

## High Sensitivity Transimpedance Amplifier with Precision Monitor for Fiber Optical Receivers up to 622Mb/s

MG2622 is a CMOS TIA with wide input dynamic range, high optical sensitivity (-33dBm with PIN detector) and high overload tolerance (0dBm). Automatic gain control (AGC) circuit is implemented in order to achieve such wide dynamic range. In addition to automatically reducing TIA gain, this AGC circuit also helps to maintain integrity of input signal with excellent transimpedance linearity over frequency. A current sourcing monitor of average photodiode current is available at MON pad for receiver power monitoring for both PIN and APD photodiodes through bonding options.

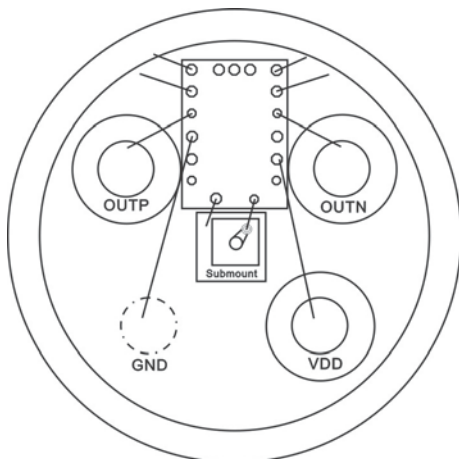
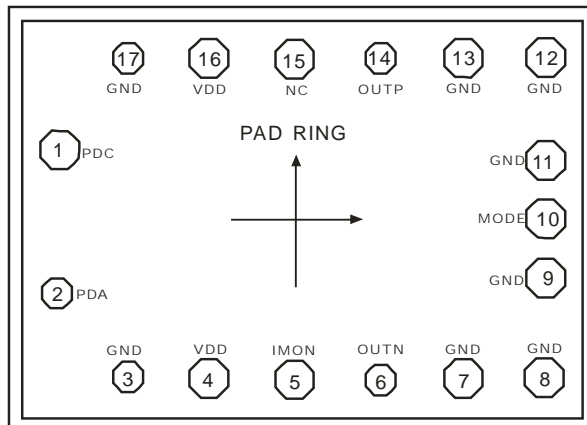
### Features

- Data rates up to 622Mbps
- Sensitivity -33dBm for PIN PD
- Input current overload 2mA<sub>pp</sub>
- Typical differential transimpedance 40kΩ
- Excellent gain linearity over frequency
- Precision I-source input current monitor
- No TO decoupling capacitor required
- Internal or external bias for photodiode
- Low power: supply current 23mA with 3.3V

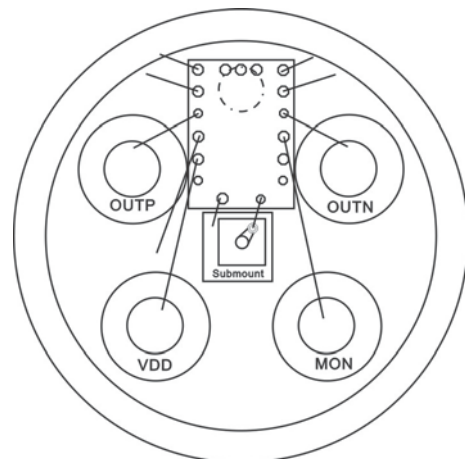
### Applications

- APON/BPON Receiver
- Fiber Channel Receiver(1x)
- Gigabit Ethernet Receiver
- SFF/SFP Modules
- GBIC Receiver
- ATM/SONET

### Pad and Bonding Diagram:



(a) 4 pin TO-CAN for PIN without monitor



(b) 5 pin TO-CAN for PIN with I-source monitor

## 1.0 Electrical Specifications

### 1.1 Absolute Maximum Ratings

Absolute maximum ratings are the values of voltage, current, temperature, power dissipation etc., which should not be exceeded at any time, otherwise deterioration or destruction of the IC may take place.

Parameter	Min	Max	Units
Power supply (VCC - GND)	-0.5	4	V
Storage temperature	-55	150	°C
Input current	0	4	mA

### 1.2 Recommended Operating Conditions

Parameter	Min	Max	Units
Power supply (VCC - GND)	2.97	3.63	V
PD capacitance		0.8	pF
Operating ambient temperature	-40	85	°C

### 1.3 DC Characteristics

Symbol	Parameter	Min	Typ	Max	Units
<b>VB</b>	Photodiode bias voltage (PDC - PDA)		2.8		V
<b>VCM</b>	Common mode output voltage		3.15		V
<b>ICC</b>	Supply current (no loads)		23	26	mA
<b>RLOAD</b>	Recommended differential output load	-	50	-	Ω

### 1.4 AC Characteristics

Typical conditions: T = 25 °C, VCC = 3.3V, C = 0.5 pF, L = 1.0nH

Parameter	Conditions	Min	Typical	Max	Units
<b>Small Signal Bandwidth</b>	Input below AGC on		500		MHz
<b>Small Signal Low Frequency Cut-off</b>	Input below AGC on		30		kHz
<b>Small Signal Transimpedance</b>	Input below AGC on		40		kΩ
<b>Input Referred Noise (RMS)</b>	1.25Gbps application		50		nA
<b>Optical Input Sensitivity with PIN</b>	SNR=14,ρ=0.9,er=10		-33		dBm
<b>Overload Input Current</b>			2		mA <sub>pp</sub>
<b>Differential Output Swing</b>	Input above 15μA <sub>pp</sub>		250		mV <sub>pp</sub>
<b>Output Resistance</b>			50		Ω
<b>Photo current monitor offset</b>			0		μA
<b>Photo current monitor Gain Ratio</b>	Input: 10μA to 2mA	0.95	1	1.05	
	Input: 1μA to 10μA	0.90	1	1.10	
<b>Power Supply Rejection Ratio</b>	DC to 4MHz		25		dB

## 2.0 Functional Description

### 2.1 Function Overview

MG2622 is a continuous mode transimpedance amplifier. Its main function is to convert input light pulse streams into output voltage pulse streams over various environment conditions (supply voltages, temperature etc) and across wide input range. It also has an important feature: to provide an indicator of optical signal strength in term of average or peak-to-peak value.

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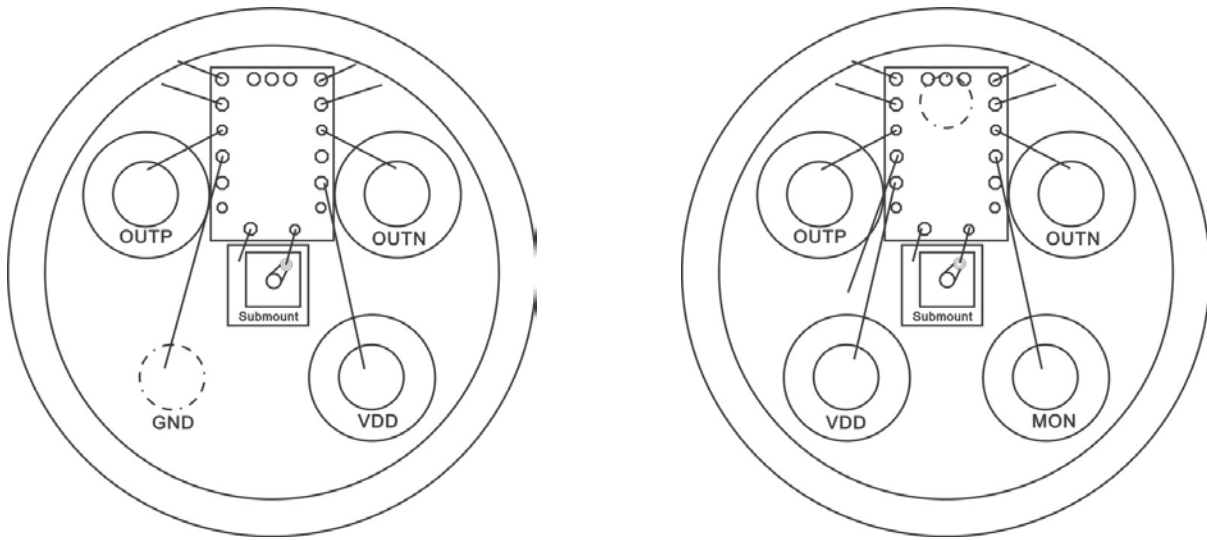
### 2.2 Monitor Output Configuration

In addition to converting high speed current input to voltage output, MG2622 can provide a precision current sourcing monitor for the input optical power. Through two bonding options of pad MODE, IMON pin in MG2622 can be configured to source current to ground accurately representing one of three values:

- 1) Average dc current through pad PDC (PD Cathode) when Mode pad is not connected, or
- 2) Average dc current through pad PDA (PD Anode) when Mode pad is connected to GROUND.

### 3.0 Applications Information

#### 3.1 TO-CAN Bonding Diagrams:



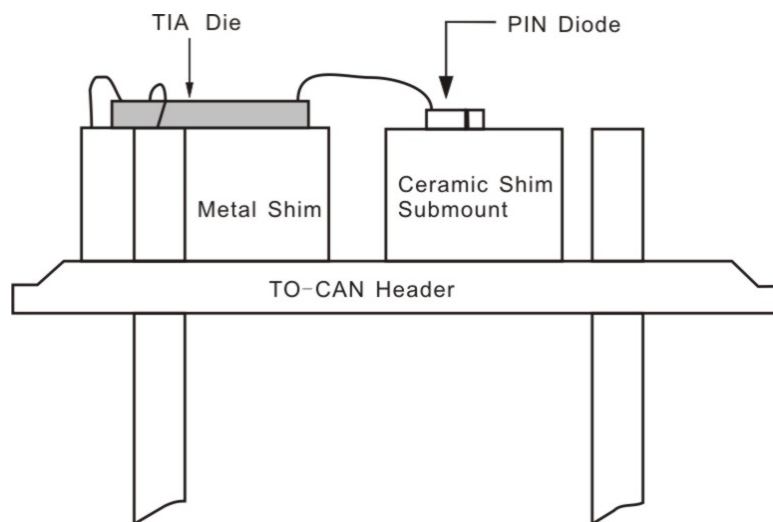
(a) 4 pin TO-CAN for PIN with I-source monitor (b) 5 pin TO-CAN for PIN without monitor

**Figure 3-1** Typical TO-CAN Bonding Diagram with Photodiode Mounted on PDC

Typical TO-CAN bonding configurations are shown in Figure 3-1(a) and (b) for different applications. The VCC bond wire de-coupling capacitor is optional. If provided, it will help to reduce the bond wire coupling.

#### 3.2 TO Assembly

Typical recommended assembly of TIA in optical TO header is shown in Figure 3-2. MG2622 is designed to work with bond wire inductance of  $\sim 1\text{nH}$ . Metal Shim is often required to raise TIA so that bonding pads are horizontally in the same level as photo diode which is typically mounted on a ceramic sub-mount for appropriate focal length.



**Figure 3-2** Suggested PIN Diode Connection Methods

## 4.0 Die Specifications

### 4.1 Pad Descriptions

Die Pad	Name	Function
1	PDC	PIN PD Common input. Connect to photo diode cathode (and optional cap).
2	PDA	Active PIN input. Connect to photo diode anode.
3,7-9,11-13,17	GND	Ground pin. Connect to the most negative supply (at least connect 4 GND).
4,16	VCC	Power pin. Connect to most positive supply (only one VCC pad needs to be connected).
5	MON	Analog current source output. Current matched to average photodiode current.
6	OUTN	Differential data output negative (goes low as light increases).
10	MODE	Monitor PD anode average current when this pad tied to ground; Monitor PD cathode average current when this pad not connected.
14	OUTP	Differential data output (goes high as light increases).
15	NC	Connected to ground for 622Mb/s operation.
NA	Backside	Backside. Connect to the lowest potential, usually ground.

### 4.2 Pad Coordinates

Pad Number	Pad	X	Y	Pad Number	Pad	X	Y
1	PDC	-430	100	10	MODE	434	0
2	PDA	-430	-100	11	GND	434	150
3	GND	-375	-334	12	GND	434	329
4	VDD	-228	-329	13	GND	228	329
5	IMON	-76	-329	14	OUTP	76	329
6	OUTN	76	-329	15	NC	-76	329
7	GND	228	-329	16	VDD	-228	329
8	GND	434	-329	17	GND	-375	334
9	GND	434	-150				

### 4.3 Other Notes

Die Thickness: 250µm

Die Size: 1060 µm x 840 µm

Pad Materials: Aluminum