Product Features

Frequency: 900MHz ~ 1.3GHz

Phase Shift Range: 360° , LSB=5.625°

Insertion Loss: 4.9dB@1.1GHz

Input Return Loss: 36.2dB@1.1GHz

RMS Phase Error: 1.8°

Supply Voltage: -5V

Control Voltage: 0/+5V

Package: QFN32 (5mm*5mm)

Apply

Radar

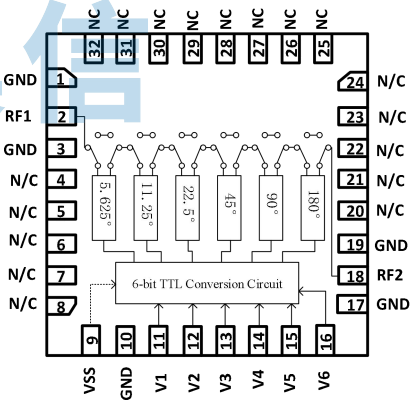
Phased Array

Data Link

General Description

The BR9594FLJ is a 6-Bit Parallel Digital-Controlled Phase Shifter covering a frequency range of 900 MHz to 1.3 GHz. It utilizes 0 V / +5 V logic control and requires an external -5 V power supply for biasing. The chip provides a phase shift step of 5.625°, a full 360° phase shift range, with a typical phase accuracy RMS of 1.8° and a typical insertion loss of 4.9 dB. Housed in a QFN32 package, it is suitable for a wide range of applications including Data Link, Radar, and Phased Array systems.

Functional Block Diagram



Ordering Information

Part Number	Package	Description
BR9594FLJ	QFN32	900MHz ~ 1.3GHz 6-Bit Parallel Digital-Controlled Phase Shifter

Electrical Specifications (Temp=+25℃)

Parameters	Test condition	Min.	Typ.	Max.	Units
Insertion Loss	900MHz	-	-5.4	-	dB
	1100MHz	-	-4.9	-	
	1300MHz	-	-4.7	-	
Input Return Loss	900MHz	-	-24.4	-	dB
	1100MHz	-	-36.2	-	
	1300MHz	-	-29.5	-	
Output Return Loss	900MHz	-	-24.1	-	dB
	1100MHz	-	-21.2	-	
	1300MHz	-	-26.3	-	
Attenuation Variation	900MHz	-0.5	-	0.7	dB
	1100MHz	-0.6	-	0.6	
	1300MHz	-0.8	-	0.6	
RMS Phase Error	900MHz	-	1.2	-	°
	1100MHz	-	1.8	-	
	1300MHz	-	1.8	-	
Input Power for 1dB Compression	900MHz	-	28.6	-	dBm
	1100MHz	-	28.7	-	
	1300MHz	-	27.8	-	

Absolute Maximum Ratings

Maximum RF Input Power: +30dBm

Maximum Supply Voltage: -5.5V

Recommended Operating Conditions

Control Voltage Threshold: 0~0.5V (“0” level)

2.7V~5V (“1” level)

Control Current: 1.1mA@5V

Storage Temperature: -65℃～+150℃

Operating Temperature: -55℃～+125℃

Note: Operation of the device outside the parameter ranges given absolute-maximum-ratings conditions may cause permanent damage, and exposure to absolute-maximum-ratings conditions for extended periods will affect the reliability.

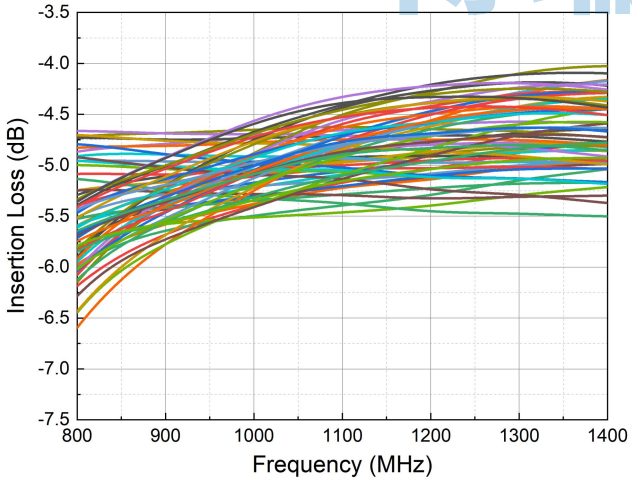
ESD WARNING

ELECTROSTATIC SENSITIVE DEVICE

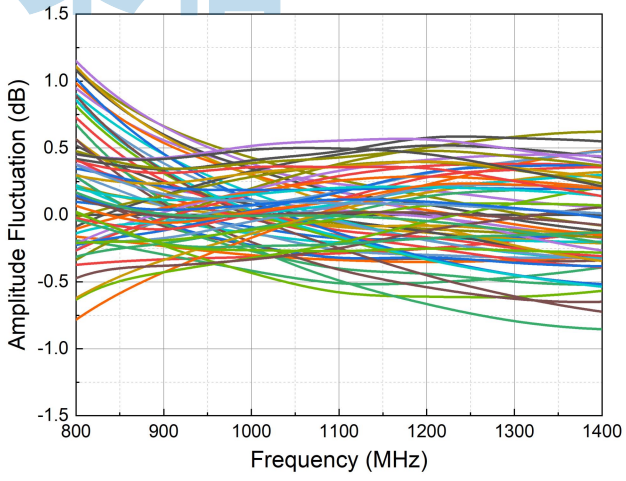
OBSERVE HANDLING PRECAUTIONS

Typical Performance (Temp=+25℃, EVB Test Results)

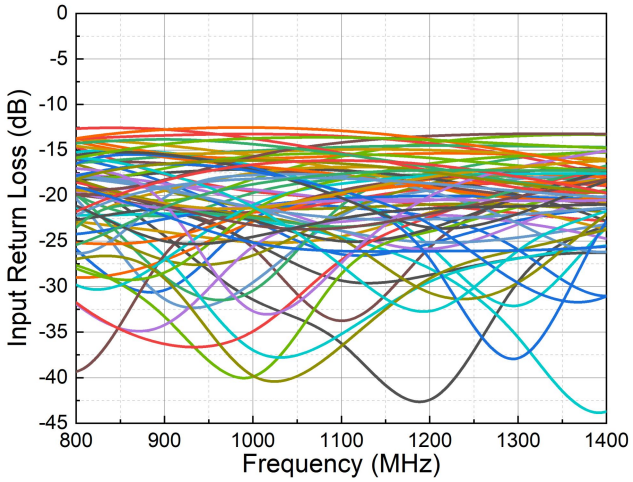
Parameters	Typ.					Units
Frequency	**900**	**1000**	**1100**	**1200**	**1300**	**MHz**
Phase Error (5.625°)	-0.20	-0.20	-0.15	-0.08	-0.18	°
Phase Error (11.25°)	0.10	-0.14	-0.28	-0.15	-0.24	°
Phase Error (22.5°)	-1.22	-0.63	-0.42	-0.53	-0.66	°
Phase Error (45°)	-0.42	-0.04	-0.05	-0.45	-1.15	°
Phase Error (90°)	-0.68	1.38	2.14	1.89	1.06	°
Phase Error (180°)	-0.36	-1.86	-1.39	0.41	3.00	°
Insertion Loss (Reference State)	-5.35	-5.08	-4.88	-4.79	-4.68	dB
Input Return Loss (Reference State)	-24.4	-31.4	-36.2	-42.4	-29.5	dB
Output Return Loss (Reference State)	-24.1	-21.3	-21.2	-23.6	-26.3	dB
Input Power for 1dB Compression (Reference State)	28.6	28.6	28.7	28.6	27.8	dBm
Test Conditions: Pin=0dBm, Temp=25°C, VSS=-5V						



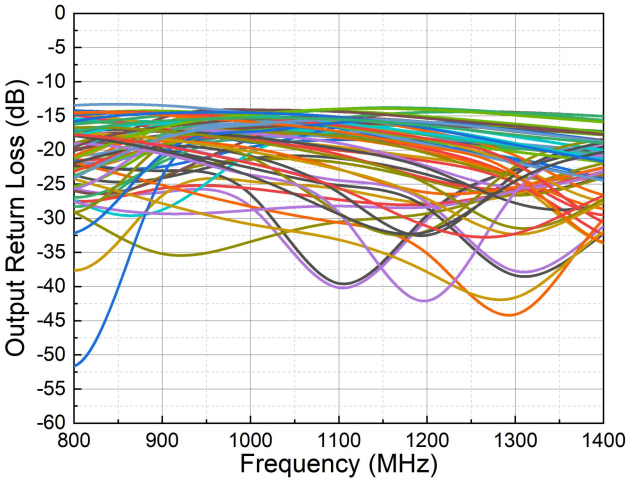
All-State Insertion Loss vs. Freq



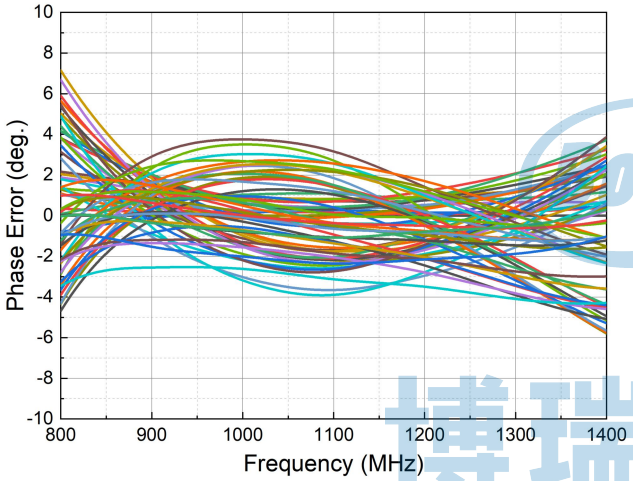
All-State Normalized Attenuation Variation vs. Freq



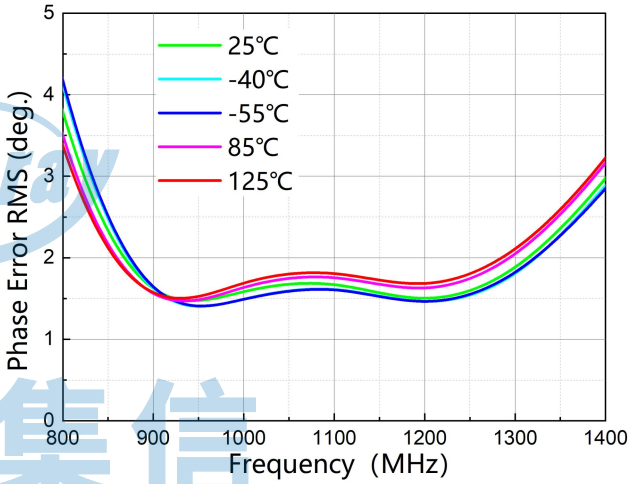
All-State Input Return Loss vs. Freq



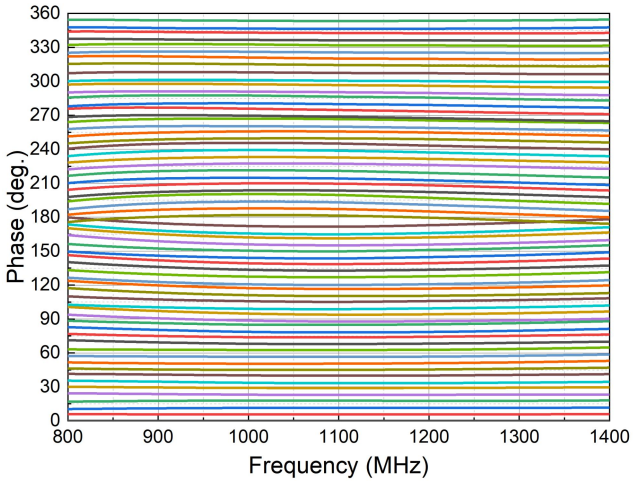
All-State Output Return Loss vs. Power



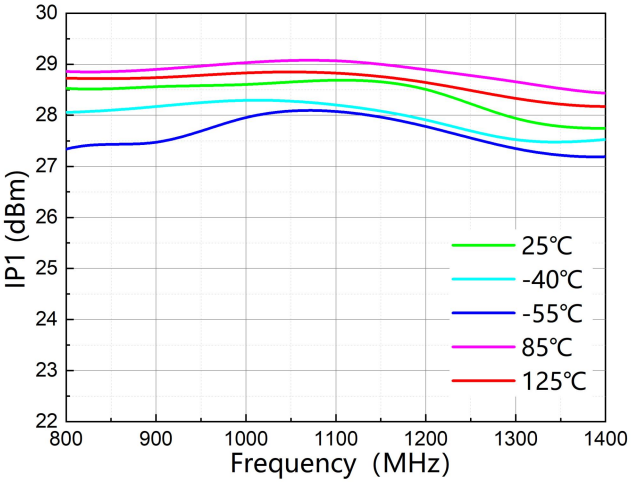
All-State Phase Error vs. Freq



RMS Phase Error vs. Freq

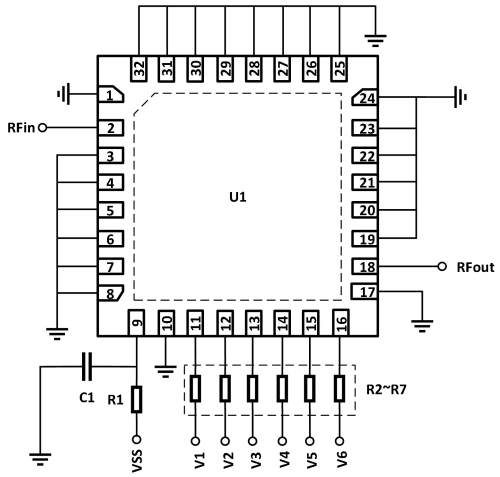


All-State Phase Shift vs. Freq



Reference-State IP1 vs. Freq

Typical Application Schematic



Bill of Material

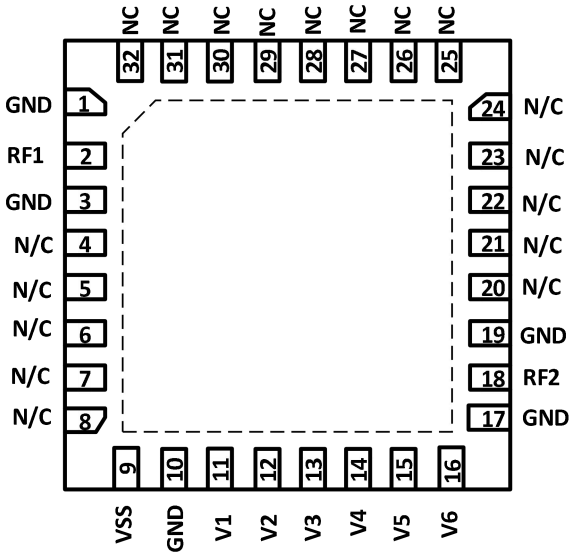
Designator	Package	Description	Part Number
U1	QFN32	/	BR9594FLJ
R1	0402	0Ω	RC0402FR-070RL
R2~R7	0402	1.3KΩ	RC0402JR-071K3L
C1	0402	1nF	GRM1555C1H102JA01D

Note: When R2 through R7 are 1.3 kΩ, the control port draws 1.1 mA at 5 V.

Truth Table

State	5.625°	11.25°	22.5°	45°	90°	180°
	V1	V2	V3	V4	V5	V6
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
“0” level range: 0~0.5V; “1” level range: 2.7~5V						

Pin Configuration and Description

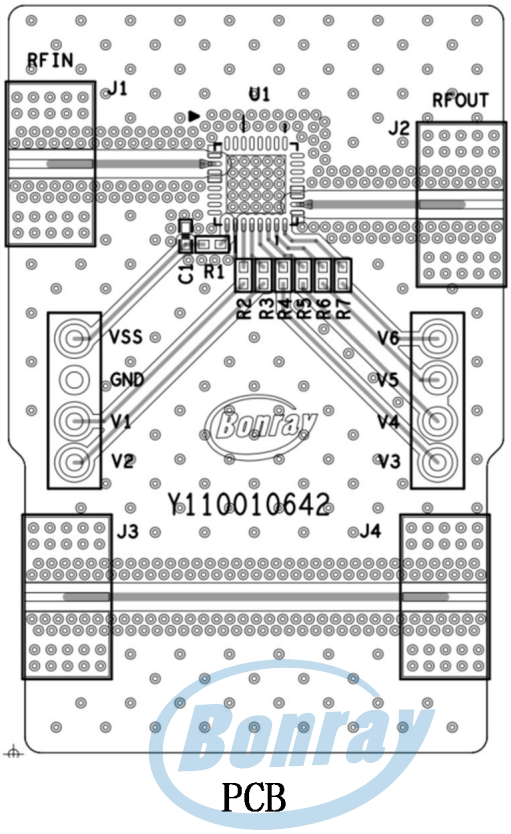


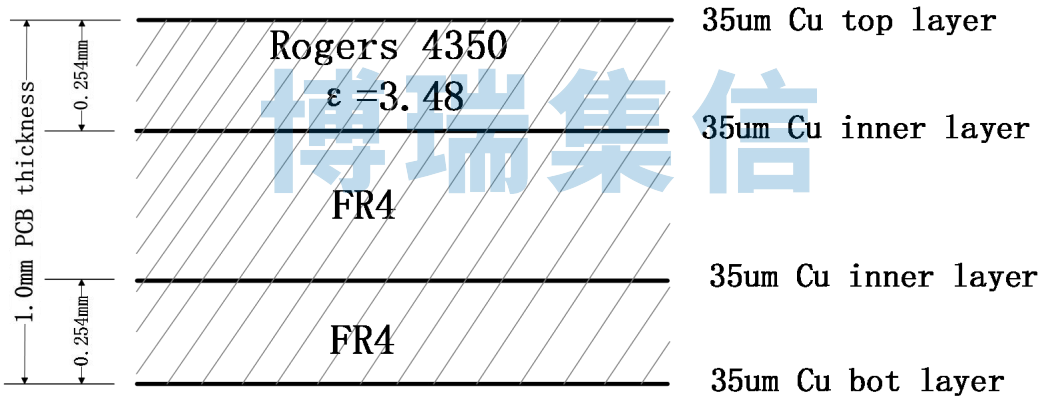
Pin Configuration

Pin Description

Pin Number	Pin Name	Description
2，18	RF1、 RF2	RF Pin, DC-coupled and matched to 50 Ω. If the RF potential is not 0 V, an external DC-blocking capacitor is required.
9	VSS	Voltage supply Pin.
11~16	V1~V6	Control Input Pin. The control logic is detailed in the truth table.
1,3,17,19	GND	Ground Pin.
4~8,20~32	NC	No Internal Connection. It is recommended to connect this pin to ground during use.
-	EP	The exposed backside pad must be properly grounded during use.

PCB Evaluation Board

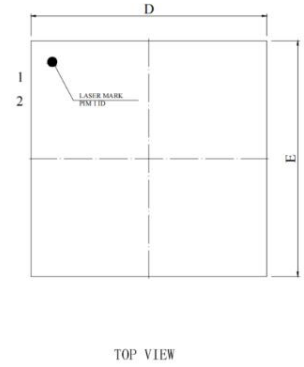




50Ωline: width=0.53mm,spacing=0.6mm

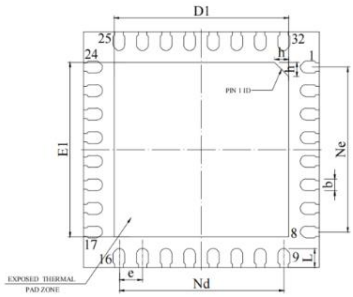
Evaluation Board Information

Package Dimensions (mm)

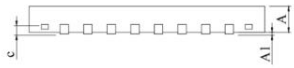


TOP VIEW

SIDE VIEW



BOTTOM VIEW



SIDE VIEW

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.20	0.25	0.30
c		0.203REF	
D	4.90	5.00	5.10
D1	3.60	3.70	3.80
e		0.50BSC	
Ne		3.50BSC	
Nd		3.50BSC	
E	4.90	5.00	5.10
E1	3.60	3.70	3.80
L	0.35	0.40	0.45
h	0.25	0.30	0.35