ANEXOS

Anexo A

Montaje experimental

Este Anexo muestra los montajes experimentales utilizados a lo largo de la memoria. La Figura A.1 muestra el montaje de la parte óptica utilizado para caracterizar sus componentes, láser y detector, en el Capítulo 4.

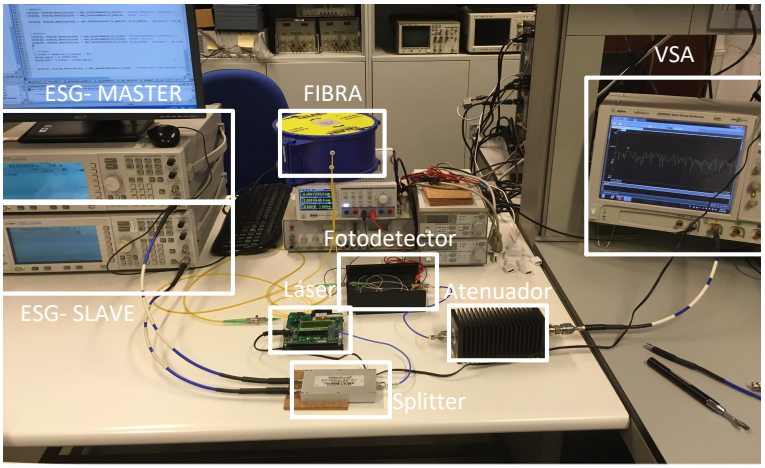


Figura A.1: Montaje experimental de la parte óptica utilizada, formada por un láser, fibra SMF, fotodetector y un atenuador.

El siguiente montaje es el mostrado en la Figura A.2, donde se muestra la parte de RF que se ha usado durante el TFG. Se ha utilizado para caracterizar el PA, elemento principal.

Por último, se juntan las dos partes anteriores obteniendo el montaje completo que consta de los elementos anteriores y se muestra en la Figura A.3. Es utilizado para capturar las señales y para probar los predistorsionadores desarrollados en este TFG. Las señales emitidas por los dos ESG, se combinarian y pasarían por el circuito mostrado para, finalmente ver los

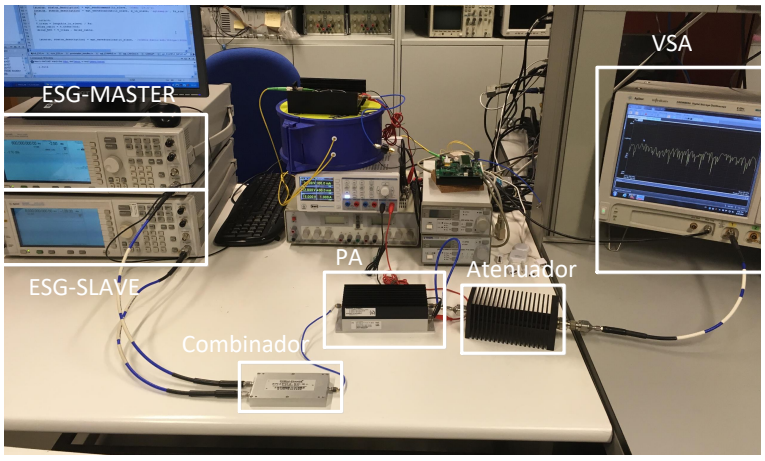


Figura A.2: Montaje experimental de la parte de RF usada formada por un PA y un atenuador

resultados en el VSA.

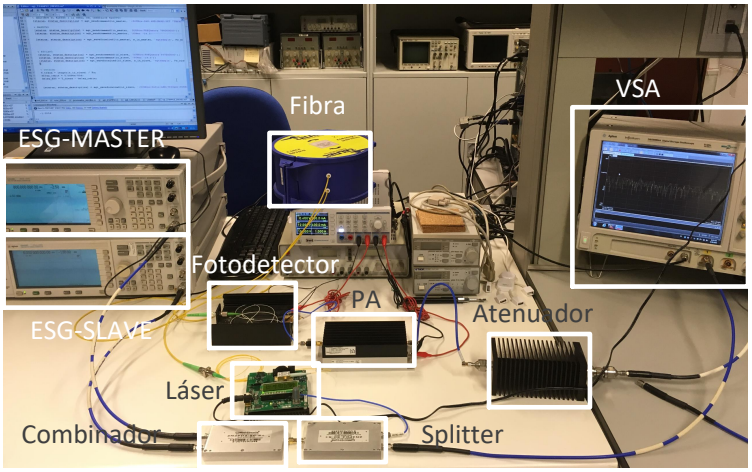


Figura A.3: Montaje experimental del esquema completo, con la parte óptica y la de RF.

Anexo B

Hojas de características

- Amplificador de potencia (PA): ZHL-4240, Mini-Circuits.
- Diodo láser (LD): DFB-EAM-1550-12, Optilab.
- Diodo fotodetector (PD): DR-125G-A, MITEQ.

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.

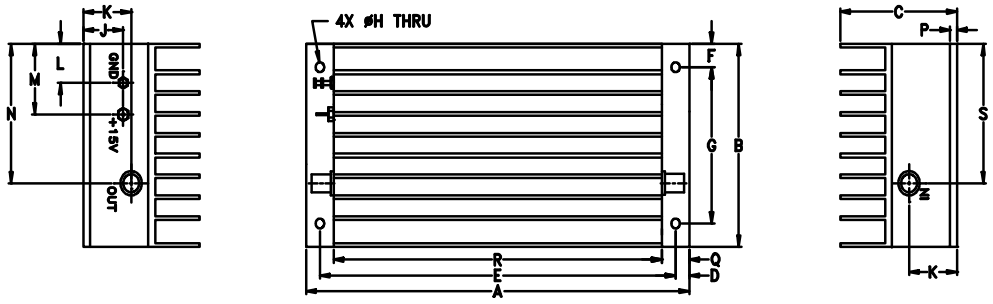
With no load derate max input power by 20 dB

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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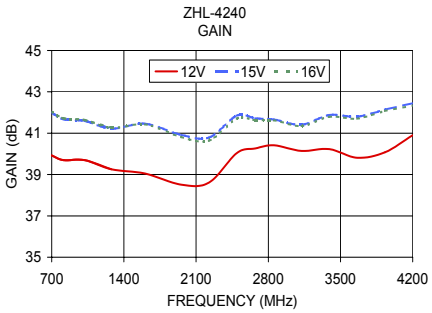
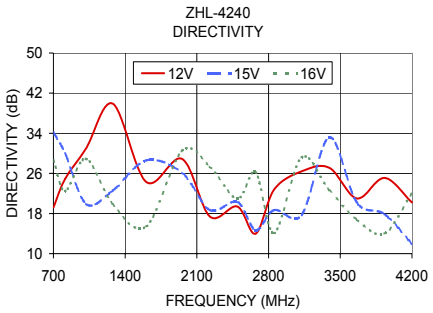
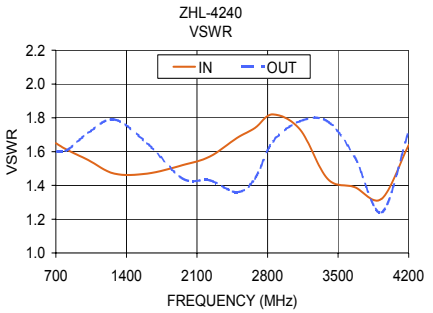
Typical Performance Data/Curves

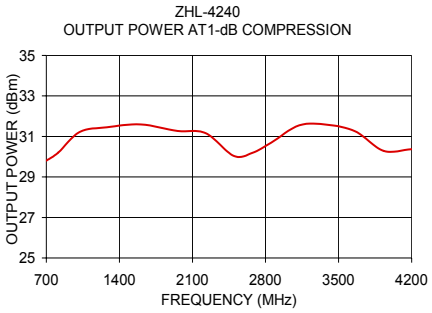
ZHL-4240

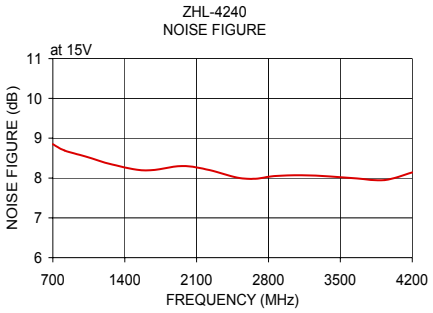
FREQUENCY (MHz)	GAIN (dB)			DIRECTIVITY (dB)			VSWR (:1)		NOISE FIGURE (dB)	POUT at 1 dB COMPR. (dBm)
	12V	15V	16V	12V	15V	16V	IN	OUT	15V	15V
700.00	39.92	42.00	42.04	19.20	34.20	28.70	1.65	1.60	8.85	29.80
814.00	39.70	41.68	41.72	24.90	30.00	22.50	1.61	1.61	8.69	30.21
1020.00	39.70	41.60	41.64	31.00	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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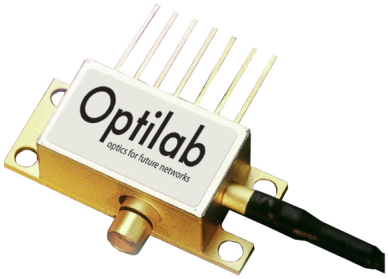
DFB-EAM-1550-12



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.

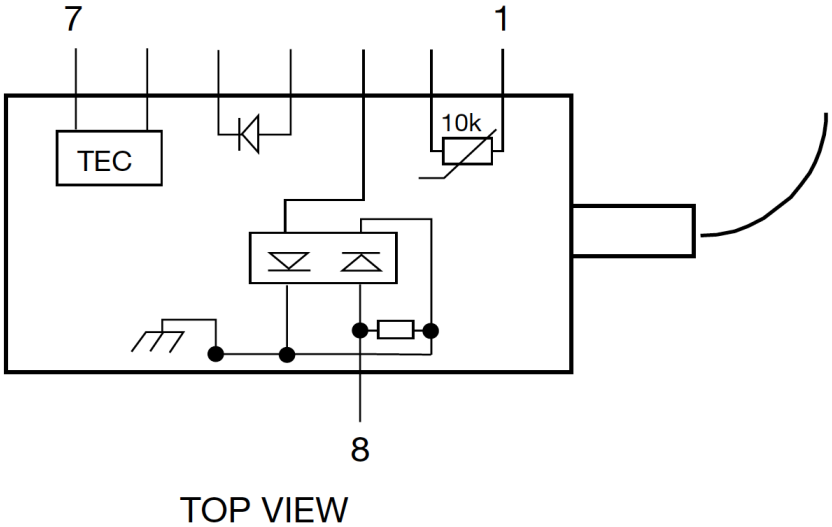
Features

- 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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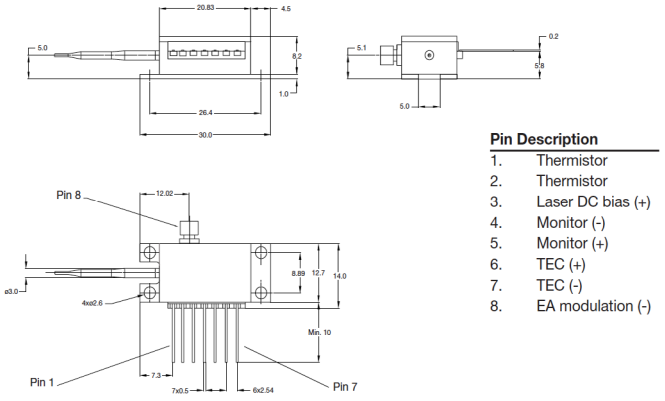
Optical Specifications	
Operating Wavelength Range	1530 nm to 1564 nm, ITU selectable
Output power	2mW min., 5mW typ.
Extinction ratio	10 dB min.
Dispersion penalty	1.5 dB max. @ 800 ps/nm disp.
Side mode suppr.ratio	35 dB min.
Optical isolation	30 dB min.
Operating current	50 mA min., 100 mA max.
Threshold 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

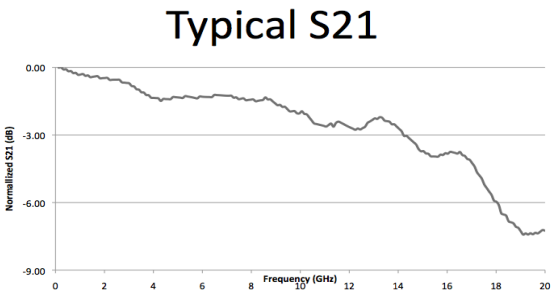
Mechanical Drawing



Pin Description

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

S21



Optilab
photonics for the future

30 kHz - 12.5 GHz OPTICAL RECEIVER

MODEL: DR-125G-A

FEATURES

- 10.7 and 12.5 Gb/s
- Hermetic Kovar package
- Available as “drop-in”
- Single voltage supply
- Customized packages and electrical specifications available

ELECTRICAL SPECIFICATIONS

PARAMETERS	CONDITION	UNITS	MIN.	TYP.	MAX.
Bandwidth	3 dB electrical		30 kHz		13 GHz
Photodiode responsitivity		A/W	0.8	0.9	0.97
Transimpedance gain		Ohms	1780	2240	2820
Transimpedance gain (dB - Ω)		dB, ohms	65	67	69
Optical to electrical transfer gain (see Note 1)		V/W	1510	1900	2395
Dark current		nA		5	50
Sensitivity (see Note 2)	10.7 Gb/s 12.5 Gb/s	dBm dBm		-18 -17	
Group delay (see Note 3)		ps		100	200
RF output impedance		Ohms		50	
RF output VSWR			2:1		
Maximum output voltage		V, p-p	3.5	4.5	5
Logic sense	Inverting (non-inverting as option)				

NOTES:
1. Optical to electrical transfer gain measured as follows: Output V, p-p (in 50 ohm)/Input optical power (W, p-p).
2. NRZ, PRBS = 2^{31-1}, B.E.R. = 10^{-10}.
3. Defined within the 3 dB optical to electrical bandwidth.

OPTICAL PERFORMANCE SPECIFICATIONS

PARAMETERS	CONDITION	UNITS	MIN.	TYP.	MAX.
Optic connector (all standards available)	FC/APC standard				
Fiber (core/cladding)	9/125µm single mode fiber (1 meter)				
Input wavelength		nm	1280		1580
Microwave input power*	Overload	dBm			+5
Optical return loss		dB	30		

* Maximum overload defined as the maximum optical input power while maintaining the Bit Error Rate (B.E.R.) of 10^{-10} or better.
Test conditions: NRZ, 12.5 Gb/s, PRBS = 2^{31-1}, B.E.R. =10^{-10}.

ORDERING INFORMATION

Receiver without monitor ..... Part number: DR-125G-A
Receiver with monitor ..... Part number: DR-125G-MV

C40-1107-39

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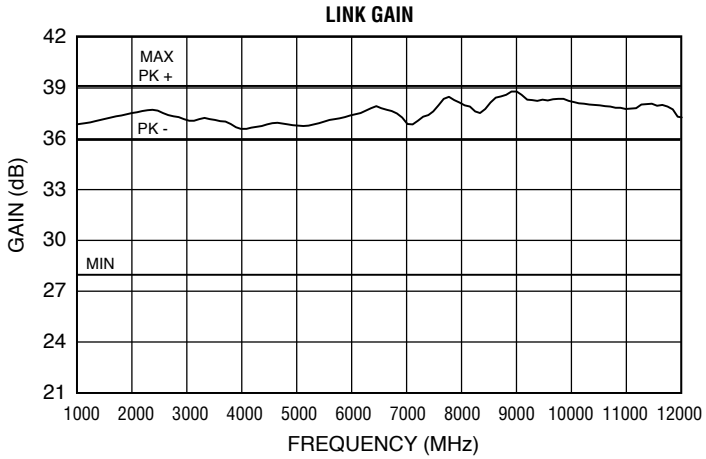
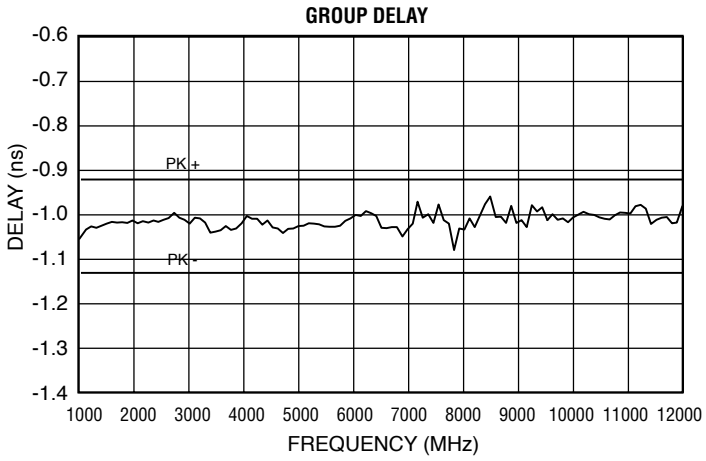
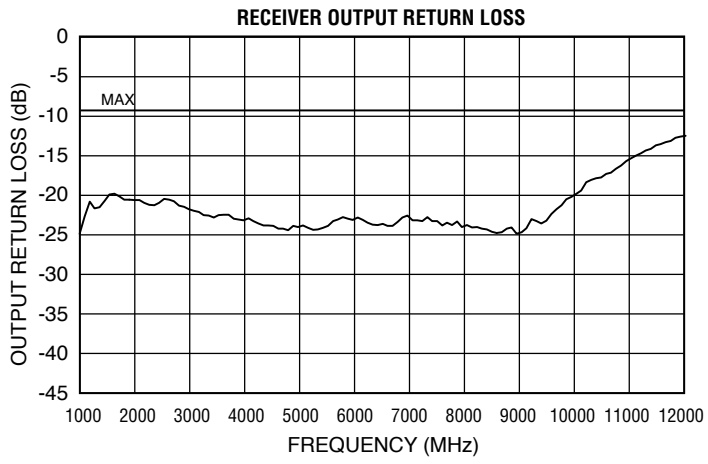
TYPICAL TEST DATA







GENERAL CONDITIONS

Voltage range ..... +11 V to +16 V
Current..... 230 mA typical to 275 mA maximum
RF connectors ..... SMA female standard
Optional operation ....+12 VDC

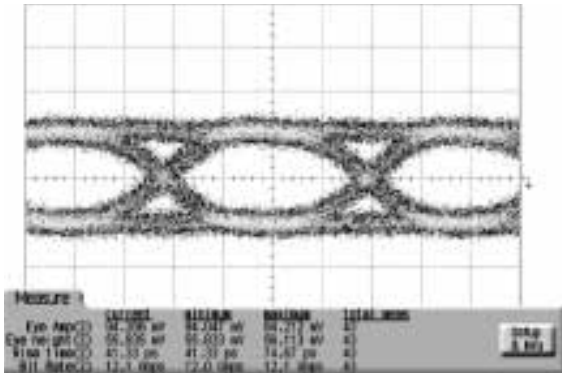
ENVIRONMENTAL CONDITIONS

Operating temperature..... -5 to +70°C
Storage temperature ..... -40 to +85°C
Humidity ..... 95% relative humidity, noncondensing

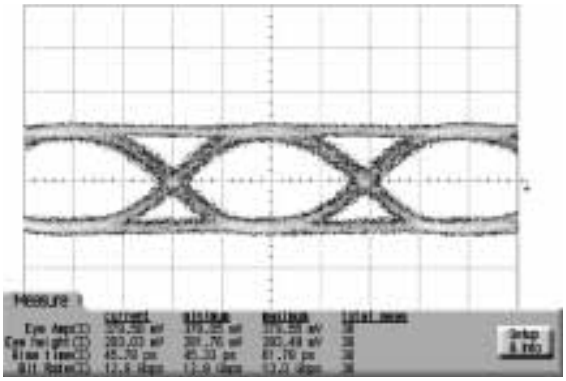
C40-1107-40

MEASUREMENTS

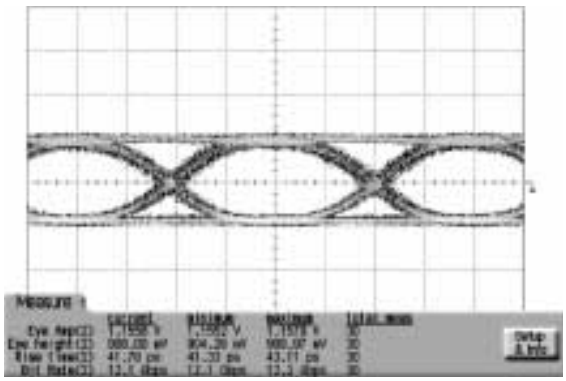
INPUT POWER -16 dBm



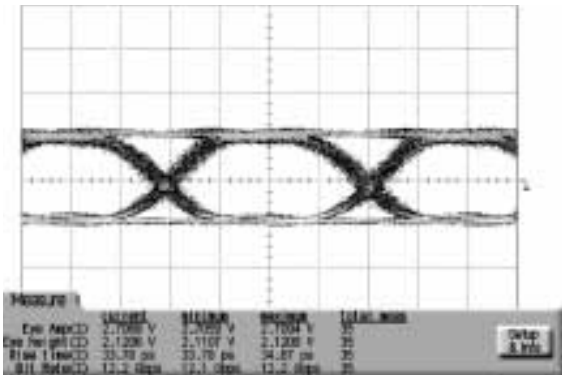
INPUT POWER -10 dBm



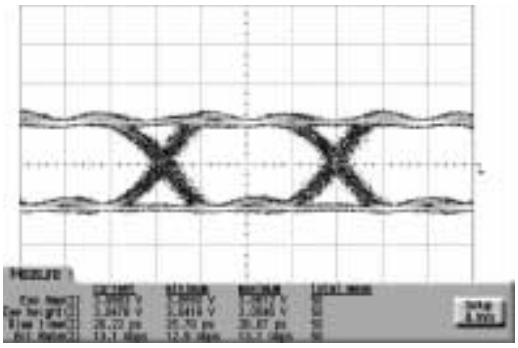
INPUT POWER -5 dBm



INPUT POWER 0 dBm



INPUT POWER +5 dBm



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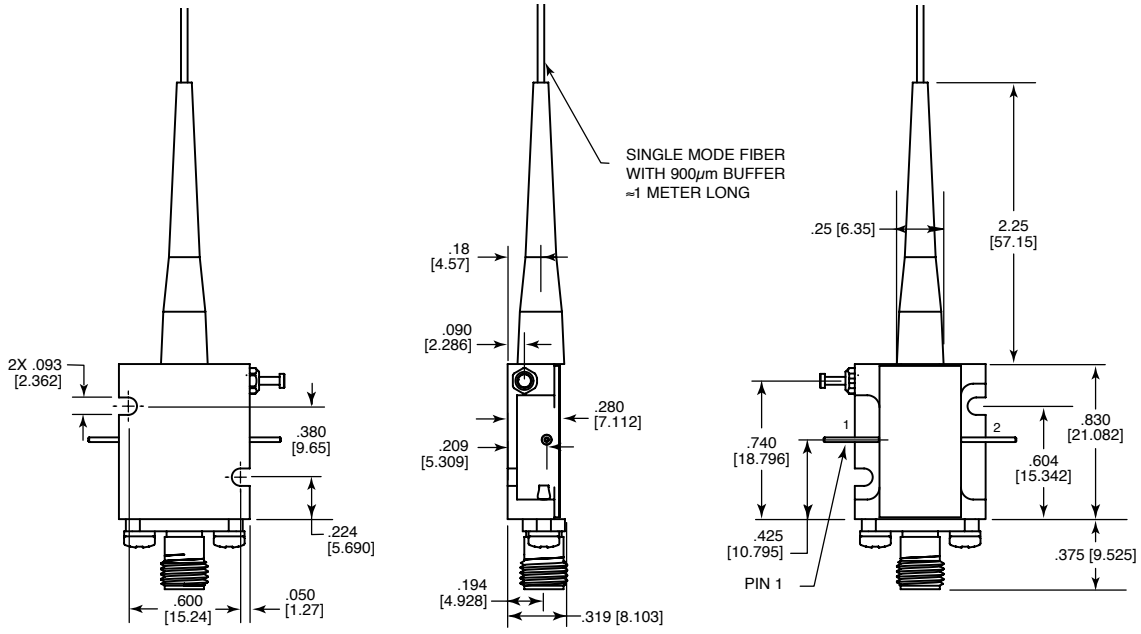
RECEIVER OUTLINE DRAWING



RECEIVER POWER SUPPLY

PIN	VOLTAGE	CURRENT (AMPS)	NOTES
1	PHOTOCURRENT MONITOR		REFER TO "OPERATIONAL STATUS"
2	+12	0.1	

RECEIVER OPERATIONAL STATUS

PIN	DESCRIPTION	NORMAL VOLTAGE	NOTES
1	OPTICAL CARRIER DETECT	> 1.0 UP TO +8	0 VOLTS INDICATES NO CARRIER PRESENT. VOLTAGE INCREASES APPROXIMATELY 1.3 V/mW WITH DETECTED OPTICAL POWER.

RF CONNECTOR: SMA (FEMALE STANDARD)
OPTICAL CONNECTOR: FC/APC STANDARD (OTHER STANDARDS AVAILABLE)
OPTICAL FIBER: 9/125 SINGLE MODE

NOTE: DIMENSIONS SHOWN IN BRACKETS [ ] ARE IN MILLIMETERS.

C40-1107-42