

# Performance of SPDT RF Switch NSG1001MX, NSVG1001MX

## AND90145/D

### Overview

This device is single pole dual throw (SPDT) type RF antenna switch MMIC. It has low insertion loss and high isolation. This is designed for wireless communication applications such as WLAN and V2X.

It adopts a small surface mount package and it is also suitable for portable devices such as smart phones and automotive antennas. NSG1001MX is for consumer Application and NSVG1001MX is for Automotive Application.

### NSG1001MX / NSVG1001MX Features

- Broadband Frequency Range 0.1 to 8.5 Ghz
- Capable of 1.6 V Operation
- Low Insertion Loss / High Isolation / Middle Power
- Small and Thin-Sized Package – 1.0 x 1.0 x 0.43 mm
- Wettable Flank Package for Optimal Automated Optical Inspection (AOI)
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Pin Configuration and Electrical Connection

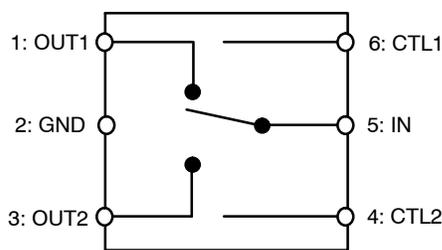


Figure 1. Pin Connection

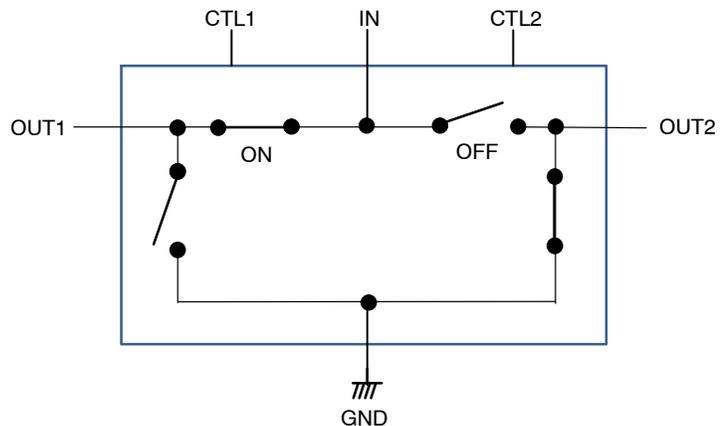


Figure 2. Electrical Connection

### TRUTH TABLE

On Path	V <sub>CTL1</sub>	V <sub>CTL2</sub>
IN – OUT1	Low	High
IN – OUT2	High	Low

# AND90145/D

## Application Board

RF microstrip line is designed with 50 Ω.

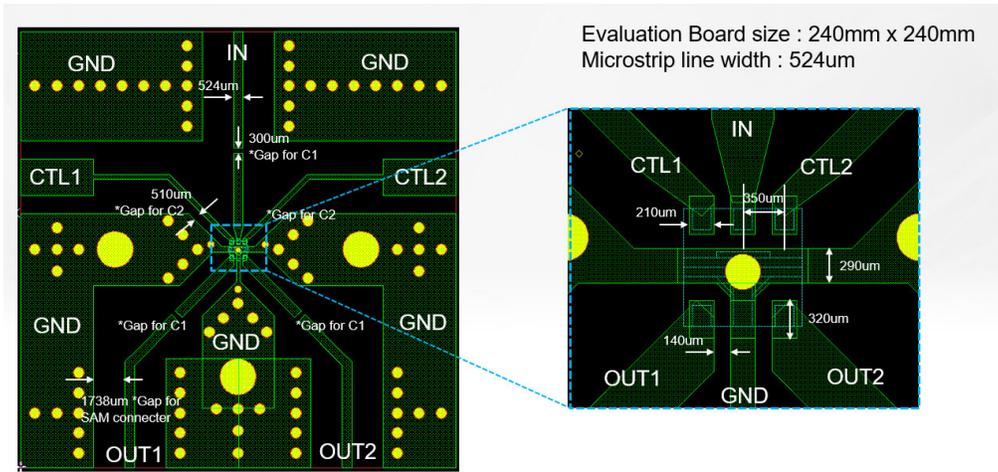


Figure 3. Application Board

## BILL OF MATERIALS

Item	Symbol	Value	Manufacturer	Size
DC Cut Capacitor	C1	5 pF	Various	0603
Bypass Capacitor	C2	1 pF	Various	1005

## SMALL SIGNAL CHARACTERISTICS

Parameter	Unit	Freq	Vctl = 1.65 V		Vctl = 1.70 V		Vctl = 1.80 V		Vctl = 2.70 V	
			IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2
Return Loss	dB	2.5 GHz	-29.0	-29.6	-29.0	-29.6	-29.0	-29.5	-29.1	-29.6
		6.0 GHz	-25.2	-22.8	-25.3	-22.8	-25.5	-22.9	-26.3	-23.6
		8.5 GHz	-18.9	-20.5	-18.9	-20.6	-19.1	-20.8	-19.7	-21.5
Insertion Loss	dB	2.5 GHz	-0.38	-0.38	-0.39	-0.39	-0.38	-0.38	-0.39	-0.39
		6.0 GHz	-0.44	-0.46	-0.44	-0.46	-0.45	-0.47	-0.43	-0.45
		8.5 GHz	-0.62	-0.60	-0.62	-0.60	-0.61	-0.60	-0.59	-0.59
Isolation	dB	2.5 GHz	-30.6	-30.5	-30.7	-30.5	-30.8	-30.7	-31.2	-31.1
		6.0 GHz	-29.8	-29.3	-29.9	-29.4	-29.8	-29.4	-30.2	-29.6
		8.5 GHz	-20.3	-20.3	-20.4	-20.4	-20.5	-20.4	-20.7	-20.6

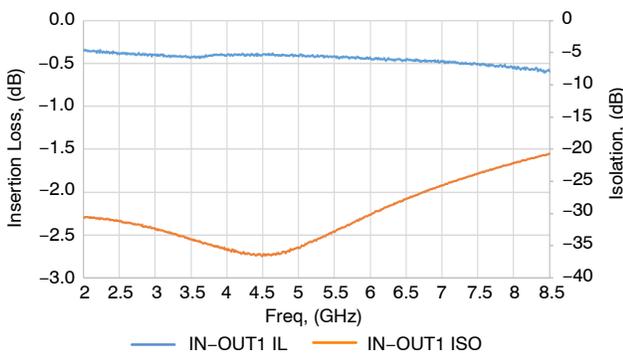


Figure 4. IN-OUT1 Vctl1 = 0 V, Vctl2 = 2.7 V

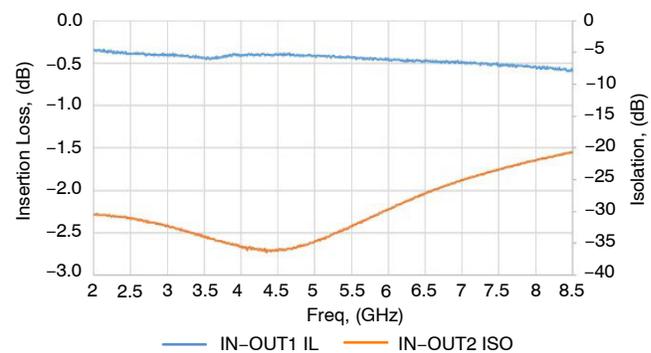


Figure 5. IN-OUT2 Vctl1 = 2.7 V, Vctl2 = 0 V

Power Compression

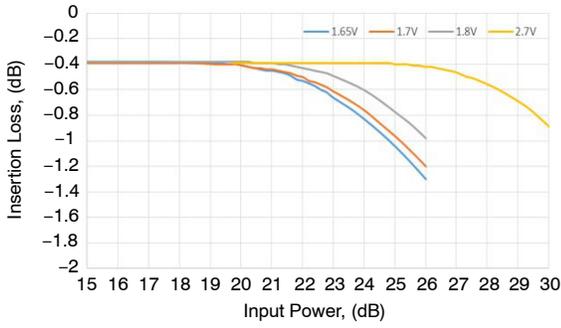


Figure 6. IN-OUT1 at 2.5 GHz

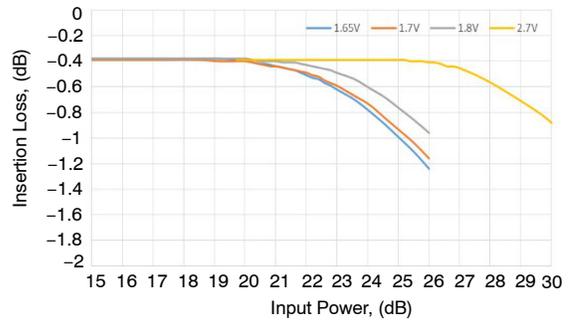


Figure 7. IN-OUT2 at 2.5 GHz

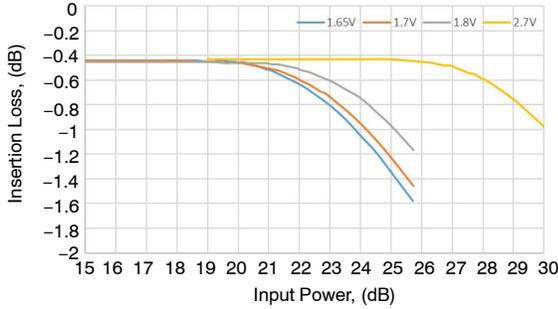


Figure 8. IN-OUT1 at 6.0 GHz

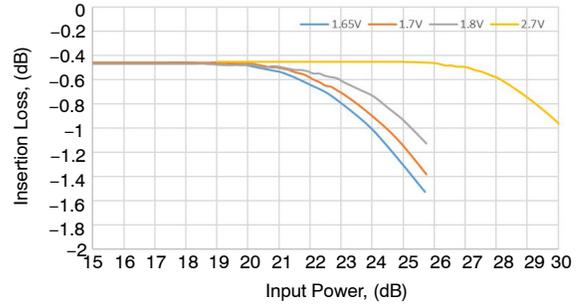


Figure 9. IN-OUT2 at 6.0 GHz

Parameter	Unit	Freq	Vctl = 1.65 V		Vctl = 1.70 V		Vctl = 1.80 V		Vctl = 2.70 V	
			IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2	IN-OUT1	IN-OUT2
Pin 0.1 dB	dBm	2.5 GHz	21.5	21.7	21.8	22.0	22.9	22.9	27.3	27.3
		6.0 GHz	21.3	21.2	21.5	21.8	22.5	22.5	27.4	27.7

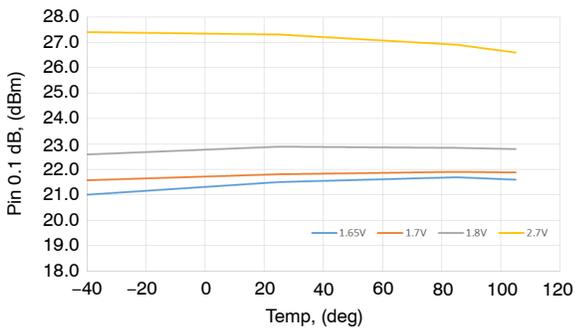


Figure 10. IN-OUT1 Pin 0.1 dB vs. Temp 2.5 GHz

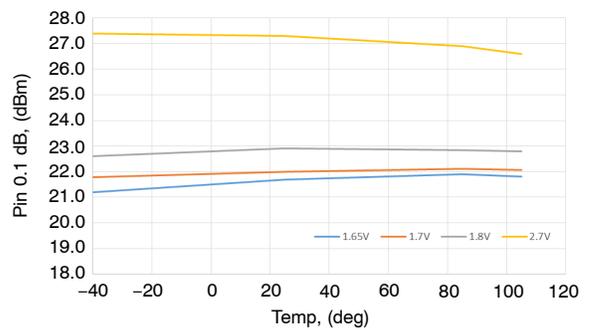


Figure 11. IN-OUT2 Pin 0.1 dB vs. Temp 2.5 GHz

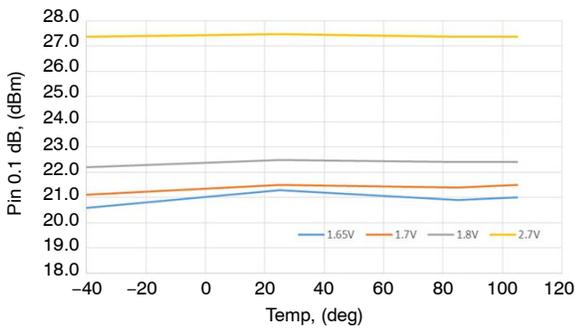


Figure 12. IN-OUT1 Pin 0.1 dB vs. Temp 6.0 GHz

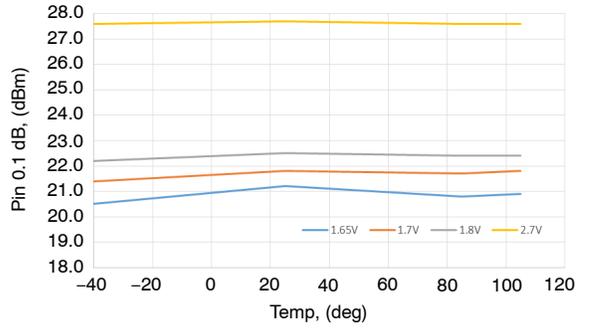


Figure 13. IN-OUT2 Pin 0.1 dB vs. Temp 6.0 GHz

# AND90145/D

## Intermodulation

f1 = 2400 MHz, f2 = 2401 MHz, Vctl = 2.7 V

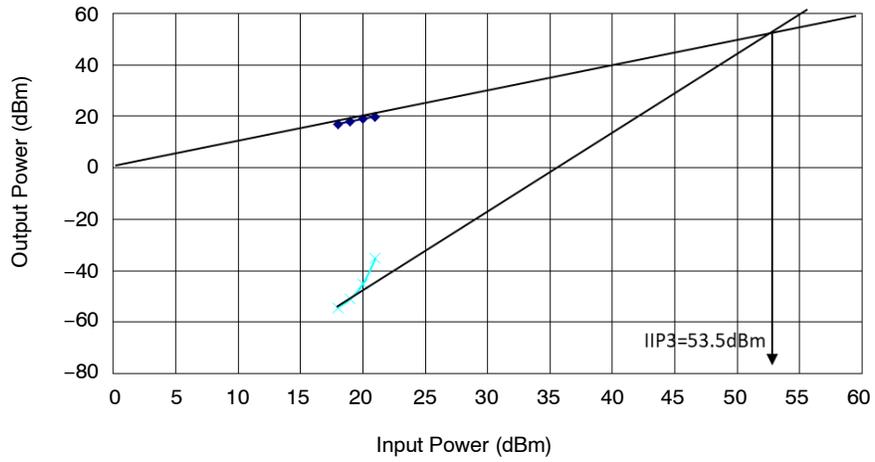
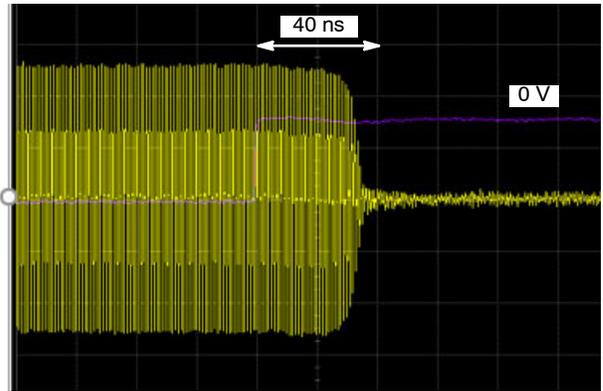
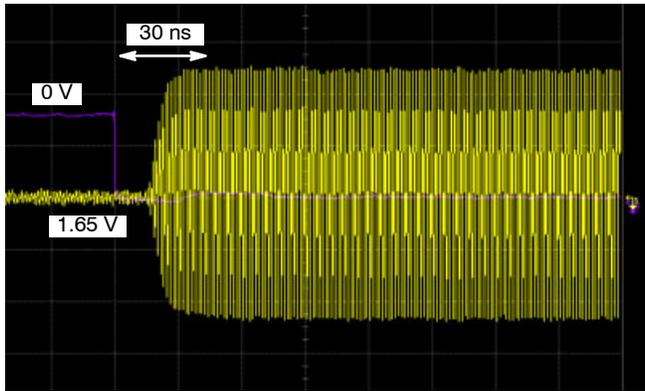


Figure 14. Intermodulation

## Switching Time

Freq = 1.0 GHz, Vctl = 1.65 V, 20 ns/Div



Freq = 1.0 GHz, Vctl = 2.7 V, 20 ns/Div

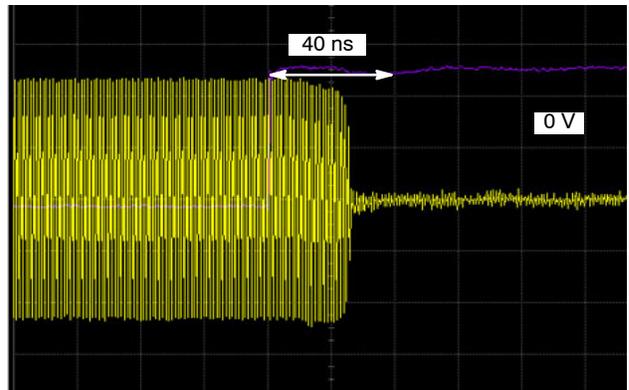
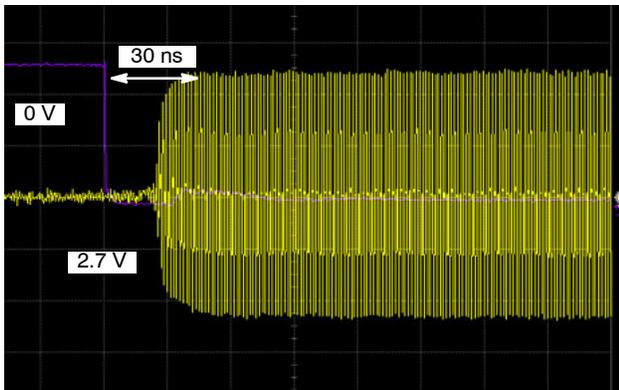


Figure 15. Switching Time

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**onsemi** Website: [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

**North American Technical Support:**  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative