

**GaAs SPDT Switch
DC - 4 GHz**

**SW-226/227/228-PIN
V5**

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 MESFET process.

Ordering Information

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

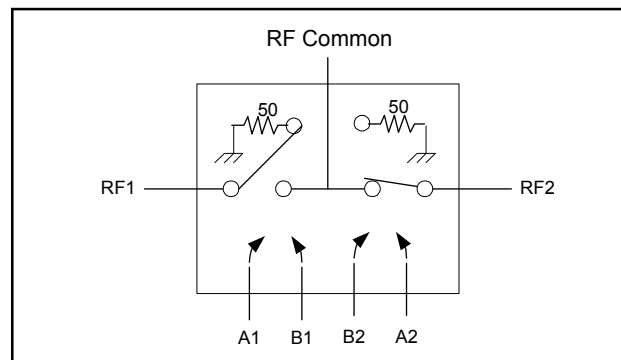
Absolute Maximum Ratings ^{1,2}

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

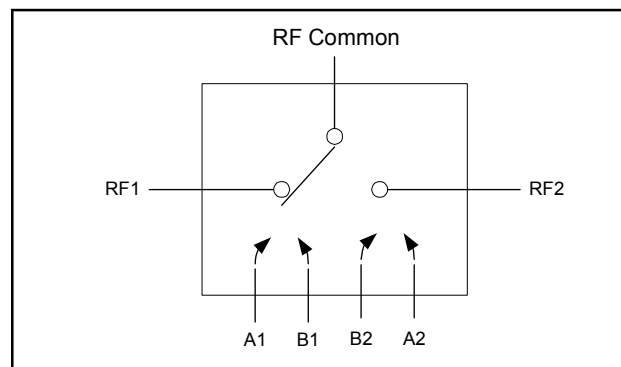
1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. M/A-COM does not recommend sustained operation near these survivability limits.

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

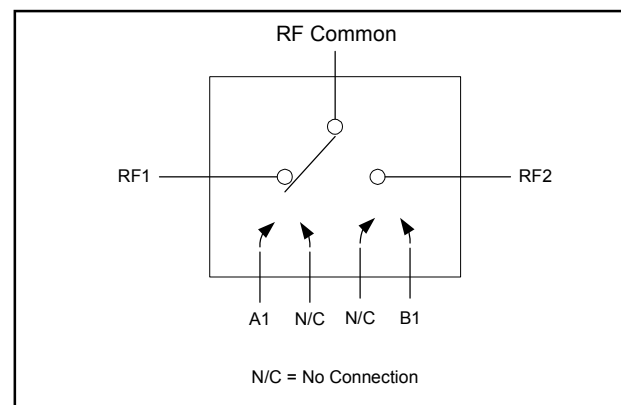
**Block Diagram/Pin Configuration
SW-226-PIN** ³



**Block Diagram/Pin Configuration
SW-227-PIN** ³



**Block Diagram/Pin Configuration
SW-228-PIN** ³



3. Bottom of case is RF ground.

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

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 ⁵	10% to 90% RF, 90% to 10% RF	nS	—	3	—
Ton, Toff ⁵	50% control to 90% RF, 50% control to 10% RF	nS	—	6	—
Transients ⁵ (SW-226-PIN,SW-227-PIN)	In-Band	mV	—	30	—
Transients ⁵ (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.

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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	dBm	—	68	—
IP3	For two-tone input power up to +13 dBm				
	0.5 - 4 GHz	dBm	—	46	—
Control Current	$ V_c = 5\text{ V}$ (SW-226-PIN, SW-227-PIN)	$ V_c = 0$ to 0.2 V	μA	—	20
		$ V_c = 8\text{ V}$ (SW-226-PIN, SW-227-PIN)	μA	—	110
Control Current	$ V_c = 8\text{ V}$ (SW-226-PIN, SW-227-PIN)	$ V_c = 5\text{ V}$ (SW-228-PIN)	μA	—	600
		$ V_c = 8\text{ V}$ (SW-228-PIN)	μA	—	50
Control Current	$ V_c = 5\text{ V}$ (SW-228-PIN)	$ V_c = 8\text{ V}$ (SW-228-PIN)	μA	—	300
		$ V_c = 5\text{ V}$ (SW-228-PIN)	μA	—	—

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^{6,7}**

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^{6,7}

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

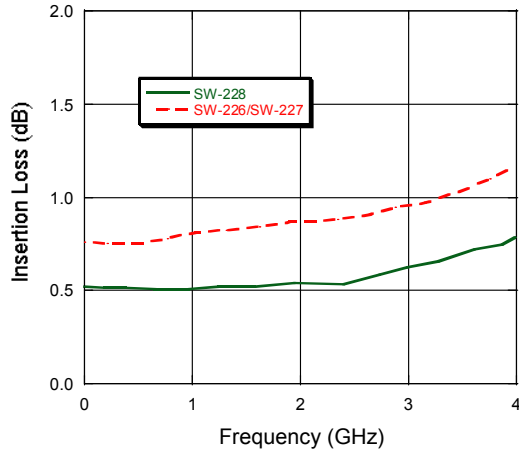
7. For the SW-227-PIN and SW-228-PIN only, when an RF output is "OFF" it is shorted to case ground.

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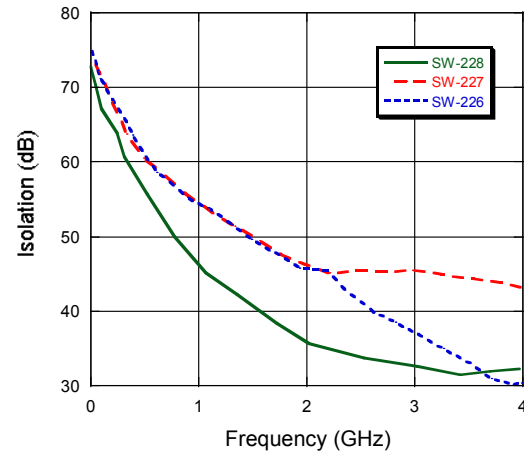
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Typical Performance Curves

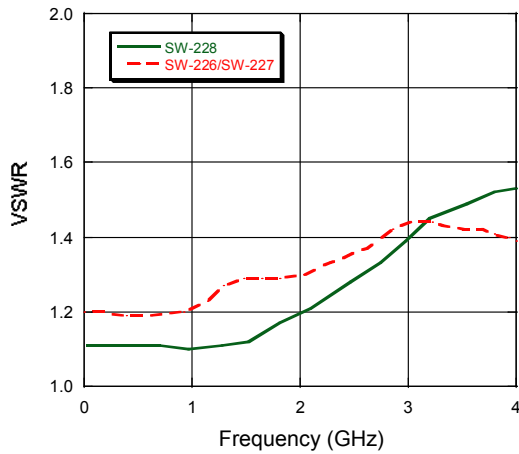
Insertion Loss



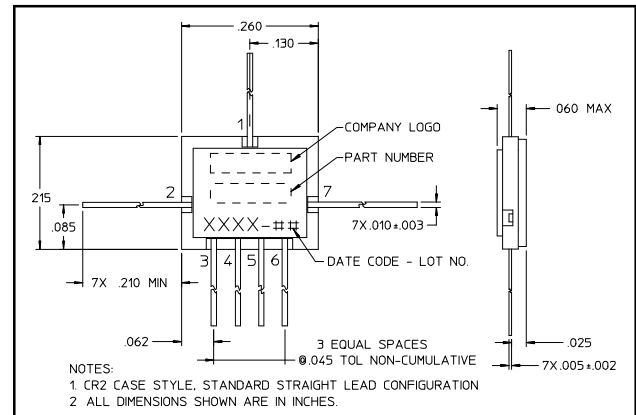
Isolation



VSWR



Lead-Free CR-2†



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