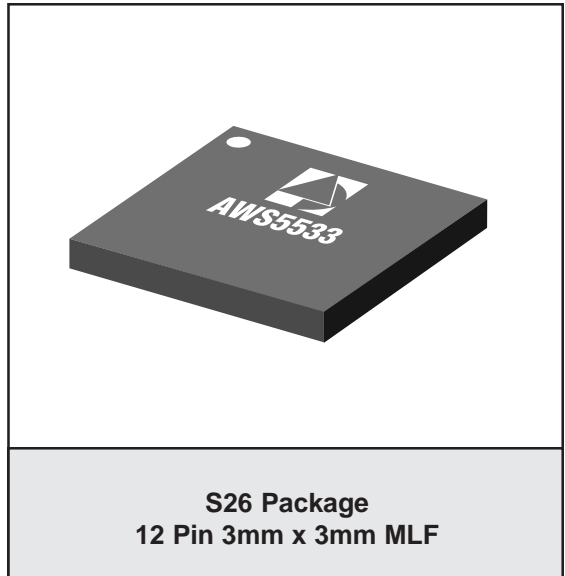


**FEATURES**

- Low Insertion Loss: 0.7 dB at 2 GHz
- High Isolation: >25 dB
- Low Control Voltage Operation: to +2.5 V
- Low Harmonic Levels
- Low Profile Surface Mount Package

**APPLICATIONS**

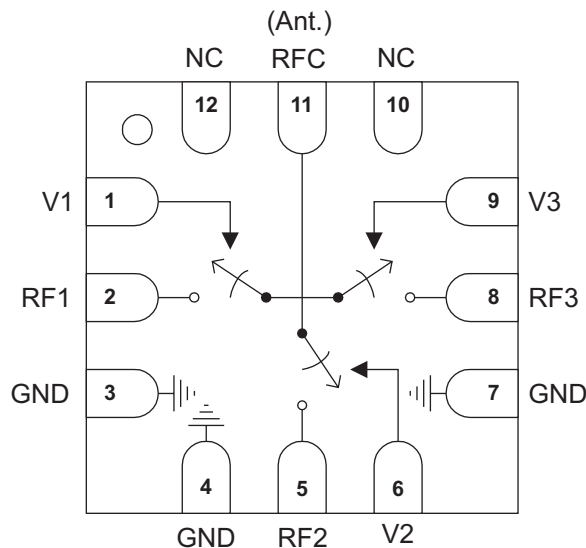
- CDMA Wireless Handsets



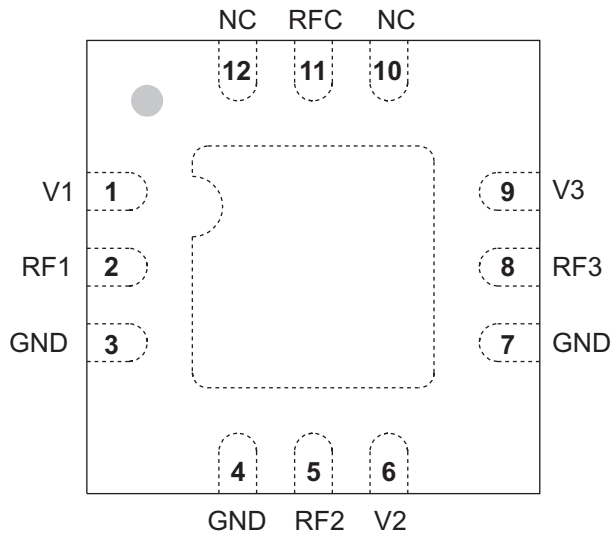
**PRODUCT DESCRIPTION**

The AWS5533 is a single pole, three throw (SP3T) RF switch developed for CDMA systems. Manufactured in ANADIGICS's state-of-the-art pHEMT process, the device uses patent-pending circuit

topologies to provide low insertion loss, high port-to-port isolation, and high linearity needed to enhance the performance of CDMA radios. The AWS5533 is offered in a 12-lead 3 mm x 3 mm MLF package.



**Figure 1: Block Diagram**



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

**Table 1: Pin Description**

PIN	NAME	DESCRIPTION
1	V1	Control Voltage, RF Path 1
2	RF1	RF Port, Path 1
3	GND	Ground
4	GND	Ground
5	RF2	RF Port, Path 2
6	V2	Control Voltage, RF Path 2
7	GND	Ground
8	RF3	RF Port, Path 3
9	V3	Control Voltage, RF Path 3
10	NC	No Connection <sup>(1)</sup>
11	RFC	RF Common Port
12	NC	No Connection <sup>(1)</sup>

**Notes:**

(1) Pins 10 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 ( $V_1, V_2, V_3$ )	-	+10.0	V
RF Input Power ( $P_{IN}$ ) <sup>(1)</sup>	-	10	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) at RF1, RF2, RF3, and RFC

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
RF Frequency (f)	0.5	-	2.5	GHz	
Control Voltages ( $V_1, V_2, V_3$ )	-0.2 +2.5	- -	+0.2 +5	V	RF path OFF state RF path ON state
Ambient Temperature ( $T_A$ )	-30	-	+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.

Table 4: ESD Ratings

PARAMETER	METHOD	RATING	UNIT
ESD Threshold Voltage (All Pins)	CDM <sup>(1)</sup>	1000 <sup>(2)</sup>	V
ESD Threshold Voltage (Supply pins only)	HBM <sup>(3)</sup>	400 <sup>(4)</sup>	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 <sup>(5)</sup>	12000 <sup>(6)</sup>	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

( $T_A = +25\text{ }^\circ\text{C}$ , RF ports terminated with  $50\ \Omega$ ,  $V_n = +2.7\ \text{V}$  and is the Control Voltage for the ON path, RFC-RFn;  $V_x = 0\ \text{V}$  and is the Control Voltage for the other two OFF paths, RFC-RFx)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Insertion Loss 1 GHz 2 GHz	- -	0.45 0.7	0.6 0.8	dB	RFC port to selected RFn port
Return Loss <sup>(1)</sup> 1 GHz 2 GHz	- -	-22 -16	-20 -15	dB	RFC port and selected RFn port
Isolation 1 GHz 2 GHz	25 25	28 27	- -	dB	RFC port to isolated RFX ports
Input Third Order Intercept <sup>(2)</sup> 800 MHz Cellular Band 1900 MHz PCS Band	- -	+66 +58	- -	dBm	RFC port to selected RFn port
Cross-Modulation <sup>(3)</sup> 800 MHz Cellular Band 1900 MHz PCS Band	- -	-105 -105	- -	dBm	RFC port to selected RFn port
2nd Harmonic Rejection 837 MHz 1880 MHz	- -	-86 -80	- -	dBc	RFC port to selected RFn port $P_{IN} = +25.5\ \text{dBm}$ $P_{IN} = +24\ \text{dBm}$
3rd Harmonic Rejection 837 MHz 1880 MHz	- -	-80 -82	- -	dBc	RFC port to selected RFn port $P_{IN} = +25.5\ \text{dBm}$ $P_{IN} = +24\ \text{dBm}$
Current Consumption	-	-	30	$\mu\text{A}$	each $V_n$ port

Notes:

(1) Isolated RFX ports have a return loss of approximately -3 dB.

(2) For the Cellular Band, two tones with  $P_{IN} = +22.5\ \text{dBm}$  each, at 837 and 838 MHz. For the PCS Band, two tones with  $P_{IN} = +21\ \text{dBm}$  each, at 1880 and 1881 MHz.

(3) For the Cellular Band, one CW interferer at 881.5 MHz with -23 dBm power, and one modulated transmit signal at 849 MHz with +25.5 dBm power. For the PCS Band, one CW interferer at 1960 MHz with -23 dBm power, and one modulated transmit signal at 1910 MHz with +24 dBm power.

Table 6: Switch Control Truth Table

CONTROL VOLTAGE			RF PATH SELECTION		
$V_1$	$V_2$	$V_3$	RFC - RF1	RFC - RF2	RFC - RF3
+2.5 to +5 V	-0.2 to +0.2 V	-0.2 to +0.2 V	ON	OFF	OFF
-0.2 to +0.2 V	+2.5 to +5 V	-0.2 to +0.2 V	OFF	ON	OFF
-0.2 to +0.2 V	-0.2 to +0.2 V	+2.5 to +5 V	OFF	OFF	ON

PERFORMANCE DATA

Figure 3: Insertion Loss vs. Frequency  
(ON path,  $V_n = +2.7$  V,  $V_x = 0$  V)

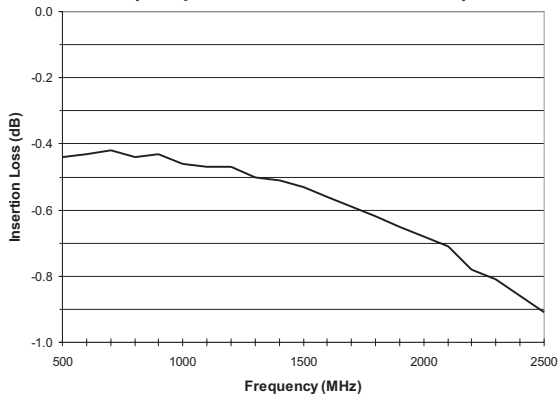


Figure 4: Harmonics of Cellular Band vs. Control Voltage,  $V_n$ ,  
( $f = 837$  MHz,  $P_{IN} = +25.5$  dBm)

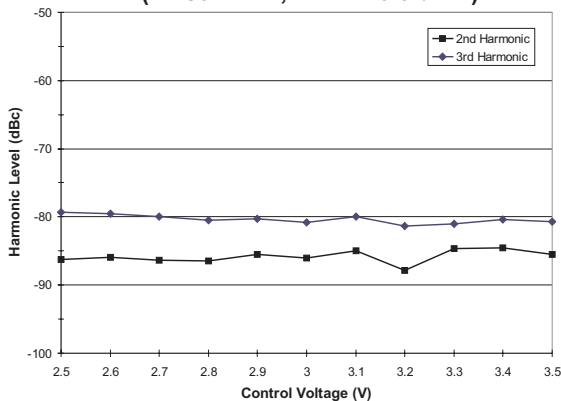


Figure 5: Return Loss vs. Frequency  
(ON path,  $V_n = +2.7$  V,  $V_x = 0$  V)

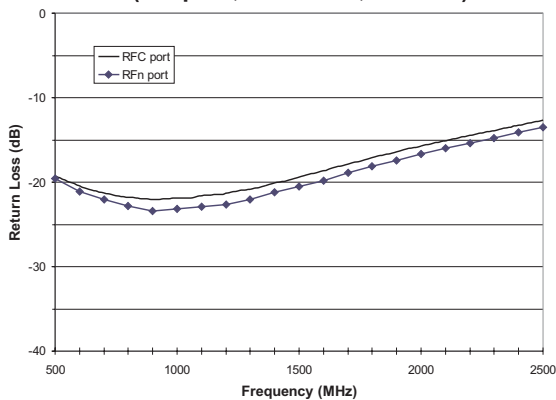


Figure 6: Harmonics of PCS Band vs. Control Voltage,  $V_n$ ,  
( $f = 1880$  MHz,  $P_{IN} = +24$  dBm)

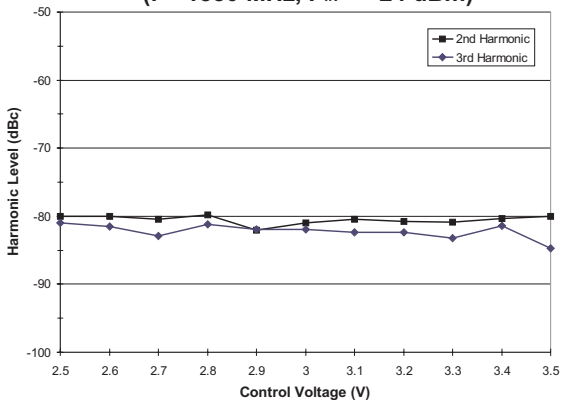
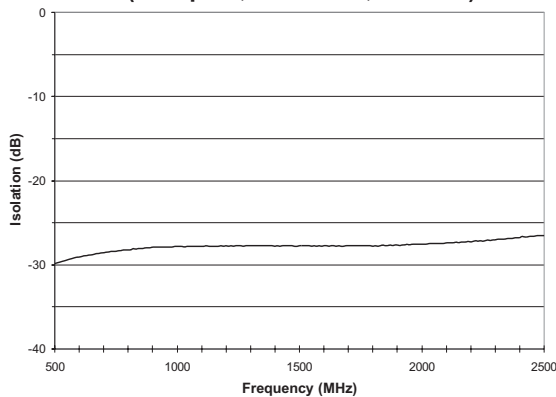


Figure 7: Isolation vs. Frequency  
(OFF path,  $V_n = +2.7$  V,  $V_x = 0$  V)



**APPLICATION INFORMATION**

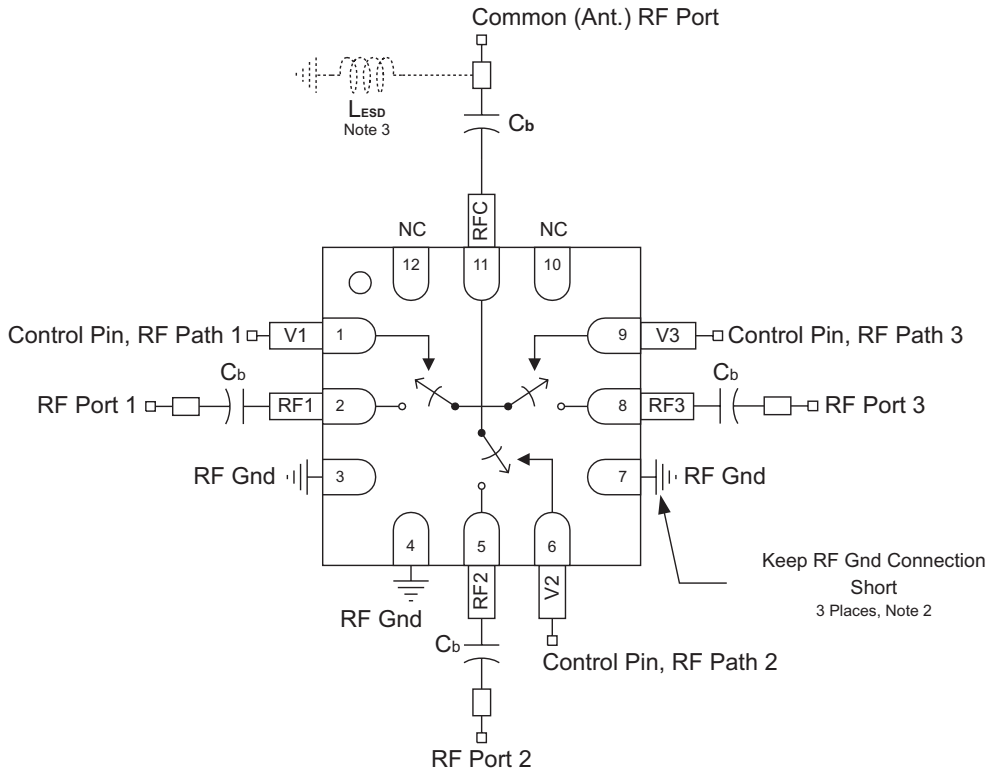
**Circuit Applications**

External component requirements for the AWS5533 are shown in Figure 8. Application details are listed in the following notes:

1.  $C_b$  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.

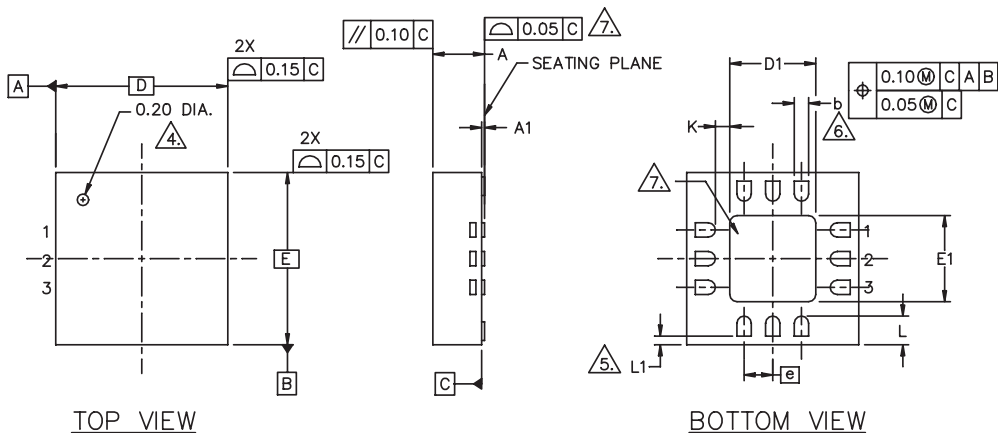
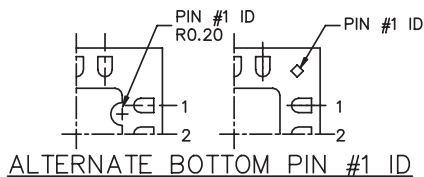
2. The RF Ground connections should be kept as short as possible and tied directly to a good RF ground for best broadband performance.

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  $\pm 12$  kV contact discharge has been demonstrated.



**Figure 8: Application Schematic**

PACKAGE OUTLINE



NOTES :

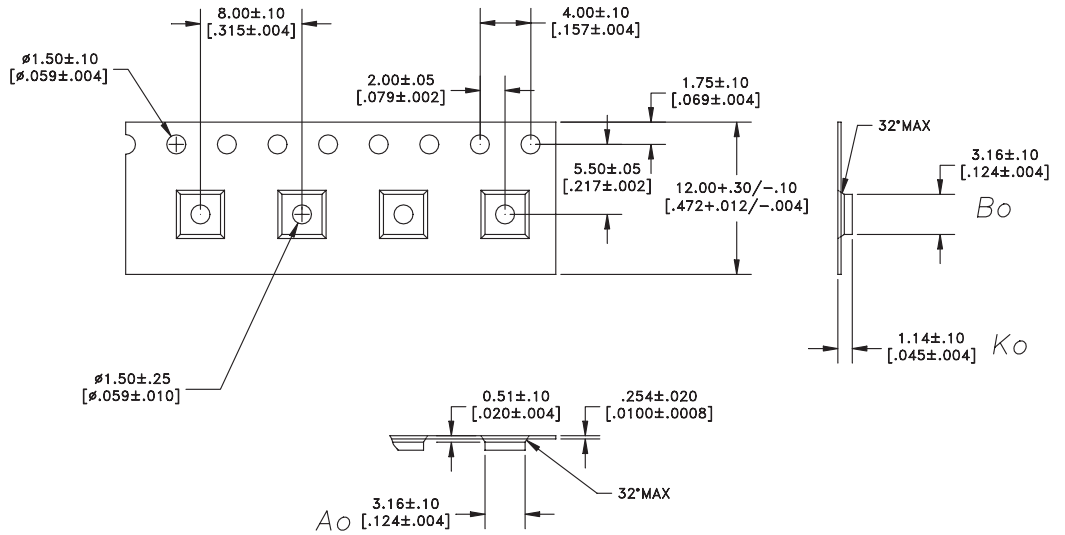
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. MAX. PACKAGE WARPAGE IS 0.05 mm.
3. MAXIMUM ALLOWABLE BURRS IS 0.076 mm IN ALL DIRECTIONS.

- 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.

SYMBOL	DIMENSIONS—MM		SYMBOL	DIMENSIONS—INCHES	
	MIN.	MAX.		MIN.	MAX.
A	0.80	1.00	A	0.031	0.039
A1	0.00	0.05	A1	0.000	0.001
b	0.18	0.30	b	0.007	0.011
D	3.00 BSC		D	0.118 BSC	
D1	1.30	1.70	D1	0.051	0.067
E	3.00 BSC		E	0.118 BSC	
E1	1.30	1.70	E1	0.051	0.067
e	0.50 BSC		e	0.019 BSC	
K	0.20 MIN.		K	0.007 MIN.	
L	0.35	0.55	L	0.014	0.022
L1	0.15 MAX.		L1	0.006 MAX.	

Figure 9: S26 Package Outline - 12 Pin 3mm x 3mm MLF

COMPONENT PACKAGING



NOTES:

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

Figure 10: Tape & Reel Packaging

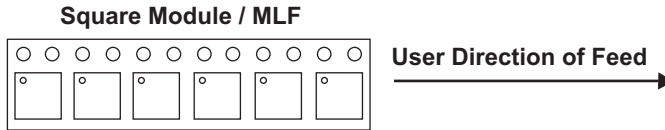


Figure 11: Tape & Reel Package Orientation

Table 7: Tape & Reel Dimensions

PACKAGE TYPE	TAPE WIDTH	POCKET PITCH	REEL CAPACITY	MAX REEL DIA
3mm X 3mm	12mm	8mm	1000	7"



NOTES

**AWS5533**

**NOTES**

NOTES

**ORDERING INFORMATION**

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWS5533S26	-30 °C to +85 °C	12 Pin 3mm x 3mm MLF	Tape and Reel

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