T-41-91

BT&D TECHNOLOGIES

British Telecom & DuPont

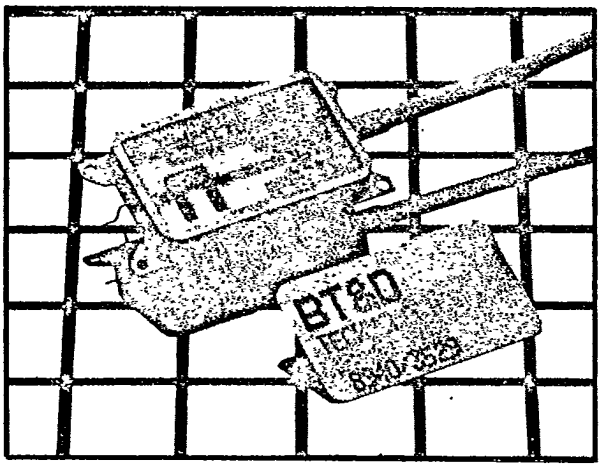
PDC2201
GaAs IC PINFET RECEIVER

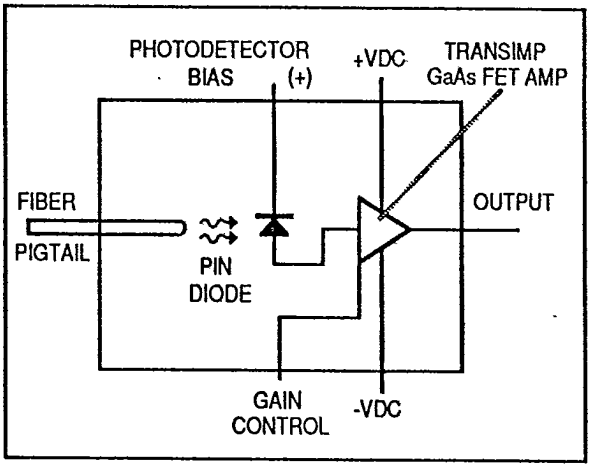
Features

- Ultra high reliability planar InGaAs PIN photodiode
- Custom GaAs IC for high performance and stability
- Transimpedance design optimised for high speed applications
- Gain control
- 1300 and 1550 nanometer operation

Applications

- Optical communication systems operating up to 2.4 Gbit/s
- Trunk telecommunications
- Subscriber loop
- Coherent detection receiver





Description

Members of the PDC2201 family of receivers are available for data rates of 1.2, 1.6 and 2.4 Gbit/s. Specific variants are optimized for several popular bit rates.

The planar PIN InGaAs photodiode is produced by MOVPE, providing very high electro-optic performance and state of the art reliability. The high speed FET amplifiers are based on 0.5µm GaAs circuits. The receiver is packaged in a 15 pin flatpack suitable for surface mounting, with a 50 ohm output pin on the package end. Other package types are available by special order.

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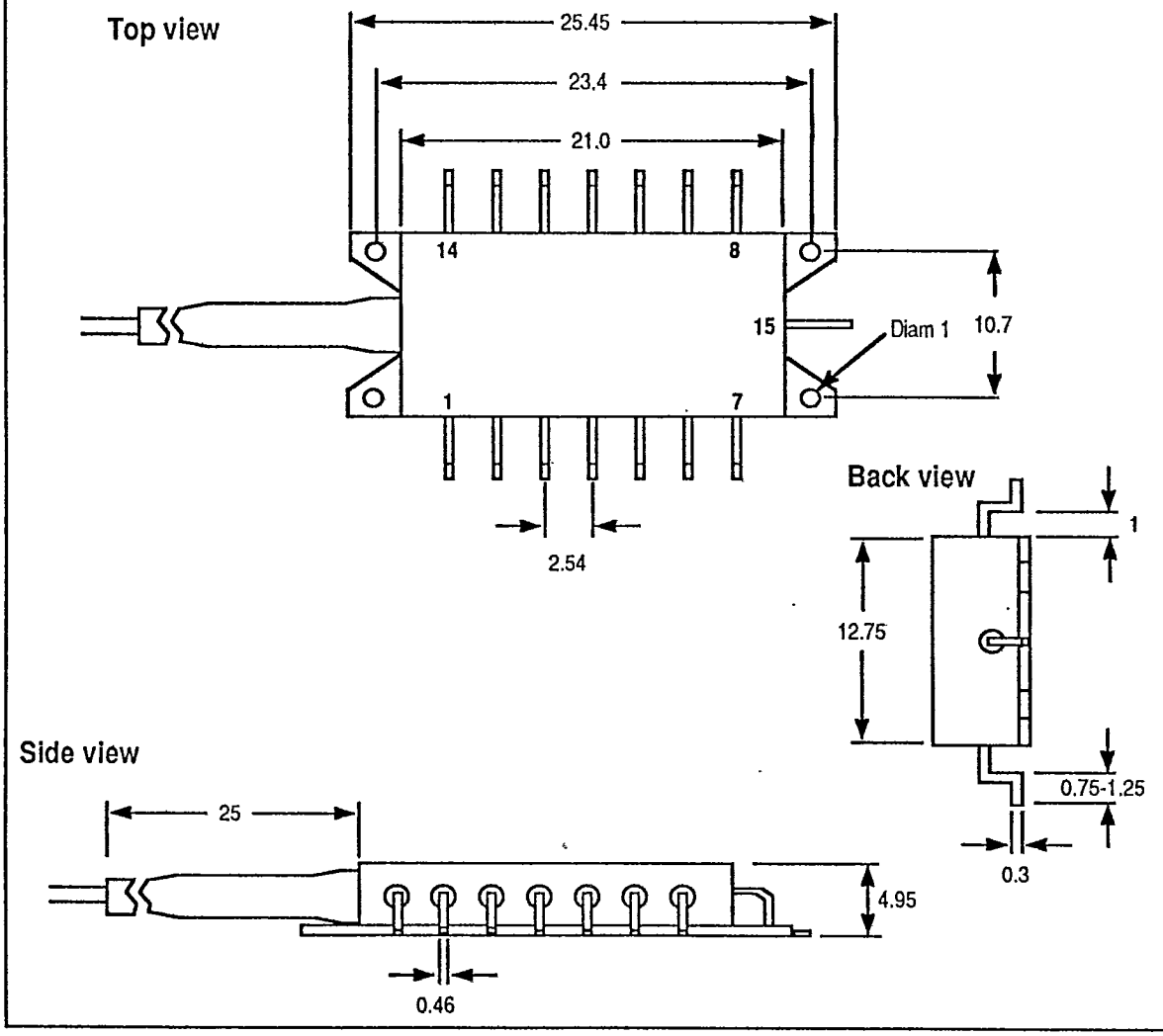
PACKAGE DIMENSIONS

dimensions in millimeters



Pin connections for high speed variants:

PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	Photodiode bias +9V	9	Ground
2	Ground	10	+V
3	Not connected	11	Leave unconnected
4	-V	12	+V
5	Gain control	13	Not connected
6	+V	14	Ground
7	Ground	15	Output
8	Not connected		

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SPECIFICATIONS

(at 25°C unless noted otherwise)

PARAMETER	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
Bit rate		1200			1600			2400		Mbit/s
-3dB frequency [1]	—	650	—	—	1100	—	—	1700	—	MHz
Sensitivity [2]	-30	-32	—	-29	-31	—	-27	-29	—	dBm
Output signal level at sensitivity [3]	—	15	—	—	15	—	—	12	—	pk-pk mV
Responsivity [3]	—	10.2	—	—	8.0	—	—	3.7	—	kV/W
Maximum optical power [4]	—	-8	—	—	-8	—	—	-8	—	dBm

PARAMETER	MIN	TYP	MAX	UNITS
Wavelength	1100	—	1650	nm
Output impedance	48	50	52	Ohms
Positive supply voltage	—	9	—	V
current	—	60	—	mA
Negative supply voltage	—	-5.2	—	V
current	—	6	—	mA
Total power	—	600	700	mW
Fiber specifications	50/125 core / cladding diameter 900 µm outside diameter silicone / nylon tight jacket temperature rated at 125°C			
Fiber length	—	1	—	meter
MTTF (@ 25°C case temp.)	500,000			hours

MAXIMUM RATINGS

PARAMETER		MIN	MAX	UNITS
Case operating temperature		-20	+85	°C
Storage temperature		-40	+85	°C
Optical input power		—	10	mW
Humidity (operating and storage)		0	noncondensing	
Supply voltage	+V	-0.5	+9.5	V
	-V	-5.5	+0.5	V

Notes:

1 Typical value given. If minimum bandwidth is required for analog applications, please specify at time of order.

2 Measured at 1300nm wavelength, 10^{-11} BER, 100% modulation depth, $2^{15}-1$ pseudo-random pattern.

3 Responsivity with gain control set for maximum gain.

4 For 10^{-11} BER.

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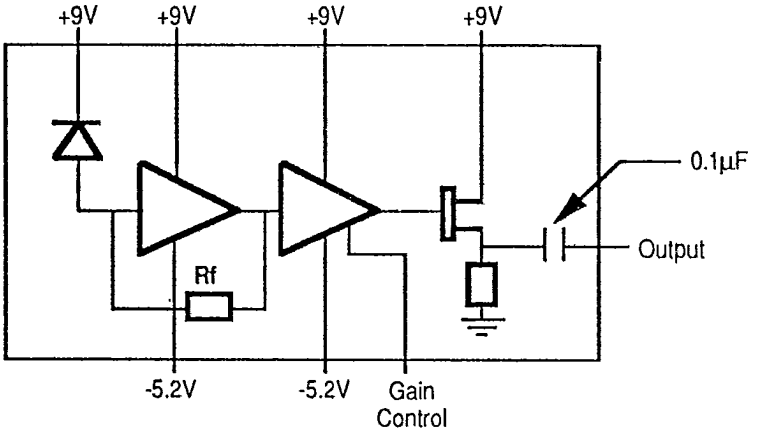
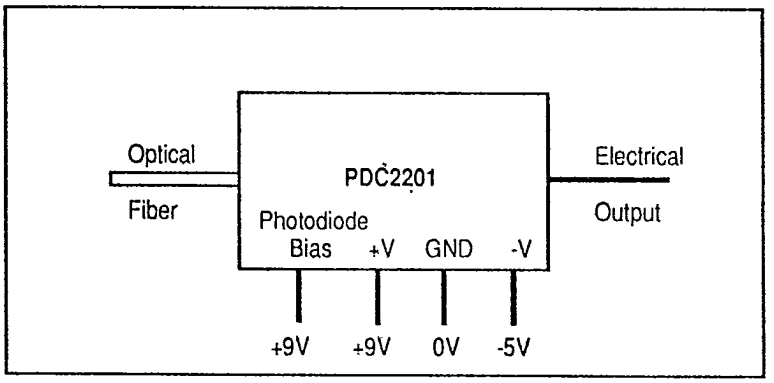
APPLICATION NOTES

See page 2 for package dimensions and pin connection diagram

1. Block Diagram



2. Basic Operating Circuit



The PDC2201 is easy to use. The figure illustrates the device connected in its standard operating configuration. Additional functionality is described in detail in the following applications guide.

3. Detailed Functional Description

The PDC2201 receiver family comprises of standard PINFET style optical receivers optimized for data rates of 1.2, 1.6 and 2.4Gbit/s. The optical fiber input is aligned to a very high reliability planar InGaAs PIN photodiode offering a high fiber coupled responsivity and very low dark current (less than 5nA). The photodiode is connected to a high performance transimpedance FET amplifier integrated on a custom GaAs IC. This amplifier is designed with an output impedance of 50Ω, and is internally capacitively coupled to the device output pin via a 0.1μF capacitor.

It is possible for the user to alter the gain of the amplifier circuit by applying a control voltage to the Gain Control pin (See Section 6).

This circuit configuration offers very high product reliability (500,000 hours MTTF at 25°C).

4. Electrical Performance

The circuit requires a positive supply of +9V, which is used to power the GaAs circuit and also bias the photodiode. The photodiode is connected out to a separate package pin to enable the user, if desired, to monitor the circuit photocurrent. The circuit also requires a negative supply of -5V, and good electrical ground integrity for optimum sensitivity performance.

The analog electrical output gives a peak to peak output voltage signal which is proportional to the incident optical input power for input powers up to the maximum optical input power. Above this power, the output voltage swing tends to limit, and the amplifier circuit saturates giving rise to pulse width distortion.

Input powers up to 10mW can be applied without damaging the device.

5. Layout Considerations

In order to optimize the device sensitivity performance at high bit rates, careful attention should be paid to the connection methods used when configuring the device. It is recommended that the following steps should be taken:

a) The device case is internally connected to ground, so it should be mounted in intimate contact with the metallized system ground on the PCB. The drilled flanges on the package can be soldered to the system ground as a further improvement.

b) In order to minimize the tuned effect due to lead inductances and decoupling capacitors, it is recommended that the device power supplies are decoupled with a series combination of 22Ω plus 0.1μF, the resistance reducing the Q of the decoupling network.

c) The device operates in a 50Ω system. It is recommended that the electrical output is routed to subsequent signal processing stages using a microstrip or coplanar line.

6. Gain Control

The high electrical gain of the PDC2201 can be reduced for applications where high optical input powers are used. This is effected by use of the Gain Control pin. Device pin 5 is internally connected to a gain control element on the GaAs IC. If left unconnected, it will self bias to approximately +1.5V, with the circuit in its maximum gain configuration. The circuit gain can be reduced by applying an external DC control voltage to this point, and taking it more negative.

There is little reduction in gain in taking this point from +1.5V to GND, so it is recommended that a unipolar supply is used, the gain reducing in a non-linear fashion by approximately 30dB on taking the gain control point from GND to -1.5V.

Alteration of the circuit gain does not significantly affect the shape of the device frequency response.

7. Measurement Techniques

Device sensitivity is quoted for a 10^{-11} bit error rate and is measured by modulating a 1.3μm laser source at the device bitrate with an NRZ, 2^{15}-1 PRBS. The laser is coupled to the device via a 2km length of singlemode fiber (to modestrip and eliminate reflections) and an optical attenuator. The device signal output is coupled, via an amplification/regeneration circuit including a filler with -3dB point at 0 7 of the bit rate, to an error Detection Set.

8. Packaging

The circuit is mounted in a hermetic 15 pin flatpack to facilitate ease of mounting with coplanar/microstrip connections. Adequate heatsinking must be provided to ensure that the case temperature does not exceed +85°C in operation.

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ORDERING INFORMATION

Please order part number **P D C 2 2 0 1 - X X X - X X**

Products are available with custom connectors; call your account representative for details.

HANDLING PRECAUTIONS

PDC2201 receivers can be damaged by current surges or overvoltage. Power supply transient protection precautions should be taken.

To place an order or to obtain more information, contact:

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