

Phase Shifter, S-Band, 6 Bit 2.3-4.1 GHz

MAPCGM0003
903218 B

Features

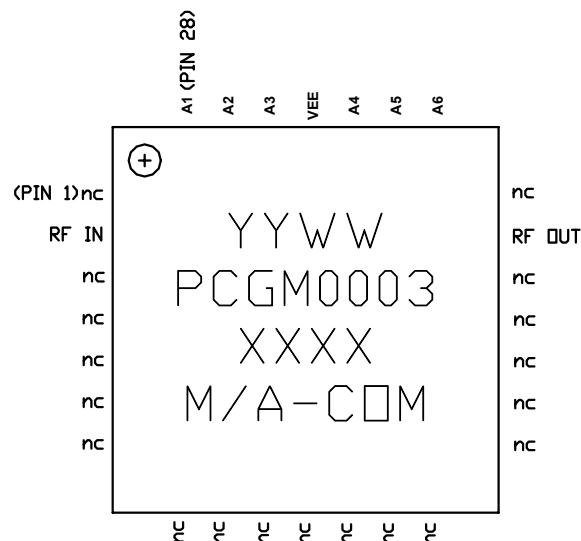
- ◆ 2.3 to 4.1 GHz Operation
- ◆ 6 Bit Phase Shifter
- ◆ 360° Coverage, LSB = 5.6°
- ◆ TTL Control Inputs
- ◆ MSAG™ Process
- ◆ 6mm, 28 Lead, PQFN Package

Description

The MAPCGM0003 is a 6-bit Phase Shifter with Parallel TTL Input Control and is packaged in a micro lead package (MLP). This product is fully matched to 50 ohms on both the input and output. This part has 360° of phase coverage in 5.6° increments.

Fabricated using M/A-COM's repeatable, high performance and highly reliable GaAs Multifunction Self-Aligned Gate MSAG™ Process, each device is 100% RF tested on wafer to ensure performance compliance.

M/A-COM's MSAG™ process features robust silicon-like manufacturing processes, planar processing of ion implanted transistors, multiple implant capability enabling power, low-noise, switch and digital FETs on a single chip, and polyimide scratch protection for ease of use with automated manufacturing processes. The use of refractory metals and the absence of platinum in the gate metal formulation prevents hydrogen poisoning when employed in hermetic packaging.



Primary Applications

Pin Number	Designation
2	RF IN
20	RF OUT
22	A6 (180°)
23	A5 (90°)
24	A4 (45°)
25	VEE
26	A3 (22.5°)
27	A2 (11.25°)
28	A1 (5.6°)
1,3-19,21	No connection

Maximum Operating Conditions ¹

Parameter	Symbol	Absolute Maximum	Units
Input Power	P _{IN}	30	dBm
Supply Voltage	V _{EE}	-6	V
Junction Temperature	T _J	180	°C
Storage Temperature	T _{STG}	-55 to +150	°C

1. Operation outside of these ranges may reduce product reliability. Operation at other than the typical values may result in performance outside the guaranteed limits.

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Recommended Operating Conditions

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	VEE	-5.2	-5.0	-4.8	V
Control Voltage	A1 thru A6				
Logic High		3	5	5	V
Logic Low		0	0	0.4	V
Junction Temperature	T _J			150	°C

Electrical Characteristics (25°C, Z₀ = 50Ω, V_{EE} = -5V)

Parameter	Symbol	Minimum	Typical ³	Maximum	Units
Bandwidth	f	—	2.3-4.1	—	GHz
Insertion Loss	IL	4	6	10	dB
Input VSWR (At Reference)	VSWR	—	1.5:1	4.4:1	
Output VSWR (At Reference)	VSWR	—	1.2:1	2.3:1	
RMS Phase Error	RMS	—	6	—	°
RMS Phase Error — Calibrated	RMS	—	3	—	°
Phase Range	ΔΦ	—	360	—	°
Phase Accuracy — 5.6° Bit	ΔΦ _{REF} ³	-7.2	-5.6	-4.2	°
Phase Accuracy — 11.2° Bit	ΔΦ _{REF}	-11.8	-11.2	-8.4	°
Phase Accuracy — 22.5° Bit	ΔΦ _{REF}	-34	-22.5	-16	°
Phase Accuracy — 45° Bit	ΔΦ _{REF}	-59	-45	-35	°
Phase Accuracy — 90° Bit	ΔΦ _{REF}	-98	-90	-84	°
Phase Accuracy — 180° Bit	ΔΦ _{REF}	-200	-180	-170	°
Phase Accuracy — All Bits	ΔΦ _{REF}	-390	-360	-340	°
Gain Variation over all Phase Shifter settings	ΔG	—	< 3	—	dB
Digital Supply Current	I _{EE}	—	< 10	—	mA
Input Third Order Intercept	ITOI	—	36	—	dBm
Input 1-dB Compression Point	P _{1dB}	—	23	—	dBm

2. Typical values shown for reference only.

3. All ΔΦ_{REF} values are relative to the Reference State (i.e. All phase bits set to 0V).

Operating Instructions

This device is static sensitive. Please handle with care. To operate the device, follow these steps.

1. Apply V_{EE} = -5 V.
2. Apply Logic Voltages to control circuit as listed in Recommended Operating Conditions Table.



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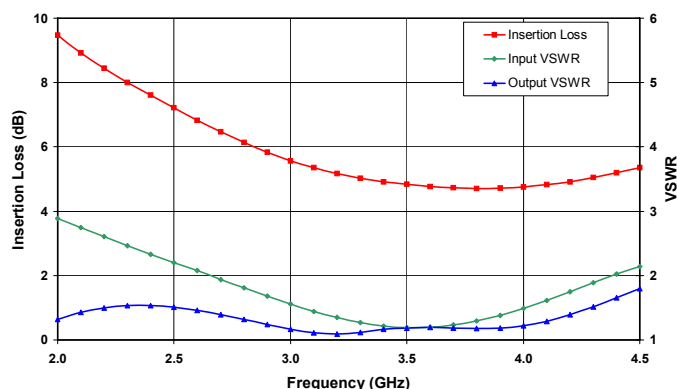


Figure 1. Reference State Insertion Loss, Input and Output VSWR vs. Frequency

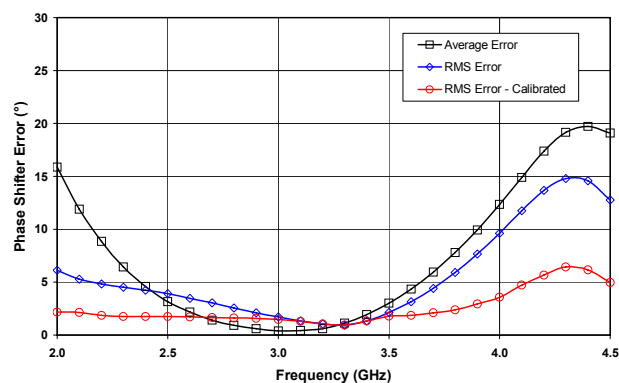


Figure 2. Phase Shifter Figures of Merit: Average Error vs. Reference State, RMS Error and Calibrated RMS Error Over All States

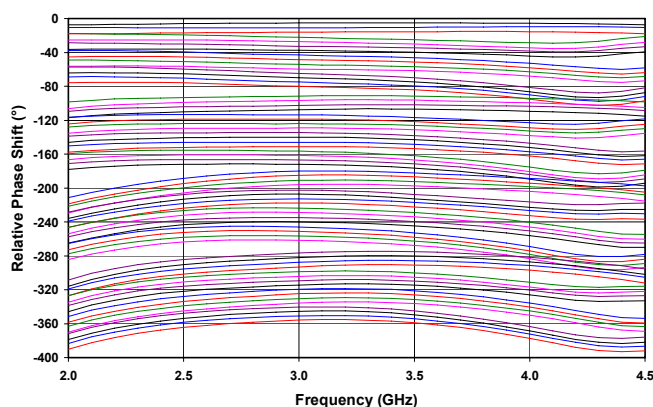


Figure 3. Relative Phase Shift vs. Phase Shifter State

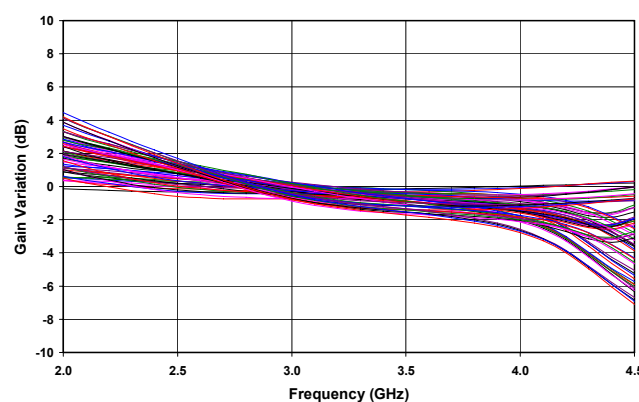


Figure 4. Relative Gain Change vs. Phase Shifter State

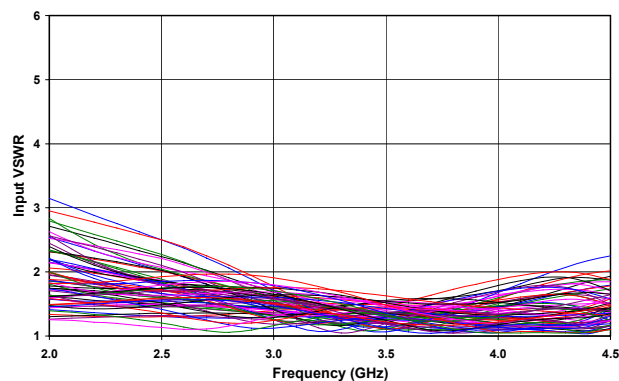


Figure 5. Input VSWR vs. Phase Shifter State

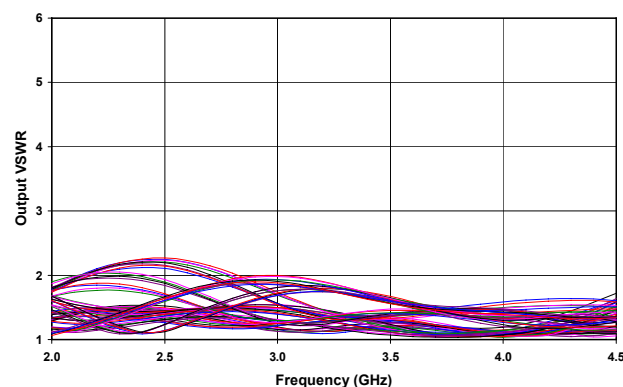


Figure 6. Output VSWR vs. Phase Shifter State

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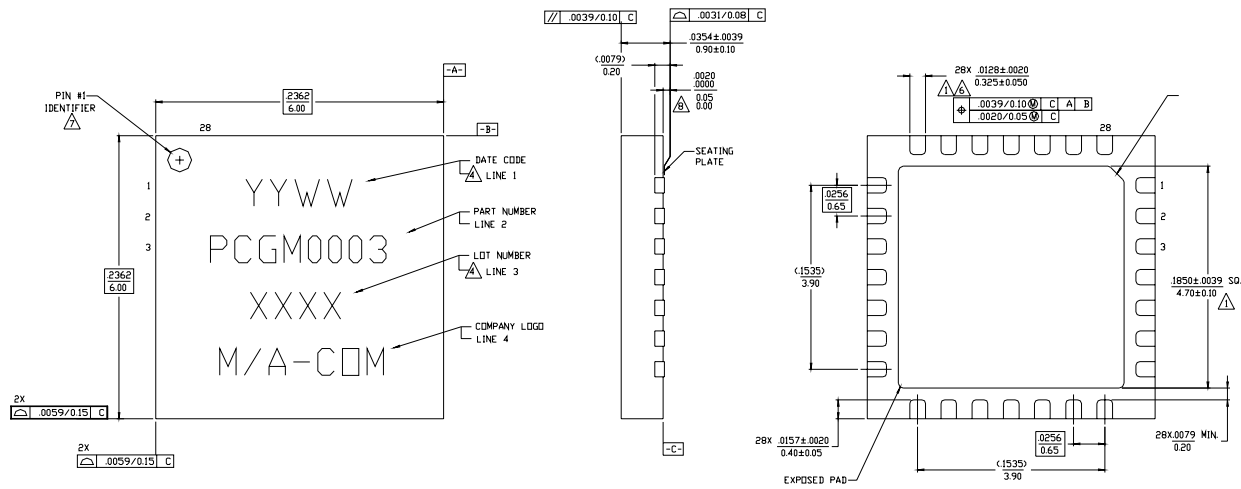


Figure 7. PQFN, 6mm, 28 Lead Package Drawing

Reference JEDEC M0-220 (see <http://www.jedec.org>), VAR. VJJC-3 (Issue E) for additional dimensional and tolerance information.

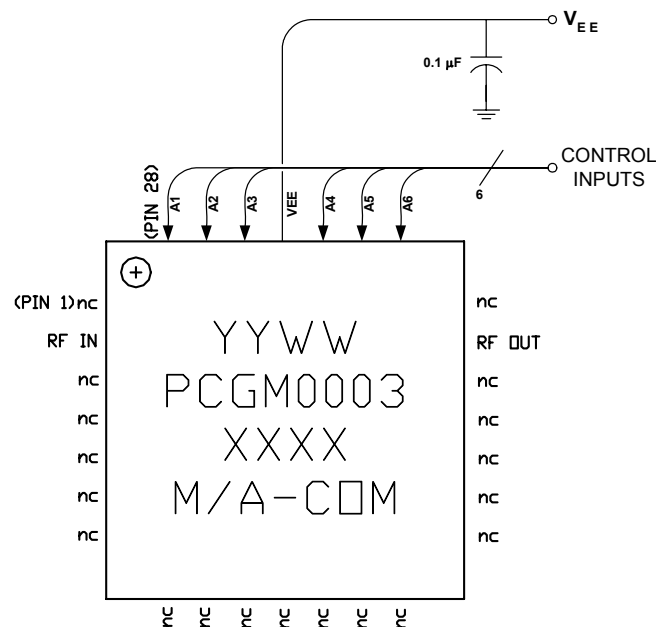


Figure 8. Recommended Bias Configuration

Refer to M/A-COM Application Note ***Surface Mounting Instructions for PQFN Packages #S2083**** for assembly guidelines.

Application Notes can be found by going to the Site Search Page on M/A-COM's web page (<http://www.macom.com/search/search.jsp>) and searching for the required Application Note.

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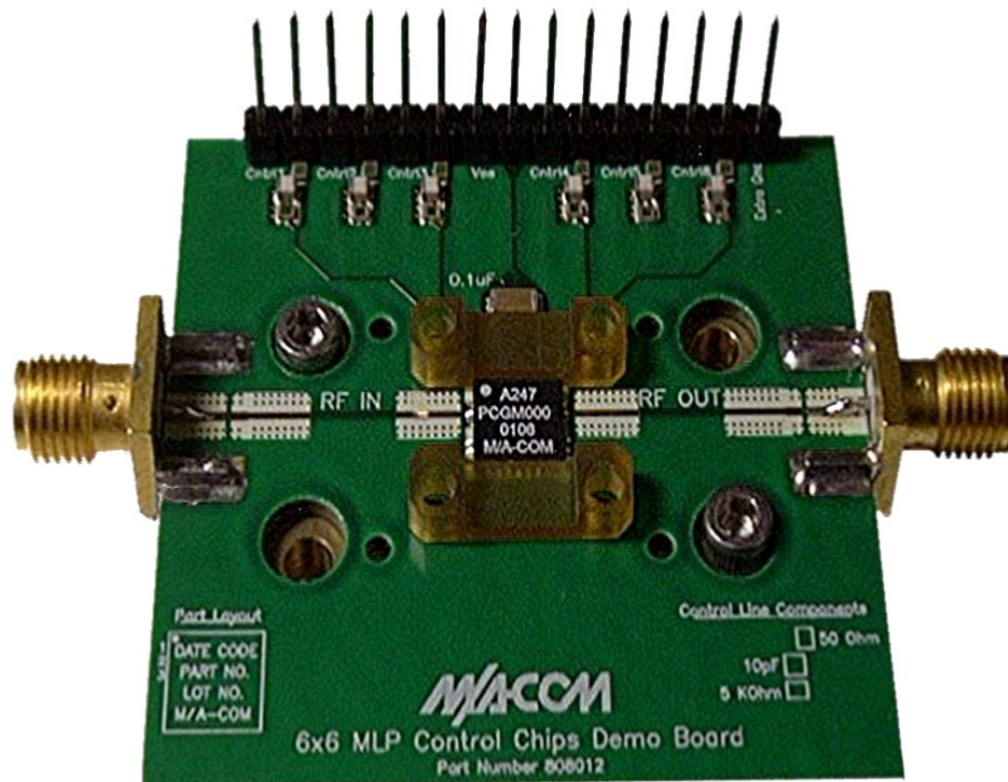


Figure 9. Demonstration Board (available upon request).