1310/1490/1555 nm Integrated Triplexer
Preliminary

ITR-155B-622-345V1-PD

Features

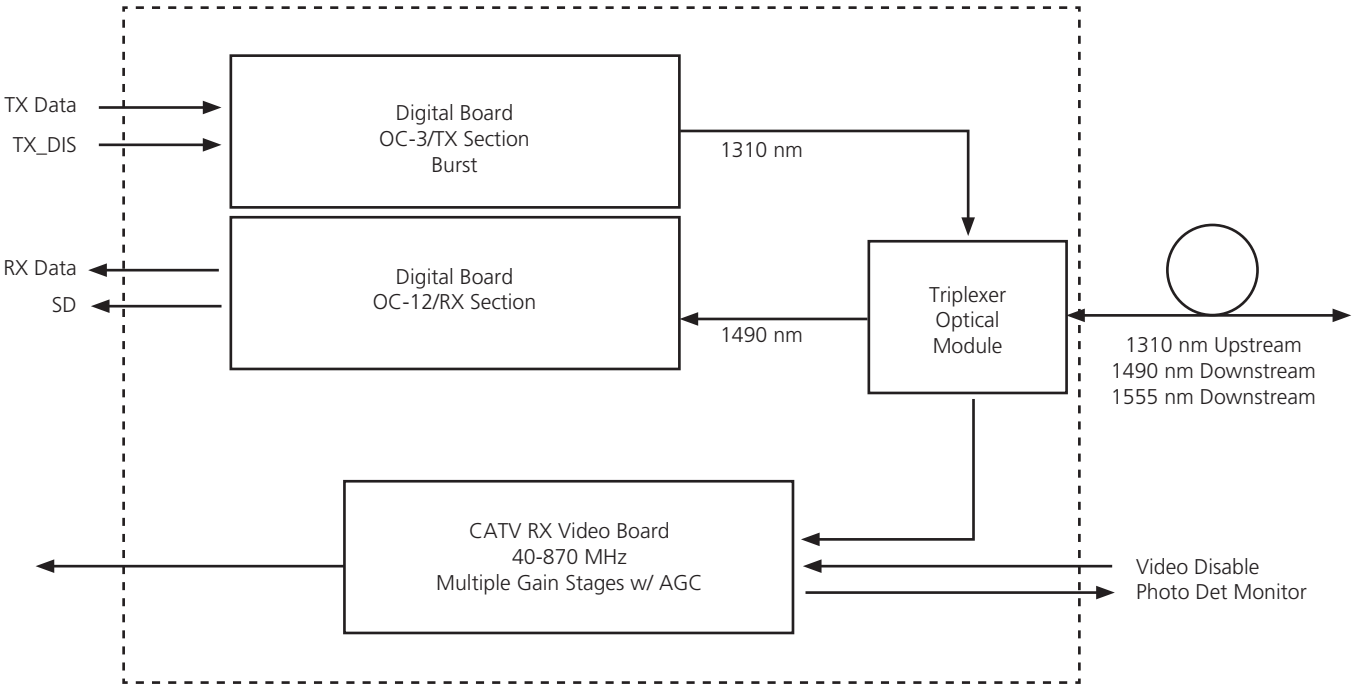
- Low Cost 1310nm Tx, 1490nm Rx, 1555nm Video Rx
- OC-3 Tx/Oc-12 Rx Asymmetric Data Rate
- Burst Mode Transmission
- 1GHz Video Bandwidth
- Suitable for Voice/Data/Video FTTx applications
- -40 to 85°C Operation
- Single Fiber Transceiver
- Full Triplexer
- Tri-channel
- Compliant to FSAN G.983 Specifications

Integrated Triplexer Components

- Digital Transmitter: A FP laser diode for return path transmission at OC-3 (155 Mbps). Includes a back facet photodetector to monitor laser intensity for APC control.

- Digital Receiver: A photodetector diode with TIA for forward path data reception at OC-12 (622 Mbps) with post amplification for LV PECL output compatibility.

- Analog Receiver: An 870 MHz forward path video (CATV) receiver with multiple gain stages, automatic gain control (AGC), and status indicators.



Integrated Triplexer transceiver Block Diagram

The triplexer module shall adhere to the following absolute maximum ratings:

Absolute Maximum Ratings

Parameter	Value
Storage Temperature	-40 to 85ºC
Operating Case Temperature	-40 to 85ºC
Vdd_+12V	15V
Vcc_Rx	-0.4 to +5.4 Volts
Vcc_Tx	-0.4 to +6.9 Volts

Stresses beyond those under "Absolute Maximum Ratings" may cause permanent damage to the unit. These are stress ratings only, and functional operation of the unit at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect unit reliability.

Module Characteristics

Parameter	Min	Typical	Max	Unit
1310nm Tx to 1490nm Rx crosstalk	-	-	-47	dB
1490nm Rx to 1555nm isolation	34	-	-	dB
1310nm Tx to 1555 Rx crosstalk	-	-	-47	dB
1555 Rx to 1490 nm isolation	34	-	-	dB

Digital Transmitter Specifications

Parameter	Min	Typical	Max	Unit	Conditions
Operating Voltage	3.14	3.30	3.46	V	V_{cc} referenced to GND_TX
Data Rate	-	155.52	-	Mb/s	
Average Optical Output Power, P_o	-2	-	4	dBm	EOL
Optical Rise and Fall Time	-	-	500	ps	20% to 80%
Supply Current	-	-	140	mA	
Center Wavelength, λ_0	1260	-	1360	nm	
Spectral Width, σ	-	2	4	nm,rms	
Extinction Ratio	10.0	-	-	dB	
Differential Input Voltage	300	-	1200	mVp-p	LVPECL. Internal 100Ω differential input impedence. DC coupled
Differential Input Impedance	-	100	-	Ω	
Tx enable time	-	-	12.86	ns	2 bits data @ 155.52 Mb/s
Tx disable time	-	-	12.86	ns	2 bits data @ 155.52 Mb/s
Tx disable input High voltage	2.0	-	-	V	
Tx disable input Low voltage	-	-	0.7	V	
Transmitter output eye	-	-	-	-	compliant to G.983.1 Figure 7
Output Power @ TX Off	-	-	-40	dBm	-

Digital Receiver Specifications

Parameter	Min	Typical	Max	Unit	Conditions
Operating Voltage	3.14	3.30	3.46	V	V_{CC} referenced to GND_RX
Data Rate	-	622.08	-	Mb/s	
Operational Wavelength Range	1480	-	1500	nm	
Received Optical Power	-26.5	-	-6	dBm	Using transmitter with parameters listed in previous section: 622 Mb/s, BER≤ 10^{-10}, PRBS 2^{23}-1
Optical Return Loss	15	-	-	dB	
Data Output Rise and Fall Time	-	-	500	ps	20% to 80%
SIGNAL DETECT Assertion level[1]	-	-	-26.5	dBm	
SIGNAL DETECT De-assertion level[2]	-36.5	-	-	dBm	
SIGNAL DETECT Hysteresis	1	-	-	dB	
Signal Detect Assert/De-assert Time	-	-	100	µs	
Supply Current	-	-	125	mA	
Differential Output Voltage	980	-	1900	mV	LVPECL. R_L =50 Ω (single-ended) connected to a level of V_{cc} -2V. RX output is internally AC coupled
SIGNAL DETECT Output HIGH Voltage	2.2	-	-	V	LVTTL, I_{OH} = -400µA
SIGNAL DETECT Output LOW Voltage	-	-	0.6	V	LVTTL, I_{OL} = 4mA

1) Transition during increasing light
2) Transition during decreasing light

Video Receiver Specifications

Parameter	Min	Typical	Max	Unit	Conditions
Operating Voltage	11.7	-	13.2	V	
Supply Current	-	150	170	mA	
Frequency Range	47	-	870	MHz	
Receiver Wavelength	1550	1555	1560	nm	
AGC Time Constant	0.5	-	-	s	
Video Photodiode Monitor	0.95	1.0	1.05	V/mW	Video Rx pin will output this voltage level based on the optical input signal level. Measurements should be made with a meter input impedence > 100 kΩ
Channel Bandwidth	-	4	-	MHz	
Channel Spacing	-	6	-	MHz	
Optical Return Loss	20	-	-	dB	
Video Receiver output power in disabled state	-	-	-50	dBmV	High TTL level applied to video Disable signal pin. This does not disable the current draw.

Analog Video Receiver (-20 to +85°C, Operational to -40°C)

Parameter	Min	Typ.[3]	Max	Unit	Conditions
Received Average Optical power[4]	-6	-2	+1.2	dBm	Test Config. for CW carriers See Note 1 OMI is reduced to 1.5% above 55 MHz
RF Output Power	14	18	17	dBmV/channel	Note 2 and 4 For channels > 550MHz, with 1.5% OMI, RF levels will be 6 dB lower
S22 output Return Loss	14	20	-	dB	75Ω
S21 Peak to Peak Flatness	-1.5	0.9	+1.5	dB	
Overshoot on sudden application of optical input signal	-	+27	+34	dBmV/carrier	on application of maximum optical input signal
video receiver supply current	-	150	170	mA	
Distortions	CSO CTB	-65 -62	-55 -59		Note1,2,3,4 For channels > 550MHz, with 1.5% OMI, CSO4 max. and CTB max. will be 7 dB higher
Carrier to Noise ratio, during Tx and Rx operations[5] CNR	48	52	-	dB	Per SCTE standard measurement method(equivalent to Spectrum Analyzer) Notes 1,2,3,4 For channels > 550 MHz, with 1.5%OMI, CNR Min. will be 7 dBlower

3) Min/Max values are guaranteed, typical values are for reference. Typical(and when applicable Median value) at 25°C and at -2 dBm optical input
4) OMI = 3.0%/carrier, CW carriers. (for OMI = 3.5% subtract 0.7 dB from the optical levels)
5) 2^{23tt} PRBS: 1600 mV differential

Note 1: Test conditions for CW carriers (allows for AGC defeat to raise RF levels by 4 dB):
- Optical input levels > -2 dBm: Apply external positive voltage source to the AGC_MON signal as required to provide 15 dBmV/carrier output level.
- Optical input levels < -2 dBm: Modify the input carrier frequency plan by dropping carriers at frequencies below 250 MHz as required to provide a 4 dB increase in the carrier level.

Note 2: With these 27 channels active below 250 MHz (channel frequencies are in MHz), except where required for low input power testing has descibed in Note 1:

Note 2 Chart				
55.25	127.25	163.25	199.25	235.25
61.25	133.25	169.25	205.25	241.25
67.25	139.25	175.25	211.25	247.25
77.25	145.25	181.25	217.25	-
83.25	151.25	187.25	223.25	-
121.25	157.25	193.25	229.25	-

Note 3: With the following channels applied (channel frequencies are in MHz). Channels below 550 MHz are 3.0% OMI. Channels above 550 MHz are 1.5% OMI:

Note 3 Chart						
-	175.25	271.25	367.25	463.25	559.25	655.25
-	181.25	277.25	373.25	469.25	565.25	661.25
55.25	187.25	283.25	379.25	475.25	571.25	667.25
61.25	193.25	289.25	385.25	481.25	577.25	673.25
67.25	199.25	295.25	391.25	487.25	583.25	679.25
77.25	205.25	301.25	397.25	493.25	589.25	685.25
83.25	211.25	307.25	403.25	499.25	595.25	691.25
121.25	217.25	313.25	409.25	505.25	601.25	697.25
127.25	223.25	319.25	415.25	511.25	607.25	703.25
133.25	229.25	325.25	421.25	517.25	613.25	709.25
139.25	235.25	331.25	427.25	523.25	619.25	715.25
145.25	241.25	337.25	433.25	529.25	625.25	721.25
151.25	247.25	343.25	439.25	535.25	631.25	727.25
157.25	253.25	349.25	445.25	541.25	637.25	733.25
163.25	259.25	355.25	451.25	547.25	643.25	739.25
169.25	265.25	361.25	457.25	553.25	649.25	745.25

Or using a customer approved two tone testing plan

Note 4: Parameters apply to the following:
17 channels automatically tested with a Multitone test system: (channel frequencies are in MHz):

Note 4 Chart			
55.25	301.25	499.25	655.25
121.25	361.25	517.25	745.25
175.25	415.25	529.25	-
205.25	445.25	547.25	-
271.25	469.25	553.25	-

Or using the multitone frequency plan in Note 3 and manually measuring with a Spectrum Analyzer the worst case channels:
445.25 + 1.25 MHz at +1.2 dBm for CSO
301.25 + 1.0 MHz at - 4.8 dBm for CNR

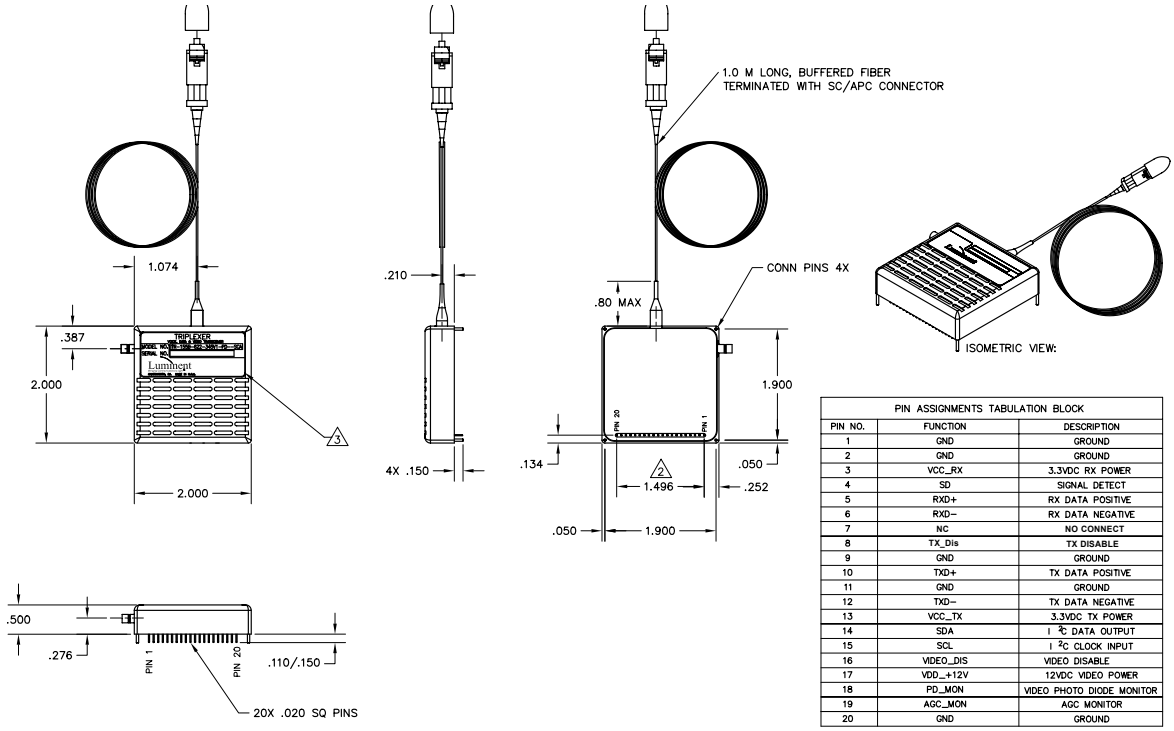
Or using a customer approved two tone testing plan.

Control/Status Signals section:

Pin Label	Logic Level	Pin Function/Description
SD	LVTTL active high	This is the Signal Detect status signal from the digital receiver, indicating a digital signal has been received
PD_MON	Analog voltage	This is a video status signal that provides an analog signal level proportional to the optical video input power level.
AGC_MON	Analog voltage	This is a video status signal that provides an analog signal level proportional to the video receiver AGC level.
I^2C SDA	LVTTL	Serial data line from the I^2C bus to the on board EEPROM chip that holds the unit ID and other information. EEPROM I^2C address = 0
I^2C SCL	LVTTL	Serial clock line from the I^2C bus to the on board EEPROM chip that holds the unit ID and other information.
TX_DIS	LVTTL active high	This is the Transmit Disable input. Low for normal operation, high to disable laser output.

Video output is a 75 ohm SMB panel mount jack.
Optical input/output for the triplexer shall be terminated with a 9/125 single-mode fiber, 900µm tight buffer, 1 meter long, terminated with a SC/APC connector.

Mechanical Drawing



PIN ASSIGNMENTS TABULATION BLOCK		
PIN NO.	FUNCTION	DESCRIPTION
1	GND	GROUND
2	GND	GROUND
3	VCC_RX	3.3VDC RX POWER
4	SD	SIGNAL DETECT
5	RXD+	RX DATA POSITIVE
6	RXD–	RX DATA NEGATIVE
7	NC	NO CONNECT
8	TX_Dis	TX DISABLE
9	GND	GROUND
10	TXD+	TX DATA POSITIVE
11	GND	GROUND
12	TXD–	TX DATA NEGATIVE
13	VCC_TX	3.3VDC TX POWER
14	SDA	I ²C DATA OUTPUT
15	SCL	I ²C CLOCK INPUT
16	VIDEO_DIS	VIDEO DISABLE
17	VDD_+12V	12VDC VIDEO POWER
18	PD_MON	VIDEO PHOTO DIODE MONITOR
19	AGC_MON	AGC MONITOR
20	GND	GROUND

3 LABEL IS ALUMINUM .003 THICK.

2 PIN CONFIGURATION: 20 PINS AT .0787 (2mm) SPACING, TOTAL DISTANCE FROM PIN 1 TO PIN 20 IS 1.496"

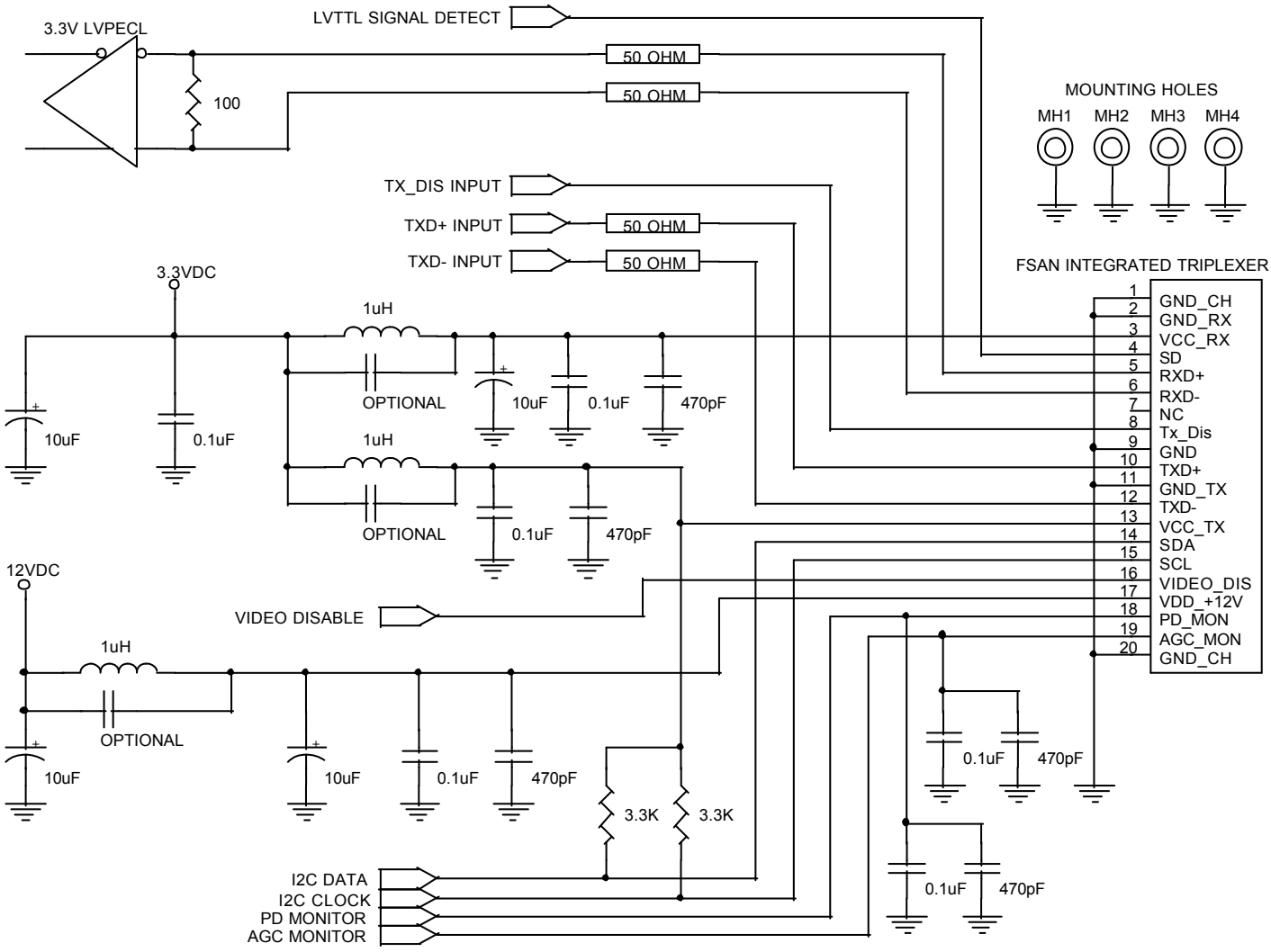
1. CUSTOMER MAKES EXTERNAL CONNECTIONS TO COMPONENT FIBER, WIRING, AND CONNECTORS

NOTES: UNLESS OTHERWISE SPECIFIED

Pin Function Definitions:

Pin Number	Function	Descriptions	Pin Number	Function	Descriptions
1	GND	Ground	11	GND	Ground
2	GND	Ground	12	TXD-	TX Data Negative
3	VCC_RX	3.3 VDC RX Power	13	VCC_TX	3.3 VDC TX Power
4	SD	Signal Detect	14	SDA	I²C Data output
5	RXD+	RX Data Positive	15	SCL	I²C Clock Input
6	RXD-	TX Data Negative	16	NC	Future option for CW/ modulated carrier
7	NC	No Connect	17	VDD_+12V	12 VDC Video Power
8	TX_DIS	TX Disable	18	PD_MON	Video Photo Diode Monitor
9	GND	Ground	19	AGC_MON	AGC Monitor
10	TXD+	TX Data Positive	20	GND	Ground

Typical interface circuit



Ordering Information

Available Options:

ITR-155B-622-345V1-PD--SCA

Warnings

Handling Precautions: This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
Laser Safety: Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

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