

# Reflective SPDT GaAs MMIC Switch

## Technical Data

### Features

- **Single-Pole, Double-Throw Output**
- **Broad Bandwidth:**  
DC to 3 GHz
- **Low Insertion Loss:**  
0.8 dB Typical at 1 GHz
- **Fast Switching Time:**  
3 ns Typical
- **Ultra Low DC Power Consumption**
- **Small Surface-Mount Plastic Package**

### Description

The MGS-70008 is a single-pole, double-throw monolithic GaAs MMIC switch. The J2 and J3 of the MGS-70008 are terminated to ground when “off” (an absorptive version, the MGS-71008, which terminates the “off” port in an internal 50 Ω resistor, is also available). The switches are

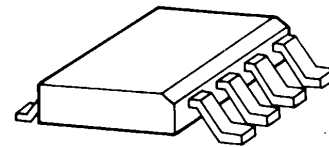
sealed in a small, plastic, surface-mount SO-8 package. Switching is actuated by a -5 V control voltage per the truth table shown on the next page. -3.3 V operation is also possible with some reduction in  $P_{1\text{ dB}}$  and  $IP_3$ .

The MGS-70008 is designed for high volume commercial applications where low insertion loss, high isolation, and fast switching speed are required. Its low cost and high performance make it suitable for a wide variety of uses such as digital cellular, spread spectrum, GPS, and other RF switching applications. Refer to applications note AN-G007 for more application details.

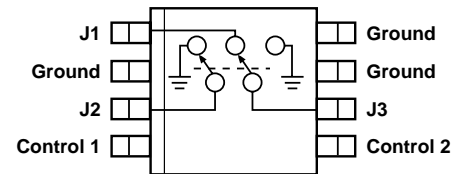
The die is fabricated using HP’s nominal 0.7 μm Schottky-barrier-gate, gold metallization, and silicon nitride passivation to achieve excellent performance, uniformity, and reliability.

## MGS-70008

### SO-8 Package



### AC Equivalent Circuit/Pinout



## MGS-70008 Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum <sup>[1]</sup>
	Maximum Input Power below 500 MHz	dBm	+27
	above 500 MHz	dBm	+30
	Control Voltage	V	-8.0
T <sub>STG</sub>	Storage Temperature	°C	-65 to 150

### Note:

1. Operation of this device above any one of these limits may cause permanent damage.

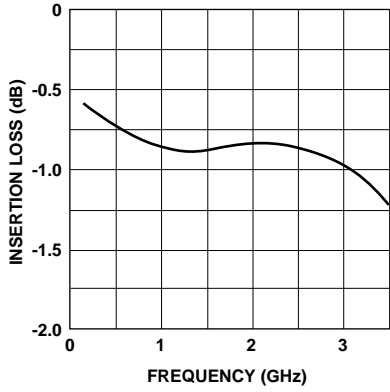
## Electrical Specifications, T<sub>A</sub> = 25°C

Symbol	Parameters and Test Conditions <sup>[1]</sup>	Units	Min.	Typ.	Max.
I <sub>C</sub>	Control Input Current DC	μA		12	110
BW	Bandwidth	GHz	DC-3		
IL	Insertion Loss	200 MHz 1000 MHz 2000 MHz 2500 MHz 3000 MHz	dB dB dB dB dB	0.6 0.8 1.0 1.1 1.2	1.1
ISO	Isolation	200 MHz 1000 MHz 2000 MHz 2500 MHz 3000 MHz	dB dB dB dB dB	29 51 33 23 19 16	
VSWR J1, J2 or J3	Voltage Standing Wave Ratio (on port)	DC-1000MHz 1000-3000MHz	— —	1.2:1 1.3:1	1.4:1
VSWR J2 or J3	Voltage Standing Wave Ratio (off port)	DC-2000 MHz 2000-3000 MHz	— —	≥ 10:1 ≥ 10:1	
I <sub>SW</sub>	Switching Speed	10%to90%	ns	3	
P <sub>1dB</sub> <sup>[2]</sup>	Output @ 1 dB Gain Compression	200 MHz 1000 MHz 2000 MHz	dBm dBm dBm	18.5 26.0 26.0	
IP <sub>3</sub> <sup>[2]</sup>	3rd Order Intercept	200 MHz 1000 MHz 2000 MHz	dBm dBm dBm	41 45 45	

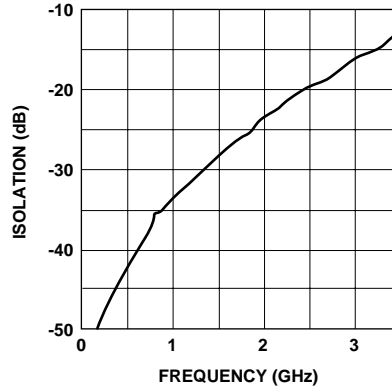
### Notes:

1. Measured in a 50 Ω system at 1 GHz, unless otherwise specified, V<sub>C</sub> = -5 V.
2. Measured in a 50 Ω system with V<sub>C</sub> = -7 V.

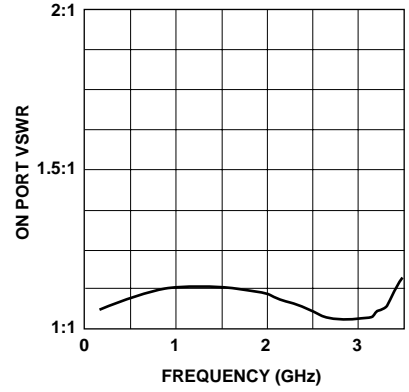
**MGS-70008 Typical Performance,  $T_A = 25^\circ\text{C}$**



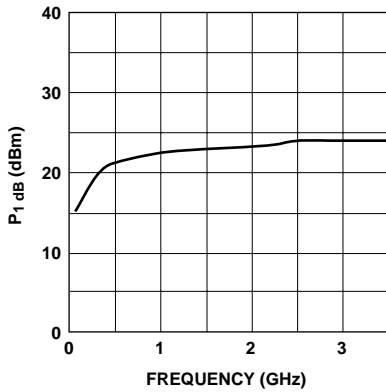
**Figure 1. Insertion Loss vs. Frequency.**  
 $V_{\text{Control}} = -5 \text{ V.}$



**Figure 2. Isolation vs. Frequency.**  
 $V_{\text{Control}} = -5 \text{ V.}$



**Figure 3. Input and Output Return Loss vs. Frequency.**  $V_{\text{Control}} = -7 \text{ V.}$



**Figure 4. Output Power vs. Frequency.**  
 $V_{\text{Control}} = -7 \text{ V.}$

**MGS-70008 Truth Table (Typical Performance at 1 GHz)**

	Control Input		Insertion Loss		Return Loss		
	C1	C2	J1-J2	J1-J3	J1	J2	J3
	0 V	0 V	16 dB	16 dB	1 dB	1 dB	1 dB
For normal SPDT use	0 V	-5 V	33 dB	.8 dB	22 dB	1 dB	22 dB
For normal SPDT use	-5 V	0 V	.8 dB	33 dB	22 dB	22 dB	1 dB
	-5 V	-5 V	19 dB	19 dB	1 dB	1 dB	1 dB

**MGS-70008 Typical Power Performance vs. Frequency and Control Voltage ( $V_C$ )**  
(All other typical specifications remain constant.)

Frequency	$V_C = -7 \text{ V}$		$V_C = -5 \text{ V}$		$V_C = -3.3 \text{ V}$	
	$P_1 \text{ dBm}$	$IP_3$	$P_1 \text{ dBm}$	$IP_3$	$P_1 \text{ dBm}$	$IP_3$
200 MHz	18.5 dBm	41 dBm	18.0 dBm	41 dBm	16.5 dBm	35 dBm
1000 MHz	26.0 dBm	45 dBm	23.7 dBm	44 dBm	17.5 dBm	38 dBm
2000 MHz	26.0 dBm	45 dBm	23.0 dBm	44 dBm	16.0 dBm	38 dBm

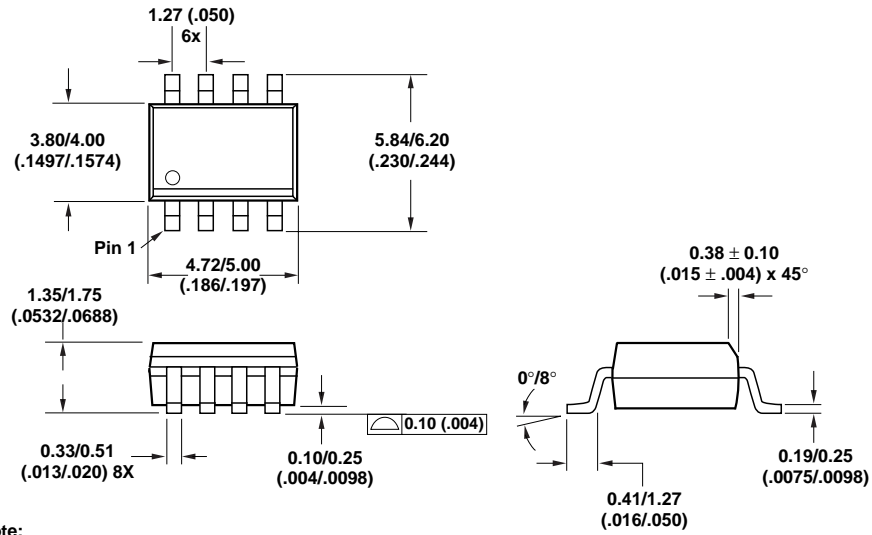
**Typical Scattering Parameters, ON Switch Port,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_C = -5\text{ V}$**

Freq. MHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
0.2	.04	-6.2	-6	.93	-4.5	-6	.934	-4.4	.04	-2.5
0.4	.04	0.3	-6	.93	-8.5	-6	.934	-8.3	.03	10.6
0.6	.04	7.6	-6	.93	-12.7	-6	.930	-12.4	.03	30.7
0.8	.05	13.6	-6	.93	-16.8	-7	.927	-16.3	.04	52.8
1.0	.06	14.7	-6	.93	-21.0	-7	.927	-20.4	.05	63.0
1.2	.07	14.5	-6	.93	-25.7	-6	.931	-24.5	.07	67.1
1.4	.09	14.0	-6	.93	-30.3	-6	.930	-28.7	.08	69.1
1.6	.10	10.2	-6	.93	-34.8	-6	.930	-32.9	.10	69.2
1.8	.11	8.1	-6	.93	-39.4	-6	.928	-37.6	.10	66.6
2.0	.11	1.4	-6	.93	-44.5	-6	.928	-41.8	.11	65.2
2.2	.11	-3.2	-7	.92	-49.9	-7	.922	-46.8	.09	62.2
2.4	.10	-8.5	-8	.91	-54.5	-7	.927	-51.5	.09	60.8
2.6	.08	-13.1	-7	.92	-58.9	-7	.920	-56.2	.07	60.0
2.8	.05	-14.1	-7	.92	-64.0	-7	.922	-62.4	.04	70.8
3.0	.01	7.4	-8	.91	-69.0	-1.0	.894	-68.7	.02	127.9
3.2	.04	141.4	-1.1	.88	-75.0	-1.3	.864	-74.4	.05	-178.2
3.4	.11	143.2	-1.2	.87	-79.2	-1.7	.823	-79.9	.10	-169.4
3.6	.17	129.5	-1.4	.85	-81.7	-1.6	.828	-85.7	.12	-178.5
3.8	.22	135.9	-1.3	.86	-85.4	-2.1	.788	-91.8	.19	-168.0
4.0	.32	133.2	1.6	.83	-94.4	-3.0	.708	-95.0	.22	165.6
4.2	.37	129.2	-2.2	.78	-96.8	-3.7	.652	-99.2	.24	166.9
4.4	.46	128.5	-2.0	.79	-96.4	-4.2	.619	-102.5	.30	163.4

**Typical Scattering Parameters, OFF Switch Port,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_C = -5\text{ V}$**

Freq. GHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
0.2	.05	5.6	-50.0	0	92.1	-44.4	.006	92.4	.81	176.3
0.4	.05	20.6	-40.0	.01	94.2	-38.4	.012	95.2	.82	172.6
0.6	.06	36.0	-35.0	.02	98.1	-35.4	.017	100.3	.83	168.9
0.8	.09	39.3	-31.9	.03	100.9	-32.4	.024	104.4	.83	165.3
1.0	.11	35.8	-30.5	.03	103.9	-30.5	.030	108.5	.85	161.6
1.2	.13	30.9	-28.0	.04	103.6	-28.4	.038	110.4	.86	158.3
1.4	.14	25.0	-28.0	.05	107.5	-26.4	.048	116.2	.87	154.9
1.6	.15	18.9	-24.4	.06	107.0	-24.7	.058	116.8	.89	151.9
1.8	.16	14.5	-23.1	.07	108.5	-23.0	.071	119.6	.90	148.6
2.0	.16	10.6	-21.9	.08	105.9	-21.6	.083	118.0	.92	146.7
2.2	.17	7.8	-20.0	.10	105.3	-19.9	.101	118.6	.92	145.0
2.4	.17	3.0	-19.2	.11	105.4	-18.8	.115	119.8	.95	143.1
2.6	.18	-2.9	-17.7	.13	103.9	-16.9	.143	120.4	.95	141.7
2.8	.16	-9.2	-16.5	.15	102.1	-15.7	.165	119.3	.98	141.2
3.0	.14	-19.6	-14.9	.18	98.5	-13.9	.202	116.4	.99	140.6
3.2	.11	-33.2	-14.0	.20	97.6	-12.2	.246	115.5	1.01	139.6
3.4	.06	-78.5	-12.0	.25	88.8	-10.3	.307	105.1	1.00	139.0
3.6	.08	-156.7	-10.5	.30	79.5	-8.4	.379	89.9	.91	140.4
3.8	.13	-153.0	-11.1	.28	70.0	-10.3	.306	77.4	.94	146.5
4.0	.18	134.3	-11.7	.26	68.9	-8.6	.370	88.3	1.26	142.8
4.2	.22	129.6	-10.8	.29	72.1	-7.8	.407	85.3	1.33	133.7
4.4	.27	128.9	-9.9	.32	72.0	-6.8	.458	83.0	1.45	131.6

## SO-8 Package Dimensions



**Note:**

1. Dimensions are shown in millimeters (inches).