Finisar

Application Note AN-2035

Digital Diagnostic Monitoring Interface for XFP Optical Transceivers

Overview

This Application Note defines Finisar implementation of the XFP 2-wire serial interface, which is used for serial ID, digital diagnostics, and certain control functions. The 2-wire serial interface is mandatory for all XFP modules and it is defined in the XFP MSA Specification. It is modeled largely after the digital diagnostics monitoring interface proposed for the SFP and GBIC optical transceivers and defined in SFF draft document SFF-8472 Rev 9.3, which in turn is an extension of the original serial ID systems defined for the GBIC and SFP transceivers. One major difference, however, is that the memory structure is changed to use a single 2-wire interface address.

IMPORTANT: The digital diagnostics functionality and memory maps described in this document apply to Beta- and Production-level units only. Please contact Finisar for information on Alpha-level units.

As with GBIC and SFP transceivers, the XFP serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C01A/02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL pin). The positive edge clocks data into those segments of the memory map that are not write-protected within the XFP transceiver. The negative edge clocks data from the XFP transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to 8 bit parameters, addressed from 0000h to the maximum address of the memory.

The structure of the memory map is shown in Figure 1. The normal 256-Byte I2C address space is divided into lower and upper blocks of 128 Bytes. The lower block of 128 Bytes is always directly available and is used for the diagnostics and control functions described in this document that must be accessed repeatedly. One exception to this is that the standard module identifier byte defined in the GBIC and SFP transceivers is located in Byte 0 of the memory map (in the diagnostics space) to allow software developed for multiple module types to have a common branching decision point. This byte is repeated in the Serial ID section so that it also appears in the expected relationship to other serial ID bits.

Multiple blocks of memories are available in the upper 128 Bytes of the address space. These are individually addressed through a table select Byte which the user enters into a location in the lower address space. Thus, there is a total available address space of 128 * 256 = 32 Kbytes in this upper memory space.

The upper address space tables are used for less frequently accessed functions such as serial ID, user writable EEPROM, reserved EEPROM and diagnostics and control spaces for future standards definition, as well as ample space for vendor specific functions. These are allocated as follows:

Table 00h:	Reserved for future diagnostic and control functions
Table 01h:	Serial ID EEPROM
Table 02h:	User-writable EEPROM
Table 03h – 7Fh:	Finisar-specific internal functions (not accessible to the user)
Table 80h – FFh:	Reserved

The details of each memory space are described in the XFP MSA document. All 2-Wire registers are read with bit 7 the MSB first.

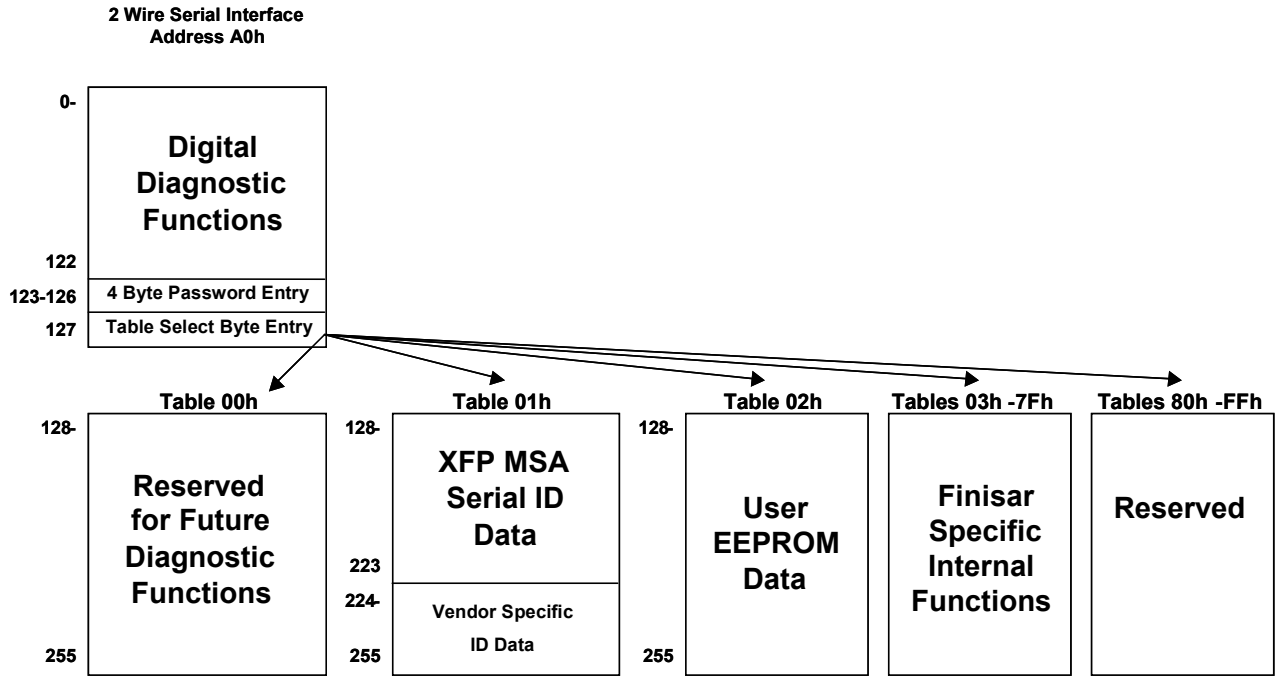

Figure 1: XFP 2-Wire Serial Interface Memory Map

The memory structure also provides for an optional password entry location in the lower memory space that may be used to protect user-writable memory (Table 02h). A password is not required to read any serial ID or diagnostics information in the lower memory address space or in Tables 00h – 02h. A password is not required to write any controls defined in the digital diagnostic functions described in the MSA document either. A password (entered into bytes 123-126) is required to allow write access to the User EEPROM Table (02h). The default password is 00001011h per the XFP MSA, and it can be changed by the host manufacturer by writing the new password into bytes 119-122 when the correct old password has been written into bytes 123-126. The host password must be in the range of 00000000h to 7FFFFFFFh.

The 2-wire serial interface address of the XFP module is 1010000X (A0h). In order to allow access to multiple XFP modules on the same 2-wire serial bus, the XFP pin-out includes a MOD_DESEL or module deselect pin. This pin (which is pulled high or deselected in the module) must be held low by the host to select the module of interest and allow communication over the 2-wire serial interface. The module does not respond to or accept 2-wire serial bus instructions unless it is selected.

Description of Finisar Memory Map Contents

Product: FTRX-1411M3

Type Codes:
NVE: Non-volatile EEPROM. Read only by Customer
VH: Volatile Host Entry Field. Set to 00h on power up or reset unless noted. Read/Write by Host
VHW: Volatile Host Write Field. Set to 00h on power up or reset unless noted. Write only by Host
VHR: Volatile Host Read Field. Set to 00h on power up or reset unless noted. Read only by Host
R: Reserved. Ignore write, Return 00h on read.

Lower Memory Map: I2C Addr: A0h, Bytes 0 – 127.

Byte Address	*Bit Address*	*Type Code*	*Size (Bytes) or (bits)*	*Field Name*	*Description of Field*	*Value*	*Value Meaning*
0		NVE	1B	Identifier	Type of serial transceiver	06h	XFP
		Signal Conditioner Control					
1	4-7	VH	4b	Data Rate Control		xxxxb	Ignored
	3	VHW	1b	Reserved		N/A	Reserved
	2	VH	1b	Line-side Loopback Control. 1b actuates loopback of optical input to optical output.		0b	Not supported, ignore write, read back as 0b
	1	VH	1b	XFI Loopback Control. 1b actuates loopback of electrical input to electrical output		xb	Power up to 0b
	0	VH	1b	Signal Conditioner Control		0b	Normal REFCLK mode only supported. Ignore write, read back as 0b
		Flag Thresholds					
2-3		NVE	2B	Temp High Alarm	Threshold for alarm	19968 d	+78 °C (assumes 3°C accuracy)
4-5		NVE	2B	Temp Low Alarm	Threshold for alarm	62208 d	-13 °C (assumes 3°C accuracy)
6-7		NVE	2B	Temp High Warning	Threshold for warn	19200 d	+75 °C (assumes 5°C accuracy)
8-9		NVE	2B	Temp Low Warning	Threshold for warn	62976 d	-10 °C (assumes 5°C accuracy)
10-17		R	8B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
18-19		NVE	2B	Bias High Alarm	Threshold for alarm	35000 d	70 mA
20-21		NVE	2B	Bias Low Alarm	Threshold for alarm	10000 d	20 mA
22-23		NVE	2B	Bias High Warning	Threshold for warn	32500 d	65 mA
24-25		NVE	2B	Bias Low Warning	Threshold for warn	12500 d	25 mA
26-27		NVE	2B	TX Power High Alarm	Threshold for alarm	14125 d	+1.5 dBm (assumes 2dB accuracy)
28-29		NVE	2B	TX Power Low Alarm	Threshold for alarm	1995d	-7.0 dBm (assumes 2dB accuracy)
30-31		NVE	2B	TX Power High Warning	Threshold for warn	12589 d	+1.0 dBm (assumes 2dB accuracy)
32-33		NVE	2B	TX Power Low Warning	Threshold for warn	2239d	-6.5 dBm (assumes 2dB accuracy)

34-35		NVE	2B	RX Power High Alarm	Threshold for alarm	17783 d	+2.5 dBm (assumes 1.5dB accuracy)
36-37		NVE	2B	RX Power Low Alarm	Threshold for alarm	100d	-20 dBm
38-39		NVE	2B	RX Power High Warning	Threshold for warn	15849 d	+2.0 dBm (assumes 1.5dB accuracy)
40-41		NVE	2B	RX Power Low Warning	Threshold for warn	158d	-18 dBm
42-43		NVE	2B	AUX1 High Alarm	Threshold for alarm	36300 d	3.63 V
44-45		NVE	2B	AUX1Low Alarm	Threshold for alarm	30000 d	3.00 V
46-47		NVE	2B	AUX1 High Warning	Threshold for warn	35000 d	3.50 V (assumes 50mV accuracy)
48-49		NVE	2B	AUX1Low Warning	Threshold for warn	31000 d	3.10 V (assumes 50mV accuracy)
50-51		NVE	2B	AUX2 High Alarm	Threshold for alarm	55000 d	5.50 V
52-53		NVE	2B	AUX2 Low Alarm	Threshold for alarm	45000 d	4.50 V
54-55		NVE	2B	AUX2 High Warning	Threshold for warn	53000 d	5.30 V (assumes 50mV accuracy)
56-57		NVE	2B	AUX2 Low Warning	Threshold for warn	47000 d	4.70 V (assumes 50mV accuracy)
58	7-4	NVE	4b	VCC2 min with Reg	Min. VCC2 with Regulator	0000b	VPS not supported. Return 0000b=1.8V
	3-0	VH	4b	VCC2 Host	VCC2 Supplied by Host	xxxxb	Written and read by host. Ignore and return 0000b
59	7-4	VH	4b	VCC2 min in Bypass	Min. VCC2 in Regulator	0000b	VPS not supported. Return 0000b=1.8V
	3-1	VH	3b	Reserved	Reserved	000b	Ignore write, return 000b
	0	VH	1b	VPS Bypass Control	Turns VPS Bypass on or off	0b	VPS not supported. Ignore write, return 0b
60-69		R	10B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
70		VH	1B	Acceptable BER	For FEC systems	00h	Not Supp. Ignore W, return 00h.
71		VH	1B	Actual BER	For FEC systems	00h	Not Supp. Ignore W, return 00h.
72-73		VH	2B	Wavelength Set	Host wavelength set	0000h	Not Supp. Ignore write, return 0000h.
74-75		VH	2B	Wavelength Error	Returned wavelength error	0000h	Not Supp., return 0000h.
76		VH	1B	FEC Amplitude Adj	Set Amp Slice	00h	Not Supp. Ignore W, return 00h.
77		VH	1B	FEC Phase Adj	Set Phase Slice	00h	Not Supp. Ignore W, return 00h.
78-79		R	2B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
80-87		VHR	8B	Latched Interrupt Flag Bits	Individual bits set per XFPMSA	xb	Latched on flag condition. Cleared on host read. (See MSA)
88-95		VH	8B	Interrupt Masking Bits	Individual bits set per XFPMSA	0b	Set and readable by host. Cleared at power-up or reset
96-		VHR	2B	Temperature Readout	MSB in First Byte	xxxxh	Reported Temperature

97							Value in Units Defined in MSA
98-99		VHR	2B	Reserved A/D Chan.	Reserved	0000h	Report 0000h on read.
100-101		VHR	2B	TX Bias A/D Chan	MSB in First Byte	xxxxh	Reported TX Bias Value in Units Defined in MSA
102-103		VHR	2B	TX Power A/D Chan	MSB in First Byte	xxxxh	Reported TX Power Value in Units Defined in MSA
104-105		VHR	2B	RX Power A/D Chan	MSB in First Byte	xxxxh	Reported RX Power Value in Units Defined in MSA
106-107		VHR	2B	AUX1 A/D Chan	MSB in First Byte	xxxxh	Report +3.3V Supply voltage.
108-109		VHR	2B	AUX2 A/D Chan	MSB in First Byte	xxxxh	Report +5V Supply voltage.
		Signal Conditioner Control					
110	7	VHR	1b	TX Disable State	Reports TXDIS	xb	Ignore writes
	6	VH	1b	Soft TX Disable	OR's with input pin	0b	Read and write by host, power up and reset to 0b
	5	VHR	1b	MOD-NR State	Reports MOD_NR	xb	Ignore writes
	4	VHR	1b	P_Down State	Reports P_Down	xb	Ignore writes
	3	VH	1b	Soft P_Down	OR's with input pin	0b	Read and write by host, power up and reset to 0b, Do not reset
	2	VHR	1b	Interrupt State	Reports Interrupt	xb	Ignore writes
	1	VHR	1b	LOS State	Reports LOS	xb	Ignore writes
	0	VHR	1b	Data Not Ready	Set low when A/D ready.	xb	Ignore writes
111	7	VH	1b	TX_NR	Identifies TX_NR	xb	Ignore writes. Set if TX CDR loss of lock.
	6	VH	1b	TX_Fault	Identifies TX_Fault	0b	Ignore writes. Conditions for set TBD. Set at 0b for now.
	5	VH	1b	TX_CDR not locked	Identifies TX_LOL	xb	Ignore writes.
	4	VH	1b	RX_NR	Identifies RX_NR	xb	Ignore writes. Set if RX CDR loss of lock.
	3	VH	1b	RX_CDR not locked	Identifies RX_LOL	xb	Ignore writes.
	2-0	R	3b	Reserved	Reserved	000b	Ignore writes, report 000b.
112-117		R	6B	Reserved			Ignore writes, report 00h.
118	7-1	R	7b	Reserved	Reserved	0b	Ignore writes, report 0000000b.
	0	VH	1b	Error Checking	Switches PEC	xb	Host sets to 1b to enable packet error checking. Power up and reset to 0b.
119-122		VH	4B	New Password entry.	Host may enter to change Password	00h	Changes host password value if current correct password entered in 123-126. Power up and reset to 00000000h.

123-126		VHW	4B	Password entry.	Host may enter Password to Access Protected Area	00h	Allows Write Access to Customer EEPROM. Power up and reset to 00000000h.
127		VHW	1B	Table Select	Host enters to select upper memory table	01h	Defines Table for subsequent upper memory map reads. Defaults to 01h on Power and reset.

Upper Memory Map: I2C Addr: A0h, Table 0
Reserved by the XFP MSA. Module returns 0 for any read from this area, and ignore all writes.

Upper Memory Map: I2C Addr: A0h, Table 1 – Serial ID Section – Read only by Host, all Nonvolatile

Byte Address	***Bit Address***	***Size*** *(Bytes) or (bits)*	***Field Name***	***Description of Field***	***Value***	***Value Meaning***
128		1B	Identifier	Type of serial transceiver	06h	XFP
129	6-7	2b	Ext. Identifier - Module Power Class	Defines Module Power Class	01b	Indicates Power Dissipation < 2.5W under all specified operating conditions.
129	5	1b	Ext. Identifier - CDR	Identifies presence of a CDR	0b	Module contains CDR function.
129	4	1b	Ext. Identifier - REFCLK	Identifies need for REFCLK	1b	Module does not need REFCLK
129	3	1b	CLEI Code Present	Indicates if CLEI Code is present in Table 2	0b	To be supported on a customer basis. Value is 1b if CLEI Code is present in Table 2
129	0-2	3b	Ext. Identifier - Reserved	Reserved	000b	
130		1B	Connector	Code for connector type	07h	LC
131-138		**8 B**	**Transceiver Code for electronic compatibility or optical compatibility**			
		10 Gigabit Ethernet Compliance Codes				
131	7	1b	10GBASE-SR		0b	
	6	1b	10GBASE-LR		1b	
	5	1b	10GBASE-ER		0b	
	4	1b	Reserved		0b	
	3	1b	10GBASE-SW		0b	
	2	1b	10GBASE-LW		1b	
	1	1b	10GBASE-EW		0b	
	0	1b	Reserved		0b	
		10 Gigabit Fibre Channel Compliance Codes				
132	7	1b	1200-MX-SN-I		0b	
	6	1b	1200-SM-LL-L		1b	
	5	1b	Extended reach 1550nm		0b	
	4	1b	Intermediate reach 1310nm		0b	
	3	1b	Reserved		0b	
	2	1b	Reserved		0b	
	1	1b	Reserved		0b	

	0	1b	Reserved	0b	
		10 Gigabit Copper Link Compliance Codes			
133	7	1b	Reserved	0b	
	6	1b	Reserved	0b	
	5	1b	Reserved	0b	
	4	1b	Reserved	0b	
	3	1b	Reserved	0b	
	2	1b	Reserved	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		Lower Speed Link Compliance Codes			
134	7	1b	1000BASE-SX/1xFC MMF	0b	
	6	1b	1000BASE-LX/1xFC SMF	0b	
	5	1b	2xFC MMF	0b	
	4	1b	2xFC SMF	0b	
	3	1b	OC-48-SR	0b	
	2	1b	OC-48-IR	0b	
	1	1b	OC-48-LR	0b	
	0	1b	Reserved	0b	
		SONET/SDH Interconnect Link Compliance Codes			
135	7	1b	I-64.1r	1b	(OC-192 VSR4-2 support, -1dBm max power)
	6	1b	I-64.1	1b	(OC-192 SR-1 support, -1 dBm max power)
	5	1b	I-64.2r	0b	
	4	1b	I-64.2	0b	
	3	1b	I-64.3	0b	
	2	1b	I-64.5	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		SONET/SDH Short Haul Link Compliance Codes			
136	7	1b	S-64.1	0b	
	6	1b	S-64.2a	0b	
	5	1b	S-64.2b	0b	
	4	1b	S-64.3a	0b	
	3	1b	S-64.3b	0b	
	2	1b	S-64.5a	0b	
	1	1b	S-64.5b	0b	
	0	1b	Reserved	0b	
		SONET/SDH Long Haul Link Compliance Codes			
137	7	1b	L-64.1	0b	
	6	1b	L-64.2a	0b	
	5	1b	L-64.2b	0b	
	4	1b	L-64.2c	0b	
	3	1b	L-64.3	0b	
	2	1b	Reserved	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		SONET/SDH Very Long Haul Link Compliance Codes			
138	7	1b	V-64.2a	0b	
	6	1b	V-64.2b	0b	
	5	1b	V-64.3	0b	
	4	1b	Reserved	0b	
	3	1b	Reserved	0b	
	2	1b	Reserved	0b	

	1	1b	Reserved		0b	
	0	1b	Reserved		0b	
		Encoding				
139	7	1b	64B/66B		1b	10GE/10GFC Coding
	6	1b	8B/10B		1b	Not used in standards but is supported
	5	1b	SONET Scrambled		1b	OC-192 Coding
	4	1b	NRZ		1b	NRZ only supported
	3	1b	RZ		0b	
	2-0	3b	Reserved		000b	
140		1B	BR, minimum	Minimum Supported Bitrate (/100Mb)	63h	9900 Mbps
141		1B	BR, maximum	Maximum Supported Bitrate (/100Mb)	6Bh	10700 Mbps
142		1B	Length (SMF) – km	Link length supported for 9/125 um fiber, units of km	0Ah	10km
143		1B	Length (E-50um)	Link length supported for extended bandwidth MMF, units of 2 m	00h	Not supported
144		1B	Length (50m)	Link length supported for 50/125 mm fiber, units of 1 m	00h	Not supported
145		1B	Length (62.5m)	Link length supported for 62.5/125 mm fiber, units of 1 m	00h	Not supported
146		1B	Length (Copper)	Link length supported for copper, units of 1m	00h	Not supported
		Device Technology				
147	4-7	4b	Transmitter Technology		0100b	1310nm DFB laser
	3	1b	Wavelength Control		0b	No wavelength control
	2	1b	Cooled Transmitter		0b	Transmitter is not cooled
	1	1b	Detector Type		0b	PIN Detector
	0	1b	Tunable Transmitter		0b	Transmitter not Tunable
148-163		16B	Vendor name	SFP vendor name (ASCII) blank padded	"FINISAR CORP. "	
		CDR Support				
164	7	1b	CDR Support for 9.95 Gb/s		1b	
	6	1b	CDR Support for 10.3 Gb/s		1b	
	5	1b	CDR Support for 10.5 Gb/s		1b	
	4	1b	CDR Support for 10.7 Gb/s		1b	
	3	1b	CDR Support for 11.1 Gb/s		0b	To be supported in future versions.
	2	1b	Reserved		0b	
	1	1b	Line-side Loopback Mode Supported		0b	
	0	1b	XFI Loopback Supported		1b	
165-167		3B	Vendor OUI	SFP vendor IEEE company ID	009065h	IEEE assigned
168-183		16B	Vendor PN	Part number provided by vendor (ASCII)	"FTRX-1411M3 "	Finisar part number
184-185		2B	Vendor rev	Revision level for part number provided by	3030h	Hardware revision level field not used

				vendor (ASCII)		
186-187		2B	Wavelength	Nominal Laser Wavelength(1/20nm)	6658h	1310nm * (20/nm)
188-189		2B	Wavelength Tolerance	+/- Wavelength (1/200nm)	0FA0h	20.0nm * (200/nm). Corresponds to 1290-1340nm range.
190		1B	Max Case Temp	Maximum Case Temperature	46h	70ºC
191		1B	CC_BASE	Check code for Base ID Fields (addresses 128 to 190)	xxh	Calculated check code, low 8 bits of sum of first 64 bytes of Serial ID info.
				EXTENDED ID FIELDS		
192-195		**4B**	**Power Supply Fields**			
192		1B	Maximum Power Dissipation (/20mW)		7Dh	= 2500 mW
193		1B	Max. Power Diss. In Power-down (/10mW)		96h	= 1500 mW
194	4-7	4b	Max. Current on +5V Supply (/50mA)		0111b	= 350 mA (actual 320 mA)
	0-3	4b	Max. Current on +3.3V Supply (/100mA)		0011b	= 300 mA (actual 265 mA)
195	4-7	4b	Max. Current on +1.8V Supply (/100mA)		0000b	Not used
	0-3	4b	Max. Current on -5V Supply (-/100mA)		0000b	Not used
196-211		16B	Vendor SN	Serial number provided by vendor (ASCII) blank padded	e.g., "A000000"	Encoded serial number
212-217		6B	Date code	Vendor's manufacturing date	e.g., "030106"	yymmdd
218-219		2B	Lot Code	Vendor lot code	2020h	May be blank
			Diagnostic Monitoring / Variable Power Supply / Special Function Support			
220	7	1b	Reserved		0b	Reserved
	6	1b	Reserved		0b	Reserved
	5	1b	Reserved		0b	Reserved
	4	1b	FEC BER Support		0b	No BER Support
	3	1b	Received power measurement type		1b	Average Power
	2	1b	Reserved		0b	Reserved
	1-0	2b	Reserved		00b	Will be Reserved
			Enhanced Options			
221	7	1b	Module supports VPS		0b	Not supported
	6	1b	Soft TX_DISABLE		1b	Soft TX_DISABLE is supported
	5	1b	Soft PWR_DWN		1b	Soft PWR_DWN is supported
	4	1b	Supports VPS LV Regulator Mode		0b	We are not supporting VPS
	3	1b	Supports VPS Bypassed Regulator Mode		0b	We are not supporting VPS
	2	1b	Active FEC Control		0b	Not supported.
	1	1b	Wavelength Tunability		0b	Not supported
	0	1b	Optional CMU Mode		0b	Not supported
222	4-7	4b	Aux A/D Input 1		0111b	+3.3V Supply Monitor on Aux A/D 1
	0-3	4b	Aux A/D Input 2		0110b	+5V Supply Monitor on Aux A/D 2
223		1B	CC_EXT	Check code for the Extended ID Fields (addresses 128 to 222)	xxh	Calculated check code. Low 8 bits of sum of Bytes 128-222

Customer Specific Fields

Data Address	*Size (Bytes)*	*Field Name*	*Description of Field*	*Value*	*Value Meaning*
224-255	32	TBD	TBD	All 00h at present	

Upper Memory Map: I2C Address: A0h, Table 02h
User-writable EEPROM. A password (entered into bytes 123-126) is required to allow write access to this table. The default password is 00001011h per the XFP MSA, and it can be changed by the user (i.e., host manufacturer) by writing the new password into bytes 119-122 when the correct old password has been written into bytes 123-126. The host password must be in the range of 00000000h to 7FFFFFFFh. This table is always readable (password not required).

Upper Memory Map: I2C Address: A0h, Table 03h–7Fh
Used by Finisar for internal parameter storage. Not readable or writable without Finisar Password.

Description of Finisar Memory Map Contents

Product: FTRX-1411D3

Type Codes:
NVE: Non-volatile EEPROM. Read only by Customer
VH: Volatile Host Entry Field. Set to 00h on power up or reset unless noted. Read/Write by Host
VHW: Volatile Host Write Field. Set to 00h on power up or reset unless noted. Write only by Host
VHR: Volatile Host Read Field. Set to 00h on power up or reset unless noted. Read only by Host
R: Reserved. Ignore write, Return 00h on read.

Lower Memory Map: I2C Addr: A0h, Bytes 0 – 127.

Byte Address	*Bit Address*	*Type Code*	*Size (Bytes) or (bits)*	*Field Name*	*Description of Field*	*Value*	*Value Meaning*
0		NVE	1B	Identifier	Type of serial transceiver	06h	XFP
		Signal Conditioner Control					
1	4-7	VH	4b	Data Rate Control		xxxxb	Ignored
	3	VHW	1b	Reserved		N/A	Reserved
	2	VH	1b	Line-side Loopback Control. 1b actuates loopback of optical input to optical output.		0b	Not supported, ignore write, read back as 0b
	1	VH	1b	XFI Loopback Control. 1b actuates loopback of electrical input to electrical output		xb	Power up to 0b
	0	VH	1b	Signal Conditioner Control		0b	Normal REFCLK mode only supported. Ignore write, read back as 0b
		Flag Thresholds					
2-3		NVE	2B	Temp High Alarm	Threshold for alarm	19968 d	+78 °C (assumes 3°C accuracy)
4-5		NVE	2B	Temp Low Alarm	Threshold for alarm	62208 d	-13 °C (assumes 3°C accuracy)
6-7		NVE	2B	Temp High Warning	Threshold for warn	19200 d	+75 °C (assumes 5°C accuracy)
8-9		NVE	2B	Temp Low Warning	Threshold for warn	62976 d	-10 °C (assumes 5°C accuracy)
10-17		R	8B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
18-19		NVE	2B	Bias High Alarm	Threshold for alarm	35000 d	70 mA
20-21		NVE	2B	Bias Low Alarm	Threshold for alarm	10000 d	20 mA
22-23		NVE	2B	Bias High Warning	Threshold for warn	32500 d	65 mA
24-25		NVE	2B	Bias Low Warning	Threshold for warn	12500 d	25 mA
26-27		NVE	2B	TX Power High Alarm	Threshold for alarm	14125 d	+1.5 dBm (assumes 2dB accuracy)
28-29		NVE	2B	TX Power Low Alarm	Threshold for alarm	1995d	-7.0 dBm (assumes 2dB accuracy)
30-31		NVE	2B	TX Power High Warning	Threshold for warn	12589 d	+1.0 dBm (assumes 2dB accuracy)
32-33		NVE	2B	TX Power Low Warning	Threshold for warn	2239d	-6.5 dBm (assumes 2dB accuracy)

34-35		NVE	2B	RX Power High Alarm	Threshold for alarm	17783d	+2.5 dBm (assumes 1.5dB accuracy)
36-37		NVE	2B	RX Power Low Alarm	Threshold for alarm	100d	-20 dBm
38-39		NVE	2B	RX Power High Warning	Threshold for warn	15849d	+2.0 dBm (assumes 1.5dB accuracy)
40-41		NVE	2B	RX Power Low Warning	Threshold for warn	158d	-18 dBm
42-43		NVE	2B	AUX1 High Alarm	Threshold for alarm	36300d	3.63 V
44-45		NVE	2B	AUX1Low Alarm	Threshold for alarm	30000d	3.00 V
46-47		NVE	2B	AUX1 High Warning	Threshold for warn	35000d	3.50 V (assumes 50mV accuracy)
48-49		NVE	2B	AUX1Low Warning	Threshold for warn	31000d	3.10 V (assumes 50mV accuracy)
50-51		NVE	2B	AUX2 High Alarm	Threshold for alarm	55000d	5.50 V
52-53		NVE	2B	AUX2 Low Alarm	Threshold for alarm	45000d	4.50 V
54-55		NVE	2B	AUX2 High Warning	Threshold for warn	53000d	5.30 V (assumes 50mV accuracy)
56-57		NVE	2B	AUX2 Low Warning	Threshold for warn	47000d	4.70 V (assumes 50mV accuracy)
58	7-4	NVE	4b	VCC2 min with Reg	Min. VCC2 with Regulator	0000b	VPS not supported. Return 0000b=1.8V
	3-0	VH	4b	VCC2 Host	VCC2 Supplied by Host	xxxxb	Written and read by host. Ignore and return 0000b
59	7-4	VH	4b	VCC2 min in Bypass	Min. VCC2 in Regulator	0000b	VPS not supported. Return 0000b=1.8V
	3-1	VH	3b	Reserved	Reserved	000b	Ignore write, return 000b
	0	VH	1b	VPS Bypass Control	Turns VPS Bypass on or off	0b	VPS not supported. Ignore write, return 0b
60-69		R	10B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
70		VH	1B	Acceptable BER	For FEC systems	00h	Not Supp. Ignore W, return 00h.
71		VH	1B	Actual BER	For FEC systems	00h	Not Supp. Ignore W, return 00h.
72-73		VH	2B	Wavelength Set	Host wavelength set	0000h	Not Supp. Ignore write, return 0000h.
74-75		VH	2B	Wavelength Error	Returned wavelength error	0000h	Not Supp., return 0000h.
76		VH	1B	FEC Amplitude Adj	Set Amp Slice	00h	Not Supp. Ignore W, return 00h.
77		VH	1B	FEC Phase Adj	Set Phase Slice	00h	Not Supp. Ignore W, return 00h.
78-79		R	2B	Reserved	Reserved	All 00h	Ignore write; return 00h on read.
80-87		VHR	8B	Latched Interrupt Flag Bits	Individual bits set per XFPMSA	xb	Latched on flag condition. Cleared on host read. (See MSA)
88-95		VH	8B	Interrupt Masking Bits	Individual bits set per XFPMSA	0b	Set and readable by host. Cleared at power-up or reset
96-		VHR	2B	Temperature Readout	MSB in First Byte	xxxxh	Reported Temperature

97							Value in Units Defined in MSA
98-99		VHR	2B	Reserved A/D Chan.	Reserved	0000h	Report 0000h on read.
100-101		VHR	2B	TX Bias A/D Chan	MSB in First Byte	xxxxh	Reported TX Bias Value in Units Defined in MSA
102-103		VHR	2B	TX Power A/D Chan	MSB in First Byte	xxxxh	Reported TX Power Value in Units Defined in MSA
104-105		VHR	2B	RX Power A/D Chan	MSB in First Byte	xxxxh	Reported RX Power Value in Units Defined in MSA
106-107		VHR	2B	AUX1 A/D Chan	MSB in First Byte	xxxxh	Report +3.3V Supply voltage.
108-109		VHR	2B	AUX2 A/D Chan	MSB in First Byte	xxxxh	Report +5V Supply voltage.
		Signal Conditioner Control					
110	7	VHR	1b	TX Disable State	Reports TXDIS	xb	Ignore writes
	6	VH	1b	Soft TX Disable	OR's with input pin	0b	Read and write by host, power up and reset to 0b
	5	VHR	1b	MOD-NR State	Reports MOD_NR	xb	Ignore writes
	4	VHR	1b	P_Down State	Reports P_Down	xb	Ignore writes
	3	VH	1b	Soft P_Down	OR's with input pin	0b	Read and write by host, power up and reset to 0b, Do not reset
	2	VHR	1b	Interrupt State	Reports Interrupt	xb	Ignore writes
	1	VHR	1b	LOS State	Reports LOS	xb	Ignore writes
	0	VHR	1b	Data Not Ready	Set low when A/D ready.	xb	Ignore writes
111	7	VH	1b	TX_NR	Identifies TX_NR	xb	Ignore writes. Set if TX CDR loss of lock.
	6	VH	1b	TX_Fault	Identifies TX_Fault	0b	Ignore writes. Conditions for set TBD. Set at 0b for now.
	5	VH	1b	TX_CDR not locked	Identifies TX_LOL	xb	Ignore writes.
	4	VH	1b	RX_NR	Identifies RX_NR	xb	Ignore writes. Set if RX CDR loss of lock.
	3	VH	1b	RX_CDR not locked	Identifies RX_LOL	xb	Ignore writes.
	2-0	R	3b	Reserved	Reserved	000b	Ignore writes, report 000b.
112-117		R	6B	Reserved			Ignore writes, report 00h.
118	7-1	R	7b	Reserved	Reserved	0b	Ignore writes, report 0000000b.
	0	VH	1b	Error Checking	Switches PEC	xb	Host sets to 1b to enable packet error checking. Power up and reset to 0b.
119-122		VH	4B	New Password entry.	Host may enter to change Password	00h	Changes host password value if current correct password entered in 123-126. Power up and reset to 00000000h.

123-126		VHW	4B	Password entry.	Host may enter Password to Access Protected Area	00h	Allows Write Access to Customer EEPROM. Power up and reset to 00000000h.
127		VHW	1B	Table Select	Host enters to select upper memory table	01h	Defines Table for subsequent upper memory map reads. Defaults to 01h on Power and reset.

Upper Memory Map: I2C Addr: A0h, Table 0
Reserved by the XFP MSA. Module returns 0 for any read from this area, and ignore all writes.

Upper Memory Map: I2C Addr: A0h, Table 1 – Serial ID Section – Read only by Host, all Nonvolatile

Byte Address	***Bit Address***	***Size*** *(Bytes) or (bits)*	***Field Name***	***Description of Field***	***Value***	***Value Meaning***
128		1B	Identifier	Type of serial transceiver	06h	XFP
129	6-7	2b	Ext. Identifier - Module Power Class	Defines Module Power Class	01b	Indicates Power Dissipation < 2.5W under all specified operating conditions.
129	5	1b	Ext. Identifier - CDR	Identifies presence of a CDR	0b	Module contains CDR function.
129	4	1b	Ext. Identifier - REFCLK	Identifies need for REFCLK	1b	Module does not need REFCLK
129	3	1b	CLEI Code Present	Indicates if CLEI Code is present in Table 2	0b	To be supported on a customer basis. Value is 1b if CLEI Code is present in Table 2
129	0-2	3b	Ext. Identifier - Reserved	Reserved	000b	
130		1B	Connector	Code for connector type	07h	LC
131-138		**8 B**	**Transceiver Code for electronic compatibility or optical compatibility**			
		10 Gigabit Ethernet Compliance Codes				
131	7	1b	10GBASE-SR		0b	
	6	1b	10GBASE-LR		1b	
	5	1b	10GBASE-ER		0b	
	4	1b	Reserved		0b	
	3	1b	10GBASE-SW		0b	
	2	1b	10GBASE-LW		1b	
	1	1b	10GBASE-EW		0b	
	0	1b	Reserved		0b	
		10 Gigabit Fibre Channel Compliance Codes				
132	7	1b	1200-MX-SN-I		0b	
	6	1b	1200-SM-LL-L		1b	
	5	1b	Extended reach 1550nm		0b	
	4	1b	Intermediate reach 1310nm		0b	
	3	1b	Reserved		0b	
	2	1b	Reserved		0b	
	1	1b	Reserved		0b	

	0	1b	Reserved	0b	
		10 Gigabit Copper Link Compliance Codes			
133	7	1b	Reserved	0b	
	6	1b	Reserved	0b	
	5	1b	Reserved	0b	
	4	1b	Reserved	0b	
	3	1b	Reserved	0b	
	2	1b	Reserved	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		Lower Speed Link Compliance Codes			
134	7	1b	1000BASE-SX/1xFC MMF	0b	
	6	1b	1000BASE-LX/1xFC SMF	0b	
	5	1b	2xFC MMF	0b	
	4	1b	2xFC SMF	0b	
	3	1b	OC-48-SR	0b	
	2	1b	OC-48-IR	0b	
	1	1b	OC-48-LR	0b	
	0	1b	Reserved	0b	
		SONET/SDH Interconnect Link Compliance Codes			
135	7	1b	I-64.1r	0b	
	6	1b	I-64.1	0b	
	5	1b	I-64.2r	0b	
	4	1b	I-64.2	0b	
	3	1b	I-64.3	0b	
	2	1b	I-64.5	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		SONET/SDH Short Haul Link Compliance Codes			
136	7	1b	S-64.1	0b	
	6	1b	S-64.2a	0b	
	5	1b	S-64.2b	0b	
	4	1b	S-64.3a	0b	
	3	1b	S-64.3b	0b	
	2	1b	S-64.5a	0b	
	1	1b	S-64.5b	0b	
	0	1b	Reserved	0b	
		SONET/SDH Long Haul Link Compliance Codes			
137	7	1b	L-64.1	0b	
	6	1b	L-64.2a	0b	
	5	1b	L-64.2b	0b	
	4	1b	L-64.2c	0b	
	3	1b	L-64.3	0b	
	2	1b	Reserved	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	
		SONET/SDH Very Long Haul Link Compliance Codes			
138	7	1b	V-64.2a	0b	
	6	1b	V-64.2b	0b	
	5	1b	V-64.3	0b	
	4	1b	Reserved	0b	
	3	1b	Reserved	0b	
	2	1b	Reserved	0b	
	1	1b	Reserved	0b	
	0	1b	Reserved	0b	

		Encoding				
139	7	1b	64B/66B		1b	10GE/10GFC Coding
	6	1b	8B/10B		1b	Not used in standards but is supported
	5	1b	SONET Scrambled		1b	OC-192 Coding
	4	1b	NRZ		1b	NRZ only supported
	3	1b	RZ		0b	
	2-0	3b	Reserved		000b	
140		1B	BR, minimum	Minimum Supported Bitrate (/100Mb)	63h	9900 Mbps
141		1B	BR, maximum	Maximum Supported Bitrate (/100Mb)	69h	10500 Mbps
142		1B	Length (SMF) – km	Link length supported for 9/125 um fiber, units of km	0Ah	10km
143		1B	Length (E-50um)	Link length supported for extended bandwidth MMF, units of 2 m	00h	Not supported
144		1B	Length (50m)	Link length supported for 50/125 mm fiber, units of 1 m	00h	Not supported
145		1B	Length (62.5m)	Link length supported for 62.5/125 mm fiber, units of 1 m	00h	Not supported
146		1B	Length (Copper)	Link length supported for copper, units of 1m	00h	Not supported
		Device Technology				
147	4-7	4b	Transmitter Technology		0100b	1310nm DFB laser
	3	1b	Wavelength Control		0b	No wavelength control
	2	1b	Cooled Transmitter		0b	Transmitter is not cooled
	1	1b	Detector Type		0b	PIN Detector
	0	1b	Tunable Transmitter		0b	Transmitter not Tunable
148-163		16B	Vendor name	SFP vendor name (ASCII) blank padded	"FINISAR CORP. "	
		CDR Support				
164	7	1b	CDR Support for 9.95 Gb/s		1b	
	6	1b	CDR Support for 10.3 Gb/s		1b	
	5	1b	CDR Support for 10.5 Gb/s		1b	
	4	1b	CDR Support for 10.7 Gb/s		1b	
	3	1b	CDR Support for 11.1 Gb/s		0b	To be supported in future versions.
	2	1b	Reserved		0b	
	1	1b	Line-side Loopback Mode Supported		0b	
	0	1b	XFI Loopback Supported		1b	
165-167		3B	Vendor OUI	SFP vendor IEEE company ID	009065h	IEEE assigned
168-183		16B	Vendor PN	Part number provided by vendor (ASCII)	"FTRX-1411D3 "	Finisar part number
184-185		2B	Vendor rev	Revision level for part number provided by vendor (ASCII)	3030h	Hardware revision level field not used

186-187		2B	Wavelength	Nominal Laser Wavelength(1/20nm)	6658h	1310nm * (20/nm)
188-189		2B	Wavelength Tolerance	+/- Wavelength (1/200nm)	2710h	20.0nm * (200/nm). Corresponds to 1260-1355nm range.
190		1B	Max Case Temp	Maximum Case Temperature	46h	70ºC
191		1B	CC_BASE	Check code for Base ID Fields (addresses 128 to 190)	xxh	Calculated check code, low 8 bits of sum of first 64 bytes of Serial ID info.
				EXTENDED ID FIELDS		
192-195		**4B**	**Power Supply Fields**			
192		1B	Maximum Power Dissipation (/20mW)		7Dh	= 2500 mW
193		1B	Max. Power Diss. In Power-down (/10mW)		96h	= 1500 mW
194	4-7	4b	Max. Current on +5V Supply (/50mA)		0111b	= 350 mA (actual 320 mA)
	0-3	4b	Max. Current on +3.3V Supply (/100mA)		0011b	= 300 mA (actual 265 mA)
195	4-7	4b	Max. Current on +1.8V Supply (/100mA)		0000b	Not used
	0-3	4b	Max. Current on -5V Supply (-/100mA)		0000b	Not used
196-211		16B	Vendor SN	Serial number provided by vendor (ASCII) blank padded	e.g., “A000000”	Encoded serial number
212-217		6B	Date code	Vendor’s manufacturing date	e.g., “030106“	yymmdd
218-219		2B	Lot Code	Vendor lot code	2020h	May be blank
			Diagnostic Monitoring / Variable Power Supply / Special Function Support			
220	7	1b	Reserved		0b	Reserved
	6	1b	Reserved		0b	Reserved
	5	1b	Reserved		0b	Reserved
	4	1b	FEC BER Support		0b	No BER Support
	3	1b	Received power measurement type		1b	Average Power
	2	1b	Reserved		0b	Reserved
	1-0	2b	Reserved		00b	Will be Reserved
			Enhanced Options			
221	7	1b	Module supports VPS		0b	Not supported
	6	1b	Soft TX_DISABLE		1b	Soft TX_DISABLE is supported
	5	1b	Soft PWR_DWN		1b	Soft PWR_DWN is supported
	4	1b	Supports VPS LV Regulator Mode		0b	We are not supporting VPS
	3	1b	Supports VPS Bypassed Regulator Mode		0b	We are not supporting VPS
	2	1b	Active FEC Control		0b	Not supported.
	1	1b	Wavelength Tunability		0b	Not supported
	0	1b	Optional CMU Mode		0b	Not supported
222	4-7	4b	Aux A/D Input 1		0111b	+3.3V Supply Monitor on Aux A/D 1
	0-3	4b	Aux A/D Input 2		0110b	+5V Supply Monitor on Aux A/D 2
223		1B	CC_EXT	Check code for the Extended ID Fields (addresses 128 to 222)	xxh	Calculated check code. Low 8 bits of sum of Bytes 128-222

Customer Specific Fields

Data Address	*Size (Bytes)*	*Field Name*	*Description of Field*	*Value*	*Value Meaning*
224-255	32	TBD	TBD	All 00h at present	

Upper Memory Map: I2C Address: A0h, Table 02h
User-writable EEPROM. A password (entered into bytes 123-126) is required to allow write access to this table. The default password is 00001011h per the XFP MSA, and it can be changed by the user (i.e., host manufacturer) by writing the new password into bytes 119-122 when the correct old password has been written into bytes 123-126. The host password must be in the range of 00000000h to 7FFFFFFFh. This table is always readable (password not required).

Upper Memory Map: I2C Address: A0h, Table 03h–7Fh
Used by Finisar for internal parameter storage. Not readable or writable without Finisar Password.

References

- 10 Gigabit Small Form Factor Pluggable Module (XFP) MSA, rev. 4.0 April 13, 2004.
- Digital Diagnostic Monitoring Interface for Optical Transceivers SFF document number: SFF-8472, rev. 9.3 August 4, 2002.

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