# SW90-0001

# GaAs SPST Switch, Absorptive, Single Supply, DC-4.0 GHz



Rev. V11

### Features

- Operates DC 4 GHz on Single Supply
- ASIC TTL / CMOS Driver
- Low DC Power Consumption
- 50 Ohm Nominal Impedance
- Test Boards are Available
- Tape and Reel are Available
- 4 x 6 mm PQFN Package

## Description

M/A-COM's SW90-0001 is a SPST absorptive pHEMT switch with integral TTL driver. This device is in an MLP plastic surface mount package. This switch offers excellent broadband performance and repeatability from DC to 4 GHz, while maintaining low DC power dissipation. The SW90-0001 is ideally suited for wireless infrastructure applications.

# Pin Configuration<sup>1,2,3,4</sup>

Pin No.	Function	Pin No.	Function	
1	NC	17	NC	
2	NC	18	NC	
3	C1	19	V <sub>cc</sub>	
4	NC	20	NC	
5	NC	21	CP2	
6	NC	22	NC	
7	NC	23	CP1	
8	NC	24	NC	
9	NC	25	V <sub>EE</sub>	
10	NC	26	GND	
11	GND	27	RF1	
12	RF2	28	GND	
13	GND	29	NC	
14	NC	30	V <sub>EE</sub>	
15	NC	31	NC	
16	NC	32	V <sub>CC</sub>	

1. NC = No Connection

 VEE is internally generated and must remain isolated from external power supplies. Generated noise is typical of switching DC-DC Converters

- 3. Connections and external components shown in functional schematic are required. 0.1  $\mu$ F Capacitors need to be located near pins 30 & 32.
- The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

## Truth Table (Switch)

Control Input	Condition of the Switch		
C1	RF1 to RF2		
0	Off		
1	On		

## **Ordering Information**

Part Number	Package	
SW90-0001	Bulk Packaging	
SW90-0001TR	1000 piece reel	
SW90-0001-TB	Sample Test Board	

Note: Reference Application Note M513 for reel size information.

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## GaAs SPST Switch, Absorptive, Single Supply, DC-4.0 GHz

## Electrical Specifications: $T_A = 25^{\circ}C$ , $Z_0 = 50\Omega$

Parameter	Test Conditions	Frequency	Units	Min	Тур	Max
Insertion Loss	RF1—RF2 (All Logic "1")	DC - 4.0 GHz	dB	_	_	0.85
Isolation	RF1—RF2 (All Logic "0")	DC - 4.0 GHz	dB	25	_	—
VSWR	On (RF1, RF2) (All Logic "1")	DC - 4.0 GHz	Ratio	_	_	1.5:1
VSWR	Off (RF1, RF2) (All Logic "0")	DC - 4.0 GHz	Ratio	_	_	1.5:1
1 dB Compression	_	50 MHz 0.5 - 4.0 GHz	dBm dBm	_	24 30	_
Input IP <sub>3</sub>	Two-tone inputs up to +5 dBm	50 MHz 0.5-4.0 GHz	dBm dBm	_	40 48	_
Switching Speed	Ton (50% Control to 10% RF)	_	ns	—	32	—
	Toff (50% Control to 90% RF)	_	ns	—	20	—
	Trise (10% to 90% RF)	_	ns	_	7	—
	Tfall (90% to 10% RF)	_	ns	—	2	—
Vcc	—	_	V	4.5	5.0	5.5
V <sub>IL</sub> V <sub>IH</sub>	LOW-level input voltage HIGH-level input voltage	_	V V	0.0 2.0	_	0.8 5.0
lin (Input Leakage Current)	Vin = V <sub>CC</sub> or GND	_	uA	-1.0	_	1.0
Icc <sup>5</sup>	Vcc min to max, Logic "0" or "1"	_	mA	_	5	8
Turn-on Current <sup>6</sup>	For guaranteed start-up	_	mA	_	_	125
∆Icc (Additional Supply Current Per TTL Input Pin)	$V_{CC}$ = Max, Vcntrl = $V_{CC}$ - 2.1 V		mA	_	_	1.0
Switching Noise	Generated from DC-DC Converter with recommended capacitors	3.5 MHz	dBm	—	-93	—
Thermal Resistance θjc	_	_	°C/W	_	15	_

5. During turn-on, the device requires an initial start up current (Icc) specified as "Turn-on Current". Once operational, Icc will drop to the specified levels.

The DC-DC converter is guaranteed to start in 100 µs as long as the power supplies have the maximum turn-on current available for start up.

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## Absolute Maximum Ratings 7,8

Parameter	Absolute Maximum		
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz <sup>9</sup>	+27 dBm +34 dBm		
V <sub>cc</sub>	$-0.5V \le V_{CC} \le +6.0V$		
Vin <sup>10</sup>	$-0.5 V \le Vin \le V_{CC} + 0.5 V$		
Operating Temperature	-40°C to +85°C		
Storage Temperature	-65°C to +125°C		

7. Exceeding any one or combination of these limits may cause permanent damage to this device.

- M/A-COM does not recommend sustained operation near these survivability limits.
- 9. When the RF input is applied to the terminated port, the absolute maximum power is +30 dBm.
- 10.Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

## **Recommended PCB Configuration**<sup>11</sup>

#### RF1 0.46 CENTER LINE OF PART 0.41 .016 0.71 0.41 028 016 27x <u>0.19</u> PIN 1 MARKER PIN 1 0.5 .0197 28X Ć 2.8 059 0.28 32X Ő PIN <u> A</u> 0.34 0135 TYP PLATED THRU RF2 <u>1.27</u> .050 <u>1.68</u> .066 0.33 .013 RECOMMENDED PC BOARD LAYOUT CIRCUIT MATERIAL: TETRA II .010 INCH THICK DIELECTRIC CONSTANT 4.4 RF LINES ARE COPLANER- USE GND SPACING OF .016 GROUND VIAS .014 GRUUNU VIAS UTA RF PORTS ARE 50 0HMS 0.1 µF ≠10% CAPACITOR REQUIRED BETWEEN PINS 21 AND 23 0.1 µF ≠10% BYPASS CAPACITOR REQUIRED ON Vcc TRACE NEAR PIN 32 0.1 µF ≠10% BYPASS CAPACITOR REQUIRED ON Vce TRACE NEAR PIN 30

#### 11.Application Note C2083 is available on line at www.macomtech.com

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## **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.

## **Moisture Sensitivity**

The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

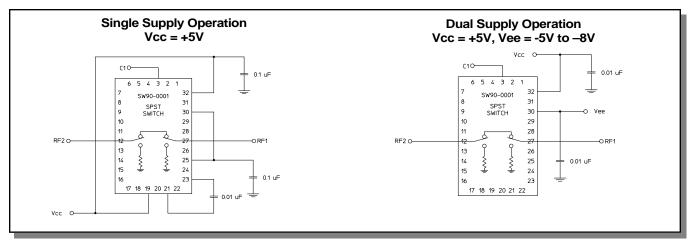
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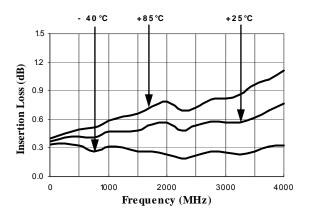
## Functional Schematic<sup>12</sup>



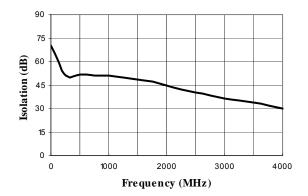
12.Dual Supply Operation will eliminate the start-up current mentioned in Note 5. It will also eliminate spurious signals caused by the DC-DC converter that are present in single supply operation.

## **Typical Performance Curves**

#### Insertion Loss vs. Frequency



#### Isolation (dB) vs. Frequency



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RF2 (Off)

3000

VSWR (Terminations) vs. Frequency

1000

2000

Frequency (MHz)

2.00

1.80

1.40

1.20

1.00

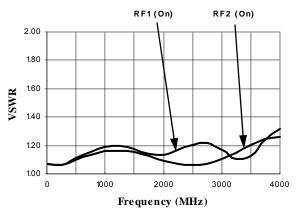
0

VSWR 1.60 RF1 (Off)

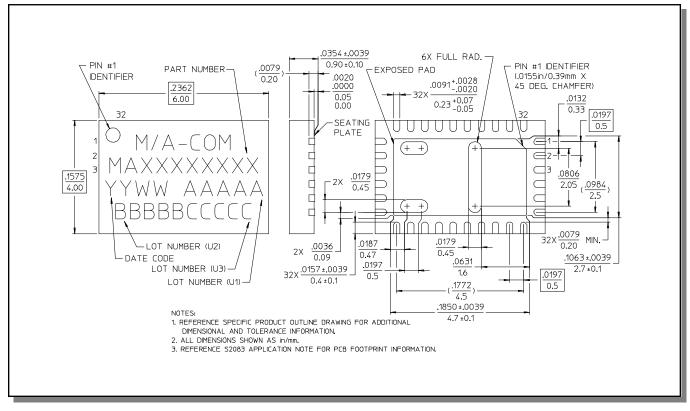
4000

## **Typical Performance Curves**

#### On VSWR vs. Frequency



# CSP-1, 4 x 6 mm, 32-lead PQFN<sup>†</sup>



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

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