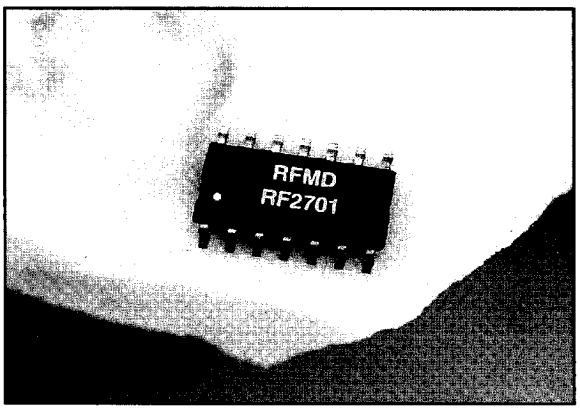
Typical Applications

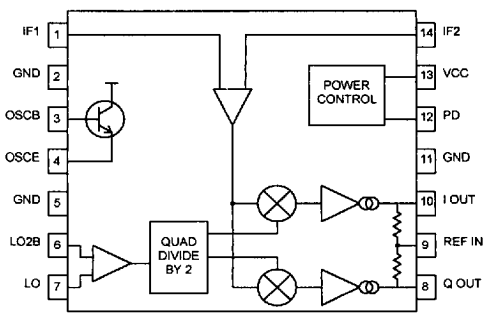
- UHF Digital and Analog Receivers
- Digital Communications Systems
- Spread Spectrum Communications Systems
- Commercial and Consumer Systems
- Portable Battery Powered Equipment
- General Purpose Frequency Conversion

Product Description

The RF2701 is a monolithic integrated quadrature demodulator intended for use in digital mobile radio receivers. In this application it is used to recover the I and Q baseband signals from the amplified and filtered IF. The RF2701 is intended for IF systems where the IF frequency ranges from 0.1 to 70 MHz, and the LO frequency is 2x the IF. The IC contains all of the required components to implement the demodulation function of the receiver and contains a digital divider type 90° phase shifter, two double balanced mixers, and baseband amplifiers designed to interface with Analog to Digital Converters. The output DC offset may be slaved to the reference of the ADC's to maintain DC accuracy.

Handle with care: ESD sensitive.





Functional Block Diagram

Features

- *5 V Power Supply*
- *Active Device for Oscillator On-Board*
- *ADC-Compatible Outputs*
- *Low LO Power Requirement*
- *Digitally Controlled Power Down Mode*
- *1 kHz - 70 MHz IF Operation*

Parameter: Specified at 25°C and 5 V	Specification Min	Typ	Max	Units
Overall:				
IF Frequency Range		0.1 - 70		MHz
Baseband Frequency Range (load impedance > 5 K, Cshunt < 1 pF)		DC - >10		MHz
Baseband Frequency Range (load impedance > 5 K, Cshunt = 10 pF)		DC - 1		MHz
Input Impedance @ 50 MHz (each input)		1000-j1300		Ω
Output Impedance		5000		Ω
Maximum Output (with 250 mV input)		> 1.25		Vp-p
Gain (small-signal, measured with 100 mV input)	13	14		dB
I/Q Amplitude Balance		0.2	0.5	dB
I/Q Phase Accuracy		±2	±5	°
Reference Voltage (Note 1)		1.5 - 3.5		V
DC Offset (I to Q)		15	60	mV
DC Offset (I or Q to REF IN)		15	60	mV
LO:				
Oscillator		Transistor Provided (external LO optional)		
LO Frequency		2X IF Frequency		
LO Level		0.1 - 1.0		Vp-p
LO Input Impedance @ 100 MHz		400-j1200		Ω
Power Supply:				
Voltage (specifications)		5		V
(operating limits)		4.5 - 5.5		V
Current (operating)		4.5	7.2	mA
(power down)			10	µA
Power Down:				
Turn on/off time		< 100		ns
PD Input Resistance		> 50		kΩ
Logic	"0" = OFF(0 V), "1" = ON(5 V)		Unloaded CMOS Gate	
Temperature Range	-40		+85	°C
Package	14 lead SOIC (SO-14), plastic			

Note 1: Reference voltage input should provide a low impedance at the I/Q frequency, and sets the DC level seen on the I and Q ports.

Absolute Maximum Ratings

	Value	Units
Supply Voltage	7	Vdc
Output Voltage	2	Vp-p
Input IF Level	2	Vp-p
Storage Temperature	+150	°C
Ambient Operating Temperature	+85	°C

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Ordering Information

Part No.	Description
RF2701	Quadrature Demodulator
RF2701PCBA	Fully Assembled Evaluation PCB
RF2701PCB	Evaluation PCB Only

For:	Contact:
• Pricing Information • Application Assistance • Samples	RF Micro Devices, Inc. (910) 855-8085

Pin	Function	Description
1	IF1	Balanced IF input. An input level of 0.4 Vp-p gives full output swing, a level of maximum 0.25 Vp-p is recommended for linear operation. This pin has no internal DC block and an external capacitor of 100 nF is needed if connected to a DC path.
2	Ground	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.
3	OSCB	Base of the LO transistor. This transistor can be used for an oscillator. The collector of the transistor is connected to VCC. This pin is not connected to anything else.
4	OSCE	Emitter of the LO transistor. This pin is not connected to anything else. Maximum collector current of this device is 1 mA, f_T = 4.5 GHz, H_{FE} = 100.
5	Ground	Same as pin 2.
6	LO2B	Balanced input for the doubled LO. An internal divide-by-2 network generates the actual LO for the mixers. The divided signal is not accessible. When the LO is driven single ended this pin should be connected to a 100 nF capacitor to ground. This pin has an internal pull-up resistor to Vcc and an external DC blocking capacitor of 100 nF is recommended.
7	LO2	Balanced input for the doubled LO. The input frequency should be 2 times the IF frequency. An internal divide-by-2 network generates the actual LO for the mixers. This pin has an internal pull-up resistor to Vcc, and an external DC blocking capacitor of 100 nF is recommended. LO frequencies below 100 kHz are acceptable, providing that the LO signal is square wave. Above 100 kHz a sine wave signal is acceptable. The quadrature accuracy of the LO/2 frequency into the mixers is affected by the duty cycle of the LO input signal. Square wave signals with other than 50% duty cycle will degrade the quadrature accuracy of the LO signal, thereby adversely affecting the I and Q quadrature accuracy. Since the LO input is AC coupled, asymmetric sine waves and sine waves clipped on either the top or bottom half will not have 50% duty cycles relative to the internal DC reference point. For this reason, distorted LO sine wave signals will degrade performance in a fashion similar to non 50% duty cycle square waves. A sine wave input with even harmonics less than -15 dBc is recommended. The internal limiting buffer amplifier ensures the amplitude stability of the demodulator.
8	Q OUT	Demodulated baseband Q output. The reference DC level of this pin is set by the voltage of pin 9 (REF IN), which is connected to this pin through a 5kΩ resistor to the collectors of this push-pull output. This results in an output impedance of 5kΩ if the REF IN pin is connected to a low capacitive source. The capacitance of the load determines the maximum baseband frequency. A very low capacitive load may stretch the 3 dB bandwidth over 10 MHz. Another way to increase bandwidth is by connecting a shunt resistor. This will trade-off gain for bandwidth.
9	REF IN	Reference voltage input for the baseband outputs. This pin can be connected to the reference voltage source of the Analog to Digital Converter. It is connected to the I and Q outputs through 5kΩ resistors. This pin should have an external decoupling capacitor large enough to decouple the lowest baseband frequency.
10	I OUT	Demodulated baseband I output. The reference DC level of this pin is set by the voltage of pin 9 (REF IN), which is connected to this pin through a 5kΩ resistor to the collectors of this push-pull output. This results in an output impedance of 5kΩ if the REF IN pin is connected to a low impedance source. The capacitance of the load determines the maximum baseband frequency. A very low capacitive load may stretch the 3 dB bandwidth over 10 MHz. Another way to increase bandwidth is by connecting a shunt resistor. This will trade-off gain for bandwidth.
11	Ground	Same as pin 2.
12	PD	Power Down control. When this pin is "low", all circuits are shut off. A "low" is typically 0.8 V or less at room temperature. When this pin is "high", all circuits are operating normally.
13	VCC	Power supply pin. An external 100 nF bypass capacitor is recommended if no other bypass capacitor is nearby.
14	IF2	Balanced IF input. An input level of 0.4 Vp-p gives full output swing, a level of maximum 0.25 Vp-p is recommended for linear operation. This pin has no internal DC block and an external capacitor of 100 nF is needed if connected to a DC path. If the IF is driven by a single ended source, connect this pin to a 100 nF capacitor to ground.

Application Schematic