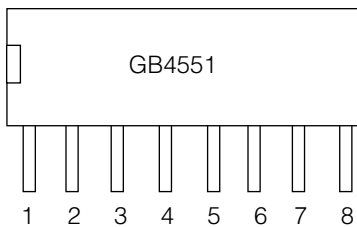


**FEATURES**

- accurate clamping to within  $\pm 1\text{mV}$
- ultra low differential gain (0.03% typ.) and differential phase (0.03° typ.)
- wideband unity gain, can typically be flattened to  $\pm 0.1\text{dB}$  at 30MHz
- can be configured as a gain stage with reduced bandwidth.
- drives 100pF loads
- convenient 8 pin SIP packaging

**PIN CONNECTIONS**



Pin No.	GB4551	Function
1	+IN	non-inverting input
2	$V_{CC}$	positive power supply
3	STB	strobe
4	GND	ground
5	$C_X$	external capacitor
6	$V_{EE}$	negative power supply
7	- IN	inverting input
8	OUT	output

**ORDERING INFORMATION**

Part Number	Package Type	Temperature Range
GB4551-CSA	8 Pin SIP	0 to 70° C

**DESCRIPTION**

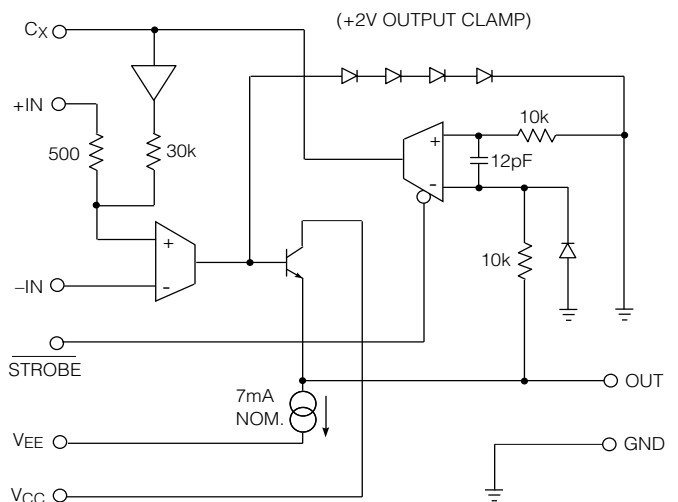
The GB4551 is a high performance video buffer with DC restore primarily used for accurate back porch clamping. The circuit features a wideband differential amplifier that can be configured as a gain stage. The output signal voltage is limited to +2V above the clamp level in order to prevent damage to crosspoints or other circuits connected to the output.

The clamping action occurs when the STROBE (STB) input is taken to ground. A typical application would be for DC restoration during the back porch period. In this case the negative-going back porch pulse would be derived from an external sync separator circuit.

The GB4551 will operate from  $\pm 9\text{V}$  to  $\pm 12\text{V}$  power supplies and will directly interface with Gennum's video crosspoint switches. The 8 pin SIP package is ideally suited for space restricted board layouts.

**APPLICATIONS**

- Input buffering and DC restoration to crosspoint switches
- Accurate back porch video signal clamping
- Inter-circuit buffering and DC restoration.



All resistors in ohms, all capacitors in microfarads unless otherwise stated.

**SIMPLIFIED CIRCUIT DIAGRAM**

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	VALUE/UNITS
Supply Voltage	$\pm 13.5$ V
Operating Temperature Range	$0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$
Storage Temperature Range	$-65^{\circ}\text{C} \leq T_S \leq 150^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)	$260^{\circ}\text{C}$
Differential Video Input Voltage	$\pm 5$ V
Strobe Input Voltage	$-V_S \leq V_{\text{STROBE}} \leq +V_S$

**CAUTION**  
CLASS 1 ESD SENSITIVITY



## ELECTRICAL CHARACTERISTICS

$V_S = \pm 10\text{V}$ ,  $T_A = 0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ ,  $R_L = 10\text{k}\Omega$ ,  $C_L = 10\text{pF}$ , unless otherwise shown

	PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLIES	Supply Voltage	$V_S$	Operating Range	$\pm 9$	$\pm 10$	$\pm 12$	V
	+ Supply Current	$I^+$		-	9	13.8	mA
	- Supply Current	$I^-$		-	9	13.8	mA
SIGNAL PATH	Frequency Response		at $\pm 0.1\text{dB}$ (NOTE 1, see Fig. 5)	25	-	-	MHz
	Full Power Bandwidth	FPBW	at $-3\text{dB}$ $V_{\text{IN}} = 1\text{V p-p}$	30	-	-	MHz
	Phase Delay		at $3.58\text{MHz}$ (see Fig. 4)	-	-3.0	-	deg
	Phase Variation		at $3.58\text{MHz}$	-	$\pm 0.1$	$\pm 0.2$	deg
	Differential Gain	$\partial g$	at $3.58\text{MHz}$ ( $V_{\text{IN}} = 40$ IRE)	-	0.03	0.05	%
	Differential Phase	$\partial p$	at $3.58\text{MHz}$ ( $V_{\text{IN}} = 40$ IRE)	-	0.03	0.05	degrees
	Max. Input Voltage	$V_{\text{IN(MAX)}}$	$A_V = +1$ Clipping occurs at:	1.8	2.0	2.2	V
	Input Resistance	$R_{\text{IN}}$		25	30	-	$\text{k}\Omega$
	Input Capacitance	$C_{\text{IN}}$	$A_V = +1$	-	2.0	-	pF
	Output Resistance	$R_{\text{OUT}}$	$A_V = +1$ , $f = 0$ to $1\text{MHz}$	-	8.6	-	$\Omega$
		$A_V = +1$ , $f = 100\text{MHz}$	-	53	-	$\Omega$	
	Clamp Accuracy		$V_{\text{IN}} = +1\text{V p-p}$	-	$\pm 1$	$\pm 2$	mV
STROBE	Strobe Pulse Width	$t_{\text{P STROBE}}$		500	1000	-	ns
	Strobe Level	$V_{\text{INH I}}$		2.0	-	-	V
$V_{\text{INLO}}$			-	-	0.8	V	

**Note: 1.** The frequency peaking can be flattened by placing a small value series resistor at the GB4551 output. The value of the resistor will depend on the load capacitance and the amount of flattening required. Figure 5 shows the frequency response for three combinations of  $R_S$  and  $C_L$ .

## DETAILED DESCRIPTION

The GB4551 is intended for video applications requiring precision DC restoration coupled with very flat frequency response. The signal path features a wide band operational amplifier designed to be unity gain stable. While this amplifier is not intended to drive 75  $\Omega$  transmission lines, it is ideal for applications where high capacitive loads, up to several hundred picofarads, must be driven. These applications include input and internal system buffering and DC restoration of video signals.

Optimal frequency response for the GB4551 occurs with load capacitances in the range of 80 pF. For smaller loads, an external capacitor can be added to extend the bandwidth of the device. As shown in Figure 7, a small resistor, R<sub>OUT</sub>, should be included in series with the GB4551 output to obtain optimal response flatness. The value of this resistor should be chosen to match the value of the load capacitance, as shown in Figure 5.

The DC restoration function is achieved through the use of a strobed operational transconductance amplifier (OTA), as shown in the Simplified Block Diagram. When enabled by taking STROBE low, the OTA sources or sinks a current depending on whether the output of the GB4551 is below or above ground, respectively. The output current from the OTA is integrated by the hold capacitor connected to pin 5, CX. The resulting voltage is buffered and fed to the non-inverting input of the op-amp through a 30k $\Omega$  resistor. The non-inverting input also receives the input video signal through a large capacitor which acts as the DC reservoir for the corrective level shift.

A 500  $\Omega$  resistor in series with the input provides some phase advance to improve the stability of the DC restoration feedback loop, and provides fast recovery for offset steps as large as  $\pm 100$  mV ( $\pm 14$  IRE). The values of the input and hold capacitors can be reduced to speed up the offset recovery time. The ratio of the capacitors should be maintained at approximately 20,000:1 to ensure closed loop stability.

The OTA receives its inputs from a differential low pass filter. This filter has a corner frequency of 600 kHz which attenuates the color burst and any high frequency noise that may be present in the signal. One input to the low pass filter senses the output of the GB4551 while the other input is connected to the ground reference.

In the application shown in figure 1, the input to pin 3 of the GB4551, STROBE, is provided by the back porch output of the GS4881 sync separator. The GS4881 generates back porch pulses which remain at horizontal rate throughout the vertical interval. Constant rate sample pulses eliminate the possibility of introducing additional DC offset due to a change in duty cycle.

The method of adjusting the DC level of the video signal used in the GB4551 integrates over the entire back porch period. This reduces sensitivity to noise and improves the accuracy of the DC restoration compared with systems using sample and hold techniques. Typical clamping accuracy of  $\pm 1$  mV is achieved by the GB4551.

## TEST CIRCUITS

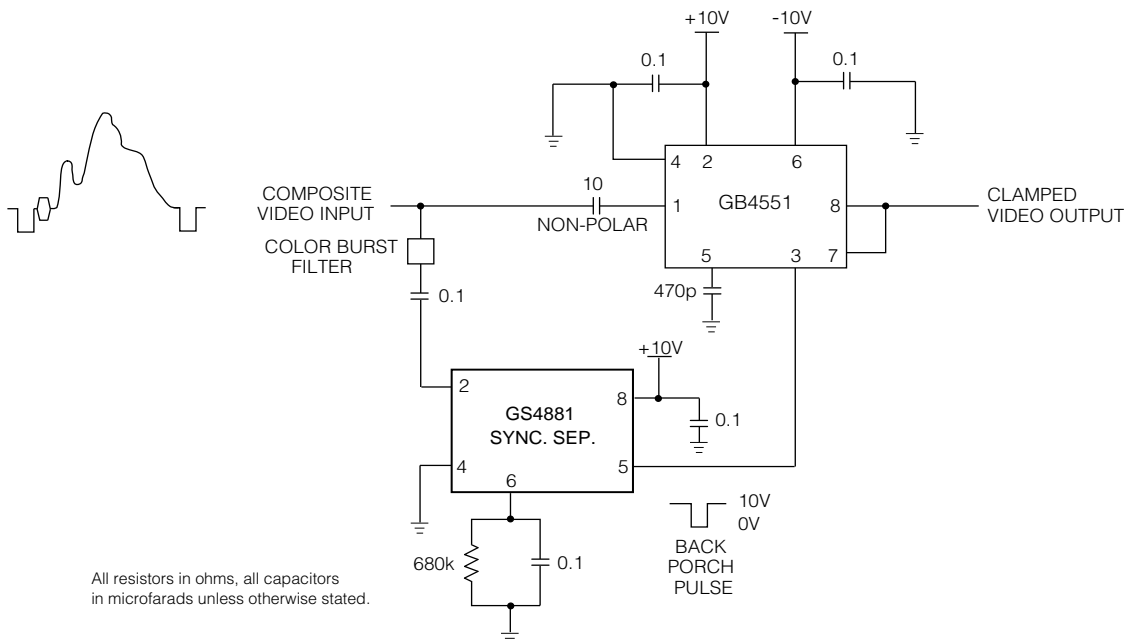


Fig.1 Clamping Operation

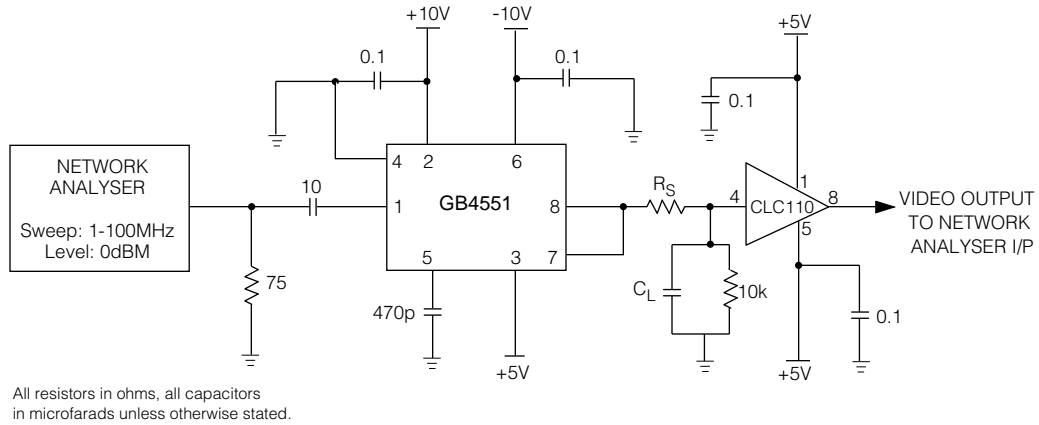


Fig. 2 Differential Gain and Phase, Frequency Response

**TYPICAL PERFORMANCE CURVES**  
(Unless otherwise shown  $V_S = \pm 10V$ )

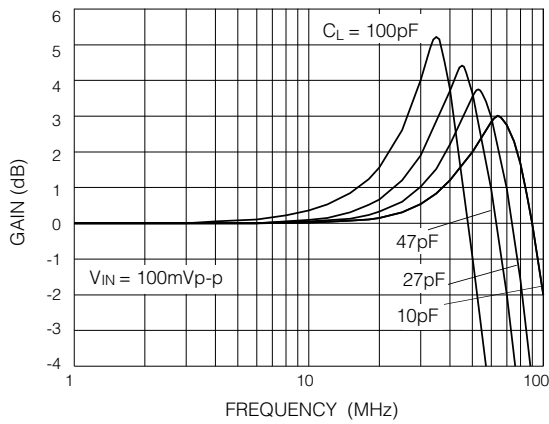


Fig. 3 Gain vs Frequency

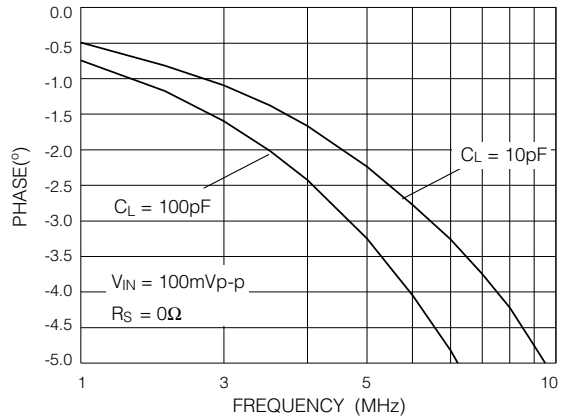


Fig. 4 Phase vs Frequency

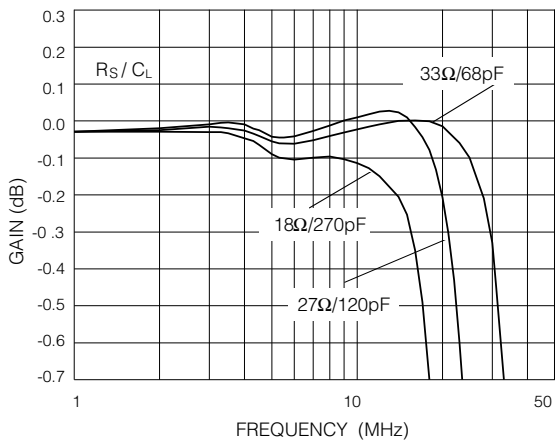


Fig. 5 Flattened Frequency Response

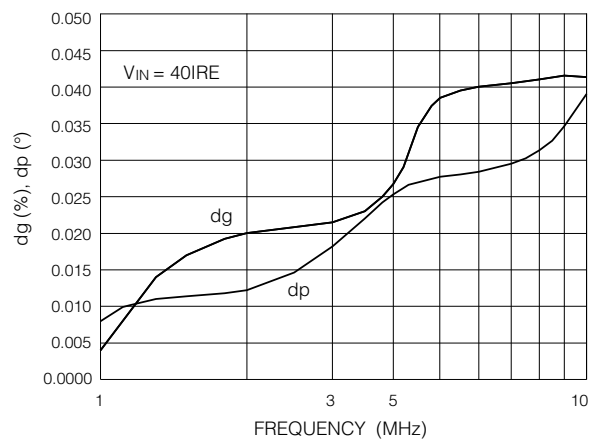


Fig. 6 Differential Gain & Phase vs Frequency

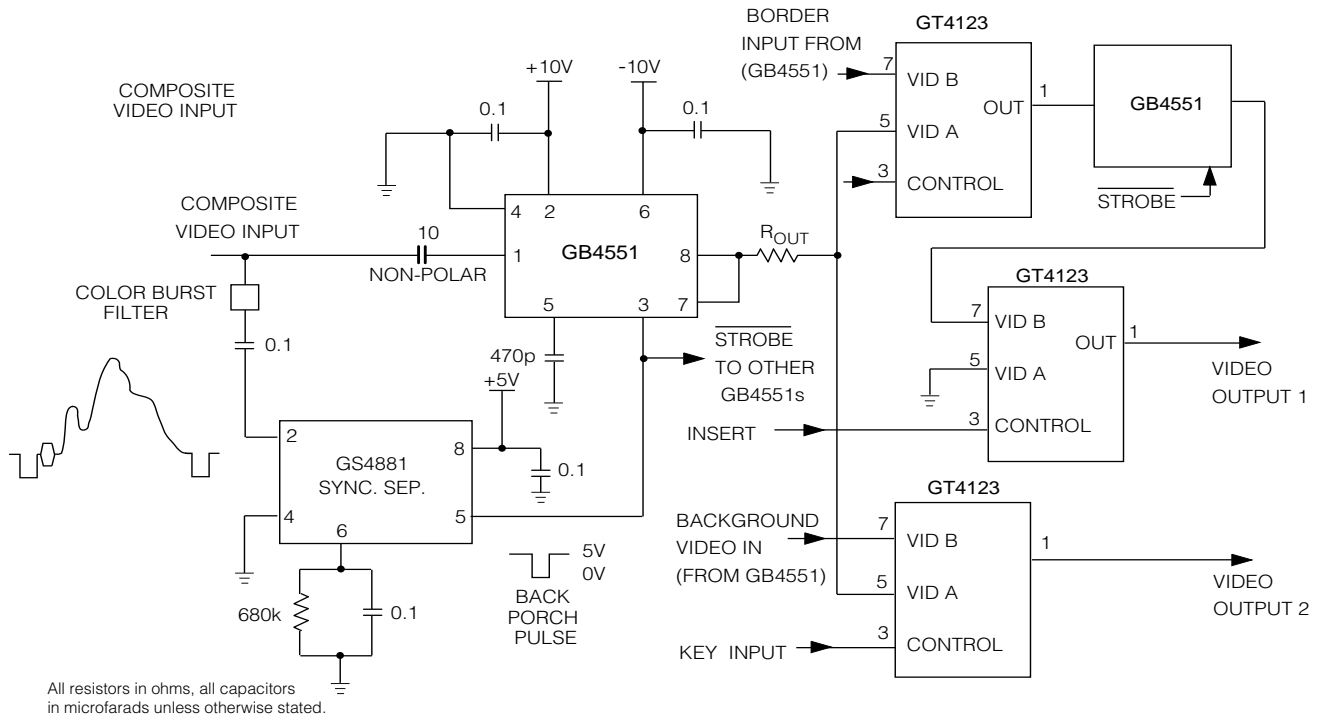


Fig. 7 GB4551 Driving Several GT4123 Video Mixers

## APPLICATION CIRCUIT

The above circuit represents a possible use of the GB4551 as an input back-porch clamp for video mixers in a simple Production Switcher. For simplicity, the STROBE input is derived from the GS4881 sync separator IC, driven from the composite input signal.

The value of  $R_{OUT}$  is chosen to roll-off the frequency response of the GB4551. The value is usually between 15 and 47 ohms depending on the total load capacitance seen by the device. The GB4551 may be used anywhere in the circuit where accurate DC restoration is required as shown by the second IC following the output of the top GT4123.

### DOCUMENT IDENTIFICATION

#### PRODUCT PROPOSAL

This data has been compiled for market investigation purposes only, and does not constitute an offer for sale.

#### ADVANCE INFORMATION NOTE

This product is in development phase and specifications are subject to change without notice. Gennum reserves the right to remove the product at any time. Listing the product does not constitute an offer for sale.

#### PRELIMINARY DATA SHEET

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