

**FEATURES**

- adjustable clamp level from -5.5 V to +5.5 V at  $\pm 10$  V supplies.
- ultra low differential gain (0.02% typ.) and differential phase (0.03° typ.)
- wideband unity gain: **GB4550**  $\pm 0.2$  dB at 25 MHz  
**GB4550A**  $\pm 0.1$  dB at 25 MHz
- both drive 150pF loads at full power, flat to 10 MHz.
- **GB4550A** — tight delay spread of  $\pm 0.15^\circ$  at colorburst.
- convenient 8 pin SIP packaging.
- both can be configured as a gain stage with reduced bandwidth.

**PIN CONNECTIONS**



| Pin No. | GB4550          | GB4550A         | Function                     |
|---------|-----------------|-----------------|------------------------------|
| 1       | +IN             | +IN             | non-inverting input          |
| 2       | V <sub>CC</sub> | V <sub>CC</sub> | positive power supply        |
| 3       | COMP            | NC              | frequency compensation or NC |
| 4       | V <sub>CL</sub> | V <sub>CL</sub> | clamp voltage input          |
| 5       | C <sub>X</sub>  | C <sub>X</sub>  | external capacitor           |
| 6       | V <sub>EE</sub> | V <sub>EE</sub> | negative power supply        |
| 7       | -IN             | -IN             | inverting input              |
| 8       | OUT             | OUT             | output                       |

**ORDERING INFORMATION**

| Part Number  | Package Type | Temperature Range |
|--------------|--------------|-------------------|
| GB4550 - CSA | 8 pin SIP    | 0 to 70°C         |
| GB4550ACSA   | 8 pin SIP    | 0 to 70°C         |

**DESCRIPTION**

The GB4550 and GB4550A are high performance monolithic video buffer/clamps made on Gennum's LSI process. They feature 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 connected to the output.

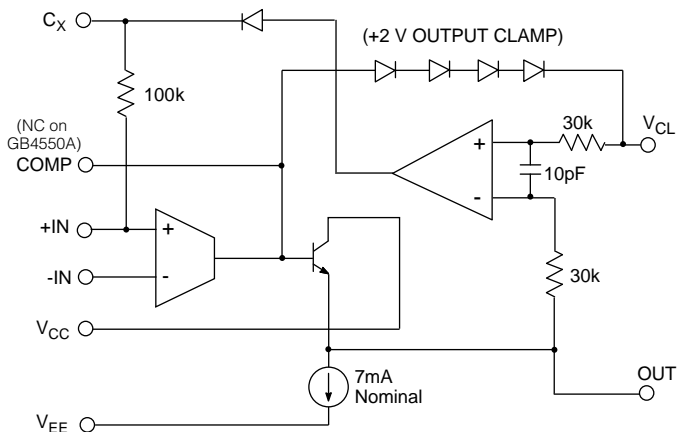
The clamping level can be set for normal sync tip clamping by connecting pin 4 to -0.286 volts. For other applications, the clamping voltage level can be varied from -5.5 to +5.5 volts.

The GB4550A features a tight delay spread of only  $\pm 0.15$  degrees while the GB4550 maintains a  $\pm 1.5$  degree delay spread. Both devices operate from  $\pm 9$  to  $\pm 12$  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 clamping to crosspoint switches
- Inter - system video signal clamping



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

**SIMPLIFIED CIRCUIT DIAGRAM**

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                            | VALUE  |
|--------------------------------------|--|
| Supply Voltage $V_S$                 | $\pm 13.5$ 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  |
| Clamp Input Voltage                  | $V_{EE} + 2.5\text{ V} \leq V_{CL} \leq V_{CC} - 2.5\text{ V}$ |

**CAUTION**  
ELECTROSTATIC  
SENSITIVE DEVICES  
DO NOT OPEN PACKAGES OR HANDLE  
EXCEPT AT A STATIC-FREE WORKSTATION



## ELECTRICAL CHARACTERISTICS $V_S = \pm 10$ V, $T_A = 0 - 70^\circ\text{C}$ , $R_L = 10\text{k}\Omega$ , $C_L = 150$ pF, $C_{COMP} = 0$ 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                   | Maximum Input Voltage Above $V_{CL}$ | $V_{IN\ MAX}$ |   | 1.8     | 2.0        | 2.25     | V                    |
|                               | Insertion Loss                       | I.L.          | $f = 100\text{kHz}$   | -       | -          | 0.03     | dB                   |
| <b>GB4550</b><br>SIGNAL PATH  | Full Power Bandwidth                 | FPBW          | -3.0dB, $V_{IN} = 1\text{V p-p}$  | 15      | 18         | -        | MHz                  |
|                               | Small Signal Bandwidth               | SSBW          | $\pm 0.2\text{dB}$ , $V_{IN} = 100\text{mV p-p}$                        | 20      | 25         | -        | MHz                  |
|                               | Frequency Response                   |               | at 10MHz, $V_{IN} = 1\text{V p-p}$                                      | -       | 0.05       | -        | dB                   |
|                               | Signal Path Delay                    | $\theta_D$    | at 3.58MHz  | -       | -8         | -        | deg                  |
|                               | Delay Tolerance                      |               | at 3.58MHz  | -       | $\pm 1.5$  | -        | deg                  |
| <b>GB4550A</b><br>SIGNAL PATH | Full Power Bandwidth                 | FPBW          | -3.0dB, $V_{IN} = 1\text{V p-p}$  | 17      | 20         | -        | MHz                  |
|                               | Small Signal Bandwidth               | SSBW          | $\pm 0.1\text{dB}$ , $V_{IN} = 100\text{mV p-p}$ , $C_L = 100\text{pF}$ | 25      | 30         | -        | MHz                  |
|                               | Frequency Response                   |               | at 10MHz, $V_{IN} = 1\text{V p-p}$                                      | -       | 0.1        | -        | dB                   |
|                               | Signal Path Delay                    | $\theta_D$    | at 3.58 MHz   | -       | -7.5       | -        | deg                  |
|                               | Delay Tolerance                      |               | at 3.58MHz  | -       | $\pm 0.15$ | -        | deg                  |
| SIGNAL PATH                   | Differential Gain                    | dg            | at 3.58MHz  | -       | 0.02       | 0.05     | %                    |
|                               | Differential Phase                   | dp            | at 3.58MHz  | -       | 0.03       | 0.05     | deg                  |
|                               | Input Resistance                     | $R_{IN}$      |   | 80      | 100        | -        | k $\Omega$           |
|                               | Input Capacitance                    | $C_{IN}$      |   | -       | 2.0        | -        | pF                   |
|                               | Output Resistance                    | $R_{OUT}$     | $A_V = +1, f = 0$ to 10MHz<br>$A_V = +1, f = 100\text{MHz}$             | -<br>-  | 8.6<br>53  | -<br>-   | $\Omega$<br>$\Omega$ |
| CLAMP                         | Clamp Voltage Range                  | $V_{CL}$      |   | -5.5    | -          | +5.5     | V                    |
|                               | Clamp Accuracy                       |               | $V_{IN} = 1\text{V p-p}$  | -       | 7          | 28       | mV                   |

## DETAILED DESCRIPTION

The GB4550(A) is intended for video applications requiring coarse DC restoration coupled with flat frequency response. As shown in Figure 1, 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, such as input buffering and DC restoration of video signals.

Optimal frequency response for the GB4550(A) occurs with load capacitances in the range of 80 pF to 100 pF as shown in Figure 4. For smaller loads, an external capacitor can be added to extend the bandwidth and improve the flatness of the device response.

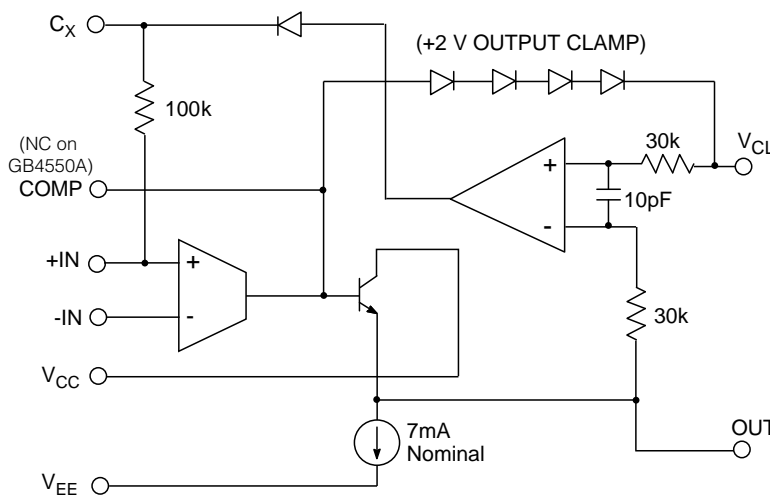
The clamping function is achieved through the use of a simple comparator. The inverting input of the comparator is connected to the GB4550(A) output, while the non-inverting input is connected to the clamp voltage reference. For output signal voltages more positive than the clamp reference the comparator output is essentially open-circuit, while signal voltages more negative than the clamp reference result in the charging of  $C_x$ . The action of the comparator is to provide a positive current which is fed back to the op-amp non-inverting input under conditions where the op-amp output is more negative than the clamp reference voltage. This negative feedback raises the DC level of the input signal to the point where all signal fluctuations occur at voltages above the clamp reference level. This is the desired clamp action.

The input to the op-amp must be AC coupled using an appropriate size of capacitor, which then acts as a DC "reservoir" for the corrective level shift.

Under equilibrium conditions the average current supplied by the comparator output is just sufficient to balance the current discharging the input capacitor. This discharge current is simply the input bias current of the op-amp, typically less than  $20\ \mu\text{A}$ . However, an external resistor can be added to increase the pull down current. Under dynamic conditions, where the system is adjusting for a change in the signal level, the charging current may be in the milliamp range. Because the corrective current is small under equilibrium conditions, the error voltage at the comparator input is small also, so clamping accuracy to within  $\pm 7\ \text{mV}$  is achievable.

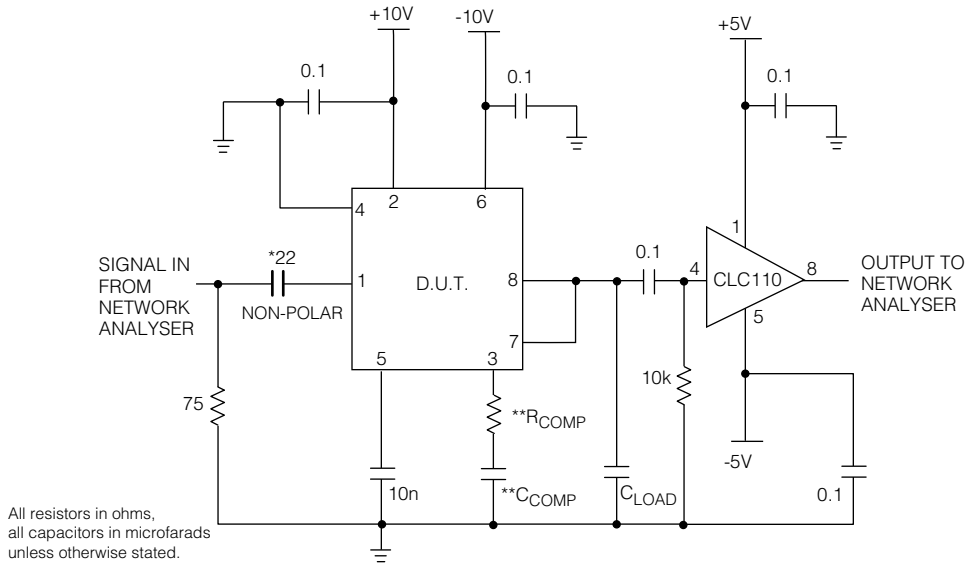
The clamp circuit makes use of a "peak hold" capacitor,  $C_x$ , at the output of the comparator. This gives rise to a more constant voltage at the comparator output which is translated to a more constant corrective current by an internal  $100\ \text{k}\Omega$  resistor connected between the comparator output and the signal input.

To avoid excessive phase shift and consequent instability of the clamp feedback loop, the peak hold capacitor needs to be considerably smaller (e.g. 1000 times) than the input coupling capacitor. If a faster clamp is desirable (e.g. for 60 Hz hum elimination) the peak hold capacitor can be removed and a smaller input coupling capacitor employed. In this application some distortion of the signal "tip" is unavoidable.



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

Fig. 1 Simplified Circuit Diagram

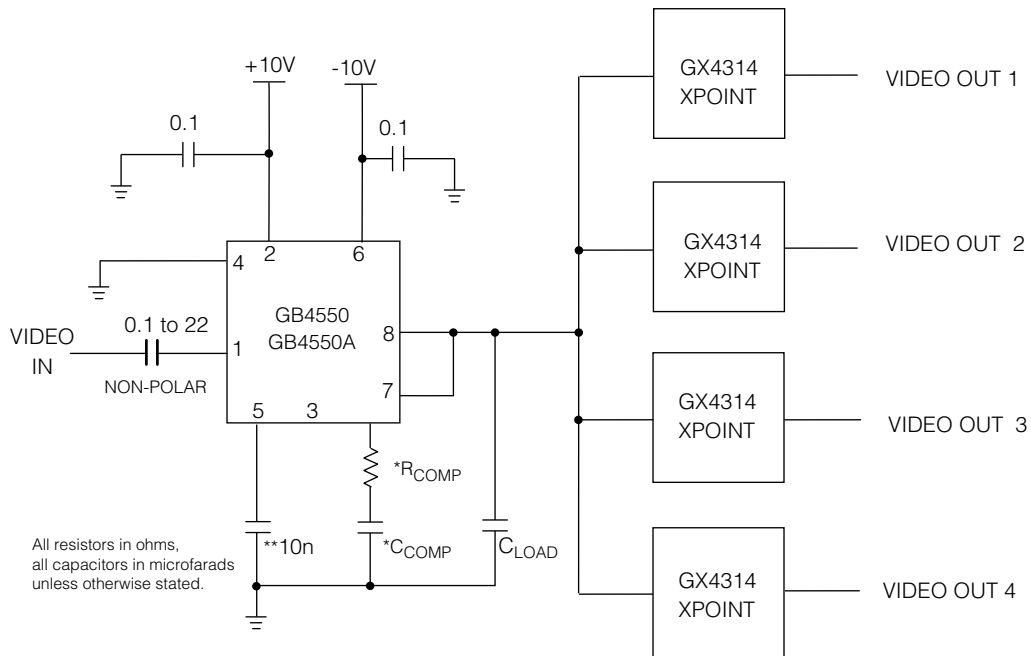


**NOTES:** This circuit can be used for Frequency Response, Delay and Differential Gain and Phase measurements.

\* This input capacitor must be shorted out when performing Differential Gain and Phase tests.

\*\*  $R_{COMP}$  and  $C_{COMP}$  are only used on GB4550.

Fig. 2 Test Circuit



**NOTES:** In most applications  $R_{COMP}$  and  $C_{COMP}$  will not be needed since the bandwidth depends on the bus capacitance.

In general, the maximum occurs when  $C_{LOAD}$  is between 82 pF and 100 pF.

They are used to control the roll-off for higher load conditions.

\* Not used on GB4550A.

\*\* The value of this capacitor should be proportional to the input capacitor used.

The value shown is for a 22  $\mu$ F input capacitor.

Fig. 3 Typical Application Circuit

## TYPICAL PERFORMANCE CURVES

Unless otherwise shown  $V = \pm 10V$

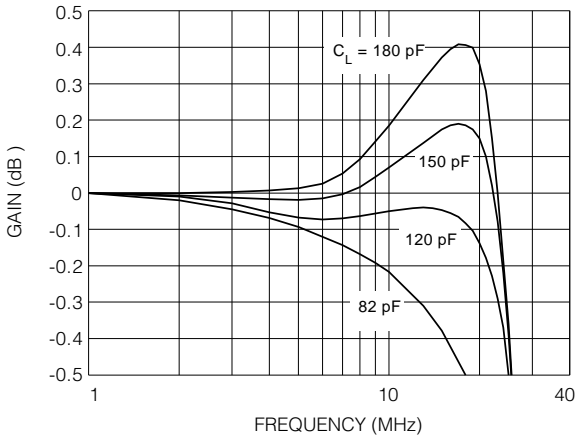


Fig. 4 GB4550 Frequency Response

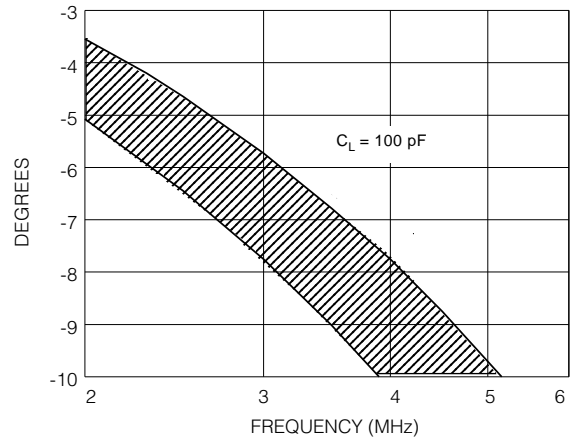


Fig. 5 GB4550 Phase Delay Spread

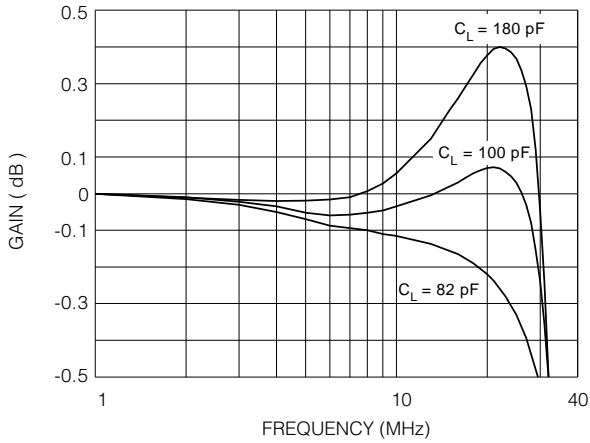


Fig. 6 GB4550A Frequency Response

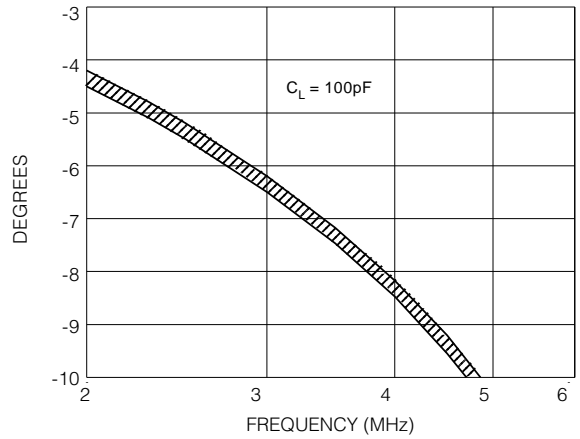


Fig. 7 GB4550A Phase Delay Spread

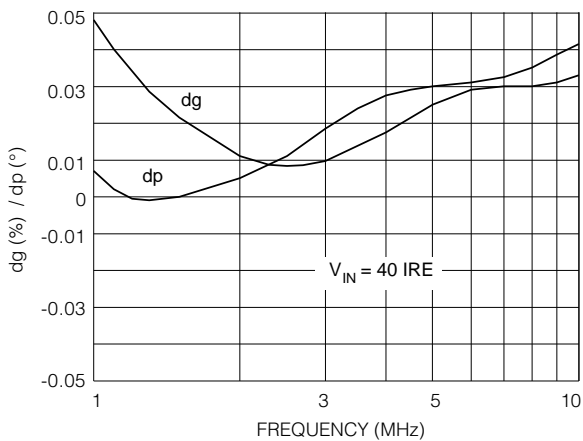


Fig. 8 Differential Gain and Phase

REVISION NOTE: Detailed Description added

### DOCUMENT IDENTIFICATION

#### PRODUCT PROPOSAL

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#### ADVANCE INFORMATION NOTE

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#### DATA SHEET

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