AWS5523

0.5 to 2.5 GHz SP3T Switch

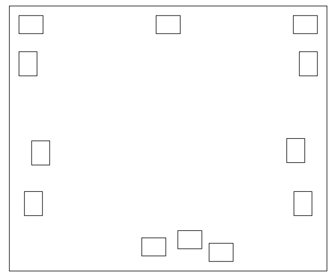
ADVANCED PRODUCT INFORMATION - Rev 0.2

FEATURES

- Low Insertion Loss: 0.5 dB at 2 GHz
- High Isolation: > 25 dB
- Low Harmonic Levels: < -65 dBc at max. GSM power
- Low Control Voltage Operation: to +2.5 V

APPLICATIONS

- Front-end Modules for GSM Wireless Handsets



D1
Die

PRODUCT DESCRIPTION

The AWS5523 is a single pole, three terminal (SP3T) RF switch developed to meet the stringent requirements of GSM systems. Manufactured in ANADIGICS's state-of-the-art pHEMT process, the device uses patent-pending circuit topologies to provide the low insertion loss, high port-to-port isolation and high linearity needed to enhance the performance of GSM radios. The AWS5523 is offered as an unpackaged MMIC die.

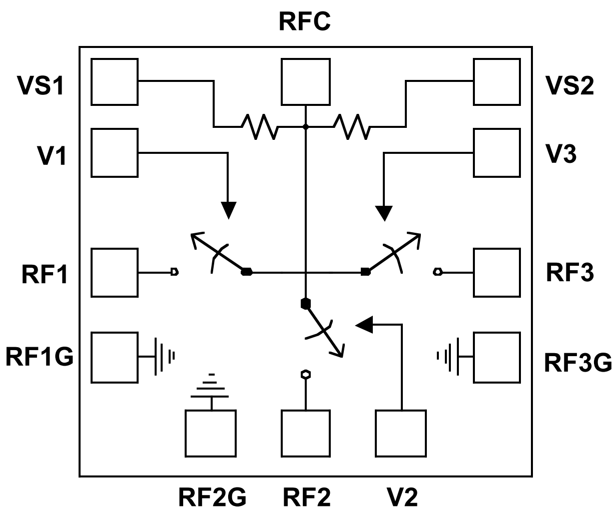
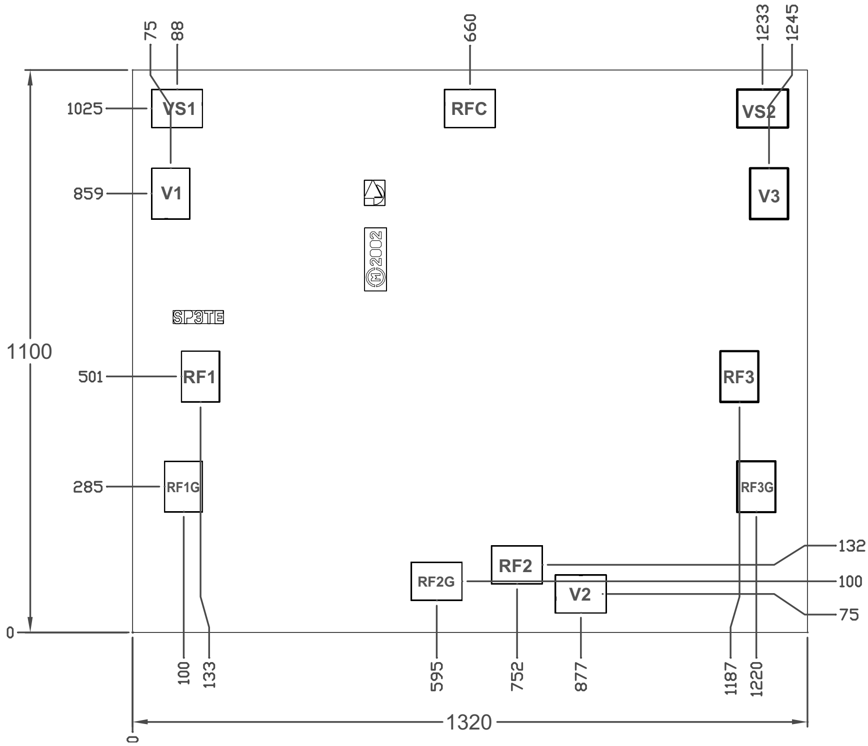


Figure 1: Block Diagram



Dimensions in μm.
Bond Pads: 100μm x 75μm.
Die Thickness: 178μm.
No backside metal.

Figure 2: Die Configuration

Table 1: Pad Description

NAME	DESCRIPTION	NAME	DESCRIPTION
V1	Control voltage, RF path 1	RFG3	Ground
RF1	RF port, path 1	RF3	RF port, path 3
RFG1	Ground	V3	Control voltage, RF path 3
RFG2	Ground	VS2	Common port bias voltage (logic high)
RF2	RF port, path 2	RFC	RF common port
V2	Control voltage, RF path 2	VS1	Common port bias voltage (logic high)

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT	COMMENTS
Common Port Bias Voltage (V_S)	-0.2	+8.0	V	at VS1 or VS2 (1)
Control Voltages (V_1, V_2, V_3)	-0.2	+8.0	V	
RF Input Power (P_{IN})	-	10	W	at RF1, RF2, RF3 and RFC
Storage Temperature (2)	-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) The VS1 and VS2 ports may remain open-circuited without damage to the device.
(2) Storage Temperature limits apply to the die only after it has been removed from the ANADIGICS shipping material.
3. The RF1, RF2, RF3 and RFC ports should be AC-coupled. No external DC bias should be applied.

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 either VS1 or VS2 port
Control Voltages (V_1, V_2, V_3)	0 +2.5	- -	+0.2 +3.5	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.

Notes:
(1) For optimal linearity performance, the Common Port Bias Voltage (V_S) should be set to the same Control Voltage used to turn ON any of the individual RF paths. The VS1 and VS2 ports may remain open-circuited without damage to the device, but with some degradation in linearity.

Table 4: Electrical Specifications
(T_A = +25 °C; RF ports terminated with 50 Ω; V_n = +2.7 V and is the Control Voltage for the ON path, RFC-RFn; V_x = 0 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	 - -	 0.4 0.5	 0.6 0.8	dB	RFC port to selected RFn port
Return Loss [1] 1 GHz 2 GHz	 - -	 -29 -23	 -20 -15	dB	RFC port and selected RFn port
Isolation 1 GHz 2 GHz	 25 25	 27 27	 - -	dB	RFC port to isolated RFx ports
Input Third Order Intercept [2] 800 MHz Cellular Band 1900 MHz PCS Band	 - -	 +66 +59	 - -	dBm	RFC port to selected RFn port
2nd Harmonic Rejection 1 GHz 2 GHz	 - -	 -77 -77	 -65 -65	dBc	RFC port to selected RFn port P_{IN} = +34 dBm P_{IN} = +32 dBm
3rd Harmonic Rejection 1 GHz 2 GHz	 - -	 -72 -75	 -65 -65	dBc	RFC port to selected RFn port P_{IN} = +34 dBm P_{IN} = +32 dBm
Current Consumption	- -	- -	30 5	µA	each Vn port VS1 or VS2 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 dBm each, at 837 and 838 MHz. For the PCS Band, two tones with P_{IN} = +21 dBm each, at 1880 and 1881 MHz.

Table 5: Switch Control Truth Table

CONTROL VOLTAGES			RF PATH SELECTION		
V_1	V_2	V_3	RFC - RF1	RFC - RF2	RFC - RF3
+2.5 to +3.5 V	0 to +0.2 V	0 to +0.2 V	ON	OFF	OFF
0 to +0.2 V	+2.5 to +3.5 V	0 to +0.2 V	OFF	ON	OFF
0 to +0.2 V	0 to +0.2 V	+2.5 to +3.5 V	OFF	OFF	ON

PERFORMANCE DATA

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

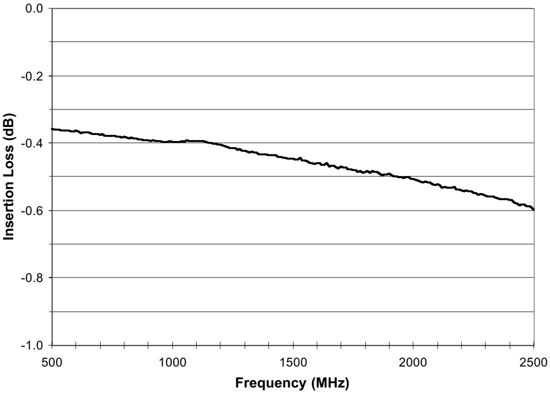


Figure 4: Harmonics of 1 GHz vs. Control Voltage (ON path, V_x = 0 V, f = 1 GHz, P_{IN} = +34 dBm)

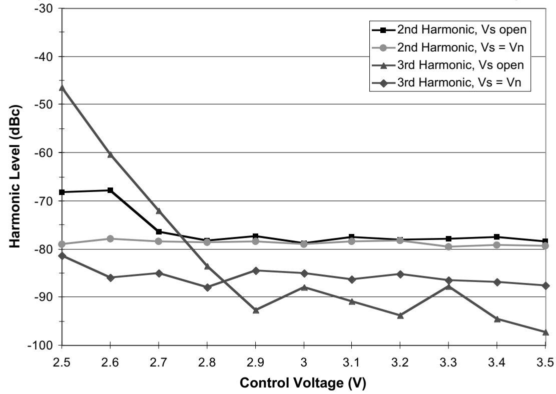


Figure 5: Return Loss vs. Frequency (ON path, V_n = +2.7 V, V_x = 0 V)

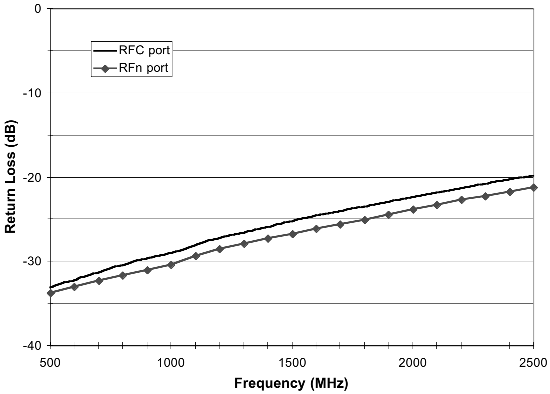


Figure 6: Harmonics of 2 GHz vs. Control Voltage (ON path, V_x = 0 V, f = 2 GHz, P_{IN} = +32 dBm)

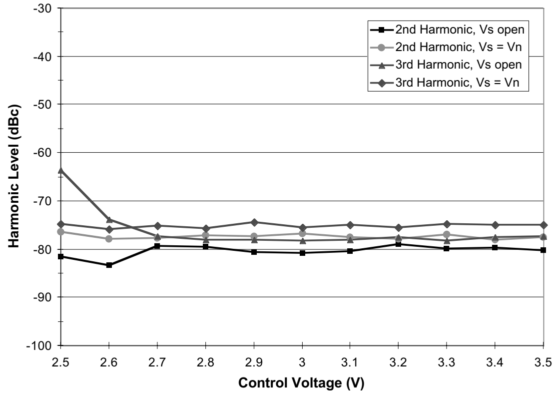
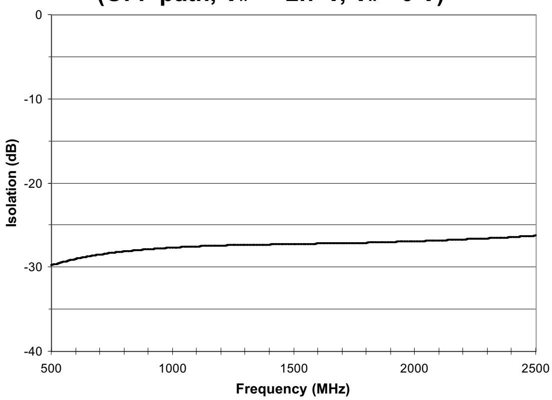


Figure 7: Isolation vs. Frequency (OFF path, V_n = +2.7 V, V_x = 0 V)



APPLICATION INFORMATION

Die Applications

Bonding and circuit connections for the unpackaged AWS5523 die are shown in Figure 8, and application details are listed in the following notes:

1. Cb are DC blocking capacitors external to the device. A value of 100pF is sufficient for operation to 500MHz. The values may be tailored to provide specific electrical responses. The isolation of the switch provides enough decoupling of RF ports 1 through 3 so that overall switch performance is not affected.

2. The VS1 and VS2 pins provide a fixed voltage potential to the common port of the switch. To get the best linear performance, either VS1 or VS2 must be tied to the logic high voltage potential (not the power supply). Only one of the pins need be attached, with the decision determined by external circuit layout. Currentdraw on this pin is less than 5µA.

3. The RF Ground bondwires should be keep short as possible and bonded directly to a good RF ground for best broadband performance.

4. L_{ESD} provides a means to increase the ESD protection on a specific RF port, typically the port attached to the antenna. The ESD rating of the device is ±125V HBM overall. This rating is associated with the control pin to RF port path. RF port to RF port/RF Gnd has been determined to be >±500V HBM for this technology. By using L_{ESD} as an RF choke on a port, an ESD protection to ±8kV contact discharge can be achieved.

5. The die may be attached by either conductive or non-conductive epoxy formulated for attaching semiconductor parts. The back of the die is electrically isolated from the switch circuit and can be grounded or left isolated.

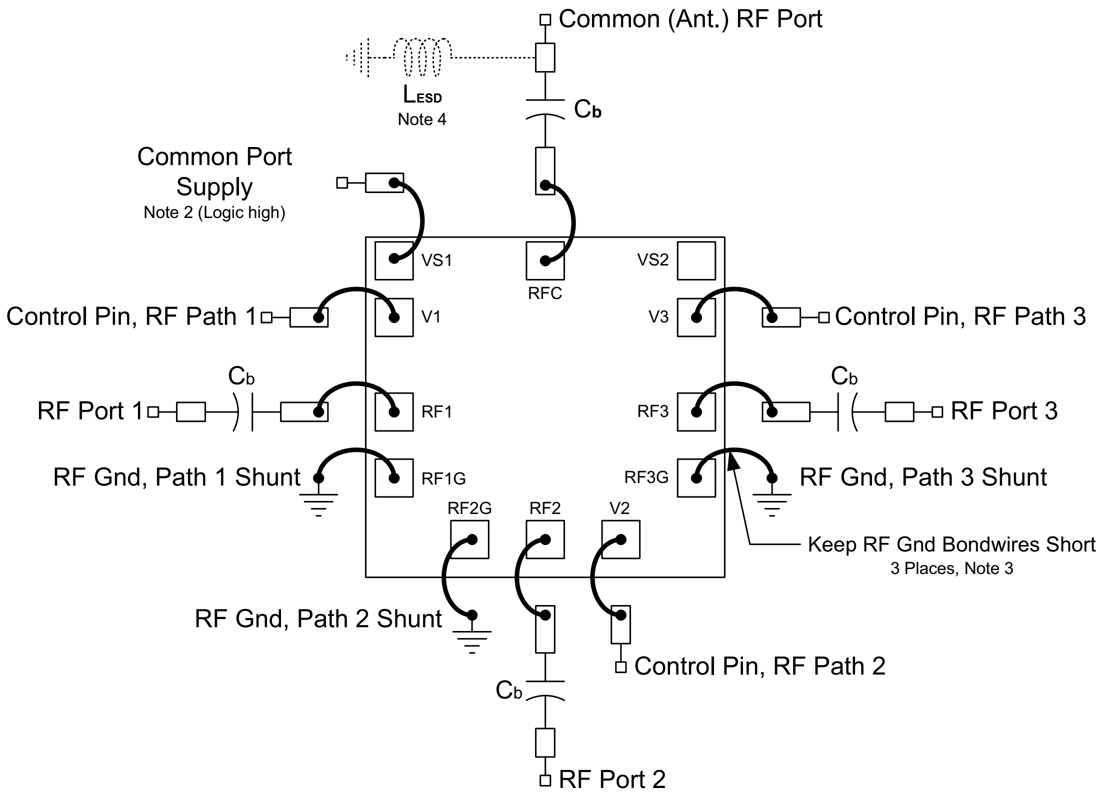


Figure 8: Application Schematic

NOTES

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWS5523D1	-30 °C to +85 °C	Die	(contact ANADIGICS for details)

ANADIGICS, Inc.
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