



# Absorptive SPDT GaAs MMIC Switch

## Technical Data

### MGS-71008

#### Features

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

#### Description

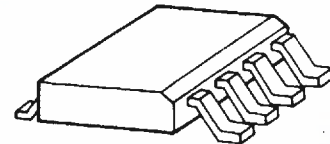
The MGS-71008 is a single-pole, double-throw monolithic GaAs MMIC switch. The J2 and J3 of the MGS-71008 are terminated to ground by internal 50  $\Omega$  load resistors when "off" (a reflective version, the MGS-70008, which terminates the "off" port to ground, is also available). The switch is sealed 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  $P_{1dB}$  and  $IP_3$ .

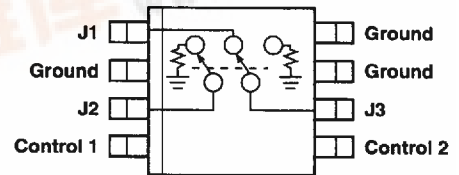
The MGS-71008 is designed for high volume commercial applications where low insertion loss, high isolation, and fast switching speed are required. Its low cost and high performance make it suitable for a wide variety of uses such as digital cellular, spread spectrum, GPS, and other RF switching applications. Refer to applications note AN-G007 for more application details.

The die is fabricated using HP's nominal 0.3 micron recessed Schottky-barrier-gate, gold metallization, and silicon nitride passivation to achieve excellent performance, uniformity, and reliability.

#### SO-8 Package



#### AC Equivalent Circuit/Pinout



### MGS-71008 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	dB		0.9	1.5
		1000 MHz	dB		1.2	
		2000 MHz	dB		1.3	
		2500 MHz	dB		1.4	
		3000 MHz	dB		1.5	
ISO	Isolation	200 MHz	dB	30	52	
		1000 MHz	dB		37	
		2000 MHz	dB		26	
		2500 MHz	dB		22	
		3000 MHz	dB		16	
VSWR J1, J2 or J3	Voltage Standing Wave Ration (on port)	DC - 1000 MHz	—		1.2:1	1.4:1
		1000 - 3000 MHz	—		1.3:1	
VSWR J2 or J3	Voltage Standing Wave Ration (off port)	DC - 2000 MHz	—		1.2:1	
		2000 - 3000 MHz	—		1.3:1	
I <sub>sw</sub>	Switching Speed	10% to 90%	ns		3	
P <sub>1 dB</sub> <sup>[2]</sup>	Output @ 1 dB Gain Compression	200 MHz	dBm		16.5	
		1000 MHz	dBm		25.2	
		2000 MHz	dBm		25.2	
IP <sub>3</sub> <sup>[2]</sup>	3rd Order Intercept	200 MHz	dBm		41	
		1000 MHz	dBm		45	
		2000 MHz	dBm		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, $T_A = 25^\circ\text{C}$

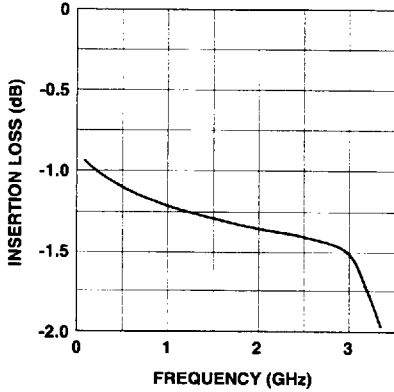


Figure 1. Insertion Loss vs. Frequency.  
 $V_{\text{Control}} = -5 \text{ V}$ .

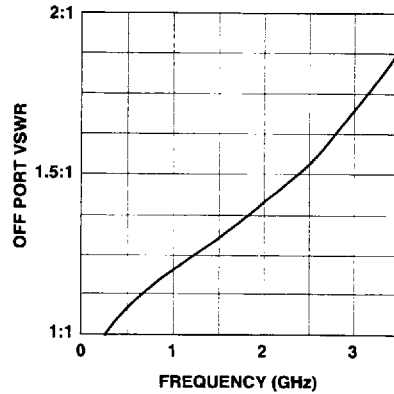


Figure 2. Off Port VSWR vs. Frequency.  
 $V_{\text{Control}} = -5 \text{ V}$ .

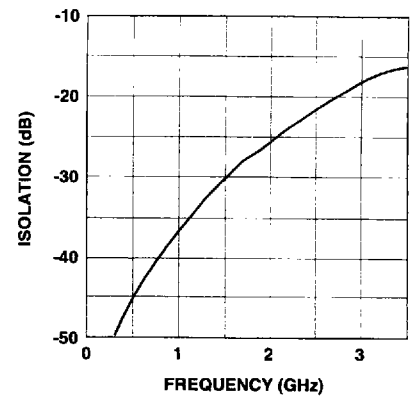


Figure 3. Isolation vs. Frequency.  
 $V_{\text{Control}} = -5 \text{ V}$ .

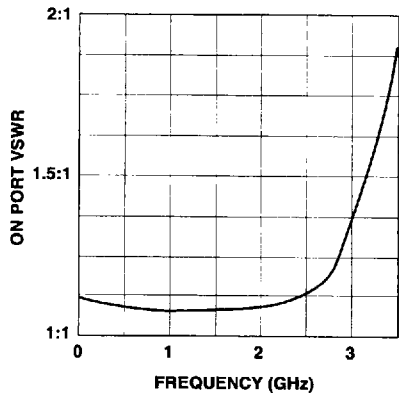


Figure 4. On Port VSWR vs. Frequency.  
 $V_{\text{Control}} = -5 \text{ V}$ .

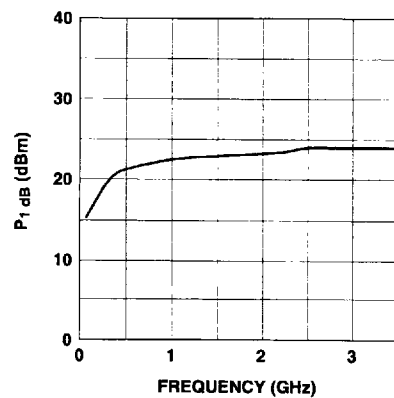


Figure 5. Output Power vs. Frequency.  
 $V_{\text{Control}} = -7 \text{ V}$ .

### MGS-71008 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	37 dB	1.2 dB	22 dB	22 dB	22 dB
For normal SPDT use	-5 V	0 V	1.2 dB	37 dB	22 dB	22 dB	1 dB
	-5 V	-5 V	26 dB	26 dB	1 dB	1 dB	1 dB

### MGS-71008 Typical Power Performance vs. Frequency and Control Voltage ( $V_C$ ) (All other typical specifications remain constant.)

Frequency	$V_C = -7 \text{ V}$		$V_C = -5 \text{ V}$		$V_C = -3.3 \text{ V}$	
	$P_1$ dBm	$IP_3$	$P_1$ dBm	$IP_3$	$P_1$ dBm	$IP_3$
200 MHz	16.5 dBm	41 dBm	16.5 dBm	41 dBm	15.5 dBm	35 dBm
1000 MHz	25.2 dBm	45 dBm	23.7 dBm	44 dBm	19.0 dBm	38 dBm
2000 MHz	25.2 dBm	45 dBm	22.5 dBm	44 dBm	18.5 dBm	38 dBm

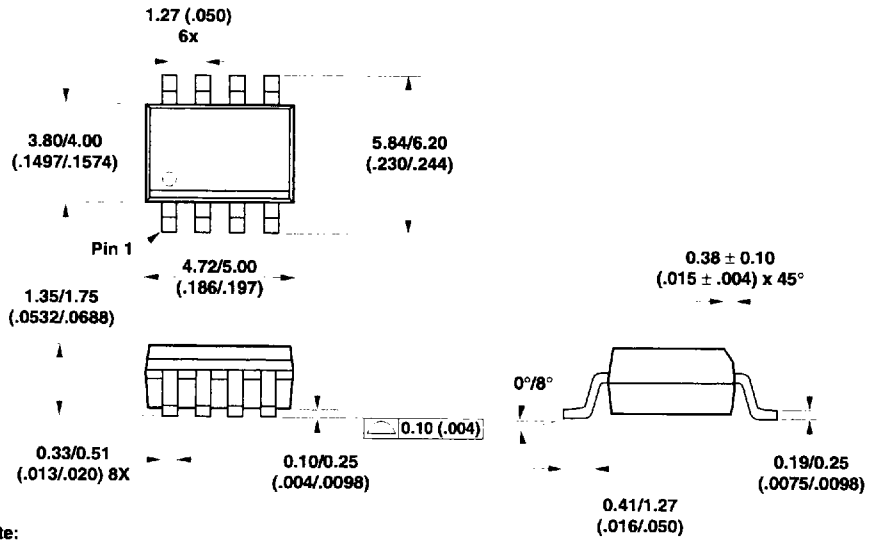
**Typical Scattering Parameters, ON Switch Port,  $Z_0 = 50 \Omega$ ,  $T_A = 25^\circ\text{C}$ ,  $V_C = -5 \text{ V}$** 

Freq. MHz	$S_{11}$		dB	$S_{21}$		dB	$S_{12}$		$S_{22}$	
	Mag.	Ang.		Mag.	Ang.		Mag.	Ang.	Mag.	Ang.
0.2	.05	-18.2	-.9	.90	-5.1	-.9	.904	-5.0	.05	-14.1
0.4	.05	-18.3	-.9	.90	-9.4	-.9	.96	-9.2	.04	-10.1
0.6	.05	-20.6	-.9	.90	-13.9	-.9	.898	-13.6	.03	-8.2
0.8	.05	-18.7	-.9	.90	-18.2	-.9	.898	-17.8	.02	8.9
1.0	.05	-20.4	-1.0	.89	-22.8	-1.0	.890	-22.3	.02	30.5
1.2	.06	-26.3	-1.0	.89	-27.8	-1.0	.893	-26.9	.01	42.3
1.4	.06	-29.1	-1.0	.89	-32.7	-1.0	.891	-31.5	.02	55.2
1.6	.07	-38.1	-1.1	.88	-37.5	-1.0	.889	-36.3	.02	59.1
1.8	.06	-46.4	-1.1	.88	-42.4	-1.1	.884	-41.5	.01	19.1
2.0	.06	-63.8	-1.2	.87	-47.8	-1.1	.879	-46.6	.01	-75.6
2.2	.06	-82.3	-1.2	.87	-53.5	-1.2	.871	-52.2	.03	-103.5
2.4	.07	-109.8	-1.3	.86	-58.5	-1.2	.867	-57.8	.05	-115.3
2.6	.08	-128.7	-1.4	.85	-63.2	-1.4	.851	-62.9	.08	-126.2
2.8	.11	-153.4	-1.5	.84	-68.7	-1.5	.838	-70.0	.11	-134.4
3.0	.14	-169.6	-1.6	.83	-74.0	-2.0	.791	-76.5	.16	-144.1
3.2	.20	178.3	-2.0	.79	-80.3	-2.5	.746	-82.8	.20	-152.8
3.4	.26	167.7	-2.3	.77	-83.8	-3.1	.700	-87.2	.26	-163.4
3.6	.31	154.5	-2.4	.76	-87.3	-3.3	.686	-93.8	.29	-168.1
3.8	.40	152.0	-2.5	.75	-90.3	-4.0	.632	-99.3	.37	-169.7
4.0	.51	145.4	-3.0	.71	-100.2	-4.6	.588	-99.6	.37	167.2
4.2	.63	139.5	-3.3	.68	-101.6	-5.4	.534	-101.6	.43	168.5
4.4	.82	133.0	-3.1	.70	-103.8	-6.1	.498	-104.6	.46	162.7

**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	.06	-9.8	-52.0	0	73.6	-46.0	.005	74.7	.01	146.5
0.4	.05	0	-42.4	.01	94.8	-41.9	.008	95.5	.03	130.7
0.6	.05	27.3	-36.4	.02	113.0	-36.5	.015	113.7	.05	125.1
0.8	.06	20.7	-35.2	.02	92.3	-35.4	.017	93.0	.07	116.9
1.0	.06	21.7	-33.7	.02	106.1	-33.6	.021	107.1	.08	115.7
1.2	.07	20.6	-31.4	.03	114.5	-32.0	.025	116.4	.10	114.8
1.4	.08	15.7	-30.5	.03	122.9	-29.1	.035	125.5	.12	114.6
1.6	.08	-5.6	-28.0	.04	112.0	-27.7	.041	114.2	.14	116.3
1.8	.08	-11.8	-26.0	.05	122.0	-26.2	.049	124.9	.16	115.2
2.0	.07	-17.0	-24.4	.06	121.9	-24.2	.062	125.4	.18	117.1
2.2	.08	-24.6	-21.9	.08	124.3	-22.3	.077	128.3	.21	118.5
2.4	.07	-40.0	-20.9	.09	119.5	-20.4	.095	123.5	.23	117.9
2.6	.06	-46.7	-20.0	.10	119.4	-19.6	.105	124.0	.25	117.8
2.8	.05	-66.2	-18.4	.12	119.0	-17.8	.129	122.9	.27	117.9
3.0	.05	-112.4	-16.5	.15	116.5	-16.1	.157	119.7	.30	118.0
3.2	.08	-158.0	-15.4	.17	111.0	-14.4	.191	113.1	.32	116.2
3.4	.16	170.2	-14.4	.19	100.7	-13.8	.204	100.3	.33	119.8
3.6	.23	158.7	-13.6	.21	100.8	-13.0	.223	96.7	.35	120.5
3.8	.34	146.0	-12.4	.24	97.3	-12.8	.229	90.9	.36	124.0
4.0	.45	138.0	-11.4	.27	83.0	-11.7	.260	78.3	.33	113.0
4.2	.54	129.9	-12.0	.25	82.7	-12.6	.234	78.8	.39	120.7
4.4	.65	125.4	-10.8	.29	81.1	-11.9	.253	74.5	.39	116.1

## SO-8 Package Dimensions



**Note:**

1. Dimensions are shown in millimeters (inches).