

## Features

- Operates DC - 4 GHz on Single Supply
- ASIC TTL / CMOS Driver
- 4 x 7 mm Chip Scale Plastic Package
- Low DC Power Consumption
- 50 Ohm Nominal Impedance
- Test Boards are Available
- Tape and Reel is Available
- CSP-2 Package

## Description

M/A-COM's SW90-0003 is a SP4T 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 SW90-0003 is ideally suited for wireless infrastructure applications.

## Ordering Information

Part Number	Package
SW90-0003	Bulk Packaging
SW90-0003TR	1000 piece reel
SW90-0003-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

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

Pin No.	Function	Pin No.	Function
1	CP2	19	GND
2	Vee	20	NC <sup>1</sup>
3	NC <sup>1</sup>	21	GND
4	C4	22	RFC
5	C3	23	GND
6	C2	24	NC <sup>1</sup>
7	C1	25	RF3
8	NC <sup>1</sup>	26	GND
9	NC <sup>1</sup>	27	NC <sup>1</sup>
10	NC <sup>1</sup>	28	GND
11	NC <sup>1</sup>	29	RF4
12	NC <sup>1</sup>	30	GND
13	GND	31	NC <sup>1</sup>
14	RF1	32	Vee
15	GND	33	Vcc
16	NC <sup>1</sup>	34	NC <sup>1</sup>
17	GND	35	Vcc
18	RF2	36	CP1

1. NC = No Connection
2. For single supply operation VEE is internally generated and must remain isolated from external power supplies. Generated noise is typical of switching DC-DC converters. Connections and external components shown in functional schematic are required. 0.1µF Capacitors need to be located near pins 32 & 33.
3. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

## Electrical Specifications: $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Frequency	Units	Min.	Typ.	Max.
Insertion Loss	RFC-RF1, 2, 3, 4	DC - 4.0 GHz	dB	—	—	2.3
Isolation	—	DC - 4.0 GHz	dB	38	—	—
VSWR	On (RFC, RF1-RF4) Logic per Truth Table	DC - 4.0 GHz	Ratio	—	—	2.0:1
	Off (RF1-RF4) Logic per Truth Table	DC - 4.0 GHz	Ratio	—	—	2.0:1
1 dB Compression	—	50 MHz	dBm	—	+15	—
	—	0.5 - 4.0 GHz	dBm	—	+27	—
Input $IP_3$	Two-tone inputs up to +5 dBm	50 MHz	dBm	—	30	—
		0.5-4.0 GHz	dBm	—	40	—
Switching Speed	Ton (50% Control to 90% RF)	—	ns	—	35	—
	Toff (50% Control to 10% RF)	—	ns	—	20	—
	Trise (10% to 90% RF)	—	ns	—	12	—
	Tfall (90% to 10% RF)	—	ns	—	2	—
$V_{CC}$	—	—	V	4.5	5.0	5.5
$V_{IL}$ $V_{IH}$	LOW-level input voltage	—	V	0.0	—	0.8
	HIGH-level input voltage	—	V	2.0	—	5.0
$I_{in}$ (Input Leakage Current)	$V_{in} = V_{CC}$ or GND	—	$\mu\text{A}$	-1.0	—	1.0
$I_{CC}^{5,7}$	$V_{CC}$ min to max, Logic "0" or "1"	—	mA	—	5	8
$I_{CC}^8$ (Quiescent Supply Current)	$V_{cntrl} = V_{CC}$ or GND	—	$\mu\text{A}$	—	250	400
Turn-on Current <sup>6</sup>	For guaranteed start-up	—	mA	—	—	125
$\Delta I_{CC}$ (Additional Supply Current Per TTL Input Pin)	$V_{CC} = \text{Max}$ , $V_{cntrl} = V_{CC} - 2.1 \text{ V}$	—	mA	—	—	1.0
Switching Noise	Generated from DC-DC Converter with recommended capacitors	3.5 MHz	dBm	—	-93	—
Thermal Resistance $\theta_{jc}$	—	—	$^\circ\text{C/W}$	—	15	—

5. During turn-on, the device requires an initial start up current ( $I_{CC}$ ) specified as "Turn-on Current". Once operational,  $I_{CC}$  will drop to the specified levels. This is not applicable to dual supply operation.
6. The DC-DC converter is guaranteed to start in 100  $\mu\text{s}$  as long as the power supplies have the maximum turn-on current available for start-up.
7. For single supply operation
8. For dual supply operation

## Absolute Maximum Ratings<sup>9,10</sup>

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz <sup>11</sup>	+27 dBm +34 dBm
$V_{CC}$ <sup>7</sup>	$-0.5V \leq V_{CC} \leq +6.0V$
$V_{CC}$ <sup>8</sup>	$-0.5V \leq V_{CC} \leq +7.0V$
$V_{EE}$ <sup>8</sup>	$-8.5V \leq V_{EE} \leq +0.5V$
$V_{CC} - V_{EE}$ <sup>8</sup>	$-0.5V \leq V_{CC} - V_{EE} \leq 14.5V$
$V_{in}$ <sup>12</sup>	$-0.5V \leq V_{in} \leq V_{CC} + 0.5V$
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

9. Exceeding any one or combination of these limits may cause permanent damage to this device.
10. M/A-COM does not recommend sustained operation near these survivability limits.
11. When the RF input is applied to the terminated port, the absolute maximum power is +30 dBm.
12. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

## Truth Table (Switch)

C1	C2	C3	C4	RFC-RF1	RFC-RF2	RFC-RF3	RFC-RF4
1	0	0	0	On	Off	Off	Off
0	1	0	0	Off	On	Off	Off
0	0	1	0	Off	Off	On	Off
0	0	0	1	Off	Off	Off	On

"0" = TTL Low "1" = TTL High

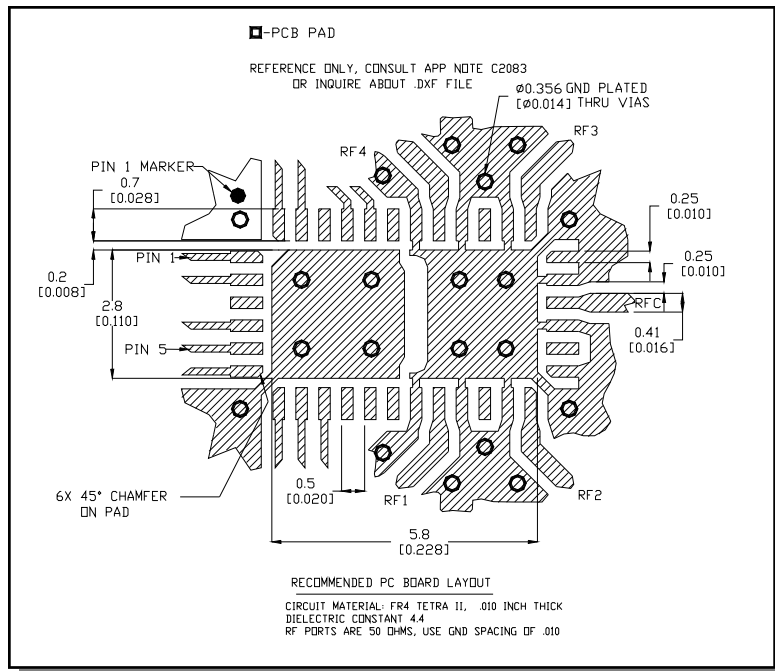
## Handling Procedures

Please observe the following precautions to avoid damage:

## Static Sensitivity

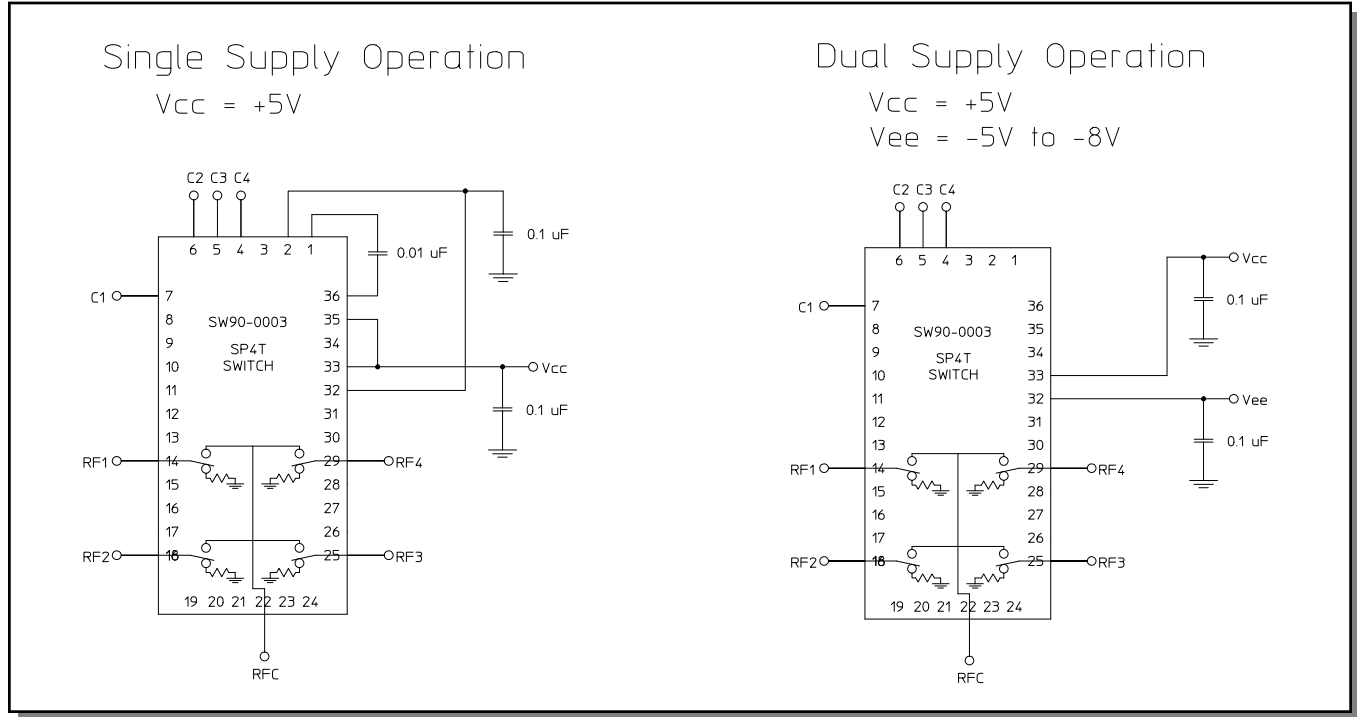
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

## Recommended PCB Configuration<sup>13</sup>



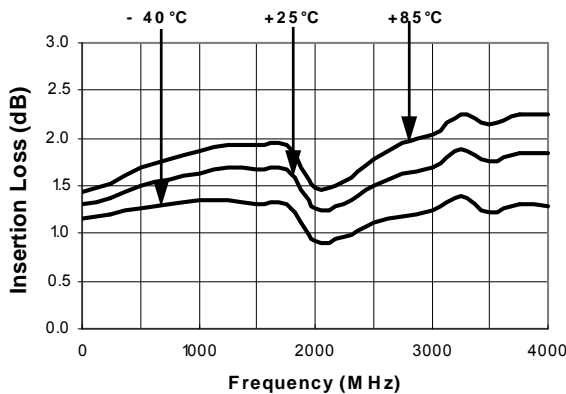
13. Application Note C2083 is available on line at [www.macomtech.com](http://www.macomtech.com)

## Functional Schematic

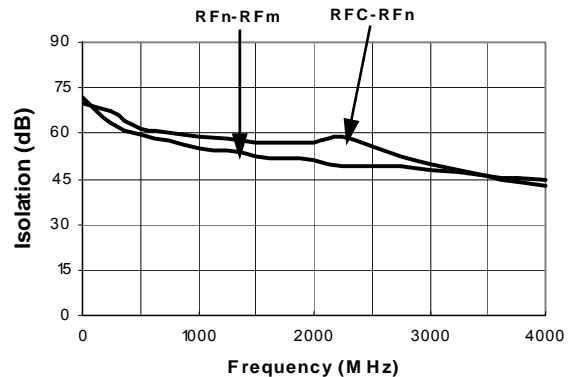


## Typical Performance Curves

Insertion Loss vs. Frequency

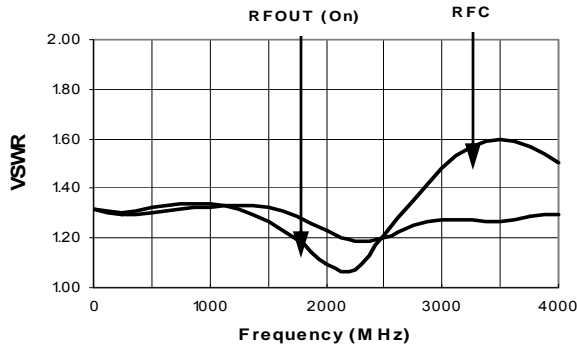


Isolation (dB) vs. Frequency

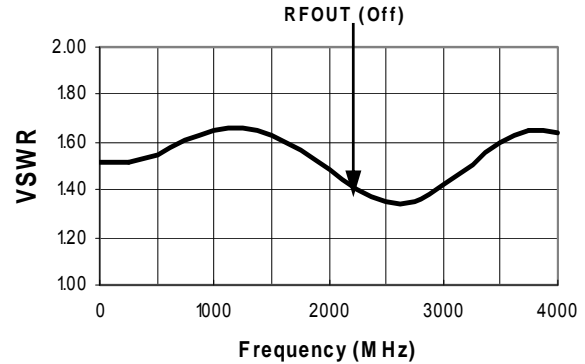


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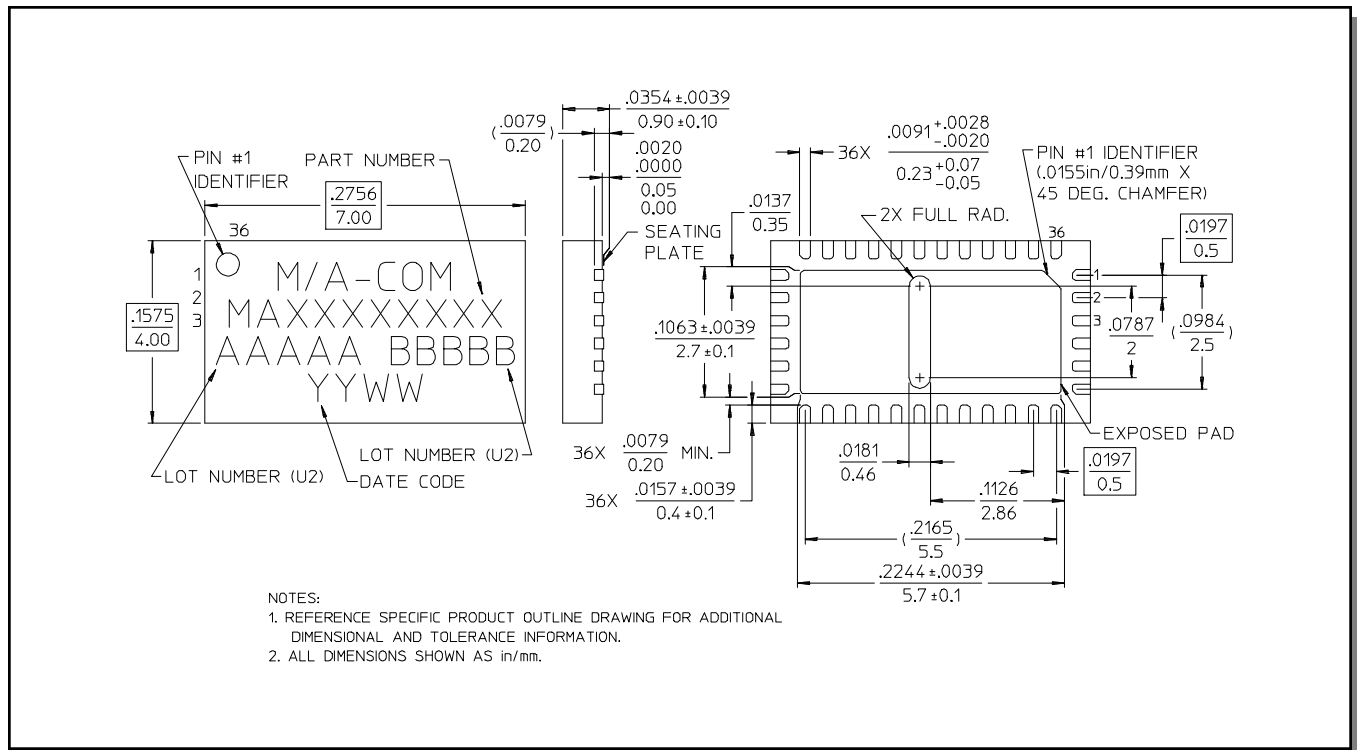
On VSWR vs. Frequency



VSWR (Terminations) vs. Frequency



## CSP-2, 4 x 7 mm, 36-lead, PQFN†



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