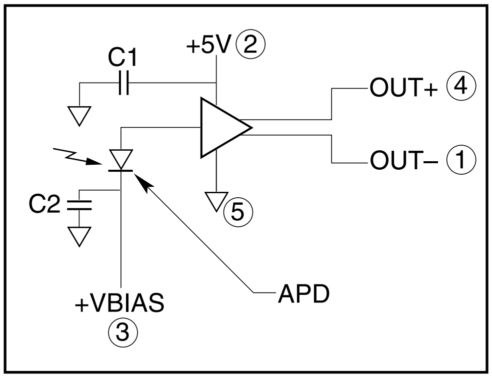
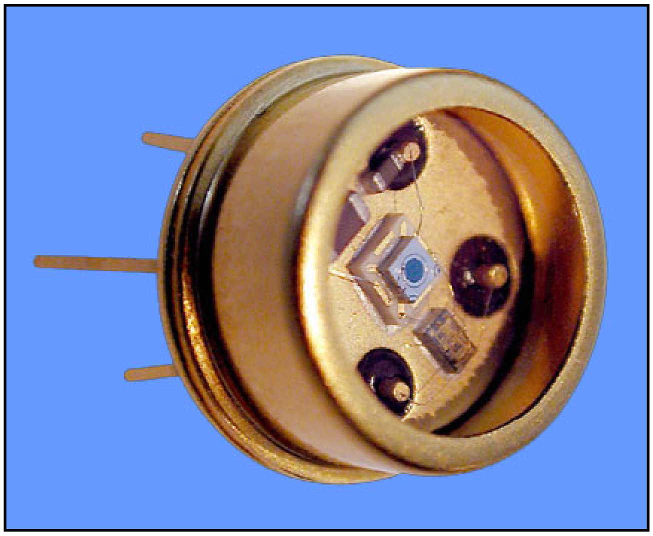
DATA SHEET PSS-AD500-2.3G-TO5

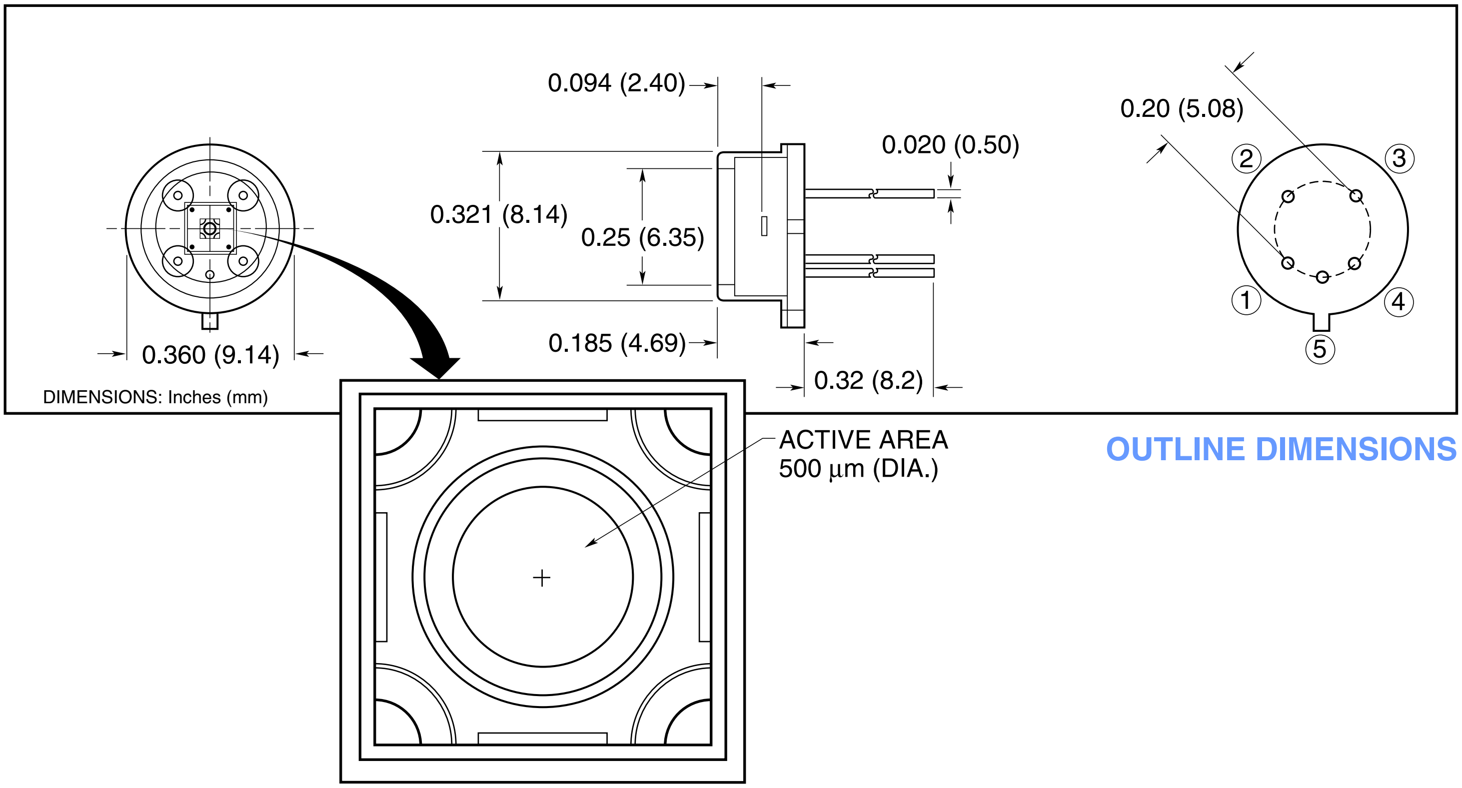
OPTICAL DATA RECEIVER USING AN AVALANCHE PHOTODIODE AND A 2.3 GHz AMPLIFIER

PSS-AD-500-2.3G-TO5 is a high frequency optical data receiver comprising an Avalanche Silicon Photodiode and a transimpedance amplifier in a hermetically sealed TO5 package.



SCHEMATIC DIAGRAM





OUTLINE DIMENSIONS

APD CHIP

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AVALANCHE PHOTODIODE DATA

TYPICAL VALUES AT 22°C

	ACTIVE AREA		V_{BR}		C_T	I_d	RESP		T_R	CUT OFF FREQUENCY	NEP
MODEL	Dia.	mm^2	V	TC of V_{NR} (%/°C)	Pf	nA	@ 780 nm A/W	GAIN	ps	GHz (–3 db)	$(W/Hz^{1/2})$
PSS-AV500-2.3G-TO5	500 µm	0.196	160	0.4	2.5	0.5	0.45	200	280	2.0	$2 * 10^{-13}$

Symbols:

- **V_{BR} - Voltage Breakdown**
- **C_T - Capacitance**
- **I_d - Dark Current**
- **Resp. - Responsivity (no avalanche effect)**
- **T_R - Rise Time**
- **NEP - Noise Equivalent Power**

TRANSCONDUCTANCE AMPLIFIER DATA

(V_{CC} = +3.0 V tp + 5.5 V. T_A = 25°C 100Ω load between OUT+ and OUT–. Typical values are at +25°, V_{CC} = 3.3 V.

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
SUPPLY VOLTAGE		3	5	6	V
SUPPLY CURRENT			26	50	mA
TRANSIMPEDANCE	DIFFERENTIAL, MEASURED W. 40µA P-P SIGNAL	1540	1900	2330	Ω
OUTPUT IMPEDANCE	SINGLE ENDED PER SIDE	48	50	52	Ω
MAXIMUM DIFFERENTIAL OUTPUT VOLTAGE	INPUT = 1ma	185	250	415	mV p-p
AC INPUT OVERLOAD		1			mV p-p
DC INPUT OVERLOAD		0.65			mA
INPUT REFERRED RMS NOISE	TO5 PACKAGE		485	655	nA
INPUT REFERRED NOISE DENSITY	NOTE 2		11		$PA/(Hz)^{1/2}$
SMALL SIGNAL BANDWIDTH		1530	1900	2420	MHz
LOW FREQUENCY CUTOFF	–3 dB, INPUT < 20 µADC		44		kHz
TRANSIMPEDANCE LINEAR RANGE	PEAK TO PEAK 0.95 < LINEARITY < 1.05	40			µA P-P
POWER SUPPLY REJECTION RATIO (PSRR)	OUTPUT REFERRED, f < 2 MHz PSRR = .2 LOG ($\Delta V_{OUT}/\Delta V_{CC}$)		50		dB

Note 1: Source capacitance is the avalanche capacitance.

Note 2: Input referred noise is calculated as RMS output noise/ (Gain at f = 10 Mhz)
Noise density is (input - referred noise)/√bandwidth

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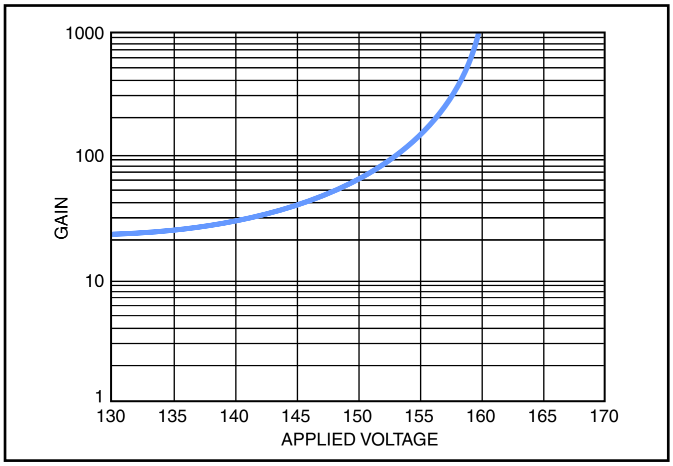

FIG. 1: APD GAIN VS BIAS VOLTAGE

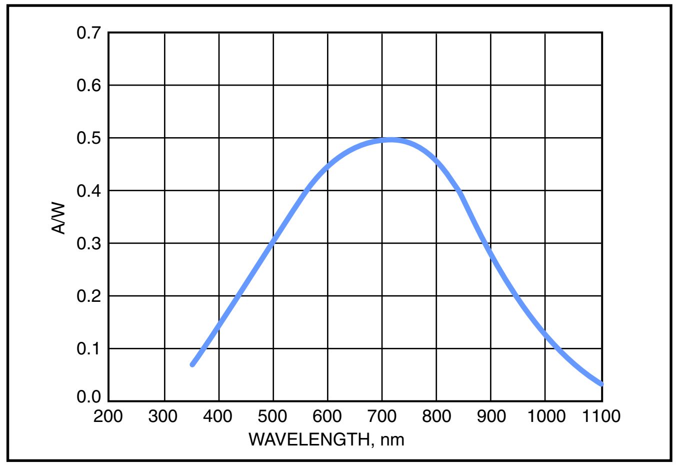

FIG. 2: APD SPECTRAL RESPONSE (NO AVALANCHE EFFECT)

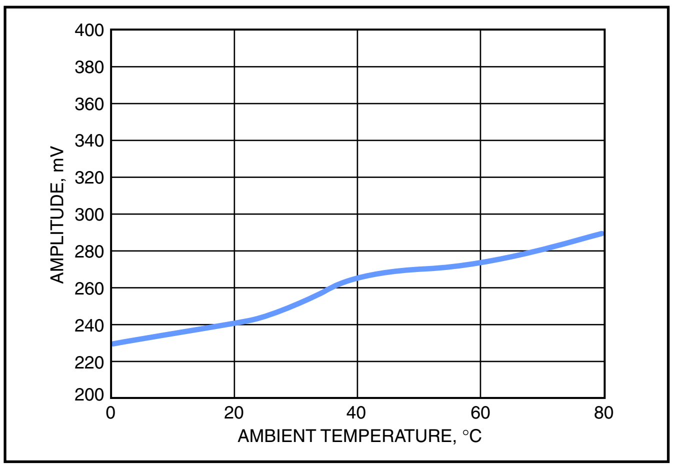

FIG. 3: AMPLIFIER OUTPUT VS TEMPERATURE

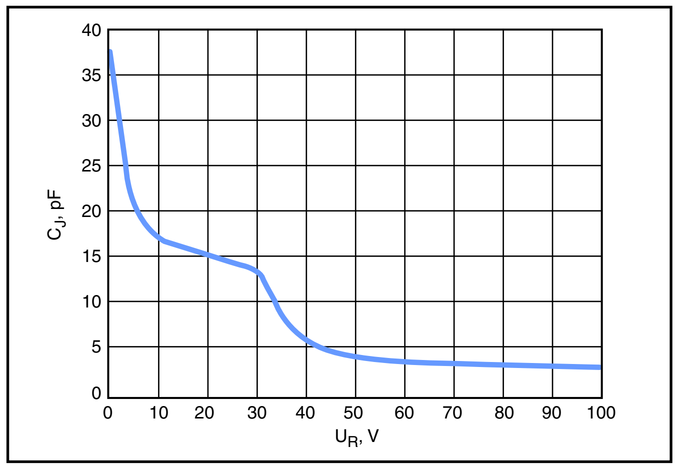

FIG. 4: APD CAPACITANCE VS VOLTAGE

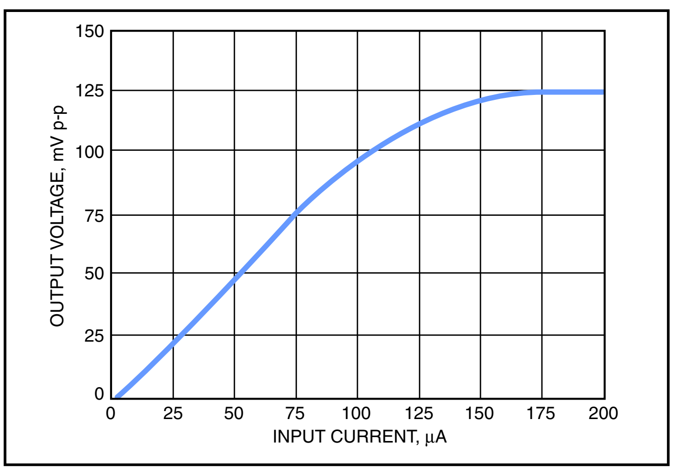

FIG. 5: AMPLIFIER TRANSFER FUNCTION

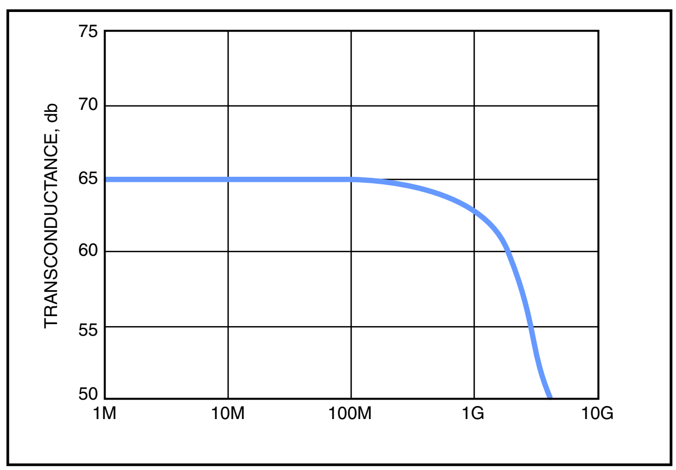

FIG. 6: TOTAL FREQUENCY RESPONSE

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HIGH SPEED OPTICAL DATA RECEIVER

TRANSFER CHARACTERISTICS

The circuit used is an avalanche photodiode directly coupled to a high speed data handling transconductance amplifier. The output of the APD in the form of light generated current is applied to the input of the amplifier. The amplifier output is in the form of a differential voltage pulsed signal.

The APD responsivity curve is provided in Fig. 2. The term Amps/Watt involves the area of the APD and can be expressed as Amps/mm^2/Watts/mm^2, where the numerator applies to the current generated divided by the area of the detector, the denominator refers to the power of the radiant energy present per unit area. As an example assuming a radiant input of 1 microwatt at 850 nm we get a responsivity of 0.4 A/W.

> Energy in = 1 μW. Then the current from the APD = 0.4 (A/W) x 10^{-6} = 0.4 μA.
> We can then factor in the typical gain of the APD of 100 then the signal applied to the amplifier is 40 μA.
> From Fig. 5 we can see the amplifier output will be 40 mV p-p.

APPLICATIONS NOTE

The PSS-AV500-2.3G-TO5 is a high speed detector for low light level pulse signals. It incorporates an internal transimpedance amplifier with an avalanche photodiode.

This detector requires 3.5 to 5.0 volt power. The internal APD follows the gain curve published for the PSS-AD500-TO52-i avalanche photodiode. The transimpedance amplifier provides differential output signals in the range of 200 millivolts differential.

In order to achieve highest gain the avalanche photodiode needs a positive biased voltage (Fig. 1). However, a current limiting resistor must be placed in series with the photodiode bias voltage to limit the current into the transimpedance amplifier. **Failure to limit this current may result in permanent failure of the device.** The suggested initial value for this limiting resistor is one megohm.

When using this receiver, good high frequency placement and routing techniques should be followed in order to achieve maximum frequency response. This includes the use of bypass capacitors, short leads and careful attention to impedance matching. The large gain bandwidth values of this device also demand that good shielding practices be used to avoid parasitic oscillations and reduce output noise.

Caution: These parts are extremely static sensitive. Standard ESD precautions must be followed.

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