



Preliminary

03.02.03

◆ Features

- Low voltage of +5.0V single power supply
- 1.5k Ω high transimpedance
- Typical 7.5GHz broad bandwidth
- 29dB high gain
- Over 20dB wide dynamic range
- Differential output

F0100613B

10Gb/s Receiver

Transimpedance Amplifier

◆ Applications

- Preamplifier of an optical receiver circuit for OC-192/STM-64(10Gb/s)

◆ Functional Description

The F0100613B is a stable GaAs integrated transimpedance amplifier capable of 29dB gain at a typical 7.5GHz 3dB-cutoff-frequency, making it ideally suited for a 10Gb/s optical receiver circuit, for example, OC-192/STM-64, instrumentation, and measurement applications. The integrated feedback loop design provides broad bandwidth and stable operation. The F0100613B typically specifies a high transimpedance of 1.5k Ω (RL=50 Ω) with a wide dynamic range of over 20dB. Furthermore, it can operate with a supply voltage of single +5.0V.

Only chip-shipment is available for all product lineups of GaAs transimpedance amplifiers, because the packaged preamplifier cannot operate with the maximum performance owing to parasitic capacitance of the package.

The F0100613B and F0100614B are various in pad assignment.

◆ **Absolute Maximum Ratings** $T_a=25^{\circ}\text{C}$, unless specified

Parameter	Symbol	Value	Units
Supply Voltage	V_{DD}	-0.5 to +7.0V	V
Supply Current	I_{DD}	100	mA
Ambient Operating Temperature	T_a	-40 to +90	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55 to +125	$^{\circ}\text{C}$

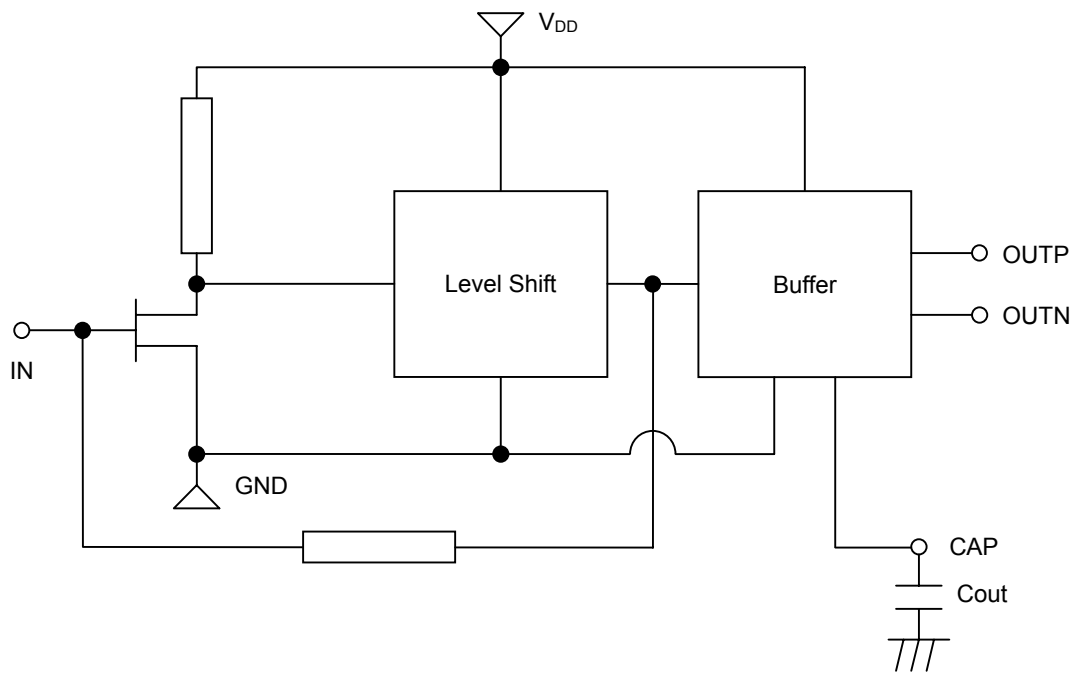
◆ **Recommended Operating Conditions** $T_a=25^{\circ}\text{C}$, $V_{DD}=+5.0\text{V}$ unless specified

Parameter	Symbol	Value			Unit
		MIN.	TYP.	MAX.	
Supply Voltage	V_{DD}	4.75	5.00	5.25	V
Ambient Operating Temperature	T_a	0	25	85	$^{\circ}\text{C}$
Photodiode Capacitance	C_{PD}	0.20	0.225	0.25	pF
Input bond wire inductance	L_{IN}	0.2	0.4	0.6	nH

◆ **Electrical Characteristics** $T_a=25^{\circ}\text{C}$, $V_{DD}=+5.0\text{V}$ unless specified

Parameters	Symbol	Test Conditions	Value			Units
			MIN.	TYP.	MAX.	
Supply Current	I_{DD}	DC	-	65	-	mA
Gain	S_{21}	PIN=-30dBm f=1GHz, RL=50 Ω	-	29	-	dB
-3dB High Frequency Cut-off	F_{Ch}	PIN=-30dBm RL=50 Ω	-	7.5	-	GHz
Input Impedance	R_I	f =1GHz	-	55	-	Ω
Transimpedance	Z_T	f =1GHz	-	1.5	-	k Ω
Output Voltage	V_O	DC	-	3.4	-	V
Input Voltage	V_I	DC	-	1.0	-	V
-3dB Low Frequency Cut-off	F_{Cl}	Cout=1000pF		60		kHz

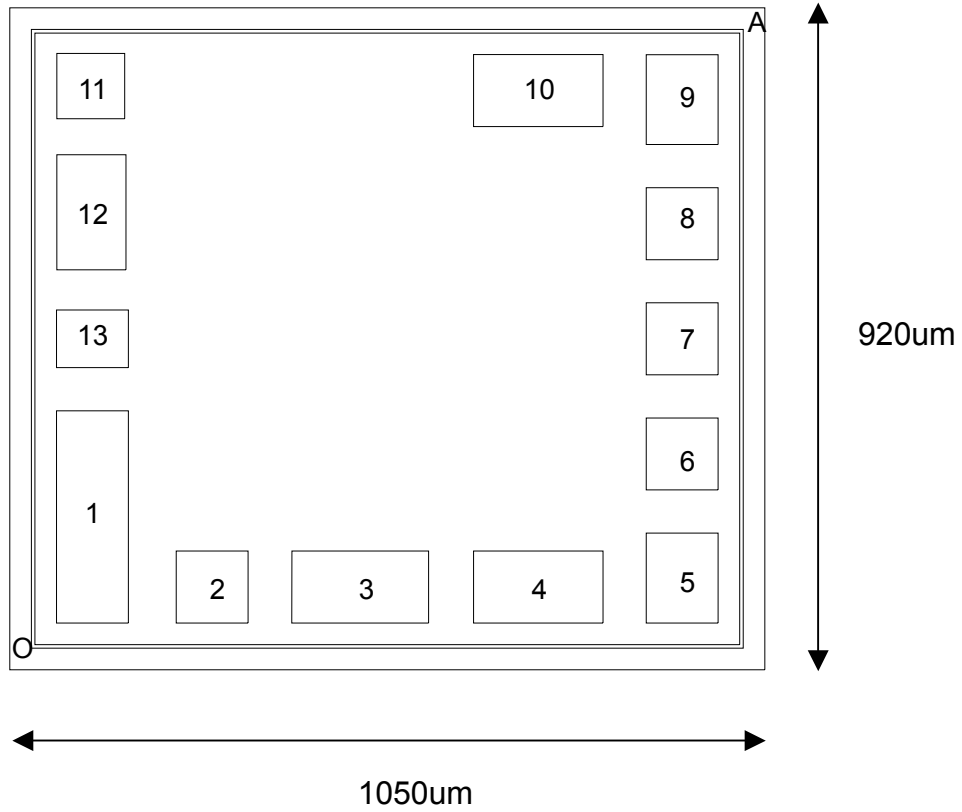
◆ Block Diagram



◆ Die Pad Description

V_{DD}	Supply Voltage
GND	Ground
IN	Input
OUTP	Output (positive)
OUTN	Output (negative)
CAP	Connect outer Capacitance

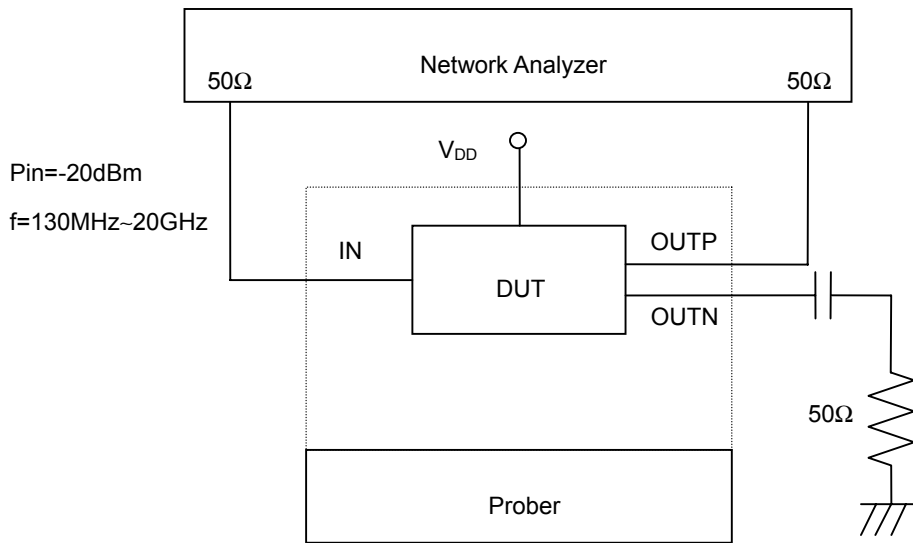
◆ Die Pad Assignment



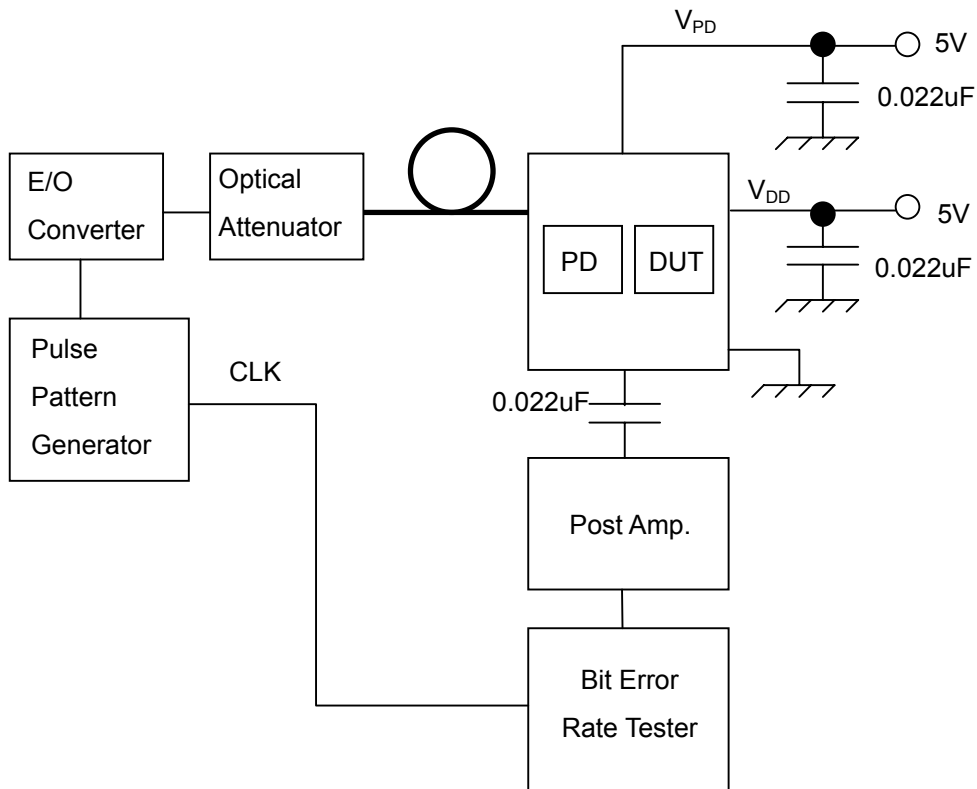
No.	Symbol	Center Coordinates (um)	No.	Symbol	Center Coordinates (um)
1	GND	(70,177.5)	10	OUTP	(685,780)
2	V _{DD}	(220,70)	11	CAP	(70,780)
3	V _{DD}	(430,70)	12	GND	(70,602.5)
4	OUTN	(685,70)	13	IN	(70,425)
5	GND	(910,92.5)			
6	OUTN	(910,265)			
7	GND	(910,425)			
8	OUTP	(910,585)	O		(0,0)
9	GND	(910,757.5)	A		(980,850)

◆ Test Circuits

1) AC Characteristics



2) Sensitivity Characteristics



◆ **General Description**

A transimpedance amplifier is applied as a pre-amplifier which is an amplifier for a faint photo-current from a PIN photo diode (PD). The performance in terms of sensitivity, bandwidth, and so on, obtained by this transimpedance amplifier strongly depend on the capacitance brought at the input terminal; therefore, “typical”, “minimum”, or “maximum” parameter descriptions can not always be achieved according to the employed PD and package, the assembling design, and other technical experts. This is the major reason that there is no product lineup of packaged transimpedance amplifiers.

Thus, for optimum performance of the transimpedance amplifier, it is essential for customers to design the input capacitance carefully.

Hardness to electro-magnetic interference and fluctuation of a power supply voltage is also an important point of the design, because very faint photo-current flows into the transimpedance amplifier. Therefore, in the assembly design of the interconnection between a PD and a transimpedance, noise should be taken into consideration.

◆ **Recommendation**

◆ **Noise Performance**

The F0100613B based on GaAs FET's shows excellent low-noise characteristics compared with IC's based on the silicon bipolar process. Many transmission systems often demand superior signal-to-noise ratio, that is, high sensitivity; F0100613B is the best choice for such applications.

The differential circuit configuration in the output enable a complete differential operation to reduce common mode noise: simple single ended output operation is also available.

◆ *Die-Chip Description*

The F0100613B is shipped like the die-chip described above. The die thickness is typically 280um \pm 20um with the available pad size uncovered by a passivation film of 75um square. The material of the pads is TiW/Pt/Au and the backside is metalized by Ti/Au.

◆ *Assembling Condition*

SEI recommends the assembling process as shown below and affirms sufficient wire-pull and die-share strength. The heating time of one minute at the temperature of 310°C gave satisfactory results for die-bonding with AuSn performs. The heating and ultrasonic wire-bonding at the temperature of 150°C by a ball-bonding machine is effective.

◆ *Quality Assurance*

For the F01 series products, there is only one technically inevitable drawback in terms of quality assurance which is to be impossible of the burn-in test for screening owing to die-shipment. SEI will not ship them if customers do not agree on this point. On the other hand, the lot assurance test is performed completely without any problems according to SEI's authorized rules. A microscope inspection is conducted in conformance with the MIL-STD-883C Method 2010.7.

◆ *Precautions*

Owing to their small dimensions, the GaAs FET's from which the F0100613B is designed are easily damaged or destroyed if subjected to large transient voltages. Such transients can be generated by power supplies when switched on if not properly decoupled. It is also possible to induce spikes from static-electricity-charged operations or ungrounded equipment.