RF210-51

Image-Reject Front End for Dual-Band GSM Applications

The RF210-51 device is available as a dual-band (EGSM900/DCS1800) front end for Global System for Mobile Communications™ (GSM™) mobile telephony applications. The device integrates all the required front-end components after the frequency pre-select filters. The components include the Low Noise Amplifiers (LNAs), the internal image-reject filters, mixers, and a Local Oscillator (LO) amplifier.

The main advantage of the RF210-51 is its ability to provide a minimum of 35 dB of image rejection for each band. The device block diagram is shown in Figure 1. The device package and pin configuration is shown in Figure 2.

Distinguishing Features

- Supports EGSM
- LNA and mixer for RF to IF conversion
- 12 dB or 20 dB switchable gain step
- Minimum 35 dB of image rejection
- No external post-LNA filters required
- Common Intermediate Frequency (IF) port for both bands
- IF range from 350 MHz to 450 MHz
- High isolation LO input buffer
- Differential IF output
- High dynamic range with low current consumption
- Three-cell battery operation (2.7 to 3.6 V)
- 20-pin Exposed paddle, Thin Shrink Small Outline Package (ETSSOP)

Applications

- Dual-band digital cellular mobile telephony (EGSM900/DCS1800)

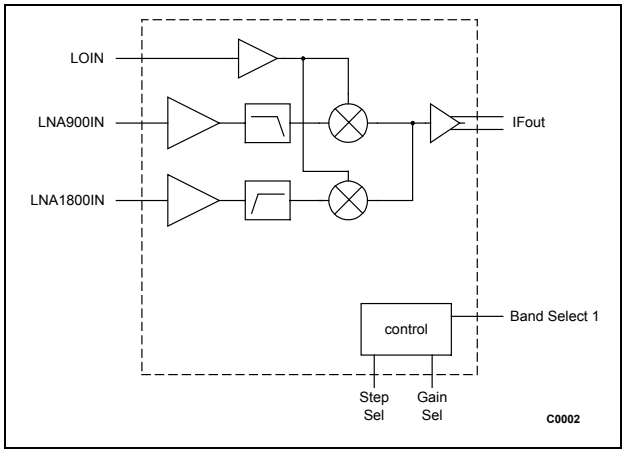

Figure 1. RF210-51 Device Block Diagram

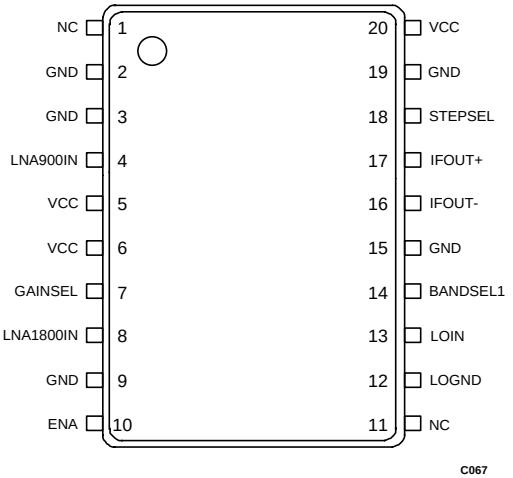

Figure 2. RF210-51 Device Pin Configuration – 20-Pin ETSSOP

Technical Description

The RF210-51 device forms the front end of a dual-band super-heterodyne receiver. The RF210-51 dual-band device is optimized for an EGSM900/DCS1800 design. Each frequency band has its own separate front-end receiver path. Each receiver path contains an LNA, an image-reject filter, and a mixer. The IF and LO ports are common to both frequency bands. The image rejection achievable by this front-end design without any additional external components is 35 dB minimum for an IF of 400 MHz. The device operates over a supply voltage range of 2.7 V to 3.6 V.

The RF210-51 dual-band device has one band selection pin (BANDSEL1 on pin 14). When BANDSEL1 is set to logic "0," the EGSM900 receiver path is active. The LO frequency needs to be higher than the RF input frequency, that is, a high side injection is used. When BANDSEL1 is set to logic "1," the DCS1800 receiver path is active. The LO frequency needs to be less than the RF input frequency, that is, a low-side injection is used. With a 400 MHz IF, this arrangement allows a single, wide-range Voltage Controlled Oscillator (VCO) to be used for each band of operation. Table 1 provides the frequency band selection settings for the dual-band device.

All the LNAs have switchable gain. The gain mode is selectable using the GAINSEL signal (pin 7). Low gain mode is selected by driving the GAINSEL signal to a logic "1"; high gain mode is selected by driving the signal to a logic "0." Depending on the need of the handset design on the gain distribution, the gain step between the high gain and low gain modes can be set to either a 12 dB step or a 20 dB step. This gain step is selectable with the STEPSEL signal (pin 18).

Electrical and Mechanical Specifications

The RF210-51 signal pin assignments and functional pin descriptions are found in Table 2. The absolute maximum ratings of the RF210-51 are provided in Table 3, the recommended operating conditions are specified in Table 4. Electrical specifications are provided in Table 3. Figure 3 shows the diagram for a typical application circuit using the RF210-51 front end. Figure 4 provides the package dimensions for this 20-pin ETSSOP device.

ESD Sensitivity

The RF210-51 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

Table 1. RF210-51 Band Selection

BANDSEL1, pin 14	Mode
0	EGSM900
1	DCS1800

Table 2. RF210-51 Device Signal Description

Pin #	Name	Description	Pin #	Name	Description
1	NC	No connect (recommend connecting to ground)	11	NC	No connect (recommend connecting to ground)
2	GND	Ground	12	LOGND	LO input ground
3	GND	Ground	13	LOIN	LO input
4	LNA900IN	900 MHz LNA input	14	BANDSEL1	Band select control
5	VCC	Supply	15	GND	Ground
6	VCC	Supply	16	IFOUT–	Mixer negative output
7	GAINSEL	LNA gain select	17	IFOUT+	Mixer positive output
8	LNA1800IN	1800 MHz LNA input	18	STEPSEL	Gain step select. STEPSEL= 0 selects a 12 dB gain step; STEPSEL = 1 selects a 20 dB gain step
9	GND	Ground	19	GND	Ground
10	ENA	Device enable, active high	20	VCC	Supply

Table 3. Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units
Storage Temperature	–40	+125	°C
Supply Voltage (VCC)	–0.3	+3.6	V
Input Voltage Range	–0.3	Vcc	V

Table 4. RF210-51 Recommended Operating Conditions

Parameter	Min	Typical	Max	Units
Supply Voltage	2.7	3.0	3.6	V
Operating Temperature	–30	+25	+85	°C

Table 5. RF210-51 Electrical Specifications (1 of 2)
(T_A = 25 °C, Vcc = 2.7 V, f_{IF} = 400 MHz, *Plo* = –10 dBm)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
EGSM900 Mode						
Supply current: Enable mode Sleep mode		 ENA = 1 ENA = 0		 15	 30	 mA µA
RF Input frequency			925		960	MHz
IF frequency	fif		350	400	450	MHz
LO to RF input isolation			30			dB
Input impedance				50		Ω
Power gain (for 2 kΩ differential output impedance): High gain mode Low gain mode 1 Low gain mode 2 Gain step 1 Gain step 2 Temperature coefficient Gain variation versus frequency	 Gmax1 Gmin1 Gmin2 Gstep1 Gstep2 Ftc1	 GAINSEL = 0 GAINSEL = 1, STEPSEL = 1 GAINSEL = 1, STEPSEL = 0	 20 –24 –14	 22 0 10 –22 –12 –0.02	 25 –20 –10 0.8	 dB dB dB dB dB dB/°C dB
Noise figure: High gain Low gain mode 1 Low gain mode 2		 GAINSEL = 0 GAINSEL = 1, STEPSEL = 1 GAINSEL = 1, STEPSEL = 0		 2.3 18 10	 3.5	 dB dB dB
Noise figure degradation with blocker: High gain		–22 dBm blocker, GAINSEL = 0 (Note 1)		 1.6		 dB
Input 1 dB compression point	IP1dB	high gain mode low gain mode	–22 –18	–20 –13		dBm dBm
Input third order intercept point	IP3			–12		dBm
Differential IF shunt output resistance				2		kΩ
Image rejection: f_{IF} = 400 MHz f_{IF} = 350 or 450 MHz			 35 25	 50		 dB dB

Table 5. RF210-51 Electrical Specifications (2 of 2)
(T_A = 25 °C, Vcc = 2.7 V, f_{IF} = 400 MHz, *Plo* = –10 dBm)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
DCS1800 Mode						
Supply current: Enable mode Sleep mode		 ENA = 1 ENA = 0		 19	 30	 mA µA
RF input frequency			1805		1880	MHz
IF frequency			350	400	450	MHz
LO to RF input isolation			30			dB
Input impedance				50		Ω
Power gain (for 2 kΩ differential output impedance): High gain mode Low gain mode 1 Low gain mode 2 Gain step 1 Gain step 2 Temperature coefficient Gain variation versus frequency	 Gmax1 Gmin1 Gmin2 Gstep1 Gstep2 Ftc1	 GAINSEL = 0 GAINSEL = 1, STEPSEL = 1 GAINSEL = 1, STEPSEL = 0	 20 –22 –14	 22 2 10 –20 –12 –0.02	 25 –18 –10 1.2	 dB dB dB dB dB dB/°C dB
Noise figure: High gain Low gain mode 1 Low gain mode 2		 GAINSEL = 0 GAINSEL = 1, STEPSEL = 1 GAINSEL = 1, STEPSEL = 0		 3.5 16.5 11	 4.5	 dB dB dB
Noise figure degradation with blocker: High gain		–22 dBm blocker, GAINSEL = 0 (Note 2)		 1.6		 dB
Input 1 dB compression point	IP1dB	high gain mode low gain mode	–23 –20	–20 –16		dBm dBm
Input third order intercept point	IP3			–12		dBm
Differential IF shunt output resistance				2		kΩ
Image rejection: f_{IF} = 400 MHz f_{IF} = 350 or 450 MHz			 35 25	 40		 dB dB
Local Oscillator (LO)						
LO frequency			1275		1640	MHz
LO input return loss (with external matching circuit)		f_{IF} = 400 MHz			–10	dB
LO input power	Plo		–15	–10	–5	dBm
Control Signals (All Modes)						
Digital input voltages (ENA, GAINSEL, BANDSEL1, BANDSEL2, and STEPSEL)	Vih Vil		Vcc – 0.4		 0.4	V V
Enable time	ton				10	µs
Bandselect switching time				15		µs

Note 1: Assumes –5 dBm @ 915 MHz blocker at the antenna input attenuated by 17 dB.

Note 2: Assumes –12 dBm @ 1785 MHz blocker at the antenna input attenuated by 10 dB.

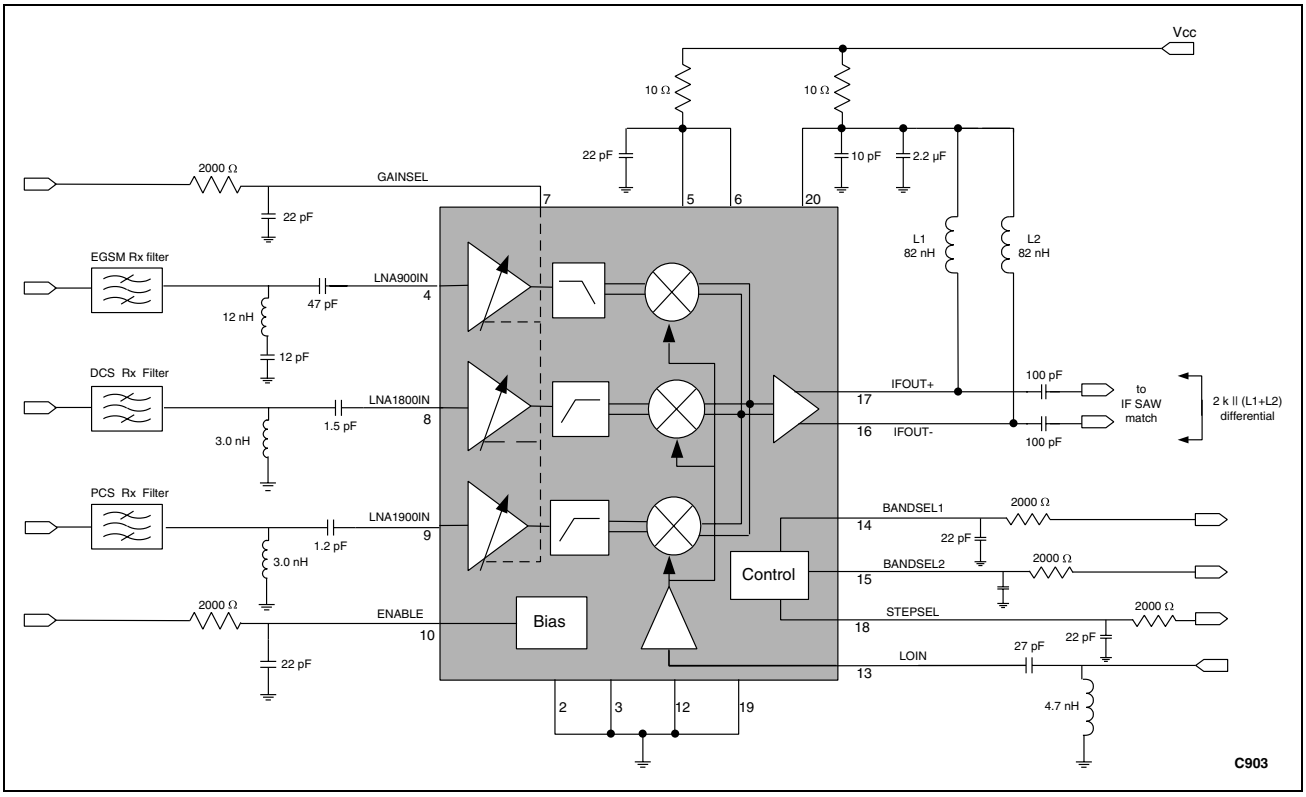

Figure 3. Typical RF210-51 Application Circuit

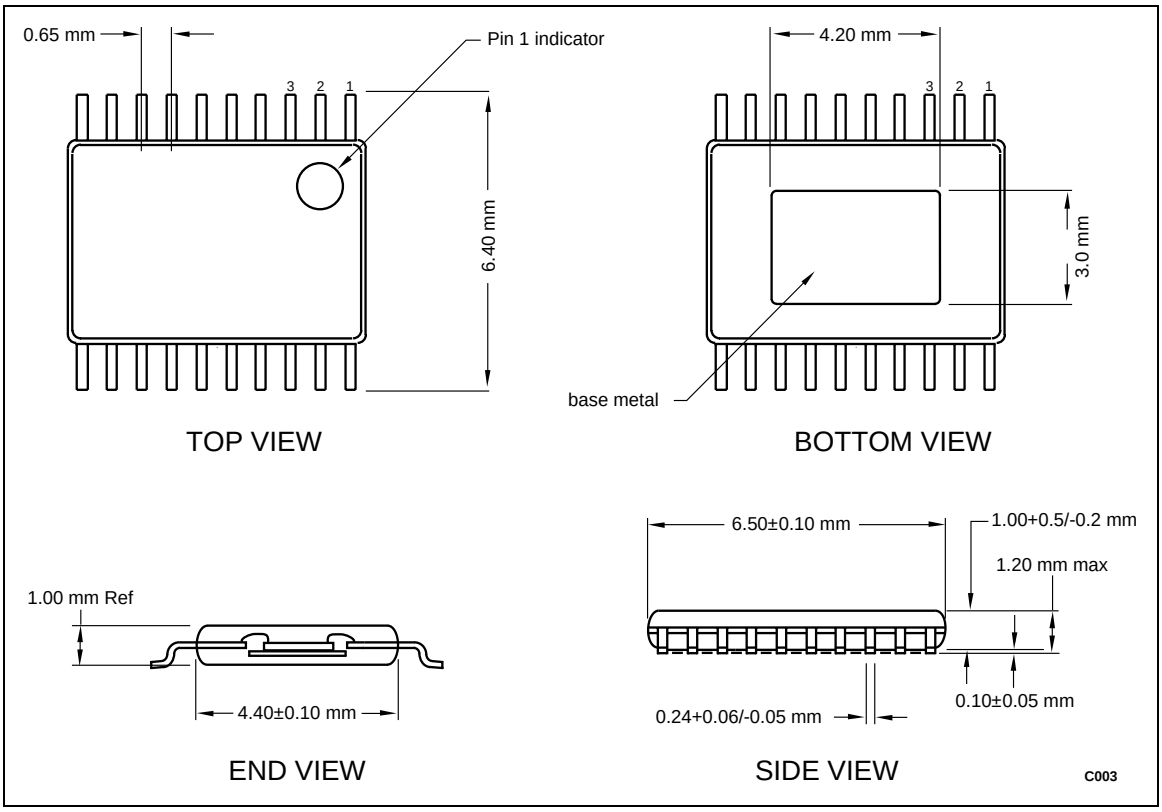

Figure 4. RF210-51 Package Dimensions – 20-Pin ETSSOP

Ordering Information

Model Name	Manufacturing Part Number
Dual-Band Image-Reject Front End	RF210-51

General Information:

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