

## 622 Mbit/s Transimpedance Amplifier

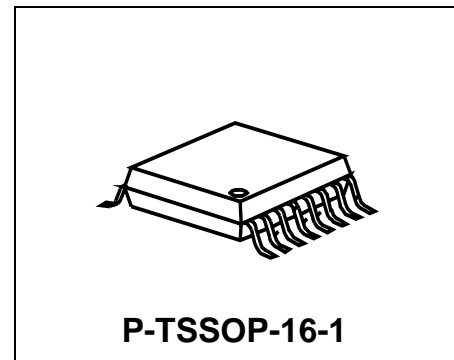
FOA1061A1  
FOA1062A1

Preliminary Data

Bipolar IC

### Features

- Data rate up to 622 Mbit/s
- Input sensitivity  $-31.0$  dBm at BER =  $10^{-9}$
- High overload:  $2$  mA<sub>pp</sub> maximum input current
- Single supply voltage:  $+4.5$  V to  $+5.5$  V
  
- Internal DC-compensation loop increases dynamic range
- No external components needed
- Internal bias generation for PIN-photodiode
- Internal low-pass filter to improve power supply rejection
- Operates with PIN- or APD-photodiode
- Monitor output for mirrored photodiode current



### Applications

- Fibre optics data communication systems
- SONET OC-12, SDH STM-4
- Pre-amplifier modules

| Type      | Ordering Code | Package      |
|-----------|---------------|--------------|
| FOA1061A1 | Q67000-H4129  | P-TSSOP-16-1 |
| FOA1062A1 | Q67000-H4130  | bare die     |

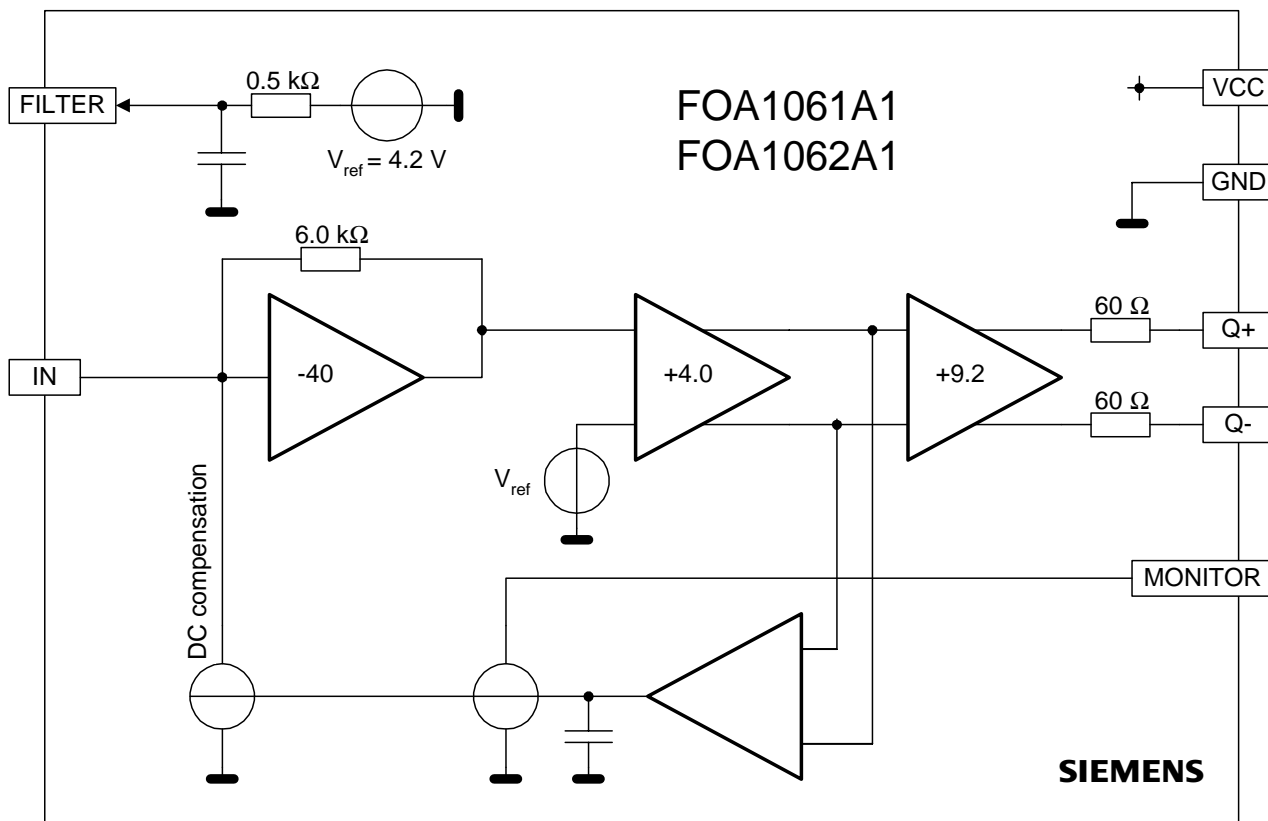


Figure 1 Block diagram.

Table 1 Pin Description

| Symbol   | Function  |
|----------|---|
| $V_{CC}$ | Supply voltage  |
| IN       | Data input from PIN- or APD-photodiode                                |
| $Q_+$    | Non-inverting data output   |
| $Q_-$    | Inverting data output   |
| FILTER   | Bias voltage for PIN-diode  |
| MONITOR  | Mirrored photodiode current (connect pin via 0 ... 2 kΩ to $V_{CC}$ ) |
| GND      | Ground  |

## Electrical Characteristics

### Absolute Maximum Ratings

Stresses listed below here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Ambient temperature  $T_{amb} = -40\text{ °C} \dots +85\text{ °C}$

| Parameter                 | Symbol    | Limit Values |       | Unit | Remarks         |
|---------------------------|-----------|--------------|-------|------|-----------------|
|                           |           | min.         | max.  |      |                 |
| Supply voltage            | $V_{CC}$  | -0.5         | 6.0   | V    |                 |
| Junction temperature      | $T_j$     | -40          | 125   | °C   |                 |
| Storage temperature       | $T_S$     | -40          | 150   | °C   |                 |
| Relative ambient humidity |           |              | 85/85 | %/°C | no condensation |
| ESD voltage               | $V_{ESD}$ | 500          |       | V    | note 1) and 2)  |

Note: 1) Except IN-pin

2) HBM according to MIL STD 883D, method 3015.7 and ESD Assn. Standard S5.1-1993.

### Recommended Operating Conditions

Ambient temperature  $T_{amb} = -40\text{ °C} \dots +85\text{ °C}$

| Parameter              | Symbol        | Limit Values |      |      | Unit   | Remarks     |
|------------------------|---------------|--------------|------|------|--------|-------------|
|                        |               | min.         | typ. | max. |        |             |
| Supply voltage         | $V_{CC}$      | +4.5         | +5.0 | +5.5 | V      |             |
| Data transmission rate |               |              | 622  |      | Mbit/s |             |
| Supply current         | $I_{CC}$      |              | 45   |      | mA     |             |
| Thermal resistance     | $\Theta_{JA}$ |              | 140  |      | K/W    | see note 1) |
| Junction temperature   | $T_j$         | -10          |      | +125 | °C     | see note 2) |

Note: 1) Junction-to-ambient thermal resistance measurement conditions for packaged device:

PCB area: 10 cm x 10 cm x 1.5 mm; copper area approx. 60 %; via holes to ground layer underneath the device; all pins soldered.

2) Do not exceed the maximum junction temperature. If used as packaged version, provide sufficient PCB heat sink to the device by soldering all pins and sufficient copper area underneath the chip (see note 1).

## AC/DC Characteristics

Conditions:  $T_{amb} = +25\text{ °C}$ ,  $V_{CC} = +5.0\text{ V}$ ,  $C_{external} = 0.85\text{ pF}$

| Parameter                              | Symbol           | Limit Values |                |      | Unit               | Remarks  |
|--|------------------|--------------|----------------|------|--------------------|--|
|  |                  | min.         | typ.           | max. |                    |  |
| Supply current                         | $I_{VCC}$        |              | 45             | 54   | mA                 |  |
| Input voltage                          | $V_{IN}$         |              | +1.65          |      | V                  |  |
| Input current                          | $I_{IN}$         |              |                | 2000 | $\mu\text{A}_{pp}$ | (Note 1)   |
| Input current before clipping          | $I_{IN,CL}$      |              | 8              |      | $\mu\text{A}_{pp}$ |  |
| Input resistance                       | $R_{IN}$         |              | 150            |      | $\Omega$           |  |
| Input sensitivity                      | $P_{IN}$         |              | -31.0          |      | dBm                | BER < $10^{-9}$ (Note 1)   |
| Optical overload                       | $P_{OVL}$        |              | 0              |      | dBm                | BER < $10^{-9}$ (Note 1)   |
| Transimpedance                         | $R_T$            |              | 96             |      | k $\Omega$         | differential<br>into $2 \times 50\ \Omega$   |
| Output voltage swing ( $Q_+$ - $Q_-$ ) | $\Delta V_{OUT}$ | 0.6          | 0.78           | 1.1  | V <sub>pp</sub>    |  |
| Bandwidth (-3 dB)                      | $f_{3db}$        |              | 450            |      | MHz                |  |
| Output resistance                      | $R_{out}$        | 48           | 60             | 72   | $\Omega$           | internally connected<br>to $V_{CC}$  |
| Output voltage                         | $V_{CM_{OUT}}$   |              | $V_{CC} - 0.6$ |      | V                  | $(Q_+ + Q_-)/2$  |
| Output pattern jitter (Note 1)         | $t_{j,P}$        |              | 15<br>45       |      | ps<br>ps           | $1.5\ \mu\text{A}_{pp} < I_{IN} < 160\ \mu\text{A}_{pp}$<br>$160\ \mu\text{A}_{pp} < I_{IN} < 1.1\ \text{mA}_{pp}$ |
| Power supply rejection ratio           | $PSSR$           |              | 35             |      | dB                 | $f < 10\text{ MHz}$<br>(Note 2)  |
| Bias resistance                        | $R_{BIAS}$       | 400          | 500            | 600  | $\Omega$           |  |
| Bias voltage                           | $V_{BIAS}$       |              | +4.2           |      | V                  |  |
| Low frequency cutoff                   | $f_{3db, low}$   |              | 65             |      | kHz                | AC-coupled outputs<br>(via 22 nF)  |

Note: 1) Data rate: 622 Mbit/s; data sequence: PRBS  $2^{23}-1$

2) Generated noise on power supply: sine curve,  $100\text{ mV}_{pp}$  (see application note b)

Package information

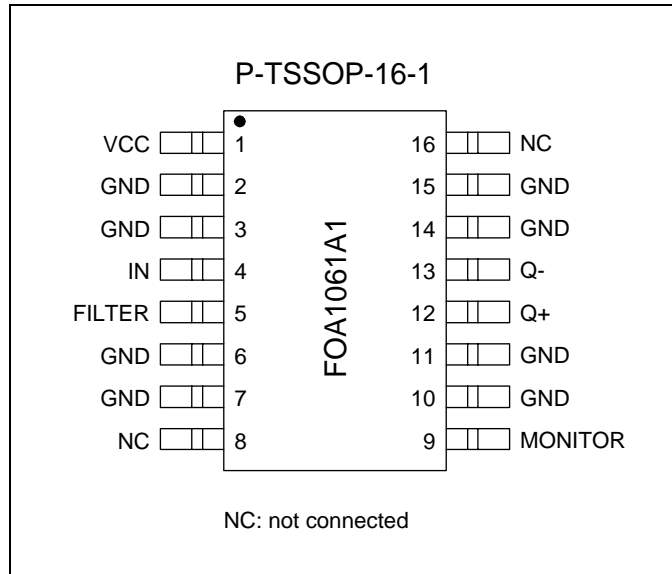


Figure 2 Package pinning.

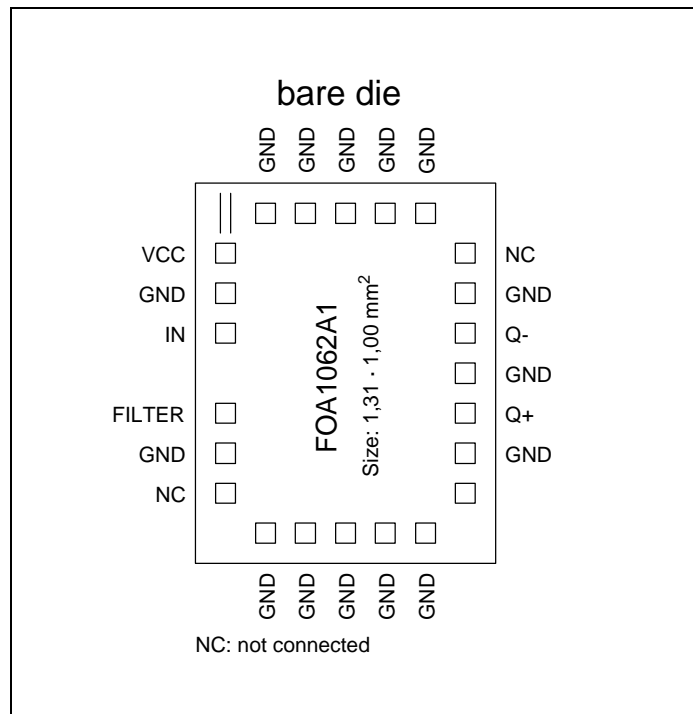


Figure 3 Pad assignment.

Eye-diagrams measured at data rates of 622 Mbit/s

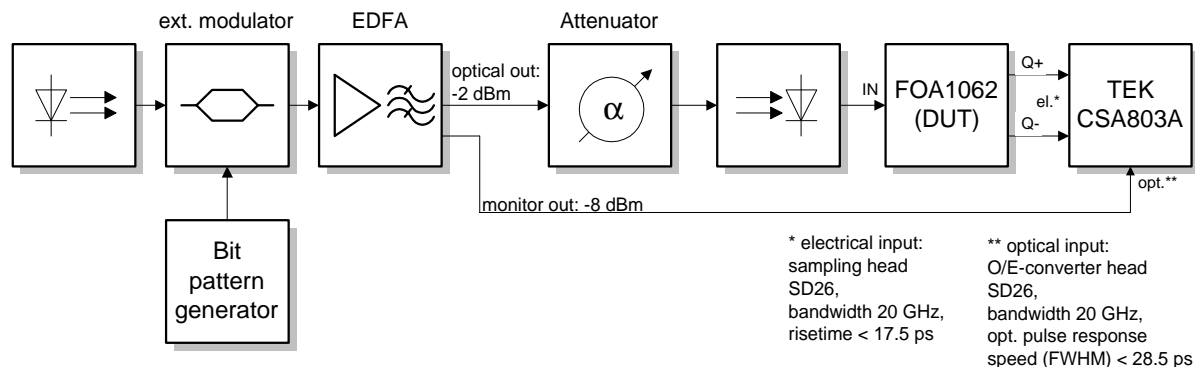


Figure 4 Measurement set-up.

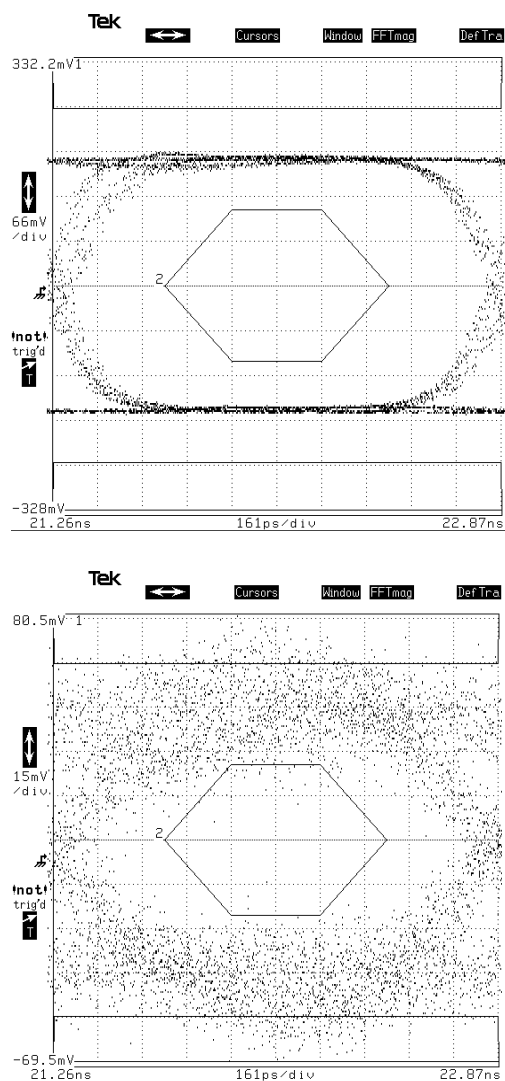


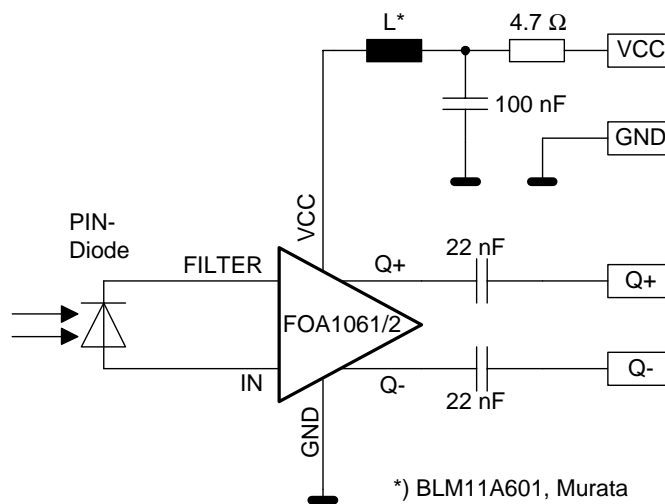
Figure 5 Eye diagrams at input power -20 dBm (top) and -30 dBm (bottom).

**Application notes**

a) General information

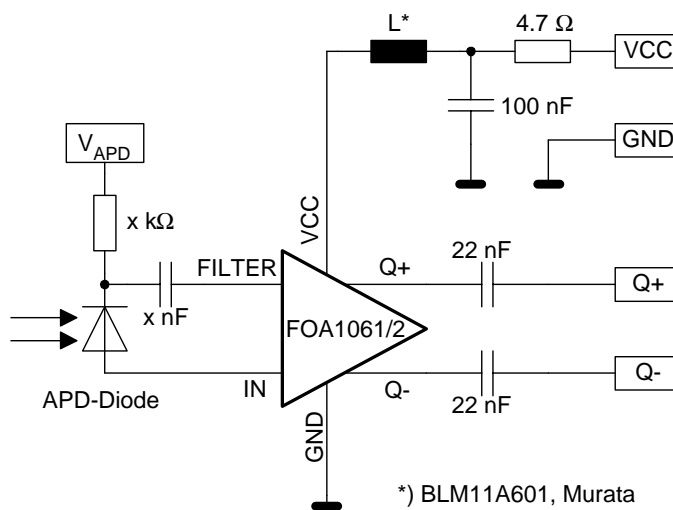
- The output pins  $Q_+$  and  $Q_-$  must be terminated equally to prevent instabilities.
- It is recommended to minimize stray capacitance when connecting photodiode to transimpedance amplifier.
- To improve power supply rejection ratio (PSRR),  $V_{CC}$  should be supplied via resistor ( $4.7 \Omega$ ), capacitor ( $100 \text{ nF}$ ) to GND, and inductor (BLM11A601, Murata) to  $V_{CC}$ -pin.
- The monitor pin (not used in these application notes) must be left open or connected to  $V_{CC}$  via resistor of  $0 \dots 2 \text{ k}\Omega$ .

b)



**Figure 6 Application using PIN-photodiode.**

c)



**Figure 7 Application using APD-photodiode.**

c)

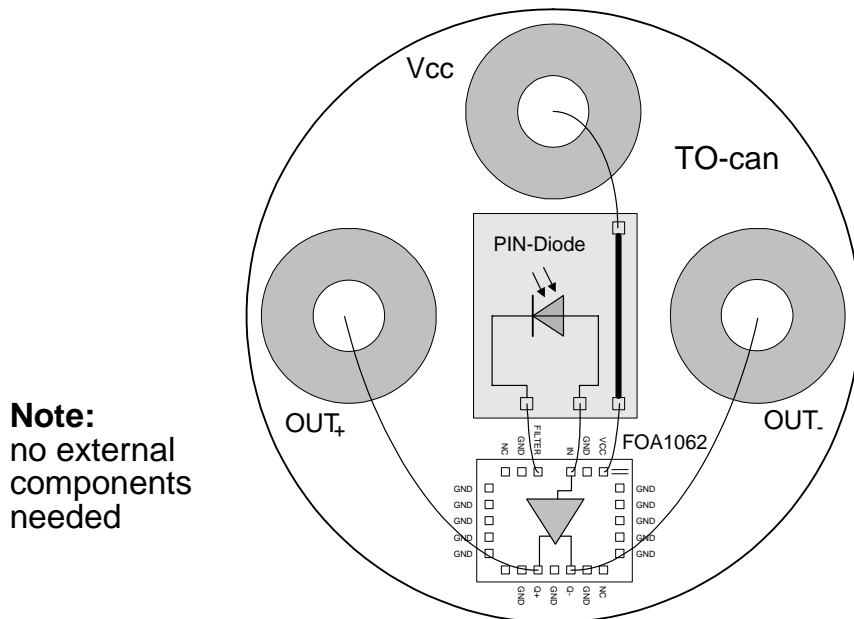
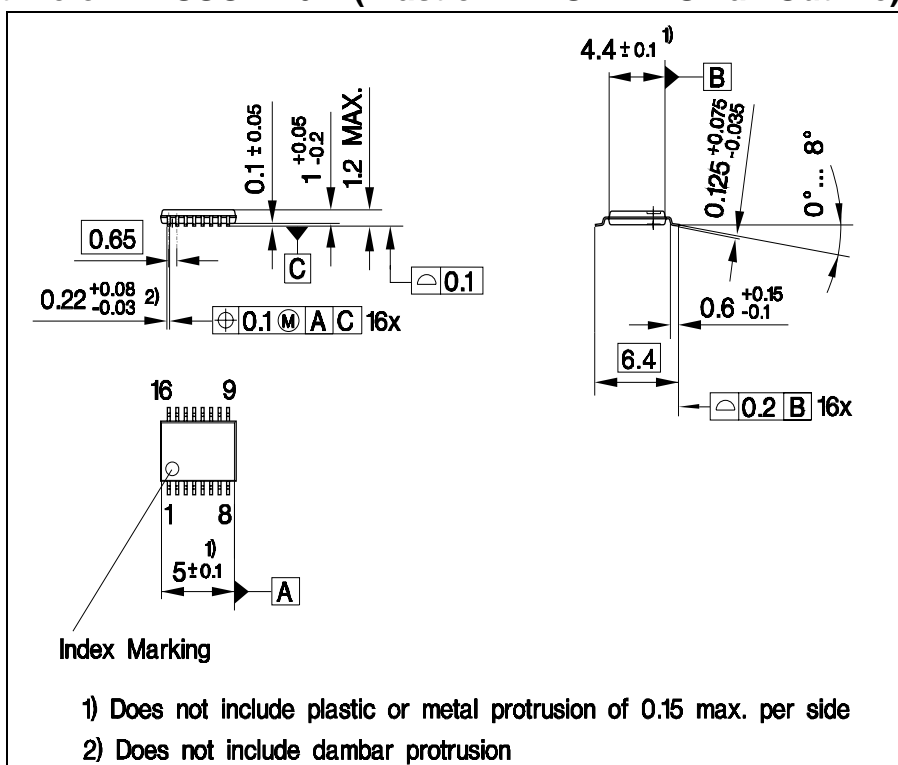


Figure 8 Application example of FOA1062 mounted in TO-can.

Package outline of P-TSSOP-16-1 (Plastic Thin Shrink Small Outline)



Sorts of Packing

For more information on package outlines for tubes, trays, etc. see our Data Book "Package Information" (Ordering No. B192-H663-7400).

SMD = Surface Mounted Device

Dimensions in mm