

40-Gbps QSFP+ Parallel Optical Transceiver Module

Product Description

Lightwave Link Inc. Quad Small Form-factor Pluggable Plus (QSFP+) product is a new high speed pluggable I/O interface products. This interconnecting system offers 4 channels and maximum bandwidth of 40Gbps which are based on the proprietary technique Silicon Optical Bench (SiOB). This module provide high performance and excellent efficiency in the optical communication.



Features

- Compliant with 40G Ethernet IEEE 802.3ae 40GBASE-SR4 standards
- Compliant to SFF-8436 QSFP+ Specification Revision 4.0
- QSFP footprint (Quad small form-factor, pluggable)
- Supports 40 Gbps data rate links of up to [distance]
- Compliant with QDR/DDR Infiniband data rates
- Power Level 1: Max power consumption < 1.5 W
- Hot pluggable electrical interface
- Links up to 100 m via OM3 fiber and 150 m via OM4 fiber
- Using standard 12/8 lane optical fiber with MPO optical connector.
- 0 to 70°C case temperature operating range
- RoHS-6 Compliant (lead-free)

Applications

- 40GBASE-SR4 Ethernet links
- Infiniband QDR and DDR interconnects
- Client-side 40G Telecom connections

Absolute Maximum Rating

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

Parameter	Symbol	Min	Typical	Max	Unit	Note
Storage Temperature	Ts	-40		100	°C	
3.3V Power Supply Voltage	Vcc	-0.5		3.6	V	
Data Input Voltage-Single Ended		-0.5		V _{cc} +0.5	V	
Data Input Voltage-Differential	V _{DIP} -V _{DIN}			1.0	V	
Relative Humidity	RH	5		85	%	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Note
Case Temperature	Tc	0	40	70	°C	
3.3 V Power Supply Voltage	Vcc	3.135	3.3	3.465	V	
Signal Rate per Channel		2.5		10.3125	Gbps	
Control* Input Voltage High	Vih	2		V _{cc} +3	V	
Control* Input Voltage Low	Vil	-0.3		0.8	V	
Two Wire Serial (TWS) Interface Clock Rate				400	kHz	
Receiver Differential Data Output Load			100		Ohms	
Fiber Length: 2000 MHz·km 50µm MMF (OM3)		0.5		100	m	
Fiber Length: 4700 MHz·km 50µm MMF (OM4)		0.5		35	m	

Transceiver Electrical Characteristics

The following characteristics are defined over the Recommended Operating Conditions unless otherwise noted. Typical values are for Tc = 40°C, Vcc = 3.3 V.

Parameter	Symbol	Min	Typical	Max	Unit	Note
10G Transceiver Power Consumption			1	1.5	W	
Transceiver Power Supply Current			300		mA	
Transceiver Power On Initialization Time	tpwr init			2000	ms	1.

Notes:

1. "Initialization Time" is the time from when the supply voltages reach and remain above the minimum "Recommended Operating Conditions" to the time when the module enables TWS access. The module at that point is fully functional.

Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
Transmitter Electrical Characteristics						
Data Input Differential Peak-to-Peak Voltage Swing	$\Delta V_{DI\ PP}$	175		1600	mVpp	
LOS Assert Threshold: Tx Data Input Differential Peak-to-Peak Voltage Swing	$\Delta V_{DI\ PP}$ LOS	50			mVpp	
Differential input threshold			50		mV	
Receiver Electrical Characteristics						
Data Output Differential Peak-to-Peak Voltage Swing (AC-Coupled)	$\Delta V_{DO\ pp}$	200		900	mVpp	
Output transition time 20% to 80%	t_{rise}, t_{fall}	28			ps	
Output Total Jitter				62	ps	

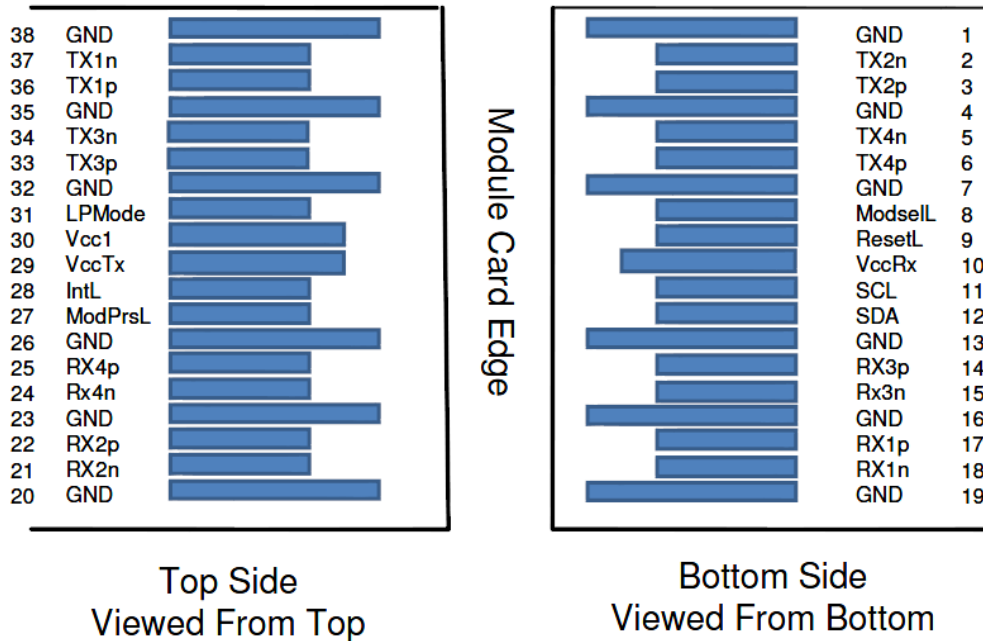
Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
Transmitter Optical Characteristics						
Center Wavelength	λ	840		860	nm	
Spectral Width – RMS	$\Delta\lambda$			0.65	nm	
Output Optical Power: Average	PO_AVE	-7.6		2.4	dBm	
Output Optical Modulation Amplitude, per lane		-5.6		3	dBm	
Extinction Ratio	ER	3			dB	
Output Optical Power: Disabled	PO_OFF			-30	dBm	
Eye Mask		Compliant with IEEE 802.3ba D3.2				
Receiver Optical Characteristics						
Center wavelength, each lane	λ	840	850	860	nm	
Damage Threshold		3.4			dBm	
Maximum Average power at receiver input, each lane				2.4	dBm	
Receiver Reflectance				-12	dB	
Stressed receiver sensitivity (Avg)				-5.4	dBm	1
LOS Assert		-30			dB	
LOS De-Assert – OMA				-7.5	dB	
LOS Hysteresis		0.5			dB	

Notes:

1. Measured with 10.3125-Gbps of PRBS-31 at 10^{-12} BER.

QSFP+ Module Pad Assignments and Descriptions



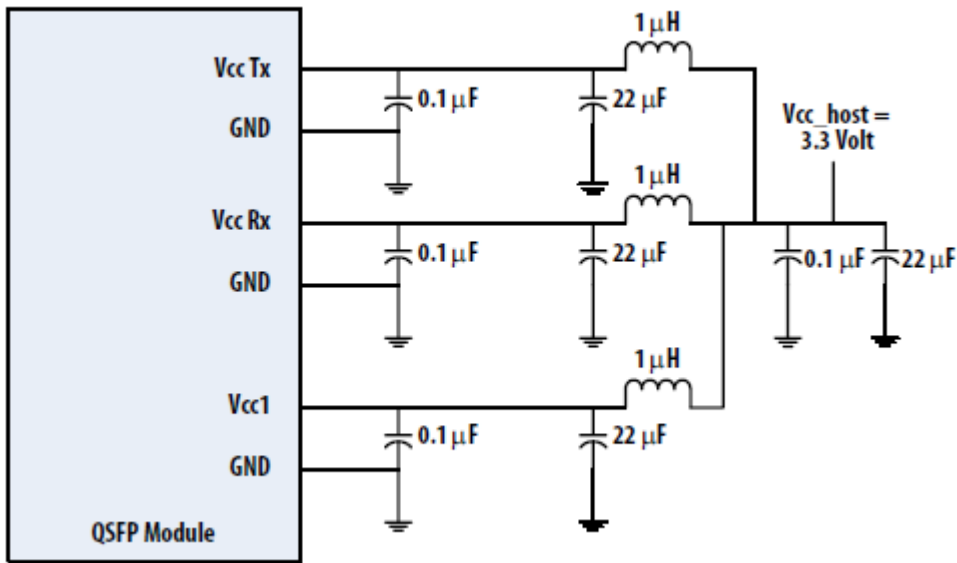
Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3	
7		GND	Ground	1	1
8	LVTTTL-I	ModSell	Module Select	3	
9	LVTTTL-I	ResetL	Module Reset	3	
10		Vcc Rx	+3.3V Power Supply Receiver	2	2
11	LVC MOS-I/O	SCL	2-wire serial interface clock	3	
12	LVC MOS-I/O	SDA	2-wire serial interface data	3	
13		GND	Ground	1	2
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	LVTTTL-O	ModPrsL	Module Present	3	
28	LVTTTL-O	IntL	Interrupt	3	
29		Vcc Tx	+3.3V Power supply transmitter	2	2
30		Vcc1	+3.3V Power supply	2	2
31	LVTTTL-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

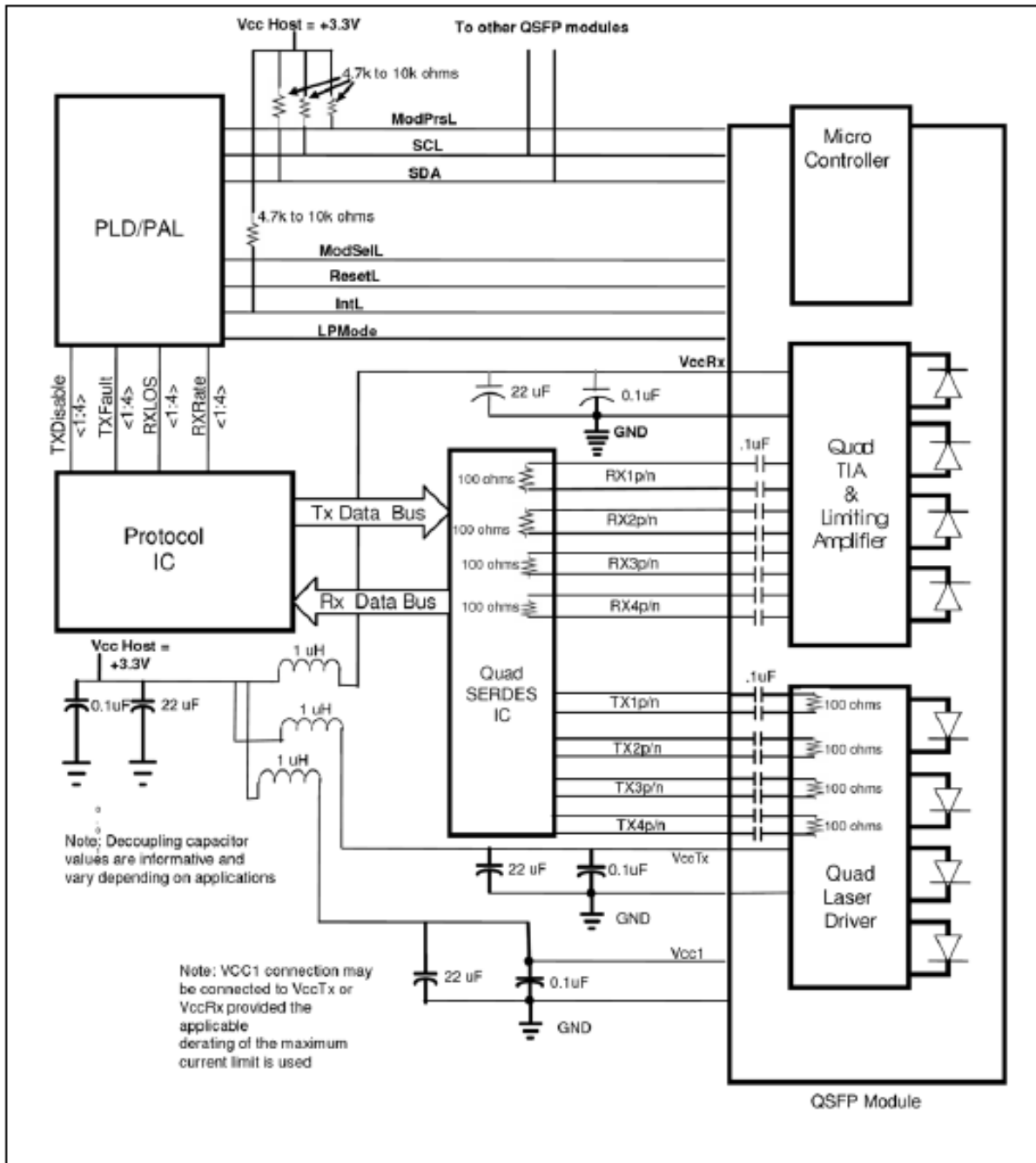
Note 1: GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

Note 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 Figure 4. 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.

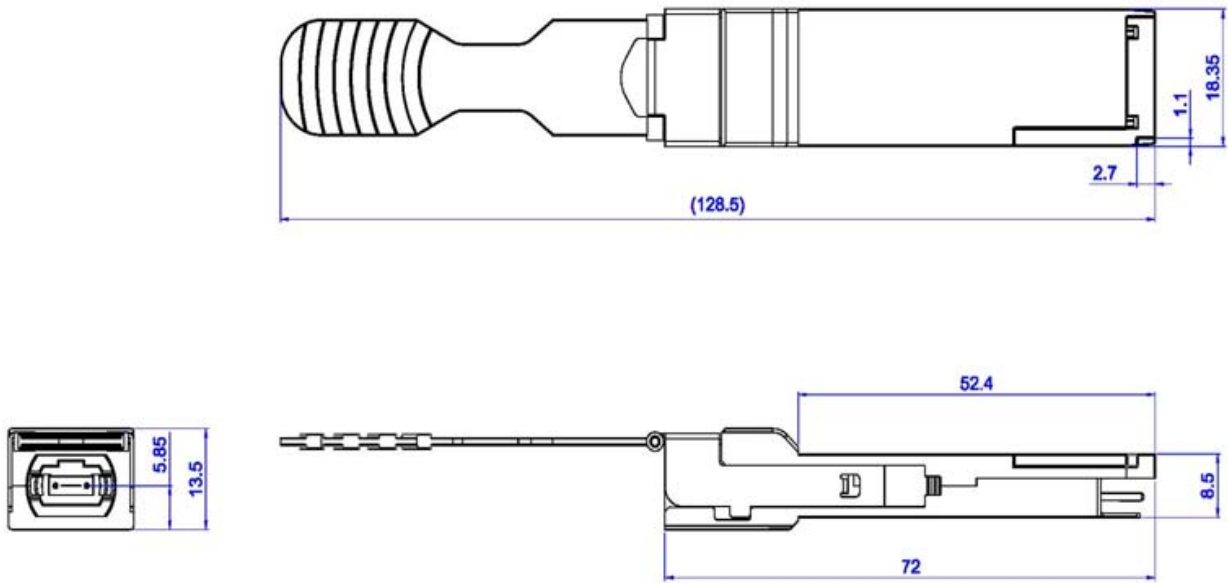
Recommended Host Board Power Supply Circuit



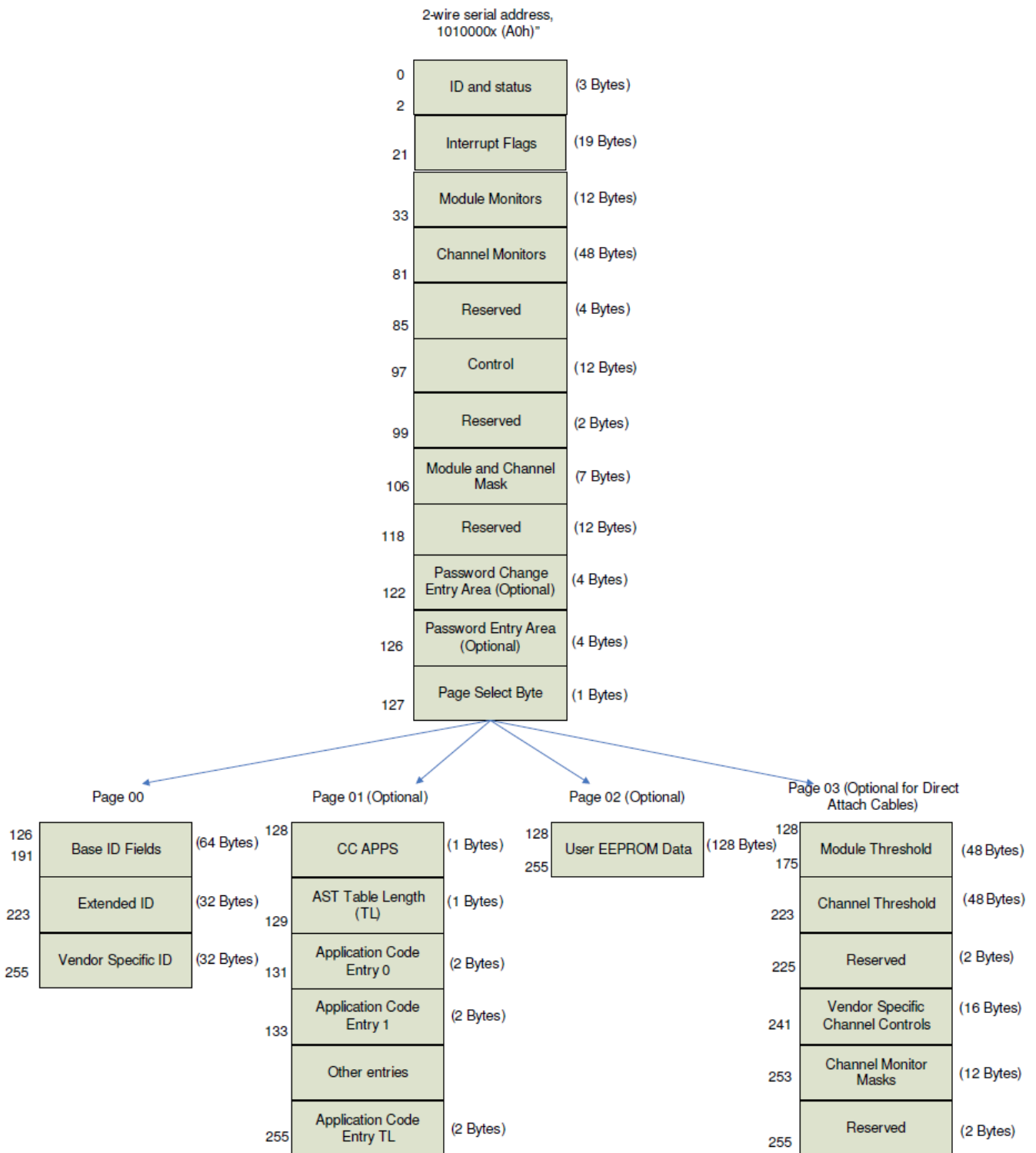
Recommended Interface Circuit



Mechanical Design Diagram



Memory Map



Lower Memory Map (Aoh)

Address	Description	Default/Typical value
0	Identifier	0C
1	Reserved	00
2	Status	02
3	Rx LOS	00
4	Tx Fault	00
6	Temp High/Low alarm/warning	00
7	Vcc high/low alarm/ warning	00
22-25	Reserved	00
26-27	Supply voltage	
28-41	Reserved	00
42-49	Tx bias	
50-85	Reserved	00
86	Tx disable	00
87-106	Reserved	00
100-106	Module and Channel Masks	
107-118	Reserved	00
119-122	Password Change Entry Area (optional)	
123-126	Password Entry Area (optional)	
127	Page Select Byte	00

Upper Memory Map (Aoh)

Address	Description	Default/Typical value
128	Identifier	0C
129	Ext. Identifier	00
130	Connector	0C
131-138	Module	10, 00, 00, 01, 40, 40, 04, 00
139	Encoding	05
140	BR, nominal	64
141	Extended rate select Compliance	00
142	Length(SMF)	00
143	Length(OM3 50 um)	00
144	Length(OM2 50 um)	0A
145	Length(OM1 62.5 um)	00
146	Length(Copper)	00
147	Device tech	00
148-163	Vendor name	
164	Extended Module	04
165-167	Vendor OUI	00
168-183	Vendor PN	
184-185	Vendor rev	
186-187	Wave length or Copper cable Attenuation	42, 68
188-189	Wavelength tolerance	0F, A0
190	Max case temp.	46
191	CC_BASE	
192-195	Options	
196-211	Vendor SN	
212-219	Date Code	
220	Diagnostic Monitoring Type	08
221-222	Enhanced Options	00
222	Reserved	00
223	CC_EXT	
224-255	Vendor Specific	

Upper Memory Map (A3h)

Address	Description	Default/Typical value
128-129	Temp high alarm	
130-131	Temp low alarm	
132-133	Temp high warning	
134-135	Temp low warning	
144-145	Vcc high alarm(3.6V)	
146-147	Vcc low alarm(3.0V)	
148-149	Vcc high warning(3.5V)	
150-151	Vcc low warning (3.1V)	
176-177	Rx power high alarm	Optional
178-179	Rx power low alarm	Optional
180-181	Rx power high warning	Optional
182-183	Rx power low warning	Optional
184-185	Tx bias high alarm	
186-187	Tx bias low alarm	
188-189	Tx bias high warning	
190-191	Tx bias low warning	

