

Features

- Simplex SC/APC Connector, Integrated Diplexer Transceiver
- SFP MSA, digital diagnostics SFF-8472 Compliant
- Compliant to FSAN G.984.2 Specifications
- 1244 Mbps Tx, 2488 Mbps Rx Asymmetric Data Rate
- Operating case temperature: -40~85°C and 0~85°C
- Subscriber location identifier (SLID)
- PON Link Status notification
- Dying Gasp notification support
- Response the TX power shut-down command from OLT when OLT detect anomaly
- TC Layer GEM encapsulation mode
- OMCI support per ITU-T G.988
- 28 dB link budget; Class B+, 20 km reach
- Compliant to IEC-60825 Class 1 laser diode
- RoHS compliant
- Internal Calibration

Description

Opway OP44B1-GU-SI is a G.984.2 (GPON) Optical Network Terminal (ONT) with Small Form-factor Pluggable (SFP) packaging. The OP44B1-GU-SI integrates a bi-directional optical transceiver function and GPON MAC function. By being plugged into the customer premise equipment (CPE) with standard SFP port directly, the OP44B1-GU-SI provides an asymmetric 1.244Gbps upstream / 2.488 Gbps downstream GPON uplink to the CPE without requiring separate power supply.

The OP44B1-GU-SI supports a sophisticated ONT management system, including alarms, provisioning, IGMP functions for a stand-alone IPTV solution at the ONT.

The OP44B1-GU-SI can be managed from the OLT over the GPON using G.988 OMCI.

The OP44B1-GU-SI fits seamlessly into existing communications equipment, providing service providers with a smooth upgrade to GPON. The OP44B1-GU-SI solution vastly decreases the installation costs of deploying fiber access in MDUs and enables service providers to improve their revenue streams while decreasing OPEX.

Block Diagram

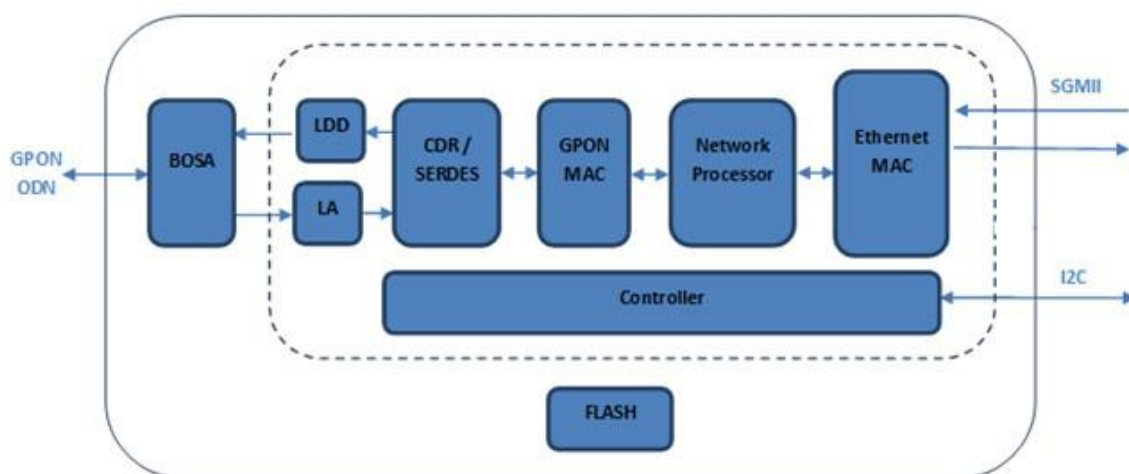


Figure 1, Block Diagram

Regulatory Compliance

Table 1 – Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1 (>500V for data pins, >2000V for other pins)
Electrostatic Discharge (ESD) to the Duplex LC Receptacle	IEC 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B)	Compatible with standards
Immunity	IEC 61000-4-3	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class I laser product.
RoHS	2011/65/EC	Compliant with standards

Absolute Maximum Ratings

Table 2 – Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Storage Temperature	T _s	-40	-	+85	° C	
Operating Voltage	V _{CC}	3.14	3.30	3.46	V	
Operating Relative Humidity	RH	5	-	95	%	

Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T _c	-40	-	85	° C	1
	T _c	0	-	85	° C	2
Total Tx and Rx Supply Current	I _{CC}	-	600	-	mA	
Power Dissipation	P _D	-	2	-	W	
Bit Rate(Tx)	BR	-	1244.16	-	Mbps	
Bit Rate(Rx)	BR	-	2488.32	-	Mbps	
Transmission Distance	TD	-	-	20,000	m	
Module Initialize time	T _{Initial}			70	s	3
Two-wire serial interface Clock rate	f _{serial_clock}			80	Khz	

Notes:

1. I temp
2. E temp
3. Suggest do not access I2C until module initialization is completed

Optical Characteristics

Table 4 – Optical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Center Wavelength Range	λ_c	1290	1310	1330	nm	
Average Output Power	P_{OUT}	0.5	-	5	dBm	
Average Output Power (Laser Off)	$P_{OUT-OFF}$	-	-	-40	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Spectral Width (-20dB)	λ_{20}	-	-	1	nm	
Extinction Ratio	ER	10	-	-	dB	1
Optical Rise and Fall Time(20%-80%)	T_R/T_F	-	-	250	ps	
Jitter Generation	JG	-	-	0.2	UI	2
Transmitter Output Eye	Compliant with G.984.2 Figure 3					
Receiver						
Center Wavelength Range	λ_c	1480	1490	1500	nm	
Overload		-8	-	-	dBm	
Sensitivity(BOL Room Temp)	Sen	-	-	-28	dBm	3
Signal Detect Assertion Level	SDA	-	-	-29	dBm	
Signal Detect De-Assertion Level	SDD	-45	-	-	dBm	
Hysteresis	$P_{SDA-SDD}$	0.5	-	6	dB	
1310nm Tx to 1490nm Rx Crosstalk		-	-	-47	dB	
1555nm Rx to 1490nm Isolation		30	-	-	dB	
(1550-1560nm) Ext to 1490 Rx Isolation		34	-	-	dB	
Back Reflection @ 1310nm		-	-	-12	dB	
Back Reflection @ 1490nm		-	-	-27	dB	
Rx Reflectance		-	-	-20	dB	
1530nm to 1490nm Rx Isolation		7	-	-	dB	
1539nm to 1490nm Rx Isolation		22	-	-	dB	
1625nm to 1490nm Rx Isolation		22	-	-	dB	

Notes:

1. Measured by Ethernet package with random payload.
2. 4kHz to 10MHz
3. Measured with Ethernet package with random payload and ER=8.2dB, BER =10⁻¹⁰.

Electrical Characteristics

Table 5 – Electrical Characteristics

Transmitter						
Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Differential Data Input Voltage	$V_{IN,P-P}$	100	-	1000	mVpp	1
Input Differential Impedance	Z_{IN}	-	100	-	Ω	2

Receiver						
Differential Output Voltage		370	-	1000	mV	3
Signal Detect Output HIGH Voltage	V _{SD_High}	2.4	-	-	V	4
Signal Detect Output LOW Voltage	V _{SD_Low}	0	-	0.8	V	5
Data Output Rise and Fall Time	T _R /T _F	-	160	-	ps	

Notes:

1. TXD+/- AC-coupled.
2. TXD+/-.
3. CML output, AC coupled(0.1uF)
4. LVTTTL with internal 1k pull up resistor. Asserts HIGH when input data amplitude is above threshold.
5. LVTTTL. De-asserts LOW when input data amplitude is below threshold.

Pin Definitions

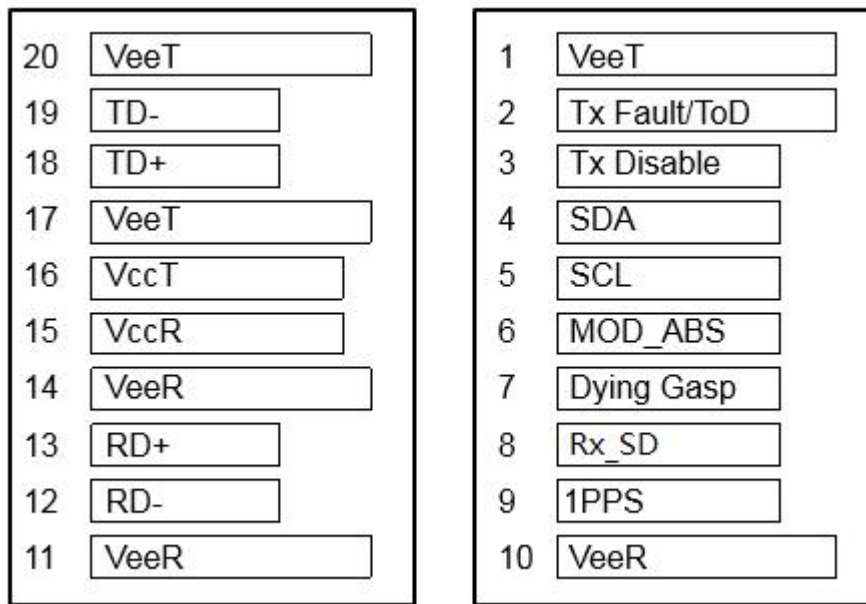


Figure 2, Pin Assignment

Table 6 – Pin definitions

Pin	Symbol	Logic	Name/Description	Note
1	VeeT	NA	Module Transmitter Ground	
2	Tx Fault/ToD	LVTTTL-O	Tx Fault/Time of Day	1
3	TX_DISABLE	LVTTTL-I	Transmitter Shut-off	6
4	SDA	LVTTTL-I/O	2-Wire Serial Interface Data Line (MOD-DEF2)	2,7
5	SCL	LVTTTL-I	2-Wire Serial Interface Clock (MOD-DEF1)	2,7
6	MOD_ABS	NA	Module Absent, connected to VeeT or VeeR in the module	
7	DYING GASP	Analog Input	Dying Gasp message indicator, active low this pin has been directly connected to MAC IC in the module	3,4,5,7
8	Rx_SD	LVTTTL-O	Rx signal detect	

9	1PPS	LVTTL-O	1 Pulse per second
10	VeeR	NA	Module Receiver Ground
11	VeeR	NA	Module Receiver Ground
12	RXD-	CML-O	Receiver Inverted Data Output
13	RXD+	CML-O	Receiver Non-Inverted Data Output
14	VeeR	NA	Module Receiver Ground
15	VccR	NA	Module Receiver 3.3V Supply
16	VccT	NA	Module Transmitter 3.3V Supply
17	VeeT	NA	Module Transmitter Ground
18	TXD+	CML-I	Transmitter Non-Inverted Data Input, CML, 100ohm differential impedance
19	TXD-	CML-I	Transmitter Inverted Data Input, CML, 100ohm differential impedance
20	VeeT	NA	Module Transmitter Ground

Notes:

1. Default Factory Mode is Tx Fault. For Small Cell type of applications, during Activation/ provisioning, it will be software configured to ToD.
2. This PIN is an open collector/drain output pin and shall be pulled up with 4.7K-10K ohms to a Host_Vcc on the host board.
3. PIN7 can support Dying Gasp function. Dying Gasp function is managed by software. If software disable the dying gasp function, ignore the PIN7 input voltage.
If software enable the function, PIN7 input voltage below Dying Gasp Assert Voltage threshold, the module will report dying gasp PLOAM to OLT.
4. Dying Gasp Voltage threshold 1.5V (typical), once software enable Dying gasp, meanwhile the pin7 input is below this threshold, it will trigger dying gasp function, transceiver will reset.
5. Host device shall maintain power to ONU module for at least 10ms during power supply drop.
6. ONU re-online process includes downlink & uplink synchronization, authentication and configuration release, etc., it normally takes >= 5 seconds
7. Transceiver full power on need 80s. Any I2C visiting.etc need to operate after this power on period.

Mechanical Diagram

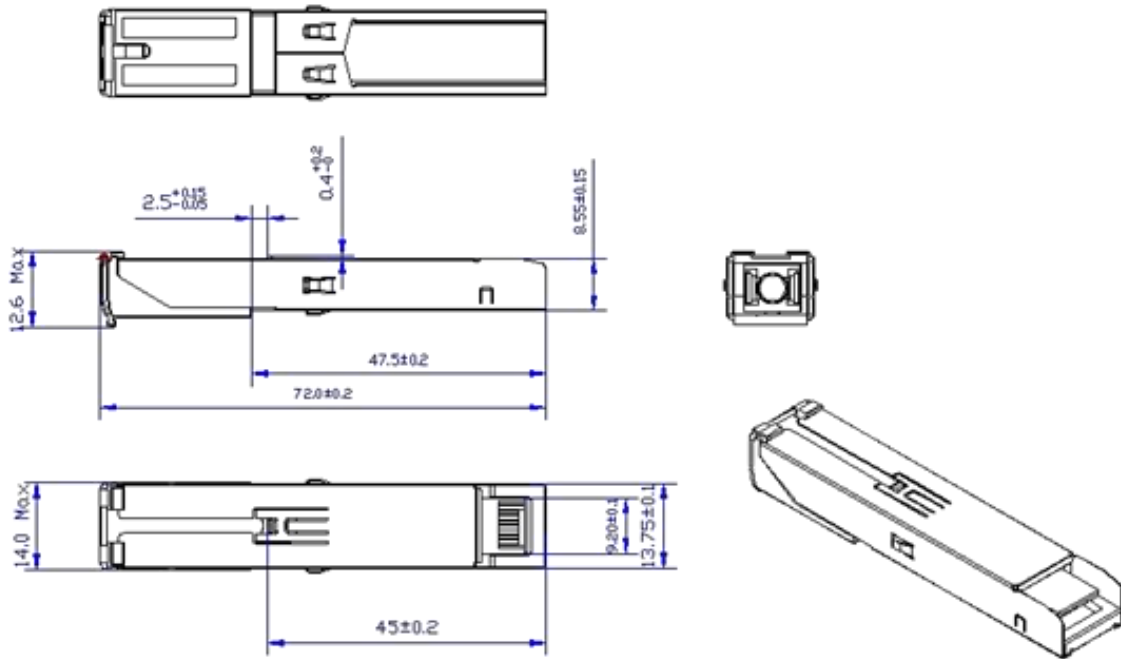


Figure 3, Mechanical Diagram

Recommended Host Board Power Supply Circuit

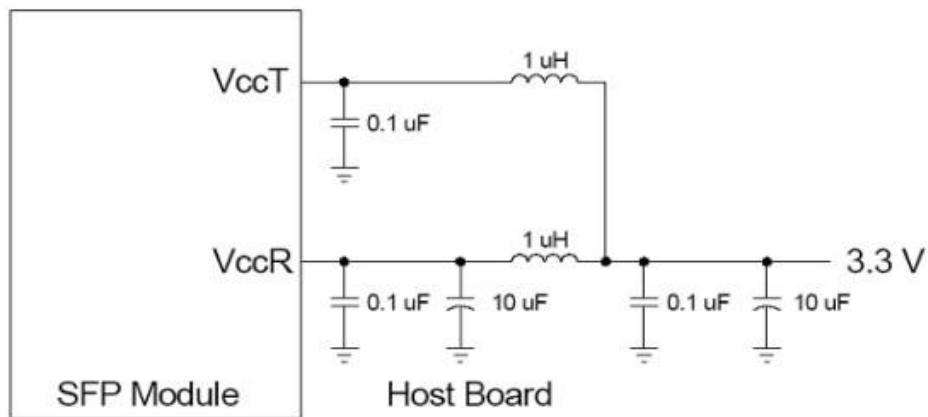


Figure 4, Recommended Host Board Power Supply Filtering Network

EEPROM Information

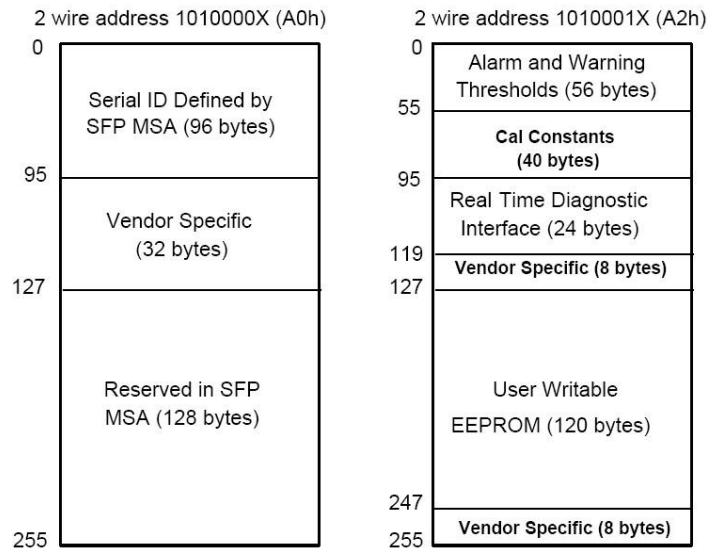


Figure 5, EEPROM Diagram

Table 7 –EEPROM Memory Content (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP transceiver
1	1	Ext. Identifier	04	MOD4
2	1	Connector	01	SC
3-10	8	Transceiver	00 00 00 00 00 00 00 00	
11	1	Encoding	03	NRZ
12	1	BR, Nominal	0C	1.244Gbps
13	1	Reserved	00	
14	1	Length (9um)-km	14	20(km)
15	1	Length (9um)	C8	200(100m)
16	1	Length (50um)	00	Not Support MMF
17	1	Length (62.5um)	00	Not Support MMF
18	1	Length (Copper)	00	Not Support Copper
19	1	Reserved	00	
20-35	16	Vendor name	XX XX XX XX...	OPWAY
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	XX XX XX XX...	OP44B1-GU-SI
56-59	4	Vendor Rev	xx xx 20 20	ASCII("30 31 20 20" means 1.0 Revision)
60-61	2	Wavelength	05 1E	Tx wavelength:1310nm
62	1	Reserved	00	
63	1	CC_BASE	xx	Check sum of byte 0-62

64-65	2	Options	00 1A	64 = 0x00, reserved
				65 = 0x1A, TX_DISABLE/ TX_FAULT/RX_LOS supported
66	1	BR, max	00	
67	1	BR, min	00	
68-83	16	Vendor SN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	ASCII
84-91	8	Date code	xx xx xx xx xx xx 20 20	Year(2 bytes),Month(2 bytes), Day(2 bytes)
92	1	Diagnostic Monitoring Type	68	
93	1	Enhanced Options	F0	Diagnostics (Optional Alarm/warning flags) Soft TX_FAULT monitoring implemented. Soft RX_LOS monitoring implemented
94	1	SFF-8472 Compliance	05	Indicates the revision of SFF-8472 with which the transceiver complies. Value depends on module features.
95	1	CC_EXT	xx	Check sum of byte 64-94
96-255	64	Vendor Specific		

Table 8 –EEPROM Memory Content (A2h)

Addr.		Field Size (Bytes)	Name of Field	Hex	Description
0	00	2	Temp High Alarm	5F 00	95°C (I temp) 95°C(E temp)
2	02	2	Temp Low Alarm	CE 00 F6 00	-50°C (I temp) -10°C(E temp)
4	04	2	Temp High Warning	5A 00	90°C (I temp) 90°C(E temp)
6	06	2	Temp Low Warning	D3 00 FB 00	-45°C (I temp) -5°C(E temp)
8	08	2	Voltage High Alarm	8C A0	3.6V
10	0A	2	Voltage Low Alarm	75 30	3.0V
12	0C	2	Voltage High Warning	88 B8	3.5V
14	0E	2	Voltage Low Warning	79 18	3.1V
16	10	2	Bias High Alarm	AF C8	90mA
18	12	2	Bias Low Alarm	00 00	0mA

20	14	2	Bias High Warning	88 B8	70mA
22	16	2	Bias Low Warning	00 00	0mA
24	18	2	TX Power High Alarm	F6 77	8dBm
26	1A	2	TX Power Low Alarm	15 F7	-2.5dBm
28	1C	2	TX Power High	C3 C6	7dBm
30	1E	2	TX Power Low Warning	1B A7	-1.5dBm
32	20	2	RX Power High Alarm	0C 5A	-5dBm
34	22	2	RX Power Low Alarm	00 08	-31dBm
36	24	2	RX Power High	09 CF	-6dBm
38	26	2	RX Power Low Warning	00 0A	-30dBm
40-45	28-2D	6	MAC address	xx xx xx xx xx xx	MAC Address
46-55	2E-37	10	Reserved	00....000	Reserved
56	38	4	RX_PWR(4) Calibration	00 00 00 00	4th order RSSI calibration coefficient
60	3C	4	RX_PWR(3) Calibration	00 00 00 00	3rd order RSSI calibration coefficient
64	40	4	RX_PWR(2) Calibration	00 00 00 00	2nd order RSSI calibration coefficient
68	44	4	RX_PWR(1) Calibration	3F 80 00 00	1st order RSSI calibration coefficient
72	48	4	RX_PWR(0) Calibration	00 00 00 00	0th order RSSI calibration coefficient
76	4C	2	TX_I(Slope) Calibration	01 00	Slope for Bias calibration
78	4E	2	TX_I(Offset) Calibration	00 00	Offset for Bias calibration
80	50	2	TX_PWR(Slope) Calibration	01 00	Slope for TX Power calibration
82	52	2	TX_PWR(Offset) Calibration	00 00	Offset for TX Power calibration
84	54	2	T(Slope) Calibration	01 00	Slope for Temperature calibration
86	56	2	T(Offset) Calibration	00 00	Offset for Temperature calibration, in units of
88	58	2	V(Slope) Calibration	01 00	Slope for VCC calibration
90	5A	2	V(Offset) Calibration	00 00	Offset for VCC calibration
92	5C	3	Reserved	00 00 00	Reserved
95	5F	1	Checksum	xx	Checksum

Table 9 – Digital Diagnostic Specification (A2h)

Data Address	Parameter	Range	Accuracy
96-97	Temperature	-40 to 85/0~85° C	±5° C
98-99	Vcc Voltage	0 to Vcc	±5%
100-101	Bias Current	0 to 100mA(Note)	±10%
102-103	TX Power	0.5 to 5dBm	±3dB
104-105	RX Power	-28 to -8dBm	±3dB

Note: Only for continuous mode