

PRELIMINARY DATASHEET

CGY2172XBUH

6-bit X-Band Phase Shifter

DESCRIPTION

The CGY2172XBUH is a high performance GaAs MMIC 6-bit Phase Shifter operating in X-band.

The CGY2172XBUH has a nominal phase shifting range of 0 – 360° in 5.625° steps and uses an optimum combination of switched line and high pass/low pass filters to obtain very low phase error and insertion loss variations. It covers the frequency range of 8 to 12 GHz and can be used in Radar, Telecommunication and Instrumentation applications.

The die is manufactured using OMMIC's 0.18 μm gate length PHEMT Technology. The MMIC uses gold bonding pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability. This technology has been evaluated for Space applications and is on the European Preferred Parts List of the European Space Agency.

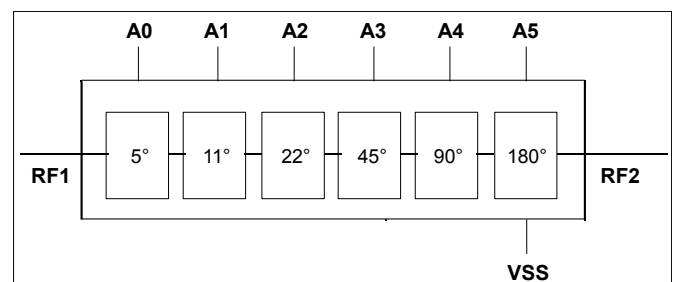
APPLICATIONS

- ▶ Radar
- ▶ Telecommunication
- ▶ Instrumentation



FEATURES

- ▶ Operating Range : 8 GHz to 12 GHz
- ▶ Insertion Loss : 8 dB at 10 GHz
- ▶ Phase Shift Range = 360°
- ▶ RMS Phase Error ≈ 2° @ 10GHz
- ▶ Input P1dB ≈ +18 dBm
- ▶ S_{11} & S_{22} < -15 dB @ 10 GHz (All states)
- ▶ 0 / +5V Control Lines
- ▶ Chip size = 3900 x 1300 μm ± 5 μm
- ▶ Tested, Inspected Known Good Die (KGD)
- ▶ Samples Available
- ▶ Demonstration Boards Available
- ▶ Space and MIL-STD Available



Block Diagram of the 6-Bit X-Band Phase Shifter

LIMITING VALUES

T_{amb} = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	MIN.	MAX.	UNIT
A _N	Phase control inputs		0	+7	V
V _{SS}	Source Supply Voltage		-7	0	V
P _{IN}	Input power	P _{RF} at RF1		TBD	dBm
T _{amb}	Ambient temperature		-40	+85	° C
T _j	Junction temperature			+150	° C
T _{stg}	Storage temperature		-55	+150	° C

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	UNIT
R _{th(j-a)}	Thermal resistance from junction to ambient (T _a = 25 °C)	TBD	° C/W

CHARACTERISTICS

T_{amb} = 25 °C – RF Performance measured on wafer.

Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT
<i>Supplies</i>						
V _{SS}	Source supply voltage			-5		V
I _{SS}	Source supply current			8		mA
<i>RF Performance at 10 GHz unless specified</i>						
BW	Bandwidth		8		12	GHz
IL	Insertion Loss			8		dB
NF	Noise Figure at reference state			8		dB
PH _{range}	Phase range			360		°
S ₁₁ , S ₂₂	Input & Output reflection coefficient	At RF1 & RF2		-17		dB
PH _{error (RMS)}	RMS Phase error vs phase setting (see note 1)			2		°
PH _{error (MAX)}	Maximum Phase error vs phase setting			+/- 5		°
ATT _{variation (RMS)}	RMS Attenuation variation with phase setting (see note 1)			0.2		dB
ATT _{variation (MAX)}	Maximum Attenuation variation with phase setting			+/- 0.4		dB
P _{1dB}	Input 1 dB compression point			18		dBm

Note 1 : The RMS value is the root mean square of the error defined as below

$$x_{\text{rms}} = \sqrt{\frac{1}{N} \sum_{i=1}^N x_i^2} = \sqrt{\frac{x_1^2 + x_2^2 + \dots + x_N^2}{N}}$$

Where x_i is the difference between the measured value and the expected value.

LOGIC TRUTH TABLE

	A0	A1	A2	A3	A4	A5
Nominal phase shift	-5°	-11°	-22°	-45°	-90°	-180°
Pad	P5	P11	P22	P45	P90	P180
Phase shift activated	+5V	+5V	+5V	+5V	+5V	+5V
Reference state	0V	0V	0V	0V	0V	0V

	A5	A4	A3	A2	A1	A0
Phase Shift (°)	-180°	-90°	-45°	-22°	-11°	-5°
0	0	0	0	0	0	0
-5	0	0	0	0	0	1
-11	0	0	0	0	1	0
-22	0	0	0	1	0	0
-45	0	0	1	0	0	0
-61	0	0	1	0	1	1
-90	0	1	0	0	0	0
-180	1	0	0	0	0	1
-270	1	1	0	0	0	0
-354	1	1	1	1	1	1

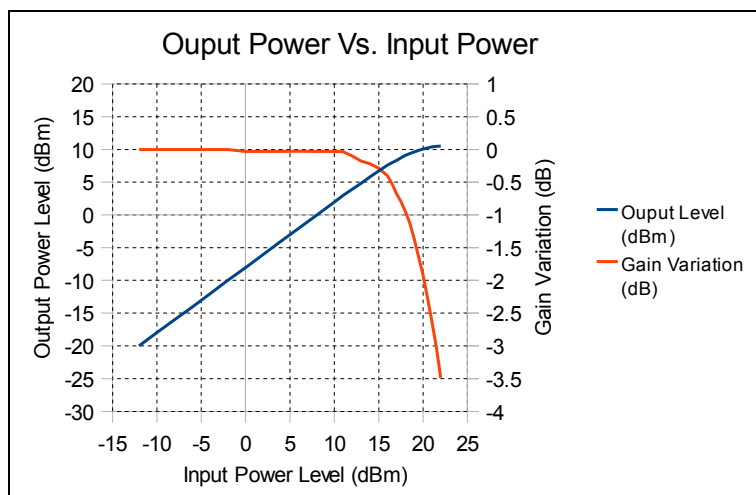
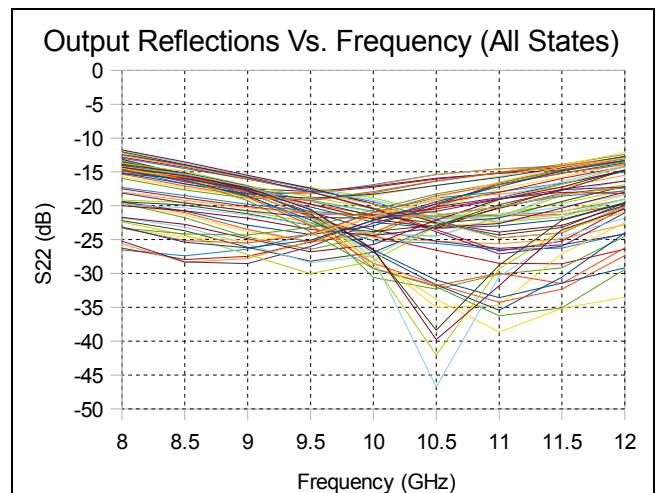
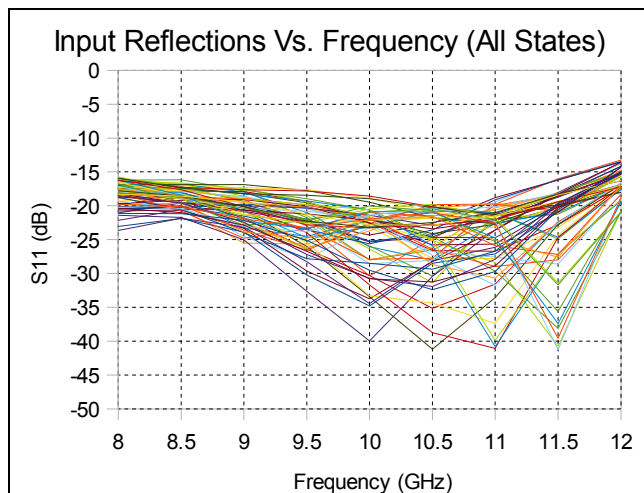
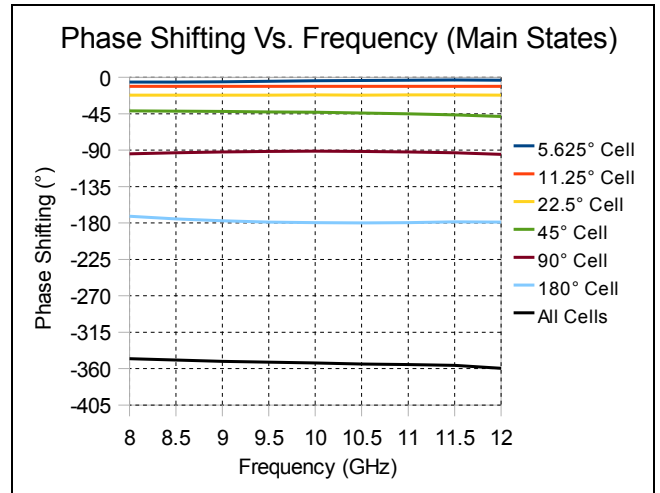
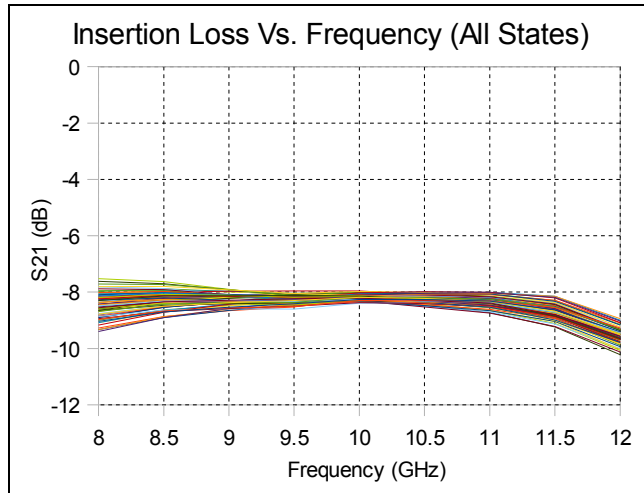
CONTROL VOLTAGE

State	MIN.	TYP.	MAX.	UNIT
Low	-0.01	0	+0.01	V
High	4.75	5	5.25	V

ON WAFER MEASUREMENTS – S PARAMETERS

Measured on wafer @ T = 25 °C

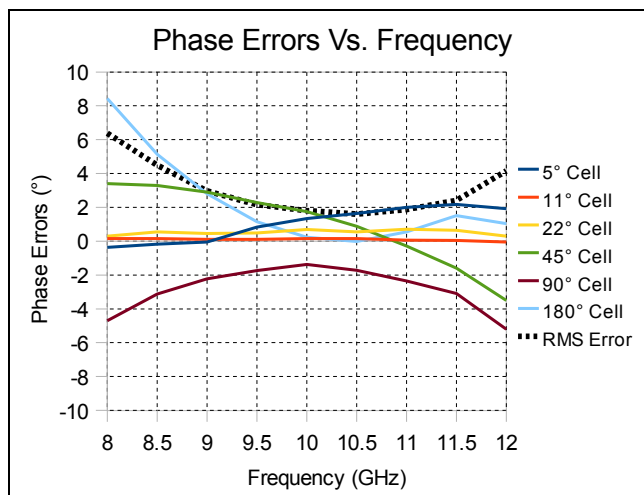
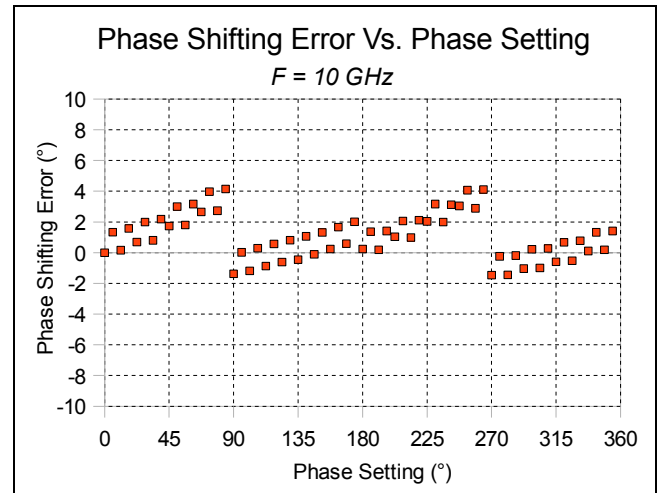
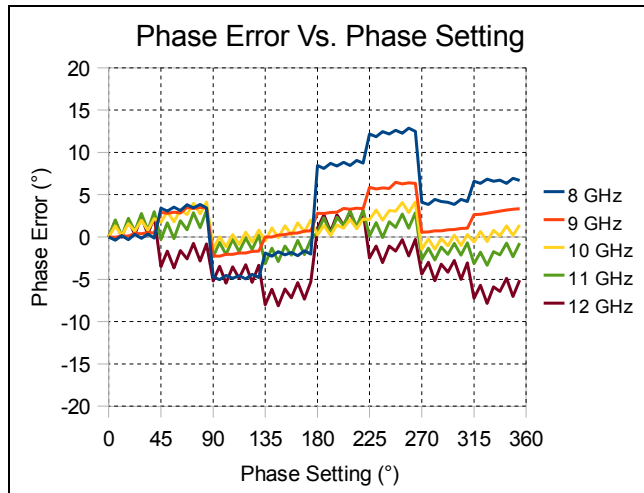
Calculated with optimized input and output inductance of 0.3 nH



ON WAFER MEASUREMENTS – PHASE SHIFTING ERRORS

Measured on wafer @ T = 25 °C

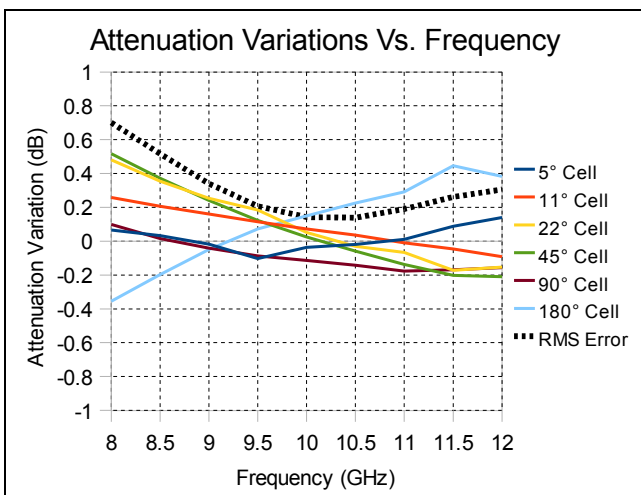
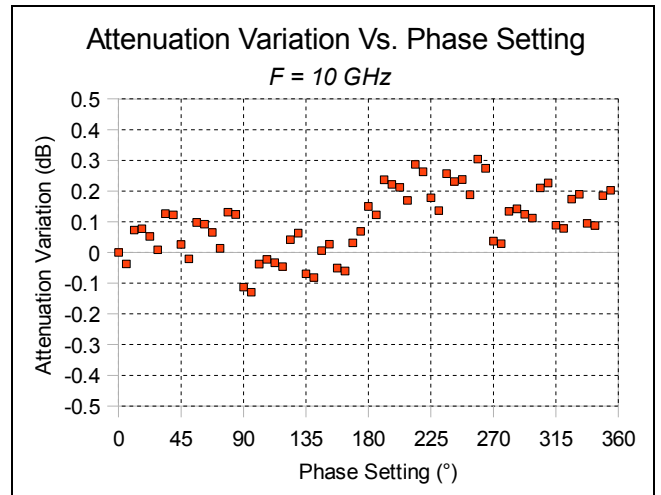
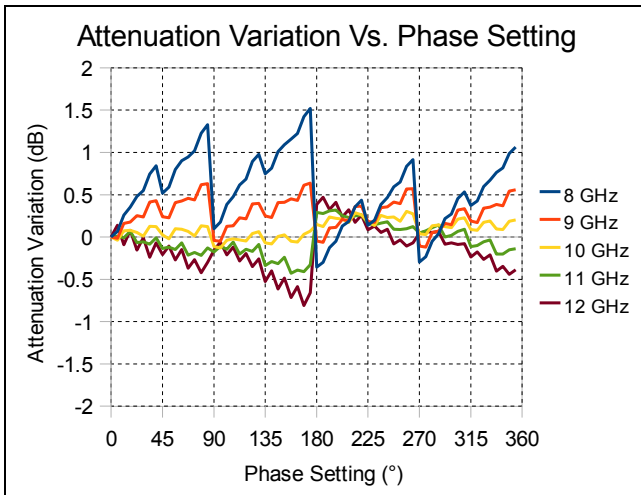
Calculated with optimized input and output inductance of 0.3 nH



ON WAFER MEASUREMENTS – ATTENUATION ERRORS

Measured on wafer @ T = 25 °C

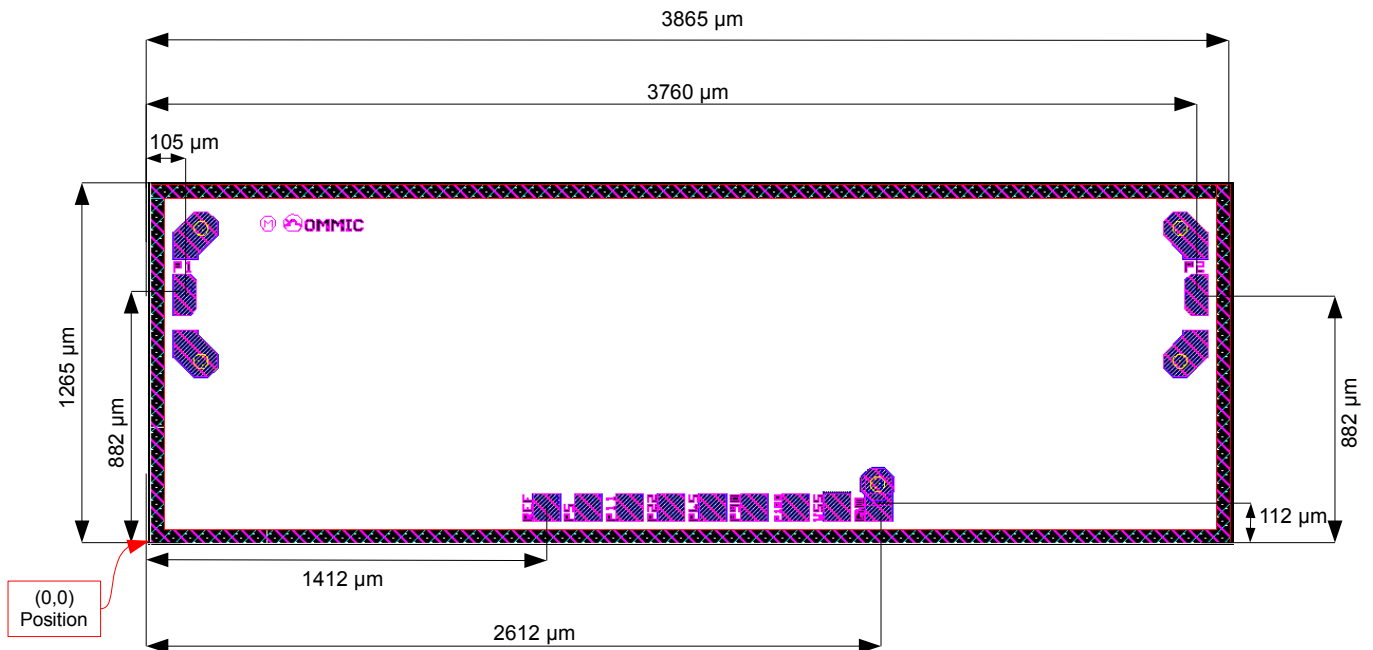
Calculated with optimized input and output inductance of 0.3 nH



MECHANICAL INFORMATION

Chip size = 3900 x 1300 μm (3865 x 1265 $\mu\text{m} \pm 5 \mu\text{m}$ after dicing)

- DC Pads = 100 x 100 μm , spacing = 150 μm , top metal = Au
- RF Pads = 85 x 150 μm , top metal = Au
- Chip Thickness 100 μm



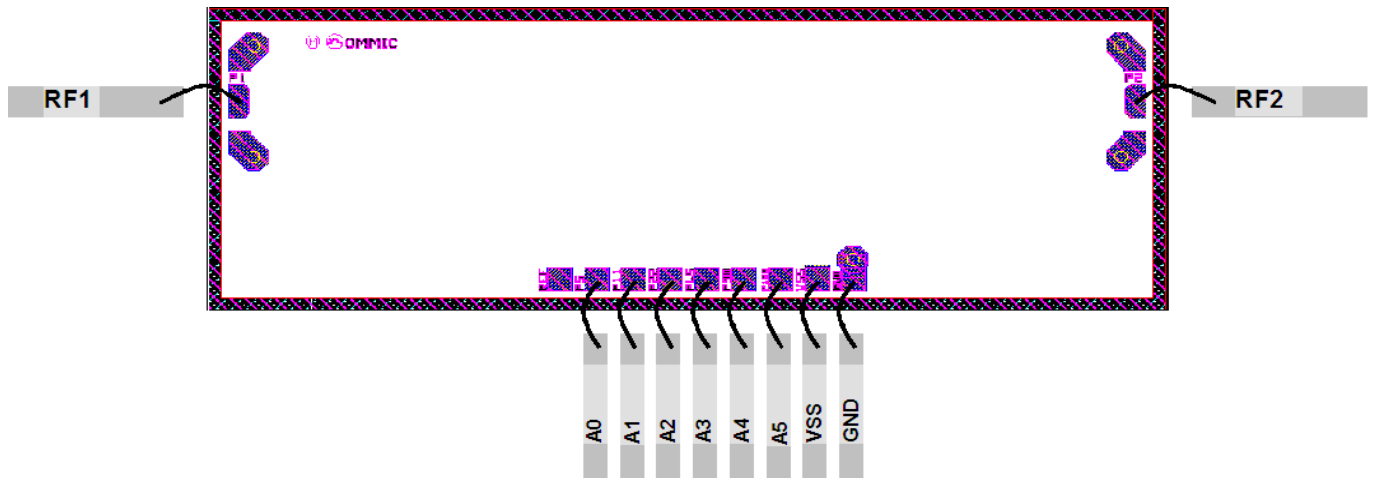
Caution : This device is a high performance RF component and can be damaged by inappropriate handling. Standard ESD precautions should be followed. OMMIC document "OM-CI-MV/ 001/ PG" contains more information on the precautions to take.

PAD POSITION

PAD NAME	SYMBOL	COORDINATES		DESCRIPTION
		X	Y	
P1	RF1	105	882	RF Port 1
P2	RF2	3760	882	RF Port 2
REF	REF	1412	112	Output Voltage Reference (Do not connect)
P5	A0	1562	112	5° cell control
P11	A1	1712	112	11° cell control
P22	A2	1862	112	22° cell control
P45	A3	2012	112	45° cell control
P90	A4	2162	112	90° cell control
P180	A5	2312	112	180° cell control
VSS	VSS	2462	112	Negative Supply Voltage
GND	GND	2612	112	Ground (back side)

X=0, Y=0 at bottom left corner.

See Mechanical Information for more details.

BONDING DIAGRAM AND ASSEMBLY INFORMATION


RF interface : coplanar or microstrip, bonding $\approx 400/500 \mu\text{m}$.



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PACKAGE

Type	Description	Terminals	Pitch (mm)	Die size (mm)
UH	Bare Die	-	-	3.9 x 1.3 (Before dicing) Die Thickness : 100 μm

DEFINITIONS
Limiting values definition

Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

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ORDERING INFORMATION

Generic type	Package type	Version	Sort type	Description
CGY2172XB	UH	C1	-	6-bit X-Band Phase Shifter


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