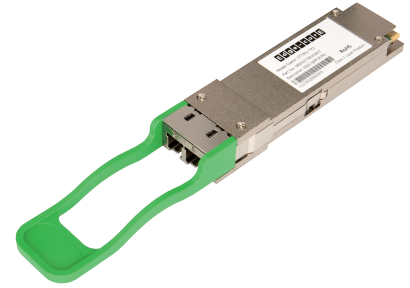**Edge-core** ®
NETWORKS

100G QSFP28 FR1 Transceiver
ET7402-FR1

The ET7402-FR1 100G QSFP28 FR transceiver is designed to provide a convenient solution for 100G applications in a QSFP28 form factor. The QSFP28 FR transceiver supports a single 53.125 GBd optical lane and is designed for uses up to a 106.25 Gb/s data rate and up to a 2 km link length. The transceiver supports an I2C and digital diagnostic management (DDM) interface.

Product Features

■ Compliant with industry standards 100G-FR lambda MSA
■ Compliant with SFF-8679 MSA hardware specification
■ Compliant with SFF-8636
■ Compliant with SFF-8661
■ 1310nm EML laser
■ PIN receiver
■ Up to 2km on 9/125um SMF
■ 100ohm differential impedance system
■ Operating Temperature: (Commercial) 0°C to +70°C
■ Trouble-free installation and network bring-up
■ RoHS Compliant
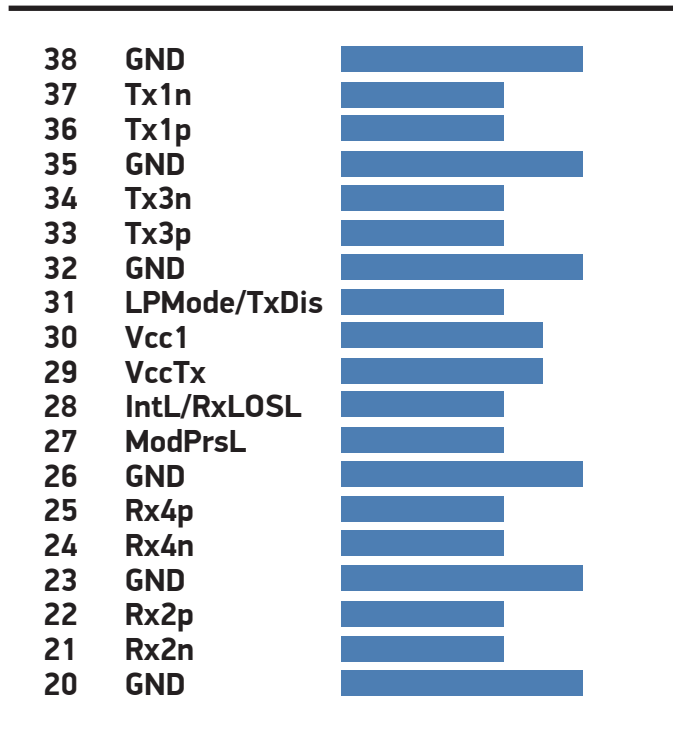
Applications

■ Data Center
■ 100 Gigabit Ethernet

Ordering Information

Part Number	Output Power (OMA each lane)	Receiver	Sensitivity (OMA each lane)	Reach	Optical Interface	Temp.	DDM	RoHS
ET7402-FR1	-0.2 ~ +4.2 dBm	PIN	< -4.5dBm	2 km	Duplex LC	0° ~ 70°C	Supported	Compliant

Electrical Pin Description

Pin	Logic	Symbol	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	LVTLL-I	ModSelL	Module Select	2
9	LVTTL-I	ResetL	Module Reset	2
10		Vcc Rx	+3.3 V Power Supply Receiver	
11	LVCMOS-I/O	SCL	2-Wire serial Interface Clock	2
12	LVCMOS-I/O	SDA	2-Wire serial Interface Data	2
13		GND	GND	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	Grounds	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/RxLOSL	Interrupt.Optionally configurable as RxLOSL via the management interface (SFF-8636).	2
29		Vcc Tx	+3.3 V Power Supply Transmitter	
30		Vcc1	+3.3 V Power Supply	
31	LVTTL-I	LPMode/TxDis	Low Power Mode.Optionally configurable as TxDis via the management interface (SFF-8636).	2
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

*Note 1: GND is the symbol for signal and supply (power) common for the module. All are common within the 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: VccRx, Vcc1 and VccTx are trapplied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A.

QSFP28 Module Pad Layout

Top Side			Bottom Side	
38	GND		GND	1
37	Tx1n		Tx2n	2
36	Tx1p		Tx2p	3
35	GND		GND	4
34	Tx3n		Tx4n	5
33	Tx3p		Tx4p	6
32	GND		GND	7
31	LPMode/TxDis		ModselL	8
30	Vcc1		ResetL	9
29	VccTx		VccRx	10
28	IntL/RxLOSL		SCL	11
27	ModPrsL		SDA	12
26	GND		GND	13
25	Rx4p		Rx3p	14
24	Rx4n		Rx3n	15
23	GND		GND	16
22	Rx2p		Rx1p	17
21	Rx2n		Rx1n	18
20	GND		GND	19

Module Card Edge
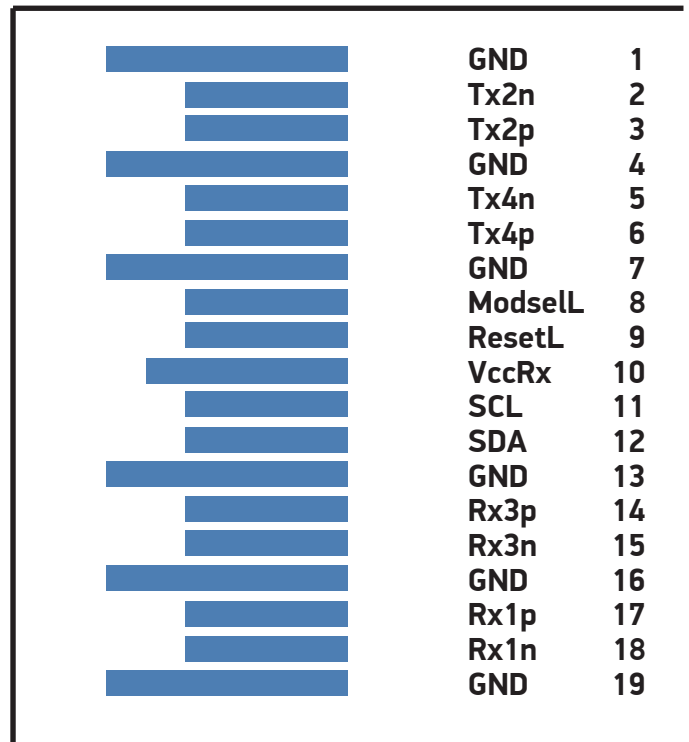
Top Side   **Bottom Side**

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_s	-40	85	°C
Relative Humidity	RH	5	95	%
Supply Voltage	V_{cc}	3.13	3.47	V
Data Input Voltage	-	-0.3	3.6	V
Control Input Voltage	-	-0.3	3.6	V

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature (Commercial)	T_c	0	-	70	°C
Supply Voltage	V_{cc}	3.135	3.3	3.465	V
Operating Relative Humidity	RH	5	-	85	%

Transceiver Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Module Supply Current	Icc	-	-	1116	mA	-
Power Dissipation	P_D	-	-	3500	mW	-

Transmitter Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Input Differential Impedance	Z_{IN}	90	100	110	Ω	-
Differential Data Input Swing	$V_{IN, P-P}$	180	-	900	mV_{P-P}	-

Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Output Differential Impedance	Z_O	90	100	110	Ω	-
Differential Data Output Swing	$V_{OUT, P-P}$	300	-	850	mV_{P-P}	-

Transmitter Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Launch Optical Power (Average)	Po	-2.4	-	4	dBm	1
Launch Optical Power (OMA)	Poma	-0.2	-	4.2	dBm	-
Extinction Ratio	ER	3.5	-	-	dB	-
Center Wavelength Range	λc	1304.5	1311	1317.5	nm	-
Transmitter and Dispersion Penalty Eye Closure for PAM4	TDECQ	-	-	3.4	dB	-
RIN17.1OMA (max)	RIN	-	-	-136	dB/Hz	
Optical Return Loss Tolerance	ORLT	-	-	17.1	dB	
Pout @TX-Disable Asserted	P_{off}	-	-	-15	dBm	

Note 1:   Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.

Receiver Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Center Wavelength	λc	1304.5	-	1317.5	nm	-
Average Receive Power	P_{avg}	-6.4		4.5	dBm	
Receiver Sensitivity (OMA)	RxSENS	-	-	-4.5	dBm	1
Receiver Overload (Pavg)	P_{OL}	4.5	-	-	dBm	-
Receiver Reflectance			-	-26	dB	-
LOS De-Assert	LOS_D	-	-	-10	dBm	-
LOS Assert	LOS_A	-16	-	-	dBm	-
LOS Hysteresis	-	0.5	-	-	dB	

Note 1: Measured with PRBS31Q test pattern, 53.125GBd, BER<2.4×10^{-4}.

General Specifications

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Data Rate	BR		53.125		GBd	-
Bit Error Rate	BER	-	-	2.4×10^{-4}	-	1
Supported Link Length on 9/125um SMF, 53.125 GBd	L	-	2	-	km	2

Note 1: Tested with a PRBS31Q test pattern for 53.125 GBd operation.

Note 2: Distances are based on FC-PI-6 Rev. 3.1 and IEEE 802.3 standards, with FEC.

Block Diagram

QSFP28 Connector

4x26.5625G NRZ →

DSP+Driver

1x106.25G PAM4 →

Laser

4x26.5625G NRZ ←

1x106.25G PAM4 ←

PD+TIA

Master I2C

IntL/RxLOSL ←

LPMode/TxDis →

ModselL →

ResetL →

I2C ↔

ModPrsL →

MCU
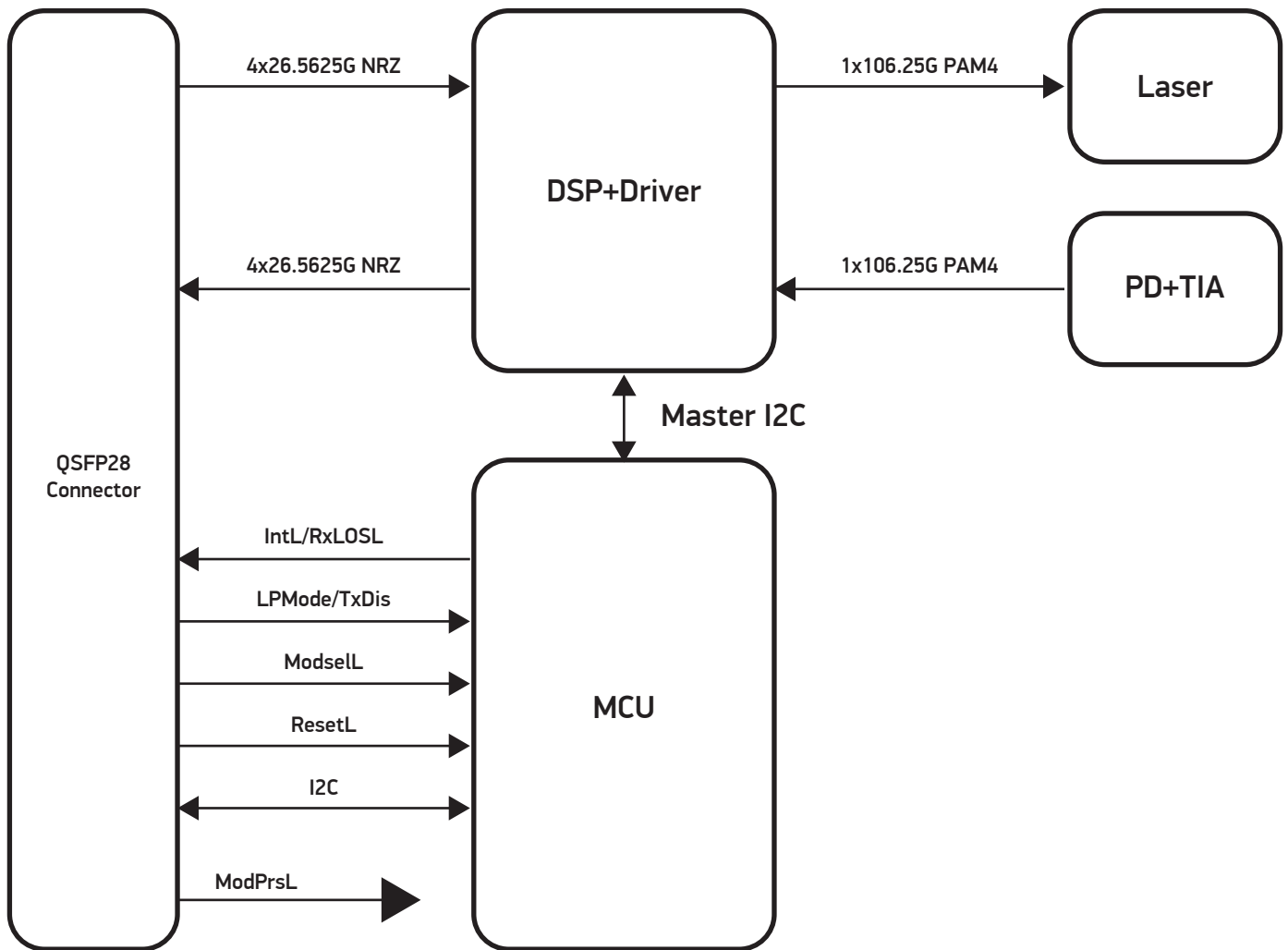
Digital Diagnostic Memory Map

The memory map is utilized for status, ID, monitoring and control functions.

The map is arranged into a single lower page address space of 128 bytes and multiple upper address pages of 128 bytes each. This structure permits timely access to information in the lower page such as interrupt flags and monitors. Less time-critical entries such as serial ID information and threshold settings are available with the page select function.

Lower Page 00h is required and includes interrupt flags and monitor results arranged to enable single block read operations for time-critical data.

Upper Page 00h is required and provides static module identity and capabilities information.

Page 01h is optional, was used to support SFF-8079, is deprecated as of SFF-8636 Rev 2.10 and is now reserved memory. Implementation of Page 01h is advertised in Page 00h, Byte 195, bit 6.

Page 02h is optional and provides a user read/write space. Implementation of Page 02h is advertised in Page 00h,Byte 195, bit 7.
Page 03h is optional and includes static monitor thresholds, advertising, and various channel controls including interrupt masks. Implementation of Page 03h is advertised in Page 00h, Byte 2, bit 2.

Pages 20h-21h contain support for additional monitored parameters for modules that have PAM4 modulation and/or have optical transmission at multiple wavelengths on a DWDM grid. Page 20h provides the alarms, warnings, masks,parameter values, and configuration. Page 21h provides the alarm and warning thresholds. Implementation of Pages 20h and 21h is advertised in Page 00, Byte 195, bit 0.
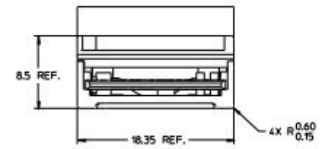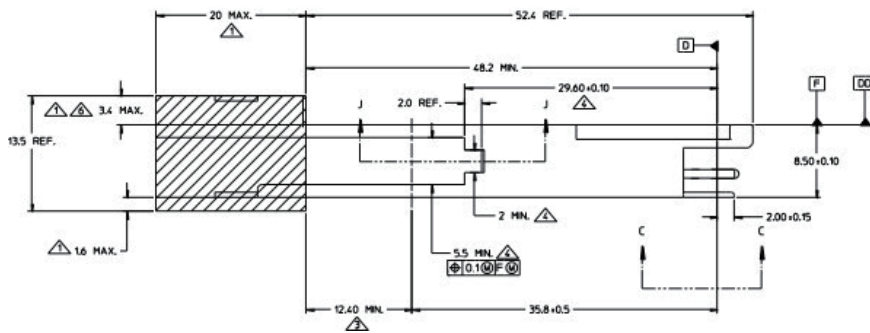
Pages 22-7Fh are reserved for future use. Pages 04-1Fh and 80-FFh are for vendor-specific functions.

Writing the value of a non-supported page shall not be accepted by the slave. The Page Select byte shall revert to 0h and read/write operations shall be to Upper Page 00h. Because Upper Page 00h is read-only, this scheme prevents the inadvertent corruption of module memory by a host attempting to write to a non-supported location.

Mechanical Specifications

Warranty
Please check www.edge-core.com for the warranty terms in your country.

For More Information
To find out more about Edgecore Networks Corporation products and solutions, visit www.edge-core.com.

About Edgecore Networks Corporation
Edgecore Networks Corporation is in the business of providing innovative network solutions. In the service provider network, in the data center or in the cloud, Edgecore Networks Corporation delivers the software and systems that transform the way the world connects. Edgecore Networks Corporation serves customers and partners worldwide. Additional information can be found at www.edge-core.com.

Edgecore Networks Corporation is a subsidiary of Accton Technology Corporation, the leading network ODM company. The Edgecore data center switches are developed and manufactured by Accton.

To purchase Edgecore Networks solutions, please contact your Edgecore Networks Corporation representatives at +886 3 563 8888 (HQ) or +1 (949)-336-6801 or authorized resellers.