IF System and I/Q Demodulator for Digital Satellite TV Transmissions

Description

The U6102B is a monolithic integrated circuit in TEMIC's UHF 5 technology for Sattelite Digital Video Broadcasting (DVBS) and other digital direct sattelite service applications. The circuit operates in a wide frequency range and in a large input level range. Incorporated are two orthogonal mixer stages, (precise phase-matched by a control loop), a gain controlled IF amplifier of high input sensitivity with two switchable isolated inputs and an AGC system for tuner and IF level control. Alternatively the output level may be controlled automatically, e.g., via the channel decoder AGC signal output. The local oscillator operates at IF input frequency. The oscillator signal is internally doubled and again divided to generate the orthogonal mixer driving signals. The oscillator is designed for direct driving a SAW tank circuit.

Features

- Frequency range from 390 to 520 MHz
- Two unbalanced switchable inputs
- High I/Q phase accuracy, based on TEMIC patented 0°/90° control loop circuit
- Input impedance 50 Ω, gain independent
- High input sensitivity
- AGC control range –35 dB
- Internal AGC detector
- Additionally external gain control and output level setting possible
- Electrostatic protected according to MIL STD 883
- SSO20 small outline package

Benefits

- Two switchable IF inputs to connect a combined SAW filter
- Oscillator for SAW tank circuit
- Adjustable tuner AGC control
- Low impedance output driver
- Balanced prescaler output
- Output signal level adjustable or fixed at typical or minimum data sheet value by pin programming
- Low power consumption, 5 V supply voltage

Block Diagram

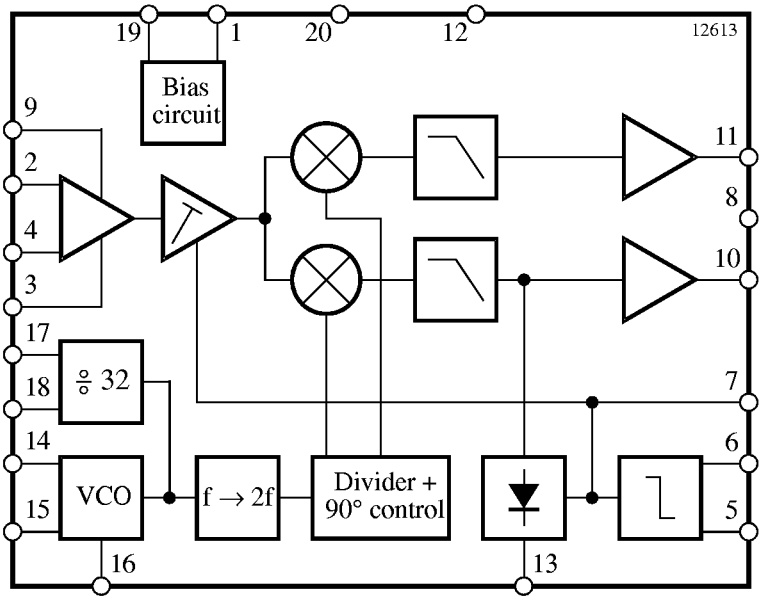


Figure 1. Block diagram

Ordering Information

Extended Type Number	Package	Remarks
U6102B-AFSG3	SSO20	Taped and reeled

Pin Description

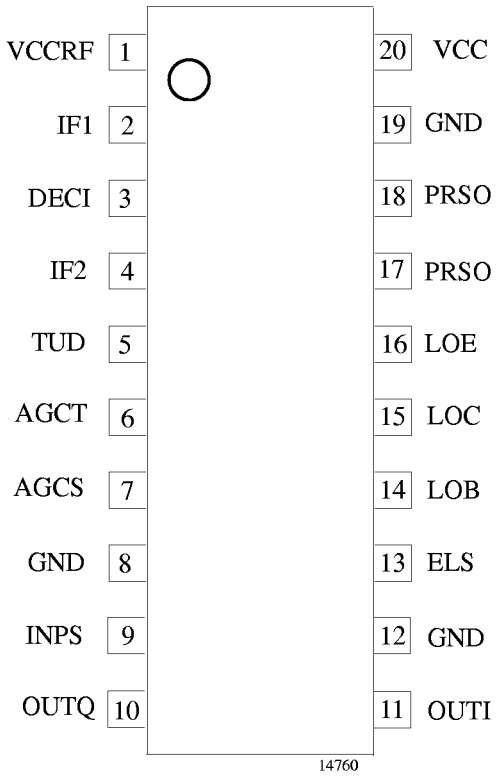


Figure 2. Pinning

Pin	Symbol	Function
1	VCCRF	RF supply voltage
2	IF1	IF input 1
3	DEC1	Input decoupling
4	IF2	IF input 2
5	TUD	Delayed tuner AGC
6	AGCT	Tuner AGC takeover
7	AGCS	AGC storage capacitor
8	GND	Ground
9	INPS	Input select
10	OUTQ	Baseband Q output
11	OUTI	Baseband I output
12	VCCPA	Supply voltage power amplifier
13	ELS	External output level set
14	LOB	Oscillator, base
15	LOC	Oscillator, collector
16	LOE	Oscillator, emitter
17	PRSO	Prescaler output
18	PRSO	Prescaler output
19	GND	Ground
20	VCC	Supply voltage

Absolute Maximum Ratings

All voltages are referred to GND (Pin 13)

Parameters		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pins 1, 12 and 20	VCCRF, VCCPA, VCC	–0.3		6.0	V
Signal inputs,external DC current	Pins 2 and 4	IF1, IF2	–0.2		0.2	mA
Signal outputs external DC voltage	Pins 10 and 11	OUT	–0.3		V_{CC}	V
Signal outputs DC current	Pins 10 and 11	OUT			8.0	mA
Maximum AGC voltage	Pin 5	TUD	–0.3		VCCRF	V
Tuner AGC current	Pin 5	TUD	0		2.0	mA
Maximum prescaler output current	Pins 17 and 18	PRSO			10	mA
Junction temperature		T_j	–40		150	°C
Storage temperature		T_{stg}	–40		125	°C

Thermal Resistance

Parameters		Symbol	Value	Unit
Junction ambient	Pins 13 and 14	R_{thJA}	147	K/W

Operating Range

All voltages are referred to GND (Pin 13)

Parameters		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pins 1, 12 and 20	VCCRF, VCCPA, VCC	4.5		5.5	V
Ambient temperature		T_{amb}	0		70	°C
Input frequency	Pins 13 and 14	IF_{in}	390		520	MHz

Electrical Characteristics

Test conditions: V_{SRF} = +5 V, T_{amb} = +25°C, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current						
Supply current	Pins 1, 12 and 20	I_S		40		mA
IF Input	**Pin 13**					
Impedance		Z_0		50		W
Operation range		f_{IF}	390	480	520	MHz
Sensitivity	f_{IF} = 480 MHz	f_{IF}		57		dBµV
2nd order intercept point	Note 1)	IP_2	76			dBµV
Third order intercept point	Note 1) Note 2)	IP_3 IP_3	80 110			dBµV dBµV
Noise figure SSB		NF		10		dB
AGC range				–35		dB
Oscillator phase noise	10 kHz offset, Note 7)		–120			dBc/Hz
Prescaler output amplitude			1.0			Vpp
Baseband outputs						
Amplitude	Note 5) Pins 10, 11		0.9	1.0	1.1	Vpp
Maximum amplitude	Pins 10, 11		1.5			Vpp
External level adjust	Note 3) Pin 12		0.6		1.0	Vpp
Bandwidth	± 0.25 dB, note 4) ± 1.0 dB, note 4) Pins 10 and 11	fout	20 30			MHz MHz
Relative phase error	Ouput I vs. Q note 3), Pins 10 and 11				3	Degree
Relative amplitude error	Output I versus Q, note 3)				0.5	dB
Input isolation	Input 1 vs. input 2		–30			dB
Spurious oscillator at outputs SAW resonator 480 MHz, interleaved, note 6), Pins 10 and 11						
Spurious at fosc	VCC = 4.5 to 5.5 V			<–40		dBc
Spurious at 2* f osc	VCC = 4.5 to 5.5 V			<–40		dBc

1) AGC set for maximum gain
2) AGC set for minimum gain
3) External AGC setting, see application circuit Fig.2
4) Load impedance 220Ω in series to 2.2 kΩ // 47pF
5) Internal AGC function activated
6) See test circuit
7) Using Siemens R669 one port SAW resonator

Functional Description

The input signal is connected via two single ended constant gain amplifiers with selectable inputs to a gain controlled amplifier. The differential output signal remains of constant amplitude to provide − behind splitting up − optimized dynamic operation points for a pair of identical mixers. The mixer stages are driven by two orthogonal oscillator signals, to generate the I- and Q-components.

The oscillator operates at IF frequency. Therefore control by an on the shelf SAW resonator is possible. Using the internal 1/32 frequency divider circuit a VCO carrier recovery loop can be closed via the base band decoding system.

Excellent accuracy of 0°/90° phase shifting between the demodulator switching carriers is provided by a TEMIC patented phase correction circuit, which operates in a wide input frequency range.

Two matched amplifiers with 2nd order low-pass characteristic to suppress oscillator spurious ensure small gain and phase errors between both channels and minimise tilt. The output stages may drive complex loads up to 220 Ω in series to 2.2 kΩ and 50 pF in a frequency range up to 40 MHz.

To avoid fast system lock in time and driving the A/D converters with defined output levels, in one channel the output signal will be peak level detected and in an internally loop level controlled. So the output signal amplitudes are independent of frequency and characteristic of the QPSK modulation. The output level can be set via an external potentiometer (or at two fixed levels by pin programming) according to the actual application. External loop control is provided by a channel decoder generated AGC signal.

The DC component of the AGC loop affects the IF input level. This signal is internally compared with a adjustable threshold and generates a tuner AGC signal.

Small tolerances based on high DC operation point stability and good spurious signal suppression are performed by an internal reference voltage source.

Basic Application Circuits

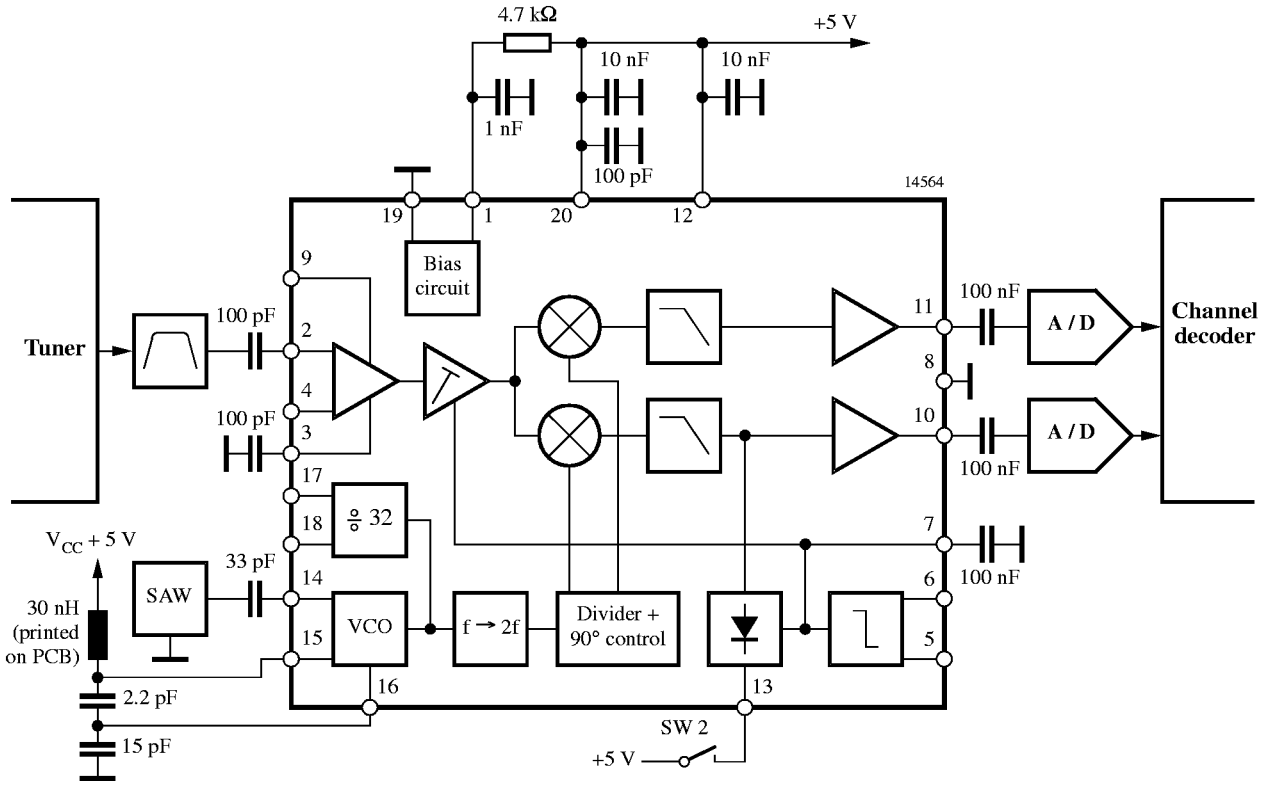


Figure 3. Internal AGC loop, output level optional changeable 0.6 Vpp to 1 Vpp by control voltage at Pin 13, SAW local oscillator

Basic Application Circuits

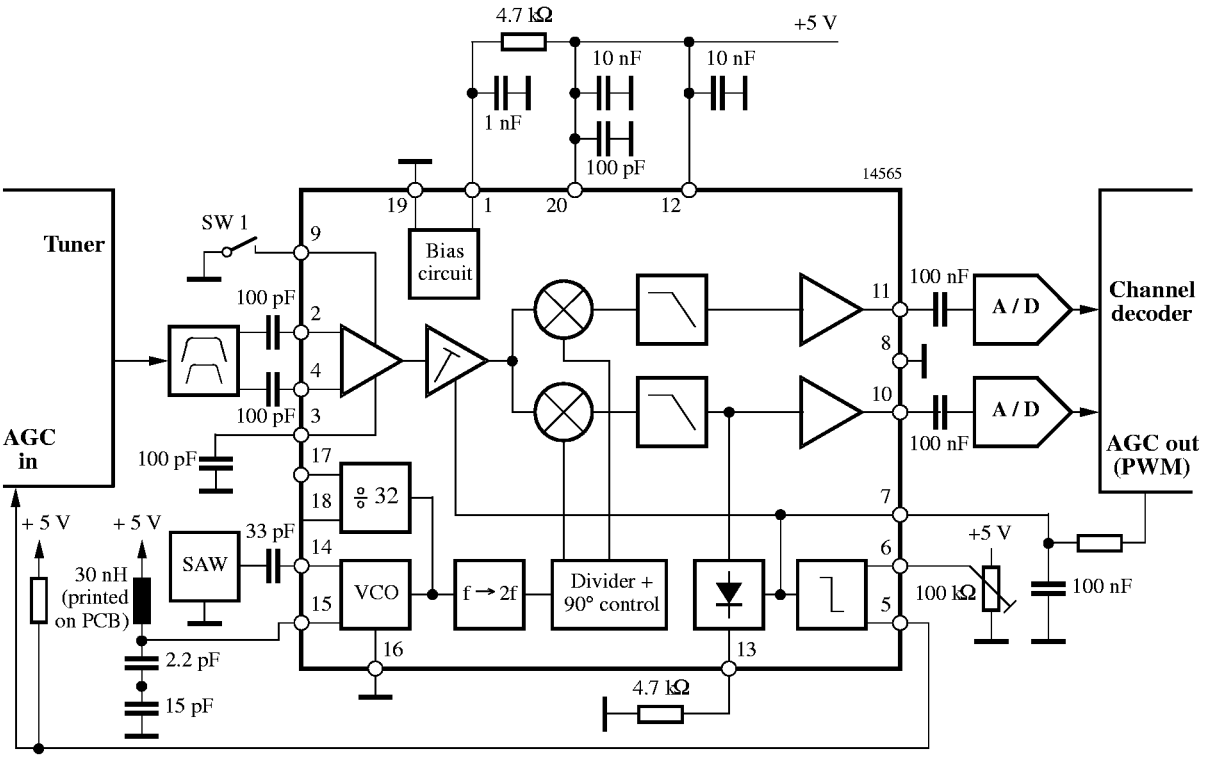
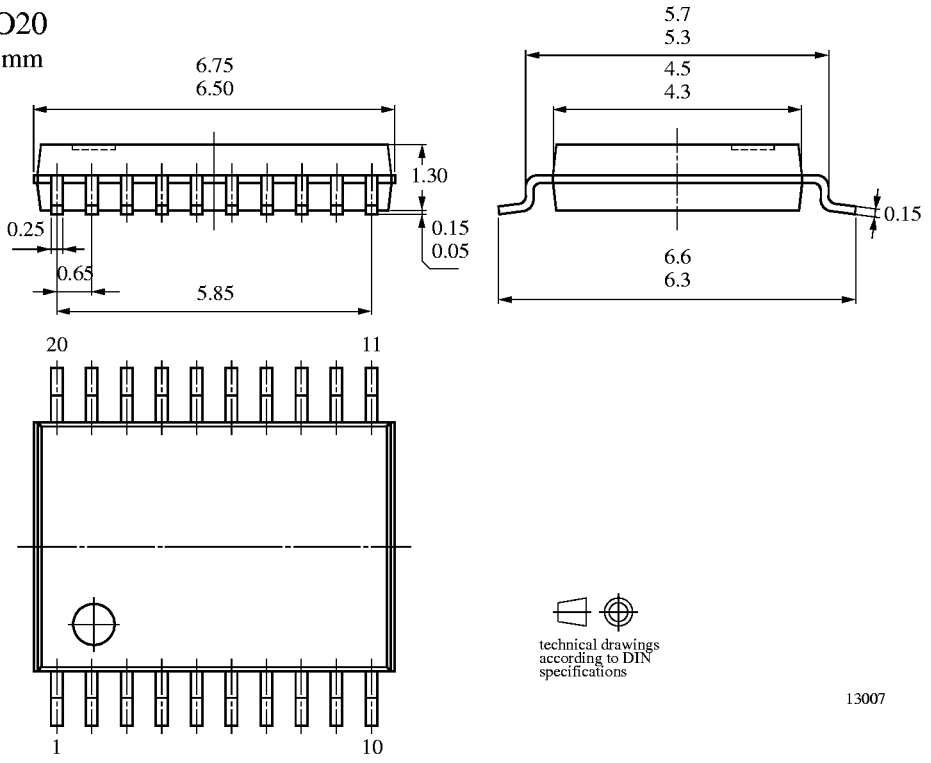


Figure 4. AGC set by channel decoder, fixed VCO frequency SAW resonator carrier recovery, dual bandwidth IF filter, SW1 selects input

Package Information

Package SSO20

Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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