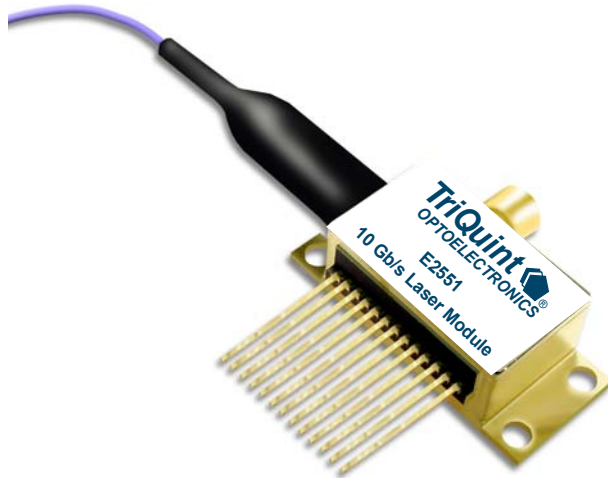


E2551 10 Gb/s EML Modules for up to 80 km Transmission



Features

- Integrated electroabsorption modulator
- 1.5 μm wavelength, full C-band
- Characterized for 10 Gb/s operation
- Applicable at 10.66 Gb/s FEC rates
- For use up to 80 km (1600 ps/nm)
- Low modulation voltage
- Temperature stabilized
- Integral driver IC
- Wavelength selectable to ITU-T standards
- Ultrastable wavelength aging for DWDM
- Replacement for E2581

Applications

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

Description

The E2551 EML, with integral driver IC, is designed for 10 Gb/s DWDM or TDM transmission applications. It integrates a CW laser with an electroabsorption modulator (EML) in the same semiconductor chip. This device can replace external modulators that are often bulkier, more expensive, and require more drive electronics than the EML. The E2551 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 E2551 operates over distances of 80 km.

The nominal input impedance of the E2551 is 50 Ω . The package is qualified to the *Telcordia Technologies*TM TA-TSY-000468 standard.

The E2551 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 $<\pm 100$ 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/ $^{\circ}\text{C}$.

The E2551 is intended as a direct replacement for TriQuint's E2581 device. It has the same functionality as the E2581 with improved electroabsorption modulator driver. The main improvement is demonstrated by the improved stability of the output eye diagram for varying input signal amplitude.

Module Characteristics

Table 1. Module Characteristics

Parameter	Description
Package Type	13-pin package with SMP-type connector RF input.
Fiber	Standard single-mode fiber.
Fiber Length	33 inches (838.20 mm) minimum.
Optical Connector	Various connectors available on request.
RF Input (SMP-type connector)	Impedance 50 Ω (exterior of RF connector is connected to case).

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	VEA	Modulator offset.
7	NC	No connect/reserved.
8	NC	No connect/reserved.
9	VOA	Optical amplitude adjust.
10	VDCA	Duty cycle adjust.
11	VSS	Voltage supply to the IC.
12	TEC+	Thermoelectric cooler (+)
13	TEC-	Thermoelectric cooler (-).

Note: For full details of pin functions and required bias levels for the version with the IC, refer to the Application Note, *10 Gb/s EML with Integral Driver IC: Pin Definitions And Operation* (AP03-049).

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	dc	—	2	V
Laser Diode Forward Current	dc	—	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	—	-10	70	°C
V _{DCA} Voltage (pin 10)	—	V _{SS} - 0.5	V _{SS} + 2.5	V
V _{OA} Voltage (pin 9)	—	V _{SS} - 0.5	V _{SS} + 1.5	V
V _{EA} Bias Voltage (pin 6)	—	V _{SS} - 0.5	V _{SS} + 2.5	V
Supply Voltage for IC Driver V _{SS} (pin 11)	—	-5.5	0	V
Supply Current for IC Driver I _{SS} (pin 11)	—	—	300	mA
Package Thermistor Temperature ¹	—	—	100	°C
Thermoelectric Cooler in Heating Mode ¹	—	—	0.5	A

1. To prevent package over-temperature conditions.

For the E2551 EML to function properly, it is very important to keep the voltage supply to the IC (V_{SS}) accurate to within ± 1% of the recommended voltage. This voltage is included on the device's testing data sheet. It is recommended that a voltage regulator be used to maintain this supply voltage at a constant level over time. This voltage should be measured on the V_{SS} pin (pin 11) of the EML.

Target Specifications (continued)

Characteristics

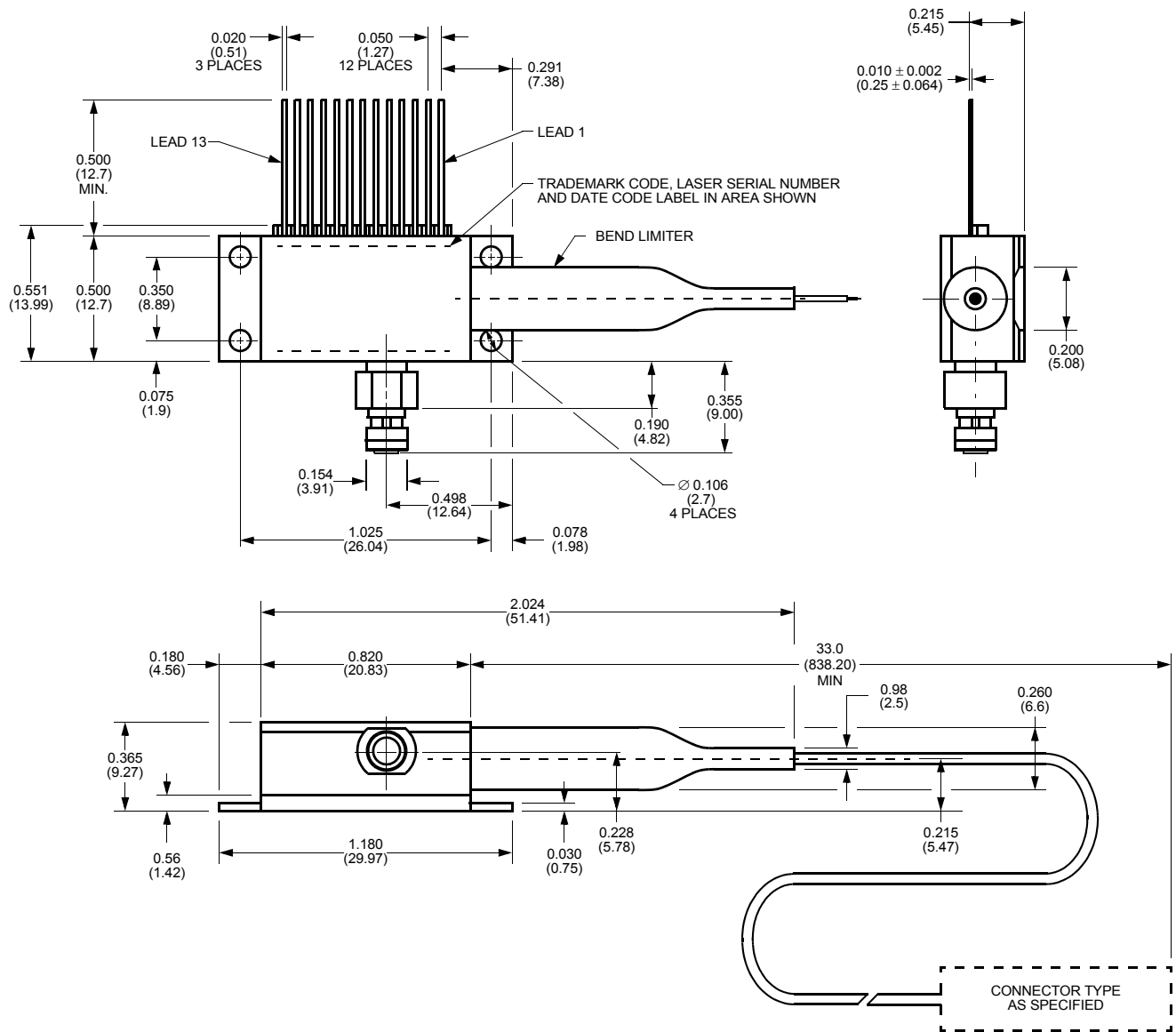
Minimum and maximum values specified over operating case temperature range. Typical values are measured at room temperature unless otherwise noted.

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	μ W
Fiber Output Power (average): Beginning of Life	$P_{AVG-BOL}$	Note 1	-2.0	—	dBm
End of Life	$P_{AVG-EOL}$	Note 1	-2.5	—	dBm
Peak Wavelength (Wavelength can be specified to the ITU 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
Dispersion Penalty BER = 10^{-10} , D = 1600 ps/nm	DP	Notes 1, 2	—	2.0	dB
Modulator/Driver					
RF Extinction Ratio	ER_{RF}	Notes 1, 3	10	—	dB
RF Return Loss (100 MHz to 10 GHz)	S_{11}	—	-10	—	dB
Input Voltage (ac coupled)	V_{IN}	—	0.5	1.0	V
Rise/Fall Time (20%—80%)	t_r/t_f	Note 4	—	40	ps
Monitor Diode					
Monitor Current	I_{BD}	$V_{BD} = 5$ V, $I_F = I_{OP}$	40	1100	μ A
Dark Current	I_D	$V_{BD} = 5$ V	—	0.1	μ A
Capacitance	C	$V_{BD} = 5$ V, F = 1 MHz	—	25	pF
Thermistor					
Resistance	R_{THERM}	T = 25 °C	9.8	10.2	k Ω
Thermistor Current	I_{TC}	—	10	100	μ A
Thermistor B Constant	B	—	3700	4100	—
Thermoelectric Cooler (TEC)					
TEC Current	I_{TEC}	Note 5	—	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 5	30	—	dB
Package					
Output Power Stability		$T_{CASE} = -10$ °C to $+70$ °C	-0.5	0.5	dB
Wavelength vs. Case Temperature	$d\lambda/dT$	$T_{CASE} = -10$ °C to $+70$ °C	-0.5	0.5	pm/°C

1. 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 within a range of 15 °C to 35 °C to take advantage of wavelength tuning, provided that it will meet all other specifications at this preset temperature. V_M = modulator voltage.
2. Over 1600 ps/nm, V_{EA} , V_{DCA} , and V_{OA} .
3. With fourth-order Bessel-Thomson filter at OC-192.
4. Without filter.
5. $T_{CASE} = 70$ °C, $T_{LASERCHIP} = T_{OP}$.

Outline Diagram



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 k Ω , capacitance = 100 pF) is widely used and can be used for comparison purposes.

Laser Safety Information

Class IIIb Laser Product

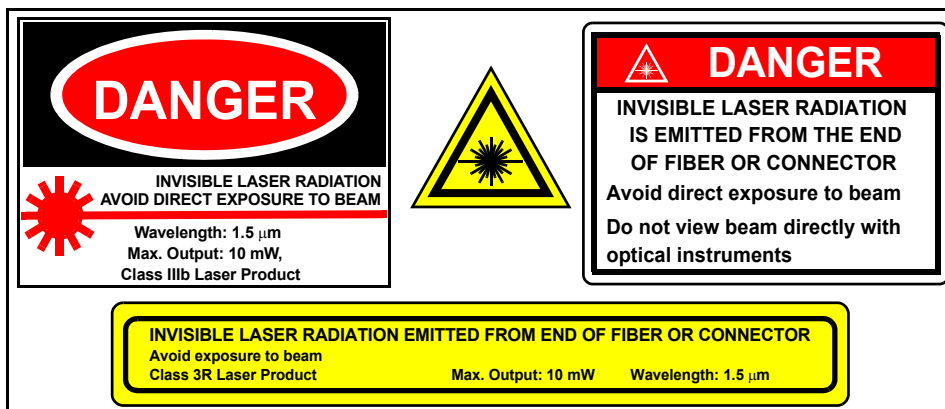
FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are classified Class 3B laser products consistent with IEC[®] 60825-1: 1993. This device family has been classified with the FDA under accession number 8720010. Measurements were made to classify the product per IEC60825-1: 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.



Ordering Information

Table 5. Ordering Information

Device Code ¹	Frequency	ITU-T Wavelength (nm)
E2551H59	195.9	1530.33
E2551H58	195.8	1531.12
E2551H57	195.7	1531.90
E2551H56	195.6	1532.68
E2551H55	195.5	1533.47
E2551H54	195.4	1534.25
E2551H53	195.3	1535.04
E2551H52	195.2	1535.82
E2551H51	195.1	1536.61
E2551H50	195.0	1537.40
E2551H49	194.9	1538.19
E2551H48	194.8	1538.98
E2551H47	194.7	1539.77
E2551H46	194.6	1540.56
E2551H45	194.5	1541.35
E2551H44	194.4	1542.14
E2551H43	194.3	1542.94
E2551H42	194.2	1543.73
E2551H41	194.1	1544.53
E2551H40	194.0	1545.32
E2551H39	193.9	1546.12
E2551H38	193.8	1546.92
E2551H37	193.7	1547.72
E2551H36	193.6	1548.51
E2551H35	193.5	1549.32
E2551H34	193.4	1550.12
E2551H33	193.3	1550.92
E2551H32	193.2	1551.72
E2551H31	193.1	1552.52
E2551H30	193.0	1553.33
E2551H29	192.9	1554.13
E2551H28	192.8	1554.94
E2551H27	192.7	1555.75
E2551H26	192.6	1556.56
E2551H25	192.5	1557.36
E2551H24	192.4	1558.17
E2551H23	192.3	1558.98
E2551H22	192.2	1559.79
E2551H21	192.1	1560.61
E2551H20	192.0	1561.42
E2551H19	191.9	1562.23
E2551H	—	1528—1564

1. With ST connector. Other types of connectors are available upon request.

Related Documents

Table 6. Related Documents

Description	Document Number
<i>10 Gb/s EML with Integrated Driver IC: Pin Definitions and Operation</i> , Application Note	AP03-049
<i>Electroabsorptive Modulated Laser (EML): Setup and Optimization</i> , Technical Note	TN00-008
<i>Use of EML Devices in DWDM Applications</i> , Technical Note	TN00-012
<i>Demounting/Remounting 2.5 Gb/s EML Lasers</i> , Technical Note	TN02-023

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Additional Information

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