

## GaAs SPDT Switch DC - 4 GHz

M/A-COM Products  
Rev. 6

### Features

- Terminated (SW-226-PIN), High Isolation (SW-227-PIN), Low Loss (SW-228-PIN)
- Fast Switching Speed: 6 nS Typical
- Ultra Low DC Power Consumption
- Lead-Free 7-Lead Ceramic Package
- RoHS\* Compliant and 260°C Reflow Compatible

### Description

M/A-COM's SW-226/227/228-PIN are GaAs MMIC SPDT switches packaged in lead-free, surface mount CR-2 ceramic style packages. The SW-226-PIN is a terminated SPDT. The SW-227-PIN offers high isolation. The SW-228-PIN offers low insertion loss. This ceramic switch platform has a common footprint for all three designs. The CR-2 package is hermetically sealed, making these switches ideal for space, military radios, and other environmentally harsh applications.

Typical applications include synthesizer switching, transmit/receive switching, switch matrices and filter banks in systems such as radio and cellular equipment, PCM, GPS, and fiber optic modules.

The SW-226/227/228-PIN are fabricated as monolithic GaAs MMICs using a 1.0 micron MEFET process.

### Ordering Information

Part Number	Package
SW-226-PIN	Ceramic (CR-2)
SW-227-PIN	Ceramic (CR-2)
SW-228-PIN	Ceramic (CR-2)

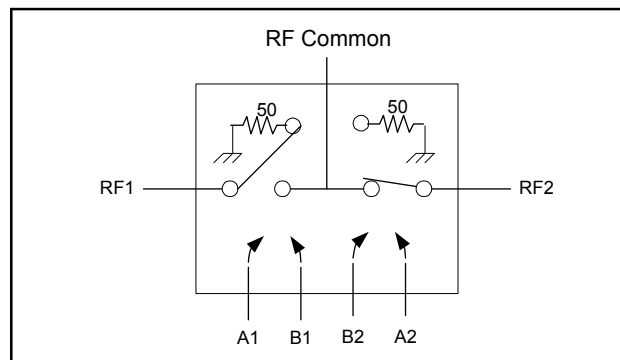
### Absolute Maximum Ratings <sup>1,2</sup>

Parameter	Absolute Maximum
Input Power 0.05 GHz 0.5 - 4.0 GHz	+27 dBm +34 dBm
Control Voltage	-8.5 V ≤ V <sub>c</sub> ≤ +5 V
Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C

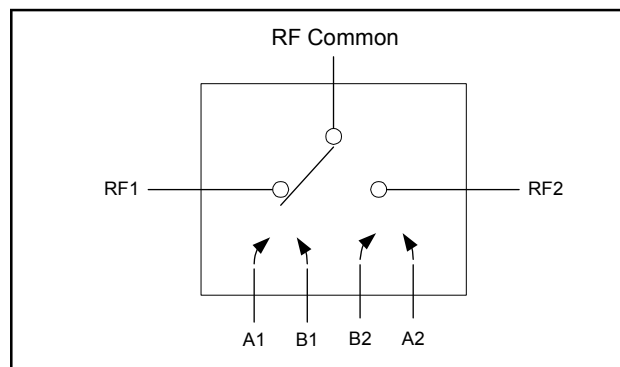
1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. M/A-COM does not recommend sustained operation near these survivability limits.

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

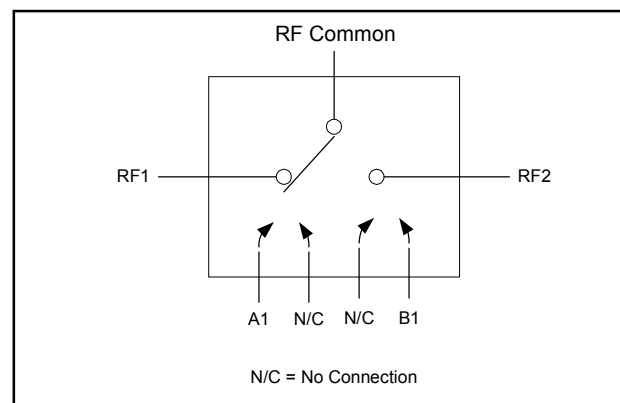
### Block Diagram/Pin Configuration SW-226-PIN <sup>3</sup>



### Block Diagram/Pin Configuration SW-227-PIN <sup>3</sup>



### Block Diagram/Pin Configuration SW-228-PIN <sup>3</sup>



3. Bottom of case is RF ground.

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.  
**PRELIMINARY:** Data Sheets contain information regarding a product M/A-COM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

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**Electrical Specifications:  $T_A = -55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_C = 0\text{ V} / -5\text{ V}$ ,  $Z_0 = 50\ \Omega$  <sup>4</sup>**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (SW-226-PIN)	DC - 0.5 GHz	dB	—	—	0.9
	DC - 1 GHz	dB	—	—	1.0
	DC - 2 GHz	dB	—	—	1.2
	DC - 4 GHz	dB	—	—	1.5
Insertion Loss (SW-227-PIN)	DC - 0.5 GHz	dB	—	—	0.9
	DC - 1 GHz	dB	—	—	1.0
	DC - 2 GHz	dB	—	—	1.1
	DC - 4 GHz	dB	—	—	1.4
Insertion Loss (SW-228-PIN)	DC - 0.5 GHz	dB	—	—	0.7
	DC - 1 GHz	dB	—	—	0.7
	DC - 2 GHz	dB	—	—	0.8
	DC - 4 GHz	dB	—	—	1.0
Isolation (SW-226-PIN)	DC - 0.5 GHz	dB	53	—	—
	DC - 1 GHz	dB	48	—	—
	DC - 2 GHz	dB	40	—	—
	DC - 4 GHz	dB	25	—	—
Isolation (SW-227-PIN)	DC - 0.5 GHz	dB	55	—	—
	DC - 1 GHz	dB	50	—	—
	DC - 2 GHz	dB	40	—	—
	DC - 4 GHz	dB	35	—	—
Isolation (SW-228-PIN)	DC - 0.5 GHz	dB	50	—	—
	DC - 1 GHz	dB	42	—	—
	DC - 2 GHz	dB	32	—	—
	DC - 4 GHz	dB	22	—	—
VSWR (SW-226-PIN)	DC - 0.5 GHz	Ratio	—	—	1.2:1
	DC - 1 GHz	Ratio	—	—	1.4:1
	DC - 2 GHz	Ratio	—	—	1.6:1
	DC - 4 GHz	Ratio	—	—	2.3:1
VSWR (SW-227-PIN)	DC - 0.5 GHz	Ratio	—	—	1.2:1
	DC - 1 GHz	Ratio	—	—	1.4:1
	DC - 2 GHz	Ratio	—	—	1.6:1
	DC - 4 GHz	Ratio	—	—	2.0:1
VSWR (SW-228-PIN)	DC - 0.5 GHz	Ratio	—	—	1.2:1
	DC - 1 GHz	Ratio	—	—	1.2:1
	DC - 2 GHz	Ratio	—	—	1.3:1
	DC - 4 GHz	Ratio	—	—	1.9:1
Trise, Tfall <sup>5</sup>	10% to 90% RF, 90% to 10% RF	nS	—	3	—
Ton, Toff <sup>5</sup>	50% control to 90% RF, 50% control to 10% RF	nS	—	6	—
Transients <sup>5</sup> (SW-226-PIN,SW-227-PIN)	In-Band	mV	—	30	—
Transients <sup>5</sup> (SW-228-PIN)	In-Band	mV	—	10	—

4. See MIL-STD-883 for environmental screening options.

5. Faster switching speed can be achieved with enhanced driver waveform.

**Electrical Specifications (continued):**  $T_A = -55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_c = 0\text{ V} / -5\text{ V}$ ,  $Z_0 = 50\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Input P1dB	0.5 - 4 GHz, 0 / -5 VDC	dBm	—	27	—
	0.05 GHz, 0 / -5 VDC	dBm	—	21	—
	0.5 - 4 GHz, 0 / -8 VDC	dBm	—	33	—
	0.05 GHz, 0 / -8 VDC	dBm	—	26	—
IP2	For two-tone input power up to +13 dBm				
	0.5 - 4 GHz 0.05 GHz	dBm dBm	— —	68 62	— —
IP3	For two-tone input power up to +13 dBm				
	0.5 - 4 GHz 0.05 GHz	dBm dBm	— —	46 40	— —
Control Current	$ V_c  = 0$ to $0.2\text{ V}$ $ V_c  = 5\text{ V}$ (SW-226-PIN, SW-227-PIN) $ V_c  = 8\text{ V}$ (SW-226-PIN, SW-227-PIN) $ V_c  = 5\text{ V}$ (SW-228-PIN) $ V_c  = 8\text{ V}$ (SW-228-PIN)	$\mu\text{A}$	—	—	20
		$\mu\text{A}$	—	110	—
		$\mu\text{A}$	—	—	600
		$\mu\text{A}$	—	50	—
		$\mu\text{A}$	—	—	300

## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

## SW-226-PIN and SW-227-PIN Truth Table<sup>6,7</sup>

Control Input				Condition of Switch, RF Common to each RF Port	
A1	B1	A2	B2	RF1	RF2
1	0	0	1	ON	OFF
0	1	1	0	OFF	ON

## SW-228-PIN Truth Table<sup>6,7</sup>

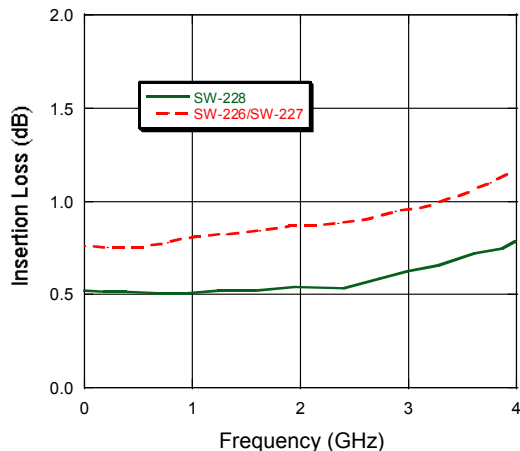
Control Input		Condition of Switch, RF Common to each RF Port	
A1	B1	RF1	RF2
1	0	ON	OFF
0	1	OFF	ON

6. 0 = 0 V to -0.2 V, 1 = -5 V to -8 V

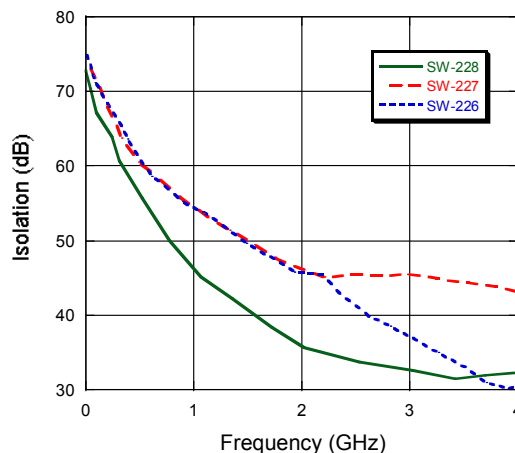
7. For the SW-227-PIN and SW-228-PIN only, when an RF output is "OFF" it is shorted to case ground.

## Typical Performance Curves

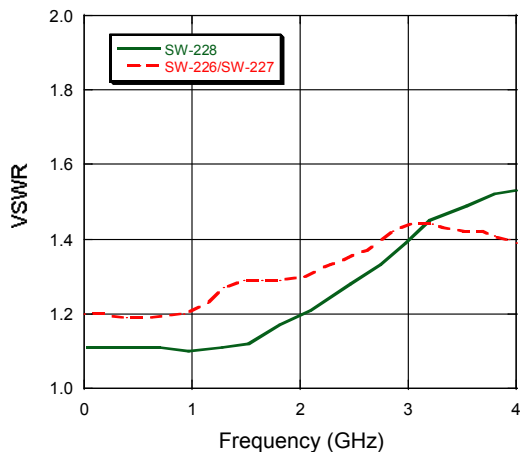
### Insertion Loss



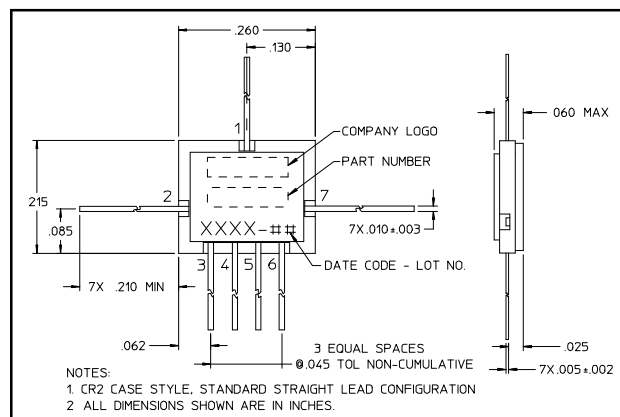
### Isolation



### VSWR



### Lead-Free CR-2†



† Reference Application Note M538 for lead-free solder reflow recommendations.