

942-741

SC Duplex Single Mode Transceiver

Technical Data

SDX1155

Features

- SC Duplex Single Mode Transceiver
- Intermediate SONET OC3 SDH STM1 (S1.1) Compliant
- Single +5 Volt Power Supply
- Multisourced 1 x 9 Pin Configuration
- Aqueous Washable Plastic Package
- Interchangeable with LED multisourced 1 x 9 Transceivers
- Unconditionally eyesafe laser IEC 825/CDRH Class 1 Compliant

Applications

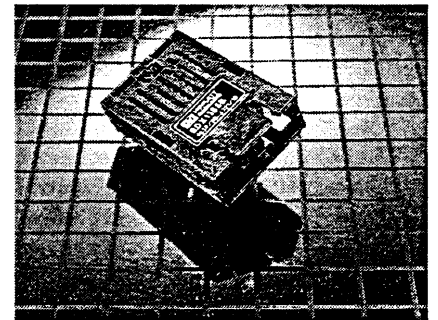
- SONET/SDH Equipment Interconnect
- ATM

Description

The SDX1155 transceiver is a high performance, cost effective module for serial optical data communications applications specified for a signal rate of 155 Mbaud. It is designed to provide a SONET/SDH compliant link for 155 Mbit/s intermediate reach links.

This module is designed for single mode fiber and operates at a nominal wavelength of 1300 nm. It incorporates Hewlett-Packard's high performance, reliable, long wavelength optical devices and proven circuit technology to give long life and consistent service.

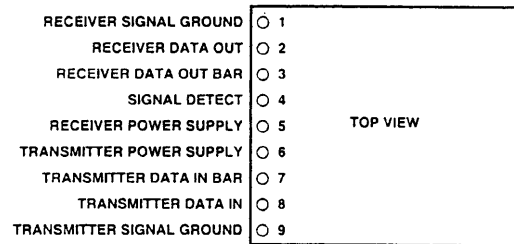
The transmitter section uses an advanced Fabry Perot laser with full IEC 825 and CDRH Class I eye safety.



The receiver section uses an MOVPE grown planar PIN photodetector for low dark current and excellent responsivity.

A pseudo-ECL logic interface simplifies interface to external circuitry.

Connection Diagrams



Pin Descriptions:

Pin 1 Receiver Signal Ground: **Pin 5 Receiver Power Supply:**

Pin 2 Receiver Data Out: **Pin 6 Transmitter Power Supply:**

Pin 3 Receiver Data Out Bar: **Pin 7 Transmitter Data In Bar:**

Pin 4 Signal Detect: **Pin 8 Transmitter Data In:**

Logic 1 = Normal Operation.
Logic 0 = Fault Condition.

Pin 9 Transmitter Signal Ground:

Functional Description Receiver Section

Design

The receiver section contains an InGaAs/InP photo detector and a preamplifier within the receptacle, coupled to a postamp/decision circuit on a separate circuit board.

The postamplifier is ac coupled to the preamplifier as illustrated in Figure 1. The coupling capacitor is large enough to pass the SONET/SDH test pattern at 155 Mbaud without significant distortion or performance penalty. If a lower signal rate, or a code which has significantly more low frequency content is used, sensitivity, jitter and pulse distortion could be degraded.

Figure 1 also shows a filter network which limits the bandwidth of the preamp output signal. The filter is designed to bandlimit the preamp output noise and thus improve the receiver sensitivity.

These components will also reduce the sensitivity of the receiver as the signal bit rate is increased above 155 Mbaud.

Noise Immunity

The receiver includes internal circuit components to filter power supply noise. Under some conditions of EMI and power supply noise, external power supply filtering may be necessary. If receiver sensitivity is found to be degraded by power supply noise, the filter network illustrated in Figure 2 may be used to improve performance. The values of the filter components are general recommendations and may be changed to suit a particular system environment. Shielded inductors are recommended.

Terminating the Outputs

The PECL Data outputs of the receiver may be terminated with the standard Thevenin-equivalent 50 Ohm to $V_{CC} - 2$ Volt termination. Other standard PECL terminating techniques may be used.

The two outputs of the receiver should be terminated with identical load circuits to avoid unnecessarily large ac current in V_{CC} . If the outputs are loaded identically, the ac current is largely nulled. The SD output of the receiver is PECL logic and must be loaded if it is to be used. The signal detect circuit is much slower than the data path, so the ac noise generated by an asymmetrical load is negligible. Power consumption may be reduced by using a higher than normal load impedance for the SD output. Transmission line effects are not generally a problem as the switching rate is slow.

The Signal Detect Circuit

The signal detect circuit works by sensing the peak level of the received signal and comparing this level to a reference.

Figure 1 - Receiver Block Diagram

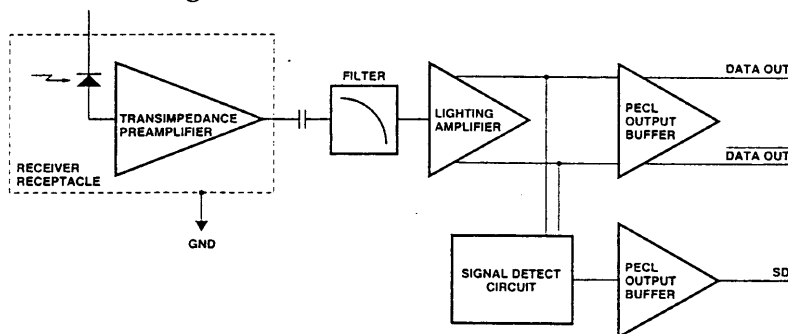
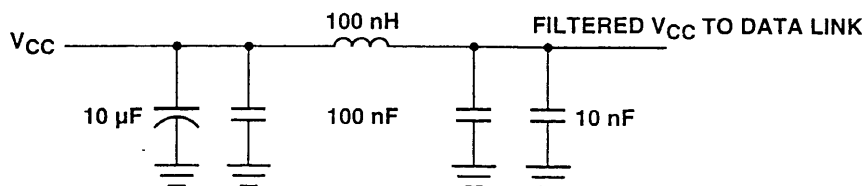


Figure 2 - π Filter Network for Noise Filtering



Functional Description Transmitter Section

Design

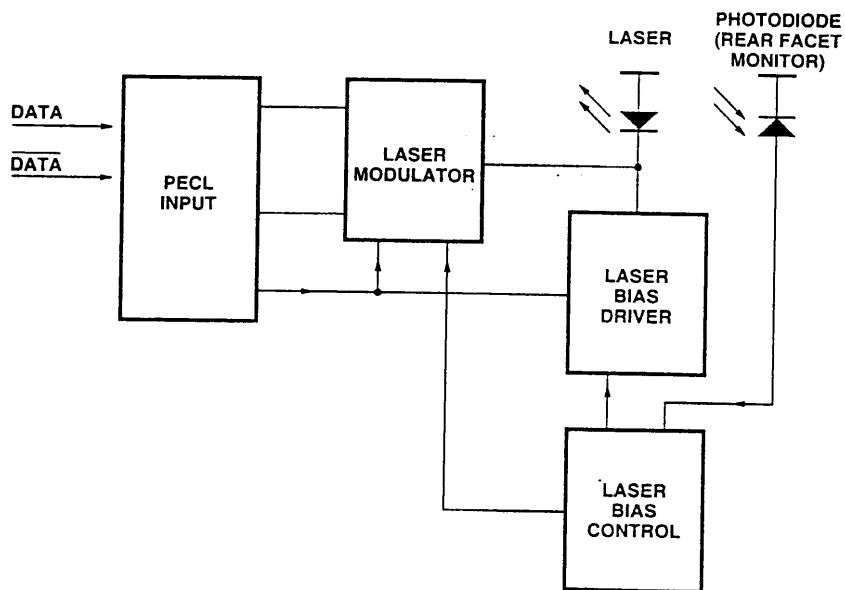
The transmitter section uses a buried heterostructure Fabry - Perot laser as its optical source. The package of this laser is designed to allow repeatable coupling into single mode fiber. In addition, this package has been designed to be compliant with IEC 825 eye safety requirements under all fault conditions. The optical output is controlled by a custom IC which detects the laser output via the monitor photodiode. This IC provides both dc and ac current drive to the laser to ensure correct modulation, eye diagram and extinction ratio over temperature, supply voltage and life.

PCB mounting

The SDX1155 has two solderable mounting studs. These studs are not electrically connected. The transceiver is designed for common production processes. It may be wave soldered and aqueous washed providing the process plug is in place.

Each process plug can only be used once during processing, although with subsequent use, it can be used as a dust cover.

Figure 3 - Simplified Transmitter Schematic



Performance Specifications

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	Ts	-40	+85	°C
Operating Temperature	-	0	70	°C
Lead Soldering Temperature/Time	-	-	240/10	°C/s
Output Current (other outputs)	I out	0	30	mA
Input Voltage	-	GND	Vcc	V
Power Supply Voltage	-	0	+6	V

Operating Environment

Parameter	Symbol	Minimum	Maximum	Units
Power Supply Voltage	Vcc	+4.75	+5.25	V
Ambient Operating Temperature	T op	0	70	°C

Transmitter Section

(Ambient Operating Temperature Ta = 0°C to 70°C , Vcc = 4.75V to 5.25V)

Parameter	Symbol	Minimum	Maximum	Units	Notes
Output Center Wavelength	λ_{ce}	1261	1360	nm	-
Output Spectral Width (RMS)	$\Delta\lambda$	-	7.7	nm	-
Average Optical Output Power	Po	-15	-8.0	dBm	1
Extinction Ratio	Er	8.2	-	dB	-
Power Supply Current	I cc	-	140	mA	2
Output Eye	Compliant with Bellcore TR-NWT-000253 and ITU recommendation G957				

Receiver Section

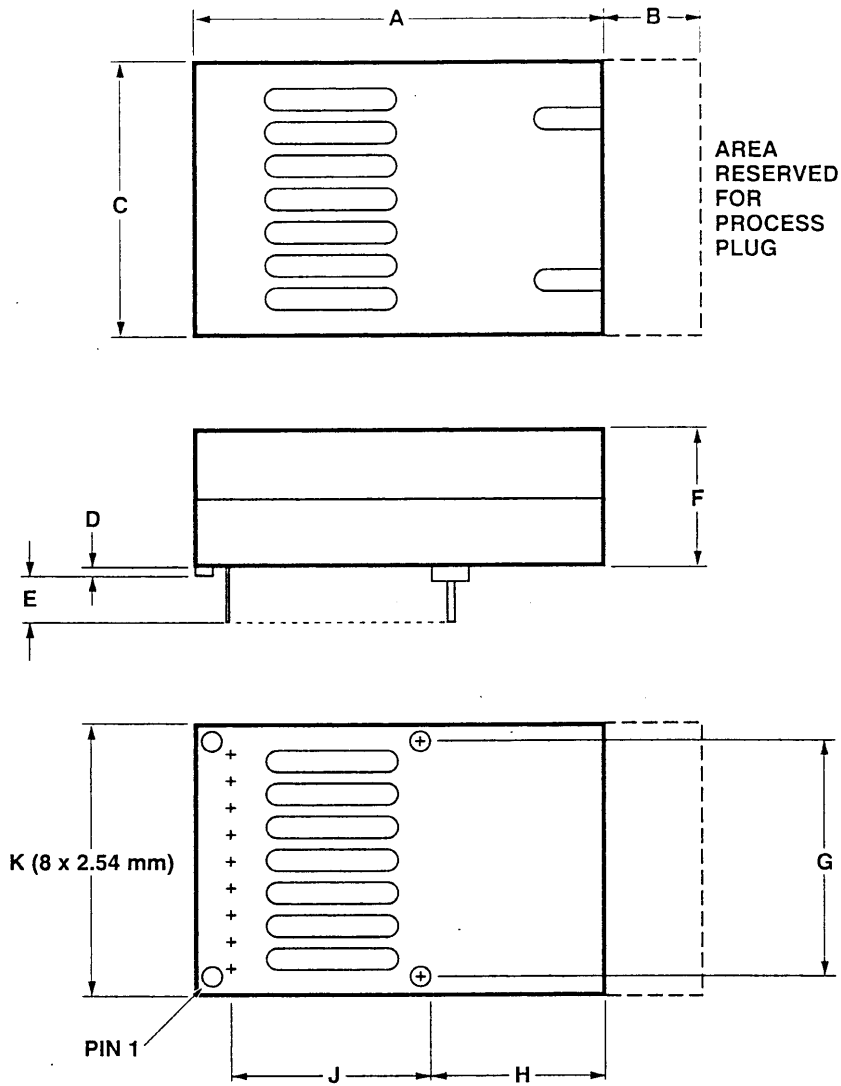
(Ambient Operating Temperature Ta = 0°C to 70°C , Vcc = 4.75V to 5.25V)

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes
Receiver Sensitivity	-	-	-	-31	dBm	3
Maximum Input Power	-	-8.0	-	-	dBm	-
Alarm ON	-	-42	-	-34	dBm	-
Hysteresis	-	0.5	-	4.0	dB	-
Power Supply Current	Icc	-	80	100	mA	4
Data Outputs PECL						
Alarm Output PECL						

Notes:

- Output power is power coupled into a single mode fiber.
- The power supply current varies with temperature. Maximum current is specified at Vcc = Maximum @ maximum temperature (not including terminations) and end of life.
- Minimum sensitivity and saturation levels for a 2²³-1 PRBS with 72 ones and 72 zeros inserted. (CCITT recommendation G958).
- The current excludes the output load current.

Drawing Dimensions



ELECTRIC PINS ARE NOMINALLY 0.46/0.018 DIAMETER.
MOUNTING POSTS ARE NOMINALLY 1.27/0.050 DIAMETER.

Electrical Pins are nominally 0.46 / 0.018 diameter
Mounting Posts are nominally 1.27 / 0.050 diameter

DIM.	MIN.	MAX.
A	-	39.16
B	-	12.70
C	-	25.40
D	0.65	0.85
E	2.92	3.68
F	-	10.35
G	-	20.32
H	-	15.93
J	-	20.32
K	AS SHOWN IN DIAGRAM	

ALL DIMENSIONS IN MILLIMETERS

Ordering Information

SDX1155*

Temperature Range:
B = 0 - 70°C, Black Case
D = 0 - 70°C, Blue Case

Allowable Part Numbers:

SDX1155B
SDX1155D

Model Name:
SDX1155

Class 1 Laser Products: This product conforms to the application requirements of 21 CFR 1040 at the date of manufacture
Date of Manufacture _____
Hewlett-Packard Ltd, Whitehouse Rd, Ipswich, England

Handling Precautions

1. The SDX1155 can be damaged by current surges or overvoltage. Power supply transient precautions should be taken.
2. Normal handling precautions for electrostatic sensitive devices should be taken.

Interim Qualification Report (2000 Hours Endurance)

Reliability Data

SDX1155B, FDX1125B

Summary

This report summarizes the Qualification testing of both the SDX1155B and FDX1125B over a range of environmental and mechanical extremes as set out in Bellcore TA-NWT-000983. All modules have passed the test requirements.

The qualification was performed by Hewlett-Packard FCO Quality and Reliability Department in accordance with Bellcore Specification TA-NWT-000983.

Introduction

The SDX1155B transceiver is a high performance, cost effective module for serial optical data communications applications specified for a signal rate of 155 Mbit/s. It is designed to provide an ATM/SONET/SDH compliant link for 155 Mbit/s intermediate reach applications. This module is designed for single mode fiber and operates at a nominal wavelength of 1300 nm. It incorporates Hewlett-Packard's high performance, reliable, long wavelength optical devices and proven circuit technology to give long life and consistent service.

The FDX1125B transceiver is identical to the SDX1155B with the exception that a lower power version of the laser is configured to meet the FDDI power requirements. The necessary power reduction is achieved by detuning the laser assembly during optical alignment. The FDX1125B is fully compliant with the FDDI SMF-PMD1 specification and is compatible with the SDX1155B.

In terms of reliability, this difference between the SDX1155B and FDX1125B has no impact. Consequently, qualification of the SDX1155B is deemed by the HP-FCO Quality and Reliability Department to include the FDX1125B by similarity. All references in this report refer to the SDX1155B.

Devices were subjected to thirteen conditional tests to guarantee mechanical integrity, endurance, flammability and susceptibility to ESD. After each test the sensitivity of the receiver and transmitter output power were measured to confirm the proper functionality of the part.

Testing

This program was completed under the supervision of Hewlett-Packard FCO Quality and Reliability Department. The devices for qualification were built by production personnel and tested on production automated test equipment (ATE) and R&D test equipment. Where the facilities to test in house do not exist the tests were sub contracted as shown:

Solderability, Flammability,
Mechanical Shock, Vibration,
Resistance to Solder Heat,
Thermal Shock

C-MAC Microcircuits Ltd
Test House
South Denes
Great Yarmouth
United Kingdom

ESD

BTL
Research Laboratories
Martlesham
United Kingdom

Appendix A shows the Qualification Plan as defined by Hewlett-Packard FCO Quality and Reliability Department in accordance with Bellcore Specification TA-NWT-000983.

Table 1. SDX1155 Qualification Status

Heading	Leg	Test	Reference	Condition	Status	No. Tested	No. Passed
Mechanical Integrity	D1	Solderability	MIL-STD 883D Method 2003.7	No Steam Aging	Complete	11	11
	D1	Connector Mate/Demate		200 cycles	Complete	11	11
	D2	Mechanical Shock	MIL-STD-883D Method 2002	Condition B 500g, 1.0ms 5 times/axis	Complete	11	11
	D2	Vibration	MIL-STD-883D Method 2007	Condition A.20g, 20-2000 Hz 4 min/cycle, 4 cycles/axis	Complete	11	11
	D3	Resistance to Solder Heat	IEC68-2-20A Method 1B	Temperature 350°C, 3.5 sec.	Complete	11	11
	D3	Thermal Shock	MIL-STD-883D Method 1001	-40°C to +80°C; 15 cycles	Complete	11	11
	Endurance	D3	Cyclic Moisture Resistance	MIL-STD-883D Method 1004	10 cycles	Complete	11
D4		Fast Temperature Cycling	MIL-STD-883D Method 1010	-40°C to +80°C; 1000 cycles	Complete	11	11
D5		Accelerated Aging (Biased)		+85°C 5000 hrs.	2000 hrs. ongoing	25	25
D6		Low Temperature Aging		+40°C 2000 hrs.	Complete	11	11
D7		Damp Heat	MIL-STD-202 Method 103	+40°C/95% R.H. 56 Days (Biased)	Complete	11	11
Special Tests	D1	Flammability	UL-94-VO		Complete	5	5
	D1	E.S.D.	H.B.M. 500 V		Complete	6	6

Results

Table 1 summarizes the qualification legs, reference, condition, status, sample size and sample results. Most of the legs are complete and all ongoing test results will appear in the final Qualification report.

During environmental testing control devices were measured along with the qualification devices. These devices were not subject to the environmental stress, and enable an estimate of the measurement error. These results along with other excepted engineering standards were used to determine the pass/fail criteria of the device measurements.

Appendix B contains summaries of all the legs of the qualification program. All legs passed to the complete satisfaction of the Hewlett-Packard FCO Quality and Reliability Department with the exception of High Temperature Endurance, which has yet to be completed.

Conclusion

At the time of publication the SDX1155 has successfully passed the interim stage (2000 hours) of the design qualification as defined by Hewlett-Packard FCO Quality and Reliability Department in accordance with Bellcore Specification TA-NWT-000983.

By similarity, the FDX1125B has successfully passed the interim stage of the qualification.