T92-Type 10 Gbits/s 1300 nm Uncooled DFB Laser Transmitter

Offering SONET/SDH compatibility, the T92-Type Uncooled Laser Transmitter is manufactured in a 24-pin DIP assembly with a single-mode fiber pigtail.

Features

- Multisource compliant
- Data rates to 10 Gbits/s
- SONET and ITU-T compliant at OC-192 and STM-64 (see footnote 7 on page 4)
- Uncooled, field-proven InGaAsP MQW laser
- 1300 nm DFB
- Clocked or nonclocked operation with single-ended or differential inputs
- 50 Ω ac-coupled 500 mVp-p—1000 mVp-p single-ended data and clock inputs
- Operation from single –5.2 V or +5.0 V power supply
- Low profile, 24-pin PWB assembly
- Automatic optical power control
- Wide operating case temperature range: 0 °C to 70 °C
- Laser bias monitor output
- Normalized laser back-facet monitor output
- Laser degrade alarm
- Clock-select input (next generation)
- Transmitter disable input
- SC, FC-PC, and LC optical connector options

Applications

- Telecommunications:
  - — SONET/SDH
  - — Subscriber loop
  - — Metropolitan area networks
- High-speed data communications

Description

The T92-Type 10 Gbits/s laser transmitters are designed for use in transmission systems and high-speed data communication applications. The transmitter operates at the SONET OC-192 rate, as well as, the ITU-T SDH rate of STM-64.

The transmitters meet all present *Telcordia Technologies** GR-253-CORE requirements and the ITU-T G.691 recommendations (see footnote 7, p.4). The transmitters are also ideally suited for extended distance data and networking applications.

Manufactured in a 24-pin DIP assembly, the transmitter uses an hermetic MQW isolated 1300 nm DFB laser, an InGaAs PIN photodiode back-facet monitor and a GaAs laser driver IC. The transmitter requires a single power supply (–5.2 V or +5.0 V). Clocked operation can be enabled for those applications where jitter is critical.

Pin information is listed in Table 1.

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Description (continued)

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 a 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).

Laser Degrade-mode Alarm

An output of the transmitter that indicates when the laser bias has reached its end-of-life condition. The transmitter will still function, but may not meet all specifications. The transmitter should be replaced when this alarm is active (active low). Specifically, this alarm indicates that the bias of the laser has changed more than 50% from its original value.

Back-facet Monitor Output

This is an analog output that indicates whether the transmitter has the correct optically generated back-facet current. It may be used for alarm purposes. It is referenced to V_{EE}. Under normal operating conditions, this monitor will output a voltage that is nominally 500 mV above V_{EE}. When the optical output power of the transmitter increases or decreases, this voltage will move proportionately.

Bias Monitor Output

This is an optional analog output voltage that indicates the bias current being supplied to the laser. It is referenced to V_{EE}. The conversion for this monitor output is 20 mV for every 1 mA of bias current to the laser. For example, a 400 mV output above V_{EE} would indicate 20 mA of bias current to the laser.

Table 1. Pin Descriptions

Pin Number	Name
1	V_{EE}
2	Back-facet Monitor[1]
3	Bias Monitor
4	Tx Enable
5	Clock Select
6	Ground
7	Temperature Monitor[2]
8	Laser Degrade Alarm
9	NUC
10	NUC
11	NUC[3]
12	V_{EE}
13	V_{CC}
14	NUC[3]
15	Ground
16	DATA[4]
17	Ground
18	$\overline{\text{DATA}}$[4]
19	Ground
20	CLOCK[4]
21	Ground
22	$\overline{\text{CLOCK}}$[4]
23	Ground
24	V_{CC}

1. Laser back-facet function is a customer-use option that is not required for normal operations of the transmitter and is normally used during manufacture and for diagnostics.
2. Laser temperature (°C) = (V_{TEMP} – 0.5 V)/0.01 V, where V_{TEMP} is the temperature monitor voltage.
3. This pin can be tied to ground.
4. For single-ended operation, data signal must be on pin 16, and $\overline{\text{DATA}}$ (pin 18) must 50 Ω terminated to ground; for single-ended clocked operation, clock signal must be on pin 20, and $\overline{\text{CLOCK}}$ (pin 22) must be 50 Ω terminated to ground.

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	V_{CC}	—	5.5	V
Operating Case Temperature Range	T_C	0	70	°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)

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_{EE}	–5.5/+4.75	–5.2/+5.0	–4.9/+5.25	V
dc Power Supply Current Drain	I	—	250	400	mA
Input Data/Clock Voltage: [2, 3] Single-ended Input	V_{IN}	500	700	1000	mVp-p
Clocked/Nonclocked Select Voltage:[4] Clocked Operation Nonclocked Operation	 V_{SEL_CLK} $V_{SEL\ CLK}$	 V_{EE} V_{CC} – 2.0	 — —	 V_{EE} + 0.8 V_{CC}	 V V
Clock/Data Input Impedance	R_{IN}	—	50	—	Ω
Clock/Data RF Return Loss (50 kHz to 10 Ghz)	S11	—	—	–10	dB
Clock/Data Input Skew[5]	dc_{SKEW}	–25	0	25	ps
Transmitter Disable Voltage[6]	V_{DIS}	V_{CC} – 2.0	—	V_{CC}	V
Transmitter Enable Voltage	V_{EN}	V_{EE}	—	V_{EE} + 0.8	V
Degrade Mode Alarm Voltage–Normal	V_{NORMAL}	V_{CC} – 2.0	—	V_{CC}	V
Degrade Mode Alarm Voltage–Alarmed[7]	$V_{ALARMED}$	V_{EE}	—	V_{EE} + 0.8	V
Laser Bias Voltage[8]	V_B	0	500	2400	mV
Back-facet Monitor Voltage (50% duty cycle)[9]	V_{BF}	460	500	540	mV

1. With V_{EE} connected to –5.2 V, V_{CC} must be at 0 V; With V_{CC} connected to +5.0V, V_{EE} must be at 0 V.
2. Inputs are ac-coupled into an equivalent input impedance of 50 Ω.
3. Single-ended or differential operation may be used. If the inputs are driven single-ended, the unused inputs ($\overline{Clock}$ and $\overline{Data}$) must be 50 Ω terminated to ground.
4. Clocked operation is normally enabled and only requires an external voltage to disable. For nonclocked operation, pin 5 must be tied to V_{CC}.
5. With clocked operation, the optical output changes state with the rising edge of the input clock signal. The skew is measured with the rising edge of the clock centered in the middle of the data eye.
6. The transmitter is normally enabled and only requires an external voltage to disable.
7. This alarm will go active when the bias current to the laser has increased 50% or more from its beginning-of-life (BOL) value.
8. This voltage is measured from Pin 3 to V_{EE} and is converted to laser bias current with the ratio of 20 mV/mA.
9. This voltage is measured from Pin 2 to V_{EE}.

Characteristics (continued)

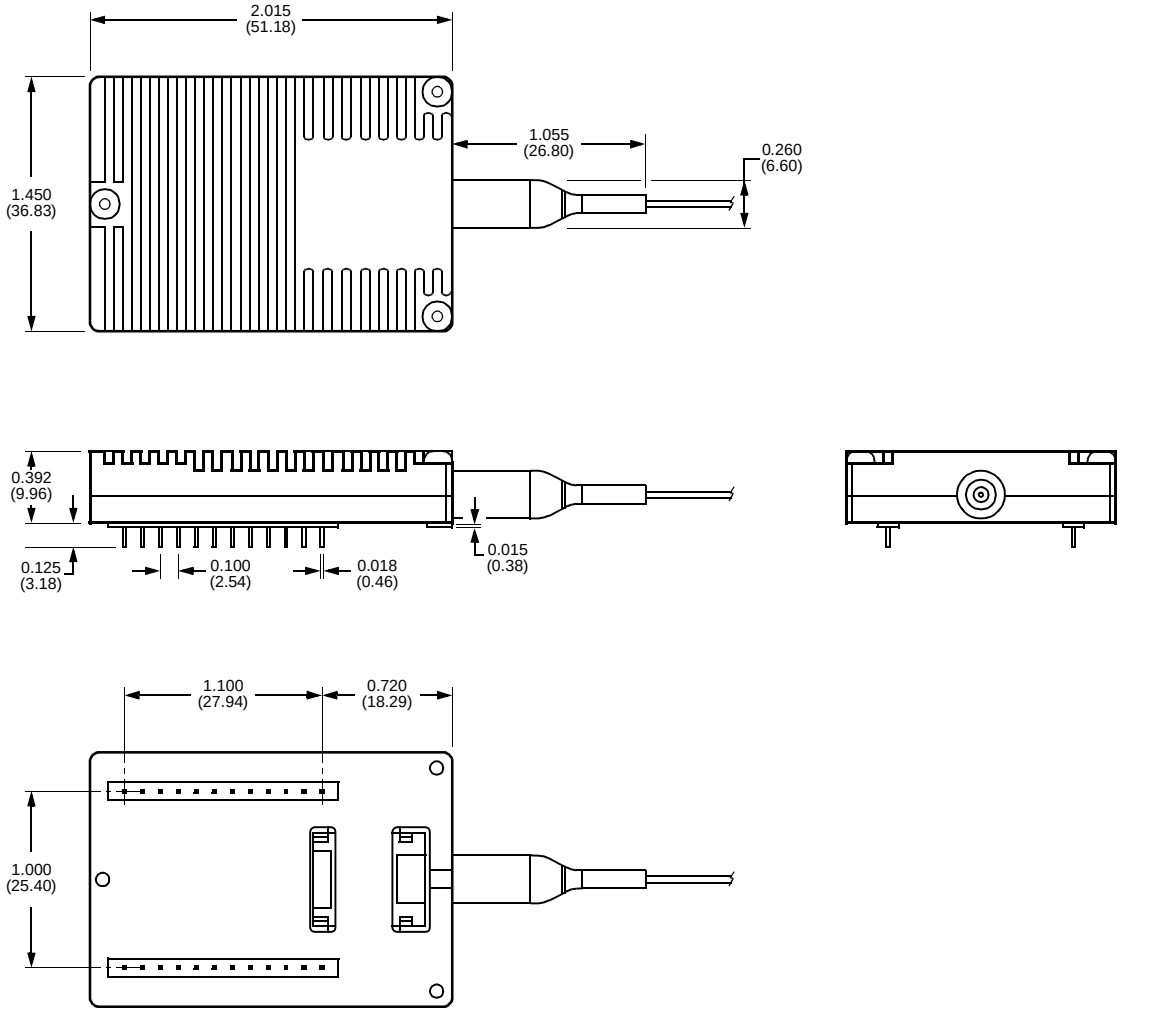
Table 3. Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Average Power Output, T923xFAA[1]	P_O	–6	–2	–1	dBm
Center Wavelength Range, T923xFAA	λ_C	1290	—	1330	nm
Spectral Width[2]	$\Delta\lambda_{20}$	—	—	1	nm
Wavelength Shift with Temperature	$\Delta\lambda/\Delta T$	—	0.1	—	nm/°C
Side-mode Suppression Ratio [3]	SMSR	30	—	—	dB
Dispersion Penalty (D = 12 km, max.)	D_P	—	—	1	dB
Extinction Ratio[4]	r_e	6	7	—	dB
Eye Mask of Optical Output [5, 6, 7]	—	See Note 7.			—

1. Output power definitions and measurements per proposals to the ITU-T Recommendation G.691.
2. Full spectral width measured 20 dB down from the maximum of the central wavelength peak under fully modulated conditions.
3. Ratio of the peak output power in the dominant longitudinal mode to the 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.691, *Optical Interfaces for Equipment and Systems Relating to the Synchronous Digital Hierarchy*.
7. The 10 Gbits/s mask has not been currently agreed to by the standards committee. Proposal is to use the 2.5 Gbits/s SONET eye mask test scaled to 10 Gbits/s. The inner mask will be met, however, the outer mask will not be met.

Outline Drawings

Dimensions are in inches and (millimeters).



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Qualification and Reliability

To help ensure high product reliability and customer satisfaction, Agere Systems is committed to an intensive quality program that starts in the design phase and proceeds through the manufacturing process. Optoelectronics modules are qualified to Agere Systems 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 Bellcore reliability practices TR-NWT-000468 and TA-TSY-000983. In addition, the Agere Systems Technologies Microelectronics Group Optoelectronics design, development, and manufacturing facility has been certified to be in full compliance with the latest *ISO** 9001 Quality System Standards.

Laser Safety Information

Class I Laser Product

All versions of the T92-type transmitters are classified as Class I laser products per FDA/CDRH, 21 CFR 1040 Laser Safety requirements. The transmitters are classified with the FDA under accession number 8720009. All versions are classified as Class I laser products per *IEC*† 60825-1:1993.

This product complies with 21 CFR 1040.10 and 1040.11.
Wavelength = 1.5 µm
Maximum power = 10 mW

Connector Options

The standard optical fiber pigtail is 8 µm core single-mode fiber having a 0.036 in. (914 mm) diameter tight-buffered outer-jacket. The standard length is 39 in. ± 4 in. (1 m ± 10 cm) and can be terminated with an SC, FC-PC, or LC optical connector.

Product is not shipped with power supply.

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

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

* *ISO* is a registered trademark of The International Organization for Standardization.
† *IEC* is a registered trademark of The International Electrotechnical Commission.

Ordering Information

Table 4. Ordering Information

Product Code	Connector	Comcode
T923CFAA	SC	108749748
T923FFAA	FC-PC	108749755
T923WFAA	LC	108749763

Ordering Code Definitions

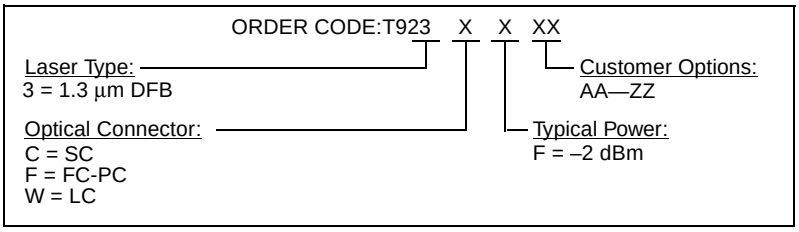

Table 5. Related Product Information

Product Code	Description	Document Number
R192-Type 10 Gbits/s Optical Receiver	10 Gbits/s Optical Receiver	DS00-261OPTO

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