

### General Information

GD16511 is a wide bandwidth, limiting amplifier designed for:

- ◆ SDH STM-16
  - ◆ SONET OC-48
- optical communication systems.

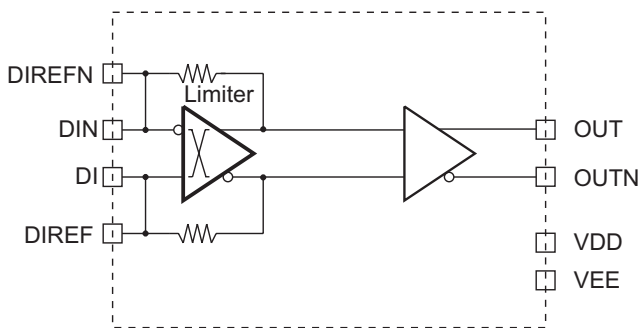
It features a linear gain of at least 28 dB and a 3 dB bandwidth larger than 3 GHz, measured in a 50  $\Omega$  system.

GD16511 has been measured together with a 2.5 Gbit/s *Clock and Data Recovery* (CDR) circuit, and error free operation has been measured down to below 3 mV<sub>PP</sub> input signal ( $10^{-9}$  BER).

The amplifier allows for input signals from 1 mV<sub>PP</sub> to above 1 V<sub>PP</sub>.

GD16511 is manufactured in a Silicon Process and uses a single positive or negative 5 V supply with a typical power dissipation of 0.13 W.

GD16511 is delivered in a TQFP 32 Lead 5x5 mm plastic package with exposed heat slug for enhanced VEE connection.



### Preliminary

### Features

- 30 dB gain (typ.).
- Large dynamic range.
- 3 dB bandwidth above 3 GHz.
- Differential loop through inputs.
- Differential CML outputs.
- Low power consumption: 0.13 W typ.
- Small 5x5 mm plastic package.

### Applications

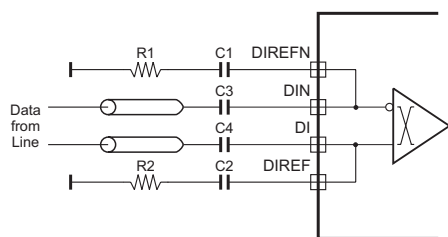
- Limiting amplifier for optical communication systems:
  - SDH STM-16
  - SONET OC-48
- Pulse shaper.

# Application Information

## Inputs

The inputs of GD16511 may be either AC or DC coupled. In either case input termination is made through the pins DIREF / DIREFN which must be terminated through the external resistors (R1 and R2) and de-coupled to ground with capacitors (C1 and C2), as shown in the Figure 1 below.

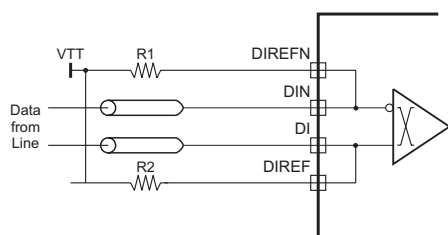
If the inputs are AC coupled GD16511 features an internal offset cancelling DC feedback. Because of the voltage division between the capacitors C3 and C1, (which must have the same value) on DI / DIREF and C4 and C2 (which also must have the same value) on DIN / DIREFN, the lower cut-off frequency is in the kHz range. Notice that the offset cancellation will only work if DIREF and DIREFN are not shorted together, and if the inputs are AC coupled, as shown in the Figure 1 below.



$$V_{diff} = |V_{DI} - V_{DIN}|$$

$$V_{CM} = \frac{V_{DI} + V_{DIN}}{2}$$

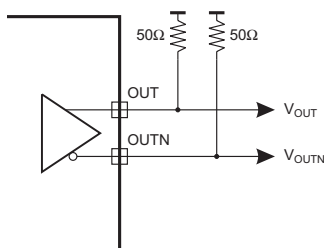
**Figure 1.** AC Coupled Input



**Figure 2.** DC Coupling for Large Input Amplitude

## Outputs

The outputs of GD16511 are open collectors (CML) and must be terminated to VDD via an external resistor matching the external transmission line impedance. Best performance is typically achieved using a 50 Ω termination resistor (please refer to Figure 3 below), however the voltage gain may be adjusted by using a different termination resistor (and characteristic transmission line impedance).

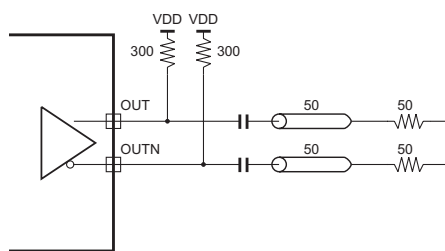


$$V_{diff} = |V_{OUT} - V_{OUTN}|$$

$$V_{CM} = \frac{V_{OUT} + V_{OUTN}}{2}$$

**Figure 3.** DC Coupled Output with 50 Ω Termination

AC coupling of the outputs are possible by using a resistor of 300 Ω to VDD for the DC return path and AC couple e.g. a transmission line terminated with its characteristic impedance, see Figure 4 below.

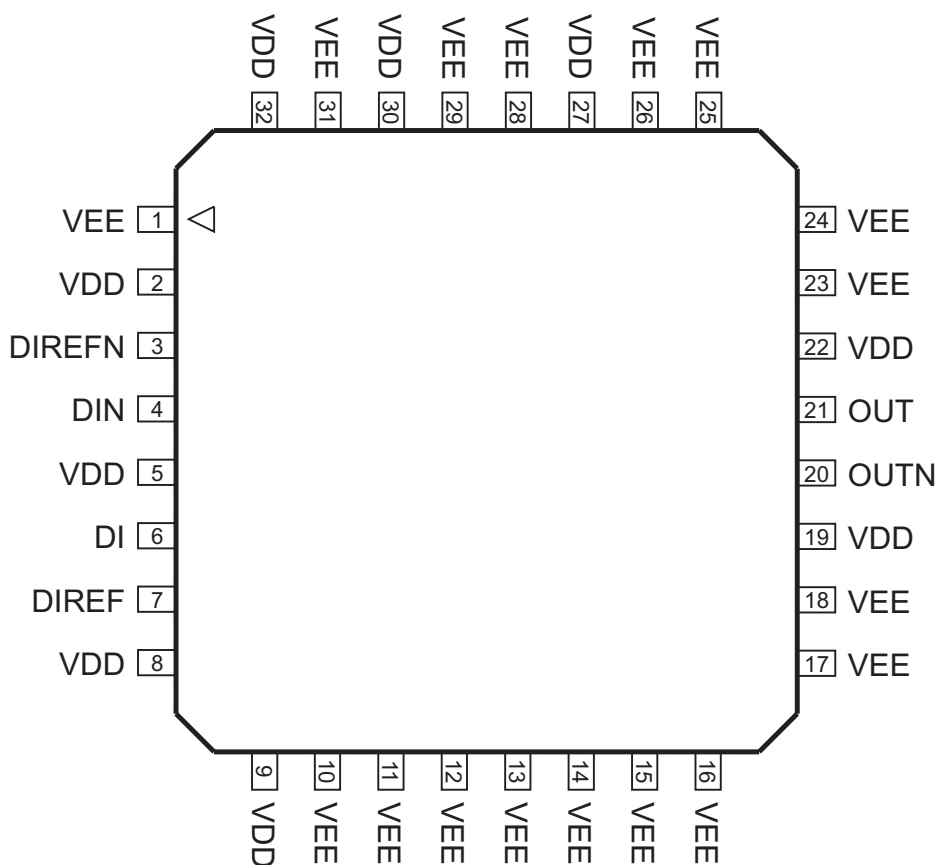


**Figure 4.** AC Coupled Output

## Pin List

| Mnemonic:     | Pin No.:                                                          | Pin Type:  | Description:                                                  |
|---------------|-------------------------------------------------------------------|------------|---------------------------------------------------------------|
| DI, DIN       | 6, 4                                                              | Anl. Input | Data inputs. If AC coupled the inputs are self biased.        |
| DIREF, DIREFN | 7, 3                                                              | Anl. Input | Loop through termination pins for data inputs.                |
| OUT, OUTN     | 21, 20                                                            | CML        | CML output pins. The outputs require an external path to VDD. |
| VDD           | 2, 5, 8, 9, 19, 22, 27, 30, 32                                    | PWR        | Ground pins.                                                  |
| VEE           | 1, 10, 11, 12, 13, 14, 15, 16, 17, 18, 23, 24, 25, 26, 28, 29, 31 | PWR        | Supply pins.                                                  |
| Heat sink     | Package backside                                                  |            | Connect to VEE                                                |

## Package Pinout



**Figure 5.** Package Pinout, 32 pin - Top View

## Maximum Ratings

These are the limits beyond which the component may be damaged.

All voltages in table is referred to VDD

All currents are defined positive out of the pin.

| Symbol:      | Characteristic:                  | Conditions: | MIN.:    | TYP.: | MAX.: | UNIT: |
|--------------|----------------------------------|-------------|----------|-------|-------|-------|
| $V_{EE}$     | Negative Supply                  |             | -7       |       | 0     | V     |
| $V_{CMLT}$   | CML Resistor Termination Voltage |             | $V_{EE}$ |       | 0     | V     |
| $V_{O\ CML}$ | CML Output Voltage               |             | $V_{EE}$ |       | 0     | V     |
| $I_{O\ CML}$ | CML Output Current               | Note 1      | -10      |       | +1    | mA    |
| $T_J$        | Junction Temperature             |             | -55      |       | +150  | °C    |
| $T_S$        | Storage Temperature              |             | -65      |       | +150  | °C    |

**Note 1:** Nominal supply voltages.

## Electrical Characteristics

$T_{CASE} = -40\ ^\circ\text{C}$  to  $85\ ^\circ\text{C}$ .

Specifications are tested at  $85\ ^\circ\text{C}$ . Performance at lower temperatures has been shown to be better in engineering samples.

All voltages in table are referred to VDD

All currents are defined positive out of pin.

| Symbol:            | Characteristic:                             | Condiions:                  | MIN.: | TYP.: | MAX.: | UNIT: |
|--------------------|---------------------------------------------|-----------------------------|-------|-------|-------|-------|
| $V_{EE}$           | Negative supply voltage                     |                             | -5.5  | -5.0  | -4.5  | V     |
| $I_{EE}$           | Supply current                              |                             |       | 25    |       | mA    |
| $V_{diff\ DI,DIN}$ | Input voltage for DI, DIN                   | Note 4, 5                   |       |       | 1.0   | V     |
| $V_{CM\ DI,DIN}$   | Common mode range for DC coupled data input | DC coupled inputs<br>Note 6 | -2.0  | -1.3  | -0.2  | V     |
| $V_{DI,DIN}$       | Input offset voltage                        |                             |       |       | 1     | mV    |
| $V_{OUT,OUTN}$     | Output voltage swing                        | Note 1, 2, 5                | 0.3   | 0.4   |       | V     |
| $V_{LO\ OUT,OUTN}$ | Minimum voltage on outputs                  |                             | -1.2  |       |       | V     |
| $t_r, t_f$         | Output rise and fall times (10 - 90%)       | Note 1, 2                   |       |       | 100   | ps    |
| $D_{OUT,OUTN}$     | Output duty cycle variation                 |                             | 45    | 50    | 55    | %     |
| G                  | Small signal gain                           | Note 1, 3                   | 28    | 32    | 35    | dB    |
| $f_{3dB}$          | 3 dB bandwidth                              | Note 1, 3                   | 3.0   | 3.5   |       | GHz   |

**Note 1:** Output externally terminated with  $50\ \Omega$  to VDD.

**Note 2:** Limiting operation.

**Note 3:** Linear operation.

**Note 4:** Single ended or differential voltage. Defined as  $|V_{DI} - V_{DIN}|$ , see [Figure 1](#).

**Note 5:** Defined as  $|V_{OUT} - V_{OUTN}|$ , see [Figure 2](#).

**Note 6:** Defined as  $\frac{V_{DI} + V_{DIN}}{2}$ , see [Figure 1](#).

## Package Outline

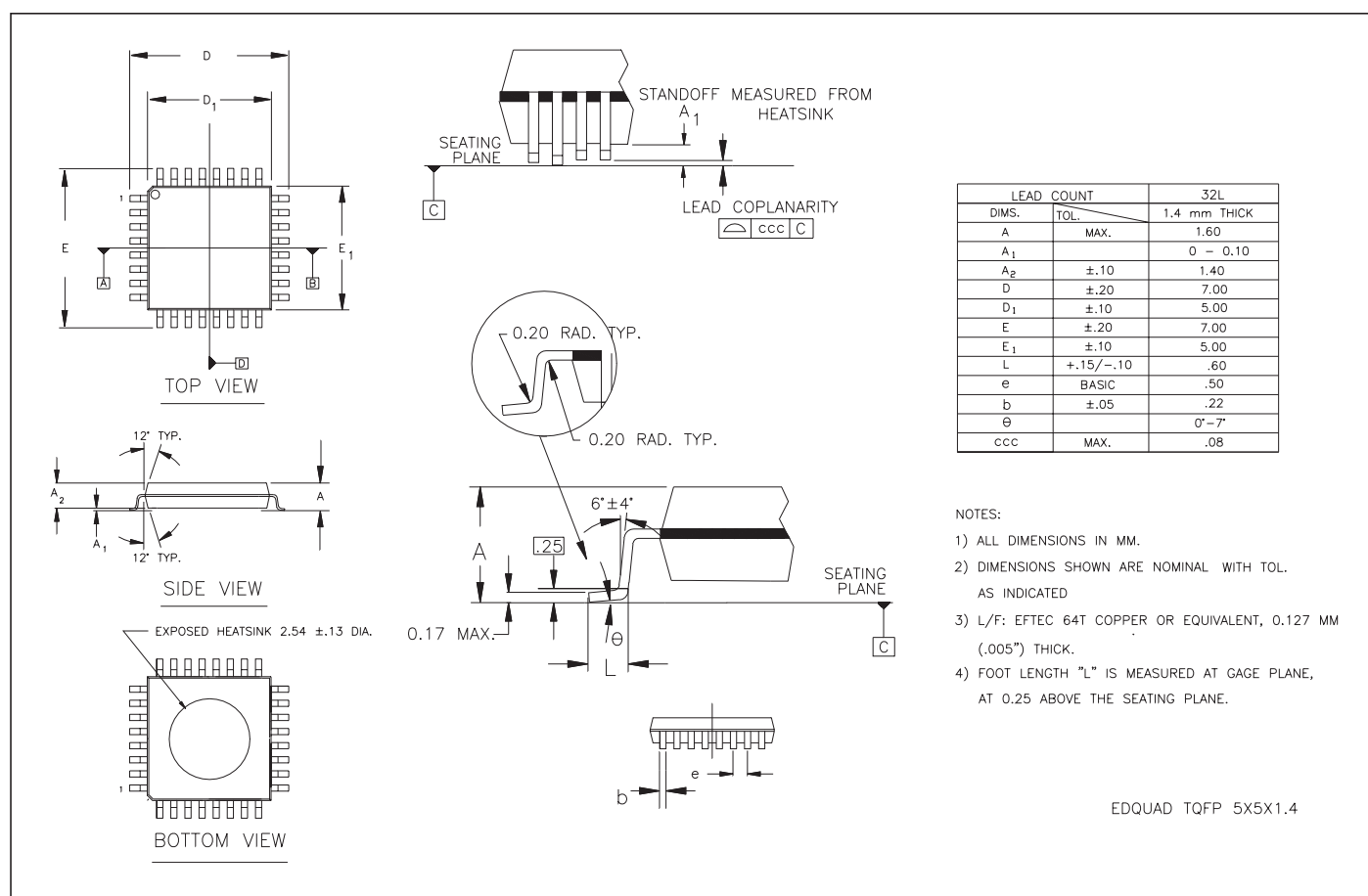


Figure 6. Package 32 pin

## Ordering Information

Please order as specified below:

| Product Name: | Package Type: | Case Temperature Range: | Options: |
|---------------|---------------|-------------------------|----------|
| GD16511-32BA  | 32pin L TQFP  | -40..85 °C              |          |

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