



# HMC252QS24 / 252QS24E

## GaAs MMIC SP6T NON-REFLECTIVE SWITCH, DC - 3 GHz

### Typical Applications

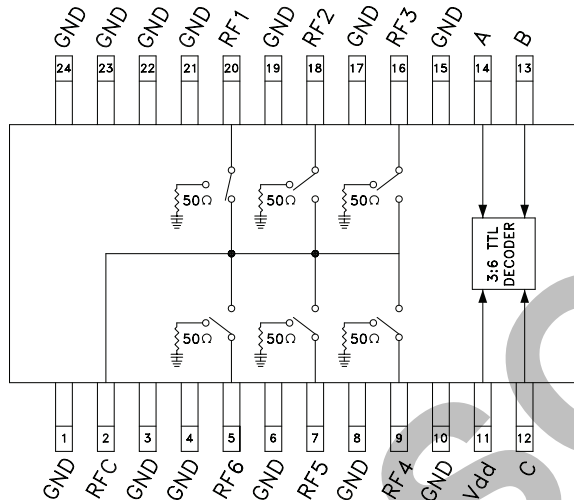
The HMC252QS24 / HMC252QS24E is ideal for:

- Base Station
- CATV / DBS
- MMDS & WirelessLAN
- Test Equipment

### Features

- Low Insertion Loss (2 GHz): 0.9 dB
- Single Positive Supply:  $V_{DD} = +5V$  or  $+3.3V$
- Integrated 3:6 TTL Decoder
- 24 Lead QSOP Package

### Functional Diagram



### General Description

The HMC252QS24 & HMC252QS24E are low-cost non-reflective SP6T switches in 24-lead QSOP packages featuring wideband operation from DC to 3.0 GHz. The switch offers a single positive bias and true TTL/CMOS compatibility. A 3:6 decoder is integrated on the switch requiring only 3 control lines and a positive bias to select each path. The HMC252QS24 & HMC252QS24E SP6T replaces multiple configurations of SP4T and SPDT MMIC switches and logic drivers.

### Electrical Specifications I,

$T_A = +25^\circ\text{C}$ , For TTL Control and  $V_{DD} = +5V$  in a 50 Ohm System

| Parameter                                                                | Frequency         | Min.          | Typ.      | Max. | Units |
|--------------------------------------------------------------------------|-------------------|---------------|-----------|------|-------|
| Insertion Loss                                                           | DC - 1.0 GHz      |               | 0.8       | 1.2  | dB    |
|                                                                          | DC - 2.0 GHz      |               | 0.9       | 1.3  |       |
|                                                                          | DC - 2.5 GHz      |               | 1.0       | 1.5  |       |
|                                                                          | DC - 3.0 GHz      |               | 1.3       | 1.8  |       |
|                                                                          |                   |               |           |      |       |
| Isolation                                                                | DC - 1.0 GHz      | 38            | 41        |      | dB    |
|                                                                          | DC - 2.0 GHz      | 32            | 35        |      |       |
|                                                                          | DC - 2.5 GHz      | 29            | 32        |      |       |
|                                                                          | DC - 3.0 GHz      | 26            | 29        |      |       |
|                                                                          |                   |               |           |      |       |
| Return Loss                                                              | "On State"        | DC - 2.5 GHz  | 14        | 18   | dB    |
|                                                                          |                   | DC - 3.0 GHz  | 7         | 12   |       |
| Return Loss                                                              | RF1-6 "Off State" | 0.3 - 3.0 GHz | 8         | 12   | dB    |
|                                                                          |                   | 0.5 - 2.5 GHz | 11        | 15   |       |
| Input Power for 1dB Compression                                          | 0.3 - 3.0 GHz     | 21            | 24        |      | dBm   |
| Input Third Order Intercept<br>(Two-Tone Input Power = +7 dBm Each Tone) | 0.3 - 3.0 GHz     | 42            | 46        |      | dBm   |
| Switching Characteristics                                                | 0.3 - 3.0 GHz     |               | 35<br>120 |      | ns    |
|                                                                          |                   |               |           |      |       |

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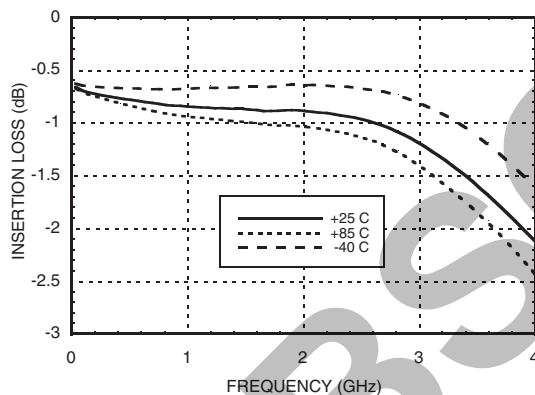
## GaAs MMIC SP6T NON-REFLECTIVE SWITCH, DC - 3 GHz

### Electrical Specifications II,

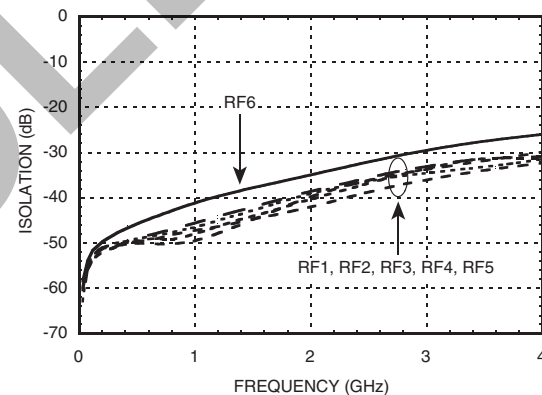
$T_A = +25^\circ\text{C}$ , For TTL Control and  $V_{DD} = +3.3\text{V}$  in a 50 Ohm System

| Parameter                       | Frequency     | Min. | Typ. | Max. | Units |
|---------------------------------|---------------|------|------|------|-------|
| Insertion Loss                  | DC - 1.0 GHz  |      | 0.8  |      | dB    |
| Isolation                       | DC - 1.0 GHz  |      | 41   |      | dB    |
| Return Loss "On State"          | DC - 1.0 GHz  |      | 21   |      | dB    |
| Return Loss RF1-6 "Off State"   | 0.3 - 1.0 GHz |      | 11   |      | dB    |
| Input Power for 1dB Compression | 0.1 - 1.0 GHz |      | 19   |      | dBm   |

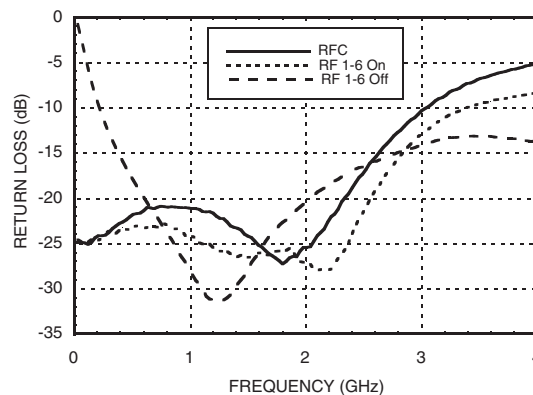
**Insertion Loss** <sup>[1]</sup>



**Isolation** <sup>[1]</sup>



**Return Loss** <sup>[1]</sup>



[1]  $V_{DD} = 5\text{V}$

### Bias Voltages & Currents

| $V_{DD}$<br>(V)              | I <sub>DD</sub> (Typ.)<br>(mA) | I <sub>DD</sub> (Max.)<br>(mA) |
|------------------------------|--------------------------------|--------------------------------|
| +3.3 (V <sub>DC</sub> ± 5%)  | 4.8                            | 8                              |
| +5.0 (V <sub>DC</sub> ± 10%) | 5                              | 8                              |

### TTL/CMOS Control Voltages

| $V_{DD}$ (V) | State | Bias Condition                            |
|--------------|-------|-------------------------------------------|
| +3.3         | Low   | 0 to +0.8 V <sub>DC</sub> @ 5μA Typ.      |
|              | High  | +2.0 to +3.3 V <sub>DC</sub> @ 70 μA Typ. |
| +5.0         | Low   | 0 to +0.8 V <sub>DC</sub> @ 5μA Typ.      |
|              | High  | +2.0 to +5 V <sub>DC</sub> @ 70 μA Typ.   |

### Truth Table

| Control Input |      |      | Signal Path State |
|---------------|------|------|-------------------|
| A             | B    | C    | RFCOM to:         |
| LOW           | LOW  | LOW  | RF1               |
| HIGH          | LOW  | LOW  | RF2               |
| LOW           | HIGH | LOW  | RF3               |
| HIGH          | HIGH | LOW  | RF4               |
| LOW           | LOW  | HIGH | RF5               |
| HIGH          | LOW  | HIGH | RF6               |
| LOW           | HIGH | HIGH | ALL OFF           |
| HIGH          | HIGH | HIGH | ALL OFF           |

#### NOTE:

- DC Blocking capacitors are required at ports RFC and RF1, 2, 3, 4, 5, 6.
- Input is reflective when "ALL OFF" state is selected.

OBSOLETE

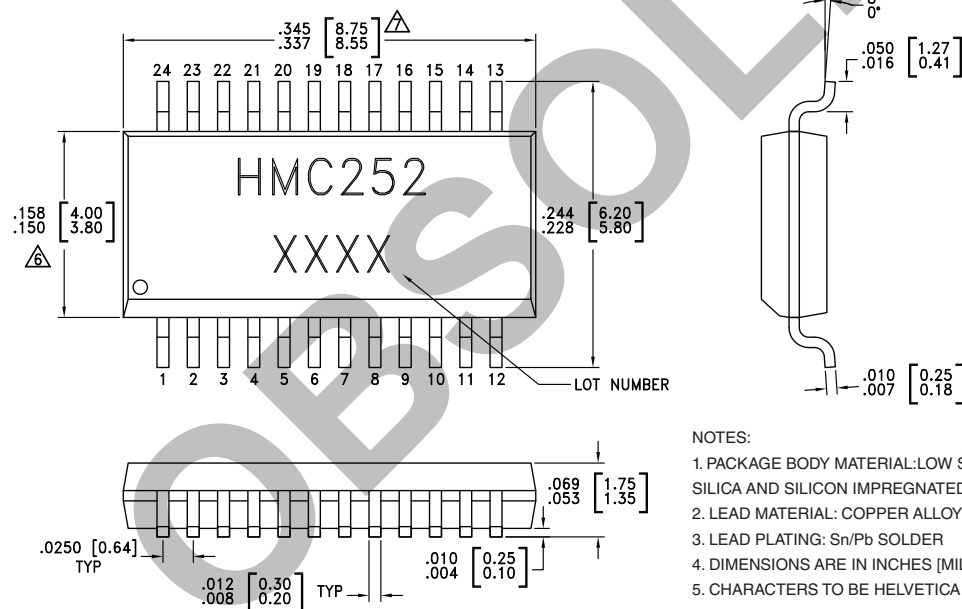
### Absolute Maximum Ratings

|                                             |                                                     |
|---------------------------------------------|-----------------------------------------------------|
| Bias Voltage Range (Port Vdd)               | +7 Vdc                                              |
| Control Voltage Range (A, B, C)             | -0.5V to Vdd +1 Vdc                                 |
| Channel Temperature                         | 150 °C                                              |
| Thermal Resistance<br>(Insertion Loss Path) | 117 °C/W                                            |
| Thermal Resistance<br>(Terminated Path)     | 210 °C/W                                            |
| Storage Temperature                         | -65 to +150 °C                                      |
| Operating Temperature                       | -40 to +85 °C                                       |
| Maximum Input Power<br>Vdd = +5 Vdc         | +20 dBm (0.05 - 0.5 GHz)<br>+26 dBm (0.5 - 3.0 GHz) |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



#### NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD MATERIAL: COPPER ALLOY
3. LEAD PLATING: Sn/Pb SOLDER
4. DIMENSIONS ARE IN INCHES [MILLIMETERS]
5. CHARACTERS TO BE HELVETICA MEDIUM, .030 HIGH, WHITE INK, LOCATED APPROXIMATELY AS SHOWN.
6. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
7. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
8. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating | Package Marking [3] |
|-------------|----------------------------------------------------|---------------|------------|---------------------|
| HMC252QS24  | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 [1]   | HMC252<br>XXXX      |
| HMC252QS24E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2]   | HMC252<br>XXXX      |

[1] Max peak reflow temperature of 235 °C

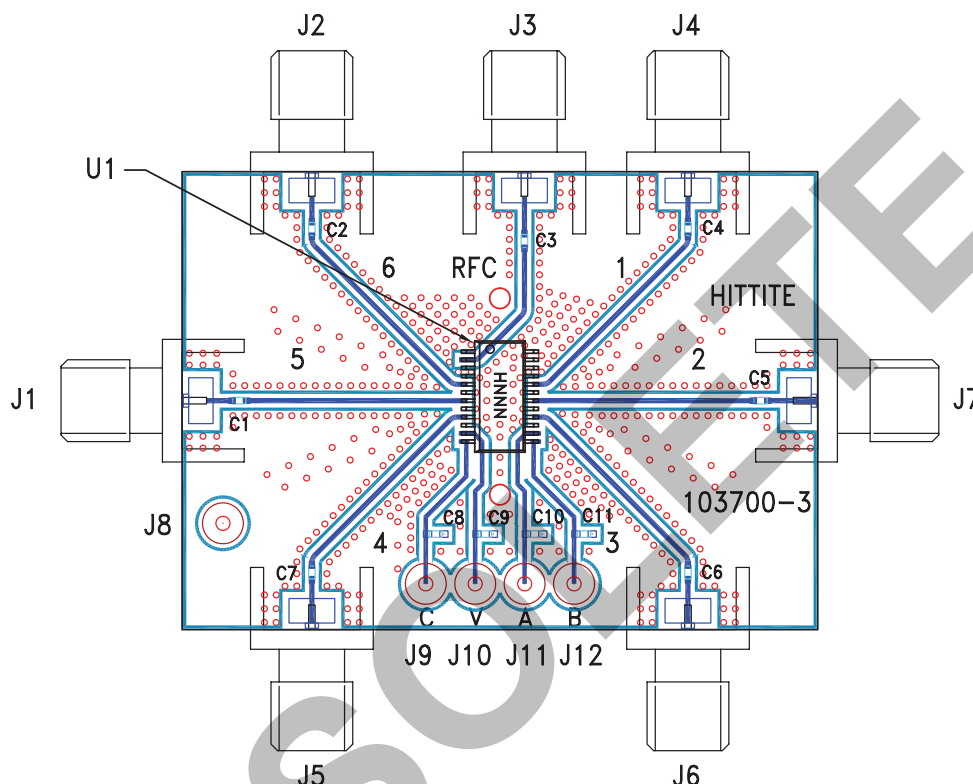
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX



**GaAs MMIC SP6T NON-REFLECTIVE  
SWITCH, DC - 3 GHz**

**Evaluation Circuit Board**



**List of Materials for Evaluation PCB 101673 [1]**

| Item     | Description                             |
|----------|-----------------------------------------|
| J1 - J7  | PCB Mount SMA Connector                 |
| J8 - J12 | DC Pin                                  |
| C1 - C7  | 100 pF Capacitor, 0402 Pkg.             |
| C8 - C11 | 10,000 pF Capacitor, 0603 Pkg.          |
| U1       | HMC252QS24 / HMC252QS24E<br>SP8T Switch |
| PCB [2]  | 103700 Eval Board                       |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should be generated with proper RF circuit design techniques. Signal lines at the RF ports should have 50 ohm impedance while the package ground leads should be connected directly to the ground plane similar to that shown above. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.