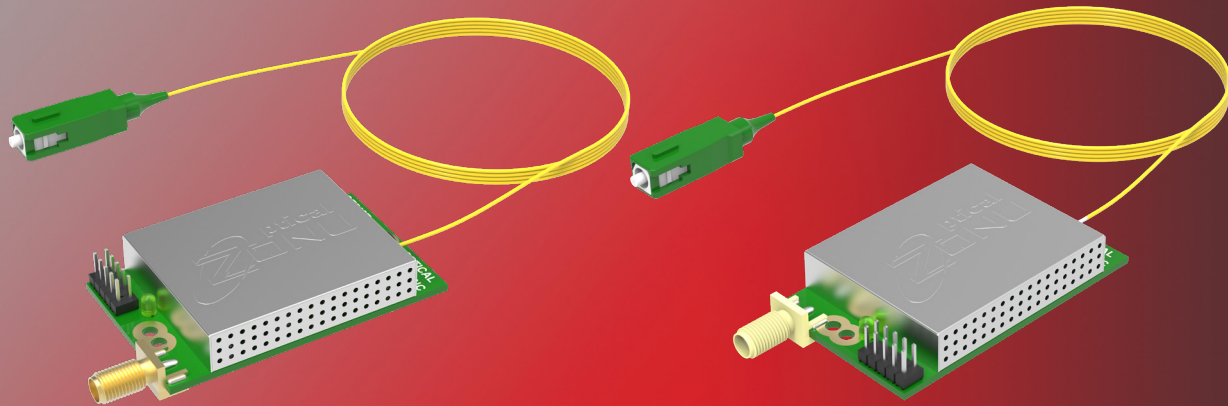




Features

- 30 MHz to 3 GHz RF Bandwidth (optional 6 GHz)
- -40°C to +70°C Operating Case Temperature Range (1310 nm)
- Small Size, 1.5" x 2.5" x 0.6"
- 1310 nm, 1550 nm, CWDM Wavelengths
- High SFDR
- Automatic Optical Power Control
- LED and Monitor/Alarm Indications
- Uncooled Isolated DFB Lasers
- Lasers Conform to Class 1 Emission Level Per CDRH and IEC-825 (EN 60825) Standards

Options

- Integrated +20 dB Transmitter LNA
- Extended High Frequency, 6 GHz
- Extended Low Frequency, 10 kHz
- +5 VDC or +12 VDC Bias-T
- Multimode Fiber Capability (3 GHz Models)

Applications

- L-Band Satcom
- Cellular Backhaul
- MMDS
- Antenna Remoting
- GPS Distribution
- Antenna Site Diversity
- Low Phase Noise Reference Clock Distribution
- Optical Delay Lines

OZ51x

Description

The OZ51x OEM fiber optic transmitter and receiver modules are broadband RF over Fiber standalone board level assemblies. The OZ51x has a wide dynamic range and supports RF transport in situations where transport distance or flexibility of cabling may prohibit the use of coaxial cable. The modules provide high Spurious Free Dynamic Range (SFDR) transport for RF signals in the frequency range 30 MHz to 3 GHz. Optional extended bandwidths of 10 kHz (for lower rolloff) and/or 6 GHz (for upper rolloff) are also available. An integrated LNA may be added to the transmitter to optimize noise figure and input/output IP3 for a variety of RF power levels and optical loss budgets. The OZ51x features a linear optically isolated DFB laser diode operating at 1310 nm or 1550 nm or a high performance InGaAs photodiode. CWDM wavelengths are also available. Standard transport is over 9/125 μm Single Mode Fiber, however Multimode fiber transport is also an option on 3 GHz models (contact Optical Zonu for details). The standard RF interface is 50 Ohm SMA and the standard optical interface is an SC/APC (FC/APC is also available) fiber pigtail. Built-in RF shielding supports low EMI/RF interference. An optional Bias-T (transmitters) is available to provide bias/power to antennas. Average Automatic Power Control (AAPC) provides closed loop control of the transmitter optical output power over the full operating temperature range. Alarm and monitoring functions are available through the on-board 10-pin connector. An LED provides status of laser bias current (transmitter) or received optical power (receiver). The OZ51x module is powered from +12 VDC. Variations of this OEM form factor also support GPS, IRIG-B/1PPS/TTL, and low phase noise clock distribution.

See patent number US 10,257,739 B1

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Temperature ¹	T_{op}	-40	-	70	°C
Storage Temperature	$T_{Storage}$	-40		85	°C
DC Supply Voltage	V_{CC}	11.5	12	12.5	V
Transmitter RF Input (no LNA)	RF_{in}	-	-	+17	dBm
Transmitter RF Input (LNA)	RF_{in}	-	-	+3	dBm
Transmitter Optical Output	$P_{Tx, out}$	-	-	+8	dBm
Receiver Optical Input	$P_{Rx, in}$	-	-	+11	dBm
Unpackaged Weight	-	-	-	90	g

¹ -40°C assumes 1310 nm. 1550 nm transmitters operate down to -20°C.

DC Characteristics

Parameter	Symbol	Min	Typical	Max	Units
DC Supply Voltage	V_{CC}	11.5	12	12.5	V
Transmitter Current (no LNA)	$I_{CC, Tx}$	-	60	80	mA
Transmitter Current (with LNA)	$I_{CC, Tx, LNA}$	-	140	160	mA
Receiver Current	$I_{CC, Rx}$	-	155	180	mA

Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Units
Transmitter Output Power	$P_{Tx, out}$	-	2.5	6	mW
Transmitter Wavelengths	λ_{Tx}	1270 1470	-	1330 1610	nm
Receiver Wavelengths	λ_{Rx}	1270	-	1610	nm

RF Characteristics (OZ510 3GHz)¹

Parameter	Symbol	Min	Typical	Max	Units	Notes
High Frequency Cutoff	f_{high}	-	3000	-	MHz	-
High Frequency Cutoff	f_{low}	20	30	-	MHz	-
Frequency Response Flatness						-
no LNA	S21	-	3	3.5	dB _{p-p}	2
with LNA	S21	-	3.5	4.0	dB _{p-p}	2
RF Gain						
no LNA	$G_{no\ LNA}$	-1	+1	+3	dB	2,3
with LNA	G_{LNA}	+19	+20	+22	dB	2,3
Equivalent Input Noise						
no LNA (1 GHz / 3 GHz)	$EIN_{no\ LNA}$	-	-134/-130	-130/-126	dBm-Hz	3,4
with LNA (1 GHz / 3 GHz)	EIN_{LNA}	-	-154/-150	-150/-146	dBm-Hz	3,4
Input 3rd Order Intercept						
no LNA (1 GHz / 3 GHz)	$IIP3_{no\ LNA}$	+29/+24	+31/+28	-	dBm	3,5
with LNA (1 GHz / 3 GHz)	$IIP3_{LNA}$	+8/+4	+10/+7	-	dBm	3,5
Spur Free Dynamic Range						
no LNA (1 GHz / 3 GHz)	$SFDR_{no\ LNA}$	-	110/105	-	dB/Hz ^{2/3}	3,4,5
with LNA (1 GHz / 3 GHz)	$SFDR_{LNA}$	-	109/105	-	dB/Hz ^{2/3}	3,4,5
Group Delay Link Variation to 3 GHz ⁶	GD	-	0.5	1	nsec	2
Input/Output Impedance	$Z_{in/out}$	-	50	-	Ω	
Input/Output VSWR						
no LNA	$VSWR_{in/out}$	-	1.5:1	1.8:1		2
with LNA	$VSWR_{in/out}$	-	1.6:1	1.8:1		2

1. All measurements are taken at 25°C

2. 30-3,000MHz

3. Measured with 1 meter single mode fiber jumper

4. NF (dB) = EIN (dBm-Hz) + 174 (dBm/Hz)

5. Equivalent to IMD 60 dB at 0 dBm total output power (2-tone measurement)

6. The absolute link delay is less than 11 nsec due to internal fiber management

RF Characteristics (OZ514 4GHz)¹

Parameter	Symbol	Min	Typical	Max	Units	Notes
High Frequency Cutoff	f_{high}	-	4000	-	MHz	
Low Frequency Cutoff	f_{low}	20	30	-	MHz	
Frequency Response Flatness						
no LNA	S21	-	3	3.5	dB _{p-p}	2
with LNA	S21	-	3.5	4.0	dB _{p-p}	2
RF Gain						
no LNA	$G_{no\ LNA}$	-2	0	+2	dB	2,3
with LNA	G_{LNA}	+16	+18	+20	dB	2,3
Equivalent Input Noise						
no LNA (1 GHz / 4 GHz)	$EIN_{no\ LNA}$	-	-133/-128	-130/-127	dBm-Hz	3,4
with LNA (1 GHz / 4 GHz)	EIN_{LNA}	-	-151/-146	-148/-146	dBm-Hz	3,4
Input 3rd Order Intercept						
no LNA (1 GHz / 4 GHz)	$IIP3_{no\ LNA}$	+26/+21	+28/+25	-	dBm	3,5
with LNA (1 GHz / 4 GHz)	$IIP3_{LNA}$	+8/+3	+10/+6	-	dBm	3,5
Spur Free Dynamic Range						
no LNA (1 GHz / 4 GHz)	$SFDR_{no\ LNA}$	-	108/103	-	dB/Hz ^{2/3}	3,4,5
with LNA (1 GHz / 4 GHz)	$SFDR_{LNA}$	-	106/100	-	dB/Hz ^{2/3}	3,4,5
Group Delay Link Variation to 4 GHz ⁶	GD	-	0.5	1	nsec	2
Input/Output Impedance	$Z_{in/out}$	-	50	-	Ω	
Input/Output VSWR						
no LNA	$VSWR_{in/out}$	-	1.5:1	1.8:1		2
with LNA	$VSWR_{in/out}$	-	1.6:1	1.8:1		2

1. All measurements are taken at 25°C

2. 30-4,000 MHz

3. Measured with 1 meter single mode fiber jumper

4. NF (dB) = EIN (dBm-Hz) + 174 (dBm/Hz)

5. Equivalent to IMD 60 dB at 0 dBm total output power (2-tone measurement)

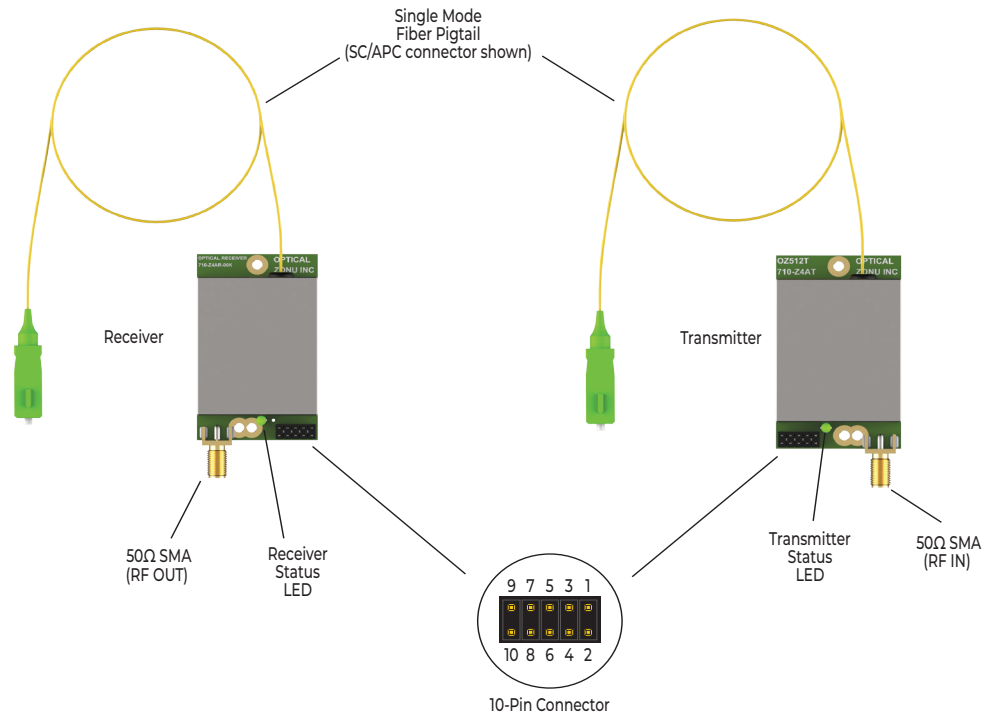
6. The absolute link delay is less than 11 nsec due to internal fiber management

RF Characteristics (OZ516 6GHz)¹

Parameter	Symbol	Min	Typical	Max	Units	Notes
High Frequency Cutoff	f_{high}	-	6000	-	MHz	
Low Frequency Cutoff	f_{low}	20	30	-	MHz	
Frequency Response Flatness						
no LNA	S21	-	3	3.5	dB _{p-p}	2
with LNA	S21	-	3.5	4	dB _{p-p}	2
RF Gain						
no LNA	$G_{no\ LNA}$	-2	0	+2	dB	2,3
with LNA	G_{LNA}	+14	+16	+18	dB	2,3
Equivalent Input Noise						
no LNA (1 GHz / 6 GHz)	$EIN_{no\ LNA}$	-	-133/-124	-130/-117	dBm-Hz	3,4
with LNA (1 GHz / 6 GHz)	EIN_{LNA}	-	-149/-140	-146/-135	dBm-Hz	3,4
Input 3rd Order Intercept						
no LNA (1 GHz / 6 GHz)	$IIP3_{no\ LNA}$	+26/+16	+28/+19	-	dBm	3,5
with LNA (1 GHz / 6 GHz)	$IIP3_{LNA}$	+8/0	+10/+2	-	dBm	3,5
Spur Free Dynamic Range						
no LNA (1 GHz / 6 GHz)	$SFDR_{no\ LNA}$	-	108/95	-	dB/Hz ^{2/3}	3,4,5
with LNA (1 GHz / 6 GHz)	$SFDR_{LNA}$	-	107/94	-	dB/Hz ^{2/3}	3,4,5
Group Delay Link Variation to 6 GHz ⁶	GD	-	0.5	1	nsec	2
Input/Output Impedance	$Z_{in/out}$	-	50	-	Ω	
Input/Output VSWR						
no LNA (30 - 3000 MHz, 3000 - 6000 MHz)	$VSWR_{in/out}$	-	1.6:1/1.8:1	1.8:1/2.2:1		
with LNA (30 - 3000 MHz, 3000 - 6000 MHz)	$VSWR_{in/out}$	-	1.7:1/1.9:1	1.9:1/2.3:1		

1. All measurements are taken at 25°C
2. 30-6,000 MHz
3. Measured with 1 meter single mode fiber jumper
4. NF (dB) = EIN (dBm-Hz) + 174 (dBm/Hz)
5. Equivalent to IMD 60 dB at 0 dBm total output power (2-tone measurement)
6. The absolute link delay is less than 11 nsec due to internal fiber management

Module Features



Pin Assignments

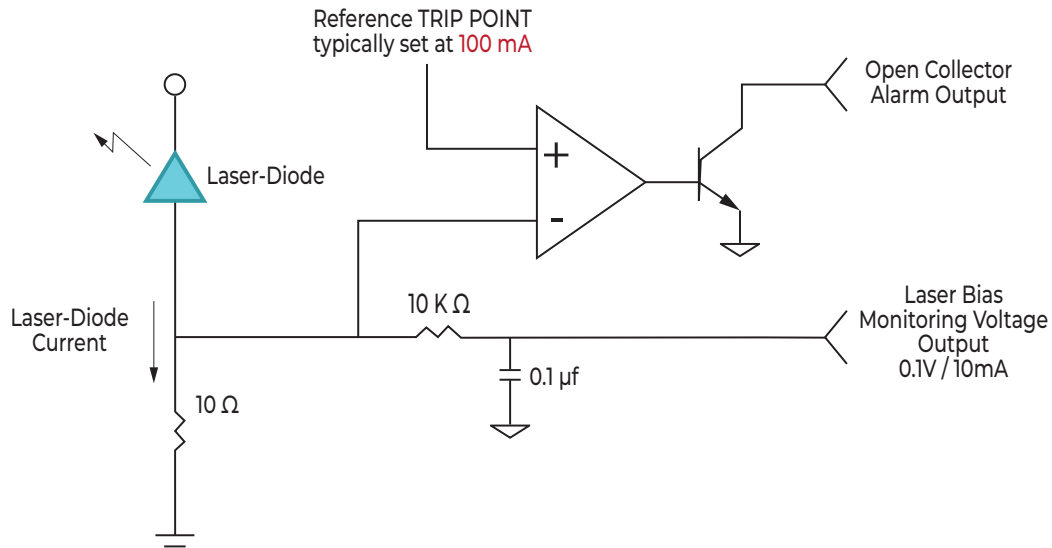
Pin	Transmitter	Receiver
1	Laser ENABLE ¹	N/C
2	N/C	N/C
3	Ground	Ground
4	N/C	N/C
5	V _{cc} (+12V)	V _{cc} (+12V)
6	N/C	N/C
7	Laser Bias Monitor (0.1V per 10 mA)	Received Power Monitor (0.1V per 1 mW)
8	N/C	N/C
9	Laser Bias Alarm (open collector, 25 mA)	Received Power Alarm (open collector, 25 mA)
10	N/C	N/C

¹+12V = LASER ENABLED, Ground = LASER DISABLED, Floating/Not Connected = LASER DISABLED.

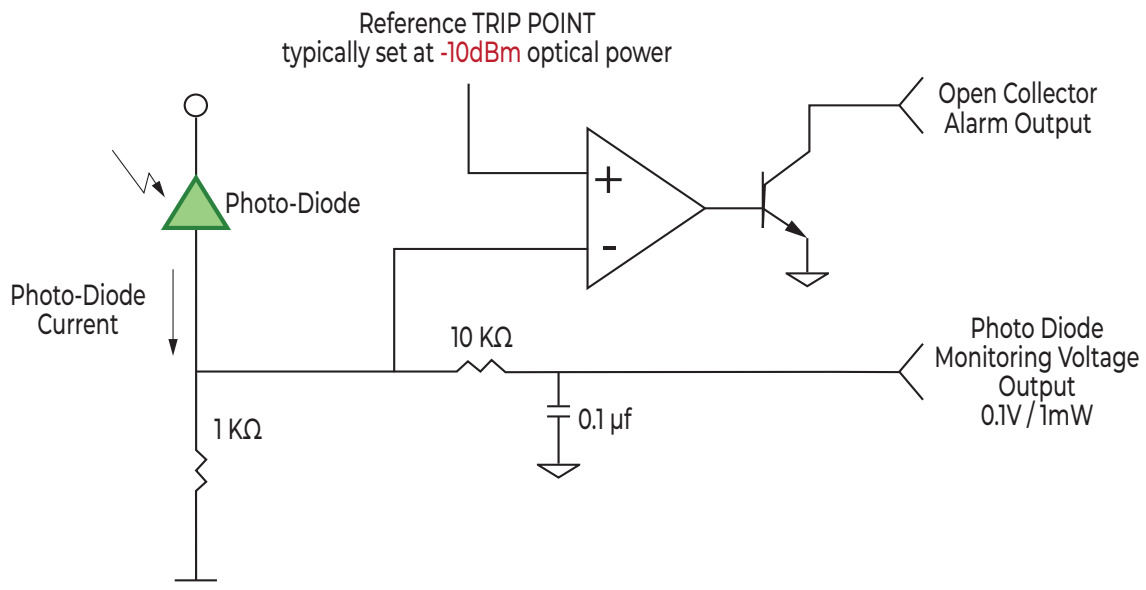
LED Definitions

LED State	Transmitter LED	Receiver LED
OFF	Module Not Powered	Module Not Powered
GREEN	Normal Operation	Normal Operation
RED	Laser Bias Current High (> 110 mA)	Optical Input Power Low (< -10 dBm)

Individual Transmitter Alarm & Monitoring Circuit Diagram

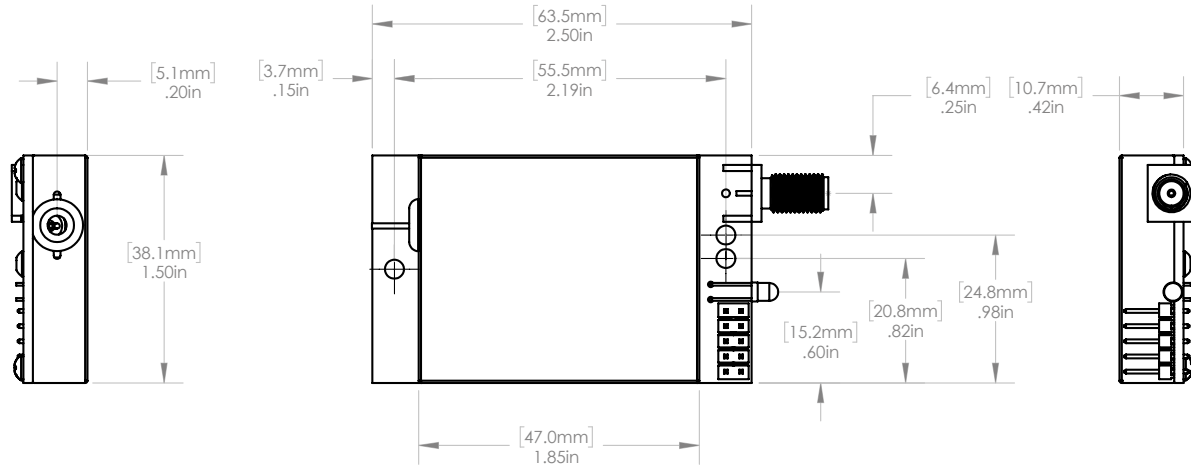


Individual Receiver Alarm & Monitoring Circuit Diagram

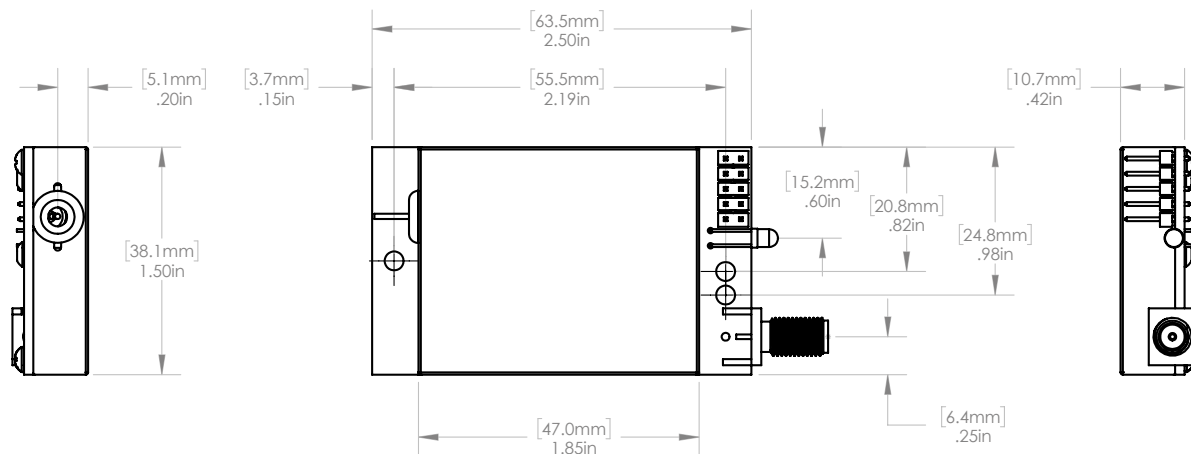


All alarms are Open Collector topology, with Active Low for Normal operation. For the duration of an Alarm condition, the open collector will Pull to High logic levels. Reverse polarity alarm is also available upon request, such as under normal conditions the Open collector will be High and vice versa under fault conditions.

Transmitter Mechanical Outline

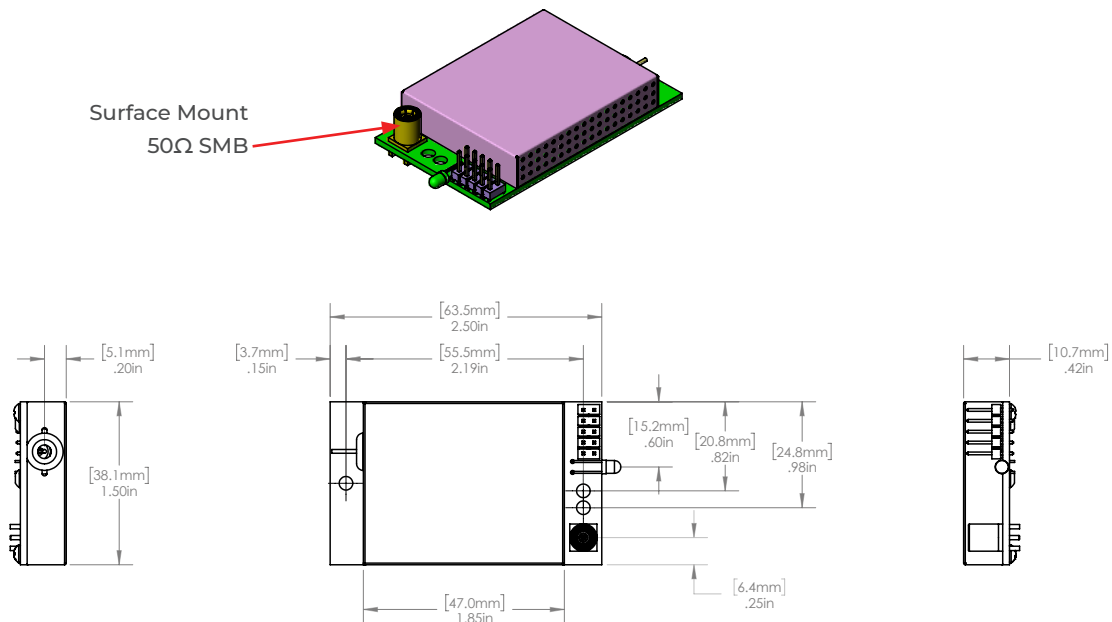
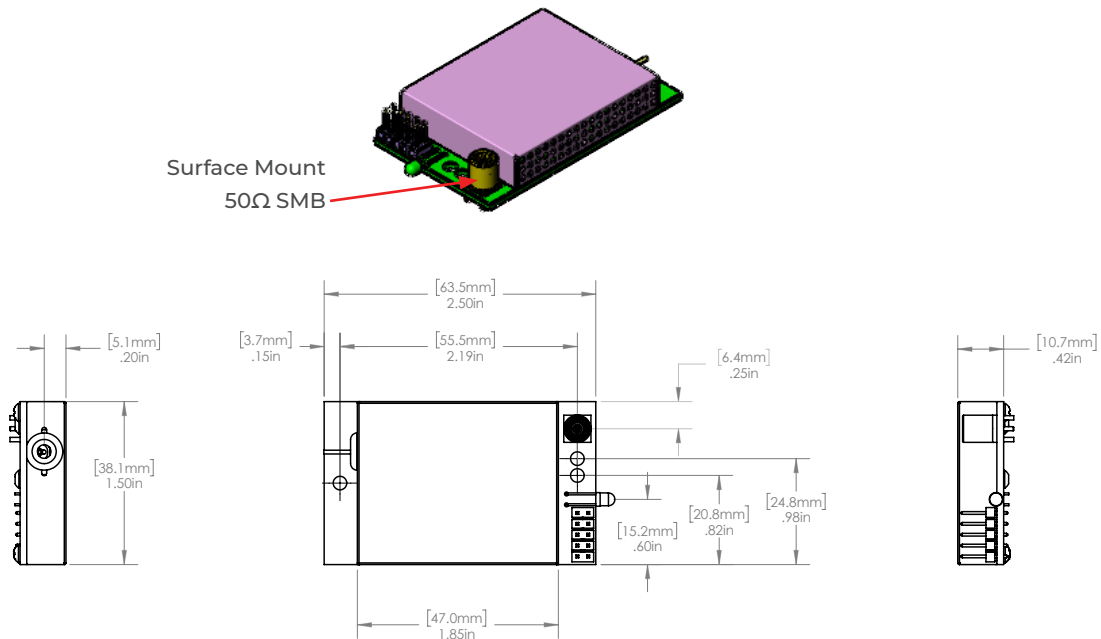


Receiver Mechanical Outline



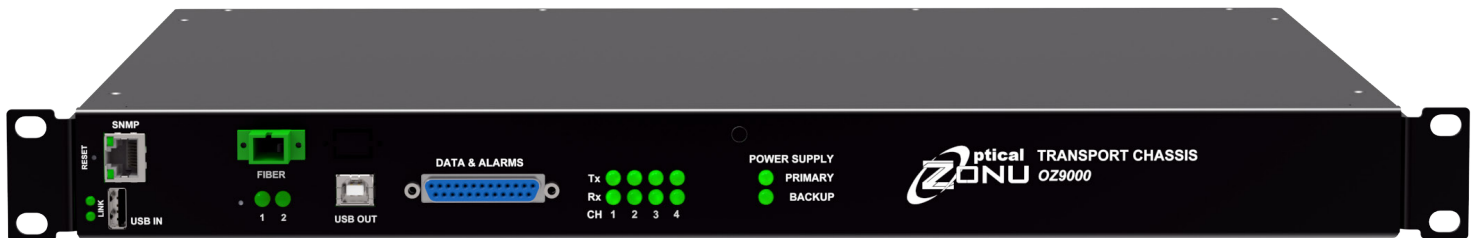
Surface Mount SMB Connector Mechanical Configuration

An alternate RF connector configuration option is a 50 Ω surface mount SMB. Mechanical drawings of this SMB option are shown below (transmitter on top, receiver on bottom).



Rack Mounted Integration

Optical Zonu OZ51x modules may be used in 19" rack mounted chassis by integrating them into higher level assemblies. The OZC9500 chassis can accommodate up to 8 OZ5xx style OEM assemblies. The 8 modules may be any combination of transmitter and receiver, as well as any type of signal format (10 kHz – 6 GHz RF, IRIG-B, 1PPS, TTL, 10 MHz low phase noise, etc.). The OZC9500 chassis provides dual redundant power supplies, local status LEDs, dry contact alarms/monitors, and remote monitoring capability via serial SSH, HTTP web user interface, Optical Zonu's J-Control graphical user interface, and SNMP v2 and v3. All Optical Zonu modules are available in CWDM wavelengths, therefore all OZC9500 signal traffic may be multiplexed for transport over a single fiber, [see the OZC9500 Datasheet](#).



Ordering Information

TRANSMITTER PART NO.

A13 - Z51X - DXX - XX - X^{2,3}XX⁴

0 - 30 - 3000 MHz	31 - 1310 nm	A - 50Ω SMA	S - SC/APC	S - Single mode	(blank) - no LNA	(blank) - no Bias-T
4 - 30 - 4000 MHz	55 - 1550 nm	B - 50Ω SMB	F - FC/APC	M - 62.5μm Multimode	L - LNA	B - 5V Bias-T
6 - 30 - 6000 MHz	yy - 1yy0 nm ¹			M50 - 50μm Multimode		

- CWDM wavelengths - 47 = 1470 nm. Standard wavelengths 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm. For others, contact Optical Zonu
- When using a mode conditioning jumper for the MMF select single mode option
- Multimode fiber option is only available for 3 GHz models.
- For 12V bias-T, contact Optical Zonu

RECEIVER PART NO.

A23 - Z51X - 00 - XX - X¹

0 - 30 - 3000 MHz	A - 50Ω SMA	S - SC/APC	S - Single mode
4 - 30 - 4000 MHz	B - 50Ω SMB	F - FC/APC	M - 62.5μm Multimode
6 - 30 - 6000 MHz		M50 - 50μm Multimode	

- Multimode fiber option is only available for 3 GHz models.

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SALES - SATCOM

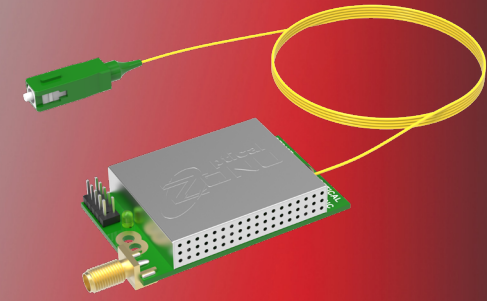
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818-579-9592
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Related Products

[OZ10x OEM Transmitter/Receiver Modules \(30 - 6000 MHz\), Low Size/Weight/Power, optional CWDM and I2C Serial Interface](#)

[Low Phase Noise Transmitter/Receiver Modules \(10 - 200 MHz\), Multiple Form Factors, optional CWDM](#)

[OZ600 Transmitter/Receiver Standalone Modules \(30 - 3000 MHz\), optional CWDM](#)

[OZ81x Transmitter/Receiver Standalone Modules \(30 - 6000 MHz\), optional AGC, CWDM, RS232 Transport, I2C Serial Interface](#)

[OZC9500 19" 1RU Chassis, up to 8 Transmitter and/or Receiver Assemblies, Remote Access via HTTP, GUI, SNMP v2 and v3](#)

[J400 Transmitter/Receiver/Transceiver Plug-in Modules \(30 - 6000 MHz\), optional CWDM, Remote Access via HTTP, GUI, SNMP](#)

[J3U Transmitter/Receiver/Transceiver Plug-in Modules \(30 - 6000 MHz\), optional Redundancy Architectures, CWDM, Remote Access via HTTP, Graphical User Interface, SNMP v2 and v3](#)

Additional Resources

[Standalone RF Over Fiber Modules](#)

[RF Over Fiber Rack Mount Integrated Subsystems](#)

[RF Over Fiber Rack Mount Modular Subsystems](#)

[RF Over Fiber Applications](#)

[19" 1RU J-Chassis](#)

[19" 3RU J3U Chassis](#)

[19" 1RU OZC9500 Chassis](#)

