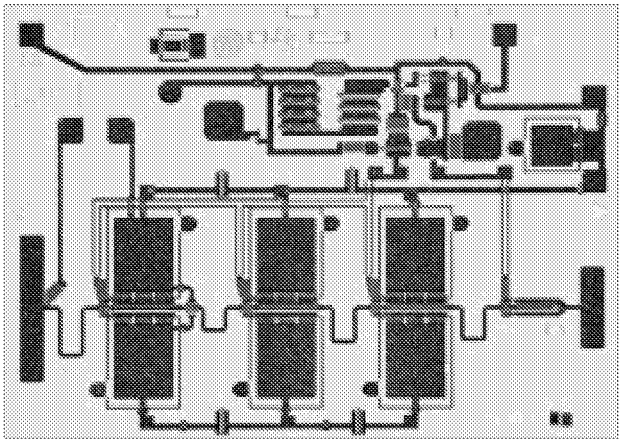
TGS8632-XCC

SPST FET Switch

# 8632

- DC to 18-GHz Frequency Range
- On-Chip Driver Compatible with CMOS or Open-Collector TTL
- Typical Insertion Loss 2.3-dB at 18-GHz
- 1.5:1 Input/Output SWR
- High Isolation; 43-dB Across Band
- 2,489 x 1,803 x 0,102 mm (0.098 x 0.071 x 0.004 in.)

**PHOTO ENLARGEMENT**



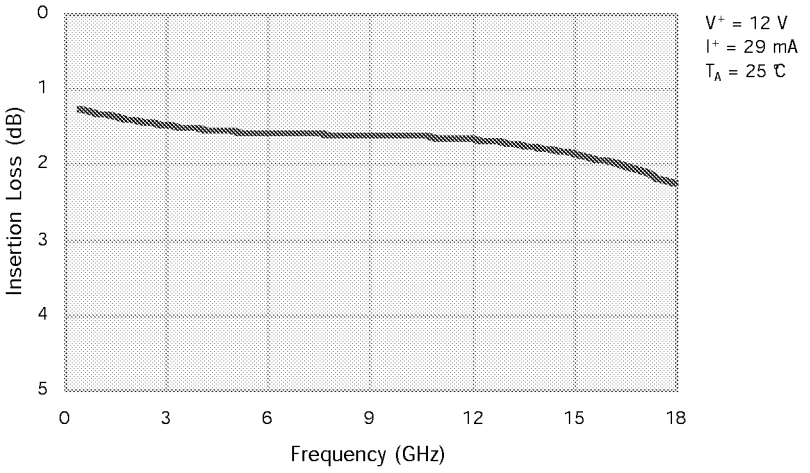
**DESCRIPTION**

The Texas Instruments TGS8632-XCC is a GaAs single-pole, single-throw (SPST) monolithic switch which operates over the DC to 18-GHz frequency range. This switch maintains 43-dB isolation and has an on-chip driver compatible with CMOS or open-collector TTL. The driver also provides a complementary output. Input and output return loss is greater than 15-dB. Input power at 1-dB gain compression is typically 25-dBm. Ground is provided to the circuitry through vias to the backside metallization.

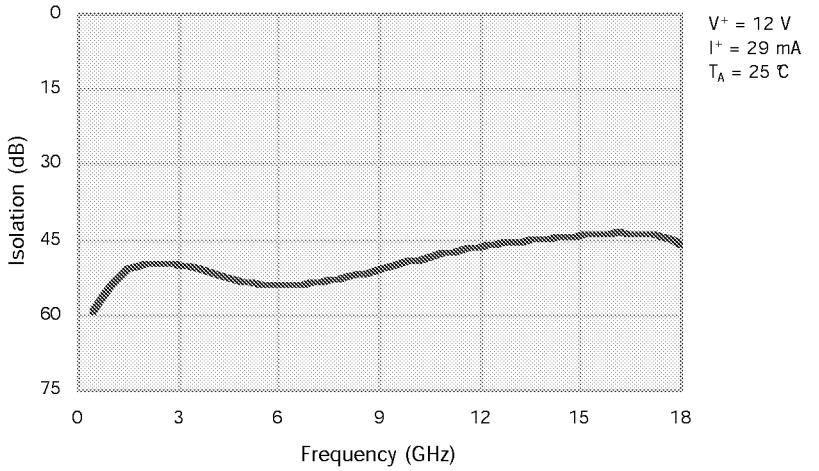
The TGS8632-XCC is suitable for a variety of wide-band applications such as radar systems and communication systems.

Bond pad and backside metallization is gold-plated for compatibility with eutectic alloy attachment methods as well as the thermocompression and thermosonic wire-bonding processes. The TGS8632-XCC is supplied in chip form and is readily assembled using automated equipment.

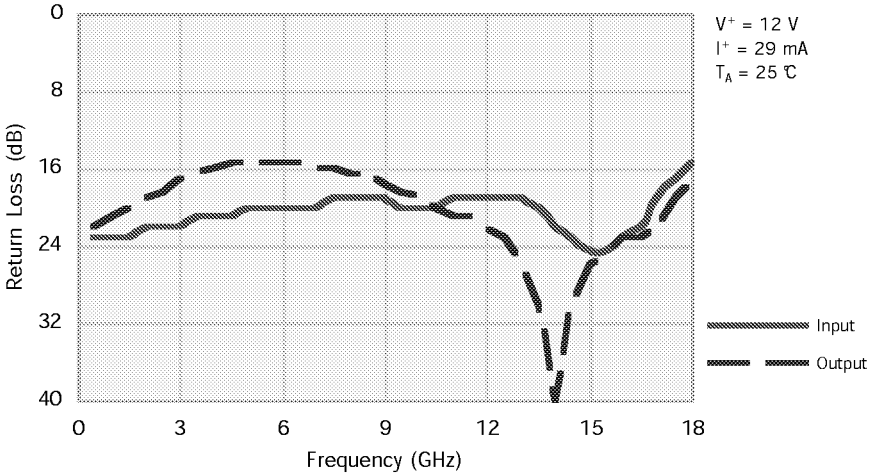
**TYPICAL INSERTION LOSS**



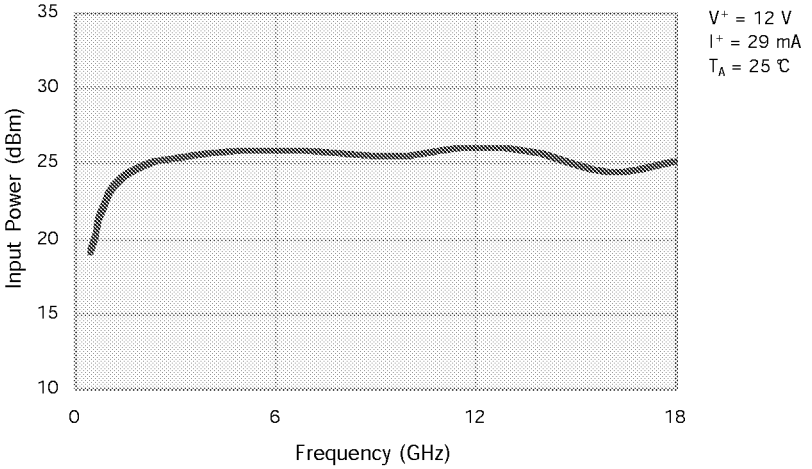

**TYPICAL ISOLATION**




**TYPICAL RETURN LOSS**



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




**ABSOLUTE MAXIMUM RATINGS**

| | |
|---|---|
| Supply voltage, $V^+$ | 15 V |
| Control voltage range, $V_{CTRL}$ | -10 V to +10 V |
| Power dissipation, $P_D$ | 0.36 W |
| Input continuous wave power, $P_{IN}$ | 1 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 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 "RF Characteristics" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

* Operating channel temperature will directly affect the device MTTF. For maximum life, it is recommended that channel temperature be maintained at the lowest possible level.

**TYPICAL S-PARAMETERS**
Through Path

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | Insertion Loss |
|---|---|---|---|---|---|---|---|---|---|
| (GHz) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | (dB) |
| 0.5 | 0.07 | -7 | 0.86 | -8 | 0.862 | -8 | 0.08 | 5 | 1.3 |
| 1.0 | 0.07 | -10 | 0.86 | -15 | 0.857 | -15 | 0.09 | 8 | 1.3 |
| 1.5 | 0.07 | -14 | 0.85 | -22 | 0.853 | -22 | 0.10 | 10 | 1.4 |
| 2.0 | 0.08 | -17 | 0.85 | -29 | 0.850 | -29 | 0.11 | 11 | 1.4 |
| 2.5 | 0.08 | -20 | 0.85 | -36 | 0.846 | -36 | 0.12 | 10 | 1.4 |
| 3.0 | 0.08 | -24 | 0.84 | -43 | 0.843 | -43 | 0.14 | 10 | 1.5 |
| 3.5 | 0.09 | -30 | 0.84 | -50 | 0.841 | -50 | 0.15 | 10 | 1.5 |
| 4.0 | 0.09 | -38 | 0.84 | -57 | 0.837 | -57 | 0.16 | 9 | 1.6 |
| 4.5 | 0.09 | -48 | 0.83 | -64 | 0.834 | -64 | 0.17 | 8 | 1.6 |
| 5.0 | 0.10 | -60 | 0.83 | -71 | 0.832 | -71 | 0.17 | 6 | 1.6 |
| 5.5 | 0.10 | -72 | 0.83 | -78 | 0.832 | -78 | 0.17 | 4 | 1.6 |
| 6.0 | 0.10 | -83 | 0.83 | -85 | 0.833 | -85 | 0.17 | 1 | 1.6 |
| 6.5 | 0.10 | -94 | 0.83 | -92 | 0.832 | -92 | 0.17 | -2 | 1.6 |
| 7.0 | 0.10 | -105 | 0.83 | -99 | 0.831 | -99 | 0.16 | -5 | 1.6 |
| 7.5 | 0.11 | -114 | 0.83 | -106 | 0.832 | -106 | 0.16 | -9 | 1.6 |
| 8.0 | 0.11 | -129 | 0.83 | -113 | 0.828 | -113 | 0.15 | -10 | 1.6 |
| 8.5 | 0.11 | -141 | 0.83 | -119 | 0.827 | -119 | 0.15 | -13 | 1.6 |
| 9.0 | 0.11 | -155 | 0.83 | -126 | 0.830 | -126 | 0.13 | -17 | 1.6 |
| 9.5 | 0.10 | -169 | 0.83 | -133 | 0.830 | -133 | 0.12 | -22 | 1.6 |
| 10.0 | 0.10 | 178 | 0.83 | -140 | 0.832 | -140 | 0.11 | -26 | 1.6 |
| 10.5 | 0.10 | 167 | 0.83 | -147 | 0.830 | -147 | 0.10 | -29 | 1.6 |
| 11.0 | 0.11 | 155 | 0.83 | -154 | 0.827 | -154 | 0.09 | -30 | 1.7 |
| 11.5 | 0.11 | 143 | 0.83 | -161 | 0.825 | -161 | 0.09 | -26 | 1.7 |
| 12.0 | 0.11 | 135 | 0.82 | -168 | 0.820 | -168 | 0.08 | -27 | 1.7 |
| 12.5 | 0.11 | 123 | 0.82 | -175 | 0.816 | -175 | 0.07 | -23 | 1.7 |
| 13.0 | 0.11 | 108 | 0.82 | 178 | 0.814 | 178 | 0.05 | -21 | 1.8 |
| 13.5 | 0.10 | 88 | 0.81 | 171 | 0.814 | 171 | 0.03 | -27 | 1.8 |
| 14.0 | 0.08 | 62 | 0.81 | 164 | 0.815 | 165 | 0.01 | -82 | 1.8 |
| 14.5 | 0.07 | 29 | 0.82 | 157 | 0.816 | 157 | 0.03 | -139 | 1.8 |
| 15.0 | 0.06 | -2 | 0.81 | 150 | 0.809 | 150 | 0.05 | -153 | 1.8 |
| 15.5 | 0.06 | -31 | 0.81 | 143 | 0.804 | 143 | 0.06 | -158 | 1.9 |
| 16.0 | 0.07 | -58 | 0.80 | 136 | 0.798 | 136 | 0.07 | -163 | 2.0 |
| 16.5 | 0.08 | -79 | 0.79 | 129 | 0.795 | 129 | 0.07 | -165 | 2.0 |
| 17.0 | 0.11 | -100 | 0.79 | 122 | 0.791 | 122 | 0.08 | -161 | 2.1 |
| 17.5 | 0.14 | -118 | 0.78 | 115 | 0.782 | 115 | 0.11 | -160 | 2.2 |
| 18.0 | 0.17 | 136 | 0.77 | 109 | 0.770 | 109 | 0.13 | -158 | 2.3 |

**$T_A$ = 25°C, $V^+$ = 12 V, $I^+$ = 29 mA**

Reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram." The S-parameters are also available on floppy disk and the world wide web.

**TYPICAL S-PARAMETERS**
Isolated Path

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | Isolation |
|---|---|---|---|---|---|---|---|---|---|
| (GHz) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | MAG | ANG(°) | (dB) |
| 0.5 | 0.87 | 179 | 0.001 | 33 | 0.001 | 44 | 0.99 | -4 | 60.0 |
| 1.0 | 0.85 | 171 | 0.002 | 33 | 0.002 | 40 | 0.99 | -9 | 54.0 |
| 1.5 | 0.83 | 165 | 0.003 | 23 | 0.003 | 29 | 0.99 | -13 | 50.5 |
| 2.0 | 0.81 | 159 | 0.003 | 13 | 0.003 | 18 | 0.99 | -17 | 50.5 |
| 2.5 | 0.79 | 155 | 0.003 | 3 | 0.003 | 7 | 0.99 | -20 | 50.5 |
| 3.0 | 0.78 | 150 | 0.003 | -7 | 0.003 | -3 | 0.99 | -23 | 50.5 |
| 3.5 | 0.77 | 146 | 0.003 | -17 | 0.003 | -14 | 0.98 | -26 | 50.5 |
| 4.0 | 0.76 | 141 | 0.003 | -26 | 0.003 | -23 | 0.98 | -28 | 50.5 |
| 4.5 | 0.76 | 137 | 0.002 | -37 | 0.002 | -34 | 0.98 | -30 | 54.0 |
| 5.0 | 0.75 | 133 | 0.002 | -50 | 0.002 | -46 | 0.98 | -32 | 54.0 |
| 5.5 | 0.74 | 129 | 0.002 | -66 | 0.002 | -62 | 0.98 | -35 | 54.0 |
| 6.0 | 0.74 | 125 | 0.002 | -83 | 0.002 | -81 | 0.98 | -39 | 54.0 |
| 6.5 | 0.73 | 122 | 0.002 | -105 | 0.002 | -105 | 0.98 | -43 | 54.0 |
| 7.0 | 0.74 | 118 | 0.002 | -125 | 0.002 | -125 | 0.97 | -47 | 54.0 |
| 7.5 | 0.74 | 114 | 0.002 | -143 | 0.002 | -144 | 0.97 | -50 | 54.0 |
| 8.0 | 0.74 | 109 | 0.002 | -157 | 0.002 | -157 | 0.96 | -54 | 54.0 |
| 8.5 | 0.73 | 105 | 0.003 | -167 | 0.002 | -167 | 0.96 | -57 | 50.5 |
| 9.0 | 0.72 | 101 | 0.003 | -175 | 0.003 | -174 | 0.97 | -61 | 50.5 |
| 9.5 | 0.72 | 97 | 0.003 | 179 | 0.003 | 180 | 0.97 | -66 | 50.5 |
| 10.0 | 0.72 | 93 | 0.003 | 174 | 0.004 | 174 | 0.97 | -71 | 50.5 |
| 10.5 | 0.71 | 90 | 0.004 | 171 | 0.004 | 170 | 0.96 | -75 | 48.0 |
| 11.0 | 0.72 | 87 | 0.004 | 167 | 0.004 | 166 | 0.95 | -80 | 48.0 |
| 11.5 | 0.73 | 83 | 0.004 | 165 | 0.004 | 165 | 0.94 | -83 | 48.0 |
| 12.0 | 0.71 | 79 | 0.005 | 162 | 0.004 | 164 | 0.94 | -87 | 46.0 |
| 12.5 | 0.70 | 76 | 0.005 | 162 | 0.004 | 164 | 0.94 | -92 | 46.0 |
| 13.0 | 0.69 | 73 | 0.005 | 161 | 0.005 | 163 | 0.95 | -98 | 46.0 |
| 13.5 | 0.69 | 69 | 0.005 | 163 | 0.005 | 162 | 0.94 | -105 | 46.0 |
| 14.0 | 0.69 | 64 | 0.005 | 164 | 0.006 | 162 | 0.93 | -112 | 46.0 |
| 14.5 | 0.70 | 59 | 0.006 | 161 | 0.006 | 160 | 0.92 | -117 | 44.4 |
| 15.0 | 0.70 | 53 | 0.006 | 159 | 0.006 | 159 | 0.90 | -121 | 44.4 |
| 15.5 | 0.69 | 48 | 0.007 | 156 | 0.007 | 158 | 0.90 | -125 | 43.1 |
| 16.0 | 0.66 | 43 | 0.007 | 146 | 0.007 | 150 | 0.90 | -129 | 43.1 |
| 16.5 | 0.64 | 40 | 0.007 | 142 | 0.007 | 144 | 0.91 | -133 | 43.1 |
| 17.0 | 0.63 | 36 | 0.006 | 136 | 0.006 | 135 | 0.91 | -138 | 44.4 |
| 17.5 | 0.62 | 33 | 0.004 | 148 | 0.004 | 146 | 0.90 | -143 | 48.0 |
| 18.0 | 0.61 | 31 | 0.006 | 167 | 0.006 | 166 | 0.87 | -145 | 44.4 |

**$T_A$ = 25°C, $V^+$ = 12 V, $I^+$ = 29 mA**

Reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram. The S-parameters are also available on floppy disk and the world wide web.

## RF CHARACTERISTICS

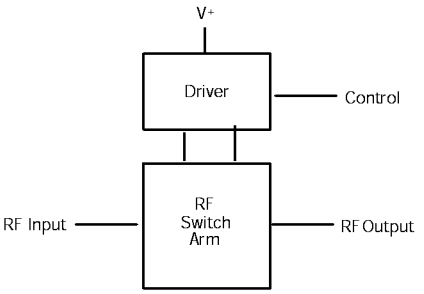
| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| IL | Insertion loss | f = DC to 10 GHz | 1.65 | dB |
| | | f = 10 to 18 GHz | 2.25 | |
| SWR (in) | Input standing wave ratio | f = DC to 10 GHz | 1.3:1 | - |
| | | f = 10 to 18 GHz | 1.5:1 | |
| SWR (out) | Output standing wave ratio | f = DC to 18 GHz | 1.5:1 | |
| ISO | Isolation | f = DC to 18 GHz | 43.0 | dB |
| P1dB(in) | Input power at 1-dB gain compression | f = DC to 2 GHz | 16 | dBm |
| | | f = 2 to 18 GHz | 26.5 | |
| $t_d$ | Delay time, 50% open–collector TTL input to 90% (10%) RF output | | 8 | ns |
| $t_r$ | Rise time, 10% RF output to 90% RF output | | 6 | ns |
| $t_f$ | Fall time, 90% RF output to 10% RF output | | 6 | ns |
| $V_{OH}$ | High–level inverting output voltage | | 5.5 | V |
| $V_{OL}$ | Low–level inverting output voltage | | 0.6 | V |
| | Inverting output current source/sink capability | | 2 | mA |

**$V^+$ = 12 V, $I^+$ = 29 mA, $T_A$ = 25°C**

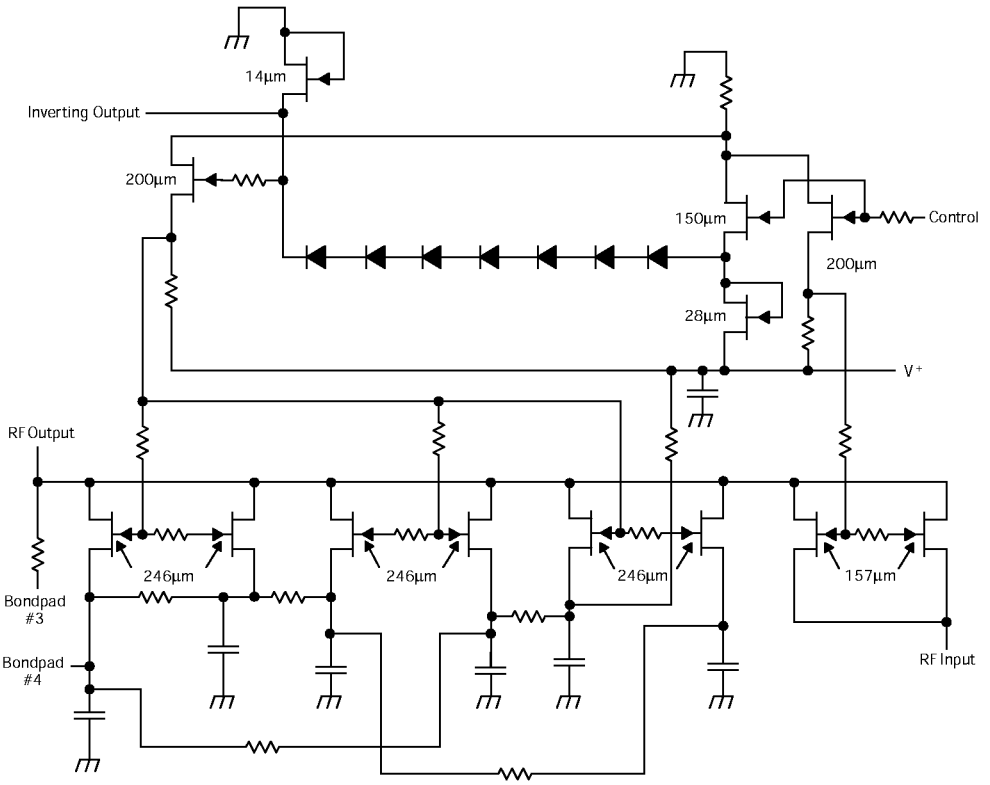
## DC CHARACTERISTICS

| PARAMETER | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|
| Supply voltage, $V^+$ | 11 | 12 | 14 | V |
| High–level control input voltage, $V_{IH}$ | 4.5 | 5 | 6 | V |
| Low–level control input voltage, $V_{IL}$ | 0 | 0 | 0.5 | V |

## FUNCTIONAL BLOCK DIAGRAM

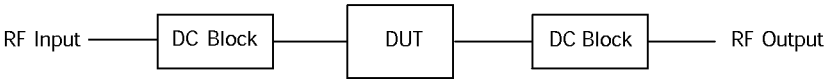



## EQUIVALENT SCHEMATIC

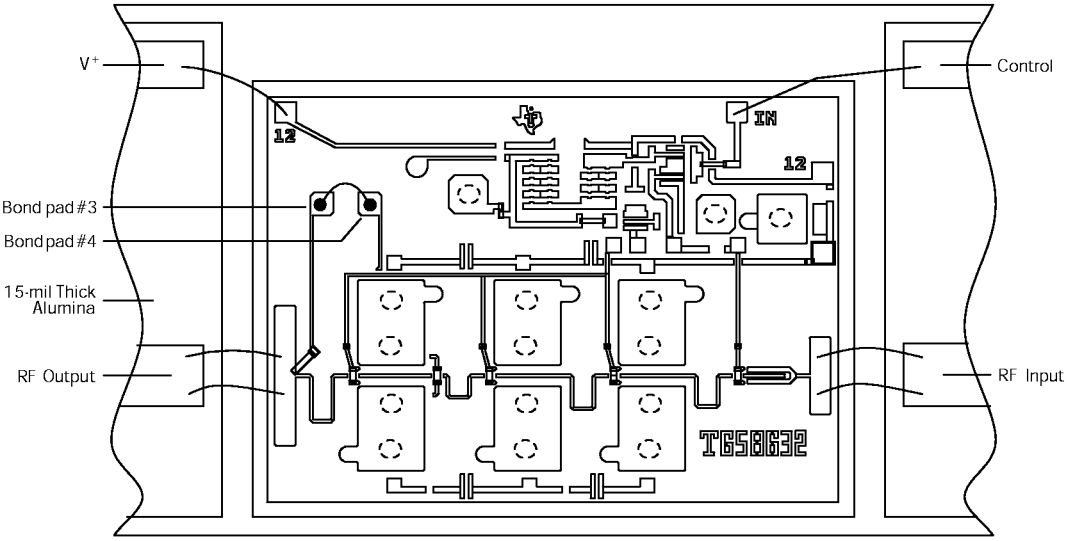



RF ports are not DC-isolated.

**RECOMMENDED TEST CONFIGURATION**




**RECOMMENDED ASSEMBLY DIAGRAM**



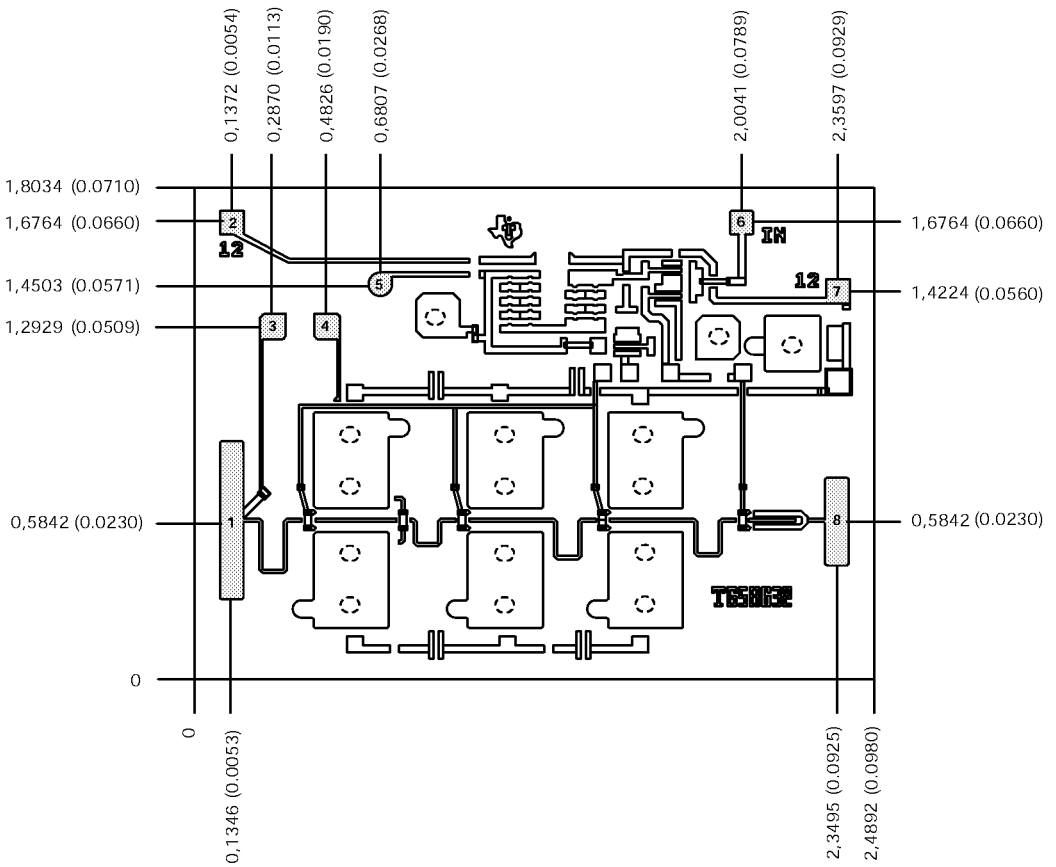

RF connections: Bond using two 1-mil diameter, 20 to 25-mil-length gold bond wires at both RF Input and RF Output ports for optimum RF performance.

Bond pads 3 and 4 must be bonded together for proper operation.

Low-loss path from RF Input to RF Output for $V_{CONTROL}$ = 0 V. Isolated path from RF Input to RF Output for $V_{control}$ = 5 V.

RF isolation will be limited by the chip operating environment.

## MECHANICAL DRAWING




Millimeters (inches)
Thickness: 0,102 (0.004) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad.
Chip size ± 0,0508 (0.002)

| | |
|---|---|
| Bond pad #1 (RF In): | 0,0965 x 0,5867 (0.0038 x 0.0231) |
| Bond pad #2 ($V^+$): | 0,0965 x 0,0965 (0.0038 x 0.0038) |
| Bond pad #3: | 0,1016 x 0,1016 (0.0040 x 0.0040) |
| Bond pad #4: | 0,1016 x 0,1016 (0.0040 x 0.0040) |
| Bond pad #5 (Inverting Output): | 0,0965 (0.0038) diameter |
| Bond pad #6 ($_{CONTROL}$): | 0,0965 x 0,0965 (0.0038 x 0.0038) |
| Bond pad #7 ($V^+$) : | 0,0991 x 0,0991 (0.0039 x 0.0039) |
| Bond pad #8 (RF Out): | 0,0965 x 0,3302 (0.0038 x 0.0130) |

Bond pad #2 and bond pad #7 are internally connected. Connect only one of these to a positive voltage supply.

This device is susceptible to damage from electric discharge. Handling and packaging of this device and/or assembly should be accomplished only with adequate provisions to prevent electrostatic discharge damage. IMPORTANT NOTICE: Export of this controlled commodity requires appropriate export license authority from the U.S. Government. © Copyright 1996. Texas Instruments Incorporated. All rights reserved.