

2.4~2.5 GHz RF Front-End Module

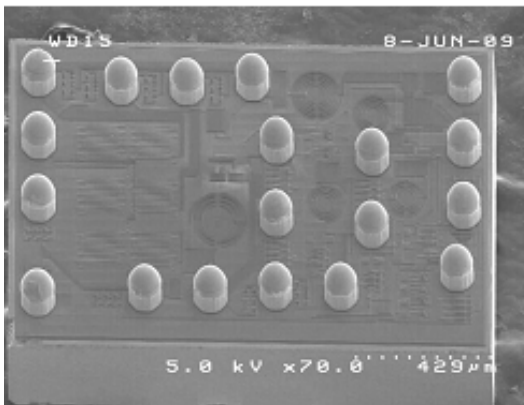
Introduction

The FM2491_FC is fully integrated RF front-end module designed for dual-mode 802.11b/g WLAN applications. The device includes a 3-Stage linearized power amplifier, high-pass filter (HPF), SP3T switch, and power detector. Input and output matching circuitry is integrated to minimize the number of external components required.

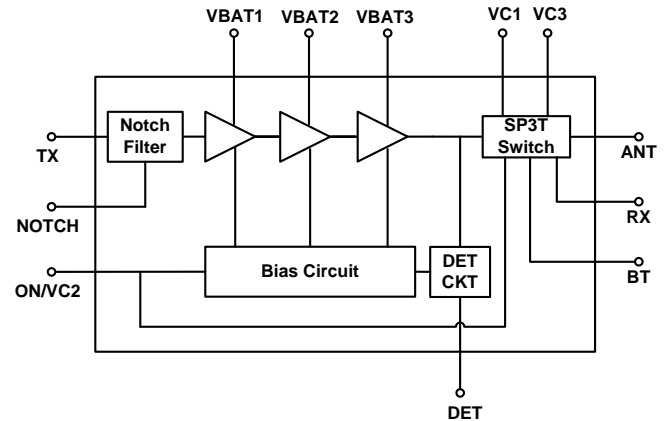
The device is sold as a RoHS compliant miniature 1.5 x 0.9 x 0.3 mm flip chip die. Its small size and low profile makes the device an ideal solution for radios and other applications that require small form factors.

Applications

- IEEE 802.11b/g WLAN
- 2.4 GHz Cordless Phones
- 2.4 GHz ISM Radios
- 2.4 GHz Smart Phones



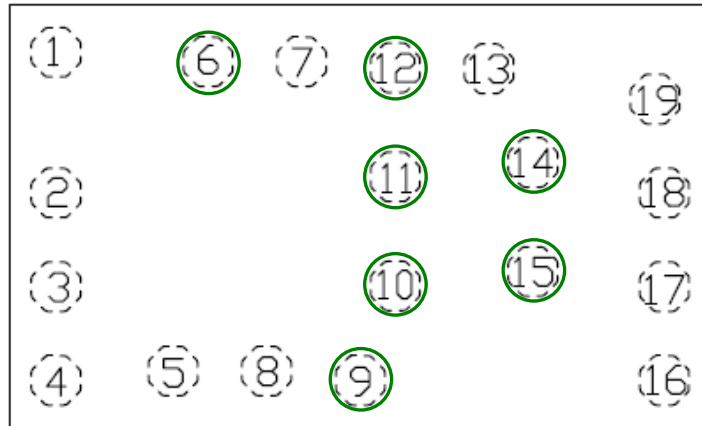
Functional Diagram



Features

- 2.4 to 2.5 GHz Operating Range
- 34 dB Gain (*Note: versions with 30 dB gain and 25 dB gain are also available*)
- 3% EVM at Pout=+17 dBm (Icc=120mA @ Vcc=+3.3V) at 54 Mbps OFDM signal
- 4% EVM at Pout=+18 dBm (Icc=135mA @ Vcc=+3.3V) at 54 Mbps OFDM
- Excellent performance over temperature (-25°C to +85°C)
- Single chip MMIC
- Low current dissipation
- Single-supply, low-voltage battery operation (2.7V – 4.8V)
- CMOS compatible control logic (control voltage range is 1.6V – 2.1V)
- RoHS compliant product

Pin Configuration



Top View < Bumps on bottom >

Pin Description

Pin	Pin Name	Pin Description
1	ANT	RF pad for common port of SP3T (RF output from PA, DC block required)
2	VC3	Switch control voltage for RX mode
3	VC1	Switch control voltage for BT mode
4	RX	RF pad for RX (DC block required)
5	DET	Detector output for PA
6	GND	Ground
7	VBAT3	3 rd Stage power supply
8	BT	RF pad for RX (DC block required)
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	VBAT2	2 nd Stage power supply
14	GND	Ground
15	GND	Ground
16	TX	RF input to PA (DC block required)
17	NOTCH	Pad for external shunt inductor used in HPF at PA input
18	ON/VC2	Control voltage to turn on PA (also used as switch control for TX mode)
19	VBAT1	1 st Stage power supply

Specifications

Absolute Maximum Ratings

PARAMETER	MIN.	MAX.	UNIT	COMMENTS
Single supply VBAT	2.3	5.1	V	
Digital Voltage (PAON & VCx)	1.6	5.1	V	
Operating Temperature Range	-30	+85	°C	
Storage Temperature Range	-65	+125	°C	
Soldering Conditions	-	TBD	°C	
ESD Tolerance (HBM)	1000	-	V	Goal for all pins, forward and reverse voltage.

Note : Stress in excess of the absolute maximum ratings may cause permanent damage to the device.

DC Electrical Characteristics (Temp.=25°C)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Voltages					
VBAT1		2.7	3.3	4.8	Volts
VBAT2		2.7	3.3	4.8	Volts
VBAT3		2.7	3.3	4.8	Volts
PA_ON		1.6	1.8	2.1	Volts
VC1		1.6	1.8	2.1	Volts
VC3		1.6	1.8	2.1	Volts
Supply Currents					
Icq	VBAT=3.3V, PAON & VC2=1.8V		72		mA
I(ON)	TBD		0.003	1	mA

Truth Table

	VC1	ON/VC2	VC3	ANT-BT	ANT-TX	ANT-RX
BT Mode	' 1 '	' 0 '	' 0 '	ON	OFF	OFF
TX Mode	' 0 '	' 1 '	' 0 '	OFF	ON	OFF
RX Mode	' 0 '	' 0 '	' 1 '	OFF	OFF	ON
BT+RX (1)	' 1 '	' 0 '	' 1 '	ON	OFF	ON

- State ' 0 ' = 0 to +0.2V, State ' 1 ' = +1.8 to +2.1V (operation down to 1.6V is possible with some performance degradation).
- (1) When both VC1 and VC3 are high and VC2 is low, the switch will split the signal between the BT and RX paths (there will be an additional 3 dB power-split loss for each path).

Transmit Path Electrical Characteristics (VBAT=3.3V, PAON/VC2=1.8V, 802.11g 64-QAM 54 Mbps, duty cycle = 85%, Temp.=25°C)

PARAMETER		CONDITIONS	MIN.	TYP.	MAX.	UNIT
RF Frequency Range (*Note 1)			2.4		2.5	GHz
Power Gain				34		dB
S11 (Input Return Loss)				-15		dB
S22 (Output Return Loss)				-15		dB
Rejection (*Note 2)		@2.17GHz		10		dBc
Psat		Using CW signal		26		dBm
Sleep Mode / Leakage current		VCC = 3.3V, V_ON = 0V		50		uA
Detector voltage		Pout=17dBm		600		mV
Linear Pout for 11g usage		Pass 802.11g OFDM 54Mbps		21.7		dBm
Linear Pout for 11b usage		Pass 802.11b CCK 1Mbps Long		21.6		dBm
Pout = 17 dBm	EVM	64QAM / 54Mbps		3		%
	Total Current	64QAM / 54Mbps		120		mA
Pout = 18 dBm	EVM	64QAM / 54Mbps		4		%
	Total Current	64QAM / 54Mbps		135		mA
2 nd Harmonics		Pout=17dBm		-35		dBc
3 rd Haemonics		Pout=17dBm		-50		dBc

***Note 1 :** Operation outside this range is possible, but not guaranteed

***Note 2 :** Rejection can be improved by tuning the notch inductor value

Receive Path Electrical Characteristics (VBAT/VC1/VC2=0V, VC3=1.8V, Temp.=25°C)

PARAMETER		CONDITIONS	MIN.	TYP.	MAX.	UNIT
Frequency Range			2.4		2.5	GHz
Insertion Loss (*Note 3)				0.7		dB
S11 (Input Return Loss)				-15		dB
S22 (Output Return Loss)				-18		dB

Bluetooth Path Electrical Characteristics (VBAT/VC2/VC3=0V, VC1=1.8V, Temp.=25°C)

PARAMETER		CONDITIONS	MIN.	TYP.	MAX.	UNIT
Frequency Range			2.4		2.5	GHz
Insertion Loss (*Note 3)				0.7		dB
S11 (Input Return Loss)				-14		dB
S22 (Output Return Loss)				-18		dB

***Note 3 :** Switch Insertion loss can be improved by using higher control voltages (>1.8V)

Switch Isolation (Temp.=25°C)

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Frequency Range		2.4		2.5	GHz
BT-RX Isolation (PA is OFF, BT Path is ON)	VC1=1.8V, VC2/VC3=0V		23		dB
BT-RX Isolation (PA is OFF, RX Path is ON)	VC3=1.8V, VC1/VC2=0V		23		dB
BT-RX Isolation (PA is ON)	VC2=1.8V, VC1/VC3=0V		25		dB
TX-RX Isolation (PA is ON)	VC2=1.8V, VC1=VC3=0V		23		dB
TX-BT Isolation (PA is ON)	VC2=1.8V, VC1=VC3=0V		23		dB

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