Anexos

Anexo A

Hojas de características

- Amplificador de potencia (PA): ZHL-4240, Mini-Circuits.
- Diodo láser (LD): DFB-EAM-1550-12 S/N7080, Optilab.
- Diodo láser (LD): DFB-EAM-1550-12 S/N7506, Optilab.
- 2 x Diodo fotodetector (PD): PP-10G, Nortel Networks.
- 2 x Amplificador de bajo ruido (LNA): AX60-P33ULN+, Mini-Circuits.
- Acoplador bi-direccional: ZABDC20-322H+, Mini-Circuits.
- Multiplexador por división de longitud de onda (WDM): BWDM21D0CRV13, Optilab.
- Multiplexador por división de longitud de onda (WDM): WD1415-JC-LWNJ2, Optilab.

Coaxial

Amplifier

ZHL-4240

50Ω Medium High Power 700 to 4200 MHz

CASE STYLE: U36

Connectors	Model
SMA	ZHL-4240

Features

- wideband, 700-4200 MHz
- high IP3, +30 dBm typ.
- high gain, 40 dB min.
- medium high power, 28dBm min

Applications

- communication systems
- instrumentation
- satellite dist./GPS/PCS
- laboratory

Electrical Specifications

MODEL NO.	FREQ. (MHz)		GAIN (dB)		MAXIMUM POWER OUTPUT (dBm)		DYNAMIC RANGE		VSWR (:1) Max.		DC POWER	
	f_L	f_U	Min.	Flatness Max.	(1 dB Compr.) Min.	Input (no damage)	NF (dB) Typ.	IP3 (dBm) Typ.	In	Out	Volt (V) Nom.	Current (A) Max.
ZHL-4240	700	4200	40	±1.5*	+28	-5	8.0	+38	2.5	2.5	15	0.90

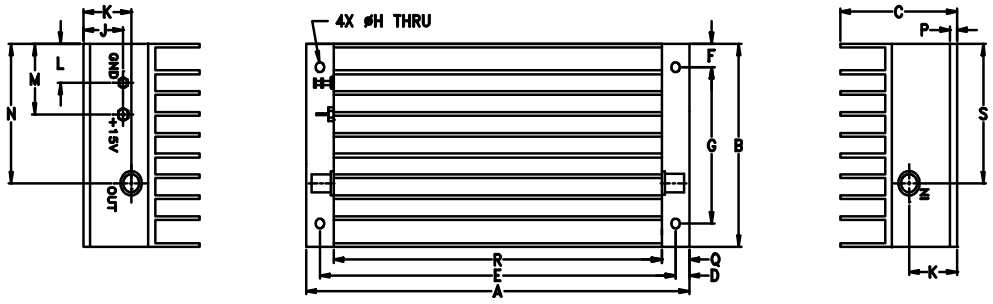
* Measured at 25°C
Open load is not recommended, potentially can cause damage.
With no load derate max input power by 20 dB

Maximum Ratings

Operating Temperature	-20°C to 65°C
Storage Temperature	-55°C to 100°C
DC Voltage	+20V Max.

Permanent damage may occur if any of these limits are exceeded.

Outline Drawing



MOUNTING INFORMATION FOR MODELS WITHOUT HEATSINK

Outline Dimensions (inch / mm)

A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	wt
7.00	3.25	2.13	.25	6.500	.38	2.500	.156	.73	.88	.63	1.13	2.23	.125	.50	6.00	2.23	grams
177.80	82.55	54.10	6.35	165.10	9.65	63.50	3.96	18.54	22.35	16.00	28.70	56.64	3.18	12.70	152.40	56.64	900

Notes
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the Standard Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp

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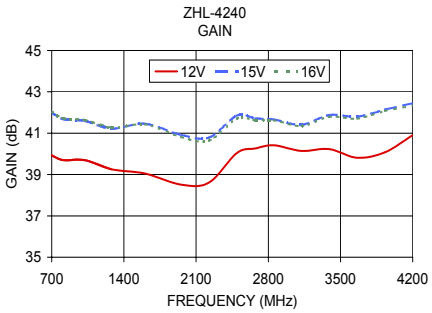
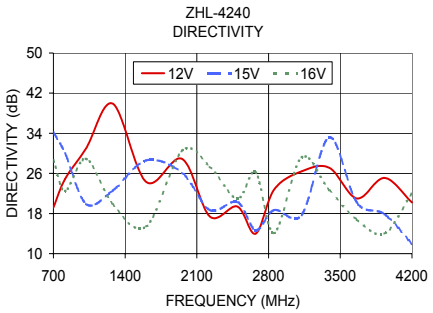
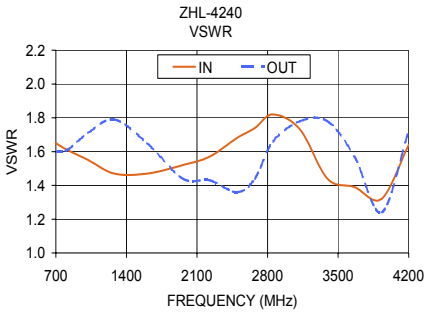
Typical Performance Data/Curves

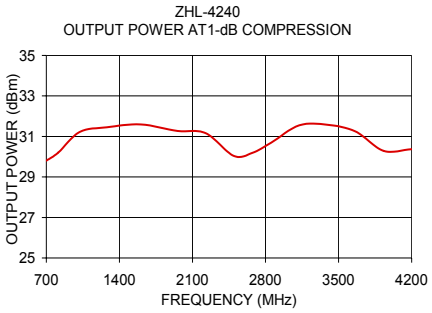
ZHL-4240

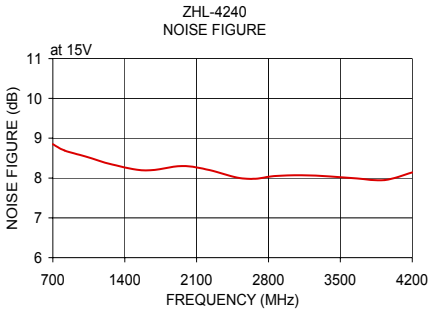
FREQUENCY (MHz)	GAIN (dB)			DIRECTIVITY (dB)			VSWR (:1)		NOISE FIGURE (dB)	POUT at 1 dB COMPR. (dBm)
	12V	15V	16V	12V	15V	16V	IN	OUT	15V	15V
700.00	39.92	42.00	42.04	19.20	34.20	28.70	1.65	1.60	8.85	29.80
814.00	39.70	41.68	41.72	24.90	30.00	22.50	1.61	1.61	8.69	30.21
1020.00	39.70	41.60	41.64	31.00	19.90	28.90	1.55	1.71	8.54	31.22
1280.10	39.25	41.22	41.26	39.90	22.60	19.80	1.47	1.79	8.34	31.45
1605.20	39.05	41.46	41.43	24.30	28.60	15.40	1.47	1.65	8.19	31.59
1956.40	38.51	40.92	40.81	28.90	26.10	30.50	1.52	1.44	8.30	31.27
2225.60	38.61	40.79	40.64	17.40	18.70	27.30	1.57	1.43	8.20	31.16
2494.90	40.04	41.85	41.71	19.40	20.30	20.90	1.68	1.36	8.01	30.04
2674.40	40.26	41.72	41.63	14.00	14.70	26.20	1.74	1.44	7.98	30.19
2853.80	40.42	41.66	41.62	22.80	18.70	14.10	1.82	1.66	8.05	30.69
3123.10	40.14	41.41	41.35	26.40	17.70	29.20	1.73	1.78	8.07	31.55
3392.30	40.23	41.88	41.79	27.10	33.20	22.60	1.44	1.78	8.04	31.58
3661.50	39.81	41.80	41.70	21.00	20.20	16.80	1.39	1.57	7.99	31.25
3930.80	40.08	42.14	42.07	25.10	17.90	14.00	1.32	1.24	7.95	30.29
4200.00	40.90	42.45	42.34	20.20	11.90	22.10	1.64	1.72	8.14	30.37











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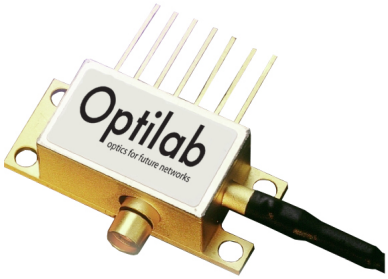
DFB-EAM-1550-12



EAM DFB Laser Diode, 12 GHz, 5 mW

The Optilab DFB-EAM laser diode is a cost effect and compact laser solution for OC-192/STM-64 DWDM applications. Consisting of a DFB laser with an integrated electro-absorption modulator (EAM), this allows for modulation speeds of over 12 GHz / 10 Gb/s applications on one 7-pin butterfly package device. Including a thermoelectric cooler (TEC), temperature thermistor, optical isolator and a GPO RF connector, the DFB-EAM is available in ITU grid wavelengths upon request, contact Optilab for more information.

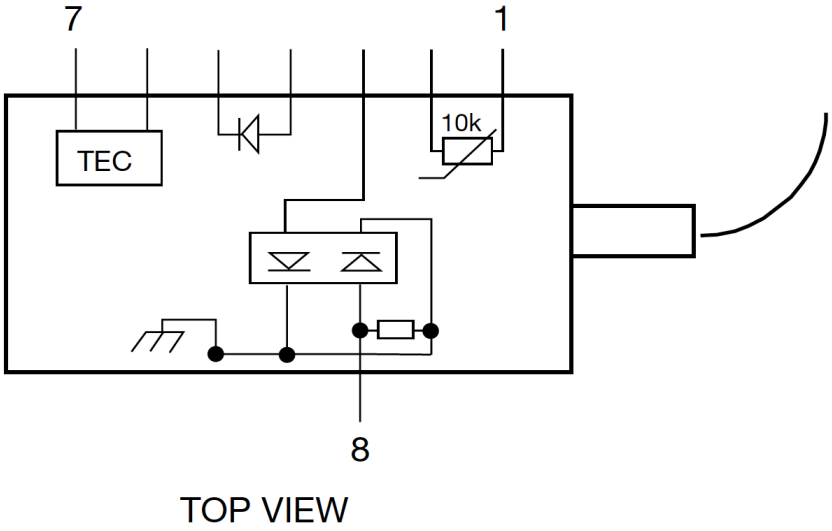
Features

- 1550 nm DFB + EAM Modulator
- Hermetic, 7 pin butterfly package
- Single-mode fiber pigtail
- 12 GHz typical bandwidth
- 5mW output power
- TEC Cooler + Thermistor

Applications

- DWDM SDH STM-64 LH
- DWDM SONET OC-192 LR

Functional Diagram



EAM DFB Laser Diode, 12 GHz, 5 mW

OPTIONS

DFB-EAM-1550-12

TECHNICAL INFO

For technical info and support:

sales@optilab.com

www.optilab.com

PHONE

Contact Optilab at:

1-888-553-3888 (toll-free)
1-602-343-1496 (direct, int'l)

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Phoenix, AZ, USA

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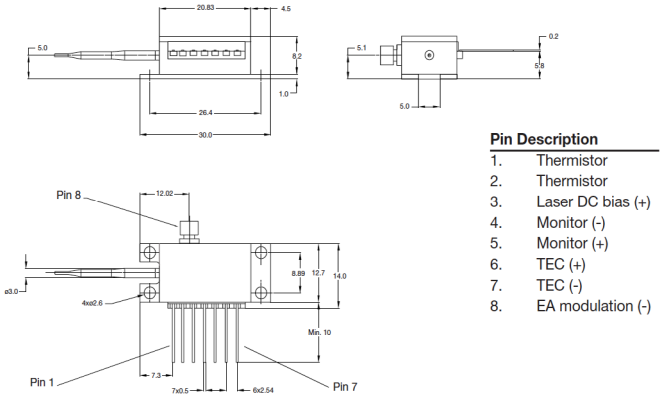
Optical Specifications	
Operating Wavelength Range	1530 nm to 1564 nm, ITU selectable
Output power	2mW min., 5mW typ.
Extinction ratio	10 dB min.
Dispersion penalty	1.5 dB max. @ 800 ps/nm disp.
Side mode suppr.ratio	35 dB min.
Optical isolation	30 dB min.
Operating current	50 mA min., 100 mA max.
Threshold current	25 mA max.
Forward voltage	2 V max.
Small signal modulation bandwidth	12 GHz min.
Rise/Fall time	40 ps max.
Monitor current	0.1 mA min., 1 mA max.
Monitor dark current	5 nA typ., 100 nA max.
Thermistor resistance	9.5 kΩ min., 10.5 kΩ max.
TEC Voltage	-2.5 V min., 2.5 V max.
TEC Current	-1.2 V min., 1.2 V max.
TEC Power	3 W max.
Mechanical Specifications	
Operating case temperature	0°C to +70°C
Storage temperature	-40 °C to +85°C
Optical Connector	LC/UPC Standard, FC/APC Optional
Fiber Type	SMF-28, 900 micron buffer
RF Connector	GPO

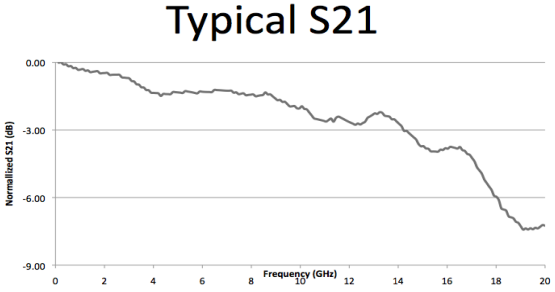
Mechanical Drawing



Pin Description

1. Thermistor
2. Thermistor
3. Laser DC bias (+)
4. Monitor (-)
5. Monitor (+)
6. TEC (+)
7. TEC (-)
8. EA modulation (-)

S21



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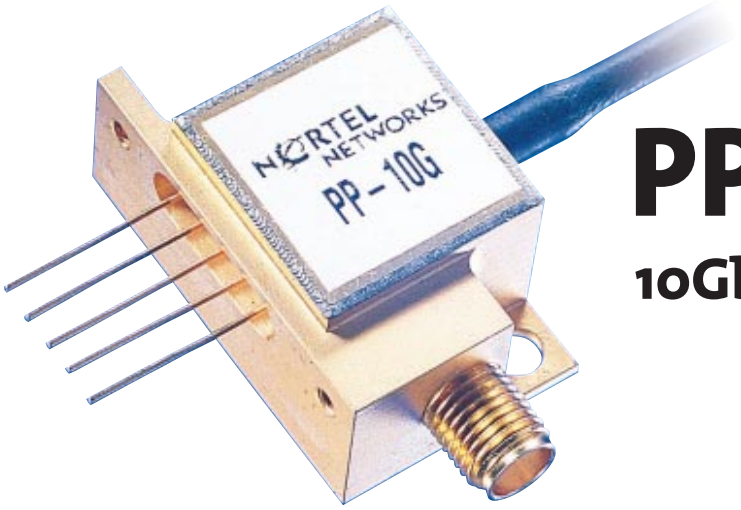
DATASHEET



PP - 10G

10Gb/s PIN Preamp Receiver

Features

Low capacitance high speed InGaAs PIN detector.

GaAs HBT preamp IC chip.

Single polarity power supply.

11GHz bandwidth.

Wide dynamic range.

Hermetically sealed.

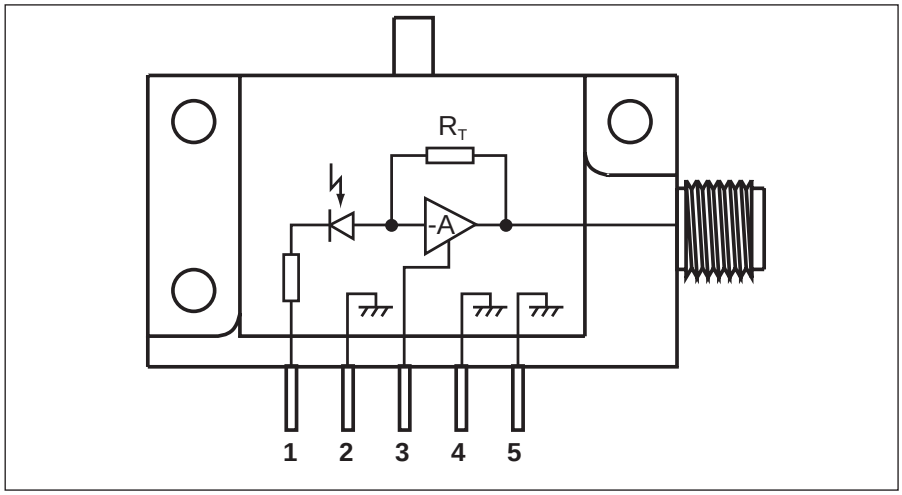
Bellcore TR-NWT-000468 compliant.

Applications

Long and short reach SONET/SDH systems
Optically preamplified receivers
Datacom systems up to 12.5 Gb/s

Description

The PP-10G module consists of a low capacitance photodetector and a low noise GaAs transimpedance amplifier in an hermetic package with a connectorized single-mode fibre pigtail and a 50 Ω SMA electrical output.



NORTEL NETWORKS™

PP - 10G

Characteristics

Over entire temperature range, at end-of-Life

General	Min	Typ	Max	Unit
NRZ data rate		10		Gb/s
Operating case temperature	0		70	°C
Physical dimensions		30 x 19 x 13.6		mm
SM fibre pigtail connector options		Standard SC-PC, Custom ST-PC, FC-PC		

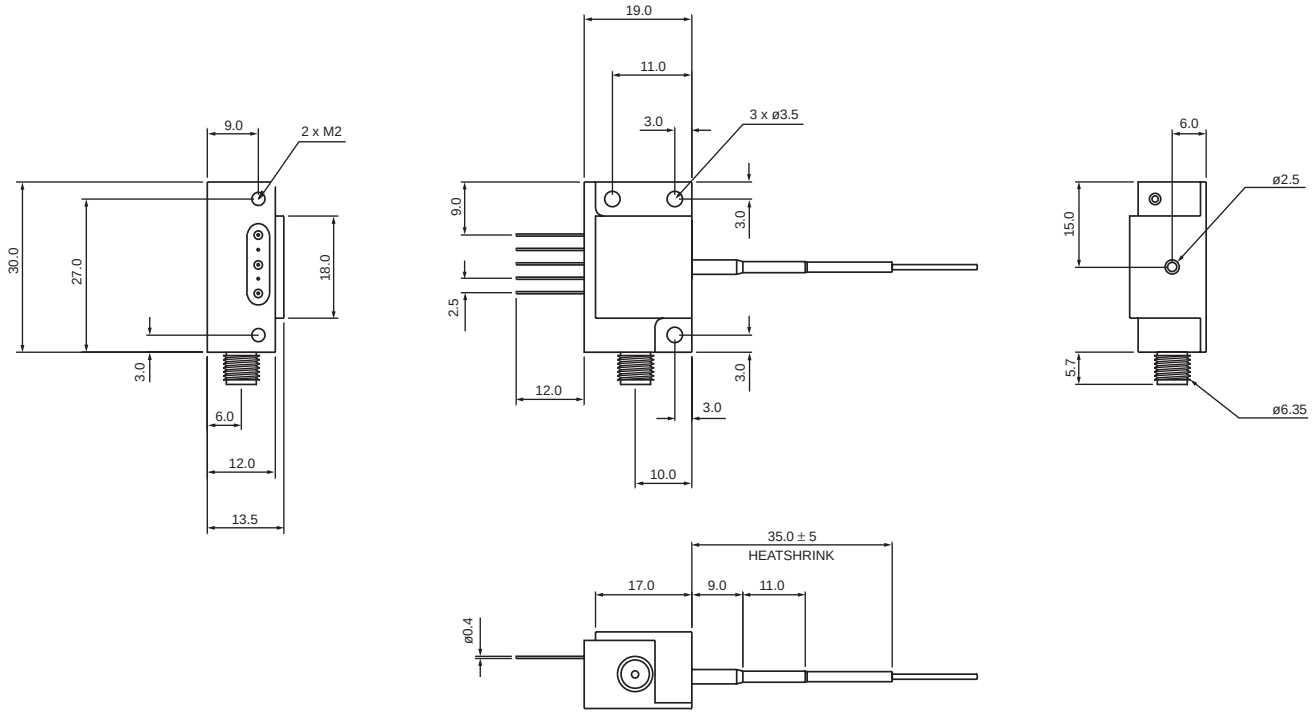
Performance	Symbol	Min	Typ	Max	Unit
Module PIN bias voltage	V_m	9.5	11.5	13.5	V
Positive supply	V_{cc}	7.5	8	8.5	V
Power dissipation	P_d		1	1.6	W
PIN responsivity (1)	R		0.88		A/W
PIN responsivity (5)	R		0.83		A/W
Responsivity variation with temperature 0°C to 70°C			5		%
Dark current (25°C)	I_d			10	nA
Optical connector loss			0.3		dB
Sensitivity (2)		-18	-19		dBm
Optical saturation power (BER< 10^{-9})	P_{sat}	0			dBm
Average input equivalent noise current density 30KHz - 10GHz	I_e			16.5	pA/√Hz
High frequency -3dB corner (3)			11		GHz
Transimpedance gain (3,4)	TZG	400	500	650	Ohms
Trans. gain variation with supply voltage and temperature (3)		-15		+15	%
Output return loss (3) 100kHz - 8GHz		10			dB

Notes :

1. Excluding optical connector loss. Optical wavelength is in the 1300nm region and between 1525 - 1575nm.
2. For 10^{-10} BER, PRBS 2^{23}-1. NRZ @10Gb/s
3. Load impedance is 50Ω with a return loss > 20dB, up to 20GHz.
4. Excluding PIN responsivity factor and connector loss.
5. Excluding optical connector loss. Optical wavelength is in the range 1576 - 1610nm.

Outline Drawing

Dimensions in mm



Instructions for Use - PP-10G

Pin 1 PIN Bias

A DC voltage, between 9.5V and 13.5V, to reverse bias the PIN. This voltage should be present BEFORE the Positive Supply (pin 3) is applied to prevent the possibility of forward biasing the PIN (which will damage the device). Power down sequence is: pin 3, then pin 1. This pin should be decoupled externally to minimise conducted noise from the power rails.

Pin 2, 4, 5 Ground

Ground all pins for optimum performance.

Pin 3 Positive Supply

DC voltage between 7.5 and 8.5V provides power to the pre-amplifier IC. This pin should be decoupled externally to minimise conducted noise from the power rails. The source should be capable of supplying up to 150 mA.

SMA Electrical Output

Device output is via the SMA connector and should be delivered into a 50Ω load. There is a DC offset of approximately 3V on this pin, so most applications will require that the output is AC coupled.

PP - 10G

Absolute Ratings

Parameter	Symbol	Ratings	Units
Positive supply	V_{cc}	9	V
Operating temperature (1)	T_{op}	0 to 70	°C
Storage temperature (2)	T_{stg}	-50 to 70	°C
Maximum optical input (3)	P_o	10	dBm
Maximum module PIN bias voltage	V_m	15	V
Maximum peak module PIN current	I_m	3	mA
Minimum fibre bend radius		35	mm

Notes :
1. The operating temperature is defined as the temperature of the module case.
2. The storage temperature is defined as the ambient temperature.
3. The optical level that causes no damage to the module. Performance specified in this document is not guaranteed at this input power.

Device Ordering Information

PP - 10G (Standard connector SC/PC (C28B)

Connector type FC/PC = C33

A Qualification Test Report QR1317B is also available for this device

Nortel Networks Optical Components Ltd.
Brixham Road
Paignton
Devon
TQ4 7BE
United Kingdom
Tel: +44 1803 662106
Fax: +44 1803 662801

Email: opticalcomponents@nortelnetworks.com
www.nortelnetworks.com/components/

PB0095 ISSUE 2 July 2000

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OBSERVE PRECAUTIONS

Certificate No. FM 15040

Certificate No. EMS 35100

Coaxial

Low Noise Amplifier

ZX60-P33ULN+

50Ω 0.4 to 3.0 GHz

Case Style: GC957

The Big Deal

- Ultra Low Noise Figure, 0.38 dB typ.
- High Dynamic Range
- Ultra small connectorized package

Product Overview

The ZX60-P33ULN+ (RoHS compliant) uses Mini-Circuits' E-PHEMT technology to offer ultra low noise figure over a broad frequency range and high IP3. Housed in a rugged, cost effective unibody chassis, this amplifier supports a wide variety of applications requiring moderate power output, low distortion and 50 ohm matched input/output ports.

Key Features

Feature	Advantages
Ultra Low Noise Figure, 0.38 dB at 0.9 GHz	Outstanding world class noise figure performance.
High IP3 vs. DC power consumption +34 dBm typical at 0.9 GHz +38 dBm typical at 3 GHz	Combining Low Noise and High IP3 makes this model ideal for use in Low Noise Receiver Front End (RFE)
Max. Input Power, +14 to +22 dBm (continuous)	Ruggedized design operates to high input powers often seen at receiver inputs.
Very Small Size, 0.75" x 0.74"	The unique unibody size and construction enable the ZX60-P33ULN+ to be used in extremely compact connectorized applications.

Coaxial

Low Noise Amplifier

ZX60-P33ULN+

50Ω 0.4 to 3.0 GHz

Case Style: GC957

Connectors	Model
SMA	ZX60-P33ULN+

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Features

- Low Noise Figure, 0.46 dB typ. at 0.9 GHz
- High IP3, +34 dBm at 0.9 GHz and +38 dBm at 3 GHz
- High Pout, P1dB, +17 dBm typ. at 0.9 GHz
- High Gain, 19.0 dB at 0.9 GHz

Applications

- Base station infrastructure
- Portable Wireless
- LTE
- GPS
- GSM
- Airborne radar

Electrical Specifications at 25°C and 3.0 V unless noted

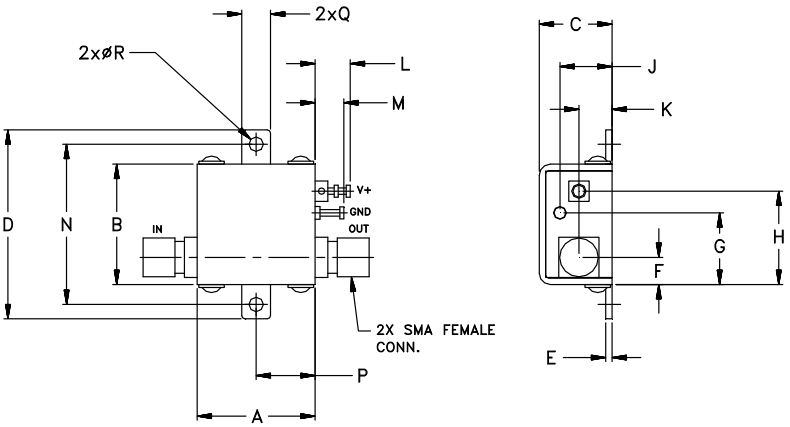
Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.4		3.0	GHz
Noise Figure	0.4		0.43	0.70	dB
	0.9		0.38		
	1.5		0.46		
	2.0		0.49		
	3.0		0.90		
Gain	0.4	17.3	24.5	21.1	dB
	0.9		19.0		
	1.5		14.8		
	2.0		12.4		
	3.0		8.8		
Output Power @ 1 dB compression	0.4	15.5	17.3		dBm
	0.9		17.4		
	1.5		17.4		
	2.0		17.6		
	3.0		17.5		
Output IP3	0.4	30.6	30.3		dBm
	0.9		33.6		
	1.5		35.3		
	2.0		36.2		
	3.0		38.0		
Input VSWR	0.4		1.90		:1
	0.9		1.90		
	1.5		1.90		
	2.0		1.90		
	3.0		1.80		
Output VSWR	0.4		1.20		:1
	0.9		1.20		
	1.5		1.30		
	2.0		1.30		
	3.0		1.30		
Active Directivity (Isolation-Gain)	0.4-3.0		4		dB
DC Supply Voltage		—	3.0	—	V
Supply Current		—	56	67	mA

Maximum Ratings

Parameter	Ratings
Operating Temperature	-40°C to 85°C Case
Storage Temperature	-55°C to 100°C
DC Voltage	5.5 V
Input RF Power (no damage) Vd=3V	+27 dBm (5 minutes max.) +14 dBm to 1.5 GHz and +22 dBm over 1.5 to 3 GHz (continuous)
Power Consumption	0.5 W

Permanent damage may occur if any of these limits are exceeded.

Outline Drawing

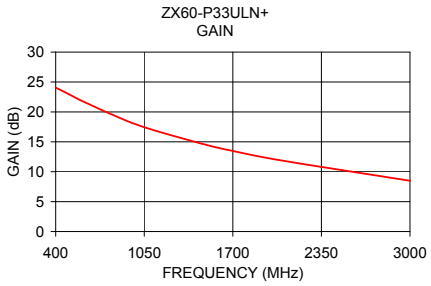


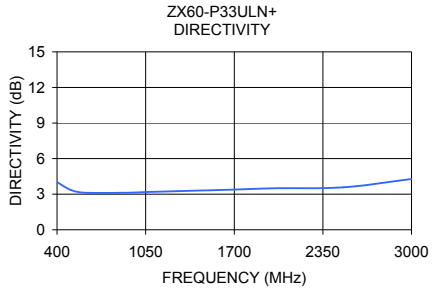
NOTE: When soldering the DC connections, caution must be used to avoid overheating the DC terminal. See Application Note. AN-40-010.

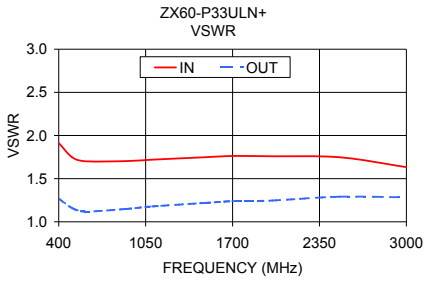
Outline Dimensions (inch / mm)

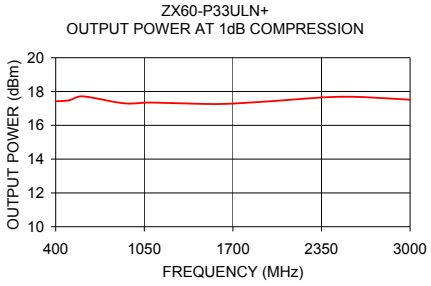
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	wt
.74	.75	.46	1.18	.04	.17	.45	.59	.33	.21	.22	.18	1.00	.37	.18	.106	grams
18.80	19.05	11.68	29.97	1.02	4.32	11.43	14.99	8.38	5.33	5.59	4.57	25.40	9.40	4.57	2.69	23.0

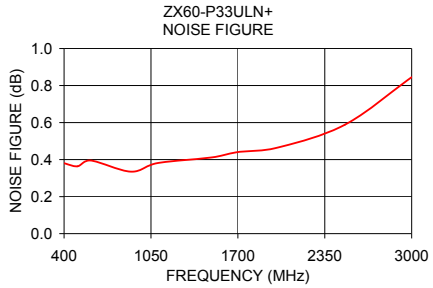
FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR (:1)		POUT at 1dB COMPR. (dBm)	NOISE FIGURE (dB)	OUTPUT IP3 (dBm)
			IN	OUT			
400.0	24.06	3.7	1.9	1.2	17.3	0.43	30.3
900.0	18.71	3.4	1.9	1.2	17.5	0.38	33.6
1500.0	14.52	3.7	1.9	1.3	17.4	0.46	35.3
2000.0	12.10	3.9	1.9	1.3	17.6	0.49	36.2
3000.0	8.49	4.7	1.8	1.3	17.5	0.90	38.0

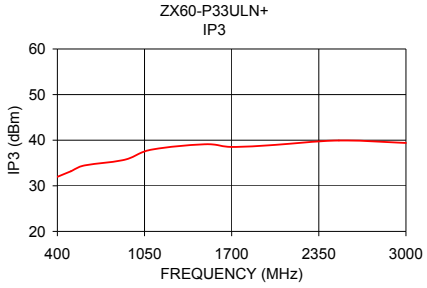












Additional Notes

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DC Pass
Bi-Directional Coupler

ZABDC20-322H+

50Ω Up to 50W 1700 to 3200 MHz

CASE STYLE: DD477-1

Connectors	Model
SMA	ZABDC20-322H-S+

+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

Maximum Ratings

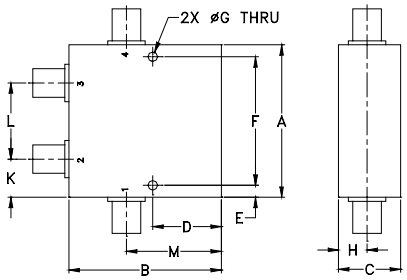
Operating Temperature	-55°C to 100°C
Storage Temperature	-55°C to 100°C
DC Current	2.0 A

* Case temperature is defined as temperature on ground leads. Permanent damage may occur if any of these limits are exceeded.

Coaxial Connections

INPUT	1
OUTPUT	4
COUPLED (forward)	2
COUPLED (reverse)	3

Outline Drawing



Outline Dimensions (inch / mm)

A	B	C	D	E	F	G
2.00	2.00	.88	.90	.156	1.688	.125
50.80	50.80	22.35	22.86	3.96	42.88	3.18

H	J	K	L	M		wt
.38	---	.50	1.00	1.25		grams
9.65	---	12.70	25.40	31.75		225

Features

- excellent mainline loss, 0.25 dB typ.
- excellent directivity, 25 dB typ.
- high power, up to 50W
- rugged shielded case
- DC current through input to output 2.0A Max. at 50 watt RF input power

Applications

- PCS/DCS/UMTS
- power leveling & monitoring
- VSWR measurement

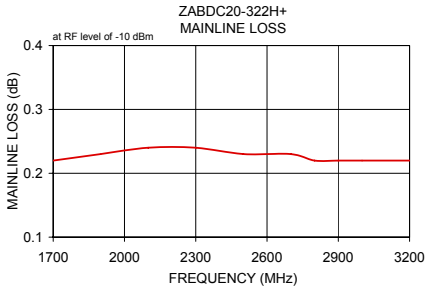
Bi-Directional Coupler Electrical Specifications

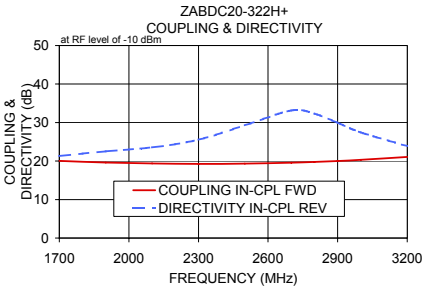
FREQ. (MHz)	COUPLING (dB)		MAINLINE LOSS[1] (dB)		DIRECTIVITY (dB)		VSWR (:1)	POWER INPUT (W)
f_L-f_U	Nom.	Flatness	Typ.	Max.	Typ.	Min.	Typ.	Max.
1700-3200	**20.5±1.0**	**±1.3**	**0.25**	**0.35**	**21**	**13**	**1.10**	**50**
1700-2500	20.0±1.0	±0.5	0.25	0.35	20	14	1.10	50
2500-3200	20.5±1.0	±1.2	0.25	0.35	25	13	1.10	50

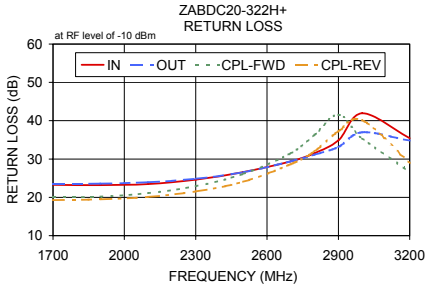
1. Mainline loss includes theoretical power loss at coupled port.

Typical Performance Data

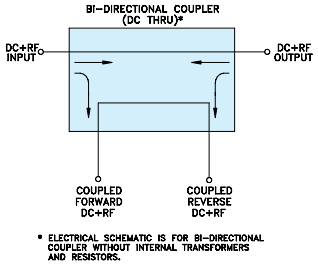
Frequency (MHz)	Mainline Loss (dB)	Coupling (dB)		Directivity (dB)		Return Loss (dB)			
	In-Out	In-Cpl Fwd	Out-Cpl Rev	Out-Cpl Fwd	In-Cpl Rev	In	Out	Cpl Fwd	Cpl Rev
1700.00	0.22	20.05	20.04	19.91	21.29	23.26	23.56	19.99	19.30
1900.00	0.23	19.62	19.63	20.77	22.51	23.18	23.59	20.19	19.49
2100.00	0.24	19.36	19.38	21.40	23.56	23.46	23.96	21.09	20.11
2300.00	0.24	19.26	19.29	23.05	25.54	24.61	24.85	22.90	21.55
2500.00	0.23	19.33	19.35	26.72	29.28	26.57	26.55	26.12	24.07
2700.00	0.23	19.57	19.59	33.66	33.12	29.40	29.40	31.50	28.65
2800.00	0.22	19.76	19.79	39.70	32.31	31.54	31.12	36.29	31.98
2900.00	0.22	20.01	20.04	40.52	29.94	34.90	33.15	41.55	37.25
3000.00	0.22	20.31	20.34	35.13	27.45	41.94	36.96	35.41	40.12
3200.00	0.22	21.08	21.09	27.62	23.91	35.44	34.81	26.71	28.95







Electrical Schematic



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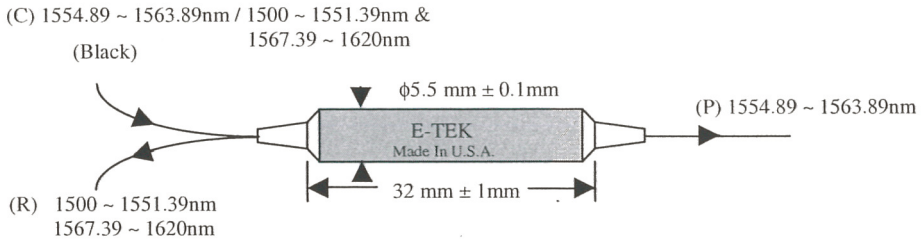
INSPECTION REPORT

Date: 12/19/00

1. Item: BWDM21D0CRV13
2. E-TEK Spec Version: 2.0
3. Serial No.: 64557379
4. Fiber: Corning SMF-28 CPC6, 250μm bare fiber
5. Fiber Length (each end): >1m
6. Schematic:



7. Performance(@ 23°C): (Center Wavelength:1559.39nm)

Insertion Loss (dB)			Insertion Loss (dB)	
@ 1559.39nm (C) ⇒ (P)	@ 1549.39nm (C) ⇒ (R)	@ 1569.39nm (C) ⇒ (R)	1554.89 ~ 1563.89nm (C) ⇒ (P)	1500 ~ 1551.39nm 1567.39 ~ 1620nm (C) ⇒ (R)
0.24	0.12	0.12	<0.8	<0.5

Flatness (dB)		PDL (dB)
1554.89 ~ 1563.89nm (C) ⇒ (P)	1500 ~ 1551.39nm 1567.39 ~ 1620nm (C) ⇒ (R)	
<0.15	<0.15	<0.1

Isolation (dB)		Return Loss (dB)
1554.89 ~ 1563.89nm (C) ⇒ (R)	1500 ~ 1551.39nm 1567.39 ~ 1620nm (C) ⇒ (P)	
>13	>20	>45

8. Connectors: None
9. Spectrum Curve attached (1 page)

E-TEK Dynamics, Inc.
1885 Lundy Avenue, San Jose, CA 95131, U.S.A.
Tel. (408) 432-6300 Fax (408) 432-8550

Test by: 1717
Check by: _____

E-TEK 51 QQA ACCEPT
PQC PASS INSPECTION 32

Optical WDM Data Sheet

Product Name: 7-S-1 Serial No.: 2015002175 Date: 2015-11-16

Parameters		Specification	Test Data
Pass Channel Wavelength Range (nm)		1547.47-1552.77	1547.47-1552.77
Reflect Channel Wavelength Range (nm)		1520-1546.37&1553.88-1570	1520-1546.37&1553.88-1570
Insertion Loss (dB)	Pass Channel	≤0.8	0.49
	Reflect Channel	≤0.6	0.25
Isolation (dB)	Pass Channel	≥30	33.50
	Reflect Channel	≥15	16.00
PDL (dB)	Pass Channel	≤0.1	0.03
	Reflect Channel	≤0.1	0.03
Directivity (dB)		≥55	59.00
Return Loss (dB)		≥50	56.00
Dimension(mm)		¢5.5×34	
Connector Type		FC/APC	
Fiber Length (m)		≥1.0	
Fiber Type		SMF-28e with 0.9mm tube	
Operating Temperature(℃)		-20~ +70	
Storage Temperature(℃)		-40℃~+85	

PASS