



## TECHNICAL SPECIFICATIONS

### G-PON CLASS B+ ONU Triplexer Transceiver

#### ONU22-GD132A14-GPC Series



#### Revision Record

Document No.	Date of Issue	Description	Incorporated by	Checked by
ONU22-GD132A14-GPC rev 0	08/08/2007	Initial issue	R.T.	H.T.
ONU22-GD132A14-GPC rev 0.1	09/28/2007	Add contact info and picture	R.T.	H.T.
ONU22-GD132A14-GPC rev 1	06/18/2008	Add Pin 21 to 23 for RF output	R.T.	T.Y.

## Features

- Single-fiber 2×2-inch Integrated Transceiver
- Fiber-to-the-x (FTTx) Triple-play Voice/Data/Video ONU Applications
- 1.244 Gbps 13100 nm Burst-Mode DFB Transmitter
- 2.488 Gbps 1490 nm Continuous-Mode APD Receiver
- 1555nm Video/RF Receiver
- Short Burst-Mode Transmitter Stabilization Time
- High Video/RF Output
- Digital Diagnostic Monitoring, Alarm, and Control Through Two-Wire Serial Interface
- +3.3 V Power Supply for Digital Circuit and +12 V Power Supply for RF Circuit
- Compliant with ITU-T G.984.2 GPON Class B+ Spec
- RoHS Complaint
- Class 1 Laser International Safety Standard IEC 60825 Compliant

## Applications

- FTTx

### 1. Absolute Maximum Ratings

Parameter	Condition	Min	Max	Unit
Storage Temperature	Ambient	-40	85	°C
Operating Temperature	Case	0	70	°C
Operating Relative Humidity	@70°C, Non-Condensing	10%	90%	
ESD Rating (Human Body Model)		–	1000	V
Lead Soldering Temperature	10 sec	–	260	°C
Vcc_TX_3.3V		-0.5	4.0	V
Vcc_RX_3.3V		-0.5	4.5	V
Vcc_Microprocessor_3.3V		-0.3	4.2	V

### 2. Module Power Requirements

Parameter	Condition	Min	Typ.	Max	Unit
Total 3.3V Current		–	–	350	mA
Video 12V Current		–	–	200	mA
Total Power Consumption		–	–	3.8	Watts

### 3. Module Characteristics

Parameter	Condition	Min	Typ.	Max	Unit
Cross Talk	1310nm Tx to 1490nm Rx	–	–	-47	dB
Cross Talk	1310nm Tx to 1555nm Rx	–	–	-47	dB
Isolation	1490nm Ext to 1555nm Rx	35	–	–	dB
Isolation	1550nm Ext to 1490nm Rx	35	–	–	dB

### 4. Digital Transmitter Specifications

Parameter	Condition	Min	Typ.	Max	Unit
Center Wavelength		1290	1310	1330	nm
Operating Voltage	Vcc referenced to GND	3.14	3.3	3.46	V
Data Rate		–	1244.16	–	Mb/s

Document No.	ONU22-GD132A14-GPC rev 1	Page No.	2
--------------	--------------------------	----------	---

Average Optical Output Power (Burst Enabled)		0.5	-	5	dBm
Average Optical Output Power (Burst Disable)		-	-	-50	dBm
Extinction Ratio	PRBS 2 <sup>23</sup> -1, NRZ, 50% duty cycle	10	-	-	dB
Optical Rise/Fall Time	20% to 80%	-	250	-	ps
Transmitter Eye Diagram	Compliant to G.984.2 Figure 3				
-20dB Spectral Width		-	-	1	nm
Side Mode Suppression Ratio		30	40	-	dB
Differential Input Voltage	Tx data+/-, Burst enabled, CML input, DC coupled	200	-	1600	mVp-p
Differential Input Impedance	Tx data+/-, Burst enabled	-	100	-	Ω
Burst Enable/Disable Time	Data rate 1244.16Mb/s	-	-	16	Bits
Common-Mode Input Voltage	Tx data, Burst enabled, CML input, DC coupled	1.8	-	2.4	V

## 5. Digital Receiver Specifications

Parameter	Condition	Min	Typ.	Max	Unit
Operating Wavelength		1480	1490	1500	nm
Operating Voltage	Vcc referenced to GND	3.14	3.3	3.46	V
Data Rate		-	2488.32	-	Mb/s
Average Optical Input Power	BER≤10 <sup>-10</sup> , PRBS 2 <sup>23</sup> -1	-29	-	-8	dBm
Optical Return Loss		20	-	-	dB
Optical Rise/Fall Time	20% to 80%	-	160	-	ps
Signal Detect (Assert)	Status changed during optical input power increasing	-	-	-27	dBm
Signal Detect (De-assert)	Status changed during optical input power decreasing	-37	-	-	dBm
Signal Detect (Hysteresis)		1	-	-	dB
Differential Output Voltage	50 Ω CML data	300	-	1200	mV

## 6. Video Receiver Specifications

Parameter	Condition	Min	Typ.	Max	Unit
Operating Wavelength		1550	1555	1560	nm
Operating Voltage		11.7	-	13.2	V
Frequency Range		54	-	870	MHz
Channel Bandwidth		-	4	-	dBm
Channel Spacing		-	6	-	dBm
Optical Return Loss		20	-	-	dB
Optical Input Power		-8	-	2	dBm
RF Channel Output Level	At 550MHz	14.5	-	22	dBmV
RF Output Power Tilt	RF output level difference between 54MHz and 870MHz	2.5	-	7.5	dB
Frequency Flatness	Peak to peak variance	-	-	3	dB
AGC Tolerance at 550MHz	Within optical input power range	0	-	3	dB
Carrier to Noise Ratio	With -6dBm optical input power	46			dB
CSO			-62	-55	dBc
CTB			-62	-59	dBc

Note: OMI=4.3%/carrier for 40 analog channels, OMI=2.15%/carrier for 63 digital channels

Document No.	ONU22-GD132A14-GPC rev 1	Page No.	3
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## 7. Serial Interface Specifications

Parameter	Condition	Min	Typ.	Max	Unit
Serial Interface Bus		Industry standard 2-wire serial bus (I <sup>2</sup> C like)			
Clock Speed		–	–	400	KHz
SDA	Serial data line	LVTTL, open collector			
SCL	Serial clock line	LVTTL, open collector			

## 8. Serial ID Memory Contents (Table A0h)

Data Address	Size (Bytes)	Status	Name of Field	Value (Hex)	Description of Field and Value
00-0B	12	Read/Write	Customer's Part Number	X X X X X X X X X X X X	Customer assigned transceiver part number (ASCII): xxxxxxxxxxxx
0C	1	Reserved			Reserved for upstream bit rate: (reserved)
0D	1	Reserved			Reserved for downstream bit rate: (reserved)
OE-OF	2	Unspecified			(unspecified)
10	1	Reserved			Reserved for minimum RF output level: (reserved)
11	1	Reserved			Reserved for low level video input power: (reserved)
12	1	Reserved			Reserved for high level video input power: (reserved)
13	1	Reserved			Reserved for nominal RF tilt: (reserved)
14-23	16	Read/Write	Vendor Name	53 45 4E 4E 53 45 45 4B 20 20 20 20 20 20 20 20	Transceiver vendor name (ASCII): SENNSEEK
24	1	Unspecified			(unspecified)
25	1	Reserved			Reserved for RF bandwidth: (reserved)
26-31	12	Unspecified			(unspecified)
32	1	Read/Write	1550 PD Responsivity	X	Responsivity of video detector (0.1A/W): xx
33-37	5	Unspecified			(unspecified)
38-3B	4	Read/Write	Revision Level	30 20 20 20	Vendor transceiver revision: 0
3C	1	Reserved			Reserved for digital TX wavelength: (reserved)
3D	1	Reserved			Reserved for digital RX wavelength: (reserved)
3E-43	6	Unspecified			(unspecified)
44-53	16	Read/Write	Serial Number	X X X X X X 20 20 20 20 20 20 20 20 20 20	Vendor assigned serial number (ASCII): xxxxxx
54 – 5B	8	Read/Write	Manufactured Date Code	X X X X X X 33 38	Vendors manufacturing date code (ASCII): yy/mm/dd/38
5C	1	Reserved			Reserved for diagnostic indicator: (reserved)
5D-5F	3	Unspecified			(unspecified)
60-7D	30	Read/Write	Vendor's Part Number	4F 4E 55 32 32 41 2D 47 44 31 33 32 41 31 34 53 41 2D 47 50 43 20 20 20 20 20 20 20 20 20	Vendor assigned transceiver part number (ASCII): ONU22A-GD132A14SA-GPC
7E -FF	130	Unspecified			(unspecified)

### Definitions for Table A0h:

1. **The Customer Part Number:** A 12-character ASCII field, left aligned and padded to the right with ASCII spaces.
2. **Module Vendor Name:** A 16-character ASCII field, left aligned and padded to the right with ASCII spaces.

Document No.	ONU22-GD132A14-GPC rev 1	Page No.	4
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3. **Responsivity:** A measured value of the module photo-detector's responsivity in units of 0.01mA/mW. Its stored value is an unsigned binary number. A binary value of 01010101 (55h or 85d) represents a value of 0.85mA/mW.
4. **Revision Level:** A 4-character ASCII field, left aligned and padded to the right with ASCII spaces.
5. **Serial Number:** A 16-character ASCII field, left aligned and padded to the right with ASCII spaces.
6. **Manufactured Date Code:** An 8-character ASCII field formatted yy/mm/dd and the last two bytes as 33h 38h. An ASCII value of "07080838" means August 8, 2007.
7. **Vendor's Part Number:** A 30-character ASCII field, left aligned and padded to the right with ASCII spaces.

## 9. Digital Diagnostic Data Fields (Table A2h)

Data Address	Size (Bytes)	Bits	Status	Name of Field	Description of Field
00-01	2	All	Reserved		<i>Reserved for Temp_Alarm_Hi</i>
02-03	2	All	Reserved		<i>Reserved for Temp_Alarm_Lo</i>
04-05	2	All	Reserved		<i>Reserved for Temp_Warn_Hi</i>
06-07	2	All	Reserved		<i>Reserved for Temp_Warn_Lo</i>
08-09	2	All	Reserved		<i>Reserved for Vcc_Alarm_Hi</i>
0A-0B	2	All	Reserved		<i>Reserved for Vcc_Alarm_Lo</i>
0C-0D	2	All	Reserved		<i>Reserved for Vcc_Warn_Hi</i>
0E-0F	2	All	Reserved		<i>Reserved for Vcc_Warn_Lo</i>
10-11	2	All	Reserved		<i>Reserved for VPDMON_Alarm_Hi</i>
12-13	2	All	Reserved		<i>Reserved for VPDMON_Alarm_Lo</i>
14-15	2	All	Reserved		<i>Reserved for VPDMON_Warn_Hi</i>
16-17	2	All	Reserved		<i>Reserved for VPDMON_Warn_Lo</i>
18-19	2	All	Reserved		<i>Reserved for RFMon_Alarm_Hi</i>
1A-1B	2	All	Reserved		<i>Reserved for RFMon_Alarm_Lo</i>
1C-1D	2	All	Reserved		<i>Reserved for RFMon_Warn_Hi</i>
1E-1F	2	All	Reserved		<i>Reserved for RFMon_Warn_Lo</i>
20-21	2	All	Reserved		<i>Reserved for RSSI_Alarm_Hi</i>
22-23	2	All	Reserved		<i>Reserved for RSSI_Alarm_Lo</i>
24-25	2	All	Reserved		<i>Reserved for RSSI_Warn_Hi</i>
26-27	2	All	Reserved		<i>Reserved for RSSI_Warn_Lo</i>
28-31	4	All	Unspecified		<i>(unspecified)</i>
32	1	All	Read/Write	RF Offset	RF Output Level Control
38-3B	4	All	Read	RSSI_COEFF4	RSSI 4 <sup>th</sup> Order Calibration Coefficient
3C-3F	4	All	Read	RSSI_COEFF3	RSSI 3 <sup>rd</sup> Order Calibration Coefficient
40-43	4	All	Read	RSSI_COEFF2	RSSI 2 <sup>nd</sup> Order Calibration Coefficient
44-47	4	All	Read	RSSI_COEFF1	RSSI 1 <sup>st</sup> Order Calibration Coefficient
48-4B	4	All	Read	RSSI_COEFF0	RSSI 0 <sup>th</sup> Order Calibration Coefficient
4C-58	13	All	Unspecified		<i>(unspecified)</i>
59-5A	2	All	Reserved		<i>Reserved for RFMON Feed Differential</i>
5D-5E	2	All	Reserved		<i>Reserved for vendor assigned firmware version number</i>
60-61	2	All	Read	TEMP	Transceiver internal temperature monitor
62-63	2	All	Reserved		<i>Reserved for microprocessor voltage monitor</i>
64-65	2	All	Read	VPDMON	1550 Photo-diode monitor voltage
66-67	2	All	Read	RFMON	RF power voltage monitor
68-69	2	All	Read	RSSI	1490 Receive signal strength indicator
6A-6D	4	All	Unspecified		<i>(unspecified)</i>
6E	1	0	Reserved		<i>Reserved for signal detect status.</i>
6E	1	1	Reserved		<i>Reserved for interrupt status</i>
6E	1	2	Reserved		<i>Reserved for Tx fail status</i>
6E	1	3	Reserved		<i>Reserved for video circuit power consumption control</i>

6E	1	4	Reserved		<i>Reserved for TX Enable/Disable</i>
6E	1	5	Read/Write	AGC_HOLD	Hold AGC. Reset on boot.
6E	1	6	Reserved		<i>Reserved for eye-safety fault.</i>
6E	1	7	Reserved		<i>Reserved for RF squelch control bit</i>
6F-77	9	All			<i>(unspecified)</i>
78	1	0	Flash Control	Reset	Hex Value 01 = Reset
78	1	1	Flash Control	Save	Hex value 02 = Save Data
79-FF	135	All	Unspecified		<i>(unspecified)</i>

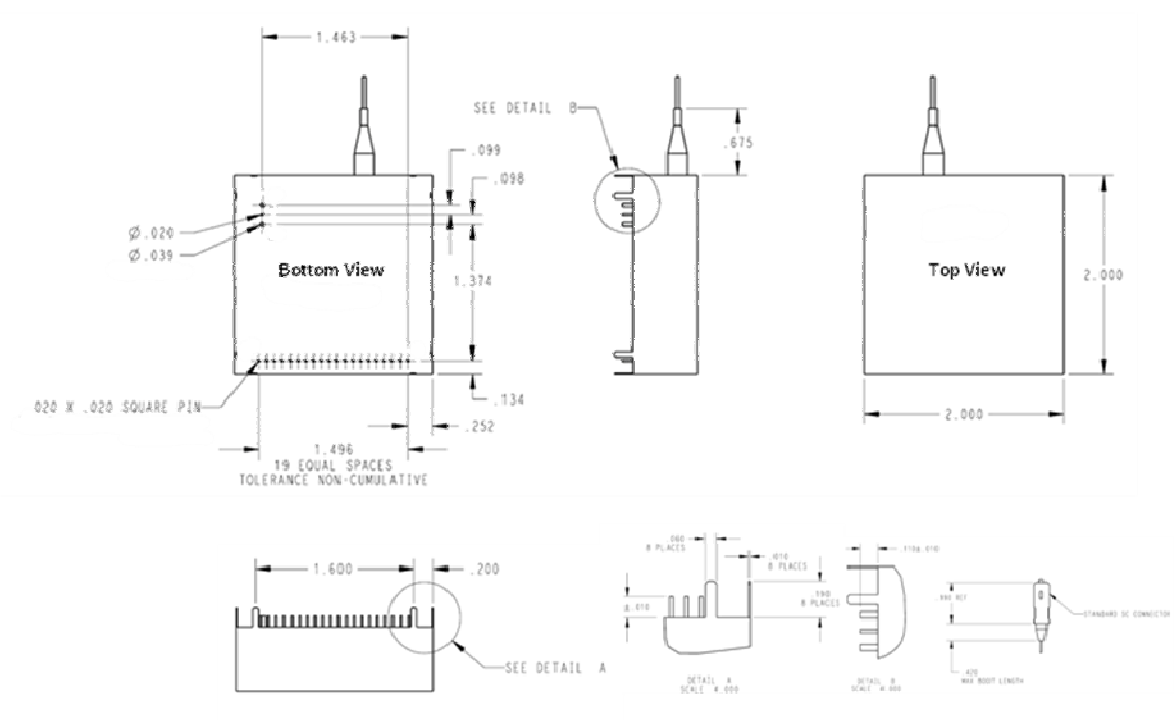
**Definitions for Table A2h:**

1. **RF\_Offset:** The RF output levels control. It is an 8-bit signed value in units of dB. The value “00000001” is 1dB attenuation, while “10000001” is 1dB amplification. Write 02h to Table A2h address 78 to save changes.
2. **RSSI\_COEFFx:** The calibration coefficients, 0<sup>th</sup> to 4<sup>th</sup> order. Format is 32 bit floating point with MSB stored first.
3. **TEMP:** A 16-bit 2’s complement binary format indicating the internal temperature of the transceiver. The upper byte is a value between +128 and -127 Celsius. The lower byte gives the fractional changes in the binary inverse relationship. To calculate the value of the temperature, treat the binary number as an unsigned number, convert it to decimal, and divide by 256. If the result is greater than or equal to 128, then subtract 256 from the results.
4. **VPdMON:** A 16-bit unsigned number that is used to derive the optical power at the photo-detector. To derive the voltage, convert the binary value into decimal, multiply by 2.44 and divide by 1024. The voltage is measured across a 500 Ohm resistor. Therefore, the current in the photo-detector can be calculated as I(mA) = VPdMON\*2. With the stored Responsivity, the optical power can be calculated by the equation: Opt Power (dBm) =10\*Log[2\*VPdMon / (Responsivity\*.01)]
5. **RFMON Voltage:** The total RF power monitor. It is a 16-bit unsigned binary number in units of 0.1 dBµV. The raw number of 905 means the total RF output power of 90.5 dBµV
6. **RSSI:** The raw 1490nm received power indicator. To convert to true RSSI in units of 0.1 uW use the equation:  

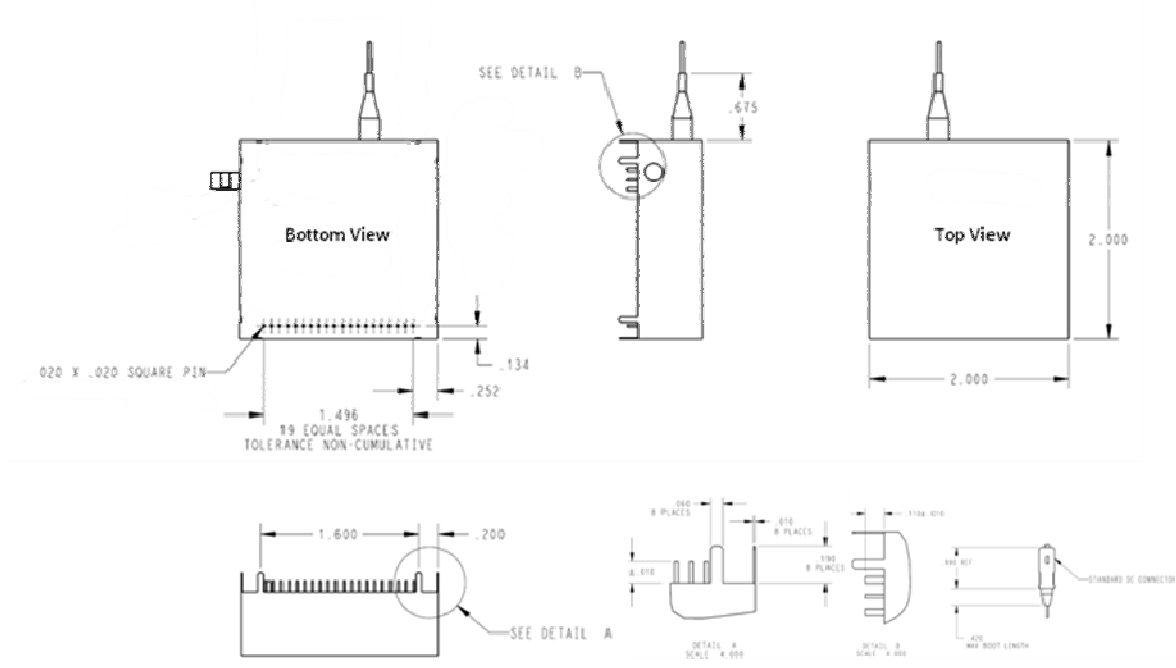
$$RSSI_{(true)} = (RSSI\_COEFF0 + RSSI\_COEFF1 * RSSI) + (RSSI\_COEFF2 * RSSI^2) + (RSSI\_COEFF3 * RSSI^3) + (RSSI\_COEFF4 * RSSI^4)$$

## 10. Dimensions

### Type A: (Digital 1×20 pins+ RF 1×3 pins)

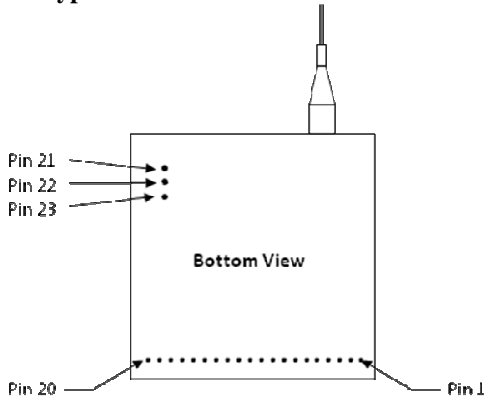


### Type B: (Digital 1×20 pins+ RF Mini SMB)

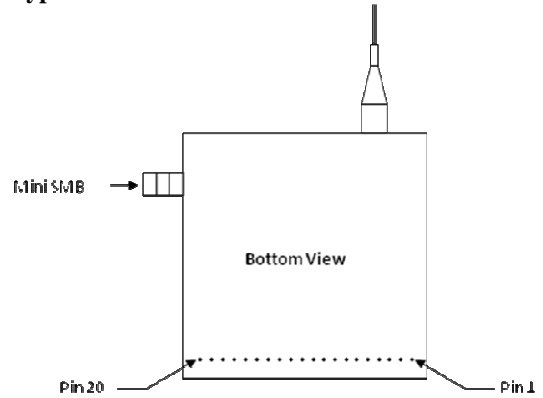


## 11. Pin Descriptions

**Type A:**



**Type B:**



PIN	Name of PIN	Description of PIN
1	GND	Ground
2	GND	Ground
3	Vcc_RX_3.3V	Digital RX Vcc 3.3 Volts
4	SD	Signal Detect. LVTTTL. High when input optical power is above threshold.
5	RXD+	Digital RX Data. CML. 50Ω terminated AC-coupled
6	RXD-	Digital RX Data Bar. 50Ω terminated AC-coupled
7	BEN+	Burst Enable. CML input
8	BEN-	Burst Enable Bar. CML input
9	GND	Ground
10	TXD+	Digital TX Data. CML input. 100Ω differentially terminated.
11	GND	Ground
12	TXD-	Digital TX Data Bar. CML input. 100Ω differentially terminated.
13	Vcc_TX_3.3V	Digital TX Vcc 3.3 Volts
14	SDA	Serial Interface Data. LVTTTL
15	SCL	Serial Interface Clock. LVTTTL
16	INT	Interrupt. LVTTTL. Internal pull-up. Active low.
17	Vdd_12V	Video RX Vdd 12 Volts
18	Vcc_Microprocessor_3.3V	Microprocessor 3.3 Volts DC
19	RST	Reset Bar. Internal pull-up. Active low.
20	GND	Ground
21 (Type A only)	GND	Ground
22 (Type A only)	RF_Out	RF Output Signal
23 (Type A only)	GND	Ground
Mini SMB (Type B only)	RF_Out	RF Output Signal

**12. Ordering Information**

**Example: ONU22A-GD132A14SA-GPC**

**ONUxxx - x x xx x x xx xx - xx x**

**Package Type**

- 22A ..... 2x2inch Type A
- 22B ..... 2x2inch Type B
- SF1 ..... SFF 2x5 Pins
- SF2 ..... SFF 2x10 Pins
- SFP ..... SFP

**TX Rate**

- 1 ..... 155Mbps
- 6 ..... 622Mbps
- G ..... 1.25Gpbs
- 2 ..... 2.5Gpbs

**TX Type**

- F ..... FP
- D ..... DFB

**Center Wavelength**

- 13 ..... 1310nm
- 14 ..... 1490nm
- 15 ..... 1550nm

**RX Rate**

- 1 ..... 155Mbps
- 6 ..... 622Mbps
- G ..... 1.25Gpbs
- 2 ..... 2.5Gpbs

**RX Type**

- P ..... PIN
- A ..... APD

**Center Wavelength**

- 13 ..... 1310nm
- 14 ..... 1490nm
- 15 ..... 1550nm

**Connector/Receptacle Type**

- FC ..... FC type
- SC ..... SC type
- ST ..... ST type
- LC ..... LC type
- FA ..... FC/APC type
- SA ..... SC/APC type
- MU ..... MU type
- NC ..... None

**Standard**

- BB ..... BPON Class B
- GB ..... GPON Class B
- GP ..... GPON Class B+
- GC ..... GPON Class C

**Application**

- C ..... Commercial
- I ..... Industrial

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Document No.	ONU22-GD132A14-GPC rev 1	Page No.	9
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