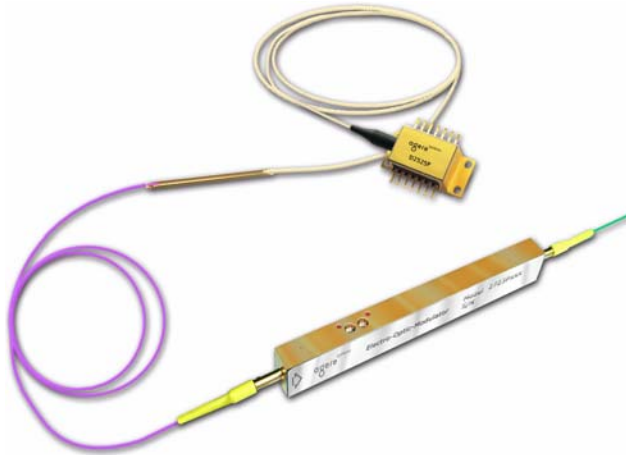


High-Power 10 Gbit/s Modulated Source



The high-power 10 Gbits/s modulated source features a DFB CW laser spliced to a 10 Gbit/s, dual-drive lithium-niobate modulator, 2723Cxxx.

Features

- ITU wavelengths available from 1529.55 nm—1610.06 nm
- Integrated optical isolator
- Industry-standard, 14-pin butterfly package
- Narrow linewidth
- Patented dual-drive technology with GPO connectors
- Minimum bandwidths of 8.5 GHz
- Tunable, zero-chirp operation
- Use of IC chip due to low drive voltages
- PMF fiber splice
- High reliability and hermetic packages

Applications

- Digital high-speed telecommunications:
 - SONET: OC-1 through OC-192
 - SDH: STM-16, STM-64
 - Undersea communications
- Internet data communications

Description

The D2525P family of DFB laser modules is designed to be used with a lithium-niobate external modulator (see Table 5). The laser module features a polarization-maintaining fiber (PMF) pigtail, enabling it to be directly connected to the modulator via a fiber splice. The module contains a multi-quantum-well (MQW), distributed-feedback (DFB) laser. This device nominally has an output power of 10 mW. The wavelength of the laser can be temperature-tuned for more precise wavelength selection by adjusting the temperature of the internal thermoelectric cooler. The laser module is fabricated in a 14-pin, hermetic, metal/ceramic butterfly package that incorporates a bias tee that separates the dc-bias path from the RF input. The RF input has a nominal 25 Ω impedance.

The 10 Gbits/s 2623W dual-drive modulator uses an integrated Mach-Zehnder configuration to convert single-polarization CW light from a semiconductor (DFB) laser into a time-varying optical output signal. The patented dual-drive configuration and Ti-diffusion process is a standard feature on this modulator.

Description (continued)

With this design configuration, tunable chirp transmission for maximum reach can be achieved. Also, balanced drive voltages can produce zero-chirp operation. Low drive voltages enable the use of IC chip drivers such as the Agere Systems TMOD0110G, which supports a small and low-cost driver solution.

Controlled Feedback (D2625P)

The module contains an internal optical isolator that suppresses optical feedback in laser-based, fiber-optic systems. Light reflected back to the laser is attenuated a minimum of 30 dB.

Controlled Temperature (D2525P)

An integral thermoelectric cooler (TEC) provides stable thermal characteristics. The TEC allows for heating and cooling of the laser chip to maintain a temperature of 25 °C for case temperatures from -40 °C to +70 °C. The laser temperature is monitored by the internal thermistor, which can be used with external circuitry to control the laser chip temperature.

Controlled Power (D2525P)

An internal, InGaAs, PIN photodiode functions as the back-facet monitor. The photodiode monitors emission from the rear facet of the laser and, when used in conjunction with control circuitry, can control optical power launched into the fiber. Normally, this configuration is used in a feedback arrangement to maintain consistent laser output power.

Pin Information

Table 1. Pin Descriptions

Pin	Name
1	Thermistor
2	Thermistor
3	Laser dc Bias (Cathode) (-)
4	Back-facet Monitor Anode (-)
5	Back-facet Monitor Cathode (+)
6	Thermoelectric Cooler (+) ¹
7	Thermoelectric Cooler (-) ¹
8	Case Ground
9	Case Ground
10	Case Ground
11	Laser Anode (+) ²
12	RF Laser Input Cathode (-)
13	Laser Anode (+) ²
14	Case Ground
15	RF/dc Input Data or $\overline{\text{Data}}$
16	RF/dc Input Data or $\overline{\text{Data}}$

- 1. A positive current through the thermoelectric heat pump cools the laser.
- 2. For optimum performance, both leads should be grounded.

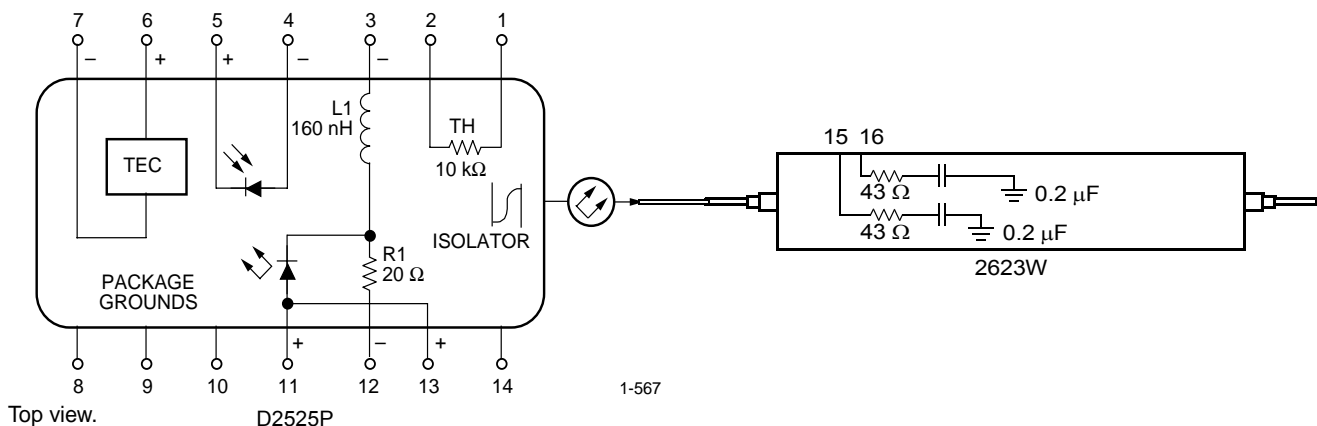


Figure 1. Circuit Schematic

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
D2525P				
Storage Case Temperature Range*	T _{stg}	-40	70	°C
Operating Case Temperature Range	T _C	-40	70	°C
Laser Reverse Voltage	V _{RLMAX}	—	2	V
dc Forward Current	I _{FLMAX}	—	225	mA
Photodiode Reverse Voltage	V _{RPDMAX}	—	10	V
Photodiode Forward Current	I _{FPDMAX}	—	2	mA
2623W				
Storage Temperature	T _{stg}	-40	85	°C
Operating Temperature	T _{OP}	0	70	°C
Optical Input Power at 1.5 μm	P _{IN}	—	30	mW
RF Voltage (peak to peak)	V _{RF}	—	10	V
dc Voltage (RF input)	V _{dCRF}	-20	20	V

* Does not apply to shipping container.

Handling Precautions

Power Sequencing

To avoid the possibility of damage to the laser module from power supply switching transients, follow this turn-on sequence:

1. All ground connections
2. Most negative supply
3. Most positive supply
4. All remaining connections

Reverse the order for the proper turn-off sequence.

Electrostatic Discharge

CAUTION: This laser 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).

Agere Systems 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, therefore, can be used for comparison purposes. The HBM ESD threshold shown here was obtained using these circuit parameters:

Parameter	Value	Unit
Human-body Model	>400	V

Mounting Instructions

The minimum fiber bend radius is 1.0 in. (25.4 mm).

To avoid degradation in performance, mount the modules on the board as follows:

1. Place the bottom flange of the laser module on a flat heat sink at least 0.5 in. x 1.180 in. (12.7 mm x 30 mm) in size. The surface finish of the heat sink should be better than 32 μin. (0.8 μm), and the surface flatness must be better than 0.001 in. (25.4 μm). Using thermal conductive grease is optional; however, thermal performance can be improved by up to 5% if conductive grease is applied between the bottom flange and the heat sink.
2. Mount four #2-56 screws with Fillister heads (M2-3 mm) at the four screw hole locations (see Outline Diagram). The Fillister head diameter must not exceed 0.140 in. (3.55 mm). Do not apply more than 1 in.-lb. of torque to the screws.
3. For the modulator, mount a minimum of two #4-40 screws into the two center screw holes located on the bottom of the package (see Outline Diagram). Do not apply more than 5.2 in.-lb. of torque to the screws.

Characteristics

Table 2. Electrical Characteristics, D2525P (at 25 °C laser temperature)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Threshold Current	I_{TH}	—	—	15	35	mA
Drive Current Above Threshold	—	$I_F = 10$ mW	—	—	110	mA
Laser Forward Voltage	V_{LF}	$I_F = 10$ mW (CW)	—	1.3	1.8	V
Laser Submount Temperature	T_{LASER}	—	20	—	30	°C
Monitor Reverse-bias Voltage*	V_{RMON}	—	3	5	10	V
Monitor Current	I_{RMON}	$P_O = 10$ mW (CW)	0.2	—	—	mA
Monitor Dark Current	I_D	$I_F = 0$, $V_{RMON} = 5$ V	—	0.01	0.1	μA
Input Impedance	Z_{IN}	—	—	25	—	Ω
Thermistor Current	I_{TC}	—	10	—	100	μA
Resistance Ratio†	—	—	9.1	9.6	10.1	—
Thermistor Resistance	R_{TH}	$T_L = 25$ °C	9.5	—	10.5	kΩ
TEC Current	I_{TEC}	$T_L = 25$ °C, $T_C = 70$ °C	—	—	1.0	A
TEC Voltage	V_{TEC}	$T_L = 25$ °C, $T_C = 70$ °C	—	—	2.0	V
TEC Capacity	ΔT	$T_C = 70$ °C	—	—	50	°C

* Standard operating condition is 5.0 V reverse bias.

† Ratio of thermistor resistance at 0 °C to thermistor resistance at 50 °C

Table 3. Optical Characteristics, D2525P (at 25 °C laser temperature)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Peak Optical Output Power	P_P	—	10.0	—	—	mW
Center Wavelength* (See Table 4.)	λ_C	$T_L = 25$ °C CW wavelength	1529.55	—	1610.06	nm
Line Width (3 dB full width)	$\Delta\lambda$	CW, $P_F = 10.0$ mW	—	2	10	MHz
Relative Intensity Noise	RIN	CW, $P_F = 10.0$ mW, 200 MHz < f < 10 GHz	—	—	-135	dB/Hz
Side-mode Suppression Ratio	SMSR	CW	35	45	—	dB
Optical Isolation	—	$T_C = 0$ °C to 75 °C	30	—	—	dB
Optical Polarization Extinction Ratio†	—	0 °C to 75 °C	20	—	—	dB
Wavelength Drift (EOL)	$\Delta\lambda$	Tested over 25 yr. lifetime	—	—	±0.1	nm
Wavelength Drift vs. Case Temperature	—	—	—	—	±1	pm/°C

* Custom wavelengths available.

† The ST ferrule key is not aligned to slow axis of fiber. Connector is intended for testing purposes only.

Characteristics (continued)

Table 4. Optical/Electrical Characteristics, 2623W

Parameter	Min	Typ	Max	Unit
Operating Wavelength	1525	—	1620	nm
Insertion Loss	—	—	6.0	dB
Combined Module Output Power (under operating current and modulation voltage)	-4	—	—	dBm
Extinction Ratio at dc	20	—	—	dB
Extinction Ratio at RF	12	—	—	dB
S11 Optical Return Loss	—	—	-30	dB
Bandwidth*	8	—	—	GHz
Drive Voltage (V_{π}) at 1 GHz	2.0	2.4	2.6	V/side
S11 Electrical Return Loss (0.3 MHz—5 GHz)	—	—	-13	dB
S11 Electrical Return Loss (5 GHz—10 GHz)	—	—	-10	dB
S11 Electrical Return Loss (10 GHz—18 GHz)	—	—	-6	dB

* Bandwidth stated is electrical-optical-electrical as determined by the frequency response of the received RF electrical power (after the photodiode) and measured relative to the RF electrical power used to drive the modulator. This response is referenced to the value at 130 MHz.

2623W Characteristic Curves

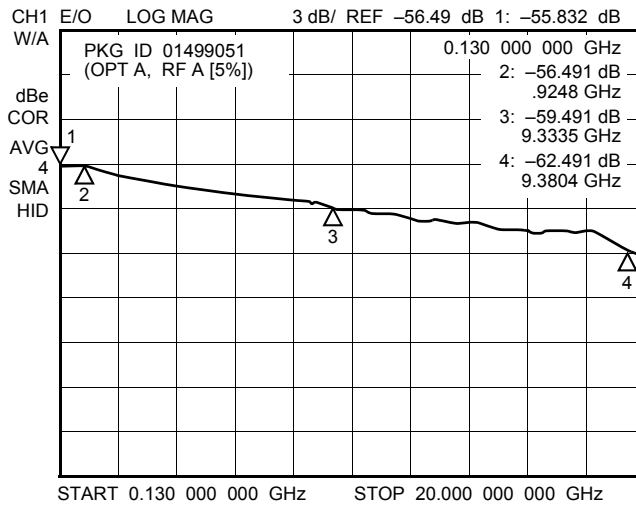


Figure 2. Magnitude of Electro-Optic Response, 0.130 MHz—20 GHz

Characteristics (continued)

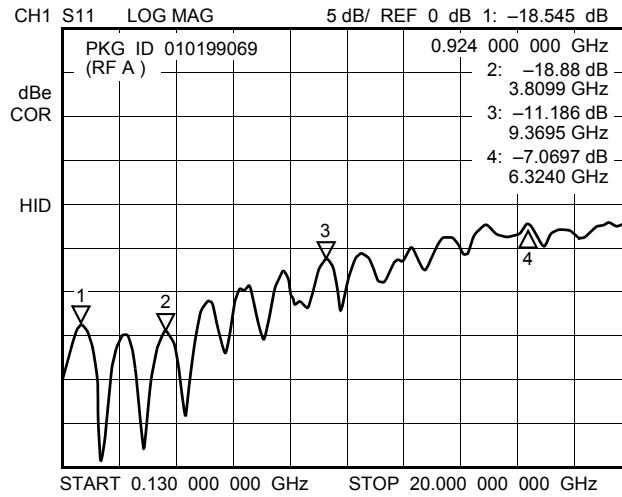


Figure 3. S11 Electrical Return Loss

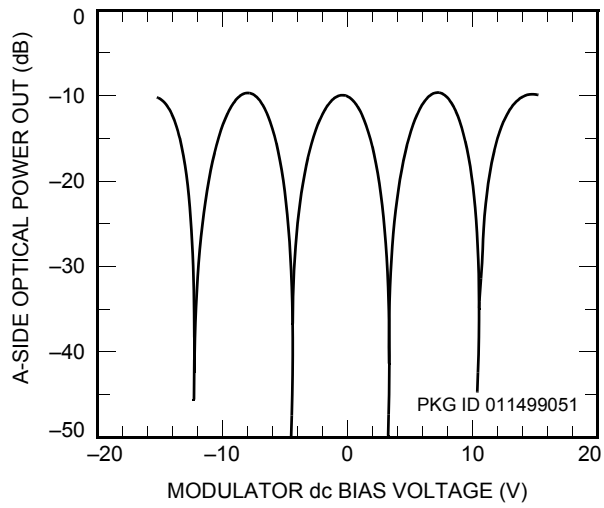
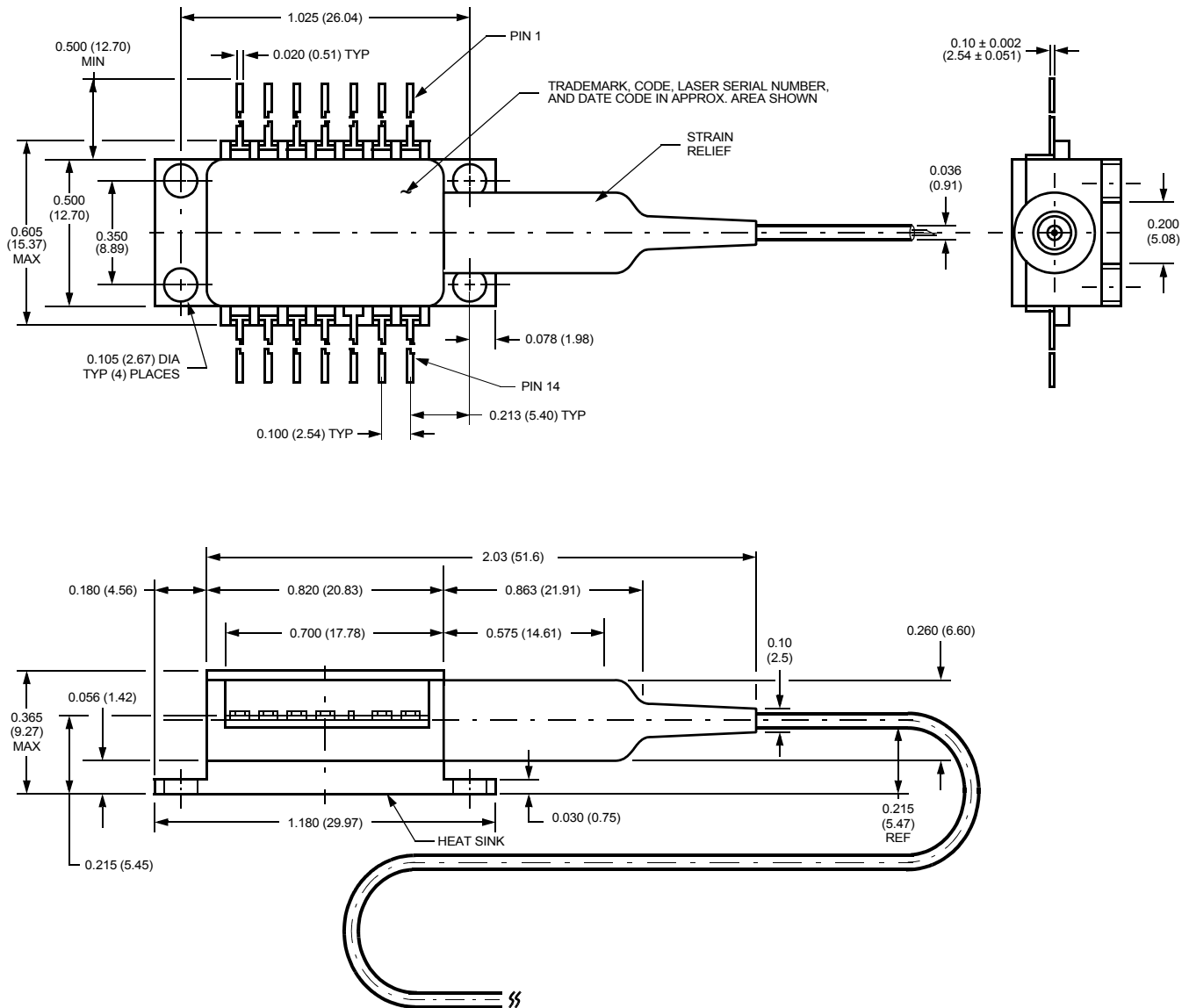


Figure 4. Output Power vs. Bias Voltage

Outline Diagrams

Dimensions are in inches and (millimeters). Tolerances are ± 0.005 in. (± 0.127 mm).

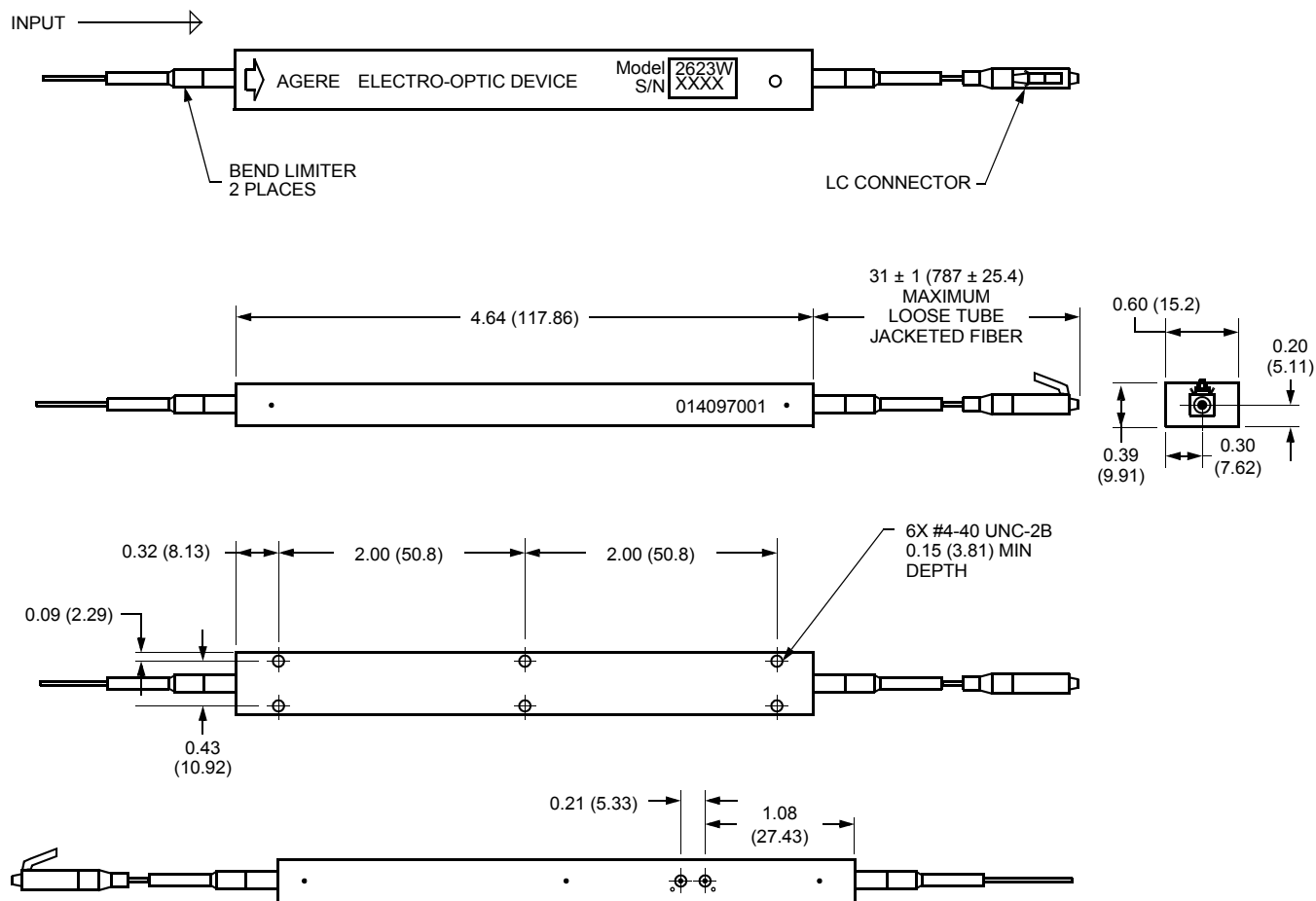
D2525P



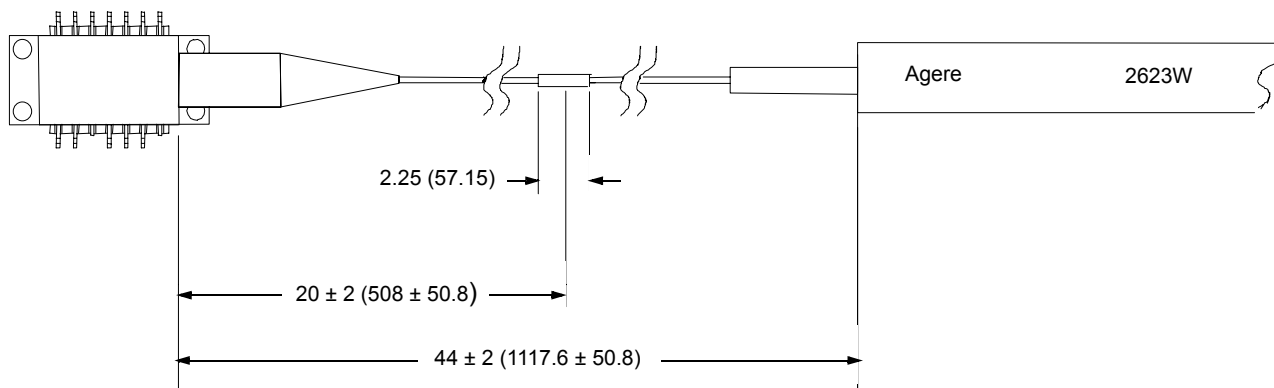
Outline Diagrams (continued)

Dimensions are in inches and (millimeters).

2623W



Spliced Assembly



Class IIIb Laser Product

FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. The device has been classified with the FDA under accession number 8720010.

This product complies with 21 CFR 1040.10 and 1040.11.

8 μm /125 $\mu\text{m} \pm 3 \mu\text{m}$ single-mode fiber with 900 μm loose-tube jacketed fiber and connector

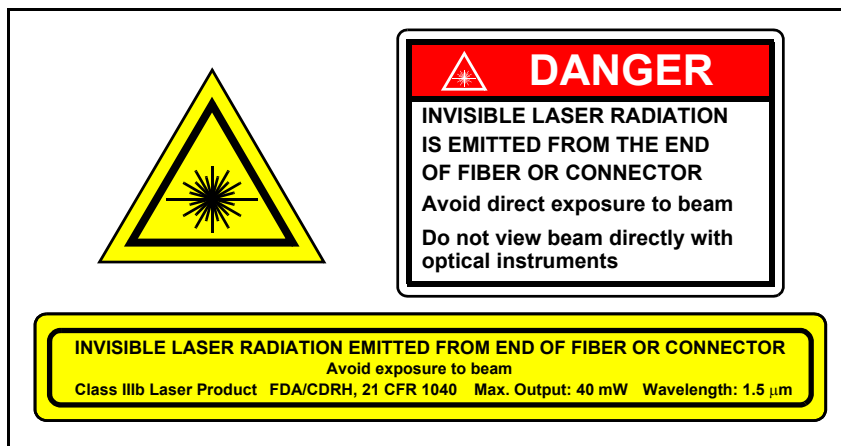
Wavelength = 1.5 μm

Maximum power = 40 mW

Because of size constraints, laser safety labeling (including an FDA Class IIIb label) is not affixed to the module but attached to the outside of the shipping carton.

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.



Ordering Information

Table 5. Ordering Information

Device Code	ITU Frequency (THz)	Wavelength (nm)	Comcode
2723Cxxx	186.2—196.0	1529.55—1610.06	Contact your local sales representative

* IEC is a registered trademark of The International Electrotechnical Commission.

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E-MAIL: docmaster@agere.com

N. AMERICA: Agere Systems Inc., 555 Union Boulevard, Room 30L-15P-BA, Allentown, PA 18109-3286

1-800-372-2447, FAX 610-712-4106 (In CANADA: **1-800-553-2448**, FAX 610-712-4106)

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