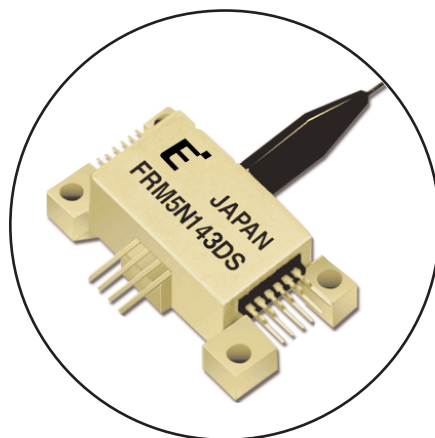


## FEATURES

- Integrated Design Optimizes Performance at High Bit Rates up to 10 Gb/s applications.
- -25 dBm Typical Sensitivity
- -7 dBm Overload Power (typ.)
- 27 dB Optical Return Loss (ORL)
- Integral Thermistor
- Simplifies Receiver Circuit Design
- Integrated HBT IC preamp



## APPLICATIONS

This 80GHz gain bandwidth product APD detector with HBT preamp is intended to function as an optical receiver for DWDM, SONET, SDH optical fiber systems operating at 10Gb/s. This detector operates at both 1310 and 1550nm. The nominal 10k $\Omega$  integral thermistor allows accurate monitoring of the APD temperature and facilitates the design of the APD bias control circuit. It has a typical transimpedance ( $Z_t$ ) value of 1100 $\Omega$ . The detector preamplifier is DC coupled and has a differential electrical output.

## DESCRIPTION

The FRM5N143DS incorporates a high bandwidth InGaAs APD photo diode, a GaAs HBT IC amplifier in a hermetically sealed butterfly type package. The APD is processed with modern MOVPE techniques resulting in reliable performance over a wide range of operating conditions. The lens coupling system and the single mode fiber are assembled using Nd YAG welding. It has differential output with DC coupling.

ABSOLUTE MAXIMUM RATINGS ( $T_C=25^{\circ}\text{C}$ )

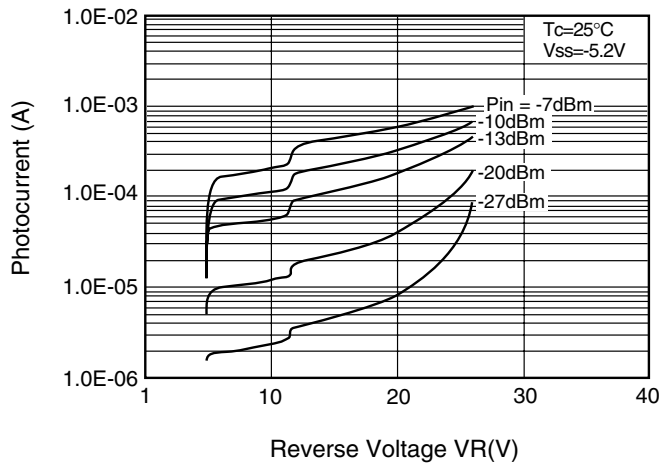
Parameter	Symbol	Ratings	Unit
Storage Temperature	$T_{\text{stg}}$	-40 to +85	$^{\circ}\text{C}$
Operating Temperature	$T_{\text{op}}$	0 to +70	$^{\circ}\text{C}$
Supply Voltage	$V_{\text{SS}}$	-6 to 0	V
APD Reverse Voltage	$V_{\text{R}}$	0 to $V_{\text{B}}$ (Note 1)	V
APD Reverse Current	$I_{\text{R}}$	1.0	mA

OPTICAL & ELECTRICAL CHARACTERISTICS ( $T_C=25^{\circ}\text{C}$ ,  $\lambda=1,550\text{nm}$ ,  $V_{\text{SS}}=-5.2\text{V}$ , unless otherwise specified)

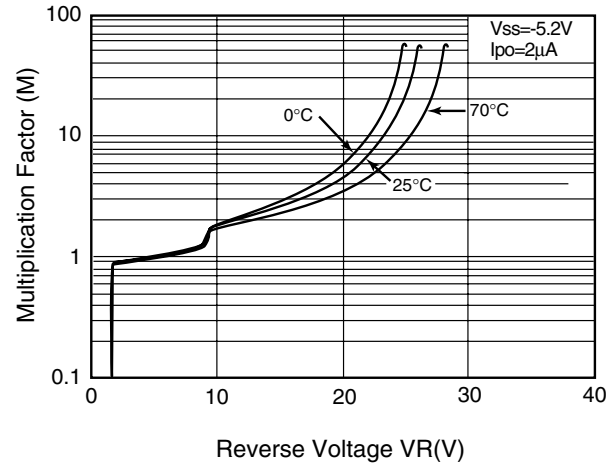
Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
APD Responsivity	R15	1,550nm, M=1	0.65	0.7	-	A/W
APD Breakdown Voltage	$V_{\text{B}}$	$I_{\text{D}}=10\mu\text{A}$	20	30	35	V
Temperature Coefficient of $V_{\text{B}}$	$\Gamma$	(Note 2)	0.03	0.05	0.07	$\text{V}/^{\circ}\text{C}$
AC Transimpedance	$Z_{\text{t}}$	$R_{\text{L}}=50\Omega$ , $f=130\text{MHz}$ ,	800	1100	1400	$\Omega$
Bandwidth	BW	$R_{\text{L}}=50\Omega$ , M=9, -3dB from 130MHz, $P_{\text{in}} = -20\text{dBm}$	7.5	8.0	-	GHz
Sensitivity	$P_{\text{r}}$	NRZ, 10Gb/s, PRBS= $2^{23}-1$ , B.E.R.= $10^{-10}$ , $V_{\text{R}}$ is set at optimum value	-	-25	-24	dBm
Maximum Overload	$P_{\text{O}}$	NRZ, 10Gb/s, PRBS= $2^{23}-1$ , B.E.R.= $10^{-10}$ , M = 3	-8	-7	-	dBm
Optical Return Loss	ORL	-	27	-	-	dB
Power Supply Current	$I_{\text{SS}}$	-	-	110	130	mA
Power Supply Voltage	$V_{\text{SS}}$	-	-5.46	-5.2	-4.94	V
Thermistor Resistance	$R_{\text{tr}}$	$V_{\text{SS}}=0\text{V}$	9.5	10	10.5	$\text{k}\Omega$
Thermistor B Constant	B	$V_{\text{SS}}=0\text{V}$	3,800	3,900	4,000	K

Note: (1)  $V_{\text{B}}$  differs from device to device.  $V_{\text{B}}$  data is attached to each devices.(2)  $\Gamma = dV_{\text{B}}/dT_{\text{C}}$

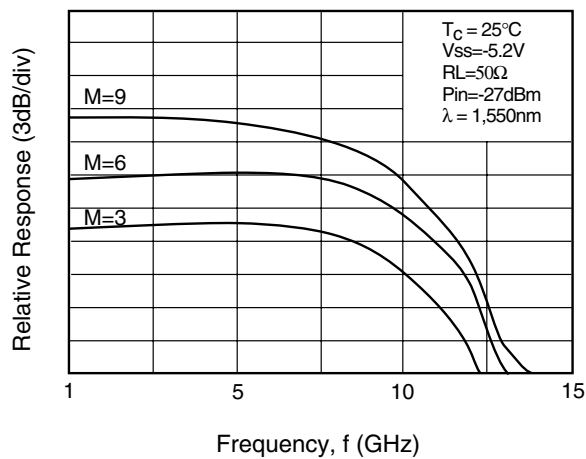
**Fig. 1 Multiplication vs. Photocurrent**



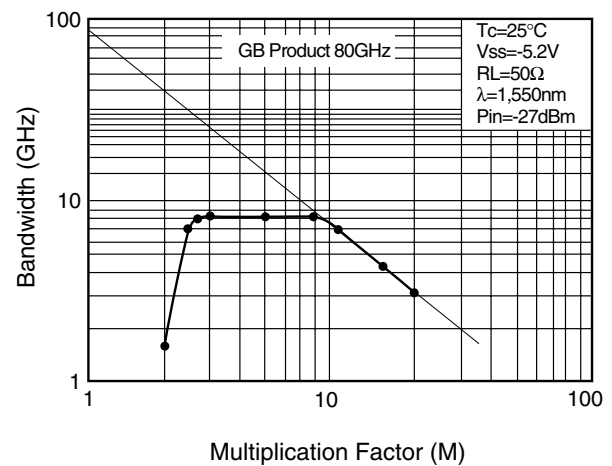
**Fig. 2 Multiplication Characteristics**



**Fig. 3 Relative Frequency Response**



**Fig. 4 Multiplication vs. Bandwidth**



**Fig. 5 Bit Error Rate**

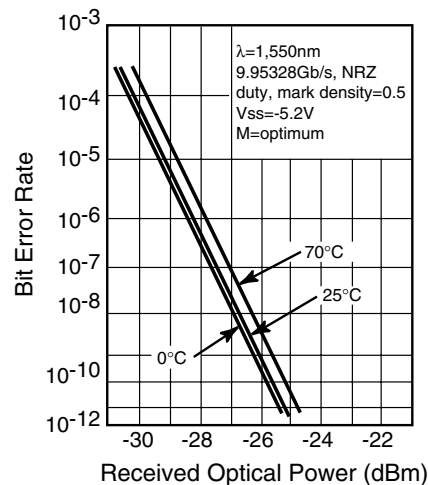
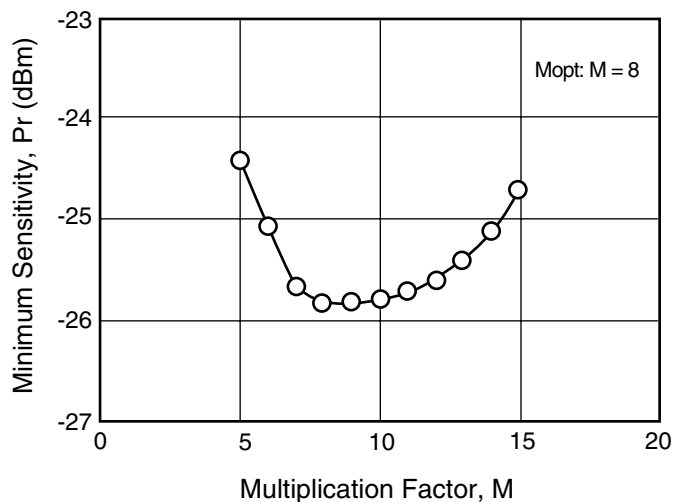
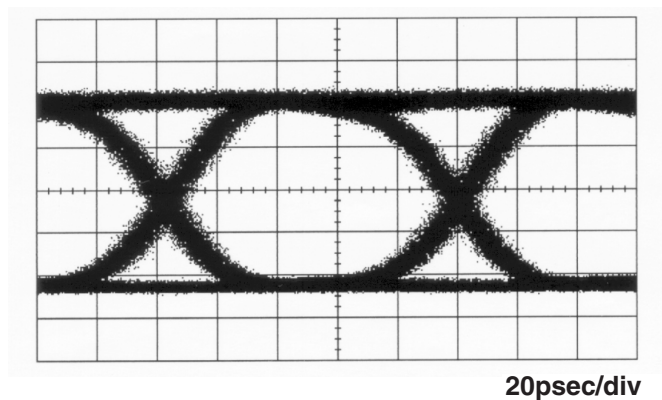
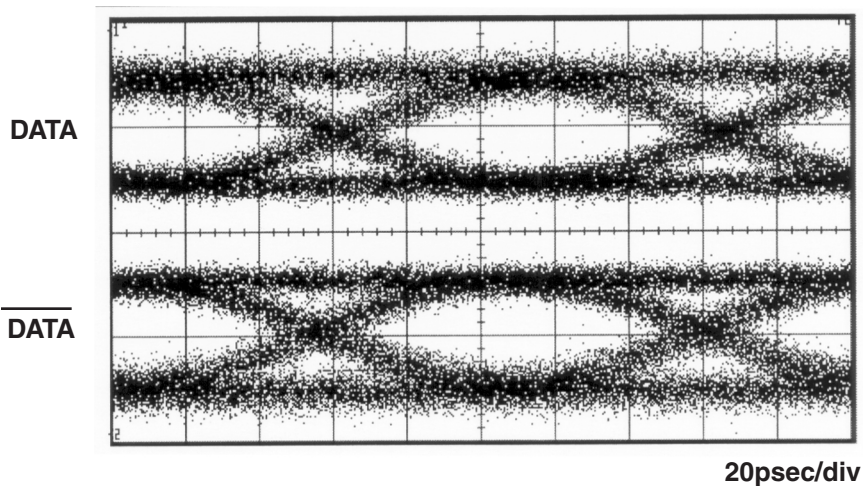
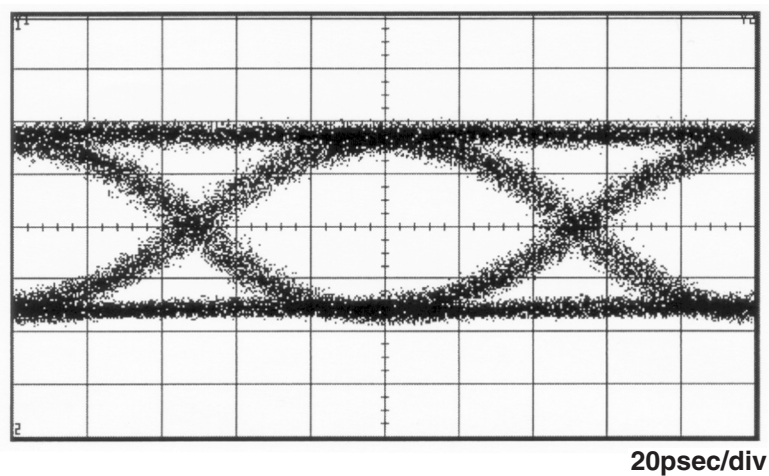


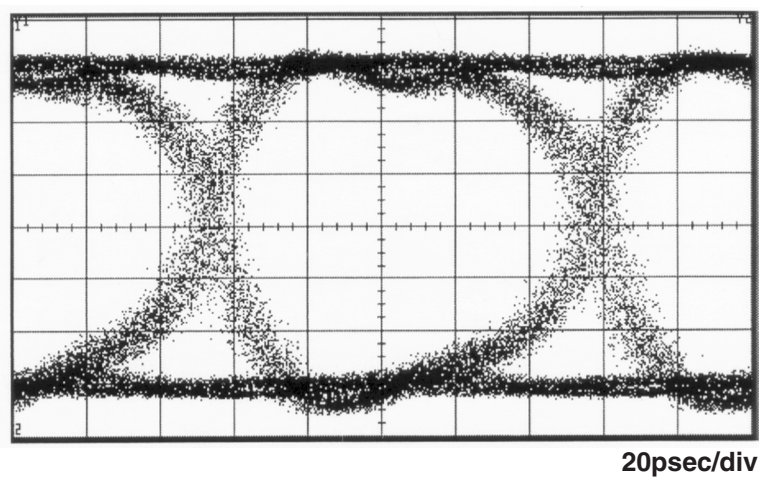
Fig. 6 Sensitivity vs. Multiplication Factor

Fig. 7 Input Wave Form 1,550nm, 9.9532Gb/s  
NRZ,  $2^{23}-1$  PRBS, duty and mark density=0.5Fig. 8 Output Wave Form  $T_c=25^{\circ}\text{C}$ ,  $R_L=50\Omega$   
 $P_{in}=-26\text{dBm}$ ,  $V_{ss}=-5.2\text{V}$ ,  $M=9$ 

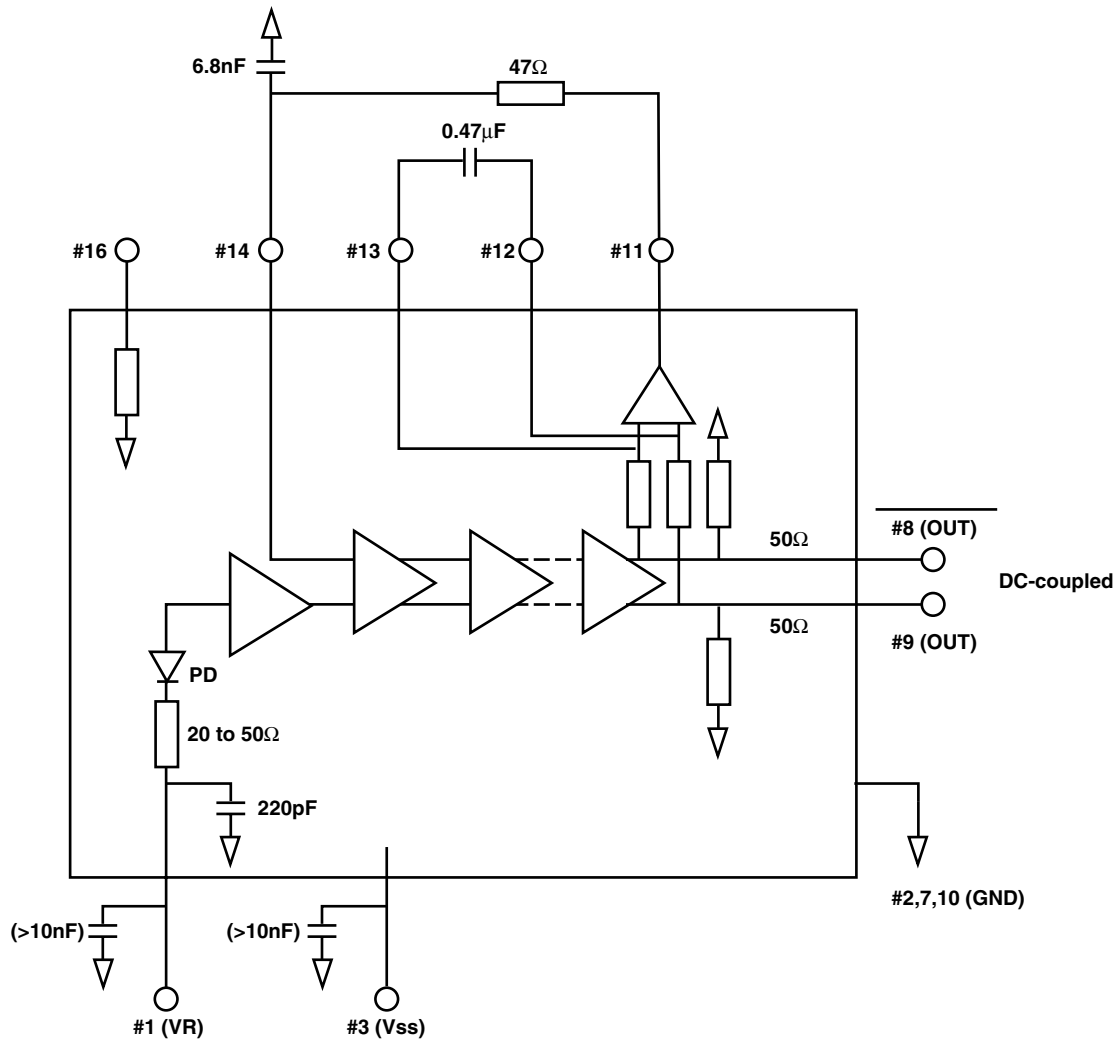
**Fig. 9 Output Wave Form  $T_c=25^\circ\text{C}$ ,  $R_L=50\Omega$ ,  $P_{in}=-20\text{dBm}$   
 $V_{ss}=-5.2\text{V}$ ,  $M=3$**



**Fig. 10 Output Wave Form  $T_c=25^\circ\text{C}$ ,  $R_L=50\Omega$ ,  
 $P_{in}=-7\text{dBm}$ ,  $V_{ss}=-5.2\text{V}$ ,  $M=3$**

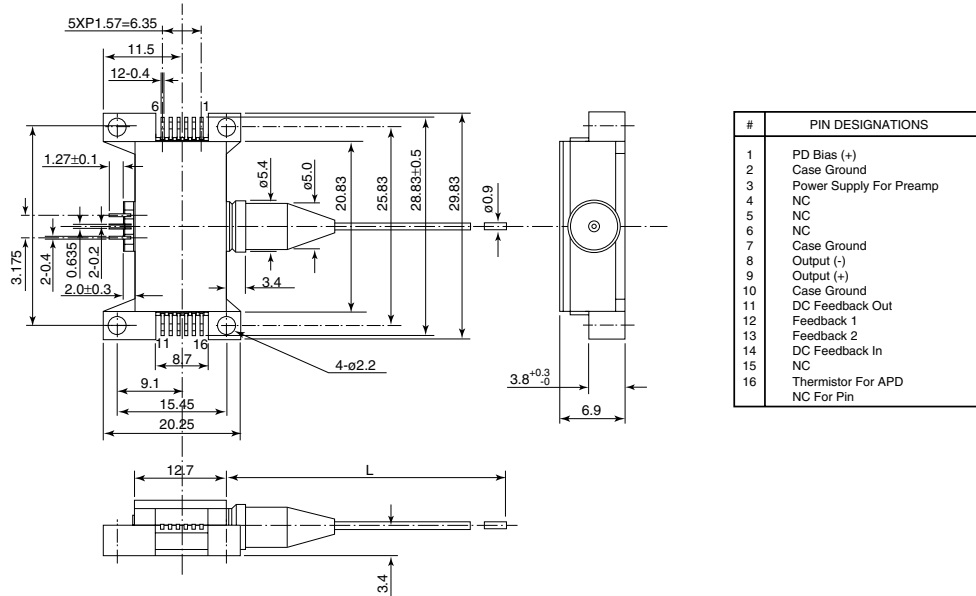


## FRM5N143DS Recommended Circuit



## "DS" PACKAGE

UNIT: mm



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