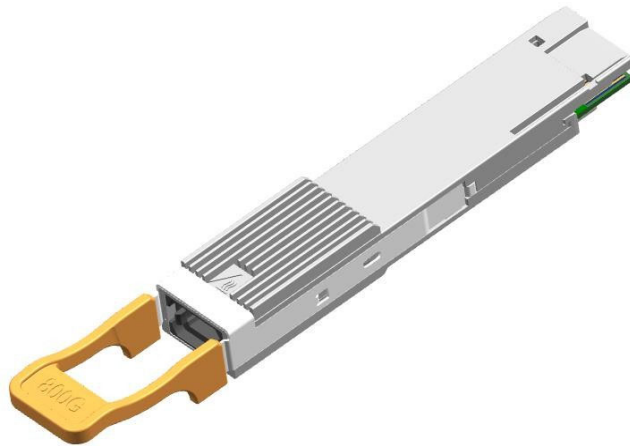


Specification

Quad Small Form-factor Pluggable Double Density
Optical Transceiver Module
QSFP-DD 800GBASE-SR8 PAM4
(Preliminary)



TQS-Q18HE-8CZ

Ordering Information:

Model Name	TQS-Q18HE-8CZ	Note
Voltage	3.3V	
Device type	850nm VCSEL	
Temperature	0°C~+70°C	
Distance	60m (OM3) / 100m (OM4)	
Optical interface	MPO16 connector	
Latch Color	Beige 	

■ Features

- Hot-pluggable QSFP-DD form factor
- 8x100G PAM4 retimed 800GAUI-8 electrical interface
- MPO-16 APC connector
- Maximum link length of 60m on OM3 MMF and 100m on OM4 MMF
- MPO-16 APC connector
- Case operating temperature: 0 ~ +70oC
- Power dissipation: < 14W
- Single 3.3V power supply voltage
- Compliant to QSFP-DD-Hardware-Rev 6.3 MSA
- Compliant to CMIS 5.2
- Compliant to IEEE 802.3db
- Compliant to IEEE 802.3ck
- RoHS Compliant

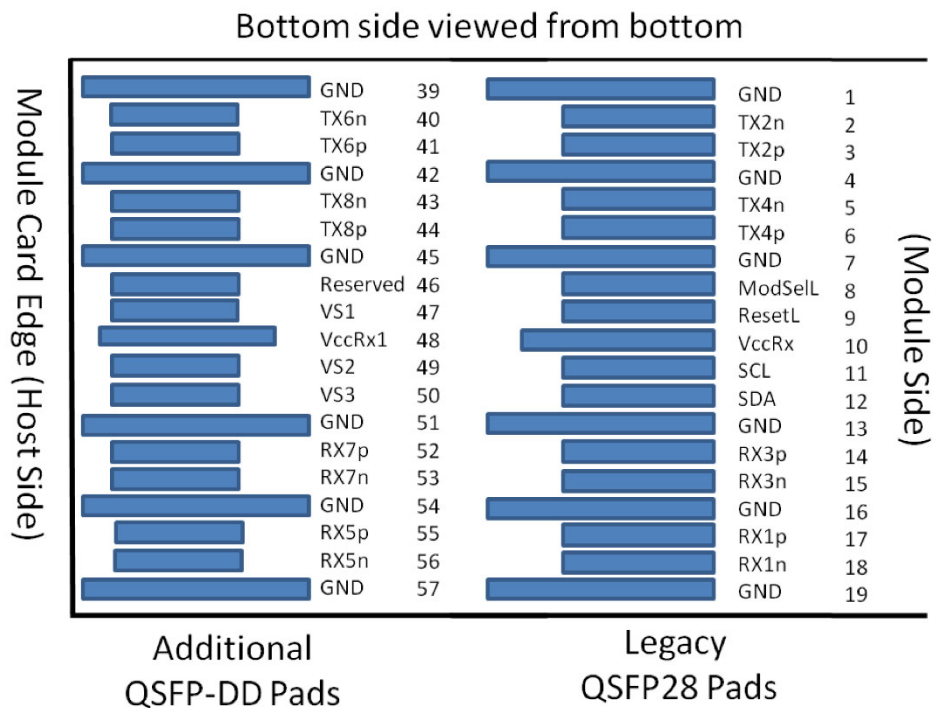
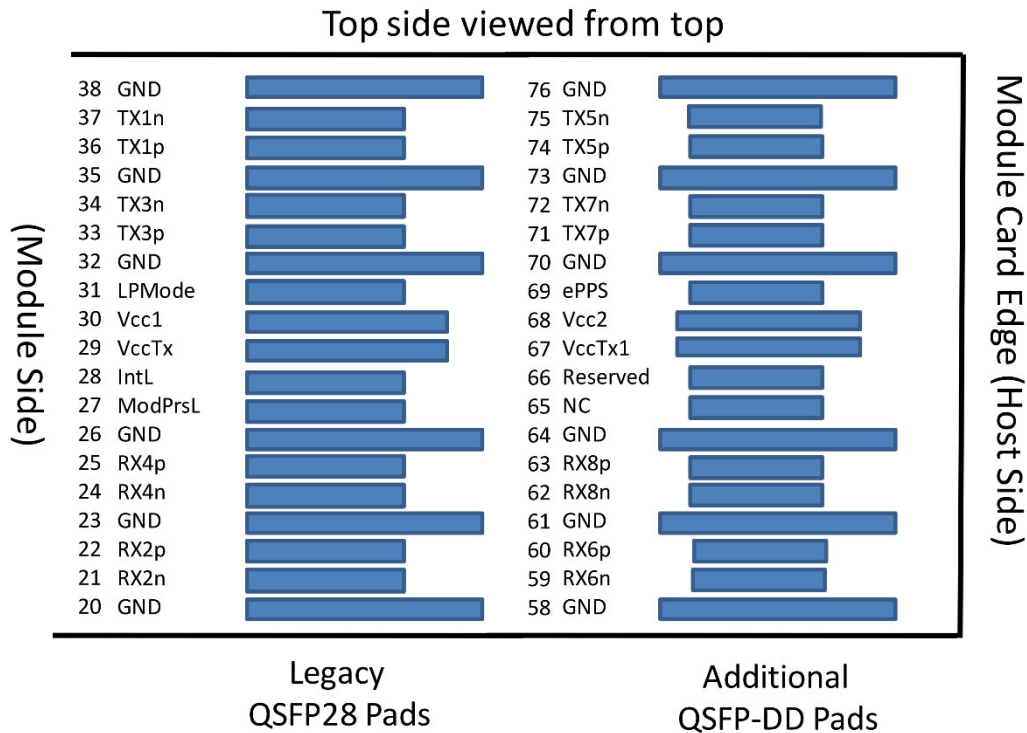
■ Applications

- 800G Ethernet
- Other optical links

■ General Description

TQS-Q18HE-8CZ is a hot pluggable QSFP-DD transceiver for 800G links over multimode fiber. It is a high performance module for short-range data communications and interconnect applications operating at 800Gbps up to 60m using OM3 multimode fiber or 100m using OM4 multimode fiber. This module is designed to operate over multimode fiber systems using a nominal wavelength of 850nm. The electrical interface uses a 76 pin connector. The optical interface is an MPO 16 APC connector.

■ QSFP-DD Module Pad Assignments and Descriptions



Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1B	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3B	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3B	
4		GND	Ground	1B	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3B	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3B	
7		GND	Ground	1B	1
8	LVTTL-I	ModSelL	Module Select	3B	
9	LVTTL-I	ResetL	Module Reset	3B	
10		VccRx	+3.3V Power Supply Receiver	2B	2
11	LVC MOS-I/O	SCL	2-wire serial interface clock	3B	
12	LVC MOS-I/O	SDA	2-wire serial interface data	3B	
13		GND	Ground	1B	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3B	
15	CML-O	Rx3n	Receiver Inverted Data Output	3B	
16		GND	Ground	1B	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3B	
18	CML-O	Rx1n	Receiver Inverted Data Output	3B	
19		GND	Ground	1B	1
20		GND	Ground	1B	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3B	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3B	
23		GND	Ground	1B	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3B	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3B	
26		GND	Ground	1B	1
27	LVTTL-O	ModPrsL	Module Present	3B	
28	LVTTL-O	IntL	Interrupt	3B	
29		VccTx	+3.3V Power supply transmitter	2B	2
30		Vcc1	+3.3V Power supply	2B	2
31	LVTTL-I	LPMODE	Low Power mode	3B	
32		GND	Ground	1B	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3B	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3B	

35		GND	Ground	1B	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3B	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3B	
38		GND	Ground	1B	1
39		GND	Ground	1A	1
40	CML-I	Tx6n	Transmitter Inverted Data Input	3A	
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	3A	
42		GND	Ground	1A	1
43	CML-I	Tx8n	Transmitter Inverted Data Input	3A	
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	3A	
45		GND	Ground	1A	1
46		Reserved	For future use	3A	3
47		VS1	Module Vendor Specific 1	3A	3
48		VccRx1	3.3V Power Supply	2A	2
49		VS2	Module Vendor Specific 2	3A	3
50		VS3	Module Vendor Specific 3	3A	3
51		GND	Ground	1A	1
52	CML-O	Rx7p	Receiver Non-Inverted Data Output	3A	
53	CML-O	Rx7n	Receiver Inverted Data Output	3A	
54		GND	Ground	1A	1
55	CML-O	Rx5p	Receiver Non-Inverted Data Output	3A	
56	CML-O	Rx5n	Receiver Inverted Data Output	3A	
57		GND	Ground	1A	1
58		GND	Ground	1A	1
59	CML-O	Rx6n	Receiver Inverted Data Output	3A	
60	CML-O	Rx6p	Receiver Non-Inverted Data Output	3A	
61		GND	Ground	1A	1
62	CML-O	Rx8n	Receiver Inverted Data Output	3A	
63	CML-O	Rx8p	Receiver Non-Inverted Data Output	3A	
64		GND	Ground	1A	1
65		NC	No Connect	3A	3

66		Reserved	For future use	3A	3
67		VccTx1	3.3V Power Supply	2A	2
68		Vcc2	3.3V Power Supply	2A	2
69	LVTTTL-I	ePPS	Precision Time Protocol (PTP) reference clock input	3A	3
70		GND	Ground	1A	1
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input	3A	
72	CML-I	Tx7n	Transmitter Inverted Data Input	3A	
73		GND	Ground	1A	1
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input	3A	
75	CML-I	Tx5n	Transmitter Inverted Data Input	3A	
76		GND	Ground	1A	1

Notes:

1. QSFP-DD uses common ground (GND) for all signals and supply (power). All are common within the QSFP-DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
2. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 shall be applied concurrently. Requirements defined for the host side of the Host Card Edge Connector are listed. VccRx, VccRx1, Vcc1, Vcc2, VccTx and VccTx1 may be internally connected within the module in any combination. For power classes 4 and above the module differential loading of input voltage pins must not result in exceeding pin current limits. The connector Vcc pins are each rated for a maximum current of 1000 mA.
3. All Vendor Specific, Reserved, No Connect and ePPS (if not used) pins may be terminated with 50 ohms to ground on the host. Pad 65 (No Connect) shall be left unconnected within the module. Vendor specific and Reserved pads shall have an impedance to GND that is greater than 10k ohms and less than 100 pF.
4. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 1A, 2A, 3A, 1B, 2B, 3B. (see pad locations) Contact sequence A will make, then break contact with additional QSFP-DD pads. Sequence 1A and 1B will then occur simultaneously, followed by 2A and 2B, followed by 3A and 3B.

Absolute Maximum Ratings

Not necessarily applied together. Exceeding these values may result in permanent damage. Functional operation under these conditions is not implied.

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Maximum Supply Voltage	Vcc	-0.5		3.6	V	
Storage Temperature	Ts	-40		85	°C	
Relative Humidity (no-condensation)	RH	15		85	%	
Case Operating Temperature	Tc	0		70	°C	
Receiver Damage Threshold, per Lane	PRdmg	5			dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Supply Current per end	Icc			4.46	A	
Total Power Consumption				14	W	
Bit Rate		850			Gbps	
Case Temperature	Top	0		70	°C	
Relative Humidity (non-condensation)						
Link Distance (OM3)				60	m	
Link Distance (OM4)				100	m	
I2C Clock Frequency				400	kHz	

Notes:

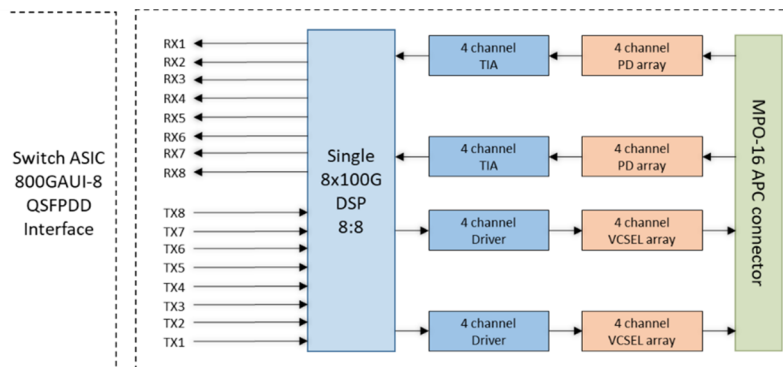
- Under condition of 3.465V operating supply voltage, and 70°C case temperature.

Electrical Characteristics

The following electrical characteristics are defined over the recommended operating environment unless otherwise specified.

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Pre FEC bit error ratio				2.4E-4		
Post FEC bit error ratio				1E-12		
Transmitter (each lane)						
Differential Peak-to-Peak input Voltage tolerance		750			mV	
Differential termination mismatch				10	%	
Eye height		10			mV	
Differential to common-mode return loss, RLcd		IEEE802.3ck Equation (120G-1)				
Vertical eye closure				12	dB	
Effective return loss, ERL		7.3			dB	
Transition Time		10			ps	
Receiver (each lane)						
Differential data output swing		300		900	mVpp	
Differential Termination Mismatch				10	%	
Eye Height (EH)		15			mV	
Vertical Eye Closure (VEC)				12	dB	
Common-mode to differential return loss, RLdc		IEEE 802.3ck Equation (120G-1)				
Effective Return Loss (ERL)		8.5			dB	
Transition Time		8.5			ps	

Optical Module Block Diagram



Optical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Transmitter						
Signaling rate, each lane		53.125±100ppm			GBd	
Modulation format		PAM4				
Center Wavelength	λ	840	860	868	nm	1
RMS spectral width	$\Delta\lambda$			0.6	nm	
Average launch power, each lane	LOP	-4.6		4.0	dBm	
Optical Power OMA, each Lane, max	OMA _{outer}	3.5			dBm	
Outer optical modulation amplitude (OMA _{outer}), each lne (min)	OMA _{outer}					
For Max (TECQ, TDECQ) <1.8 dB		-2.6			dBm	
For 1.8 < max (TECQ, TDECQ) <4.4 dB		-4.4 + max (TECQ, TDECQ)				
Transmitter and Dispersion penalty, each lane (max)	TDECQ			4.4	dB	
Transmitter eye closure for PAM4 (TECQ), each lane (max)	TECQ			4.4	dB	
Extinction ration, each lane	ER	2.5			dB	
Average Launch Power of OFF Transmitter, each lane		-	-	-30	dBm	
Optical Return Loss Tolerance	ORLT			14	dB	
Encircled fluxb		$\geq 86\%$ at 19um $\leq 30\%$ at 4.5um				2

Notes:

1. Defined according to the performance of the laser used
2. If measured into type A1a.2 or type A1a.3, or A1a.4, 50 um fiber, in accordance with IEC 61280-1-4.
3. Receiver sensitivity is informative and is defined for a transmitter with a value of TECQ. Measured with conformance test signal at TP3 for BER = 2.4E-4 Pre FEC

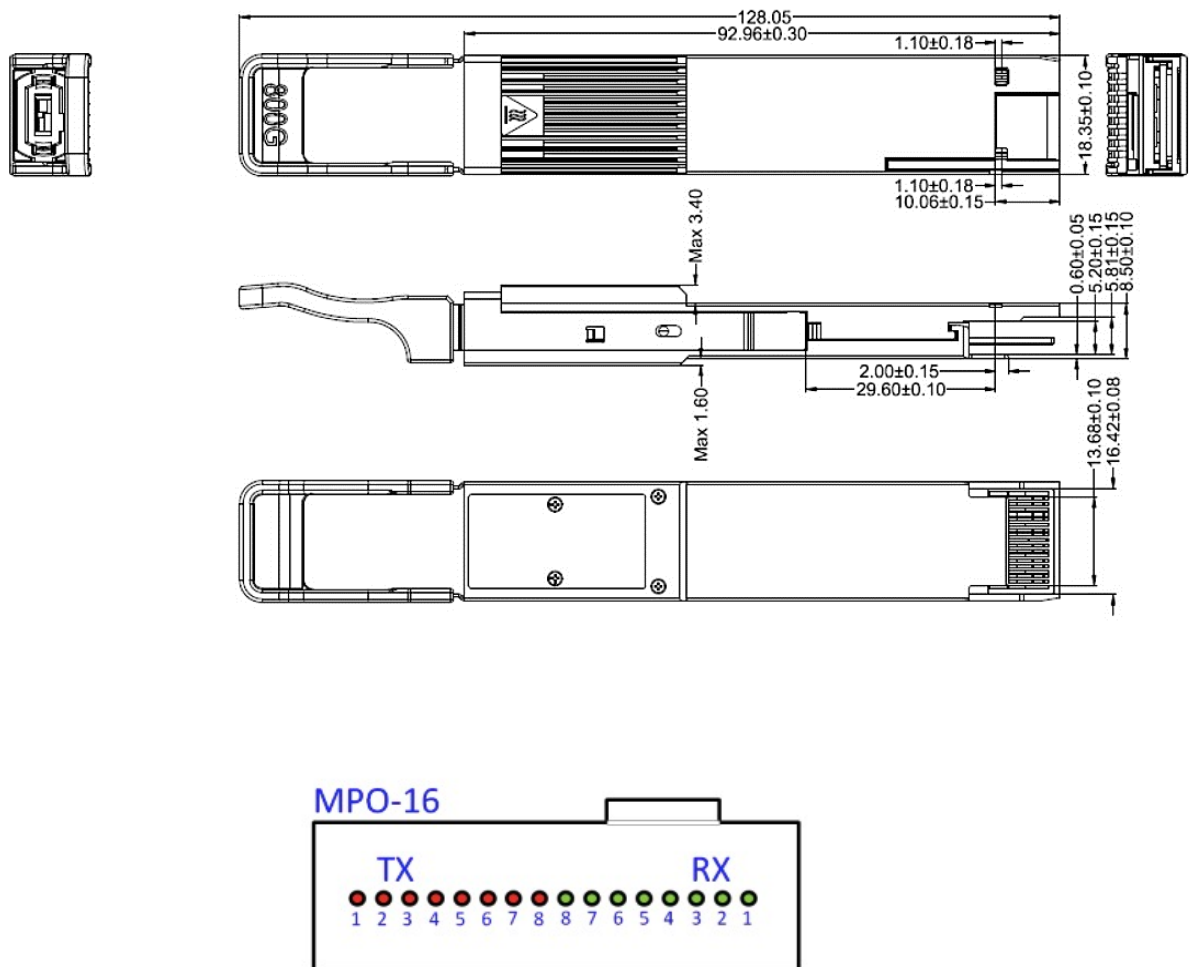
Parameter	Symbol	Min	Typ.	Max	Unit	Note
Receiver						
Signaling rate, each lane		53.125±100ppm			GBd	
Modulation format		PAM4				
Center Wavelength	λ	842	850	948	nm	
Damage Threshold, average optical power, each lane		5	-	-	dBm	
Average receive power, each lane		-6.4	-	4.0	dBm	
Receive Power (OMA _{outer}), each lane		-	-	3.5	dBm	
Receiver Reflectance				-15	dB	
Receiver sensitivity (OMA _{outer}), each lane		RX = max (-4.6, TECQ -6.4)			dBm	1
Stressed receiver sensitivity (OMA _{outer}), each lane				-2.0	dBm	
RX LOS Assert	LOSA	-15			dBm	
RX LOS De-assert	LOSD			-7.5	dBm	
RX LOS Hysteresis	LOSH	0.5			dB	

Notes:

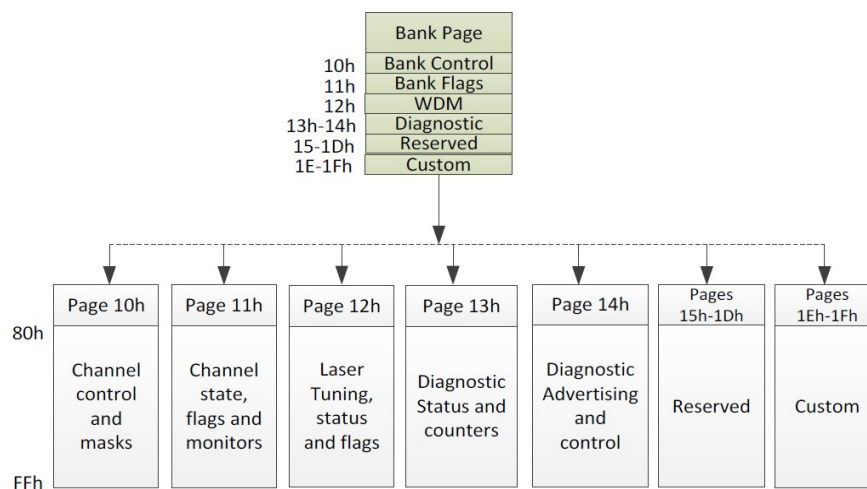
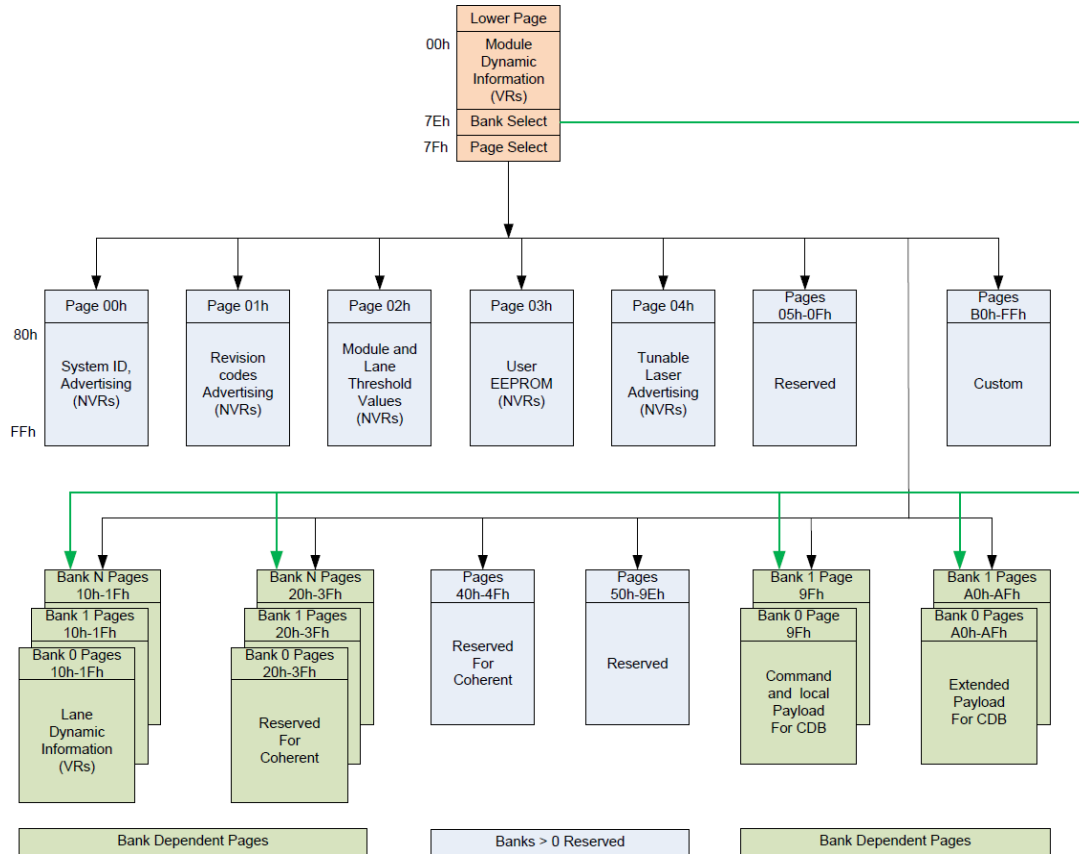
1. Defined according to the performance of the laser used

Mechanical Design Diagram

(Unit: mm)



CMIS Memory Map



Digital Diagnostic Monitor Accuracy

Parameter	Accuracy	Unit
Internally measured transceiver temperature ¹	±3	°C
Internally measured transceiver supply voltage	±3	%
Measured Tx bias current	±10	%
Measured Tx output power ²	±3	dB
Measured Rx received average optical power	±3	dB

Notes:

1. Test point is the hotspot of the module.
2. DDM report stability shall be within 0.5 dB when temperature is stable. TX DDM must report -40 dBm when TX disable.

■ Contact Information

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■ Revision History

Date	Version	Description
3/25/2024	0.1	Preliminary release