

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC1352C

CHROMINANCE AND LUMINANCE PROCESSOR FOR NTSC COLOR TV

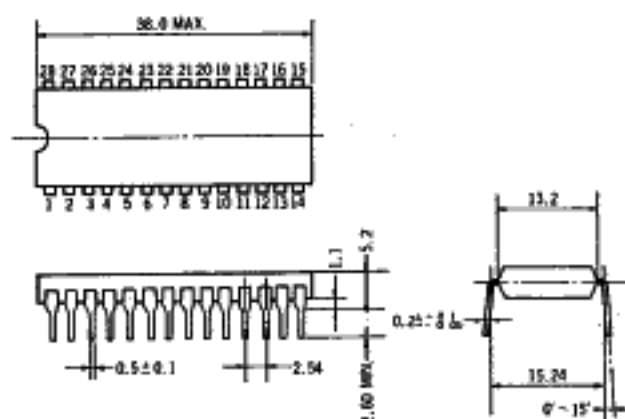
DESCRIPTION

μ PC1352C is an integrated circuit for NTSC system to process both color and luminance signals of the color televisions. It is an MSI contained in a 28 pins dual in line package and provides two functions. One is the processing of color signal for the band pass amplifier, color synchronizer, demodulator circuits, and the other is the processing of luminance signal for the luminance amplifier and pedestal clamp circuits, the number of peripheral parts and controls can be minimized, and the manhours required for the assembling can be considerably reduced.

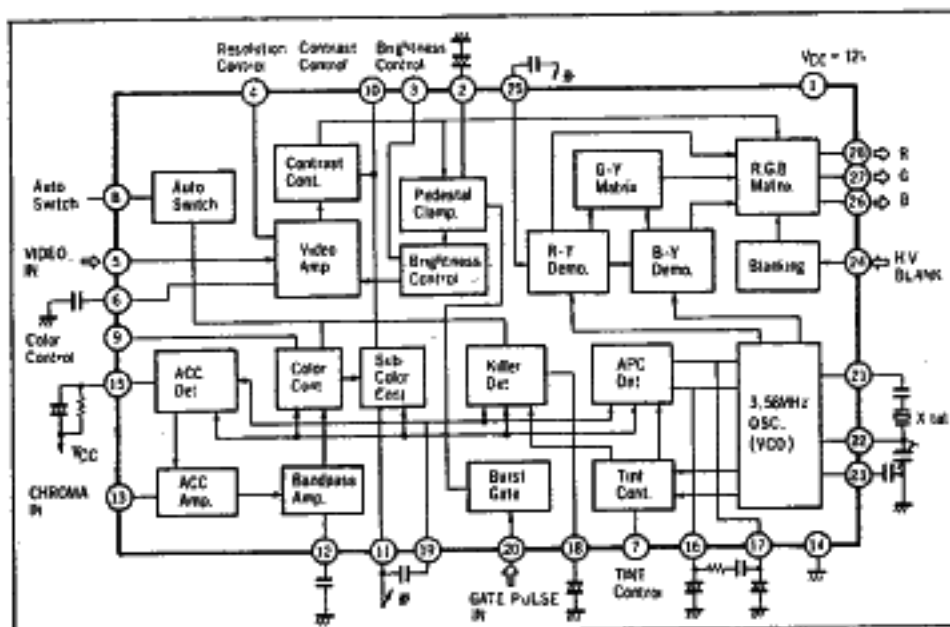
FEATURES

- It needs very few external components, and minimize the adjustments.
- DC controlled circuits make a remote controlled system easy.
- Protection diodes in every input terminals and output terminals.
- "Color killer" does not need any adjustments.
- "Contrast" control does not prevent the natural color of the picture any more, as the color saturation level changes simultaneously.
- ACC (Automatic color controller) circuit operates very smoothly with peak level detector.
- "Brightness control" terminal can be used for ABL (Automatic beam limiter) also.

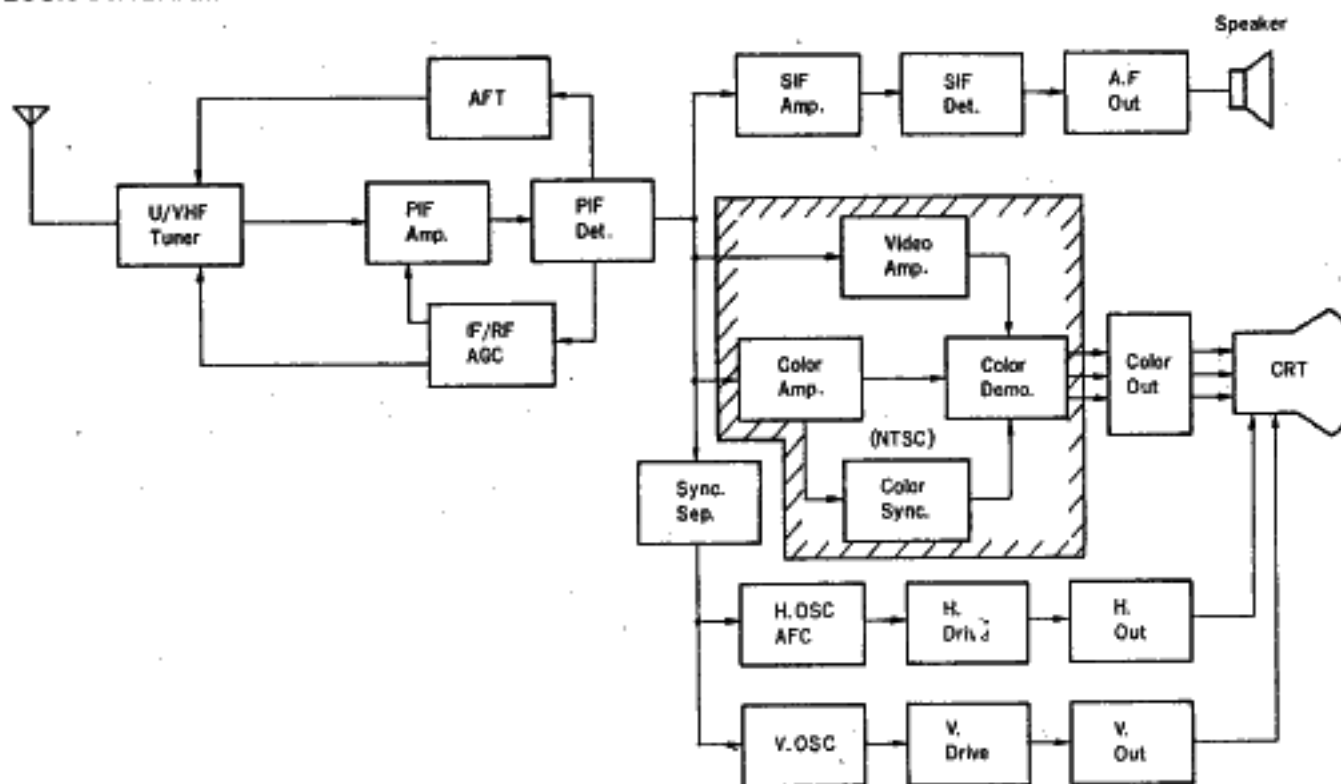
PACKAGE DIMENSIONS in millimeters



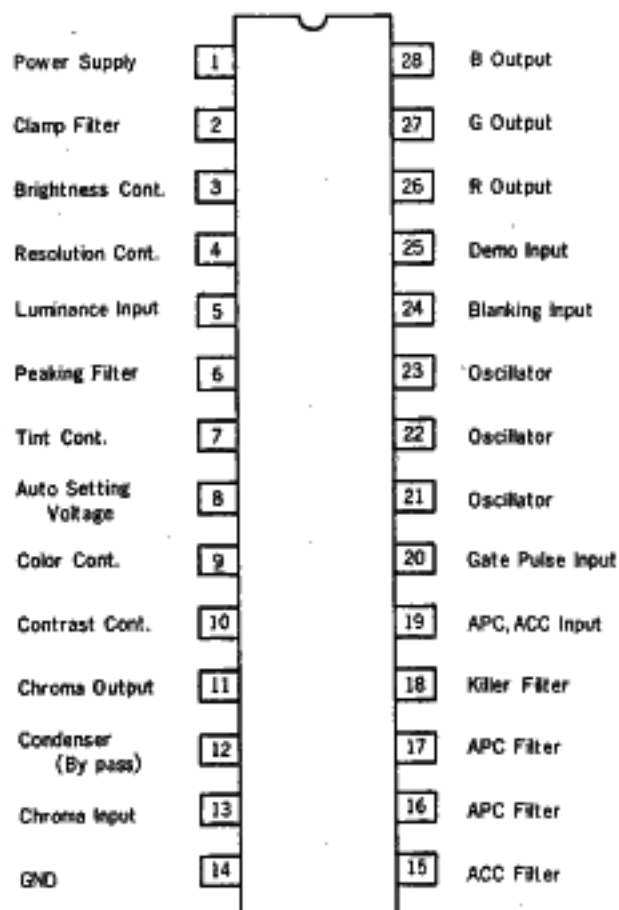
BLOCK DIAGRAM



TV BLOCK DIAGRAM



PIN CONNECTION (Top View)



THE STANDARD OPERATING CONDITIONS

Characteristic	Value	Unit
Supply Voltage	12	V
Chrominance Input Voltage (Burst signal level)	160	mVp-p
Luminance Input Voltage (Sync White Level)	1.0	Vp-p
Burst Gate Pulse Input Voltage	3.0	Vp
Blanking Pulse Input Voltage	2.5	Vp
Color saturation controlling Voltage Range	0~5.7 (at $V_{CC}=12$ V)	V
Tint controlling Voltage Range	0~5.7 (at $V_{CC}=12$ V)	V
Contrast controlling Voltage Range	0~12 (at $V_{CC}=12$ V)	V
Resolution controlling Voltage Range	0~12 (at $V_{CC}=12$ V)	V
Brightness controlling Voltage Range	8~10 (at $V_{CC}=12$ V)	V

Note: In case of operating in $V_{CC}=14.4$ V, Set the surrounding temperature T_a to be 67 °C.

ABSOLUTE MAXIMUM RATINGS ($T_a=+25$ °C)

Supply Voltage	V_{CC}	14.4	V
Brightness Controlling Voltage	V3	14.4	V
Resolution Controlling Voltage	V4	14.4	V
Contrast Controlling Voltage	V10	14.4	V
Tint Controlling Voltage	V7	14.4	V
Color Controlling Voltage	V9	14.4	V
Auto Controlling Voltage	V8	14.4	V
Luminance Input Signal Voltage	V5	+5	V
Chrominance Signal Input Voltage	V13	+2.5	V
Demodulator Input Signal Voltage	V25	+5	V
R.G.B Output Current	I26,I27,I28	-40	mA
Gate Pulse Input Voltage	V20	+5	V
Gate Pulse Output Current	I20	-10	mA
Blanking Pulse Input Voltage	V24	±6	V
Power Dissipation	Pd1 ($T_a=25$ °C)	1.2	W
Power Dissipation	Pd2 ($T_a=70$ °C)	750	mW
Operating Temperature	T_{opt}	-20~+70	°C
Storage Temperature	T_{stg}	-40~+125	°C

Test Conditions ($V_{CC}=12$ V)

Characteristic	MIN.	TYP.	MAX.
Color saturation controlling terminal 9	0 V	$V_{B/2}$ V	V8 V
Tint controlling terminal 7	0 V	$V_{B/2}$ V	V8 V
Contrast controlling terminal 10	0 V	$V_{CC} \times 0.78$ V	V_{CC} V
Resolution controlling terminal 4	0 V	-	V_{CC} V

ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$ unless otherwise noted $V_{CC} = 12\text{ V}$)

Color control is manual state and tint is center for the items not specifically specified

No.	Characteristic	Symbol	Test Ckt.	Test Condition	MIN.	TYP.	MAX.	Unit
1	Supply Current	I_{CC}	1		32	43	54	mA
2	Burst Output Voltage	e_b	3	Rainbow color bar signal input 150 mVp-p, Color auto center, Contrast max.	0.5	0.7	0.9	Vp-p
3	ACC Range 1	ACC1	3	Rainbow color bar signal input 300 mVp-p, Burst Output Voltage/ e_b	0.9	1.0	1.1	times
4	ACC Range 2	ACC2	3	Rainbow color bar signal input 15 mVp-p, Burst Output Voltage/ e_b	0.6	0.8	1.0	times
5	Chroma Output Voltage 1	e_{c1}	3	Rainbow color bar signal input 150 mVp-p, Color min, Contrast max.	0.5	0.7	0.9	Vp-p
6	Chroma Output Voltage 2	e_{c2}	3	Rainbow color bar signal input 150 mVp-p, Color min, Contrast max.	—	—	5	mVp-p
7	Chroma Output Voltage 3	e_{c3}	3	Rainbow color bar signal input 150 mVp-p, Color center, Contrast max.	120	190	260	mVp-p
8	Chroma Output Voltage 4	e_{c4}	3	Rainbow color bar signal input 150 mVp-p, Color auto center, Contrast max.	130	190	260	mVp-p
9	Variable Range of Chroma Output Voltage at auto	Δe_{ca}	3	Rainbow color bar signal input 150 mVp-p, Color auto max min, Contrast max.	+25 -25	+35 -35	+45 -45	%
10	Free running Frequency	f_o	2	No input signal to Terminal 19 Be trimmed 3.579545 MHz by using a trimer capacitor for standard sample, Deviation from f ; 3.579545 MHz	—	—	± 150	Hz
11	Oscillator controlling sensitivity	β	2	Burst signal input 0.7 Vp-p, Converted from V16-17 in case of 100 Hz burst frequency variation	1.0	1.5	2.0	Hz/mV
12	Phase detector sensitivity	μ	2	Burst signal input 0.7 Vp-p, Converted from phase error and V16-17 in case of 100 Hz burst frequency variation	25	45	65	mV/ degree
13	Phase error	$\Delta\phi$	2	Burst signal input 0.7 Vp-p, Phase error to 100 Hz of burst frequency variation	—	1.5	3.0	degree /100 Hz
14	A.P.C. pull-in frequency range	f_p	2	Burst signal input 0.7 Vp-p, Measured by changing the burst frequency	± 350	± 500	—	Hz
15	Variable Range of Tint	$\Delta\theta 1$	2	Burst signal input 0.7 Vp-p, Tint; max min, manual, Tint center, Range from 0 as a standard	+37 -37	+45 -45	+53 -53	degree
16	Variable Range of Tint at auto	$\Delta\theta 2$	2	Burst signal input 0.7 Vp-p, Tint; max min, auto Tint center, Range from 0 as a standard	12 -12	+17 -17	+22 -22	degree

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No.	Characteristic	Symbol	Test Ckt.	Test Condition	MIN.	TYP.	MAX.	Unit
17	B-Y Output Voltage	e_{o1}	3	Dem. input 0.2 Vp-p, $f=3.59$ MHz, Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	1.5	2.0	2.5	Vp-p
18	Ratio of R-Y to B-Y	R/B	3	Dem. input 0.2 Vp-p, $f=3.59$ MHz, R Output Voltage/ e_{o1} Bright VR was set to be $V_{26}=3.5$ (DC) No blanking input	0.86	0.94	1.04	times
19	Ratio of G-Y to B-Y	G/B	3	Dem. input 0.2 Vp-p, $f=3.59$ MHz, G Output Voltage/ e_{o1} Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	0.26	0.30	0.35	times
20	Relative Output phase G-Y to R-Y	$\angle R$	3	Dem. input 0.2 Vp-p, $f=3.59$ MHz, B=0 degree, phase difference Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	94	97.5	102	degree
21	Relative Output phase G-Y to B-Y	$\angle G$	3	Dem. input 0.2 Vp-p, $f=3.59$ MHz, B=0 degree, phase difference Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	228	235	242	degree
22	Maximum Color difference Output Voltage	e_{o2}	3	Dem. input 1.2 Vp-p, $f=3.59$ MHz, Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	4.8	5.7	—	Vp-p
23	Residual Carrier	e_{car}	3	No signal input, Output; 3.58 MHz each, Carrier leak component, Bright VR was set to be $V_{26}=3.5$ V(DC) No blanking input	—	—	100	mVp-p
24	Demodulation frequency characteristic	e_{of}	3	Attenuation factor of demodulation output at $f=500$ kHz, Dem. input 0.2 Vp-p, $f=3.08$ MHz, Assuming the output at $f=10$ kHz is 0 dB	-1.5	-0.9	-0.4	dB
25	Overall Color difference Output Voltage	e_{o3}	3	Rainbow color bar signal input 150 mVp-p, Color auto center, Contrast max, in R output	1.0	1.7	2.4	Vp-p
26	Overall Color difference Output Variable Range by Contrast	Δe_{oc}	3	Rainbow color bar signal input 150 mVp-p, Color auto center, Contrast max/min, in R output	3.4	3.85	4.3	Vp-p
27	Color killer tolerance	e_k	3	Burst input Voltage at terminal 13 150 mVp-p=0 dB, Attenuation value in operating the killer	-27	-32	-40	dB
28	Luminance Gain	A_{v1}	3	R,G,B Output each, Studio color bar input 1 Vp-p in white level, Contrast max, Resolution min, Pedestal of terminal 26 is 2 V, Bright VR was set	4.5	5.0	5.5	times
29	Luminance Gain Variable Range by Contrast	Δe_{vc}	3	Studio color bar input 1 Vp-p in white level, Contrast max/min, Resolution min, in B output	4.0	4.5	5.0	times

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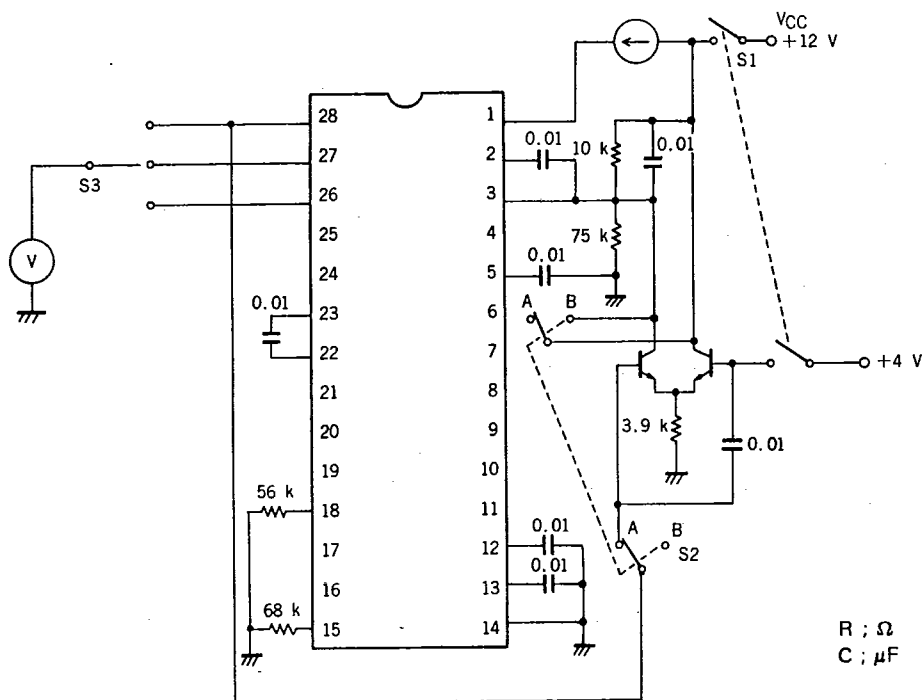
No.	Characteristic	Symbol	Test Ckt.	Test Condition	MIN.	TYP.	MAX.	Unit
30	Luminance Amp. frequency characteristic	f_v	3	Sine wave signal input 0.1 Vr.m.s. Input frequency at Av1=-6 dB Resolution min, in B output, Bright VR was set to be V26=3.5 V(DC) No blanking input, 0 dB=16 kHz Output	5	6	—	MHz
31	Resolution Variation Range	Δf_{vp}	3	Sine wave signal 0.1 Vr.m.s., f=2 MHz Contrast max, Resolution min~max, in B Output max/min	5.0	7.0	9.0	dB
32	DC Restored	TDC	3	Stair Step signal input 1 Vp-p, APL 10~90 % in B Output	65	75	85	%
33	Brightness controlling sensitivity	BR	3	$\Delta E_o/\Delta V_3$, $E_o=2V\sim 5V$, R,G,B Output each	4.0	4.5	5.0	—
34	Maximum R,G,B Output Voltage	E_{oM}	1	R,G,B Output Voltage each at V3=12 V	7.0	—	—	V
35	Differential Gain	D.G.	3	Stair Step signal input 1 Vp-p, f=3.58 MHz, APL=50 %, Contrast max, Resolution min, Pedestal of terminal 26 is 2 V, Bright VR was set	—	—	5.0	%
36	Quiescent Output Voltage	E_o	3	R,G,B Output each, Bright VR was set to be V3=9 V, No Luminance signal input, Contrast max, VCO is operating, Blanking	2.5	3.5	4.5	V
37	E_o Supply Voltage Coefficient	E_{o-v}	3	$V_{CC}=12V\pm 20\%$, V26=3.5 V ($V_{CC}=12V$), R, G, B Output each Blanking	0.2	0.25	0.3	V/V
38	E_o Temperature Coefficient	ΔE_{o-t}	3	$T_a=-20\sim +70^\circ C$, V26=3.5 V ($T_a=25^\circ C$) R,G,B Output each	-4.0	-2.0	0	mV/ $^\circ C$
39	Difference Output Voltage	ΔE_{R-G} ΔE_{G-B} ΔE_{B-R}	3	V26=3.5 V VCO is operating, R,G,B Output each, No blanking input	—	0	300	mV

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Test Circuit 1



Supply Current
Maximum R,G,B
Output Voltage

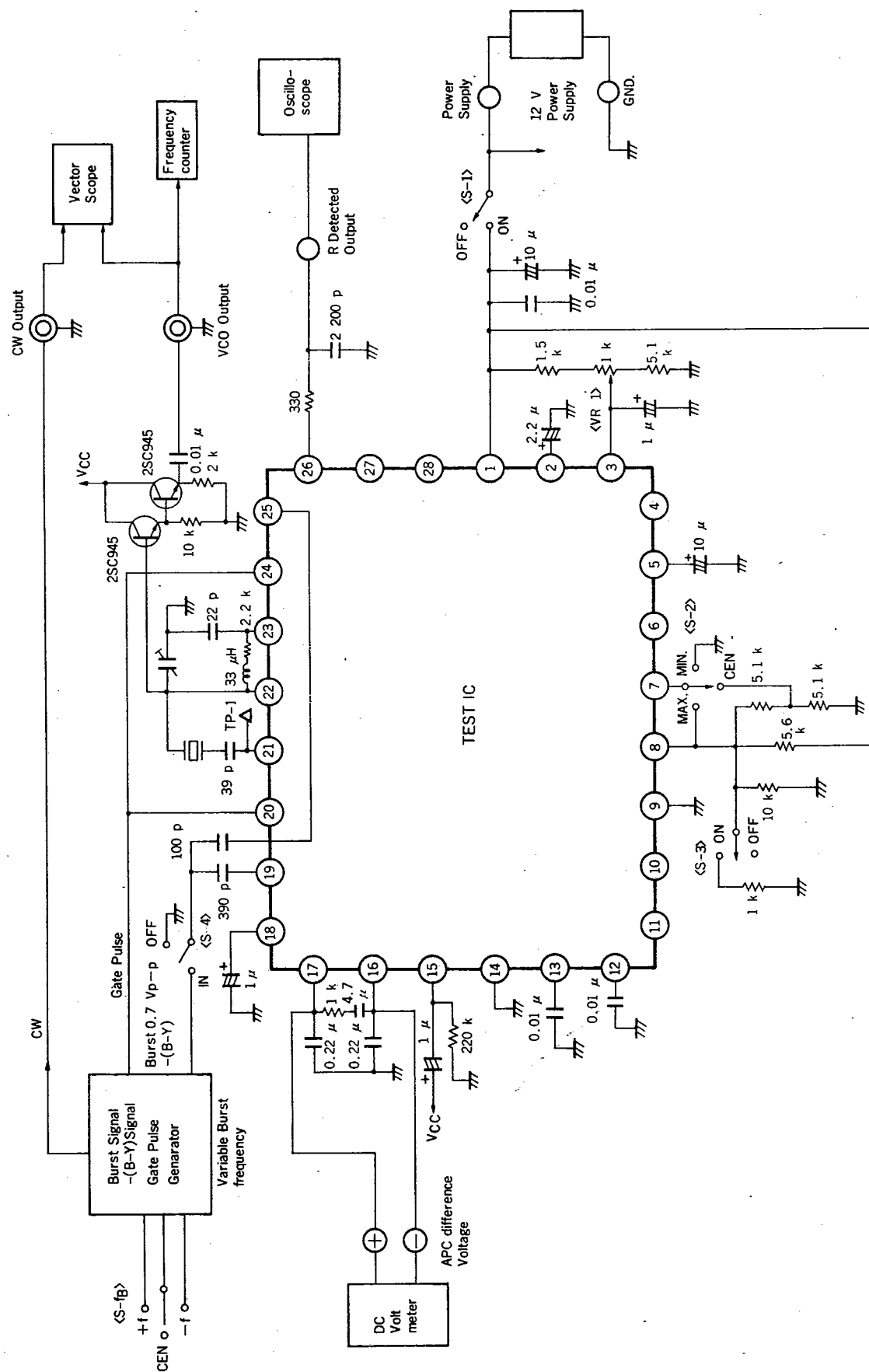
I_{CC}
 E_{OM}

S1 ; ON
S1 ; ON

S2 ; Side A
S2 ; Side B

S3 ; Each

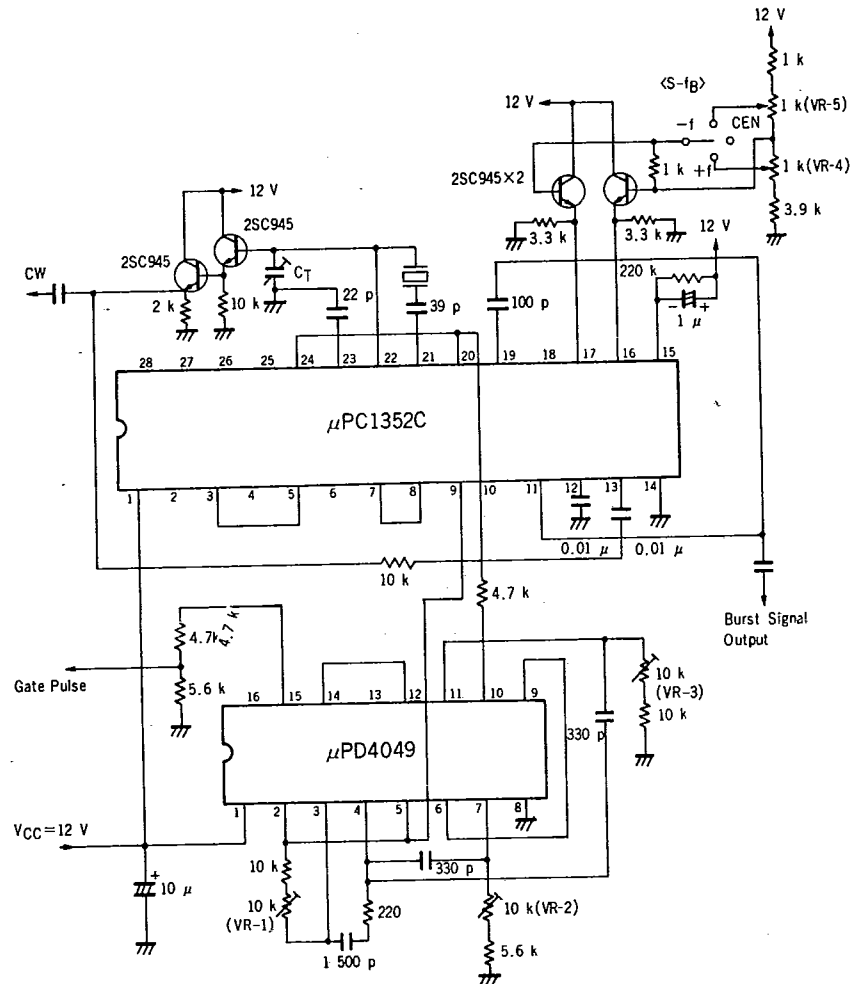
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Burst Signal
—(B-Y) Signal
Gate Pulse

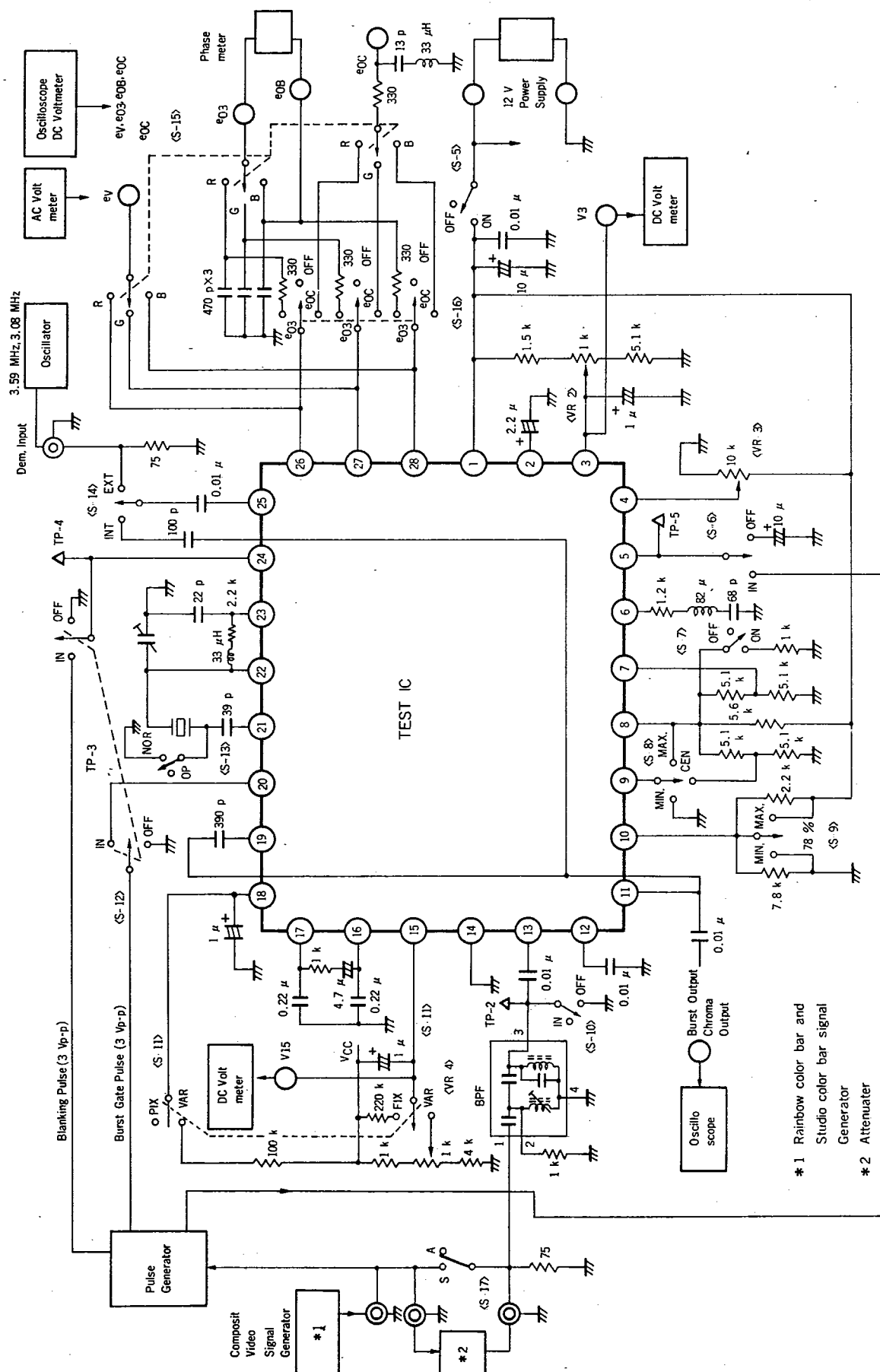
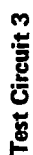
Generator

Test Circuit 2



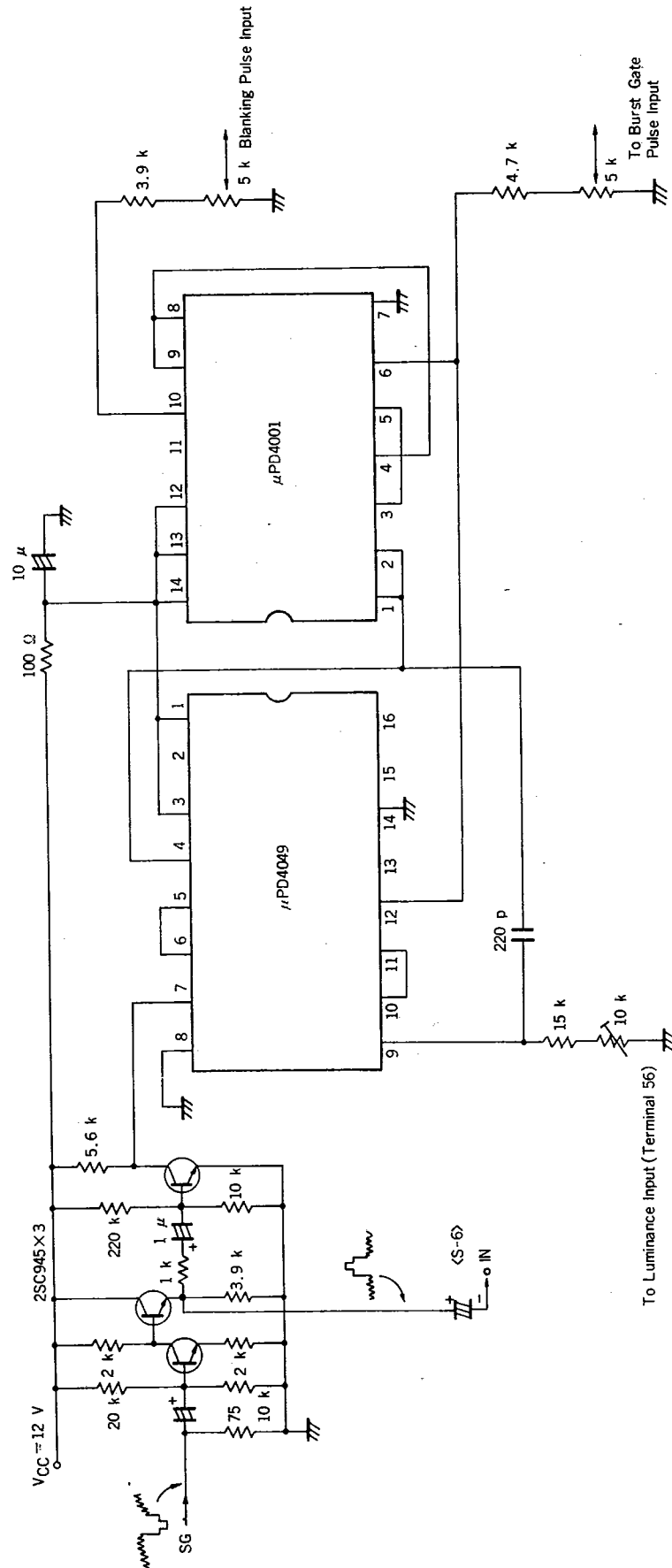
- VR-1 Set to $f_H = 15.75$ kHz.
 VR-2 Set to Burst width (10 cycle)
 VR-3 Set to Gate Pulse width = $3.5 \mu s$.
 VR-4 +f Be trimmed $f_o = 3579545$ Hz by C_T at the VR are center.
 VR-5 -f

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Pulse Generator Circuit (Test Circuit 3)



PC13520

NEC ELECTRON DEVICE

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Characteristic	Symbol	Test Ckt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4	Measuring Apparatus
Burst Output Voltage	e_b	3					OFF ↓ ON	OFF	ON	CEN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Burst signal
ACC Range 1	ACC1	3					OFF ↓ ON	OFF	ON	CEN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 300 mVp-p			MIN	-	Oscilloscope Burst signal
ACC Range 2	ACC2	3					OFF ↓ ON	OFF	ON	CEN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Burst signal
Chroma Output Voltage	e_{c1}	3					OFF ↓ ON	OFF	OFF	MAX	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Chroma signal
Chroma Output Voltage	e_{c2}	3					OFF ↓ ON	OFF	OFF	MIN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Chroma signal
Chroma Output Voltage	e_{c3}	3					OFF ↓ ON	OFF	OFF	CEN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Chroma signal
Chroma Output Voltage	e_{c4}	3					OFF ↓ ON	OFF	ON	CEN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Chroma signal
Variable Range of Chroma Output Voltage at auto	Δe_a	3					OFF ↓ ON	OFF	ON	MAX ↓ MIN	MAX	IN	FIX	IN	OP	INT	-	e_{o3}	A TP-2 150 mVp-p			MIN	-	Oscilloscope Variation of Chroma signal
Free running Frequency	f_o	2	OFF ↓ ON	CEN	ON	OFF																		Frequency Counter
Oscillator controlling sensitivity	β	2	OFF ↓ ON	CEN	ON	ON																		D.C. Voltage Meter
Phase Det. sensitivity	μ	2	OFF ↓ ON	CEN	ON	ON																		Vector Scope D.C. Vol. Meter Difference APC Voltage
Phase error	$\Delta\phi$	2	OFF ↓ ON	CEN	ON	ON																		Vector Scope
A.P.C. pull-in Freq. range	f_p	2	OFF ↓ ON	CEN	ON	ON																		Oscilloscope
Variable Range of Tint	$\Delta 01$	2	OFF ↓ ON	MAX ↓ MIN	OFF	ON																		Vector Scope
Variable Range of Tint at auto	$\Delta 02$	2	OFF ↓ ON	MAX ↓ MIN	OFF	ON																		Vector Scope
B-Y Output Voltage	e_{o1}	3					OFF ↓ ON	OFF	ON	-	-	OFF	FIX	OFF	OP	EXT 0.2 V _{in} -p f=3.59	B	e_{o3}	-			V26= 3.5 V	MIN	Oscilloscope Demo. Output Voltage B

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Characteristic	Symbol	Test Ckt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Bright-ness	1	Bright-ness	2	3	4	Measuring Apparatus
			Power Supply	Auto Tint	Burst Input (B-Y)	Burst freq.	Power Supply	Luminance Input	Auto	Color	Contrast	Chroma Input	ACC	Pulse Input	VCO	Demo Input	R G B	Demo Output	Attenuator							
Ratio of R-Y to B-Y	R/B	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.59	B	e ₀₃	-		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage R B	
Ratio of G-Y to B-Y	G/B	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.59	G	e ₀₃	-		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage G B	
Relative Output phase B-Y to R-Y	/R	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.59	B	e ₀₃	-		V26= 3.5 V		MIN	-	Phase Meter Relative phase R B	
Relative Output phase G-Y to B-Y	/G	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.59	B	e ₀₃	-		V26= 3.5 V		MIN	-	Phase Meter Relative phase B G	
Maximum Detected Output Voltage	e ₀₂	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.59	B	e ₀₃	-		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage B R	
Residual Carrier	e _{car}	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT No.	R	e _{0c}	-		V26= 3.5 V		MIN	-	Oscilloscope Output 3.58M Carrier	
Demodulation frequency characteristic	e _{of}	3					OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT f=3.08	R	OFF	-		V26= 3.5 V		MIN	-	A.C. Voltage Meter	
Overall Detected Output Vol.	e ₀₃	3					OFF ↓ ON	OFF	ON	CEN	MAX	IN	FIX	IN	OP	INT	R	e ₀₃	A TP-2 150 mVp-p		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage R	
Overall Detected Output Variable Range by Cont. controlling	Δe _{0c}	3					OFF ↓ ON	OFF	ON	CEN	MAX ↓ MIN	IN	FIX	IN	OP	INT	R	e ₀₃	A TP-2 150 mVp-p		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage R	
Color killer tolerance	e _k	3					OFF ↓ ON	OFF	-	-	-	IN	FIX	IN	OP	INT	R	e ₀₃	A TP-2 150 mVp-p		V26= 3.5 V		MIN	-	Oscilloscope Demo. Output Voltage R	
Luminance Gain 1	AV1	3					OFF ↓ ON	IN Studio Color Bar White 1 Vp-p	-		MAX	OFF	VAR	IN	NOP	EXT NO.	R G B	OFF	-			Terminal 26 Pedestal 2 V		MIN	V15= 8 V	Oscilloscope ev
Luminance Gain Variable Range by Contrast cont.	Δe _{ve}	3					OFF ↓ ON	IN Studio Color Bar White 1 Vp-p			MAX	OFF	VAR	IN	NOP	EXT NO.	B	OFF	-			Terminal 26 Pedestal 2 V		MIN	V15= 8 V	Oscilloscope ev
Luminance Amp. Frequency characteristic	f _v	3					OFF ↓ ON	IN Sine Wave 0.1 Vr.m.s.			MAX	OFF	VAR	OFF	NOP	EXT NO.	B	OFF	-			V26= 3.5 V		MIN	V15= 8 V	A.C. Voltage Meter 0dB= 16 kHz ev
Resolution Variation Range	Δf _{up}	3					OFF ↓ ON	IN Sine Wave 2M 0.1 Vr.m.s.			MAX	OFF	VAR	OFF	NOP	EXT NO.	B	OFF	-			V26= 3.5 V		MIN MAX	V15= 8 V	A.C. Voltage Meter ev

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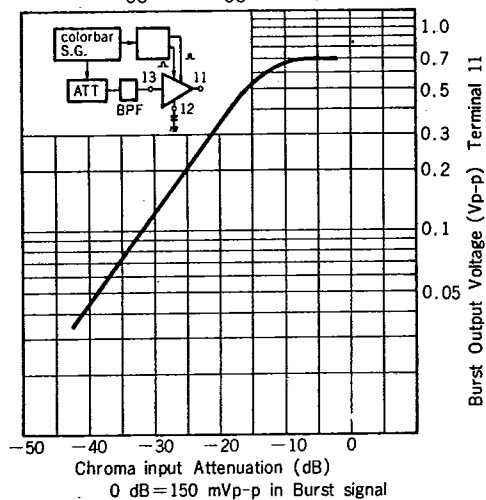
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Characteristic	Symbol	Test Ckt	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4	Measuring Apparatus	
			Power Supply	Tint	Auto	Burst (B-Y) Input	Burst frq	Power Supply	Luminescence Input	Auto	Color	Contrast	Chromina Input	ACC	Pulse Input	VCO	Demo Input	R G B	Demo Output	Attenuator	Bright-ness	Bright-ness	Resolu-tion	ACC Level	
D.C. Transfer	TDC	3						OFF ↓ ON	IN Stair step 1 Vp-p APL 90%	-		MAX	OFF	VAR	IN	NOP	EXT NO.	B	OFF	-	Terminal 26 Pedestal 2 V	MIN	V15= 8 V	Oscilloscope	
Brightness Controlling Sensitivity	BR	3						OFF ↓ ON	OFF	-	-	MAX	OFF	VAR	IN	OP	EXT NO.	R G B	e03	-	e03 D.C. 2-5 V	MIN	V15= 8 V	V3 e03 D.C. Voltage Meter	
Differential Gain	D.G.	3						OFF ↓ ON	IN Stair step step APL 50%			MAX	OFF	VAR	IN	NOP	EXT NO.	B	OFF	-	Terminal 26 Pedestal 2 V	MIN	V15= 8 V	Vector Scope	
Quiescent Output Voltage	E ₀	3						OFF ↓ ON	OFF	-	-	MAX	OFF	FIX	IN	OP	EXT NO.	R G B	e03	-	V3= 9 V	MIN	-	D.C. Voltage Meter	
E ₀ Supply Vol. Coefficient	E _{0-v}	3						OFF ↓ ON	OFF	-	-	-	OFF	FIX	IN	OP	EXT NO.	R G B	e03	-	V3= 9 V	MIN	-	D.C. Voltage Meter	
E ₀ Temperature Coefficient	E _{0-t}	3						OFF ↓ ON	OFF	-	-	-	OFF	FIX	IN	OP	EXT NO.	R G B	e03	-	V3= 9 V	MIN	-	D.C. Voltage Meter	
Difference Output Voltage	ER-G EG-B EB-R	3						OFF ↓ ON	OFF	-	-	-	OFF	FIX	OFF	OP	EXT NO.	R G B	e03	-	V26= 3.5 V (VCC= 12 V)	MIN	-	D.C. Voltage Meter	

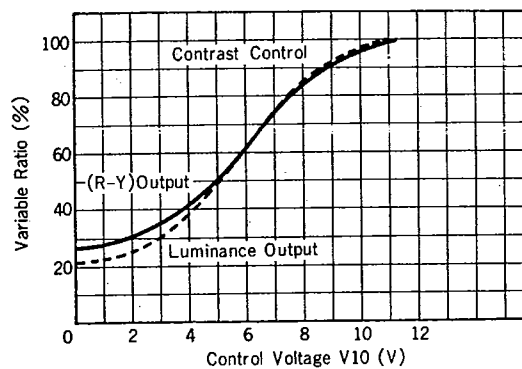
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ACC Characteristic

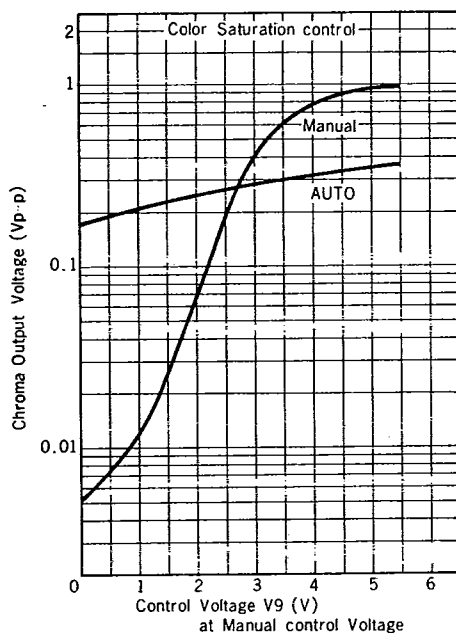
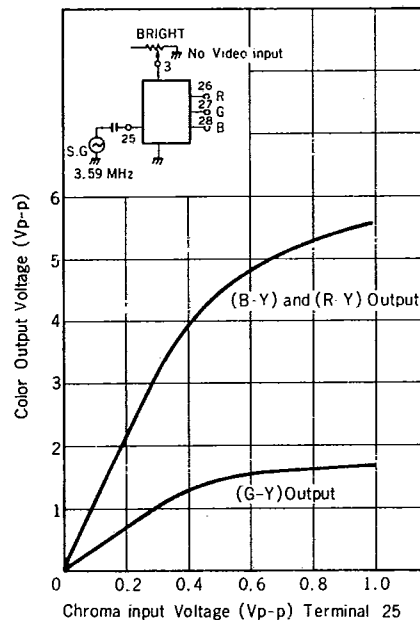
ACC Gain reduction
 $V_{CC} = 12\text{ V}$ V_{CO} is No operation



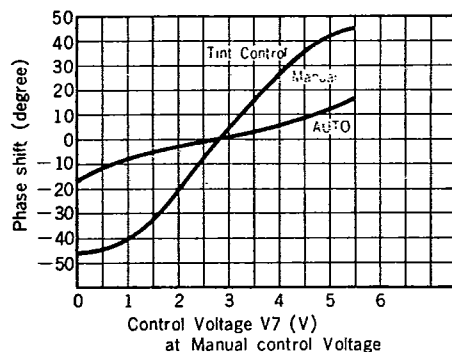
Contrast Control Characteristic



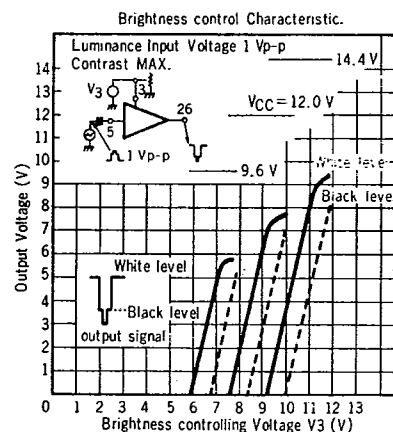
Color Control Characteristic

Brightness Control Characteristic
Demodulator input vs. Output

Tint Control Characteristic



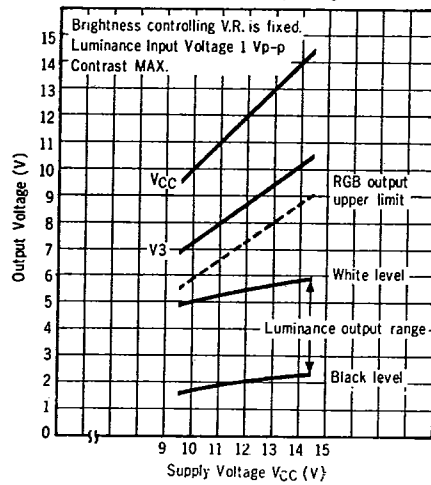
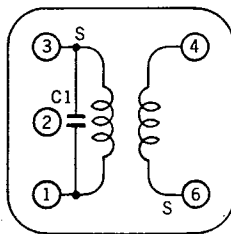
Demodulator Input-Output



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R.G.B. Output Stage Dynamic Page

Luminance Output Voltage vs. Supply Voltage Characteristic.

 μ PC1352C BAND PASS COIL

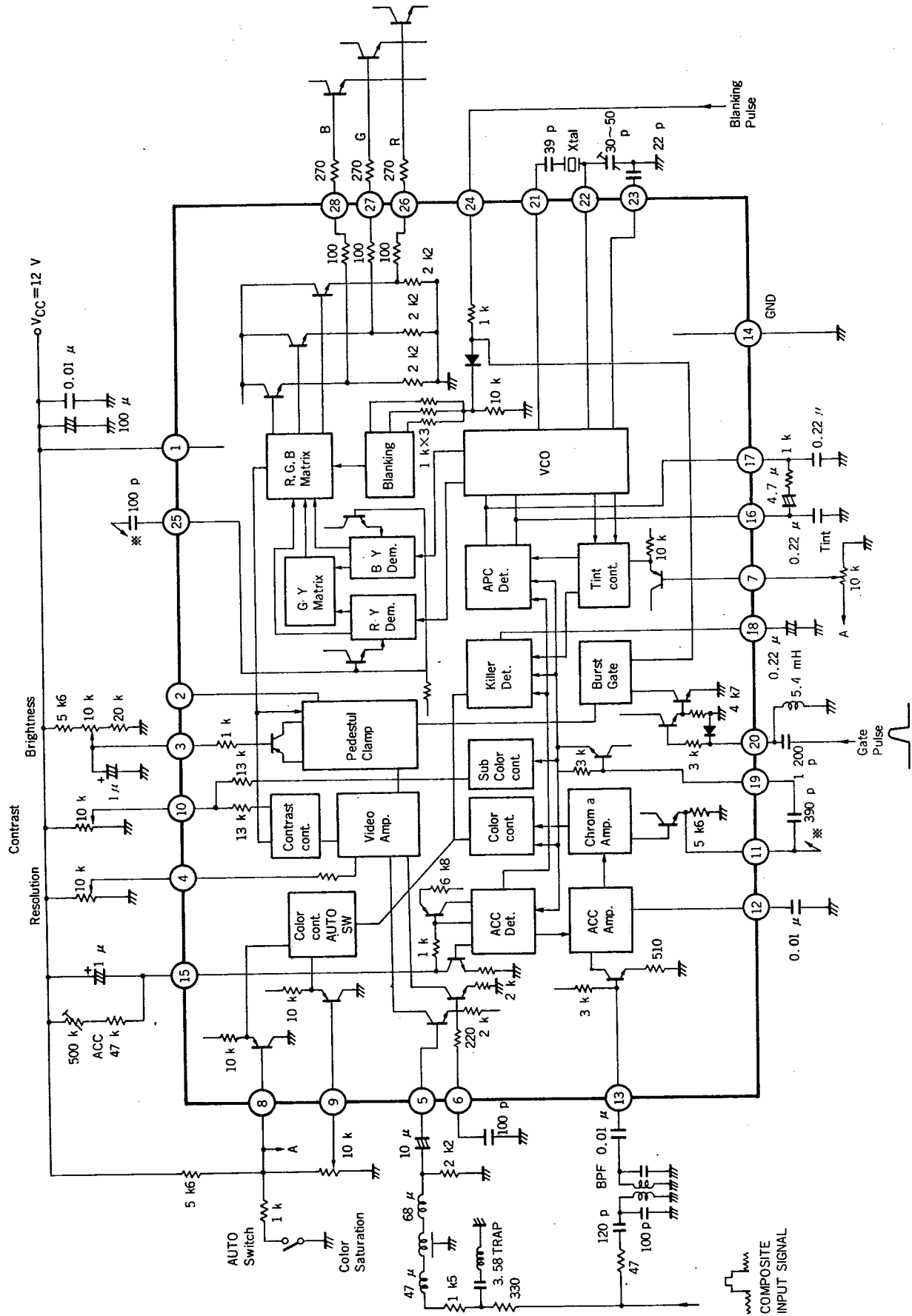
Pin Connection

- ①-③ 88T
④-⑥ 43-1/4T

Q_u 15 $\pm$ 20 % at $f=3.58$ MHz
 Q_u 24 $\pm$ 20 % at $f=3.58$ MHz

WIRE MATERIAL
0.12 ϕ OUEW
INSIDE CAPACITOR
 $C_1 = 47$ pF

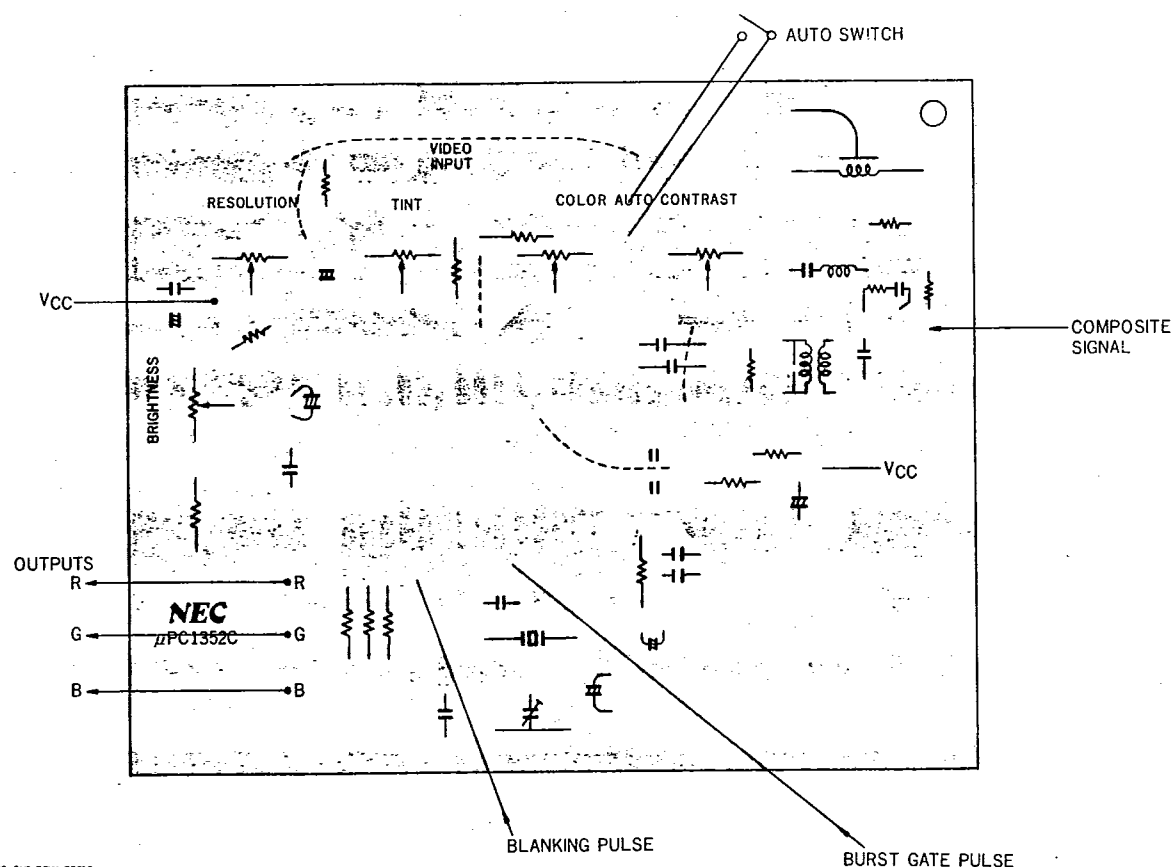
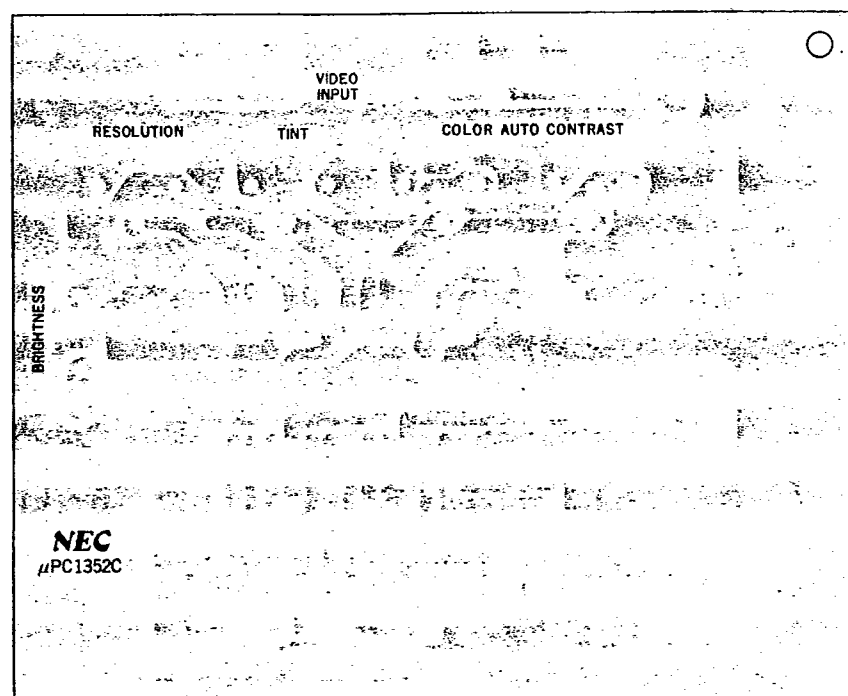
371



μ PC1352C

NEC ELECTRON DEVICE

T-77-07-09

 μ PC1352C PRINTED CIRCUIT BOARD PATTERN (BOTTOM VIEW)

Please note our new name.
NEC Corporation
 starting April 1, 1983.

Nippon Electric Co., Ltd.

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