

### QPM-2101WG

(RoHS Compliant)

### 40Gb/s / 850nm QSFP+ MPO Multi-Mode Optical Transceiver for 40GBASE-eSR4

#### FEATURES

- Up to 10.3125 Gbps Bi-directional Data Links Per Lane
- Compliant with SFF-8436 QSFP+ MSA
- Complaint with IEEE 802.3ba 40GBASE-SR4
- Hot Pluggable Electrical Interface
- Link Length up to 300 m with OM3 MMF
- 850 nm VCSEL Transmitter
- 2-Wire Interface for Integrated Digital Diagnostic Monitoring
- Low Power Dissipation < 1.5W
- Single +3.3V Power Supply
- RoHS Compliant
- 0 to 70°C Operating Case Temperature
- Standard 12/8 lane optical fiber with MPO pluggable optical connector

#### APPLICATIONS

- 40GBASE-SR4 Ethernet
- InfiniBand QDR, DDR and SDR
- 10G/8G/4G Fibre Channel
- SATA/SAS Storage
- HPC Interconnects
- Proprietary Interconnections

#### DESCRIPTION

QPM-2101WG series multi-mode QSFP+ transceiver is designed for serial optical data communications such as 40GBASE-SR4. It supports the 40Gbps transmission on both OM3 MMF. It is with the QSFP+ 38-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I2C. This module is designed for multi-mode fiber and operates at a nominal wavelength of 850 nm. The transmitter section uses four Vertical Cavity Surface Emitted Lasers (VCSEL). The receiver section uses four integrated GaAs detector preamplifiers (IDPs) and four limiting post-amplifier ICs.

A serial EEPROM in the transceiver allows the user to access transceiver digital diagnostic monitoring and configuration data via the 2-wire QSFP+ Management Interface. This interface uses a single address, A0h, with a memory map divided into a lower and upper area. Basic digital diagnostic data is held in the lower area while specific data is held in a series of tables in the high memory area.

#### LASER SAFETY

This multi-mode transceiver is a Class 1 laser product. It complies with IEC-60825-1 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

#### ORDER INFORMATION

P/No.	Bit Rate per lane (Gb/s)	Distance (m)	Wavelength (nm)	Package	Connector	Temp (°C)	RoHS Compliant
QPM-2101WG	10.3125	300	850	QSFP+ with DMI	MPO	0 to 70	Yes

\*: 300 m for OM3 MMF.

Absolute Maximum Ratings					
Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	Tstg	-40	85	°C	
Operating Case Temperature	Topr	0	70	°C	
Relative Humidity	RH	5	85	%	Non condensing
Power Supply Voltage	V <sub>CC</sub>	-0.5	3.6	V	
Data Input Voltage- Single Ended	---	-0.5	V <sub>cc</sub> +0.5	V	

Recommended Operating Conditions					
Parameter	Symbol	Min	Typ	Max	Units / Notes
Power Supply Voltage	V <sub>CC</sub>	3.135	3.3	3.465	V
Power Supply Current	I <sub>CC</sub>			420	mA
Power Dissipation	P <sub>D</sub>			1.5	W
Operating Case Temperature	T <sub>opr</sub>	0		70	°C
Data Rate per Channel		2.5		10.3125	Gb/s

Transmitter Optical Specifications (T <sub>opr</sub> = 0 to 70°C, V <sub>cc3</sub> = 3.3V ±5%)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
Average Launch Power, each lane	P <sub>O, Avg</sub>	-7.6		2.4	dBm	1
Launch Power in OMA, each lane	P <sub>O, OMA</sub>	-2.5			dBm	1
Extinction Ratio	ER	3			dB	
Output Center Wavelength	λ <sub>c</sub>	840	850	860	nm	
Output Spectrum Width	σ <sub>λ</sub>			0.65	nm	RMS (σ)
Difference in Power between any two lanes in OMA				4.0	dB	
Transmitter and Dispersion Penalty, each lane	TDP			3.5	dB	2
Optical Eye Mask	Compliant with IEEE 802.3ba 40GBASE					
Average Launch Power of OFF Transmitter				-30	dBm	

1. Output power is power coupled into a MMF.
2. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125 Gbps per lane for MMF.

Receiver Optical Specifications (T <sub>opr</sub> = 0 to 70°C, V <sub>cc3</sub> = 3.3V ±5%)						
Parameter	Symbol	Min	Typ	Max	Units	Notes
RX Sensitivity	Sen		---	-7.5	dBm	3
Receiver Overload, each lane			---	2.4	dBm	
OMA, each lane				3	dBm	
Damage Threshold		3.4	---		dBm	
LOS -- Deasserted	LOS <sub>D</sub>	---	---	-7.5	dBm	Transition: low to high
LOS -- Asserted	LOS <sub>A</sub>	-30	---	---	dBm	Transition: high to low
LOS -- Hysteresis		0.5	---		dB	
Wavelength of Operation	λ <sub>c</sub>	840		860	nm	

3. Average received power @ BER=1E-12 and PRBS 2<sup>31</sup>-1.

Electrical Characteristics						
Parameter	Symbol	Min	Typ	Max	Units	Notes
<b>High-Speed Signal (CML) Interface Specification</b>						
Input Data Rate		2.5		10.3125	Gps	
Differential Input Impedance	R <sub>in</sub>		100		Ω	
Differential Data Input Amplitude				1200	mVpp	Internally AC coupled
Output Data Rate		2.5		10.3125	Gps	
Differential Output Impedance	R <sub>out</sub>		100		Ω	
Differential Data Output Amplitude		200		900	mVpp	Internally AC coupled
<b>Low-Speed Signal (LVTTTL) Interface Specification</b>						
Input High Voltage		2.0		V <sub>cc</sub> +0.3	V	
Input Low Voltage		-0.3		0.8	V	
Output High Voltage		V <sub>cc</sub> -0.5		V <sub>cc</sub> +0.3	V	
Output Low Voltage		0		0.4	V	

## MANAGEMENT INTERFACE

The structure of the memory map is shown in Figure 1, which is accessible over a 2-wire serial interface at the 8-bit address 1010000X (A0h). The normal 256 byte I2C address space is divided into low and upper blocks of 128 Bytes. The lower block of 128 Bytes is always directly available and is used for the diagnostics and control function. Multiple blocks of memories are available in the upper 128 Bytes of the address space. These are individually addressed through a table select Byte which the user enters into a location in the lower address space. Thus, there is a total available address space of 128\*256 = 32 Kbytes in this upper memory space. Please refer SFF-8436 (Revision 4.1) for detailed information.

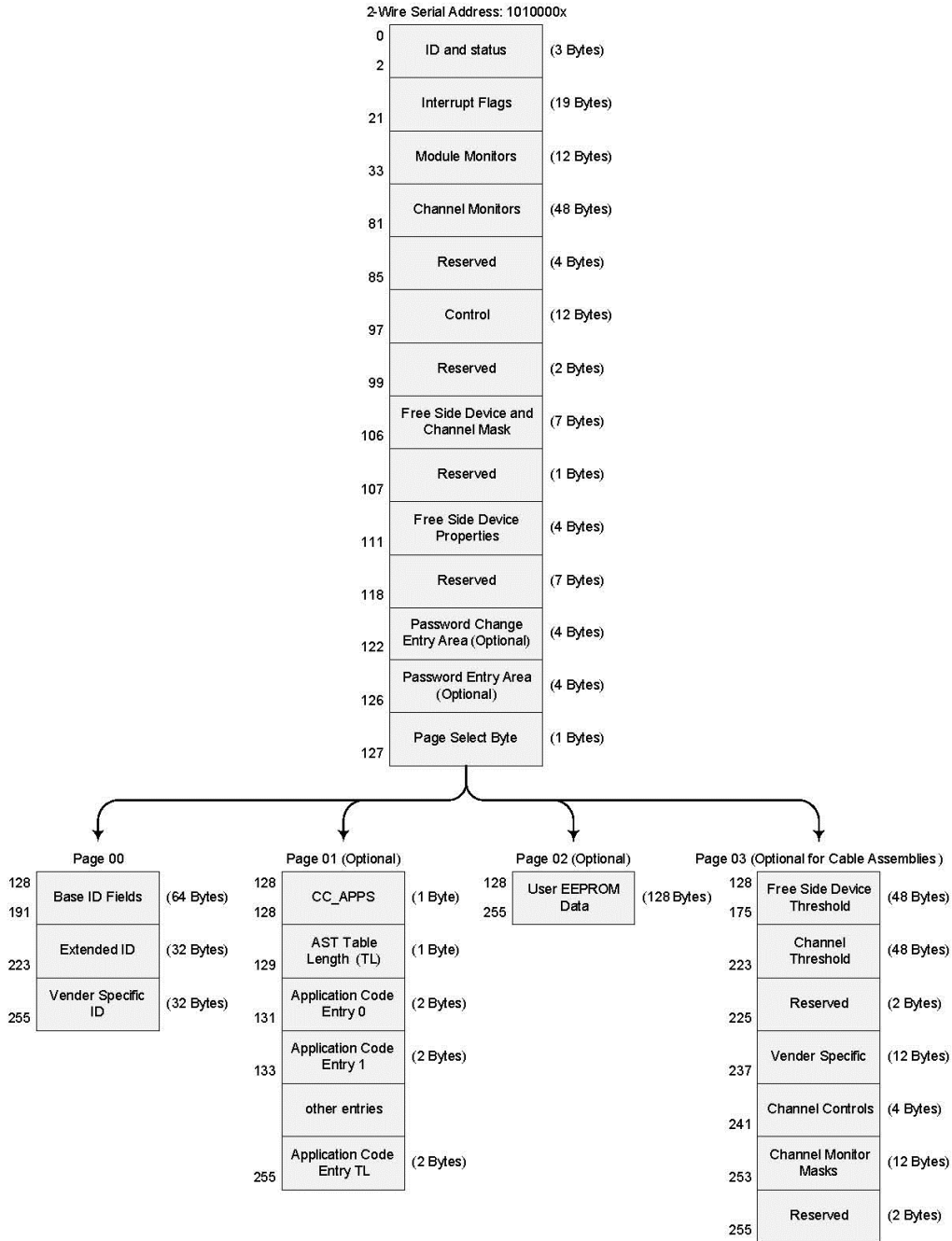
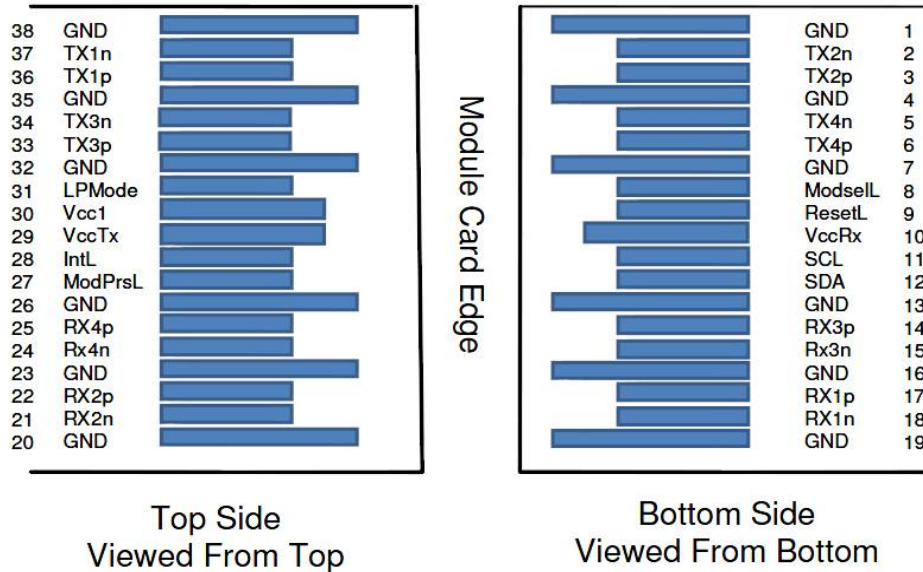


Figure 1. 2-wire Serial Digital Diagnostic Memory Map

### CONNECTION DIAGRAM



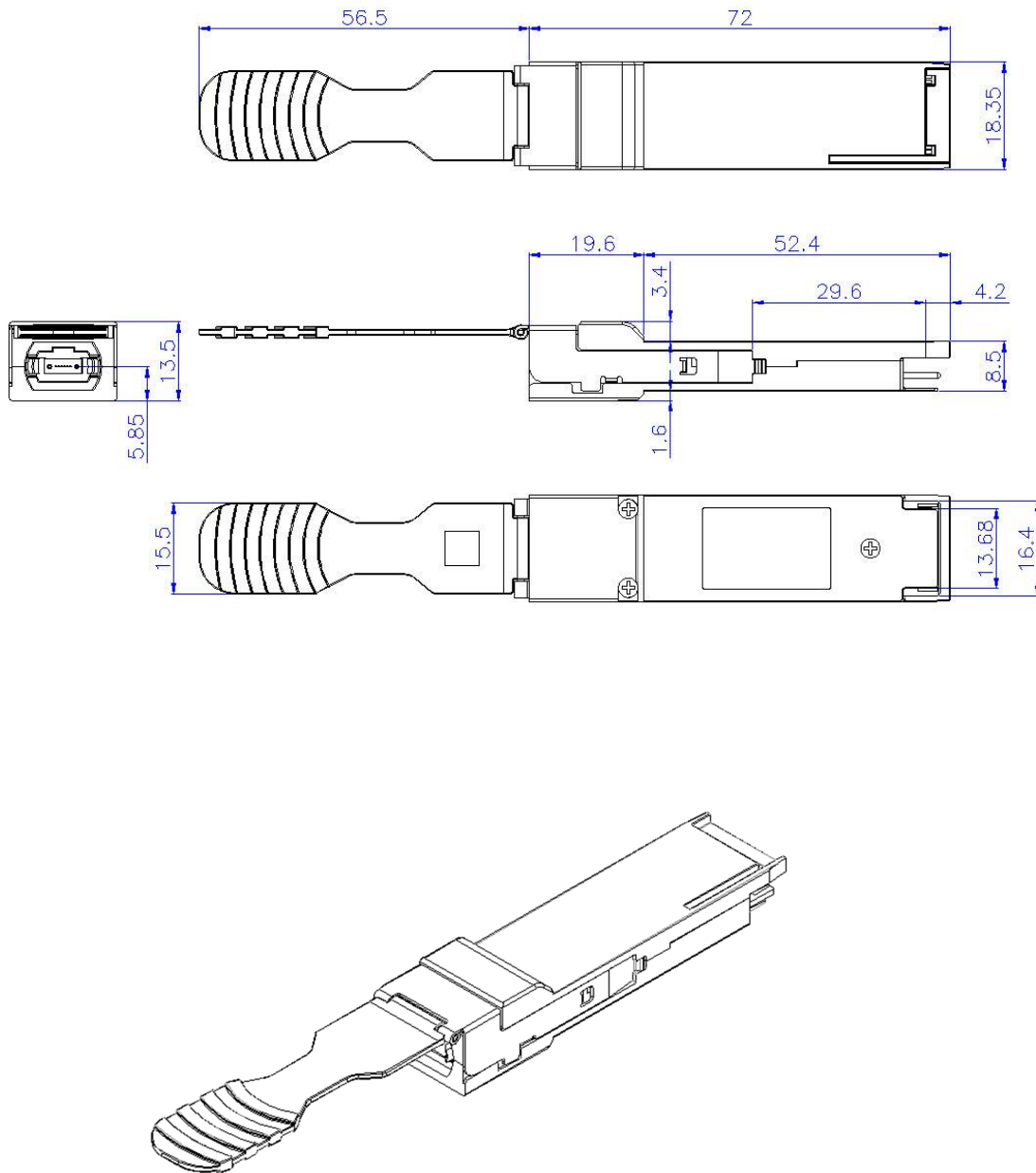
**Table 3 PIN Description**

PIN	Logic	Signal Name	Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVC MOS-I/O	SCL	2-wire serial interface clock	
12	LVC MOS-I/O	SDA	2-wire serial interface data	
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		Vcc Tx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1

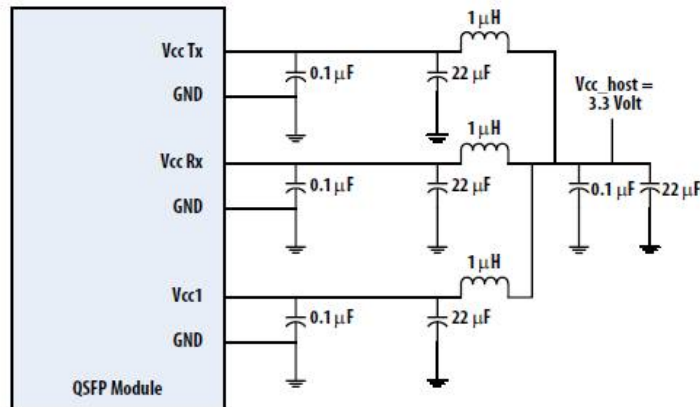
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	1

1. Module ground pins GND are isolated from the module case and chassis ground within the module.
2. Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP+ module in any combination. The connector pins are each rated for a maximum current of 500 mA.

### MECHANICAL SPECIFICATION (UNITS IN MM)



### RECOMMENDED POWER CIRCUIT SCHEMATIC



### RECOMMENDED INTERFACE CIRCUIT

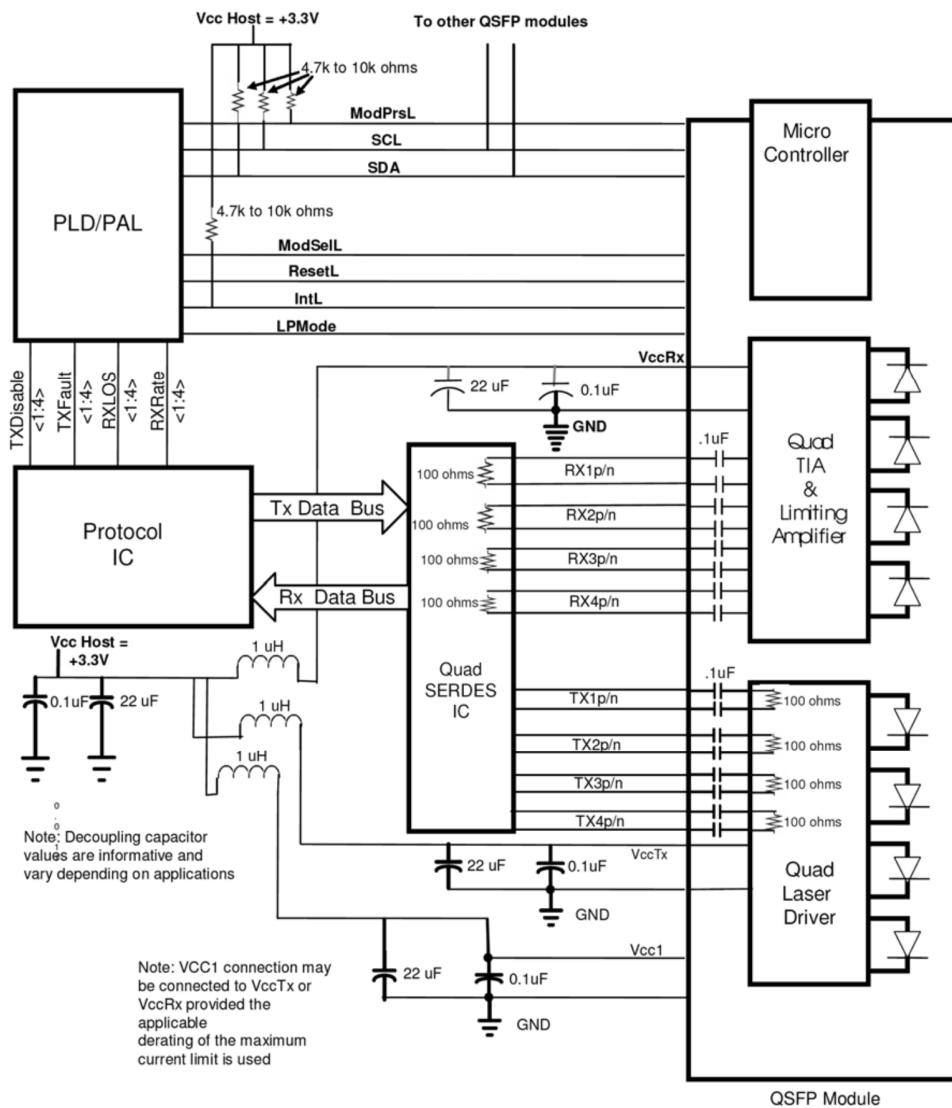


Table 4 Serial ID Memory Contents (Page 00h)

Address	Field Size (Byte)	Name of Filed	Description	Hex
128	1	Identifier	QSFP+	0D
129	1	Ext. Identifier	power consumption <1.5W, no CLEI code, no CDR in TX, no CDR in RX	00
130	1	Connector type	MPO	0C
131~138	8	Transceiver	40GBASE-SR4, SAS 6.0G/3.0G, Fibre Channel Short Distance (S), Shortwave laser w/o OFC (SN), Multi-mode 50um (M5 & OM3), 1200/800/400 Mbytes/sec	04 00 30 00 40 40 06 D0
139	1	Encoding	64B66B,	05
140	1	BR, nominal	10.3Gbps	67
141	1	Extended Rate Select	Not supported	00
142	1	length (SMF)-km		00
143	1	Length (OM3)	300m	96
144	1	Length (OM2)		00
145	1	Length (OM1)		00
146	1	Length (Copper)		00
147	1	Device Tech	850 nm VCSEL, No Wavelength Ctrl, Uncooled TX, PIN detector, TX not tunable	00
148~163	16	Vendor name	OPTOWAY	4F 50 54 4F 57 41 59 20 20 20 20 20 20 20 20 20
164	1	InfiniBand Compliance	QDR, DDR, SDR	07
165~167	3	Vendor OUI		00 0E FA
168~183	16	Vendor PN	QPM-2101WG	51 50 4D 2D 32 31 30 30 57 47 20 20 20 20 20 20
184~185	2	Vendor rev	ASCII ("31 61" means 1a revision)	xx xx
186~187	2	Wavelength	850 nm	42 68
188~189	2	Wavelength Tolerance	+/- 10nm	07 D0
190	1	Max Case Temp	70deg	46
191	1	CC_BASE	Check sum of Byte 128 -- 190	
192~195	4	Options	Page 02/01 not supported	00 00 00 D8
196~211	16	Vendor SN	ASCII	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx
212~219	8	Date code	ASCII Year (2 Byte), Month (2 Byte), Day (2 Byte)	xx xx xx xx xx xx 20 20
220	1	Diagnostic Monitoring Type	RX: Average Power	08
221	1	Enhanced Options	Not supported	00
222	1	Reserved		00
223	1	CC_EXT	Check sum of Byte 192 -- 222	
224~255	32	Vendor Specific		00 00

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**REVISION HISTORY**

Version	Subject	Release Date
1.0	Initial datasheet	2021/7/23