3.2 Gbps 3.3 V Low Noise Transimpedance Amplifier

Preliminary Technical Data

ADN2880

FEATURES

Technology: high performance SiGe
Bandwidth: 2.1GHz minimum
Input noise current density: 8 pA√Hz
Optical sensitivity: –24 dBm
Differential transimpedance: 5000 V/A
Power dissipation: 75 mW
Differential output swing: 250 mV p-p
Input current overload: +3.25 dBm
Output resistance: 50 Ω/side
Low-freq cutoff: 20 kHz
On-chip PD filter: R_F = 200 Ω C_F = 20 pF
RSSI voltage and current ratio: 0.8V/mA
Die size: 0.7 mm × 1.2 mm

APPLICATIONS

3.2 Gbps optical modules
SFF-8472 compliant receivers
PIN/APD-TIA receive optical subassembly
SONET/GbE/FC optical receivers, transceivers, transponders

PRODUCT DESCRIPTION

The ADN2880 is a compact, high performance 3.3 V power supply SiGe transimpedance amplifier (TIA) optimized for small-form-factor pluggable (SFP) optical receivers, up to 3.2 Gbps SFF/SPF optical receivers, and meets OC48 SR/IR sensitivity requirements. The ADN2880 is a single-chip solution for detecting photodiode current with a differential output voltage. The ADN2880 features low input referred noise current of 400 nA enabling –24 dBm sensitivity; 2.1 GHz minimum BW enables up to 3.2 Gbps operation; +3.25 dBm nominal operation at 10 dB extinction ratio. RSSI output signal proportional to average input current is available for monitoring and alarm generation. To facilitate assembly in small form factor packages such as a TO-46 or TO-56 header, the ADN2880 integrates the photodiode filter network on chip and features 20 kHz low frequency cutoff without any external components. The ADN2880 chip area is less than 1 mm^2, operates with a 3.3 V power supply and is available in die form.

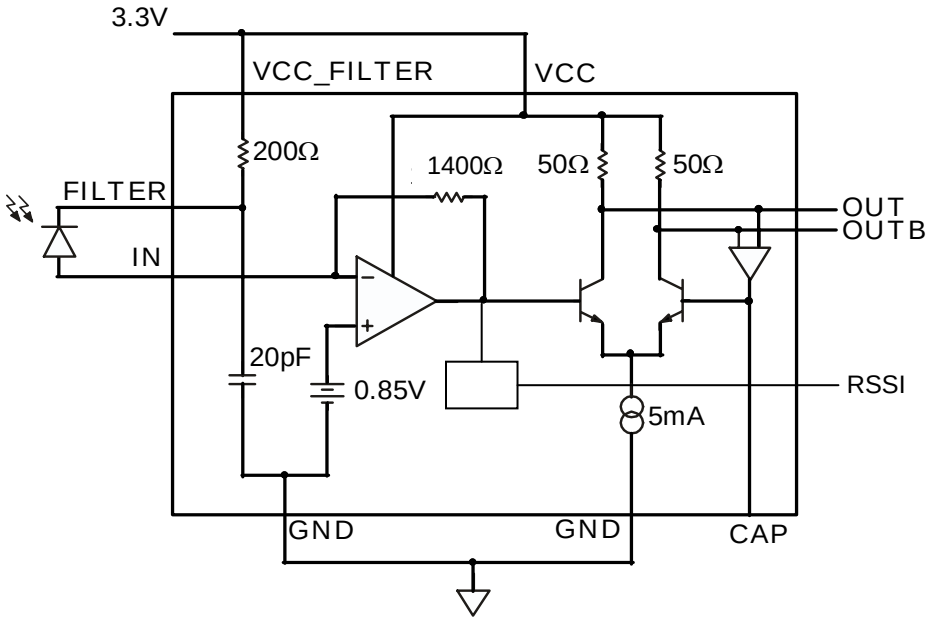

Figure 1. ADN2880 Block Diagram

Rev. PrC

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REVISION HISTORY

07/04—Revision PrB

11/04 – Revision C – RSSI added.

ELECTRICAL SPECIFICATIONS

Table 1.

Parameter	Conditions[1]	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
Bandwidth (BW)[2]	−3 dB	2.1	2.3		GHz
Total Input RMS Noise (I_{RMS})[2]	DC to 3.2 GHz		375	400	nA
Small Signal Transimpedance (Z_T)	100 MHz	4000	5000	6000	V/A
Low Frequency Cutoff	CAP = Open		20		kHz
	CAP = 1nF		2		kHz
Output Return Loss[2]	DC to 3.2 GHz, differential		−20	−12	dB
Input Overload Current[3]	Pavg	TBD	3.25		dBm
Maximum Output Swing	pk-pk diff, $I_{IN,PK-PK}$ = 2.0 mA	180	250	350	mV
Output Data Transition Time	20% to 80% rise/fall time $I_{IN,PK-PK}$ = 2.5 mA		55		ps
PSRR	< 10 MHz		−35		dB
Group Delay Variation	50 MHz to 3.2 GHz		TBD		ps
Transimpedance Ripple	50 MHz to 3.2 GHz		TBD		dB
Total Jitter[2]	10 µA < $I_{IN,PK-PK}$ ≤ 100 µA		TBD	TBD	ps
	100 µA < $I_{IN,PK-PK}$ ≤ 2.0 µA		TBD	TBD	ps
Deterministic Jitter[2]	10 µA < $I_{IN,PK-PK}$ ≤ 100 µA		4		ps
	100 µA < $I_{IN,PK-PK}$ ≤ 2.0 µA		8		ps
DC PERFORMANCE					
Power Dissipation	$I_{IN,AVE}$ = 0 mA	50	75	120	mW
Input Voltage			0.85		V
Output Common-Mode Voltage	DC terminated to Vcc		Vcc – 0.12		V
Output Impedance	Single-ended		50		Ω
PD FILTER Resistance	R_F		200		Ω
PD FILTER Capacitance	C_F		20		pF
RSSI Sensitivity	$I_{IN, AVE}$ = 0 uA to 1 mA		0.8		V/mA
RSSI Offset	$I_{IN, AVE}$ = 0 uA		TBD		mV

[1] Min/Max Vcc = +3.3V ± 0.3V, $T_{ambient}$ = −40 °C to +95°C; Typ Vcc=3.3V, $T_{ambient}$ = +25C

[2] Photodiode capacitance C_D = 0.7 pF ± 0.15 pF, photodiode resistance = 5 Ω input wire bond inductance L_{IN} = 0.3nH ± 0.1nH, Output bond wire inductance $L_{OUT,OUTB}$ = 0.8nH ± 0.1nH Load impedance = 50 Ω (each output, ac-coupled)

[3] 10^{-10} BER, 10dB ER, 0.85 A/W PIN responsivity

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameters	Ratings
Supply Voltage (Vcc to GND)	5 V
Internal Power Dissipation	
Output Short Circuit Duration	TBD
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	165°C
Die Attach Temperature (<60 seconds)	450°C

Stresses above those listed under 'Absolute Maximum Rating' may cause permanent damage to the device. This is a stress rating only and 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. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

PAD DESCRIPTIONS

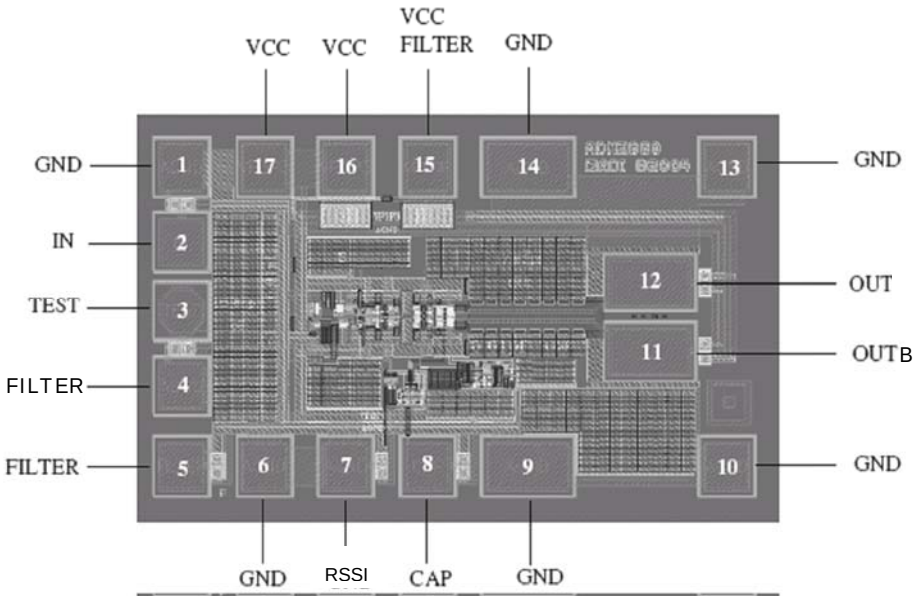

Table 3.

PAD #	PAD	FUNCTION
1	GND	Ground (input return).
2	IN	Current Input. Bond directly to PD anode.
3	TEST	Test Probe Pad. Leave Floating.
4	FILTER	Filter Output.
5	FILTER	Filter Output
6	GND	Ground.
7	RSSI	Voltage Output (provides average input current reading)
8	CAP	Low Frequency Setpoint. Connect with 1 nF capacitance to GND for < 30 kHz.
9	GND	Ground.
10	GND	Ground (output return).
11	OUTB	Negative Output. Drives 50 ohm termination (ac or dc termination).
12	OUT	Positive Output. Drives 50 ohm termination (ac or dc termination).
13	GND	Ground (output return).
14	GND	Ground
15	VCCFILTER	Filter Supply. Connect to Vcc to enable on-chip 200 Ω*20 pf filter.
16	VCC	3.3 V Positive Supply. Recommended bypass to GND is 100 pF RF capacitor.
17	VCC	3.3 V Positive Supply. Recommended bypass to GND is 100 pF RF capacitor.

PAD LAYOUT

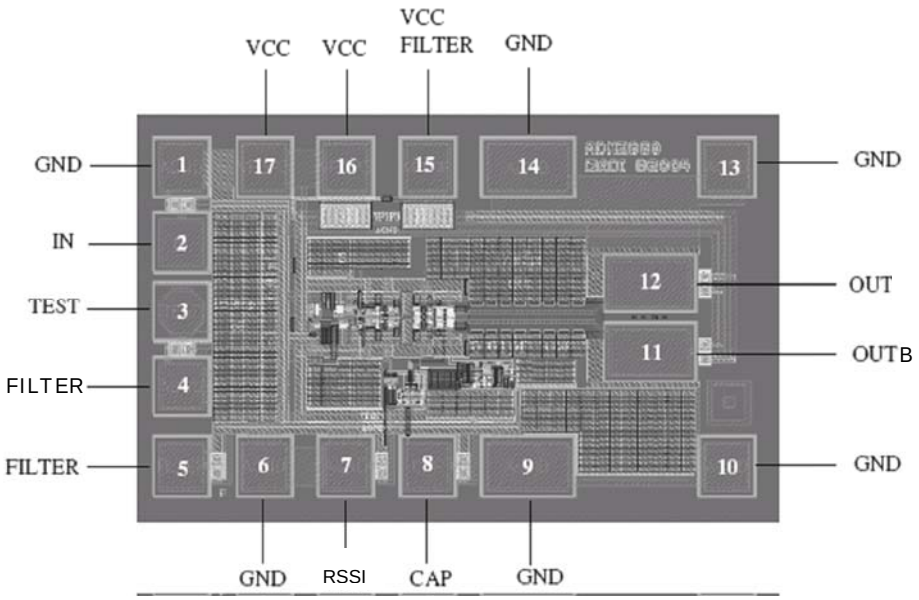

Figure 2.. Pad Layout

PAD COORDINATES

Table 4.

PAD #	PAD	X (um)	Y (um)
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

0.7mm × 1.2mm

(edge-edge including 1mil scribe)

Die Thickness

10mils = 0.25mm

Passivation Openings

0.075 mm × 0.075 mm

(pads 1-8, 9, 10, 13, 15, 16, 17)

0.144mm × 0.075mm

(pads 9, 11, 12, 14)

Passivation Composition

5000Å Si_3N_4 (top)

+5000 Å SiO_2 (bot)

Pad Composition

Al/1%Cu

Backside Contact

ASSEMBLY RECOMMENDATIONS

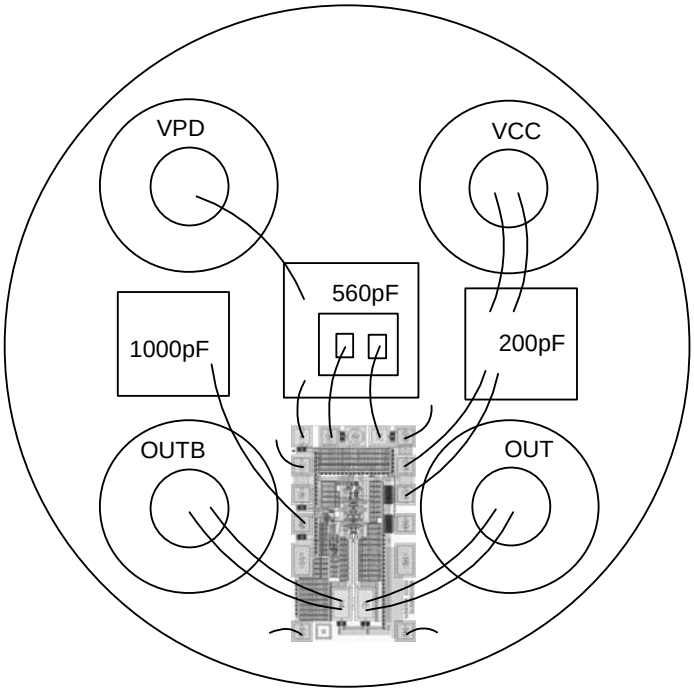

Figure 3. 5-Pin TO-46 with External Photodiode Supply V_{PD} Connected through FILTER Pin

1× Vendor Specific (0.3 mm × 0.3 mm) 2.5 Gbps Photo Diode

1× ADN2880 (0.7mm × 1.2 mm) Analog Devices SiGe 3.2 Gbps Transimpedance Amplifier

1× 200 pF RF Single-Layer Capacitor

1× 560 pF RF Single Layer Capacitor

1x 1000pF Ceramic Capacitor

Notes

Minimize all GND bond wire lengths

Minimize IN, OUT and OUTB bond wire lengths

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

Maintain symmetry between IN and OUT/OUTB bond wires

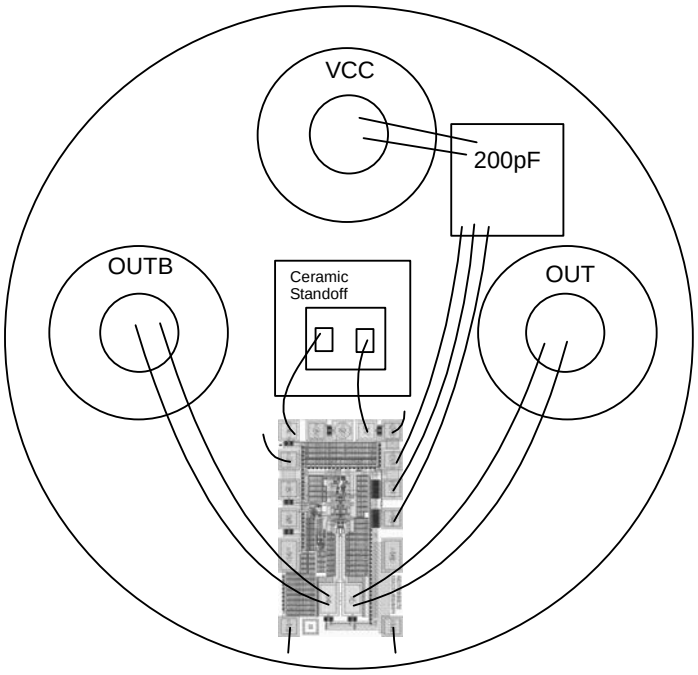

Figure 4. Recommended Layout of 4-Pin TO-46

1× Vendor Specific (0.3 mm × 0.3 mm) 2.5 Gbps Photo Diode

1× ADN2880 (0.7mm × 1.2 mm) Analog Devices SiGe 3.2 Gbps Transimpedance Amplifier

1× 200 pF RF Single-Layer Capacitor

1× Ceramic Standoff

1x 1000pF Ceramic Capacitor

Notes

Minimize all GND bond wire lengths

Minimize IN, OUT and OUTB bond wire lengths

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

Maintain symmetry between IN and OUT/OUTB bond wires

ORDERING GUIDE

Model	Temperature	Package Description	Package Option
ADN2880XCHIPS-WP	-40°C to 95°C	NA	Tested Die

PR04945–0–11/04(PrC)

ANALOG DEVICES

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