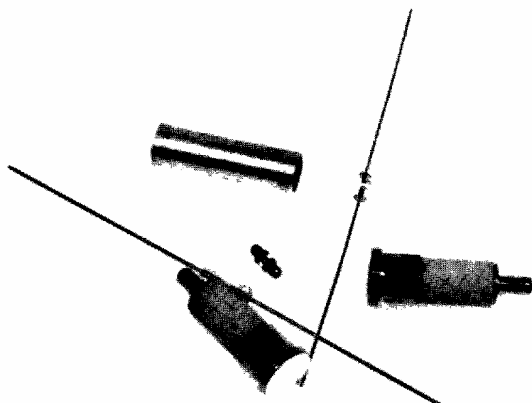


Silicon Point Contact Detector Diodes

T-07-07



Features

- Broadband Operation
- Bias Not Required

Description

Alpha's point contact detector diodes are designed for applications through mm-band (60.0 GHz). These diodes employ epitaxial silicon optimized for high tangential signal sensitivity. Since they are point contact diodes, they are efficient detectors not requiring the use of bias.

They are available in a variety of packages, which make them suitable for use in waveguide, coaxial and stripline applications.

Applications

These diodes are categorized by TSS (Tangential Signal Sensitivity) for detector applications in eight frequency ranges: L, S, X, Ku, K, Ka, and mm-bands. TSS is one parameter that best describes a diode's use as a video detector. It is defined as the amount of signal power, below a one milliwatt reference level, required to produce an output pulse whose amplitude is sufficient to raise the noise fluctuations by an amount equal to the average noise level. TSS is approximately 4 dB above the Minimum Detectable Signal.

Since the point contact diode has a turn-on voltage of essentially zero, it exhibits a typical video impedance of 10 K ohms without the use of bias and is an efficient detector under these conditions. The use of a small forward bias will increase sensitivity and greatly reduce parameter variation due to temperature change. Video impedance is a direct function of bias and closely follows the $28/I$ (mA) relationship. This is important to pulse fidelity, since the video impedance in conjunction with the detector output capacitance and video amplifier input capacitance affects the effective amplifier bandwidth. Bias does, however, increase noise, particularly in the $1/f$ region. Therefore, it should be kept as low as a level as possible (typically 5-50 microamps).

Matched Pairs

Matched pairs of detector diodes are used when near equal sensitivities are required. This is achieved by matching the voltage outputs at a point in the square law region.

The voltage outputs are matched within 1 dB as follows:

$$\Delta \text{dB} = 10 \log \frac{M1}{M2} = 1 \text{ dB Max.}$$

where M1 is the higher Figure of Merit of the two diodes.

The video impedances are also matched:

$$\Delta Z_v = 20\% \text{ Max.}$$

Custom matching may be performed to other tolerances or as a function of frequency, power level and load resistance.

Maximum Ratings

Operating Temperature.....	-55°C to +150°C
Storage Temperature	-55°C to +150°C
Power Dissipation DC	100 mW ⁽¹⁾

1. Derate linearly above 25°C at .8mW/°C

Silicon Point Contact Detector Diodes

Frequency Band	Type Number			Electrical Characteristics				Package Outline	Test Conditions		Basic Type
	Polarity			TSS ⁽³⁾ -dBm Min.	FM Min.	Z _v			Frequency MHz	Holder	
	Forward	Reverse	Reversible			K ohms					
						Min.	Max.				
UHF			1N830		Efficiency 65% min		062-001	100		1N830	
UHF			1N830A ⁽⁴⁾		Efficiency 65% min BV = 5.0 Vmin		062-001	100		1N830A	
UHF			DDA5090		Efficiency 65% min		075-001	100		DDA5090	
UHF			DDA5090A		Efficiency 65% min BV = 5.0 V min		075-001	100		DDA5090A	
L-X	1N358 ⁽⁴⁾	1N358R ⁽⁴⁾		40	15	4.5	18.0	007-001	1000-12400	P-009	1N358
L-X	1N358A ⁽⁴⁾	1N358AR ⁽⁴⁾		45	30	4.5	18.0	007-001	1000-12400	P-009	1N358A
L-X	DDA563B	DDA563BR		45	30	4.5	18.0	007-001	1000-12400	P-009	DDA563B
X			1N833	40	15	4.5	18.0	062-001	9375	105-JAN	1N833
X			DDA5093	40	15	4.5	18.0	075-001	9375	105-JAN	DDA5093
X			DDA5233	40	15	4.5	18.0	013-001	8375	P-017	DDA5233
			DDA6797 See Note 5 below				—	10.0	013-001		DDA6797
X			1N833A	45	30	4.5	18.0	062-001	9375	105-JAN	1N833A
X			DDA5093A	45	30	4.5	18.0	075-001	9375	105-JAN	DDA5093A
X	1N1611	1N1611R		51 ⁽²⁾	130 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-802	9000	P-007	1N1611
X			DDA4072	51 ⁽²⁾	130 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-801	9000	P-007	DDA4072
X	1N1611A	1N1611AR		53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-802	9000	P-007	1N1611A
X			DDA4072A	53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-801	9000	P-007	DDA4072A
X	1N1611B	1N1611BR		53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-802	9000	P-007	1N1611B
X			DDA4072B	53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	005-801	9000	P-007	DDA4072B
X			DDA5012	53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	062-001	9000	105-JAN	DDA5012
X			DDA5036	53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	075-001	9000	105-JAN	DDA5036
X			DDA5236	53 ⁽²⁾	220 ⁽²⁾	0.6 ⁽²⁾	0.8 ⁽²⁾	013-001	9000	P-017	DDA5236

Notes:

- Maximum operating temperature = 150°C.
- With 50μA bias.
- Bandwidth = 10 MHz.
- Available as JAN or single service types which meet all applicable requirements of MIL-S-19500.
- This diode has a high self resonant frequency and is specifically designed for broadband, flat detector applications up to 18 GHz.
- Diodes are available in other configurations, consult factory with your specific requirements.
- Diodes can be supplied with TX type screening. Details of recommended screening procedures will be supplied on request.
- For stripline applications, all diodes in the 062-001 and 075-001 packages are available with flattened leads.

Frequency Band	Type Number			Electrical Characteristics		Package Outline	Test Conditions		Basic Type
	Polarity			TSS ⁽¹⁰⁾ -dBm Min.	Video Sensitivity ⁽¹²⁾ mv/mw Min.		Frequency Range GHz	Holder	
	Forward ⁽⁹⁾	Reverse	Reversible						
Ku	DDA5360	DDA5360R		58 ⁽¹¹⁾	500	002-001	12.0-18.0	Optimized	DDA5360
K	DDA5361	DDA5361R		58 ⁽¹¹⁾	450	002-001	18.0-26.5	Optimized	DDA5361
K			DDA5362	58 ⁽¹¹⁾	450	013-001	18.0-26.5	Optimized	DDA5362
Ka	DDA5363	DDA5363R		55 ⁽¹¹⁾	400	003-001	26.5-40.0	Optimized	DDA5363
Ka			DDA5364	55 ⁽¹¹⁾	400	013-001	26.5-40.0	Optimized	DDA5364
mm	DDA5365	DDA5365R		50 ⁽¹¹⁾	200	003-001	33.0-50.0	Optimized	DDA5365
mm			DDA5366	50 ⁽¹¹⁾	200	013-001	33.0-50.0	Optimized	DDA5366
mm ⁽¹⁴⁾	DDA5367	DDA5367R		45 ⁽¹¹⁾	200 ⁽¹³⁾	003-001 ⁽¹⁴⁾	40.0-60.0	Optimized	DDA5367
mm			DDA5368	50 ⁽¹¹⁾	200 ⁽¹³⁾	013-001	40.0-60.0	Optimized	DDA5368

Notes:

- Positive Output (Negative Output available using reverse type).
- Measured at a 40 Hz video bandwidth.
- Increased TSS levels up to 10 dBm attainable with 10 mA bias.
- Measured with a 1 Megohm video load.
- To 55 GHz, 100 mv/mw to 60 GHz.
- Package type usable up to 100 GHz with reduced performance characteristics.

Silicon Point Contact Detector Diodes

Typical X-Band Detector Diode

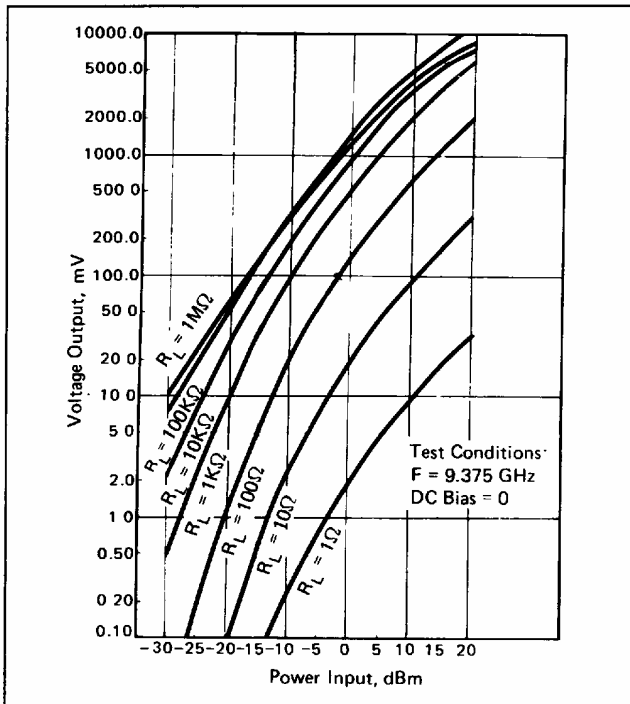


Figure 1a. Voltage Output vs. Power Input as a Function of Load Resistance

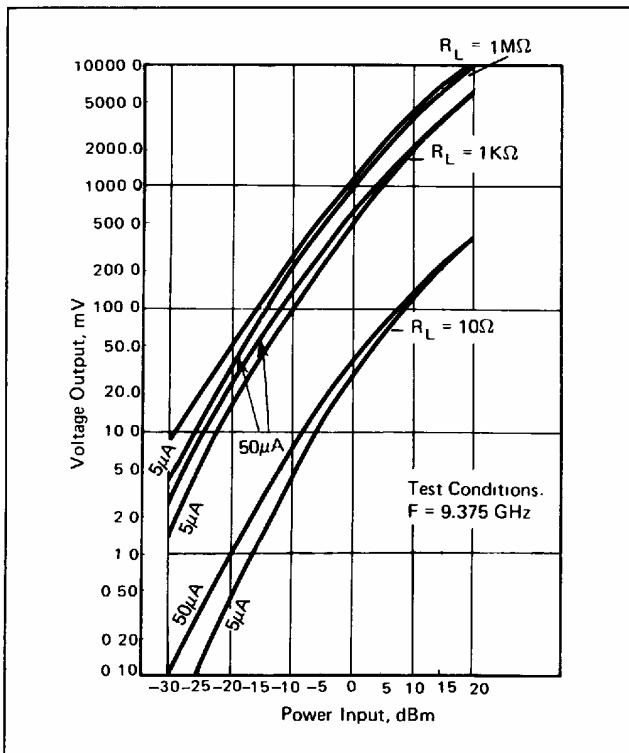
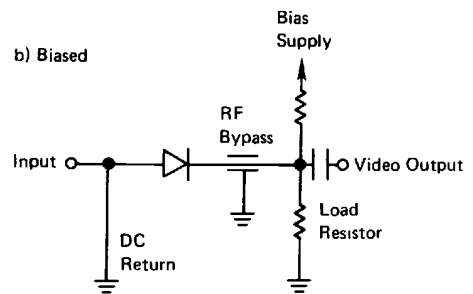
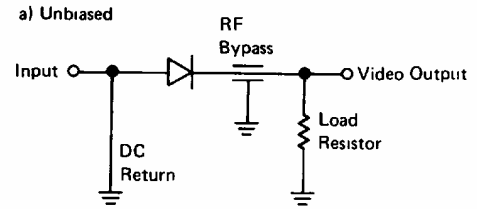


Figure 1b. Voltage Output vs. Power Input as a Function of Load Resistance and Bias

Multi Octave—High Sensitivity



Broadband—Low Sensitivity

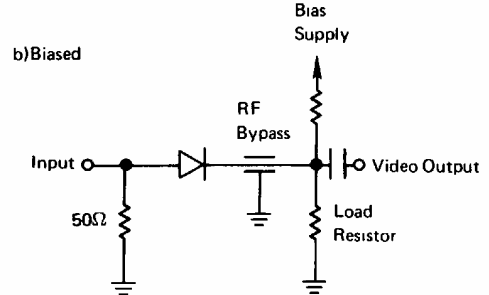
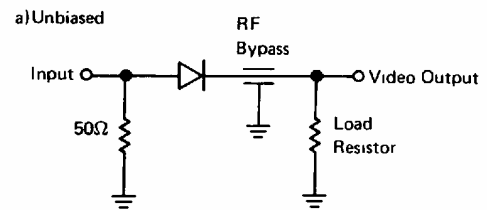


Figure 2. Typical Video Detector Circuits

BAND	Frequencies (GHz)
UHF	Up to 1
L	1 to 2
S	2 to 4
C	4 to 8
X	8.2 to 12.4
Ku	12.4 to 18.0
K	18.0 to 26.5
Ka	26.5 to 40.0
mm	40.0 to 100.0