Data Sheet, Rev. 1
February 2003

TriQuint Optoelectronics

T48-Type 1300 and 1500 nm Uncooled 2.5 Gb/s Laser Transmitters

Offering multiple output power options and SONET/SDH compatibility, the T48-Type Uncooled Laser Transmitters are manufactured in a 24-pin plastic DIP with a single-mode fiber pigtail.

Features

- Multisource compliant
- Data rates to 2.5 Gb/s
- SONET and ITU-T compliant at OC-48 and STM-16
- Uncooled, field-proven InGaAsP MQW laser
- 1300 nm and 1500 nm versions
- Clocked or nonclocked operation with single-ended or differential inputs
- 50 Ω ac-coupled ECL or PECL compatible data and clock inputs
- Operation from single +5 V or –5 V power supply
- Low-profile, 24-pin nonconductive package
- Automatic power control
- Wide operating case temperature range:
  — T481, T483, –40 °C to +85 °C
  — T485, –25 °C to +70 °C
- Laser back-facet monitor output
- Laser degrade alarm
- Transmitter-disable input
- FC, SC, LC, or MU connectors

Applications

- Telecommunications:
  — SONET/SDH SR/IR/LR
  — Subscriber loop
  — Metropolitan area networks
- High-speed data communication

Description

The T48-Type 2.5 Gb/s Laser Transmitters are designed for use in transmission systems and high-speed data communication applications. The transmitter operates at the SONET OC-48 rate, as well as the ITU-T SDH rate of STM-16.

The transmitters meet all present *Telcordia Technologies*™ GR-253CORE requirements and the ITU-T G.957 and G.958 recommendations. They are also ideally suited for extended-distance data and networking applications.

Manufactured in a 24-pin, plastic-encased DIP, the transmitter incorporates an InGaAs PIN photodiode back-facet monitor, a GaAs laser driver IC, and a choice of lasers, including:

- 1300 nm hermetic Fabry-Perot laser (T481 versions)
- 1300 nm hermetic MQW isolated DFB laser (T483 versions)
- 1550 nm hermetic MQW isolated DFB laser (T485 versions)

The transmitter requires a single power supply (+5 V or –5 V). A clock input can be enabled for those applications where jitter is critical.

Pin information is listed in Table 1.

Transmitter Processing

The transmitter can withstand normal wave soldering processes. The complete transmitter module is not hermetically sealed; therefore, it should not be immersed in or sprayed with any cleaning solution or solvents. The process cap and fiber-pigtail jacket can deform at temperatures greater than 85 °C. The transmitter pins can be wave-soldered at maximum temperature of 250 °C for 10 seconds.

Installation Considerations

Although the transmitter has been designed with ruggedness in mind, care should be used during handling. The optical connector should be kept free from dust, and the process cap should be kept in place as a dust cover when the device is not connected to a cable. If contamination is present on the optical connector, the use of canned air with an extension tube should remove any debris. Other cleaning procedures are identified in the *Cleaning Fiber-Optic Assemblies* Technical Note (TN95-010LWP).

Connector Options

The standard fiber-optic pigtail is an 8 μm core single-mode fiber in a 0.036 in. (914 μm) diameter, tight-buffered outer jacket. The standard length is 39 in. ± 4 in. (1 m ± 10 cm) and can be terminated with either an FC, SC, LC, or MU optical connector. Other connector options may be available on special order.

Table 1. Pin Descriptions

Pin Number	Name
1	V_{EE}
2	BF Monitor*
3	Bias Monitor*
4	Tx Disable
5	Clock Select
6	Ground
7	NUC†
8	Laser Degrade Alarm
9	NUC†
10	NUC†
11	Ground
12	V_{EE}
13	V_{CC}
14	NUC†
15	Ground
16	DATA
17	Ground
18	$\overline{\text{DATA}}$
19	Ground
20	Clock
21	Ground
22	$\overline{\text{Clock}}$
23	Ground
24	V_{CC}

* Laser back-facet and bias monitor functions are customer-use options that are not required for normal operations of the transmitter. They are normally used during manufacture and for diagnostics.

† Pins designated no user connection (NUC) cannot be tied to ground or any other circuit potential.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Supply Voltage*	—	—	5.5	V
Operating Case Temperature Range: T481 and T483 T485	T_C	 –40 –25	 85 70	 °C °C
Storage Case Temperature Range:	T_{stg}	–40	85	°C
Lead Soldering Temperature/Time	—	—	250/10	°C/s
Relative Humidity (noncondensing)	RH	—	85	%
Minimum Fiber Bend Radius	—	1.00 (25.4)	—	in. (mm)

*With V_{EE} connected to –5 V, V_{CC} must be at 0 V; with V_{CC} connected to +5 V, V_{EE} must be at 0 V.

Characteristics

Minimum and maximum values specified over operating case temperature range at 50% duty cycle data signal. Typical values are measured at room temperature unless otherwise noted.

Table 2. Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
dc Power Supply Voltage[1]	V	4.75	5.0	5.25	V
dc Power Supply Current Drain	I	—	180	300	mA
Input Data/Clock Voltage:[2, 3] Single-ended Input Differential Input	 V_{IN} V_{IN}	 400 200	 800 400	 1000 500	 mVp-p mVp-p
Clocked/Nonclocked Select Voltage:[4] Clocked Operation (active-low) Nonclocked Operation	 V_{SEL_CLK} V_{SEL_CLK}	 V_{EE} V_{CC} – 2.0	 — —	 V_{EE} + 0.8 V_{CC}	 V V
Input Impedance	R_{IN}	—	50	—	Ω
Transmitter Disable Voltage[5]	V_{DIS}	V_{CC} – 2.0	—	V_{CC}	V
Transmitter Enable Voltage (enabled low)	V_{EN}	V_{EE}	—	V_{EE} + 0.8	V
Laser Degrade Alarm: Normal Alarmed	— 	 V_{CC} – 2.0 V_{EE}	 — —	 V_{CC} V_{EE} + 0.8	 V V
Laser Bias Voltage [6]	V_B	0	200	1600	mV
Back-facet Monitor Voltage (50% duty cycle)	V_{BF}	470	500	530	mV
Set Time (See Figure 1.)	t_{SET}	70	—	330	ps
Hold Time (See Figure 1.)	t_{HOLD}	70	—	—	ps
Optical Rise Time (20%—80%)	t_R	—	—	70	ps
Optical Fall Time (80%—20%)	t_F	—	—	150	ps

1. With V_{EE} connected to –5 V, V_{CC} must be at 0 V; with V_{CC} connected to +5 V, V_{EE} must be at 0 V.
2. Inputs are ac-coupled into an equivalent input impedance of 50 ¾.
3. Single-ended or differential operation may be used. If the inputs are driven single-ended, the unused inputs must be ac-coupled (0.1 μF) to ground.
4. Clocked operation is optional. For clocked operation, pin 5 must be tied to V_{EE}. With clocked operation, the optical output changes state with the rising edge of the input clock signal. If left unconnected, the pin will be pulled low, enabling the clock mode.
5. The transmitter is normally enabled and only requires an external voltage to disable.
6. This voltage is measured from pin 3 to V_{EE} and is converted to laser bias current with the ratio of 20 mV/mA.

Characteristics (continued)

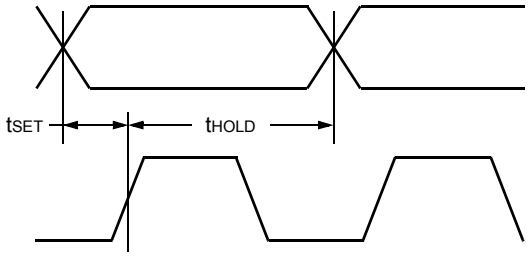

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Figure 1. Electrical Input/Output Interface Timing Diagram

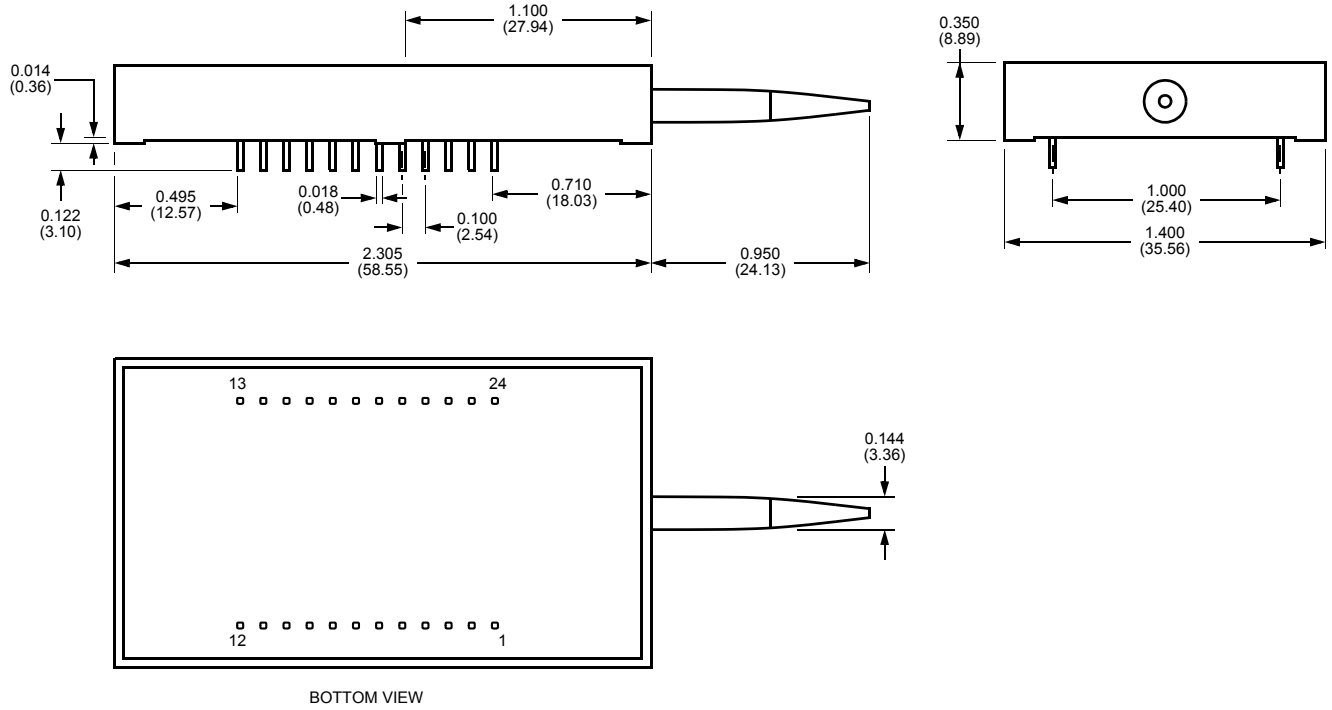
Table 3. Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Average Power Output:[1]					
T481xLAA	P_O	–10	–5	–3	dBm
T483xFAA, T485xFAA	P_O	–5	–2	0	dBm
T483xDAA, T485xDAA	P_O	–2	0	2	dBm
Center Wavelength Range:					
T481xLAA	λ	1266	—	1360	nm
T483xFAA	λ	1270	—	1360	nm
T483xDAA	λ	1280	—	1335	nm
T485xFAA	λ	1430	—	1580	nm
T485xDAA	λ	1500	—	1580	nm
Spectral Width (T481 Version, F-P Laser)	$\Delta\lambda_{RMS}$	—	—	4	nm
Spectral Width (T483/T485 Versions, DFB Laser)[2]	$\Delta\lambda 20$	—	—	1	nm
Wavelength Shift with Temperature:					
T481 Version	$\Delta\lambda/\Delta T$	—	0.4	—	nm/°C
T483/T485 Versions	$\Delta\lambda/\Delta T$	—	0.1	—	nm/°C
Side-mode Suppression Ratio (T483/T485 Version)[3]	SSR	30	—	—	dB
Extinction Ratio[4]	r_e	8.2	—	—	dB
Shutdown Optical Power	P_{SD}	—	–80	–70	dBm
Eye Mask of Optical Output [5, 6]	—	Meets SONET and ITU-T			

1. Output power definitions and measurement per ITU-T Recommendation G.957 and G.958.
2. Full spectral width measured 20 dB down from the maximum of the central wavelength peak under fully modulated conditions.
3. Ratio of the average output power in the dominant longitudinal mode to the optical power in the most significant side mode under fully modulated conditions.
4. Ratio of logic 1 output power to logic 0 output under fully modulated conditions.
5. GR-253-CORE, *Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria.*
6. ITU-T Recommendation G.957, *Optical Interfaces for Equipment and Systems Relating to the Synchronous Digital Hierarchy.*

Outline Drawing

Dimensions are in inches and (millimeters).



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Qualification and Reliability

To help ensure high product reliability and customer satisfaction, TriQuint is committed to an intensive quality program that starts in the design phase and proceeds through the manufacturing process. Optoelectronics modules are qualified to TriQuint's internal standards using MIL-STD-883 test methods and procedures and using sampling techniques consistent with *Telcordia Technologies* requirements. This qualification program fully meets the intent of *Telcordia Technologies* reliability practices TR-NWT-000468 and TA-TSY-000983. In addition, the TriQuint optoelectronics design, development, and manufacturing facility has been certified to be in full compliance with the latest *ISO*® 9001 Quality System Standards.

Electrostatic Discharge

CAUTION: This device is susceptible to damage as a result of electrostatic discharge. Take proper precautions during both handling and testing. Follow guidelines such as JEDEC Publication No. 108-A (Dec. 1988).

TriQuint Semiconductor employs a human-body model (HBM) for ESD-susceptibility testing and protection-design evaluation. ESD voltage thresholds are dependent on the critical parameters used to define the model. A standard HBM (resistance = 1.5 kΩ, capacitance = 100 pF) is widely used and can be used for comparison purposes.

Laser Safety Information

Class I Laser Product

FDA/CDRH Class I laser product. All versions of the T48-Type transmitters are Class I laser products per CDRH, 21 CFR 1040 Laser Safety requirements. The transmitters have been classified with the FDA under accession number 8720009. All versions are Class I laser products per *IEC*® 60825-1:1993.

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

This product complies with 21 CFR 1040.10 and 1040.11.
8.8 μm/125 μm single-mode fiber pigtail with 914 μm tight-buffered outer jacket and connector
Wavelength = 1.3 μm, 1.5 μm
Maximum power = 1.6 mW

Because of size constraints, laser safety labeling is shipped with the device.
Product is not shipped with power supply.

Notice
Unterminated optical connectors can emit laser radiation.
Do not view with optical instruments.

Ordering Information

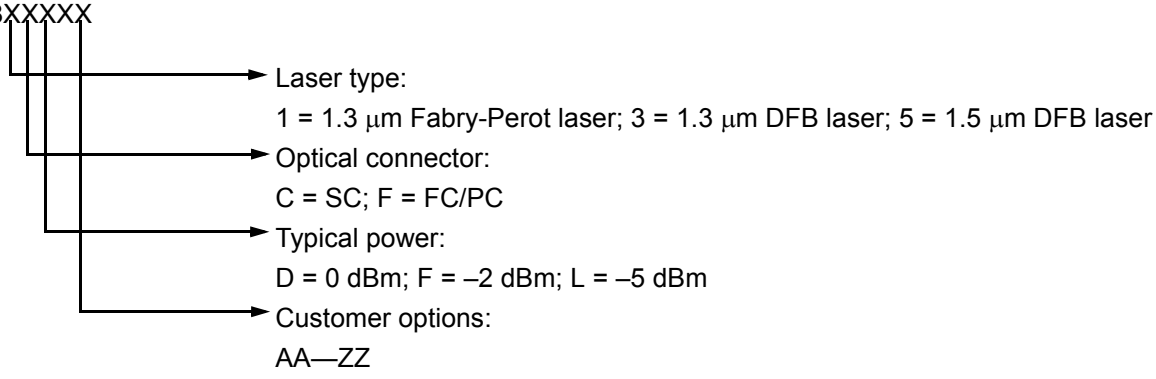
Table 4. Ordering Information*

Product Code	Laser Type	Connector	Typical Power (dBm)	Comcode
T481CLAA	1.3 FP	SC	–5	108309162
T481FLAA	1.3 FP	FC	–5	108309170
T481WLAA	1.3 FP	LC	–5	108825795
T481JLAA	1.3 FP	MU	–5	TBD
T483CDAA	1.3 DFB	SC	0	108309196
T483FDAA	1.3 DFB	FC	0	108309212
T483WDAA	1.3 DFB	LC	0	108825803
T483JDAA	1.3 DFB	MU	0	TBD
T483CFAA	1.3 DFB	SC	–2	108309204
T483FFAA	1.3 DFB	FC	–2	108309220
T483WFAA	1.3 DFB	LC	–2	108825811
T483JFAA	1.3 DFB	MU	–2	TBD
T485CDAA	1.5 DFB	SC	0	108400300
T485FDAA	1.5 DFB	FC	0	108400995
T485WDAA	1.5 DFB	LC	0	108825829
T485JDAA	1.5 DFB	MU	0	TBD
T485CFAA	1.5 DFB	SC	–2	108400987
T483FFAA	1.5 DFB	FC	–2	108401001
T483WFAA	1.5 DFB	LC	–2	108825845
T483JFAA	1.5 DFB	MU	–2	TBD

* Please contact a TriQuint account manager for more information.

Coding Scheme

Example: T48XXXXX



Related Product Information

Product Code	Description	Document Number
R485	Lightwave Receiver with Clock Recovery for 2.488 Gb/s Applications	DS01-005OPTO
R480	Lightwave Receiver with CML Data Output for 2.488 Gb/s Applications	DS01-011OPTO
P172	2.5 Gb/s MiniDIL Receiver	DS01-283-1
C48	2.5 Gb/s Cooled Laser Transmitters	DS02-278-1

Additional Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: www.triquint.com **Tel: (503) 615-9000**

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