

Absorptive SPDT GaAs MMIC Switch

Technical Data

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 Ω 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,

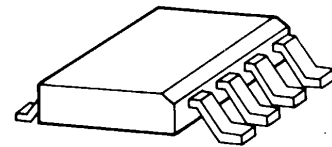
surface-mount SO-8 package. Switching is actuated by a -5 V control voltage per the truth table shown on the next page. -3.3 V operation is also possible with some reduction in P_1 dB and IP_3 .

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.

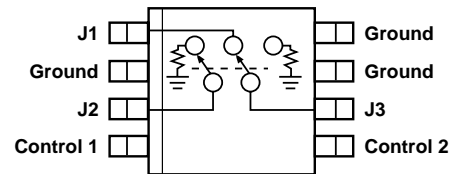
The die is fabricated using HP’s nominal 0.3 micron recessed Schottky-barrier-gate, gold metallization, and silicon nitride passivation to achieve excellent performance, uniformity, and reliability.

MGS-71008

SO-8 Package



AC Equivalent Circuit/Pinout



MGS-71008 Absolute Maximum Ratings

| Symbol | Parameter | Units | Absolute Maximum ^[1] |
|------------------|--------------------------------------|-------|---------------------------------|
| | Maximum Input Power below 500 MHz | dBm | +27 |
| | above 500 MHz | dBm | +30 |
| | Control Voltage | V | -8.0 |
| T _{STG} | 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_A = 25°C

| Symbol | Parameters and Test Conditions ^[1] | Units | Min. | Typ. | Max. |
|---------------------------------|---|-----------------|------|-------|-------|
| I _C | Control Input Current DC | μA | | 12 | 110 |
| BW | Bandwidth | GHz | DC-3 | | |
| IL | Insertion Loss | 200 MHz | | 0.9 | 1.5 |
| | | 1000 MHz | | 1.2 | |
| | | 2000 MHz | | 1.3 | |
| | | 2500 MHz | | 1.4 | |
| | | 3000 MHz | | 1.5 | |
| ISO | Isolation | 200 MHz | | 52 | |
| | | 1000 MHz | 30 | 37 | |
| | | 2000 MHz | | 26 | |
| | | 2500 MHz | | 22 | |
| | | 3000 MHz | | 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 _{SW} | Switching Speed | ns | | 3 | |
| P _{1dB} ^[2] | Output @ 1 dB Gain Compression | 200 MHz | | 16.5 | |
| | | 1000 MHz | | 25.2 | |
| | | 2000 MHz | | 25.2 | |
| IP ₃ ^[2] | 3rd Order Intercept | 200 MHz | | 41 | |
| | | 1000 MHz | | 45 | |
| | | 2000 MHz | | 45 | |

Notes:

1. Measured in a 50 Ω system at 1 GHz, unless otherwise specified, V_C = -5 V.
2. Measured in a 50 Ω system with V_C = -7 V.

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

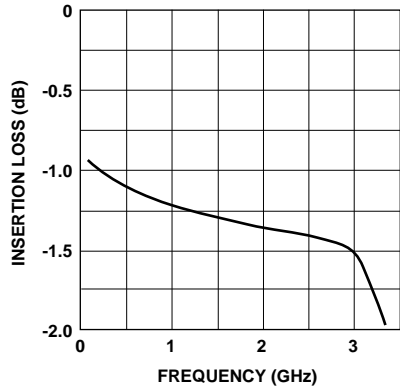


Figure 1. Insertion Loss vs. Frequency.
 $V_{\text{Control}} = -5 \text{ V.}$

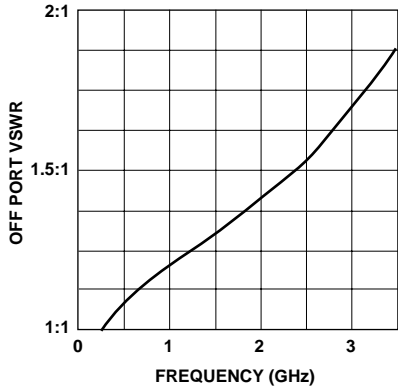


Figure 2. Off Port VSWR vs. Frequency.
 $V_{\text{Control}} = -5 \text{ V.}$

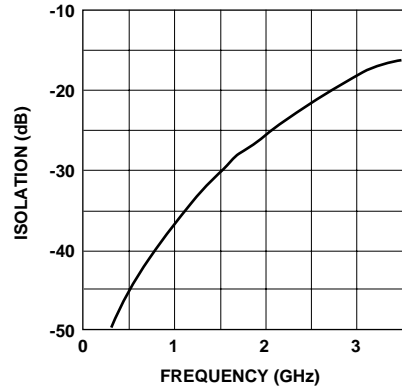


Figure 3. Isolation vs. Frequency.
 $V_{\text{Control}} = -5 \text{ V.}$

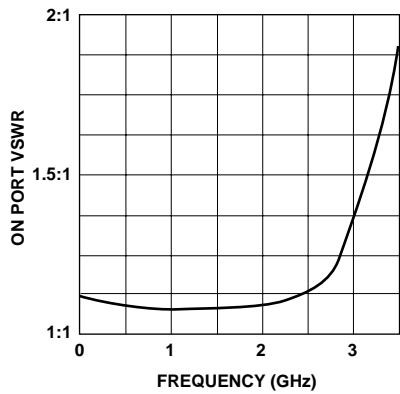


Figure 4. On Port VSWR vs. Frequency.
 $V_{\text{Control}} = -5 \text{ V.}$

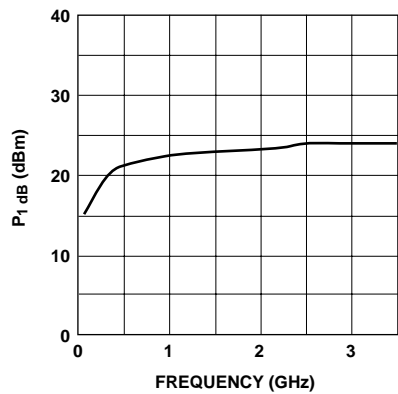


Figure 5. Output Power vs. Frequency.
 $V_{\text{Control}} = -7 \text{ V.}$

MGS-71008 Truth Table (Typical Performance at 1 GHz)

| | Control Input | | Insertion Loss | | Return Loss | | |
|---------------------|---------------|-----|----------------|--------|-------------|-------|-------|
| | C1 | C2 | J1-J2 | J1-J3 | J1 | J2 | J3 |
| | 0V | 0V | 16 dB | 16 dB | 1 dB | 1 dB | 1 dB |
| For normal SPDT use | 0V | -5V | 37 dB | 1.2 dB | 22 dB | 22 dB | 22 dB |
| For normal SPDT use | -5V | 0V | 1.2 dB | 37 dB | 22 dB | 22 dB | 1 dB |
| | -5V | -5V | 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 |

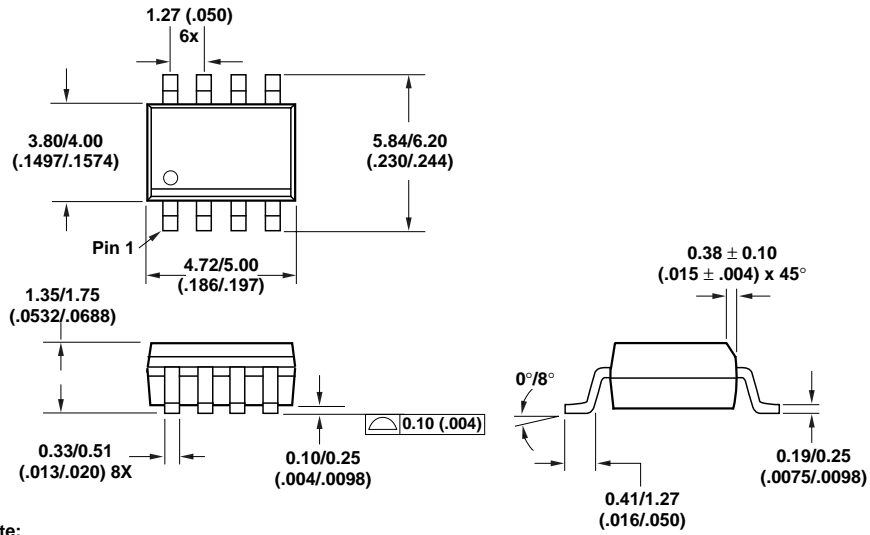
Typical Scattering Parameters, ON Switch Port, $Z_0 = 50 \Omega$, $T_A = 25^\circ\text{C}$, $V_C = -5\text{ V}$

| 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).