Please read this data sheet before purchasing and keep it on file for future reference. It contains important information on the product specifications.

Optocom
Optoelectronics Group

OPT1165-5∅
OC-3 Optical Receiver
with Clock Recovery

Data Sheet
2004/5
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General

Description
The OPT1165-5∅ is a 20-pin DIP fiber optic receiver module which converts lightwaves in the 1310/1550 nm band to electrical data signals at a data rate of 155.52 Mbps. The receiver has a hermetically sealed InGaAs photodiode aligned to a multimode fiber.

Applications
The device is designed for data communication systems and telecommunication transmission systems over singlemode or multimode fiber.

Standards Met
The specifications met are: the SONET/SDH STS-3/STM-1 interface, the Long Reach OC-3 Optical Parameters (LR1, LR2 & LR3) of Bellcore GR-253-CORE, the Longhaul Recommendation (L-1.1, L-1.2 & L-1.3) of ITU-T G.957, and the monitor & alarm requirements of Bellcore GR-253-CORE & ITU-T G.783 and G.988.

Features

Operation
The OPT1165-5∅ optical receiver operates using a single +5 V power supply. The device maintains electrical and optical stability over the specified temperature and voltage ratings. Outputs include data & clock signals and signal detect (SD).

User Options and Assurance
Operator can measure the photocurrent generated in response to the incoming optical signal. The photocurrent can be calculated based on the voltage drop across an external resistor connected between the monitoring pin 10 and +5 V. If photocurrent measurement is not required, pin 10 should be connected to a +5 V power supply directly.

Every device is optically and electrically tested to ensure highest performance and reliability.

Ratings

Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V_C</td>
<td>0</td>
<td>60</td>
<td>V</td>
</tr>
<tr>
<td>Operating Case Temperature Range</td>
<td>T_E</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Relative Humidity</td>
<td>H_R</td>
<td>—</td>
<td>85</td>
<td>%</td>
</tr>
<tr>
<td>Lead Soldering Temperature/Time</td>
<td>T/t</td>
<td>—</td>
<td>250</td>
<td>°C/s</td>
</tr>
<tr>
<td>Minimum Fiber Bend Radius</td>
<td>R_F</td>
<td>32/1.25</td>
<td>—</td>
<td>mm/in</td>
</tr>
<tr>
<td>Storage Case Temperature Range</td>
<td>T_STG</td>
<td>-40</td>
<td>85</td>
<td>°C</td>
</tr>
</tbody>
</table>
## Operating Characteristics

### Optical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Wavelength</td>
<td>( \lambda )</td>
<td>1260</td>
<td>-</td>
<td>1580</td>
<td>nm</td>
</tr>
<tr>
<td>Measured Average Sensitivity(^1)</td>
<td>( R_L )</td>
<td>-340</td>
<td>-36</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>Maximum Input Power</td>
<td>( P_{RH} )</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>dBm</td>
</tr>
</tbody>
</table>

**Signal Detect Threshold:**

- **Decreasing Light Input:** \( SDT_D \)
  - Min: -53 dBm
  - Typ: -43 dBm
  - Max: -36 dBm
- **Increasing Light Input:** \( SDT_I \)
  - Min: -52 dBm
  - Typ: -40 dBm
  - Max: -36 dBm
- **Hysteresis:** \( SDT_H \)
  - Min: -
  - Typ: 2 dBm
  - Max: -

**Photodiode Responsivity\(^2\):** \( PD_R \)
- Min: 0.8 A/W
- Typ: ---
- Max: 1.0 A/W

\(^1\) At a BER of \( 1 \times 10^{-10} \) and an extinction ratio of 10 dB or more

\(^2\) Photocurrent \( = \) Responsivity \( \times \) Mean Power.

### Electrical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>dc Power Supply Voltage</td>
<td>( V_C )</td>
<td>4.75</td>
<td>50</td>
<td>5.25</td>
<td>V</td>
</tr>
<tr>
<td>dc Power Supply Current</td>
<td>( I_C )</td>
<td>50</td>
<td>-</td>
<td>300</td>
<td>mA</td>
</tr>
</tbody>
</table>

**Output Voltage\(^3\):**

- **Low:** \( V_L \)
  - Min: -20 dBm
  - Typ: -18 dBm
  - Max: -17 V
- **High:** \( V_H \)
  - Min: -12 dBm
  - Typ: -10 dBm
  - Max: -0.7 V

**Output Transition Time\(^4\):** \( t_i \)
- Min: -
- Typ: -
- Max: 17 ns

**Output Signal Detect Voltage:**

- **Low:** \( V_{SDL} \)
  - Min: -
  - Typ: -
  - Max: 0.4 V
- **High:** \( V_{SDH} \)
  - Min: 36 V
  - Typ: -
  - Max: -

**Clock/Data Alignment\(^5\):** \( T_{DA} \)
- Min: -0.8 ns
- Typ: -
- Max: +0.8 ns

**Clock Duty Cycle:** \( 45 \%

**Output Clock Random Jitter:** \( j_c \)
- Min: -
- Typ: 12 ns
- Max: 36 ° RMS

**Output Clock Jitter Peaking:** \( j_p \)
- Min: 0.04 ns
- Typ: 0.05 ns
- Max: 0.06 dB

**Signal Detect Response Time\(^6\):**

- **Decreasing Light Input:** \( SDRT_D \)
  - Min: 10 µs
  - Typ: -
  - Max: 100 µs
- **Increasing Light Input:** \( SDRT_I \)
  - Min: 10 µs
  - Typ: -
  - Max: 100 µs

\(^3\) At a BER of \( 1 \times 10^{-10} \) and an extinction ratio of 10 dB or more

\(^4\) Decreasing Light Input

\(^5\) Increasing Light Input
Operating Characteristics - continued

1. Output measured from \( V_C \) with 50Ω load to \( [V_C \cdot 2] \) V.
2. Between 10% and 90% (50% duty cycle).
3. Data transition relative to the rising edge of \( \text{CLOCK} \).
4. Measured from the onset of an all-zeros pattern lasting 100 µs or longer (see GR-253-CORE). The SD output shall not respond to an all-zeros pattern lasting less than 23 µs.
5. Measured from the transition to a pseudorandom \( (2^{23} \cdot 1) \) polynomial word having a 50% duty cycle and an average optical input power, \( P_I \), where \( P_L \leq P_I \leq P_H \) from a pre-existing all-zeros pattern of 100 µs or longer duration (see GR-253-CORE).

Receiver Output Data/Clock Alignment

![Data and Clock Alignment Diagram]

Physical

Pin Designations

<table>
<thead>
<tr>
<th>Pin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>CLOCK+</td>
<td>CLOCK-</td>
<td>GND</td>
<td>DATA+</td>
<td>GND</td>
<td>DATA-</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>Pin</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>GND</td>
<td>GND</td>
<td>DATA-</td>
<td>GND</td>
<td>DATA+</td>
<td>NC</td>
</tr>
</tbody>
</table>

OPT1165-5.0 OC-3 Optical Receiver Data Sheet
Physical - continued

The device package conforms to the 20-pin DIP outline shown below.

Outline Diagram

![Outline Diagram]

Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Typ</th>
<th>Inches</th>
<th>Metric (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>1.300</td>
<td>33.0</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>0.635</td>
<td>16.13</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>1.22</td>
<td>30.99</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>0.365</td>
<td>9.27</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>0.100</td>
<td>2.54</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>0.010</td>
<td>2.79</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td>0.018</td>
<td>0.46</td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>0.400</td>
<td>10.16</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>0.244</td>
<td>6.20</td>
</tr>
</tbody>
</table>
**Physical - continued**

An assigned serial number in both barcode and human readable formats appear on the device.

All markings and labels are permanent and meet the requirements of MIL-STD-883C-2015.

**Connections**

The pigtail consists of a multimode (MM) fiber with a 50 µm core. The outer jacket has a nominal 900 µm diameter and is terminated with an ST®, FC, or SC connector. The minimal pigtail length is 1 meter (39.4 inches) long.

*ST® is a registered trademark of AT&T*

**Safety**

Please embrace all customary precautions & discretion while handling this device.

<table>
<thead>
<tr>
<th>Optical</th>
<th>• Avoid direct eye exposure to laser beam projection area or a broken fiber under operation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>• Warning against excessive overvolts or current surges as these may cause failure or electrical shock.</td>
</tr>
<tr>
<td></td>
<td>• Solder leads to electronics entirely so as to eschew short circuits.</td>
</tr>
<tr>
<td></td>
<td>• Solder or plug in device while power is turned off.</td>
</tr>
<tr>
<td>Other</td>
<td>• Avoid storage above maximum temperature rating &amp; other extreme conditions.</td>
</tr>
<tr>
<td></td>
<td>• Avoid device disassembly as damages may be incurred.</td>
</tr>
<tr>
<td></td>
<td>• Avoid excessive force to fiber pigtail and bending beyond a 30 mm radius.</td>
</tr>
<tr>
<td></td>
<td>• Take normal handling precautions as for all electrostatic sensitive devices.</td>
</tr>
</tbody>
</table>
Appendix

Terms
- BER: Bit Error Rate
- SD: indicates the presence of an incoming signal level that has a workable BER
- GND: Ground
- NC: not connected

Additional Information

Contact
For additional information, product specifications, or information about Optocom:

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