VIDEO COLOR SUPERIMPOSER

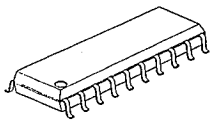
■ GENERAL DESCRIPTION

NJM2256 is the multi-functional color super-imposer IC for video base band (Y, R-Y, B-Y), Various type of Y, R-Y, B-Y output signals can be made by the digital controlled signals.

The signal control at the base band, made it possible on operation with less external parts, as well as for non adjustment on opertaion.

NJM2256 can be operated much higher switching speed comparing to NJM2247.

■ PACKAGE OUTLINE



NJM2256M

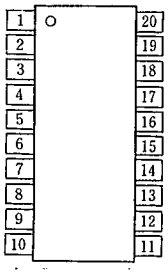
■ FEATURES

- 5 V Single Power Supply
- 8 Types Color Super-imposer
- Burst Flag Insert Function
- Y Inversion, C Inversion Function
- NTSC/PAL Matching
- Non Operational Adjustment
- Less External Parts
- Higher switching speed can be made comparing to NJM2247
- Package Outline DMP20
- Bipolar Technology

■ RECOMMENDED INPUT CONDITIONS

- Y Signal $0.7V_{P-P}$
- R-Y Signal $1.0V_{P-P}$
- B-Y Signal 0.7^{VP-P}
- Control Voltage
- Low Level 0~0.25V
- High Level 4.75~5V

■ PIN CONFIGURATION



NJM2256M

Pin Function

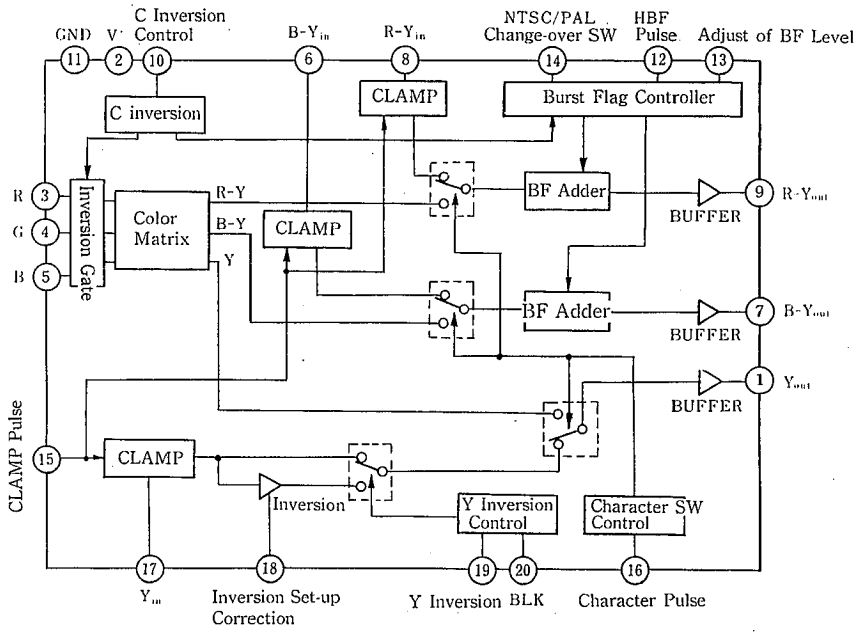
1. Y_{out}	11. GND
2. V^+	12. HBF Pulse
3. R	13. BF Pulse
4. G	14. NTSC/PAL Switching
5. B	15. Clamp Pulse
6. $B\text{-}Y_{in}$	16. Character Pulse
7. $B\text{-}Y_{out}$	17. Yin
8. $R\text{-}Y_{in}$	18. Inversion Set Up Correction
9. $R\text{-}Y_{out}$	19. Y Inversion
10. C Inversion	20. BLK Pulse

■ CONTROL PIN CHARACTERISTICS

(V^+=5V)

PIN NO.	PIN FUNCTIONS	THRESHOLD LEVEL(V)		SINK/SOURCE CURRENT(μA)	
		LOW	HIGH	0V	5V
3	R				
4	G	0.7	0.8	−500	500
5	B				
3					
4	(at C Inversion)	2.5	2.6	−100	100
5					
10	C Inversion	3.5	4.5	−200	400
12	HBF Pulse	0.5	2.0	−2	1
14	NTSC/PAL	0.7	0.8	0	150
15	Clamp Pulse	2.5	2.8	−2	0
16	Character Pulse	0.5	0.9	−0.5	0
19	Y Inversion	0.4	0.8	−0.5	0
20	BLK Pulse	0.4	0.8	−0.5	0

■ BLOCK DIAGRAM



■ INFORMATIONS

Following four points are the outstanding function of the NJM2256. These functions are to go through three input (Y, R-Y, B-Y) signals control by ten control pins.

1. Color Superimpose
   DC level of each equivalent colors shall be supplied to Y, R-Y and B-Y inputs.
2. Burst Flag Insertion
   150 mV burst flag shall be added to R-Y, B-Y input signals.
   Burst flag is selected by the NTSC/PAL switch.
3. C Inversion
   The color phase of the picture shall be inverted for one hundred and eighty degrees. The color phase of the imposed character shall not be altered. This function shall be proceeded when inverting the burst flag, and at the same time, the imposed character level shall be inverted too.
4. Y Inversion
   It is the brightness level inversion. The imposed character color shall not be changed. This function shall be proceeded the switching Y signal output to the inverter side.

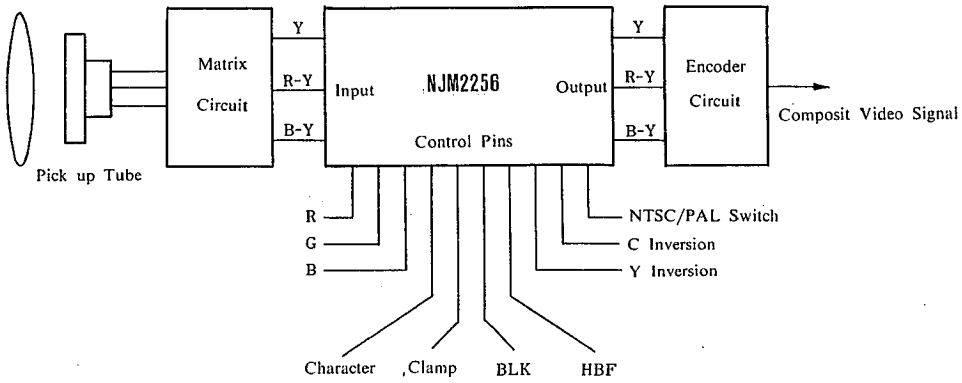
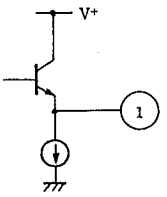
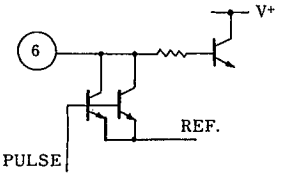
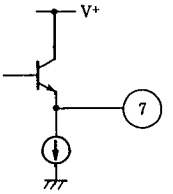
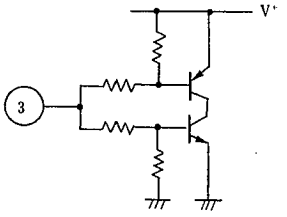
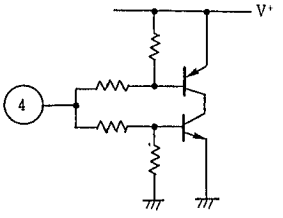
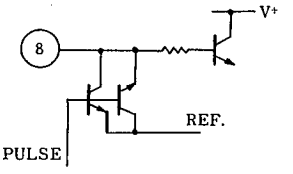
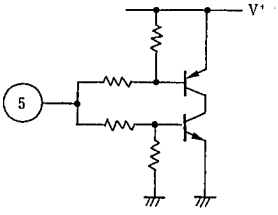
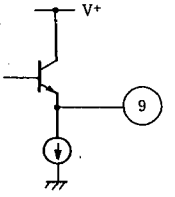
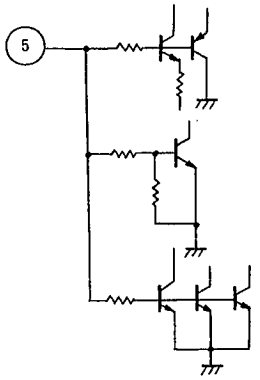
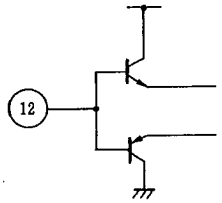
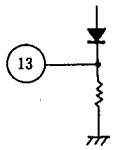
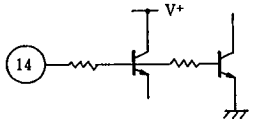


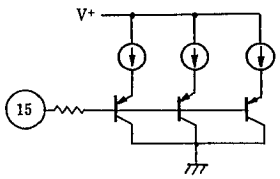
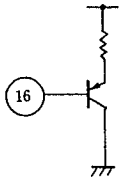
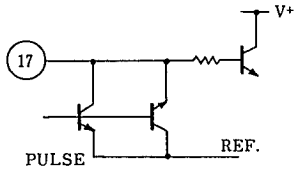
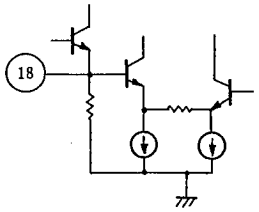
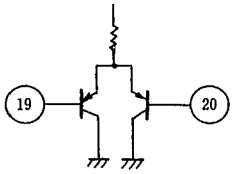
Fig. 1 Video Camera Application

■ EQUIVALENT CIRCUIT

PIN NO.	PIN FUNCTION	INSIDE EQUIVALENT CIRCUIT	PIN NO.	PIN FUNCTION	INSIDE EQUIVALENT CIRCUIT
1	Y_{out}		6	$B-Y_{in}$	
2	V^+		7	$B-Y_{out}$	
3	R				
4	G		8	$R-Y_{in}$	
5	B		9	$R-Y_{out}$	

■ EQUIVALENT CIRCUIT

PIN NO.	PIN FUNCTION	INSIDE EQUIVALENT CIRCUIT
10	C Inversion	
11	GND	
12	HBF Pulse	
13	BF Level	
14	NTSC/PAL	

PIN NO.	PIN FUNCTION	INSIDE EQUIVALENT CIRCUIT
15	Clamp Pulse	
16	Character Pulse	
17	Y_{in}	
18	Inversion Set up Correction	
19 20	Y Inversion BLK	

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	8	V
Power Dissipation	P_D	350	mW
Operating Temperature Range	T_{opr}	−20～+75	℃
Storage Temperature Range	T_{stg}	−40～+125	℃

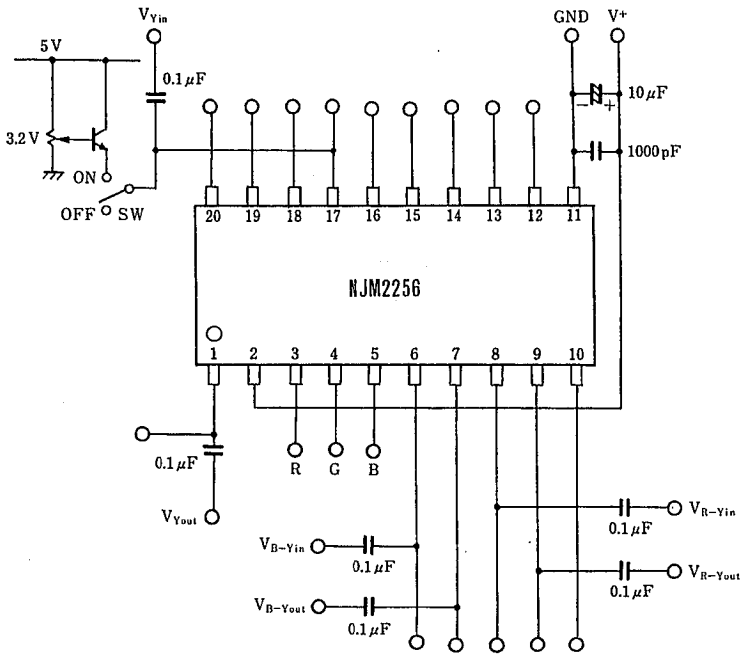
■ ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONTROL PIN ③④⑤⑩⑫⑭⑮⑯⑲⑳	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	0 0 0 0 0 0 0 0 0 0		12	18.5	26	mA
Terminal Sink Current 1	I17	0 0 0 0 0 0 0 0 0 0	V⑰=2.5V Current when application	0		10	μA
Terminal Sink Current 1	I6	0 0 0 0 0 0 0 0 0 0	V⑥=3.0V Current when application	0		6	μA
Terminal Sink Current 3	I8	0 0 0 0 0 0 0 0 0 0	V⑧=3.0V Current when application	0		6	μA
Terminal Voltage 1	V_1	0 0 0 0 0 5 0 0 0 0	① Open Voltage	1.68		1.92	V
Terminal Voltage 2	V_7	0 0 0 0 0 5 0 0 0 0	⑦ Open Voltage	2.18		2.42	V
Terminal Voltage 3	V_9	0 0 0 0 0 5 0 0 0 0	⑨ Open Voltage	2.18		2.42	V
Terminal Voltage 4	V_{13}	0 0 0 0 0 5 0 0 0 0	⑬ Open Voltage	0.23		0.37	V
Terminal Voltage 5	V_{18}	0 0 0 0 0 5 0 0 0 0	⑱ Open Voltage	1.68		1.92	V
Y Non Inversion							
Voltage Gain	G_{YP}	0 0 0 0 0 0 0 0 0 0	$V(Y_{IN})=1V_{P-P}$, 1MHz	−0.5	0	0.5	dB
Frequency Gain	DG_P	0 0 0 0 0 0 0 0 0 0	$G_{YP}(6MHz)-G_{YP}(1MHz)$	−1	0	1	dB
Differential Gain	DP_P	0 0 0 0 0 0 0 0 0 0	$VY_{IN})=1V_{P-P}$, Standard Staircase	−3	0	3	%
differentail Phase	DP_P	0 0 0 0 0 0 0 0 0 0		−3	0	3	deg
Y Inversion							
Voltage Gain	G_{YN}	0 0 0 0 0 0 0 0 5 5	$V(Y_{IN})=0.6V_{P-P}$, 1MHz	−2.3	−1.3	0.3	dB
Frequency	G_{FYN}	0 0 0 0 0 0 0 0 5 5	$G_{YN}(6MHz)-G_{YN}(1MHz)$	−2	−0.1	1	dB
Differential Gain	DG_N	0 0 0 0 0 0 0 0 5 5	$V(Y_{IN})=0.5V_{P-P}$, Standard Staircase	−8		8	%
Differential Phase	DP_P	0 0 0 0 0 0 0 0 5 5		−3	0	3	deg
Inversion Block Level	BL_N	0 0 0 0 0 0 5 0 5 5 0 0 0 0 0 0 5 0 5 5	① Voltage: a ① Voltage: b $BL_N=a-b$	0.59	0.68	0.77	V
Inversion BLK		0 0 0 0 0 0 5 0 5 0	① Voltage: c $BLK=c-b$	−0.1	0	0.1	V
R-Y							
Voltage Gain	G_{R-Y}	0 0 0 0 0 0 5 0 0 0	$V(R-Y_{IN})=1V_{P-P}$, 1MHz	−0.5		0.5	dB
Burst Level Non Inversion	BF_{RP}	0 0 0 0 0 0 5 0 0 0 0 0 0 5 5 0 5 0 0 0	⑨ Voltage: d ⑨ Voltage: e $BF_{RP}=e-d$	135	150	165	mV
Burst Level Inversion	BF_{RN}	0 0 0 5 5 0 5 0 0 0	⑨ Voltage: f $BF_{RN}=f-d$	−165	−150	−135	mV
B-Y							
Voltage Gain	G_{R-Y}	0 0 0 0 0 0 5 0 0 0	$V(B-Y_{IN})=1V_{P-P}$, 1MHz	−0.5	0	0.5	dB
Burst Level Non Inversion	BF_{HP}	0 0 0 0 5 5 5 0 0 0 0 0 0 0 0 5 5 0 0 0	⑦ Voltage: g ⑦ Voltage: h $BF_{RP}=g-h$	135	150	165	mV
Burst Level Inversion	BF_{RN}	0 0 0 5 5 5 5 0 0 0	⑦ Voltage: i $BF_{RN}=g-i$	−165	−150	−135	mV
R-Y Switching Speed		X 0 0 0 0 0 5 5 0 0	X=1MHz $5V_{PP}$ Rectangular Wave			*100	nS
B-Y Switching Speed		X 0 0 0 0 0 5 5 0 0	X=1MHz $5V_{PP}$ Rectangular Wave			*100	nS

* Remark 1) * Item indicates design assurance rating.

■ ELECTRICAL CHARACTERISTICS

PARAMETER		SYMBOL	CONTROL PIN ③④⑤⑩⑬⑭⑮⑯⑲⑳	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Character Output Level 1 C inversion								
White	Y	M_{PWY}	5 5 5 0 0 0 5 5 0 0	① Voltage: A, $M_{PWY}=A-V_1$	630	700	770	mV
	R−Y	M_{PWR}		⑨ Voltage: B, $M_{PWR}=B-V_9$	−16	0	16	mV
	B−Y	M_{PWB}		⑦ Voltage: C, $M_{PWB}=C-V_7$	−14	0	14	mV
Yellow	Y	M_{PYY}	5 5 0 0 0 0 5 5 0 0	① Voltage: A, $M_{PYY}=A-V_1$	472	525	578	mV
	R−Y	M_{PYR}		⑨ Voltage: B, $M_{PYR}=B-V_9$	13	33	53	mV
	B−Y	M_{PYB}		⑦ Voltage: C, $M_{PYR}=C-V_7$	−165	−146	−127	mV
Cyanoge	Y	M_{PCY}	0 5 5 0 0 0 5 5 0 0	① Voltage: A, $M_{PCY}=A-V_1$	409	455	501	mV
	R−Y	M_{PCR}		⑨ Voltage: B, $M_{PCR}=B-V_9$	−232	−209	−186	mV
	B−Y	M_{PCB}		⑦ Voltage: C, $M_{PCB}=C-V_9$	28	50	72	mV
Green	Y	M_{PGY}	0 5 0 0 0 0 5 5 0 0	①Voltage: A, $M_{PGY}=A-V_1$	252	280	308	mV
	R−Y	M_{PGR}		⑨ Voltage: B, $M_{PGR}=B-V_9$	−197	−176	−155	mV
	B−Y	M_{PCB}		⑦ Voltage: C, $M_{PGB}=C-V_7$	−117	−97	−77	mV
Mazenta	Y	M_{PMY}	5 0 5 0 0 0 5 5 0 0	① Voltage: A, $M_{PMY}=A-V_1$	378	420	462	mV
	R−Y	M_{PMR}		⑦ Voltage: B, $M_{PMR}=B-V_9$	155	176	197	mV
	B−Y	M_{PMB}		⑦ Voltage: C, $M_{PMB}=C-V_7$	77	97	117	mV
Red	Y	M_{PRY}	5 0 0 0 0 0 5 5 0 0	① Voltage: A, $M_{PRY}=A-V_1$	220	245	270	mV
	R−Y	M_{PRR}		⑨ Voltage: B, $M_{PRR}=B-V_9$	186	209	232	mV
	B−Y	M_{PRB}		⑦ Voltage: C, $M_{PRB}=C-V_7$	−72	−50	−28	mV
Blue	Y	M_{PBY}	0 0 0 0 0 0 5 5 0 0	① Voltage: C, $M_{PBY}=A-V_1$	156	175	194	mV
	R−Y	M_{PBR}		⑨ Voltage: B, $M_{PBR}=B-V_9$	−53	−33	−13	mV
	B−Y	M_{PBB}		⑦ Voltage: C, $M_{PBB}=C-V_7$	127	146	165	mV
Black	Y	M_{PPY}	0 0 0 0 0 0 5 5 0 0	① Voltage: A, $M_{PPY}=A-V_1$	−20	0	20	mV
	R−Y	M_{PPR}		⑨ Voltage: B, $M_{PPR}=B-V_9$	−14	0	14	mV
	B−Y	M_{PPB}		⑦ Voltage: C, $M_{PPB}=C-V_7$	−12	0	12	mV
Character Output Level 2 C Inversion								
White	Y	M_{NWY}	5 5 5 5 0 0 5 5 0 0	① Voltage: A, $M_{NWY}=A-V_1$	630	700	770	mV
	R−Y	M_{NWR}		⑨ Voltage: B, $M_{NWR}=B-V_9$	−16	0	16	mV
	B−Y	M_{NWB}		⑦ Voltage: C, $M_{NWB}=C-V_7$	−14	0	14	mV
Yellow	Y	M_{NYY}	5 5 0 5 0 0 5 5 0 0	① Voltage: A, $M_{NYY}=A-V_1$	472	525	578	mV
	R−Y	M_{NYR}		⑨ Voltage: B, $M_{NYR}=B-V_9$	−53	−33	−13	mV
	B−Y	M_{NYB}		⑦ Voltage: C, $M_{PYB}=C-V_7$	127	146	165	mV
Cyanoge	Y	M_{NCY}	0 5 5 5 0 0 5 5 0 0	① Voltage: A, $M_{NCY}=A-V_1$	409	455	501	mV
	R−Y	M_{NCR}		⑨ Voltage: B, $M_{NCR}=B-V_9$	186	209	232	mV
	B−Y	M_{NCB}		⑦ Voltage: C, $M_{NCB}=C-V_7$	−72	−50	−28	mV
Green	Y	M_{NGY}	0 5 0 5 0 0 5 5 0 0	① Voltage: A, $M_{NGY}=A-V_1$	252	280	308	mV
	R−Y	M_{NGR}		⑨ Voltage: B, $M_{NGR}=B-V_9$	155	176	197	mV
	B−Y	M_{NGB}		⑦ Voltage: C, $M_{NGB}=C-V_7$	77	97	117	mV
Mazenta	Y	M_{NMY}	5 0 5 5 0 0 5 5 0 0	⑨ Voltage: A, $M_{NMY}=A-V_1$	378	420	462	mV
	R−Y	M_{NMR}		⑨ Voltage: B, $M_{NMR}=B-V_9$	−197	−176	−155	mV
	B−Y	M_{NMB}		⑦ Voltage: C, $M_{NMB}=C-V_7$	−117	−97	−77	mV
Red	Y	M_{NRY}	5 0 0 5 0 0 5 5 0 0	① Voltage: A, $M_{NRY}=A-V_1$	220	245	270	mV
	R−Y	M_{NRR}		⑨ Voltage: B, $M_{NRR}=B-V_9$	−232	−209	−186	mV
	B−Y	M_{NRB}		⑦ Voltage: C, $M_{NRB}=C-V_7$	28	50	72	mV
Blue	Y	M_{NBY}	0 0 5 5 0 0 5 5 0 0	① Voltage: A, $M_{NBY}=A-V_1$	156	175	194	mV
	R−Y	M_{NBR}		⑨ Voltage: B, $M_{NBR}=B-V_9$	13	33	53	mV
	B−Y	M_{NBR}		⑦ Voltage: C, $M_{NBB}=C-V_7$	−165	−146	−127	mV
Black	Y	M_{NPY}	0 0 0 5 0 0 5 5 0 0	① Voltage: A, $M_{NPY}=A-V_1$	−20	0	20	mV
	R−Y	M_{NPR}		⑨ Voltage: B, $M_{NPR}=B-V_9$	−14	0	14	mV
	B−Y	M_{NPB}		⑦ Voltage: C, $M_{NPB}=C-V_7$	−12	0	12	mV



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■ APPLICATION NOTES

I/O Explanation

• Supply Voltage	V^+	5V	②
	GND		⑪
• Input Signals	Y	0.7 V_{P-P}	⑰
	R-Y	1.0 V_{P-P}	⑧
	B-Y	0.7 V_{P-P}	⑥
• Output Signals	Y	0.7 V_{P-P}	①
	R-Y	1.0 V_{P-P}	⑨
	B-Y	0.7 V_{P-P}	⑦

■ APPLICATION NOTES

I/O Explanation

- Control Pin Low=0V, HIGH=5V

R③, G④, B⑤ ┐ Superimposed color adjustment

Clamp Pulse ⑮, Character Pulse ⑯, HBF Pulse ⑫, BLK Pulse ⑳ ┐ Y, R-Y, B-Y signal process pulse input

C Inversion ⑩, Y Inversion ⑲ ┐ Color difference, brightness inverting pin

NTS/PAL Switch ⑭

- Adjusting Pin (Normally open → non adjustment)

BF level ⑬ Burst flag insert level adjusting pin.
Inversion set up correction ⑱ Y inversion signal level adjusting pin.

1. Input Signal

Superimposed color level shall be determined by the following standard signal level.

Y $0.7V_{P\text{-}P}$
R-Y $1.0V_{P\text{-}P}$
B-Y $0.7V_{P\text{-}P}$

The character output standard level on the specification shall be determined through calculation out of 75 % of superimposed color level.

(In order to avoide the clipping of the encoding signal, the character output level is determined to lower level)

- The character output level converting expression

The basic expression

$E_R - E_Y = 0.70E_R - 0.59E_G - 0.11E_B$
$E_B - E_Y = -0.30E_R - 0.59E_G + 0.89E_B$
$\therefore E_Y = 0.30E_R + 0.59E_G + 0.11E_B$

From standard level and practical input level, each color signal level imposed in R-Y, B-Y and Y signals are as in the following.

$V_{R\text{-}Y} = 0.75 \times 1[V_{P\text{-}P}] \times E_{R\text{-}Y}/1.4$
$= 0.375E_R - 0.316E_G - 0.059E_B$
$V_{B\text{-}Y} = 0.75 \times 0.7[V_{P\text{-}P}] \times E_{B\text{-}Y}/1.78$
$= -0.088E_R - 0.174E_G + 0.263E_B$
$V_Y = 0.75 \times 0.7[V_{P\text{-}P}] \times E_Y/1$
$= 0.158E_R + 0.310E_G + 0.058E_B$
(E_R, E_G, E_B は, LOW 0, HIGH 1)

2. Clamp Pulse

During the interval of blanking, input the pulse through clamp pulse pin ⑳ the blanking level (0 level) of input signal (Y, R-Y, B-Y) is to be fixed at the bias point within the IC.

Note) The pulse width of clamp pulse shall be set more than 3 μs. (see figure 2)

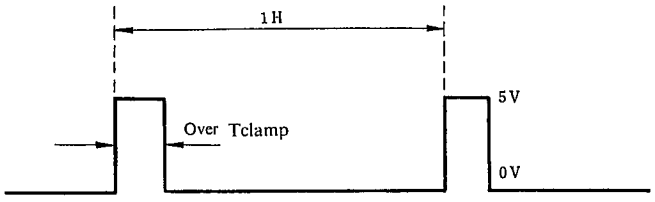


Fig. 2 Clamp Pulse Width

3. Character Color Adjustment

Superimposed color adjustment of the character can be determined in eight different colors, by choosing R, G, B input levels.

(LOW 0V, HIGH 5V)

R	G	B	COLOR
5	5	5	White
5	5	0	Yellow
0	5	5	Cyan
0	5	0	Green
5	0	5	Magenta
5	0	0	Red
0	0	5	blue
0	0	0	Black

Character Color Selecting Code

4. Character Insertion

Pulse informations from outside character generater shall be given input at the character pulse pin ⑯. During the period of pulse process, the selected color level shall be inserted into each Y, R-Y, B-Y.

5. Burst Flag Insertion

Inputting burst period pulse at the HBF pin ⑫, the burst flag (150mV) can be inserted in the B-Y, R-Y signals. At the same time, by putting NTSC/PAL switch ⑭, the burst flag can be altered to NTSC or PAL system.

	NTSC/PAL SWITCH⑭	
	LOW 0V (PAL)	HIGH 5V (NTSC)
R-Y Signal	+150mV	non insertion
B-Y Signal	−150mV	−150mV

Burst Flag Inserting

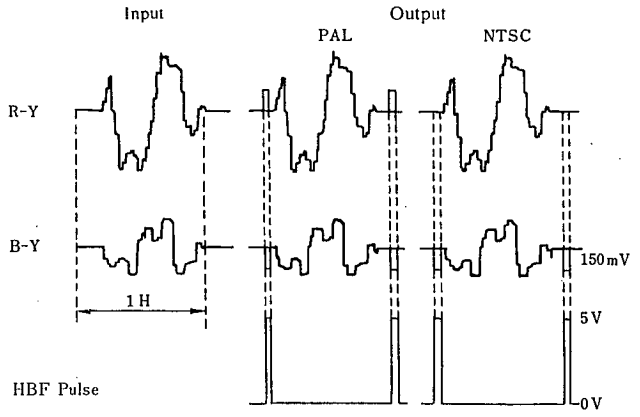


Fig.3 Burst Flag Inserting Example

6. C Inversion

The color phase of the picture shall be inverted for one hundred and eighty degrees setting C inversion pin ⑩. It is applied that the reference signal (burst flag) shall be inverted into one hundred and eighty degrees at the time of de-coding.

Superimposed character color do not change at the picture inversion.

	C INVERSION PIN ⑩	
	LOW 0V	HIGH 5V
Burst	Non Inversion	Inversion

C Inversion Form

7. Y Inversion

The brightness of the picture shall be inverted by setting Y inversion pin ⑲. It is that Y signal shall be inverted by the inverter, and then blanking period signal shall be adjusted to the black level with blanking pulse.

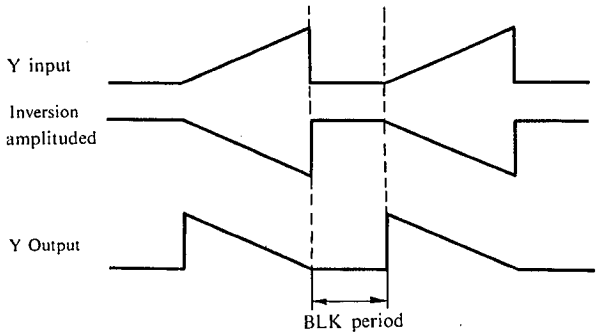


Figure 4. Y Inversion Output Example

	Y INVERSION PIN ⑲	
	LOW 0V	HIGH 5V
Y output	Non inversion	Inversion

Y Inversion Form

8. Adjusting pin

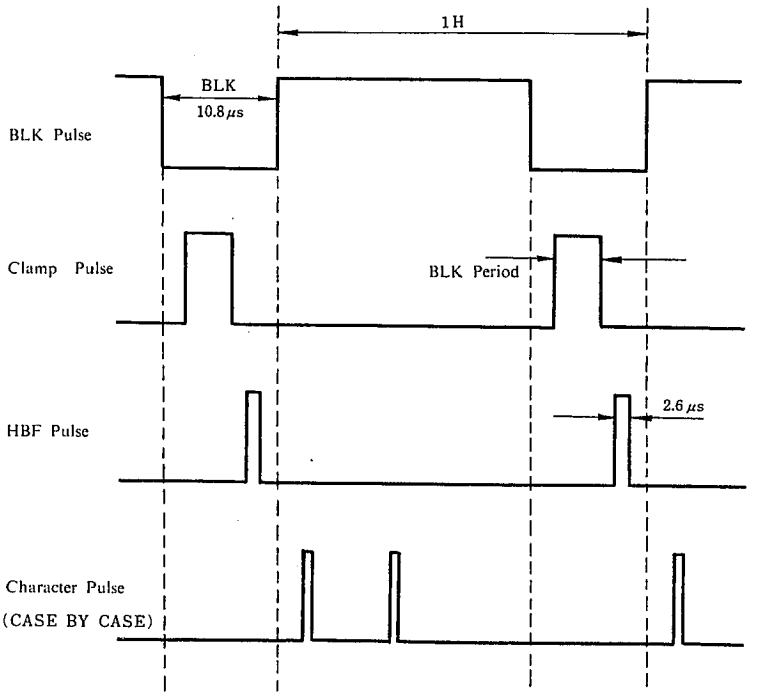
(1) BF Level Pin ⑬

It is the burst flag minor adjusting pin. The burst level shall be adjusted at the open voltage, 0.3V level adjustment. Therefore, the most recommended on operation with the open condition, as it has been controlled at 135 to 165 mV (burst level) on specification.

(2) Inversion Set Up Correction Pin ⑱

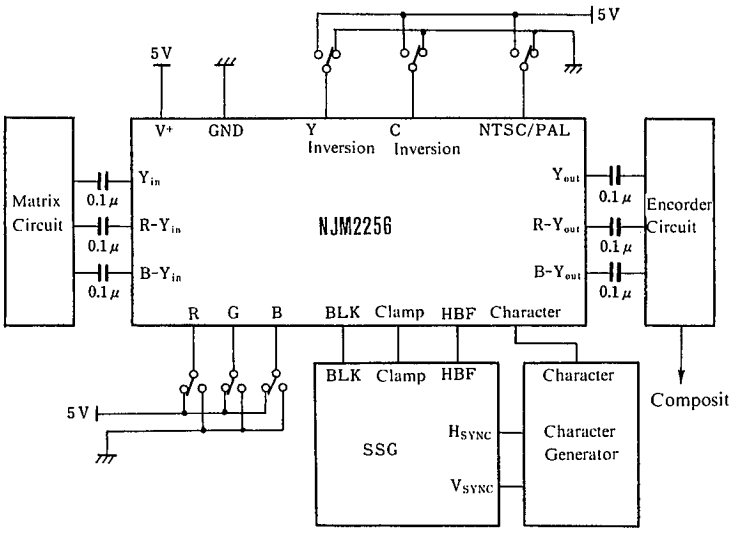
It is the minor adjusting pin of Y inversion signal level. The inverting black level shall be adjusted at the open voltage, 1.8 V level adjustment. Therefore, the most recommended on operation with the open condition, as it has been controlled with 0.59 to 0.77 V (inverting black level) on specification.

9. Pulse Timing
The pulse input timing should be proceeded as in the following.



5

■ TYPICAL APPLICATION



This IC requires 1MΩ resistance between INPUT and GND pin for clamp type input since the minute current causes an unstable pin voltage.

MEMO