

Product Features

Operating Frequency: 2GHz ~ 8GHz
 Attenuation Range: 0.5dB LSB Steps to 31.5dB
 Parallel Control Interface
 TTL/CMOS-Compatible Control
 +5V/+3.3V Power Supply
 Package: QFN16

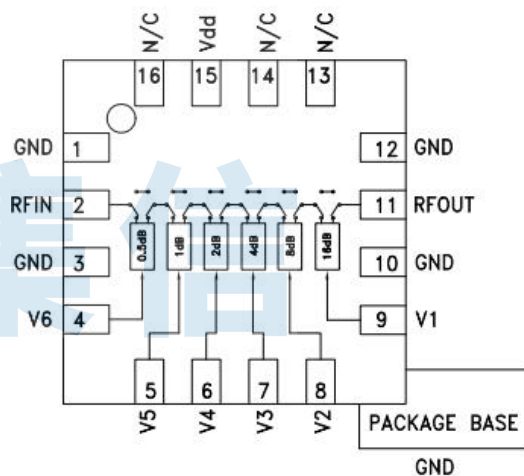
Application

Communication Base Stations
 Test and Measurement Equipment
 Point-to-Point Communication
 VHF/UHF Stations
 Microcellular /3G/4G and UWB

General Description

The BR9156FD is a wideband 6-bit digital attenuator in a low-cost leadless surface-mount QFN16 package. Covering a frequency band of 2GHz ~ 8GHz, the BR9156FD typically offers insertion loss of less than 2.5dB, and can be programmed to provide an attenuation range of 31.5dB in 0.5dB steps. 6-bit TTL/CMOS control inputs are used to select each attenuation state. A single Vdd bias of +5V/+3.3V is required.

Functional Block Diagram



Ordering Information

Part Number	Package	Description
BR9156FD	QFN16	2GHz ~ 8GHz 6-Bit Parallel Digital Attenuator

Electrical Specifications

Parameter	Test Conditions	Min.	Typ.	Max.	Units
Insertion Loss	2GHz to 5GHz	-1.8	-2.0	-2.2	dB
	3GHz to 8GHz	-2.2	-2.8	-3.3	
Attenuation Range	2GHz to 8GHz	-	31.5	-	dB
Return Loss	2GHz to 8GHz	-	-15	-	dB
Attenuation Accuracy: All Attenuated States	2GHz to 5GHz 5GHz to 8GHz	+ / - 0.3 + / - 1.2			dB
Input Power for 1dB Compression	2GHz to 2.5GHz	-	30.5	-	dBm
Output Third-Order Interception	2GHz to 4.2GHz	-	46	-	dBm
Switching Characteristics tRISE,tFALL (10/90% RF) tON,tOFF (50% CTL-10/90% RF)	2GHz to 8GHz at 31.5dB attenuation state	- -	50 50	- -	ns ns
Test Conditions: Vdd=+5V, I=2mA, IIP3 spacing=1MHz, Pin=0dBm/tone, Temp=+25°C					

Absolute Maximum Ratings

Maximum Operating Voltage (Vdd): +7V;

Maximum RF Input Power:

+27dBm (all attenuated states);

Control Voltage Range: 0V ~ Vdd;

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.

Recommended Operating Conditions

Supply Voltage: 5V/3.3V;

Control Voltage Threshold:

0V ~ 0.8V (low level);

2.7V ~ Vdd (high level);

Storage Temperature: -65°C ~ +150°C;

Operating Temperature: -55°C ~ +125°C;

Operating Current: 2mA;

Note: when Vdd=5V, Vctl=0V/3.3V can also work normally;
But when Vdd=3.3V, Vctl=0V/5V will not work properly.

ESD WARNING

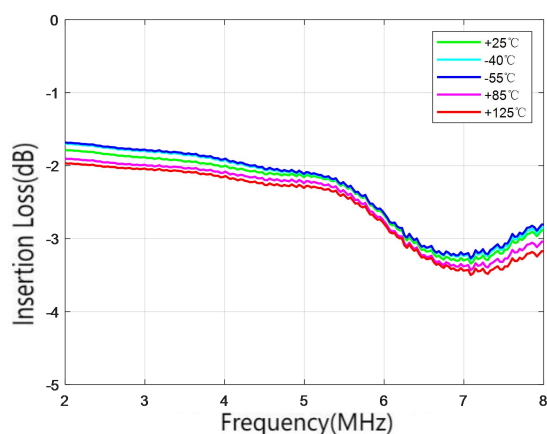
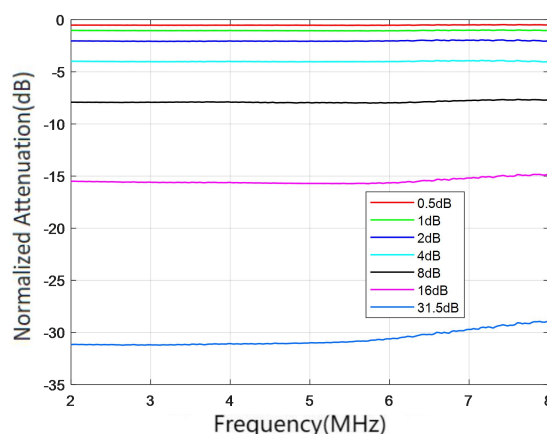


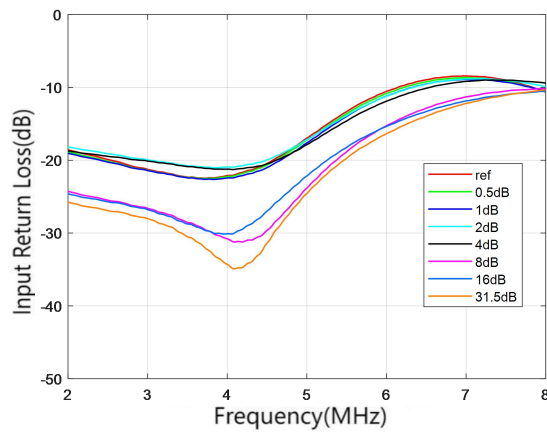
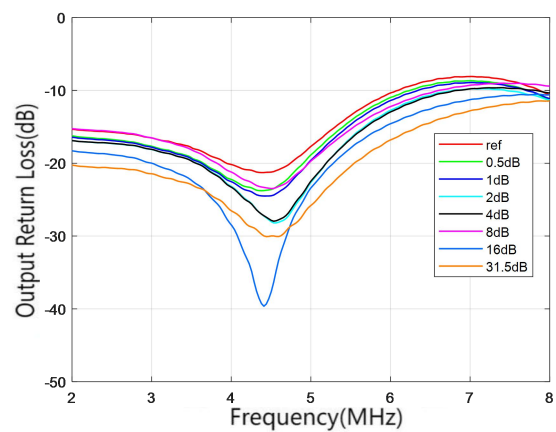
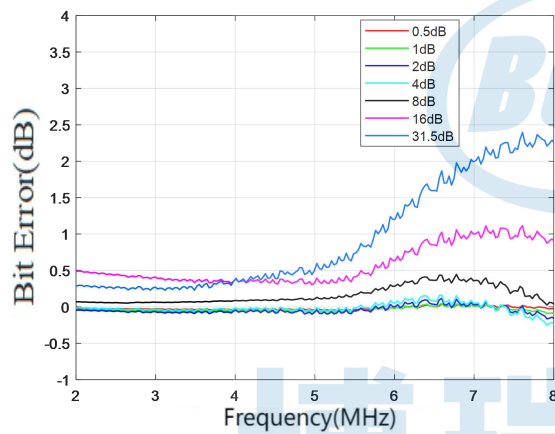
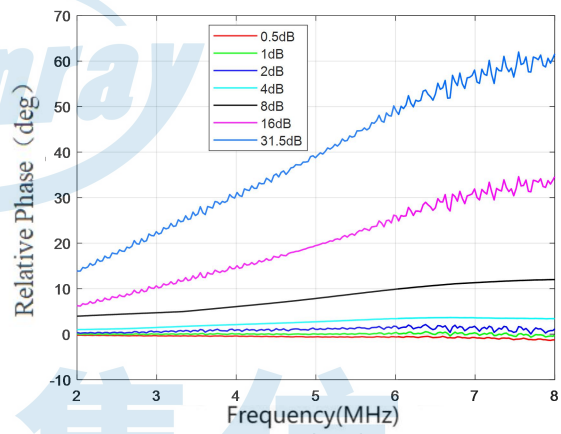
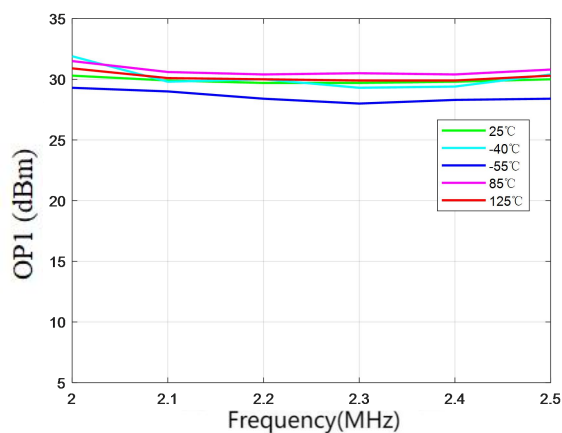
ELECTROSTATIC SENSITIVE DEVICE

OBSERVE HANDLING PRECAUTIONS

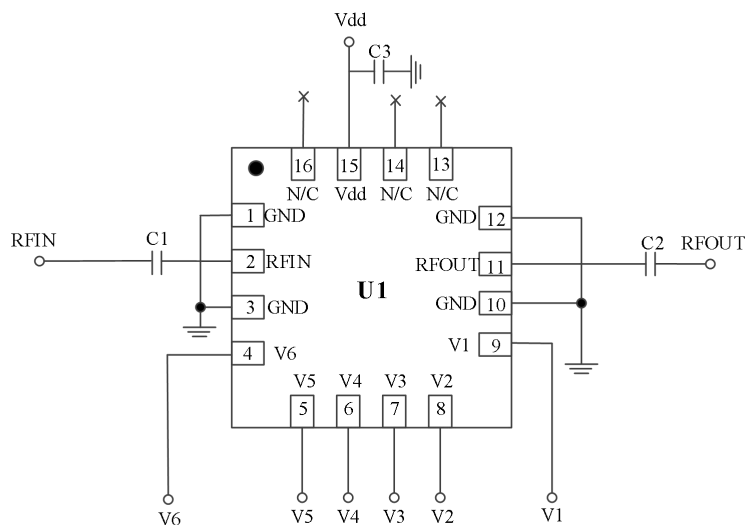
Typical Performance (EVB test results)

Parameter	Typ.							Units
Frequency	2000	3000	4000	5000	6000	7000	8000	MHz
Reference State Insertion Loss	-1.8	-1.9	-2.0	-2.1	-2.5	-3.1	-2.8	dB
Attenuation Accuracy (0.5dB)	0.00	-0.03	0.00	-0.03	0.00	0.00	0.00	dB
Attenuation Accuracy (1 dB)	0.00	0.00	0.00	-0.03	0.00	0.00	0.00	dB
Attenuation Accuracy (2 dB)	0.00	-0.03	-0.03	-0.03	0.03	0.06	0.06	dB
Attenuation Accuracy (4 dB)	0.00	0.03	0.00	0.03	0.03	0.06	-0.1	dB
Attenuation Accuracy (8 dB)	0.1	0.06	0.1	0.03	0.13	0.3	0.1	dB
Attenuation Accuracy (16 dB)	0.5	0.4	0.4	0.3	0.5	0.93	1.1	dB
Attenuation Accuracy (31.5dB)	0.3	0.3	0.4	0.5	1.03	1.93	2.46	dB
Input Return Loss	-17.1	-18.8	-18.8	-18.8	-17.9	-10.9	-10.7	dB
Output Return Loss	-14.5	-16.5	-22.6	-23.2	-14.7	-9.5	-10.5	dB
Input Power for 1dB Compression	2000	2100	2200	2300	2400	2500	-	MHz
	31.8	31.0	30.6	30.7	30.7	31.0	-	dBm
Input-Third-Order Interception	2000	2400	2800	3200	3600	4000	4200	MHz
	44.3	46.7	47.6	44.6	44.8	45.1	46.7	dBm
Switching Time	50ns rise switch			50ns down switch				ns
Test Conditions: Vdd=+5V, I=2mA, Input IP3 spacing=1MHz, Pin=0dBm/tone, Temp=+25°C								


Insertion Loss

Normalized Attenuation


Input Return Loss

Output Return Loss

Bit Error

Relative Phase

Input Power for 1dB Compression

Typical Application Schematic



Bill of Material

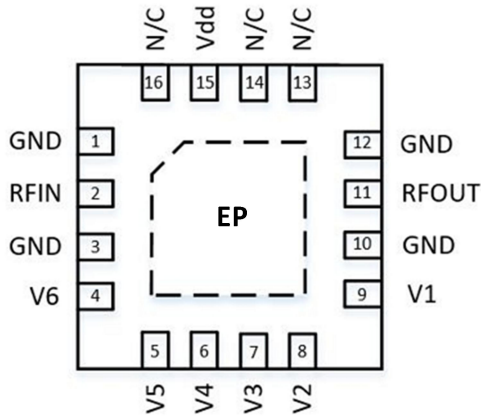
Reference Designator	Package	Description	P/N
C3	0402	1nF	GRM1555C1H102JA01D
C1, C2	0402	20pF	GRM1555C1H200JA01D

Control Voltage Truth Table

Control Input						Attenuated state
V1 16dB	V2 8dB	V3 4dB	V4 2dB	V5 1dB	V6 0.5 dB	RF1/RF2
1	1	1	1	1	1	Insertion loss in reference state
1	1	1	1	1	0	0.5 dB
1	1	1	1	0	1	1 dB
1	1	1	0	1	1	2 dB
1	1	0	1	1	1	4 dB
1	0	1	1	1	1	8 dB
0	1	1	1	1	1	16 dB
0	0	0	0	0	0	31.5dB

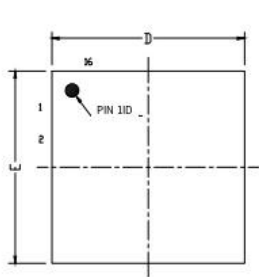
Note: Any combination of the above states will provide an attenuation approximately equal to the sum of the bits selected.

Pin Configuration and Description



Pin Number	Pin Name	Description
13,14,16	N/C	No electrical connection. These pins should be connected to ground
15	Vdd	Supply power supply.
2,	RFIN, RFOUT	Attenuator RF input/output pins. DC block is required.
4~9	V6 ~ V1	Parallel control voltage input pins. Select the required attenuation. See Truth Table.
1,3,10,12	GND	Ground pins; These pins a must be connected to the RF/DC ground.
-	EP	Exposed pin. The exposed pad must be connected to RF/DC ground.

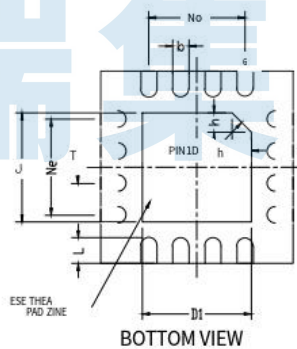
Package Dimensions (mm)



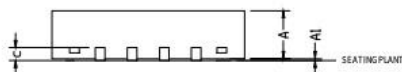
TOP VIEW



SIDBVIEW



BOTTOM VIEW



SIDBVIEW

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.75	0.80	0.85
A1	0.01	0.02	0.05
b	0.20	0.25	0.30
c	0.270REF		
D	2.90	3.00	3.10
D1	1.60	1.70	1.80
e	0.50BSC		
Ne	1.50BSC		
Nd	1.50BSC		
E	2.90	3.00	3.10
E1	1.60	1.70	1.80
L	0.25	0.30	0.35
h	0.30	0.35	0.40