Microwave DFB Laser Transmitters

The distributed feedback (DFB) laser transmitters provide exceptional performance for linear fiber-optics communications in very wide bandwidth applications. Ortel's linear fiberoptics are an excellent alternative to using coaxial cable systems to transmit 10 MHz to 18 GHz signals. They offer significant improvements in reliability in microwave communication networks by transmitting the RF signal in its original format. As a result of these properties, these microwave DFB laser transmitters provide significant improvements in signal quality for a wide variety of applications, including antenna remoting, timing and reference signal distribution, telemetry, measurement, and delay lines.

Microwave DFB lasers are available in several packaging styles. The basic laser module can be integrated into a complete transmitter, packaged either as a flange-mount for extreme environments or as a plug-in for integration with Ortel's System 10000 rack-mountable chassis and power supplies. Electronics within the flange-mount and plug-in transmitters control the laser temperature and dc bias current and provide warnings whenever the temperature or power deviates from their intended levels, thus providing a self regulating, fully integrated microwave product. These units provide high-quality noise performance in sensitive optical links.

Applications

- **Antenna remoting**
- **Cellular and PCS networks**
- **Military triband communications**
- **Tracking, telemetry, and control**

Features

- **High dynamic range**
- **Long distance communications**
- **10 MHz to 18 GHz bandwidth**
- **Built-in optical isolator, 1310 nm or 1550 nm**
- **CE certified**

Performance Highlights

	Min	Typical	Max	Units
Wavelengths	1290 1520	1310 1550	1340 1580	nm nm
Optical Output Power 1310 nm 1550 nm	- -	8 6	- -	mW
Temperature Range Plug-in Module and Flange Mount	 0 -40	 - -	 +50 -65	 ° C ° C
Frequency Range	10	-	18000	MHz

See following pages for complete specifications and conditions.

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	Condition	Min	Max	Units
Operating Temperature Range of Baseplate: Module and Flange-mount Plug-in	T_{OP}	continuous	 -40 0	 +65 +50	 °C °C
Storage Temperature Module and Flange-mount Plug-in	T_{STG}	-	 -40 -20	 +85 +65	 °C °C
RF Input Power Module and Flange-mount Plug-in	P_{IN}	60 seconds	 - -	 20 20	 dBm dBm
Laser Forward dc Current	-	-	-	100	mA
Photodiode Reverse Voltage	V_{RPD}	-	-	10	V
Laser Reverse Voltage	-	-	-	1	V
ESD	-	HBM: R = 1500 Ohm, C = 100 pF	-500	500	V
TEC Current	I_{TEC}	continuous	-1.9	1.9	A

Electrical/Optical Characteristics

Optical[1]

Parameter	Specifications						
Model Number Module Flange-mount Tx Plug-in Tx	 1540A 3540A 10340A	 1541A 3541A 10341A	 1541B 3541B 10341B	 1541C 3541C 10341C	 1541C-E05 3541C-E05 10341C-E18	 1740A 3740A 10370A	 1741A 3741A 10371A
Wavelength	1310 nm ± 30 nm	1310 nm ± 30 nm	1310 nm ± 30 nm	1310 nm ± 30 nm	1310 nm ± 30 nm	1550 nm ± 30 nm	1550 nm ± 30 nm
Spectral Width, FWHM[2], Typ., Max	10 MHz	10 MHz	10 MHz	10 MHz	10 MHz	10 MHz	10 MHz
Optical Power, Typical @ I_{TH} + 55 mA	8 mW	8 mW	8 mW	8 mW	8 mW	6 mW	6 mW
Optical Power Stability vs. Temperature	± 15 %	± 15 %	± 15 %	± 15 %	± 15 %	± 15 %	± 15 %
dc Modulation Gain, Typical	0.14	0.14	0.14	0.14	0.14	0.1	0.1

1: Specifications guaranteed when unit is connected to an optical path with return loss > 35 dB.
2: No RF input

RF Characteristics [1]

Parameter	Specifications						
Model Number							
Module	1540A	1541A	1541B	1541C	1541C-E05	1740A	1741A
Flange-mount Tx	3540A	3541A	3541B	3541C	3541C-E05	3740A	3741A
Plug-in Tx	10340A	10341A	10341B	10341C	1034C-E18	10370A	10371A
Maximum Frequency	5 GHz	10 GHz	13 GHz	15 GHz	18 GHz	4 GHz	10 GHz
Minimum Frequency	0.1 GHz	0.1 GHz	0.1 GHz	0.1 GHz	0.1 GHz	0.1 GHz	0.1 GHz
Option -001	0.01 GHz	0.01 GHz	0.01 GHz	0.01 GHz	0.01 GHz	0.01 GHz	0.01 GHz
Amplitude Flatness [2]	± 2.0 dB	± 2.5 dB	± 3.0 dB	± 3.0 dB	+3 dB, -6 dB	± 2.5 dB	± 2.5 dB
Option -001	± 3.0 dB	± 3.0 dB	± 3.5 dB	± 3.5 dB	+3.5 dB, -6 dB	± 3.0 dB	± 3.0 dB
Input VSWR (50 Ω)	1.8:1	1.8:1	3.0:1	3.0:1	3.0:1	1.8:1	1.8:1
Input 1 dB Compression	+13 dBm	+13 dBm	+20 dBm	+20 dBm	+20 dBm	+13 dBm	+ 13 dBm
Input Third Order Intercept [3]							
0.01 GHz – 2.5 GHz							
2.5 GHz – 4.0 GHz	30	35	35	35	35	28	23
2.5 GHz – 4.0 GHz	22	30	30	30	30	28	23
5.0 GHz – 10.0 GHz	22	25	25	25	25	23	23
10.0 GHz – 13.0 GHz	-	25	25	25	25	-	23
13.0 GHz – 15.0 GHz	-	-	25	25	25	-	-
15.0 GHz – 18.0 GHz	-	-	-	25	25	-	-
	-	-	-	-	20	-	-
Noise Figure (dB) [4]							
0.01 GHz – 2.5 GHz	44	44	44	44	44	56	56
1.0 GHz – 2.5 GHz	48	44	44	44	44	56	56
2.5 GHz – 3.0 GHz	59	44	44	44	44	56	56
3.0 GHz – 4.0 GHz	59	49	49	49	49	56	56
4.0 GHz – 5.0 GHz	59	49	49	49	49	-	56
5.0 GHz – 6.0 GHz	-	49	49	49	49	-	58
6.0 GHz – 10 GHz	-	54	54	54	54	-	62
10.0 GHz – 13.0 GHz	-	-	59	59	59	-	-
13.0 GHz – 15.0 GHz	-	-	-	59	59	-	-
15.0 GHz – 18.0 GHz	-	-	-	-	59	-	-

1: Specifications guaranteed when unit is connected to an optical path with return loss > 35 dB.
2: Peak to peak
3: Two carrier test
4: No RF input

Connector Options

Parameter	Specifications						
Model Number							
Module	1540A	1541A	1541B	1541C	1541C-E05	1740A	1741A
Flange-mount Tx	3540A	3541A	3541B	3541C	3541C-E05	3740A	3741A
Plug-in Tx	10340A	10341A	10341B	10341C	10341C-E18	10370A	10371A
RF Connector							
Laser Module	SMA (f)	k-conn (f)[1]	k-conn (f)[1]	k-conn (f)[1]	k-conn (f)[1]	SMA (f)	k-conn (f)[1]
Flange Mount	SMA (f)	SMA (f)	SMA (f)	SMA (f)	SMA (f)	SMA (f)	SMA (f)
Plugin	SMA (f)	SMA (f)	k-conn (f)[1]	k-conn (f)[1]	k-conn (f)[1]	SMA (f)	SMA (f)

1: K-connector is a trademark of Anritsu Company. K-connectors are SMA compatible

DC (Laser Module)

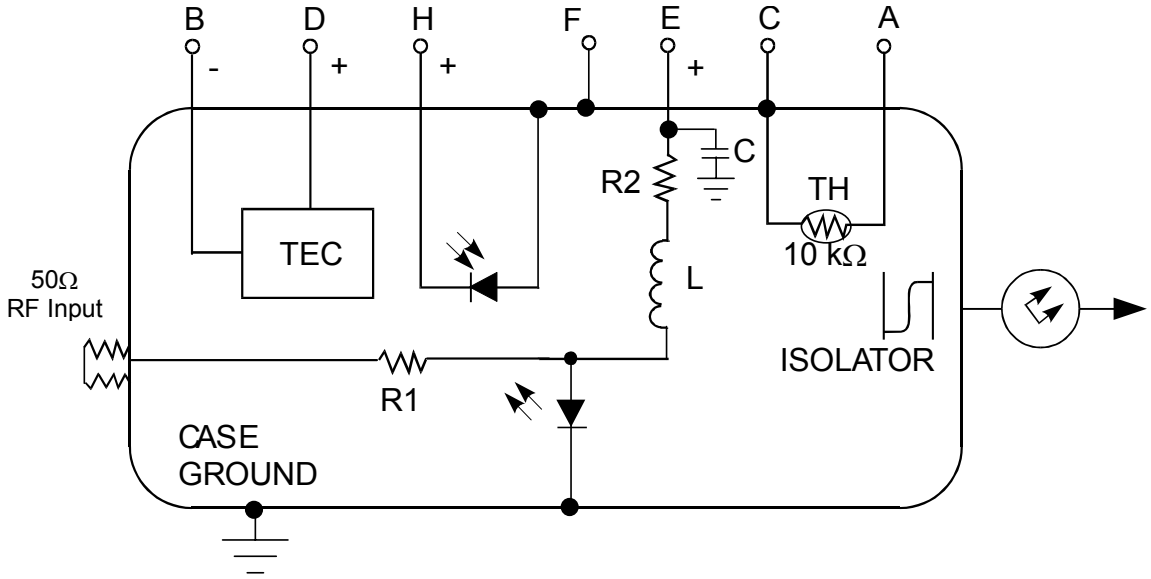
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Laser Bias	I_{OP}	25°C	-	65	100	mA
Threshold Current	I_{TH}	25°C	-	25	35	mA
Forward Voltage	V_F	$I_{OP} = I_{TH} + 50$ mA	-	6	-	V
Thermo Electric Cooler	I_{TEC}	-	-1.1	-	+1.4	A
Thermistor	R_{TH}	25 °C	9.5	10	10.5	kΩ
Thermistor Temperature Coefficient	TE_{TH}	25 °C	-	-4.4	-	%/°C

DC (Flange-mount / Rack-mount)

Pin Number	Min	Typ	Max	Max Ripple	Current
1	14V	15V	16V	100 mV p-p	0.3 A max
2	4.75V	5V	5.5V	200 mV p-p	1.5 A max

Electrical Schematic

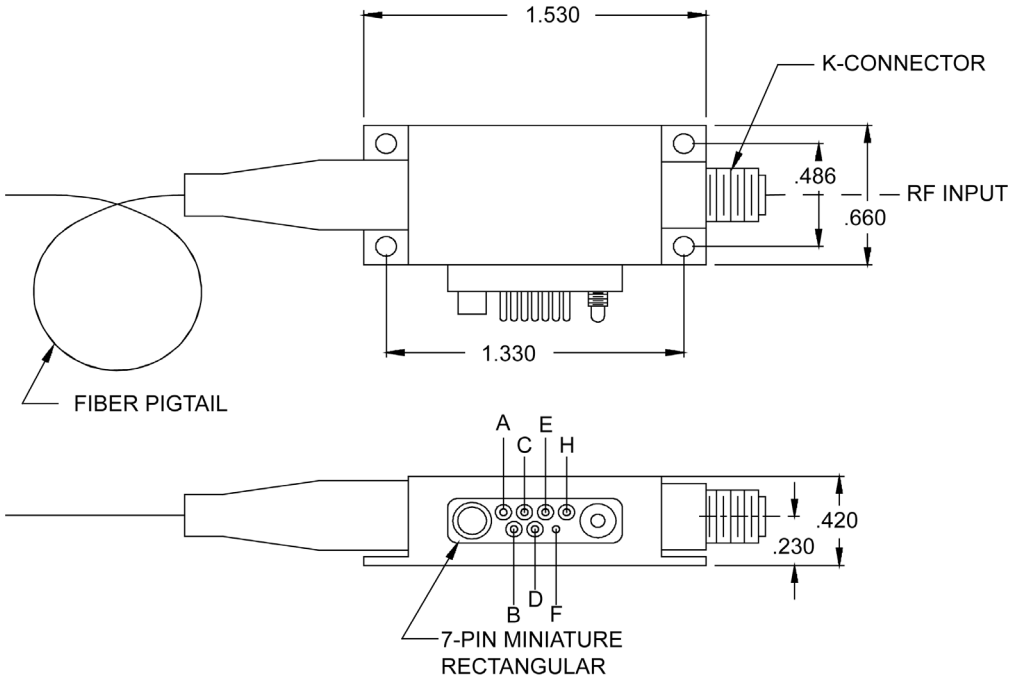
1540A, 1541A/B/C/C-E05, 1740A, 1741A Lasers



Outline Diagram

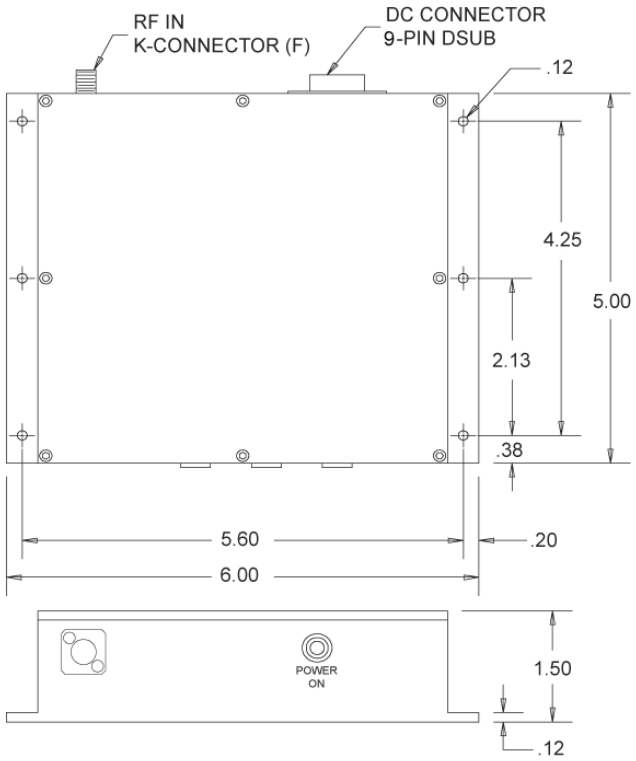
Dimensions are in inches.

1540A, 1541A/B/C/C-E05, 1740A, 1741A Lasers



10340A, 10341A/B/C, 10370A, 10371A Transmitters

3540A, 3541A/B/C, 3740A, 3741A Transmitters



Pin/Package Information

Nine-Pin D-sub Connector (10340A, 10341A/B/C, 10370A, 10371B, and 3540A, 3541A/B/C, 3740A, 3741B Transmitters)

Pin	Description
1	+15 Vdc
2	+5 Vdc
3	NC
4	Power Ground
5	Reference Ground
6	Photodiode Current Monitor
7	Low Optical Power Alarm[1]
8	Laser Current Monitor
9	Over-temperature Alarm[1]

1: Open collector outputs

Seven-Pin Miniature Rectangular Connector (1540A, 1541A/B/C, 1740A, 1741B Transmitters)

Pin	Description
A	Thermistor
B	TEC (-)
C	Thermistor
D	TEC (+)
E	Laser Bias
F	Ground
H	Monitor Photodiode

Front Panel LEDs

- Power on
- Laser power stable
- Laser temperature stable

dc Monitor Voltages

- Photodiode current, pin 6
  - 1V/mA ±2% accuracy (into 1 MΩ load). Proportional to laser output power
- Laser dc current, pin 8
  - 1V/100mA ±2% accuracy (into 1 MΩ load).

Alarm Circuits

The alarms are open-collector outputs capable of providing 20 mA when active and withstanding 15V when off.

- Low optical power, pin 7
  - Sinks current when power is below 90% of set-point.
- Laser temperature, pin 9
  - Sinks current when laser internal temperature exceeds ± 2 °C of set-point (nominally 25°C).

Ordering Information

Option	Connector/Pigtail	Package Type		
		Module	Flange	Plug-in
-001	dc Coupled	X	X	X
-005	1.5 Stage Isolator	X	X	X
-020	FC/APC Bulkhead Optical Connector	-	X	X
-021	FC/SPC Bulkhead Optical Connector	-	X	X
-022	FC/APC Optical Connector/ 3mm Fiber Pigtail	-	X	X
-023	FC/SPC Optical Connector/ 3mm Fiber Pigtail	-	X	X
-031	FC/PC Optical Connector/900 μm Buffered Fiber	X	-	-
-032	FC/APC Optical Connector/900 μm Buffered Fiber	X	-	-

Laser Safety

Class IIIb Laser Product

FDA/CDRH Class IIIb laser product. All versions are Class IIIb laser products per CDHR 1040 Laser Safety Requirements. All versions are class 3B laser products per *IEC*® 60825-1:1993. The device has been classified with the FDA under accession number 220191.

This product complies with 21 CFR 1040.10 and 1040.11.

Single-mode fiber pigtail

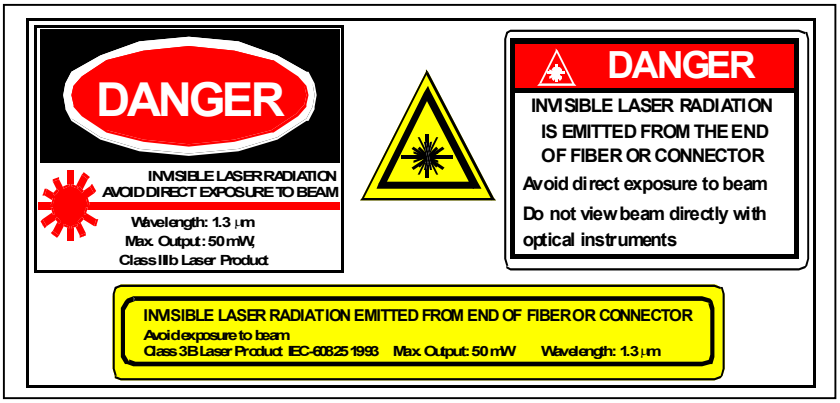
Wavelength = 1310 or 1550 nm

Maximum power = 50 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 a power supply.

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



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