THE DATASHEET OF

STM1E-SFP02

STM1E-SFPxx 155Mbps Copper Transceiver
Final Datasheet

Features

- Compatible with the Multi-Source Agreement (MSA) for SFP transceivers
- 75Ω media interface compliant with ITU-T G.703 and Telcordia GR-253 for CMI coded 155Mbps electrical interfaces
- ITU-T G.783 compatible loss of signal detect
- Transmit power down and tri-state control
- Handles over 12.7dB of cable loss
- Extended Temperature operation: -20 C to 85 C
- 75Ω DIN 1.0/2.3 female coaxial media interface supports Type A and Type D coupling
- Low power dissipation (0.6 W typical)
- Compliant with RoHS 6/6 (lead-free)

Benefits

- Compatible with existing OC3/STM1o line cards using the pluggable SFP form factor
- Provides end user flexibility on a per port basis
- Reduces cost to system developers for offering STM-1 electrical interfaces
- Eliminates risk of laser wear out for central office interconnects

Description

The **STM1E-SFPxx** is a Small Form-factor Pluggable (SFP) module compatible with the Multi Source Agreement (MSA) for SFP transceivers. The module utilizes the latest generation of Line Interface Units (LIUs) for 155 Mbit/s electrical interfaces (STM-1e, ES1) from Teridian Semiconductor Corporation (TSC). It also includes all the necessary components for interfacing to 75Ω telecommunications coaxial cable.

The Teridian 78P2351R physical layer IC includes Clock & Data Recovery in both directions and a CMI encoder/decoder for transparent NRZ to CMI line code conversion. It provides Receive Loss of Signal (LOS) detection for electrical CMI interfaces and the option to disable (and tri-state) the transmit driver. A serial interface provides access to an on board EEPROM for identification information.

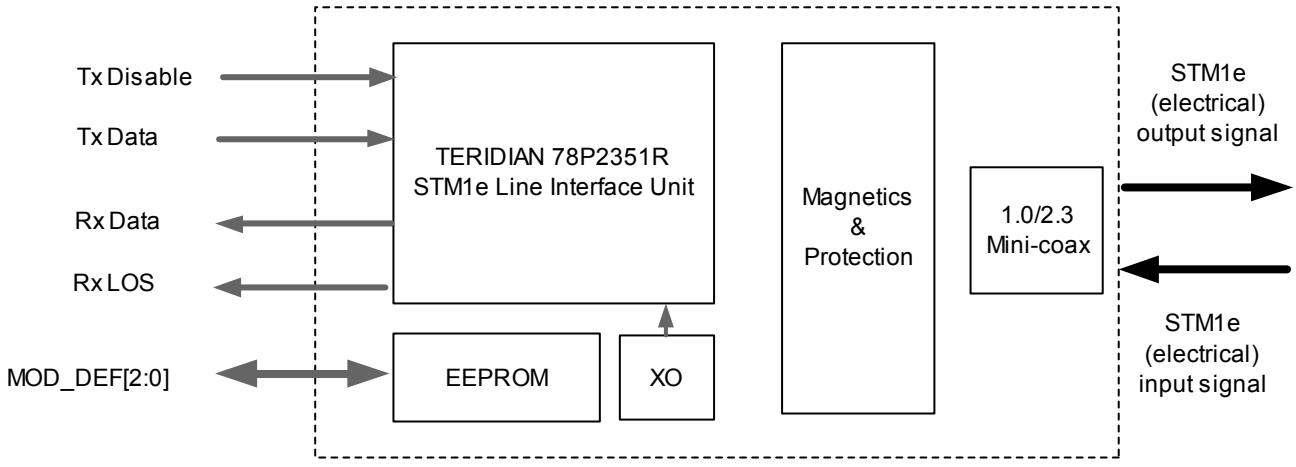


Figure 1: Transceiver Functional Diagram

Data and Control Interface

The STM1E-SFPxx data I/Os accept and provide differential signals at 155.52Mbit/s. AC-coupling for both transmit and receive traces is handled internally and is thus not required on the host board.

The receive data outputs (RD+/-) provide the recovered STM1/STS3 data to the host in NRZ coding. During Rx LOS of signal conditions, the receive outputs are squelched. The RD+/- traces on the host card should be of equal length and differentially terminated with 100Ω at the user SerDes.

The transmit data inputs (TD+/-) accept STM1/STS3 NRZ data at CML or LVPECL levels. The transmit timing is recovered inside the 78P2351R LIU and used for the CMI line encoding and transmit pulse driver. The TD+/- traces on the host card should be of equal length.

The physical layer IC used in the STM1E-SFPxx does not require reset or software configuration. Only an optional Transmit Disable control pin is available for enabling or powering down the transmit driver.

For status monitoring, a Receive Loss of Signal indicator is provided. Loss of Signal detection for STM-1e (electrical) interfaces is inherently different from optical LOS detection. Reference ***Receiver Loss of Signal Condition*** section for more info on LOS detection criteria for STM-1e (ES1) interfaces.

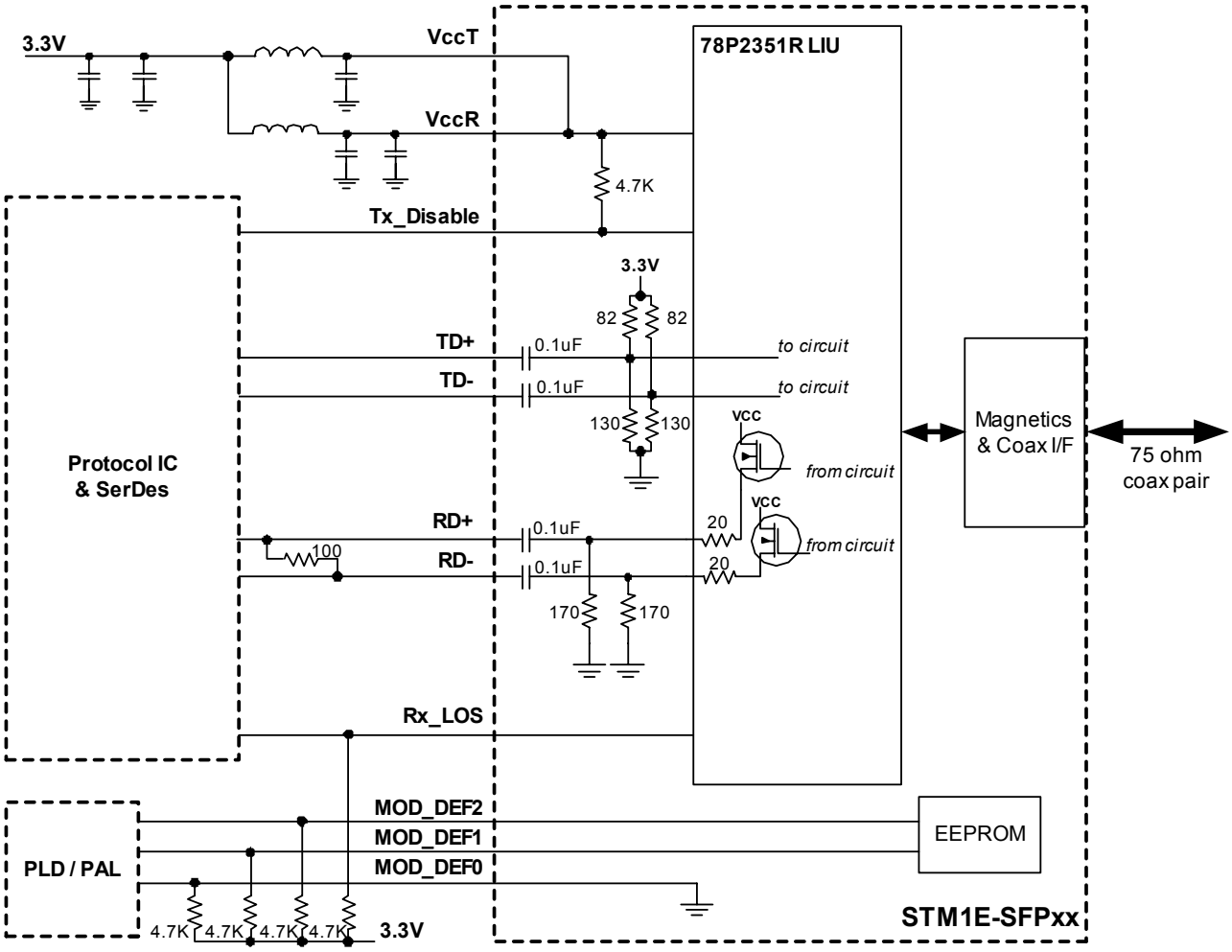


Figure 2: Typical Application Configuration

Serial ID Interface

The STM1E-SFPxx supports the 2-wire serial EEPROM protocol for the ATMEL AT24C01 as defined by the MSA. The serial interface provides access to identification information. The memory is organized as byte wide data words that can be addresses individually or sequentially at device address 1010000X (A0h).

Special Design Considerations for Using STM1E-SFPxx Transceivers

Host enclosures that use SFP devices should provide appropriate clearances between the SFP transceivers to allow room for the larger width of the 1.0/2.3 mini-coax front end. For most systems a nominal centerline-to-centerline spacing of 16.25mm (0.640") is sufficient, but preferred coax cable types and routing clearances may require additional spacing.

NOTE: To accommodate the preferred Type D coax coupling and cable types, the width of the nosepiece or front end was designed to exceed the MSA requirements of 13.7mm (+/- 0.1).

- Reference INF-8074 [Appendix A, Table 1, Designator A] for MSA recommendations
- Reference ***Mechanical Drawings*** section for STM1E-SFPxx transceiver dimensions.

The SFP transceiver insertion slot should be clear of nearby moldings and covers that might block convenient access to the unique latching mechanism used in the STM1E-SFPxx. A bail-style de-latch was not feasible with a coaxial network interface so a simple push button actuator was employed. Detaching the coax cable from the STM1E-SFPxx is not required for de-latching the transceiver from the host card.

NOTES:

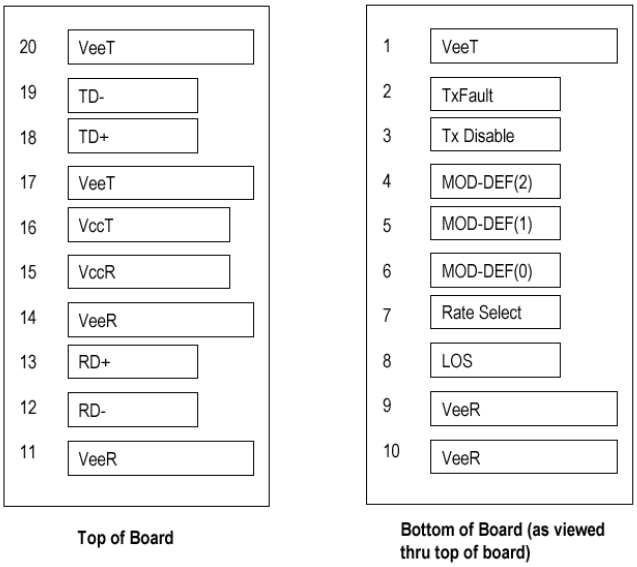
1. In order to secure the larger push button de-latch mechanism, the length of the bottom of the transceiver exceeds the maximum MSA requirements of 2.0mm.
   - Reference INF-8074 [Appendix A, Table 1, Designator Y] for MSA recommendations
   - Reference ***Mechanical Drawings*** section for STM1E-SFPxx transceiver dimensions.
2. Note: Double-sided board mounting is generally not recommended due to the limited clearance for de-latching the STM1E-SFPxx transceiver.

Mating the STM1E-SFPxx PCB to Host Connector

The SFP utilizes a printed circuit board (PCB) to mate with a host card equipped an SFP electrical connector. The pads are designed for sequenced mating as follows:

1. Ground contacts first
2. Power contacts second
3. Data & Control contacts third

The design of the mating portion of the transceiver printed circuit board is illustrated below. Reference INF-8074 for generic SFP guidelines for the host board.



Top of Board

Bottom of Board (as viewed thru top of board)

Host Interface Pinout

Pin	Name	Description	Notes
1	VeeT	Transmitter ground.	Note 1
2	Tx Fault	Not supported in STM1E-SFPxx. Grounded internally.	
3	Tx Disable	Transmit Disable. When pin is high or open, the transmitter is powered down and tri-stated.	
4	MOD-DEF2	Module Definition 2. Bi-directional data pin of two wire serial ID interface. This pin is open-drain and may be wired-ORed with other open-drain or open-collector devices.	
5	MOD-DEF1	Module Definition 1. Clock pin of two wire serial ID interface. Data is clocked into EEPROM device on the positive edge and clocked out on the negative edge.	
6	MOD-DEF0	Module Definition 0. Grounded internally. Used to notify host system that an SFP is present.	
7	Rate Select	Not supported in STM1E-SFPxx. Floating internally.	
8	RLOS	Receive Loss of Signal. Asserted when the received signal is less than approximately 19dB below nominal for 110 UI. The RLOS condition is cleared when the received signal is greater than approximately 18dB below nominal for 110 UI.	Note 2
9	VeeR	Receiver ground.	Note 1
10	VeeR	Receiver ground.	Note 1
11	VeeR	Receiver ground.	Note 1
12	RD-	Recovered receive NRZ data output (inverted).	
13	RD+	Recovered receive NRZ data output.	
14	VeeR	Receiver ground.	Note 1
15	VccR	Receiver power supply (+3.3V).	Note 3
16	VccT	Transmitter power supply (+3.3V).	Note 3
17	VeeT	Transmitter ground.	Note 1
18	TD+	Transmit NRZ data input.	
19	TD-	Transmit NRZ data input (inverted).	
20	VeeT	Transmitter ground.	Note 1

Notes:

1. Transmit and Receive grounds are connected directly together internally. For STM1E-SFP08 version, circuit grounds are also connected to frame/chassis ground.
2. During Rx LOS conditions, the receive data outputs RD+/- are squelched. See Receiver Loss of Signal Condition section for more information on LOS detection for STM-1e interfaces.
3. Transmit and Receive power supplies are connected together internally.

ABSOLUTE MAXIMUM RATINGS
Operation beyond these limits may permanently damage the device.

PARAMETER	RATING
Supply Voltage (VccT, VccR)	-0.5 to 3.6 VDC
Storage Temperature	-65 to 150 °C

RECOMMENDED OPERATING CONDITIONS
Unless otherwise noted all specifications are valid over these temperatures and supply voltage ranges.

PARAMETER	RATING
DC Voltage Supply (VccT, VccR)	3.15 to 3.45 VDC
Ambient Operating Temperature	-20 to 85°C

DC CHARACTERISTICS:

PARAMETER	SYMBOL	CONDITIONS	MIN	NOM	MAX	UNIT
Supply Current	Idd	Max cable length		170	190	mA
Receive-only Supply Current	Iddr	Transmitter disabled		100		mA

DIGITAL I/O CHARACTERISTICS:
Tx Disable input:

PARAMETER	SYMBOL	CONDITIONS	MIN	NOM	MAX	UNIT
Input Voltage Low	Vil				0.8	V
Input Voltage High	Vih		2.0			V

TD+/- data inputs:

PARAMETER	SYMBOL	CONDITIONS	MIN	NOM	MAX	UNIT
Single-ended Signal Swing	Vpki		0.3		1.2	V

RD+/- data outputs:

PARAMETER	SYMBOL	CONDITIONS	MIN	NOM	MAX	UNIT
Single-ended Signal Swing	Vpk	Differentially terminated with100Ω	0.5	0.7	1.0	V
Rise & Fall Time	Tf	10-90%		0.8	1.2	ns

RxLOS output:

PARAMETER	SYMBOL	CONDITIONS	MIN	NOM	MAX	UNIT
Output Voltage Low	Vol	Iol = 8mA			0.4	V
Pull-up Resistor	Rpu			4.7		kΩ

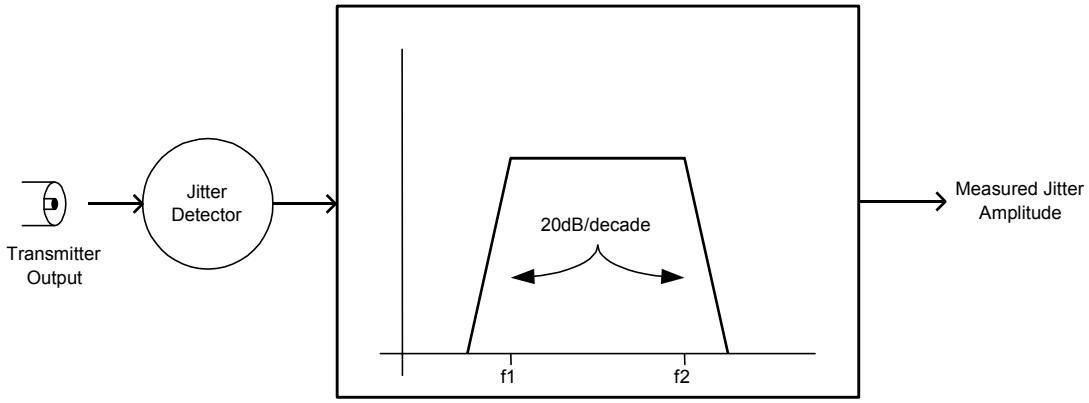
TRANSMITTER SPECIFICATIONS FOR CMI (COAX) INTERFACE

Bit Rate: 155.52Mbits/s ± 20ppm
Line Code: Coded Mark Inversion (CMI)
Relevant Specification: ITU-T G.703, ANSI T1.102, Telcordia GR-253-CORE

With the coaxial output port driving a 75Ω load, the output pulses conform to the templates in ITU-T G.703 and G.783. These specifications are tested during production test.

PARAMETER	CONDITION	MIN	NOM	MAX	UNIT
Peak-to-peak Output Voltage	Template, steady state	0.9		1.1	V
Rise/ Fall Time	10-90%			2	ns
Transition Timing Tolerance	Negative Transitions	-0.1		0.1	Ns
	Positive Transitions at Interval Boundaries	-0.5		0.5	
	Positive Transitions at mid-interval	-0.35		0.35	
Return Loss	7MHz to 240MHz	15			dB

TRANSMITTER OUTPUT JITTER
The transmit jitter specification ensures compliance with ITU-T G.813, G.823, G.825, G.958 and Telcordia GR-253-CORE for STS-3/STM-1. Transmit output jitter is not tested during production test.



PARAMETER	CONDITION	MIN	NOM	MAX	UNIT
Transmitter Output Jitter	200 Hz to 3.5 MHz, measured with respect to CKREF for 60s		0.055	0.075	UIpp

RECEIVER SPECIFICATIONS FOR CMI (COAX) INTERFACE

The input signal is assumed compliant with ITU-T G.703 and can be attenuated by the dispersive loss of a cable. The minimum cable loss is 0dB and the maximum is –12.7dB at 78MHz.

PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
Flat-loss Tolerance	0 to 12.7dB cable (loss) attenuation	-2		4	dB
Latency			5	10	UI
DLL Lock Time			1	10	µs
Return Loss	7MHz to 240MHz	15			dB

RECEIVER JITTER TOLERANCE

The STM1E-SFPxx exceeds all relevant jitter tolerance specifications shown in Figure 10. Receive jitter tolerance is not tested during production test.

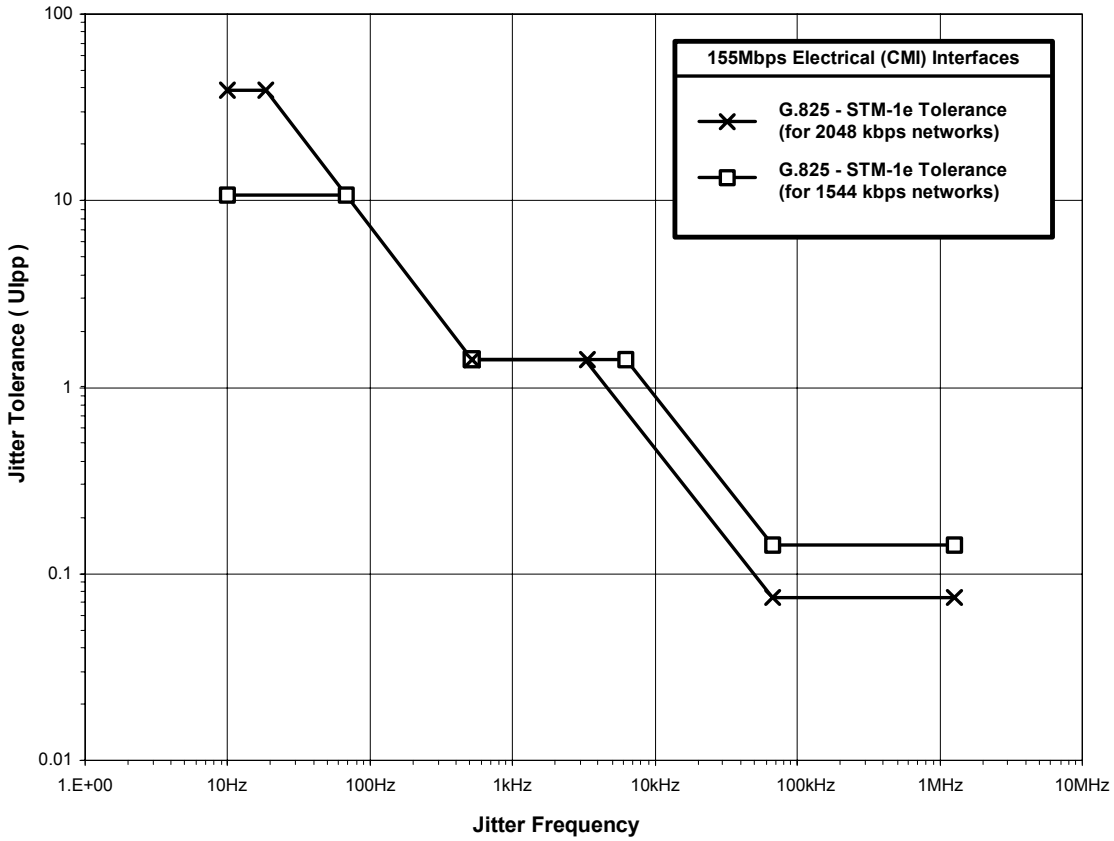


Figure 10: Jitter Tolerance - electrical (CMI) interfaces

PARAMETER	CONDITION	MIN	NOM	MAX	UNIT
STM-1e Jitter Tolerance	10Hz to 19.3Hz	38.9			UIpp
	19.3Hz to 500Hz		750 f-1		µs
	500Hz to 6.5kHz	1.5			UIpp
	6.5kHz to 65kHz		9800 f-1		µs
	65kHz to 1.3MHz	0.15	0.30		UIpp

RECEIVER JITTER TRANSFER FUNCTION

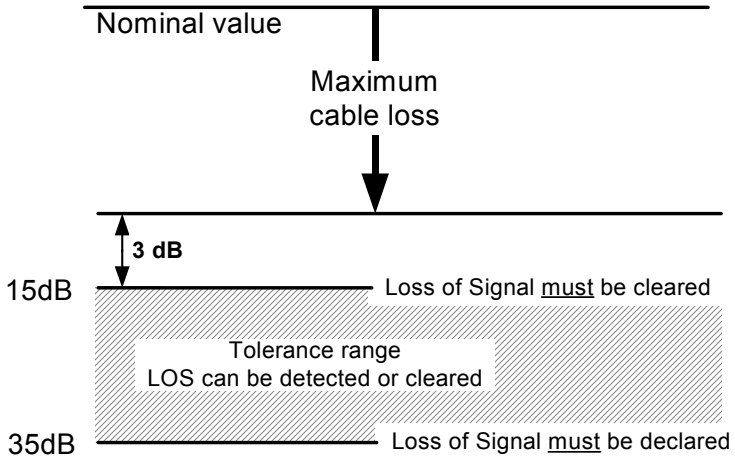
The receiver clock recovery loop filter characteristics such that the receiver has the following transfer function. The corner frequency of the DLL is approximately 120 kHz. Receiver jitter transfer function is not tested during production test.

Figure 11: Jitter Transfer

PARAMETER	CONDITION	MIN	NOM	MAX	UNIT
Receiver Jitter transfer function	below 120 kHz			0.1	dB
Jitter transfer function roll-off			20		dB per decade

Receiver Loss of Signal Condition

PARAMETER	CONDITION	MIN	TYP	MAX	UNIT
LOS threshold		-35	-19	-15	dB
LOS timing		10	110	255	UI



ENVIRONMENTAL & REGULATORY COMPLIANCE

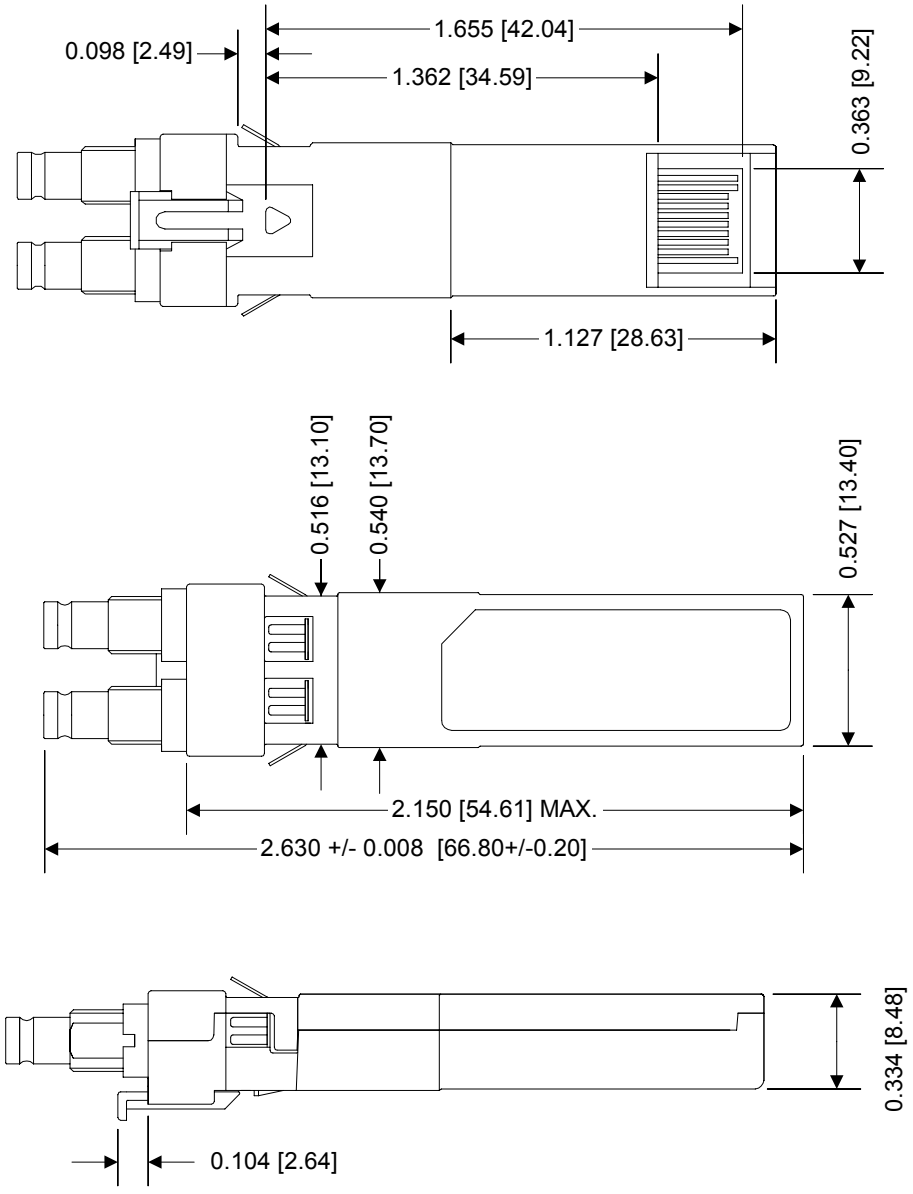
Description	Test Method	STM1E-SFPxx Result
ESD threshold (at electrical pins)	Human Body Model MIL-STD-883	Class 2 (≥ 2000 Volts)
*ESD Immunity at faceplate	IEC-61000-4-2 Contact Discharge	A/B
	IEC-61000-4-2 Air Discharge	A
Surge Immunity, 1.0kV	ITU-T K.41 IEC-61000-4-5	B
Radiated Emission	FCC Part 15 Class B EN55022 CISPR 22	Pass > 6dB Margin
Radiated Immunity	IEC-801-3 EN55082-1 IEC-61000-4-3 GR-1089	A
Component Recognition	CSA C22.2 UL 60950-1	Pass / UL File# E143101

*Immunity performance for ESD Immunity at the faceplate may vary with system design.

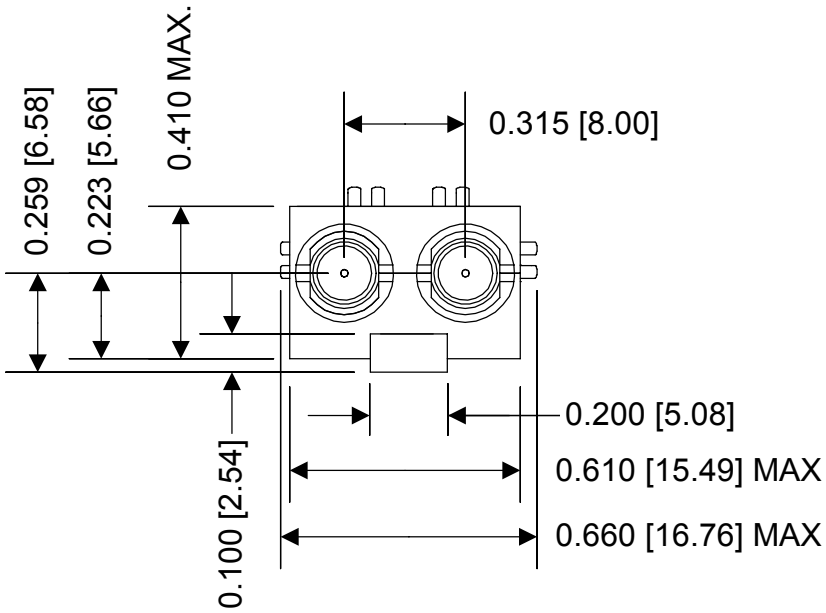
MECHANICAL DRAWINGS

The STM1E-SFPxx is assembled in a Nickel plated Zinc die cast housing. The coaxial connectors feature a Brass body with Gold over Nickel plating and an inner contact made of Beryllium Copper.

The STM1E-SFPxx complies with RoHS directive 2002/95/EC (RoHS-6) and is UL94-V0 compliant.



MECHANICAL DRAWINGS



NOTES:
1. HOUSINGS -- NICKEL PLATED ZINC DIE CAST BODIES.
2. ACTUATOR -- UL94 V0 POLYCARBONATE
3. GROUNDING TAB -- TIN OR NICKEL PLATED BRASS
4. 1.0/2.3 CONNECTORS -- BULKHEAD STYLE JACKS WITH THREADED COUPLING INTERFACE
5. REFERENCE SFP MULTISOURCE AGREEMENT FOR DIMENSIONAL REQUIREMENTS

EEPROM CONTENTS

The MOD-DEF interface of the STM1E-SFPxx provides access to serial ID information per MSA guidelines. The data is stored in a write-protected EEPROM at device address A0h. Contact Teridian for availability of custom EEPROM maps.

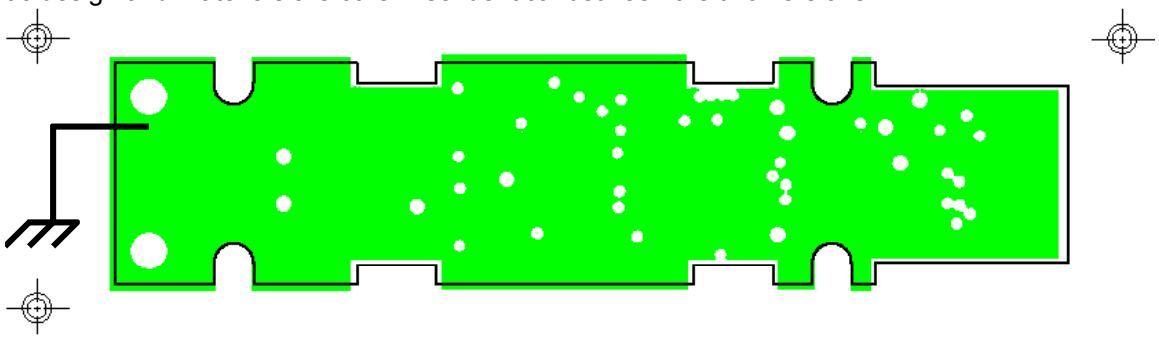
Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	ASCII
0	03		39	39		78			117	00	
1	04		40	53	**S**	79			118	00	
2	FE		41	54	**T**	80	**Note 3**		119	00	
3	00		42	4D	**M**	81			120	00	
4	00		43	31	**1**	82			121	00	
5	00		44	45	**E**	83			122	00	
6	00		45	2D	**-**	84			123	00	
7	00		46	53	**S**	85	**Note 4**		124	00	
8	00		47	46	**F**	86			125	00	
9	00		48	50	**P**	87			126	00	
10	00		49	30	**0**	88	20		127	00	
11	05		50	**Note 1**		89	20				
12	02		51	20		90	20				
13	00		52	20		91	20				
14	00		53	20		92	00				
15	00		54	20		93	00				
16	00		55	20		94	00				
17	00		56	**Note 2**		95	**Note 5**				
18	78		57			96	00				
19	00		58	20		97	00				
20	54	**T**	59	20		98	00				
21	45	**E**	60	00		99	00				
22	52	**R**	61	00		100	00				
23	49	**I**	62	00		101	00				
24	44	**D**	63	**Note 5**		102	00				
25	49	**I**	64	00		103	00				
26	41	**A**	65	12		104	00				
27	4E	**N**	66	00		105	00				
28	20		67	00		106	00				
29	20		68			107	00				
30	20		69			108	00				
31	20		70			109	00				
32	20		71			110	00				
33	20		72	**Note 3**		111	00				
34	20		73			112	00				
35	20		74			113	00				
36	00		75			114	00				
37	00		76			115	00				
38	C0		77			116	00				

Notes:

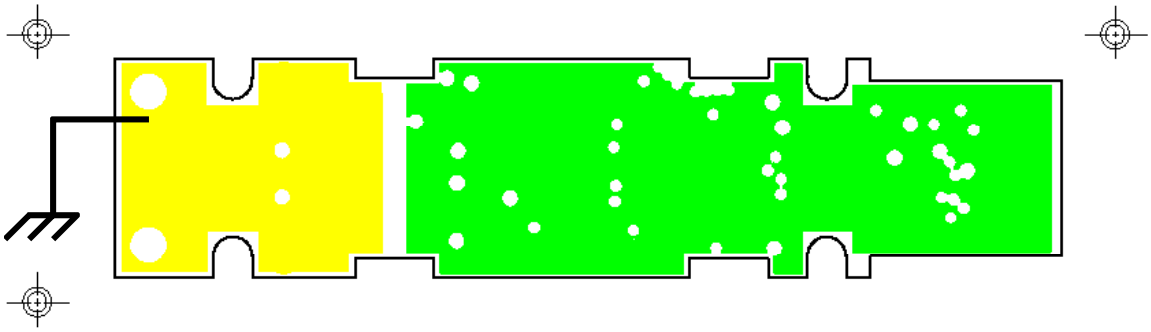
1. Address 50 specified the unique model.
   - 32h used for STM1E-SFP02 and 38h used for STM1E-SFP08.
2. Address 56-57 specifies the product revision code.
3. Address 68-83 specifies a unique serial number
4. Address 84-87 specifies the date code in format YYWW
5. Address 63 and 95 are check sums for bytes 0-62 and bytes 64-94 respectively.

PRODUCT VERSIONS

Two versions of the STM1E-SFPxx are available to match the grounding implementation of the host system. Schematic design and materials are otherwise identical between the two versions.

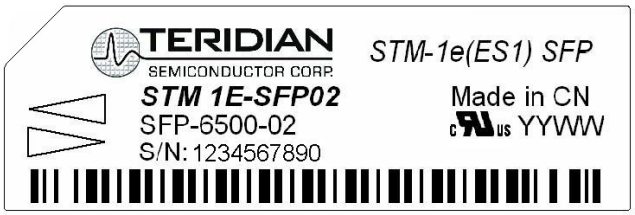


STM1E-SFP08: Frame and supply grounds connected together



STM1E-SFP02: Frame (left) and supply (right) grounds isolated at transformer.

ORDERING INFORMATION

PART DESCRIPTION	ORDER NUMBER	LABEL MARKING
STM-1e (ES1) SFP Transceiver; Grounds Isolated; Lead-free	STM1E-SFP02	
STM-1e (ES1) SFP Transceiver; Grounds Connected; Lead-free	STM1E-SFP08	

REVISION HISTORY

v2-0	**February 22, 2006:** ***Final Datasheet Initial Release***
v2-1	**February 7, 2007** ▪ Added 6/6 RoHS compliant feature (lead-free)
v2-2	**August 2008** ▪ Updated the product label with UL logo

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http://www.Teridian.com

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