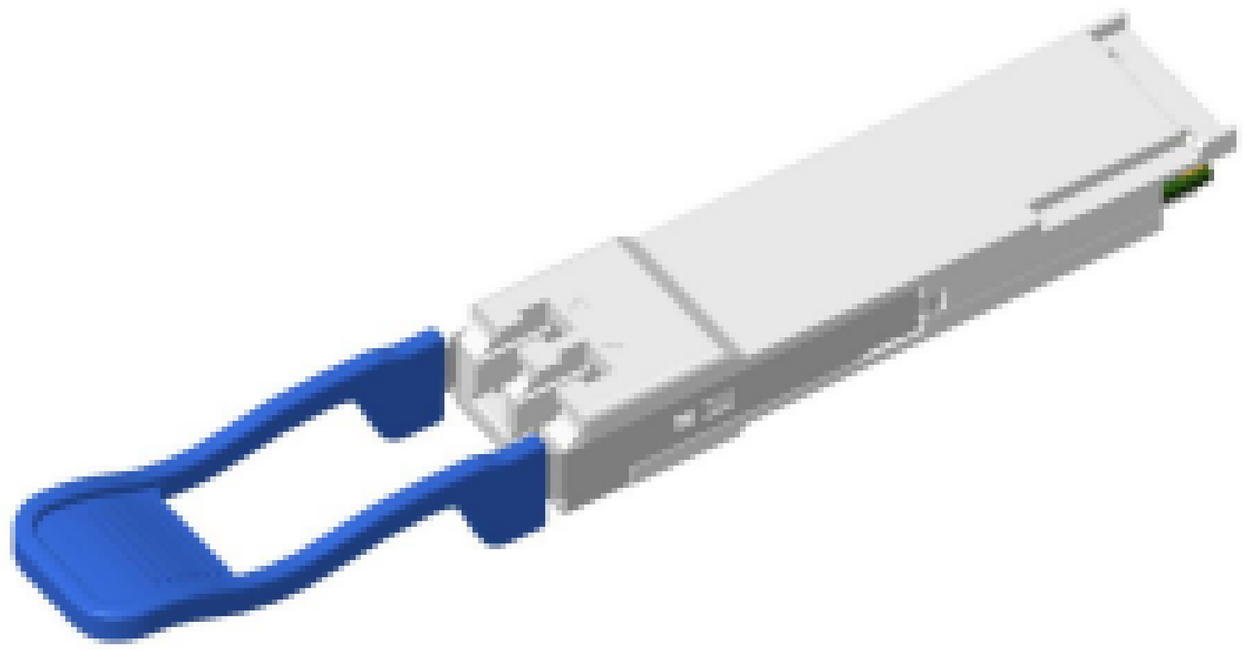
QSFP-ZR4-80-40

40G QSFP+ ZR4 80km Transceivers

allmon
Telecomunicações e TI



FEATURES

- Support line rates for 41.25 Gb/s;
- Lane bit rate 10.3125 Gb/s 40GE
- Up to 80km transmission on single mode fiber
- LAN WDM EML laser and APD
- Support Multi-Pin function with IntL/RxLOSL and LPMode/TxDIS
- High speed I/O electrical interface (CAUI-4)
- I2C interface with integrated Digital Diagnostic monitoring
- QSFP+ MSA package with duplex LC connector
- Single +3.3V power supply
- Power dissipation
- Commercial：< 4.5W
- Industrial：< 5.5W
- Complies with EU Directive 2015/863/EU

APPLICATIONS

- Data centers Switches and Routers
- Metro networks
- Switches and Routers
- 40G BASE-ER4

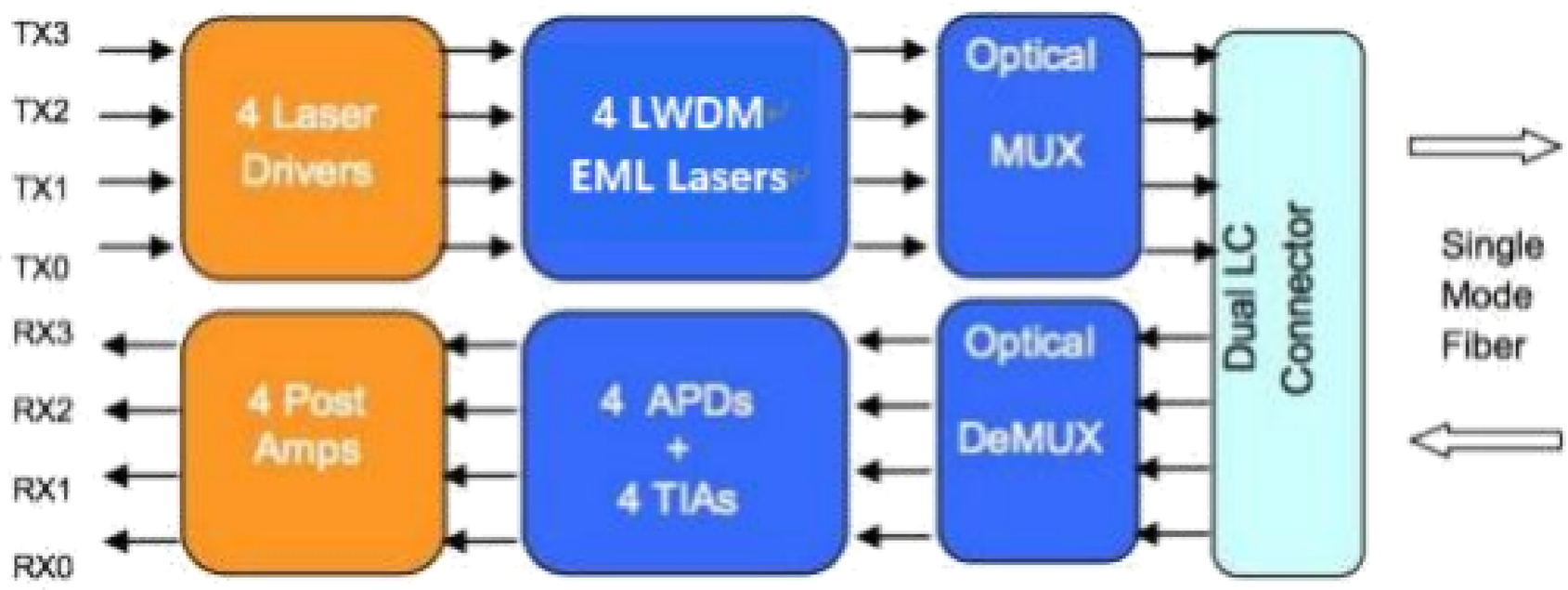
Ordering Information

Part Number	Data Rate(optical)	Laser	Fiber Type	Distance	Optical Interface	Temp	DDMI
QSFP-ZR4-80-40	41.25G	EML	SMF	80 KM	LC	0~70°C	Yes
QSFP-ZR4-80-40-I	41.25G	EML	SMF	80 KM	LC	-40~85°C	Yes

Description

QSFP-ZR4-80-40 is designed for 80km optical communication applications. Optical transceiver integrates the transmit and receive path onto one module. On the transmit side, four lanes of serial data streams are recovered, retimed and passed on to four laser drivers, which control four electric-absorption modulated lasers (Lan-WDM) with 1296, 1300, 1305, and 1309 nm center wavelengths. The optical signals are then multiplexed into a single-mode fiber through an industry-standard LC connector. On the receive side, four lanes of optical data streams are optically De multiplexed by an integrated optical De multiplexer. And passed on to an output driver, the receiver adopts APD. This module features a hot-pluggable electrical interface, low power consumption, and 2-wire serial interface.

Module Block Diagram



Absolute Maximum Rating

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this mod

Parameter	Symbol	Min	Max	Unit	Notes
Storage Temperature	TS	-40	85	degC	
Operating Case Temperature	TOP	-40	85	degC	
Power Supply Voltage	VCC	-0.5	3.6	V	
Damage Threshold, each Lane	THd	-2.5		dBm	
Relative Humidity (non-condensation)	RH	0 to 85% non-condensing		%	

The following characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Recommended Operating Environments

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Operating Case Temperature	Top	0		+70	°C	1
		-40		+85		2
Power Supply Voltage	VCC	3.14	3.3	3.47	V	
Maximum Power Dissipation	P_D			4.5	W	1
Maximum Power Dissipation	P_D			5.5	W	2
Lane Bit Rate			10.3125		Gb/s	
Transmission Distance	TD			40	km	
Coupled fiber	Single mode fiber					3

Notes:
1. The product name is TS-QP-3140-80DC.
2. The product name is TS-QP-3140-80DI
3. Optical fiber use 9/125um SMF。

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified

Parameter	Test Point	Min	Typ	Max	Unit	Notes
Transmitter (Module Input)						
Data Rate, each lane			10.3125		Gbps	
Differential Voltage pk-pk	Vpp			900	Mv	1
Common Mode Voltage	Vcm	-350		2850	Mv	
Transition time	Trise/Tfall	10			ps	2
Receiver (Module Output)						
Data Rate, each lane					10.3125	
Common Mode Noise, RMS	Vrms			17.5	Mv	
Differential output voltage swing	Vout, pp			900	Mv	
Eye width	EW15	0.57			UI	
Eye height	EH15	228			mV	
Differential Termination Resistance Mismatch				10	%	1
Transition time	Trise/Tfall	12			ps	
Common Mode Noise, RMS	Vrms			17.5	Mv	

Notes:
1. At 1 MHz.
2. 20%~80%

Optical Characteristics and Characteristics

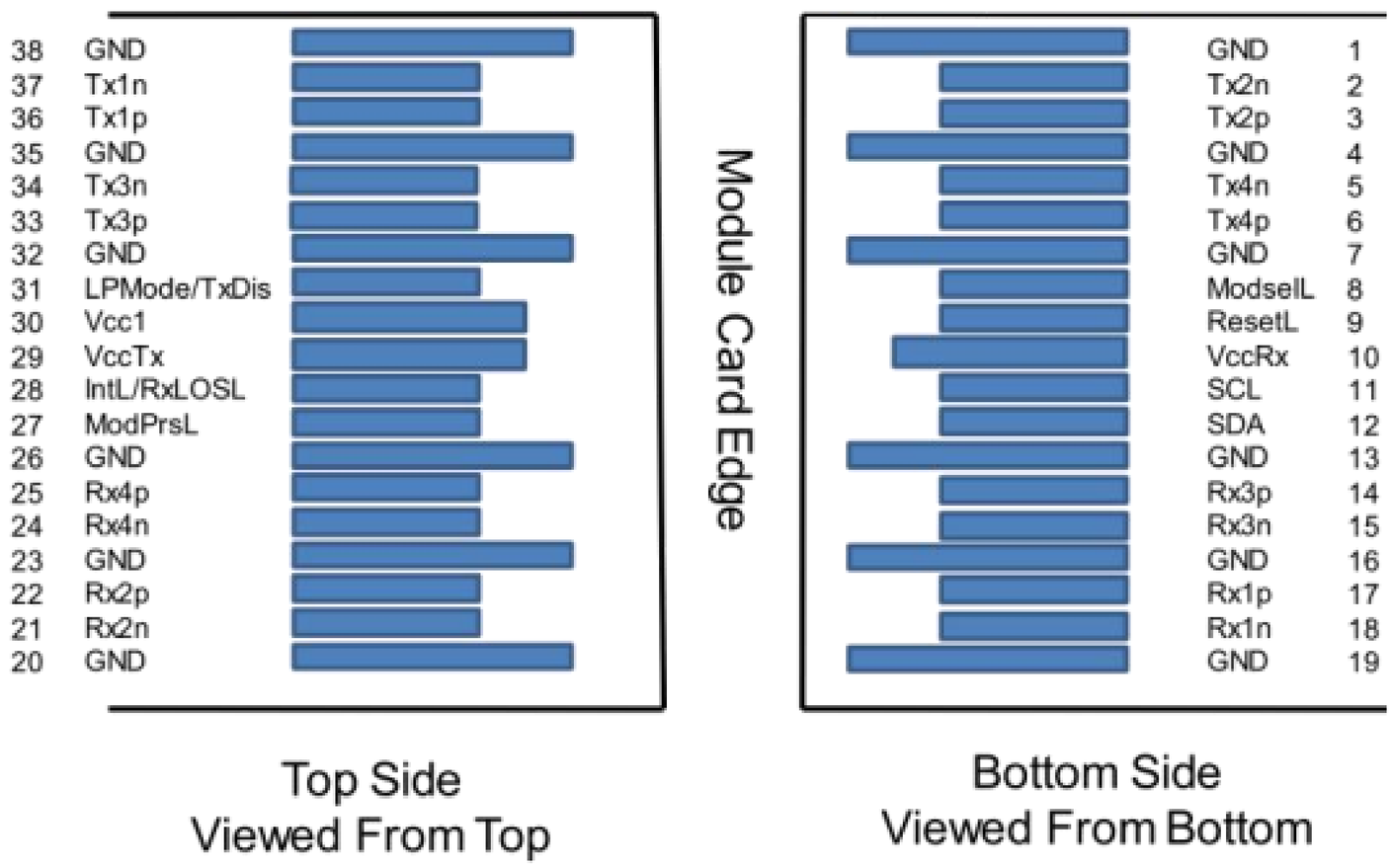
Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter						
Signaling Speed per Lane			10.3125		Gbps	
Center Wavelength Lane 0	λ0	1294.53	1295.56	1296.59	nm	
Center Wavelength Lane 1	λ1	1299.02	1300.05	1301.09	nm	
Center Wavelength Lane 2	λ2	1303.54	1304.58	1305.63	nm	
Center Wavelength Lane 3	λ3	1308.09	1309.14	1310.19	nm	
Total Launch Power,40GE	P_T			12.5	dBm	1
Average Launch Power per Lane,	Pavg	1		6.5	dBm	1
OMA, each Lane	P_{OMA}	2		6.5	dBm	1
Difference in launch power between any two lanes(Average and OMA) between any Two Lanes (OMA)	Ptx,diff			3	Db	
Average Output Power (Laser Turn off)	P_{off}			-30	dBm	
Side Mode Suppression Ratio	SMSR	30			Db	
Extinction Ratio, 100GE	ER	8.2			Db	
RIN20OMA	RIN			-130	Db/Hz	
Optical Return Loss Tolerance	TOL			20	Db	
Transmitter Reflectance	R_T			-12	Db	
Optical Eye Mask	{0.25,0.4, 0.45, 0.25, 0.28, 0.4}				%	
Receiver						
Signaling rate, each lane			10.3125		Gbps	
Center Wavelength Lane 0	λ0	1294.53	1295.56	1296.59	nm	
Center Wavelength Lane 1	λ1	1299.02	1300.05	1301.09	nm	
Center Wavelength Lane 2	λ2	1303.54	1304.58	1305.63	nm	
Center Wavelength Lane 3	λ3	1308.09	1309.14	1310.19	nm	
Damage threshold , each lane	Pd amage	-2.5			dBm	
Average power at receiver input , each lane	R	-24		-6	dBm	2
Los Assert	LosA	-35			dBm	
Los De-assert	LosDA			-25	dBm	
Los Hysteresis	LosH	0.5			dB	

Notes:
1. The optical power is launched into SMF。
2. Measured with a PRBS 2 31 -1 test pattern @10.3125 Gb/s, PRBS 2^31-1.

Digital Diagnostics

Parameter	Unit	Specification
Temperature Monitor absolute error	℃	±3.0
Supply Voltage Monitor absolute error	%	± 5
I_bias Monitor absolute error	%	± 10
Received Power (Rx) Monitor absolute error	dB	± 3.0
Transmit Power (Tx) Monitor absolute error	dB	± 3.0

PIN DIAGRAM



PIN DESCRIPTION

PIN	Logic	Symbol	Description	Plug Seq.	Notes
1		GND	Ground	1	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	3	
4		GND	Ground	1	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	3	
7		GND	Ground	1	1
8	LVTLL-I	ModSelL	Module Select	3	
9	LVTLL-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	
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	1
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/Rx_LOS	Interrupt/Rx_LOS	3	
29		VccTx	+3.3 V Power Supply transmitter	2	2
30		Vcc1	+3.3 V Power Supply	2	2
31	LVTTL-I	LPMode/TxDIS	Low Power Mode/Tx_Disable	3	
32		GND	Ground	1	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3	
34	CML-I	Tx3n	Transmitter Inverted Data Output	3	
35		GND	Ground	1	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3	
37	CML-I	Tx1n	Transmitter Inverted Data Output	3	
38		GND	Ground	1	1

Notes:
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 MSA. The connector pins are each rated for a maximum current

Recommended Interface Cirucuit

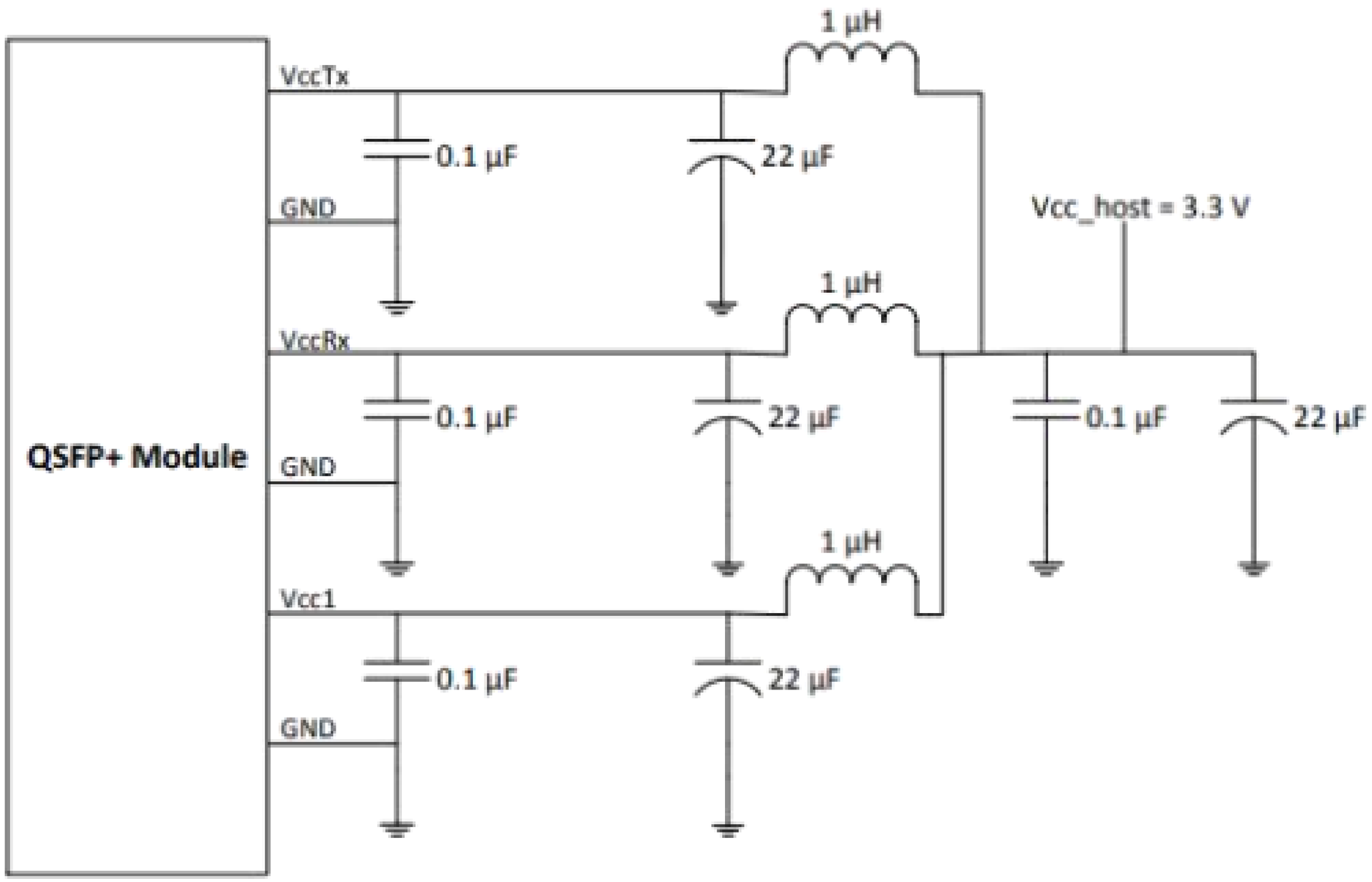
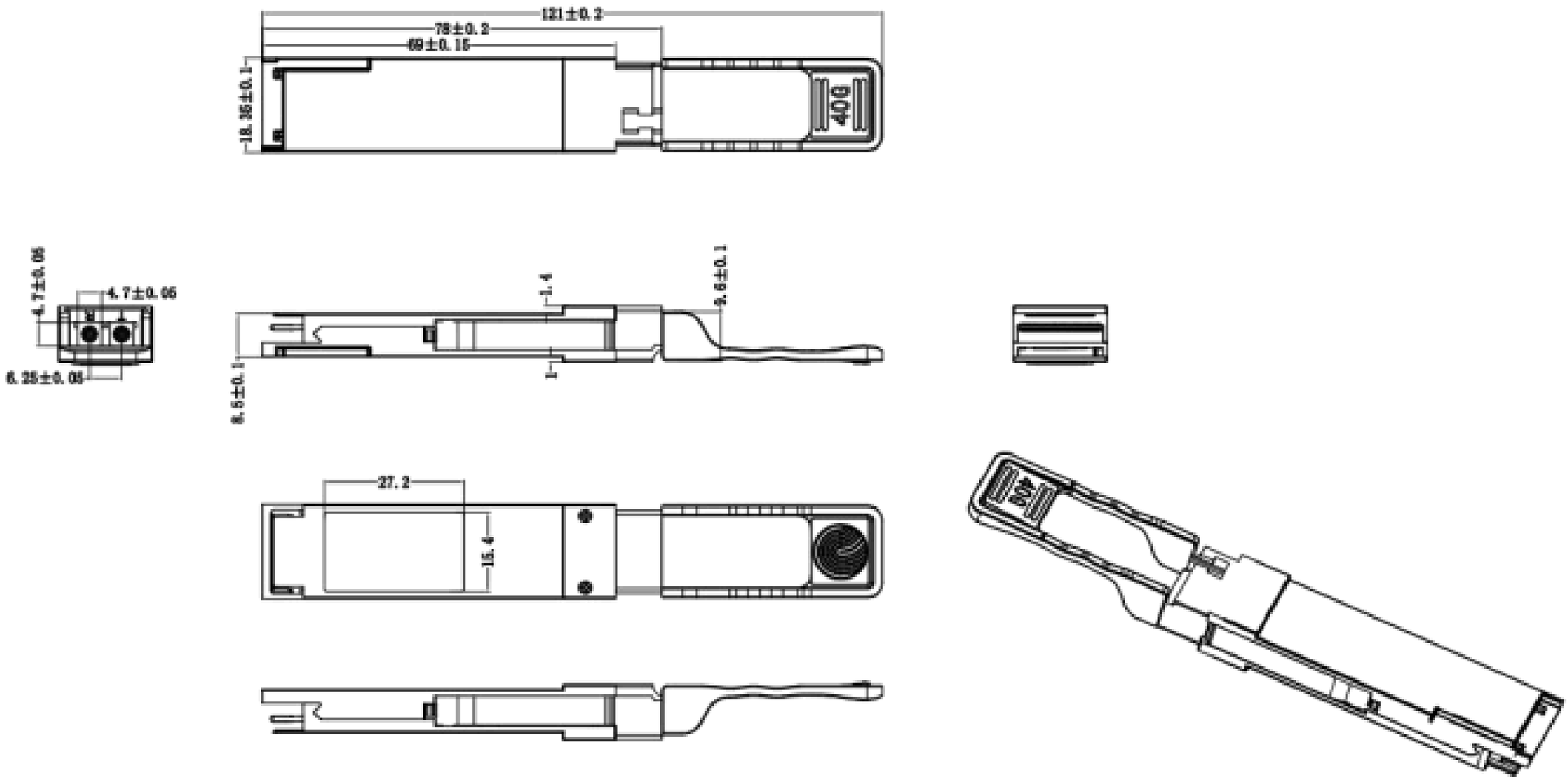


FIGURE 5-4 RECOMMENDED HOST BOARD POWER SUPPLY FILTERING

Mechanical Diagram

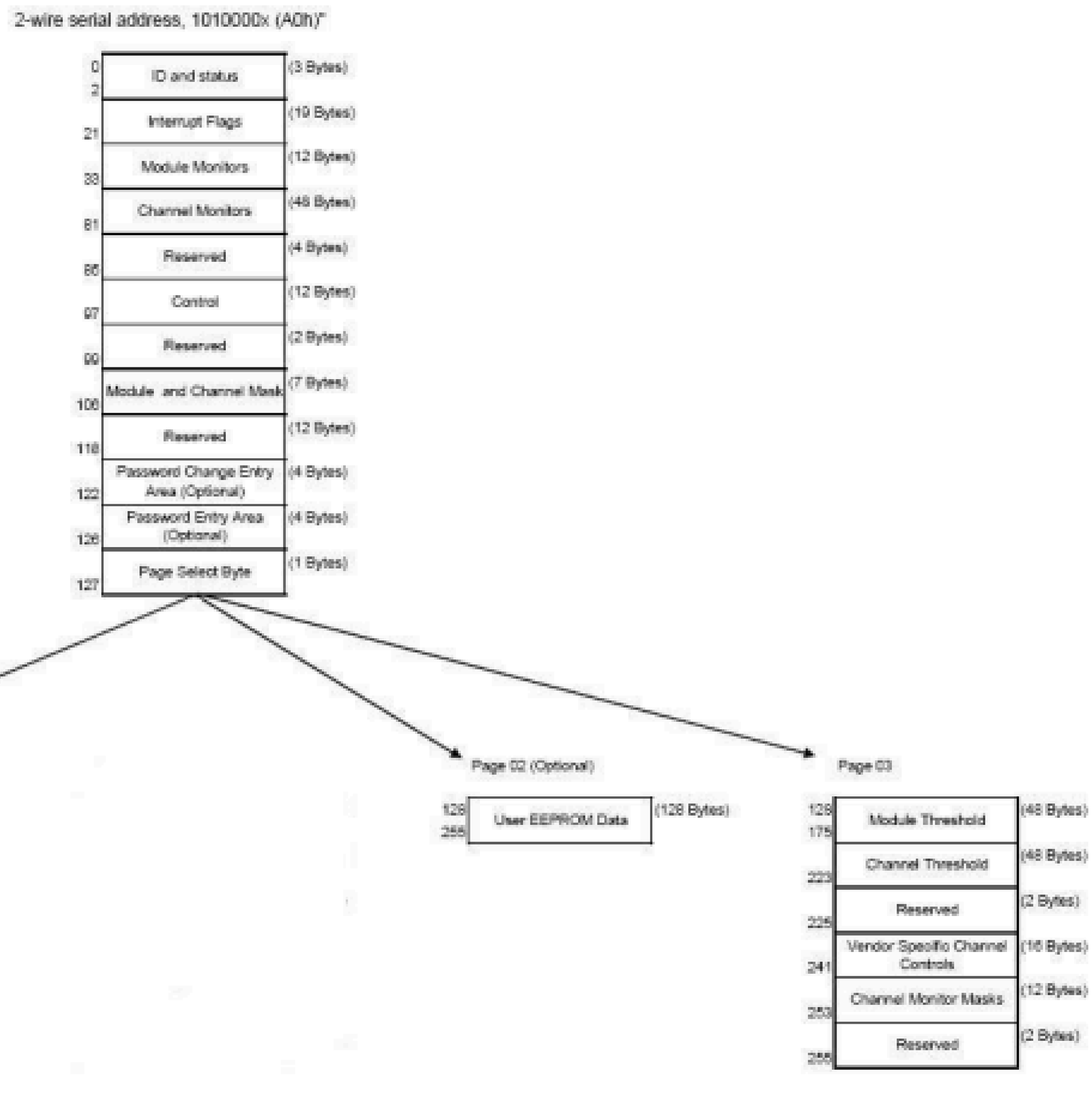


Digital Diagnostic Functions

Digital diagnostics monitoring function is available on all QSFP+ ER4. A 2-wire serial interface provides user to contact with module. The structure of the memory is shown in flowing. 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.

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

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



EEPROM Serial ID Memory Contents (A0h)

Data Address	Length (Byte)	Name of Length	Description and Contents
Base ID Fields			
128	1	Identifier	Identifier Type of serial Module(D=QSFP+)
129	1	Ext. Identifier	Extended Identifier of Serial Module(90=2.5W)
130	1	Connector	Code of connector type(7=LC)
131-138	8	Specification compliance	Code for electronic compatibility or optical compatibility(40GBASE-LR4)
139	1	Encoding	Code for serial encoding algorithm(5=64B66B)
140	1	BR, Nominal	Nominal bit rate, units of 100 MBits/s(6C=108)
141	1	Extended rateselect Compliance	Tags for extended rate select compliance
142	1	Length(SMF)	Link length supported for SMF fiber in km (28=60km)
143	1	Length(OM3 50um)	Link length supported for EBW 50/125um fiber(OM3), units of 2m
144	1	Length(OM2 50um)	Link length supported for 50/125um fiber(OM2), units of 1m

145	1	Length(OM1 62.5um)	Link length supported for 62.5/125um fiber (OM1), units of 1m
146	1	Length(Copper)	Link length of copper or active cable, unites of 1m Link length supported for 50/125um fiber (OM4), units of 2m when Byte 147 declares 850nm VCSEL as defined in Table 37
147	1	Device tech	Device technology
148-163	16	Vendor name	QSFP+ vendor name: TIBTRONIX (ASCII)
164	1	Extended Module	Extended Module codes for InfiniBand
165-167	3	Vendor OUI	QSFP+ vendor IEEE company ID(000840)
168-183	16	Vendor PN	Part number: TQPLFG60D (ASCII)
184-185	2	Vendor rev	Revision level for part number provided by vendor (ASCII) (X1)
186-187	2	Wave length or Copper cable Attenuation	Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5GHz (Adrs 186) and 5.0GHz (Adrs 187) (65A4=1301)
188-189	2	Wavelength tolerance	Guaranteed range of laser wavelength(+/- value) from nominal wavelength. (wavelength Tol.=value/200 in nm) (1C84=36.5)
190	1	Max case temp.	Maxinum case temperature in degrees C (70)
191	1	CC_BASE	Check code for base ID fields (addresses 128-190)
Extended ID fields			
192-195	4	Options	Rate Select, TX Disable, Tx Fault, LOS, Warning indicators for: Temperature, VCC, RX, power, TX Bias
196-211	16	Vendor SN	Serial number provided by vendor (ASCII)
212-219	8	Date Code	Vendor's manufacturering date code
220	1	Diagnostic Monitoring Type	Indicates which types of diagnostic monitoring are implemented (if any) in the Module. Bit 1, 0 Reserved (8=Average Power)
221	1	Enhanced Options	Indicates which optional enhanced features are implemented in the Module.
222	1	Reserved	
223	1	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)
Vendor Specific ID Fields			
224-255	32	Vendor Specific EEPROM	

EEPROM Serial ID Memory Contents (A0h)

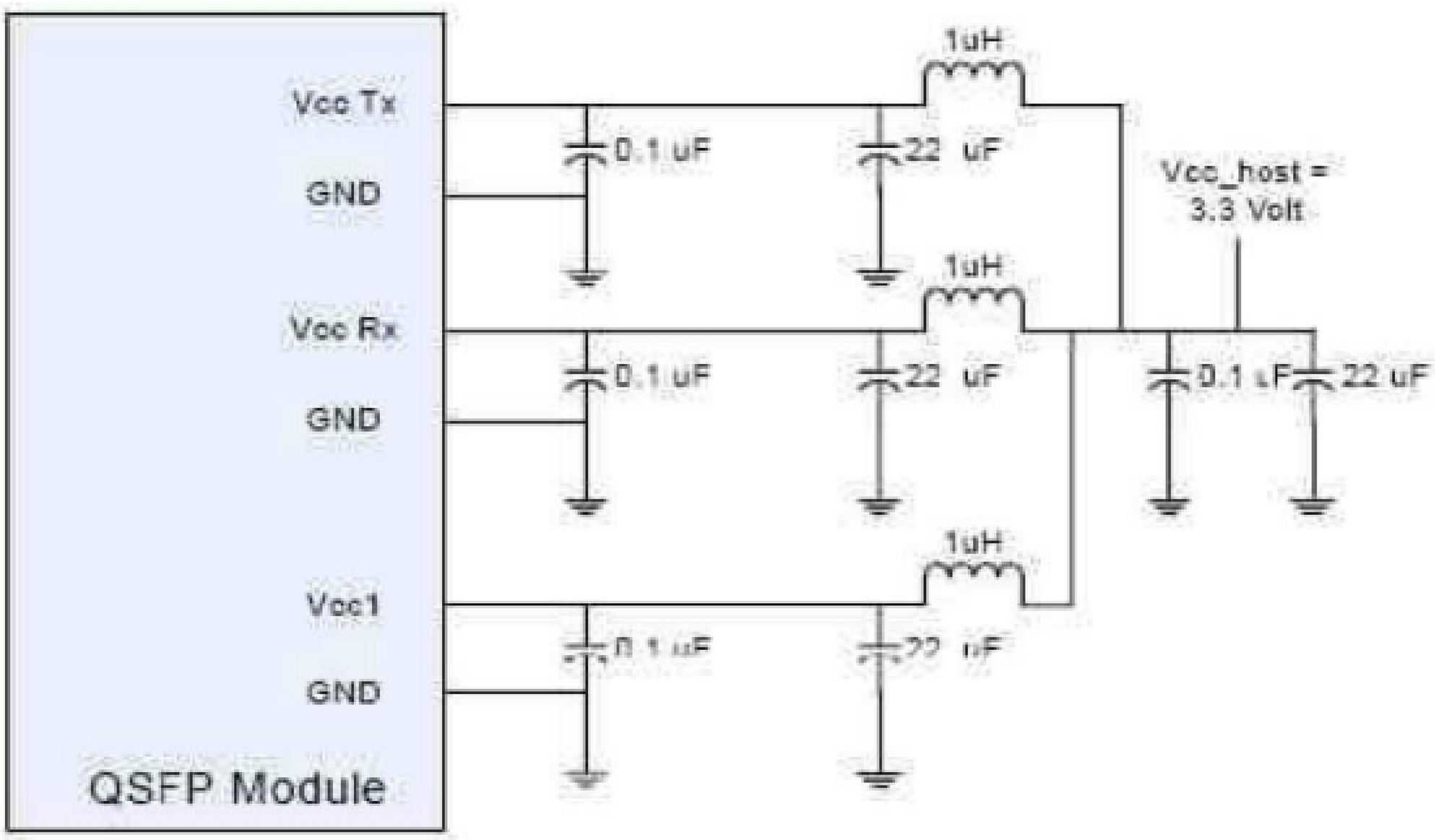
Timing for Soft Control and Status Functions

Table 6- Timing for Soft Control and Status Functions

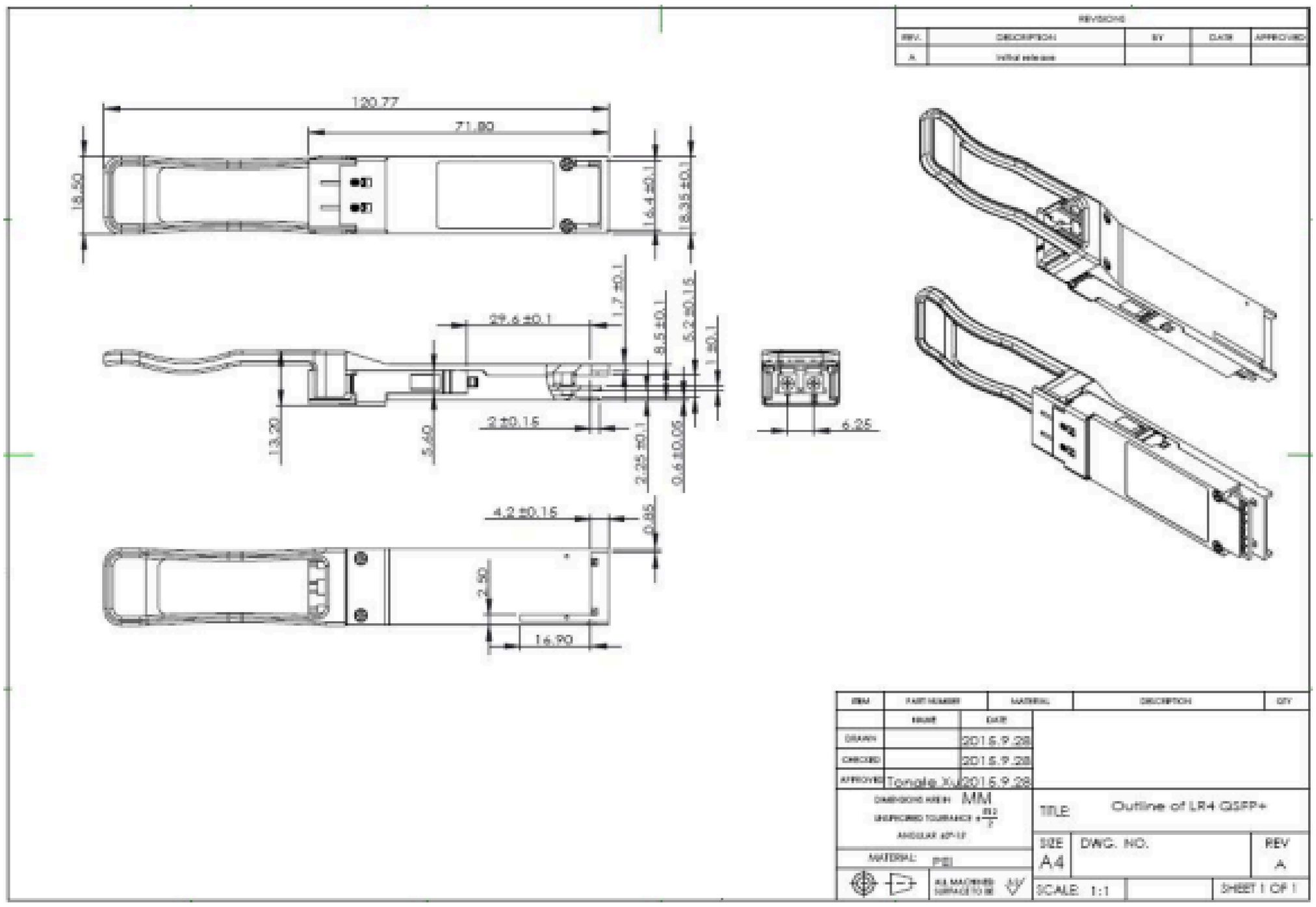
Parameter	Symbol	Max	Unit	Conditions
Initialization Time	t_init	2000	ms	Time from power on1, hot plug or rising edge of Reset until the module is fully functional2
Reset Init Assert Time	t_reset_init	2	μs	A Reset is generated by a low level longer than the minimum reset pulse time present on the ResetL pin.
Serial Bus Hardware Ready Time	t_serial	2000	ms	Time from power on1 until module responds to data transmission over the 2-wire serial bus
Monitor Data Ready Time	t_data	2000	ms	Time from power on1 to data not ready, bit 0 of Byte 2, deasserted and IntL asserted
Reset Assert Time	t_reset	2000	ms	Time from rising edge on the ResetL pin until the module is fully functional2
LPMode Assert Time	ton_LPMode	100	μs	Time from assertion of LPMode (Vin:LPMode =Vih) until module power consumption enters lower Power Level
IntL Assert Time	ton_IntL	200	ms	Time from occurrence of condition triggering IntL until Vout:IntL = Vol
IntL Deassert Time	toff_IntL	500	μs	toff_IntL 500 μs Time from clear on read3 operation of associated flag until Vout:IntL = Voh. This includes deassert times for Rx LOS, Tx Fault and other flag bits.
Rx LOS Assert Time	ton_los	100	ms	Time from Rx LOS state to Rx LOS bit set and IntL asserted
Flag Assert Time	ton_flag	200	ms	Time from occurrence of condition triggering flag to associated flag bit set and IntL asserted
Mask Assert Time	ton_mask	100	ms	Time from mask bit set4 until associated IntL assertion is inhibited
Mask De-assert Time	toff_mask	100	ms	Time from mask bit cleared4 until associated IntlL operation resumes
ModSelL Assert Time	ton_ModSelL	100	μs	Time from assertion of ModSelL until module responds to data transmission over the 2-wire serial bus
ModSelL Deassert Time	toff_ModSelL	100	μs	Time from deassertion of ModSelL until the module does not respond to data transmission over the 2-wire serial bus
Power_over-ride or Power-set Assert Time	ton_Pdown	100	ms	Time from P_Down bit set 4 until module power consumption enters lower Power Level
Power_over-ride or Power-set De-assert Time	toff_Pdown	300	ms	Time from P_Down bit cleared4 until the module is fully functional3

Note：
1. Power on is defined as the instant when supply voltages reach and remain at or above the minimum specified value.
2. Fully functional is defined as IntL asserted due to data not ready bit, bit 0 byte 2 de-asserted.
3. Measured from falling clock edge after stop bit of read transaction. 4. Measured from falling clock edge after stop

Recommended Circuit



Mechanical Dimensions



ESD

This transceiver is specified as ESD threshold 1kV for high speed data pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment

Laser Safety

This is a Class 1 Laser Product according to EN 60825-1:2014. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007). Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous