**ATA30013**
Transimpedance Amplifier
SONET 0C- 48
Preliminary
Rev 1

## FEATURES

- 3K Ω Transresistance
- Low Noise: < 3pA/√ Hz
- 2 GHz Analog Bandwidth
- Wide Dynamic Range
- Good Sensitivity and High Bit Rates
- Low Distortion

## APPLICATIONS

- SONET OC-48 Receiver
- Wideband Gain Block
- Low Noise RF Amplifier

## ELECTRICAL SPECIFICATIONS: ($T_A$ = 25 °C, $V_{DD}$ = + 5 V, $V_{SS}$ = - 5V, $C_{DIODE}$ + $C_{STRAY}$ = 0.4 pF)

| DC CHARACTERISTICS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|
| Transresistance ($R_L$ = ∞ ) | 2.5 | 2.9 | 3.2 | KΩ |
| Input Impedance | | 50 | | Ω |
| Supply Current $V_{DD}$<br>$V_{SS}$ | 70 | 100<br>70 | 140<br>90 | mA<br>mA |
| Output Drive Current Source/Sink [1] | | 10 | | mA |
| Output Offset Voltage | | +0.1 | | V |
| Input Bias Voltage | - 0.8 | - 0.6 | - 0.1 | V |
| Operating Temperature Range | 0 | | + 85 | °C |
| Operating Voltage Range $V_{DD}$<br>$V_{SS}$ | 4.5<br>- 6 | 5.0<br>- 5 | 6.0<br>- 4 | V<br>V |

| AC CHARACTERISTICS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|
| Tran<br>sresistance f = 300 MHz $R_L$ = 50 | 1.4 | 1.8 | 2.3 | KΩ |
| Input Capacitance | | 0.6 | | pF |
| 3 dB Bandwidth | | 2 | | GHz |
| Output Impedance | 10 | 15 | 30 | Ω |
| Input Noise Current, 150 KHz - 1 GHz<br>1 GHz - 2.5 GHz | | 165<br>400 | 230<br>600 | nA RMS<br>nA RMS |
| Gain Flatness (150 KHz - 500 MHz) | | ± 0.5 | ± 1 | dB |
| Peaking (Relative to 100 MHz) | | 1.5 | 2.5 | dB |
| Input 1 dB Compression (100 Mb/s) | 500 | 600 | | μAp-p |

[1] CAUTION: Output is not short circuit protected.

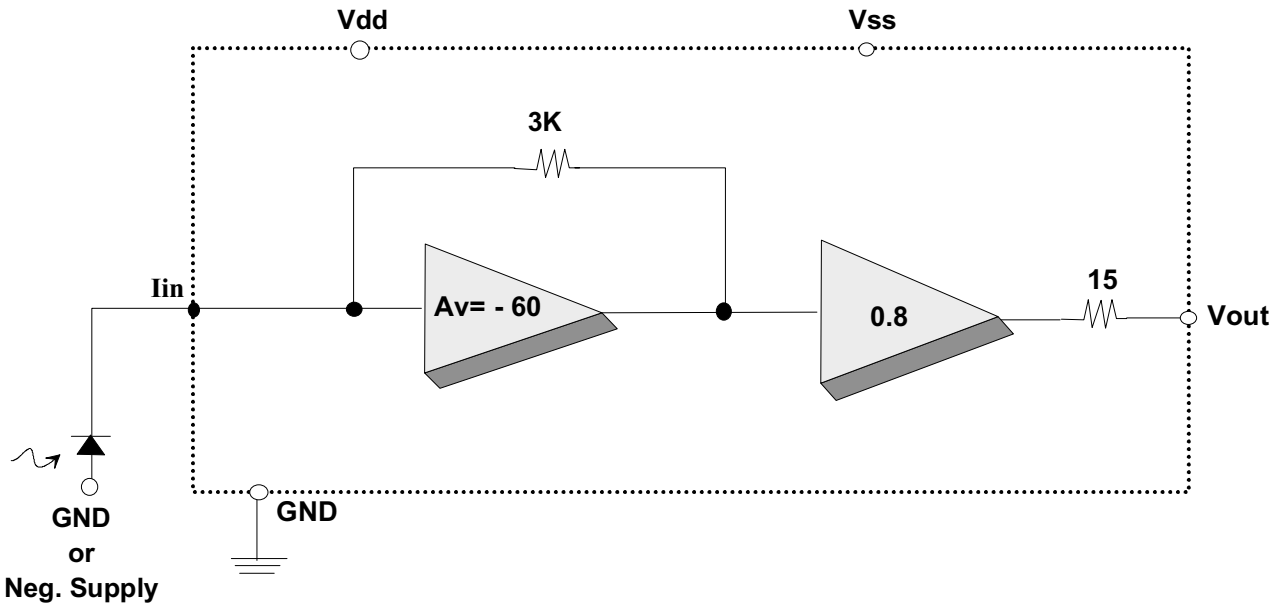
## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| $V_{DD}$ | 7.0V |
| Ta | Operating Temp. - 40°C to 125°C |
| Ts | Storage Temp. - 65°C to 150°C |

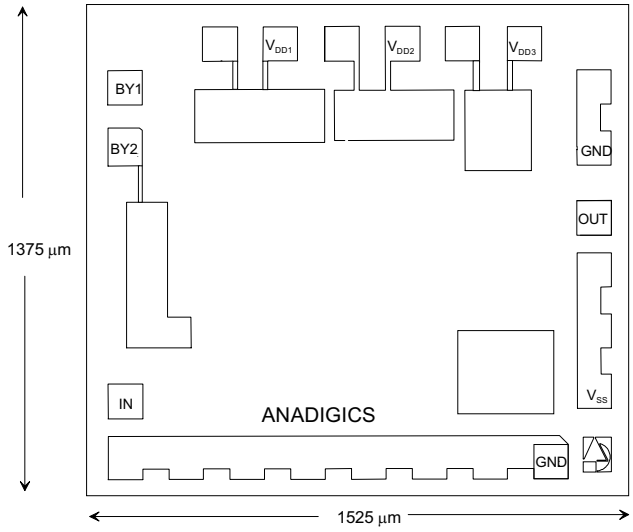
## ATA30013 PAD DESCRIPTION

| PAD | DESCRIPTION | COMMENT |
|---|---|---|
| $V_{DD}$ | Positive Supply Voltage | |
| $V_{SS}$ | Negative Supply Voltage | |
| $I_{IN}$ | TIA Input Current | |
| $V_{out}$ | TIA Output Voltage | Requires External DC Block |

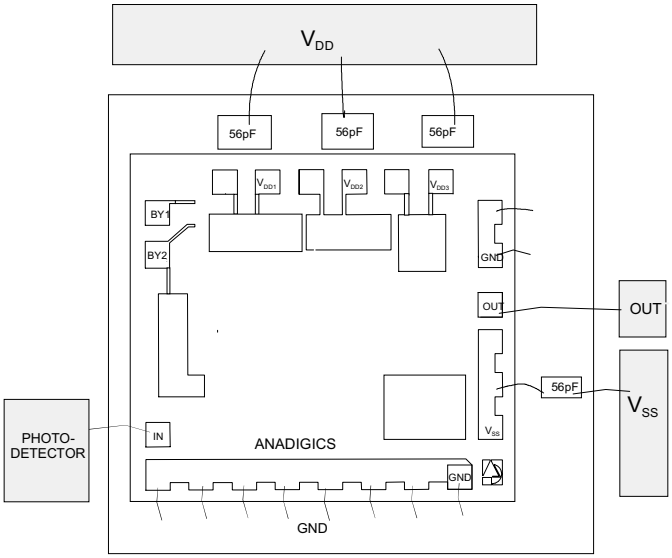
### ATA30013 EQUIVALENT CIRCUIT



**ATA30013 BOND PAD LAYOUT**




**ATA30013 BONDING DIAGRAM**




## $V_{OUT}$ CONNECTION

The output pad should be connected via a coupling capacitor to the next stage of the receiver ( filter or decision circuits), as the output buffers are not designed to drive a DC coupled 15 ohm load. If $V_{out}$ is connected to a high input impedance decision circuit (>500 Ω), then a coupling capacitor may not be required, although caution should be exercised since DC offsets of the photo detector/TIA combination may cause clipping of subsequent gain or decision circuits.

## POWER SUPPLIES AND GENERAL LAYOUT CONSIDERATIONS

The ATA30013 may be operated from a positive supply as low as + 4.5 V and as high as + 6.0 V. Below + 4.5 V, bandwidth and sensitivity will degrade, while at + 6.0 V, bandwidth, and sensitivity improve. The device is much less sensitive to the same changes in Vss. Use of surface mount (preferably MIM type capacitors), low inductance power supply bypass capacitors (>=56pF) are essential for good high frequency and low noise performance. The power supply bypass capacitors should be mounted on or connected to a good low inductance ground plane.

## GENERAL LAYOUT CONSIDERATIONS

Since the gain stages of the transimpedance amplifier have an open loop bandwidth in excess of 2.0 GHz, it is essential to maintain good high frequency layout practices. To prevent oscillations, a low inductance RF ground plane should be made available for power supply bypassing. Traces that can be made short should be made short, and the utmost care should be taken to maintain very low capacitance at the photodiode-TIA interface ($I_{in}$), as excess capacitance at this node will cause a degradation in bandwidth and sensitivity.

## SENSITIVITY AND BANDWIDTH

In order to guarantee sensitivity and bandwidth performance, the TIA is subjected to an extensive series of tests at the die sort level (100% testing at 25°C) to verify the DC parametric performance and the high frequency performance (i.e. adequate $|S21|$) of the amplifier. Acceptably high $|S21|$ of the internal gain stages will ensure low amplifier input capacitance, and hence, low input reference noise current. Transimpedance sensitivity and bandwidth are then guaranteed by design and correlation with RF and DC die sort test results.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