NN3478FAS-A

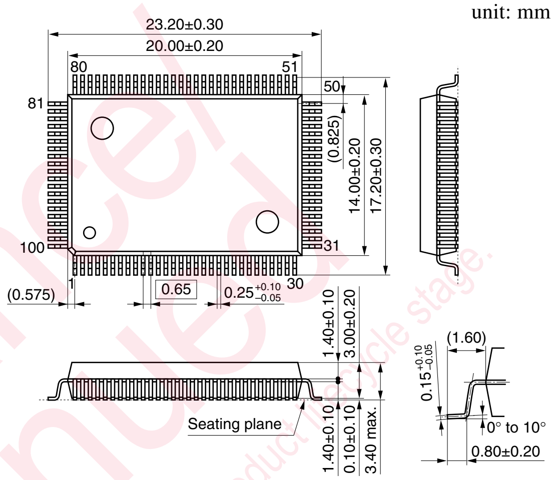
Video signal processor MCP IC for South American PAL system

■ Overview

The NN3478FAS-A is a multi-chip package (MCP) IC which integrates a video (South American PAL) luminance/chroma IC AN3478A and CCD MN3887. By adopting a low frequency comb system in a chroma signal processing circuit of the Y/C signal processor IC, a system cost down has been achieved due to several steps reduction in the CCD circuit. Also a record/playback equalizer circuit has been integrated on a luminance signal processing circuit. Further, due to addition of normal audio signal record/playback circuit, it made it possible to share a common P board design with HiFi equipment for a normal audio signal processing block, thus allowing a space saving.

Also this IC is fully adjustment-free thanks to Zener zap adjustment-free technology.

unit: mm



QFH100-P-1420D

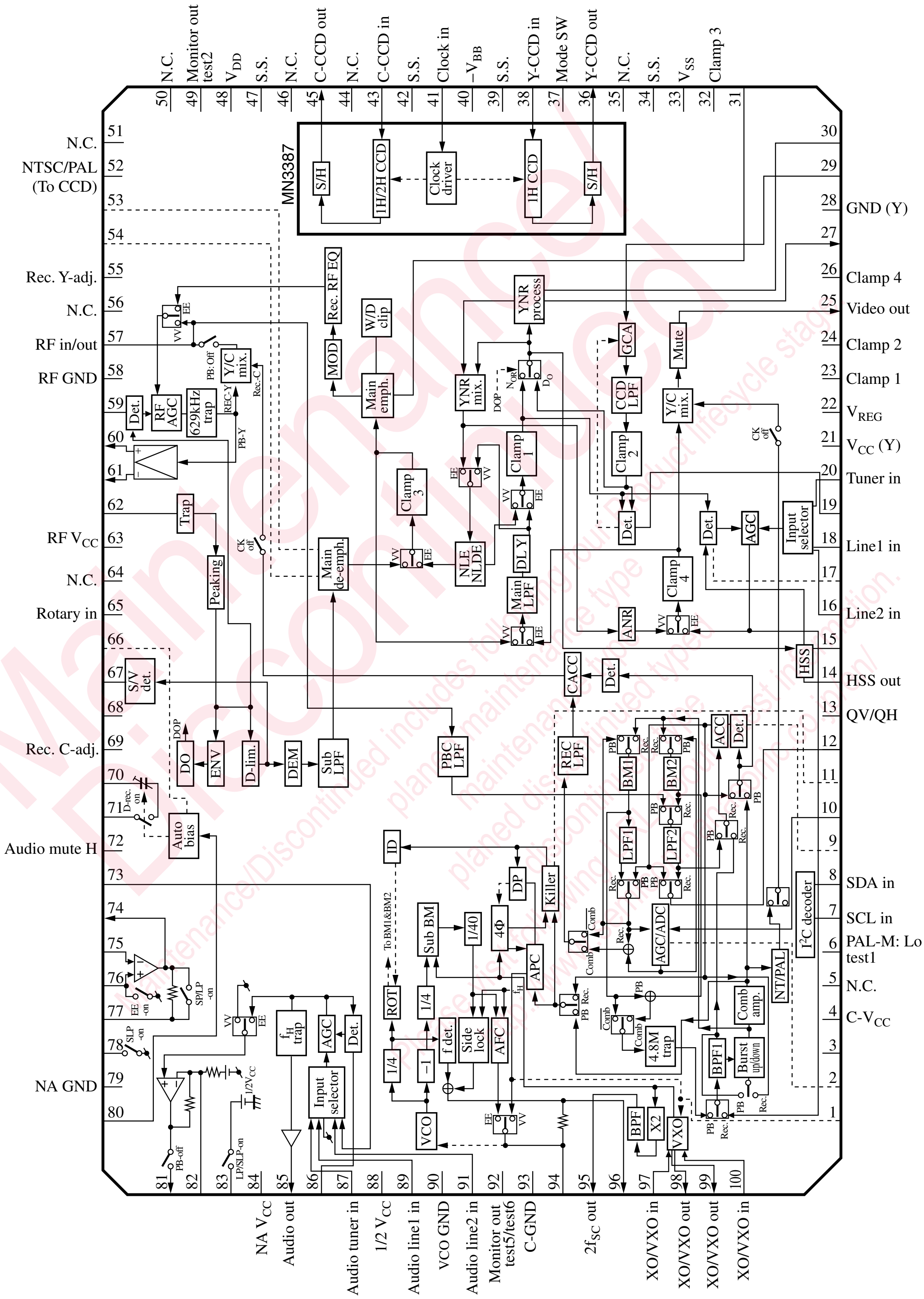
■ Features

- Supply voltage range: 4.8 V to 5.2 V (875 mW typ.)
- Available for 3.58 MHz system
  - NTSC/PAL-M/PAL-N
- Adjustment-free
  - Video output level (recording mode)
  - Video output level (playback mode)
  - f_O frequency: Sync. tip frequency
  - FM deviation
  - FM level (recording mode)
  - Chroma level (recording mode)
  - S-VHS/VHS discrimination threshold frequency
  - White clip level
    (2-stage switch by I²C: 190%, 200%)
- Normal audio circuit built-in
  - BIAS oscillation level adjustment-free
- Building in all filters including CCD filter

■ Applications

- VCR, camera recorder, video-television hybrid

■ Block Diagram



■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	Rec. APC det. / N/P conv./ f_H VCO det.	35	N.C.
2	CCD AGC det. (C)	36	Y-CCD out
3	MESECAM ID out	37	Mode SW in
4	C -V_{CC}	38	Y-CCD in
5	N.C.	39	S.S.
6	PAL-M: Lo / test 1	40	$-V_{BB}$
7	SCL in	41	Clock in ($2f_{SC}$)
8	SDA in	42	S.S.
9	ACC det.	43	C-CCD in
10	C-comb in	44	N.C.
11	Killer det.	45	C-CCD out
12	C-comb out	46	N.C.
13	Artificial sync. pluse in	47	S.S.
14	HSS out	48	V_{DD}
15	Sync. sepa. det.	49	Test2 monitor
16	Line2 in	50	N.C.
17	AGC det.	51	N.C.
18	Line1 in	52	Mode control out (NTSC/PAL)
19	CCD AGC det. (Y)	53	Main de-emphasis peaking
20	Tuner in	54	Main de-emphasis out
21	Y-V_{CC}	55	REC Y-adj.
22	V_{REG}	56	N.C.
23	F.B.clamp det. 1	57	RF in/out
24	F.B.clamp det. 2	58	RF GND
25	Video out	59	RF AGC det.
26	F.B.clamp det. 4	60	Phase shift POS./S EQ out
27	CCD DL out (Y)	61	Phase shift NEG.
28	Y- GND	62	8M trap in
29	CCD DL in (Y)	63	RF V_{CC}
30	YNR lim.DC	64	N.C.
31	Main emphasis F.B.in	65	Rotary pulse in
32	F.B.clamp det. 3	66	Auto bias det./S EQ in
33	V_{SS}	67	S/V det. (VHS: High)
34	S.S.	68	Chroma ACC det.

■ Pin Descriptions (continued)

Pin No.	Description	Pin No.	Description
69	Rec. C-adj.	85	NA line out
70	NA auto bias control out	86	NA AGC det.
71	NA auto bias rec. SW	87	NA tuner in
72	NA mute	88	NA V_{REF}
73	NA PB amp. in/auto bias det.	89	NA line1 in
74	NA PB EQ out	90	VCO GND
75	NA PB NF	91	NA line2 in
76	NA PB in	92	Test5 / test monitor
77	NA PB EQ SW	93	C-GND
78	NA PB SLP SW	94	Rec. AFC / PB APC det.
79	NA GND	95	$2f_{SC}$ out
80	NA auto bias detector in	96	Side lock det.
81	NA rec. out	97	XO / VXO in
82	NA rec. NF	98	XO / VXO out
83	NA rec. EQ LP/SLP SW	99	XO / VXO out
84	NA V_{CC}	100	XO / VXO in

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	5.3	V
Supply current	I_{CC}	220	mA
Power dissipation *2	P_D	715	mW
Operating ambient temperature *1	T_{opr}	–20 to +60	°C
Storage temperature *1	T_{stg}	–55 to +125	°C

Note) *1: Except for the operating ambient temperature and storage temperature, all ratings are for $T_a = 25°C$.
*2: The power dissipation shown is the value for $T_a = 60°C$.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CC}	4.8 to 5.2	V

■ Electrical Characteristics at $V_{CC} = 5$ V, $T_a = 25°C$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-rec. processing						
EE output amplitude 1	V_{EE1}	Input a 1 V[p-p], 100% white video signal into pin 18 and measure pin 25 output amplitude (NTSC/PAL-M)	2.04	2.15	2.26	V[p-p]
EE output amplitude 2	V_{EE2}	Input a 1 V[p-p], 100% white video signal into pin 18 and measure pin 25 output amplitude (PAL-N)	1.93	2.15	2.37	V[p-p]
Keyed AGC control sensitivity	S_{KAGC}	Input a 0.5 V[p-p] and 2 V[p-p] of 100% white video signal into pin 18 and measure pin 25 output amplitude, respectively, then calculate the ratio.	—	0.3	2.0	dB
AGC frequency characteristic *CLP	ΔG_{AGC}	Input a 100 mV[p-p] sine wave of 1 MHz and 5 MHz to pin 18 and measure pin 25 output amplitude, respectively, then calculate the ratio. pin 17 = 1.5 V (AGC max. gain)	−1.5	− 0.3	1.5	dB
Y-MLPF frequency characteristic 1 *CLP	ΔG_{YL1}	Input a 400 mV[p-p] sine wave of 320 kHz and 2.3 MHz to pin 18 and set pin 92 test output to MLPF out with I^2C and measure pin 92 output amplitude, respectively, then calculate the ratio.	−4.2	−1.7	− 0.2	dB
Y-MLPF frequency characteristic 2 *CLP	ΔG_{YL2}	Input a 400 mV[p-p] sine wave of 320 kHz and 3.58 MHz to pin 18 and set pin 92 test output to MLPF out with I^2C and measure pin 92 output amplitude, respectively, then calculate the ratio.	—	—	−27	dB
Sync. sepa. front edge delay time	t_{dSS}	Input a 1 V[p-p], 100% white video signal into pin 18 and measure the time from a fall of input sync. to a rise of pin 14 output pulse.	1.25	1.50	1.75	μsec
Sync. sepa. output amplitude	V_{SS}	Input a 330 mV[p-p], 100% white video signal into pin 18 and measure pin 14 output pulse amplitude.	4.0	4.6	—	V[p-p]
Vertical emphasis (1-K) value gain 1 *CLP	G_{VE1}	Input a 100 kHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 400 mV[p-p]). Switch pin 31 external capacitor to 0.1 μF and measure pin 27 output amplitude, then calculate a ratio to 400 mV[p-p].	−3.2	−1.7	− 0.2	dB

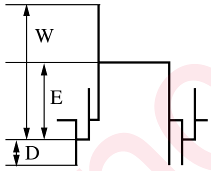
Note) ∗: CLP: Apply an optimum voltage to each clamp pin.

■ Electrical Characteristics at $V_{CC} = 5$ V, $T_a = 25$°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-rec. processing (continued)						
Vertical emphasis (1-K) value gain 2 *CLP	G_{VE2}	Input a 100 kHz and 2 MHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 400 mV[p-p]). Switch pin 31 external capacitor to 0.1 μF and measure pin 27 output amplitude, then calculate a ratio to 400 mV[p-p].	−1.5	0	1.5	dB
Vertical emphasis X value gain *CLP	G_{VEX}	Input a 40 mV[p-p], 100 kHz sine wave to pin 30 (Set pin 49 test output to white clip with I^2C.) Switch pin 31 externals to open and measure pin 49 output amplitude, then calculate I/O gain.	−15.3	−11.8	−8.3	dB
Supply current (Rec.)	I_{REC}	Measure supply current on condition of V_{EE1}.	135	163	195	mA
Non-Linear emphasis frequency characteristic 1 *CLP	ΔG_{NLE1}	Input a 100 kHz and 1 MHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 400 mV[p-p].) Set pin 49 test output to white clip with I^2C and measure the amplitude, respectively, then calculate the ratio in SLP,EDIT mode. (Pin 31 = open)	3.0	5.0	7.0	dB
Non-Linear emphasis frequency characteristic 2 *CLP	ΔG_{NLE2}	Input a 100 kHz and 2 MHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 40 mV[p-p].) Set pin 49 test output to white clip with I^2C and measure the amplitude, respectively, then calculate the ratio in SLP,EDIT mode. (Pin 31 = open)	4.5	6.5	8.5	dB
Non-Linear emphasis frequency characteristic 3 *CLP	ΔG_{NLE3}	Input a 2 MHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 40 mV[p-p].) Set pin 49 test output to white clip with I^2C and switch to SP, SLP and measure the amplitude, respectively, then calculate the ratio. (Pin 31 = open)	−2.1	− 0.6	0.9	dB
Main emphasis gain *CLP	G_{ME}	Input a 100 kHz sine wave to pin 18 (Set pin 92 test output to MLPF out with I^2C and adjust to 60 mV[p-p].) Switch pin 31 external to 0.1 μF and set pin 49 output to white clip with I^2C. Then, measure the amplitude and calculate the I/O gain.	12.9	14.4	15.9	dB

Note) ∗: CLP: Apply an optimum voltage to each clamp pin.

■ Electrical Characteristics at $V_{CC} = 5$ V, $T_a = 25°C$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-rec. processing (continued)						
Dark clip level	DC	Input a 1 V[p-p], 100% white video signal into pin 18 and set pin 49 test output to white clip with I²C  	40	50	60	%
White clip level	WC	Calculate: WC = W/E × 100% DC = D/E × 100%	180	190	200	%
FM carrier interleave	Δf_{CI}	No input Measure pin 57 output frequencies which can be obtained by switching pin 65 voltage to 0 V and 5 V, respectively. Then calculate the difference.	6.4	7.9	9.4	kHz
f_O frequency 1	f_{O1}	No input Measure pin 57 output frequency. (NTSC/PAL-M)	3.35	3.45	3.55	MHz
f_O frequency 2	f_{O2}	No input Measure pin 57 output frequency. (PAL-N)	3.6	3.8	4.0	MHz
Deviation 1	Δf_{DEV1}	Input a 1 V[p-p], 100% white video signal into pin 18 and measure the frequencies responding to sync. and peak of pin 57 output, respectively, and calculate the difference. (NTSC/PAL-M)	0.9	1.0	1.1	MHz
Deviation 2	Δf_{DEV2}	Input a 1 V[p-p], 100% white video signal into pin 18 and measure the frequencies responding to sync. position and peak position of pin 57 output, respectively, and calculate the difference. (PAL-N)	0.8	1.0	1.2	MHz
Rec.-Y output amplitude	V_{YR}	Measure the amplitude responding to sync. position in the same condition as f_{O1}.	270	300	330	mV[p-p]
FM mod. harmonic distortion	D_{2fMOD}	No input Measure the second harmonic component to pin 57 output frequency f_O.	—	−37	−32	dB
Y-PB processing						
S/V discriminating frequency	f_{SV}	Lower gradually the frequency of pin 57 sine wave of 350 mV[p-p] from 6 MHz and measure the input frequency which makes the pin 31 DC voltage to High→Low. (NTSC)	4.2	4.4	4.6	MHz

■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-PB processing (continued)						
VV output amplitude	V_{VV}	Switch the frequency of pin 57 input sine wave of 350 mV[p-p] to 3.45 MHz and 4.45 MHz, every 1/2f_H. Measure pin 25 output amplitude VV. (NTSC/PAL-M)	1.99	2.1	2.21	V[p-p]
FM demod. demodulation sensitivity	S_{DEMS}	Switch the frequency of pin 57 input sine wave of 350 mV[p-p] to 5.4 MHz and 7.0 MHz, every 1/2f_H. Measure pin 25 output amplitude VS. Switch the frequency to 3.45 MHz and 4.45 MHz, in the same condition. Measure the output amplitude VV and calculate VS/VV.	–1.0	0.0	1.0	—
Video out Quasi-V offset	ΔV_{DV}	Measure a sync. tip voltage in the same condition as V_{VV} and then measure it when pin 13 = 5 V. Calculate the difference.	–80	0	80	mV
Sub LPF frequency characteristic	ΔG_{SL}	Input a 350 mV[p-p] sine wave of 1.5 MHz and 2.0 MHz to pin 66 and measure an attenuation level of 4 MHz component to 3 MHz of pin 53 output.	–2.0	0.0	—	dB
DOC detecter on level	S_{DON}	Lower the 4 MHz sine wave of pin 62 gradually from 350 mV[p-p] and measure the input amplitude of DOC on. Calculate the ratio to 350 mV[p-p].	–30	–26	–22	dB
DOC detecter off level	S_{DOFF}	Raise the 4 MHz sine wave of pin 62 gradually from 0 mV[p-p] and measure the input amplitude of DOC off. Calculate the ratio to 350 mV[p-p] and calculate the difference from S_{DON}.	1.8	3.8	5.8	dB
DOC prohibition time *1	t_{DOFF}	Input the data of 'with or without signal' to pin 62 every 15f_H, input f_H pulse to pin 14 and then measure DOC prohibition time of pin 25 output.	6.5	7.5	8.5	H
NLDE frequency characteristic 1 *CLP	ΔG_{NLD1}	Input a 16 mV[p-p] sine wave of 100 kHz and 2 MHz to pin 54 (with offset 2 V). Set pin 92 test output to MLPF out with I^2C and measure the output amplitude and calculate the ratio.	–8.7	–6.7	–4.7	dB
NLDE frequency characteristic 2 *CLP	ΔG_{NLD2}	Input a 160 mV[p-p] sine wave of 100 kHz and 2 MHz to pin 54 (with offset 2 V). Set pin 92 test output to MLPF out with I^2C and measure the output amplitude and calculate the ratio.	–3.4	–2.3	–1.2	dB

Note) *CLP: Apply an optimum voltage to each clamp pin.
*1: The unit H stands for one period of a horizontal sync. signal.

■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-PB processing (continued)						
NLDE frequency characteristic 3 *CLP	ΔG_{NLD3}	Input a 16 mV[p-p] sine wave of 2 MHz to pin 54 (with offset 2 V). Set pin 92 test output to MLPF out with I^2C, switch to SP and SLP, and measure the output amplitude and calculate the ratio.	1.5	3.0	4.5	dB
NLDE frequency characteristic 4 *CLP	ΔG_{NLD4}	Input a 16 mV[p-p] sine wave of 100 kHz to pin 54 (with offset 2 V). Set pin 92 test output to MLPF out with I^2C, measure the output amplitude to be obtained when pin 67 S/V det. pin is set to 5 V and 0 V (VHS, SQPB) and calculate the difference.	0.2	1.0	1.8	dB
Supply current (PB)	I_{PB}	Measure the supply current in the condition of V_{VV}.	145	175	205	mA
YNR (1-K) value gain EDNC *CLP	G_{EDK}	Input a 160 mV[p-p] sine wave of 100 kHz to pin 54 (with offset 2 V). Measure pin 27 output amplitude, then I/O gain and calculate the ratio. EDIT mode	3.3	4.8	6.3	dB
YNR (1-K) value gain VNC *CLP	G_{VNK}	Input a 160 mV[p-p] sine wave of 100 kHz to pin 54 (with offset 2 V). Measure pin 27 output amplitude, then I/O gain. Normal mode	1.6	3.1	4.6	dB
YNR X value gain EDNC *CLP	G_{EDX}	Input a 100 kHz, 40 mV[p-p] sine wave to pin 30, measure pin 25 output amplitude and then calculate I/O gain. EDIT mode	−2.2	− 0.2	1.8	dB
YNR X value gain VNC *CLP	G_{VNX}	Input a 100 kHz, 40 mV[p-p] sine wave to pin 30, measure pin 25 output amplitude and then calculate I/O gain. Normal mode	1.6	3.6	5.6	dB
YNR LIM output *CLP	V_{YL}	Input a 100 kHz, 300 mV[p-p] sine wave to pin 30, measure pin 25 output amplitude.	10	65	160	mV[p-p]
NC frequency characteristic *CLP	ΔG_{NC}	ANR setting of I^2C: Typical Input a 12.6 mV[p-p] (−30 dB) sine wave of 100 kHz and 2 MHz to pin 29. Measure pin 25 output amplitude and calculate the ratio. (Forced DOC mode)	−17	−12	−7	dB
P.C. frequency characteristic 1 *CLP	ΔG_{PC1}	PC setting of I^2C: Sharpest Input a 100 mV[p-p] sine wave of 3 MHz to pin 29. Measure pin 25 output amplitude and calculate the ratio. (Forced DOC mode)	0.3	2.0	6.0	dB

Note) ∗CLP: Apply an optimum voltage to each clamp pin.

■ Electrical Characteristics at $V_{CC} = 5$ V, $T_a = 25°C$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Y-PB processing (continued)						
P.C. frequency characteristic 2 *CLP	ΔG_{PC2}	PC setting of I^2C: Softest Input a 100 mV[p-p] sine wave of 3 MHz to pin 29. Measure pin 25 output amplitude and calculate the ratio. (Forced DOC mode)	−9.0	−6.0	−3.0	dB
CCD insertion gain difference (Y)	G_{CY}	Input a 0.5 V[p-p] sine wave of 200 kHz to pin 38. Measure pin 36 output amplitude and then I/O gain.	0.0	3.0	6.0	dB
C-rec. processing						
Rec.-C output amplitude	V_{RC}	Input a chroma signal (burst: chroma = 286: 630) to pin 18 and measure output chroma amplitude. SLP, rec. comb off, pin 59 = 4 V	76.5	85.0	93.5	mV[p-p]
Rec. ACC control sensitivity	S_{ACC}	Input a chroma signal (burst 845 mV[p-p] and 53 mV[p-p]) to pin 18 and set pin 92 test output of I^2C to BM1 in and measure each output chroma amplitude, then calculate the ratio.	—	0.7	3.0	dB
Rec. killer on	S_{RKON}	Input chroma signal to pin 18 and lower a burst amplitude gradually from 286 mV[p-p] (0 dB) to measure the input signal makes killer on and calculate the ratio to 286 mV[p-p].	—	—	−39	dB
Rec. killer off	S_{RKOFF}	Input chroma signal to pin 18 and raise a burst amplitude gradually from 0 mV[p-p] and measure the input signal makes killer off (return) and calculate the ratio to 286 mV[p-p].	−22	—	—	dB
Burst up gain *f_H	G_{BU}	Input a 300 mV[p-p] sine wave of 3.58 MHz to pin 18, set pin 49 test output of I^2C to rec C-out and then measure the amplitude ratio of the burst and chroma block. (NTSC/SP)	4.8	5.9	7.0	dB
Rec. APC pull-in range *f_H	f_{APC1}	Input f_{SC} ±300 Hz, 300 mV[p-p] sine wave to Pin18 to check that the input frequency and pin 95 output frequency is locked. (As pin 95 output is $2f_{SC}$, it is converted to f_{SC}.)	−300	0	300	Hz
Rec.-C output amplitude	G_{RC}	Input a chroma signal (burst: chroma = 286: 630) to pin 18 and measure the output chroma amplitude ratio in an SLP mode to SP mode. SLP, rec. comb off, pin 59 = 4 V	0.4	1.4	2.4	dB

Note) *CLP: Apply an optimum voltage to each clamp pin.
*f_H: Input a pulse of f_H period (5 V[p-p]) to pin 14.

■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
C-rec. processing (continued)						
Burst discrimination high level	V_{BH}	Input a 1 V[p-p], 100% white video signal to pin 18 and set pin 49 test output to burst det. Measure DC voltage.	2.3	3.4	—	V
Burst discrimination low level	V_{BL}	Input a chroma signal (burst: chroma = 300: 660) to pin 18 and set pin 49 test output to burst det. and measure DC voltage.	—	0.8	1.5	V
Color killer high level	V_{CH}	Input a chroma signal (burst: chroma = 300: 660) to pin 18 and set pin 92 test output to CK and measure DC voltage.	2.5	3.2	—	V
Color killer low level	V_{CL}	Input the 100% white video signal 1 V[p-p] to pin 18 and set pin 92 test output to CK. Measure DC voltage.	—	1.0	1.5	V
C-PB processing						
PB C output amplitude 1 $^{*}f_H$	V_{PBC1}	Input a 100 mV[p-p] sine wave of 629 kHz to pin 57 and measure pin 25 output amplitude (PAL).	390	480	570	mV[p-p]
PB C output amplitude 2 $^{*}f_H$	V_{PBC2}	Input a 100 mV[p-p] sine wave of 629 kHz to pin 57 and measure pin 25 output amplitude (NTSC).	670	820	970	mV[p-p]
PB ACC control sensitivity $^{*}f_H$	S_{ACC}	Assuming that a 80 mV[p-p] sine wave of 629 kHz to pin 57 is 0 dB, input +3 dB and –10 dB and measure the output amplitude. Calculate the ratio.	—	0.4	3.0	dB
PB killer on $^{*}f_H$	S_{PKON}	Input a 80 mV[p-p] sine wave of 629 kHz to pin 57 and lower the amplitude gradually from 80 mV[p-p] (0 dB) and measure the input amplitude that makes killer on. Calculate the ratio to 80 mV[p-p].	—	—	–43	dB
PB killer off $^{*}f_H$	S_{PKOFF}	Input a 629 kHz sine wave to pin 57 and raise an amplitude gradually from 0 mV[p-p] and measure the input amplitude that makes killer off. Calculate the ratio to 80 mV[p-p] and the difference from S_{PKON}.	–28	—	—	dB
Burst down gain 1 $^{*}f_H$	G_{BD1}	Input a 100 mV[p-p] sine wave of 629 kHz to pin 57, set pin 92 test output to PB C-out with I²C and measure the decreased amount of the output burst. (NTSC/SP)	–6.2	–4.7	–3.2	dB
Burst down gain 2 $^{*}f_H$	G_{BD2}	Input a 100 mV[p-p] sine wave of 629 kHz to pin 57, set pin 92 test output to PB C-out with I²C and measure the decreased amount of the output burst. (NTSC/LP)	– 0.9	0.4	1.9	dB

Note) $*f_H$: Input a pulse of f_H period (5 V[p-p]) to pin 14.

■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
C-PB processing (continued)						
PB comb depth	G_{PBC}	Input a 200 mV[p-p] sine wave of 40f_H to pin 6. Set pin 92 test output to comb mix. with I^2C. Measure the output when PB comb is on and off. Calculate the ratio.	—	–37	–23	dB
Main BM carrier-leak *f_H	C_{LBM}	No input. Set pin 92 test output to PB C-out with I^2C. Measure 4.21 MHz component.	—	–37	–30	dB
XO free-run frequency 1	f_{XO1}	At no input, measure pin 95 output frequency (convert pin 95 output to f_{SC} from 2f_{SC} as unit.) and calculate the difference from f_{SC}. (PAL-M)	–70	0	70	Hz
XO free-run frequency 2	f_{XO2}	At no input, measure pin 95 output frequency (convert pin 95 output to f_{SC} from 2f_{SC} as unit.) and calculate the difference from f_{SC}. (NTSC)	–70	0	70	Hz
XO free-run frequency 3	f_{XO3}	At no input, measure pin 95 output frequency (convert pin 95 output to f_{SC} from 2f_{SC} as unit.) and calculate the difference from f_{SC}. (PAL-N)	–70	0	70	Hz
2f_{SC} output amplitude	V_{2fsc}	At no input, measure pin 95 output amplitude.	260	400	540	mV[p-p]
CCD insertion gain difference (C)	G_{CC}	Input a 0.5 V[p-p] sine wave of 200 kHz to pin 43. Measure pin 45 output amplitude. Measure I/O gain.	–1.0	2.0	5.0	dB
RF						
Rec. RF EQ frequency characteristic 1	ΔR_{EQ1}	Set to test 4 with I^2C. Input a 40 mV[p-p] sine wave of 2 MHz and 4 MHz to pin 54. (with the offset voltage of 2.5 V.) Measure respectively pin 57 output amplitude. Calculate the ratio.	1.5	3.0	4.5	dB
Rec. RF EQ frequency characteristic 2	ΔR_{EQ2}	Set pin 54 input frequency to 5 MHz and 8 MHz, measure just as done in ΔR_{EQ1}.	–4.9	–3.4	–1.9	dB
PB RF EQ output amplitude	V_{PRFA}	Input a 200 mV[p-p] sine wave of 4 MHz to pin 57. (Set pin 49 test output to PB RFEQ out with I^2C.) and measure pin 49 output amplitude.	320	420	520	mV[p-p]
PB RF AGC control sensitivity	S_{PRFA}	Input a 4 MHz sine waves of 160 mV[p-p] and 650 mV[p-p], respectively, to pin 57. (Set pin 49 test output to PB RFEQ out with I^2C.) Calculate the measurement ratio of pin 49 output amplitude.	—	0.7	3.7	dB

Note) *f_H: Input a pulse of f_H period (5 V[p-p]) to pin 14.

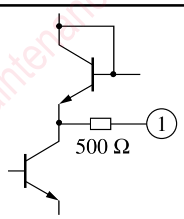
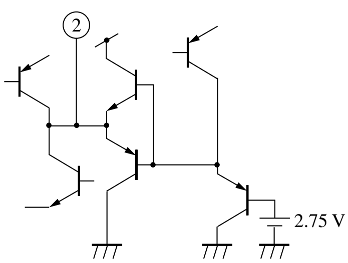
■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
RF (continued)						
PB RF EQ frequency characteristic 1	ΔG_{PEQ1}	Input a 60 mV[p-p] sine wave of 630 kHz and 5 MHz to pin 57. (Set pin 49 test output to PB RFEQ out with I^2C.) Calculate the measurement ratio of pin 49 output amplitude.	—	−26	−15	dB
PB RF EQ frequency characteristic 2	ΔG_{PEQ2}	Input frequencies of 1 MHz and 5 MHz to pin 57. Measure just as done in ΔG_{PEQ1}.	−14.5	−11.5	−8.5	dB
PB RF EQ frequency characteristic 3	ΔG_{PEQ3}	Input frequencies of 8 MHz and 5 MHz to pin 57. Measure just as done in ΔG_{PEQ1}.	—	−25	−20	dB
PB RF EQ frequency characteristic 4	ΔG_{PEQ4}	Input frequencies of 4 MHz and 7.5 MHz to pin 57. Measure just as done in ΔG_{PEQ1}. Pin 67 = 1 V (SQPB mode)	−17.5	−11.5	−5.5	dB
PB RF EQ frequency characteristic 5	ΔG_{PEQ5}	Input frequencies of 11.5 MHz and 7.5 MHz to pin 57. Measure just as done in ΔG_{PEQ1}. Pin 67 = 1 V (SQPB mode)	—	−26	−20	dB
Normal audio						
Line out output gain	G_{LO1}	Input a −29.0 dBV, 1 kHz sine wave to pin 89. Measure pin 85 output gain. Calculate I/O gain.	20.3	21.8	23.3	dB
Line output harmonic distortion	D_{LO}	Measure pin 85 output distortion on the condition of G_{LO1}.	—	0.30	0.6	%
AGC control sensitivity	S_{AGC}	Input a 1 kHz sine wave of −29.0 dBV and −9.0 dBV to pin 89. Measure pin 85 output gain.	−1.0	1.1	3.0	dB
Rec. output gain 1	ΔG_{RO1}	Input a −29.0 dBV, 1 kHz sine wave to pin 89. Measure pin 81 output gain and calculate the difference from G_{LO1}. (SP mode)	2.0	3.5	5.0	dB
Rec. output gain 2	ΔG_{RO2}	Input a −29.0 dBV, 1 kHz sine wave to pin 89. Measure pin 81 output gain and calculate the difference from ΔG_{RO1}. (SLP mode)	0.1	0.3	1.2	dB
Rec. output harmonic distortion	D_{RO}	Measure the pin 81 output distortion on the same condition as ΔG_{RO2}.	—	0.3	0.95	%
Rec. out S/N	V_{RO}	Measure pin 81 S/N at no input. (SLP mode)	—	—	−60	dBV
f_H trap frequency characteristic 1	ΔG_{FT1}	Input a −29.0 dBV of 1 kHz sine wave and 12 kHz to pin 89. Measure pin 85 output gain and calculate the difference.	−2.5	0.1	2.5	dB
f_H trap frequency characteristic 2	ΔG_{FT2}	Input a −29.0 dBV of 1 kHz sine wave and 15.75 kHz to pin 89. Measure pin 85 output level and calculate the difference.	—	−12	−1	dB

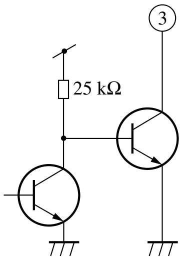
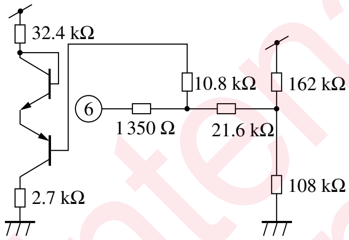
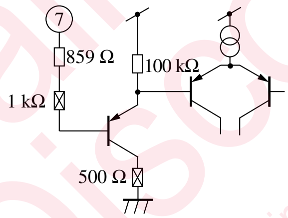
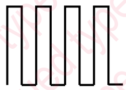
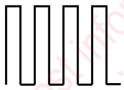
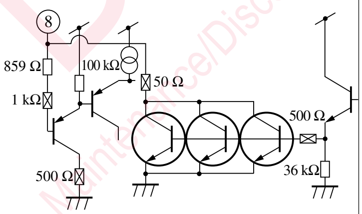
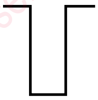
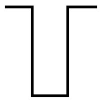
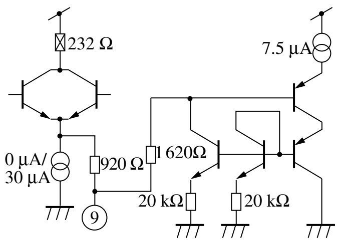
■ Electrical Characteristics at V_{CC} = 5 V, T_a = 25°C (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Normal audio (continued)						
Rec. out max.level	V_{RMAX}	Increase a sine wave of 1 kHz (pin 89) gradually so as to get 1% of output distortion. Then measure the output gain.	– 0.3	1.1	—	dBV
PB line output 1	G_{PLO1}	Input a –68.3 dBV, 1 kHz sine wave to pin 76. Measure pin 85 output gain. Calculate I/O gain. (SP mode)	59	60	61	dB
PB line output 2	G_{PLO2}	Input a –70.8 dBV, 1 kHz sine wave to pin 76. Measure I/O gain. Calculate the difference from the I/O gain of G_{PLO1}. (SLP mode)	1.4	2.4	3.4	dB
PB line distortion	D_{PO}	Measure Pin85 output distortion on the same condition as G_{PLO2}.	—	0.7	0.95	%
PB line output S/N 1	V_{GPLO1}	Ground pin 76 with 1.5 kΩ. Measure pin 85 S/N. (SP mode) through DIN audio filter.	—	—	1.8	µV[rms]
PB line output S/N 2	V_{GPLO2}	In SLP mode, carry out the same measurement as in V_{GPLO1}.	—	—	3.30	µV[rms]
PB line out max.level	V_{LMAX}	Increase a sine wave of 1 kHz (pin 76) gradually so as to get an output distortion of 1%. Then measure an output level.	–1.5	1.6	—	dBV
Mute gain attenation	ΔG_M	Input a –68.3 dBV, 1 kHz sine wave to pin 76. Measure pin 85 gain. Measure pin 85 gain when pin 72 is 5 V and calculate the difference.	—	–92	–80	dB

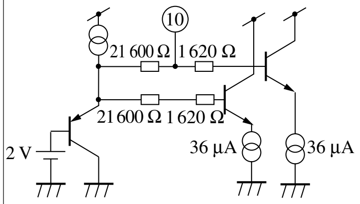
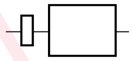
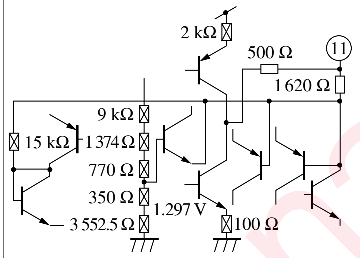
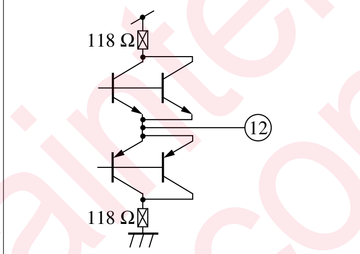
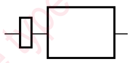
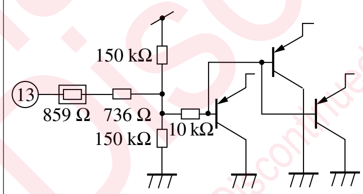
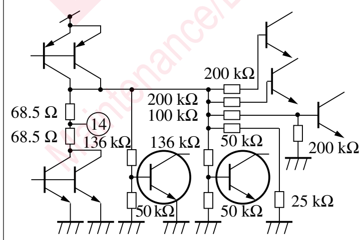
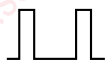
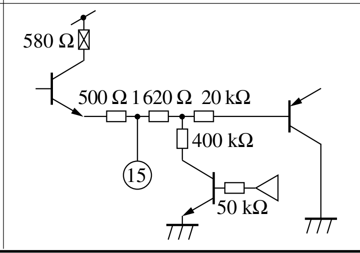
■ Terminal Equivalent Circuits

Pin No.	Equivalent circuit	Impedance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
1		500 Ω	Rec APC det. N/P conv. f_H VCO det.	DC	←	2.0
2		—	CCD AGC det. (C)	DC	←	3.5

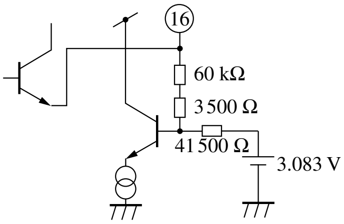
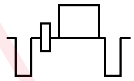
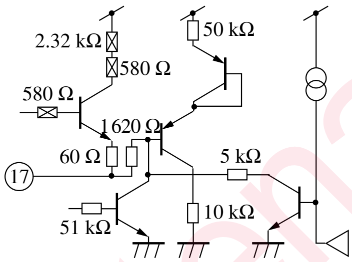
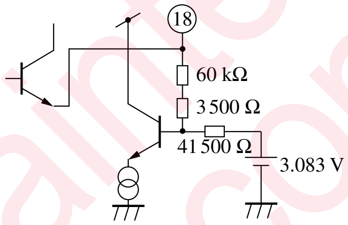
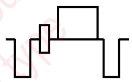
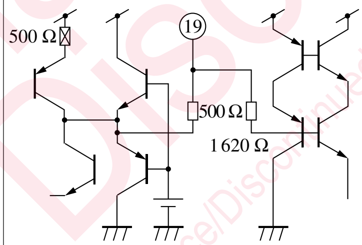
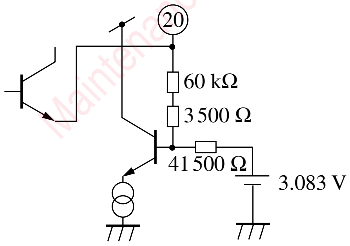
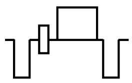
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Impedance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
3		O.C.	MESECAM ID out	—	—	—
4	—	—	C- V_{CC}	DC	←	5.0
5	—	—	N.C.	—	—	—
6		87.8 kΩ	PAL-M: Lo/ test 1	DC	←	2.0
7		O.B.	SCL in	 max. 100 kHz	 max. 100 kHz	—
8		—	SDA in	Synchronized with pin 7 	Synchronized with pin 7 	—
9		920 Ω + r_e	ACC det.	DC	←	—

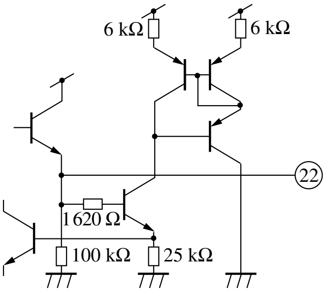
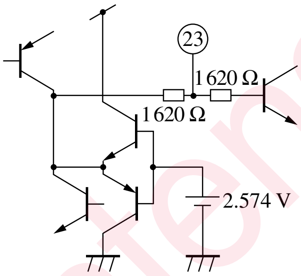
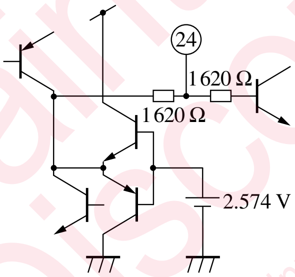
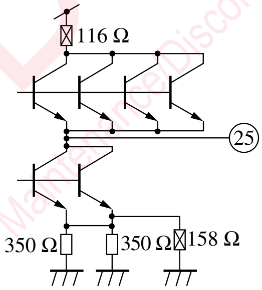
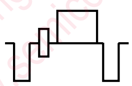
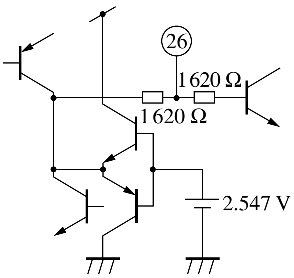
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Impedance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
10		21 600 Ω	C-comb in		←	2.8
11		—	Killer det.	DC	←	—
12		P.P.	C-comb out		←	2.8
13		76.6 kΩ	Artificial sync. pluse in	Single level 3.5 V to 5V Gray level 1.5 V to 3V through 0 V to 1V	Single level 3.5 V to 5V Gray level 1.5 V to 3V through 0 V to 1V	2.5
14		36.5 kΩ	HSS out	 5 V[p-p]	←	—
15		500 Ω + V_T / I_E	Sync. sepa. det.	DC	←	1.4

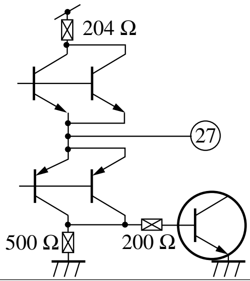
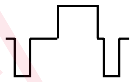
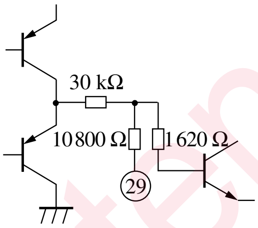
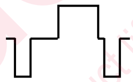
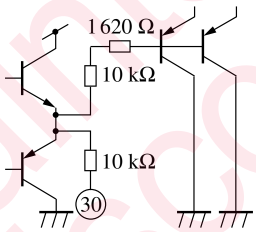
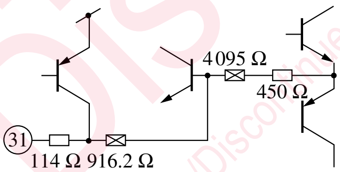
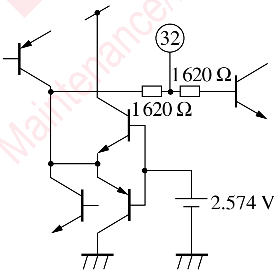
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
16		105 kΩ	Line 2 in	 1 V[p-p]	—	3.1
17		60 Ω + V_T / I_E	AGC det.	DC	—	1.9
18		105 kΩ	Line 1 in	 1 V[p-p]	—	3.1
19		—	CCD AGC det. (Y)	DC	←	typ. 2.5
20		105 kΩ	Tuner in		—	3.1
21	—	—	Y-V_{CC}	DC	←	5.0

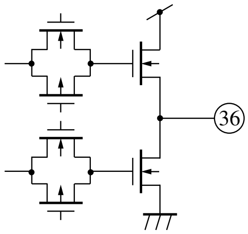
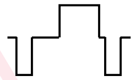
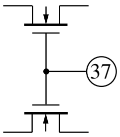
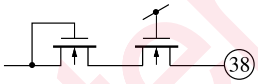
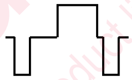
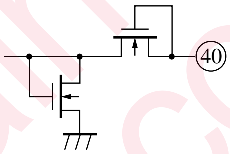
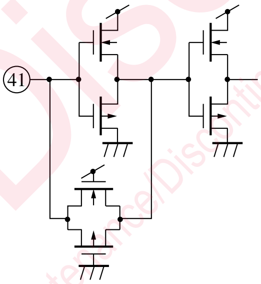
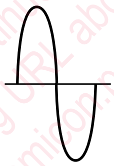
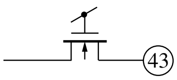
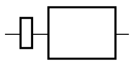
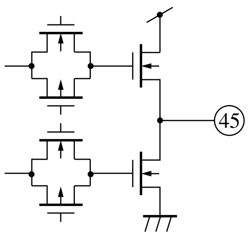
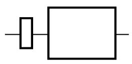
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
22		E.F.	V_{REG}	DC	←	2.0
23		Hi	F.B. clamp det. 1	DC	←	2.6
24		Hi	F.B. clamp det. 2	DC	←	2.6
25		E.F.	Video out	 2.1 V[p-p]	←	Sync. 1.0
26		Hi	F.B. clamp det. 4	DC	←	2.6

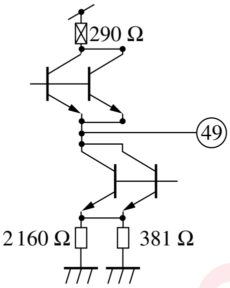
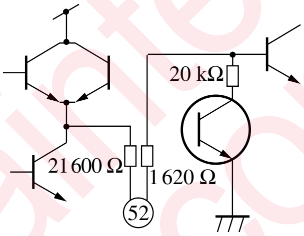
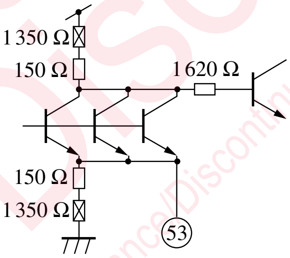
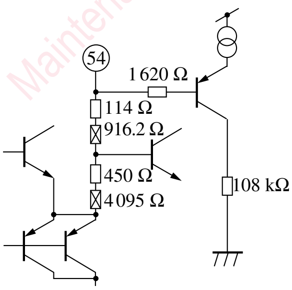
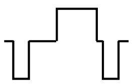
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
27		30 kΩ	CCD DL out (Y)	 400 mV[p-p]	←	2.0
28	—	—	Y-GND	—	—	0
29		E.F.	CCD DL in (Y)	 400 mV[p-p]	←	Sync. 1.7
30		10 kΩ	YNR lim. DC	DC	←	—
31		E.F.	Main emphasis F.B. in	 400 mV[p-p]	—	Sync. 1.7
32		Hi	F.B. clamp det. 3	DC	←	2.6
33	—	—	V_{SS}	—	—	0
34	—	—	S.S.	—	—	—
35	—	—	N.C.	—	—	—

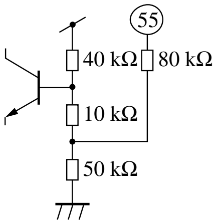
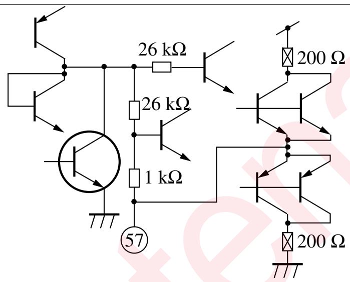
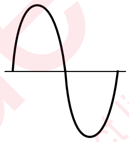
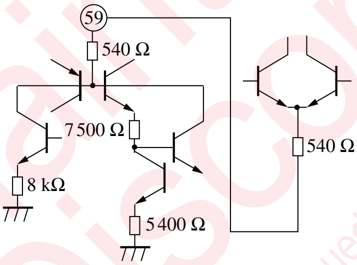
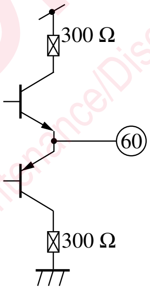
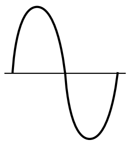
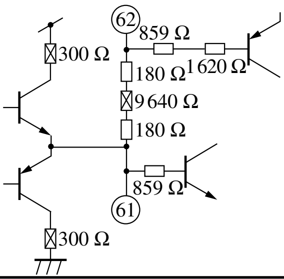
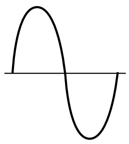
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
36		S/F (500 Ω)	Y-CCD out	 400 mV[p-p]	←	2.6
37		Hi	Mode SW in	—	—	—
38		Hi	Y-CCD in	 400 mV[p-p]	←	2.95
39	—	—	S.S.	—	—	—
40		—	$-V_{BB}$	DC	←	–2.8
41		Hi	Clock in ($2f_{SC}$)		←	2.2
42	—	—	S.S.	—	—	—
43		Hi	C-CCD in		←	2.86
44	—	—	N.C.	—	—	—
45		S/F (500 Ω)	C-CCD out		←	2.7

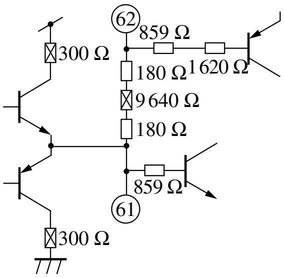
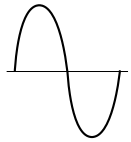
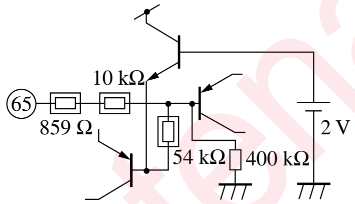
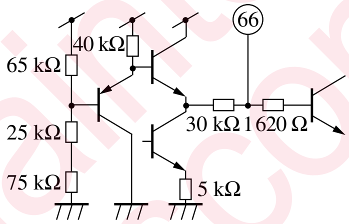
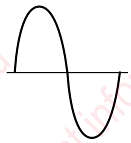
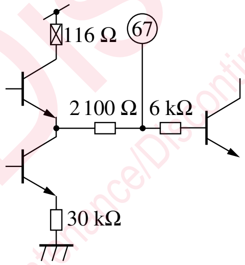
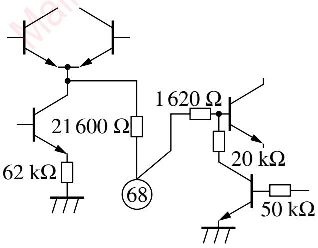
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
46	—	—	N.C.	—	—	—
47	—	—	S.S.	—	—	—
48	—	—	V_{DD}	DC	←	5.0
49		E.F.	Test 2 monitor	—	—	—
50	—	—	N.C.	—	—	—
51	—	—	N.C.	—	—	—
52		21 600 Ω	Mode control out (NTSC/PAL)	—	—	—
53		V_T / I_E	Main de-emphasis peaking	—		—
54		5 575.2 Ω	Main de-emphasis out	—	 200 mV[p-p]	—

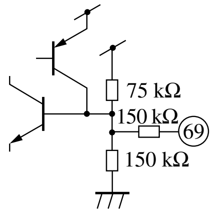
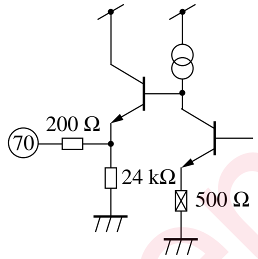
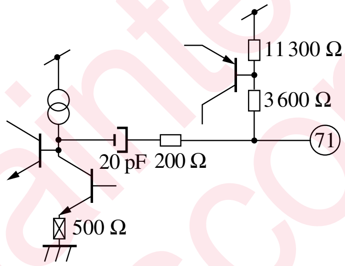
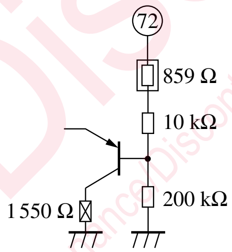
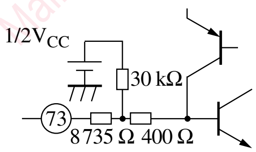
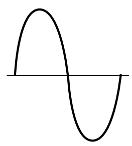
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
55		105 kΩ	Rec. Y-adj.	DC	←	3.0
56	—	—	N.C.	—	—	—
57		P.P.	RF in/out		←	Rec. 2.7 PB 3.4
58	—	—	RF GND	—	—	0
59		—	RF AGC det.	DC	←	2.5
60		P.P.	Phase shift POS./S EQ out	—	 200 mV[p-p]	2.5
61		P.P.	Phase shift NEG.	—	 200 mV[p-p]	2.5

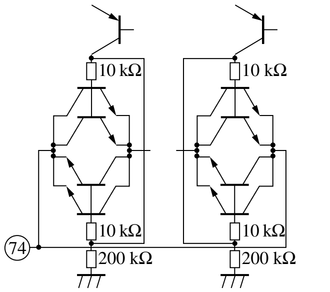
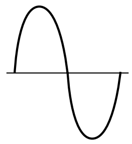
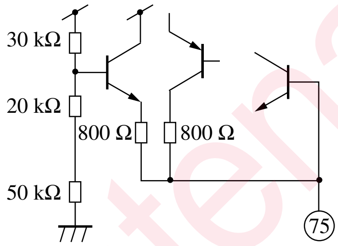
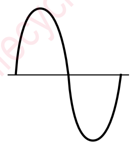
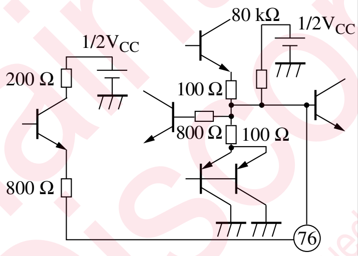
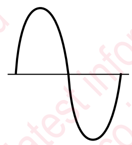
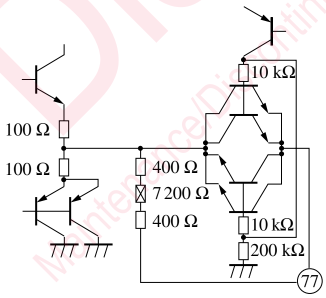
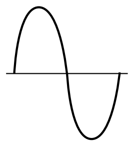
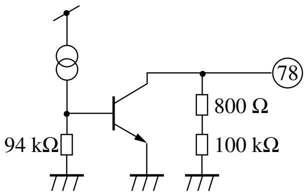
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
62		O.B.	8M trap in	—	 200 mV[p-p]	2.5
63	—	—	RF V_{CC}	DC	←	5.0
64	—	—	N.C.	—	—	—
65		411 kΩ	Rotary pulse in	DC	←	—
66		30 kΩ	S-EQ in	—		3.0
67		2 100 Ω	S/V det. (VHS: Hi)	DC	←	3.4
68		21.6 kΩ + re	Chroma ACC det.	DC	—	—

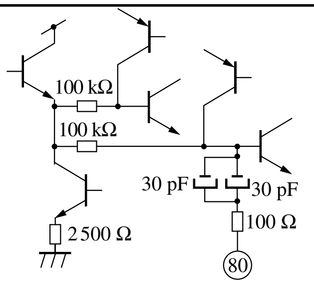
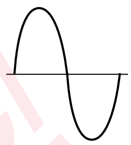
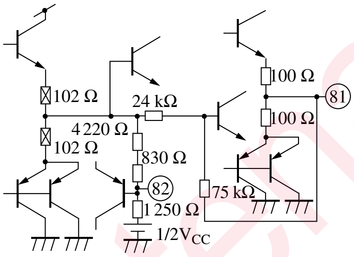
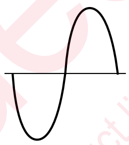
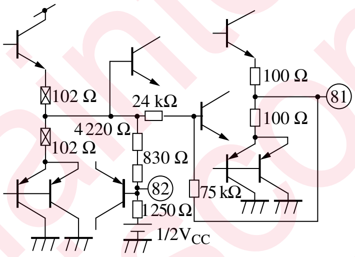
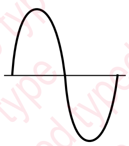
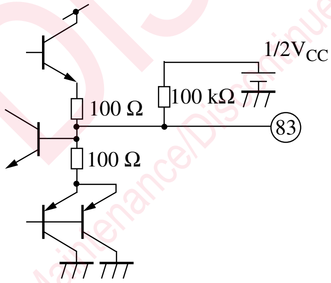
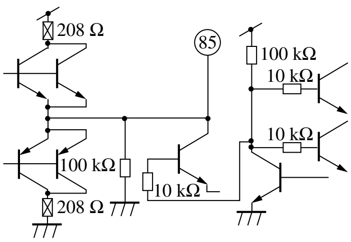
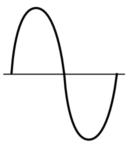
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
69		200 kΩ	Rec. C-adj.	DC	←	3.3
70		E.F.	NA auto bias control out	DC	—	—
71		14.9 kΩ	NA auto bias rec. SW	DC	—	—
72		210 kΩ	NA mute	DC	←	—
73		35 kΩ	NA PB amp. in/ auto bias det.	—	 −29.5 dBV = 94.7 mV[p-p]	2.5

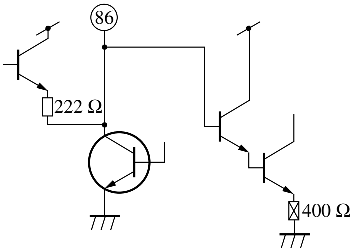
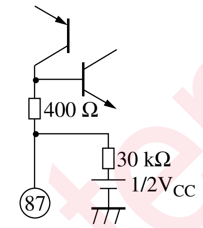
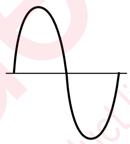
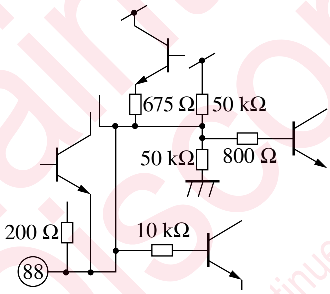
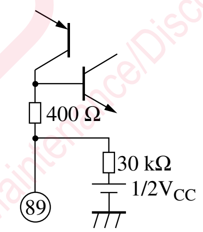
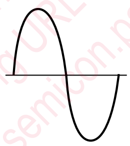
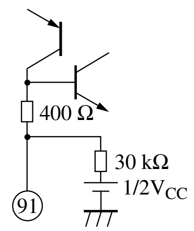
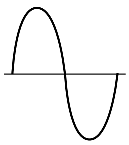
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped- ance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
74		P.P.	NA PB EQ out	—	 −29.5 dBV = 94.7 mV[p-p]	2.5
75		O.B.	NA PB NF	—		2.5
76		E.E. P.P. V.V. 80 kΩ	NA PB in	DC		2.5
77		SP SLP 12 500 Ω	NA PB EQ SW	—		2.5
78		SP/LP 100.8 kΩ SLP On-resistance	NA PB SLP SW	DC	←	2.5
79	—	—	NA GND	—	—	0

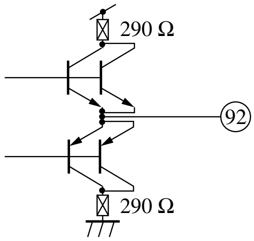
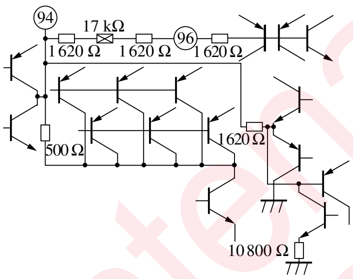
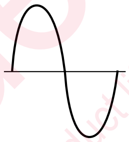
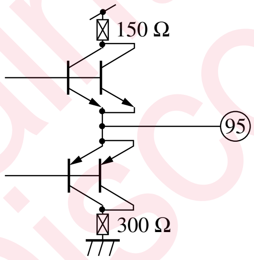
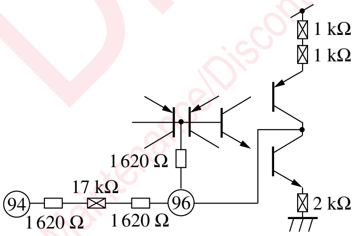
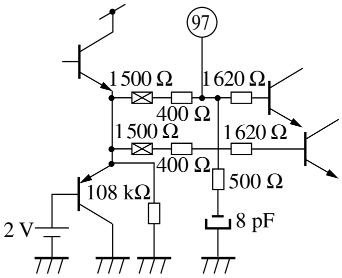
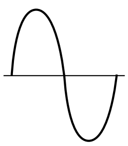
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Impedance Z	Description	Waveform Rec. mode	Waveform PB mode	Pin voltage DC (V)
80		Hi	NA auto bias detector in		—	—
81		E.E. P.P. V.V. 100 kΩ	NA rec. out		DC	2.5
82		1 kΩ	NA rec. NF		—	2.5
83		SP 100 kΩ LP/SLP P.P.	NA rec. EQ LP/SLP SW	DC	←	2.5
84	—	—	NA V_{CC}	DC	←	5.0
85		P.P.	NA line out	 (typ.) −8.0 dBV = 1.13 V[p-p]	←	2.5

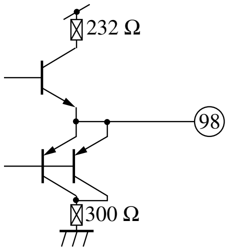
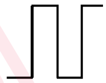
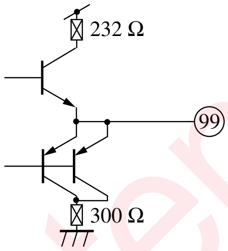
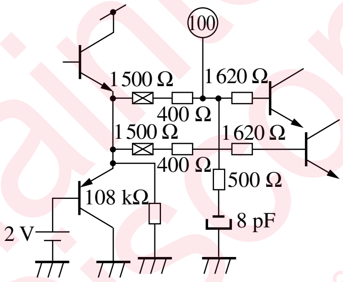
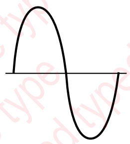
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
86	NAA, NAB, NAC block 	—	NA AGC det.	DC	←	—
87	NAA, NAB, NAC block 	30 kΩ	NA tuner in	 (typ.) −29.0 dBV= 100 mV[p-p]	—	2.5
88		—	NA V_{REF}	DC	←	2.5
89		30 kΩ	NA line 1 in	 (typ.) −29.0 dBV = 100 mV[p-p]	—	2.5
90	—	—	VCO GND	—	—	0
91		30 kΩ	NA line 2 in	 (typ.) −29.0 dBV = 100 mV[p-p]	—	2.5

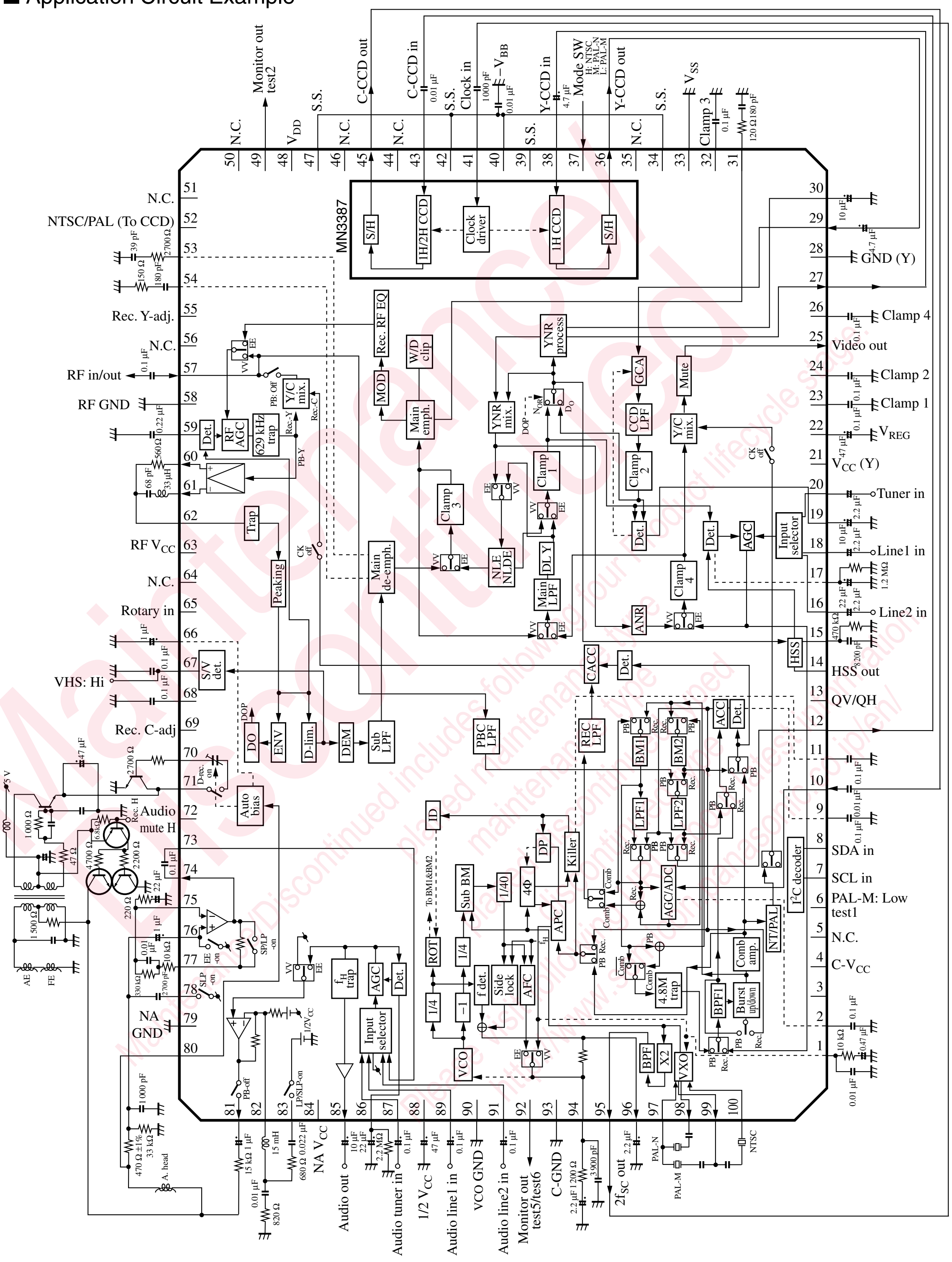
■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Impedance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
92		E.F.	Test 5/ test monitor	—	—	2.5
93	—	—	C-GND	—	—	0
94		P.P.	Rec. AFC/ PB APC det.	DC 	←	2.0
95		E.F.	$2f_{SC}$ out		←	—
96		C.C.	Side lock det.	DC	←	2.0
97		1.9 kΩ	XO/VXO in (PAL-M or PAL-N)	 300 mV[p-p]	←	2.8

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Imped-ance Z	Description	Waveform		Pin voltage DC (V)
				Rec. mode	PB mode	
98		P.P.	XO/VXO out (PAL-N)	 400 mV[p-p]	←	E.E. 2.4 V.V. 2.8
99		P.P.	XO/VXO out (NTSC or PAL-M)	 400 mV[p-p]	←	E.E. 2.4 V.V. 2.8
100		1.9 kΩ	XO/VXO in (NTSC)	 300 mV[p-p]	←	2.8

■ Application Circuit Example



■ Usage Notes

1. Be cautious of handling this device because a reverse polarity mounting causes a flow of over-current which is likely to deteriorate its characteristics and damage.
2. A serial control is likely to affect badly the screen. Therefore, manage to make a data transfer within V-period.
3. Serial data transfer

Whenever you send one line of data, you have to issue both start and stop conditions. When you want to change a serial mode setting, you have only to transfer one line of the changed data.

Example: On transferring all two lines of data:

Start	Address	ACK	Sub address	ACK	Data	ACK	Stop	Start	Address	ACK	Sub address	ACK	Data	ACK	Stop

First line of data (Start … Stop) Second line of data (Start … Stop)

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