



## GS9028 GENLINX™ II Cable Driver with Two Adjustable Outputs

### Features

- SMPTE 259M compliant
- Two complementary outputs, adjustable from 50 to 1000mVp-p into 75Ω loads
- Operational from DC to 622Mb/s
- Nominal 470ps rise and fall times
- <math>\pm 7\%</math> output amplitude control
- 45% system power reduction over the GS9008
- No external pulldown resistors required
- Input hysteresis
- Operational down to 80mV input amplitude
- Operates from a single +5 or -5 volt supply
- 8-pin SOIC
- Pb-free and Green

### Applications

- 4fsc, 4:2:2, and 4:4:4:4 serial digital video interfaces from 143Mb/s to 540Mb/s; general purpose high-speed cable driver applications.

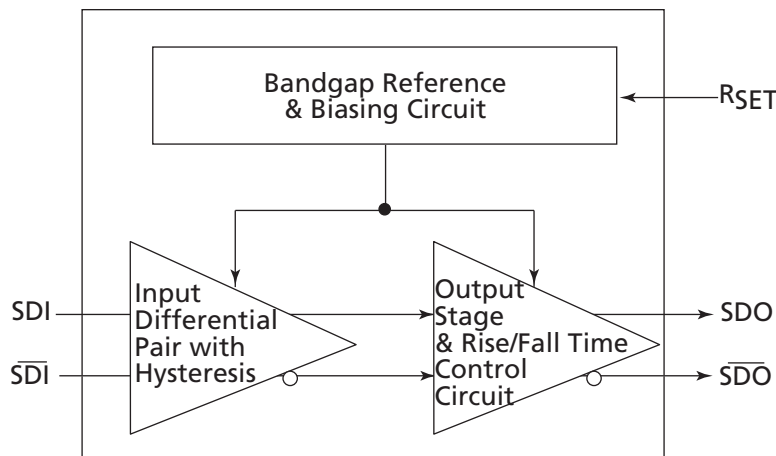
### Description

The GS9028 is a second generation bipolar integrated circuit designed to drive two 75Ω co-axial cables.

The GS9028 features two complementary outputs whose amplitude is controlled within  $\pm 7\%$ . The output signal levels are also adjustable from as low as 50mV to as high as 1000mV with little change in other performance parameters. The output amplitude of the output stage is varied by adjusting the  $R_{SET}$  resistor value.

The GS9028 consumes 45% less system power than the GS9008, and does not require external pulldown resistors, resulting in a smaller PCB footprint. Operational with input amplitudes as low as 80mV, the GS9028 is a robust serial interface device.

The GS9028 is packaged in an 8-pin SOIC and operates from a single +5V or -5V supply.



Block Diagram

# 1. Pin Out

## 1.1 Pin Assignment

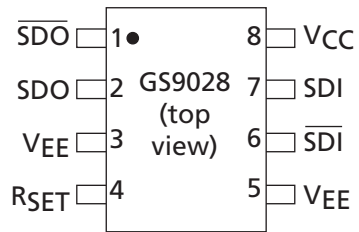


Figure 1-1: Pin Assignment

## 1.2 Pin Descriptions

Table 1-1: Pin Descriptions

Number	Symbol	Type	Description
1, 2	$\overline{\text{SDO}}$ , SDO	O	Serial digital differential output.
3, 5	$V_{EE}$	P	Most negative power supply connection. Connect to GND.
4	RSET	I	Output amplitude control resistor.
6, 7	$\overline{\text{SDI}}$ , SDI	I	Serial digital differential input.
8	$V_{CC}$	P	Most positive power supply connection. Connect to +3.3V.

## 2. Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Table 2-1: Absolute Maximum Ratings

Parameter	Value
Supply Voltage	5.5V
Input Voltage Range (any input)	-0.3 to ( $V_{CC} + 0.3$ )V
Operating Temperature Range	0 to 70°C
Storage Temperature	-65 to 150°C
Lead Temperature (soldering, 10 sec)	260°C

### 2.2 DC Electrical Characteristics

Table 2-2: DC Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Notes	Test Level
Supply Voltage	$V_{CC}$	—	4.75	5.00	5.25	V	—	1
System Power Consumption	$P_D$	Driving two 75Ω cables	—	165	195	mW	—	3
Supply Current	$I_S$	—	—	33	39	mA	—	3
Common Mode Input Voltage Range	$V_{CM,IN}$	—	$2.4 + (V_{DIFF}/2)$	—	$V_{CC} - (V_{DIFF}/2)$	V	—	2
Differential Input	$V_{DIFF}$	—	80	—	1000	mV	—	2
Common Mode Output Voltage Range	$V_{CM,OUT}$	—	—	$V_{CC} - V_{OUT}$	—	V	—	2
Differential Output	$V_{OUT}$	$R_{SET} = 59\Omega$	750	800	850	mV	—	1
Input Hysteresis	—	—	10	—	—	mV	—	2

### 2.3 AC Electrical Characteristics

Table 2-3: AC Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Notes	Test Level
Serial Data Rate	—	—	0	—	622	Mb/s	—	1
Additive Jitter	—	270Mb/s	—	25	—	ps p-p	1	2
		540Mb/s	—	25	—			
		622Mb/s	—	50	—			
Output Rise/Fall Time	$t_R, t_F$	20% to 80%	400	470	700	ps	—	3

**Table 2-3: AC Electrical Characteristics**

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Notes	Test Level
Mismatch in Output Rise/Fall Times	—	—	—	50	100	ps	—	1
Overshoot	—	—	—	5	8	%	—	1
Duty Cycle Distortion	—	—	—	50	100	ps	—	2
Output Return Loss	—	540MHz	—	17	—	dB	2	

**TEST LEVELS:**

1. 100% tested at 25°C.
2. Guaranteed by design.
3. Correlated value.

**NOTES:**

1. RMS additive jitter measured using Pseudo Random bit sequence ( $2^{23} - 1$ ).
2. Measured with Gennum Evaluation Board (EB-RD35).

### 3. Input/Output Circuits

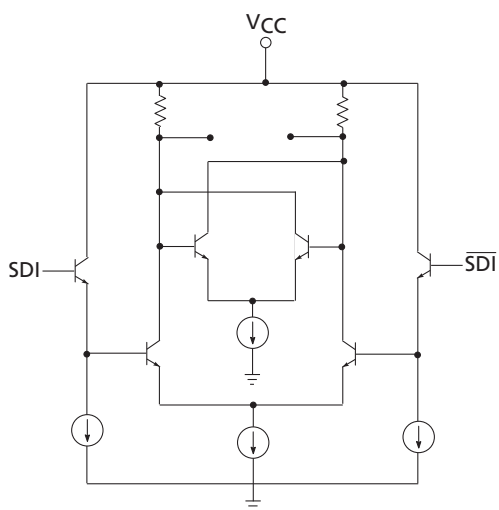


Figure 3-1: SDI/ $\overline{\text{SDI}}$

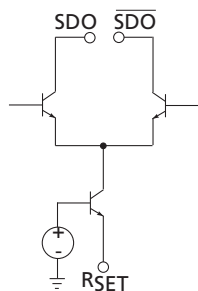


Figure 3-2: SDO/ $\overline{\text{SDO}}$

# 4. Detailed Description

## 4.1 Input Interfacing

SDI/ $\overline{\text{SDI}}$  are high-impedance differential inputs. Two conditions must be observed when interfacing to these inputs:

1. The input signal amplitude must be between 80mV and 1000mV.
2. The common mode voltage range must be as specified in the [DC Electrical Characteristics](#). For 800mV input amplitude signals, this corresponds to a common mode voltage range between 2.8V and 4.6V.

Figure 4-1 and Figure 4-2 illustrate two methods of interfacing the GS9028 to the Gennum GS9024 (Cable Equalizer), GS9035 (Reclocker) or the GS9025 (Receiver).

Figure 4-1 illustrates the simplest interface, and is recommended when the trace lengths between the driver and the GS9028 are less than 0.5in. The pull-up resistors should be placed near the GS9028 to serve as end-terminations.

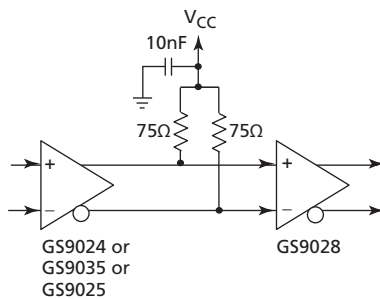


Figure 4-1: Input Interfacing (trace lengths <0.5in)

When trace lengths become longer than 0.5in and data rates greater than 360Mb/s, electromagnetic reflections begin to affect signal integrity. To minimize reflections, controlled impedance traces and source and end terminations should be used, as shown in Figure 4-2. Although terminations on both sides reduce the signal swing by a factor of two, the GS9028 is designed to meet this need with ultra-low input amplitude requirements (as low as 80mV). This low input amplitude requirement also allows the use of 50Ω transmission lines (which are more robust and easier to control in multi-layer boards) to interconnect the GS9024/25/35 and the GS9028.

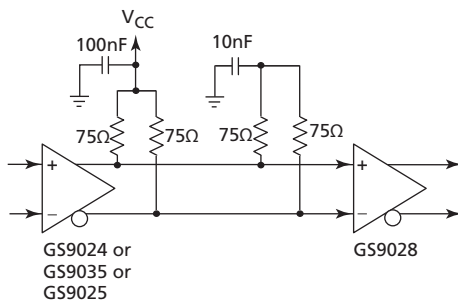


Figure 4-2: Input Interfacing (trace lengths >0.5in)

The GS9028 can also be configured to accept AC-coupled input signals. In this case, the inputs must be DC-biased, as illustrated in Figure 4-3.

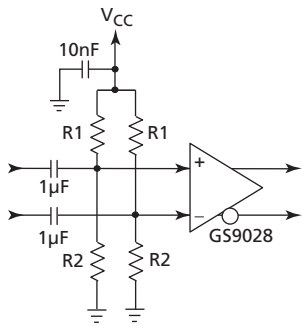


Figure 4-3: Input Interfacing (AC-coupled)

The recommended values for R1 and R2 are:

$$R1 = 1.35Z_O$$

$$R2 = 3.85Z_O$$

Where  $Z_O$  is the transmission line characteristic impedance.

For 75Ω cable,  $R1 = 100\Omega$  and  $R2 = 287\Omega$ .

## 4.2 Output Interfacing

Figure 4-4 illustrates the recommended interface for AC-coupled outputs:

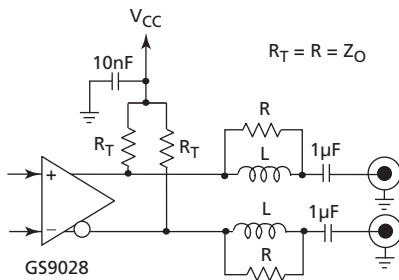


Figure 4-4: Output Interfacing (AC-coupled)

The termination resistor ( $R_T$ ) value should be equal to the characteristic impedance of the cable. Controlled-impedance traces should be used for the outputs, and the termination resistors should be placed near the GS9028. The inductor (L) and resistor (R) are used to optimize the output return loss and are PCB-dependent. Typically, R equals the transmission line characteristic impedance and L is approximately 8.2nH.

## 4.3 Output Amplitude Adjustment

The GS9028 outputs are adjustable from as low as 50mV to as high as 1000mV. The output amplitude is set by the  $R_{SET}$  resistor connected to pin 4. The relationship between the output amplitude ( $V_{OUT}$ ) and  $R_{SET}$  is approximately given by the equation below:

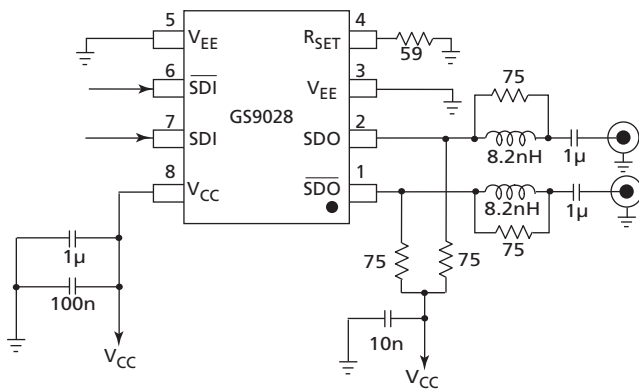
$$R_{SET} = (1.3696 \times Z_O) / (2 \times V_{OUT}) - 5.5$$

where  $Z_O$  is in Ohms and  $V_{OUT}$  is in Volts.

The minimum value of  $R_{SET}$  is 46Ω. For 75Ω cable and 800mV output amplitudes, the value of  $R_{SET}$  is 59Ω. Also, note that the above formula assumes that the transmission line is properly end-terminated.

## 5. Application Information

### 5.1 Typical Application Circuit



All resistors in Ohms, all capacitors in Farads, unless otherwise shown.

Figure 5-1: Typical Application Circuit

# 6. Package and Ordering Information

## 6.1 Package Dimensions

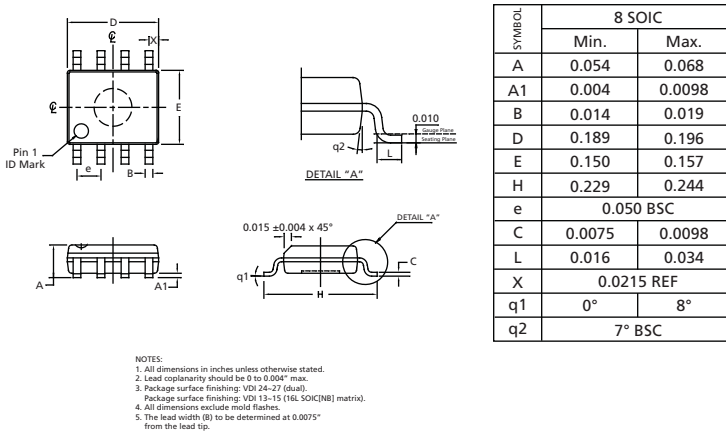


Figure 6-1: Package Dimensions

## 6.2 Ordering Information

Part Number	Package	Temperature	Pb-free and Green
GS9028-CKAE3	8-pin SOIC	0°C to 70°C	Yes
GS9028-CTAE3	8-pin SOIC, tape & reel (250pc)	0°C to 70°C	Yes
GS9028-CTAE3Z	8-pin SOIC, tape & reel (2500pc)	0°C to 70°C	Yes



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**DOCUMENT IDENTIFICATION  
DATA SHEET**

The product is in production. Gennum reserves the right to make changes to the product at any time without notice to improve reliability, function or design, in order to provide the best product possible.

**CAUTION**

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



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