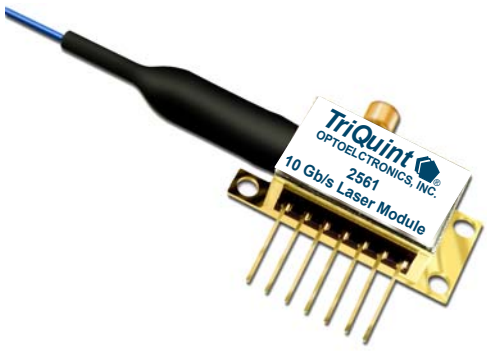
TriQuint OPTOELECTRONICS, INC.

Data Sheet
March 2003

E2561-Series 10 Gb/s EML Modules for up to 80 km Transmission



Features

- Integrated electroabsorption modulator
- 1.5 μm wavelength, full C-band
- Characterized for 10 Gb/s operation
- For use up to 80 km at 10 Gb/s
- Low modulation voltage
- Temperature stabilized
- Wavelength selectable to ITU-T standards
- Ultrastable wavelength aging for DWDM

Applications

- SONET/SDH applications
- Ultrahigh capacity WDM system application
- High-speed data communication
- Digitized video

Description

The E2561-series EMLs are designed for 10 Gb/s DWDM or TDM transmission applications. The EML integrates a CW laser with an electroabsorption modulator in the same semiconductor chip. These devices can replace external modulators that are often bulkier, more expensive, and require more drive electronics than the EML. The 10 Gb/s EML uses an SMP-type, subminiature, push-on connector to handle the RF signal. The package also contains a thermoelectric cooler (TEC), thermistor, rear-facet monitor photodiode, and an optical isolator.

The nominal input impedance of the 10 Gb/s EML is 50 Ω. The package is qualified to the *Telcordia Technologies*™ TA-TSY-000468 standard.

The EML is available in the full range of C-band ITU-T wavelengths for use in DWDM systems operating at 10 Gb/s per channel. The device exhibits excellent wavelength stability, supporting operation at 100 GHz channel spacing over 20 years (assuming an end-of-life aging condition of <±100 pm). Typically, external wavelength stabilization is not required in systems of this type, using TriQuint's EML products. The package also offers excellent stability of wavelength vs. case temperature, with a maximum coefficient of ±0.5 pm/°C.

Module Characteristics

Table 1. Module Characteristics

Parameter	Description
Package Type	E2561: 7-pin package with SMP-type connector RF input.
Fiber	Standard single-mode fiber.
Fiber Length	32.7 inches minimum.
Connector	See Table 6 (additional connector types available on request).
RF Input	Impedance 50 Ω.

Pin Information

Table 2. Pin Descriptions

Pin Number	Pin Name	Description
1	THERM, LASER–, CASE	Combined thermistor/laser cathode/case
2	THERM	Thermistor
3	LASER+	Laser anode
4	BACK DET–	Monitor anode (–)
5	BACK DET+	Monitor cathode (+)
6	TEC+	Thermoelectric cooler (+)
7	TEC–	Thermoelectric cooler (–)

Target Specifications

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.

Table 3. Absolute Maximum Ratings

Parameter	Conditions	Min	Max	Unit
Laser Diode Reverse Voltage	CW	—	2	V
Laser Diode Forward Current	CW	—	150	mA
Optical Output Power	CW	—	10	mW
Modulator Reverse Voltage	—	—	3.5	V
Modulator Forward Voltage	—	—	1	V
Monitor Diode Reverse Voltage	—	—	10	V
Monitor Diode Forward Voltage	—	—	1	V
Storage Temperature Range	—	–40	85	°C
Operating Temperature Range	—	–5	70	°C

Target Specifications (continued)

Characteristics

Minimum and maximum values specified over operating case temperature range. Typical values are measured at room temperature unless otherwise noted.

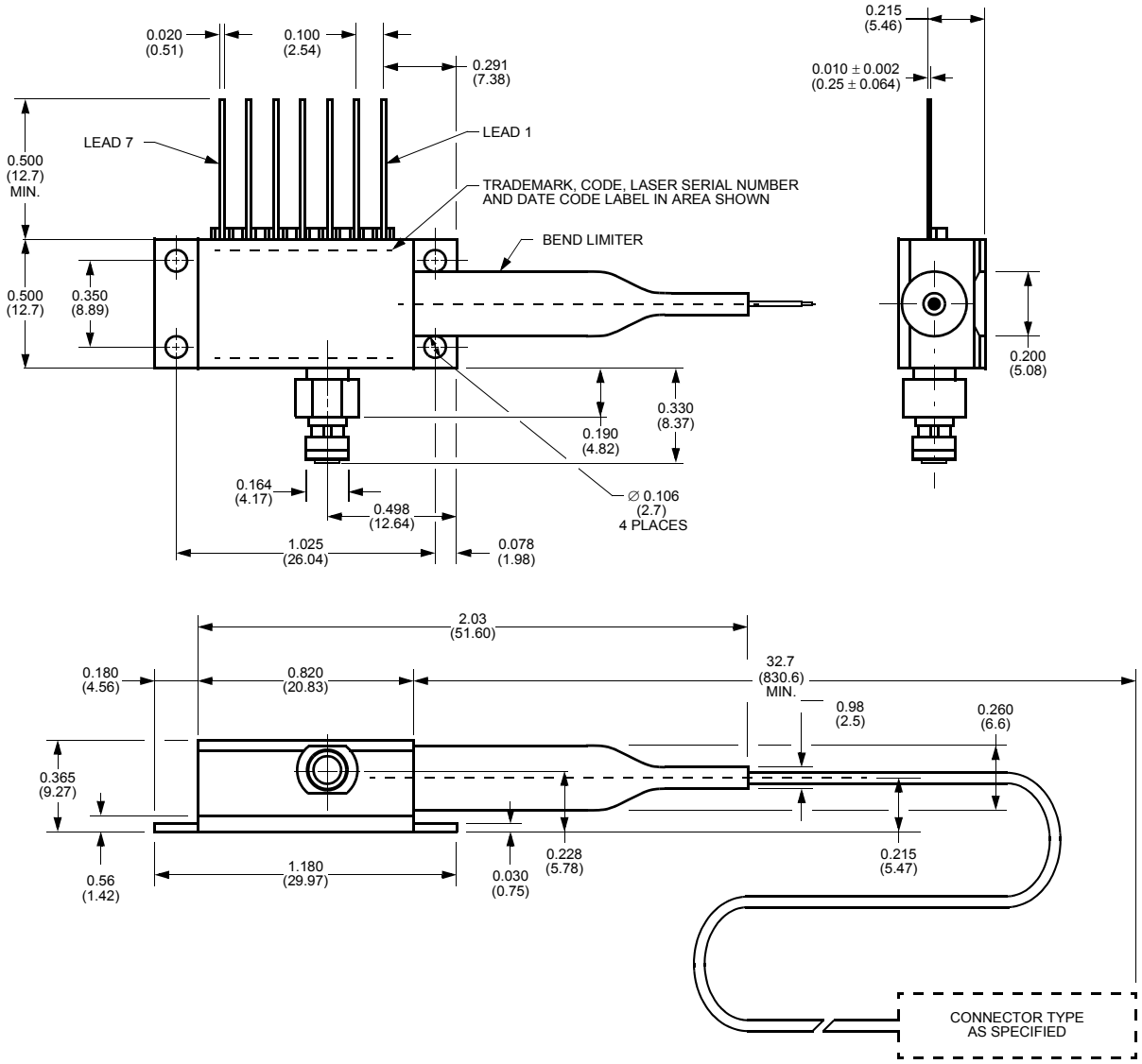
Table 4. Optical and Electrical Specifications (Chip operating temp. = 15 °C to 35 °C, except where noted.)

Parameter	Symbol	Conditions	Min	Max	Unit
Threshold Current (BOL)	I_{TH}	—	5	35	mA
Forward Voltage	V_F	$I_F = I_{OP}$ @ T_{OP}	—	2.2	V
Operating Current	I_{OP}	—	50	100	mA
Threshold Power	P_{TH}	$I_F = I_{TH}$ V_M = 0 V	—	80	µW
Fiber Output Power (average)	P_{AVG}	Note 1	–2	—	dBm
Peak Wavelength (Wavelength can be specified to the ITU-T wavelength channels.)	λ_{PK}	Note 1	1528.7	1563.9	nm
Side-mode Suppression Ratio	SMSR	V_M = 0 V, $I_F = I_{OP}$, T_{OP}	35	—	dB
Modulator Voltage	V_{PP}	—	1.5	2.5	V
Onstate Voltage	V_{ON}	—	–1.0	0	V
Modulator/Driver					
RF Extinction Ratio	ER_{RF}	Notes 1, 4	10	—	dB
RF Return Loss (130 MHz to 10 GHz)	S_{11}	V_M = –1 V, $I_F = I_{OP}$		-10	dB
–3 dB Bandwidth	BW	V_M = –1 V, $I_F = I_{OP}$	11	—	GHz
Rise/Fall Time (20%—80%)	t_R/t_F	Note 5	—	30	ps
Dispersion Penalty	DP	1600 ps/nm, BER = 10^{-10} Notes 1, 2	—	2.0	dB
Monitor Diode					
Monitor Current	I_{BD}	V_{BD} = 5 V, $I_F = I_{OP}$	40	1100	µA
Dark Current	I_D	V_{BD} = 5 V	—	0.1	µA
Capacitance	C	V_{BD} = 5 V, F = 1 MHz	—	25	pF
Thermistor					
Resistance	R_{THERM}	T = 25 °C	9.8	10.2	kΩ
Thermistor Current	I_{TC}	—	10	100	µA
Thermistor B Constant	B	—	3700	4100	—
Thermoelectric Cooler (TEC)					
TEC Current	I_{TEC}	Note 3	—	1.1	A
TEC Voltage	V_{TEC}		—	2.6	V
TEC Power	P_{TEC}		—	2.9	W
TEC Capacity	ΔT		55	—	C
Optical Isolation					
Optical Isolation	—	Note 3	30	—	dB
Package					
Wavelength vs. Case Temperature	$d\lambda/dT$	T_{CASE} = –10 °C to +70 °C	–0.5	0.5	pm/°C

1. Modulated for 80 km (1600ps/nm) operation. Modulated operational values are defined to be I = I_{OP}, T = T_{OP}, at all specified operating conditions, 9.95328 Gb/s modulation, $2^{31} - 1$ PRBS (operating parameters for 80 km will be provided). Laser diode temperature can be set in a 15 °C to 35 °C range to take advantage of wavelength tuning, provided that it will meet all other specs at this preset temperature. V_M = modulator voltage.
2. Over 1600 ps/nm (80 km).
3. T_{CASE} = 70 °C, $T_{LASERCHIP}$ = 15 °C to 35 °C.
4. With fourth-order Bessel-Thomson filter.
5. Without filter.

Outline Diagram

Dimensions are in inches and (millimeters).



Laser Safety Information

Class IIIb Laser Product

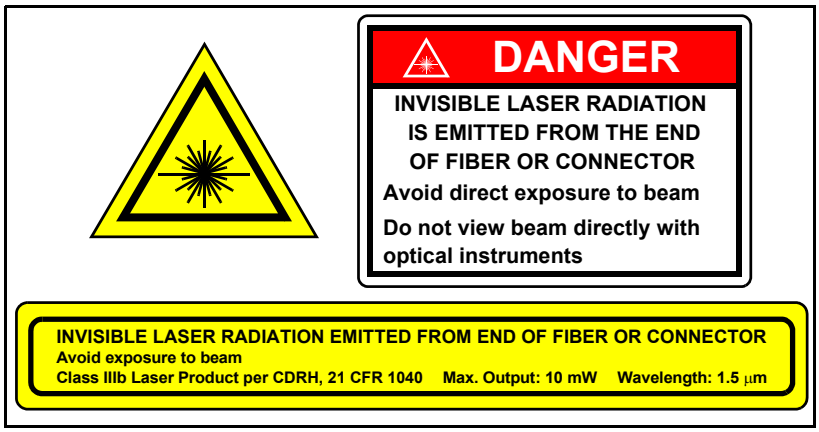
FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are classified Class 3B laser products consistent with *IEC*® 60825-1: 1993. This device family has been classified with the FDA under accession number 8720010. Measurements were made to classify the product per *IEC*60825-1: 1993.

This product complies with 21 CFR 1040.10 and 1040.11.
8.8/125 μm single-mode fiber pigtail and connector.
Wavelength = 1.5 μm
Maximum power = 10 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.**



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 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.

Ordering Information

Table 5. Ordering Information

Parameter		Device Description					
ITU-T Wavelength (nm)	Frequency	ST Connector		LC Connector		SC Connector	
		Code	Comcode	Code	Comcode	Code	Comcode
1530.33	195.9	E2561H59	108587791	E2561S59	700021645	E2561A59	700021602
1531.12	195.8	E2561H58	108587783	E2561S58	700021644	E2561A58	700021601
1531.90	195.7	E2561H57	108587775	E2561S57	700021643	E2561A57	700021600
1532.68	195.6	E2561H56	108587767	E2561S56	700021642	E2561A56	700021599
1533.47	195.5	E2561H55	108587759	E2561S55	700021641	E2561A55	700021598
1534.25	195.4	E2561H54	108587742	E2561S54	700021640	E2561A54	700021597
1535.04	195.3	E2561H53	108587734	E2561S53	700021639	E2561A53	700021595
1535.82	195.2	E2561H52	108587726	E2561S52	700021638	E2561A52	700021594
1536.61	195.1	E2561H51	108587718	E2561S51	700021637	E2561A51	700021593
1537.40	195.0	E2561H50	108587700	E2561S50	700021636	E2561A50	700021592
1538.19	194.9	E2561H49	108587692	E2561S49	700021635	E2561A49	700021591
1538.98	194.8	E2561H48	108587676	E2561S48	700021633	E2561A48	700021590
1539.77	194.7	E2561H47	108587668	E2561S47	700021632	E2561A47	700021589
1540.56	194.6	E2561H46	108587650	E2561S46	700021631	E2561A46	700021588
1541.35	194.5	E2561H45	108587635	E2561S45	700021630	E2561A45	700021587
1542.14	194.4	E2561H44	108587627	E2561S44	700021629	E2561A44	700021586
1572.94	194.3	E2561H43	108587585	E2561S43	700021628	E2561A43	700021585
1543.73	194.2	E2561H42	108587577	E2561S42	700021627	E2561A42	700021584
1544.53	194.1	E2561H41	108587569	E2561S41	700021626	E2561A41	700021583
1545.32	194.0	E2561H40	108587544	E2561S40	700021625	E2561A40	700021582
1546.12	193.9	E2561H39	108587536	E2561S39	700021624	E2561A39	700021581
1546.92	193.8	E2561H38	108587528	E2561S38	700021623	E2561A38	700021580
1547.72	193.7	E2561H37	108587510	E2561S37	700021622	E2561A37	700021579
1548.51	193.6	E2561H36	108587502	E2561S36	700021621	E2561A36	700021578
1549.32	193.5	E2561H35	108587411	E2561S35	700021620	E2561A35	700021577
1550.12	193.4	E2560H34	108587403	E2560S34	700021619	E2560A34	700021576
1550.92	193.3	E2561H33	108587395	E2561S33	700021618	E2561A33	700021575
1551.72	193.2	E2561H32	108587387	E2561S32	700021617	E2561A32	700021574
1552.52	193.1	E2561H31	108587379	E2561S31	700021616	E2561A31	700021573
1553.33	193.0	E2561H30	108587353	E2561S30	700021615	E2561A30	700021572
1554.13	192.9	E2561H29	108587346	E2561S29	700021614	E2561A29	700021571
1554.94	192.8	E2561H28	108587338	E2561S28	700021613	E2561A28	700021569
1555.75	192.7	E2561H27	108587320	E2561S27	700021612	E2561A27	700021568
1556.56	192.6	E2561H26	108587312	E2561S26	700021611	E2561A26	700021567
1557.36	192.5	E2561H25	108587304	E2561S25	700021610	E2561A25	700021566
1558.17	192.4	E2561H24	108587296	E2561S24	700021609	E2561A24	700021565
1558.98	192.3	E2561H23	108587288	E2561S23	700021608	E2561A23	700021564
1559.79	192.2	E2561H22	108587262	E2561S22	700021607	E2561A22	700021563
1560.61	192.1	E2561H21	108587254	E2561S21	700021606	E2561A21	700021562
1561.42	192.0	E2561H20	108587247	E2561S20	700021605	E2561A20	700021561
1562.23	191.9	E2561H19	108587239	E2561S19	700021604	E2561A19	700021560
1528 to 1565	—	E2561H	108592551	E2561S	700021603	E2561A	700021558

Ordering Information (continued)

Table 6. Ordering Information (connector type)

Device Code	Connector Type*	Comcodes
E2561A	SC	700021558-700021602
E2561H	ST	108587791-108592551
E2561S	LC	700021603-700021645

* Other connectors available on request

Related Product Information

Table 7. Related Product Information

Description	Part Number	Document Number
1.5 μm EML with Driver at 10 Gb/s up to 40 km	E2580-Type	DS02-336
1.5 μm EML with Driver at 10 Gb/s up to 80 km	E2581-Type	DS02-335-1
1.5 μm EML at 10 Gb/s up to 40 km	E2560-Type	DS02-336
10 Gb/s APD Receiver	RA192-Type	DS02-185
10 Gb/s PIN Receiver	R192P-Type	DS01-064-5
10 Gb/s APD Receiver	R195A-Type	DS03-011

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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**

E-mail: info_opto@tqs.com **Fax: (503) 615-8902**

For technical questions and additional information on specific applications:

E-mail: info_opto@tqs.com