CSD07130606VP

7-13 GHz 6 bit Phase shifter QFN MMIC

General description

The CSD07130606VP is a X band GaAs MMIC
- 6-bit phase shifter
- Digital control logic

The device is packaged in a 5x5 mm 24 lead Plastic Surface Mount Package (ROHS).

The digital control logic allows for parallel data input, so phase shifter may be changed instantaneously.

This Digital Phase Shifter has an LSB of 5.6 Degree and controlled by 6 digital binary inputs, compatible with LVCMOS levels. This device uses a single -7.5 V Bias supply voltage.

Features

- Operating frequency range : 7 to 13 GHz
- 6-bit Phase shifter
- LSB 5.625 Degree
- 24 dBm P1dB input compression
- Digital control (0 – 5 V)
- Parallel data input
- Package : QFN 5x5 mm 24 Lead

Tools

S2P file can be provided for system design simulation.
DXF drawing file is available for mechanical design.
Evaluation board available on request.

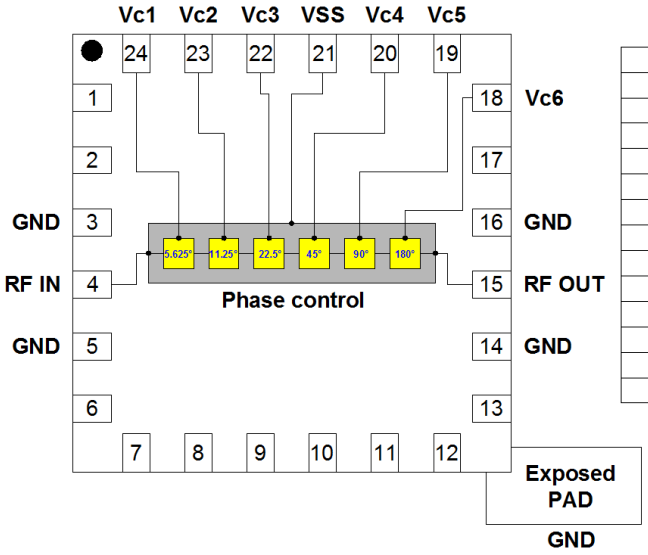
Ordering information

Product code	Definition
CSD07130606VP	QFN 5x5 mm 24 Lead Phase shifter

Applications

- Active Antenna
- RF Communication
- RF Front End
- Test and Measurement

Functional diagram / Pinout



PINOUT			
PIN	Name	PIN	Name
1	NC	13	NC
2	NC	14	GND
3	GND	15	RF OUT
4	RF IN	16	GND
5	GND	17	NC
6	NC	18	VC6
7	NC	19	VC5
8	NC	20	VC4
9	NC	21	VSS
10	NC	22	VC3
11	NC	23	VC2
12	NC	24	VC1

Typical Characteristics (Ambient temperature T= 25°C)

Operating conditions:
VSS=-7.5V

Parameters	Symbol	Min	Typ	Max	Unit
Frequency range	F	7		13	GHz
6 Bit Phase Shifter - Resolution	LSB		5.625		Deg
Insertion Loss @ 10 GHz (reference state)	IL		6.5		dB
Input Return Loss (all states)	RL In		-12		dB
Output Return Loss (all states)	RL Out		-12		dB
Input Power @ 1dB	Input P1dB		24		dBm
RMS Attenuation error	RMS A		0.5		dB
Max Attenuation error	A error		2		dB
RMS phase error	RMS P		3		Deg
Max phase error	P error		10		Deg
Switching speed	ST/SF		50		ns
Supply voltage	Vss		-7.5		VDC
Supply current	Iss		10		mA
V control High	VCi_H	2		5	V
V vontrol Low	VCi_L	0		0.8	V

Absolute maximum ratings

Maximum ratings	Symbols	Min	Max	Units
Supply voltage	VSS	-15		V
Supply current	ISS		+12	mA
CW RF input power	Pin		+30	dBm
Storage temperature	Tst	-55	+125	°C
Operating temperature	Top	-40	+85	°C
Channel temperature	Tch		+150	°C

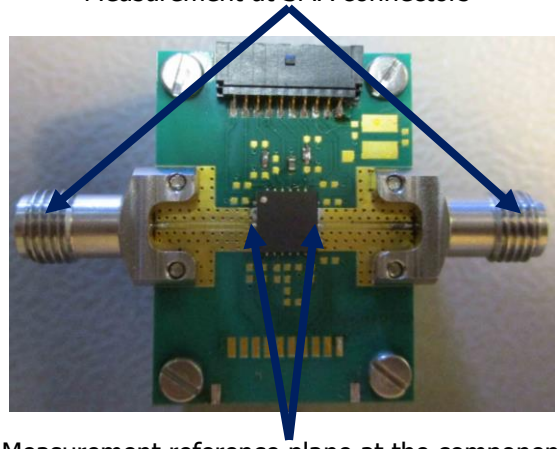
Operation of this device above any of these parameters may cause permanent damages.

Care should be taken to avoid supply transient and over voltage. Over voltage above the maximum specified in absolute maximum rating section may cause permanent damage to the device.

Typical performances measurements (Ambient temperature T= 25°C)

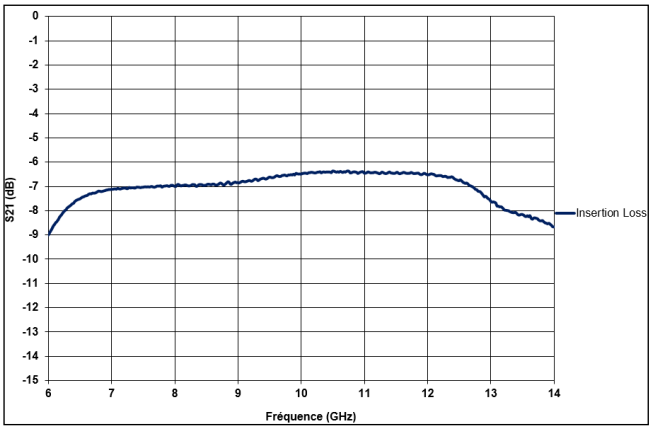
Operating conditions:
VSS = -7.5 V

Measurement at SMA connectors

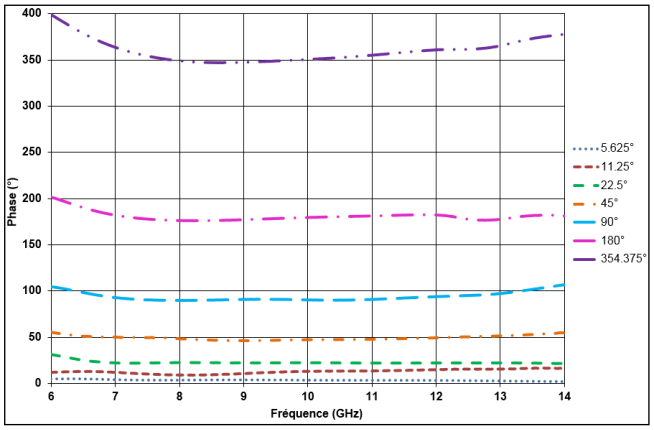


Measurement reference plane at the component.

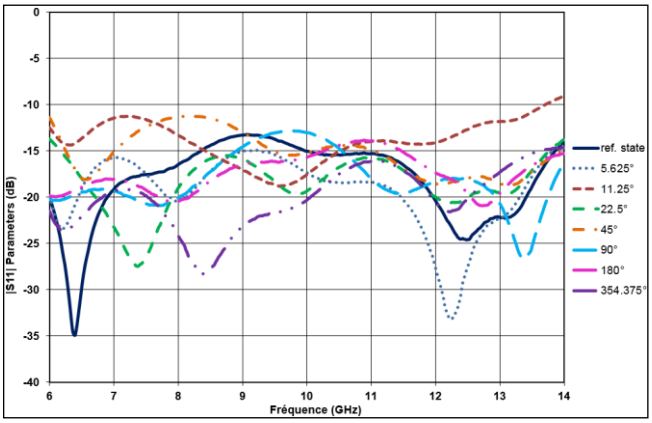
Reference state – insertion loss



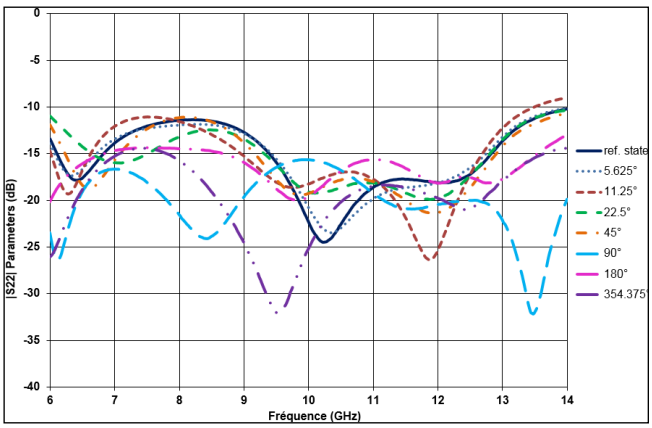
Absolute Relative phase-Major state



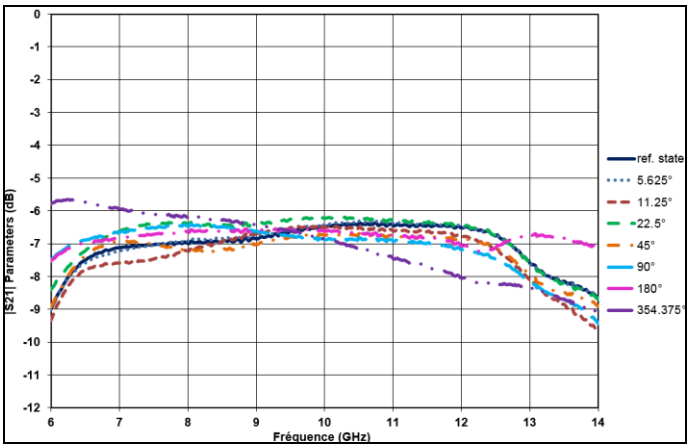
Input return loss-Major state



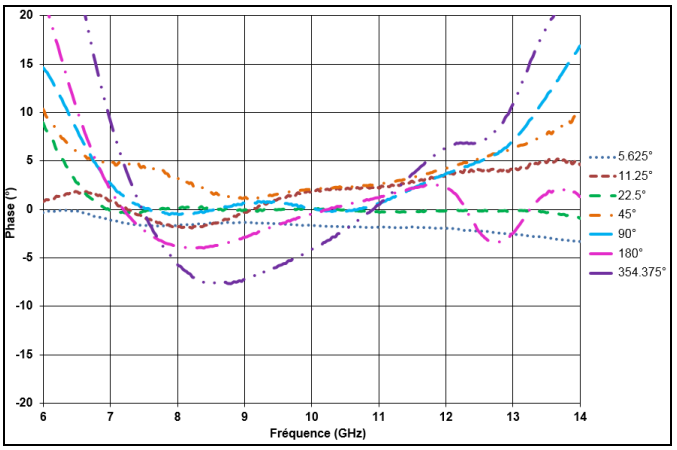
Output return loss-Major state



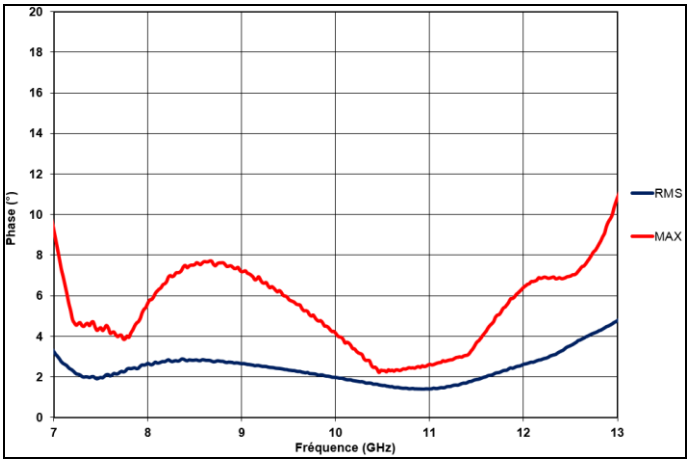
Attenuation level-Major state



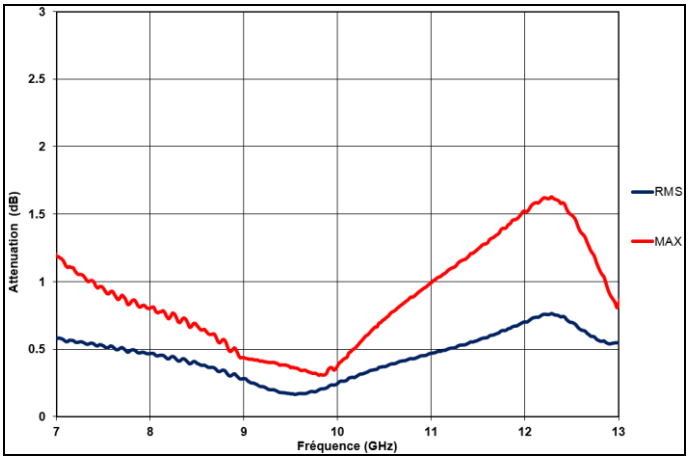
Bit error-Major state



Relative phase error-Major state



Relative Attenuation error-Major state

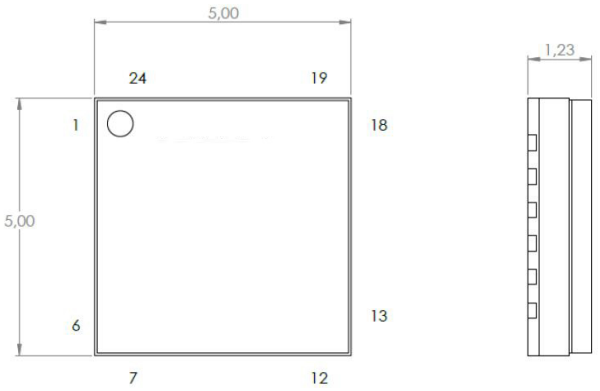


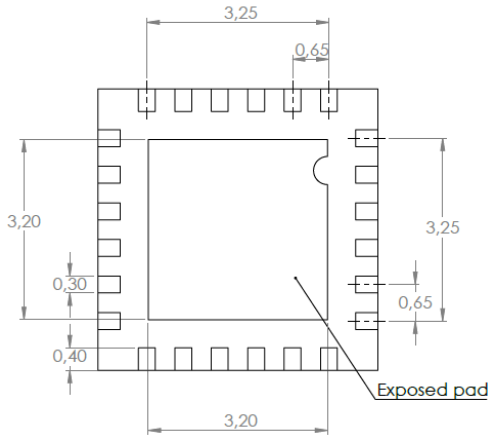
Logic truth table (Major State)

Phase Shift (Degrees)	Vc1	Vc2	VC3	Vc4	Vc5	Vc6
0 (reference state)	0	0	0	0	0	0
5.625	1	0	0	0	0	0
11.25	0	1	0	0	0	0
22.5	0	0	1	0	0	0
45	0	0	0	1	0	0
90	0	0	0	0	1	0
180	0	0	0	0	0	1
354.375	1	1	1	1	1	1

On each control PAD (Vc1 to Vc6), a decoupling capacitor and a source resistance can be used. Choose adequate component not to deteriorate dynamic switching performances.

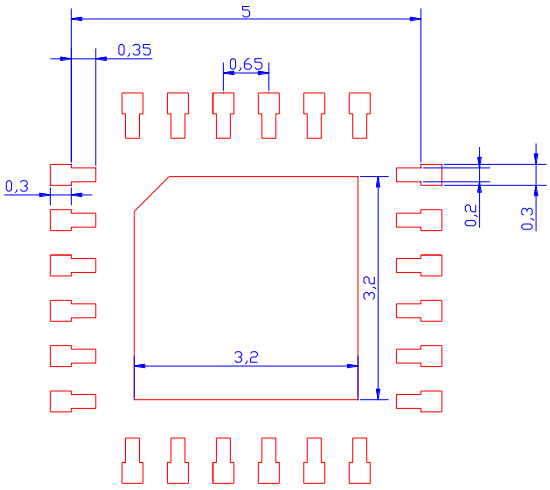
Mechanical Drawing



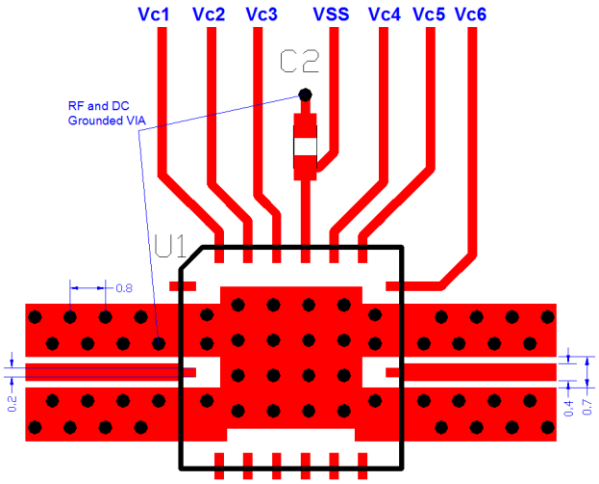


- QFN exposed PAD must be connected to ground (RF and DC).

Recommended Land pattern



Suggested Board Layout



C2 : 0402 1µF/16V capacitor

Substrate : RO4350B, thickness 0.254mm

Soldering recommendation

Solder Stencil thickness : 127μm
Solder : SAC 305 (ROHS)

Temperature profile example : maximum recommended reflow profile (leadfree)

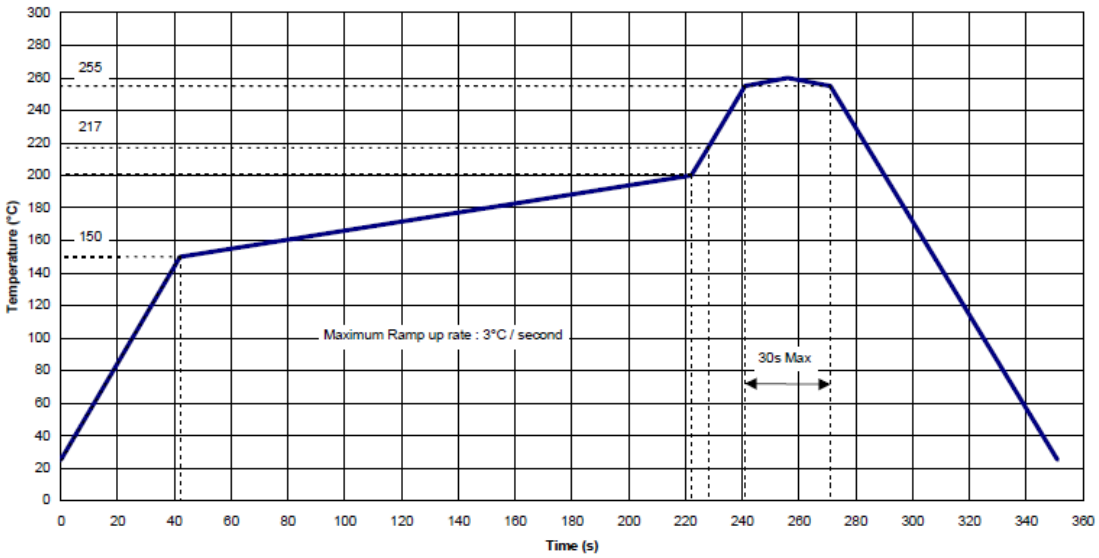


Figure 1: Temperature reflow profile example

Handling

This product is sensitive to electrostatic discharge and should not be handled except at a static free workstation. Take precautions to prevent ESD; use wrist straps, grounded work surfaces and recognized anti-static techniques when handling the CSD07130606VP device.