High Sensitivity Transimpedance Amplifier with Precision Monitor for Fiber Optical Receivers up to 1.25Gb/s

MG2125 is a CMOS TIA with wide input dynamic range, high optical sensitivity (-30.5dBm 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.

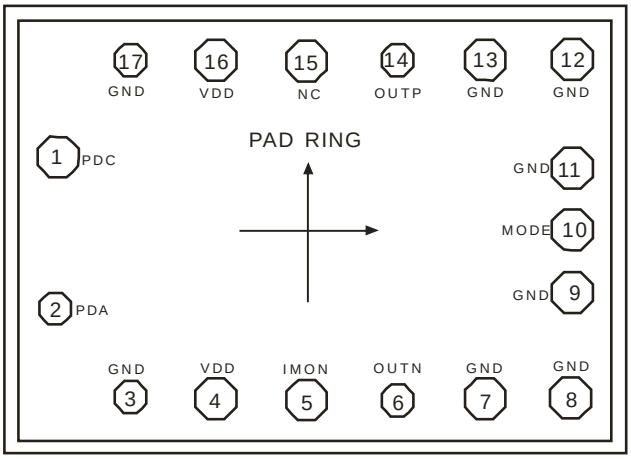
Features

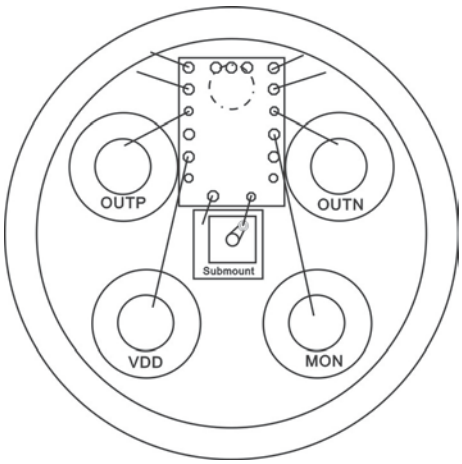
- Data rates up to 1.25 Gbps
- Sensitivity -30.5dBm
- Input current overload 2mA
- Typical differential transimpedance 20kΩ
- Excellent gain linearity over frequency
- Precision average current monitor(sourcing)
- No TO decoupling capacitor required
- Internal or external bias for photodiode
- Low power：supply current 26mA with 3.3V

Applications

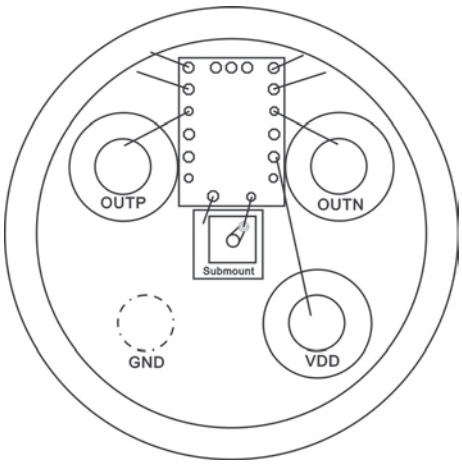
- 1G EPON ONU Receiver
- Fiber Channel Receiver (1X and 2X)
- Gigbit Ethernet Receiver
- SFF/SFP Modules
- GBIC Receiver
- ATM/SONET

Pad and Bonding Diagram:





5 pin TO-CAN for PIN PD with I-source monitor



4 pin TO-CAN for PIN PD without 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 for 1.25 Gbps	0.5	0.7	pF
Operating ambient temperature	-40	85	°C

1.3 DC Characteristics

Symbol	Parameter	Min	Typ	Max	Units
VB	Photodiode bias voltage (PDC - PDA)		2.8		V
VCM	Common mode output voltage		3.15		V
ICC	Supply current (no loads)		26	30	mA
RLOAD	Recommended differential output load	-	100	-	Ω

1.4 AC Characteristics

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

Parameter	Conditions	Min	Typical	Max	Units
Small Signal Bandwidth	Input below AGC on		1000		MHz
Small Signal Low Frequency Cut-off	Input below AGC on		10		kHz
Small Signal Transimpedance	Input below AGC on		20		kΩ
Input Referred Noise (RMS)	1.25Gbps application		90		nA
Optical Input Sensitivity with PIN	SNR=14,ρ=0.9,er=11		-30.5		dBm
Overload Input Current			2		mA
Differential Output Swing	Input above 15μA_{pp}		300		mV_{PP}
Total Harmonic Distortion (THD)	50μA_{pp} 100MHz Sine		10		%
Single Ended Output Resistance			50		Ω
Photo current monitor offset			0		μA
Photo current monitor Gain Ratio	Input: 10μA to 2mA	0.95	1	1.05	
	Input: 1μA to 10μA	0.9	1	1.10	
Power Supply Rejection Ratio	DC to 4MHz		25		dB

2.0 Functional Description

2.1 Function Overview

MG2125 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.

MG2125 is a CMOS TIA with wide input dynamic range, high optical sensitivity (-30.5dBm) 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 or peak-to-peak photodiode current is available at the MON pad for photo-alignment for both PIN and APD photodiodes through bonding options.

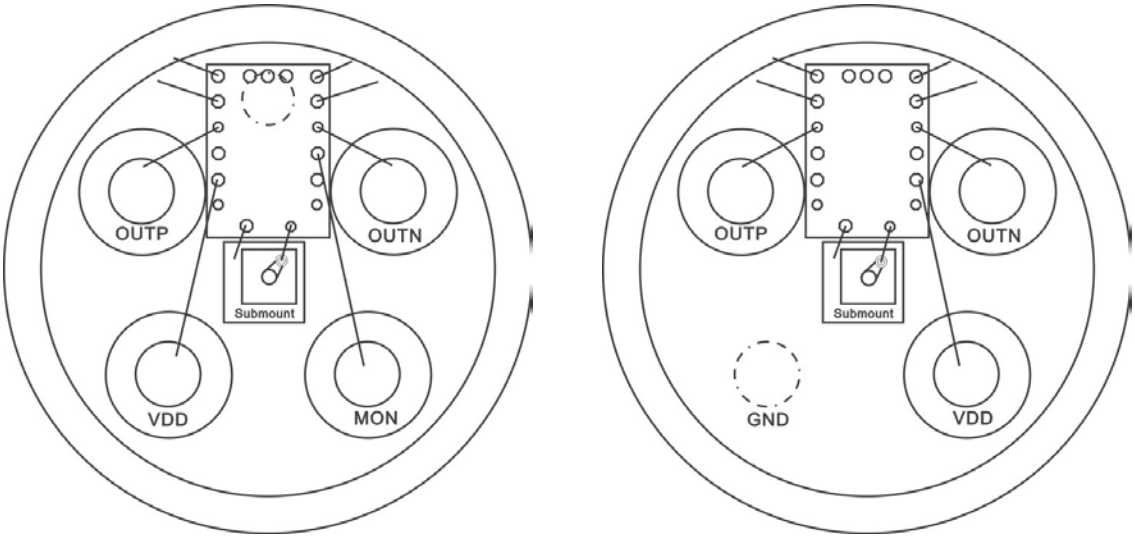
2.2 Monitor Output Configuration

In addition to converting high speed current input to voltage output, MG2125 can provide a precision current sourcing monitor for the input optical power. Through two bonding options of pad MODE, IMON pin in MG2125 can be configured to source current to ground accurately representing one of two 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) 5 pin TO-CAN for PIN with I-source monitor (b) 4 pin TO-CAN without current monitor

Figure 3-1 Typical TO-CAN Bonding Diagram with PIN or APD Photodiode

Typical TO-CAN bonding configurations are shown in Figure 3-1(a) and (b) for 4 pin and 5 pin TO PIN diode applications. The VCC bond wire de-coupling capacitor is optional. If provided, it can 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. MG2125 is designed to work with bond wire inductance of ~1nH. 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.

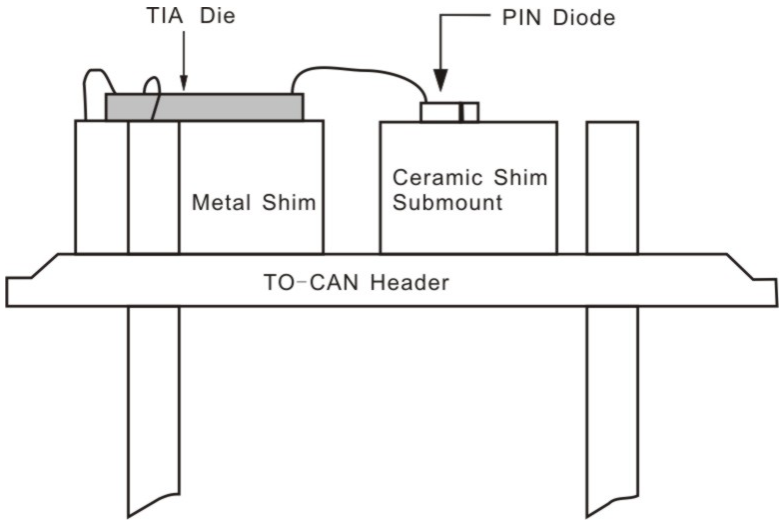


Figure 3-2 Suggested PIN Diode Connection Methods

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	Not used for normal 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