Technical Data Sheet

August 2001

SAMSUNG ELECTRONICS

OPTOELECTRONICS DIVISION

TR111SA
155Mbps 1310nm SC Duplex Single Mode Transceiver

Features

- 1.3µm InGaAsP MQW Fabry-Perot laser
- Highly sensitive InGaAs PIN photodiode
- Operating temperature range of -20~70°C
- Single +5V power supply
- 9-pin SIP with duplex SC receptacle
- Positive ECL level data and signal detect outputs
- Wave solder process compatible

Applications

ATM systems, LAN and WAN equipment, Adapters, Routers and Switches, Backbone equipment, SONET OC-3 / SDH STM-1 and Inter/intra-office.

Product Code

Product Code	Extinction Ratio	Output Power	Distance
TR111SA-0D30S	≥8.2dB	-15~-8dBm	15Km
TR111SA-0D40S	≥10dB	-5~0dBm	40Km

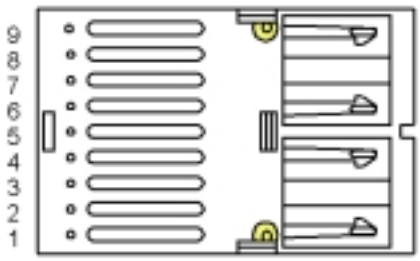
Description

The TR111SA is Samsung's 155Mbps uncooled transceiver module utilizing an optical subassembly (OSA) and a low cost plastic package. A reliable 1.3μm InGaAsP MQW Fabry-Perot laser diode and a highly sensitive InGaAs PIN photodiode constitute the major part of this module, which also boasts uncooled operation over the temperature range of -20°C to 70°C

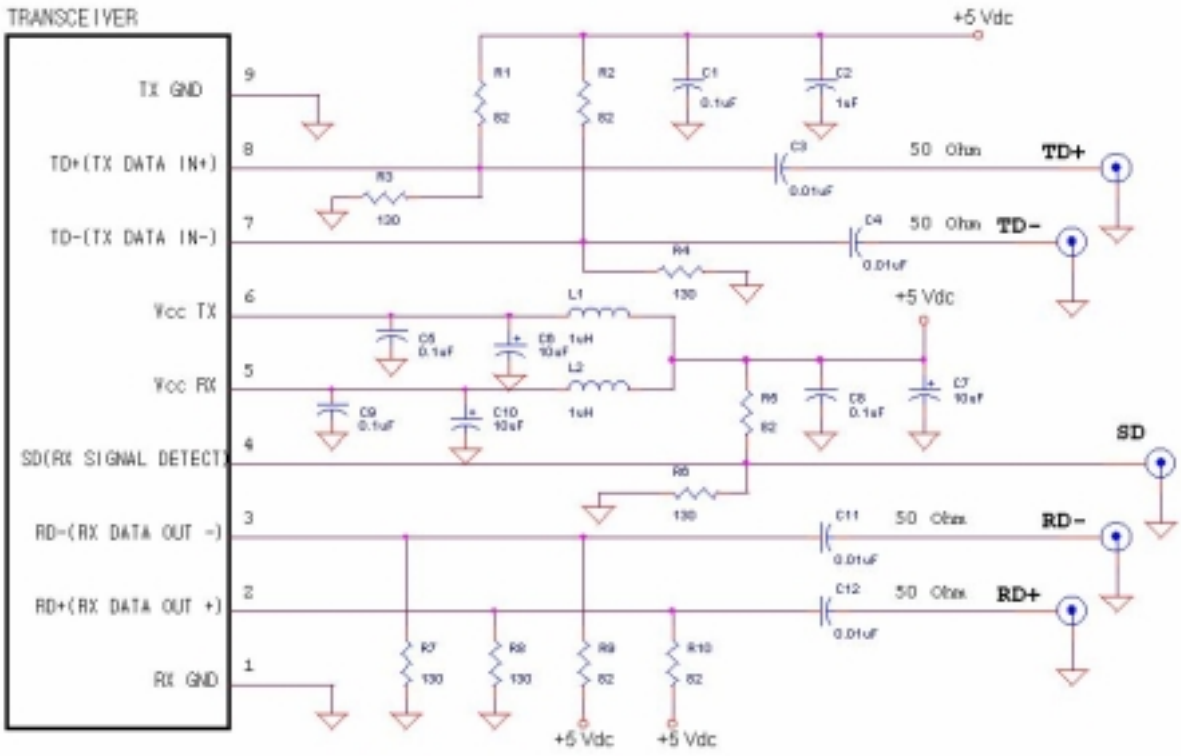
This module will meet the growing demand on the optical network unit (ONU) for access network and local area network (LAN) for SONET OC-3 and SDH STM-1.

Pin Information

TR111SA	
Pin	**Descriptions**
1 : Rx GND	Receiver Signal Ground. Directly connect this pin to the receiver ground plane.
2 : RD +	Receiver Data Out. RD+ is an open-emitter output circuit. Terminate this high-speed differential PECL output with standard PECL techniques at the follow-on device input pin.
3 : RD -	Receiver Data Out Bar. RD– is an open-emitter output circuit. Terminate this high-speed differential PECL output with standard PECL techniques at the follow-on device input pin.
4 : SD	Signal Detect. Normal optical input levels to the receiver result in a logic "1" output. Low optical input levels to the receiver result in a fault condition indicated by a logic "0" output. This signal detect output can be used to drive a PECL input on an upstream circuit, such as signal detect input or loss of signal-bar.
5 : Rx V_{CC}	Receiver Power Supply. Provide +5V DC via the recommended receiver power supply filter circuit. Locate the power supply filter circuit as close as possible to the Rx V_{CC} pin.
6 : Tx V_{CC}	Transmitter Power Supply. Provide +5V DC via the recommended transmitter power supply filter circuit. Locate the power supply filter circuit as close as possible to the Tx V_{CC} pin.
7 : TD -	Transmitter Data In Bar. Terminate this high-speed differential PECL input with standard PECL techniques at the transmitter input pin.
8 : TD +	Transmitter Data In. Terminate this high-speed differential PECL input with standard PECL techniques at the transmitter input pin.
9 : Tx GND	Transmitter Signal Ground. Directly connect this pin to the transmitter signal ground plane.
Mounting Studs	The mounting pins are provided for transceiver mechanical attachment to the circuit board. They are embedded in the nonconductive plastic housing and are not connected to the transceiver internal circuit. They should be soldered into the plated-through holes on the printed circuit board.



TR111SA Transceiver, 9-pin Configuration, Bottom View



Application Circuit

Module Performance Characteristics

Electrical Characteristics

Transmitter Section (Ambient operating temperature V_{CC}=4.75V to 5.25V)					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Power supply current[1]	I_{CC}	-	-	140	mA
Data input current-low	I_{IL}	-350	-	-	µA
Data input current-high	I_{IH}	-	-	350	µA
Differential input voltage	$V_{IH} – V_{IL}$	300	-	-	mV
Data input voltage-low	V_{IL}	$V_{CC} – 2.1$	-	$V_{CC} – 1.45$	V
Data input voltage-high	V_{IH}	$V_{CC} – 1.15$	-	$V_{CC} – 0.5$	V
1 Specified at V_{CC} max. and max. temp.					
Receiver Section (Ambient operating temperature V_{CC}=4.75V to 5.25V)					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Power supply current[1]	I_{CC}	-	-	100	mA
Data output voltage-low	V_{OL}	$V_{CC} – 1.9$	-	$V_{CC} – 1.4$	V
Data output voltage-high	V_{OH}	$V_{CC} – 1.05$	-	$V_{CC} – 0.85$	V
Signal detect output voltage-low	V_{OL}	$V_{CC} – 1.9$	-	$V_{CC} – 1.4$	V
Signal detect output voltage-high	V_{OH}	$V_{CC} – 1.05$	-	$V_{CC} – 0.85$	V
1 Excludes output load current					

Optical Characteristics

Transmitter Section (Ambient operating temperature V_{CC}=4.75V to 5.25V)					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Average output power[1] TR111SA-0D30S TR111SA-0D40S	 P_O P_O	 -15 -5		 -8 0	 dBm dBm
Center wavelength	λ_C	1261		1360	nm
Output spectral width (RMS)	$\Delta\lambda_{RMS}$			4	nm
Dynamic extinction ratio TR111SA-0D30S TR111SA-0D40S	 E_R E_R	 8.2 10			 dB dB
Output eye	Comply with Bellcore TR-NWT-000253 and ITU G.957				
Optical rise time (10% to 90%)	t_R			2	ns
Optical fall time (90% to 10%)	t_F			2	ns
1 SMF coupled					
Receiver Section (Ambient operating temperature V_{CC}=4.75V to 5.25V)					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Average receiver sensitivity[1]				-36	dBm
Maximum input power	P_{MAX}	-3			dBm
Link status switching threshold Decreasing light Increasing light	 LST_D LST_I	 -50		 -36	 dBm dBm
Link status hysteresis			3.5		dB
1 Measured at $1x10^{-10}$ BER with 2^{23}-1 PRBS, according to ITU-T G.958 spec.					

Absolute Maximum Ratings

These are absolute maximum ratings only. Higher stress than these ratings may adversely affect device reliability or cause permanent damage to the device.

Parameter	Symbol	Min	Max	Unit
Power supply voltage	V_{CC}	0	6	V
Lead soldering temperature/time			250/10	°C/sec
Operating case temperature range	T_{OPC}	-20	70	°C
Storage case temperature range	T_{STC}	-40	85	°C

Operating Environment

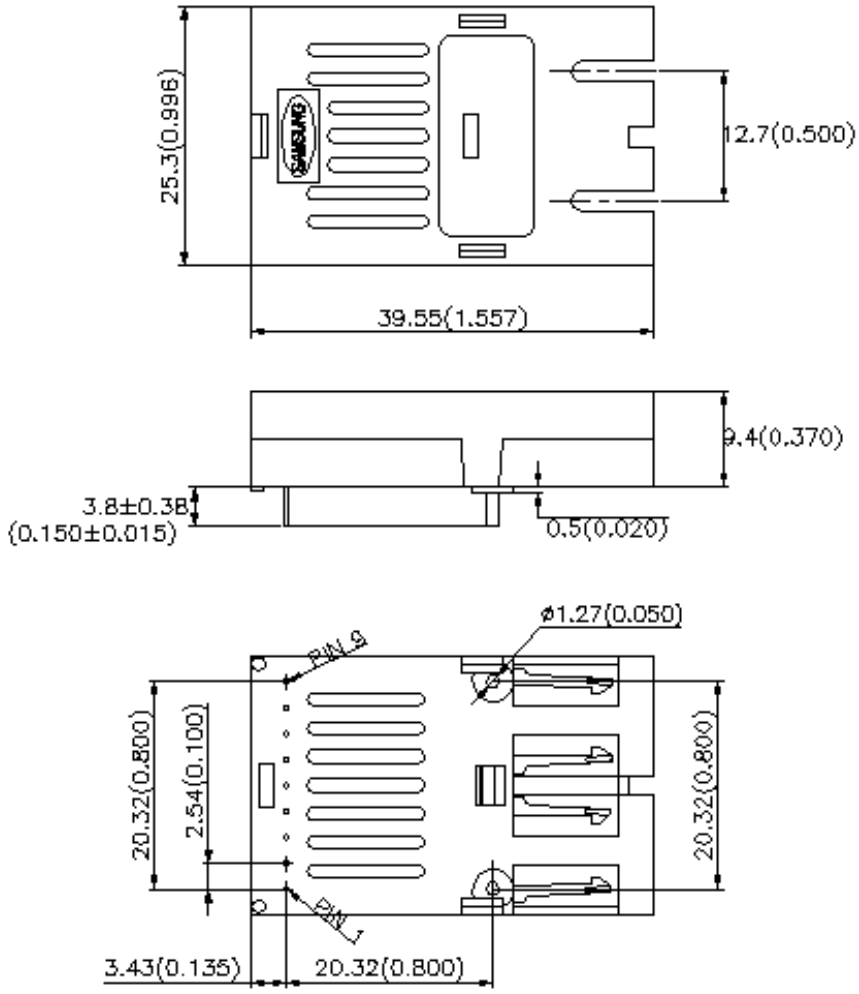
Parameter	Symbol	Min	Max	Unit
Power supply voltage	V_{CC}	+4.75	+5.25	V
Ambient operating temperature	T_{OP}	-20	70	°C

Outline Diagram

Dimensions are in millimeters (inches).

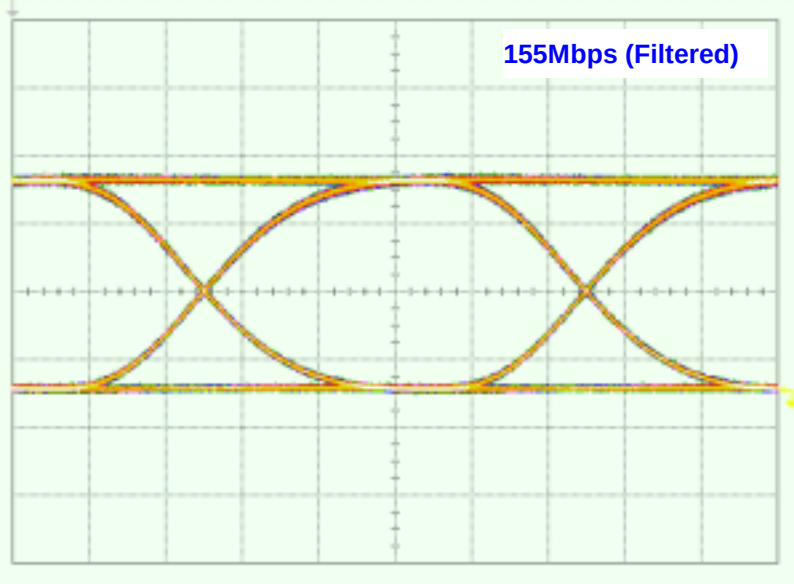
Tolerances : x.xx ± 0.025mm

x.x ± 0.05mm, unless otherwise specified

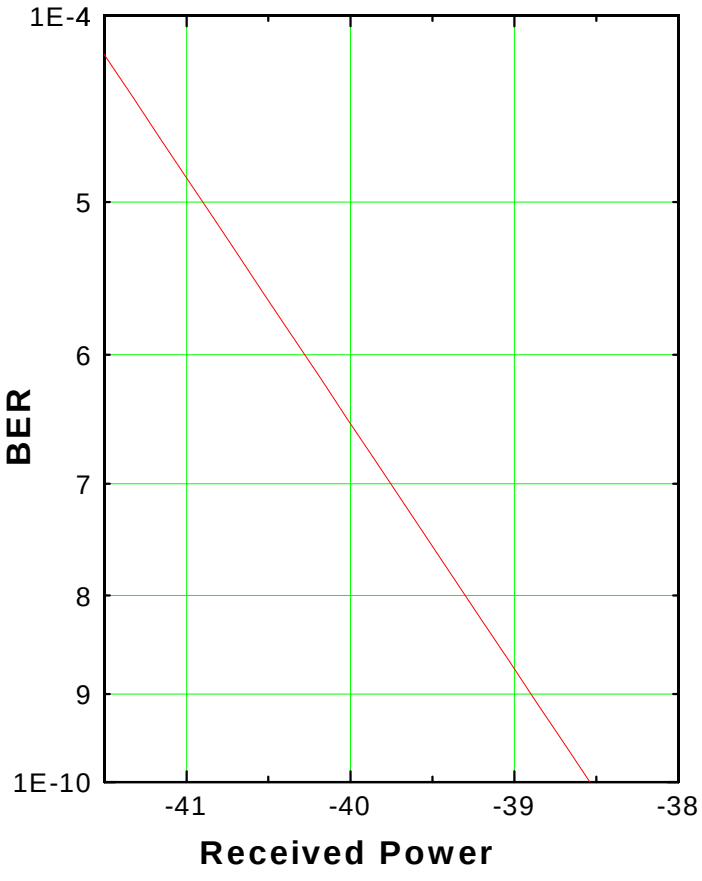


Performance Characteristics

1. Transmitter Eye Diagram (2^{23}-1 PRBS)



2. Receiver Sensitivity



Functional Description Receiver Section

Design

The receiver section contains an InGaAs PIN photodiode mounted together with a transimpedance preamplifier IC in the OSA, 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 155MBd without significant distortion or performance penalty. If a lower signal rate is used, sensitivity, jitter and pulse distortion could be degraded.

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 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}-2V termination. Other standard PECL terminating techniques may be used. The two outputs of the receiver should be terminated with identical load circuits to avoid an 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.

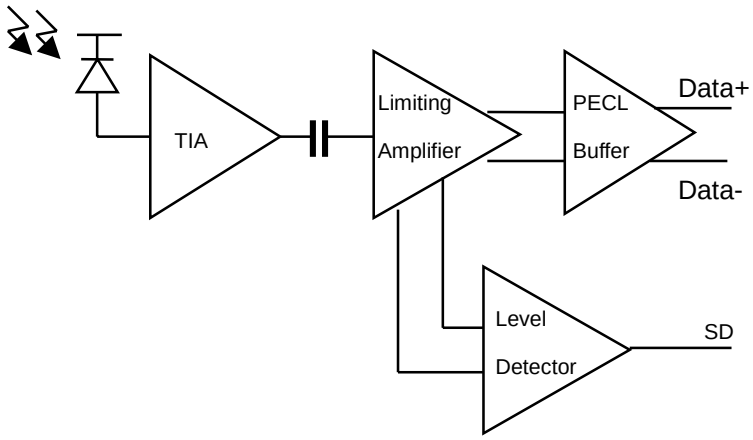


Figure 1 Receiver Block Diagram

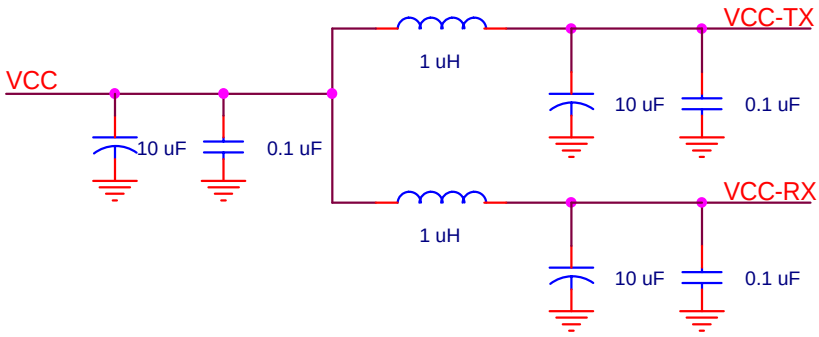


Figure 2 Power Supply Filtering Circuit

Functional Description-Transmitter Section

Design

The transmitter section uses a Fabry-Perot laser as its optical source. This laser source is mounted in an OSA separated from the printed circuit board. The OSA has been designed to be compliant with IEC 825 Class 1 and CDRH Class 1 eye safety requirements. The optical output is controlled by a custom IC that detects the laser output via the monitor photodiode as shown in Figure 3. This IC provides both DC and AC current drivers to the laser to ensure correct modulation, eye diagram and extinction ratio over temperature, supply voltage and life.

PCB Mounting

The model 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 provided that 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.

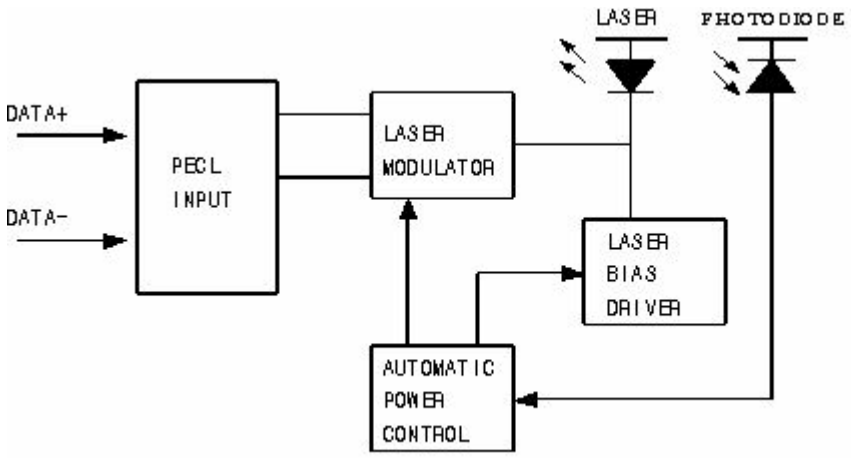


Figure 3 Transmitter Block Diagram

Laser Safety Information

Class I Laser Product

This product complies with IEC825-1, IEC825-2 laser safety requirements

Single-mode connector

Wavelength=1.3µm

Maximum power = 0.2mW (TR111SA-0D30S) / 1.0mW (TR111SA-0D40S)

Label is not affixed to the module because of size constraints but is contained in the shipping carton.

Product is not shipped with power supply

Caution: Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure

NOTICE

Unterminated optical connectors may emit laser radiation.

Do not view with optical instruments

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