# AWS5532R

0.5 to 2.5 GHz 10 W SPDT Switch

**PRELIMINARY DATA SHEET - Rev 1.3**

## FEATURES

- Low Insertion Loss: 0.4 dB at 2 GHz
- High Isolation: >25 dB
- High Input P0.1 dB: +40.5 dBm
- Low Control Voltage Operation
- Low Profile Surface Mount Package
- RoHS Compliant Package, 260 °C MSL-1

## APPLICATIONS

- Automotive Telematic Applications
- GSM Wireless Handsets and Front-end Modules
- CDMA Wireless Handsets and Front-end Modules


**S26 Package**
**12 Pin 3 mm x 3 mm x 1 mm QFN**

## PRODUCT DESCRIPTION

The AWS5532R is a single pole, double throw (SPDT) RF switch developed for applications requiring very low distortion at high input drive levels. Manufactured in ANADIGICS's state-of-the-art pHEMT process, the device uses patented circuit topologies to provide low insertion loss, high port-to-port isolation, and high linearity performance. The AWS5532R is offered in a 12-lead 3 mm x 3 mm x 1 mm QFN package.

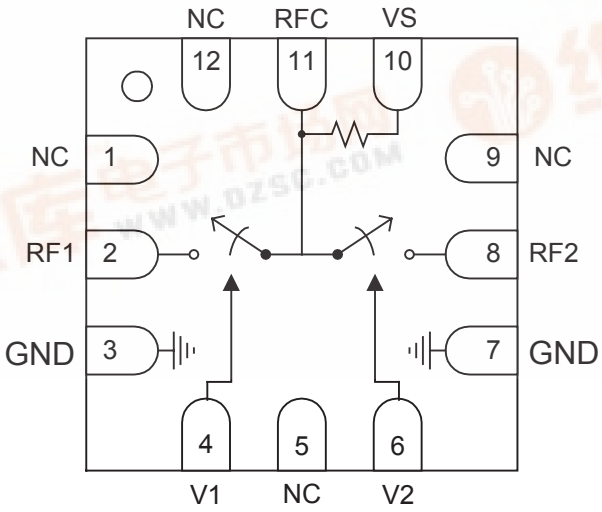



Figure 1: Block Diagram

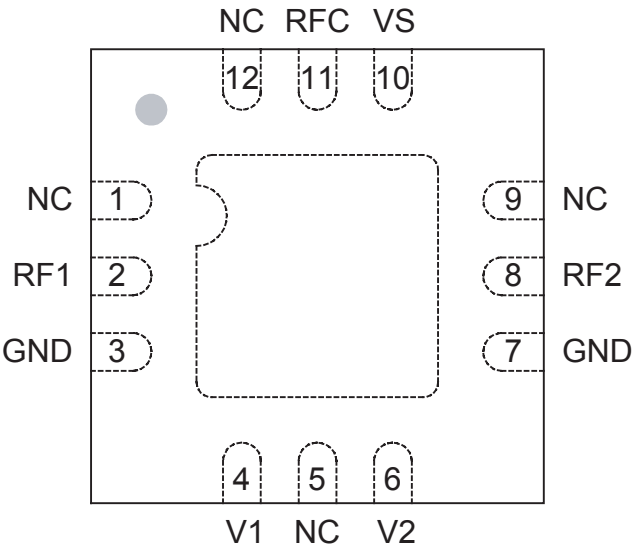



**Figure 2: Pinout (X-ray Top View)**

**Table 1: Pin Description**

| PIN | NAME | DESCRIPTION |
|---|---|---|
| 2 | RF1 | RF Port, Path 1 |
| 4 | V1 | Control Voltage, RF Path 1 |
| 6 | V2 | Control Voltage, RF Path 2 |
| 8 | RF2 | RF Port, Path 2 |
| 10 | VS | Common Port Bias Voltage (logic high) |
| 11 | RFC | RF Common Port |
| 3,7 | GND | Ground |
| 1, 5, 9, 12 | NC | No Connection (1) |

*Notes:*
*(1) Pins 1, 5, 9 and 12 are not connected in the package. Recommend pins be grounded, but is not necessary.*

## ELECTRICAL CHARACTERISTICS

**Table 2: Absolute Minimum and Maximum Ratings**

| PARAMETER | MIN | MAX | UNIT |
|---|---|---|---|
| Control Voltages ($V_1$, $V_2$, $V_S$) (1) | - | +10.0 | V |
| RF Input Power ($P_{IN}$) (2) | - | 15 | W |
| Storage Temperature ($T_{STG}$) | -65 | +150 | °C |

**Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability.**

*Notes:*
*(1) $V_S$ port may remain open without damage to the device.*
*(2) at RF1, RF2, and RFC*

**Table 3: Operating Ranges**

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|---|---|---|---|---|---|
| RF Frequency (f) | 0.5 | - | 2.5 | GHz | |
| Common Port Bias Voltage ($V_S$) | - | (1) | - | - | applied at VS port (Pin 10) |
| Control Voltages ($V_1$, $V_2$) | -0.2<br>+2.5 | -<br>- | +0.2<br>+5 | V | RF path OFF state<br>RF path ON state |
| Ambient Temperature ($T_A$) | -40 | - | +85 | °C | |

**The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.**

*Notes:*
*(1) The Common Port Bias Voltage (Vs) is not required for normal operation, and can be left open. To operate the switch in an "all off" state (both V1 and V2 set to logic **LOW**), the logic **HIGH** voltage should be applied to this port. Under no circumstances should this port be grounded.*

**Table 4: ESD Ratings**

| PARAMETER | METHOD | RATING | UNIT |
|---|---|---|---|
| ESD Threshold Voltage (All Pins) | CDM (1) | 1000 (2) | V |
| ESD Threshold Voltage (Supply pins only) | HBM (3) | 400 (4) | V |
| ESD Threshold Voltage (Supply-Signal pins) | HBM | 400 | V |
| ESD Threshold Voltage (RF Signal pins only) | HBM | 450 | V |
| ESD Threshold Voltage (Antenna Common Port) | HBM (5) | 12000 (6) | V |

*Notes:*

*(1) Tested in conformance with JEDEC specification JESD22-C101-A*

*(2) A CDM ESD threshold of this voltage classifies the device as a Class IV component per JEDEC JESD22-C101-A*

*(3) Tested in conformance with ESD/EOS Society specification STM5.1-2001*

*(4) A HBM ESD threshold at these voltages classifies the device as a Class 1A component per ESD/EOS Society Specification STM5.1-2001*

*(5) This test was done in conformance with ESD/EOS Society HBM specification STM5.1-2001. 3000 ESD strikes were applied using multiple groups of 100 strikes each where the interval between strikes within a group is 1 second and the interval between groups is 30 seconds.*

*(6) This voltage rating REQUIRES the use of an inductor as an RF choke as defined in Note #3 in the application circuit information. This rating has been tested with inductor values of 47nH and 100nH.*

**Table 5: Electrical Specifications**
**($T_A$ = +25 °C, RF ports terminated with 50 Ω, $V_n$ = +3.0 V and is the Control Voltage for the ON path, RFC-RFn; $V_X$ = 0 V and is the Control Voltage for the other OFF path, RFC-RFx)**

| PARAMETER | MIN | TYP | MAX | UNIT | COMMENTS |
|---|---|---|---|---|---|
| Insertion Loss<br>1 GHz<br>2 GHz | <br>-<br>- | <br>0.30<br>0.40 | <br>0.5<br>0.6 | dB | RFC port to selected RFn port |
| Return Loss (1)<br>1 GHz<br>2 GHz | <br>-<br>- | <br>24<br>22 | <br>20<br>18 | dB | RFC port and selected RFn port |
| Isolation<br>1 GHz<br>2 GHz | <br>27<br>25 | <br>30<br>27 | <br>-<br>- | dB | RFC port to isolated RFx port |
| Input Third Order Intercept (2)<br>824 - 849 MHz | <br>+68 | <br>+71 | <br>- | dBm | RFC port to selected RFn port |
| Input Power for 0.1 dB Compression<br>824 - 849 MHz | <br>+39 | <br>+40.5 | <br>- | dBm | |
| Current Consumption | - | - | 50 | µA | each Vn port |

*Notes:*
*(1) Isolated RFx ports have a return loss of approximately -3 dB.*
*(2) Two tones with PIN = +27 dBm each, 1 MHz channel spacing.*

**Table 6: Switch Control Truth Table**

| CONTROL VOLTAGE | | RF PATH SELECTION | |
|---|---|---|---|
| $V_1$ | $V_2$ | RFC - RF1 | RFC - RF2 |
| +2.5 to +5 V | -0.2 to +0.2 V | ON | OFF |
| -0.2 to +0.2 V | +2.5 to +5 V | OFF | ON |

## PERFORMANCE DATA

**Figure 3: Insertion Loss vs. Frequency (ON Path, Vn = +3.0 V, Vx = 0 V)**

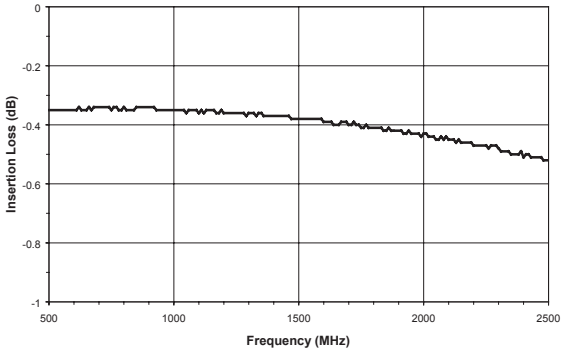



**Figure 4: Insertion Loss vs. Temperature (Vn = 3.0 V, F = 836 MHz)**

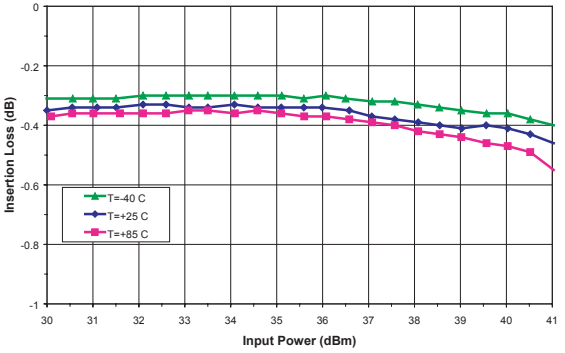



**Figure 5: Return Loss vs. Frequency (ON Path, Vn = +3.0 V, Vx = 0 V)**

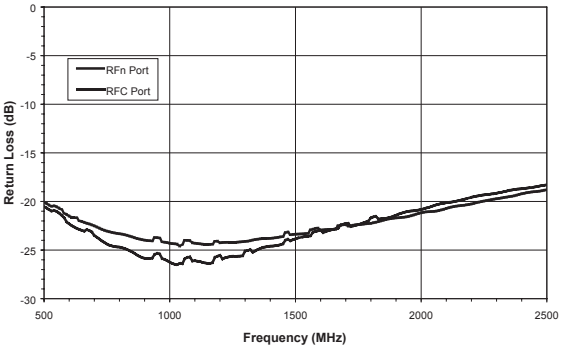



**Figure 6: Compression vs. Temperature (Vn = 3.0 V, F = 836 MHz)**

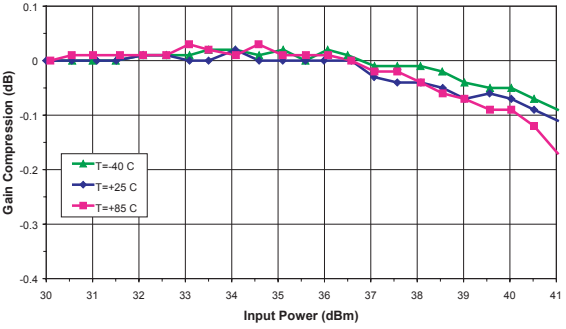



**Figure 7: Isolation vs. Frequency (OFF Path, Vn = +3.0 V, Vx = 0 V)**

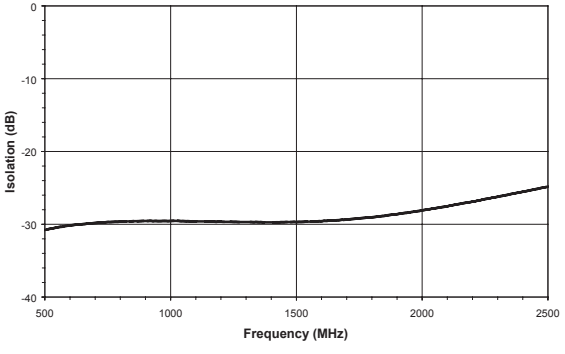
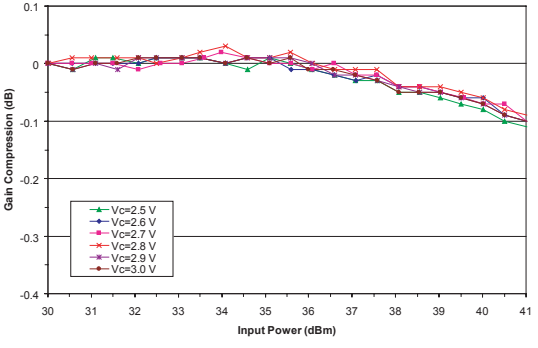



**Figure 8: Compression vs. $V_{CONTROL}$ (VS = Vn, F = 836 MHz)**



## APPLICATION INFORMATION

### Circuit Applications

External component requirements for the AWS5532R are shown in Figure 9. Application details are listed in the following notes:

1. Cb are DC blocking capacitors external to the device. A value of 100 pF is sufficient for operation to 500 MHz. The values may be tailored to provide specific electrical responses.

2. The RF Ground connections should be kept as short as possible and tied directly to a good RF ground for best broadband performance.

3. $L_{ESD}$ provides a means to increase the ESD protection on a specific RF port, typically the port attached to the antenna. By using $L_{ESD}$ as an RF choke on an RF port, an ESD protection to ±12 kV contact discharge has been demonstrated.

4. The VS pin provides a fixed voltage potential to the common port of the switch, and is not required for normal operation (can be left open). To operate the switch in an "all off" state (V1 = V2 = logic low), VS should be tied to the logic high voltage potential (not the power supply). Current draw on this pin is less than 5 μA.

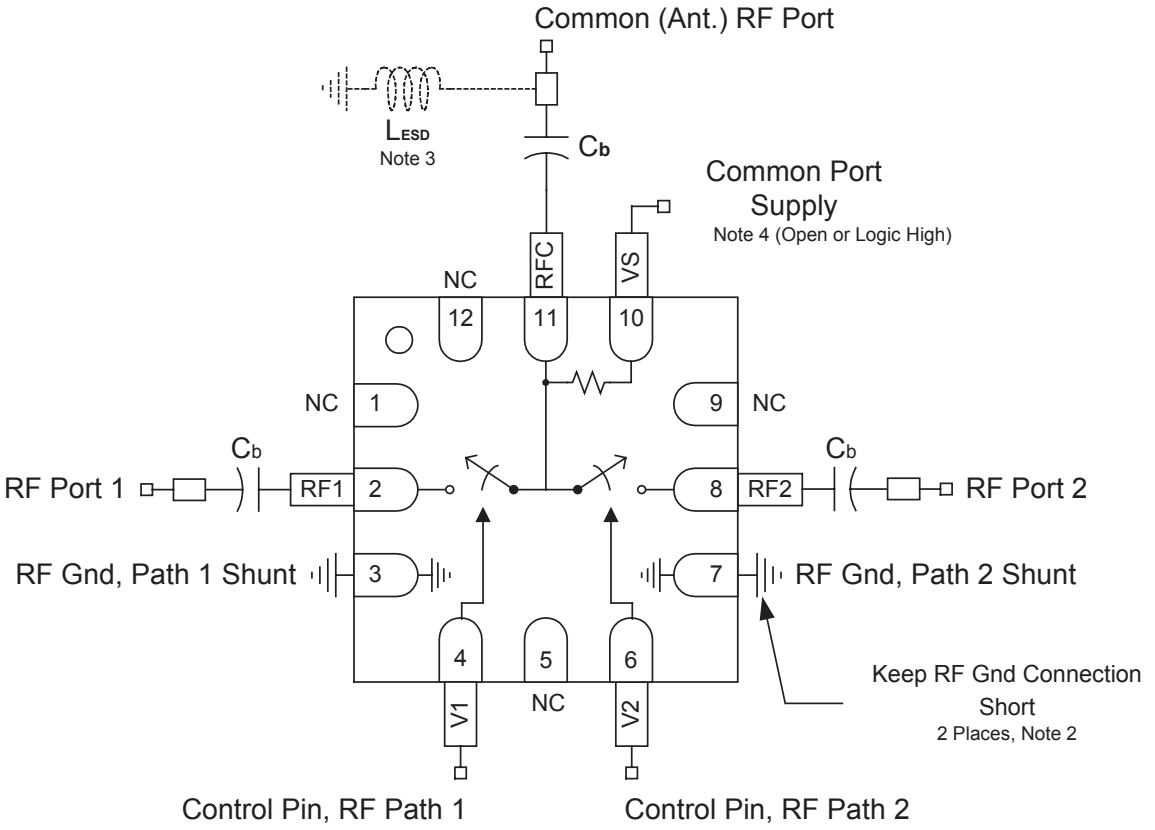
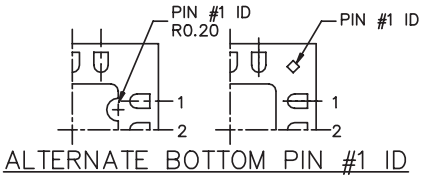
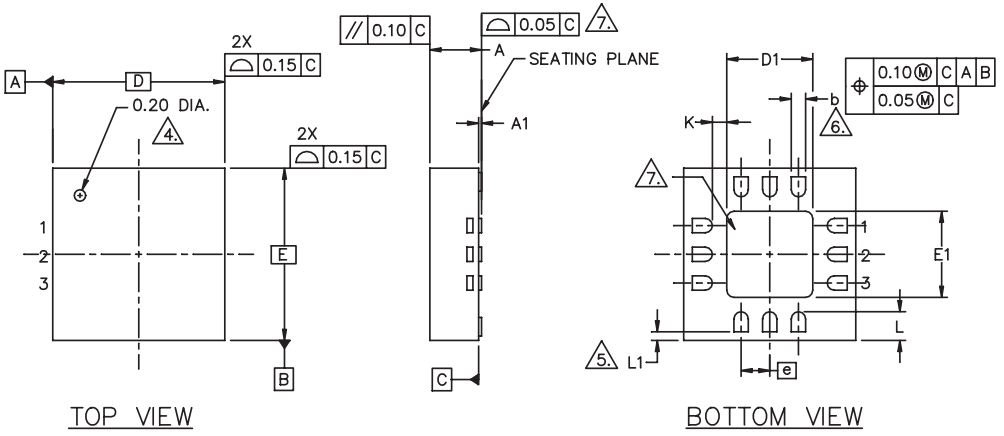



**Figure 9: Application Schematic**

**AWS5532R**

## PACKAGE OUTLINE




| SYMBOL | DIMENSIONS—MM MIN. | MAX. | NOTE |
|---|---|---|---|
| A | 0.80 | 1.00 | |
| A1 | 0.00 | 0.05 | |
| b | 0.18 | 0.30 | |
| D | 3.00 BSC | | |
| D1 | 1.30 | 1.70 | |
| E | 3.00 BSC | | |
| E1 | 1.30 | 1.70 | |
| e | 0.50 BSC | | |
| K | 0.20 MIN. | | |
| L | 0.35 | 0.55 | |
| L1 | | 0.15 MAX. | |

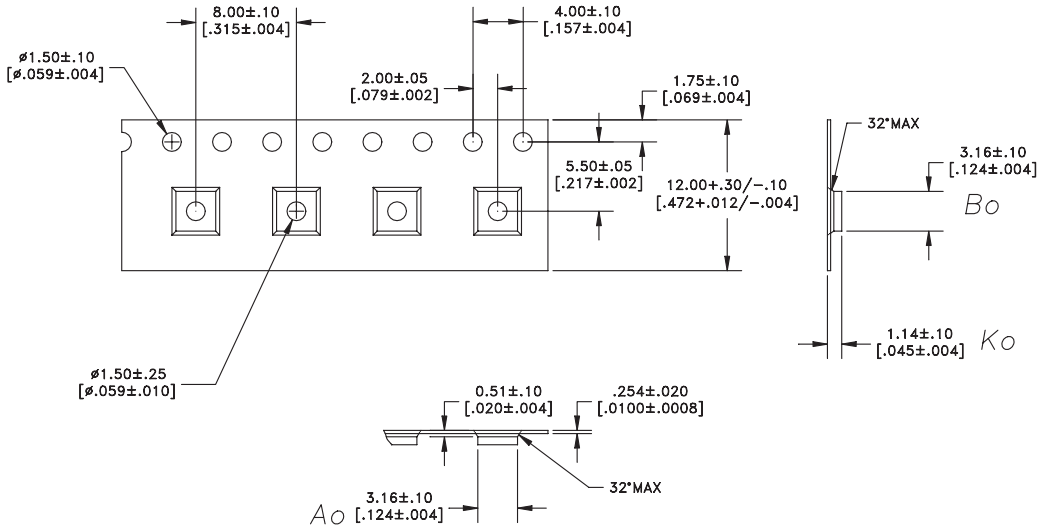
| SYMBOL | DIMENSIONS—INCHES MIN. | MAX. | NOTE |
|---|---|---|---|
| A | 0.031 | 0.039 | |
| A1 | 0.000 | 0.001 | |
| b | 0.007 | 0.011 | |
| D | 0.118 BSC | | |
| D1 | 0.051 | 0.067 | |
| E | 0.118 BSC | | |
| E1 | 0.051 | 0.067 | |
| e | 0.019 BSC | | |
| K | 0.007 MIN. | | |
| L | 0.014 | 0.022 | |
| L1 | | 0.006 MAX. | |

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.
4. PIN #1 ID ON TOP WILL BE LASER MARKED.
5. A MAXIMUM 0.15mm PULL BACK (L1) MAYBE PRESENT. L MINUS L1 TO BE EQUAL TO OR GREATER THAN 0.30mm.
6. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30mm FROM TERMINAL TIP. IF THE TERMINAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMINAL, THE DIMENSION b SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
7. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
8. REFERENCE JEDEC OUTLINE MO—220.

**Figure 10: S26 Package Outline - 12 Pin 3 mm x 3 mm x 1 mm QFN**

## COMPONENT PACKAGING




NOTES:

1. MATERIAL: 3000 (CARBON FILLED POLYCARBONATE)
   100% RECYCLABLE.

**Figure 11: Tape & Reel Packaging**

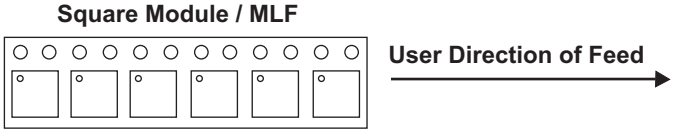



**Figure 12: Tape & Reel Package Orientation**

**Table 7: Tape & Reel Dimensions**

| PACKAGE TYPE | TAPE WIDTH | POCKET PITCH | REEL CAPACITY | MAX REEL DIA |
|---|---|---|---|---|
| 3 mm x 3 mm x 1 mm | 12 mm | 8 mm | 1000 | 7" |

## NOTES

NOTES

## ORDERING INFORMATION

| ORDER NUMBER | TEMPERATURE RANGE | PACKAGE DESCRIPTION | COMPONENT PACKAGING |
|---|---|---|---|
| AWS5532RS26Q1 | -40 °C to +85 °C | RoHS Compliant<br>12 Pin QFN<br>3 mm x 3 mm x 1 mm | Tape and Reel, 1000 pieces per Reel |

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