ATA7601

5.0V 10 Gb/s TIA

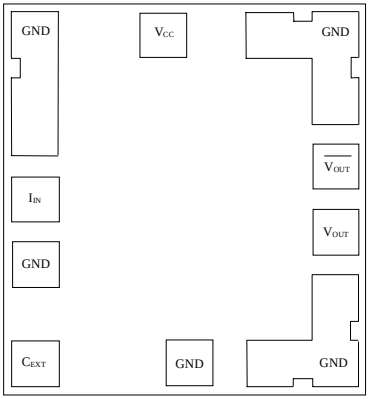
PRELIMINARY DATA SHEET - Rev 2

FEATURES

- 10 Gb/s Differential Output TIA
- +5V Power Supply
- Low Group Delay
- Small Size: 0.95mm x 1.014mm
- 340mW (typ) power dissipation

APPLICATIONS

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



D1
Die Package

PRODUCT DESCRIPTION

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

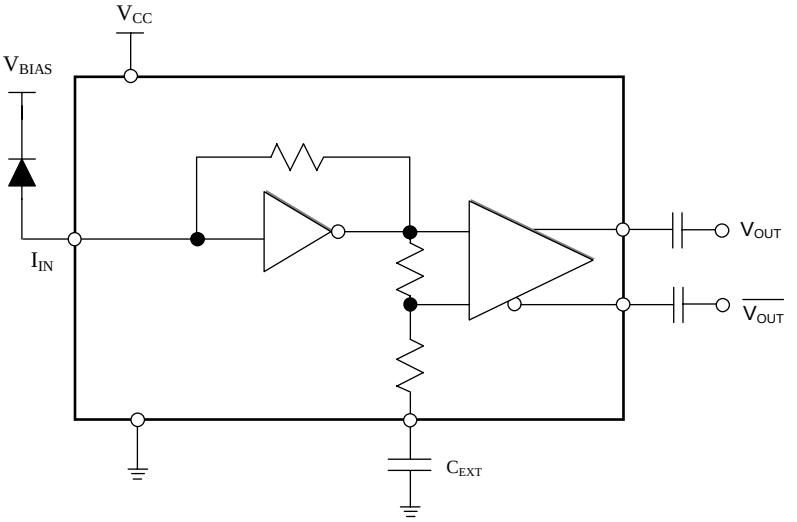


Figure 1: Circuit Block Diagram

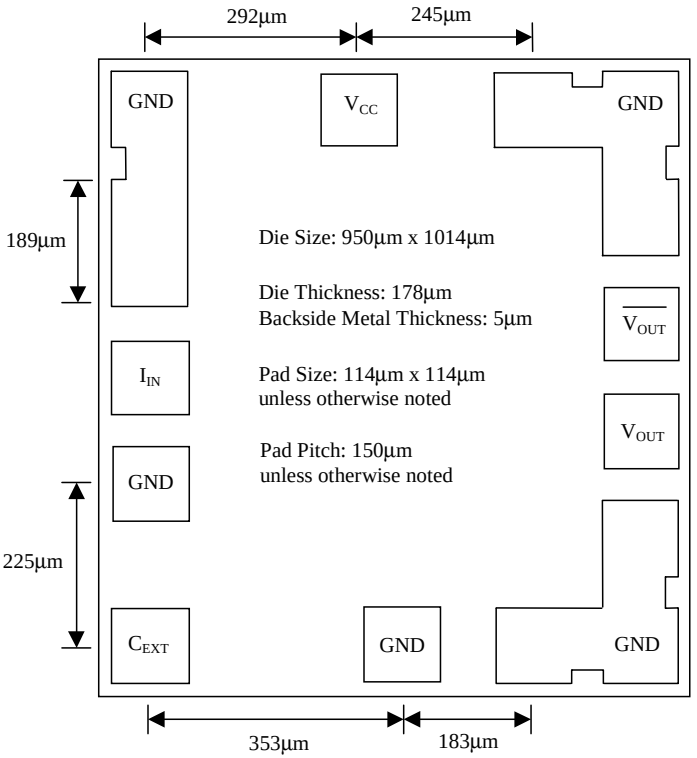


Figure 2: Die Size and Layout

Table 1: 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

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Maximum Ratings

PAD	COMMENT
V_{CC}	7.0V
I_{IN}	3mApp
T_S	Storage Temp -65 °C to 125 °C

Table 3: Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT
Operating Voltage Range	+4.75	+5.0	+5.25	V
Operating Temperature Range(1)	-10		85	°C
Die Attach Temperature			260	°C

The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

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

Table 4: DC Electrical Specifications

PARAMETER	MIN	TYP	MAX	UNIT
Input Offset Voltage		1.35		V
Output Offset Voltage		3.0		V
Supply Current		68	95	mA
Power Dissipation		340	525	mW

Table 5: AC Electrical Specifications [2]

PARAMETER	MIN	TYP	MAX	UNIT
Small Signal Differential Transresistance (RL - 100Ω)	800	1000		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		dBm
Input Noise Current (RMS) [5]			1.8	µA
Optical Overload [4]	-3	-2		dBm
Input Current at which Output Limits [6]		400		µA
Maximum Differential Output Voltage		525	700	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 0.8A/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.*

PERFORMANCE DATA

Figure 3: External Capacitor Required for Low Frequency Cutoff

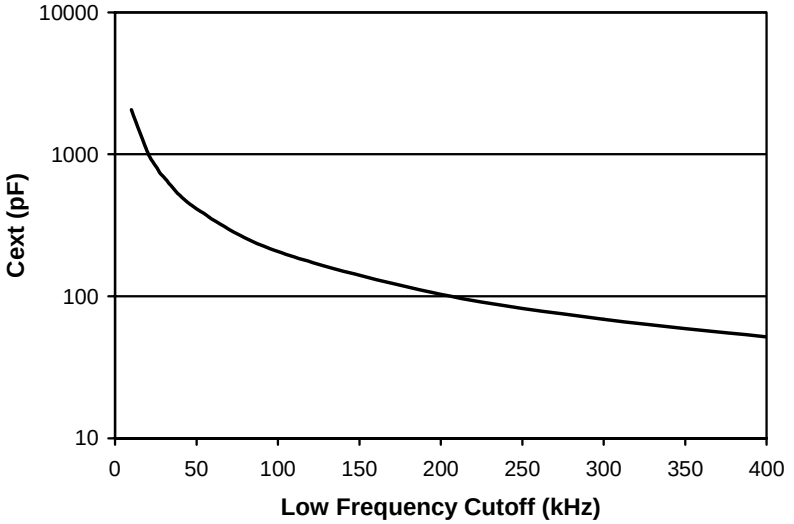


Figure 4: Differential Output Voltage vs. Input Current

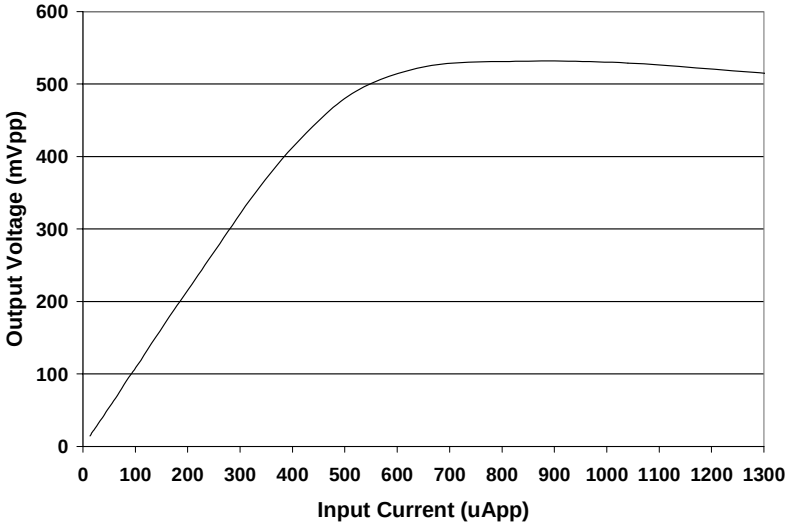
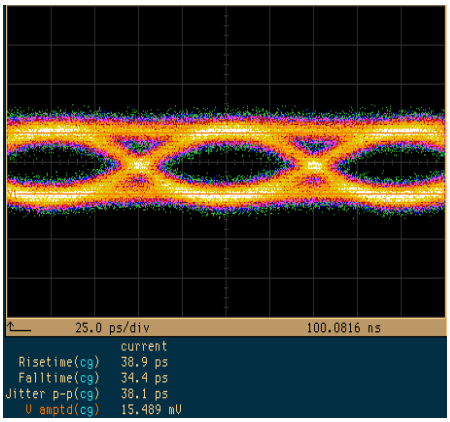
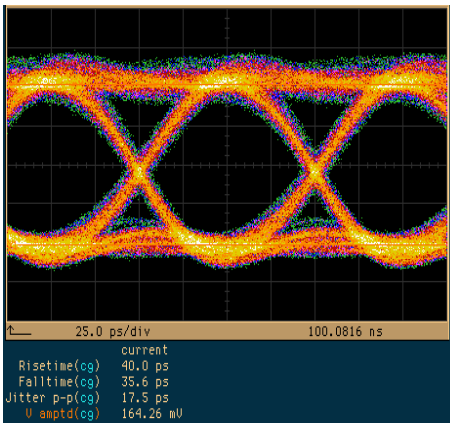


Figure 5: Eye Diagram with an Optical Input Power of -19dBm



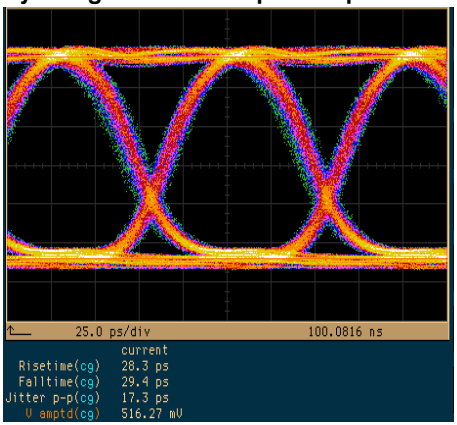
10mV/Div. 25ps/Div.

Figure 6: Eye Diagram with an Optical Power of -9dBm



40mV/Div. 25ps/Div.

Figure 7: Eye Diagram with an Optical Input Power of -2dBm



100mV/Div. 25ps/Div.

APPLICATION INFORMATION

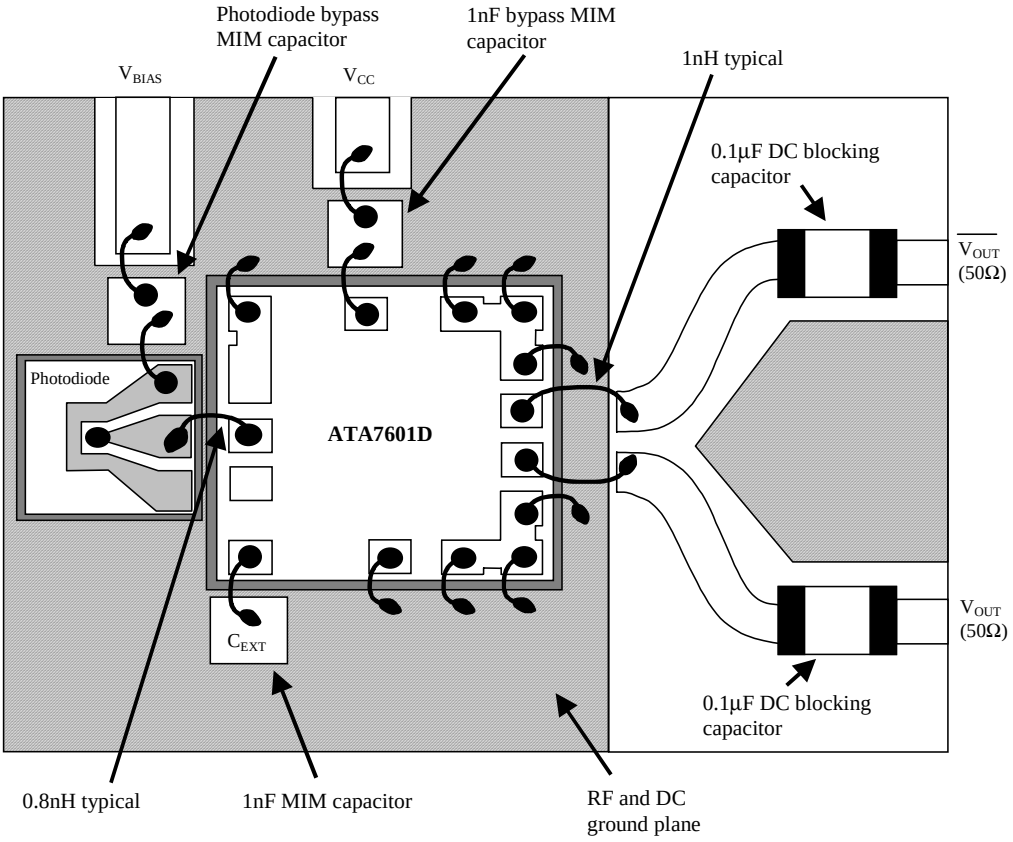


Figure 8: Bonding Diagram

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. When packaging the ATA7601D1, the temperature of the die must be kept below 260°C to ensure the device reliability. The ATA7601D1 has backside metal and can be epoxy mounted or solder attached. A good thermally conductive, silver filled epoxy is recommended for epoxy mounting. If a solder attach is being used, the die attach temperature must be kept less than 260°C to ensure the device reliability. A soft silicon/rubber tip collet or pyramidal collet should be used for die mounting, although tweezers can be used with extreme care.

Thermosonic ball bonding, at a stage temperature of 150 to 175°C with 1 to 1.3 mil gold wire, is the recommended interconnect technique. The bond force, time and ultrasonic power are all critical parameters and may require optimization to achieve the correct bond without causing bonding pad delamination or damage under the bonding pad.

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 50Ω load. For single-ended applications, one output of the ATA7601D1 must be AC terminated to a 50Ω 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 –19.0dBm. 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: 32μm
Photodetector capacitance: 0.2pF
Photodetector responsivity: 0.80A/W
Lensed fiber beam width: 13μm (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.

NOTES

NOTES

ORDERING INFORMATION

PART NUMBER	PACKAGE OPTION	PACKAGE DESCRIPTION
ATA7601D1C	D1	Die

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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传真：0755-83376182 （0）13823648918 MSN: SUNS8888@hotmail.com

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TEL：021-28311762 56703037 13701955389 FAX：021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL：029-81022619 13072977981 FAX:029-88789382