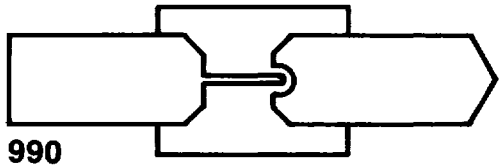
Zero Bias Detector Diodes



Features

- **CAN BE USED WITHOUT EXTERNAL DC BIAS**
- **EXHIBIT UNIFORM Rv CHARACTERISTICS**
- **HIGH VOLTAGE SENSITIVITY**
- **AVAILABLE IN PACKAGES, CHIPS AND BEAM LEADS**

Description

This family of Zero Bias Detector (ZBD) diodes is designed for use in video detectors and power monitors eliminating the need to provide external DC bias to the diode.

These diodes offer good output sensitivity and low junction capacitance.

M/A-COM's Zero Bias Detector diodes are available in a wide range of hermetic packages, and as bondable chips and beam lead diodes. This series of diodes are offered with video impedances of 0.5 to 15 kilohms at zero bias.

Applications

This series of diodes is useful as video detectors and power monitors through K band and do not require external DC bias.

Schottky Isoplanar ZBD Beam Lead Diodes

Model[6] Number	Test Frequency Band	Minimum[2] T_{ss} (−dBm)	Minimum[2] Eo, mV (Minimum)	R_V[3,4,5] (kilohms) (Minimum)	(Maximum)
MA40188	X	49	4.0	0.5	1.0
MA40189	Ku			0.5	1.0
MA40188A	X	52	8.0	1.0	2.0
MA40189A	Ku			1.0	2.0
MA40188B	X	55	12.0	2.0	5.0
MA40189B	Ku			2.0	5.0
MA40188C	X	56	15.0	5.0	10.0
MA40189C	Ku			5.0	10.0
MA40188D	X	56	15.0	10.0	15.0
MA40189D	Ku			10.0	15.0

Silicon Packaged and Chip ZBD Diodes

Model[1,7] Number	Case Style	Minimum[2,7] T_{ss} (−dBm)	Minimum[2] Eo, mV (Minimum)	R_V[3,4,5] (kilohms) (Minimum)	(Maximum)
MA4E928	54	49	4.0	0.5	1.0
MA4E928A	54	52	8.0	1.0	2.0
MA4E928B	54	55	12.0	2.0	5.0
MA4E928C	54	56	15.0	5.0	10.0
MA4E928D	54	56	15.0	10.0	15.0
MA4E929	119	49	4.0	0.5	1.0
MA4E929A	119	52	8.0	1.0	2.0
MA4E929B	119	55	12.0	2.0	5.0
MA4E929C	119	56	15.0	5.0	10.0
MA4E929D	119	56	15.0	10.0	15.0
MA4E930	120	49	4.0	0.5	1.0
MA4E930A	120	52	8.0	1.0	2.0
MA4E930B	120	55	12.0	2.0	5.0
MA4E930C	120	56	15.0	5.0	10.0
MA4E930D	120	56	15.0	10.0	15.0
MA4E931	135	49	4.0	0.5	1.0
MA4E931A	135	52	8.0	1.0	2.0
MA4E931B	135	55	12.0	2.0	5.0
MA4E931C	135	56	15.0	5.0	10.0
MA4E931D	135	56	15.0	10.0	15.0
MA4E932	186	49	4.0	0.5	1.0
MA4E932A	186	52	8.0	1.0	2.0
MA4E932B	186	55	12.0	2.0	5.0
MA4E932C	186	56	15.0	5.0	10.0
MA4E932D	186	56	15.0	10.0	15.0

NOTES:

1. Schottky barrier diodes are thermocompression bonded in case styles 119, 120 and 186. Case style 54 is pressure contact. Case style 135 is a bondable chip. Other case styles are available upon request. For additional information, contact the factory.
2. Test conditions:
   - For T_{SS}: Video Bandwidth = 2 MHz; Noise Amplifier = 3.5 dB
   - Test Frequency: X-Band = 10 GHz; Ku-Band = 16 GHz
   - Voltage Sensitivity: P_{IN} = −30 dBm; R_L = 1 M (ohms); Test Frequency = as stated
3. Higher R_V values are available on request. Contact the factory.
4. The nominal junction capacitance values are as follows:
   Diodes with R_V ~0.5 to 2.0 Kohms, C_j ~0.30 pF (maximum)
   Diodes with R_V ~2.0 to 5.0 Kohms, C_j ~0.25 pF (maximum)
   Diodes with R_V ~5.0 to 15.0 Kohms, C_j ~0.20 pF (maximum)
5. The nominal R_S is ~30 ohms maximum.
6. Case style is Beam Lead style in ODS 990
7. Test frequency band is X-Band

Specifications @ $T_A = 25°C$

MAXIMUM RATINGS

Temperature Ratings:

Operating and Storage Temperature	−65°C to +150°C

Power Ratings:

Maximum Peak Incident RF Power	0.5 Watts for 1 μsec maximum
Maximum Peak CW RF Power	100 mW

Both ratings at 25°C. Derate linearly to zero at maximum operating temperature.

Solder Temperature Ratings:

For case style 54, 186	230°C for 5 sec (1mm from package)
For case style 119, 120	200°C for 5 sec (maximum)

Suggested Screening for JANTX or JANTVX Equivalency for Packaged Diodes

SCREENED DIODES MIL-STD-19500

INSPECTION	METHOD	CONDITION
Internal Visual	2074	See note 1
High Temperature Life (stabilization bake)	1032	T = 24 hours, T_A = 150°C
Thermal Shock	1051	20 cycles −65°C to +125°C T extreme >10 minutes
Constant Acceleration	2006	20,000 g's, Y1 direction
Fine Leak	1071	H
Gross Leak	1071	C or E
Electrical		See note 1
HTRB	1038	T_A = +25°C V_r = 80% V_b T = 48 hours minimum
Pre Burn-In Electrical		See note 1
Burn-in	1038	Condition B T_A = +25°C I_{pk} = 10 mA T = 96 hours minimum
Final Electricals and Delta		See note 2
PDA		Less than 10%

NOTES:
1. Chips may be screened by packaging and testing on a sample basis. Information is available upon request from the factory.
2. Conditions and details of test depend on the specific model number. Information available from the factory upon request.

Typical Performance Curves

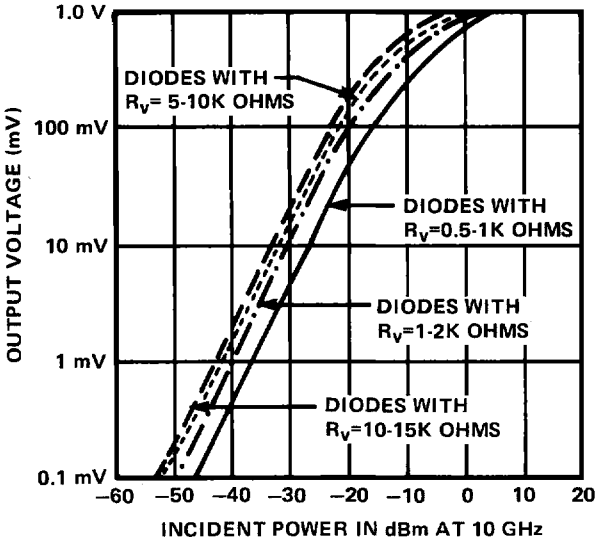


FIGURE 1. Zero Bias Silicon Schottky Detector Diode Nominal Output Voltage at 25°C and 10 GHz with a Fixed Tuned Holder an R_L = 10K Ohms.

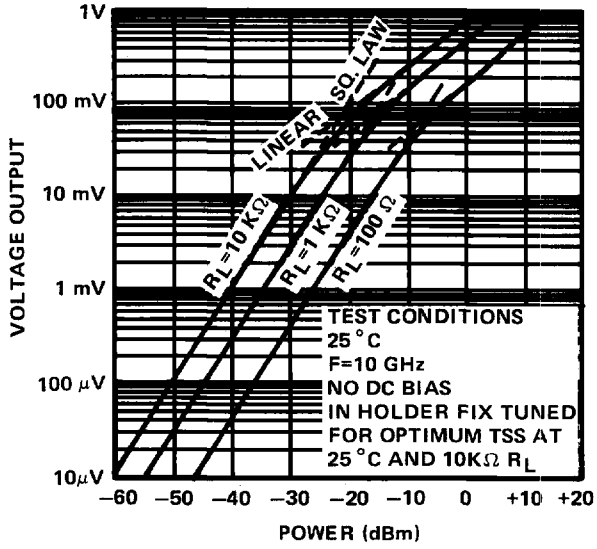


FIGURE 2. Zero Bias Schottky Detector Voltage Sensitivity for Diodes with 2-8K Ohm Video Impedance.

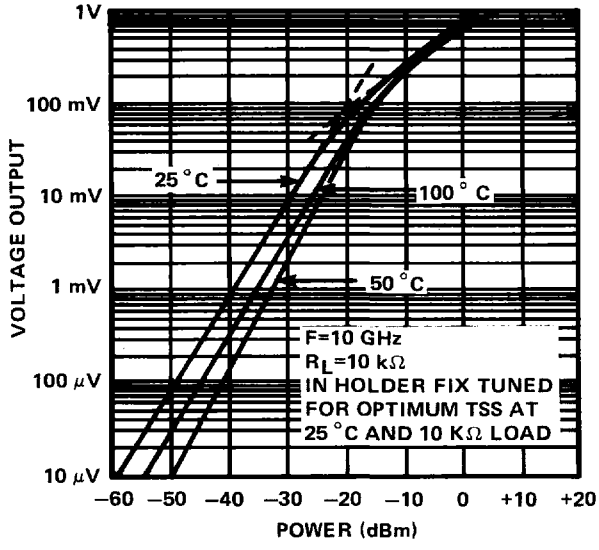


FIGURE 3. Zero Bias Schottky Detector Voltage Sensitivity Characteristics Under Temp for Diode with 2-8K Ohm Video Impedance.

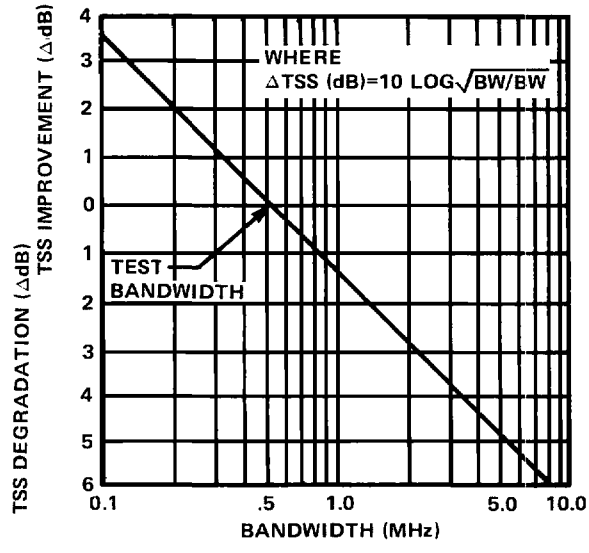


FIGURE 4. TSS Conversion for Bandwidths other than Test Bandwidth.

Typical Performance Curves (Cont'd)

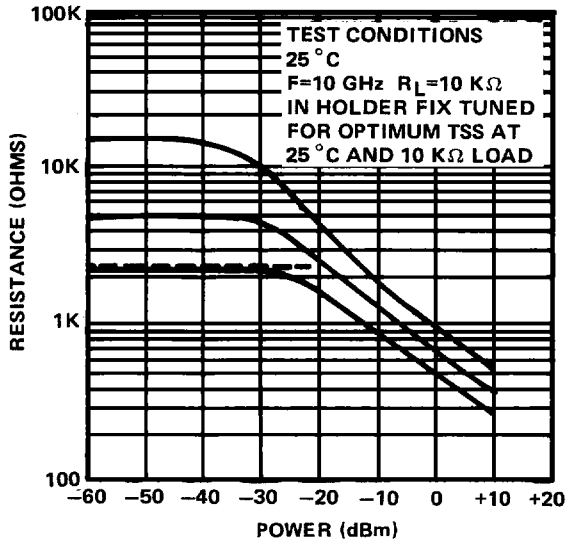
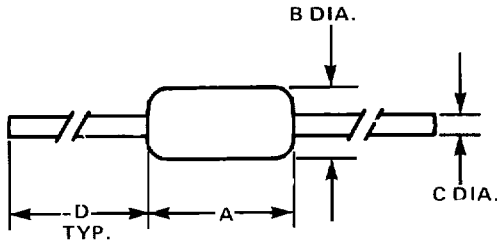


FIGURE 5. Zero Bias Schottky Detector Dynamic Resistance (R_V) vs. Power for Diodes of Different Impedance Ranges.

Case Styles

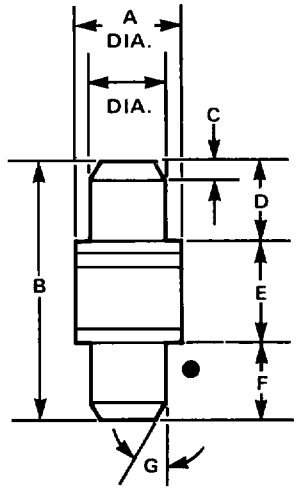
54



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.145	0.165	3,68	4,19
B	0.068	0.075	1,72	1,91
C	0.014	0.016	0,35	0,41
D	1.000	1.500	25,40	38,10

C_P = 0.10 pF Typical
L_S = 1.00 nH Typical

119

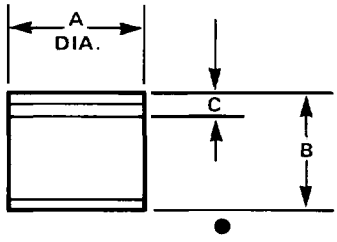


DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.078	0.086	1,98	2,18
B	0.190	0.210	4,83	5,33
C	0.009	0.015	0,23	0,38
D	0.060	0.064	1,52	1,63
E	0.070	0.087	1,68	2,21
F	0.060	0.064	1,52	1,63
G	25°	35°	25°	35°
H	0.060	0.064	1,52	1,63

C_P = 0.15 pF Typical
L_S = 0.50 nH Typical

Case Styles (Cont'd)

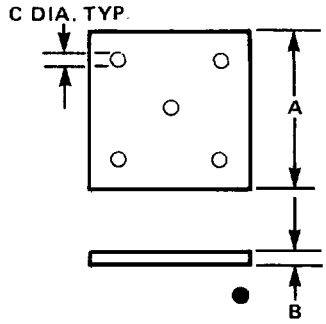
120



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.051	0.055	1,30	1,40
B	0.040	0.050	1,02	1,27
C	— —	0.015	— —	0,38

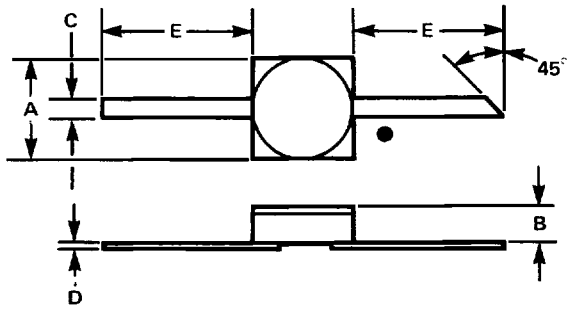
$C_P \approx 0.13$ pF Typical
$L_S \approx 0.40$ nH Typical

135



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.013	0.017	0,33	0,43
B	0.004	0.006	0,10	0,15
C	0.001	— —	0,03	— —

186

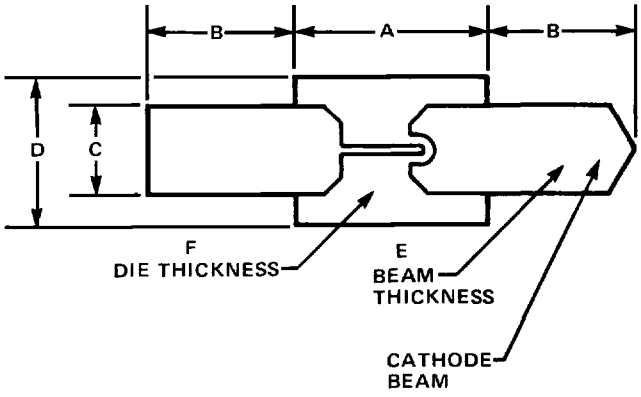


DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.094	0.102	2,39	2,59
B	0.031	0.044	0,79	1,12
C	0.019	0.021	0,48	0,53
D	0.003	0.006	0.0076	0,15
E	0.130	0.170	3,30	4,32

C_P = 0.15 pF Typical
L_S = 0.40 nH Typical

Case Styles (Cont'd)

990



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.0128	0.0132	0,325	0,335
B	0.010	0.011	0,254	0,279
C	0.0060	0.0062	0,152	0,157
D	0.0095	0.010	0,241	0,254
E	0.0003	0.0005	0,0076	0,0127
F	0.0014	0.0015	0,035	0,038