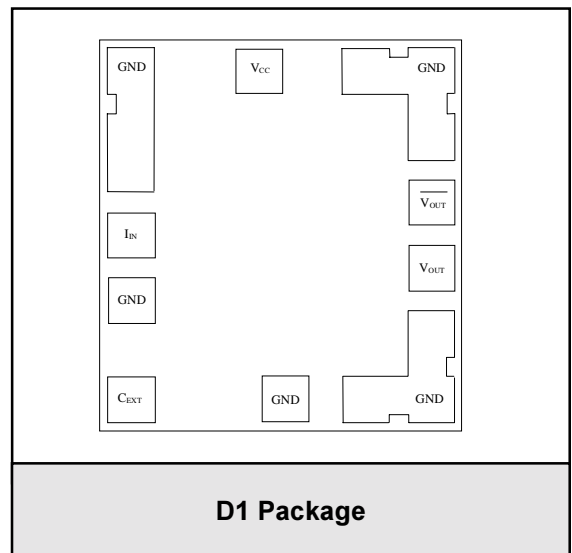


FEATURES

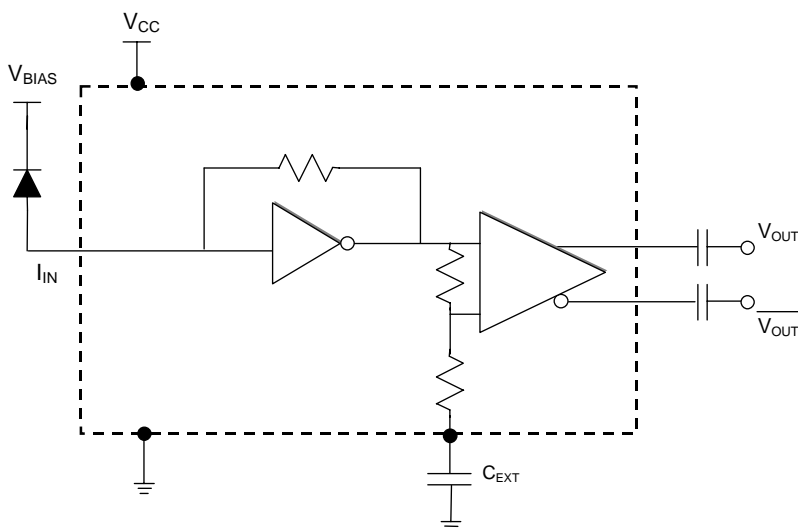
- 10 Gb/s Differential Output TIA
- +5V Power Supply
- Low Group Delay
- Small Size: 0.85mm x 0.914mm
- 325mW (typ) power dissipation

APPLICATIONS

- SONET OC-192
- 10 Gb/s DWDM
- 10 Gb/s Ethernet


Product Description

The ANADIGICS ATA7601D1 is a 5V high-speed to convert an optical signal into a differential voltage transimpedance amplifier (TIA) for 10 Gb/s that must be AC coupled to a post amplifier. With its applications available in bare die form and low input noise, a sensitivity of better than -19dBm manufactured using an InGaP HBT process. (BER <math><10^{-10}</math>) can be achieved with the ATA7601D1. The device is used in conjunction with a photodetector

Figure 1: Circuit Block Diagram


Absolute Maximum Ratings

V_{CC}	7.0V
I_{IN}	4mApp
T_S	Storage Temp -65 °C to 125 °C

Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT
Operating Voltage Range	+4.75	+5.0	+5.25	V
Operating Temperature Range ⁽¹⁾	-40		85	°C

1. Defined at the interface between the die and the substrate.

DC Characteristics

PARAMETER	MIN	TYP	MAX	UNIT
Input Offset Voltage		1.35		V
Output Offset Voltage		3.0		V
Supply Current		65	95	mA
Power Dissipation		325	500	mW

AC Characteristics⁽²⁾

PARAMETER	MIN	TYP	MAX	UNIT
Small Signal Differential Transresistance (RL - 100Ω)	900	1100		Ω
Bandwidth (-3dB)	8.0	9.0		GHz
Low Frequency Cutoff ⁽³⁾		30		kHz
Group Delay (1MHz to 8GHz)	-25		+25	ps
Optical Sensitivity ⁽⁴⁾		-19.5		dBm
Input Noise Current (RMS) ⁽⁵⁾			1.8	μA
Optical Overload ⁽⁴⁾	-3	-2		dBm
Input Current at which Output Limits ⁽⁶⁾		350		μA
Maximum Differential Output Voltage			400	mV
Output Return Loss (1MHz to 10GHz)	10			dB

2. The specifications are based upon the use of a PIN photodetector with a responsivity at 1550nm of 0.85A/W and a capacitance of $C_{DIODE} + C_{STRAY} = 0.3pF$ max connected to I_{IN} via a 0.8nH bond wire.

3. With the use of an external capacitor.

4. Measured at 10^{-10} BER with a $2^{23} - 1$ PRBS at 10Gb/s.

5. 11GHz bandwidth.

6. Defined as 80% of the maximum output voltage.

Pad Description

PAD	DESCRIPTION	COMMENT
V_{CC}	Positive Supply Voltage	+5.0V
I_{IN}	TIA Input	Photocurrent input
C_{EXT}	Connection for an external Capacitor	Sets the low frequency cutoff
V_{OUT}	TIA Output Voltage (Non-inverted)	Logical '1' with optical input
$\overline{V_{OUT}}$	TIA Output Voltage (inverted)	Logical '0' with optical input

Figure 2: Die Size and Layout

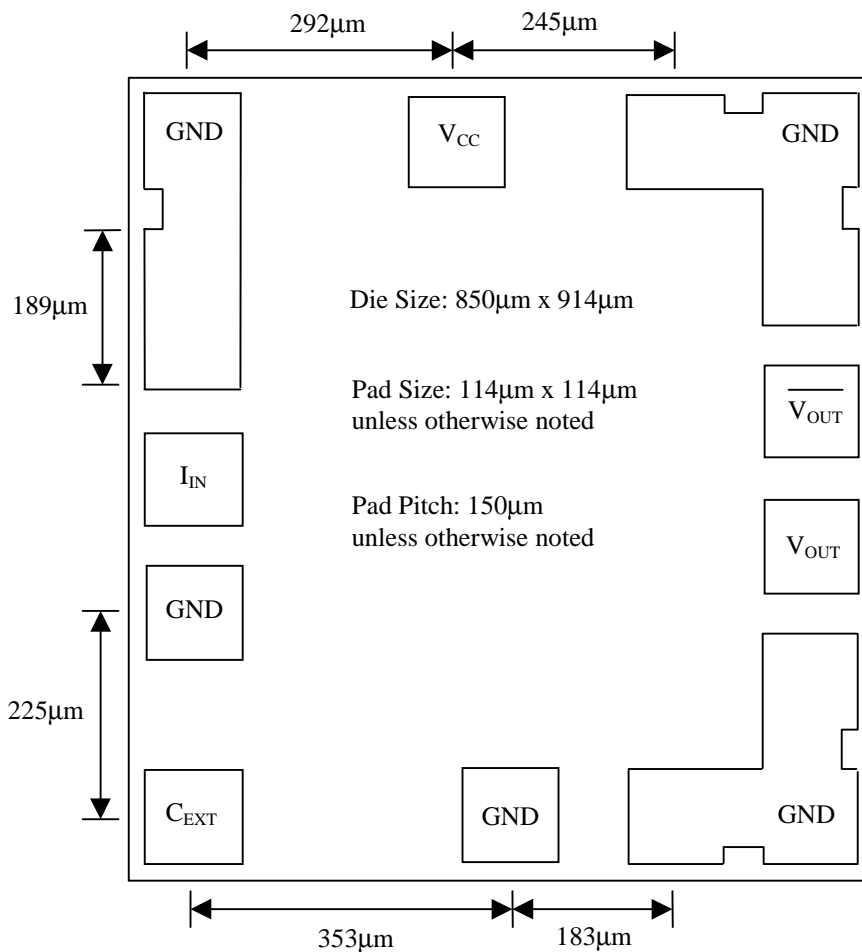


Figure 3: External Capacitor Required for Low Frequency Cutoff

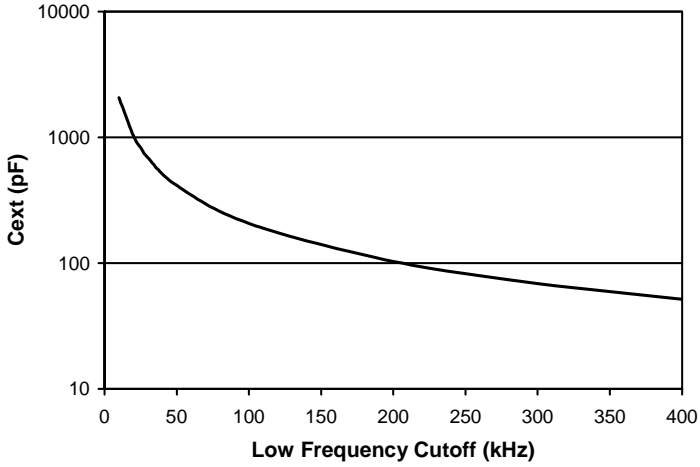


Figure 4: Eye Diagram with an Optical Input Power of -19dBm

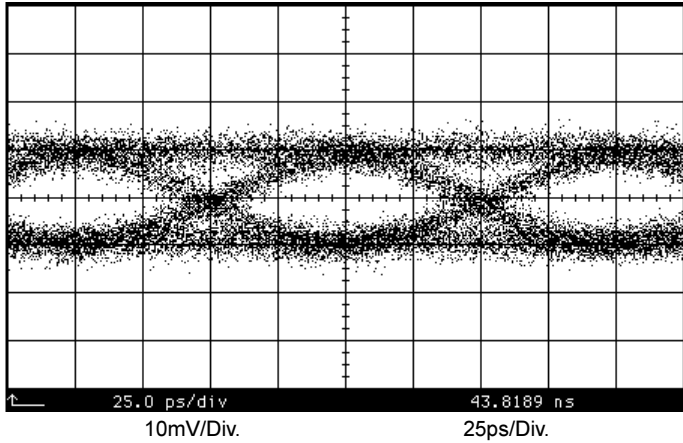


Figure 5: Eye Diagram with an Optical Input Power of -9dBm

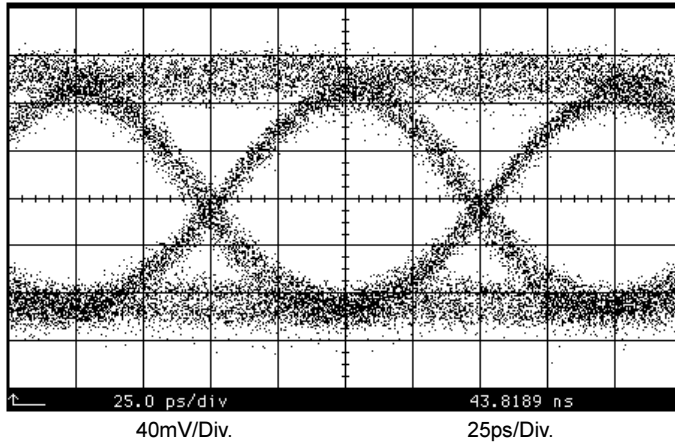


Figure 6: Eye Diagram with an Optical Input Power of -4dBm

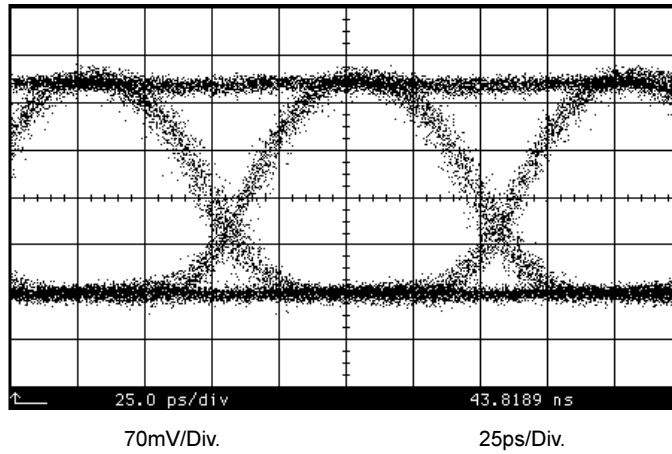


Figure 7: Differential Output Voltage vs. Input Current

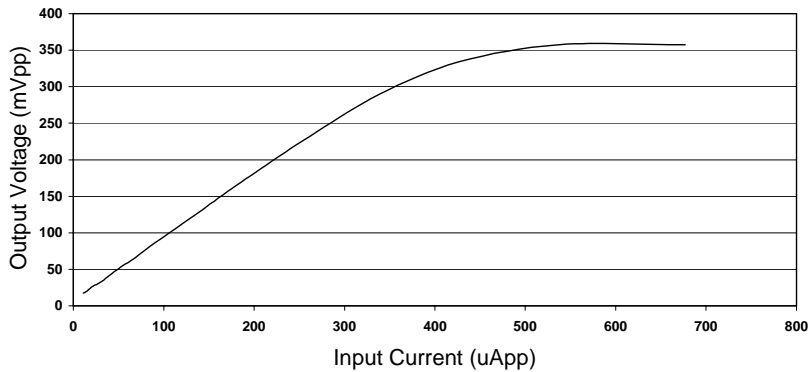
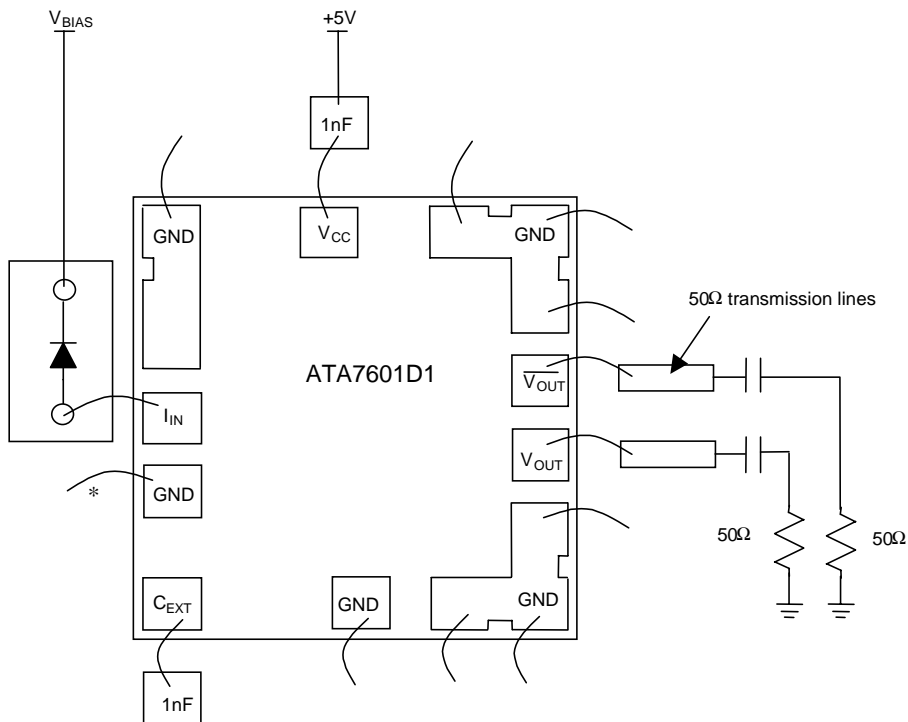


Figure 8: Typical Bonding Diagram
Application Information



* This ground bond can be omitted if it interferes with the placement of the photodetector.

Packaging

The ATA7601D1 is provided as bare die. For optimum performance, the die should be packaged in a hermetic enclosure and a low inductance ground plane should be made available for power supply bypassing and ground bonds. The bond wire from the photodetector to I_{IN} should be made as short as possible. As the inductance of this connection increases beyond 1nH, more gain peaking will occur and the group delay performance will degrade.

Output Connections

The ATA7601D1 provides a differential output that must be AC coupled to the next stage of the receiver as the output buffer is not designed to drive a DC coupled 50 Ω load. For single-ended applications, one output of the ATA7601D1 must be AC terminated to a 50 Ω load.

C_{EXT} Connection

In order to achieve the desired low frequency cutoff, an external capacitor is required. A low inductance surface mount chip capacitor or MIM capacitor is recommended.

Sensitivity Measurement

The typical sensitivity, as specified in the AC characteristics, is -19.5dBm. This was measured at a BER of 10^{-10} with a 10Gb/s, $2^{23}-1$ PRBS, using a lensed single mode fiber with the photodetector and TIA in an open test fixture under the following conditions:

- Photodetector active area: 32 μ m
- Photodetector capacitance: 0.2pF
- Photodetector responsivity: 0.85A/W
- Lensed fiber beam width: 13 μ m (86.5% of contained power)
- Lensed fiber focal distance: 3mm

When the photodetector and TIA are packaged in a hermetic enclosure, with the fiber optimally aligned to the active area of the photodiode, an improvement in sensitivity should be observed.

Device Modeling and Simulation

S-parameter files of the TIA are available on the Anadigics web site (<http://www.anadigics.com>) or upon request. Also included on the web-site is a "virtual sample". This is an encrypted model of the TIA that can be downloaded into the ADS simulation environment.



ANADIGICS, Inc.

141 Mount Bethel Road

Warren, New Jersey 07059, U.S.A

Tel: +1 (908) 668-5000

Fax: +1 (908) 668-5132

<http://www.anadigics.com>

Mktg@anadigics.com

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