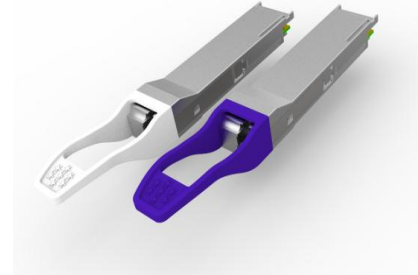


## GIGALIGHT 100G QSFP28 BiDi 80km Transceiver

P/N:GBQ-x101-ZR4

### Features

- ✓ 4 channels full-duplex transceiver modules
- ✓ Transmission data rate up to 25.78125Gbps per channel
- ✓ 4 X 25G LAN-WDM EML Integrated Cooling transmitter
- ✓ 4 X PIN+SOA Receivers
- ✓ Internal CDR circuits on both receiver and transmitter channels
- ✓ Power consumption < 6W
- ✓ Hot Pluggable QSFP form factor
- ✓ Up to 80km transmission on single mode fiber
- ✓ Simplex LC receptacles
- ✓ Built-in digital diagnostic functions
- ✓ Operating case temperature 0°C to +70°C
- ✓ 3.3V power supply voltage
- ✓ RoHS compliant(lead free)



### Applications

- ✓ 100GBASE-ZR4
- ✓ Data center

### Description

This product is a 100Gbps transceiver module designed for optical communication applications compliant to 100GBASE-ZR4. The module converts 4 input channels of 25Gb/s electrical data to 4 channels of LAN WDM optical signals and then multiplexes them into a single channel for 100Gb/s optical transmission. Reversely on the receiver side, the module de-multiplexes a 100Gb/s optical input into 4 channels of LAN WDM optical signals and then converts them to 4 output channels of electrical data.

The central wavelengths of the 4 LAN WDM channels are 1273.54, 1277.89, 1282.26, 1286.66nm-TX/1295.56, 1300.05, 1304.58, 1309.14nm-RX(1295.56, 1300.05, 1304.58, 1309.14nm- TX/1273.54, 1277.89, 1282.26, 1286.66nm-RX) as members of the LAN WDM wavelength grid defined in IEEE 802.3ba. The high performance cooled LAN WDM EML transmitters and high sensitivity PIN+SOA receivers provide superior performance for 100Gigabit Ethernet applications up to 80km links. This bidirectional unit must be used with another transceiver or network appliance of complimenting

wavelengths. Digital diagnostics functions are also available via the I2C interface, as specified by the QSFP28 MSA, to allow access to real-time operating parameters.

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	$T_s$	-20		+85	°C
Supply Voltage	$V_{CC,T,R}$	-0.3		3.6	V
Input Voltage	$V_{in}$	-0.3		$V_{CC}+0.3$	V
Relative Humidity	RH	5		85	%
Case Operating Temperature	$T_{op}$	0		+70	°C

### Recommended Operating Environment

Parameter	Symbol	Min.	Typical	Max.	Unit
Case operating Temperature	$T_{Ca}$	0		+70	°C
Supply Voltage	$V_{CC,T,R}$	+3.13	3.3	+3.47	V
Supply Current	$I_{CC}$		1200	1800	mA
Power Dissipation	P			6.5	W
Link Distance with G.652	D		70	80	km

### Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
Data Rate, each Lane		-	25.78125		Gbps
			27.9525		
Power Consumption	P			6	W
Supply Current	$I_{CC}$			1.9	A
Transmitter(each Lane)					
Differential Input Voltage Swing	$V_{in}$			900	mVpp
Differential Input Impedance	$Z_{in}$	90	100	110	Ohm
Receiver(each Lane)					
Differential Output Voltage Swing	$V_{out}$	300		300	mVpp
Differential Output Impedance	$Z_{out}$	90	100	110	Ohm

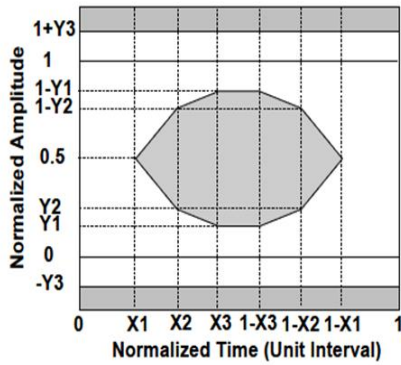
## Optical Parameters

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Purple Side Four Lane Wavelength Range (U)	L0	1272.54	1273.54	1274.54	nm	
	L1	1276.89	1277.89	1278.89	nm	
	L2	1281.26	1282.26	1283.26	nm	
	L3	1285.66	1286.66	1287.66	nm	
White Side Four Lane Wavelength Range (D)	L0	1294.56	1295.56	1296.56	nm	
	L1	1299.05	1300.05	1301.05	nm	
	L2	1303.58	1304.58	1305.58	nm	
	L3	1308.14	1309.14	1310.14	nm	
Side-mode Suppression Ratio	SMSR	30	-	-	dB	
Total Average Launch Power	PT	-	-	12.5	dBm	
Average Launch Power, each Lane		+2	-	6.5	dBm	
Difference in Launch Power between any two Lanes (OMA)		-	-	3.6	dB	
Extinction Ratio	ER	6	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				1
Optical Return Loss Tolerance		-	-	20	dB	
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Relative Intensity Noise	Rin			-130	dB/HZ	
Optical return loss tolerance				20	dB	
Transmitter reflectance		-	-	12	dB	
<b>Receiver</b>						
Purple Side Four Lane Wavelength Range(U)	L0	1294.56	1295.56	1296.56	nm	
	L1	1299.05	1300.05	1301.05	nm	
	L2	1303.58	1304.58	1305.58	nm	
	L3	1308.14	1309.14	1310.14	nm	
White Side Four Lane Wavelength Range(D)	L0	1272.54	1273.54	1274.54	nm	
	L1	1276.89	1277.89	1278.89	nm	
	L2	1281.26	1282.26	1283.26	nm	
	L3	1285.66	1286.66	1287.66	nm	
Total Damage Threshold	THd			5.5	dBm	
Receiver Sensitivity per Lane(100GbE)	SEN			-28	dBm	2
Average Power at Receiver Input, each		-28		-3.5	dBm	

Lane						
LOS Assert	LOS <sub>A</sub>	-38			dBm	
LOS De-Assert	LOS <sub>D</sub>			-29	dBm	
LOS Hysteresis	LOS <sub>H</sub>	0.5			dB	

**Notes:**

1. See Figure below.
2. Sensitivity is specified at BER@5E-5 with FEC.



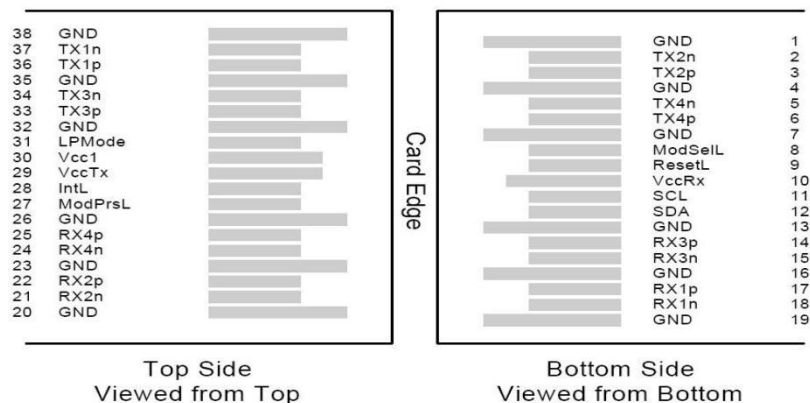
**Pin Descriptions**

Pin	Logic	Symbol	Name/Description	Ref.
1		GND	Module Ground	1
2	CML-I	Tx2-	Transmitter inverted data input	
3	CML-I	Tx2+	Transmitter non-inverted data input	
4		GND	Module Ground	1
5	CML-I	Tx4-	Transmitter inverted data input	
6	CML-I	Tx4+	Transmitter non-inverted data input	
7		GND	Module Ground	1
8	LVTTL-I	MODSEIL	Module Select	2
9	LVTTL-I	ResetL	Module Reset	2
10		VCCRx	+3.3v Receiver Power Supply	
11	LVC MOS-I	SCL	2-wire Serial interface clock	2
12	LVC MOS-I /O	SDA	2-wire Serial interface data	2
13		GND	Module Ground	1
14	CML-O	RX3+	Receiver non-inverted data output	
15	CML-O	RX3-	Receiver inverted data output	
16		GND	Module Ground	1
17	CML-O	RX1+	Receiver non-inverted data output	

18	CML-O	RX1-	Receiver inverted data output	
19		GND	Module Ground	1
20		GND	Module Ground	1
21	CML-O	RX2-	Receiver inverted data output	
22	CML-O	RX2+	Receiver non-inverted data output	
23		GND	Module Ground	1
24	CML-O	RX4-	Receiver inverted data output	
25	CML-O	RX4+	Receiver non-inverted data output	
26		GND	Module Ground	1
27	LVTTL-O	ModPrsL	Module Present, internal pulled down to GND	
28	LVTTL-O	IntL	Interrupt output, should be pulled up on host board	2
29		VCCTx	+3.3v Transmitter Power Supply	
30		VCC1	+3.3v Power Supply	
31	LVTTL-I	LPMode	Low Power Mode	2
32		GND	Module Ground	1
33	CML-I	Tx3+	Transmitter non-inverted data input	
34	CML-I	Tx3-	Transmitter inverted data input	
35		GND	Module Ground	1
36	CML-I	Tx1+	Transmitter non-inverted data input	
37	CML-I	Tx1-	Transmitter inverted data input	
38		GND	Module Ground	1

**Notes:**

1. Module circuit ground is isolated from module chassis ground within the module.
2. Open collector; should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.



**Figure1. Electrical Pin-out Details**

### ModSelL Pin

The ModSelL is an input pin. When held low by the host, the module responds to 2-wire serial communication commands. The ModSelL allows the use of multiple QSFP modules on a single 2-wire interface bus. When the ModSelL is “High”, the module will not respond to any 2-wire interface communication from the host. ModSelL has an internal pull-up in the module.

### ResetL Pin

ResetL. LPMoDe\_Reset has an internal pull-up in the module. A low level on the ResetL pin for longer than the minimum pulse length ( $t_{Reset\_init}$ ) initiates a complete module reset, returning all user module settings to their default state. Module Reset Assert Time ( $t_{init}$ ) starts on the rising edge after the low level on the ResetL pin is released. During the execution of a reset ( $t_{init}$ ) the host shall disregard all status bits until the module indicates a completion of the reset interrupt. The module indicates this by posting an IntL signal with the Data\_Not\_Ready bit negated. Note that on power up (including hot insertion) the module will post this completion of reset interrupt without requiring a reset.

### LPMoDe Pin

Gigalight QSFP28 module operate in the low power mode (less than 1.5 W power consumption)

This pin active high will decrease power consumption to less than 1.5W.

### ModPrsL Pin

ModPrsL is pulled up to Vcc on the host board and grounded in the module. The ModPrsL is asserted “Low” when the module is inserted and deasserted “High” when the module is physically absent from the host connector.

### IntL Pin

IntL is an output pin. When “Low”, it indicates a possible module operational fault or a status critical to the host system. The host identifies the source of the interrupt by using the 2-wire serial interface. The IntL pin is an open collector output and must be pulled up to Vcc on the host board.

## DIAGNOSTIC MONITORING INTERFACE

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	+3	degC	Over operating temperature range

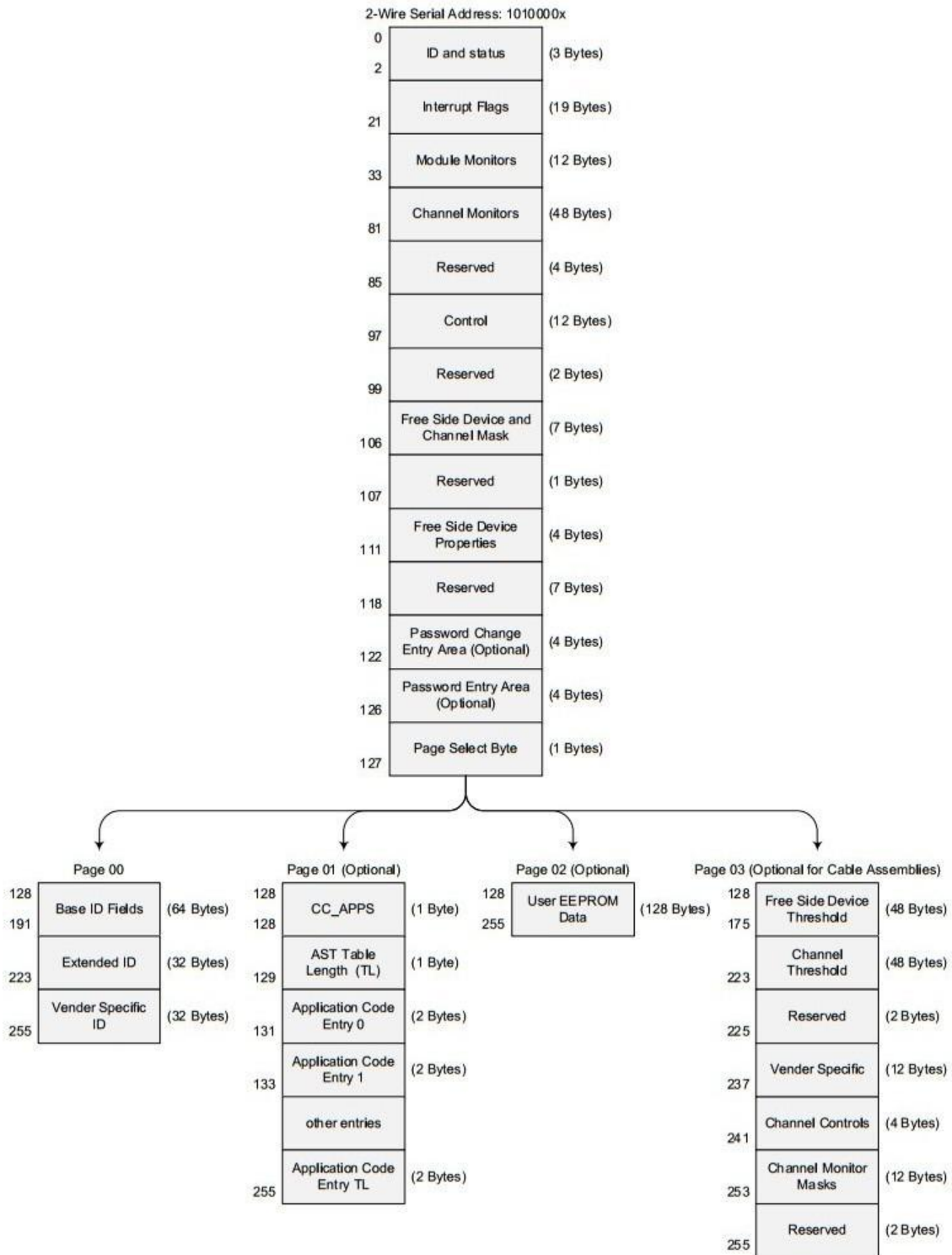
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

**Notes:**

Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Digital diagnostics monitoring function is available on all Gigalight QSFP28 module. A 2-wire serial interface provides user to contact with module.

The structure of the memory is shown in Figure 3. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages. This structure permits timely access to addresses in the lower page, such as Interrupt Flags and Monitors. Less time critical time entries, such as serial ID information and threshold settings, are available with the Page Select function. The interface address used is A0xh and is mainly used for time critical data like interrupt handling in order to enable a one-time-read for all data related to an interrupt situation. After an interrupt, IntL, has been asserted, the host can read out the flag field to determine the affected channel and type of flag.



**Figure2. QSFP Memory Map**



Byte Address	Description	Type
0	Identifier (1 Byte)	Read Only
1-2	Status (2 Bytes)	Read Only
3-21	Interrupt Flags (31 Bytes)	Read Only
22-33	Module Monitors (12 Bytes)	Read Only
34-81	Channel Monitors (48 Bytes)	Read Only
82-85	Reserved (4 Bytes)	Read Only
86-97	Control (12 Bytes)	Read/Write
98-99	Reserved (2 Bytes)	Read/Write
100-106	Module and Channel Masks (7 Bytes)	Read/Write
107-118	Reserved (12 Bytes)	Read/Write
119-122	Reserved (4 Bytes)	Read/Write
123-126	Reserved (4 Bytes)	Read/Write
127	Page Select Byte	Read/Write

**Figure3. Low Memory Map**

Byte Address	Description	Type
128-175	Module Thresholds (48 Bytes)	Read Only
176-223	Reserved (48 Bytes)	Read Only
224-225	Reserved (2 Bytes)	Read Only
226-239	Reserved (14 Bytes)	Read/Write
240-241	Channel Controls (2 Bytes)	Read/Write
242-253	Reserved (12 Bytes)	Read/Write
254-255	Reserved (2 Bytes)	Read/Write

**Figure4. Page 03 Memory Map**

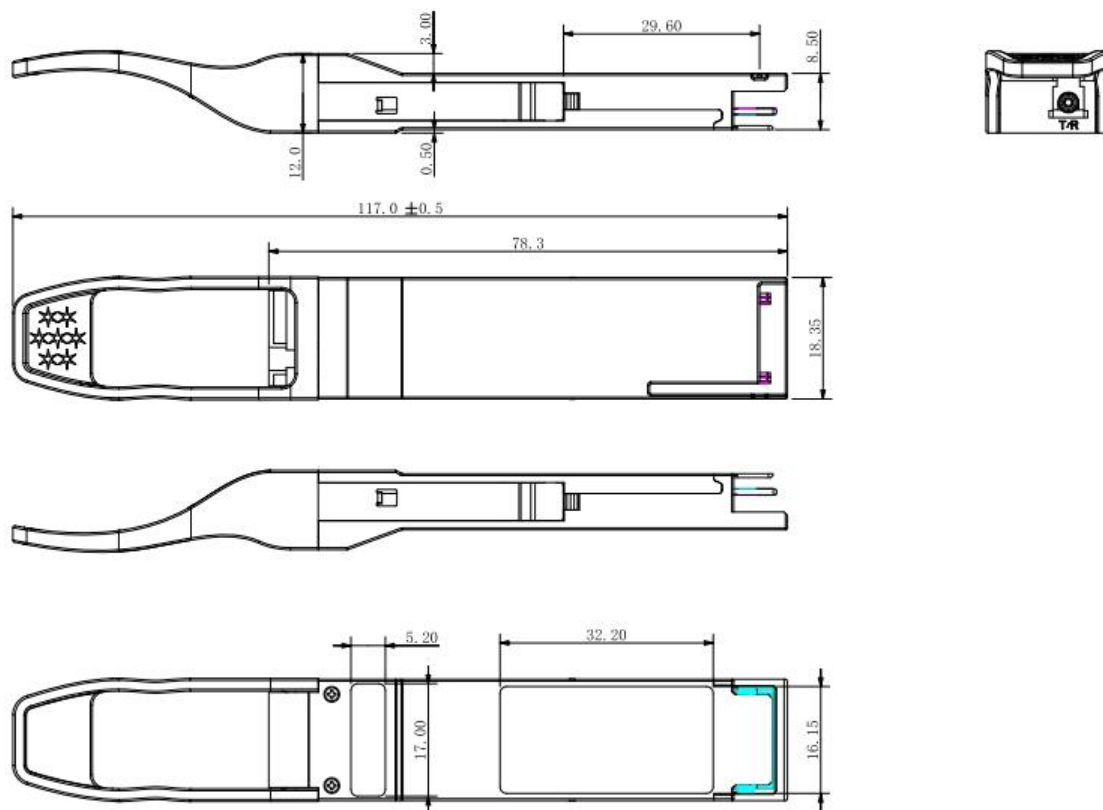
Address	Name	Description
128	Identifier (1 Byte)	Identifier Type of serial transceiver
129	Ext. Identifier (1 Byte)	Extended identifier of serial transceiver
130	Connector (1 Byte)	Code for connector type
131-138	Transceiver (8 Bytes)	Code for electronic compatibility or optical compatibility
139	Encoding (1 Byte)	Code for serial encoding algorithm
140	BR, nominal (1 Byte)	Nominal bit rate, units of 100 Mbits/s
141	Extended RateSelect Compliance (1 Byte)	Tags for Extended RateSelect compliance
142	Length SMF (1 Byte)	Link length supported for SM fiber in km
143	Length E-50 $\mu$ m (1 Byte)	Link length supported for EBW 50/125 $\mu$ m fiber, units of 2 m
144	Length 50 $\mu$ m (1 Byte)	Link length supported for 50/125 $\mu$ m fiber, units of 1 m
145	Length 62.5 $\mu$ m (1 Byte)	Link length supported for 62.5/125 $\mu$ m fiber, units of 1 m
146	Length copper (1 Byte)	Link length supported for copper, units of 1 m
147	Device Tech (1 Byte)	Device technology
148-163	Vendor name (16 Bytes)	QSFP vendor name (ASCII)
164	Extended Transceiver (1 Byte)	Extended Transceiver Codes for InfiniBand <sup>†</sup>
165-167	Vendor OUI (3 Bytes)	QSFP vendor IEEE vendor company ID
168-183	Vendor PN (16 Bytes)	Part number provided by QSFP vendor (ASCII)
184-185	Vendor rev (2 Bytes)	Revision level for part number provided by vendor (ASCII)
186-187	Wavelength (2 Bytes)	Nominal laser wavelength (Wavelength = value / 20 in nm)
188-189	Wavelength Tolerance (2 Bytes)	Guaranteed range of laser wavelength (+/- value) from Nominal wavelength (Wavelength Tol. = value / 200 in nm)
190	Max Case Temp (1 Byte)	Maximum Case Temperature in Degrees C
191	CC_BASE (1 Byte)	Check code for Base ID fields (addresses 128-190)
192-195	Options (4 Bytes)	Rate Select, TX Disable, TX Fault, LOS
196-211	Vendor SN (16 Bytes)	Serial number provided by vendor (ASCII)
212-219	Date code (8 Bytes)	Vendor's manufacturing date code
220	Diagnostic Monitoring Type (1 Byte)	Indicates which type of diagnostic monitoring is implemented
221	Enhanced Options (1 Byte)	Indicates which optional enhanced features are implemented
222	Reserved (1 Byte)	Reserved
223	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)
224-255	Vendor Specific (32 Bytes)	Vendor Specific EEPROM

**Figure5. Page 00 Memory Map**

Page02 is User EEPROM and its format decided by user.

The detail description of low memory and page00.page03 upper memory please see SFF-8436 document.

## Mechanical Dimensions



Unit(MM)

**Figure6. Mechanical Specifications**

## Regulatory Compliance

Gigalight GBQ-U101-ZR4/ GBQ-D101-ZR4 transceivers are Class 1 Laser Products. They meet the requirements of the following standards:

Feature	Standard
Laser Safety	IEC 60825-1:2014 (3rd Edition) IEC 60825-2:2004/AMD2:2010 EN 60825-1: 2014 + A11: 2021 EN 60825-2:2004+A1+A2
Electrical Safety	EN 62368-1: 2014 + A11: 2017 IEC 62368-1:2014 UL 62368-1:2019
Environmental protection	Directive 2011/65/EU with amendment(EU)2015/863

CE EMC	EN 55032:2015+A11:2020 EN 55035:2017+A11:2020 EN IEC 61000-3-2:2019 +A1:2021 EN 61000-3-3:2013+A1:2019
FCC	FCC Part 15, Subpart B ANSI C63.4-2014

## References

1. SFF-8436 QSFP+
2. Ethernet 100GBASE-ZR4

## CAUTION:

Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

## Ordering Information

Part Number	Product Description
GBQ-U101-ZR4	100G QSFP28 BIDI one fiber , 80KM, 1273.54, 1277.89, 1282.26, 1286.66nm- TX
GBQ-D101-ZR4	100G QSFP28 BIDI one fiber , 80KM, 1295.56, 1300.05, 1304.58, 1309.14nm- TX

## Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by Gigalight before they become applicable to any particular order or contract. In accordance with the Gigalight policy of continuous improvement specifications may change without notice.

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## Revision History

Revision	Date	Description
V0	2025-02-28	Advance Release.