Proposal Specification
TO-BIDI* Transceiver Optical Module
Coax-BIDI™ 1550/1300 nm with DIL10 Adaptation Board and Receiver Preamplifier

- Designed for application in passive-optical networks
- Integrated Wavelength Division Multiplexer
- Bidirectional Transmission in 2nd and 3rd optical window
- Laser diode with Multi-Quantum Well structure
- Suitable for bit rates up to OC-3 and STM-1
- Ternary Photodiode at rear mirror for monitoring and control of radiant power
- Low noise/high bandwidth PIN diode
- Hermetically sealed subcomponents, similar to TO 18
- With singlemode fiber pigtail
- DIL10 adaptation board with receiver preamplifier

Applications

Stable Operation with High Capacitance Detectors Low Noise Preamplifiers
Single-Ended to Differential Conversion I-to-V Converters

Preamp description

The TIA is a wide bandwidth, single supply transimpedance amplifier optimized for use in a fiber optic receiver circuit. It is a complete, single chip solution for converting photodiode current into a differential voltage output. The 240 MHz bandwidth enables application in FDDI receivers and SONET/SDH receivers with data rates up to 155 Mbps. The differential outputs drive ECL directly, or can drive a comparator/ fiber optic post amplifier.
The IC can be used with a standard ECL power supply (– 5.2 V) or a PECL (+5 V) power supply; the common mode at the output is ECL compatible.

Maximum Ratings

Module	Symbol	Values	Unit
Operating Temperature range at case	T_C	-40 ... +85	°C
Storage Temperature range	T_{stg}	-40 ... +85	°C
Soldering Temperature T_{max} = 10 s, 2 mm distance from bottom edge of case	T_S	260	°C

Laserdiode	Symbol	Values	Unit
Direct forward current	$I_{F\ max}$	120	mA
Radiant power CW	Φ_e	1	mW
Reverse Voltage	$V_{R\ max}$	2	V

Monitor Diode	Symbol	Values	Unit
Reverse Voltage	$V_{R\ max}$	10	V

Characteristics

All optical data refer to the optical port (10/125µm SM fiber), T_C = -40 ... +85°C

Laser Diode	Symbol	Values	Unit
Optical Peak Output Power	Φ_e	> 0.4	mW
Emission wavelength center of range Φ_e = 0.2 mW	λ	1510...1590	nm
Spectral bandwidth Φ_e = 0.2 mW (RMS)	$\Delta\lambda$	< 5	nm
Threshold current	I_{th}	2...55	mA
Forward voltage Φ_e = 0.2 mW	V_F	< 1.5	V
Slope Efficiency	η	10...150	mW/A
Differential series resistance	R_S	< 8	Ω
Rise Time/Fall Time	t_R, t_F	< 1	ns

Monitor Diode	Symbol	Values	Unit
Dark Current, V_R = 5 V, Φ_e = 0	I_R	< 200	nA
Photocurrent, Φ_e = 0.2 mW		100...800	µA
Capacitance, V_R = 5 V, f = 1MHz	C_5	< 10	pF
Tracking Error, V_R = 2 V (see note 1)	TE	-1...1	dB

Detector + Preamplifier	Symbol	Values			Unit
		Min.	Typ.	Max.	
Power Supply T_{min} to T_{max} Operating range single supply Current		 +4.5	 +5 25	 +11 26	 V mA
Bandwidth 3 dB		180	240		MHz
Overload				-6	dBm
Sensitivity (BER > 10^{-10}; P_{opt} (Transmitter) < -7dBm; I_{mod} < 40mA) under discussion		-25			dBm
Output Noise: (Minimum S/N > 10 (2.4 V/mW / 0.2 V/mW) -> equivalent to BER > 10^{-10}) Signal: Output voltage to optical power (Input power < 100 µW tbd) Single Ended Sλ * Rtrs Differential Sλ * Rtrs		 2.4 4.8	 6 12	 0.2 12 24	 V/mW V/mW V/mW

Module	Symbol	Values	Unit
Optical Crosstalk (see note 2)	CRT	< -30	dB

Note 1: The tracking error TE is the variation rate of Φ_e at constant current I_{mon} over a specified temperature range and relative to the reference point: $I_{mon,ref} = I_{mon}(T = 25°C, \Phi_e = 0.2 mW)$. Thus, TE is given by:

$$TE\left[dB\right] = 10 \times \log \frac{\phi_e\left[T_c\right] - \phi_e\left[25°C\right]}{\phi_e\left[25°C\right]}$$

Note 2: Optical Crosstalk is defined as CRT=10*log ($I_{Det,0}$ / $I_{Det,1}$) with: $I_{Det,0}$ the photo-current with Φ_e = 0.2 mW, CW laser operation, V_R = 2 V, with minimum optical return loss from fiber end and $I_{Det,1}$ the photocurrent without Φ_e, but 0.2 mW optical input power, λ = 1300nm.

Proposal for Measuring Crosstalk

Needed equipment:

- Average Voltmeter (R&S URV5)
- Lowpassfilter 125 MHz
- Signalgenerator (Pseudorandom Word generator 155 Mbit/s or Sine wave frequency tbd)

Measuring

Connect the preamplifier output (perhaps with an additional amplifier - not limiting!!!) with Average Voltmeter

Step 1 Output voltage without any incoming optical signal, BIDI internal transmitter off -> Uo

Step 2 Output voltage with incoming optical signal 1 µW 100% modulated (Pseudorandom Word 155 Mbit/s) light, BIDI internal transmitter off -> U1

Step 3 Output voltage without any incoming optical signal, BIDI internal transmitter modulated (Pseudorandom Word 155 Mbit/s) 10 mApp bias 5 mA (below threshold) -> U3

Step 4 Output voltage without any incoming optical signal, BIDI internal transmitter modulated (Pseudorandom Word 155 Mbit/s) 10 mApp bias 25 mA (over threshold) -> U4

Calculations:

Check the difference U3 (only electrical crosstalk) and U4 electrical + optical crosstalk (electrical crosstalk is dominating if U4 = U3; optical crosstalk is dominating if U4 > U3)

Check the needed modulation current for W 100% modulated light (EOL max temp) $I_{mod\ max}$ and change U3 to U3corr = U3*$I_{mod\ max}$ [mA]/10.

The same procedure for U4.

TO_BIDI Performance

U1 should be > 10 * Uo

Normally the sensitivity will be limited by crosstalk. The needed optical power is $P_{optical}$ min [µW] = 10*U4corr/U1

Accompanying Information

T = 25°C: Threshold current, current above threshold for 0.2 mW output power, monitor current for 0.2 mW output power, peak wavelength.

T = 85°C: Threshold current, current above threshold for 0.2 mW output power, monitor current for 0.2 mW output power.

End of Life Values

Parameter	**Symbol**	**Values**	**Unit**
Threshold current at T = 85 °C	I_{th}	80	mA
Slope efficiency (– 40...+ 85 °C)	S	> 5	mW/A
Tracking error (**see note 1**)	TE	– 1.0...1.0	dB
Detector dark current, V_R = 2 V, T = 85 °C	I_R	< 400	nA
Monitor dark current, V_R = 2 V, T = 85 °C	I_R	< 1	µA

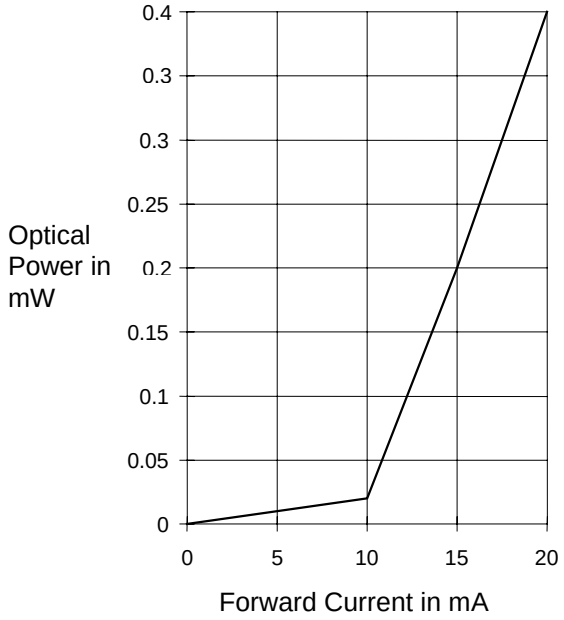
Fiber Pigtail

Type: single mode, silica

Parameter	**Values**	**Unit**
Mode field diameter	9 ± 1	µm
Cladding diameter	125 ± 2	µm
Mode field/cladding concentricity error	< 1	µm
Cladding non-circularity	< 2	%
Mode field non-circularity	< 6	%
Cut-off wavelength	> 1270	nm
Jacket diameter	0.9 ± 0.1	mm
Bending radius	> 30	Mm
Allowed Tensile strength fiber/case	max. 5	N
Length	1 ± 0.2	m

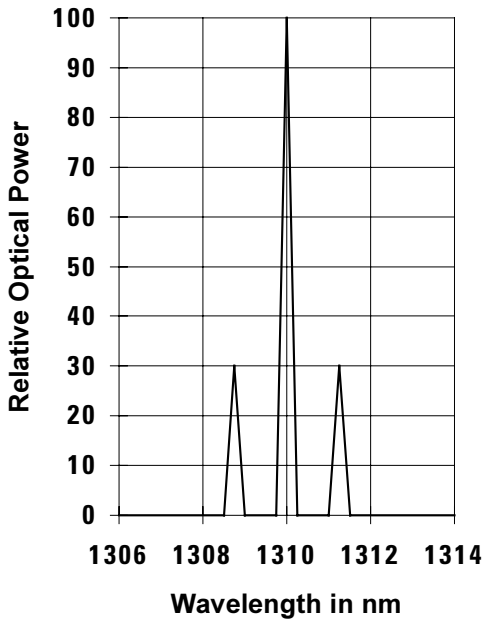
Laser Diode

Radiant Power in Single mode Fiber



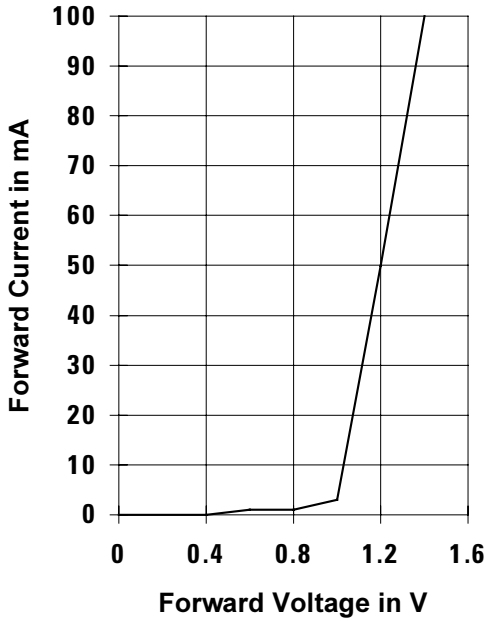
Relative Radiant Power

$\Phi_e = f(\lambda)$

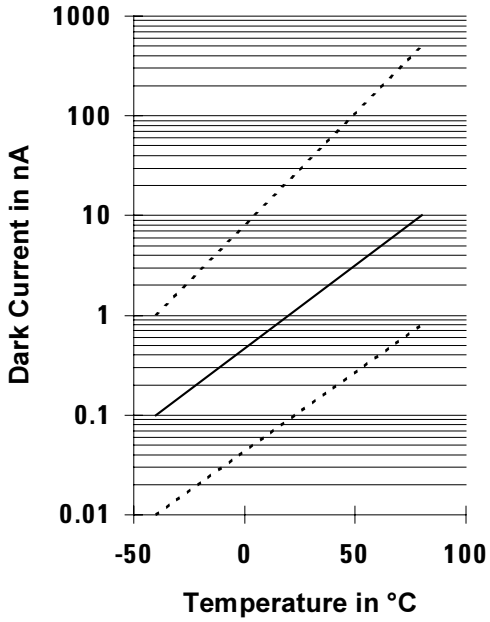


Laser Forward Current

$I_F = f(V_F)$



Monitor Diode Dark Current I_R = $f(T_A)$ Φ_{port} = 0, V_R = 5 V



Package Outlines (Dimensions in mm):

Coaxial modules have to be mechanically fixed. Only soldered pins do not fulfill mechanical connection of the coaxial module. Preferred for mechanical connection is our laser flange.