Finisar

Product Specification

2.125 Gb/s RoHS Compliant Short Wavelength 2x5 SFF Transceiver

FTLF8519F2xCL

PRODUCT FEATURES

- Up to 2.125 Gb/s bi-directional data links
- Standard 2x5 pin SFF footprint (MSA compliant)
- 850nm Oxide VCSEL laser transmitter
- Duplex LC connector
- RoHS compliant and Lead Free
- Up to 500m on 50/125µm MMF, 300m on 62.5/125µm MMF
- Metal enclosure, for lower EMI
- Single 3.3V power supply
- Low power dissipation <750mW
- Commercial operating temperature range: 0°C to 70°C

APPLICATIONS

- 1.25 Gb/s 1000Base-SX Ethernet
- Dual Rate 1.063/2.125 Gb/s Fibre Channel

Finisar's FTLF8519F2xCL Small Form Factor (SFF) transceivers comply with the 2x5 standard package defined by the Small Form Factor Multi-Sourcing Agreement (MSA)[1]. They are simultaneously compatible with Gigabit Ethernet as specified in IEEE Std 802.3[2] and Fibre Channel FC- PI-2 Rev. 7.0[3]. They are RoHS compliant and lead-free per Directive 2002/95/EC[4] and Finisar Application Note AN-2038.

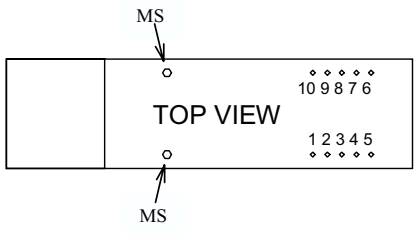
PRODUCT SELECTION

FTLF8519F2xCL

x	G	2 Grounding Pins, Short EMI shield
	K	2 Grounding Pins, Long EMI shield

I. Pin Descriptions

Pin	Symbol	Name/Description	Logic Family
MS	MS	Mounting Studs are for mechanical attachment and are connected to chassis ground. **Chassis ground is internally isolated from circuit grounds.** Connection to user's ground plane is recommended.	NA
1	V_{EER}	Receiver Ground (Common with Transmitter Ground)	NA
2	V_{CCR}	Receiver Power Supply	NA
3	SD	Signal Detect. Logic 1 indicates normal operation.	LVTTL
4	RD-	Receiver Inverted DATA out. AC Coupled	See Rx spec.
5	RD+	Receiver Non-inverted DATA out. AC Coupled	See Rx spec.
6	V_{CCT}	Transmitter Power Supply	NA
7	V_{EET}	Transmitter Ground (Common with Receiver Ground)	NA
8	T_{DIS}	Transmitter Disable	LVTTL
9	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	See Tx spec.
10	TD-	Transmitter Inverted DATA in. AC Coupled	See Tx spec.



II. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	T_S	-40		85	°C	
Case Operating Temperature	T_{OP}	0		70	°C	
Relative Humidity	RH	0		85	%	1
Hand Lead Soldering Temperature/Time				260/10	°C/s	
Wave Lead Soldering Temperature/Time				260/10	°C/s	

Notes:
1. Non condensing.

III. Electrical Characteristics (T_{OP} = 0 to 70 °C, V_{CC} = 3.0 to 3.6 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.0		3.6	V	
Supply Current	Icc		180	240	mA	
Transmitter						
Input differential impedance	R_{in}	80	100	120	Ω	1
Single ended data input swing	Vin,pp	250		1200	mV	
Transmit Disable Voltage	V_D	2		Vcc	V	
Transmit Enable Voltage	V_{EN}	Vee		Vee+ 0.8	V	2
Receiver						
Output differential impedance	Rout	80	100	120	Ω	1
Single ended data output swing	Vout,pp	250	350	550	mV	3
Data output rise/fall time	t_r/ t_f			170	ps	4
Signal Detect Normal	SD_{normal}			Vcc_{HOST}	V	5
Signal Detect Fault	SD_{fault}	Vee		Vee+0.5	V	5
Power Supply Rejection	PSR			100	mVpp	6
Total Jitter Contribution (p-p)	RX ΔTJ			123	ps	7

Notes:
1. AC coupled.
2. Or open circuit.
3. Into 100 Ω differential termination. Data pattern is PRBS 2^7-1.
4. 20 – 80 %.
5. Signal detect is LVTTL. Logic 1 indicates normal operation; logic 0 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver MultiSource Agreement (MSA), September 14, 2000[5].
7. If measured with TJ-free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

IV. Optical Characteristics (T_{OP} = 0 to 70 °C, V_{CC} = 3.0 to 3.6 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Pwr: 50 or 62.5 MMF	P_{OUT}	-9		-3	dBm	1
Optical Wavelength	λ	830		860	nm	
Spectral Width	σ			0.85	nm	
Optical Modulation Amplitude	OMA_{Tx}	196			µW	2
Optical Rise/Fall Time	t_r/ t_f			150	ps	3
Relative Intensity Noise	RIN			-120	dB/Hz	
Total Jitter Contribution (p-p)	TX ΔTJ			119	ps	4
Extinction Ratio @ 1.25 Gb/s	ER	9			dB	
Receiver						
Receiver Sensitivity = 1.0625 Gb/s	Rx_{SENS}			-20	dBm	5
Receiver Sensitivity = 2.125 Gb/s	Rx_{SENS}			-18	dBm	5
Receiver Sensitivity = 1.25 Gb/s	Rx_{SENS}			-20	dBm	6
Stressed RX sens. = 1.0625 Gb/s		0.055			mW	7
Stressed RX sens. = 2.125 Gb/s		0.096			mW	7
Stressed RX sens = 1.25 Gb/s				-13.5	dBm	8
Average Received Power	Rx_{MAX}			0	dBm	
Receiver Elec. 3 dB cutoff freq.				1500	MHz	
Optical Center Wavelength	λ_C	770		860	nm	
Return Loss	RL	12			dB	
Signal Detect Normal	SD_{normal}			-20	dBm	
Signal Detect Fault	SD_{fault}	-30			dBm	
Signal Detect Hysteresis		0.5			dB	

Notes:
1. Class 1 Laser Safety per FDA/CDRH, EN (IEC) 60825 laser safety regulations.
2. Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
3. Unfiltered, 20-80%. Complies with FC 1x and 2x eye mask when filtered.
4. If measured with TJ-free data input signal. In actual application, output TJ will be given by:

$$TJ_{OUT} = DJ_{IN} + \Delta DJ + \sqrt{(TJ_{IN} - DJ_{IN})^2 + (\Delta TJ - \Delta DJ)^2}$$

5. Specifications are for 50 micro-meter or 62.5 micro-meter fiber
6. As measured with 9dB extinction ratio.
7. Measured with conformance signals defined in FC-PI-2 Rev. 7.0 specifications.
8. Measured with conformance signals defined in IEEE 802.3 specifications.

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Data Rate	BR		1.062, 1.25 2.125		Gb/sec	1
Bit Error Rate	BER			10^{-12}		4
Fiber Length on 50/125µm MMF	L			500 300	m	2 3
Fiber Length on 62.5/125µm MMF	L			300 150	m	2 3

Notes:
1. Gigabit Ethernet and 1x, 2x Fibre Channel compatible per IEEE 802.3 and FC-PI-2 Rev. 7.0 respectively.
2. At 1.0625 Gb/s Fibre Channel and 1.25 Gb/s Gigabit Ethernet data rates.
3. At 2.125 Gb/s Fibre Channel data rate.
4. At 1.0625, 1.25, and 2.125Gb/s with PRBS 2^7-1.

VI. Environmental Specifications

FTLF8519F2xCL SFF transceivers have an operating temperature range from 0°C to +70°C case temperature.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T_{op}	0		70	°C	
Storage Temperature	T_{sto}	-40		85	°C	

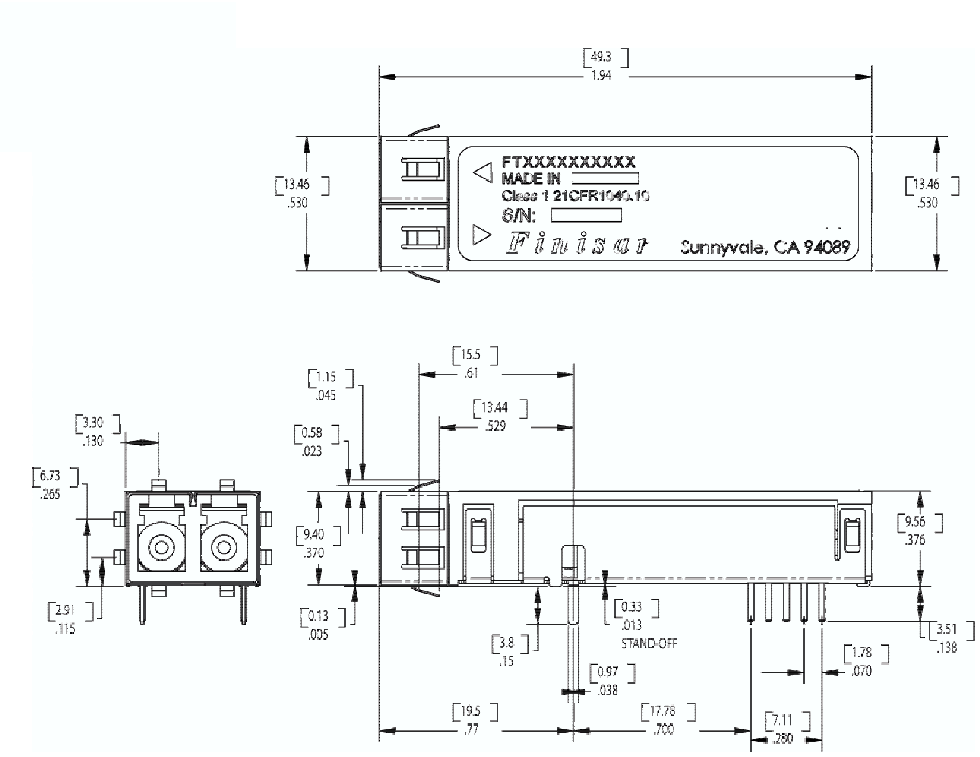
Notes:
1. SFF transceivers may be water washed. However, the process must be followed by a baking step at 80°C for one hour, to ensure the drying of any water which may be trapped inside then shells of the modules.

VII. Regulatory Compliance

Finisar transceivers are Class 1 Laser Products and comply with US FDA regulations. These products are certified by TÜV and CSA to meet the Class 1 eye safety requirements of EN (IEC) 60825 and the electrical safety requirements of EN (IEC) 60950. Copies of certificates are available at Finisar Corporation upon request.

VIII. Mechanical Specifications

Finisar's Small Form Factor (SFF) transceivers comply with the standard dimensions defined by the Small Form Factor Multi-Sourcing Agreement (MSA).



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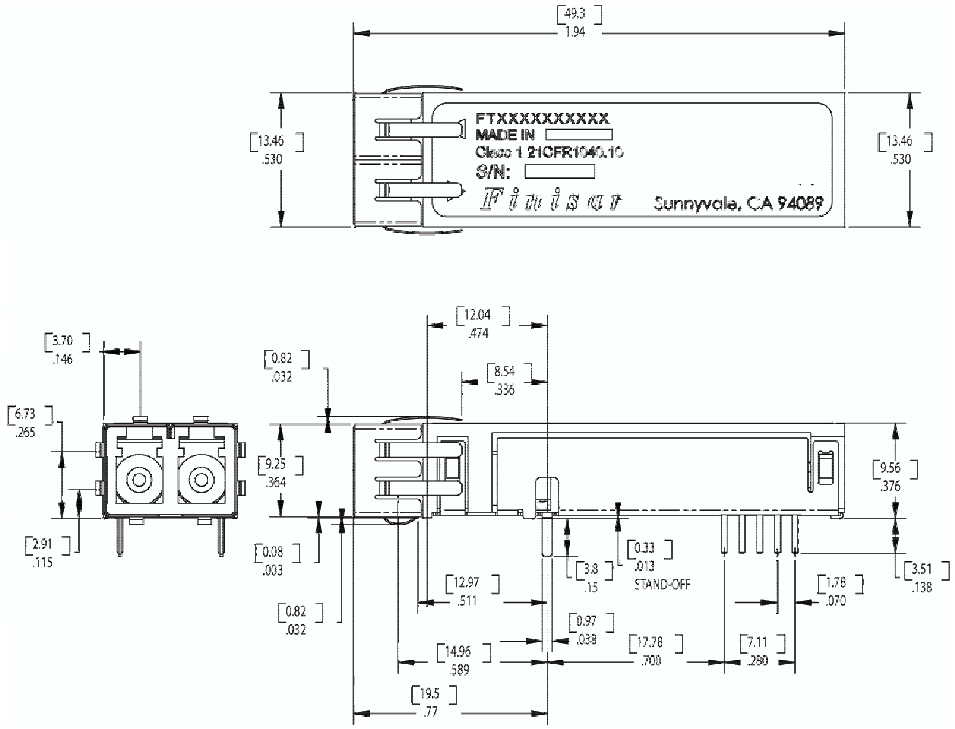

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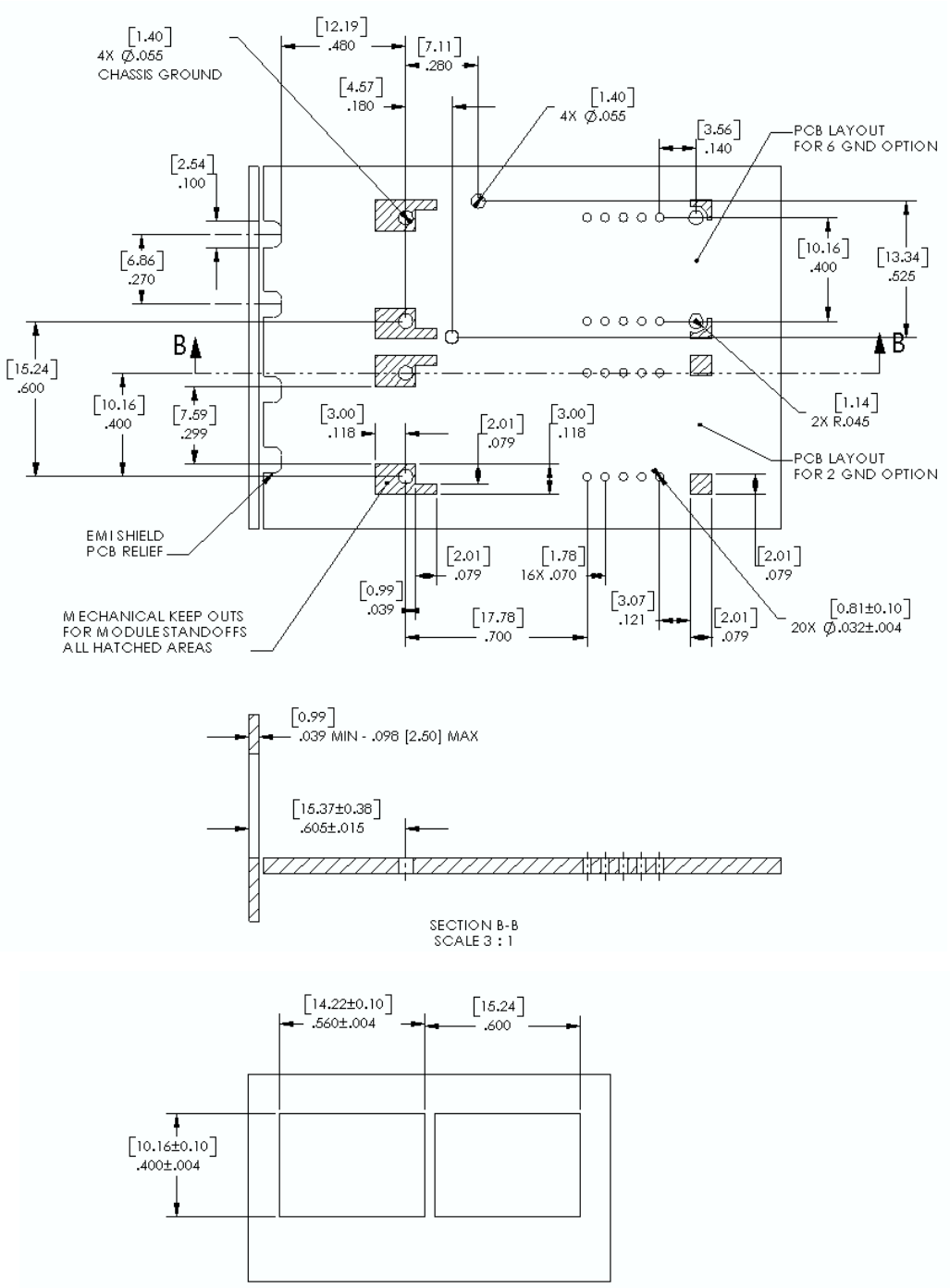
IX. PCB Layout and Bezel Recommendations



Minimum Recommended Pitch is 0.600”

X. References

1. Small Form Factor (SFF) Transceiver Multi-source Agreement (MSA). July 5, 2000.

2. IEEE Std 802.3, 2002 Edition, Clause 38, PMD Type 1000BASE-SX.
   IEEE Standards Department, 2002.

3. "Fibre Channel Draft Physical Interface Specification (FC-PI-2 Rev. 7.0)". American National Standard for Information Systems.

4. Directive 2002/95/EC of the European Council Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment." January 27, 2003.

5. Small Form-factor Pluggable (SFP) Transceiver Multi-source Agreement (MSA), September 14, 2000.

XI. For More Information

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Finisar

Application Note AN-2038

Finisar Implementation of RoHS Compliant Transceivers

On January 23, 2003 the European Parliament issued the following directive to support the objectives of their environmental policy;

> 2002/95/EC deals with the **R**estriction on the use **o**f certain **H**azardous **S**ubstances (RoHS) in electrical and electronic equipment. Commonly referred to as the RoHS directive, it becomes effective July 1, 2006.

Finisar has developed, and continues to develop, products that comply with the European Union's RoHS legislation. The law requires that new electrical and electronic equipment put on the market effective July 1, 2006 do not contain certain specified substances. This directive can be found using the following link;

http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_037/l_03720030213en00190023.pdf

The six restricted hazardous substances are:

Lead (Pb)
Mercury (Hg)
Cadmium (Cd)
Hexavalent Chromium (Cr6)
Polybrominated biphenyls (PBB)
Polybrominated diphenyl ethers (PBDE)

For concentration limits of the restricted substances in components Finisar is using the levels recommended by the Technical Adaptation Committee of the European Commission. The maximum concentration limits for the restricted hazardous substances are:

0.1% by weight in homogeneous materials for Pb, Hg, Cr^6, PBB, and PBDE.
0.01% by weight in homogeneous materials for Cd.

Homogeneous material is defined as material that cannot be mechanically broken down into different constituents.

The Annex of Directive 2002/95/EC lists several exemptions to the restriction of hazardous substances. The only exemption that is being invoked for Finisar Transceivers is item 5 of the annex which exempts “Pb in the glass of cathode ray tubes, electronic components and fluorescent tubes.” Finisar transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

Other Pb-Free Product Application Issues

1. Since SFPs and GBICs are pluggable modules there is no issue with attachment of these transceivers to a customer’s host board.
2. For SFF modules, Finisar has chosen to use gold flash over Ni for all the pins that attach to the host board. The pins of the transceivers are capable of withstanding 260ºC for 10 seconds, which is the typical condition required for wave soldering of the pins.
3. The gold plated pins on lead free transceivers are backwards compatible with lead-based solder attachment processes.
4. The industry has had a concern over the use of bright tin on copper leads, because under certain conditions tin whiskers are known to have developed causing bridging and shorting against adjacent leads. For components that require tin on copper Finisar transceivers use matte tin over Ni plate to overcome this problem.

Finisar

Application Note AN-2041

Assembly Application Note
For Pin-Through-Hole Transceiver Modules

SOLDERING:

Finisar through-hole leaded modules may be wave soldered or hand soldered during assembly. Reflow soldering assembly methods should not be used.

Below is provided guidance on typical soldering conditions in terms of time and temperature. However, since there are differences among soldering systems, the conditions below are only provided as a guideline. Additional information is provided below that should make it possible to find the specific conditions for any wave soldering line.

Soldering Process	Acceptable Conditions
Wave Soldering	• Module case temperature should not exceed 100^{o}C for more than 30 seconds during preheat. • Solder wave temperature < 260^{o}C for < 10 sec
Soldering Iron	Iron Temperature < 350^{o}C, < 5 seconds
Reflow Soldering	Not Recommended

FLUXES AND CLEANING:

No clean processes are generally preferred but water-soluble fluxes / aqueous cleaning can also be used. The modules have been tested in aqueous cleaning conditions with no adverse effects, provided that the units are thoroughly dried to drive off entrapped moisture after cleaning. Baking the washed assembly at 80^{o}C for an hour is recommended to ensure complete drying. The use of process plugs in the optical ports is also recommended to avoid entrapping contaminants inside the optics.

ADDITIONAL INFORMATION:

This information is based on the premise that in wave soldering systems the board and components on the board never reach the steady-state temperature of the preheat zone. Rather the system program attempts to preheat the board and components to a minimum desired temperature by exposing them to a higher, and potentially component damaging temperature, for a short enough period of time that the components do not reach damage threshold.

The transceiver module can withstand 90^{o}C temperatures continuously without damage. In a typical wave soldering system the transceiver module should be safe as long as the temperature of the case at its upper side does not exceed 100^{o}C for more than 30 seconds during the preheat cycle. Making a measurement with a thermocouple firmly attached to the case in a trial run would confirm the maximum dwell time in the preheat zone that could be used.