# ATA7550

5.0V 2.5 Gb/s TIA

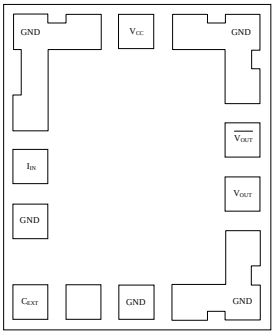
**PRELIMINARY DATA SHEET - Rev 0**

## FEATURES

- 2.5 Gb/s Differential Output TIA
- Low Group Delay
- Single +5V Power Supply
- Small Size: 0.864mm x 1.014mm
- 300mW (typ) Power Dissipation

## APPLICATIONS

- SONET/SDH OC-48/STM-16
- 2.5Gb/s DWDM
- Fiber optic receivers, transceivers and transponders




**D1 Package**

## PRODUCT DESCRIPTION

The Anadigics ATA7550D1 is a high-speed 5V transimpedance amplifier (TIA) available in bare die form and manufactured using an InGaP based HBT process. The device is used in conjunction with a photodetector to convert an optical signal into a differential output voltage. With its low group delay, the ATA7550 is ideally suited for DWDM applications.

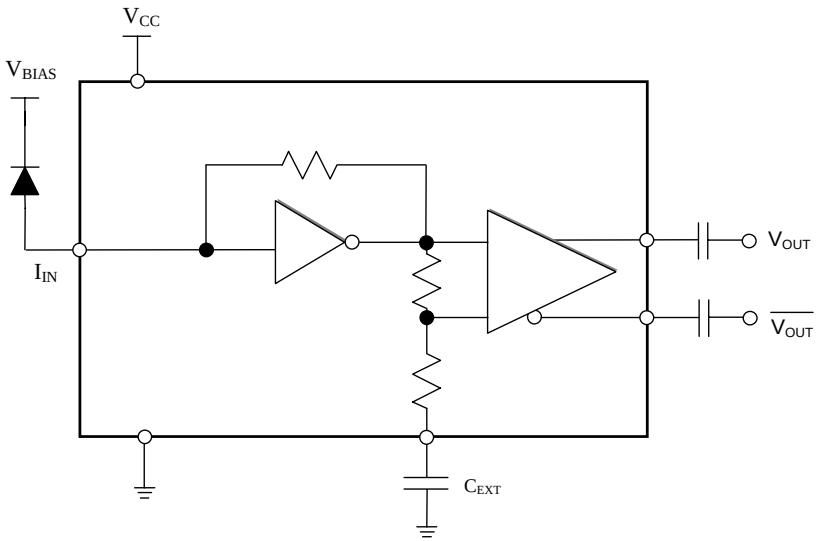



**Figure 1: Circuit Block Diagram**

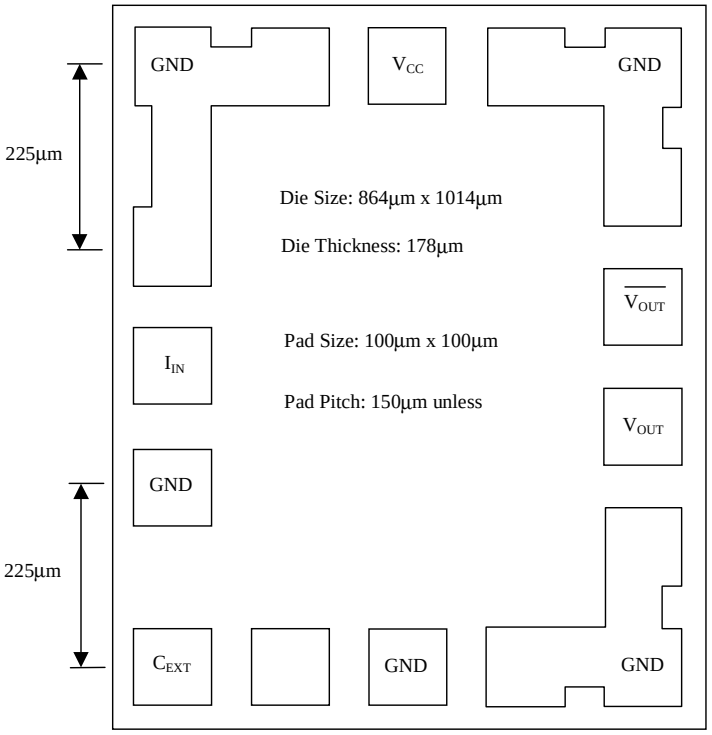



**Figure 2: Die Size and Layout**

**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**

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

**Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.**

**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 | | 70 | °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 | | 2.6 | | V |
| Output Offset Voltage | | 3.5 | | V |
| Supply Current | | 60 | 80 | mA |
| Power Dissipation | | 300 | 420 | mW |

**Table 5: AC Electrical Specifications (2)**

| PARAMETER | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|
| Small Signal Differential Transresistance (RL - 100Ω) | 1500 | 2000 | | Ω |
| Bandwidth (-3dB) | 1600 | 1900 | | MHz |
| Low Frequency Cutoff (3) | | 30 | | kHz |
| Group Delay (1MHz to 1.7GHz; $I_{IN}$< 250μApp) | | ±30 | | ps |
| Optical Sensitivity (4) | | -23 | | dBm |
| Input Noise Current (RMS) (5) | | | 800 | nA |
| Optical Overload (4) | -3 | -1 | | dBm |
| Input Current at which Output Limits (6) | | 250 | | μA |
| Single-Ended Output Voltage ($I_{IN}$ = 20μApp) | 15 | 20 | | mVpp |
| Maximum Differential Output Voltage | | | 500 | mVpp |
| Output Return Loss (1MHz to 10GHz) | 10 | | | B |

*Notes:*

2. *The specifications are based upon the use of a PIN photodetector with a responsivity at 1310nm of 0.9A/W (typical) and a capacitance of $C_{DIODE}$ + $C_{STRAY}$ = 0.5pF max connected to $I_{IN}$ via a 1nH bond wire.*
3. *With the use of an external capacitor.*
4. *Measured at $10^{-10}$ BER with a $2^{23}$ -1 PRBS at 2.488Gb/s.*
5. *1.9 GHz bandwidth.*
6. *Defined as 80% of the maximum output voltage.*

## PERFORMANCE DATA

**Figure 3: External Capacitor Required for Low Frequency Cutoff**

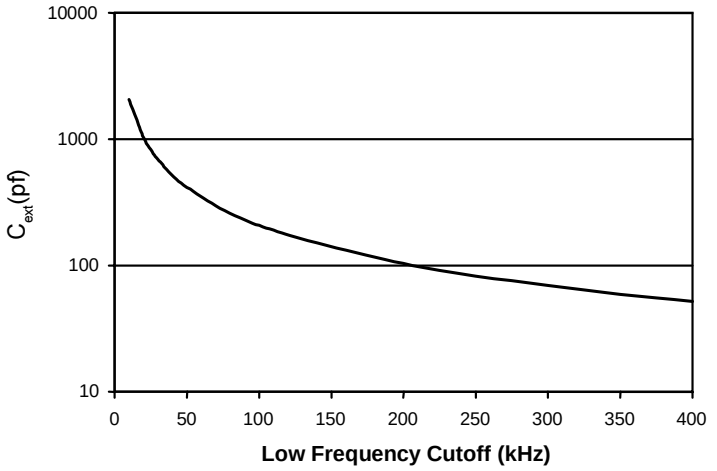



**Figure 4: Differential Output Voltage vs. Input Current**

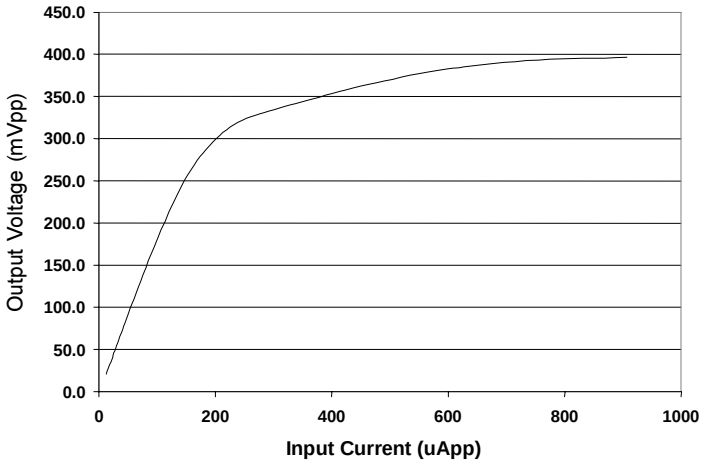
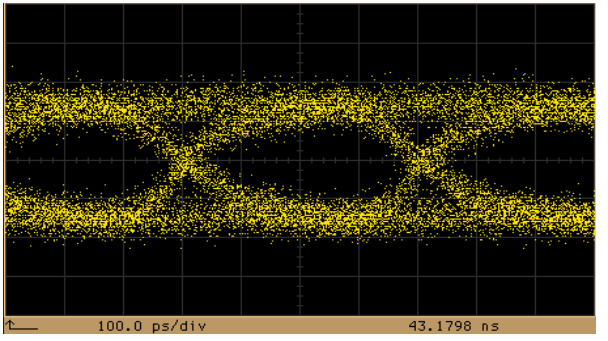
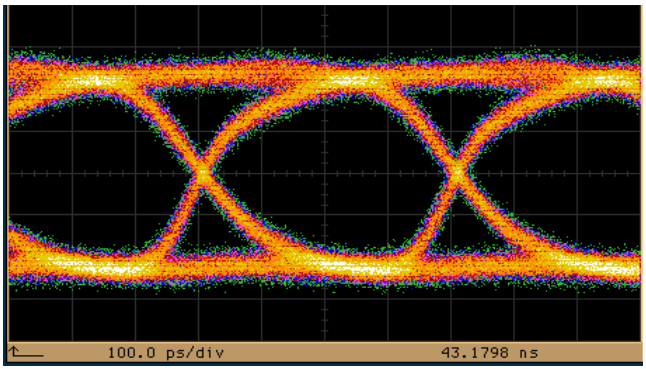



**Figure 5: Eye Diagram with an Optical Input Power of -20dBm**



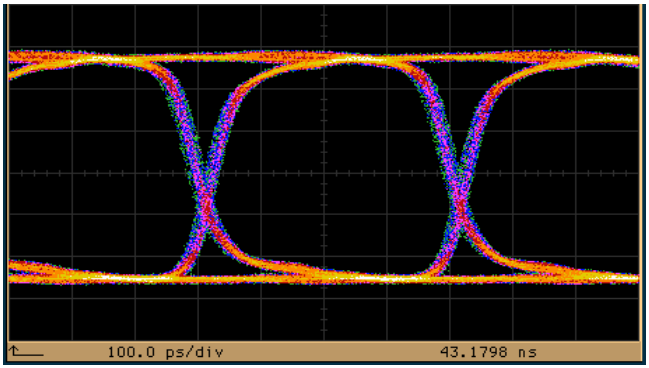

10mV/Div. 100ps/Div.

**Figure 6: Eye Diagram with an Optical Input Power of -15dBm**



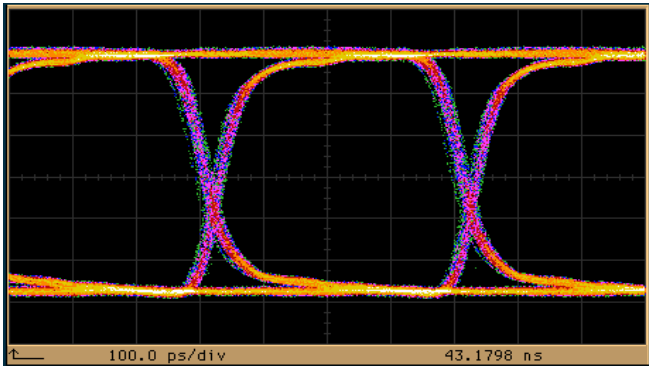

20mV/Div. 100ps/Div.

**Figure 7: Eye Diagram with an Optical Input Power of -5dBm**




70mV/Div. 100ps/Div.

**Figure 8: Eye Diagram with an Optical Input Power of -2dBm**




70mV/Div. 100ps/Div.

## APPLICATION INFORMATION

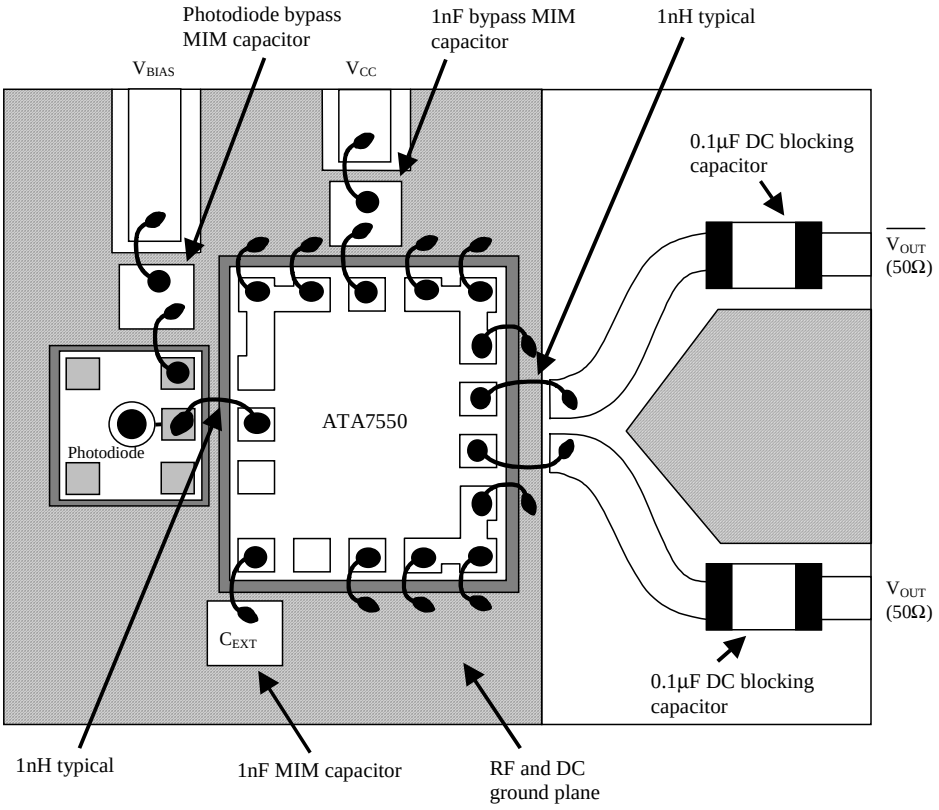



**Figure 9: Bonding Diagram**

**Packaging**

The ATA7550D1 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 ATA7550D1, the temperature of the die must be kept below 260°C to ensure the device reliability. The ATA7550D1 does not have backside metal and must be epoxy mounted. A good thermally conductive, silver filled epoxy is recommended for epoxy mounting. 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 ATA7550D1 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 ATA7550D1 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 –23dBm. This was measured at a BER of $10^{-10}$ with a 2.5Gb/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: 50μm
Photodetector capacitance: 0.3pF
Photodetector responsivity: 0.90A/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.

## NOTES

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## ORDERING INFORMATION

| PART NUMBER | PACKAGE OPTION | PACKAGE DESCRIPTION |
|---|---|---|
| ATA7550D1 | D1 | Die |

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