

Specification**TO-BIDI* Transceiver Optical Module****Coax-BIDI™ 1550/1310 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), $T_C = -40...+85^\circ\text{C}$

Laser Diode	Symbol	Values	Unit
Optical Peak Output Power	Φ_e	>0,4	mW
Emission wavelength center of range $\Phi_e = 0,2$ mW	λ	1510...1590	nm
Spectral bandwidth $\Phi_e = 0,2$ mW (RMS)	$\Delta\lambda$	<5	nm
Threshold current	I_{th}	2...55	mA
Forward voltage $\Phi_e = 0,2$ 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, $V_R = 5V$, $\Phi_e = 0$	I_R	<200	nA
Photocurrent, $\Phi_e = 0,2mW$		30...400	μA
Capacitance, $V_R = 5V$, $f = 1MHz$	C_5	<10	pF
Tracking Error, $V_R = 2V$ (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 3dB		180	240		MHz
Overload				-6	dBm
Sensitivity (BER > 10 ⁻¹⁰ ; Popt.(Transmitter) < -7dBm; I _{mod} < 40mA)		-22			dBm
Output Noise: (Minimum S/N > 10 (2,4V/mW / 0,2V/mW) -> equivalent to BER > 10 ⁻¹⁰) Signal: Output voltage to optical power (Input power < 100 μW tbd) Single Ended $S_\lambda * R_{trs}$ Differential $S_\lambda * R_{trs}$				0,2	V/mW
		2,4 4,8	6 12	12 24	V/mW V/mW

Module	Symbol	Values	Unit
Optical Crosstalk (see note 2)	CRT	<-27	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: $I_{mon,ref} = I_{mon}(T=25^\circ C, \Phi_e = 0,2mW)$. Thus, TE is given by:

$$TE [dB] = 10 \times \log \frac{\phi [T_c] - \phi [25^\circ C]}{\phi [25^\circ C]}$$

Note 2: Optical Crosstalk is defined as $CRT = 10 \cdot \log(I_{Det,0}/I_{Det,1})$ with: $I_{Det,0}$ the photo-current with $\Phi_e = 0,2mW$, CW laser operation, $V_R = 2V$, with minimum optical return loss from fiber end and $I_{Det,1}$ the photocurrent without Φ_e , but 0,2mW optical input power, $\lambda = 1550nm$.

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 -> U_0

Step 2 Output voltage with incoming optical signal 1 μW 100% modulated (Pseudorandom Word 155 Mbit/s) light, BIDI internal transmitter off -> U_1

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) -> U_3

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) -> U_4

Calculations:

Check the difference U_3 (only electrical crosstalk) and U_4 electrical + optical crosstalk (electrical crosstalk is dominating if $U_4 = U_3$; optical crosstalk is dominating if $U_4 > U_3$)

Check the needed modulation current for W 100% modulated light (EOL max temp) I_{modmax} and change U_3 to $U_{3\text{corr}} = U_3 \cdot I_{\text{modmax}} [\text{mA}] / 10$.

The same procedure for U_4 .

TO_BIDI Performance

U_1 should be $> 10 \cdot U_0$

Normally the sensitivity will be limited by crosstalk. The needed optical power is

Optical min $[\mu\text{W}] = 10 \cdot U_{4\text{corr}} / U_1$

Accompanying Information

$T = 25\text{ }^\circ\text{C}$: Threshold current, current above threshold for 0.2 mW output power, monitor current for 0.2 mW output power, peak wavelength.

$T = 85\text{ }^\circ\text{C}$: 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 $T = 85\text{ °C}$	I_{th}	80	mA
Slope efficiency ($-40...+85\text{ °C}$)	S	> 5	mW/A
Tracking error (see note 1)	TE	$-1.0...1.0$	dB
Detector dark current, $V_R = 2\text{ V}$, $T = 85\text{ °C}$	I_R	< 400	nA
Monitor dark current, $V_R = 2\text{ V}$, $T = 85\text{ °C}$	I_R	< 1	μA

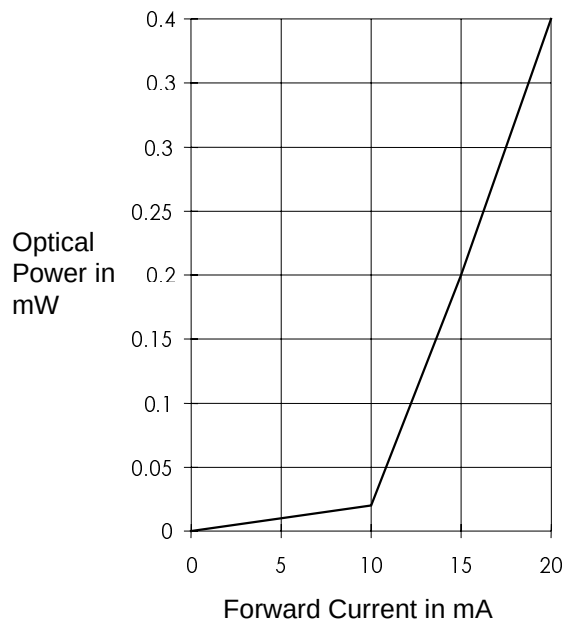
Fiber Pigtail

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

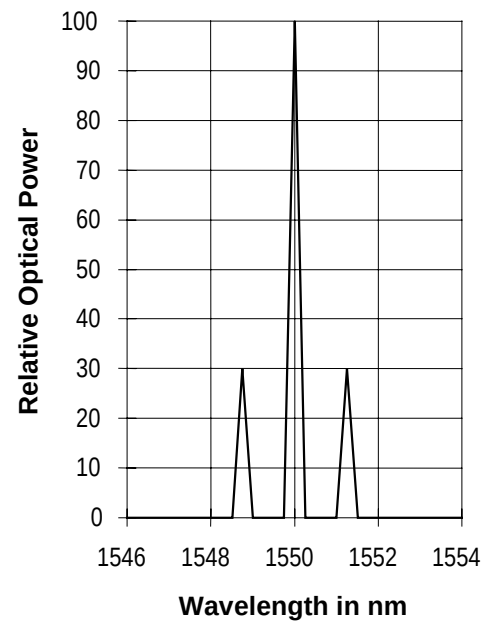
Laser Diode

Radiant Power in Singlemode Fiber



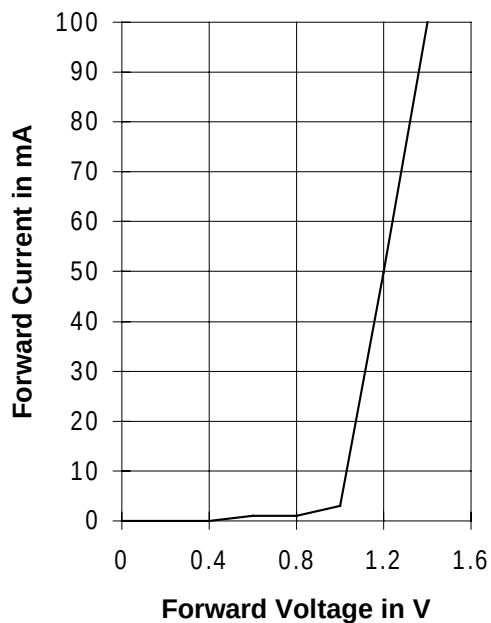
Relative Radiant Power

$$\Phi_e = f(\lambda)$$



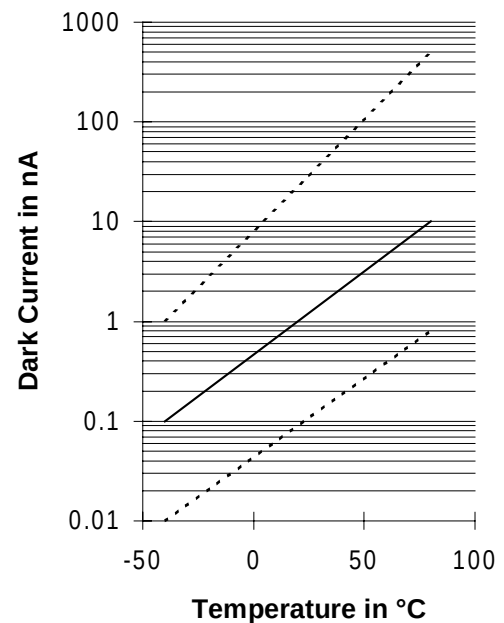
Laser Forward Current

$$I_F = f(V_F)$$



Monitor Diode Dark Current $I_R =$

$$f(T_A) \quad \Phi_{\text{port}} = 0, V_R = 5 \text{ V}$$



Coaxial module have to be mechanical fixed. Only Soldered pins doesn't fulfill mechanical connection of the coaxial module. Preferred for mechanical connection is our laser flange.

