

LCD, TV

RECOMMENDED OPERATING CONDITION

Supply voltage range ..... 4.0 ~ 5.0V
Rated supply voltage 4.5V

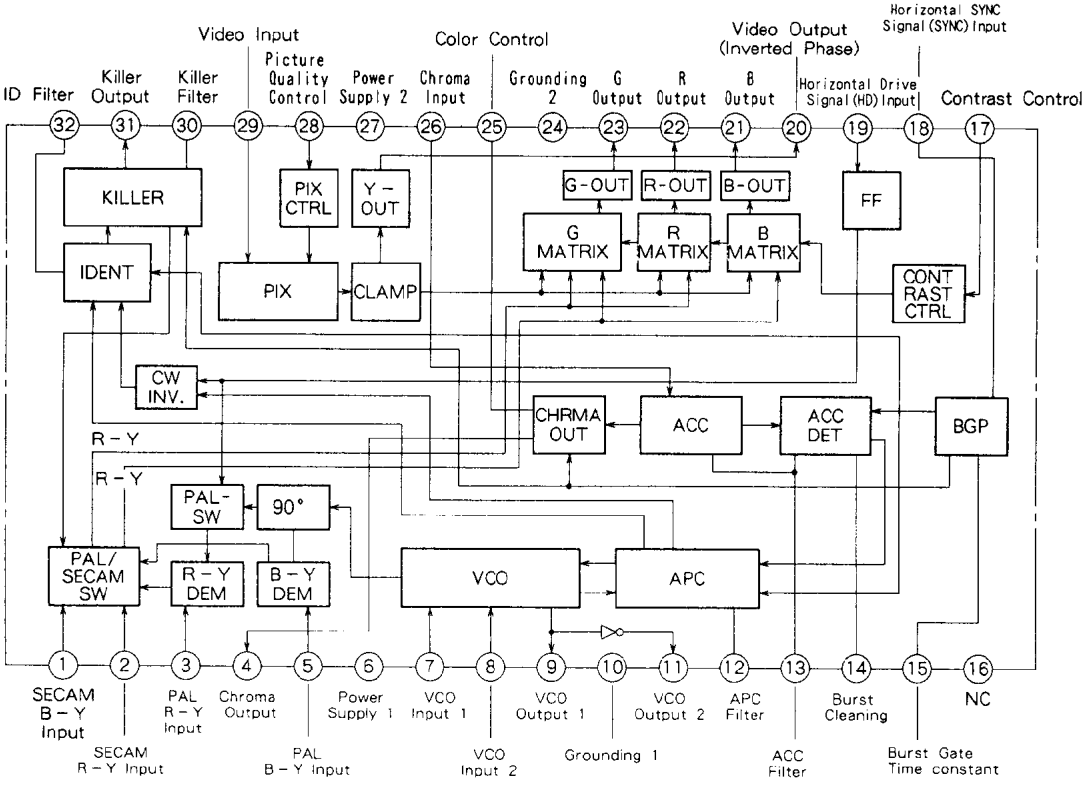
PIN CONFIGURATION (TOP VIEW)



Outline 32P2W-A (FP)
32P2U-B (GP)

NC: No connection

BLOCK DIAGRAM



MITSUBISHI ELECTRIC

ABSOLUTE MAXIMUM RATINGS

Symbol	Parametr	Ratings	Unit
V_{CC}	Supply voltage	5.0	V
Surge	Surge withstand voltage (200pF)	± 300*	V
$V_{IN⑧}$	Input amplitude at pin ⑧	500	mV_{P-P}
$I_{OUT㉛}$	Outflow current at pin ㉛	800	mA
$I_{OUT⑳}$	Outflow current at pin ⑳	900	mA
$V_{IN⑱}$	Input voltage at pin ⑱	V_{CC} + 0.3	V
$V_{IN⑲}$	Input voltage at pin ⑲	V_{CC} + 0.3	V
I_{OUT} ㉑ ㉒ ㉓	Outflow current at ㉑, ㉒, ㉓	900	mA
$I_{OUT⑪}$	Outflow current at pin ⑪	450	mA
P_d	Internal power dissipation	600 (FP) 430 (GP)	mW
T_{opr}	Operating temperature	− 20~75	℃
T_{stg}	Storage temperature	− 40~125	℃

* : The voltage on pins ①, ②, ⑤ is ± 200 V.

ELECTRICAL CHARACTERISTICS (Ta = 25℃, unless otherwise noted)

Symbol	Parameter	Test No.	Test method The numbers in circle below indicate Pin Nos.	Limits Min.	Typ.	Max.	Unit
I_{CC}	circuit current	1	Measure the inflow current when 4.5 V_{DC} of voltage is applied to pin ⑥, ㉗.	15	20	27	mA
Video Section							
Ymax	Maximum output	2	Input 100kHz sine wave of 0.3 Vp − p to pin ㉘, and measure the output amplitude at pin ㉑ when the voltage at pin ⑰ is 4.5 V_{DC}.	1.8	2.2	2.7	V_{P-P}
G_Y	Video amplifier gain	3	Input 100kHz sine wave of 0.3 Vp − p to pin ㉘ and measure the output amplitude at pin ㉑ when the voltage at pin ⑰ is 1.0 V DC to calculate the ratio between the measured amplitude and input amplitude.	11	14.3	16	dB
$Y_{CTRST(2.0)}$	Contrast control characteristics	4	Input 100kHz sine wave of 0.3 Vp − p to pin ㉘, and when the voltage at pin ⑰ is changed to 2.0, 0.5 and 0 V_{DC}, measure each outout amplitude at pin ㉑ to calculate the measured amplitude to Test 3 output amplitude ratio.	0.5	3.0	5.0	dB
$Y_{CTRST(2.5)}$				− 8.0	− 4.8	− 3.0	dB
$Y_{CTRST(0)}$				− 50	− 19	− 14	dB
$Y_{TONE(4.5)}$	Picture quality control characteristics	5	Input 1.5 MHz sine wave of 0.3 Vp − p to pin ㉘, and when the voltage at pin ⑰ is 1.0 V_{DC}, and the voltage at pin ㉘ is changed to 2.25, 4.5 and 0 V_{DC}, measure each output amplitude at pin ㉑ to calculate the ratio of the measured amplitude to the output amplitude when the voltage at pin ㉘ is 2.25V_{DC}.	− 4.0	− 2.6	− 1.5	dB
$Y_{TONE(0)}$				4.0	5.7	7.0	dB
Y_{FREQ}	Frequency characteristics	6	Input 200kHz and 2 MHz sine waves of 0.3 Vp-p to pin ㉘, and when the voltage at pin ㉘ and ⑰ are 2.25 and 1.0 V_{DC} respectively, measure the output amplitude at pin ㉑ to calculate the ratio between the measured amplitude and output amplitude at 2 MHz in relation to 200 kHZ.	− 9.5	− 6.2	− 3.5	dB
Chroma Section							
Cmax	Maximum output	7	Input a sine wave of 0 dB to pin ㉖, and measure the output amplitude at pin ㉑ when the voltage at pin ⑰, ㉕ are 4.5 V_{DC}.	1.5	2.0	2.5	V_{P-P}
G_C	Chroma maximum gain	8	Input a sine wave of −26 dB to pin ㉖, and when the voltage at pins ⑰, ㉕ are 4.5 V DC, measure the output amplitude at pin ㉑ to calculate the ratio between the measured amplitude and input amplitude.	45	52	57	dB
$C_{ACC(+6)}$	ACC control characteristics	9	Input sine wave of 0, +6, -20 dB to pin ㉖, and when the voltage at pin ⑰, ㉕ are 1.0 and 0.3 V_{DC} respectively, measure each putput amplitude at pin ㉑ to calculate the ratio between the measured amplitude and output amplitude at 0 dB input.	0	0.1	2.0	dB
$C_{ACC(-20)}$				− 6.0	− 1.8	0	dB
C_{IKLR}	Killer operation input	10	Input PAL simple chroma signal of 0 dB to pin ㉖, reduce the amplitude, measure the input amplitude when the voltage at pin ㉛ exceeds 2.9 V, and calculate the ratio of the measured amplitude to the input amplitude at 0 dB.		− 48	− 40	dB
D_{KLR}	Killer color residual	11	Input a sine wave of 0 dB to pin ㉖, and measure the output amplitude at pin ㉑ when the voltage at pin ⑰, ㉕ are 1.0 and 0.3 V_{DC} respectively.	0	10	30	mV_{P-P}
$C_{SAT(4.5)}$	Color saturation control characteristics	12	Input a sine wave of 0 dB to pin ㉖, and when the voltage at pin ⑰, is 1.0 V_{DC}, and the voltage at pin ㉕ is changed to 4.5, 1.0, 0.5, 0.3 and 0.1 V_{DC}, measure each output amplitude at pin ㉑ to calculate the ratio between the measured amplitude and the output amplitude when the voltage at pin ㉕ is 0.3V_{DC} (To be continued)	1.5	3.5	6.0	dB
$C_{SAT(1.0)}$				1.5	3.5	6.0	dB
$C_{SAT(0.5)}$				1.0	3.0	5.5	dB
$C_{SAT(0.1)}$				− 16	− 13	− 10	dB

ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test No.	Test method	Limits			Unit
			The numbers in circle below indicate Pin Nos.	Min.	Typ.	Max.	
$C_{CTRL(4.5)}$	Color control characteristics	13	Input a sine wave of 0 dB to pin ㉖, and when the voltage at pin ⑰, ㉕ are 4.5 V_{DC}, measure the amplitude at pin ④; it shall be CCTRL(4.5). In the same manner, measure the output amplitude at pin④ when the voltage at pin ㉕ is 2.0 and 0.5 V_{DC} to calculate the ratio between the mwasured amplitude and CCTRL(4.5): te amplitude shall be CCTRL(2.0) and CCTRL (0.5) respectively.	0.8	1.2	1.6	V_{P-P}
$C_{CTRL(2.0)}$				− 6	− 2.8	0	dB
$C_{CTRL(0.5)}$				− 20	− 17	− 14	dB
Δ f_{VCO}	VCO free run frequency	14	Input only SYNC to pin ⑱ and measure the oscillation frequency at pin ⑪ to calculate the difference from 4.433619 MHz. (No input at pin ㉖)	− 950	0	+ 950	Hz
Δ $f_{VCOpull}$	APC pull − in range	15	Input a sine wave of 0 dB to pin ㉖ and change the frequency. Measure the input frequency at which the voltage at pin ㉛ change from "H" to "L." (The center frequency shall be 4.433619MHZ.)	+ 200	+ 300		Hz
					− 300	− 200	
D_B	B demodulator sensitivity	16	Input a sine wave of 0 dB to pin ⑳ and measure the output amplitude at pin ㉑ when the voltages at pin ⑰, ㉕ are 1.0 and 0.3 V_{DC} respectively.	0.4	0.7	1.2	V_{P-P}
R (R/B)	Demodulated output voltage ratio	17	Input a sine wave of 0 dB to pin ㉖ and measure the output amplitude at pin ㉒, ㉓ when the voltages at pin ⑰, ㉕ are 1.0 and 0.3 V_{DC} respectively to calculate the ratio between the measured amplitude and the output amplitude in Test No. 16 above.	0.40	0.57	0.70	−
R (G/B)				0.25	0.35	0.45	−
D_{leakB}	Demodulated output carrier leak	18	Input a sine wave of 0 dB to pin ㉖ and measure the output amplitude at pin ㉑, ㉒, ㉓ for the element of 8.9 MHz when the voltages at pins ⑰, ㉕ are 1.0 and 0 V_{DC} respectively.	0	8	25	mV_{P-P}
D_{leakR}				0	8	30	mV_{P-P}
D_{leakG}				0	8	25	mV_{P-P}
R_{DC}	PAL/SECAM output DC voltage difference	19	Measure each DC voltage difference at pin ㉑, ㉒, ㉓ when pin ㉚ is grounded with V_{CC} AT 10KΩ with noinput at pins ㉔ and ㉕. * 4.5 V_{DC} for voltage at pin ⑰ and ㉖	0	19	50	mV_{DC}
G_{DC}				0	6	50	mV_{DC}
B_{DC}				0	10	50	mV_{DC}
$V_{31KLR-H}$	"H" voltage at killer pin	20	Input only SYNC and measure each DC voltage at pin ㉛ when pin ㉚ is connected through 10kΩ to "GND (L)," and it is connected to "V_{cc} (H)" in the same manner. (No input at pin ㉖)	3.3	3.7	4.5	V_{DC}
$V_{31KLR-L}$	"L" voltage at killer pin	20		0	0.1	0.3	V_{DC}
V_{CONT}	Voltage at no signal input	21	Measure output DC voltage at pin ⑳ when no signal is input.	2.7	3.1	3.7	V
G_{CO}	Luminance amplifier gain	22	Input 100 kHz sine wave of 0.1 Vp-p to pin ㉘ and measure the output amplitude at pin ⑳ to calculate the ratio between the measured amplitude and input amplitude.	11.0	14.0	17.0	dB
G_{max}	Maximum output	23	Input 100 kHz sine wave of 0.5 Vp-p to pin ㉘ and measure the output amplitude at pin ⑳.	1.7	2.5	3.0	V_{P-P}
SB	SECAM demodulated luminance	24	Input 100 kHz sine wave of 0.3 Vp-p to pin ①, ② when pin ㉚ is connected through 10 KΩ to "Vcc" with pin ⑰ =1.0 V_{DC} and pin㉕ =0 V_{DC}, and measure the output amplitude at pin ㉑.	0.7	1.0	1.3	V_{P-P}
SR (R/B)	SECAM demodulated output voltage ratio	25	Measure the output amplitude at pin ㉒, ㉓ under the conditions in Test No. 24 above, and calculate the ratio between the measured amplitude and output amplitude in Test.	0.55	0.67	0.80	−
SR (G/B)				0.45	0.55	0.65	−

SWITCH CONDITIONS IN TEST CIRCUIT

Test No.	Pin Voltage (VDC) ⑰	㉕	㉖	㉘	㉙	㉚	S S1	S3	S17	S19	S25	S26	S28	W S29-1	S29-2	S30
1	2.7	2.25	4.5	2.25			OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
2	4.5	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
3	1.0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
4	2.0 0.5 0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
5	1.0	0	4.5	2.25 4.5 0			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
6	1.0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
7	4.5	4.5	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
8	4.5	4.5	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
9	1.0	0.3	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
10	1.0	0.3	4.5	2.25	2.9		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
11	1.0	0.3	4.5	2.25	2.9	4.5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
13	4.5	4.5 2.0 0	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
14	1.0	0.3	4.5	2.25	2.9		OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
15	1.0	0.3	4.5	2.25	2.9		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
16	1.0	0.3	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
17	1.0	0.3	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
18	1.0	0	4.5	2.25	2.9	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
19	4.5	4.5	4.5	4.5		4.5 0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
20	1.0		4.5	2.25	2.9	4.5 0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
21	1.0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
22	1.0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
23	1.0	0	4.5	2.25			OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF
24	1.0	0.3	4.5	2.25	2.9	4.5	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
25	1.0	0.3	4.5	2.25	2.9	4.5	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

* Normally S5 should be OFF.

Input Pulse Pin Threshold

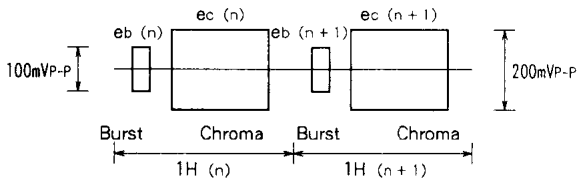
HD pulse	Pin ⑲	Vth = 1.5V
Sync PULSE	Pin ⑱	Vth = 1.5V

NOTE: When a pulse is input wuth the HD pulse polarity facing downward "⊓":
* Fall position: This position should be within the fly-back period and ahead of the burst signal.
* Rise position: This position should be within the fly-back period and not come into contact with the image.

ELECTRICAL CHARACTERISTICS TEST METHOD

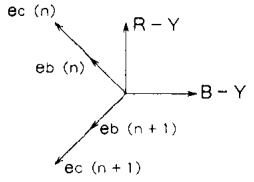
NOTE1. "Sine wave of 0dB" in the chroma section above refers to 4.43MHz, 100mVP-P.

NOTE2. PAL simple chroma signal (0dB)



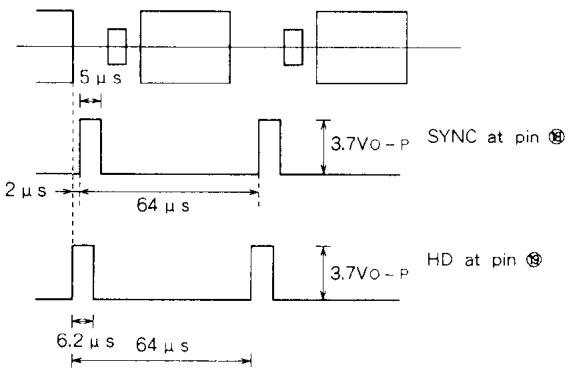
fsb (n) = fsc (n) = 4.433619MHz (Same phase)

The phase relation of the above signal is as shown on the right. The phase relation of ec (n) and ec (n+1) to the burst may not always be as shown in the figure above: the test items for the phase relation in particular should be variable.

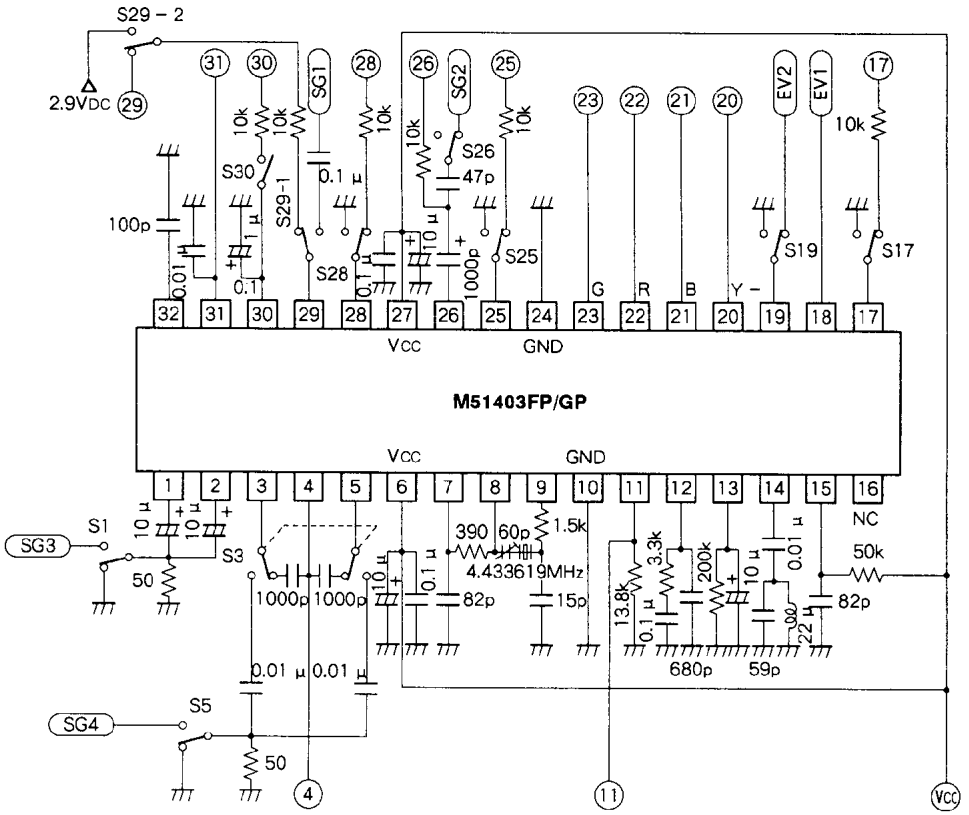


The above timing is standard: there is an allowance of 1.5 µs after SYNC fall and 12 µs before SYNC fall in HD rise, and 2 to 7.5 µs in HD width.
The input amplitude should be 1.7VO-P~VCC.

INPUT SIGNAL



TEST CIRCUIT

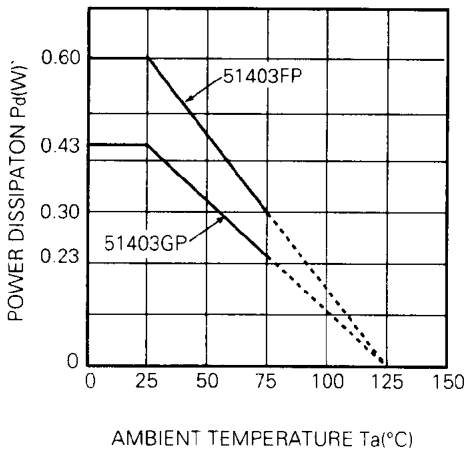


Units Resistance: Ω

Capacitance: F

TYPICAL CHARACTERISTICS

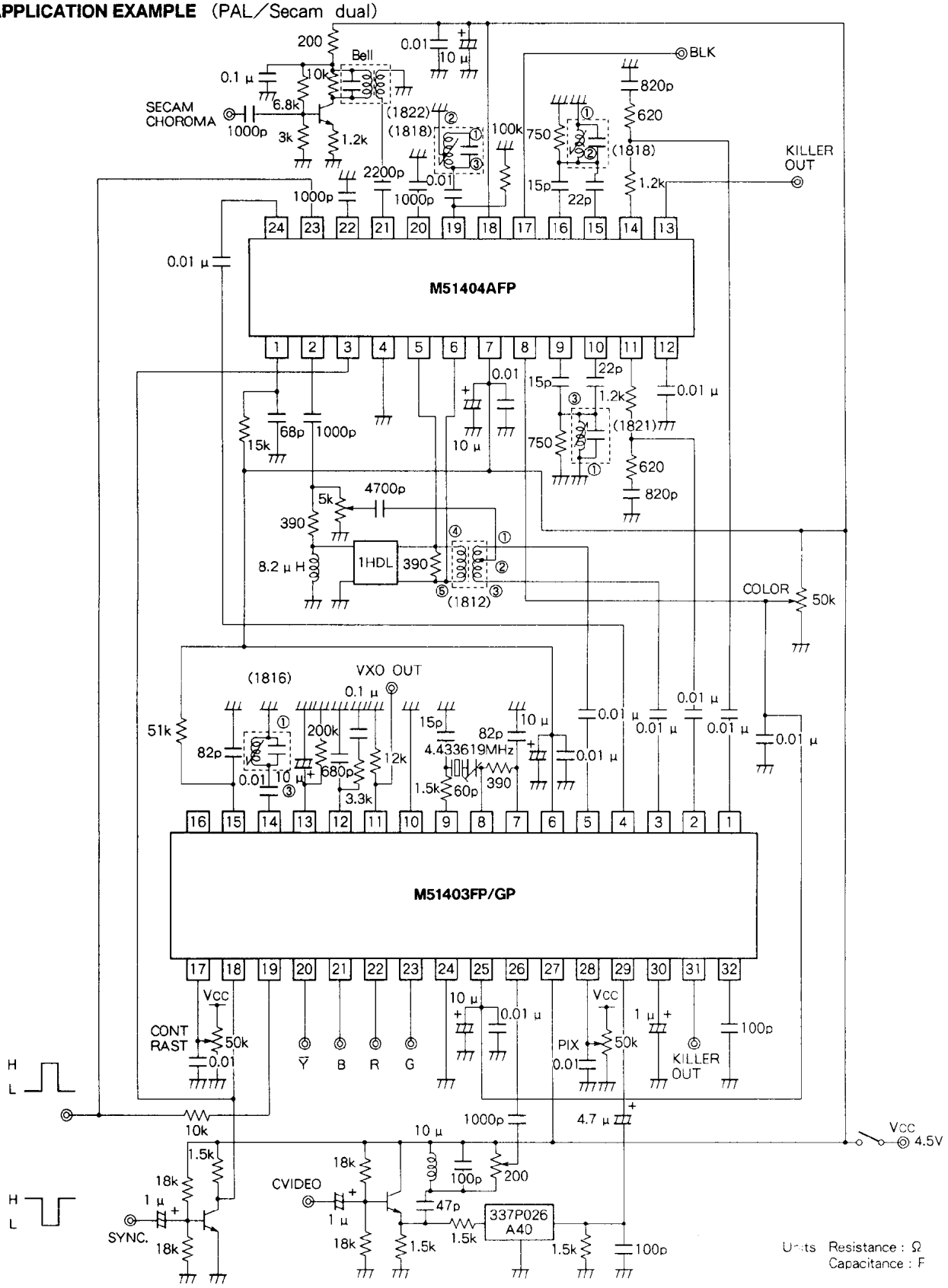
THERMAL DERATING (MAXIMUM RATING)



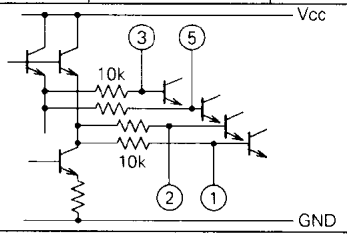
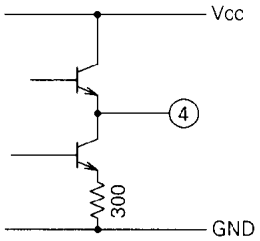
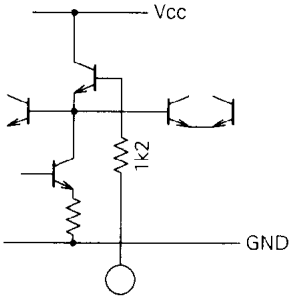
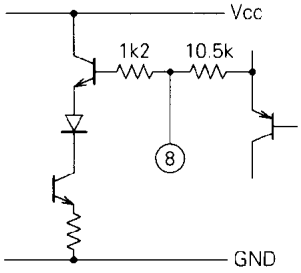
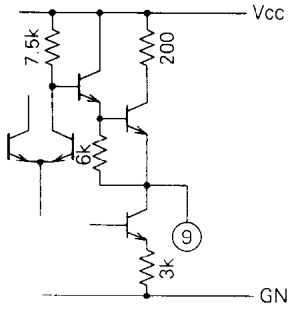
M51403FP/GP

PAL VIDEO CHROMA SIGNAL PROCESSOR

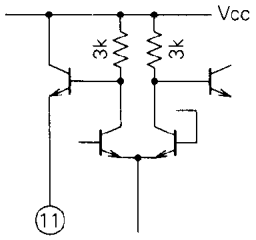
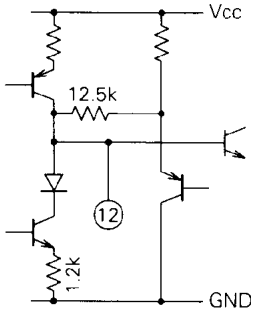
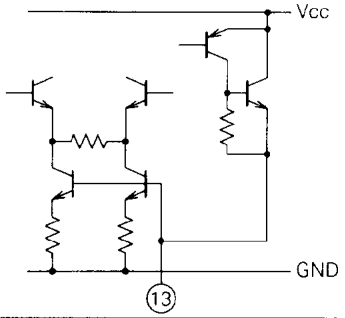
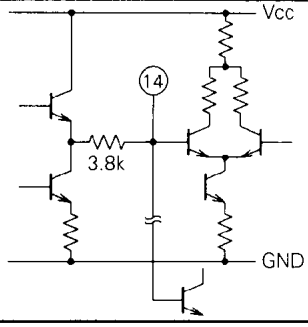
APPLICATION EXAMPLE (PAL/Secam dual)



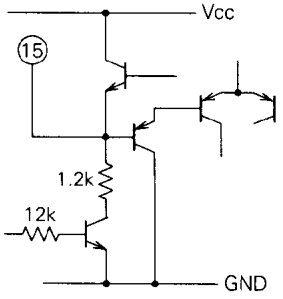
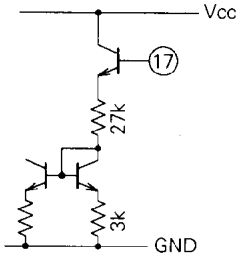
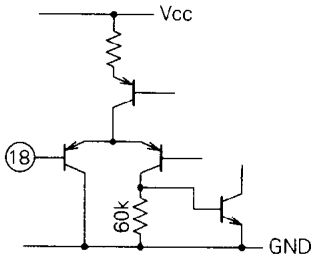
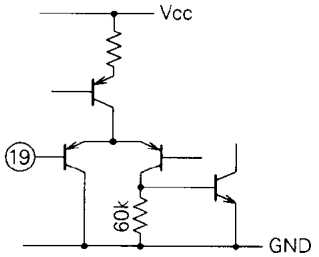
DESCRIPTION OF PIN

Pin No.	Name	Peripheral circuit of pins
①	SECAM B-Y Input	
②	SECAM R-Y Input	
③	PAL R-Y Input	
⑤	PAL B-Y Input	
④	Chroma Output	
⑥	Vcc1	
⑦	VCO Input 1	
⑧	VCO Input 2	
⑨	VCO Output 1	

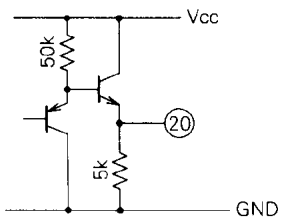
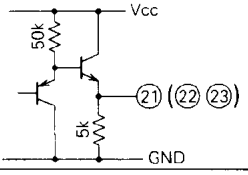
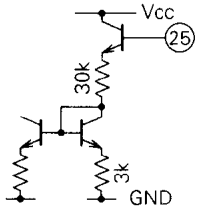
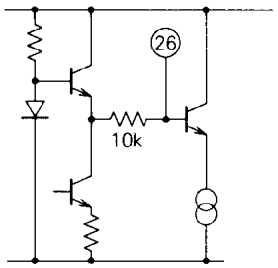
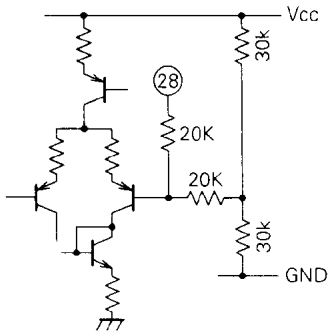
DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
⑩	GND	
⑪	VCO Output 2	
⑫	APC Filter	
⑬	ACC Filter	
⑭	Burst Cleaning	

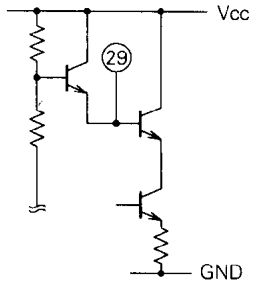
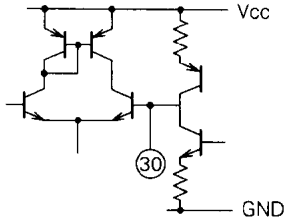
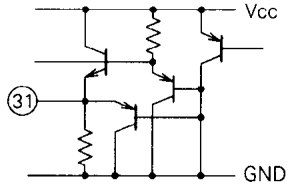
DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
⑮	Burst Gate Time Constant	
⑯	N.C.	—
⑰	Contrast Control	
⑱	Horizontal Sync Signal Input (SYNC)	
⑲	Horizontal Drive Signal Input (HD)	

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
⑳	VIDEO Output (Inverted phase)	
㉑	B Output	
㉒	R Output	
㉓	G Output	
㉔	GND	—
㉕	Color Control	
㉖	Chroma Input	
㉗	Vcc2	—
㉘	Picture Quality Control	

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Peripheral circuit of pins
㉙	VIDEO Input	
㉚	Killer Filter	
㉛	Killer Output	
㉜	ID Filter