

M51406FP**NTSC VIDEO CHROMA INTERFACE****DESCRIPTION**

The M51406FP is a semiconductor integrated circuit with video signal processing functions best suited to NTSC color LCD TV. This IC outputs optimum RGB signals for driving an LCD from luminance and color signals.

FEATURES

- The 2-power supply system is employed for a larger output amplitude, and a low power dissipation of 210 mW is realized.
- A single chip permits all video signal processings.
- The on-screen signal input switch applicable to external analog input signals is built in this IC.
- VIDEO AGC is incorporated to increase the contrast.
- The γ correction circuit is provided to correct nonlinearity of luminance characteristics for the applied voltage, which are peculiar to the LCD panel.
- This IC contains multiple control functions, such as color contrast control, picture quality control, brightness control, driver circuit bias control and γ control.

APPLICATION

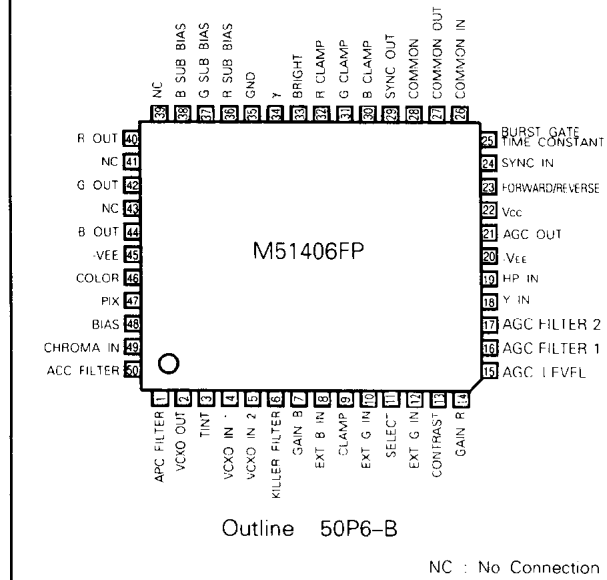
Active matrix color LCD TV

RECOMMENDED OPERATING CONDITION

Rated supply voltage	$V_{CC}=+4.5\pm 0.5V$ $V_{EE}=-7.5\pm 0.5V$
Video input	0.5V _{P-P}
Chroma input	100mV _{P-P} (Burst level)
External RGB input	0.8V _{P-P}

FUNCTION

- Video AGC:
Processes the input luminance signal amplitude by AGC using the mean value, to minimize contrast fluctuations and reduce black or white compression of the picture. AGC operation level is output to the AGC LEVEL pin. The standard input level is 0.5V_{P-P}.
- Picture quality control:
Changes the frequency characteristics of luminance signal which are controlled by DC voltage.
- Matrix:
Produces RGB signals from luminance and color difference signals in matrix, which are then output to INT/EXT switch block.
- ACC:
Processes input chroma signals by ACC, which are then sent to the chroma demodulator. The ACC range is between -20 and 6dB. (The 100mV_{P-P} burst level is set at 0dB.)

PIN CONFIGURATION (TOP VIEW)

- Killer:
Outputs a color signal if PLL is locked to the input chroma signal.
- VCXO and APC:
These functions constitute PLL which locks the input chroma signal. The standard lock range is 1 kHz.
- Tint:
Controls the tint of the demodulated color signal.
- Color decoder:
Demodulates NTSC chroma signal processed by ACC into a color difference signal, which is then sent to the matrix.
- Contrast:
Controls the amplitude of matrix-synthesized RGB signal.
- Gain control B:
Controls B signal gain to adjust the white balance.
- Gain control R:
Controls R signal gain.
- INT/EXT switch:
Selects external RGB signal or internal signal produced in matrix from the color difference and Y components of video signal.
- Clamp control:
Adjusts the pedestal level of internal signal and external signal.

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● BRIGHT control:

Controls the brightness after clamping INT/EXT switch output. The γ amplifier operating point changes with the brightness level.

● γ amplifier:

This nonlinear amplifier adjusts a drive signal to γ curve peculiar to LCD. Nonlinearity changes with γ control.

● Bias inversion stage:

Independently controls R, G and B signal inversion amplitude to adjust the white balance. Panel drive signal amplitude is the sum of bias amount and common electrode amplitude.

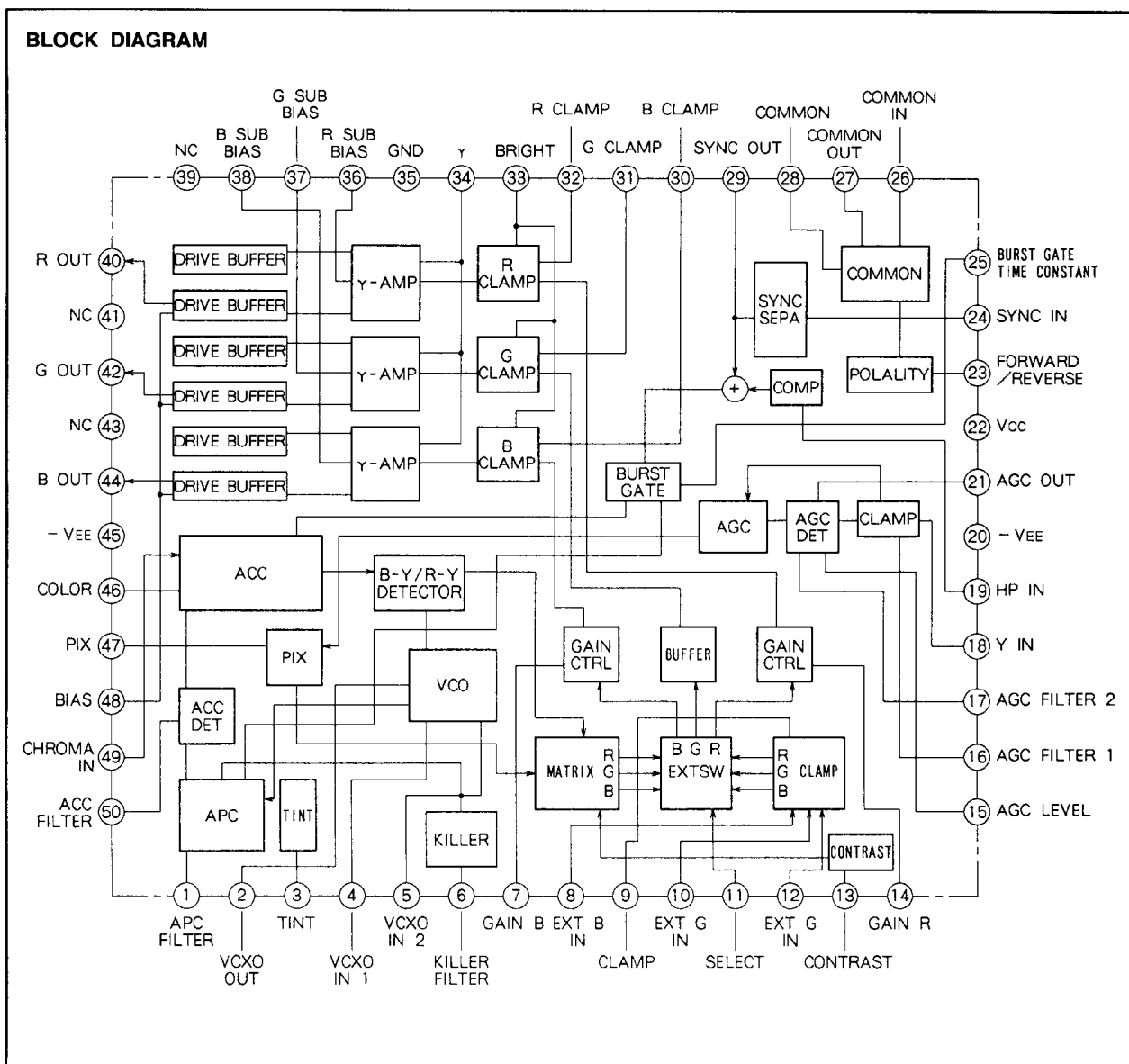
● Sync separation burst gate:

Sync separation circuit output is sent to SYNC SEPA OUT pin, which is simultaneously added to HP pulse and sent to the burst gate generator. When no signal is input, HP pulse must be used for clamping.

● Common electrode driver:

Drives common electrodes of LCD panel. Output is inverted according to inversion signal. Polarity can be reversed although RGB outputs are inverted simultaneously.

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V _{CC}	Supply voltage	14	V
V _{in}	Input voltage	0~V _{CC} + 0.3	V
V _{iv}	Video input amplitude	2	V _{P-P}
V _{ic}	Chroma input amplitude	0.5	V _{P-P}
V _{os}	Sync separation output voltage	V _{CC} + 0.5	V
V _{oi}	Sync separation output current	2.5	mA
V _{co}	Common output load current	- 3~3	mA
V _{CC}	R.G.B output load current	- 3~3	mA
V _{CE}	External R.G.B input amplitude	2	V _{P-P}
P _d	Power dissipation	550	mW
T _{opr}	Operating temperature	- 20~75	°C
T _{stg}	Storage temperature	- 40~125	°C

ELECTRICAL CHARACTERISTICS (T_a = 25 °C, V_{CC} + 4.5V, - V_{EE} = - 7.5V unless otherwise noted)

Symbol	Parameter	Test No.	Test point	Test conditions	Limits			Unit
					Min.	Typ.	Max.	
I _{CC1}	Circuit current (Positive)	T1	22	No-signal input	23.0	32.0	43.0	mA
I _{CC2}	Circuit current (Negative)	T2	20.45	No-signal input	- 10.5	- 8.0	- 5.5	mA
SSoL	Sync separation L voltage	T3	29	I ₂₉ = 1mA	0.1	0.5	0.9	V
SSoH	Sync separation H voltage	T4	29		4.0	4.5		V
CoL	Common driver output voltage	T5	27	I ₂₇ = 3mA, V ₂₆ = 4V	- 7.5	- 6.5	- 5.5	V
CoH	Common driver output voltage	T6	27	I ₂₇ = - 3mA, V ₂₆ = 0V	1.8	2.8	3.8	V
RoL	R output voltage L	T7	40	I ₄₀ = 2mA, V ₂₆ = 4V	- 7.2	- 6.2	- 5.2	V
RoH	R output voltage H	T8	40	I ₄₀ = - 2mA, V ₂₆ = 0V	1.2	2.2	3.2	V
GoL	G output voltage L	T9	42	I ₄₂ = 2mA, V ₂₆ = 4V	- 7.2	- 6.2	- 5.2	V
GoH	G output voltage H	T10	42	I ₄₂ = - 2mA, V ₂₆ = 0V	1.2	2.2	3.2	V
BoL	B output voltage L	T11	44	I ₄₄ = 2mA, V ₂₆ = 4V	- 7.2	- 6.2	- 5.2	V
BoH	B output voltage H	T12	44	I ₄₄ = - 2mA, V ₂₆ = 0V	1.2	2.2	3.2	V
Sync Separation								
SSO - 1	SYNC separation output 1	S1	29	Input 1V _{P-P} video	3.6	4.3	4.5	V _{P-P}
SSO - 2	SYNC separation output 2	S2	29	Input 300mV _{P-P} video	3.6	4.3	4.5	V _{P-P}
SSO - 3	SYNC separation output 3	S3	29	Input 2V _{P-P} video	3.6	4.3	4.5	V _{P-P}
HP - 1	HP input	S4	29	Pulse width 4 μs, peak value 3V _{P-P}		0		V _{P-P}
SSD - 1	Output delay time 1	S5	29	Input 1V _{P-P} video, rise	0.4	0.8	1.2	μs
SSD - 2	Output delay time 2	S6	29	Input 1V _{P-P} video, fall	0.1	0.4	0.7	μs
HPD - 1	Output delay time 3	S7	29	HP input, rise				μs
HPD - 2	Output delay time 4	S8	29	Input, fall				μs
AGC Video								
AGL - 1	AGC level - 1 (Min.)	A1	42	Input 0.5V _{P-P} video, V ₁₅ = 1.0V	0.7	1.2	1.7	V _{P-P}
AGL - 2	AGC level - 2 (Max.)	A2	42	Input 0.5V _{P-P} video, V ₁₅ = 3.5V	2.8	4.5	6.2	V _{P-P}
AGL - 3	AGC level - 3 (Typ.)	A3	42	Input 0.5V _{P-P} video, V ₁₅ = 3.0V	1.1	1.8	2.5	V _{P-P}
AGL - 4	AGC level - 4	A4	42	Input 0.3V _{P-P} video, V ₁₅ = 3.0V	0.6	1.1	1.6	V _{P-P}
AGL - 5	AGC level - 5	A5	42	Input 0.7V _{P-P} video, V ₁₅ = 3.0V	1.5	2.4	3.3	V _{P-P}
AGM	AGC maximum gain	A6	42	Input 0.2V _{P-P} video, V ₁₅ = 4.5V	6.0	7.5	10.0	V _{P-P}
AGoH	AGC voltage output H	A7	21	Input 0.2V _{P-P} video, V ₁₅ = 4.0V	2.5	3.3	4.5	V
AGoL	AGC voltage output L	A8	21	Input 0.7V _{P-P} video, V ₁₅ = 1V		0.3	1.0	V
AGR	AGC level - R	A9	40	Input 0.5V _{P-P} video, V ₁₅ = 3.0V	1.2	1.9	2.6	V _{P-P}
AGB	AGC level - B	A10	44	Input 0.5V _{P-P} video, V ₁₅ = 3.0V	1.2	1.9	2.6	V _{P-P}
AGG - R	Gain control - R	A11	40	Input 0.5V _{P-P} video, V ₁₅ = 3.0V, V ₁₄ = 2V	2.7	4.0	5.3	V _{P-P}
AGG - B	Gain control - B	A12	44	Input 0.5V _{P-P} video, V ₁₅ = 3.0V, V ₇ = 2V	2.7	4.0	5.3	V _{P-P}

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ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test No.	Test point	Test conditions	Limits			Unit
					Min.	Typ.	Max.	
Picture Quality Control								
Plot	Picture quality, center	P1	42	Video input 0.3V _{P-P} , 100k/2MHz	-9.0	-6.5	-4.0	dB
Plma-1	Picture quality, maximum 1	P2	42	Video input 0.3V _{P-P} , 100k/1MHz	-5.5	-4.0	-2.5	dB
Plma-2	Picture quality, maximum 2	P3	42	Video input 0.3V _{P-P} , 100k/2MHz	-12.5	-9.5	-6.5	dB
Plma-3	Picture quality, maximum 3	P4	42	Video input 0.3V _{P-P} , 100k/500kHz	-2.0	-1.3	-0.6	dB
Plmi-1	Picture quality, minimum 1	P5	42	Video input 0.3V _{P-P} , 100k/1MHz	0.3	0.8	1.3	dB
Plmi-2	Picture quality, minimum 2	P6	42	Video input 0.3V _{P-P} , 100k/2MHz	-0.9	-0.5	-0.1	dB
Plin-1	Picture quality, change 1	P7	42	Video input 0.3V _{P-P} , 2MHz, V ₄₇ = 0/2.5V	4.5	7.5	10.5	dB
Plin-2	Picture quality, change 2	P8	42	Video input 0.3V _{P-P} , 2MHz, V ₄₇ =2.5V/4.5V	1.8	3.0	4.2	dB
Plin-3	Picture quality, change 3	P9	42	Video input 0.3V _{P-P} , 1MHz, V ₄₇ =0V/2.5V	3.0	4.5	6.0	dB
Plin-4	Picture quality, change 4	P10	42	Video input 0.3V _{P-P} , 1MHz, V ₄₇ =2.5V/4.5V	0.6	1.3	2.0	dB
Plv	Inversion frequency characteristics	P11	42	Video input 0.3V _{P-P} , 2MHz, V ₂₆ = 1V/4V	-3.0	0	3.0	dB
Chroma Section								
ACC-1	ACC characteristics 1	C1	42	Standard level input	400	800	1200	mV _{P-P}
ACC-2	ACC characteristics 2	C2	42	-20dB input	-2.7	-1.7	-0.7	dB
ACC-3	ACC characteristics 3	C3	42	+6dB input		0.2	2.0	dB
CTL-1	Color control(Standard)	C4	42	V ₄₆ = 2.5V	700	1200	1700	mV _{P-P}
CTL-2	Color control(Minimum)	C5	42	V ₄₆ = 1.2V	-11.5	-8.5	-5.5	dB
CTL-3	Color control(Maximum)	C6	42	V ₄₆ = 4.5V	1.4	2.2	3.0	dB
APC-1	APC pull-in range 1	C7	42		200	650	1100	Hz
APC-2	APC pull-in range 2	C8	42		-1300	-850	-400	Hz
KIL	Killer operating input level	C9	42		-55	-40	-25	dB
KILR	Killer color residual	C10	42	No burst • chroma		10	100	mV _{P-P}
DEM-1	Demodulated output amplitude ratio 1	C11	40/44		0.4	0.6	0.8	-
DEM-2	Demodulated output amplitude ratio 2	C12	42/44		0.1	0.3	0.5	-
CL	Demodulated output carrier leak	C13	42			20	200	mV _{P-P}
CTIN	Tint control variance	C14	44		70	100	-	deg.
DPH-1	Demodulated phase angle-1	C15	40		70	110	150	deg.
DPH-2	Demodulated phase angle-2	C16	42		210	250	290	deg.
V _{APC}	APC filter pin voltage	C17	1	Voltage measurement in locked conditions	2.8	3.0	3.1	V
R Output Section								
BRR	R output brightness change	R1	40	V ₃₃ = 1V/3V	2.0	3.0	4.0	V
SBR	R output sub bias change	R2	40	V ₃₆ = 0V/3V	3.3	4.3	5.3	V
INR-1	R output, inverted output 1	R3	40	V ₂₆ = 1V/4V, V ₃₆ = 0V	2.4	3.4	4.4	V _{P-P}
INR-2	R output, inverted output 2	R4	40	V ₂₆ = 1V/4V, V ₃₆ = 3V	7.0	9.5	12.0	V _{P-P}
INR-3	R output, inverted output 3	R5	40	V ₂₆ = 1V/4V, V ₃₆ = 3V, V ₂₃ = 4.5V	7.0	9.5	12.0	V _{P-P}
YR-1	R output Y characteristics-1	R6	40	V _{in12} = 0.1V, V ₃₄ = 3.5V/4.5V	1.2	2.2	3.2	-
YR-2	R output Y characteristics-2	R7	40	V _{in12} = 0.4V, V ₃₄ = 3.5V/4.5V	0.8	1.4	2.0	-
YR-3	R output Y characteristics-3	R8	40	V _{in12} = 0.6V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
YR-4	R output Y characteristics-4	R9	40	V _{in12} = 0.8V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
GCR	R output gain control	R10	40	V _{in12} = 0.6V, V ₁₄ = 3.8V/3.2V	0.4	0.9	1.4	-
MOR	R output maximum output difference	R11	40	V _{in12} = 0.9V, V ₂₆ = 1V/4V	0.4	0.9	1.4	-
VCR	R output center voltage	R12	40	V _{in12} = 0.2V, V ₂₆ = 1V/4V	-2.3	-1.7	-1.6	V
VOR	R output amplitude	R13	40	V _{in18} = 0.5V _{P-P} , V ₁₃ = 0V	7.0	9.0	12.0	V _{P-P}
CLR	R output EXT clamping level	R14	40	V _{in18} = 0.41V _{P-P} , V ₁₃ = 0V, V ₁₁ = 0V/4V	-0.1	1.6		V

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ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test No.	Test point	Test conditions	Limits			Unit
					Min.	Typ.	Max.	
G Output Section								
BR _G	G output brightness change	G1	42	V ₃₃ = 1V/3V	2.0	3.0	4.0	V
SB _G	G output sub bias change	G2	42	V ₃₇ = 0V/3V	3.3	4.3	5.3	V
IN _G - 1	G output, inverted output 1	G3	42	V ₂₆ = 1V/4V, V ₃₇ = 0V	2.4	3.4	4.4	V _{P-P}
IN _G - 2	G output, inverted output 2	G4	42	V ₂₆ = 1V/4V, V ₃₇ = 3V	7.0	9.5	12.0	V _{P-P}
IN _G - 3	G output, inverted output 3	G5	42	V ₂₆ = 1V/4V, V ₃₇ = 3V, V ₂₃ = 4.5V	7.0	9.5	12.0	V _{P-P}
Y _G - 1	G output Y characteristics - 1	G6	42	V _{in10} = 0.1V, V ₃₄ = 3.5V/4.5V	1.2	2.2	3.2	-
Y _G - 2	G output Y characteristics - 2	G7	42	V _{in10} = 0.4V, V ₃₄ = 3.5V/4.5V	0.8	1.4	2.0	-
Y _G - 3	G output Y characteristics - 3	G8	42	V _{in10} = 0.6V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
Y _G - 4	G output Y characteristics - 4	G9	42	V _{in10} = 0.8V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
MO _G	G output maximum output difference	G10	42	V _{in10} = 0.9V, V ₂₆ = 1V/4V	0.4	0.9	1.4	-
VC _G	G output center voltage	G11	42	V _{in10} = 0.2V, V ₂₆ = 1V/4V	- 2.3	- 1.7	- 1.6	V
VO _G	G output amplitude	G12	42	V _{in18} = 0.5V _{P-P} , V ₁₃ = 0V	7.0	9.0	12.0	V _{P-P}
CL _G	G output EXT clamping level	G13	42	V _{in18} = 0.41V _{P-P} , V ₁₃ = 0V, V ₁₁ = 0V/4V		0.1	1.6	V
B Output Section								
BR _B	B output brightness change	B1	44	V ₃₃ = 1V/3V	2.0	3.0	4.0	V
SB _B	B output sub bias change	B2	44	V ₃₈ = 0V/3V	3.3	4.3	5.3	V
IN _B - 1	B output, inverted output 1	B3	44	V ₂₆ = 1V/4V, V ₃₈ = 0V	2.4	3.4	4.4	V _{P-P}
IN _B - 2	B output, inverted output 2	B4	44	V ₂₆ = 1V/4V, V ₃₈ = 3V	7.0	9.5	12.0	V _{P-P}
IN _B - 3	B output, inverted output 3	B5	44	V ₂₆ = 1V/4V, V ₃₈ = 3V, V ₂₃ = 4.5V	7.0	9.5	12.0	V _{P-P}
Y _B - 1	B output Y characteristics - 1	B6	44	V _{in8} = 0.1V, V ₃₄ = 3.5V/4.5V	1.2	2.2	3.2	-
Y _B - 2	B output Y characteristics - 2	B7	44	V _{in8} = 0.4V, V ₃₄ = 3.5V/4.5V	0.8	1.4	2.0	-
Y _B - 3	B output Y characteristics - 3	B8	44	V _{in8} = 0.6V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
Y _B - 4	B output Y characteristics - 4	B9	44	V _{in8} = 0.8V, V ₃₄ = 3.5V/4.5V	0.6	1.2	1.8	-
GC _B	B output gain control	B10	44	V _{in8} = 0.6V, V ₇ = 3.8V/3.2V	0.4	0.9	1.4	-
MO _B	B output maximum output difference	B11	44	V _{in8} = 0.9V, V ₂₆ = 1V/4V	0.4	0.9	1.4	-
VC _B	B output center voltage	B12	44	V _{in8} = 0.2V, V ₂₆ = 1V/4V	- 2.3	- 1.7	- 1.6	V
VO _B	B output amplitude	B13	44	V _{in18} = 0.5V _{P-P} , V ₁₃ = 0V	7.0	9.0	12.0	V _{P-P}
CL _B	B output EXT clamping level	B14	44	V _{in18} = 0.41V _{P-P} , V ₁₃ = 0V, V ₁₁ = 0V/4V		- 0.1	1.6	V

ELECTRICAL CHARACTERISTICS TESTING CONDITIONS

Test No.	Input Pin	Input signal		Pin setting voltage (V)															S W		Testing
		Signal	Level	3	7	9	13	14	15	28	33	34	36	37	38	46	47	48	S11	S23	
S1	24	Video	1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S2	24	Video	0.3V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S3	24	Video	2V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S4	24	Sync	3V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S5	24	Video	1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S6	24	Video	1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S7	24	Sync	3V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
S8	24	Sync	3V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	

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ELECTRICAL CHARACTERISTICS TESTING CONDITIONS (cont.)

Test No.	Input Pin	Input signal		Pin setting voltage (V)															S W		Testing
		Signal	Level	3	7	9	13	14	15	28	33	34	36	37	38	46	47	48	S11	S23	
A1	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	1.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A2	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A3	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A4	18	Video	0.3V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A5	18	Video	0.7V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A6	18	Video	0.2V _{P-P}	1.7	3.5	1.3	2.0	3.5	4.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A7	18	Video	0.2V _{P-P}	1.7	3.5	1.7	2.0	3.5	4.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A8	18	Video	0.7V _{P-P}	1.7	3.5	1.7	2.0	3.5	1.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A9	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A10	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A11	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	2.0	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
A12	18	Video	0.5V _{P-P}	1.7	2.0	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
P1	18	Video0.3V _{P-P}	100k/2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	2.5	4.5	L	L	
P2	18	Video0.3V _{P-P}	100k/1MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
P3	18	Video0.3V _{P-P}	100k/2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
P4	18	Video0.3V _{P-P}	100k/500kHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
P5	18	Video0.3V _{P-P}	100k/1MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	1.0	4.5	L	L	
P6	18	Video0.3V _{P-P}	100k/2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	1.0	4.5	L	L	
P7	18	Video0.3V _{P-P}	2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	0/2.5	4.5	L	L	
P8	18	Video0.3V _{P-P}	2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	2.5/4.5	4.5	L	L	
P9	18	Video0.3V _{P-P}	1MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	0/2.5	4.5	L	L	
P10	18	Video0.3V _{P-P}	1MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	2.5/4.5	4.5	L	L	
P11	18	Video0.3V _{P-P}	2MHz	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	V ₂₆ =1V/4V
C1	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C2	49	Chroma	-20dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C3	49	Chroma	+6dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C4	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	2.5	4.0	4.5	L	L	
C5	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.2	4.0	4.5	L	L	
C6	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	4.5	4.0	4.5	L	L	
C7	49	Chroma frequency decrease	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C8	49	Chroma frequency increase	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C9	49	Chroma	Input level reduced from -30dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C10	49	Chroma with no burst	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C11	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C12	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C13	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C14	49	Chroma	0dB	0/4.5	3.5	1.7	2.0	3.5	4.3	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C15	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C16	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
C17	49	Chroma	0dB	1.7	3.5	1.7	2.0	3.5	3.5	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
R1	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0/3.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
R2	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	0/3.0	1.7	1.7	1.7	4.0	4.5	L	L	
R3	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	0	1.7	1.7	1.7	4.0	4.5	L	L	V ₂₆ 1V/4V
R4	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	3.0	1.7	1.7	1.7	4.0	4.5	L	H	V ₂₆ 1V/4V
R5	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	3.0	1.7	1.7	1.7	4.0	4.5	L	H	V ₂₆ 1V/4V
R6	12	Video	0.1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	
R7	12	Video	0.4V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	
R8	12	Video	0.6V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	
R9	12	Video	0.8V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	
R10	12	Video	0.6V _{P-P}	1.7	3.5	1.7	2.0	3.8/3.2	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	
R11	12	Video	0.9V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V
R12	12	Video	0.2V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V
R13	18	Video	0.5V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	
R14	18	Video	0.41V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	V ₁₁ 0V/4V

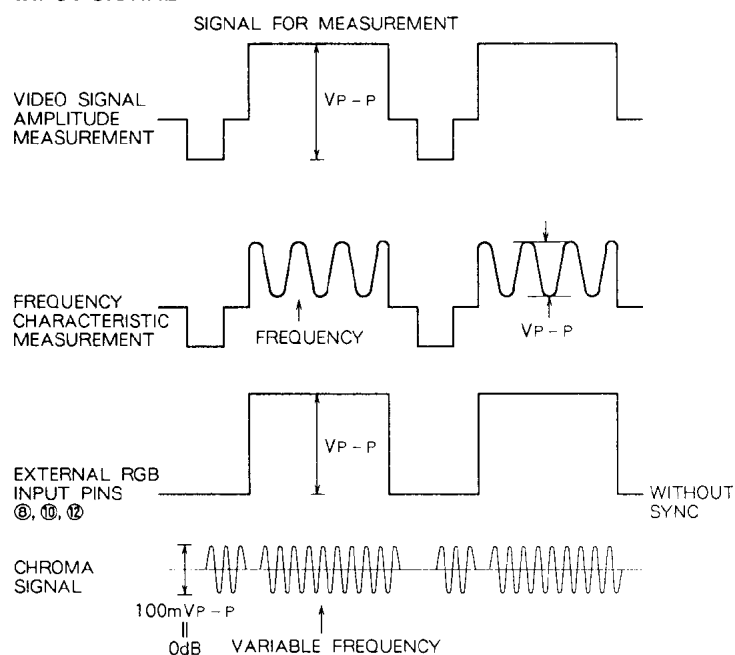
M51406FP

NTSC VIDEO CHROMA INTERFACE

ELECTRICAL CHARACTERISTICS TESTING CONDITIONS (cont.)

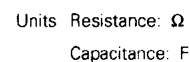
Test No.	Input Pin	Input signal		Pin setting voltage (V)																S W		Testing
		Signal	Level	3	7	9	13	14	15	28	33	34	36	37	38	46	47	48	S11	S23		
G1	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0/3.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L		
G2	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	0/3.0	1.7	1.7	4.0	4.5	L	L		
G3	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	0	1.7	1.7	4.0	4.5	L	L	V ₂₆ 1V/4V	
G4	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	3.0	1.7	1.7	4.0	4.5	L	L	V ₂₆ 1V/4V	
G5	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	3.0	1.7	1.7	4.0	4.5	L	H	V ₂₆ 1V/4V	
G6	10	Video	0.1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
G7	10	Video	0.4V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
G8	10	Video	0.6V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
G9	10	Video	0.8V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
G10	10	Video	0.9V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V	
G11	10	Video	0.2V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V	
G12	18	Video	0.5V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L		
G13	18	Video	0.41V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	V ₁₁ 0V/4V	
B1	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0/3.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L		
B2	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	0/3.0	1.7	4.0	4.5	L	L		
B3	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	0	1.7	4.0	4.5	L	L	V ₂₆ 1V/4V	
B4	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	3.0	1.7	4.0	4.5	L	L	V ₂₆ 1V/4V	
B5	18	Video	0.5V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	3.0	1.7	4.0	4.5	L	H	V ₂₆ 1V/4V	
B6	8	Video	0.1V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
B7	8	Video	0.4V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
B8	8	Video	0.6V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
B9	8	Video	0.8V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5/3.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
B10	8	Video	0.6V _{P-P}	1.7	3.8/3.2	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L		
B11	8	Video	0.9V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V	
B12	8	Video	0.2V _{P-P}	1.7	3.5	1.7	2.0	3.5	3.0	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	H	L	V ₂₆ 1V/4V	
B13	18	Video	0.5V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L		
B14	18	Video	0.41V _{P-P}	1.7	3.5	1.3	0	3.5	3.55	4.0	1.0	4.5	1.7	1.7	1.7	1.7	4.0	4.5	L	L	V ₁₁ 0V/4V	

INPUT SIGNAL

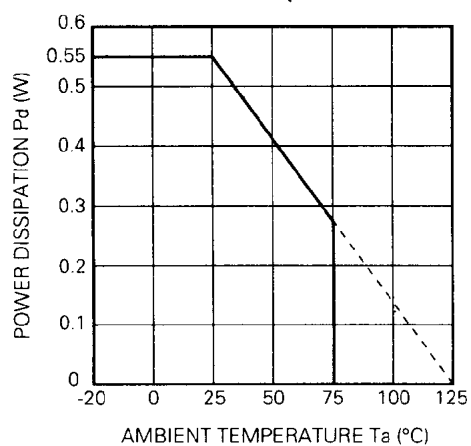


Unless otherwise specified, input a video signal of 1V_{P-P} to Pin ⑧ (sync separation input).

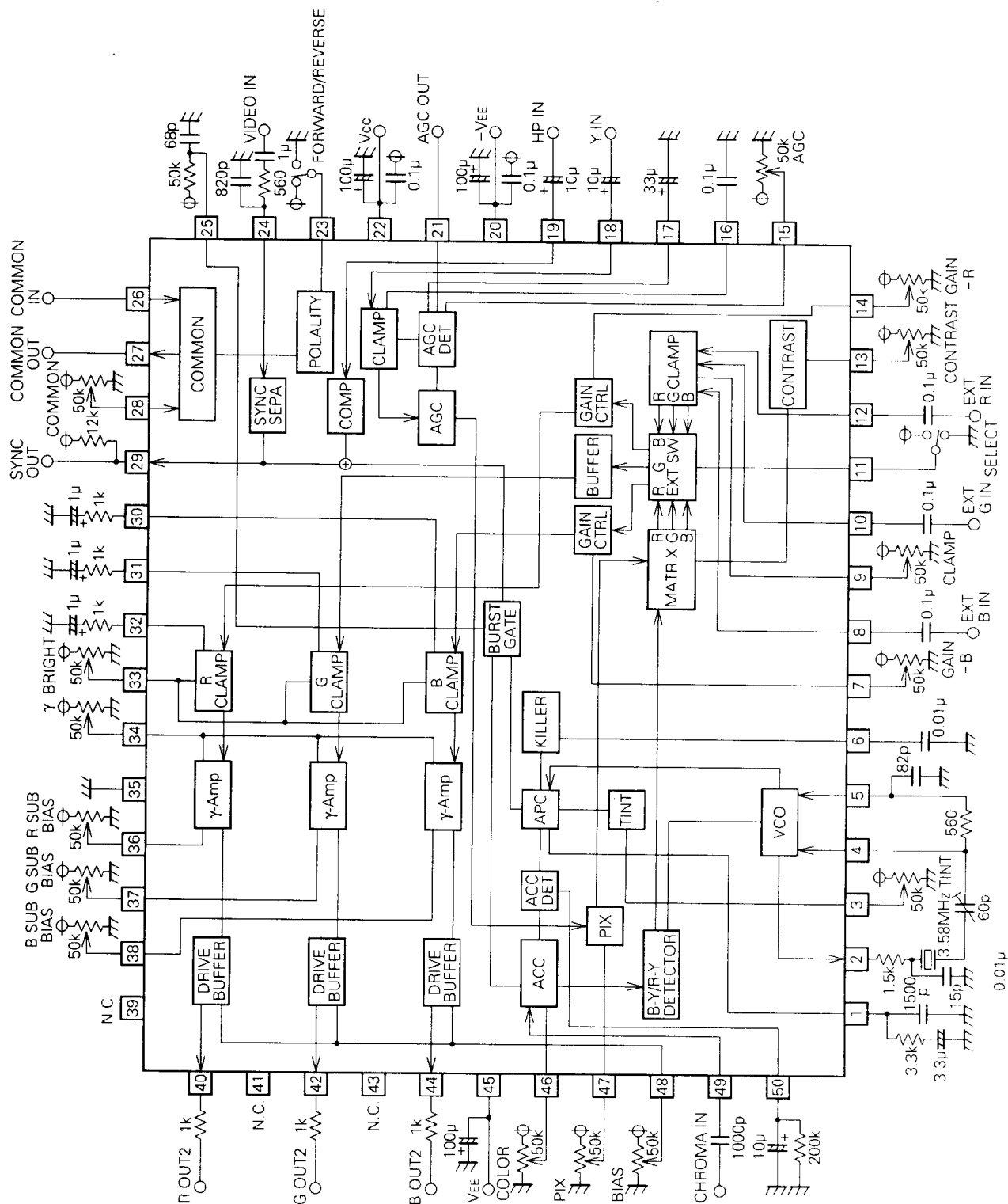
TEST CIRCUIT



THERMAL DERATING (MAXIMUM RATING)



APPLICATION EXAMPLE



Capacitance: F

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (DC voltage described below is that in normal AC operation or that to be set at each pin.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
①	APC FILTER	3.0V	
②	VCXO OUT	2.5V	
③	TINT	1.7V	
④	VCXO IN 1 (0 deg)	3.8V	

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑤	VCXO IN 2 (-45 deg)	3.8V	
⑥	KILLER FILTER	3.0V	
⑦	GAIN B	3.5V	
⑭	GAIN R		
⑧	EXT "B" IN	2.8V	
⑩	"G"		
⑫	"R"		
⑨	CLAMP	1.3V	

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑪	SELECT	Vcc Pullup H → EXT L → TV	
⑬	CONTRAST	2.0V	
⑮	AGC LEVEL	3.5V	
⑯	AGC FILTER 1	0.2V	
⑰	AGC OUT	3.5V	

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑰	AGC FILTER 2	3.0V	
⑱	Y-IN	PED 3.0V	
⑲	HP IN	Vth = 2.5V	
⑳	- VEE	—	—
㉑	Vcc	—	—
㉓	FORWARD/ REVERSE	Vth = 2.5V	

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
②④	SYNC IN	2.0V	
②⑤	BURST GATE TIME CONSTANT	$V_{th} = 2.5V$	
②⑥	COMMON IN	$V_{th} = 2.2V$	
②⑦	COMMON OUT	-6.5V	

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
②⑧	COMMON	—	
②⑨	SYNC OUT	—	
③①	B CLAMP	2.0V	
③②	G CLAMP		
③③	R CLAMP		
③④	BRIGHT	1.0V	
③④	γ	—	

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NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
(35)	GND	—	—
(36)	R SUB BIAS	1.7V	
(37)	G SUB BIAS		
(38)	B SUB BIAS		
(39) (41) (43)	NC	—	—
(40)	R-OUT	-1.5V	
(42)	G-OUT	-1.5V	
(44)	B-OUT	-1.5V	
(45)	- VEE	—	—
(46)	COLOR	1.7V	
(47)	PIX	1.5V	

M51406FP

NTSC VIDEO CHROMA INTERFACE

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
④⑧	BIAS	Vcc	
④⑨	CHROMA IN	3.5V	
⑤①	ACC FILTER	0.5V	

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DESCRIPTION OF FUNCTION

Pin No.	Name	Description of function	DC voltage(V)
①	APC FILTER	Determines the APC time constant of VCXO.	3.0
②	VCXO OUT	Output for VCXO oscillator	2.5
③	TINT	Controls the demodulated color tint.	($\approx 1.7V_{DC}$)
④	VCXO IN 1	Feedback input for VCXO oscillator	3.8
⑤	VCXO IN 2	The phase of signal at pin ④ is delayed before input.	3.8
⑥	KILLER FILTER	Killer filter connecting pin	3.0
⑦	GAIN B	Controls the gain of signal B to adjust the white balance. If the voltage is increased, the gain is reduced. The standard voltage is 3.5 V.	
⑧	EXT B IN	Inputs external B signal. The standard input is 0.8V _{p-p}	2.8
⑨	CLAMP	Controls the clamping voltage to adjust the clamping level of internal signal and external RGB signal.	($\approx 1.3V_{DC}$)
⑩	EXT G IN	Inputs external G signal.	2.8
⑪	SELECT	Switches internal and external signals. External and internal signals are output at the "H" and "L" sides respectively.	
⑫	EXT R IN	Inputs external R signal.	2.8
⑬	CONTRAST	Controls internal signal contrast. If the voltage is high, the contrast is decreased, and if it is low, the contrast is increased.	(2.0V _{DC})
⑭	GAIN R	Controls R signal gain to adjust the white balance.	($\approx 3.5V_{DC}$)
⑮	AGC LEVEL	Sets the AGC operating point.	($\approx 3.5V_{DC}$)
⑯	AGC FILTER 1	AGC filter pin	0.2
⑰	AGC FILTER 2	AGC filter pin	3.0
⑱	Y IN	Luminance signal input pin. This pin can be pedestal clamped. A sync negative signal with standard amplitude 0.5 V _{p-p} is inputted.	
⑲	HP IN	Inputs external sync signal. If this pin is used simultaneously with the sync separation output, the input signal should rise earlier than the sync separation output. V _{th} is approx. 2.5 V.	
⑳	- VEE	Connects - 7.5V power supply.	
㉑	AGC OUT	The AGC operating point is output. If this AGC is actuated, the voltage will lower.	3.5
㉒	Vcc	Connects + 4.5 V power supply.	
㉓	FORWARD/REVERSE	Controls the reversed polarity of output.	
㉔	SYNC IN	Sync separation input pin. A sync negative video signal of 1 V _{p-p} is input.	2.0
㉕	BURST GATE TIME CONSTANT	Time constant which determines the burst gate width: a burst gate pulse of duration determined by this time constant from the trailing edge of sync separation output is generated. (V _{th} = 2.5 V)	
㉖	COMMON IN	Inputs a pulse for output inversion. Common output and RGB output are inverted at the same time. RGB output polarity changes by polarity reversing control. (V _{th} = 2.2V)	
㉗	COMMON OUT	Common electrode driver output pin	- 6.5
㉘	COMMON	Set the common electrode driver output amplitude.	($\approx 4.0V_{DC}$)
㉙	SYNC OUT	Sync separation output pin: a sync positive output is transmitted with open collector output. Connect a load resistor before use.	
㉚	B CLAMP	Connects B signal clamping capacitance.	2.0
㉛	G CLAMP	Connects G signal clamping capacitance.	2.0
㉜	R CLAMP	Connects R signal clamping capacitance.	2.0
㉝	BRIGHT	Brightness control pin: if the voltage increases, the picture becomes white.	($\approx 1.0V_{DC}$)
㉞	Y	Sets the γ value of γ amplifier. If no γ amplifier is required, connect this pin to the power supply.	
㉟	GND	Grounding pin: connect this pin to "GND".	
㊱	R SUB BIAS	Sets R - signal bias.	($\approx 1.7V_{DC}$)
㊲	G SUB BIAS	Sets G - signal bias.	
㊳	B SUB BIAS	Sets B - signal bias.	
㊴	NC	Not used.	
㊵	R OUT	R - signal output pin: an inverted signal is output.	($\approx 7V_{PP}$ output)
㊶	NC	Not used.	
㊷	G OUT	G - signal output pin	($\approx 7V_{PP}$ output)
㊸	NC	Not used.	
㊹	B OUT	B - signal output pin	($\approx 7V_{PP}$ output)
㊺	- VEE	Connect this pin to - 7.5 V power supply. The voltage is the same as in pin ㉑.	
㊻	COLOR	Adjusts the color level. If the voltage is increased, color saturation increases.	($\approx 1.7V_{DC}$)
㊼	PIX	Pin for picture quality control: if the voltage is increased and decreased, the picture will be sharper and softer respectively.	($\approx 1.5V_{DC}$)
㊽	BIAS	This pin cannot be used. Connect this pin to the power supply.	
㊾	CHROMA IN	Chroma signal input pin: burst 100 mV _{p-p} standard.	
㊿	ACC FILTER	This pin sets the ACC time constant.	0.5V