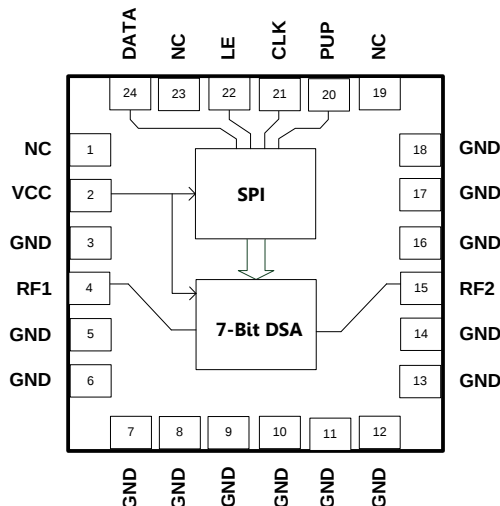




Features

- Frequency Range 50MHz to 4000MHz
- 7-Bit, 31.75dB Range, 0.25dB Step
- High Linearity, IP3 > 50dBm
- 3V and 5V Logic Compatible
- Serial-to-Parallel Controller
- Serial Programming Interface
- Power-up Programming Modes
- On-chip ESD Protection > 500V HBM
- Single Supply, 3V to 5V Operation
- Footprint compatible with most 24-Pin, 4mm QFNs



Functional Block Diagram

Applications

- Transceiver IF Applications
- Cellular, PCS, GSM, UMTS, LTE,
- WiMax/WLAN
- Wireless Data, Satellite Terminals
- Test Equipment

Product Description

RFMD's RFSA2724 is a 7-bit Digital Step Attenuator (DSA) that features high-linearity over the entire 31.75dB gain control range with excellent step accuracy in 0.25dB steps. The RFSA2724 is programmed via a serial mode control interface that is both 3V and 5V compatible. The RFSA2724 also offers a rugged Class 1B HBM ESD rating via on-chip ESD circuitry. The MCM package is footprint compatible with most 24-pin 4mm x 4mm QFN packages.

Ordering Information

RFSA2724SR	7" Reel with 100 pieces
RFSA2724SQ	Sample bag with 25 pieces
RFSA2724TR7	7" Reel with 750 pieces
RFSA2724TR13	13" Reel with 2500 pieces
RFSA2724PCK-410	PCBA with 5-piece sample bag

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☒ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☒ Si CMOS	☐ RF MEMS
☐ InGaP HBT	☐ SiGe HBT	☐ Si BJT	☐ LDMOS

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	+5.5	V
DC Supply Current	15	mA
Power Dissipation	83	mW
Max RF Input Power	27	dBm
Operating Temperature (Tcase)	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Junction Temperature	150	°C
ESD Rating (HBM)	Class 1B	
Moisture Sensitivity Level	MSL3	



Caution! ESD sensitive device.

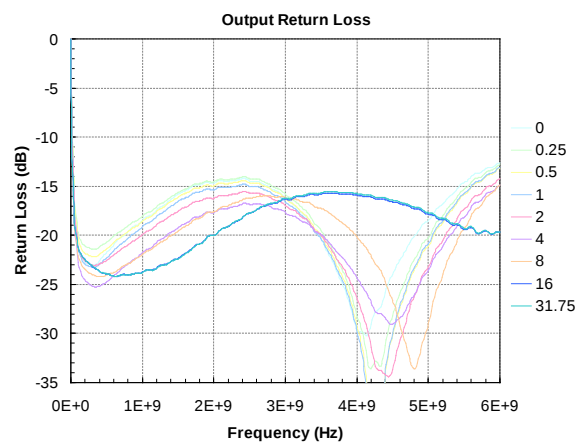
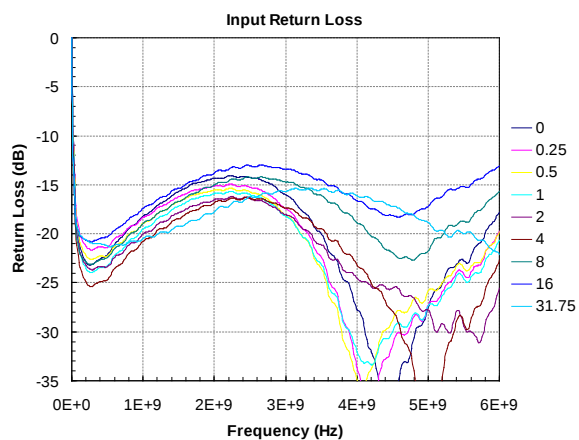
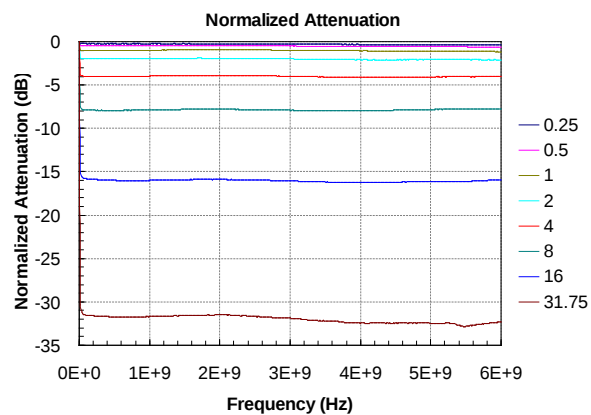
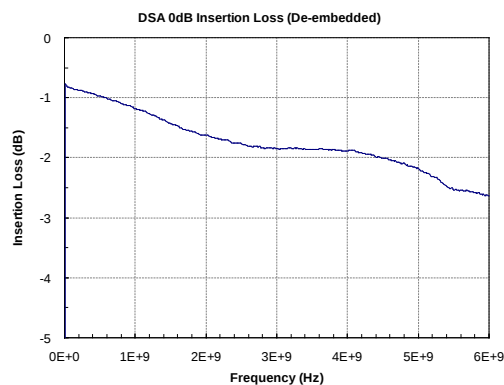
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

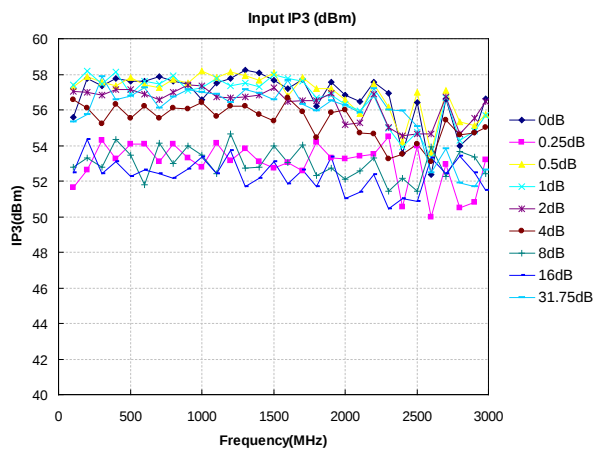
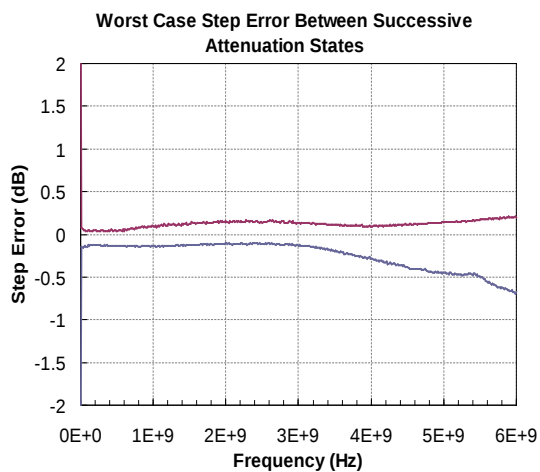
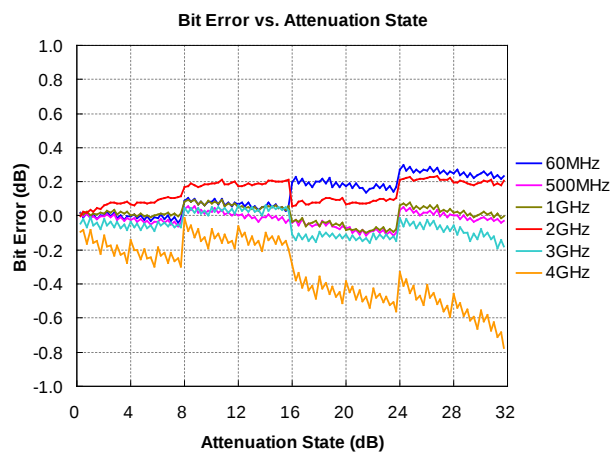
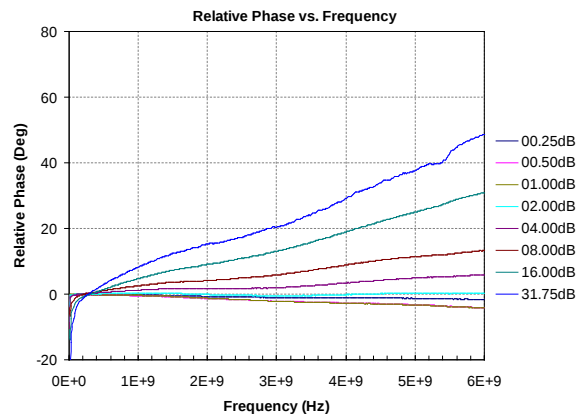
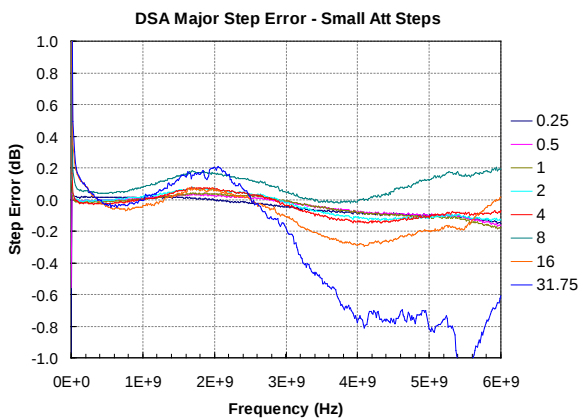
RoHS status based on EUDirective2002/95/EC (at time of this document revision).

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Frequency Range	50		4000	MHz	
Insertion Loss		0.85 1.1 1.6 2.1		dB	150MHz – 0dB attenuation 850MHz – 0dB attenuation 2700MHz – 0dB attenuation 3800MHz – 0dB attenuation
Gain Control Range		31.75		dB	0.25dB step size
Step Accuracy	+/- (0.1 + 2.0% attenuation setting)			dB	
Input IP3		50		dBm	100 – 4000MHz
Input P0.1dB		25		dBm	1000MHz
Return Loss		15		dB	DC - 3500MHz, all states
Control Interface		7-bit, Serial			Serial Interface
Settling Time		200		ns	t _{RISE} , t _{FALL} (10%/90% RF)
Switching Speed		200		ns	t _{ON} , t _{OFF} (50% CTL to 10%/90% RF)
Supply Voltage (V _{DD})	4.75	5.0	5.25	V	
Supply Current		7.5		mA	
Control Voltage (V _{CTL})	Low, V _{CTL} =0 to 0.8V High, V _{CTL} =2.0 to V _{DD}			V	
Notes:					
1. V _{DD} =5V, V _{CTL} =5V, T=25C					
2. IIP3 measured with Pin=+10dBm/tone, 1MHz spacing					

Typical Performance - Broadband Application Circuit (25 °C)





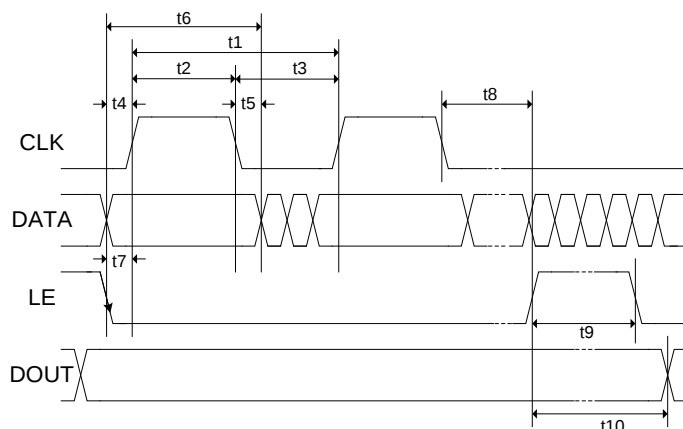
Truth Table

Control Bit							Relative Gain Setting
C16	C8	C4	C2	C1	C0.5	C0.25	
1	1	1	1	1	1	1	Max Gain
1	1	1	1	1	1	0	-0.25 dB
1	1	1	1	1	0	1	-0.5 dB
1	1	1	1	0	1	1	-1 dB
1	1	1	0	1	1	1	-2 dB
1	1	0	1	1	1	1	-4 dB
1	0	1	1	1	1	1	-8 dB
0	1	1	1	1	1	1	-16 dB
0	0	0	0	0	0	0	-31.75 dB

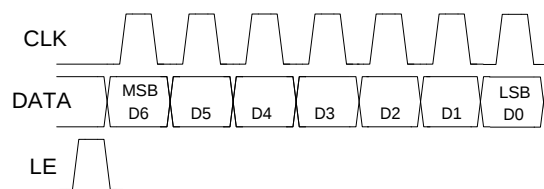
Note: C0.25=D0, C0.5=D1, ..., C16=D6 (for the purpose of the example below)

Serial Port Interface

SPI Timing Diagram



Programming example – 7 bit



SPI Timing Diagram Specifications

Parameter	Limit	Unit	Comment
t1	25	MHz max	CLK Frequency
t2	20	ns min	CLK High
t3	20	ns min	CLK Low
t4	5	ns min	DATA to CLK Setup time
t5	5	ns min	DATA to CLK Hold time
t6	30	ns min	DATA Valid
t7	5	ns min	LE to CLK Setup time
t8	5	ns min	CLK to LE Setup time
t9	10	ns min	LE pulse width
t10	20	ns max	Output set

Logic Voltage Levels	
State	Logic
Low	0V to 0.8V
High	2.0V to 5.0V

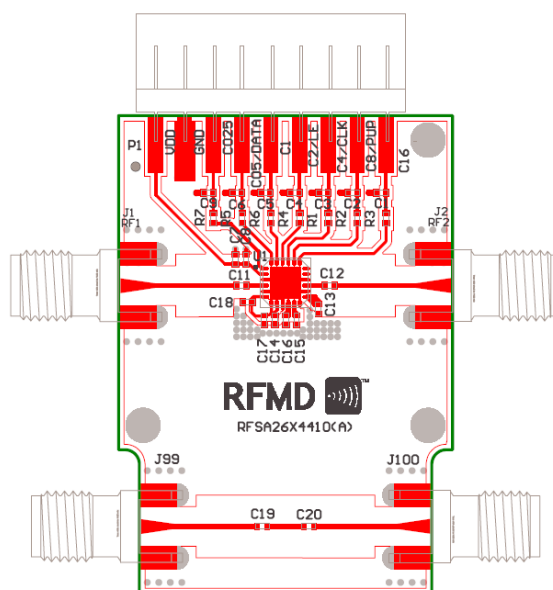
Pin Description Table

Pin	Function	Description
1	NC	No Internal Connection. EVB can be ground or no connect
2	VDD	Power Supply
3	GND	DC & RF Ground
4	RF1	RF Port. External DC Block Required.
5	GND	DC & RF Ground
6	GND	DC & RF Ground
7	GND	DC & RF Ground
8	GND	DC & RF Ground
9	GND	DC & RF Ground
10	GND	DC & RF Ground
11	GND	DC & RF Ground
12	GND	DC & RF Ground
13	GND	DC & RF Ground
14	GND	DC & RF Ground
15	RF2	RF Port. External DC Block Required.
16	GND	DC & RF Ground
17	GND	DC & RF Ground
18	GND	DC & RF Ground
19	NC	No Internal Connection. EVB can be ground or no connect
20	PUP	Power-up Programming Pin Low=Max Attenuation (31.75dB) at power-up High=Min Attenuation (0dB) at power-up
21	CLK	Serial Clock
22	LE	Latch Enable
23	NC	No Internal Connection. EVB can be ground or no connect
24	DATA	Serial Data
EPAD	GND	DC & RF Ground. Must be soldered to EVB ground plane over a bed of vias for thermal and RF performance.

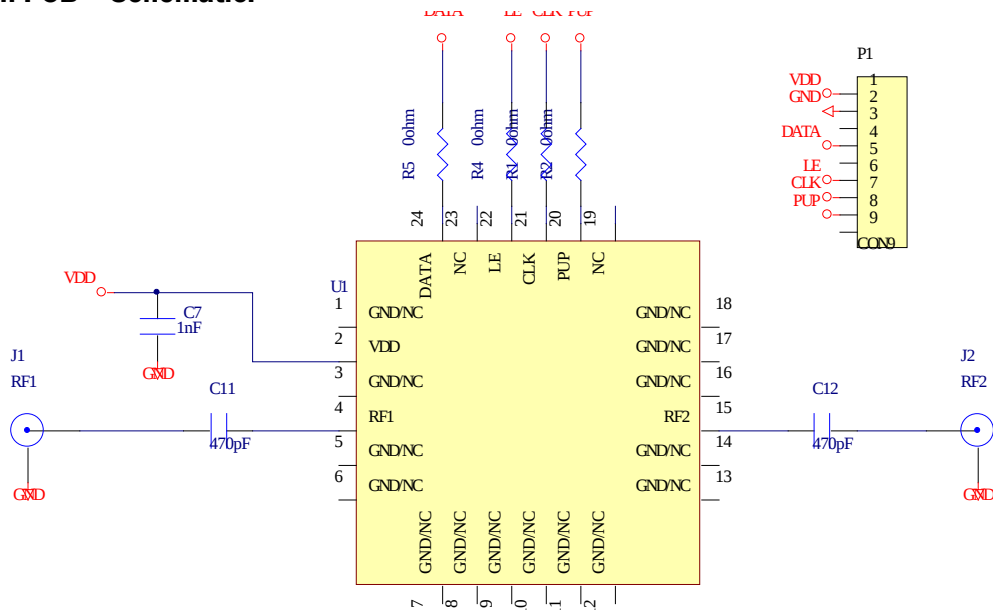
Power Up Programming Truth Table

PUP	Attenuator Setting
Low	Attenuation at Max, 31.75dB
High	Attenuation at Min, 0dB

Evaluation PCB:



Evaluation PCB – Schematic:



Material List for RFSA2724 Evaluation Board

Designator	Description	Qty
U1	RFSA2724 Digital Step Attenuator	U1
J1, J2	PCB Mount SMA Connector	J1, J2
P1	9-Pin DC Connector	P1
C7	CAP, 1nF, 10%, 10V, X5R, 0402	1
C11, C12,	CAP, 470pF, 10%, 50V, X7R, 0402	2
R1, R2, R4, R5	RES, 0Ω, 5%, 1/16W, 0402	4