

**Applications**

- SONET/SDH-based transmission systems, test equipment and modules
- OC-48 fibre optic modules
- Gigabit Ethernet
- Fibre Channel
- Wideband RF gain block

**Features**

- Single +3.3 V supply
- Power dissipation = 230 mW (typ)
- Noise figure < 12 dB
- Small signal gain = 23.5 dB differential
- Fully integrated AGC function
- On-chip 50 Ω input and output terminations
- Wide bandwidth (–3 dB) > 2.0 GHz
- Maximum input level of 200 mVpk
- AGC output level of 370 mVpk differential
- Loss of signal functionality
- Single-ended or differential operation
- Minimal external components
- Operating ambient temperature range = -40°C to +85°C
- Equivalent to Nortel Networks AC10

**Product Description**

SiGe Semiconductor offers a portfolio of optical networking ICs for use in high-performance optical transmitter and receiver functions, from 155 Mb/s up to 12.5 Gb/s.

SiGe Semiconductor’s SE1230 is a fully integrated AGC amplifier aimed primarily at SONET OC-48 and SDH STM-16 systems. The device may also be used in any datacom application with input data rates up to 2.5 Gb/s.

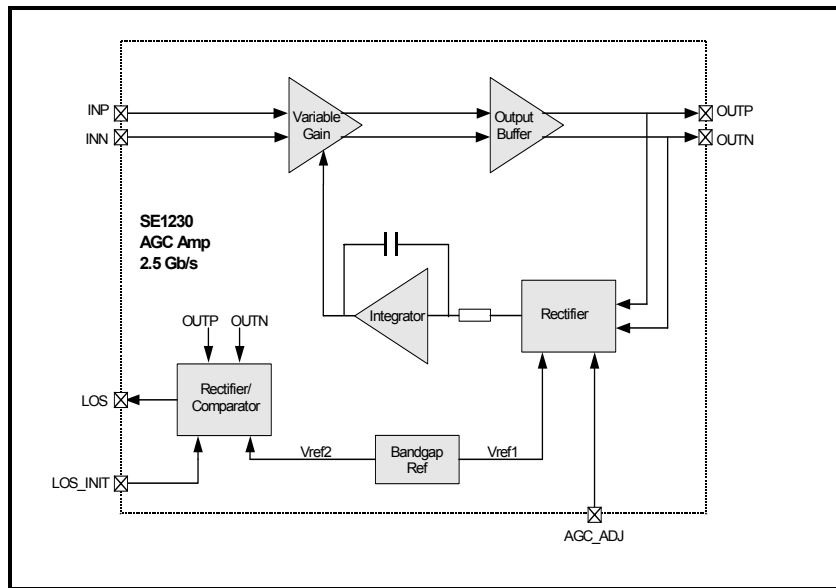
The device is designed with differential I/Os and signal levels compatible with SiGe Semiconductor’s SE1030 and SE1031 transimpedance amplifiers. A system block diagram is shown after the functional description, on page 4.

Optimum performance is provided by differential connections but with appropriate terminations, the device can also be used in single-ended mode if required by the application.

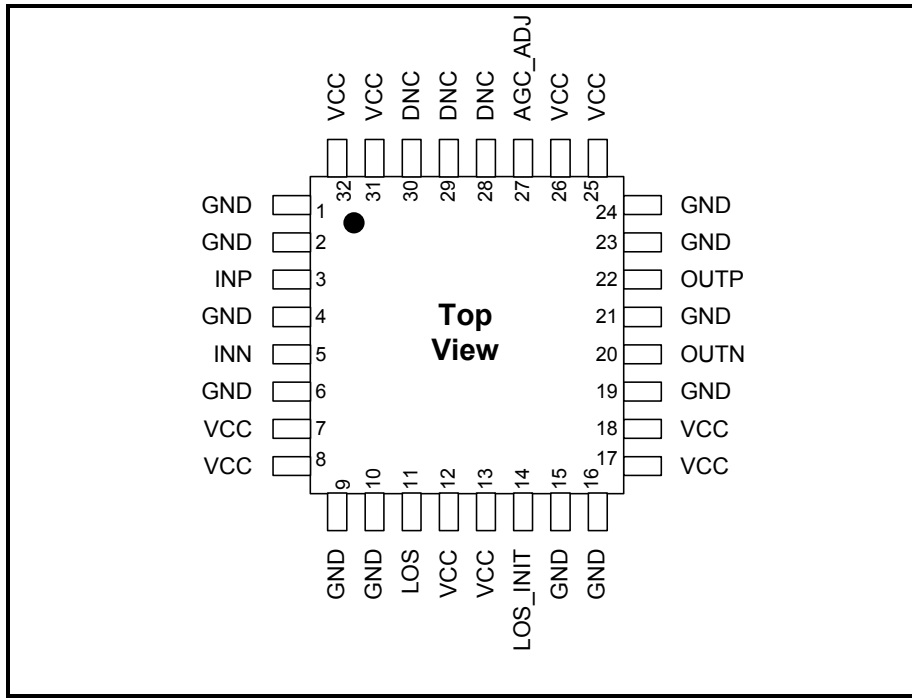
**Ordering Information**

| Type    | Package           | Remark |
|---------|-------------------|--------|
| SE1230Q | 5 mm, 32 pin LQFP | None   |

**Functional Block Diagram**



**Pin Out Diagram**



**Pin Out Description**

| Pin No. | Name     | Description                            |
|---------|----------|--|
| 1       | GND      | Negative supply (0 V)                  |
| 2       | GND      | Negative supply (0 V)                  |
| 3       | INP      | Non-inverting input (50 Ω impedance)   |
| 4       | GND      | Negative supply (0 V)                  |
| 5       | INN      | Inverting input (50 Ω impedance)       |
| 6       | GND      | Negative supply (0 V)                  |
| 7       | VCC      | Positive supply (3.3 V)                |
| 8       | VCC      | Positive supply (3.3 V)                |
| 9       | GND      | Negative supply (0 V)                  |
| 10      | GND      | Negative supply (0 V)                  |
| 11      | LOS      | Loss of signal output (open collector) |
| 12      | VCC      | Positive supply (3.3 V)                |
| 13      | VCC      | Positive supply (3.3 V)                |
| 14      | LOS_INIT | Sets initial state of LOS output       |

|    |         |   |
|----|---------|---|
| 15 | GND     | Negative supply (0 V)                       |
| 16 | GND     | Negative supply (0 V)                       |
| 17 | VCC     | Positive supply (3.3 V)                     |
| 18 | VCC     | Positive supply (3.3 V)                     |
| 19 | GND     | Negative supply (0 V)                       |
| 20 | OUTN    | Inverted output (50 $\Omega$ impedance)     |
| 21 | GND     | Negative supply (0 V)                       |
| 22 | OUTP    | Non-inverted output (50 $\Omega$ impedance) |
| 23 | GND     | Negative supply (0 V)                       |
| 24 | GND     | Negative supply (0 V)                       |
| 25 | VCC     | Positive supply (3.3 V)                     |
| 26 | VCC     | Positive supply (3.3 V)                     |
| 27 | AGC_ADJ | AGC output level adjust                     |
| 28 | DNC     | Do not connect                              |
| 29 | DNC     | Do not connect                              |
| 30 | DNC     | Do not connect                              |
| 31 | VCC     | Positive supply (3.3 V)                     |
| 32 | VCC     | Positive supply (3.3 V)                     |

## Functional Description

The SE1230 is configured as a variable gain amplifier, with automatic gain control. It comprises a variable-gain block driving a 50 Ω output driver (see the functional block diagram on page 1). The device requires a single +3.3 V power supply.

## System Inputs

The inputs INP and INN are differential and are each internally terminated to 50 Ω. To avoid problems with offset or common-mode voltage, use AC-coupling for differential or single-ended connection (for the latter, AC-couple the unused input to ground via 50 Ω). The maximum input level is 200 mVpk, applied single-ended or differentially.

## System Outputs

The outputs OUTP and OUTN are differential and are each internally terminated to 50 Ω. To avoid problems with offset or common-mode voltage, use AC-coupling for differential or single-ended connection (for the latter, AC-couple the unused output to ground via 50 Ω). The default output level (under AGC) is 370 mVpk differential.

## Automatic Gain Control (AGC)

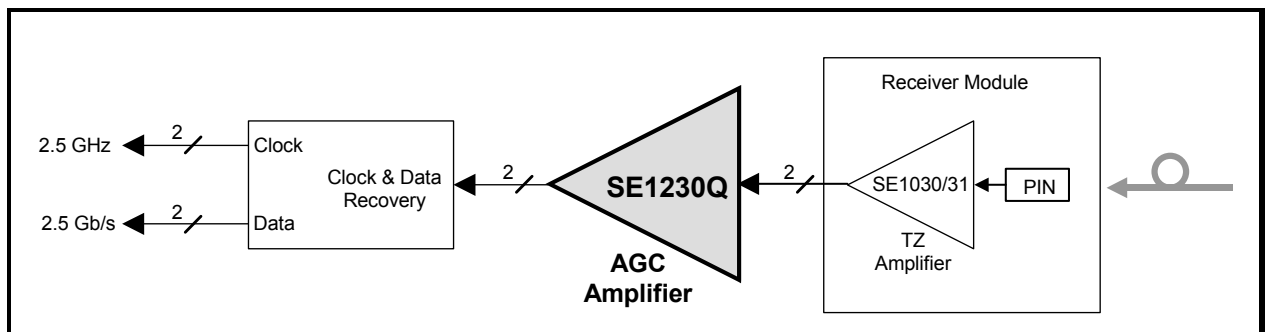
A rectifier compares the output signal voltage with a reference level to invoke gain control. When operating in the controlled gain region, the fully integrated long time-constant integrator provides filtered control voltages to the variable gain stages to maintain a fixed output level. This output level may be varied by injecting current into AGC\_ADJ (leave unconnected if adjustment is not required).

## Loss of Signal

A two-level comparator block is used to detect the input signal level. If it drops below the lower threshold, LOS goes low. This output is an open collector to allow wired-OR connection to other system alarm signals; it requires an external pull-up resistor. It goes high only when the input level exceeds the upper comparator threshold level. If this function is not required, LOS may be left unconnected.

By connecting an external series-RC to the LOS\_INIT pin, LOS can be forced low on first power up if the signal level is between the upper and lower comparator thresholds. If this function is not required, leave LOS\_INIT unconnected.

## System Block Diagram



### Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings may cause permanent damage to, or affect the reliability of the device. Avoid operating the device outside the recommended operating conditions defined below.

| Symbol           | Parameter  | Min  | Max     | Unit |
|------------------|--|------|---------|------|
| VCC              | Supply Voltage   | -0.5 | 5.0     | V    |
| V <sub>IO</sub>  | Voltage at any input or output                                 | -0.5 | VCC+0.5 | V    |
| I <sub>IO</sub>  | Current sourced into any input or output, except OUTP and OUTN | -20  | 20      | mA   |
| I <sub>IO</sub>  | Current sourced into pins OUTP and OUTN                        | -40  | 40      | mA   |
| V <sub>ESD</sub> | Electrostatic Discharge (100 pF, 1.5 kΩ), all pins             | -2   | 2       | kV   |
| T <sub>stg</sub> | Storage Temperature  | -65  | 150     | °C   |

### Recommended Operating Conditions

| Symbol               | Parameter   | Min | Typ | Max | Unit |
|----------------------|---|-----|-----|-----|------|
| VCC                  | Supply Voltage  | 3.1 | 3.3 | 3.5 | V    |
| I <sub>LOS</sub>     | LOS Output Load Current   |     |     | 5   | mA   |
| R <sub>LOSI</sub>    | LOS_INIT Resistor   |     | 1   |     | kΩ   |
| C <sub>LOSI</sub>    | LOS_INIT Capacitor (increase value for slow power supply rise time) |     | 1   |     | μF   |
| I <sub>AGC_ADJ</sub> | AGC Threshold Adjust Input Current (on AGC_ADJ pin) – note 1        | 0   |     | 150 | μA   |
| T <sub>a</sub>       | Operating Ambient Temperature                                       | -40 |     | 85  | °C   |

Note 1: This current can be produced by connecting a suitable resistor between VCC and AGC\_ADJ.

### DC Electrical Characteristics

| Symbol               | Parameter   | Min | Typ  | Max | Unit |
|----------------------|---|-----|------|-----|------|
| I <sub>CC</sub>      | Supply current  |     | 70   | 100 | mA   |
| P <sub>D</sub>       | Power Dissipation                                       |     | 230  | 350 | mW   |
| V <sub>AGC_ADJ</sub> | Open-circuit AGC_ADJ Voltage                            |     | 0.37 |     | V    |
| V <sub>LOS</sub>     | Output Low Voltage on LOS, with I <sub>LOS</sub> = 1 mA |     |      | 0.4 | V    |
| R <sub>T</sub>       | Input/Output Termination Resistance                     |     | 50   |     | Ω    |

### AC Electrical Characteristics

| Symbol                          | Parameter  | Min | Typ  | Max | Unit                    |
|---------------------------------|--|-----|------|-----|-------------------------|
| BW (3dB)                        | Small Signal Bandwidth at -3dB point                                       | 2.0 |      |     | GHz                     |
| Gain                            | Small Signal Gain (f = 100 MHz), differential input / output               | 21  | 23.5 | 26  | dB                      |
| V <sub>in</sub>                 | Maximum Input Signal Level   |     |      | 200 | mV pk<br>(differential) |
|                                 | Input Signal Level at AGC Threshold (I <sub>AGC_ADJ</sub> = 0 μA) – note 2 |     | 25   |     |                         |
|                                 | Lower LOS Threshold (LOS = low)  | 5   | 8    |     |                         |
|                                 | Upper LOS Threshold (LOS = high)   |     | 12   | 18  |                         |
| V <sub>out</sub>                | Output AGC Signal Level (I <sub>AGC_ADJ</sub> = 0 μA) – note 3             | 250 | 370  | 500 | mV pk<br>(differential) |
|                                 | Output AGC Signal Level (I <sub>AGC_ADJ</sub> = 150 μA) – note 3           | 80  | 170  | 300 |                         |
| S <sub>11</sub>                 | Input Reflection Coefficient (< 1.3 GHz)                                   |     |      | -10 | dB                      |
| S <sub>22</sub>                 | Output Reflection Coefficient (< 1.3 GHz)                                  |     |      | -10 | dB                      |
| NF                              | Noise Figure (diff. in / diff. out)  |     |      | 12  | dB                      |
| t <sub>R</sub> / t <sub>F</sub> | Output Rise / Fall Time (Input rise / fall time = 20 ps)                   |     | 120  |     | ps                      |

Note 2: V<sub>in</sub> at AGC threshold is calculated by dividing V<sub>out</sub> by the small signal gain.

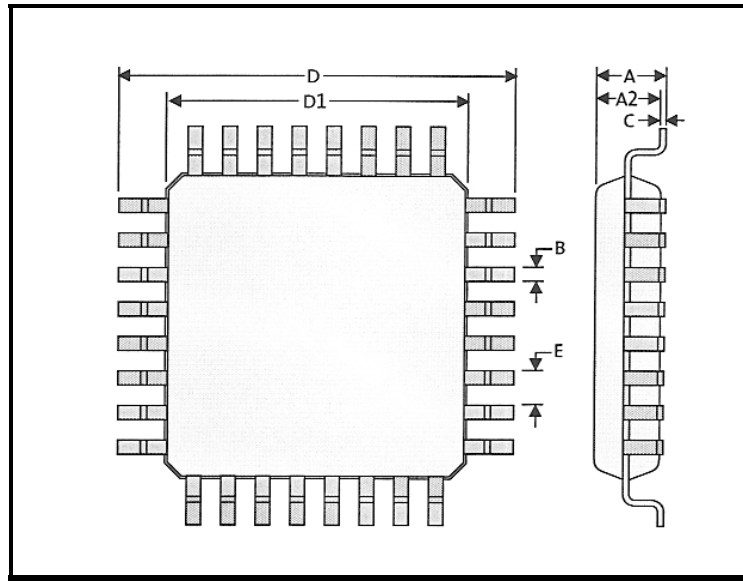
Note 3: Measured at V<sub>in</sub> = 100 mV pk, f = 100 MHz. For intermediate values of I<sub>AGC\_ADJ</sub> the output amplitude can be estimated by linear interpolation.

DC and AC electrical characteristics are specified over the recommended operating conditions, and with load resistor (R<sub>L</sub>) of 50 Ω, AC coupled via 100 nF, for each output. All characteristics are specified for differential signals on inputs and outputs.

## Package Information

The device is packaged in a 5 mm, 32 pin plastic low profile quad flat pack (LQFP).

### Package Outline

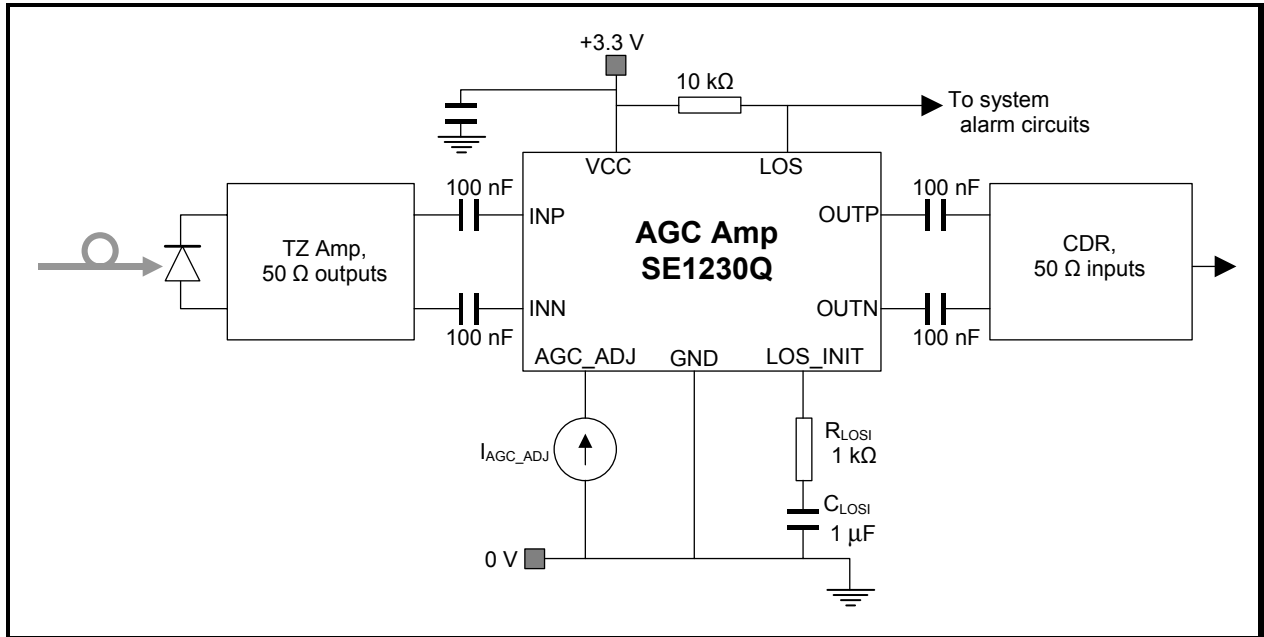


### Package Dimensions

| Dimension                   | Min (mm) | Nom (mm) | Max (mm) |
|-----------------------------|----------|----------|----------|
| Lead Count                  |          | 32       |          |
| Lead Pitch (E)              |          | 0.5      |          |
| Body Size (D1)              |          | 5.00     |          |
| Component Tip-to-Tip (D)    |          | 7.00     |          |
| Component Height (A)        |          |          | 1.60     |
| Component Standoff          | 0.05     |          | 0.15     |
| Body Thickness (A2)         | 1.35     | 1.40     | 1.45     |
| Lead width (plated) (B)     | 0.17     | 0.22     | 0.27     |
| Lead Thickness (plated) (C) | 0.09     |          | 0.175    |

## Applications Information

For optimum performance it is recommended that the device be used in differential mode with the circuit shown in the diagram below. Components connected to LOS, LOS\_INIT and AGC\_ADJ are optional, depending on whether or not the loss of signal and/or AGC adjust functions are required.





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Product Preview

The datasheet contains information from the product concept specification. SiGe Semiconductor Inc. reserves the right to change information at any time without notification.

Preliminary Information

The datasheet contains information from the design target specification. SiGe Semiconductor Inc. reserves the right to change information at any time without notification.

Final

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