

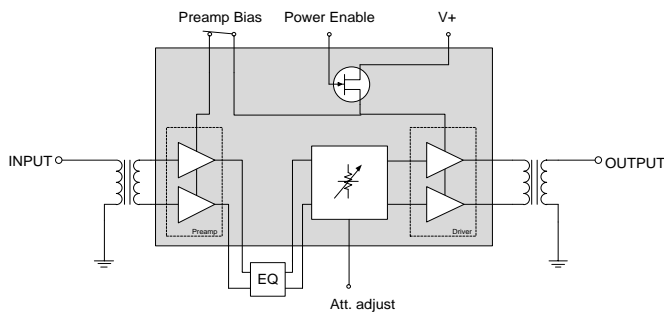


### Product Description

The RFCM5304 is an Integrated Reverse Amplifier Module. The part employs Silicon die, a 20dB range variable attenuator, Preamp switch off, interstage port and a power enable feature, has high output capability and is operated from 5MHz to 220MHz. It provides excellent linearity and superior return loss performance with low noise and optimal reliability.

21 pin, 11.0 mm x 11.0 mm x 1.375 mm package

### Functional Block Diagram



### Product Features

- Excellent Linearity
- Extremely High Output Capability
- Voltage Controlled Attenuator
- Power Enable Feature
- Preamp Power Off Feature
- Low Distortion
- Optimal Reliability
- Low Noise
- Unconditionally Stable Under all Terminations
- 39dB Typical Gain at 220MHz
- 208mA Typical at 12VDC

### Applications

- 5MHz to 220MHz CATV Amplifier For Reverse Channel Systems
- Headend Equipment

### Ordering Information

Part No.	Description
RFCM5304SB	Sample bag 5 pcs
RFCM5304SR	7" Reel with 100 pcs
RFCM5304TR7	7" Reel with 250 pcs
RFCM5304PCBA-410	Fully assembled Evaluation Board
RFCM5304PCK-410	Fully assembled Evaluation Board with sample bag

## Absolute Maximum Ratings

Parameter	Value / Range
DC Supply Over-Voltage (5 minutes)	+14V
Storage Temperature	-40 to 100 °C
Operating Mounting Base Temperature	-30 to 110 °C

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.

## Electrical Specifications – tested in evaluation circuit

Parameter	Conditions (V+=12V, TMB=30°C, ZS=ZL=75Ω, ATT=0dB)	Min	Typ	Max	Unit
Supply Current (I <sub>DD</sub> )	Steady state operation, current draw during attenuation state transitions is higher.		205	220	mA
Power Gain	f=5MHz	38.5	39.2	40.5	dB
	f=220MHz	38.3		41.2	dB
Slope [1]	f=5 MHz to 220MHz	-0.2		1.2	dB
Flatness of Frequency response	f=5 MHz to 220MHz			1.0	dB
Input Return Loss	f=5 MHz to 200MHz	20			dB
	f=200MHz to 220MHz	18			dB
Output Return Loss	f=5 MHz to 200MHz	20			dB
	f=200MHz to 220MHz	18			dB
Noise Figure	f=10MHz		2.5	2.8	dB
	f=100MHz		2.9	3.2	dB
	f=220MHz		3.2	3.5	dB
Attenuator range	V+=12V, TMB=30°C, ZS=ZL=75Ω, Att adjust= 0V to 12V	0 to 20			dB
Power enable	Logic high (3.3V) applied to power enable pin [2]		Enable		
Power disable	Logic low (0V) applied to power enable pin [3]		Disable		

[1] The slope is defined as the difference between the gain at the start frequency and the gain at the stop frequency

[2] Logic high is defined as power enable voltage >2V

[3] Logic low is defined as power enable voltage <0.4V

Parameter	Conditions (V+=12V, TMB=30°C, ZS=ZL=75Ω, ATT=0dB)	Min	Typ	Max	Unit
CTB	7 ch flat; VO=50dBmV [4]			-70	dBc
XMOD	7 ch flat; VO=50dBmV [4]			-60	dBc
CSO	7 ch flat; VO=50dBmV [4]			-70	dBc
CTB	28 ch flat; VO=46dBmV [5]			-63	dBc
XMOD	28 ch flat; VO=46dBmV [5]			-55	dBc
CSO	28 ch flat; VO=46dBmV [5]			-60	dBc
OIP2	VO=11dBm [6]		65		dBm
OIP3	VO=11dBm [7]		41.5		dBm

[4] 7 channels, NTSC frequency raster: T7-T13 (7.0MHz to 43.0MHz), +50dBmV/ch flat output level.

[5] 28 channels, NTSC frequency raster: T7-T13 (7.0MHz to 43.0MHz), 2-6 (55.25MHz to 83.25MHz), A2-11 (121.25MHz to 199.25MHz), +46dBmV/ch flat output level.

[6] 2-tone, 11dBm/tone, f1=99.0MHz, f2=100.0MHz, 1 MHz tone spacing, fm=199.0MHz (f1+f2)

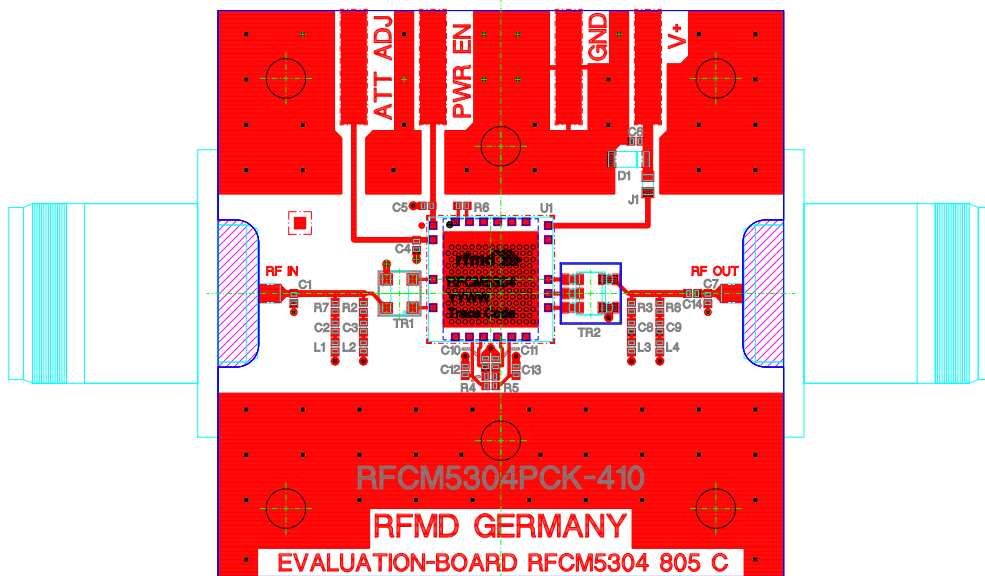
[7] 2-tone, 11dBm/tone, f1=199.0MHz, f2=200.0MHz, 1 MHz tone spacing, fm=201.0MHz (2xf2-f1)

Composite Second Order (CSO) - The CSO parameter (both sum and difference products) is defined by ANSI/SCTE 6.

Composite Triple Beat (CTB) The CTB parameter is defined by ANSI/SCTE 6.

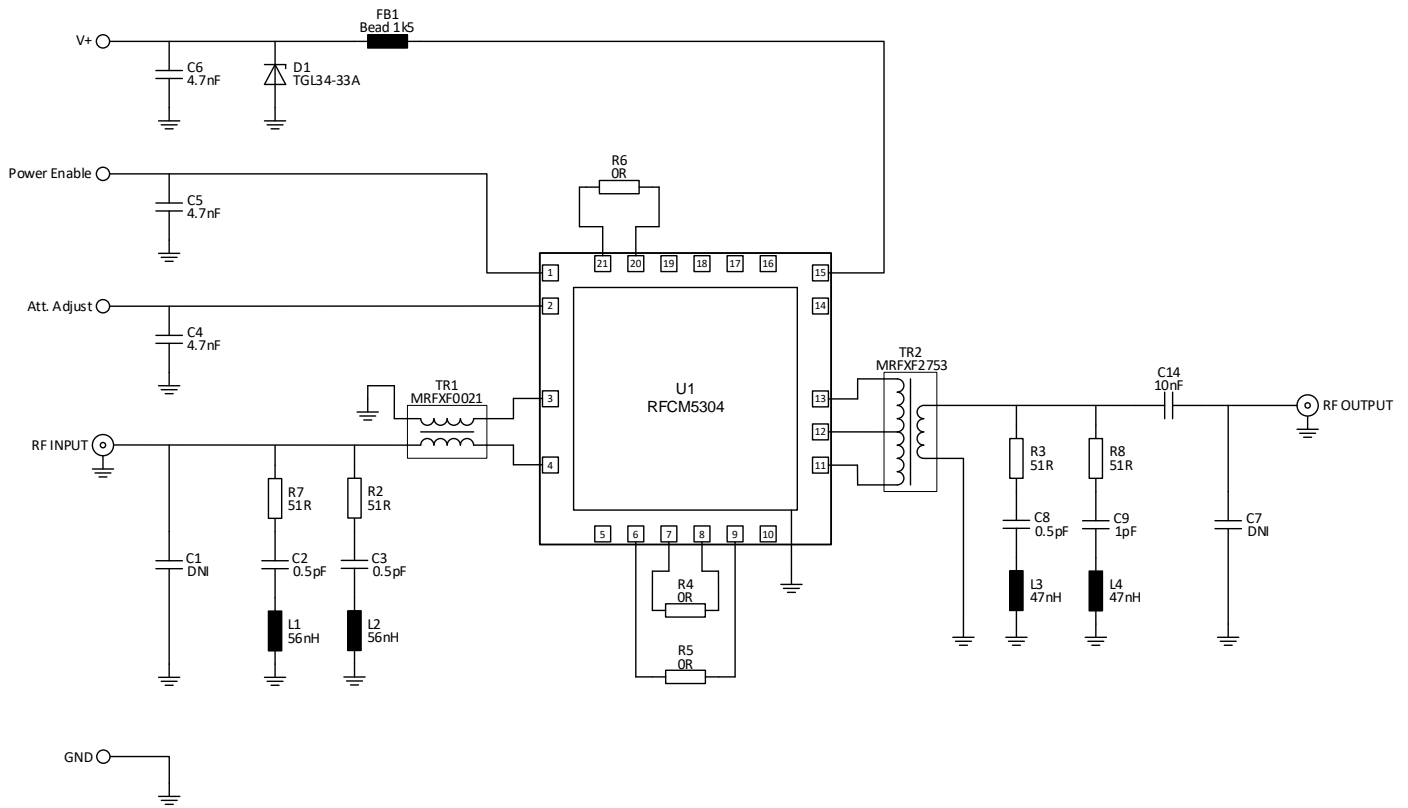
Cross Modulation (XMOD) - Cross modulation (XMOD) is measured at baseband (selective voltmeter method), referenced to 100% modulation of the carrier being tested.

Evaluation Board Assembly Drawing



Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. A via drill diameter of 0.4mm and a minimum via wall copper plating thickness of 25um is recommended. Open vias are preferred to allow flux and gases to escape during reflow soldering and therefore to minimize voiding. Underneath this via array a heat sink with thermal grease needs to be placed which is able to dissipate the complete module DC power (up to 2.6 Watts). In any case the module backside temperature should not exceed 110 °C.

Evaluation Board Schematic

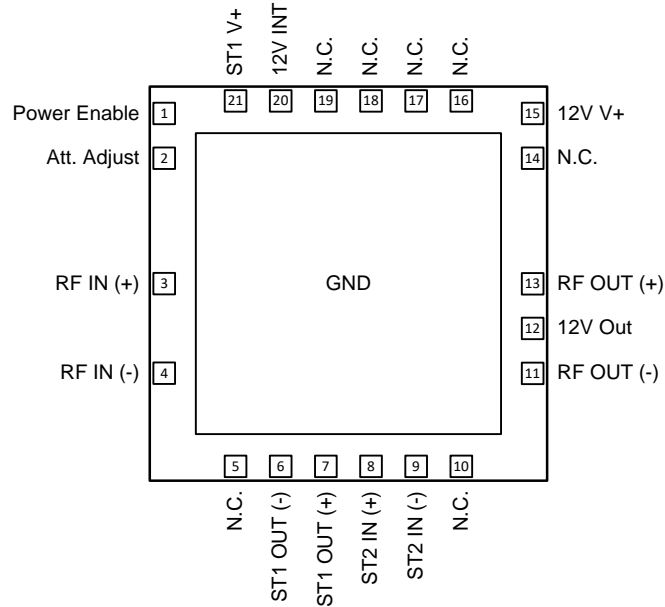


## Evaluation Board Bill of Materials (BOM)

Ref. Designator	Value, package	Description	Manufacturer	Part Number
C2, C3, C8	0.5 pF, 0402	Capacitor, NP0, 50V, 0.25pF	Murata, Taiyo Yuden	
C4, C5, C6	4.7 nF, 0402	Capacitor, X7R, 50V, 10%	Murata, Taiyo Yuden	
C9	1.0pF, 0402	Capacitor, NP0, 50V, 0.25pF	Murata, Taiyo Yuden	
C14	10nF, 0402	Capacitor, X7R, 25V, 10%	Murata, Taiyo Yuden	
R2, R3, R7, R8	51R, 0402	Resistor, TK100, 1%	various	
R4, R5, R6	0R, 0402	Jumper	various	
L1, L2	56nH, 0402	Inductor, 5%	Taiyo Yuden	HK1005 56NJ-T
L3, L4	47nH, 0402	Inductor, 5%	Taiyo Yuden	HK1005 47NJ-T
FB1	1k5@100MHz, 0603	Impedance Bead, DCR 0.75R, 250mA	Taiyo Yuden	BK1608LM152-T
D1	33V	Transient Suppressor Diode, 5%	Diotec	TGL34-33A
T1	1:1	RF Transformer	Mini-RF	MRFXF0021
T2	1:4	RF Transformer	Mini-RF	MRFXF2753
U1		Amplifier	Qorvo	RFCM5304
C1, C7, C10, C11, C12, C13		DNI		

Notes: Evaluation board PCB: FR4, double sided, 1.5mm, 35um Cu

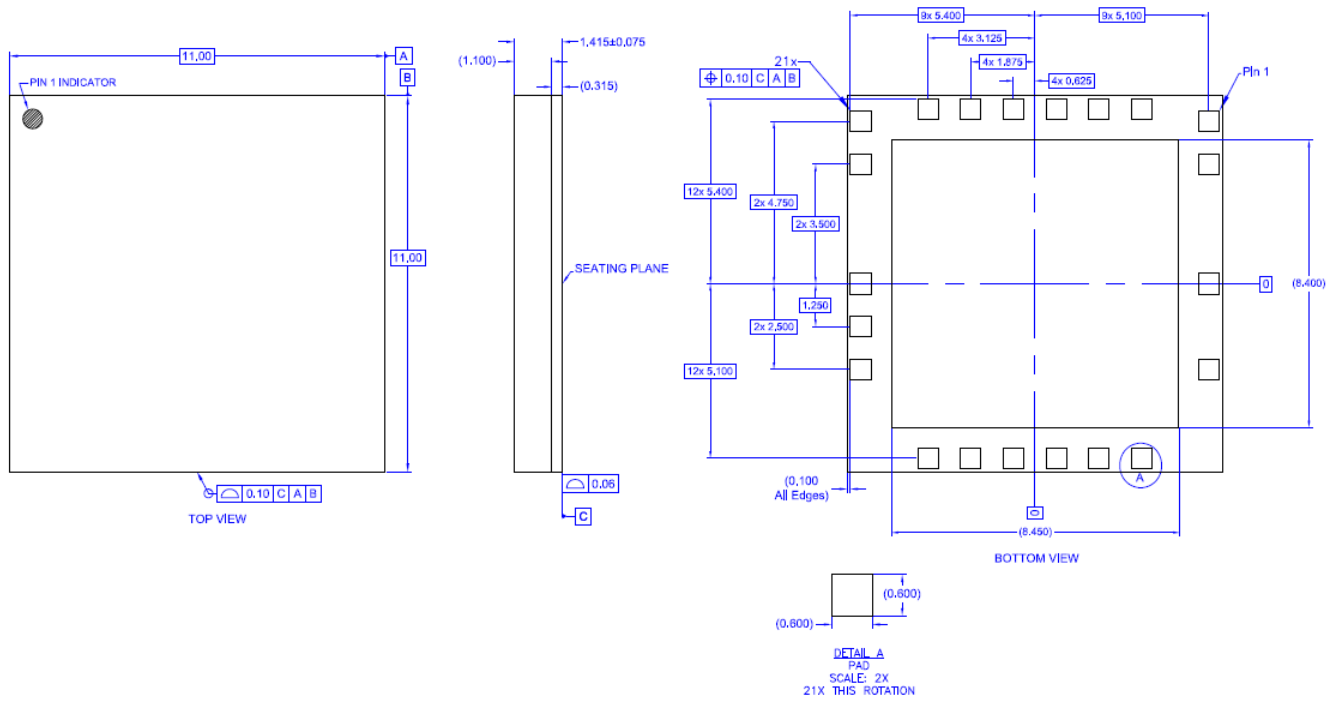
## Pin Configuration



## Pin Description

Pin No.	Label	Description
1	Power Enable	Logic Level (3.3V) Power Enable Control
2	Att. Adjust	Voltage Adjustable Attenuator
3	RF IN (+)	RF AMP Positive Input
4	RF IN (-)	RF AMP Negative Input
5	N.C.	
6	ST1 OUT (-)	Stage 1 Positive Output
7	ST1 OUT (+)	Stage 1 Negative Output
8	ST2 IN (+)	Stage 2 Positive Input
9	ST2 IN (-)	Stage 2 Negative Input
10	N.C.	
11	RF OUT (-)	RF AMP Negative Output
12	12V Out	12V Output
13	RF OUT (+)	RF AMP Positive Output
14	N.C.	
15	12V V+	Supply Voltage 12V
16 – 19	N.C.	
20	12V INT	12V internal
21	ST1 V+	12V Stage 1

Package Outline Drawing (Dimensions in millimeters)

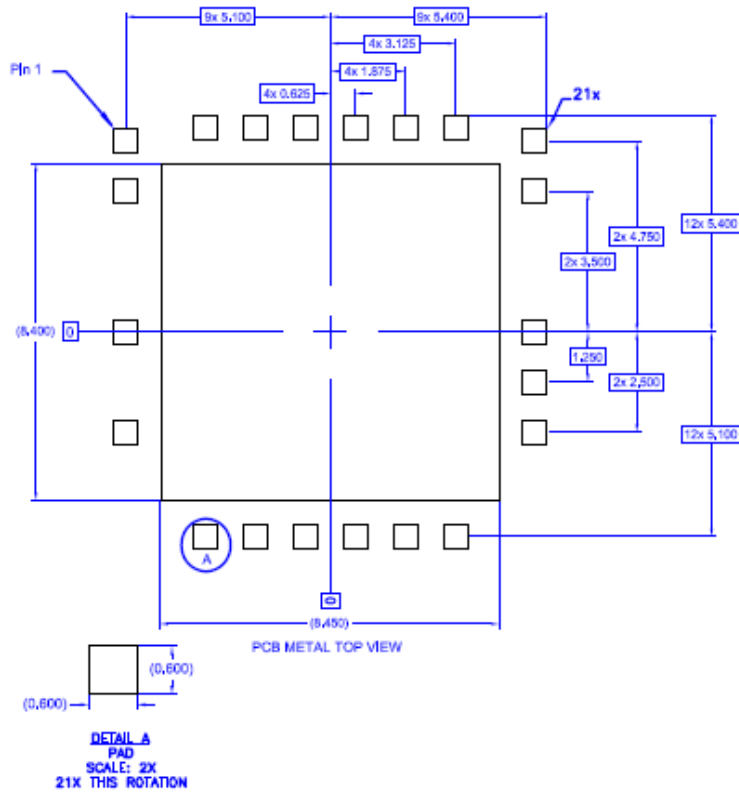


Notes:

1. Dimension and tolerance formats conform to ASME Y14.5M-1994.
2. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.
3. Co-planarity applies to the exposed ground/thermal pad as well as the contact pins.
4. Package body length/width does not include plastic flash protrusion across mold parting line.



PCB Metal Land Pattern (Dimensions in millimeters)



Note: All dimensions are in millimeters. Angles are in degrees.