Copper QSFP28 Cable *Preliminary*

EOLQ-1HG-C-XX-30

QSFP Cable Assemblies, With 1×RX CDR, 0.4m/0.5m/1m/2m/3m Reach
RoHS6 Compliant

Features

- Supports 103.125Gb/s, 111.8Gb/s and 112.2Gb/s bit rates
- Lower Power Consumption for Single Module < 1.5W
- 30AWG up to 3 meters distance
- Power Supply: +3.3V
- Compatible to SFF-8665
- Compatible to SFF-8636
- Temperature Range: 0~ 70℃
- RoHS6 Compliant
- With 1×RX CDR

Applications

- 100G Ethernet
- OTU4
- 32GFC

Order Information

Part No.	Data rate(per lane)	Length	AWG	Passive/Active	Temp
EOLQ-1HG-C-P40-30	Up to 28.05G	0.4m	30	Active	0~ 70℃
EOLQ-1HG-C-H-30	Up to 28.05G	0.5m	30	Active	0~ 70℃
EOLQ-1HG-C-01-30	Up to 28.05G	1m	30	Active	0~ 70℃
EOLQ-1HG-C-02-30	Up to 28.05G	2m	30	Active	0~ 70℃
EOLQ-1HG-C-03-30	Up to 28.05G	3m	30	Active	0~ 70℃

*The product image only for reference purpose.

Regulatory Compliance*[Note1]

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12+A2
		EN 60825-1:2014
		EN 60825-2:2004+A1+A2
UL	E317337	UL 60950-1
		CSA C22.2 No. 60950-1-07
EMC CE	AE 50384190 0001	EN 55032:2012
		EN 55032:2015
		EN 55024:2010
		EN 55024:2010+A1
'FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	/	CDRH 1040.10
ROHS	/	2011/65/EU

Note1: The above certificate number updated to June 2018, because some certificate will be updated every year, such as FDA and ROHS. For the latest certification information, please check with Eoptolink.

Product Description

EOLQ-1HG-C-XX-30 Copper Cable assemblies are high-performance, cost effective I/O solutions for 100G Ethernet, OTU4 and 32GFC applications. QSFP28 copper modules allow hardware manufacturers to achieve high port density, configurability and utilization at a very low cost and to reduce power budget.

Absolute Maximum Ratings*[Note2]

Parameter	Symbol	Min	Typ	Max	Units
Maximum Supply Voltage	Vcc	-0.5		4.0	V
Storage Temperature	T_S	-40		85	°C

Note2: Exceeding any one of these values may destroy the device immediately.

Normal operating condition

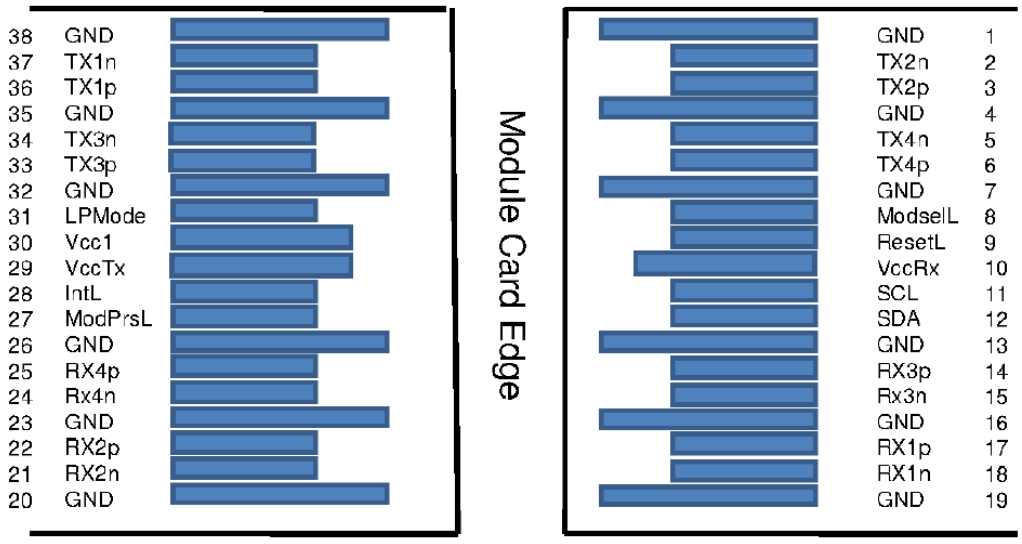
Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Case Temperature	Tc	0		70	°C	
Supply Voltage	Vcc	3.15	3.3	3.45	V	
Power Consumption	P			1.5	W	Note3
Data Rate(per channel)				28.05	Gbps	

Note3: The power consumption value is just depended on single module.

Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter Differential Input Voltage	V_{IN}	500	-	1200	mV_{pp}	
Receiver Differential Output Voltage	V_O	500	-	1200	mV_{pp}	
Impedance	Zcable	90	100	110	Ohms	

QSFP28 Transceiver Electrical Pad Layout



Top Side
Viewed From Top

Bottom Side
Viewed From Bottom

Pin Function Definitions

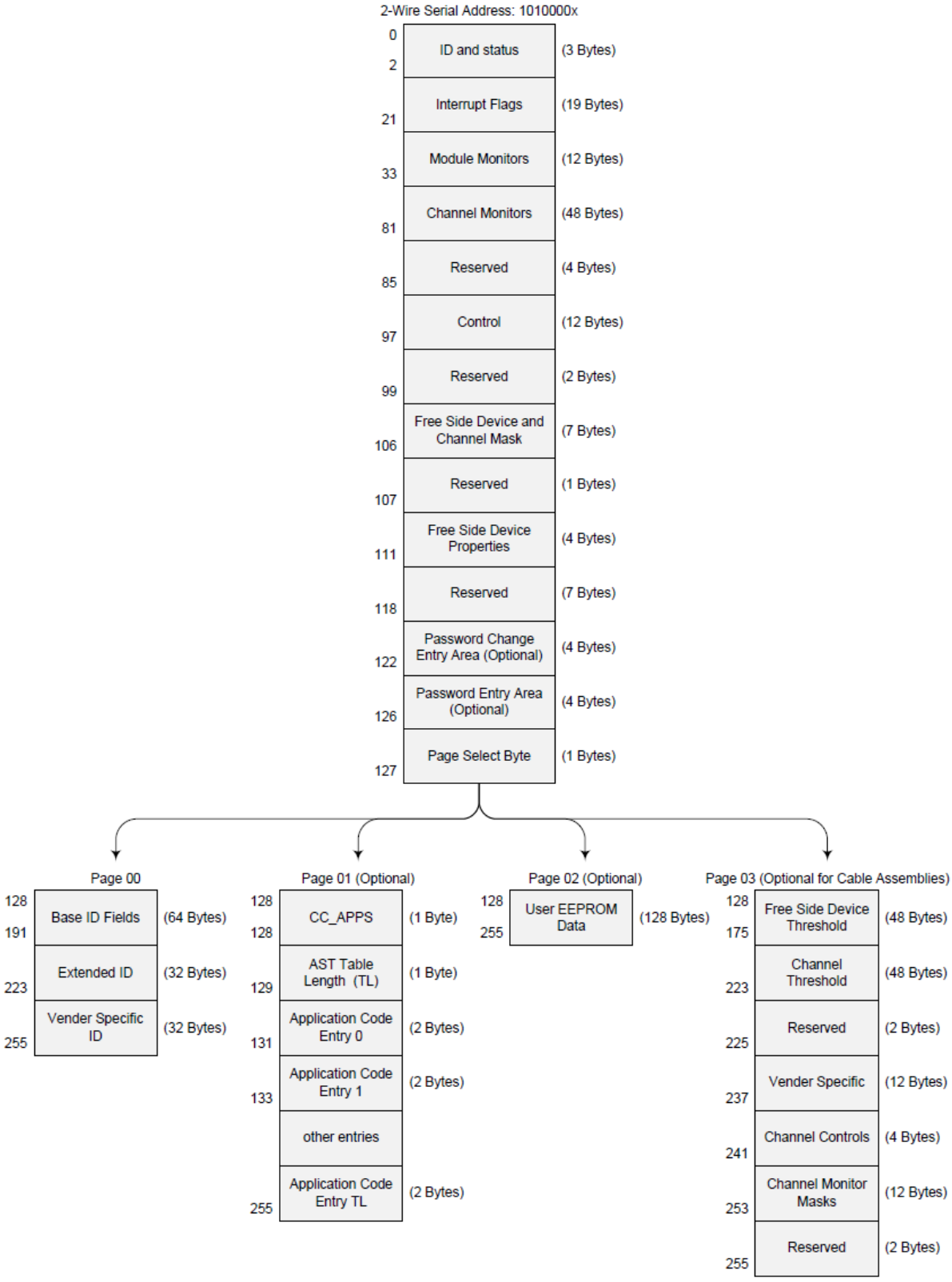
Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTL-I	ModSelL	Module Select	3	
9	LVTTL-I	ResetL	Module Reset	3	
10		VccRx	+3.3V Power Supply Receiver	2	2
11	LVCMOS- I/O	SCL	2-wire serial interface clock	3	
12	LVCMOS- I/O	SDA	2-wire serial interface data	3	

13		GND	Ground	1	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3	
15	CML-O	Rx3n	Receiver Inverted Data Output	3	
16		GND	Ground	1	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3	
18	CML-O	Rx1n	Receiver Inverted Data Output	3	
19		GND	Ground	1	1
20		GND	Ground	1	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3	
23		GND	Ground	1	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3	
26		GND	Ground	1	1
27	LVTTL-O	ModPrsL	Module Present	3	
28	LVTTL-O	IntL	Interrupt	3	
29		VccTx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTL-I	LPMode	Low Power Mode	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Input	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Input	3	
38		GND	Ground	1	1

1: GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 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: Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table 6. Recommended host board power supply filtering is shown in Figures 3 and 4. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP28 Module in any combination. The connector pins are each rated for a maximum current of 500mA.

Memory Map


2-Wire Serial Address: 1010000x
0
2
ID and status
(3 Bytes)
21
Interrupt Flags
(19 Bytes)
33
Module Monitors
(12 Bytes)
81
Channel Monitors
(48 Bytes)
85
Reserved
(4 Bytes)
97
Control
(12 Bytes)
99
Reserved
(2 Bytes)
106
Free Side Device and Channel Mask
(7 Bytes)
107
Reserved
(1 Bytes)
111
Free Side Device Properties
(4 Bytes)
118
Reserved
(7 Bytes)
122
Password Change Entry Area (Optional)
(4 Bytes)
126
Password Entry Area (Optional)
(4 Bytes)
127
Page Select Byte
(1 Bytes)
Page 00
128
191
Base ID Fields
(64 Bytes)
223
Extended ID
(32 Bytes)
255
Vender Specific ID
(32 Bytes)
Page 01 (Optional)
128
128
CC_APPS
(1 Byte)
129
AST Table Length (TL)
(1 Byte)
131
Application Code Entry 0
(2 Bytes)
133
Application Code Entry 1
(2 Bytes)
other entries
255
Application Code Entry TL
(2 Bytes)
Page 02 (Optional)
128
255
User EEPROM Data
(128 Bytes)
Page 03 (Optional for Cable Assemblies)
128
175
Free Side Device Threshold
(48 Bytes)
223
Channel Threshold
(48 Bytes)
225
Reserved
(2 Bytes)
237
Vender Specific
(12 Bytes)
241
Channel Controls
(4 Bytes)
253
Channel Monitor Masks
(12 Bytes)
255
Reserved
(2 Bytes)

EEPROM Serial ID Memory Contents

EEPROM Address			Lower memory	Version	V1.0
Data Addr	**Field Size (Byte)**	**Name Of filed**	**Description of field**	**Coded value**	**Hex**
Alarm & Warning Thresholds					
0	1	Identifier	Identifier	QSFP28	11H
1	2	Status	Status	SFF-8636 Rev 2.5, 2.6 and 2.7	07H
2					00H
3-21	19	Interrupt Flags	Interrupt Flags		00H
22-33	12	Module Monitors	Module Monitors		00H
34-81	48	Channel Monitors	Channel Monitors		00H
82-85	4	Reserved	Reserved		00H
86-97	12	Control	Control		00H
98-99	2	Reserved	Reserved		00H
100-106	7	Module and Channel Masks	Module and Channel Masks		00H
107-118	12	Reserved	Reserved		00H
119-122	4	Password Change Entry Area	Password Change Entry Area		00H
123-126	4	Password Entry Area	Password Entry Area		00H
127	1	Page Select Byte	Page Select Byte		00H

EEPROM Address			Page00h	Version	V1.0
Data Addr	**Field Size (Byte)**	**Name Of filed**	**Description of field**	**Coded value**	**Hex**
BASE ID FIELDS					
128	1	Identifier	Type of serial transceiver	QSFP28	11
129	1	Ext.Identifier	Extended identifier of Type of serial transceiver	Power class 1 module, No CLEI code present in Page 02h, No CDR in TX; CDR present in RX	04
130	1	Connector	Code for connector type	No separable connector	23
131	8	Specification compliance	10/40G/100G Ethernet Compliance Code	Extended Specification Compliance Codes are maintained	80

132			SONET Compliance codes		00
133			SAS/SATA compliance codes		00
134			Gigabit Ethernet Compliant codes		00
135			Fibre Channel link length/Transmitter Technology		00
136			Fibre Channel link length/Transmitter Technology		00
137			Fibre Channel transmission media		00
138			Fibre Channel Speed		00
139	1	Encoding	Code for serial encoding algorithm		00
140	1	BR, Nominal	Nominal bit rate,units of 100 Mbits/sec.	Bit Rate Exceeds 25.4G	FF
141	1	Extended rateselect Compliance	Tags for extended rate select compliance		00
142	1	Length(SMF)	Link length supported for SMF fiber in km		00
143	1	Length(OM3 50um)	Link length supported for EBW 50/125 um fiber (OM3),units of 2m		00
144	1	Length(OM2 50um)	Link length supported for 50/125 um fiber (OM2),units of 1m		00
145	1	Length(OM1 62.5 um)	Link length supported for 62.5/125 um fiber (OM1),units of 1m		00
146	1	Length (Copper)	Link length of copper or active cable, units of 1m	x(m) Note1	xx
147	1	Device tech	Device technology	Copper cable unequalized,No wavelength control,Uncooled transmitter device,Transmitter not tunable	A0
148	16	Vendor name	Vendor name (ASCII)	E	45
149				o	6F

150				p	70
151				t	74
152				o	6F
153				l	6C
154				i	69
155				n	6E
156				k	6B
157				<space>	20
158				<space>	20
159				<space>	20
160				<space>	20
161				<space>	20
162				<space>	20
163				<space>	20
164	1	Extended Module	Extended Module codes for InfiniBand		00
165	3	Vendor OUI	QSFP28 vendor IEEE company ID		00
166					00
167					00
168	16	Vendor PN	Part number provided by vendor (ASCII)	E	45
169				O	4F
170				L	4C
171				Q	51
172				-	2D
173				1	31
174				H	48
175				G	47
176				-	2D
177				C	43
178				-	2D
179				x Note1	xx
180				x Note1	xx
181				x Note1	xx
182				x Note1	xx
183				<space>	20
184	2	Vendor rev	Revision level for part number provided by vendor (ASCII)	A	41
185					20
186	2	Wave length or Copper cable Attenuation	Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5GHz	Note2 Fill in attenuation at 2.5GHz in dB	xx
187				Note2 Fill in attenuation at 5.0GHz in dB	xx

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			(Adrs 186) and 5.0GHz (Adrs 187)		
188	2	Wavelength tolerance	Guaranteed range of laser wavelength(+/- value) from nominal wavelength.(wavelength Tol.=value/200 in nm)		00
189					00
190	1	Max case temp.	Maximum case temperature in degrees C	70℃	46
191	1	CC_BASE	Check code for Base ID Fields (addresses 128-190)	Note3	xx
192	1	Link codes	Extended Specification Compliance Codes(See SFF-8024)	100GBASE-CR4	0B
193	3	Options	Rate Select, TX Disable, TX Fault, LOS, Warning indicators for:Temperature, VCC, RX power, TX Bias	TX Input Equalization Fixed Programmable Settings not implemented; RX Output Emphasis Fixed Programmable Settings, RX Output Amplitude Fixed Programmable Settings implemented	03
194				RX CDR On/Off Control; RX CDR Loss of Lock (LOL) Flag; Rx Squelch Disable implemented; Rx Output Disable capable implemented; Tx Squelch Disable not implemented; Tx Squelch not implemented	5C
195				Memory page 02 provided; Memory page 01 provided; RATE_SELECT not implementde; Tx_ DISABLE not implemented; Tx_FAULT signal not implemented;Tx Squelch not implemented to reduce Pave;Tx Loss of Signal not implemented	C0
196	16	Vendor SN	Serial number provided by	x	xx

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197			vendor (ASCII)	x	xx
198				x	xx
199				x	xx
200				x	xx
201				x	xx
202				x	xx
203				x	xx
204				x	xx
205				x	xx
206				<space>	xx
207				<space>	xx
208				<space>	xx
209				<space>	20
210				<space>	20
211				<space>	20
212	8	Date code	Vendor's manufacturing date code	Year	xx
213				Year	xx
214				Month	xx
215				Month	xx
216				Day	xx
217				Day	xx
218				<Space>	20
219				<Space>	20
220	1	Diagnostic Monitoring Type	Indicates which types of diagnostic monitoring are implemented (if any) in the Module. Bit 1,0 Reserved		00
221	1	Enhanced Options	Indicates which optional enhanced features are implemented in the Module	Module does not support rate selection;Module does not support application select and page 01 does not exist	00
222	1	BR, nominal	Nominal bit rate per channel,units of 250 Mbps. Complements Byte 140	25.78Gbps	67
223	1	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)	Note4	xx
Vendor Specific ID Fields					
224-255	32	Vendor Specific EEPROM			00

Note 1: The value on these addresses is according to specific QSFP28 pat number.

Note 2: The value on these addresses is based on length/gage.

Note 3: The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte

128 to byte 190, inclusive.
Note 4: The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte 192 to byte 222, inclusive.

EEPROM Address			Page 03h	Version	V1.0
Data Addr	**Field Size (Byte)**	**Name Of filed**	**Description of field**	**Coded value**	**Hex**
Alarm & Warning Thresholds					
128	2	Temp High Alarm	Temp High Alarm	+80℃	50H
129					00H
130	2	Temp Low Alarm	Temp Low Alarm	-5℃	FBH
131					00H
132	2	Temp High Warning	Temp High Warning	+75℃	4BH
133					00H
134	2	Temp Low Warning	Temp Low Warning	0℃	00H
135					00H
136-143	8	Reserved			00H
144	2	Voltage High Alarm	Voltage High Alarm	3.6V	8CH
145					A0H
146	2	Voltage Low Alarm	Voltage Low Alarm	3.0V	75H
147					30H
148	2	Voltage High Warning	Voltage High Warning	3.5V	88H
149					B8H
150	2	Voltage Low Warning	Voltage Low Warning	3.05V	77H
151					24H
152-159	8	Reserved			00H
160-175	16	Vendor Specific			00H
176	2	RX Power High Alarm	RX Power High Alarm		00H
177					00H
178	2	RX Power Low Alarm	RX Power Low Alarm		00H
179					00H
180	2	RX Power High Warning	RX Power High Warning		00H
181					00H
182	2	RX Power Low Warning	RX Power Low Warning		00H
183					00H
184	2	Tx Bias High Alarm	Tx Bias High Alarm		00H
185					00H
186	2	Tx Bias Low Alarm	Tx Bias Low Alarm		00H
187					00H

188	2	Tx Bias High Warning	Tx Bias High Warning		00H
189					00H
190	2	Tx Bias Low Warning	Tx Bias Low Warning		00H
191					00H
192-199	8	Reserved			00H
200-207	8	Reserved			00H
208-223	16	Vendor Specific			00H
224-225	2	Reserved			00H
226-237	12	Reserved			00H
238	1	RX1 output amplitude	Output amplitude levels with no equalization enabled		00H
		RX2 output amplitude	Output amplitude levels with no equalization enabled		
239	1	RX3 output amplitude	Output amplitude levels with no equalization enabled		00H
		RX4 output amplitude	Output amplitude levels with no equalization enabled		
240	1	Rx4 SQ Disable	Rx Squelch Disable Channel 4		00H
		Rx3 SQ Disable	Rx Squelch Disable Channel 3		
		Rx2 SQ Disable	Rx Squelch Disable Channel 2		
		Rx1 SQ Disable	Rx Squelch Disable Channel 1		
		Tx4 SQ Disable	Tx Squelch Disable Channel 4		
		Tx3 SQ Disable	Tx Squelch Disable Channel 3		
		Tx2 SQ Disable	Tx Squelch Disable Channel 2		
		Tx1 SQ Disable	Tx Squelch Disable Channel 1		
241	1	Rx4 Output Disable	Rx Output Disable channel 4		00H
		Rx3 Output Disable	Rx Output Disable channel 3		
		Rx2 Output Disable	Rx Output Disable channel 2		

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		Rx1 Output Disable	Rx Output Disable channel 1		
242	1	M-Rx1 Power High Alarm	Masking Bit for high RX Power alarm channel 1		00H
		M-Rx1 Power Low Alarm	Masking Bit for low RX Power alarm channel 1		
		M-Rx1 Power High Warning	Masking Bit for high RX Power warning channel 1		
		M-Rx1 Power Low Warning	Masking Bit for low RX Power warning channel 1		
		M-Rx2 Power High Alarm	Masking Bit for high RX Power alarm channel 2		
		M-Rx2 Power Low Alarm	Masking Bit for low RX Power alarm channel 2		
		M-Rx2 Power High Warning	Masking Bit for high RX Power warning channel 2		
		M-Rx2 Power Low Warning	Masking Bit for low RX Power warning channel 2		
243	1	M-Rx3 Power High Alarm	Masking Bit for high RX Power alarm channel 3		00H
		M-Rx3 Power Low Alarm	Masking Bit for low RX Power alarm channel 3		
		M-Rx3 Power High Warning	Masking Bit for high RX Power warning channel 3		
		M-Rx3 Power Low Warning	Masking Bit for low RX Power warning channel 3		
		M-Rx4 Power High Alarm	Masking Bit for high RX Power alarm channel 4		
		M-Rx4 Power Low Alarm	Masking Bit for low RX Power alarm channel 4		
		M-Rx4 Power High Warning	Masking Bit for high RX Power warning channel 4		
		M-Rx4 Power Low Warning	Masking Bit for low RX Power warning channel 4		

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244	1	M-Tx1 Bias High Alarm	Masking Bit for high TX Bias alarm channel 1		00H
		M-Tx1 Bias Low Alarm	Masking Bit for low TX Bias alarm channel 1		
		M-Tx1 Bias High Warning	Masking Bit for high TX Bias warning channel 1		
		M-Tx1 Bias Low Warning	Masking Bit for low TX Bias warning channel 1		
		M-Tx2 Bias High Alarm	Masking Bit for high TX Bias alarm channel 2		
		M-Tx2 Bias Low Alarm	Masking Bit for low TX Bias alarm channel 2		
		M-Tx2 Bias High Warning	Masking Bit for high TX Bias warning channel 2		
		M-Tx2 Bias Low Warning	Masking Bit for low TX Bias warning channel 2		
245	1	M-Tx3 Bias High Alarm	Masking Bit for high TX Bias alarm channel 3		00H
		M-Tx3 Bias Low Alarm	Masking Bit for low TX Bias alarm channel 3		
		M-Tx3 Bias High Warning	Masking Bit for high TX Bias warning channel 3		
		M-Tx3 Bias Low Warning	Masking Bit for low TX Bias warning channel 3		
		M-Tx4 Bias High Alarm	Masking Bit for high TX Bias alarm channel 4		
		M-Tx4 Bias Low Alarm	Masking Bit for low TX Bias alarm channel 4		
		M-Tx4 Bias High Warning	Masking Bit for high TX Bias warning channel 4		
		M-Tx4 Bias Low Warning	Masking Bit for low TX Bias warning channel 4		
246-255	10	Reserved			00H

LOGO

Input equalization, output emphasis and output swing setting

The RX CDR's input equalization, RX CDR's output emphasis and output swing can be modified by host refer to SFF-8636 "Optional Channel Controls" part. The specific setting values are listed in tables below. Some reserved codes which are marked red are used for more setting choices.

Table 1 Input Equalization Control (PAGE 03h BYTES 234-235)

Code	Input Equalization	
	Nominal	Units
1111	22.7	dB
1110	21.5	dB
1101	20.2	dB
1100	18.9	dB
1011	17.9	dB
1010	16.7	dB
1001	15.2	dB
1000	14.2	dB
0111	13.1	dB
0110	12.4	dB
0101	11.1	dB
0100	9.9	dB
0011	8.8	dB
0010	7.8	dB
0001	6.7	dB
0000	5.5	dB

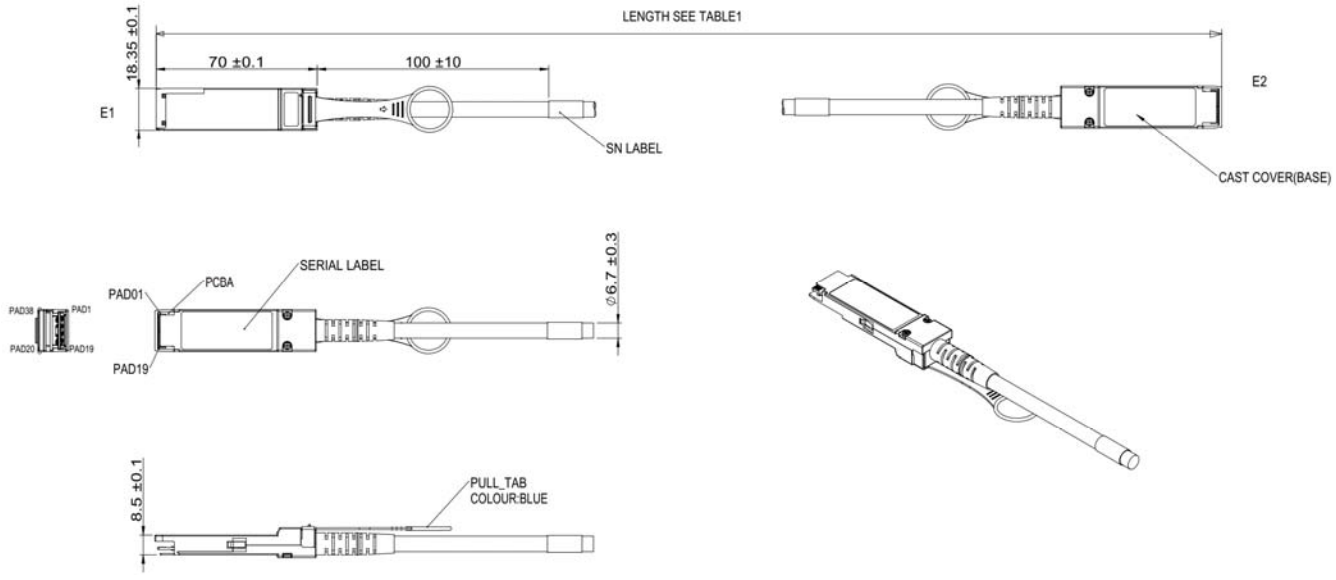
Table 2 Output Emphasis Control (PAGE 03h BYTES 236-237)

Code	Output Emphasis	
	Nominal	Units
1111	8.2	dB
1110	6.6	dB
1101	4.6	dB
1100	3.5	dB
1011	2.4	dB
1010	1.5	dB
1001	0.7	dB
1000	0.3	dB
0111	7.4	dB
0110	5.9	dB
0101	5.2	dB
0100	4	dB
0011	2.8	dB
0010	1.9	dB
0001	1.1	dB
0000	0	dB

Table 3 Output Swing Control (PAGE 03h BYTES 238-239)

Code	Output Swing	
	Nominal	Units
1111	1000	mV
1110	950	mV
1101	900	mV
1100	850	mV
1011	750	mV
1010	700	mV
1001	650	mV
1000	550	mV
0111	500	mV
0110	450	mV
0101	300	mV
0100	200	mV
0011	1100	mV
0010	800	mV
0001	600	mV
0000	400	mV

Mechanical Specifications



Obtaining Document

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Revision History

Revision	Initiated	Review	Approved	Revision History	Release Date
V1.a	Roty/Yi.Wan/Young	Marvin		Preliminary	MAR 30, 2016
V1.b	Marvin/Leon			Add EQ emphasis and swing control	MAY 17,2016
V1.c	Nico/Yi.Wan	Marvin		Update the product image, order info and 32GFC application; Revised the EEPROM definition and mechanical spec.	MAR 16, 2017
V1.d	Yi.Wan	Marvin		Update the regulatory compliance, EEPROM definition (Update byte129 of Page00h to no CLEI code and the temp threshold) and contact.	Aug 27, 2018

Notice:

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