Features:

- Illuminates optical fiber cables for continuity defects
- 650nm FP laser source with options for Class 1M or Class 2 compliant operation
- LC connector receptacle or 1x2 (50:50) splitter options
- SFP form factor defined by MSA standards INF-8074i and SFF-8431
- Digital Diagnostics per SFF-8472
- For use in conjunction with devices such as:
  - Communication network switches
  - Servers or server blades
  - COTSWORKS' media converters
- Mechanical control of laser source via push button
- Control VFL-SFP features via I2C interface
  - Optical output power
  - Auto shut-off timer
  - Modulation frequency

A VFL-SFP is the ideal tool for troubleshooting optical continuity or breaks in fiber optic cable links utilizing an MSA standard SFP form factor transceiver.
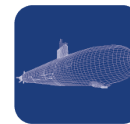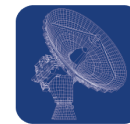
COMMERCIAL AEROSPACE MILITARY AEROSPACE MILITARY TACTICAL SUBSEA NETWORKING RADAR & SENSING OIL & EXPLORATION

General Description

The VFL-SFP offers extended functionality beyond a conventional visual fault locator in a standard SFP form factor with Class 2 Laser Eye Safety and long-term reliability. Compatible with existing hardware, install the VFL-SFP into an open switch port, and it will illuminate optical fiber cables to find continuity defects in your links. Use in communication network switches, servers or server blades, and COTSWORKS' media converters, such as the 1G Lightning Stick and 10G OptoCube. Control VFL-SFP features through an I2C interface for optical output power, an auto shut-off, and modulation frequency. Monitor device functionality via standard SFF-8472 Digital Diagnostics, as well as an extended suite of module-specific diagnostics such as laser & module uptime, power cycle counter, and more.

Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN.	MAX.	UNIT	NOTES
Maximum Supply Voltage	V_{CC}	−0.3	4.0	V	
Storage Temperature	T_{sto}	−40	85	ºC	
Operating Temperature	T_{OP}	−10	70	ºC	

Electrical Specifications

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTES
Supply Voltage	V_{CC}	3.14	3.3	3.47	V	
Power Consumption	P_{DISS}			1.04	W	
Total Supply Current	I_{CC}			300	mA	
Modulation Frequency	f	1	2	User Defined	Hz	2 Hz default, modulation can be using software

Optical Specifications

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTES
Optical Output Power (Class 1M)	P_{OUT_1M}			3.5	mW	(1)(2)
Optical Output Power (Class 2)	P_{OUT_2}			4.99	mW	(1)(2)(3)
Optical Wavelength	λ	635		680	nm	Visible Red Light

Notes:
1) Measured at the end of a 2–5m 62.5µm multi-mode fiber patch cord.
2) Maximum output power determined by ordering configuration.
3) Output power characterized per-channel of a preinstalled 1x2 (50:50) splitter.

Push Button Settings

Push Button State	Laser Output State	Notes
Default	No Output	Laser is not active
Press and Hold 5 seconds	Activate/Deactivate Device	VFL-SFP will turn-on/turn-off if the button is held for several seconds
Double-Click Button	Constant / Modulated Output	Output power level and modulation frequency can be controlled by the user in Lightning Stick Software or through I2C commands described below

I2C Commands for Device Control

Command	Default Settings	Command Text	Description	Example Commands
Change Optical Output Power	100%	VFL_POWER_SET ### {0:100}	Set optical output power in percentage	"VFL_POWER_SET0 050" - Set optical power to 50%
Change Modulation Frequency	2 Hz	VFL_BLINK_FRQ ## {0:8}	Set modulation frequency in Hz	"VFL_BLINK_FRQ 04" - Set modulation frequency to 4Hz
Change Auto Shutoff Timer	1 minute	VFL_A_TIMEOUT ## {0:60}	Set automatic power off time in minutes. A value of 0 disabled automatic power off	"VFL_A_TIMEOUT 10" - Set the automatic power off time to 10 minutes
Save Changes to Flash Memory	-	VFL_SAVE_SETN	Save the current VFL settings to flash	"VFL_SAVE_SETN" - Save all changes
Virtual Button	-	VFL_BUTTON_PS	Cycles between "laser on," "modulate," and "laser off"	"VFL_BUTTON_PS" - Changes laser state along path defined in **Description**
TX En/Disable	Power Off / TX Enabled	VFL_EN_DISABL # {0:1}	Set TX disable state (0 = TX Enabled: 1 = TX Disabled)	"VFL_EN_DISABL 1" - Set TX Disable feature to Disable
Display VFL-SFP Info	-	VFL_DSPL_INFO	Request info packet from the VFL-SFP	"VFL_DSPL_INFO" - Displays VFL-SFP info packet

Address A0h Data Fields

A0h Address (dec)	# Bytes	Name	Description	Value (hex)
			Base ID Fields	
00	1	Identifier	Type of transceiver	03
01	1	Ext. Identifier	Extended identifier of type of transceiver	04
02	1	Connector	Code for connector type	07
03	8	Transceiver	Code for electronic or optical compatibility	00
04				00
05				00
06				00
07				00
08				00
09				00
10				00
11	1	Encoding	Code for high speed serial encoding algorithm	00
12	1	BR, Nominal	Nominal signaling rate, units of 100 MBd	00
13	1	Rate Identifier	Type of rate select functionality	00
14	1	Length (SMF, km)	Link length supported for single mode fiber, units of km	00
15	1	Length (SMF)	Link length supported for single mode fiber, units of 100 m	00
16	1	Length (50um)	Link length supported for 50 um OM2 fiber, units of 10 m	00
17	1	Length (62.5um)	Link length supported for 62.5 um OM1 fiber, units of 10 m	00
18	1	Length (OM4 or copper cable)	Link length supported for 50um OM4 fiber, units of 10m. Alternatively copper or direct attach cable, units of m	00
19	1	Length (OM3)	Link length supported for 50 um OM3 fiber, units of 10 m	00
20	16	Vendor Name	SFP vendor name (ASCII)	43
21				4F
22				54
23				53
24				57
25				4F
26				52
27				4B
28				53
29				20
30				20
31				20
32				20
33				20
34				20
35				20
36	1	Transceiver	Code for electronic or optical compatibility	00
37	3	Vendor OUI	SFP vendor IEEE company ID	00
38				00
39				00
40	16	Vendor PN	Part number provided by SFP vendor (ASCII)	56
41				46
42				4C
43				53

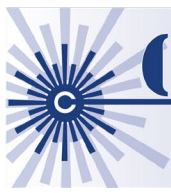|				
44				46
45				50
46				XX
47				XX
48				XX
49				XX
50				XX
51				XX
52				XX
53				XX
54				XX
55				XX
56				XX
57	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	XX
58				XX
59				XX
60	2	Wavelength	Laser wavelength	02
61				8A
62	1	Unallocated		00
63	1	CC_BASE	Check code for Base ID Fields (addresses 0 to 62)	XX
Extended ID Fields				
64	2	Options	Indicates which optional transceiver signals are implemented	00
65				10
66	1	BR, max	Upper bit rate margin, units of %	00
67	1	BR, min	Lower bit rate margin, units of %	00
68				XX
69				XX
70				XX
71				XX
72				XX
73				XX
74				XX
75	16	Vendor SN	Serial number provided by vendor (ASCII)	XX
76				XX
77				XX
78				XX
79				XX
80				XX
81				XX
82				XX
83				XX
84				XX
85				XX
86				XX
87	8	Date code	Vendor's manufacturing date code	XX
88				XX
89				XX
90				XX
91				XX
92	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (if any) in the transceiver	60
93	1	Enhanced Options	Indicates which optional enhanced features are implemented (if any) in the transceiver	00

| 94 | 1 | SFF-8472 Compliance | Indicates which revision of SFF-8472 the transceiver complies with | 08 |
| 95 | 1 | CC_EXT | Check code for the Extended ID Fields (addresses 64 to 94) | XX |

Address A4h Data Fields (I2C Controls & Extended Diagnostics)

| A4h Address (dec)	# Bytes	Name	Description	Value (hex)
64	1	Current Button State	Dynamic state of the laser diode. Edit this field to change the physical state of the laser. [READ / WRITE]	0x00: Off 0x01: On 0x02: Modulate
65	1	Current Modulation Frequency	User set rate at which the laser diode blinks if in modulation mode. Edit this field to change the "blink frequency." (DEC) [READ / WRITE]	Modulation frequency in Hz (1-8 Hz) [0x01 – 0x08]
66	1	Current Brightness	User set percentage of maximum laser brightness. Edit this state to change the brightness of the laser diode. (DEC) [READ / WRITE]	Brightness in percentage (0-100%) [0x00 – 0x64]
67	1	Current Laser Time-Out	User set laser on time-out. Edit this field to change the duration the laser will remain on. (DEC) [READ / WRITE]	Laser Time On in minutes (1-10 minutes) [0x00 – 0x0A]
72	1	Default Button State	Default state of the laser diode. [READ ONLY]	Default: Off 0x00
73	1	Default Modulation Frequency	Default rate at which the laser diode blinks if in modulation mode. Retained between sessions. (DEC) [READ / WRITE]	Default: 2 Hz 0x02
74	1	Default Brightness	Default percentage of maximum laser brightness. Retained between sessions. (DEC) [READ / WRITE]	Default: 100% 0x64
75	1	Default Laser Time-Out	Default laser on time-out. Retained between sessions. (DEC) [READ / WRITE]	Default: 1 min 0x01
80	4	Cumulative Laser On Time	Total laser on time in seconds. Retained and added to between sessions. (DEC) [READ ONLY]	[VARIABLE]
81				[VARIABLE]
82				[VARIABLE]
83				[VARIABLE]

100	2	Power Cycle Counter	Power cycle counter of the module. (DEC)	[VARIABLE]
101			[READ ONLY]	[VARIABLE]
102	4	Current Session Module Uptime	Running counter of module uptime in current session. Resets between sessions. (DEC)	[VARIABLE]
103				[VARIABLE]
104				[VARIABLE]
105			[READ ONLY]	[VARIABLE]
106	4	Cumulative (Total) Module Uptime	Running counter of total module uptime. Retained and added to between sessions. (DEC)	[VARIABLE]
107				[VARIABLE]
108				[VARIABLE]
109			[READ ONLY]	[VARIABLE]
***Requires password entry in A4h bytes 123-126 for WRITE**				
114	1	A0_Page Erase	Erases A0 table in flash memory. [READ / WRITE*]	Write 0x01 to erase A0
115	1	A0_Page Save	Byte to save A0 RAM table in flash memory. [READ / WRITE*]	Write 0x01 to save A0
116	1	A2_Page Erase	Erases A2 table in flash memory. [READ / WRITE*]	Write 0x01 to erase A2
117	1	A2_Page Save	Byte to save A2 RAM table in flash memory. [READ / WRITE*]	Write 0x01 to save A2
118	1	A4_Page Erase	Erases A4 table in flash memory. [READ / WRITE*]	Write 0x01 to erase A4
119	1	A4_Page Save	Byte to save A4 RAM table in flash memory. [READ / WRITE*]	Write 0x01 to save A4
Default password is "00 00 00 00" – Enables WRITE to A0h bytes 0-95, A2h bytes 0-95 & 118-255, A4h bytes 72-79 & 114-119				
123	1	Unlock	A0 / A2 / A4 password (byte 3) [READ / WRITE]	0x00 unlocks write
124	1	Unlock	A0 / A2 / A4 password (byte 2) [READ / WRITE]	0x00 unlocks write
125	1	Unlock	A0 / A2 / A4 password (byte 1) [READ / WRITE]	0x00 unlocks write
126	1	Unlock	A0 / A2 / A4 password (byte 0) [READ / WRITE]	0x00 unlocks write

Mechanical Dimensions
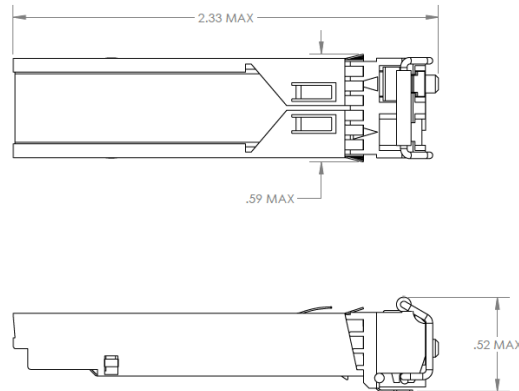
Representative ONLY, final dimensions are subject to change, dimensions in inches

Note:
1. VFL-SFP mechanical dimensions are defined by the Small Form Factor Pluggable (SFP) Multi-Sourcing Agreement (MSA).

Warnings

Handling Precautions: This device is susceptible to damage from electrostatic discharge (ESD).

Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid exposure to direct or indirect radiation. The VFL-SFP has two orderable configurations with different eye safety classifications. The 3.5mW MAX output configuration is designed to be Class 1M compliant. The 10mW MAX output configuration is designed for use with a 1x2 (50:50) splitter which yields Class 2 compliant output on each channel of the 1x2 (50:50) splitter. Failure to use the supplied 1x2 (50:50) splitter with a 10mW MAX output configuration results in a Class 2M compliant output.

Ordering Information

VFL-SFP	-X
	Output Power
SFP Form Factor	*1: Class 1M compliant*
	(3.5 mW Maximum output power)
Visual Fault Locator	*2: Class 2 compliant*
	(4.9 mW Maximum output power per lane of duplex LC)

Contact COTSWORKS for mechanical information and other configuration options.