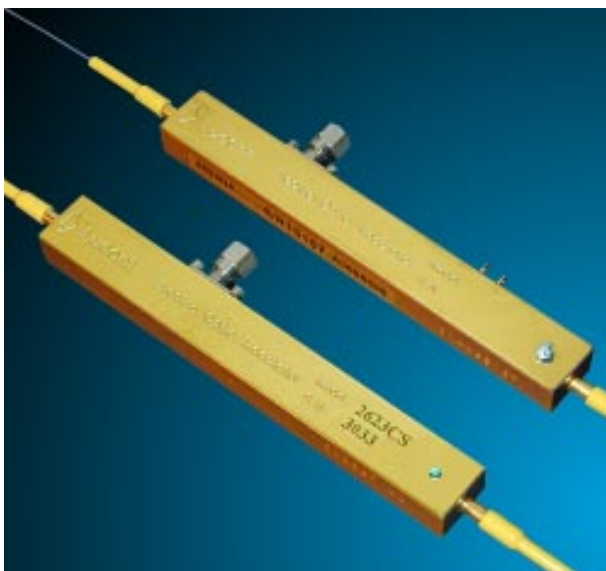




10 Gbits/s Lithium Niobate Electro-Optic Modulator



The Lithium Niobate Modulators include a single-drive modulator (2623CS) and a single-drive modulator with an integrated attenuator (2623CSA). Both devices are capable of modulation rates up to 10 Gbits/s.

Features

- Ti-diffusion process
- Single-drive technology
- Operation at 1.55 μm wavelength
- Slim, hermetic package
- Bandwidths up to 16 GHz
- Operational over a temperature range of 0 $^{\circ}\text{C}$ to 70 $^{\circ}\text{C}$
- 43 Ω design for minimal electrical reflections
- Angled interfaces for minimal optical reflections
- Integrated optical attenuator available on 10 Gbits/s modulator (2623CSA)
- Tested to Bellcore 468

Benefits

- Excellent long-term bias stability
- Internal polarizer
- Low modulation voltages

Applications

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

Description

The 10 Gbits/s Electro-Optic Modulator is designed for long-wavelength, single-mode external amplitude modulation applications. It uses an integrated Mach-Zehnder configuration to convert single polarization CW light from a semiconductor (DFB) laser into a time-varying optical output signal. Lucent also offers a 10 mW, CW laser with polarization-maintaining fiber (D2525P) to use as source for the modulator.

The Ti-diffusion process is a standard feature on all modulator devices. The 2623CS is a single-drive, 10 Gbits/s modulator; the 2623CSA is a single-drive, 10 Gbits/s modulator with an attenuating section. Variable attenuation to >18 dB is achieved through a dc bias voltage.

The package is hermetic to protect the LiNbO₃ die from the environment. Novel processing techniques now make it possible to achieve 20-year operation with little drift in the dc bias point. The modulator is tested to, and meets the intent of, TR-NWT-00468.

Other standard features include Panda-type polarization-maintaining fiber (PMF) for the optical input and output fiber with FC-type connectors that are keyed to the axis of polarization. Custom designs are available.

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 operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

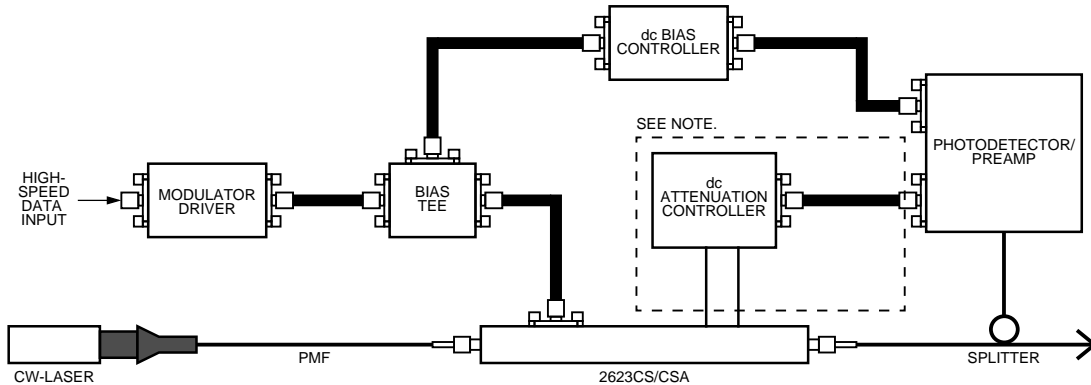
Parameter	Symbol	Min	Max	Unit
Storage Temperature	T _{stg}	-40	85	°C
Optical Input Power @ 1.5 μm	P _{IN}	—	30	mW
RF Voltage (RF input)	V _{RF}	—	20	V
dc Voltage (RF input)	V _{dcRF}	-20	20	V
dc Voltage (Attenuator input)	V _{dcATT}	-25	25	V
Operating Temperature	T _{OP}	0	70	°C

Optical/Electrical Characteristics

Table 1. Optical/Electrical Characteristics

Parameter	Min	Typ	Max	Unit
Operating Wavelength	1525	1550	1565	nm
Insertion Loss:				
2623CS	3	3.7	5.5	dB
2623CSA	3.5	4.5	6.5	dB
Extinction Ratio @ dc	20	27	—	dB
Extinction Ratio @ RF	—	13	—	dB
S11 Optical Return Loss	—	—	-35	dB
Bandwidth*	8	10	—	GHz
Drive Voltage ($V\pi$) @ dc	2.5	3.1	4.5	V
Drive Voltage ($V\pi$) @ 1 GHz	3.5	4.1	5.5	V
Attenuation Voltage @ -19 dB	15	19	22	V
Electrode Impedance	—	43	—	Ω
S11 Electrical Return Loss (0.13 GHz—5 GHz)	—	-15	-13	dB
S11 Electrical Return Loss (5 GHz—8 GHz)	—	-12	-10	dB
S11 Electrical Return Loss (8 GHz—18 GHz)	—	-8	-6	dB

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



Note: Circuitry in dotted lines is used only with the 2623CSA.

Figure 1. Recommended Operating Circuit Diagram

1-1062 (F)

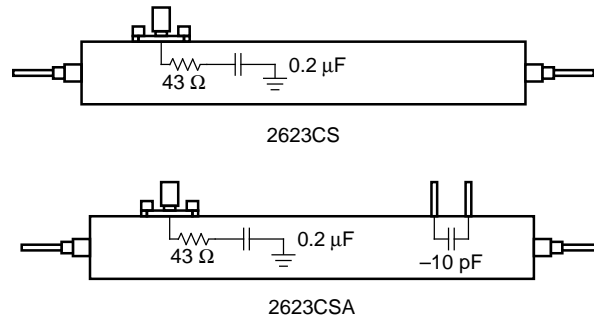


Figure 2. Equivalent Circuit Diagram

1-1063 (F)

Optical/Electrical Characteristics (continued)

Electrical Signal Input

Electrical signal input is made through SMA coaxial connectors. The standard device includes an internal termination network. Care must be taken not to exceed the recommended 8 in./lb. of torque when making connections to these inputs. High-frequency coaxial cable is recommended.

Characteristic Curves

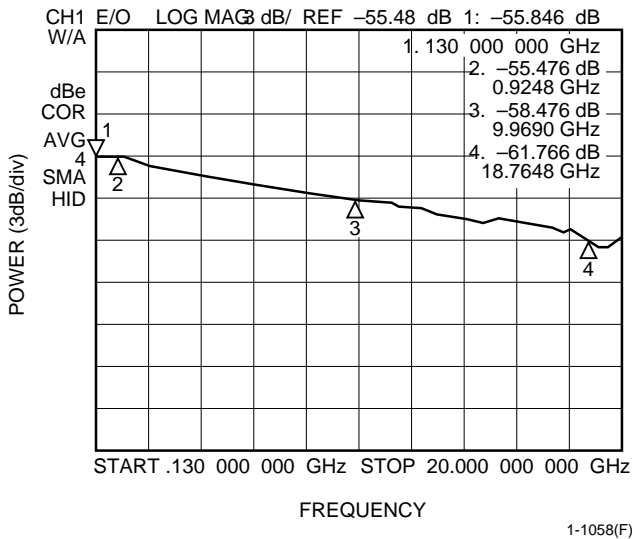


Figure 3. Magnitude of Electro-Optic Response, 0.130 GHz—20 GHz.

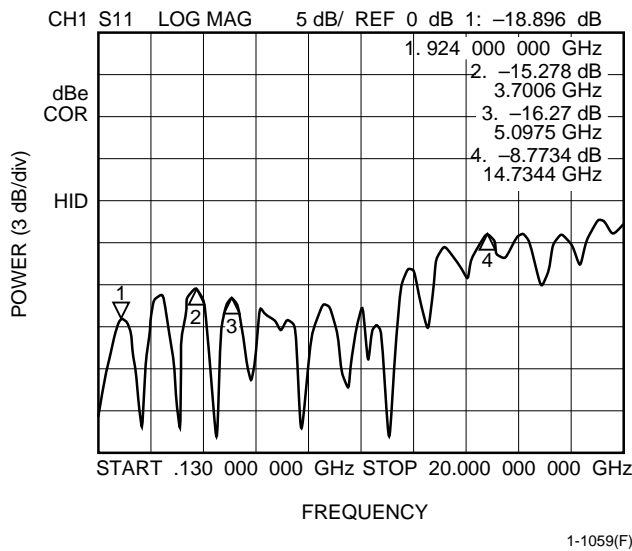


Figure 4. S11, 0.130 GHz—20 GHz

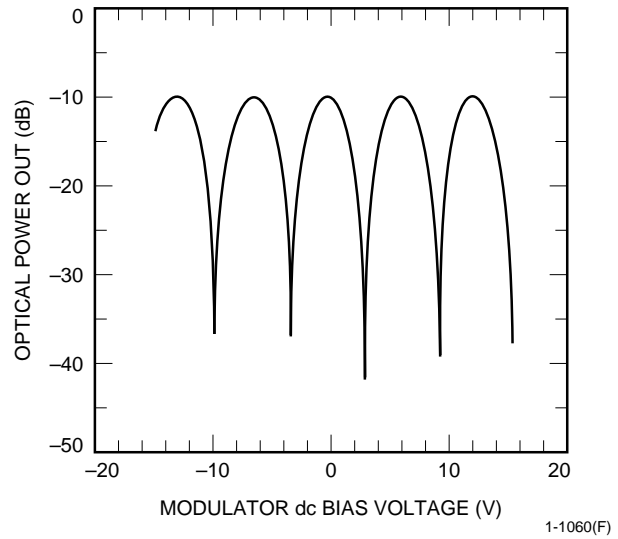


Figure 5. Output Power vs. Bias Voltage

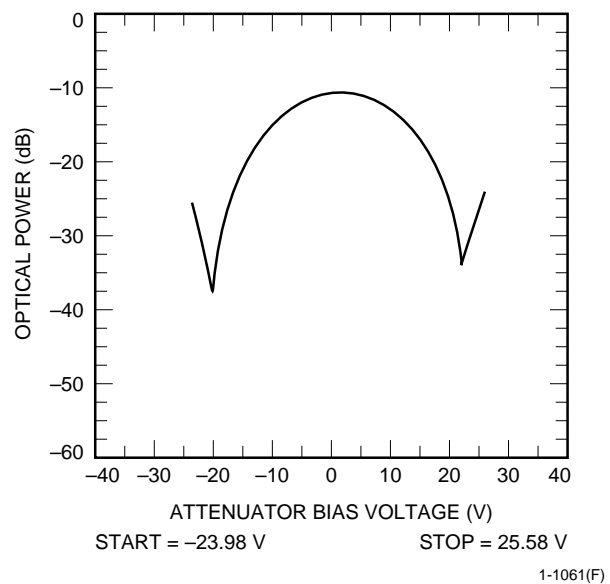
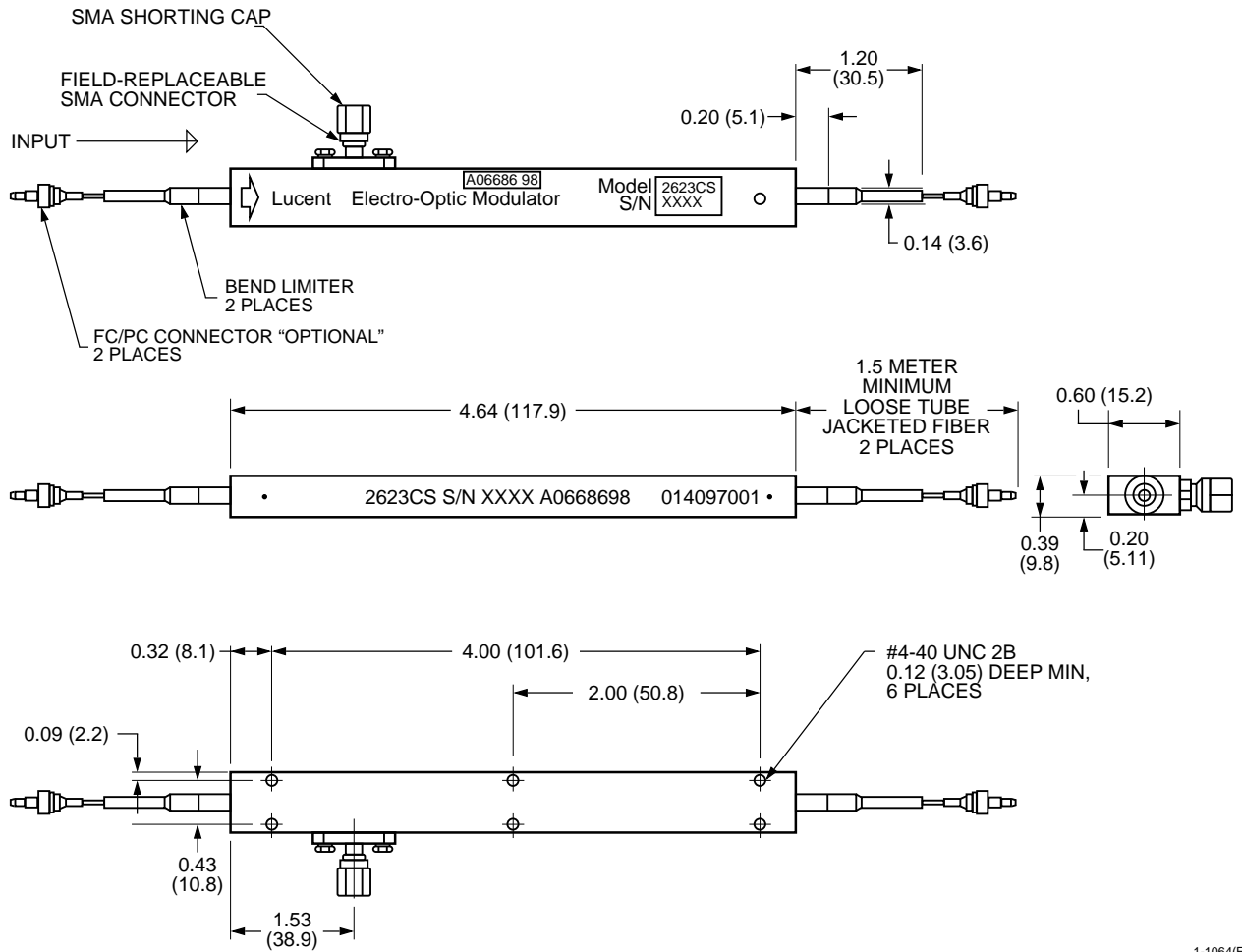


Figure 6. Optical Power vs. Attenuator Bias Voltage

Outline Diagrams

Dimensions are in inches and (millimeters).

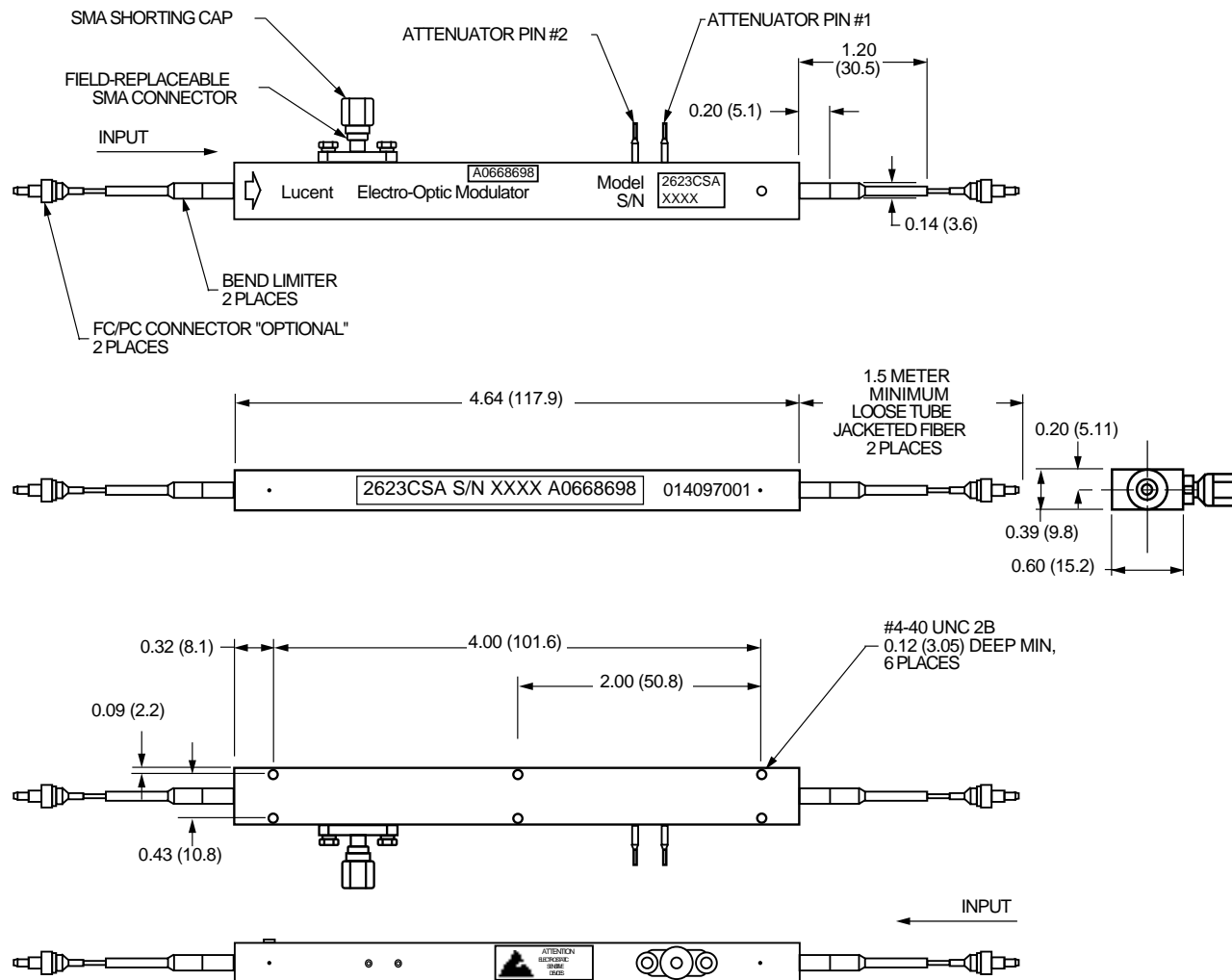
2623CS Lithium Niobate Modulator



1-1064(F)

Outline Diagrams (continued)

2623CSA Lithium Niobate Modulator



1-1005 C

Package Information

Designed to NEBS (inside plant) standards, the hermetic package design incorporates a laser-sealed lid and soldered fibers. The minimum bend radius for the fiber is 1.5 in. To prevent warping, use only the two center screws to mount the device.

Table 2. Package Information

Description	Type
Input Optical Fiber CS/CSA	PANDA-type PMF
Output Optical Fiber CS/CSA	PANDA-type PMF
Fiber Connector	FC
Fiber Length	1.5 meter max
RF Connector	SMA
Package Dimensions	See Outline Drawings, page 5, 6.

Ordering Information

Table 3. Device Information

Description*	Part Number	Optical Connector Type	Comcode
High-speed Electro-optic Modulator	2623CS	FC	107862823
	2623CSA [†]	FC	108433954

* Bias and drive circuitry information is available on request. Higher operating speeds and custom designs are also available.

[†] Single drive with optical attenuator.

Table 4. Related Product Information

Description	Document Number
Wavelength-Selected D2525P Laser 2000 Isolated Laser Module with PMF	DS98-423LWP
Lithium Niobate Intensity (Amplitude) Modulator	TN94-017LWP
Using the Lithium Niobate Modulator: Electro-Optical and Mechanical Connections	TN98-004LWP
The Relationship Between Chirp and Voltage in Mach-Zehnder Lithium Niobate Modulators	TN95-009LWP

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