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## FEATURES

**Bandwidth: 3.5 GHz**  
**Input noise current density: 8 pA/√Hz**  
**Optical sensitivity**  
 –22.0 dBm<sup>1</sup>  
 –20.4 dBm<sup>2</sup>  
**Differential transimpedance: 3700 V/A**  
**Power dissipation: 80 mW**  
**Differential output swing: 260 mV p-p**  
**Input overload current: 5.6 mA p-p**  
**On-chip RSSI function**  
**Low frequency cutoff: 12 kHz**  
**On-chip PD filter: R<sub>F</sub> = 200 Ω, C<sub>F</sub> = 20 pF**  
**Die size: 0.7 mm × 1.2 mm**

## APPLICATIONS

**4.25 Gbps optical receivers**  
**GbE/FC optical receivers**  
**SFF-8472-compliant receivers**  
**PIN/APD-TIA receiver optical subassemblies**

## GENERAL DESCRIPTION

The [ADN2882](#) is a 3.3 V high gain SiGe transimpedance amplifier (TIA) which converts the small signal current of a photo detector to a large differential voltage output. The [ADN2882](#) features a typical 475 nA input-referred noise, enabling an optical sensitivity of –22 dBm (0.85 A/W PIN). With a bandwidth of 3.5 GHz, the [ADN2882](#) allows a data rate operation up to 4.25 Gbps. Typical power dissipation is 80 mW.

To facilitate the assembly in small form factor packages, such as TO-46 headers, the [ADN2882](#) provides an on-chip RC filter (200 Ω, 20 pF) and features a 12 kHz low frequency cutoff without using an external capacitor. An on-chip RSSI circuit, which generates a voltage proportional to the average photodiode current, is available for power monitoring and assembly alignment.

The [ADN2882](#) is available in die form. With a chip area of 1.2 mm × 0.7 mm, the TIA layout is optimized for TO-Can-based packages.

<sup>1</sup> Based on 1550 nm PIN, C<sub>D</sub> = 0.5 ± 0.10 pF, responsivity = 0.85 A/W, ER = 9 dB, PRBS 2<sup>31</sup> – 1 at 4.25 Gbps, BER < 10<sup>-12</sup>.

<sup>2</sup> Calculated result based on an 850 nm PIN, C<sub>D</sub> = 0.5 ± 0.15 pF, responsivity = 0.48 A/W, ER = 9 dB, at 4.25 Gbps, BER < 10<sup>-12</sup>.

## FUNCTIONAL BLOCK DIAGRAM

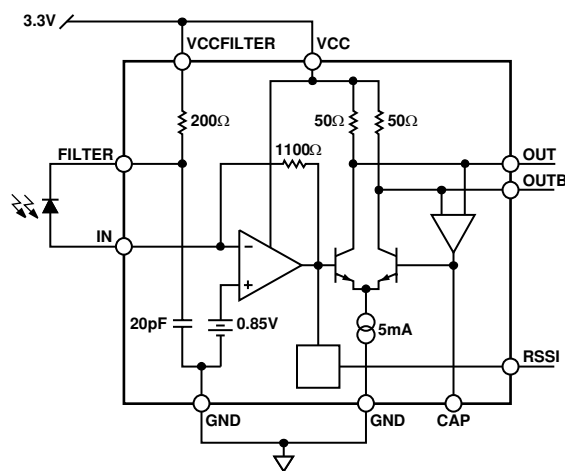


Figure 1.

Rev. A

[Document Feedback](#)

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# ADN2882\* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

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## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- ADN2882 Evaluation Board

## DOCUMENTATION

### Data Sheet

- ADN2882: 4.25 Gbps 3.3V Low Noise Transimpedance Amplifier Data Sheet

## REFERENCE MATERIALS

### Informational

- Optical and High Speed Networking ICs
- SFP Chipset and Reference Design Simplify 4.25 GBPS Transceivers

## DESIGN RESOURCES

- ADN2882 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all ADN2882 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

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**REVISION HISTORY**

**9/14—Rev. 0 to Rev. A**

|                                |    |
|--------------------------------|----|
| Changes to Figure 19.....      | 9  |
| Changes to Figure 22.....      | 10 |
| Changes to Ordering Guide..... | 12 |

**6/05—Revision 0: Initial Version**

## SPECIFICATIONS

Minimum/maximum VCC = 3.3 V  $\pm$  0.3 V, T<sub>AMBIENT</sub> = -40°C to +95°C; typical VCC = 3.3 V, T<sub>AMBIENT</sub> = 25°C, unless otherwise noted.

Table 1.

| Parameter  | Conditions  | Min  | Typ        | Max  | Unit        |
|--|---|------|------------|------|-------------|
| <b>DYNAMIC PERFORMANCE</b>                                 |   |      |            |      |             |
| Bandwidth (BW) <sup>1</sup>                                | -3 dB   | 2.9  | 3.5        |      | GHz         |
| Total Input Referred RMS Noise (I <sub>RMS</sub> )         | C <sub>D</sub> = 0.5 pF, 4.0 GHz low-pass filter                        |      | 475        | 605  | nA          |
| Small Signal Transimpedance (Z <sub>T</sub> ) <sup>1</sup> | 100 MHz, differential   | 2800 | 3700       | 4800 | V/A         |
|  | 100 MHz, single-ended   | 1400 | 1850       | 2400 | V/A         |
| Low Frequency Cutoff                                       | I <sub>IN</sub> = 20 $\mu$ A, CAP open                                  |      | 12         |      | kHz         |
|  | I <sub>IN</sub> = 500 $\mu$ A, CAP open                                 |      | 84         |      | kHz         |
| Output Return Loss   | DC to 4.0 GHz, differential   |      | -25        |      | dB          |
| Input Overload Current                                     | ER = 10 dB  | 3.5  | 5.6        |      | mA p-p      |
| Maximum Differential Output Swing                          | I <sub>IN, P-P</sub> = 2.0 mA   | 170  | 260        | 375  | mV p-p      |
| Output Data Transition Time                                | I <sub>IN, P-P</sub> = 1.0 mA; 20% to 80% rise/fall time                |      | 46         |      | ps          |
| PSRR   | I <sub>IN</sub> = 0 mA, 1 MHz < frequency < 10 MHz                      |      | 40         |      | dB          |
| Group Delay Variation                                      | 1.0 GHz to 4.0 GHz  |      | $\pm$ 12   |      | ps          |
| Transimpedance Ripple                                      | 50 MHz to 1.0 GHz, single-ended   |      | 0.5        |      | dB          |
| Deterministic Jitter                                       | 10 $\mu$ A < I <sub>IN, P-P</sub> $\leq$ 100 $\mu$ A, K28.5 @ 4.25 Gbps |      | 8          |      | ps p-p      |
|  | 100 $\mu$ A < I <sub>IN, P-P</sub> $\leq$ 1.0 mA, K28.5 @ 4.25 Gbps     |      | 15         |      | ps p-p      |
| Linear Output Range  | Differential output, <1 dB compression                                  |      | 190        |      | mV p-p      |
| Linear Input Current Range                                 | Single-ended input, <1 dB compression                                   |      | 45         |      | $\mu$ A p-p |
| <b>DC PERFORMANCE</b>                                      |   |      |            |      |             |
| Power Dissipation  | I <sub>IN, AVE</sub> = 0  |      | 80         | 110  | mW          |
| Input Voltage  | Compliance voltage  |      | 0.85       |      | V           |
| Output Common-Mode Voltage                                 | DC (50 $\Omega$ ) terminated to VCC                                     |      | VCC - 0.12 |      | V           |
| Output Impedance   | Single-ended  |      | 50         |      | $\Omega$    |
| PD Filter Resistance                                       | R <sub>F</sub>  |      | 200        |      | $\Omega$    |
| PD Filter Capacitance                                      | C <sub>F</sub>  |      | 20         |      | pF          |
| RSSI Gain  | I <sub>IN, AVE</sub> = 5 $\mu$ A to 1 mA                                |      | 0.83       |      | V/mA        |
| RSSI Offset  | I <sub>IN, AVE</sub> = 10 $\mu$ A                                       |      | 4.6        |      | mV          |
| RSSI Accuracy  | 5 $\mu$ A < I <sub>IN, P-P</sub> $\leq$ 20 $\mu$ A                      |      | $\pm$ 9    |      | %           |
|  | 20 $\mu$ A < I <sub>IN, P-P</sub> $\leq$ 1 mA                           |      | $\pm$ 3    |      | %           |

<sup>1</sup> A signal current equivalent to I<sub>IN, P-P</sub> = 10  $\mu$ A is applied to the TIA input. No input capacitor is applied.

## ABSOLUTE MAXIMUM RATINGS

Table 2.

| Parameter   | Rating          |
|---|-----------------|
| Supply Voltage (VCC to GND)                         | 5 V             |
| Maximum Voltage to All Input and Output Signal Pins | VCC + 0.4 V     |
| Minimum Voltage to All Input and Output Signal Pins | GND – 0.4 V     |
| Maximum Input Current                               | 10 mA           |
| Storage Temperature Range                           | –65°C to +125°C |
| Operating Ambient Temperature Range                 | –40°C to +95°C  |
| Maximum Junction Temperature                        | 125°C           |
| Die Attach Temperature (<30 sec)                    | 410°C           |

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

## PIN LAYOUT AND FUNCTION DESCRIPTIONS

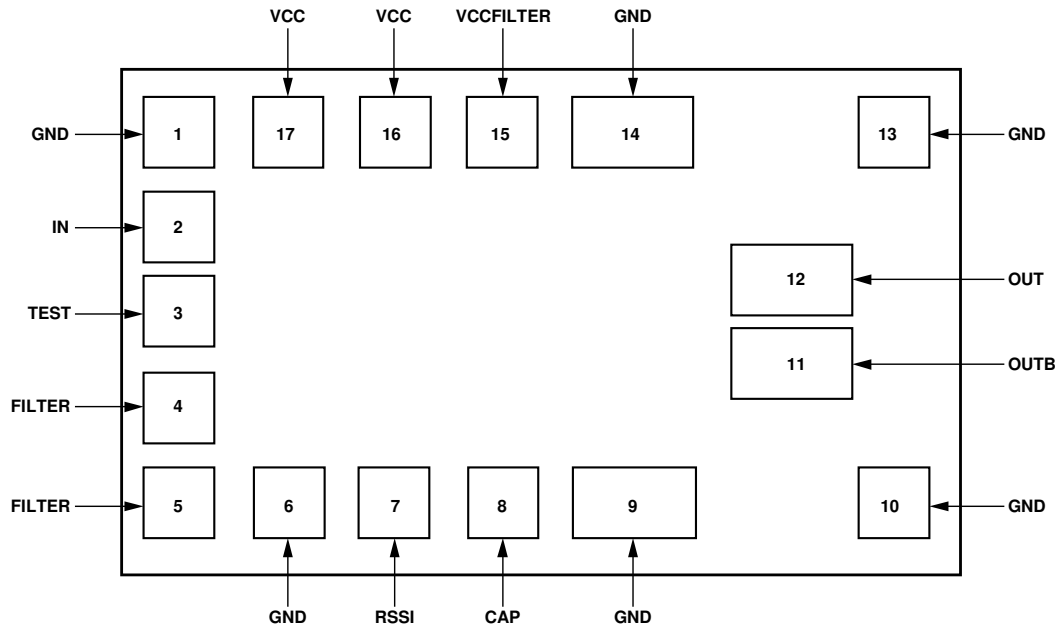


Figure 2. Pad Layout

Table 3. Pad Function Descriptions

| Pad No. | Mnemonic  | Pin Type <sup>1</sup> | Description   |
|---------|-----------|-----------------------|---|
| 1       | GND       | P                     | Ground. (Input return.)   |
| 2       | IN        | AI                    | Current Input. Bond directly to a photodiode (PD) anode.  |
| 3       | TEST      | AI                    | Test Probe Pad. Do not connect.   |
| 4       | FILTER    | AO                    | Filter Output. Pad 4 and Pad 5 are metal connected. Optional bond to a PD cathode.  |
| 5       | FILTER    | AO                    | Filter Output. Pad 4 and Pad 5 are metal connected. Optional bond to a PD cathode.  |
| 6       | GND       | P                     | Ground.   |
| 7       | RSSI      | AO                    | Voltage Output. Provides average input current monitoring. Leave it open, if not used.  |
| 8       | CAP       | AI                    | Leave This Pin Open for Non-SONET Applications. For SONET applications, see Figure 10 and contact sales for assembly details. |
| 9       | GND       | P                     | Ground. (Output return.)  |
| 10      | GND       | P                     | Ground. (Output return.)  |
| 11      | OUTB      | AO                    | Negative Output, CML, On-Chip 50 $\Omega$ Termination (AC or DC Termination).   |
| 12      | OUT       | AO                    | Positive Output, CML, On-Chip 50 $\Omega$ Termination (AC or DC Termination).   |
| 13      | GND       | P                     | Ground. (Output return.)  |
| 14      | GND       | P                     | Ground. (Output return.)  |
| 15      | VCCFILTER | P                     | On-Chip Filter Supply. Connect to VCC to Enable On-Chip RC Filter (200 $\Omega$ , 20 pF). Leave it open, if not used.         |
| 16      | VCC       | P                     | 3.3 V Power Supply. Place a 200 pF, RF decoupling capacitor close to the power pad to reduce the power noise.                 |
| 17      | VCC       | P                     | 3.3 V Power Supply. Place a 200 pF, RF decoupling capacitor close to the power pad to reduce the power noise.                 |

<sup>1</sup> P = power; AI = analog input; and AO = analog output.

TYPICAL PERFORMANCE CHARACTERISTICS

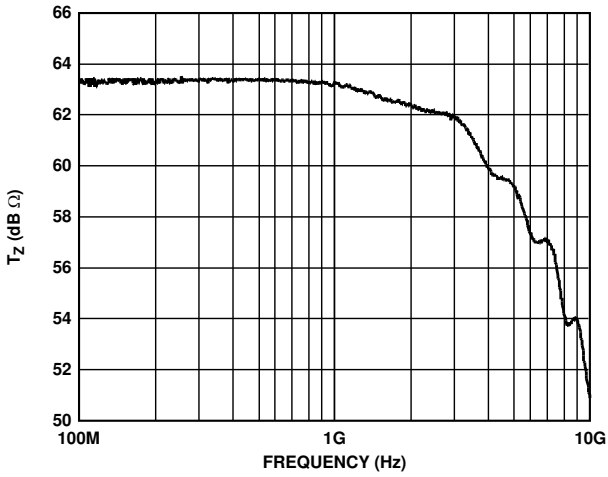


Figure 3. Single-Ended Transimpedance vs. Frequency

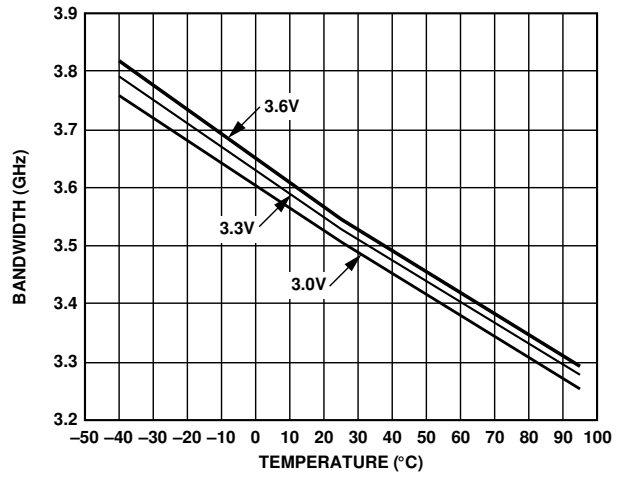


Figure 6. Bandwidth vs. VCC and Temperature

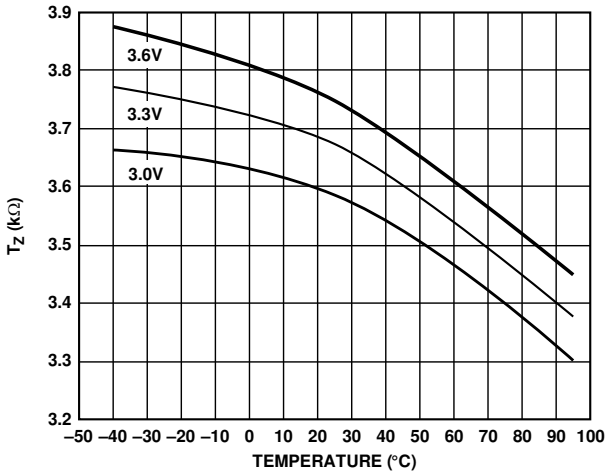


Figure 4. Differential Transimpedance vs. VCC and Temperature

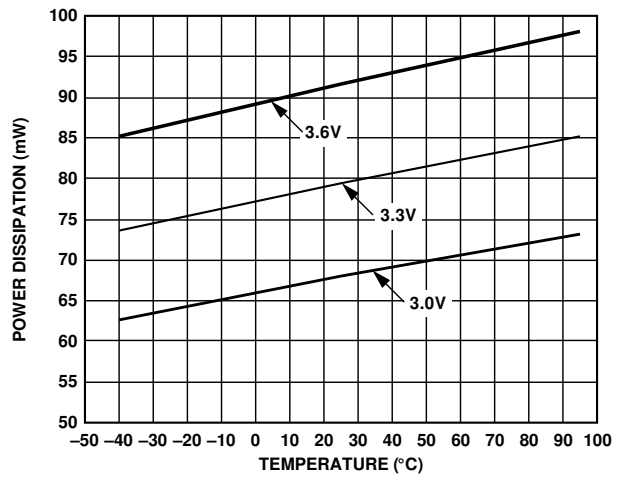


Figure 7. Power Dissipation vs. VCC and Temperature

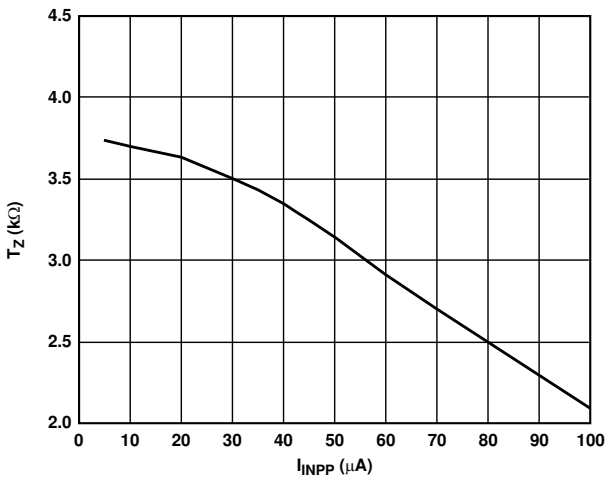


Figure 5. Differential Transimpedance vs. Input Current

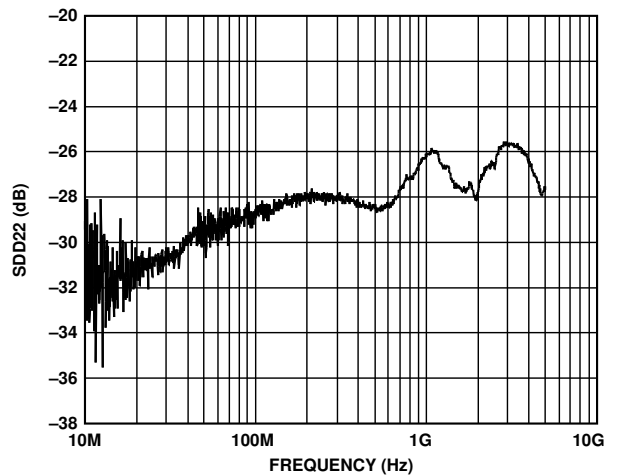


Figure 8. SDD22 vs. Frequency Up to 5 GHz, CAP = Open



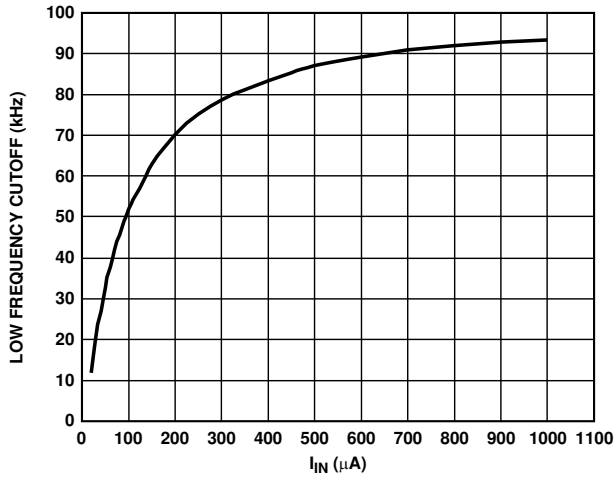


Figure 9. Low Frequency Cutoff vs. Input Current (CAP = OPEN)

04946-012

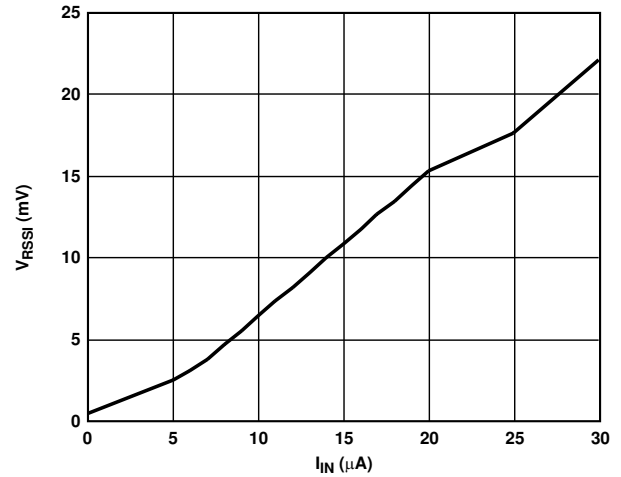


Figure 12. RSSI Voltage Output vs. Input Current (0  $\mu$ A to 30  $\mu$ A)

04946-015

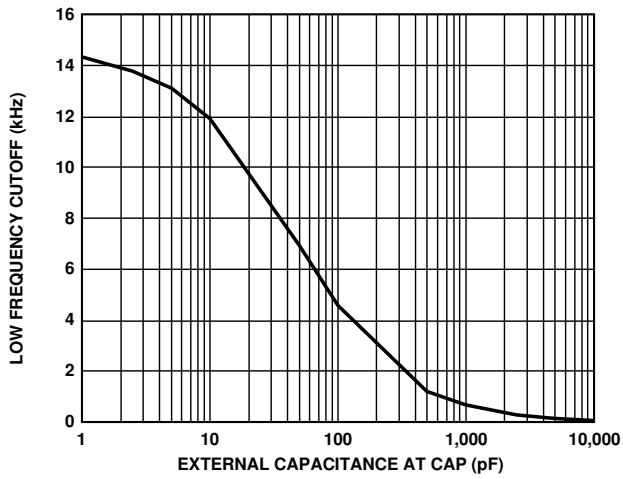


Figure 10. Low Frequency Cutoff vs. External Capacitance at CAP

04946-033

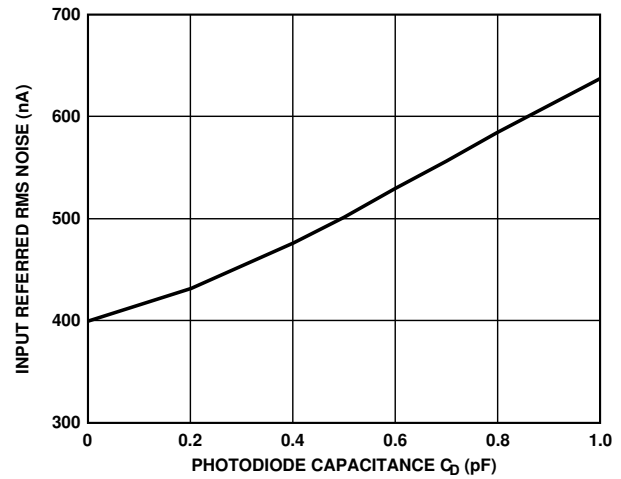


Figure 13. Input Referred Noise (DC to 4.0 GHz) vs. PD Capacitance

04946-016

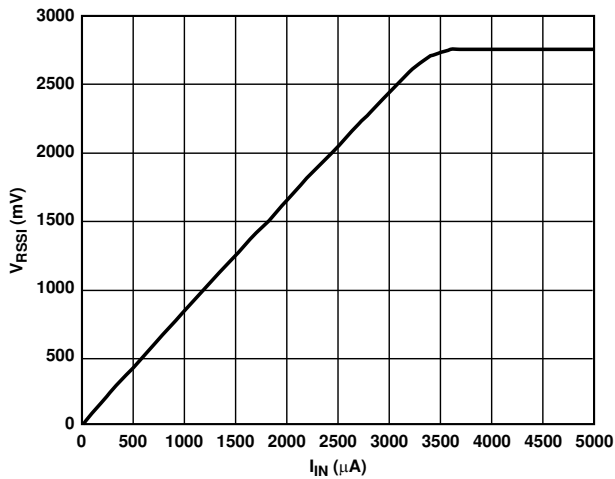


Figure 11. Full-Scale of RSSI Voltage Output vs. Input Current

04946-013

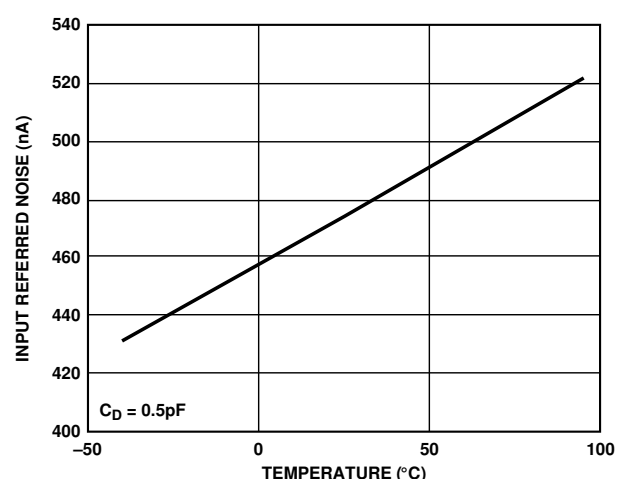


Figure 14. Input Referred Noise vs. Temperature

04946-017

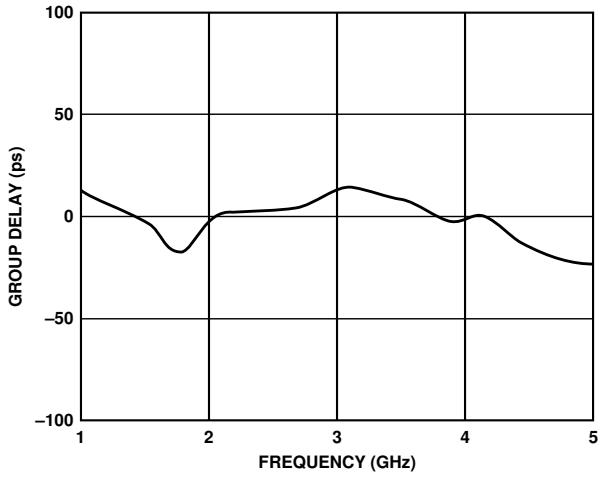


Figure 15. Group Delay vs. Frequency

04946-018

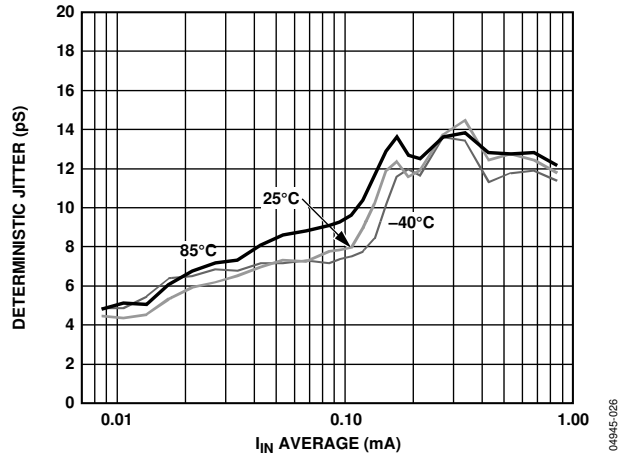


Figure 17. Deterministic Jitter vs. Input Current (K28.5 @ 4.25 Gbps)

04946-026

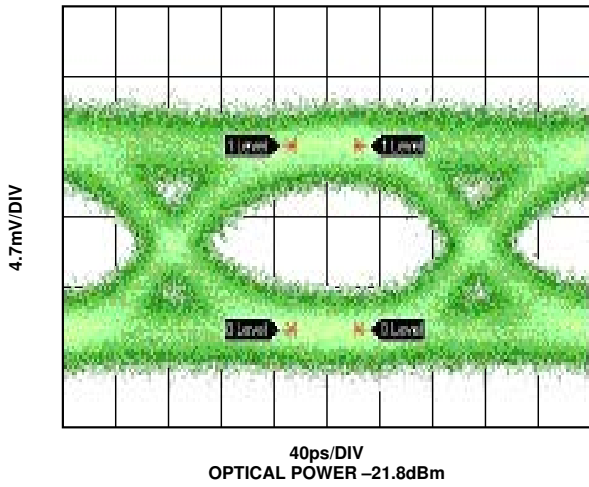
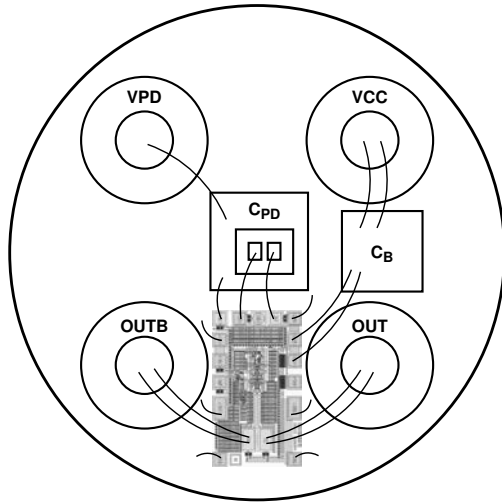


Figure 16. Output Eye at 4.25 Gbps  
(1550 nm PD with Responsivity = 0.85 A/W,  
ER = 9 dB, PRBS  $2^{31} - 1$ , BER <  $10^{-12}$ )

04946-019

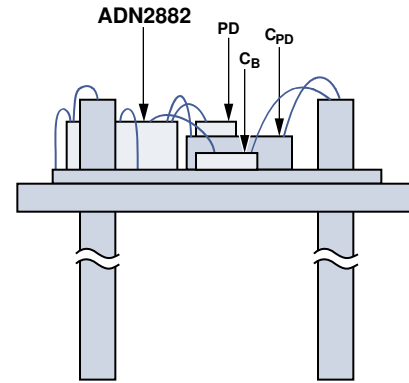
### 5-PIN TO-46 ASSEMBLY RECOMMENDATIONS

Contact sales for more details.



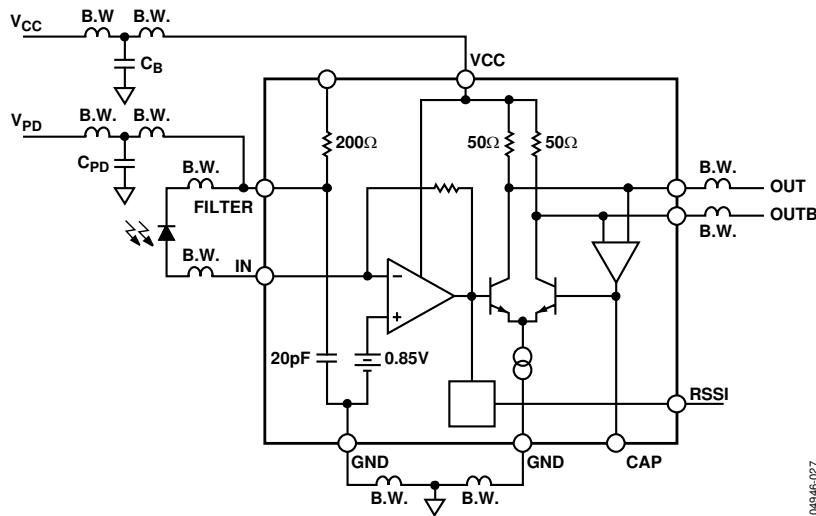
04946-003

Figure 18. 5-Pin TO-46 with External Photodiode Supply VPD



04946-031

Figure 19. Side View of the Assembly



04946-027

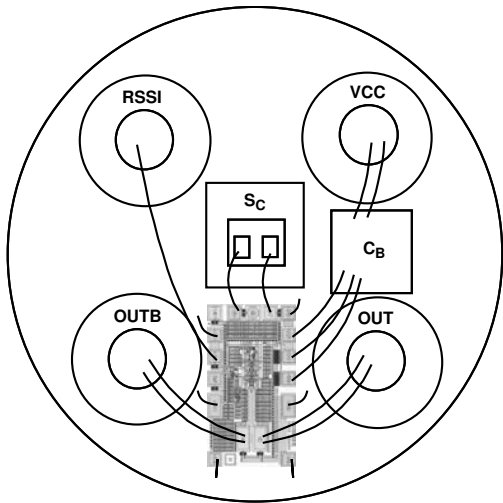
Figure 20. Equivalent Circuit of Assembly Including Bond Wires

Table 4. Bill of Materials (BOM)

| Component       | Description   |
|-----------------|---|
| PD              | 1× vendor specific, 4.25 Gbps, photodiode                         |
| TIA             | 1× ADN2882 (0.7 mm × 1.2 mm), 4.25 Gbps, transimpedance amplifier |
| C <sub>B</sub>  | 1× 200 pF, RF single-layer capacitor                              |
| C <sub>PD</sub> | 1× 560 pF, RF single-layer capacitor                              |

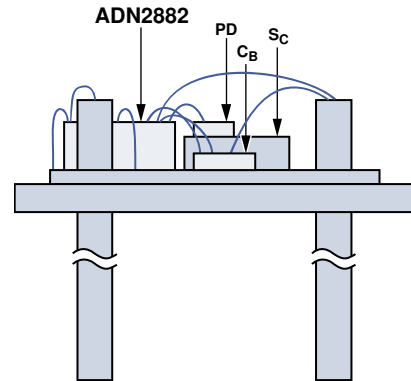
#### Notes

- One mil thickness gold wire, ball bond recommended.
- Minimize all GND bond-wire lengths.
- Minimize IN, FILTER, OUT, and OUTB bond-wire lengths.
- Maintain symmetry in length and orientation between OUT and OUTB bond wires.
- Maintain symmetry between IN/FILTER and OUT/OUTB bond wires.



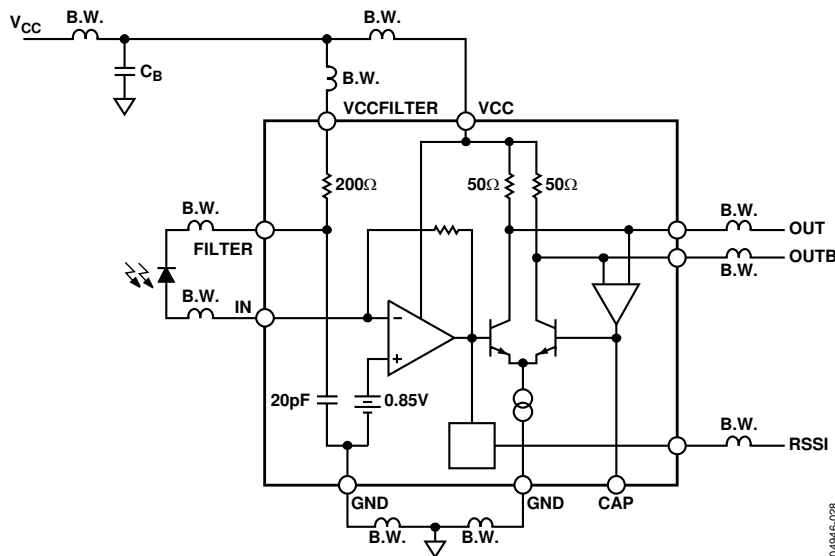
04946-023

Figure 21. 5-Pin TO-46 with Internal PD Biasing and RSSI Output



04946-022

Figure 22. Side View of the Assembly



04946-028

Figure 23. Equivalent Circuit of the Assembly Including Bond Wires

Table 5. Bill of Materials (BOM)

| Component      | Description   |
|----------------|---|
| PD             | 1× vendor specific, 4.25 Gbps, photodiode                         |
| TIA            | 1× ADN2882 (0.7 mm × 1.2 mm), 4.25 Gbps, transimpedance amplifier |
| C <sub>B</sub> | 1× 200 pF, RF single-layer capacitor                              |
| S <sub>C</sub> | 1× ceramic standoff or 1× optional capacitor                      |

Notes

- One mil thickness gold wire, ball bond recommended.
- Minimize all GND bond-wire lengths.
- Minimize IN, FILTER, OUT, and OUTB bond-wire lengths.
- Maintain symmetry in length and orientation between OUT and OUTB bond wires.
- Maintain symmetry between IN/FILTER and OUT/OUTB bond wires.

### 4-PIN TO-46 ASSEMBLY RECOMMENDATIONS

Contact sales for more details.

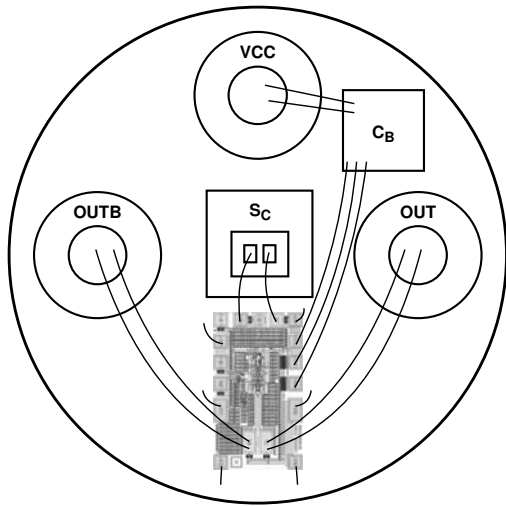


Figure 24. 4-Pin TO-46 with Internal PD Biasing

04946-004

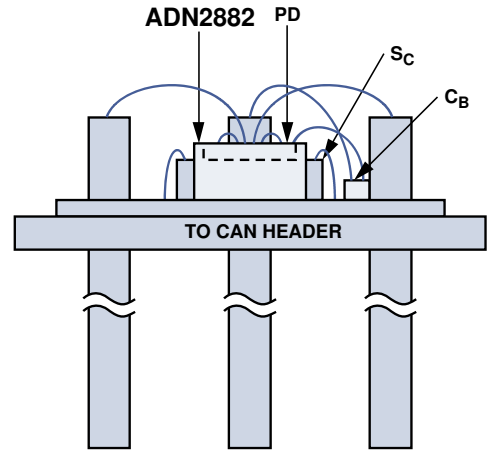


Figure 25. Side View of the Assembly

04946-030

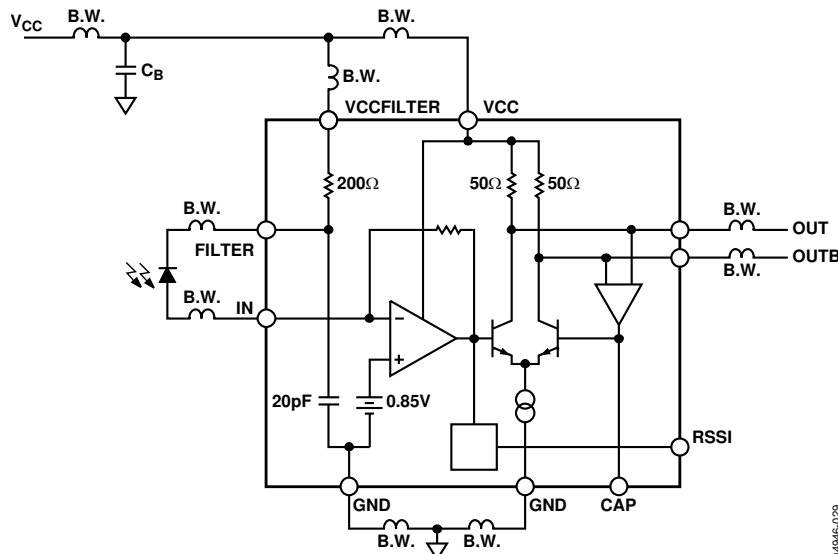


Figure 26. Equivalent Circuit of Assembly Including Bond Wires

04946-029

Table 6. Bill of Materials (BOM)

| Component | Description   |
|-----------|---|
| PD        | 1× vendor specific, 4.25 Gbps, photodiode                         |
| TIA       | 1× ADN2882 (0.7 mm × 1.2 mm), 4.25 Gbps, transimpedance amplifier |
| CB        | 1× 200 pF, RF single-layer capacitor                              |
| SC        | 1× ceramic standoff or 1× optional capacitor                      |

#### Notes

One mil thickness gold wire, ball bond recommended.

Minimize all GND bond-wire lengths.

Minimize IN, FILTER, OUT, and OUTB bond-wire lengths.

Maintain symmetry in length and orientation between OUT and OUTB bond wires.

Maintain symmetry between IN/FILTER and OUT/OUTB bond wires.

## OUTLINE DIMENSIONS

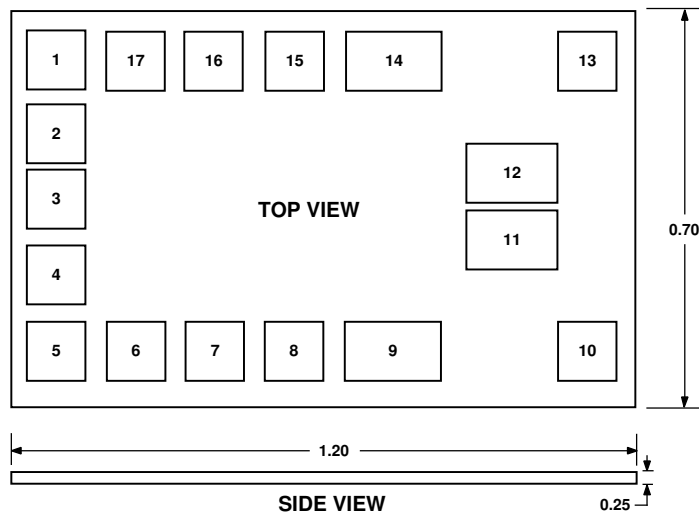


Figure 27. 17-Pad Bare Die Sales [CHIP]  
C-17-1

Dimensions shown in millimeters

Table 7. Pad Coordinates

| Pad No. | Mnemonic  | X ( $\mu\text{m}$ ) | Y ( $\mu\text{m}$ ) |
|---------|-----------|---------------------|---------------------|
| 1       | GND       | -500                | +260                |
| 2       | IN        | -500                | +130                |
| 3       | TEST      | -500                | +10                 |
| 4       | FILTER    | -500                | -120                |
| 5       | FILTER    | -500                | -260                |
| 6       | GND       | -350                | -260                |
| 7       | RSSI      | -200                | -260                |
| 8       | CAP       | -50                 | -260                |
| 9       | GND       | +130                | -260                |
| 10      | GND       | +500                | -260                |
| 11      | OUTB      | +350                | -60                 |
| 12      | OUT       | +350                | +60                 |
| 13      | GND       | +500                | +260                |
| 14      | GND       | +130                | +260                |
| 15      | VCCFILTER | -50                 | +260                |
| 16      | VCC       | -200                | +260                |
| 17      | VCC       | -350                | +260                |

## DIE INFORMATION

**Die Size**

0.7 mm  $\times$  1.2 mm (edge to edge, including 1 mil scribe)

**Die Thickness**

10 mils = 0.25 mm

**Passivation Openings**

0.075 mm  $\times$  0.075 mm (Pad 1 to 8, 10, 13, and Pad 15 to 17)

0.144 mm  $\times$  0.075 mm (Pad 9, 11, 12, and Pad 14)

**Passivation Composition**

5000 Å Si<sub>3</sub>N<sub>4</sub> (top)

5000 Å SiO<sub>2</sub> (bottom)

**Pad Composition**

Al/1%Cu

**Substrate Contact**

To ground

## ORDERING GUIDE

| Model         | Temperature    | MOQ   | Description <sup>1</sup>                 | Package Option |
|---------------|----------------|-------|--|----------------|
| ADN2882ACHIPS | -40°C to +95°C | 200   | 17-Pad Die Sales                         | C-17-1         |
| ADN2882A-DF   | -40°C to +95°C | 5,704 | Reconstituted die on 8" metal film frame |                |

<sup>1</sup> Contact Analog Devices, Inc., sales for more information on the film frame ADM2882A-DF.