

Features

- 6 Bit Digital Phase Shifter
- 360° Coverage with LSB = 5.6°
- Low DC Power Consumption
- Minimal Attenuation Variation over Phase Shift Range
- 50 Ω Impedance
- EAR99
- RoHS* Compliant

Description

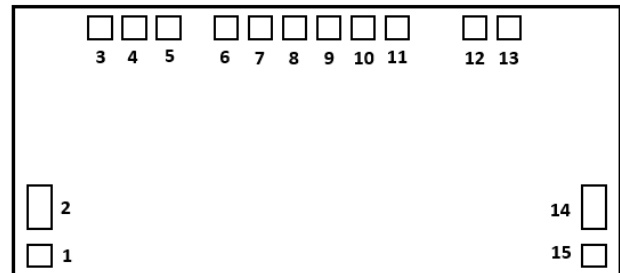
The MAPS-010164-DIE is a GaAs pHEMT 6-bit digital phase shifter. Step size is 5.6° providing phase shift from 0° to 360° in 5.6° steps. This design has been optimized to minimize variation in attenuation over the phase shift range.

The MAPS-010164-DIE is ideally suited for use where high phase accuracy with minimum loss variation over the phase shift range are required. Typical applications include communications antennas and phased array radars.

Ordering Information

Part Number	Package
MAPS-010164-DIE	50 piece Gel Pak

Functional Schematic



Pad Configuration¹

Pad #	Name	Function
1, 15	GND	Ground
2	RF _{IN}	RF Input
3	A1	5.6° Control
4	B1	5.6° Control
5	A2	11.2° Control
6	A3	22.5° Control
7	B3	22.5° Control
8	A4	45° Control
9	B4	45° Control
10	A5	90° Control
11	B5	90° Control
12	A6	180° Control
13	B6	180° Control
14	RF _{OUT}	RF Output

1. The backside of the die must be connected to RF, DC, and thermal ground.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications: Freq. = 2.3 - 3.8 GHz, T_A = 25°C, Z₀ = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	Any Phase State	dB	—	3.6	4.5
Attenuation Variation	Across All Phase States	dB	—	± 0.6	—
RMS Attenuation Error ²	All Values Relative to Insertion Loss at Reference Phase	dB	—	0.3	—
RMS Phase Error ²	All Values Relative to Reference Phase	deg.	—	3	—
Phase Relative to Reference Loss State	5.6° Bit 11.2° Bit 22.5° Bit 45° Bit 90° Bit 180° Bit Sum of All Bits	deg.	—	7.0 10.5 24 47 90 178 356	—
VSWR	RF IN RF OUT	Ratio	—	1.3:1 1.3:1	—
1 dB Compression	Reference State	dBm	—	25	—
Input IP3	Two-tone inputs up to 5 dBm	dBm	—	45	—
T _{RISE} , T _{FALL}	10% to 90% RF, 90% to 10% RF	ns	—	50	—
V _L V _H	LOW-level input voltage HIGH-level input voltage	V	—	-5 0	—

2. RMS is calculated across all 63 amplitude or phase states relative to the amplitude or phase in the 0° phase state at a given frequency.

Truth Table³

A1	B1	A2	A3	B3	A4	B4	A5	B5	A6	B6	Phase Shift
V _L	V _H	V _L	V _L	V _H	V _L	V _H	V _L	V _H	V _L	V _H	Reference Phase
V _H	V _L	V _L	V _L	V _H	V _L	V _H	V _L	V _H	V _L	V _H	5.6°
V _L	V _H	V _H	V _L	V _H	V _L	V _H	V _L	V _H	V _L	V _H	11.2°
V _L	V _H	V _L	V _H	V _L	V _L	V _H	V _L	V _H	V _L	V _H	22.5°
V _L	V _H	V _L	V _L	V _H	V _H	V _L	V _L	V _H	V _L	V _H	45°
V _L	V _H	V _L	V _L	V _H	V _L	V _H	V _H	V _L	V _L	V _H	90°
V _L	V _H	V _L	V _L	V _H	V _L	V _H	V _L	V _H	V _H	V _L	180°
V _H	V _L	V _H	V _H	V _L	V _H	V _L	V _H	V _L	V _H	V _L	354.4°

3. V_L = -5 V, V_H = 0 V.

Absolute Maximum Ratings^{4,5}

Parameter	Absolute Maximum
Input Power 2.3 - 3.8 GHz	27 dBm
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

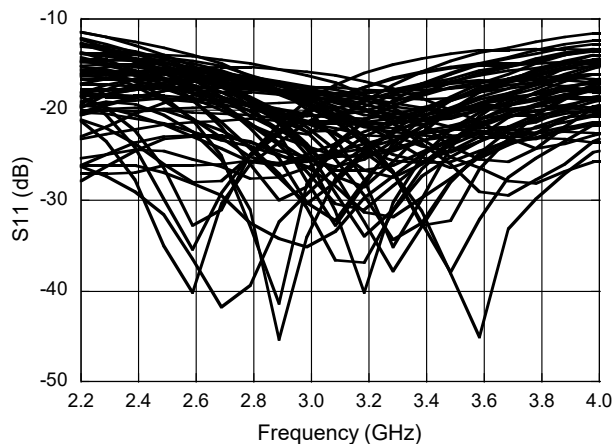
Please observe the following precautions to avoid damage:

Static Sensitivity

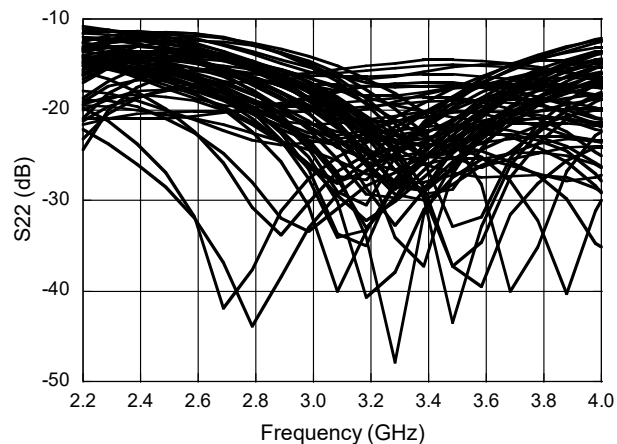
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves

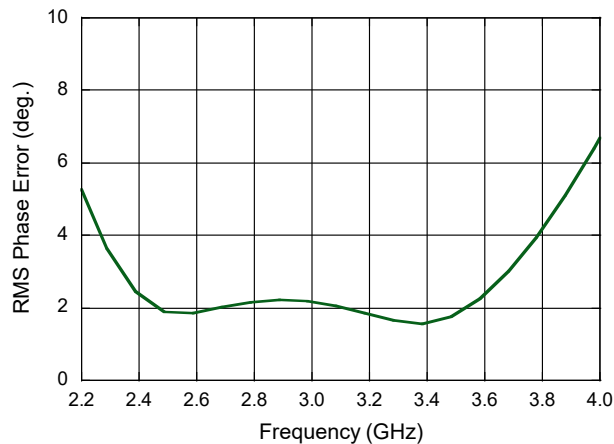
RF_{IN} Return Loss vs. Frequency (All States)



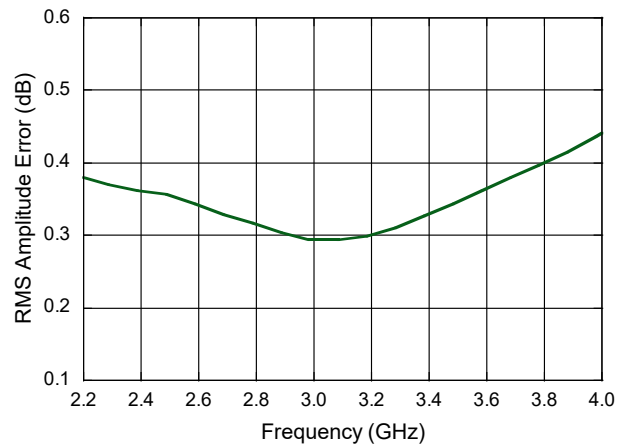
RF_{OUT} Return Loss vs. Frequency (All States)



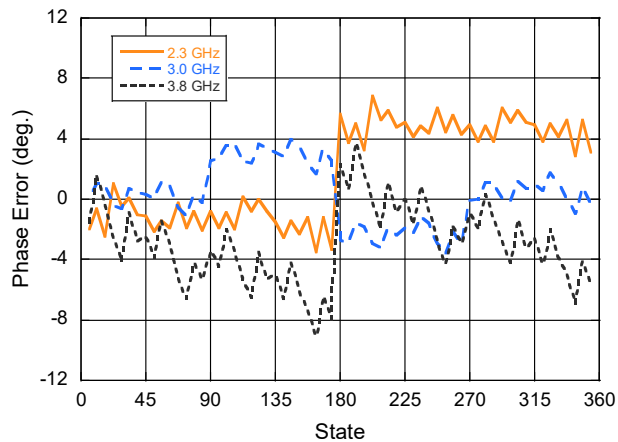
Mean RMS Phase Error vs. Frequency



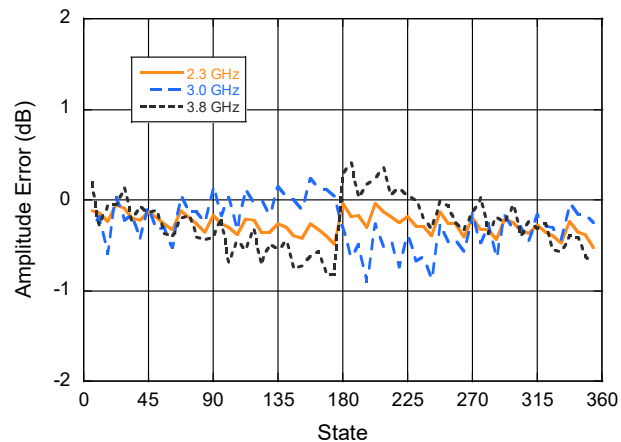
Mean RMS Amplitude Error vs. Frequency



Phase Error vs. State

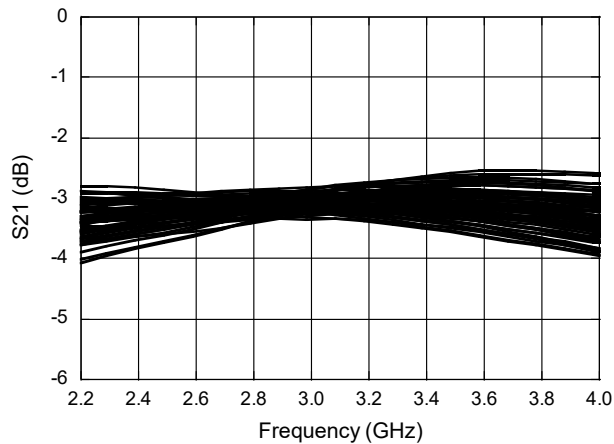


Amplitude Error vs. State

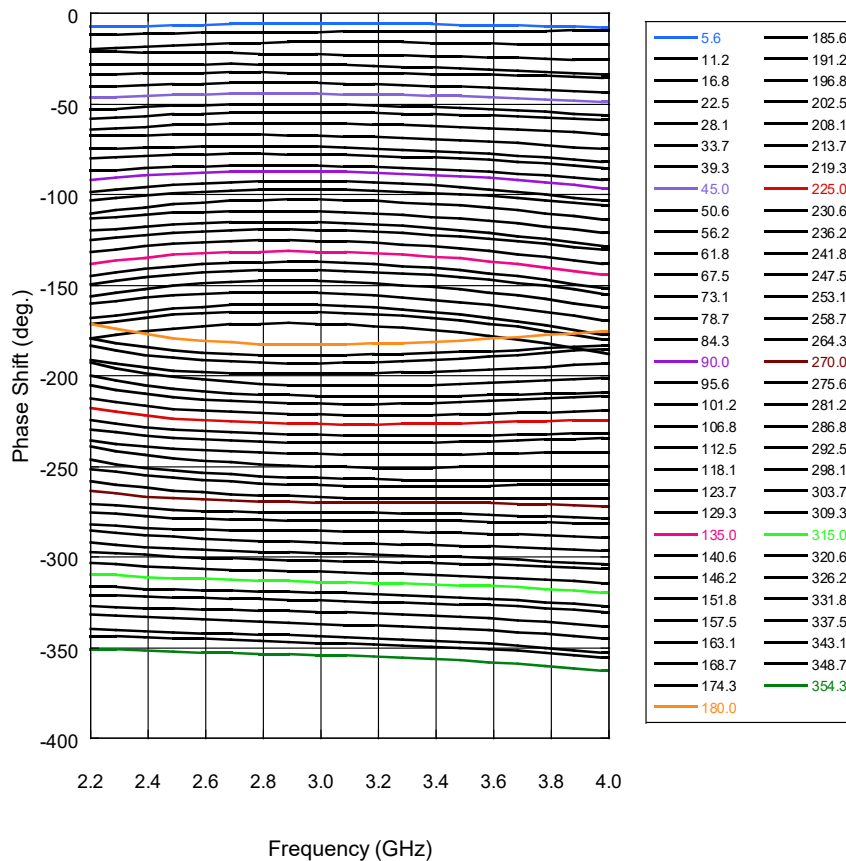


Typical Performance Curves

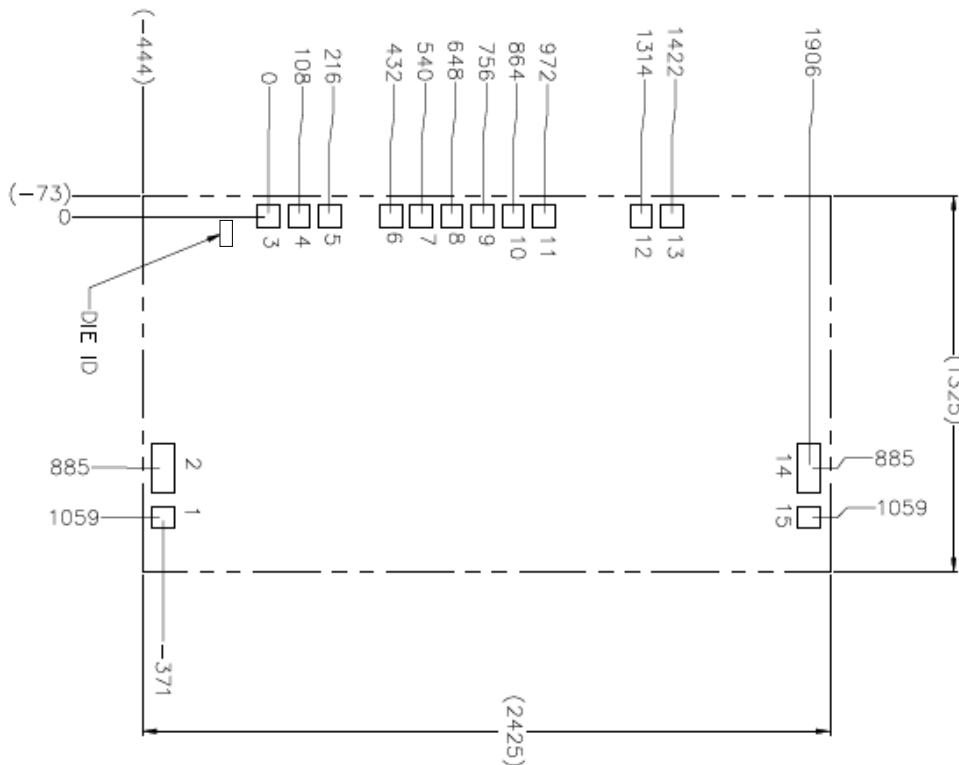
Amplitude Variation vs. Phase State



Phase Shift vs. Frequency (All States)



Outline Drawing ^{6,7,8,9}



6. Unless otherwise specified, all dimensions are μm with a tolerance of $\pm 5\mu\text{m}$.
7. Die thickness is $100 \pm 10\mu\text{m}$.
8. Bond pad/backside metallization: Gold.
9. Die size reflects uncut dimensions. Saw or laser kerf reduces die size by $\sim 25\mu\text{m}$ each dimension.

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