Surface Mount Low Barrier X-Band Schottky Diodes

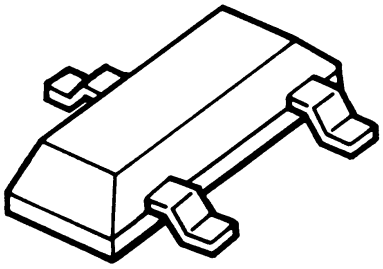
MA4E1245 Series

V3.00

Features

- Designed for High Volume Low Cost Detector and Mixer Applications
- Low Noise Figure: 5.7 dB (SSB) at X-Band
- High Detector Sensitivity: -55 dBm TSS
- Low Capacitance: 0.25 pF
- Fully Characterized Performance
- Single and Series Pair Configurations
- Available on Tape and Reel

SOT-23



Description

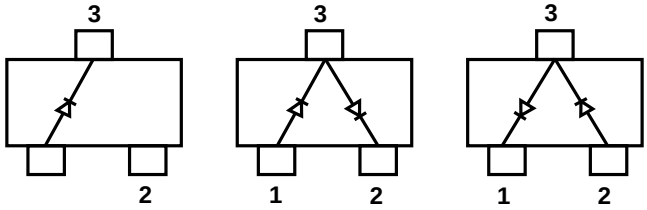
The MA4E1245 series is a low barrier n-type silicon Schottky diode assembled in a low cost surface mount plastic package. It is designed for service as a high performance mixer and detector diode at frequencies from VHF through X-band.

M/A-COM incorporated its HMIC technology in the MA4E1245 series allowing the use of pure glass in conjunction with an offset bond pad, to manufacture a low capacitance, low series resistance, Schottky diode chip. M/A-COM's high volume plastic packaging facility which is capable of manufacturing high quality microwave diode and transistor products is utilized in the production of these components. SPC controls are used during processing to ensure high quality.

The MA4E1245KA is a single element Schottky diode characterized for use as a single ended mixer and detector. The MA4E1245KB and MA4E1245KE incorporate two Schottky chips in the SOT-23 package in series pair configurations. These devices are useful in balanced mixers and detector voltage doubler circuits. Applications for the MA4E1245 series include VSAT and DBS mixers and other frequency converters. Their small size and low cost make them attractive for use in RF tag applications for identification and toll collection.

Configurations

TOP VIEW



SINGLE	SERIES PAIR	SERIES PAIR
MA4E1245KA	MA4E1245KB	MA4E1245KE

Maximum Ratings

Parameter	Unit	Values
Operating Temperature	°C	-65 to +125
Storage Temperature	°C	-65 to +125
Incident RF Power (CW)	mW	75°
Reverse Voltage @ 25°C	V	3
Soldering Temperature	°C	+260 for 5 sec.

* At 25°C case temperature. Derate linearly to zero watts at 125°C case temperature.

Electrical Specifications @ 25°C

Parameter	Condition	Symbol	Specification
Breakdown Voltage	I_R = 10 µA	V_B	3.0 V min.
Total Capacitance	V_R = 0 F = 1 MHz	C_T	0.25 pF max.
Capacitance Difference*	V_R = 0	ΔC_T	0.04 pF max.
Dynamic Resistance	I_F = 10 mA	R_D	14 Ohms max.
Dynamic Resistance Difference*	I_F = 10 mA	ΔR_D	2 Ohms max.
Forward Voltage	I_F =1 mA	V_F	250 mV min. 350 mV max.
Forward Voltage Difference*	I_F = 1 mA	ΔV_F	20 mV max.

* Applies to MA4E1245KB and MA4E1245KE.

Typical RF Performance @ 25°C

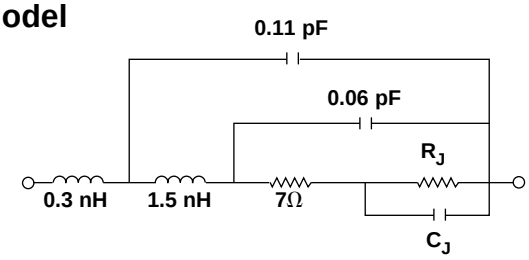
Parameter	Typical Value	Conditions
Mixer Noise Figure[1] IF Impedance	5.7 dB (SSB) 200 Ohms	f = 9.375 GHz LO = 0 dBm I_F = 30 MHz
Tangential Signal Sensitivity[2]	-55 dBm	I_F = 20 µA BW = 2 MHz Video NF = 1.5 dB
Detector Output Voltage at -30 dBm[2]	20 mV	R_L = 100K Ohms I_F = 20 µA
Detector Output Voltage at -30 dBm[2]	20 mV	R_L = 1M Ohm Zero Bias

Notes:
1. Fixture tuned to 9.375 GHz.
2. Fixture tuned to 2.5 GHz. See Figure 3 through Figure 6 for untuned fixture performance.

Typical Scattering Parameters

Frequency (GHz)	0 dBm (Zero Bias) S11 Mag.	0 dBm (Zero Bias) S11 Ang.	-30 dBm (Zero Bias) S11 Mag.	-30 dBm (Zero Bias) S11 Ang.	-30 dBm (20 µA Bias) S11 Mag.	-30 dBm (20 µA Bias) S11 Ang.
1.00	0.56	-3.31	0.99	-9.88	0.97	-10.59
1.50	0.54	-13.76	0.99	-15.13	0.97	-15.91
2.00	0.52	-14.54	0.98	-19.94	0.96	-21.32
2.50	0.54	-17.80	0.98	-24.70	0.95	-27.12
3.00	0.50	-28.60	0.98	-29.79	0.95	-32.55
3.50	0.48	-35.04	0.98	-35.58	0.95	-39.21
4.00	0.48	-38.71	0.99	-41.97	0.95	-45.97
5.00	0.41	-54.30	0.97	-54.95	0.94	-60.45
6.00	0.33	-68.19	0.96	-69.62	0.92	-76.48
7.00	0.13	-103.79	0.95	-89.11	0.90	-97.46
8.00	0.07	148.85	0.91	-125.67	0.87	-123.48
9.00	0.20	89.00	0.90	-141.97	0.84	-157.67
10.00	0.29	63.62	0.88	178.71	0.81	158.60
11.00	0.41	51.93	0.87	140.49	0.83	120.07
12.00	0.48	38.25	0.86	99.44	0.82	81.04

Circuit Model



Circuit Model Values

RF Power	R_J (Ω)	C_J (pF)
-30 dBm*	2500	0.090
-3 dBm	300	0.125
0 dBm	170	0.140
3 dBm	100	0.200

* I_F= 20 µA at -30 dBm; I_F= 0 at other power levels.

Spice Model Parameters

IS = 3 x 10^{-8} A	M = 0.50
RS = 7Ω	EG = 0.69 eV
N = 1.05	BV = 5.0 V
TT = 0 S	IBV = 1 x 10^{-5} A
CC = 0.08 x 10^{-12} F	
VJ = 0.85 V	

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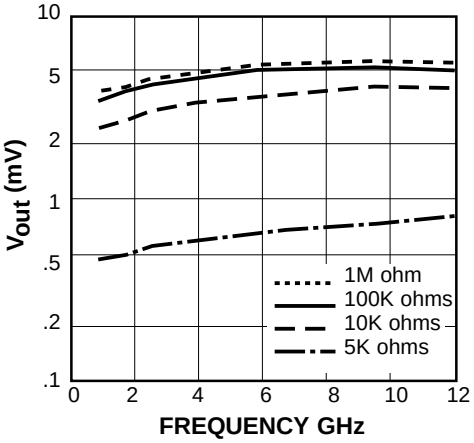
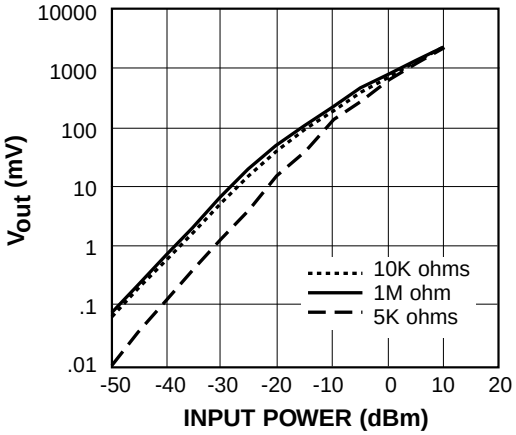
Typical Performance Curves @ 25°C
(MA4E1245KE)

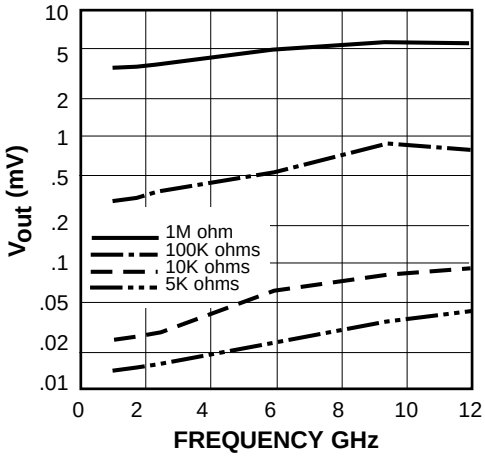
DETECTOR OUTPUT VOLTAGE vs FREQUENCY AND LOAD RESISTANCE AT -30 DBM. DIODE FORWARD BIASED AT 20 µA. UNTUNED FIXTURE.



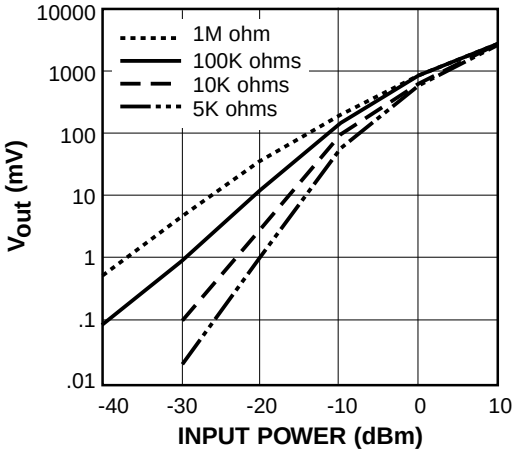
DETECTOR OUTPUT VOLTAGE vs INPUT POWER AND LOAD RESISTANCE. DIODE FORWARD BIASED AT 20 µA. UNTUNED FIXTURE AT 9.375 GHZ.



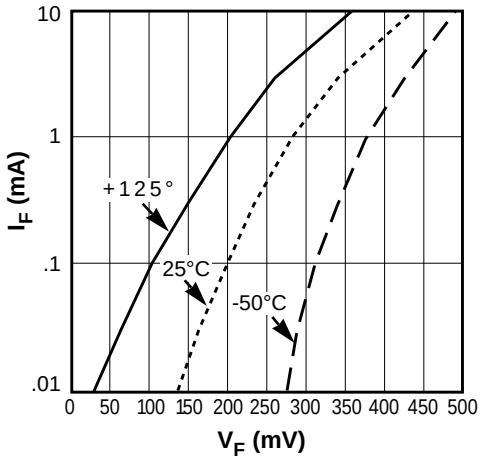
DETECTOR OUTPUT VOLTAGE vs FREQUENCY AND LOAD RESISTANCE AT -30 DBM. DIODE AT ZERO BIAS.



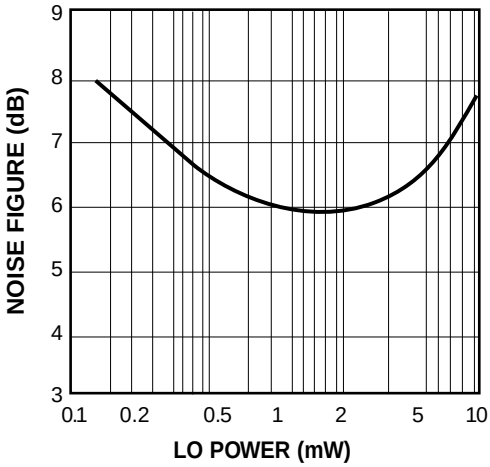
DETECTOR OUTPUT VOLTAGE vs INPUT POWER AND LOAD RESISTANCE. DIODE AT ZERO BIAS. UNTUNED FIXTURE AT 9.375 GHZ.



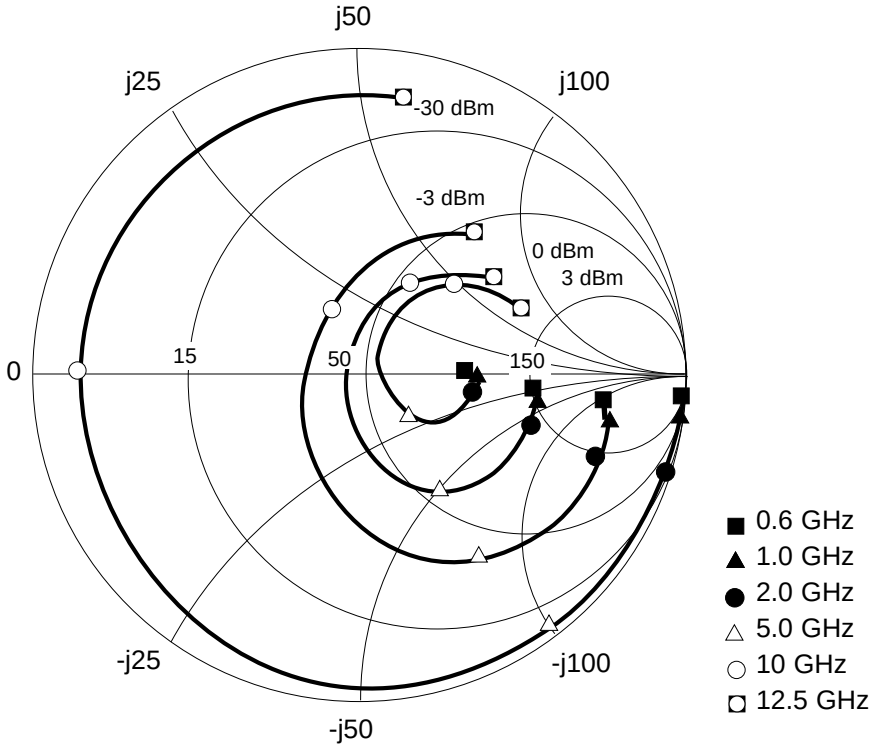
FORWARD CURRENT vs FORWARD VOLTAGE AND TEMPERATURE.



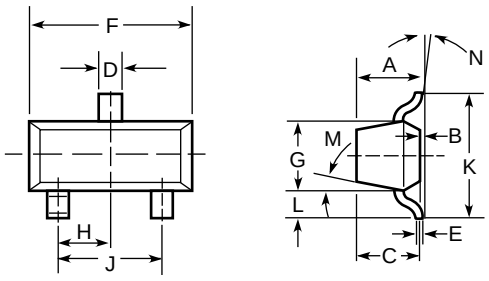
NOISE FIGURE vs LO POWER AT 9.375 GHZ.



RF Impedance of the MA4E1245KA



SOT-23 (High Profile)



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	—	0.048	—	1,22
B	—	0.008	—	0,20
C	—	0.040	—	1,00
D	0.013	0.020	0,35	0,50
E	0.003	0.006	0,08	0,15
F	0.110	0.119	2,80	3,00
G	0.047	0.056	1,20	1,40
H	0.037 typical		0,95 typical	
J	0.075 typical		1,90 typical	
K	—	0.103	—	2,60
L	—	0.024	—	0,60

DIM.	GRADIENT
M	10° max.[1]
N	2°…30°

Note:
1. Applicable on all sides

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