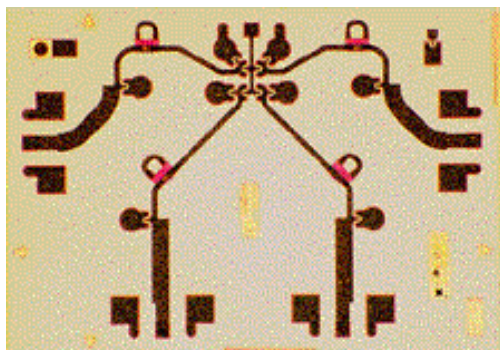


June 29, 2007

0.2- 20 GHz SP4T PIN Switch**TGS2304-SCC****Key Features and Performance**

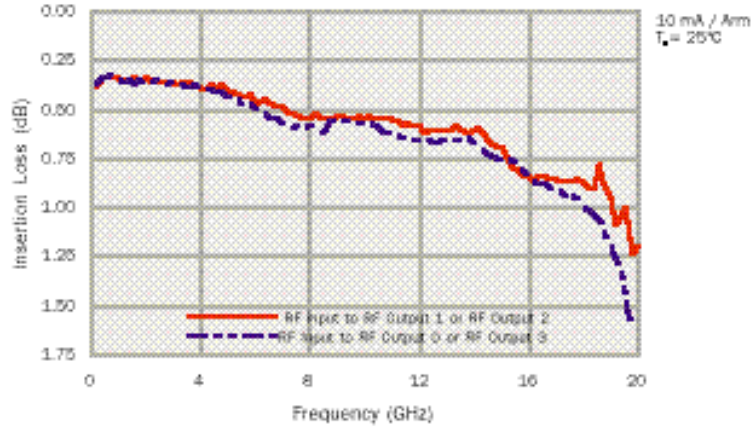
- 0.2 to 20 GHz Frequency Range
- 0.6 dB Typical Midband Insertion Loss
- 38 dB Typical Midband Isolation
- Typical Input / Output SWR 1.2:1, Midband
- 23 dB Typical Input Power at 1 dB Gain Compression
- 2.5 x 3.6 x 0.1 mm (0.100 x 0.140 x 0.004 in.)

Description

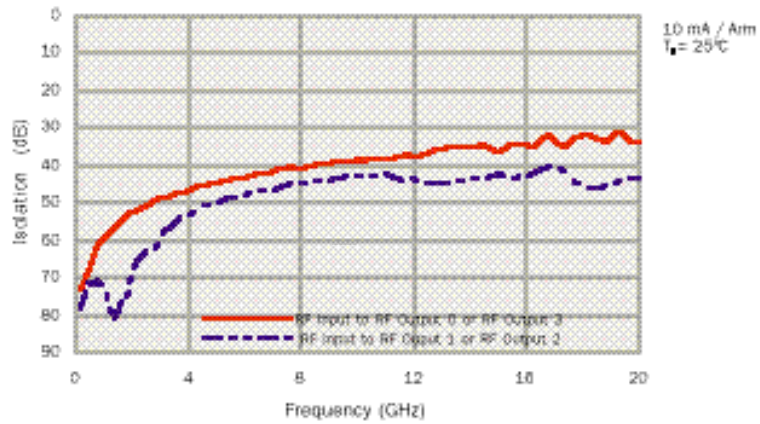
The TriQuint TGS2304-SCC is a GaAs monolithic PIN-diode single-pole, four-throw switch, in chip form, that operates from 0.2 to 20 GHz. Each arm consists of one series and two shunt PIN diodes. At a bias current of 10 mA per RF output arm, typical midband insertion loss is 0.6 dB; midband return loss is approximately 20 dB. Typical isolation at 10 mA bias is 40 dB. Insertion loss and isolation can be adjusted by varying the switch arm bias currents.

Using a GaAs vertical PIN diode process, TriQuint has produced switches with high power handling capability, low on-state resistance, and low off-state capacitance. The higher cutoff frequency of the PIN diode element makes this switch ideal for broadband electronic components and communication systems wherein the MMIC construction offers reduced size, cost, and assembly time. Bond pad and backside metallization is gold plated for compatibility with eutectic alloy attach methods as well as thermocompression and thermosonic wire-bonding processes.

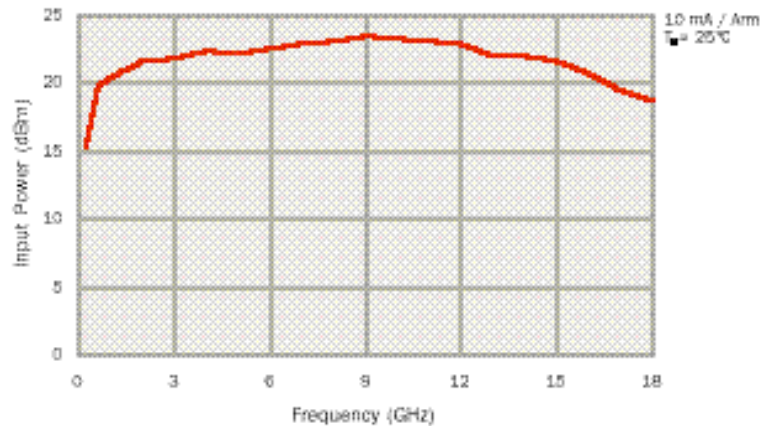
**TYPICAL
INSERTION
LOSS**



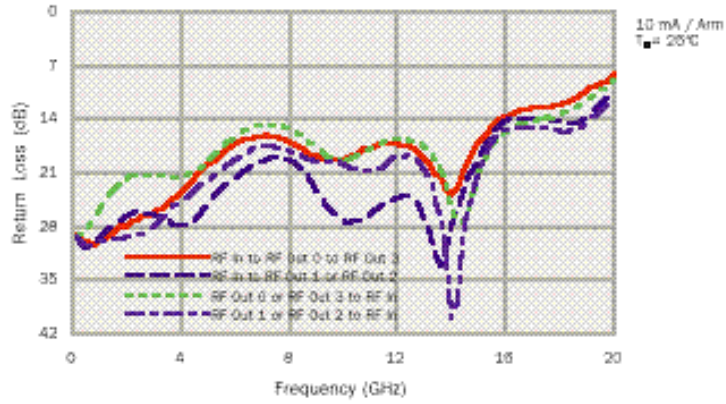
**TYPICAL
ISOLATION**



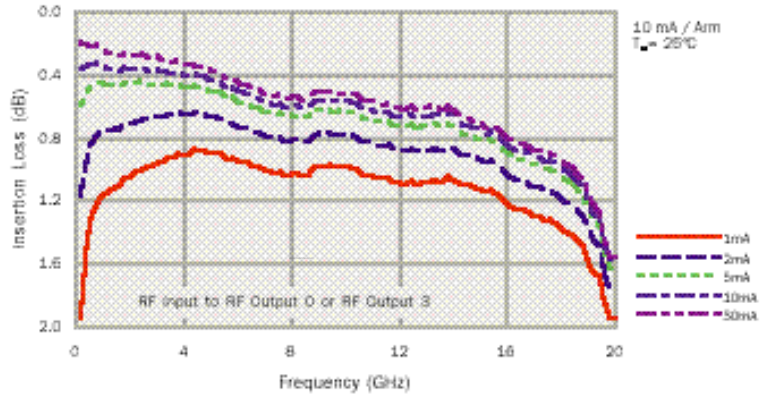
**TYPICAL
INPUT POWER
 P_{1dB}**



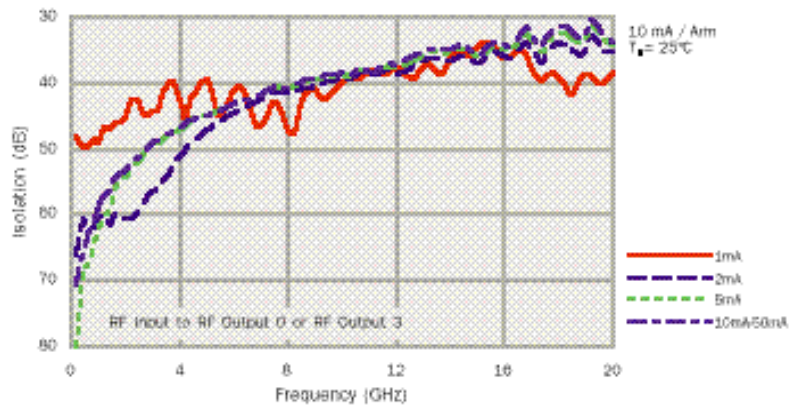
**TYPICAL
RETURN LOSS**



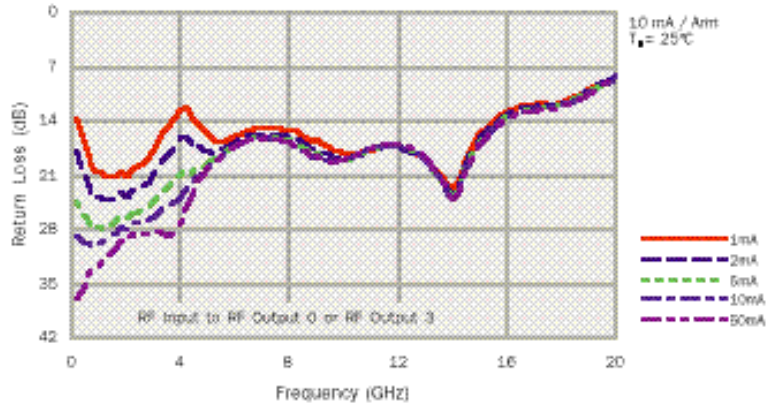
**TYPICAL
INSERTION
LOSS VS. CONTROL
BIAS CURRENT**



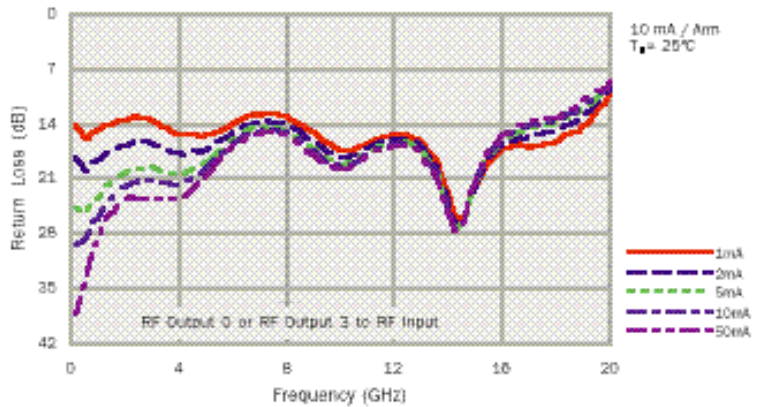
**TYPICAL ISOLATION
VS. CONTROL
BIAS CURRENT**



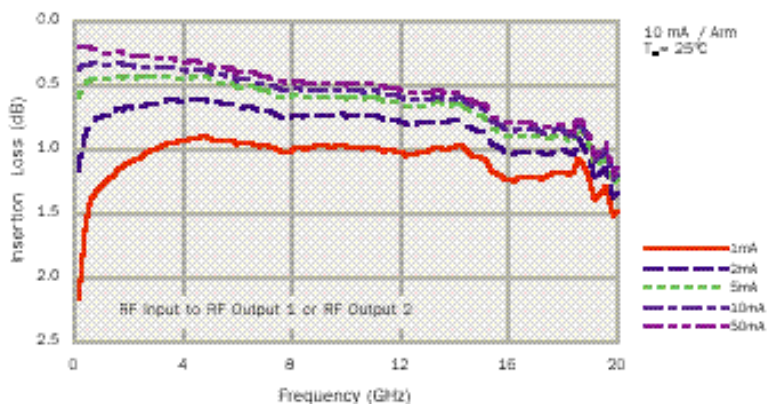
**TYPICAL INPUT
RETURN LOSS VS.
CONTROL BIAS
CURRENT**



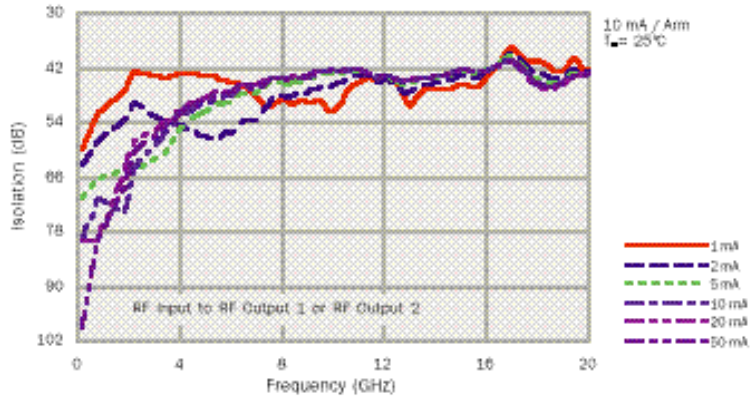
**TYPICAL OUTPUT
RETURN LOSS VS.
CONTROL BIAS
CURRENT**



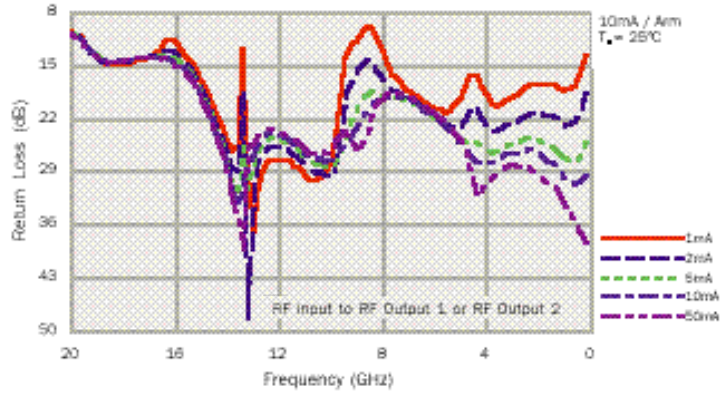
**TYPICAL INSERTION
LOSS VS. CONTROL
BIAS CURRENT**



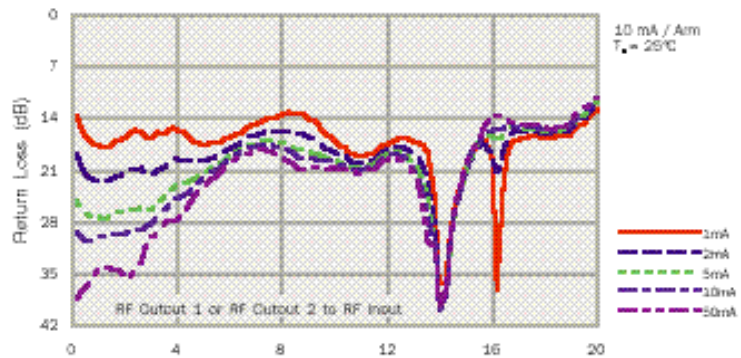
TYPICAL ISOLATION VS. CONTROL BIAS CURRENT



TYPICAL INPUT RETURN LOSS VS. CONTROL BIAS CURRENT



TYPICAL INPUT RETURN LOSS VS. CONTROL BIAS CURRENT



| | | |
|---|---|--------------|
| ABSOLUTE MAXIMUM RATINGS | Forward Voltage, V_F | 2.5 V |
| | Forward Voltage, V_R | 30 V |
| | Bias current..... | 50 mA |
| | Power dissipation, P_{DISS} | 0.2 W/arm |
| | Input continuous wave power, P_{IN} | 2 W |
| | Operating channel temperature, T_{CH} | 150°C |
| | Mounting temperature (30 sec.), T_M | 320°C |
| | Storage temperature range, T_{STG} | -65 to 150°C |

Ratings over operating channel temperature range, T_{CH} (unless otherwise noted).

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

DC blocks are not provided at RF ports.

TABLE I
DC PROBE TESTS (100%)
($T_A = 25^\circ\text{C}$, Nominal)

| NOTES | SYMBOL <u>2/</u> | TEST CONDITIONS <u>1/</u> | LIMITS | | UNITS |
|-----------|---------------------|----------------------------|--------|------|-------|
| | | | MIN | MAX | |
| <u>1/</u> | BREV | $I_R = 10 \mu\text{A}$ | 30 | 60 | V |
| | RES | $I_F = 10 - 20 \text{ mA}$ | 2.50 | 5.05 | Ohms |

1/ BREV is negative.

2/ Test conditions and limits apply to all diodes (D1 – D12).

TABLE II
ELECTRICAL CHARACTERISTICS
(T_A = 25° C, Nominal)

| TEST | THROUGH PATH IDENTIFICATION | MEASUREMENT CONDITIONS | VALUE | | | UNITS | STATE <u>1/</u> |
|--------------------|-----------------------------|------------------------|-------|------|-----|-------|--------------------|
| | | | MIN | TYP | MAX | | |
| INSERTION LOSS | RF INPUT TO RF OUTPUT 3 | F = 0.2 - 5 GHz | - | 0.4 | 0.5 | dB | C |
| | | F = 5 - 18 GHz | - | 0.7 | 1.4 | | |
| | | F = 18 - 20 GHz | - | 1.3 | 2 | | |
| | RF INPUT TO RF OUTPUT 2 | F = 0.2 - 5 GHz | - | 0.4 | 0.5 | | A |
| | | F = 5 - 18 GHz | - | 0.6 | 1 | | |
| | | F = 18 - 20 GHz | - | 1 | 1.8 | | |
| ISOLATION | RF INPUT TO RF OUTPUT 3 | F = 0.2 - 17.9 GHz | 30 | 38 | - | dB | D |
| | | F = 18 - 20 GHz | 28.5 | 32 | | | |
| | RF INPUT TO RF OUTPUT 2 | F = 0.2 - 15.9 GHz | 36 | 44 | - | | B |
| | | F = 16 - 18 GHz | 33 | 40 | | | |
| | | F = 18.1 - 20 GHz | 36 | 44 | | | |
| | | | | | | | |
| INPUT RETURN LOSS | RF INPUT TO RF OUTPUT 3 | F = 0.2 - 18 GHz | 8 | 16.5 | - | dB | C |
| | | F = 18 - 18.9 GHz | 7 | 9.6 | - | | |
| | | F = 19 - 20 GHz | 5 | 8 | | | |
| | RF INPUT TO RF OUTPUT 2 | F = 0.2 - 18 GHz | 10 | 14.9 | - | | A |
| | | F = 18 - 18.9 GHz | 7 | 11.4 | - | | |
| | | F = 19 - 20 GHz | 6 | 8 | | | |
| OUTPUT RETURN LOSS | RF INPUT TO RF OUTPUT 3 | F = 0.2 - 18 GHz | 9 | 23.1 | - | dB | C |
| | | F = 18 - 18.9 GHz | 8 | 12 | - | | |
| | | F = 19 - 20 GHz | 5 | 8 | | | |
| | RF INPUT TO RF OUTPUT 2 | F = 0.2 - 18 GHz | 10 | 19.2 | - | | A |
| | | F = 18 - 18.9 GHz | 7.5 | 14 | - | | |
| | | F = 19 - 20 GHz | 6 | 8 | | | |

1/ See Table III

TABLE III
SWITCH BIAS CONDITIONS

| STATE | RF PATH | RF INPUT | RF OUTPUT 3 | | RF OUTPUT 2 | |
|-------|----------|----------|-------------|---------|-------------|---------|
| | | | VOLTAGE | CURRENT | VOLTAGE | CURRENT |
| A | LOW LOSS | GND | +V | +10 mA | -V | -10 mA |
| B | ISOLATED | GND | -V | -10 mA | +V | +10 mA |
| C | LOW LOSS | GND | -V | -10 mA | +V | +10 mA |
| D | ISOLATED | GND | +V | +10 mA | -V | -10 mA |

| STATE | RF PATH | RF INPUT | RF OUTPUT 1 | | RF OUTPUT 0 | |
|-------|----------|----------|-------------|---------|-------------|---------|
| | | | VOLTAGE | CURRENT | VOLTAGE | CURRENT |
| A | LOW LOSS | GND | +V | +10 mA | +V | +10 mA |
| B | ISOLATED | GND | +V | +10 mA | +V | +10 mA |
| C | LOW LOSS | GND | +V | +10 mA | +V | +10 mA |
| D | ISOLATED | GND | +V | +10 mA | +V | +10 mA |

TYPICAL
S-PARAMETERS
(through path)
RF Input to RF output 3, 0

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | Insertion Loss (dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|------------------------|
| | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | |
| 0.5 | 0.03 | -36 | 0.962 | -6 | 0.960 | -6 | 0.04 | -45 | 0.3 |
| 1.0 | 0.03 | -63 | 0.963 | -11 | 0.963 | -11 | 0.05 | -59 | 0.3 |
| 1.5 | 0.04 | 90 | 0.959 | -17 | 0.961 | -17 | 0.07 | -65 | 0.4 |
| 2.0 | 0.04 | -106 | 0.959 | -23 | 0.959 | -23 | 0.08 | -69 | 0.4 |
| 2.5 | 0.05 | -117 | 0.961 | -28 | 0.958 | -28 | 0.09 | -74 | 0.3 |
| 3.0 | 0.05 | -117 | 0.960 | -34 | 0.959 | -34 | 0.09 | -82 | 0.4 |
| 3.5 | 0.06 | -114 | 0.957 | -40 | 0.957 | -40 | 0.09 | -94 | 0.4 |
| 4.0 | 0.07 | -111 | 0.955 | -46 | 0.954 | -45 | 0.08 | -110 | 0.4 |
| 4.5 | 0.08 | -112 | 0.955 | -51 | 0.953 | -51 | 0.09 | -129 | 0.4 |
| 5.0 | 0.10 | -117 | 0.951 | -57 | 0.951 | -57 | 0.11 | -143 | 0.4 |
| 5.5 | 0.12 | -126 | 0.948 | -63 | 0.948 | -63 | 0.13 | -152 | 0.5 |
| 6.0 | 0.14 | -136 | 0.945 | -69 | 0.946 | -69 | 0.15 | -159 | 0.5 |
| 6.5 | 0.15 | -146 | 0.940 | -75 | 0.941 | -74 | 0.17 | -164 | 0.5 |
| 7.0 | 0.15 | -154 | 0.937 | -80 | 0.937 | -80 | 0.18 | -167 | 0.6 |
| 7.5 | 0.15 | -163 | 0.935 | -86 | 0.933 | -86 | 0.18 | -171 | 0.6 |
| 8.0 | 0.15 | -169 | 0.935 | -91 | 0.932 | -91 | 0.18 | -175 | 0.6 |
| 8.5 | 0.13 | -171 | 0.932 | -97 | 0.933 | -97 | 0.16 | 177 | 0.6 |
| 9.0 | 0.12 | -166 | 0.938 | -102 | 0.939 | -102 | 0.14 | 169 | 0.6 |
| 9.5 | 0.11 | -162 | 0.937 | -108 | 0.936 | -108 | 0.12 | 157 | 0.6 |
| 10.0 | 0.11 | -158 | 0.937 | -114 | 0.936 | -114 | 0.11 | 142 | 0.6 |
| 10.5 | 0.12 | -161 | 0.935 | -120 | 0.933 | -120 | 0.11 | 130 | 0.6 |
| 11.0 | 0.13 | -167 | 0.932 | -126 | 0.931 | -126 | 0.13 | 120 | 0.6 |
| 11.5 | 0.14 | -175 | 0.930 | -132 | 0.929 | -132 | 0.14 | 112 | 0.6 |
| 12.0 | 0.14 | 176 | 0.927 | -138 | 0.924 | -138 | 0.15 | 108 | 0.7 |
| 12.5 | 0.13 | 165 | 0.927 | -144 | 0.926 | -144 | 0.15 | 106 | 0.7 |
| 13.0 | 0.11 | 158 | 0.927 | -150 | 0.926 | -150 | 0.13 | 103 | 0.7 |
| 13.5 | 0.09 | 160 | 0.927 | -156 | 0.926 | -156 | 0.10 | 96 | 0.7 |
| 14.0 | 0.06 | -171 | 0.926 | -163 | 0.925 | -163 | 0.06 | 75 | 0.7 |
| 14.5 | 0.10 | -133 | 0.920 | -169 | 0.919 | -169 | 0.04 | -4 | 0.7 |
| 15.0 | 0.15 | -129 | 0.917 | -175 | 0.915 | -175 | 0.09 | -44 | 0.8 |
| 15.5 | 0.18 | -131 | 0.916 | 179 | 0.913 | 179 | 0.13 | -57 | 0.8 |
| 16.0 | 0.21 | -137 | 0.909 | 172 | 0.908 | 172 | 0.16 | -63 | 0.8 |
| 16.5 | 0.23 | -145 | 0.904 | 166 | 0.902 | 166 | 0.18 | -68 | 0.9 |
| 17.0 | 0.24 | -152 | 0.900 | 159 | 0.899 | 159 | 0.19 | -72 | 0.9 |
| 17.5 | 0.24 | -159 | 0.897 | 152 | 0.896 | 152 | 0.20 | -77 | 0.9 |
| 18.0 | 0.25 | -166 | 0.893 | 145 | 0.892 | 145 | 0.21 | -87 | 1.0 |
| 18.5 | 0.27 | -165 | 0.887 | 137 | 0.885 | 138 | 0.23 | -104 | 1.0 |
| 19.0 | 0.31 | -161 | 0.871 | 130 | 0.872 | 130 | 0.27 | -124 | 1.2 |
| 19.5 | 0.34 | -154 | 0.854 | 122 | 0.845 | 123 | 0.31 | -143 | 1.4 |
| 20.0 | 0.39 | -156 | 0.833 | 118 | 0.839 | 119 | 0.36 | -156 | 1.6 |

T_A = 25°C, I = 10 mA

The reference planes for S-parameter data include bond wires as specified in the test assembly diagram. The S-parameters are also available on floppy disk and the world wide web.

TYPICAL
S-PARAMETERS
(isolated path)
RF Input to RF output 3

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | Isolation (dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-------------------|
| | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | |
| 0.5 | 0.06 | 15 | 0.0005 | -87 | 0.0005 | -75 | 0.90 | 177 | 66.3 |
| 1.0 | 0.06 | -2 | 0.0011 | -113 | 0.0011 | -119 | 0.90 | 173 | 59.2 |
| 1.5 | 0.05 | -22 | 0.0017 | -132 | 0.0017 | -129 | 0.88 | 169 | 55.2 |
| 2.0 | 0.04 | -5 | 0.0023 | -151 | 0.0023 | -149 | 0.87 | 166 | 52.8 |
| 2.5 | 0.06 | -52 | 0.0029 | -160 | 0.0029 | -162 | 0.87 | 163 | 50.8 |
| 3.0 | 0.02 | -34 | 0.0037 | -168 | 0.0037 | -170 | 0.86 | 158 | 48.6 |
| 3.5 | 0.08 | -57 | 0.0041 | -180 | 0.0041 | -180 | 0.87 | 153 | 47.7 |
| 4.0 | 0.07 | -103 | 0.0046 | 175 | 0.0046 | 175 | 0.87 | 148 | 46.7 |
| 4.5 | 0.05 | -95 | 0.0054 | 167 | 0.0054 | 168 | 0.88 | 144 | 45.4 |
| 5.0 | 0.08 | -112 | 0.0058 | 163 | 0.0058 | 161 | 0.88 | 141 | 44.7 |
| 5.5 | 0.08 | -131 | 0.0064 | 158 | 0.0064 | 157 | 0.88 | 138 | 43.9 |
| 6.0 | 0.07 | -149 | 0.0070 | 154 | 0.0070 | 155 | 0.89 | 136 | 43.1 |
| 6.5 | 0.12 | -140 | 0.0076 | 151 | 0.0076 | 150 | 0.88 | 133 | 42.4 |
| 7.0 | 0.13 | 173 | 0.0082 | 151 | 0.0082 | 150 | 0.88 | 129 | 41.7 |
| 7.5 | 0.05 | -169 | 0.0095 | 143 | 0.0095 | 142 | 0.88 | 126 | 40.4 |
| 8.0 | 0.11 | 177 | 0.0092 | 140 | 0.0092 | 141 | 0.88 | 123 | 40.7 |
| 8.5 | 0.04 | 170 | 0.0103 | 138 | 0.0103 | 138 | 0.87 | 119 | 39.7 |
| 9.0 | 0.06 | -153 | 0.0109 | 135 | 0.0109 | 135 | 0.87 | 114 | 39.3 |
| 9.5 | 0.08 | -141 | 0.0115 | 130 | 0.0115 | 130 | 0.87 | 111 | 38.8 |
| 10.0 | 0.09 | -164 | 0.0120 | 126 | 0.0120 | 126 | 0.87 | 107 | 38.4 |
| 10.5 | 0.10 | -171 | 0.0123 | 127 | 0.0123 | 128 | 0.87 | 102 | 38.2 |
| 11.0 | 0.14 | 165 | 0.0123 | 124 | 0.0123 | 124 | 0.87 | 96 | 38.2 |
| 11.5 | 0.12 | 97 | 0.0134 | 126 | 0.0134 | 126 | 0.87 | 90 | 37.5 |
| 12.0 | 0.10 | 141 | 0.0132 | 123 | 0.0132 | 122 | 0.87 | 86 | 37.6 |
| 12.5 | 0.13 | 69 | 0.0153 | 125 | 0.0153 | 125 | 0.87 | 84 | 36.3 |
| 13.0 | 0.09 | 32 | 0.0167 | 120 | 0.0167 | 121 | 0.88 | 83 | 35.6 |
| 13.5 | 0.09 | -42 | 0.0179 | 113 | 0.0179 | 113 | 0.87 | 82 | 34.9 |
| 14.0 | 0.09 | -84 | 0.0178 | 109 | 0.0178 | 109 | 0.86 | 78 | 35.0 |
| 14.5 | 0.18 | -78 | 0.0188 | 104 | 0.0188 | 102 | 0.86 | 73 | 34.5 |
| 15.0 | 0.22 | -148 | 0.0159 | 102 | 0.0159 | 102 | 0.85 | 67 | 36.0 |
| 15.5 | 0.07 | -79 | 0.0197 | 103 | 0.0197 | 104 | 0.86 | 62 | 34.1 |
| 16.0 | 0.22 | -128 | 0.0188 | 95 | 0.0188 | 95 | 0.85 | 56 | 34.5 |
| 16.5 | 0.08 | 76 | 0.0220 | 101 | 0.0220 | 102 | 0.85 | 52 | 33.2 |
| 17.0 | 0.28 | -97 | 0.0229 | 76 | 0.0229 | 76 | 0.85 | 48 | 32.8 |
| 17.5 | 0.08 | -140 | 0.0197 | 89 | 0.0197 | 89 | 0.85 | 46 | 34.1 |
| 18.0 | 0.24 | -90 | 0.0257 | 77 | 0.0257 | 77 | 0.86 | 43 | 31.8 |
| 18.5 | 0.40 | -133 | 0.0238 | 61 | 0.0238 | 62 | 0.86 | 39 | 32.5 |
| 19.0 | 0.16 | -156 | 0.0232 | 71 | 0.0232 | 72 | 0.85 | 31 | 32.7 |
| 19.5 | 0.51 | -141 | 0.0247 | 44 | 0.0247 | 46 | 0.86 | 23 | 32.2 |
| 20.0 | 0.43 | -164 | 0.0201 | 48 | 0.0201 | 48 | 0.83 | 18 | 33.9 |

T_A = 25°C, I = 10 mA

The reference planes for S-parameter data include bond wires as specified in the test assembly diagram. The S-parameters are also available on floppy disk and the world wide web.

TYPICAL
S-PARAMETERS
(through path)
RF Input to RF output 2, 1

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | Insertion Loss (dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|------------------------|
| | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | |
| 0.5 | 0.03 | -26 | 0.962 | -6 | 0.964 | -6 | 0.03 | -33 | 0.3 |
| 1.0 | 0.03 | -41 | 0.962 | -12 | 0.963 | -12 | 0.03 | -49 | 0.3 |
| 1.5 | 0.04 | -51 | 0.962 | -18 | 0.963 | -18 | 0.03 | -61 | 0.3 |
| 2.0 | 0.05 | -56 | 0.962 | -24 | 0.962 | -24 | 0.03 | -72 | 0.3 |
| 2.5 | 0.05 | -62 | 0.960 | -29 | 0.960 | -30 | 0.04 | -81 | 0.4 |
| 3.0 | 0.05 | -67 | 0.960 | -35 | 0.959 | -35 | 0.04 | -86 | 0.4 |
| 3.5 | 0.04 | -76 | 0.960 | -41 | 0.957 | -41 | 0.05 | -91 | 0.4 |
| 4.0 | 0.04 | -91 | 0.957 | -48 | 0.957 | -47 | 0.06 | -99 | 0.4 |
| 4.5 | 0.04 | -107 | 0.958 | -53 | 0.956 | -53 | 0.07 | -109 | 0.4 |
| 5.0 | 0.06 | -123 | 0.954 | -59 | 0.954 | -59 | 0.08 | -123 | 0.4 |
| 5.5 | 0.07 | -133 | 0.952 | -65 | 0.952 | -65 | 0.09 | -136 | 0.4 |
| 6.0 | 0.08 | -142 | 0.948 | -71 | 0.951 | -71 | 0.11 | -147 | 0.5 |
| 6.5 | 0.10 | -150 | 0.949 | -77 | 0.945 | -77 | 0.12 | -157 | 0.5 |
| 7.0 | 0.11 | -154 | 0.946 | -83 | 0.946 | -83 | 0.13 | -166 | 0.5 |
| 7.5 | 0.11 | -155 | 0.941 | -89 | 0.944 | -89 | 0.13 | -176 | 0.5 |
| 8.0 | 0.11 | -158 | 0.940 | -95 | 0.940 | -95 | 0.13 | 176 | 0.5 |
| 8.5 | 0.09 | -164 | 0.940 | -101 | 0.940 | -101 | 0.12 | 172 | 0.5 |
| 9.0 | 0.07 | -175 | 0.941 | -106 | 0.940 | -106 | 0.11 | 178 | 0.5 |
| 9.5 | 0.05 | 162 | 0.940 | -112 | 0.939 | -112 | 0.11 | -176 | 0.5 |
| 10.0 | 0.04 | 144 | 0.939 | -118 | 0.937 | -118 | 0.10 | -175 | 0.5 |
| 10.5 | 0.04 | 143 | 0.939 | -124 | 0.940 | -124 | 0.10 | 178 | 0.5 |
| 11.0 | 0.05 | 146 | 0.940 | -130 | 0.938 | -130 | 0.09 | 165 | 0.5 |
| 11.5 | 0.06 | 133 | 0.936 | -136 | 0.939 | -137 | 0.10 | 156 | 0.6 |
| 12.0 | 0.06 | 110 | 0.935 | -143 | 0.935 | -143 | 0.11 | 155 | 0.6 |
| 12.5 | 0.06 | 95 | 0.933 | -149 | 0.933 | -149 | 0.11 | 152 | 0.6 |
| 13.0 | 0.05 | 92 | 0.933 | -155 | 0.932 | -155 | 0.10 | 145 | 0.6 |
| 13.5 | 0.02 | 139 | 0.934 | -161 | 0.932 | -161 | 0.05 | 128 | 0.6 |
| 14.0 | 0.04 | -143 | 0.933 | -167 | 0.932 | -167 | 0.01 | 66 | 0.6 |
| 14.5 | 0.07 | -113 | 0.928 | -174 | 0.931 | -174 | 0.04 | -84 | 0.6 |
| 15.0 | 0.11 | -93 | 0.924 | 180 | 0.921 | 180 | 0.09 | -111 | 0.7 |
| 15.5 | 0.16 | -90 | 0.912 | 174 | 0.914 | 174 | 0.14 | -123 | 0.8 |
| 16.0 | 0.19 | -94 | 0.908 | 168 | 0.907 | 168 | 0.17 | -130 | 0.8 |
| 16.5 | 0.20 | -103 | 0.908 | 161 | 0.907 | 161 | 0.18 | -129 | 0.8 |
| 17.0 | 0.21 | -108 | 0.907 | 154 | 0.908 | 155 | 0.18 | -133 | 0.8 |
| 17.5 | 0.20 | -113 | 0.905 | 148 | 0.907 | 148 | 0.18 | -138 | 0.9 |
| 18.0 | 0.20 | -122 | 0.906 | 141 | 0.907 | 141 | 0.17 | -143 | 0.9 |
| 18.5 | 0.19 | -142 | 0.909 | 135 | 0.904 | 134 | 0.17 | -133 | 0.8 |
| 19.0 | 0.21 | -167 | 0.896 | 127 | 0.900 | 127 | 0.19 | -125 | 1.0 |
| 19.5 | 0.25 | -178 | 0.891 | 120 | 0.883 | 120 | 0.22 | -130 | 1.0 |
| 20.0 | 0.30 | -174 | 0.871 | 113 | 0.882 | 114 | 0.26 | -151 | 1.2 |

T_A = 25°C, I = 10 mA

The reference planes for S-parameter data include bond wires as specified in the test assembly diagram. The S-parameters are also available on floppy disk and the world wide web.

TYPICAL
S-PARAMETERS
(isolated path)
RF Input to RF output 2, 1

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | Isolation (dB) |
|--------------------|-----------------|--------|-----------------|--------|-----------------|--------|-----------------|--------|-------------------|
| | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | |
| 0.5 | 0.06 | 10 | 0.0003 | 127 | 0.0003 | 59 | 0.90 | 177 | 70.3 |
| 1.0 | 0.06 | -35 | 0.0002 | 98 | 0.0002 | 48 | 0.90 | 173 | 74.0 |
| 1.5 | 0.08 | -69 | 0.0001 | -70 | 0.0001 | -112 | 0.89 | 169 | 79.3 |
| 2.0 | 0.07 | -80 | 0.0004 | 147 | 0.0004 | 159 | 0.88 | 165 | 68.0 |
| 2.5 | 0.12 | -88 | 0.0007 | 156 | 0.0007 | 161 | 0.87 | 162 | 63.1 |
| 3.0 | 0.06 | -102 | 0.0011 | 163 | 0.0011 | 161 | 0.87 | 158 | 59.2 |
| 3.5 | 0.09 | -77 | 0.0017 | 155 | 0.0017 | 149 | 0.87 | 155 | 55.4 |
| 4.0 | 0.09 | -106 | 0.0022 | 145 | 0.0022 | 140 | 0.87 | 151 | 53.2 |
| 4.5 | 0.07 | -102 | 0.0029 | 138 | 0.0029 | 139 | 0.88 | 147 | 50.9 |
| 5.0 | 0.11 | -117 | 0.0032 | 130 | 0.0032 | 130 | 0.88 | 143 | 49.9 |
| 5.5 | 0.13 | -135 | 0.0036 | 124 | 0.0036 | 123 | 0.88 | 140 | 48.8 |
| 6.0 | 0.12 | -150 | 0.0040 | 120 | 0.0040 | 120 | 0.89 | 137 | 48.0 |
| 6.5 | 0.16 | -141 | 0.0048 | 115 | 0.0048 | 113 | 0.89 | 134 | 46.4 |
| 7.0 | 0.18 | -172 | 0.0047 | 108 | 0.0047 | 110 | 0.89 | 132 | 46.6 |
| 7.5 | 0.12 | -155 | 0.0059 | 109 | 0.0059 | 108 | 0.89 | 128 | 44.6 |
| 8.0 | 0.19 | -169 | 0.0059 | 93 | 0.0059 | 94 | 0.88 | 124 | 44.6 |
| 8.5 | 0.10 | -177 | 0.0061 | 91 | 0.0061 | 91 | 0.89 | 121 | 44.3 |
| 9.0 | 0.10 | -156 | 0.0062 | 90 | 0.0062 | 90 | 0.88 | 118 | 44.2 |
| 9.5 | 0.10 | -139 | 0.0072 | 86 | 0.0072 | 85 | 0.88 | 115 | 42.9 |
| 10.0 | 0.12 | -148 | 0.0075 | 77 | 0.0075 | 76 | 0.88 | 111 | 42.5 |
| 10.5 | 0.15 | -150 | 0.0073 | 70 | 0.0073 | 70 | 0.87 | 107 | 42.7 |
| 11.0 | 0.21 | -170 | 0.0076 | 59 | 0.0076 | 61 | 0.88 | 103 | 42.4 |
| 11.5 | 0.14 | 151 | 0.0066 | 47 | 0.0066 | 48 | 0.88 | 101 | 43.6 |
| 12.0 | 0.18 | 172 | 0.0067 | 51 | 0.0067 | 53 | 0.89 | 100 | 43.5 |
| 12.5 | 0.13 | 122 | 0.0059 | 44 | 0.0059 | 44 | 0.88 | 98 | 44.5 |
| 13.0 | 0.07 | 115 | 0.0057 | 44 | 0.0057 | 44 | 0.89 | 94 | 44.9 |
| 13.5 | 0.03 | -134 | 0.0061 | 43 | 0.0061 | 43 | 0.87 | 88 | 44.3 |
| 14.0 | 0.11 | -145 | 0.0065 | 38 | 0.0065 | 39 | 0.88 | 81 | 43.7 |
| 14.5 | 0.15 | -112 | 0.0066 | 35 | 0.0066 | 34 | 0.87 | 76 | 43.6 |
| 15.0 | 0.31 | -152 | 0.0077 | 28 | 0.0077 | 27 | 0.87 | 72 | 42.3 |
| 15.5 | 0.12 | -153 | 0.0070 | 20 | 0.0070 | 20 | 0.85 | 71 | 43.1 |
| 16.0 | 0.28 | -141 | 0.0075 | 22 | 0.0075 | 22 | 0.87 | 66 | 42.5 |
| 16.5 | 0.17 | 139 | 0.0086 | 14 | 0.0086 | 13 | 0.85 | 64 | 41.3 |
| 17.0 | 0.26 | -108 | 0.0102 | -5 | 0.0102 | -5 | 0.87 | 62 | 39.8 |
| 17.5 | 0.18 | -178 | 0.0073 | -25 | 0.0073 | -24 | 0.87 | 63 | 42.7 |
| 18.0 | 0.20 | -110 | 0.0057 | -22 | 0.0057 | -24 | 0.87 | 59 | 44.9 |
| 18.5 | 0.39 | -143 | 0.0050 | -20 | 0.0050 | -18 | 0.88 | 52 | 46.1 |
| 19.0 | 0.27 | 173 | 0.0055 | -14 | 0.0055 | -16 | 0.86 | 39 | 45.2 |
| 19.5 | 0.55 | -160 | 0.0065 | -23 | 0.0065 | -27 | 0.89 | 29 | 43.7 |
| 20.0 | 0.55 | 178 | 0.0070 | -28 | 0.0070 | -29 | 0.85 | 27 | 43.1 |

T_A = 25°C, I = 10 mA

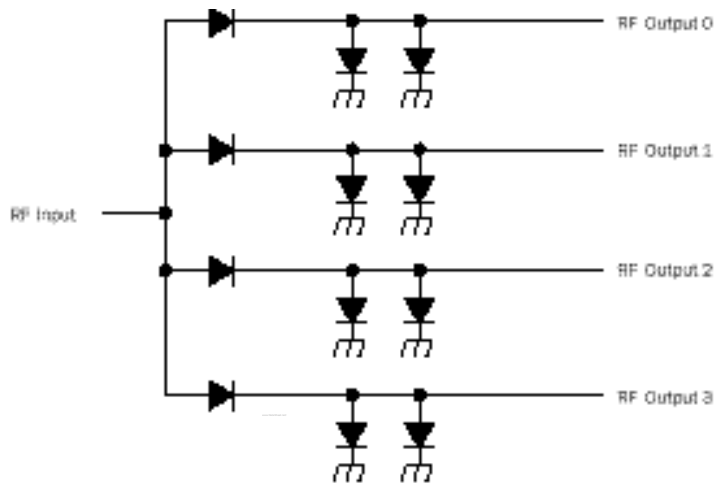
The reference planes for S-parameter data include bond wires as specified in the test assembly diagram. The S-parameters are also available on floppy disk and the world wide web.

RF CHARACTERISTICS

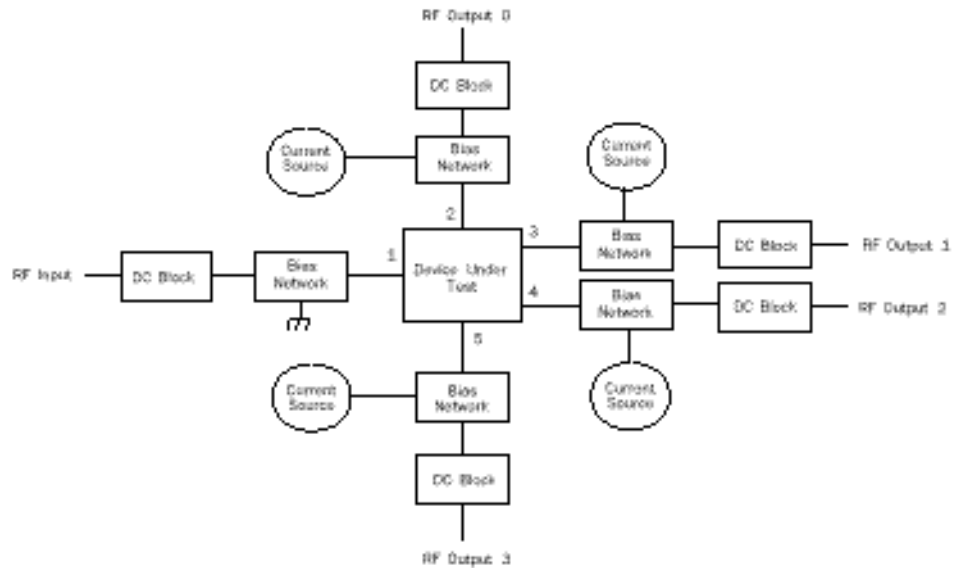
| PARAMETER | | TEST CONDITIONS | TYP |
|---------------|--------------------------------------|--------------------------------------|-------|
| IL | Insertion loss | Midband | 0.6 |
| ISO | Isolation | Midband | 38 |
| SWR(in) | Input standing-wave ratio | Midband | 1.2:1 |
| SWR(out) | Output standing-wave ratio | Through selected output arm, midband | 1.2:1 |
| $P_{1dB(in)}$ | Input power at 1-dB gain compression | | 23 |

$T_A = 25^\circ\text{C}$

EQUIVALENT SCHEMATIC



RECOMMENDED TEST CONFIGURATION

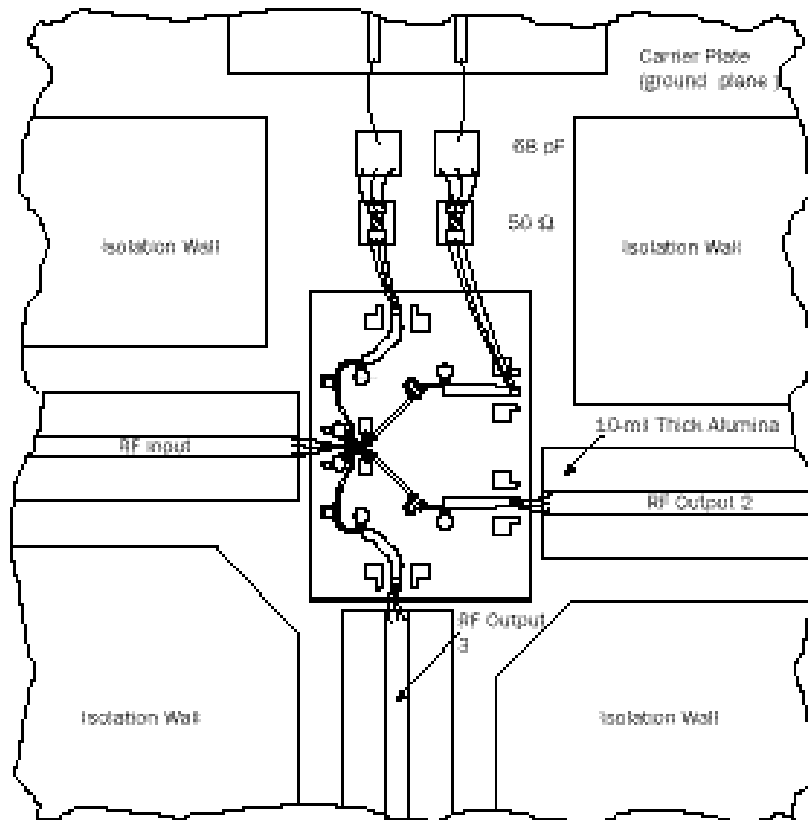


DC blocks are not provided at RF ports.

FUNCTION TABLE

| LOW-LOSS PATH | RF INPUT | RF OUTPUT 0 | RF OUTPUT 1 | RF OUTPUT 2 | RF OUTPUT 3 |
|-------------------------|----------|-------------|-------------|-------------|-------------|
| RF Input to RF Output 0 | 0 V | -10 mA | 10 mA | 10 mA | 10 mA |
| RF Input to RF Output 1 | 0 V | 10 mA | -10 mA | 10 mA | 10 mA |
| RF Input to RF Output 2 | 0 V | 10 mA | 10 mA | -10 mA | 10 mA |
| RF Input to RF Output 3 | 0 V | 10 mA | 10 mA | 10 mA | -10 mA |

**TEST ASSEMBLY
DIAGRAM**

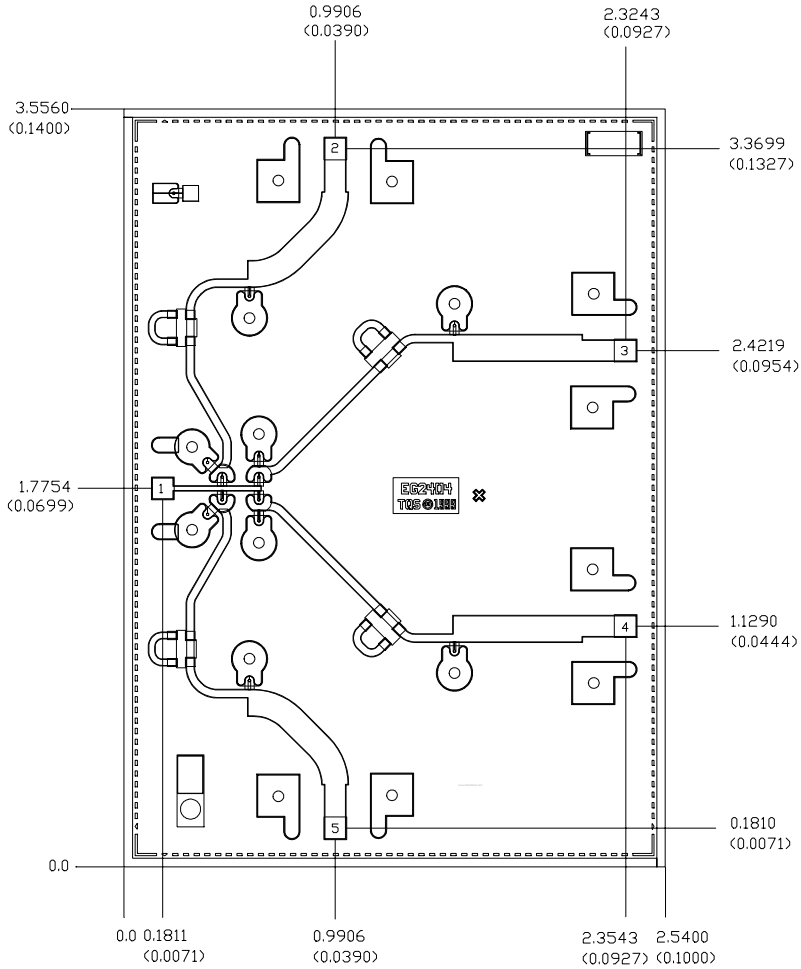


RF connections: bond using three 1.0-mil diameter, 20 to 25-mil-length gold bond wires at both RF Input and RF Output for optimum RF performance.

Close placement of external components is essential for resonant-free performance.

Refer to TriQuint's Gallium Arsenide Products Designer's Information, MMIC Assembly Procedures, on our web site.

June 29, 2007



Units: millimeters (inches)

Thickness: 0.1016 (0.004) (reference only)

Chip edge to bond pad dimensions are shown to center of bond pad

Chip size tolerance: +/- 0.0508 (0.0020)

Bond Pad #1 (RF Input) 0.1016 x 0.1016 (0.004 x 0.004)

Bond Pad #2 (RF Output 0) 0.1016 x 0.1016 (0.004 x 0.004)

Bond Pad #3 (RF Output 1) 0.1016 x 0.1016 (0.004 x 0.004)

Bond Pad #4 (RF Output 2) 0.1016 x 0.1016 (0.004 x 0.004)

Bond Pad #5 (RF Output 3) 0.1016 x 0.1016 (0.004 x 0.004)

Mechanical Drawing

June 29, 2007

Application Notes: Driver Circuit for 2300 Series GaAs PIN Diode Switches

INTRODUCTION

This section describes how a single 5 V power supply and a 74F240N line driver are used in a driver circuit for the TGS2304 PIN-diode switch. The PIN switch must be mounted on a silicon MOS capacitor (MOSCAP or equivalent) of approximately 1000 pF (see Mounting Diagram, page 15). Eight separate drivers are provided in a single 'F240 DIP (see Driver Circuit, page 15). In addition, the 'F240 can be set to provide an inverted or a non-inverted output. The inverted is preferred in this application because it allows the 1G pin to be tied to ground instead of 5 V, eliminating the use of an extra power supply. The 74BCT240, 74BCT240N, and 74S240N also work with this driver circuit.

CONNECTION INSTRUCTIONS

The Interface Schematic (see page 16) shows a voltage divider that can be used to provide approximately 2 V to the RF Input (common) port of the TGS2304-SCC. This bias voltage should be connected to the RF Input through a bias tee or some equivalent RF choke/DC block network.

Connect this same bias voltage to the top plate of the MOSCAP through a ~3-nH coil bonded to MMIC ground pad as shown in the Interface Schematic and RF Input Bias Coil Assembly (both on page 16). Care should be taken not to bond the inductor close to the via, as this could result in device damage. The ground pad is connected to the backside of the TGS2304-SCC by plated-through vias. This sets the top plate of the MOSCAP to 2 V, effectively providing a 2 V reference for the RF input port and the cathodes of the two shunt diodes in each arm. The bottom plate of the MOSCAP is true DC ground.

Connect the four RF Output ports of the TGS2304-SCC to the 'F240 outputs through a bias tee or some equivalent RF choke/DC block, as shown in the Interface Schematic on page 16.

OPERATING INSTRUCTIONS

For proper switch operation, only one arm should be turned on at any one time as shown in the Control Logic Table on page 15. The following description of how the driver circuit controls one arm of the TGS2304-SCC applies to all arms.

To turn an arm on: A TTL high at the 'F240 input results in approximately 0.3 V at the corresponding output. This is applied to the appropriate RF Output port. Since the RF Input port of the TGS2304-SCC is at 2 V, the arm is turned on. The series diode in that arm is forward biased by approximately 1.7 V, and the two shunt diodes are reverse biased (off) by 1.7 V. Under these conditions, the bias current is typically 12 mA and midband insertion loss is typically 0.9 dB.

To turn an arm off: A TTL low at the 'F240 input results in approximately 3.1 V at the corresponding output. This is applied to the appropriate RF Output port. Since the RF Input port of the TGS2304-SCC is at 2 V, the arm is turned off. The series diode in that arm is reverse biased by approximately 1.1 V, and the shunt diodes in that arm are forward biased (on) by 1.1 V. Under these conditions, the bias current is typically 9 mA and the midband isolation is typically 40 dB.

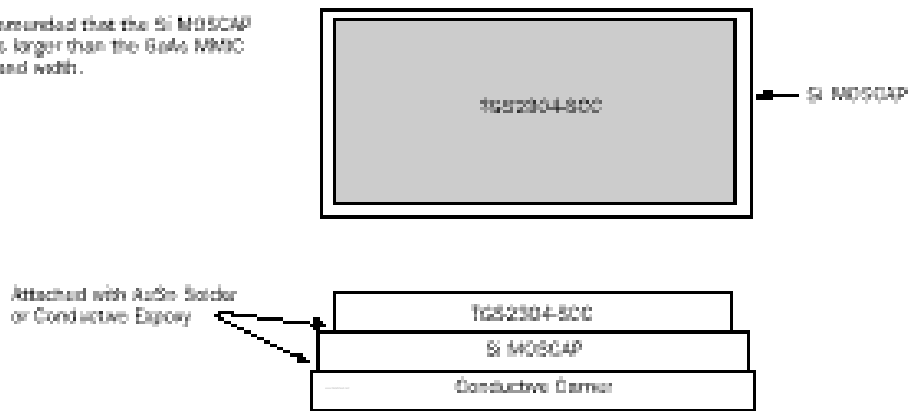
CONTROL LOGIC TABLE

| | DRIVER VOLTAGE APPLIED AT RF | | | | RF SWITCH ARMS | | | |
|-------------|------------------------------|---|---|---|----------------|-----|-----|-----|
| | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 |
| TGS2304-SCC | L | H | H | H | ON | OFF | OFF | OFF |
| | H | L | H | H | OFF | ON | OFF | OFF |
| | H | H | L | H | OFF | OFF | ON | OFF |
| | H | H | H | L | OFF | OFF | OFF | ON |
| | H | H | H | L | OFF | OFF | OFF | ON |

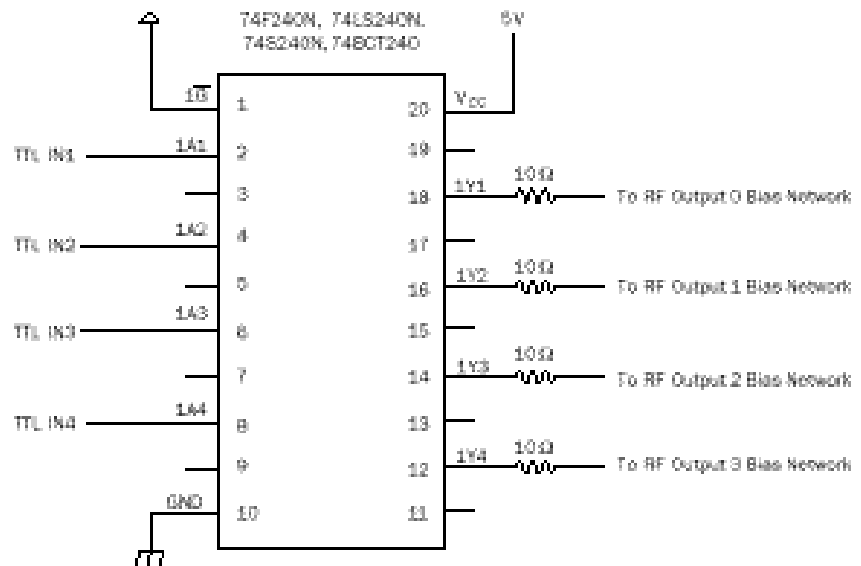
L = low (typically 0.3 V), H = high (typically 3.1 V)

MOUNTING DIAGRAM

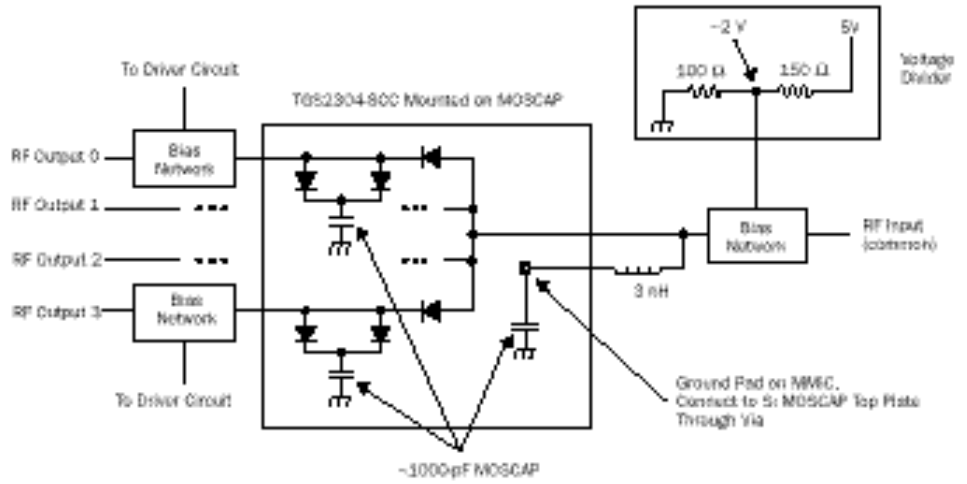
It is recommended that the Si MOSCAP be 10-mils larger than the Gate MMIC in length and width.



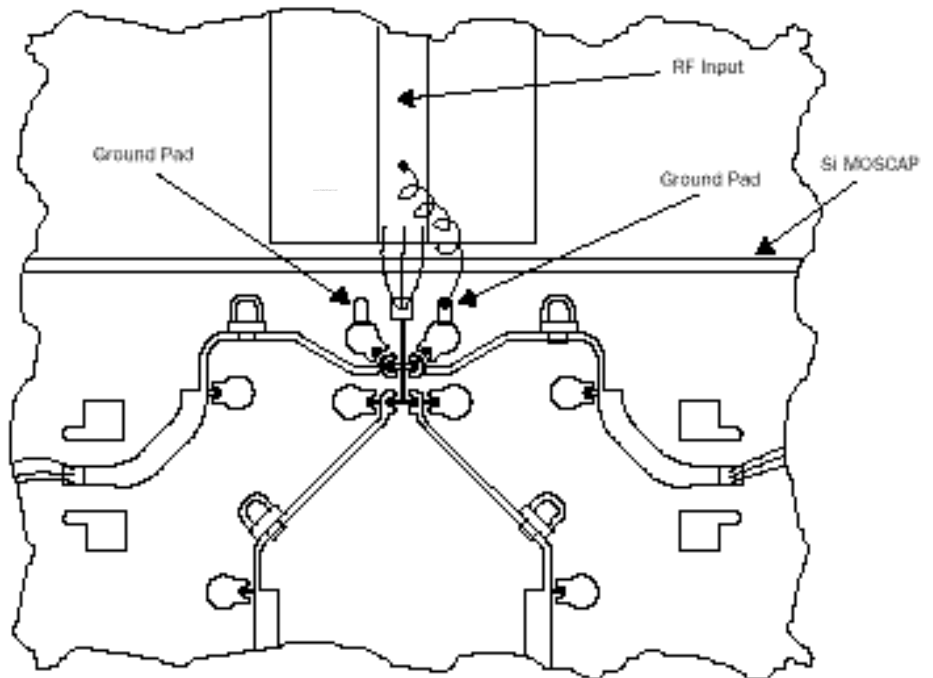
DRIVER CIRCUIT



INTERFACE SCHEMATIC



RF INPUT BIAS COIL ASSEMBLY



GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.