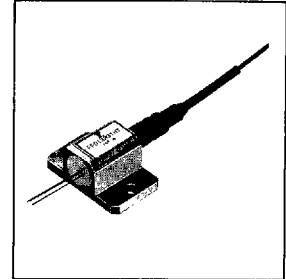


FPD13R31HT

GERMANIUM AVALANCHE PHOTODIODES

DESCRIPTION

The FPD13R31HT is a germanium avalanche photodiode (APD) with a singlemode fiber pigtail designed for use in optical transmission systems operating at a high-bit-rate and a long distance. The APD chip with a photosensitive area diameter of $30\mu\text{m}$ is used for low capacitance. Employment of the planar structure with a guard ring provides a long-term reliability of the APD chip as well as low dark current, wide bandwidth, and high quantum efficiency. A singlemode fiber is aligned to a hermetically sealed APD through a lens. The optical alignment system has high coupling efficiency and a stability.



FEATURES

- Single-mode fiber pigtail: SI 10/125 (mode field diam. $10\pm 1\mu\text{m}$, cladding diameter $125\pm 2\mu\text{m}$)
- Photosensitive diameter: $30\mu\text{m}$
- High quantum efficiency: 70% at $1.3\mu\text{m}$
- Cut-off frequency: 3.0GHz
- Low dark current: $0.1\mu\text{A}$
- Low multiplied dark current: 5nA
- High reliability planar structure with guard ring.

APPLICATIONS

- High-bit-rate optical transmission system up to 1.0Gb/s.

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

Parameter	Symbol	Ratings	Unit
Storage Temperature	T_{stg}	-20 to +70	$^\circ\text{C}$
Operating Temperature	T_{op}	-10 to +60	$^\circ\text{C}$
Forward Current	I_F	50	mA
Reverse Current	I_R	0.5	mA

OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_a = 25^\circ\text{C}$)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Quantum Efficiency (Responsivity)	η (R)	$\lambda = 1300\text{nm}$, $M = 1$	60 (0.63)	70 (0.73)	—	% (A/W)
Breakdown Voltage	V_B	$I_D = 100\mu\text{A}$	25	30	40	V
Temperature Coefficient of V_B	γ		—	0.11	—	$\% / ^\circ\text{C}$
Dark Current	I_D	$V_R = 0.9V_B$	—	0.1	0.2	μA
Multiplied Dark Current	I_{DM}	$M = 1$	—	5	10	nA
Excess Noise Factor	F	$\lambda = 1300\text{nm}$, $M = 10$ $f = 30\text{MHz}$, $B = 1\text{MHz}$ $I_{po} = 2\mu\text{A}$	—	0.9	—	—
	X		—	0.95	—	—
Cut-off Frequency	f_c	$\lambda = 1300\text{nm}$, $M = 10$ $R_L = 50\Omega$ -3dB from 500KHz	2.0	3.0	—	GHz
Capacitance	C_t	$f = 1\text{MHz}$, $V_R = 0.9V_B$	—	0.6	1	pF

FPD13R31HT

TYPICAL CHARACTERISTICS

Fig. 1 Spectral Response (η vs. λ)

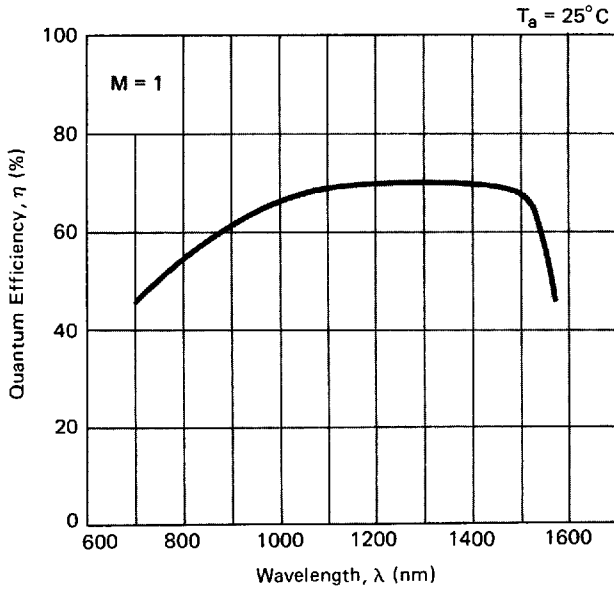


Fig. 2 Spectral Response (R vs. λ)

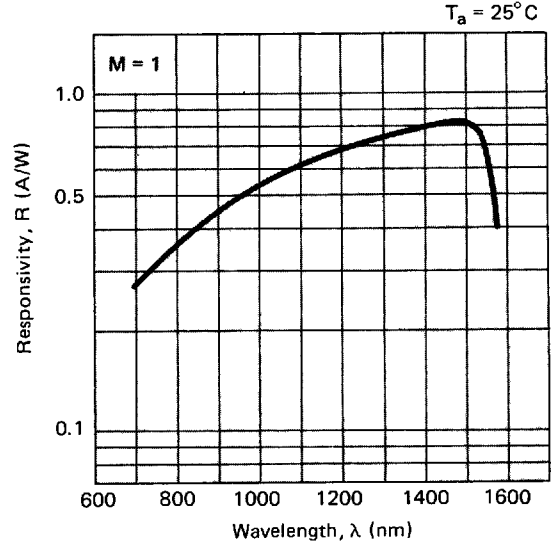


Fig. 3 Temperature Dependence of Responsivity

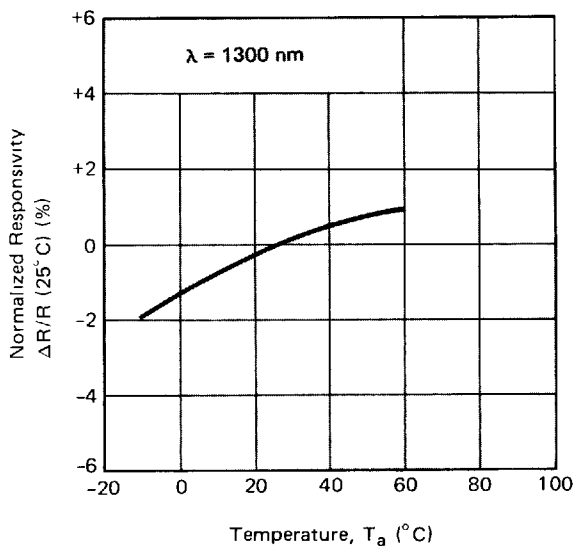
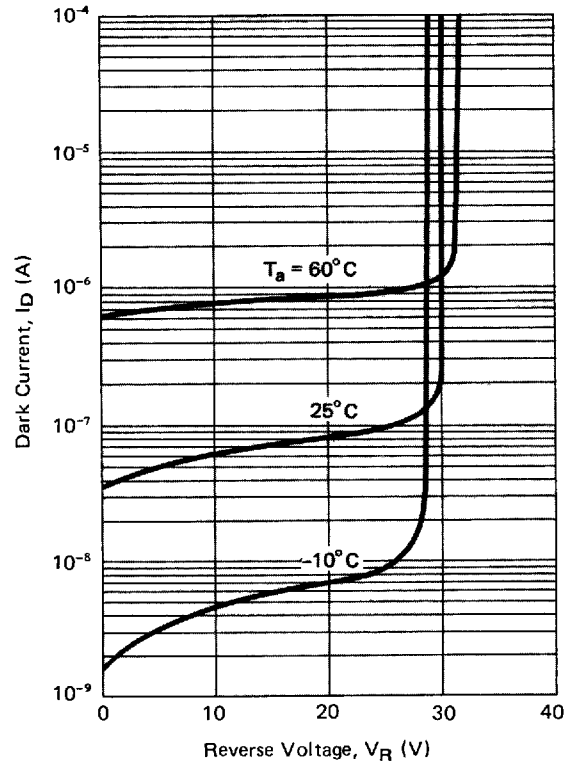


Fig. 4 Dark Current vs. Reverse Voltage



GERMANIUM AVALANCHE PHOTODIODE

Fig. 5 Temperature Dependence of Dark Current and Multiplied Dark Current

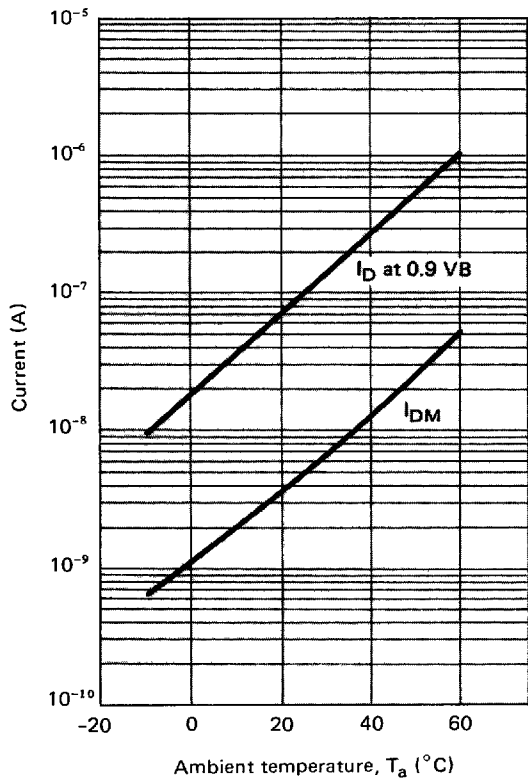


Fig. 6 Multiplication Characteristics

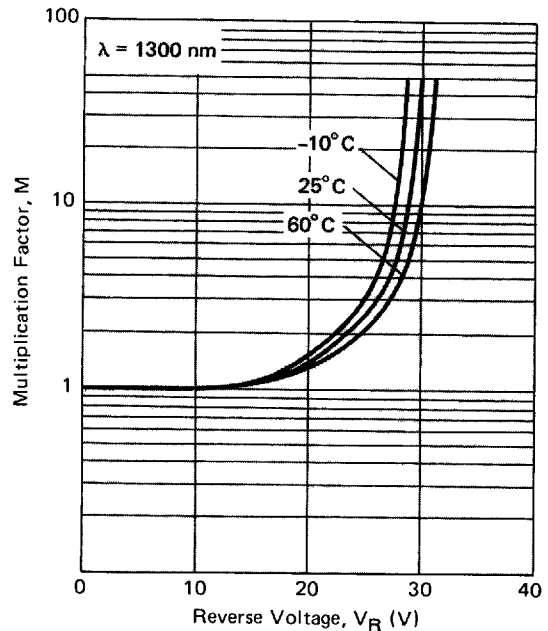


Fig. 7 Multiplication Factor vs. Photocurrent at $M = 1$

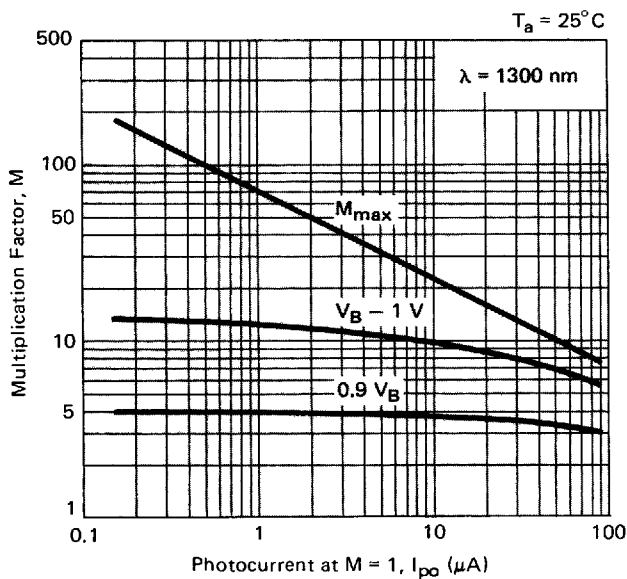


Fig. 8 Frequency Response

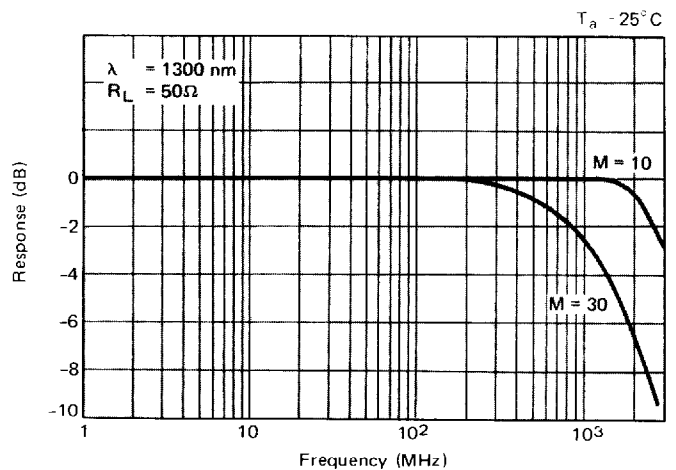


Fig. 9 Excess Noise factor vs. Multiplication Factor $T_a = 25^\circ\text{C}$

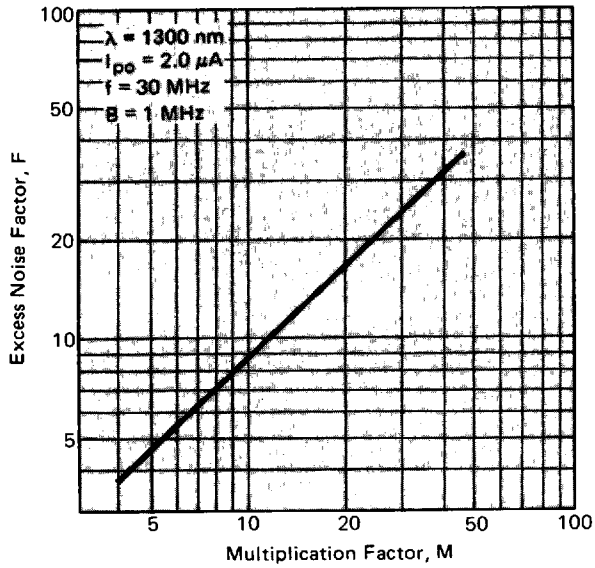


Fig. 10 Capacitance vs. Reverse Voltage $T_a = 25^\circ\text{C}$

