T-41-91

B T & D TECHNOLOGIES

PDC2201-1.2/2.4
GaAs IC PINFET RECEIVER

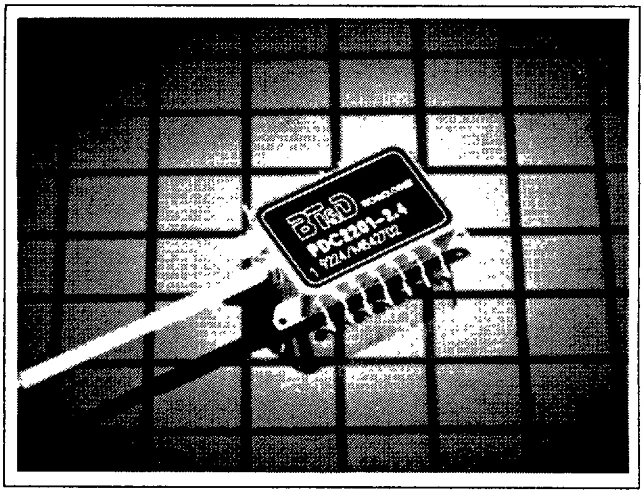
Features:

- 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

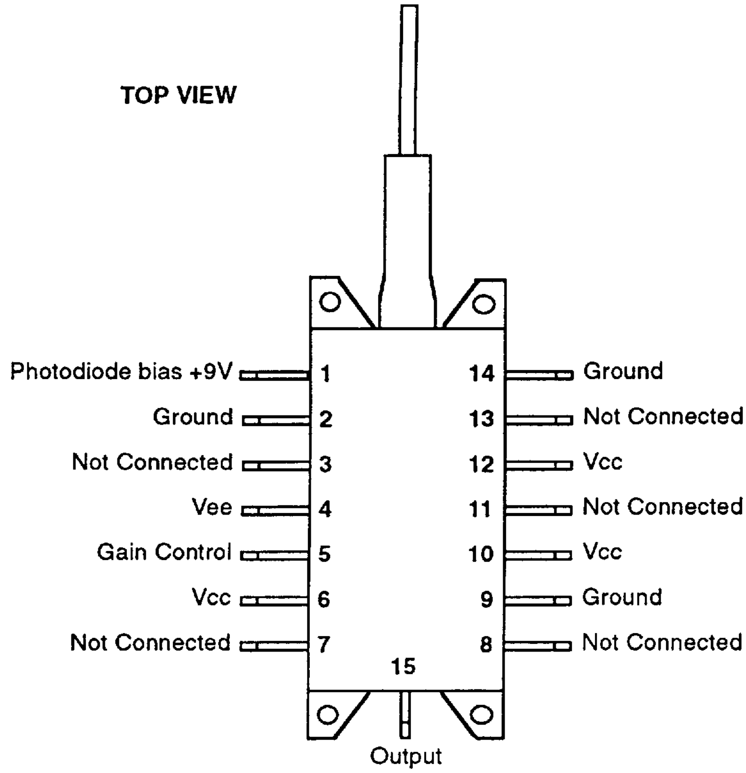
PDC2201



PDC2201 receivers are available for data rates of 1.2 and 2.4 Gbit/s. Each variant is optimised for the particular bit rate. They serve as high sensitivrty, wide dynamic range front-ends for a variety of optical receiver applications.

The planar PIN InGaAs photodiode provides excellent 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 a15 pin flatpack suitable for surface mounting, with a 50 ohm output pin on the package end.

PDC2201 CONNECTION DIAGRAM



PIN DESCRIPTIONS:

Photodiode Bias +9V:
+9 volts, photodiode bias, current dependent upon incoming light level, internally bypassed with 100pF chip capacitor.

Ground:
These pins are to be connected to the system ground.

Not Connected:
No internal connection.

Vee:
-5.2 Volts, negative supply pin for first stage output buffer, 6-8mA nominal current, internally bypassed with 100pf chip capacitor.

Gain Control:
Internally biased at +1 volt (maximum gain), controls second stage gain. Internal circuit consists of series 100 Ohm resistor with 1000 pF shunt capacitor to ground.

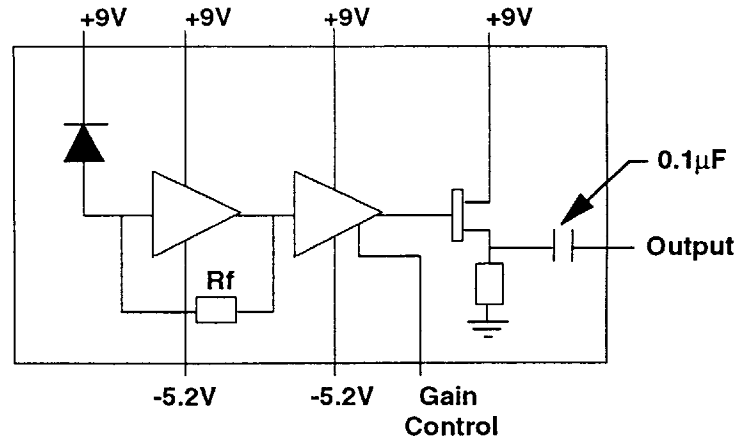
Vcc Pin 6:
+9 volts, output buffer stage supply, 12mA nominal supply current, internally bypassed with 100 pF chip capacitor.

Vcc Pin 10:
+9 volts, gain stage supply pin, 15mA nominal current, internally bypassed with 100 pF chip capacitor.

Vcc Pin 12:
+9 volts, transimpedance stage supply pin, 18mA nominal current, internally bypassed with 100 pF chip capacitor.

Output:
Signal Output Pin, connected to I. C. through 0.1 uF chip capacitor.

PDC2201 BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The PDC2201 receiver family consists of standard PINFET style optical receivers optimized for data rates of 1.2 and 2.4 Gbit/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).

Electrical Performance

The circuit requires a positive supply of +9V, which is used to power the GaAs circuit and also bias the photodiode. The circuit also requires a negative supply of -5V, and good electrical ground integrity for optimum sensitivity.

The photodiode cathode is connected to a separate package pin to enable the user to monitor the detector photocurrent.

The analog electrical output gives a peak to peak output voltage signal which is proportional to the incident optical input power for inputs 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 power up to 10mW can be applied without damaging the device.

Layout Considerations

In order to optimize the device sensitivity 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 with good contact to the metallized system ground on the PCB. The drilled flanges on the package can be soldered, riveted or bolted ground plane to the system ground as a further improvement.

b) In order to damp the resonance due to lead inductances and decoupling capacitors, it is recommended that the device power supplies be 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.

FUNCTIONAL DESCRIPTION (CONT.)

Gain Control

The high electrical gain of the PDC2201 can be reduced for applications where high optical input power is used. This is done using the Gain Control pin. 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 to the negative rail.

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

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 specified data rate with an NRZ, 2^{15}-1 PRBS.

The laser source 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 amplifier/regenerator, and a filter with -3dB point at 0.7 of the bit rate, to an error rate test set.

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.

PDC2201 SPECIFICATIONS [6]

PARAMETER	-1.2 Version MIN	TYP	MAX	-2.4 Version MIN	TYP	MAX	UNITS
Bit Rate	-	1200		-	2400	-	Mbit/s
-3dB frequency [1]	-	650	-	-	1700	-	MHz
Sensitivity [2]	-	-	-30			-27	dBm
Output signal at sens. [3]	-	15	-	-	12	-	pk-pk mV
Responsivity [3]	-	10.2	-	-	3.7	-	kV/W
Maximum opt. power [4]	-	-8	-	-	-8	-	dBm

PARAMETER	MIN	TYP	MAX	UNITS
Wavelength	1100	-	1650	nm
Output impedance	48	50	52	Ohms
Vcc supply voltage	-	9	-	V
current	-	60	-	mA
Vee supply voltage	-	-5.2	-	V
current	-	6	-	mA
Total power	-	600	700	mW
Fiber Length [5]	0.4	1	-	meter
MTTF (@ 25°C case temp.)	-	500,000	-	hours

MAXIMUM RATINGS

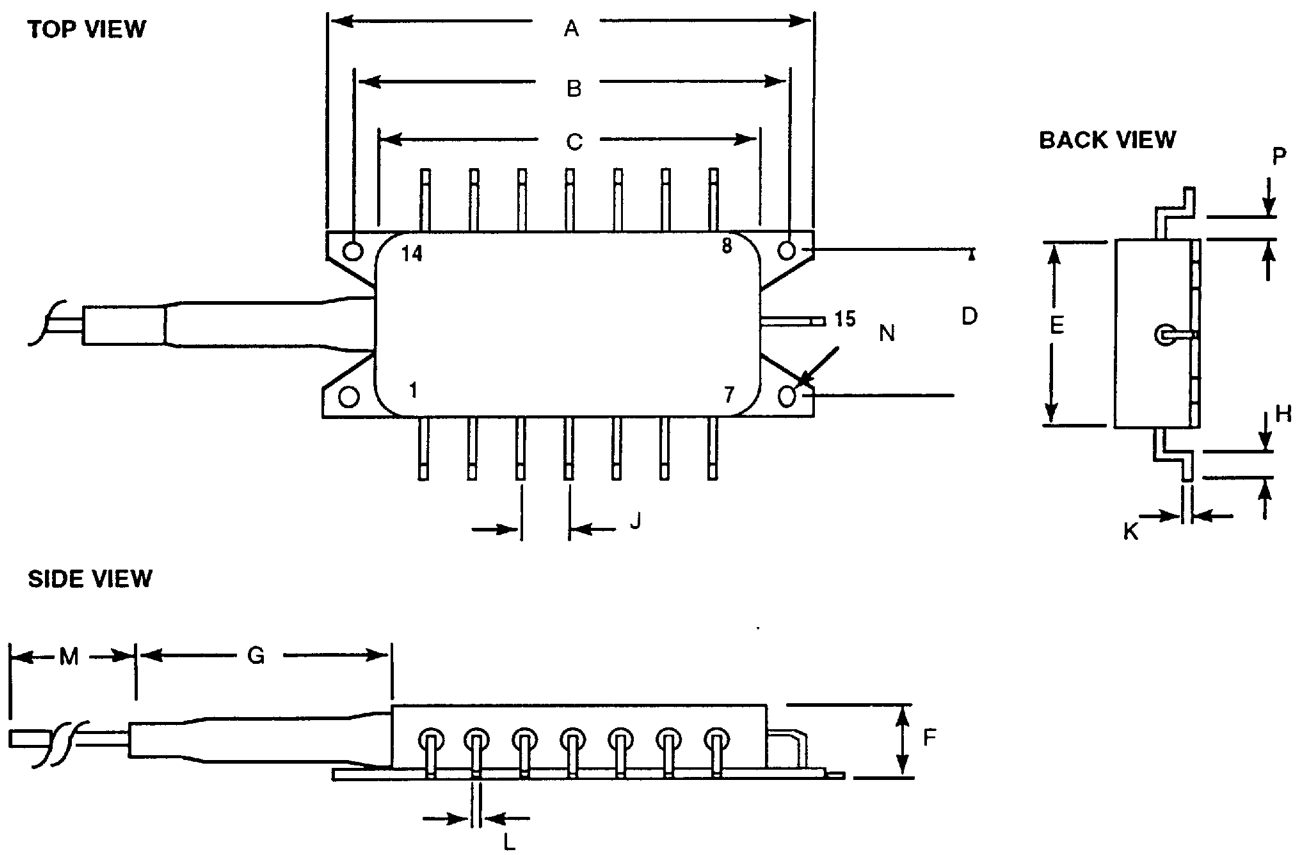
PARAMETER	MIN	TYP	MAX	UNITS
Case operating temperature	-20	-	85	°C
Storage temperature	-40	-	85	°C
Optical input power	-	-	10	mW
Supply voltage Vcc	-0.5	-	9.5	V
Vee	-5.5	-	0.5	V

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.
5. Fiber specifications - 50/125 core/cladding diameter 900 µm outside diameter silicone/nylon tight jacket temperature rated at 85°C.
6. At 25°C unless otherwise noted.

PDC2201 DIMENSIONS

DIM	MIN	NOM	MAX
A	25.26	———	25.46
B	———	23.40	———
C	20.45	———	20.95
D	———	10.70	———
E	12.60	———	12.80
F	6.03	———	6.39
G	———	———	25.00
H	0.75	———	1.25
J	———	2.54	———
K	———	0.30	———
L	———	0.38	———
M	———	1000	———
N	———	1.00	———
P	———	1.00	———

All dimensions in mm



ORDERING INFORMATION:

When ordering please specify the part number as indicated below.

PDC2201 - XXX - XX

Connector Suffix:
FP = FC/PC
ST®= ST
SA = SMA
BI = Biconic

Data Rate:
1.2 = 1.2 Gbit/s
2.4 = 2.4 Gbit/s

Product Number:
PDC2201

HANDLING PRECAUTIONS

The PDC2201 can be damaged by current surges or overvoltage. Power supply transient precautions should be taken. Normal handling precautions for electrostatic sensitive devices should be taken.

Americas

BT&D Technologies
500 North Walnut Road
Kennett Square
PA 19348

Telephone:
(800) 545-4306 (U.S. only)
(215) 444-6888

Fax:
(215) 444-6868

Boston, MA
(617) 229-5805

San Jose, CA
(408) 428-9377
(800) 848-1923 (U.S. only)

Irvine, CA
(714) 453-8111

Dallas,TX
(214) 503-0085

Asia Pacific

BT&D Technologies
Du Pont Japan Technical Center
4997 Shin-Yoshida-Cho
Kohoku-Ku, Yokohama-Shi
Kanagawa 223, Japan

Telephone:
(045) 593-4870

Fax:
(045) 593-4852

Europe

BT&D Technologies, Ltd.
Whitehouse Road
Ipswich, Suffolk
IP1 5PB
England

Telephone:
0473-742250
Int: +44-473-742250

Fax:
+44-473-241110