

# M52320SP

## 3-CHANNEL VIDEO PREAMPLIFIER WITH OSD MIXING FUNCTION FOR HIGH-RESOLUTION COLOR DISPLAYS

### DESCRIPTION

The M52320SP semiconductor integrated circuit is a video signal amplifier with OSD mixing function. It has three 150MHz band amplification channels.

For each channel, OSD blanking function, OSD mixing function, wide-band amplification, main and sub contrast controls, and main brightness control are provided.

This IC is optimal for high-resolution displays with OSD.

### FEATURES

- Frequency band : RGB 150MHz (3V<sub>PP</sub>)  
OSD 50MHz
- Input : RGB 0.7V<sub>PP</sub> (typ)  
OSD 3V<sub>PP</sub> min.(positive)  
BLK 3V<sub>PP</sub> min.(positive)
- Output : RGB 4.0V<sub>PP</sub> (max.)  
OSD 4.0V<sub>PP</sub> (max.)
- For control of contrast and OSD, a main control and sub control are provided. The main control works on three channels simultaneously. The sub control is used to adjust each channel independently. Each control pin features a 0 ~5V control voltage range.
- A feedback circuit is built in the IC, ensuring stable DC supply from output pins.

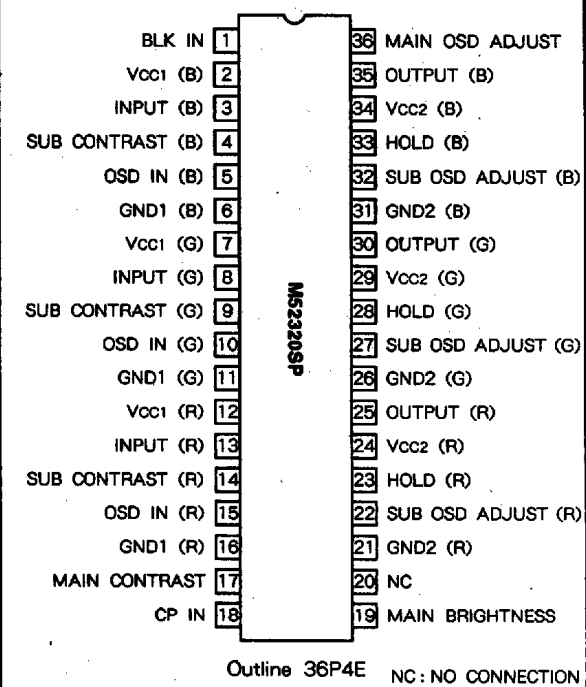
### APPLICATION

Cathode-ray tube displays

### RECOMMENDED OPERATING CONDITION

Supply voltage range.....11.5~12.5V  
Rated supply voltage.....12.0V

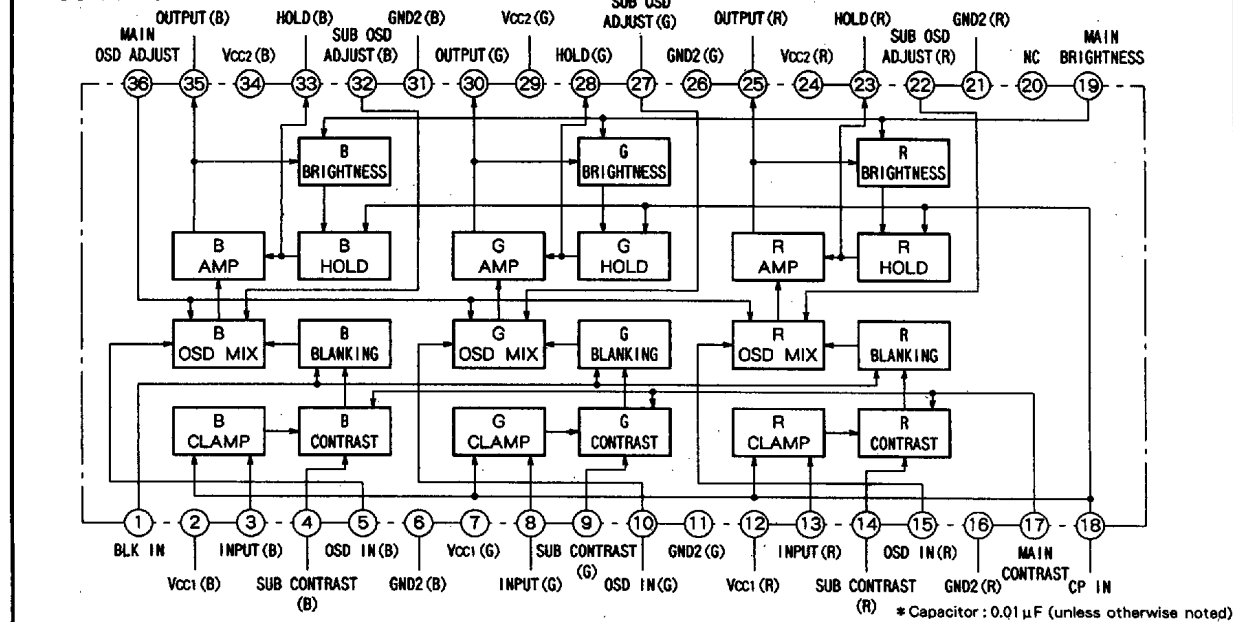
### PIN CONFIGURATION (TOP VIEW)



### MAIN FUNCTION

Amplification of 150MHz band video signals  
3 channels  
With OSD mixing function

### BLOCK DIAGRAM



**M52320SP****3-CHANNEL VIDEO PREAMPLIFIER WITH OSD MIXING  
FUNCTION FOR HIGH-RESOLUTION COLOR DISPLAYS****ABSOLUTE MAXIMUM RATINGS** ( $T_a = 25^\circ\text{C}$ )

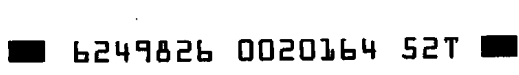
Symbol	Parameter	Ratings	Unit
V <sub>cc</sub>	Supply voltage	13.0	V
P <sub>d</sub>	Power dissipation	2016	mW
T <sub>opr</sub>	Operating temperature	-20~+85	°C
T <sub>stg</sub>	Storage temperature	-40~+150	°C
V <sub>opr</sub>	Recommended operating voltage	12.0	V
V <sub>opr'</sub>	Recommended operating voltage range	11.5~12.5	V
Surge	Surge voltage resistivity	±200	V

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**ELECTRICAL CHARACTERISTICS** (Ta = 25°C, Vcc = 12V, unless otherwise noted)

Symbol	Parameter	Test point	Input				External power supply (V)					Pulse input			Limits		Unit	
			SW13 R-ch	SW8 G-ch	SW3 Bch	V4	V17	V19	V32	V36	SW18	SW15 10,15	Min.	Typ.	Max.			
Icc	Circuit current	A	a	a	a	5	5	5	5	5	2	2	b SG5	a	70	100	140	mA
Vomax	Output dynamic range	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	5	5	Variable	5	5	5	b SG5	a	5.8	6.8	9.0	Vpp	
Vimax	Maximum allowable input	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	5	2.5	1	5	5	5	b SG5	a	1	1.8	-	Vpp	
Gv	Maximum gain	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	5	5	2	5	5	5	b SG5	a	15	17	20	dB	
ΔGv	Relative maximum gain		Calculate using the measured values.															
Vcr1	Contrast control characteristic (typical)	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	5	4	2	5	5	5	b SG5	a	14	15.5	17	dB	
ΔVcr1	Relative contrast control characteristic (typical)		Calculate using the measured values.															
Vcr2	Contrast control characteristic (minimum)	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	5	1	2	5	5	5	b SG5	a	0.3	0.6	0.9	Vpp	
ΔVcr2	Relative contrast control characteristic (minimum)		Calculate using the measured values.															
Vscr1	Sub contrast control characteristic (typical)	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	4	5	2	5	5	5	b SG5	a	14	15.5	17	dB	
ΔVscr1	Relative sub contrast control characteristic (typical)		Calculate using the measured values.															
Vscr2	Sub contrast control characteristic (minimum)	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	1	5	2	5	5	5	b SG5	a	0.5	0.9	1.3	Vpp	
ΔVscr2	Relative sub contrast control characteristic (minimum)		Calculate using the measured values.															
Vscr3	Main/Sub contrast control characteristic (typical for both main and sub controls)	T.P35 T.P30 T.P25	b SG6	b SG6	b SG6	3	3	2	5	5	5	b SG5	a	0.8	1.5	2.2	Vpp	
ΔVscr3	Relative main/sub contrast control characteristics (typical for both main and sub controls)		Calculate using the measured values.															



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**ELECTRICAL CHARACTERISTICS (cont.)** (Ta = 25 °C, Vcc = 12V, unless otherwise noted)

Symbol	Parameter	Test point	Input			External power supply (V)					Pulse input			Limits			Unit
			SW13 R-ch	SW8 G-ch	SW3 B-ch	V4	V17	V19	V32	V36	SW18 10,15	SW15 10,15	Min.	Typ.	Max.		
V <sub>B1</sub>	Brightness control characteristic (maximum)	T.P35 T.P30 T.P25	a -	a -	a -	5 5 5	4 5 5	5 5 5	5 5 5	b SG5 -	a -	3.0	3.6	4.2	V		
ΔV <sub>B1</sub>	Relative brightness characteristic (maximum)		Calculate using the measured values.														
V <sub>B2</sub>	Brightness control characteristic (typical)	T.P35 T.P30 T.P25	a -	a -	a -	5 5 5	2.5 5 5	5 5 5	5 5 5	b SG5 -	a -	1.7	2.3	2.9	V		
ΔV <sub>B2</sub>	Relative brightness characteristic (typical)		Calculate using the measured values.														
V <sub>B3</sub>	Brightness control characteristic (minimum)	T.P35 T.P30 T.P25	a -	a -	a -	5 5 5	1 5 5	5 5 5	5 5 5	b SG5 -	a -	0.5	0.9	1.3	V <sub>oc</sub>		
ΔV <sub>B3</sub>	Relative brightness characteristic (minimum)		Calculate using the measured values.														
F <sub>c1</sub>	Frequency characteristic 1 (f = 50MHz, maximum)	T.P35 T.P30 T.P25	b SG2	b SG2	b SG2	5 5 5	2.5 5 5	V <sub>T</sub>	-	a -	a -	-2.5	-1	3	dB		
ΔF <sub>c1</sub>	Relative frequency characteristic 1 (f = 50MHz, maximum)		Calculate using the measured values.														
F <sub>c1'</sub>	Frequency characteristic 1 (f = 150MHz, maximum)	T.P35 T.P30 T.P25	b SG3	b SG3	b SG3	5 5 5	2.5 5 5	V <sub>T</sub>	-	a -	a -	-3	-2	3	dB		
ΔF <sub>c1'</sub>	Relative frequency characteristic 1 (f = 150MHz, maximum)		Calculate using the measured values.														
F <sub>c2</sub>	Frequency characteristic 2 (f = 150MHz, typical)	T.P35 T.P30 T.P25	b SG3	b SG3	b SG3	5 5 5	1.5 5 5	V <sub>T</sub>	-	a -	a -	-3	0	3	dB		
ΔF <sub>c2</sub>	Relative frequency characteristic 2 (f = 150MHz, typical)		Calculate using the measured values.														
C.T.1	Crosstalk 1 (f = 50MHz)	T.P35 T.P30 T.P25	b SG2	a -	a -	5 5 5	5 5 5	V <sub>T</sub>	5	a -	a -	-	-30	-20	dB		
C.T.1'	Crosstalk 1 (f = 150MHz)	T.P35 T.P30 T.P25	b SG3	a -	a -	5 5 5	5 5 5	V <sub>T</sub>	5	a -	a -	-	-20	-15	dB		



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**ELECTRICAL CHARACTERISTICS** (cont.) (Ta = 25°C, Vcc = 12V, unless otherwise noted)

Symbol	Parameter	Test point	Input				External power supply (V)				Pulse input			Limits			Unit
			SW13 R-ch	SW8 G-ch	SW3 B-ch	V4	V17	V19	V32	V36	SW18	SW15 10,15	Min.	Typ.	Max.		
C.T.2	Crosstalk 2 (f = 50MHz)	T.P35	a	b	a	5	5	Vr	5	-	a	a	-	-30	-20	dB	
		T.P30	-	SG2	-	-	-	-	-	-	-	-	-	-	-	dB	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	dB	
C.T.2'	Crosstalk 2 (f = 150MHz)	T.P35	a	b	a	5	5	Vr	5	-	a	a	-	-20	-15	dB	
		T.P30	-	SG3	-	-	-	-	-	-	-	-	-	-	-	dB	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	dB	
C.T.3	Crosstalk 3 (f = 50MHz)	T.P35	a	a	b	5	5	Vr	5	-	a	a	-	-30	-20	dB	
		T.P30	-	-	SG2	-	-	-	-	-	-	-	-	-	-	dB	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	dB	
C.T.3'	Crosstalk 3 (f = 150MHz)	T.P35	a	a	b	5	5	Vr	5	-	a	a	-	-20	-15	dB	
		T.P30	-	-	SG3	-	-	-	-	-	-	-	-	-	-	dB	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	dB	
Tr	Pulse characteristic 1	T.P35	b	b	b	5	5	3	5	-	b	a	-	3	6	ns	
		T.P30	SG4	SG4	SG4	-	-	-	-	-	SG5	-	-	-	-	ns	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	ns	
Tf	Pulse characteristic 2	T.P35	b	b	b	5	5	3	5	-	b	a	-	3	6	ns	
		T.P30	SG4	SG4	SG4	-	-	-	-	-	SG5	-	-	-	-	ns	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	ns	
V14th	Clamp pulse threshold voltage	T.P35	a	a	a	5	5	2	5	-	a	a	1.0	1.5	2.0	Vdc	
		T.P30	-	-	-	-	-	-	-	-	-	-	-	-	-	Vdc	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	Vdc	
W14	Clamp pulse operating minimum width	T.P35	a	a	a	5	5	2	5	-	a	a	-	0.1	0.5	μs	
		T.P30	-	-	-	-	-	-	-	-	-	-	-	-	-	μs	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	μs	
PdcH	Pedestal voltage temperature characteristic 1	T.P35	b	b	b	5	5	2	5	-	b	b	-0.3	0	0.3	Vdc	
		T.P30	SG6	SG6	SG6	-	-	-	-	-	SG5	-	-	-	-	Vdc	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	Vdc	
PdcL	Pedestal voltage temperature characteristic 2	T.P35	b	b	b	5	5	2	5	-	b	b	-0.3	0	0.3	Vdc	
		T.P30	SG6	SG6	SG6	-	-	-	-	-	SG5	-	-	-	-	Vdc	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	Vdc	
OTr	OSD pulse characteristic 1	T.P35	a	a	a	5	5	2	5	3	a	b	-	3	8	ns	
		T.P30	-	-	-	-	-	-	-	-	-	SG7	-	-	-	ns	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	ns	
OTf	OSD pulse characteristic 2	T.P35	a	a	a	5	5	2	5	3	a	b	-	3	8	ns	
		T.P30	-	-	-	-	-	-	-	-	-	SG7	-	-	-	ns	
		T.P25	-	-	-	-	-	-	-	-	-	-	-	-	-	ns	

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**ELECTRICAL CHARACTERISTICS (cont.)** (Ta = 25°C, Vcc = 12V, unless otherwise noted)

Symbol	Parameter	Test point	Input			External power supply (V)					Pulse input			Limits			Unit			
			SW13 R-ch	SW8 G-ch	SW3 B-ch	V4	V17	V19	V32	V36	SW18	SW15,10,15	Min.	Typ.	Max.					
Oaj1	Main OSD adjusting control characteristic (maximum)	T.P35 T.P30 T.P25	a	a	a	5	5	2	5	4	a	b	3.5	4.0	4.5	Vpp				
ΔOaj1	Relative main OSD adjusting control characteristic (maximum)		Calculate using the measured values.														0.8	1	1.2	-
Oaj2	Main OSD adjusting control characteristic (minimum)	T.P35 T.P30 T.P25	a	a	a	5	5	2	5	0	a	b	-	0	0.5	Vpp				
ΔOaj2	Relative main OSD adjusting control characteristic (minimum)		Calculate using the measured values.														0.8	1	1.2	-
OSDth	OSD input threshold voltage	T.P35 T.P30 T.P25	a	a	a	5	5	2	5	5	a	b	1.7	2.5	3.5	Vdc				
V1th	BLK input threshold voltage	T.P35 T.P30 T.P25	b	b	b	5	5	2	5	5	a	b	1.7	2.5	3.5	Vdc				
SOaj1	Sub OSD adjusting control characteristic (typical)	T.P35 T.P30 T.P25	a	a	a	5	5	2.5	2	5	a	b	1.4	2.0	2.6	Vpp				
SOaj2	Sub OSD adjusting control characteristic (minimum)	T.P35 T.P30 T.P25	a	a	a	5	5	1	0	5	a	b	-	0	0.5	Vpp				

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**ELECTRICAL CHARACTERISTIC TEST METHOD**

Because signal input pin switch numbers and pulse input pin switch numbers are specified in Table of ELECTRICAL CHARACTERISTIC, we mention only the switch numbers of externally connected power supplies in these notes.

Sub OSD Adjust voltages V32, V27 and V22 are set to the same value, therefore, we mentioned only V32 in Supplementary Table of ELECTRICAL CHARACTERISTIC. Sub contrast voltages V4, V9 and V14 are also set to the same value, therefore we mentioned only V4 in Supplementary Table of ELECTRICAL CHARACTERISTIC.

**Icc**

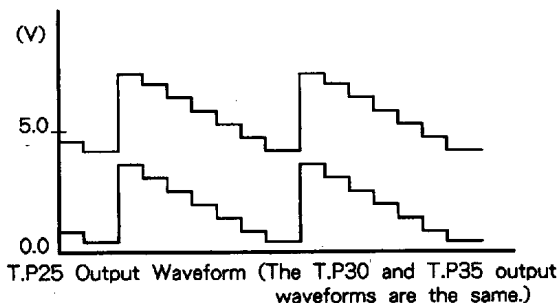
Test conditions are as specified in Table of ELECTRICAL CHARACTERISTIC. Measure using ammeter A with SWA set to "b".

**Vomax**

Set V19 as follows :

1. Input SG6 to pin ⑬ (pin ⑧ or pin ③). Increase V19 gradually, and read voltage V19 when the T.P25 (T.P30 or T.P35) output waveform peak becomes distorted. This reading is called VTR1 (VTG1 or VTB1).

Next, lower V19 gradually, and read voltage V19 when the T.P25 (T.P30 or T.P35) output waveform bottom becomes distorted. This reading is called VTR2 (VTG2 or VTB2).



2. With these readings, VT (VTR, VTG and VTB) can be calculated as follows :

$$V_{TR}(V_{TG}, V_{TB}) = \frac{V_{TR1}(V_{TG1}, V_{TB1}) + V_{TR2}(V_{TG1}, V_{TB1})}{2}$$

Select a relevant reading, depending on the output pin. When T.P25 is measured, use VTR1 ; when T.P30 is measured, use VTG1 ; and when T.P35 is measured, use VTB1.

3. After setting VTR (VTG or VTB), increase the SG6 amplitude gradually starting from 700mV, and read the amplitude when T.P25 (T.P30 and T.P35) output waveform peak and bottom start being distorted simultaneously.

**Vimax**

Under the same starting conditions as described in Vomax, adjust V17 to 25V as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC. Increase the input signal

amplitude gradually starting from 700mV<sub>P-P</sub>, and read it when output signal starts being distorted.

**Gv, ΔGv**

1. Input SG6 to pin ⑬ (pin ⑧ or pin ③), and read the T.P25 (T.P30 or T.P35) output amplitude. This reading is called VOR1 (VOG1 and VOB1).
2. Maximum gain Gv is :

$$G_v = 20 \log \frac{V_{OR1}(V_{OG1}, V_{OB1})}{0.7} \frac{[V_{P-P}]}{[V_{P-P}]}$$

3. Relative maximum gain ΔG can be calculated with the equation given below :

$$\Delta G = V_{OR1}/V_{OG1}, V_{OG1}/V_{OB1}, V_{OB1}/V_{OR1}$$

**VCR1, ΔVCR1**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25 (T.P30 or T.P35) output amplitude. This reading is called VOR2 (VOG2 or VOB2).
3. Contrast control characteristic VCR1 and relative contrast control characteristic ΔVCR1 can be calculated as follows :

$$V_{CR1} = 20 \log \frac{V_{OR2}(V_{OG2}, V_{OB2})}{0.7} \frac{[V_{P-P}]}{[V_{P-P}]}$$

$$\Delta V_{CR1} = V_{OR2}/V_{OG2}, V_{OG2}/V_{OB2}, V_{OB2}/V_{OR2}$$

**VCR2, ΔVCR2**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC, except that V17 is set to 1.0V.
2. Read the T.P25 (T.P30 or T.P35) output amplitude. This reading is called VOR3 (VOG3 or VOB3). It is used as VCR2.
3. Relative contrast control characteristic ΔVCR2 is calculated as follows :

$$\Delta V_{OR2} = V_{OR3}/V_{OG3}, V_{OG3}/V_{OB3}, V_{OB3}/V_{OR3}$$

**VSCR1, ΔVSCR1**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25 (T.P30 or T.P35) output amplitude. This reading is called VOR4 (VOG4 or VOB4).
3. Sub contrast control characteristic VSCR1 and relative sub contrast control characteristic ΔVSCR1 are calculated as follows :

$$V_{SCR1} = 20 \log \frac{V_{OR4}(V_{OG4}, V_{OB4})}{0.7} \frac{[V_{P-P}]}{[V_{P-P}]}$$

$$\Delta V_{SCR1} = V_{OR4}/V_{OG4}, V_{OG4}/V_{OB4}, V_{OB4}/V_{OR4}$$

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FUNCTION FOR HIGH-RESOLUTION COLOR DISPLAYS**V<sub>CR2</sub>, Δ V<sub>CR2</sub>**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC, except that V4, V9 and V14 are set to 1.0V.
2. Read the T.P25(T.P30 or T.P35) output amplitude. This reading is called V<sub>OR5</sub>(V<sub>OG5</sub> or V<sub>OB5</sub>).
3. Relative sub contrast characteristic V<sub>CR2</sub> is calculated as follows :  

$$\Delta V_{CR2} = V_{OR5}/V_{OG5}, V_{OG5}/V_{OB5}, V_{OB5}/V_{OR5}$$

**V<sub>CR3</sub>, Δ V<sub>CR3</sub>**

1. The testing conditions are as shown in Supplementary Table of ELECTRICAL CHARACTERISTIC, except that V17 is set to 3.0V, and that V4, V9 and V14 are set to 3.0V.
2. Read the T.P25(T.P30 or T.P35) output amplitude. This reading is called V<sub>OR6</sub>(V<sub>OG6</sub> or V<sub>OB6</sub>).

$$V_{CR3} = 20 \text{ LOG } \frac{V_{OR6}(V_{OG6}, V_{OB6})}{0.7} \frac{[V_{P-P}]}{[V_{P-P}]}$$

$$\Delta V_{CR3} = V_{OR6}/V_{OG6}, V_{OG6}/V_{OB6}, V_{OB6}/V_{OR6}$$

**V<sub>B1</sub>, Δ V<sub>B1</sub>**

1. The testing conditions are as shown in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25(T.P30 or T.P35) output with a voltmeter. This reading is called V<sub>OR7</sub>(V<sub>OG7</sub> or V<sub>OB7</sub>).  
It is used as V<sub>B1</sub>.
3. The relative brightness control characteristic is difference among channels, which can be calculated by using V<sub>OR7</sub>, V<sub>OG7</sub> and V<sub>OB7</sub>, as follows :  

$$\Delta V_{B1} = V_{OR7} - V_{OG7} \quad (\text{mV})$$

$$= V_{OG7} - V_{OB7}$$

$$= V_{OB7} - V_{OR7}$$

**V<sub>B2</sub>, Δ V<sub>B2</sub>**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25(T.P30 or T.P35) output with a voltmeter. This reading is called V<sub>OR7'</sub>(V<sub>OG7'</sub> or V<sub>OB7'</sub>).  
It is used as V<sub>B2</sub>.
3. Relative brightness control characteristic Δ V<sub>B2</sub> is the difference among channels, which can be calculated by using V<sub>OR7'</sub>, V<sub>OG7'</sub> and V<sub>OB7'</sub>, as follows :  

$$\Delta V_{B2} = V_{OR7'} - V_{OG7'} \quad (\text{mV})$$

$$= V_{OG7'} - V_{OB7'}$$

$$= V_{OB7'} - V_{OR7'}$$

**V<sub>B3</sub>, Δ V<sub>B3</sub>**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25(T.P30 or T.P35) output with a voltmeter. This reading is called V<sub>OR7''</sub>(V<sub>OG7''</sub> or V<sub>OB7''</sub>).

It is used as V<sub>B3</sub>.

3. Relative brightness control characteristic Δ V<sub>B3</sub> is the difference among channels, which can be calculated by using V<sub>OR7''</sub>, V<sub>OG7''</sub> and V<sub>OB7''</sub>, as follows :

$$\Delta V_{B3} = V_{OR7''} - V_{OG7''} \quad (\text{mV})$$

$$= V_{OG7''} - V_{OB7''}$$

$$= V_{OB7''} - V_{OR7''}$$

**F<sub>C1</sub>, F<sub>C1'</sub>**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. SG2 and SG3 are applied. Measure the T.P25(T.P30 or T.P35) output waveform amplitude by the procedure as described in G<sub>v</sub>, Δ G<sub>v</sub>.
3. The readings are called as follows :  
 Output amplitude with input of SG1 : V<sub>OR1</sub>(V<sub>OG1</sub> or V<sub>OB1</sub>)  
 Output amplitude with input of SG2 : V<sub>OR8</sub>(V<sub>OG8</sub> or V<sub>OB8</sub>)  
 Output amplitude with input of SG3 : V<sub>OR9</sub>(V<sub>OG9</sub> or V<sub>OB9</sub>)  
 Frequency characteristics F<sub>C1</sub> and F<sub>C1'</sub> can be calculated as follows :

$$F_{C1} = 20 \log \frac{V_{OR8}(V_{OG8}, V_{OB8})}{V_{OR1}(V_{OG1}, V_{OB1})} \frac{[V_{P-P}]}{[V_{P-P}]}$$

$$F_{C1'} = 20 \log \frac{V_{OR9}(V_{OG9}, V_{OB9})}{V_{OR1}(V_{OG1}, V_{OB1})} \frac{[V_{P-P}]}{[V_{P-P}]}$$

4. To obtain relative frequency bandwidths Δ F<sub>C1</sub> and Δ F<sub>C1'</sub>, calculate the difference between F<sub>C1</sub> and F<sub>C1'</sub> for each channel.

**F<sub>C2</sub>, Δ F<sub>C2</sub>**

The testing procedure is the same as described in F<sub>C1</sub>, F<sub>C1'</sub>, except that CONTRAST (V17) is throttled to 1.5V.

**C.T.1, C.T.1'**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Input SG2 (or SG3) to pin③(R-ch), and measure the T.P25(T.P30 or T.P35) output waveform. The measured value is called V<sub>OR</sub>(V<sub>OG</sub> or V<sub>OB</sub>).
3. Crosstalk C.T.1 is calculated as follows :

$$C.T.1 \text{ (C.T.1')} = 20 \log \frac{V_{OG} \text{ or } V_{OB}}{V_{OR}} \frac{[V_{P-P}]}{[V_{P-P}]} \quad [\text{dB}]$$

**C.T.2, C.T.2'**

1. Input SG2 (or SG3) to pin④(G-ch), and read output in the same way as described in C.T.1, C.T.1'.
2. Crosstalk C.T.2 is calculated as follows :

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$$\text{C.T.2} = 20 \log \frac{V_{OR} \text{ or } V_{OB}}{V_{OG}} \frac{[V_{P-P}]}{[V_{P-P}]} \text{ [dB]}$$

(C.T.2')

**C.T.3, C.T.3'**

1. Input SG1 (or SG2) to pin③(B-ch), and read output in the same way as described in C.T.1, C.T.1'.
2. Crosstalk C.T.3 is calculated as follows:

$$\text{C.T.3} = 20 \log \frac{V_{OR} \text{ or } V_{OG}}{V_{OB}} \frac{[V_{P-P}]}{[V_{P-P}]} \text{ [dB]}$$

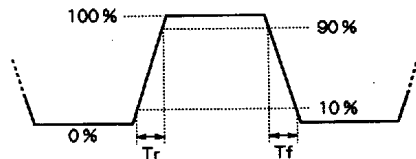
(C.T.3')

**Tr, Tf**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Measure rise time  $T_{r1}$ , during which an input pulse rises from 10% to 90%. Also measure fall time  $T_{f1}$ , during which an input pulse falls from 90% to 10%. Use an active probe for this measurement.
3. Measure rise time  $T_{r2}$ , during which an output pulse rises from 10% to 90%, and measure fall time  $T_{f2}$  during which an output pulse falls from 90% to 10%. Use an active probe for this measurement.
4. Pulse characteristics  $T_r$  and  $T_f$  are calculated as follows:

$$T_r(\text{ns}) = \sqrt{(T_{r2})^2 - (T_{r1})^2}$$

$$T_f(\text{ns}) = \sqrt{(T_{f2})^2 - (T_{f1})^2}$$



**V14th**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Monitoring output (approximately 2.0Vbc), reduce SG5 input gradually, and read the SG5 level when output becomes 0V.

**W14**

Under the same conditions as described in  $P_{DCH}$ ,  $P_{DCL}$ , diminish the SG5 pulse width gradually while monitoring output.

Measure the SG5 pulse width when output becomes 0V.

**$P_{DCH}$ ,  $P_{DCL}$**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Measure pedestal voltage at room temperature. The measurement is called  $P_{DC1}$ .
3. Measure pedestal voltage at  $-20^\circ\text{C}$  and at  $85^\circ\text{C}$ . The

measurements are called, respectively,  $P_{DC2}$  and  $P_{DC3}$ .

$$4. P_{DCH} = P_{DC1} - P_{DC2}$$

$$P_{DCL} = P_{DC1} - P_{DC3}$$

**$O_{Tr}$ ,  $O_{Tf}$**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Measure rise time  $O_{Tr}$  and fall time  $O_{Tf}$ , during each of which an output pulse fluctuates between 10% and 90%. Use an active probe for this measurement.

**$O_{aj1}$ ,  $\Delta O_{aj1}$**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25(T.P30 and T.P35) output amplitude. The reading is called  $V_{ORA}$  ( $V_{OGA}$  or  $V_{OBA}$ ). It is used as  $O_{aj1}$ .
3. Relative OSD adjusting control characteristic  $\Delta O_{aj1}$  is calculated as follows:  
 $\Delta O_{aj1} = V_{ORA}/V_{OGA}$ ,  $V_{OGA}/V_{OBA}$ ,  $V_{OBA}/V_{ORA}$

**$O_{aj2}$ ,  $\Delta O_{aj2}$**

1. The testing conditions are as specified in Supplementary Table, except that V36 is set to 0V.
2. Read the T.P25(T.P30 and T.P35) output amplitude. The reading is called  $V_{ORB}$  ( $V_{OGB}$  or  $V_{OBB}$ ). It is used as  $O_{aj2}$ .
3. Relative OSD adjusting control characteristic  $\Delta O_{aj2}$  is calculated as follows:  
 $\Delta O_{aj2} = V_{ORA}/V_{OGA}$ ,  $V_{OGA}/V_{OBA}$ ,  $V_{OBA}/V_{ORA}$

**OSDth**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Monitoring output, reduce SG7 input. Read the SG7 level when output voltage becomes zero. The reading is called OSDth.

**V1th**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Check that no signal is output synchronously with SG7 (blanking period).
3. Monitoring output, reduce SG7 input. Measure the SG7 level when the blanking period disappears. The reading is called V1th.


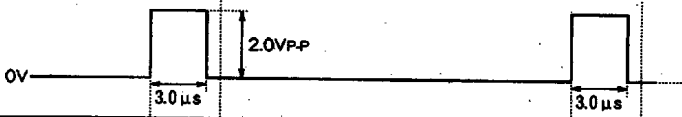

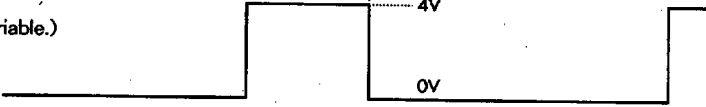
**$SO_{aj1}$ ,  $SO_{aj2}$**

1. The testing conditions are as specified in Supplementary Table of ELECTRICAL CHARACTERISTIC.
2. Read the T.P25(T.P30 and T.P35) output amplitude. The reading is called  $V_{ORC}$  ( $V_{ORC}$  or  $V_{ORC}$ ). It is used as  $SO_{aj1}$  or  $SO_{aj2}$ .

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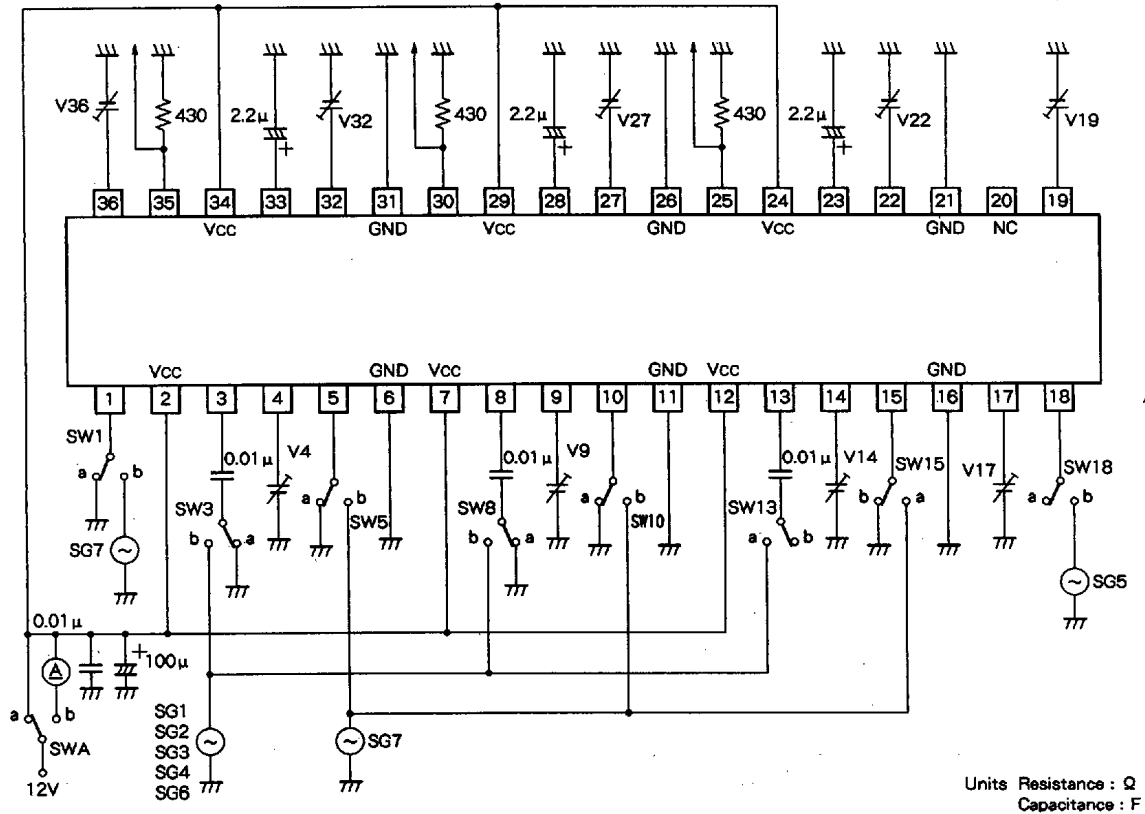
**INPUT SIGNALS**

SG No.	Input signal
SG1	Sine wave with amplitude of $0.7V_{PP}$ ( $f = 1\text{MHz}$ )
SG2	Sine wave with amplitude of $0.7V_{PP}$ ( $f = 50\text{MHz}$ )
SG3	Sine wave with amplitude of $0.7V_{PP}$ ( $f = 150\text{MHz}$ )
SG4	Sine wave with amplitude of $0.7V_{PP}$ ( $f = 1\text{MHz}$ , and duty = 50%. Amplitude is partially variable.) Should be synchronous with SG5 pedestals. 
SG5	Pulse with amplitude of $2.0V_{PP}$ and width of $3.0\mu\text{s}$ . Synchronous with standard step form wave pedestal. (Pulse width and amplitude are variable.) 
SG6 video step wave	 Sine wave with amplitude of $0.7V_{PP}$ ( $f = 30\text{kHz}$ . Amplitude is partially variable.)
SG7 BLK signal and OSD signal	Pulse with amplitude of $4.0V_{PP}$ and width of $25\mu\text{s}$ . Synchronous with standard step form wave video steps. (Amplitude is partially variable.) 

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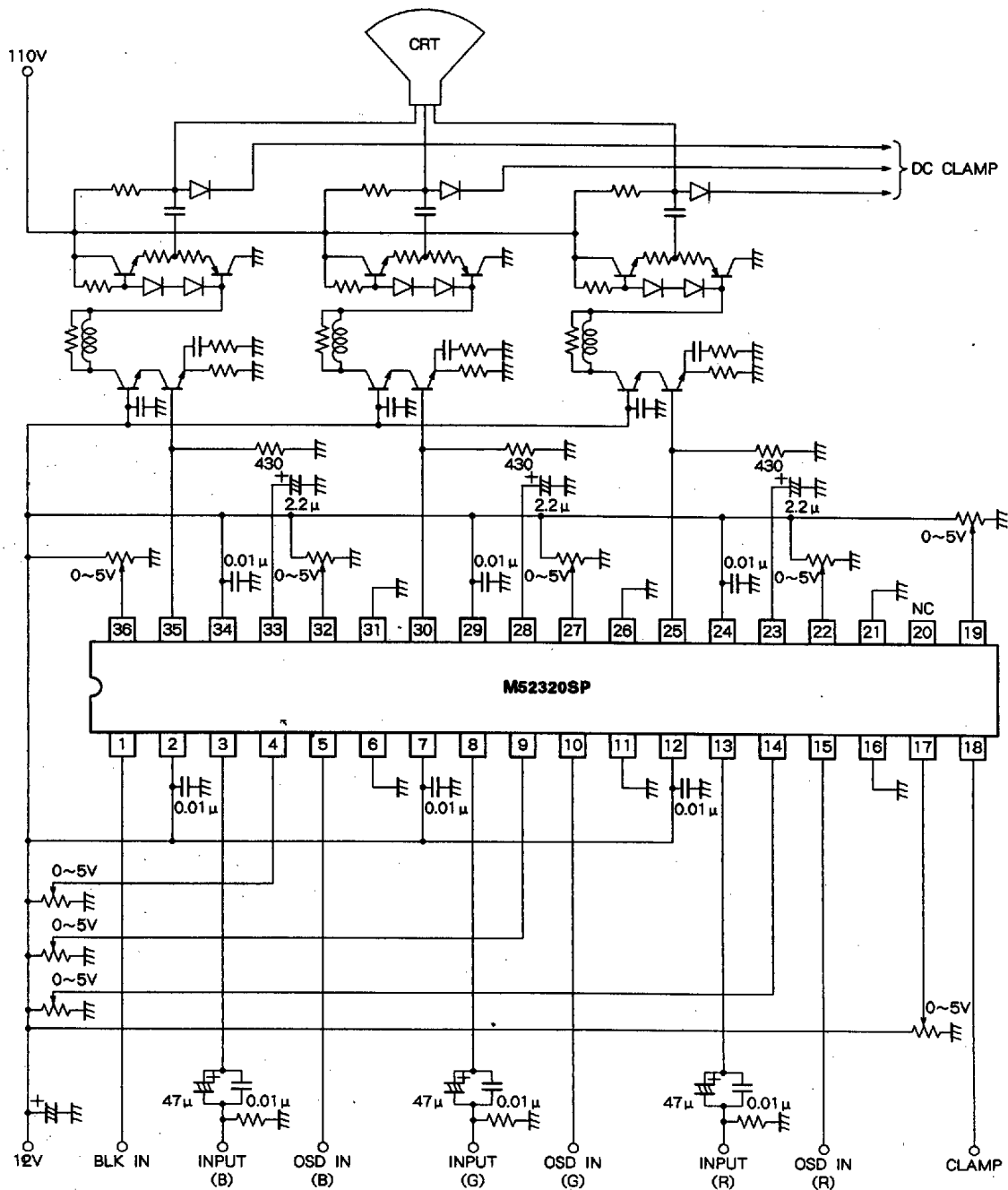
**TEST CIRCUIT**



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## APPLICATION EXAMPLE



Units Resistance : Ω  
Capacitance : F

6249826 0020176 241



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**DESCRIPTION OF PIN**

Pin No.	Name	DC voltage(V)	Peripheral circuit	Remarks
①	BLK IN	-		<ul style="list-style-type: none"> <li>● Apply pulses of between 3V and 5V.</li> </ul> <ul style="list-style-type: none"> <li>● Earth this pin to GND when it is not used.</li> </ul>
② ⑦ ⑫	Vcc (B) Vcc (G) Vcc (R)	12	-	<ul style="list-style-type: none"> <li>● Apply an equivalent level of voltage to 3 channels.</li> </ul>
③ ⑧ ⑬	INPUT (B) INPUT (G) INPUT (R)	2.5		<ul style="list-style-type: none"> <li>● Clamped to approximately 2.5V due to clamp pulses from pin ⑧.</li> <li>● Input at low impedance.</li> </ul>
④ ⑨ ⑭	SUB CONTRAST (B) SUB CONTRAST (G) SUB CONTRAST (R)	2.5		<ul style="list-style-type: none"> <li>● Apply voltage of 5V or less for stable operation.</li> </ul>
⑤ ⑩ ⑮	OSD IN (B) OSD IN (G) OSD IN (R)	-		<ul style="list-style-type: none"> <li>● Apply pulses of between 3V and 5V.</li> </ul> <ul style="list-style-type: none"> <li>● Earth these pins to GND when they are not used.</li> </ul>
⑥、⑪ ⑬、⑯ ⑮、⑳	GND (B) GND (G) GND (R)	GND	-	

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**DESCRIPTION OF PIN (cont.)**

Pin No.	Name	DC voltage(V)	Peripheral circuit	Remarks
⑰	MAIN CONTRAST	2.5		<ul style="list-style-type: none"> <li>● Apply voltage of 5V or less for stable operation.</li> </ul>
⑱	CP IN	-		<ul style="list-style-type: none"> <li>● Input pulses of no less than 2.5V.</li> </ul> <ul style="list-style-type: none"> <li>● Input at low impedance.</li> </ul>
⑲	MAIN BRIGHTNESS	-		
⑳	NC	-	-	<ul style="list-style-type: none"> <li>● Earth this pin to GND or set to OPEN normally.</li> </ul>
㉑ ㉒ ㉓	SUB OSD ADJUST (R) SUB OSD ADJUST (G) SUB OSD ADJUST (B)	Apply 5.5V DC when the pin is open.		<ul style="list-style-type: none"> <li>● Open this pin or pull it up to Vcc when it is not used.</li> </ul>
㉔ ㉕ ㉖	HOLD (R) HOLD (G) HOLD (B)	Variable		<ul style="list-style-type: none"> <li>● Capacitance should be connected between these pins and GND.</li> </ul>

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**DESCRIPTION OF PIN (cont.)**

Pin No.	Name	DC voltage(V)	Peripheral circuit	Remarks
② ③ ④	Vcc2 (R) Vcc2 (G) Vcc2 (B)	Apply 12V		<ul style="list-style-type: none"> <li>● Used exclusively for output emitter follower.</li> <li>● Apply an equivalent level of voltage to 3 channels.</li> </ul>
② ③ ④	OUTPUT (R) OUTPUT (G) OUTPUT (B)	Variable		<ul style="list-style-type: none"> <li>● Connect resistance to GND such that the amperage will be no more than 15mA when necessary driving capacity is provided.</li> </ul>
⑤	MAIN OSD ADJUST	Apply 5.5V DC when the pin is open.		<ul style="list-style-type: none"> <li>● Open this pin or pull it up to Vcc when it is not used.</li> </ul>

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**APPLICATION INSTRUCTIONS**

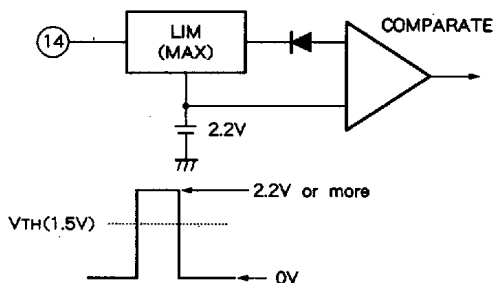
1) Clamp pulse input

Clamp pulses are input as shown in the illustration. The input can be calculated as follows :

$$V_{TH} = 2.2V - \text{Diode} \times 1$$

$$= 1.5V$$

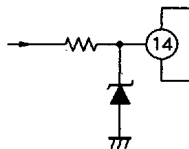
The highest possible voltage is 2.2V. The recommended voltage is as specified in the illustration.



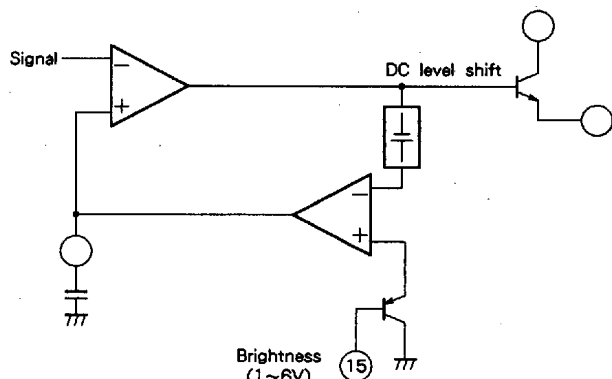
The pulse width is :

- 1.0μs minimum at 15kHz
- 0.5μs minimum at 30kHz
- 0.3μs minimum at 64kHz

Clamp pulse input wiring is often long, and can possibly be connected to high voltage or to an externally connected pin indirectly, or may be exposed to surge input. For protection, it is recommended that a protection circuit as shown in the illustration be formed.



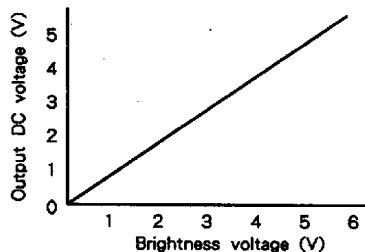
2) Brightness control



The mechanism is as shown above.

2-1) Brightness pin

Use in a range between 1V and 6V. The control characteristics are as shown in the diagram.



2-2) Sub brightness control

This IC has no sub brightness control.

2-3) Holding capacitance

Capacitance should be at least 0.01μ (when fH is 15kHz). However, necessary capacitance varies depending on the hold time (periods other than during clamping). The longer the hold time, the larger the capacitance should be. With regard to IC operation, the smaller the capacitance, the quicker the response, while the larger the capacitance, the stabler the operation. Therefore, capacitance should be provided according to the characteristics of signals and clamp pulses, especially pulse condition at vertical synchronizing output timing.

3) BLK and OSD input pins

- Open-base input. (Refer to P.4)
- Threshold voltage is 2.5V.
- BLK function cannot be used for retrace line blanking.
- If an OSD mixing signal is input without BLK pulse input, operation becomes abnormal. Be sure to input BLK pulses when OSD mixing signals are input.
- When OSD mixing function is not used, connect the input pin to GND.

4) Main and sub OSD adjusting pins

- Use in a range between 0V and 5V.
- Control characteristics are as shown in the diagram.
- If either main or OSD adjusting function is not used, set the pin to OPEN.
- If it is possible that interrupting waves enter from outside due to wiring on the circuit board and influence IC output adversely, consider adding bus control.
- When OSD mixing function is not used, connect main and sub OSD adjusting pins to GND.