

## GaAS MMIC MSOP8 SPDT SWITCH DC - 3 GHz

FEBRUARY 2001

v01.0700

### Features

LOW INSERTION LOSS: 0.4 dB

ULTRA SMALL PACKAGE: MSOP8

HIGH INPUT IP3: +50 dBm

POSITIVE CONTROL: 0/+3V @ 10  $\mu$ A



### General Description

The HMC190MS8 is a low cost SPDT switch in an 8-lead MSOP package. The switch can control signals from DC to 3.0 GHz. It is especially suited for low and medium power applications using positive control voltages. The two control voltages require a minimal amount of DC current, which is optimal for battery powered radio systems at 0.9, 1.9, and 2.4 GHz.

The HMC190MS8 design provides exceptional third order intermodulation performance of +50 dBm. The design has been optimized for the small MSOP package, and maintains a VSWR of better than 1.2:1 up to 2 GHz. This device is the positive control MSOP8 packaged version of our HMC239S8 negative control device.

### Guaranteed Performance $V_{ctl} = 0/+3$ to $+8$ Vdc, $-40$ to $+85$ deg C

| Parameter                                                              | Frequency                             | Min. | Typ.    | Max. | Units    |
|------------------------------------------------------------------------|---------------------------------------|------|---------|------|----------|
| Insertion Loss                                                         | DC - 1.0 GHz                          |      | 0.4     | 0.6  | dB       |
|                                                                        | DC - 2.0 GHz                          |      | 0.4     | 0.6  | dB       |
|                                                                        | DC - 2.5 GHz                          |      | 0.5     | 0.8  | dB       |
|                                                                        | DC - 3.0 GHz                          |      | 0.7     | 1.0  | dB       |
| Isolation                                                              | DC - 1.0 GHz                          | 23   | 27      |      | dB       |
|                                                                        | DC - 2.0 GHz                          | 23   | 27      |      | dB       |
|                                                                        | DC - 2.5 GHz                          | 22   | 26      |      | dB       |
|                                                                        | DC - 3.0 GHz                          | 19   | 22      |      | dB       |
| Return Loss                                                            | DC - 1.0 GHz                          | 24   | 28      |      | dB       |
|                                                                        | DC - 2.0 GHz                          | 20   | 28      |      | dB       |
|                                                                        | DC - 2.5 GHz                          | 15   | 20      |      | dB       |
|                                                                        | DC - 3.0 GHz                          | 10   | 16      |      | dB       |
| Input Power for 1dB Compression<br>( $V_{ctl} = 0/+5$ V)               | 0.5 - 1.0 GHz                         | 25   | 30      |      | dBm      |
|                                                                        | 0.5 - 3.0 GHz                         | 23   | 29      |      | dBm      |
| Input Third Order Intercept<br>( $V_{ctl} = 0/+5$ V, +7 dBm Each Tone) | 0.5 - 1.0 GHz                         | 45   | 50      |      | dBm      |
|                                                                        | 0.5 - 3.0 GHz                         | 44   | 49      |      | dBm      |
| Switching Characteristics                                              | DC - 3.0 GHz                          |      |         |      |          |
|                                                                        | tRISE / tFALL (10/90% RF / 90/10% RF) |      | 3<br>10 |      | nS<br>nS |
|                                                                        | tON / tOFF (50% CTL to 10/90% RF)     |      |         |      |          |

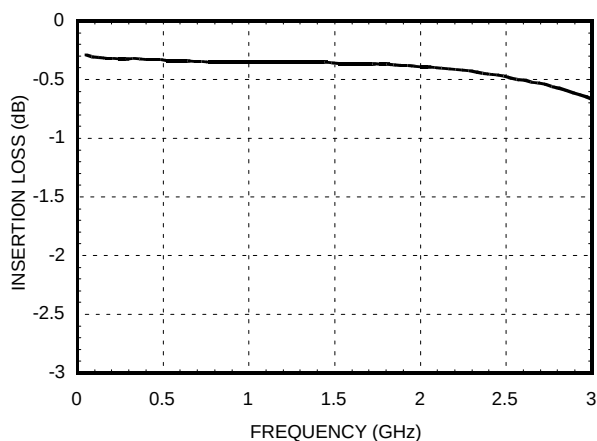


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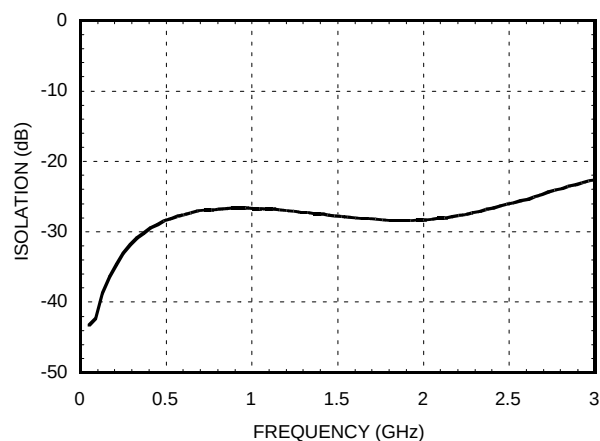
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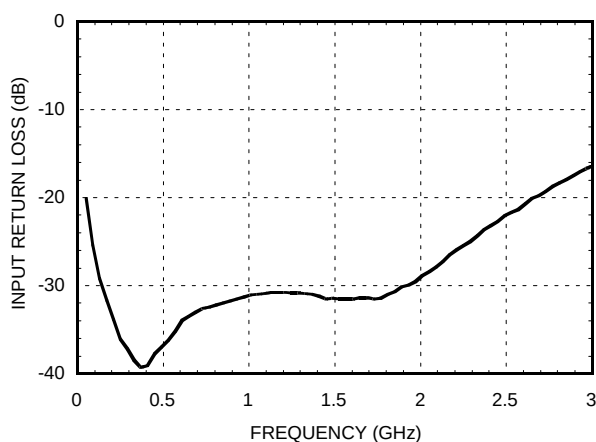
### Insertion Loss



### Isolation



### Return Loss



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SMT | SPDT SWITCHES

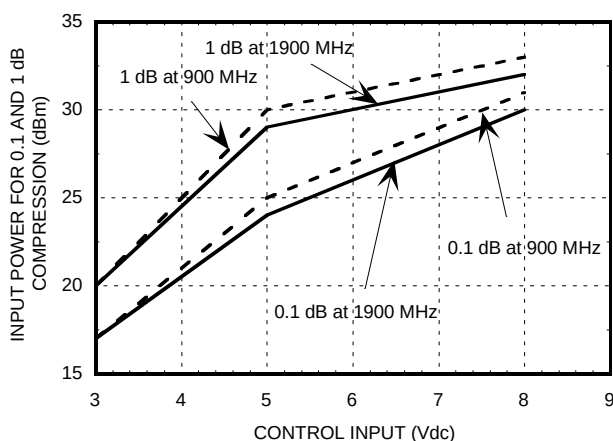


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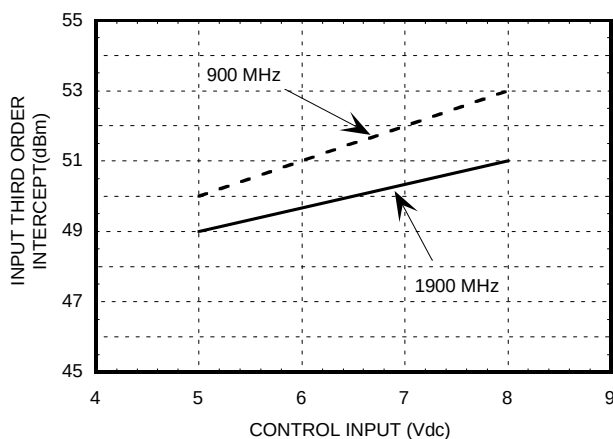
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### Input 0.1 and 1.0 dB Compression vs Control Voltage



### Input Third Order Intercept Point vs Control Voltage



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### Compression vs Control Voltage

| Control Input<br>(Vdc) | Carrier at 900MHz                       |                                       | Carrier at 1900MHz                      |                                       |
|------------------------|-----------------------------------------|---------------------------------------|-----------------------------------------|---------------------------------------|
|                        | Input Power for 0.1dB Compression (dBm) | Input Power for 1dB Compression (dBm) | Input Power for 0.1dB Compression (dBm) | Input Power for 1dB Compression (dBm) |
| +3                     | 17                                      | 20                                    | 17                                      | 20                                    |
| +5                     | 25                                      | 30                                    | 24                                      | 29                                    |
| +8                     | 31                                      | 33                                    | 30                                      | 32                                    |

Caution: Do not operate in 1dB compression at power levels above +31 dBm ( $V_{ctl}=+5$  Vdc) and do not 'hot switch' power levels greater than +20dBm ( $V_{ctl}=+5$  Vdc).

DC blocks are required at ports RFC, RF1 and RF2.

### Distortion vs Control Voltage

| Control Input<br>(Vdc) | Third Order Intercept (dBm)<br>+7 dBm Each Tone |          |
|------------------------|-------------------------------------------------|----------|
|                        | 900 MHz                                         | 1900 MHz |
| +5                     | 50                                              | 49       |
| +8                     | 53                                              | 51       |

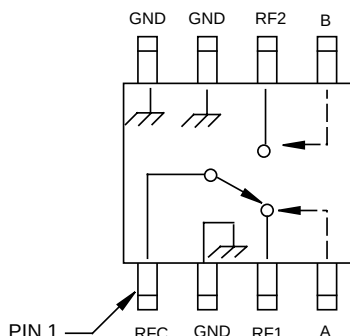


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### Functional Diagram



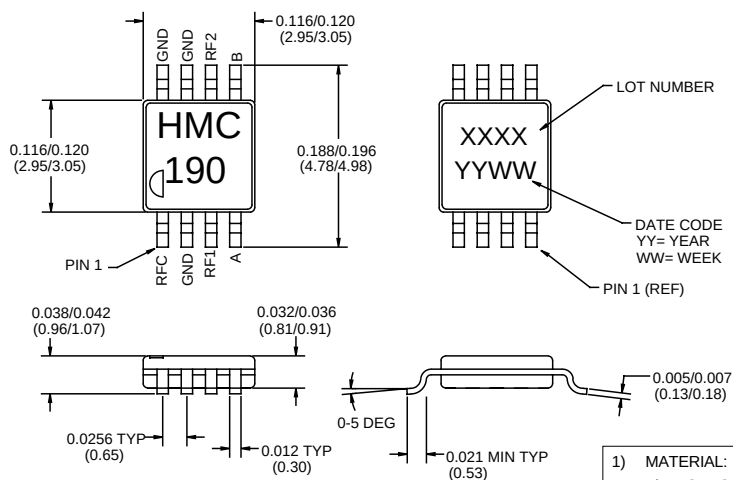
### Truth Table \*Control Input Tolerances are +/- 0.2 Vdc

| Control Input * |         | Control Current |         | Signal Path |           |
|-----------------|---------|-----------------|---------|-------------|-----------|
| A (Vdc)         | B (Vdc) | Ia (uA)         | Ib (uA) | RF to RF1   | RF to RF2 |
| 0               | +3      | -10             | 10      | On          | Off       |
| +3              | 0       | 10              | -10     | Off         | On        |
| 0               | +5      | -55             | 55      | On          | Off       |
| +5              | 0       | 55              | -55     | Off         | On        |
| 0               | +7      | -210            | 210     | On          | Off       |
| +7              | 0       | 210             | -210    | Off         | On        |
| 0               | +8      | -280            | 280     | On          | Off       |
| +8              | 0       | 280             | -280    | Off         | On        |

### Absolute Maximum Ratings

|                                       |                       |                    |
|---------------------------------------|-----------------------|--------------------|
| Max. Input Power<br>$V_{CTL} = 0/+8V$ | 0.05 GHz<br>0.5-2 GHz | +27 dBm<br>+34 dBm |
| Control Voltage Range (A & B)         | -0.2 to +12Vdc        |                    |
| Storage Temperature                   | -65 to +150 deg. C    |                    |
| Operating Temperature                 | -40 to +85 deg. C     |                    |

### Outline



- MATERIAL:  
A) PACKAGE BODY: LOW STRESS INJECTION MOLDED PLASTIC, SILICA & SILICONE IMPREGNATED  
B) LEADFRAME MATERIAL: COPPER ALLOY
- PLATING: LEAD-TIN SOLDER PLATE
- DIMENSIONS ARE IN INCHES (MILLIMETERS)

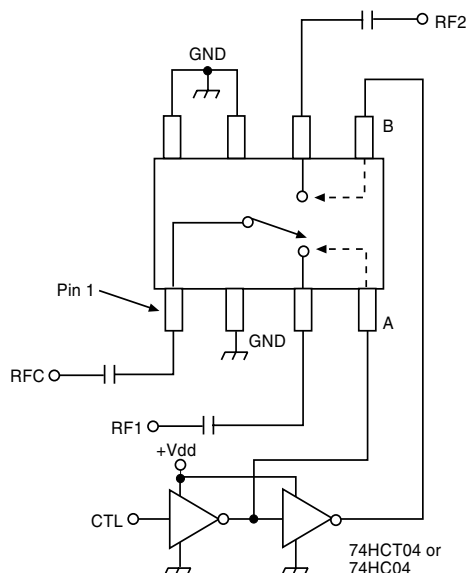


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### Typical Application Circuit



#### Notes:

1. Set logic gate and switch Vdd = +3V to +5V and use HCT series logic to provide a TTL driver interface.
2. Control inputs A/B can be driven directly with CMOS logic (HC) with Vdd of 5 to 8 Volts applied to the CMOS logic gates.
3. DC Blocking capacitors are required for each RF port as shown. Capacitor value determines lowest frequency of operation.
4. Highest RF signal power capability is achieved with Vdd = +8V and A/B set to 0/+8V.



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**NOTES:**

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