MITEL
SEMICONDUCTOR

SL2018

Full Band Satellite Tuner

Preliminary Information

DS4969 - 1.4 August 1998

The SL2018 is a fully integrated mixer oscillator with output AGC, intended primarily for application in satellite tuners, where it downconverts the first high IF from the outdoor unit to the second IF for data demodulation.

The device contains a low noise RF input amplifier and mixer functioning to 2.15GHz, an integrated local oscillator and an AGC IF output buffer amplifier. The IF signal is available at one of two outputs selected by the IF-OP-SEL input.

The signal handling of the SL2018 is sufficient to greatly simplify or remove the requirement for input AGC with appropriate image filtering in full band systems, or to remove the requirement for band limit filtering with appropriate AGC in half band systems.

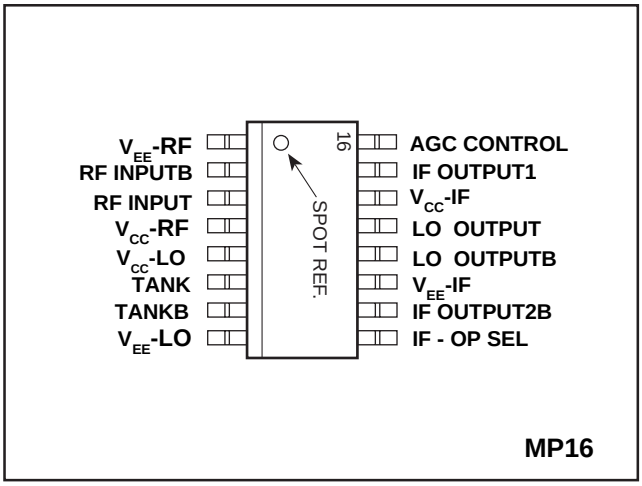

Figure1 Pin connections - top view

FEATURES

- Single chip full band solution, compatible with digital and analog transmissions
- Low noise RF input
- High input signal handling to eliminate the requirement for front end AGC
- Low radiation design
- IF AGC amplifier with dual selectable outputs
- ESD protection. (Normal ESD handling procedures should be observed)

ORDERING INFORMATION

SL2018/KG/MP1S (Tubes)
SL2018/KG/MP1T (Tape and Reel)

APPLICATIONS

- Satellite tuners
- Communications systems

QUICK REFERENCE DATA

Characteristic		Units
RF input noise figure	16	dB
Maximum conversion gain	33	dB
Minimum conversion gain	-5	dB
IF1 and IF2 output gain match	2	dB
$IP3_{2T}$ input referred at minimum conversion gain	+3	dBm
$IP2_{2T}$ input referred at minimum conversion gain	+17	dBm
LO phase noise at 10kHz	-65	dBc/Hz

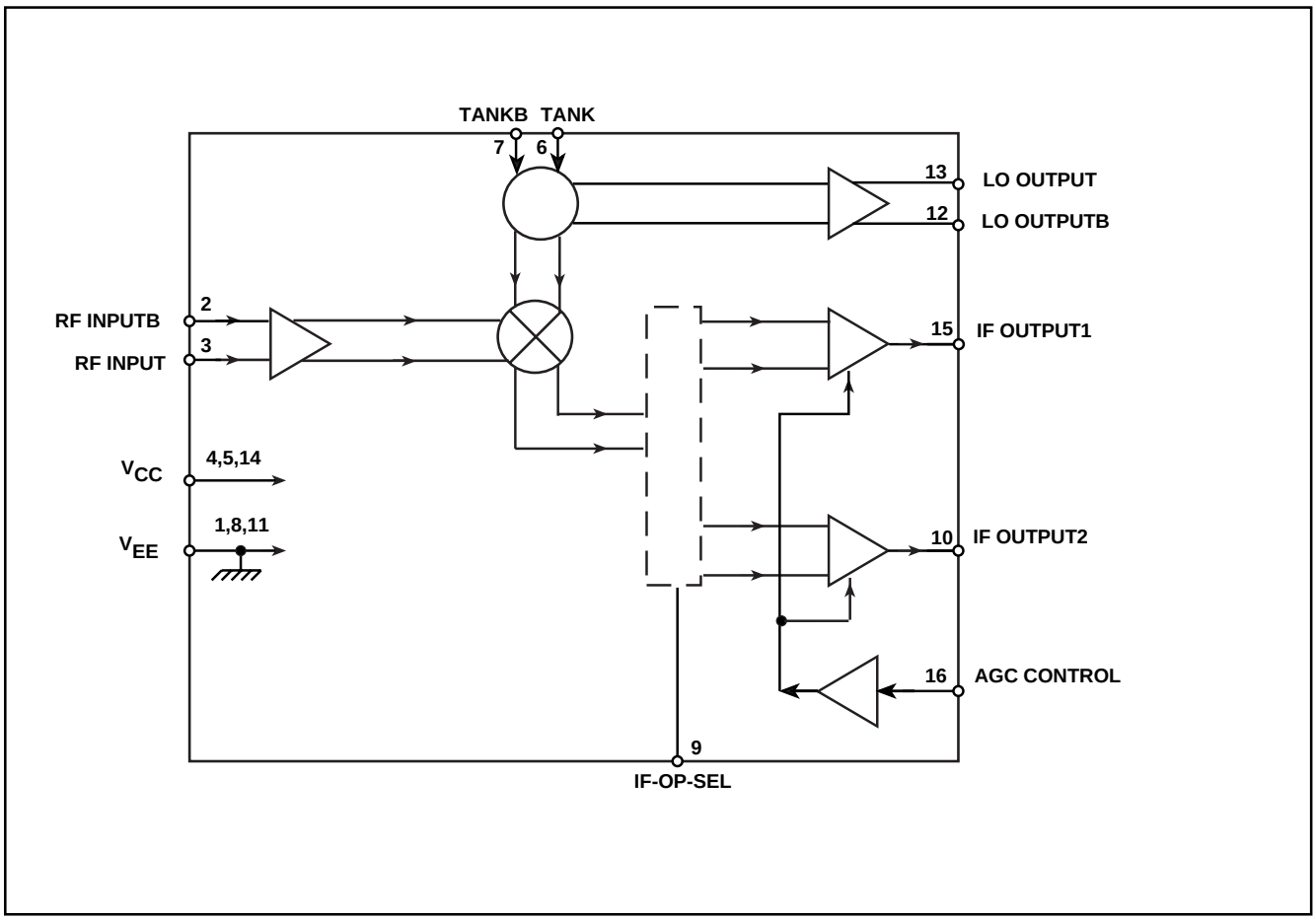

Figure 2 Block diagram

FUNCTIONAL DESCRIPTION

The SL2018 is a downconverter mixer oscillator with an output AGC amplifier, which when used with appropriate external varactor tuned oscillator sustaining network performs the first IF tuning function for a full band satellite receiver system. A block diagram is contained in Figure 2.

In application the RF input of the device is interfaced through appropriate impedance matching to the first IF signal, which is downlinked from the outdoor unit at typically 950-2150MHz. The RF input preamplifier of the device is designed for low noise figure and for low distortion so eliminating the requirement for RF AGC. The preamplifier also provides gain to the mixer section and back isolation from the local oscillator section.

The output of the preamplifier is fed to the mixer section where the RF signal is mixed with the local oscillator frequency, which is generated by an on-board oscillator. The oscillator block uses an external tunable sustaining network and is optimised for wide tuning range.

Signals from the mixer are fed to the AGC IF amplifier, which gives an overall conversion gain programmable from -10 to +30dB. The output of this stage can be switched to one of two outputs to facilitate IF processing.

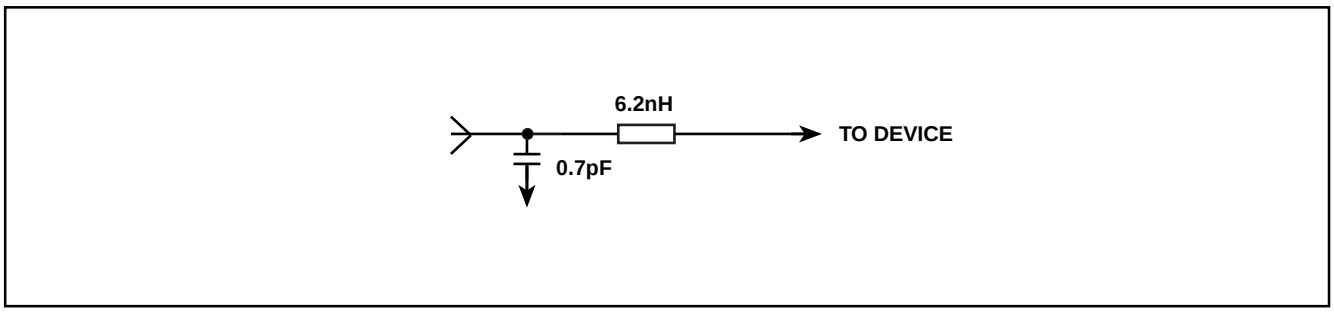

Figure 3 RF input matching network

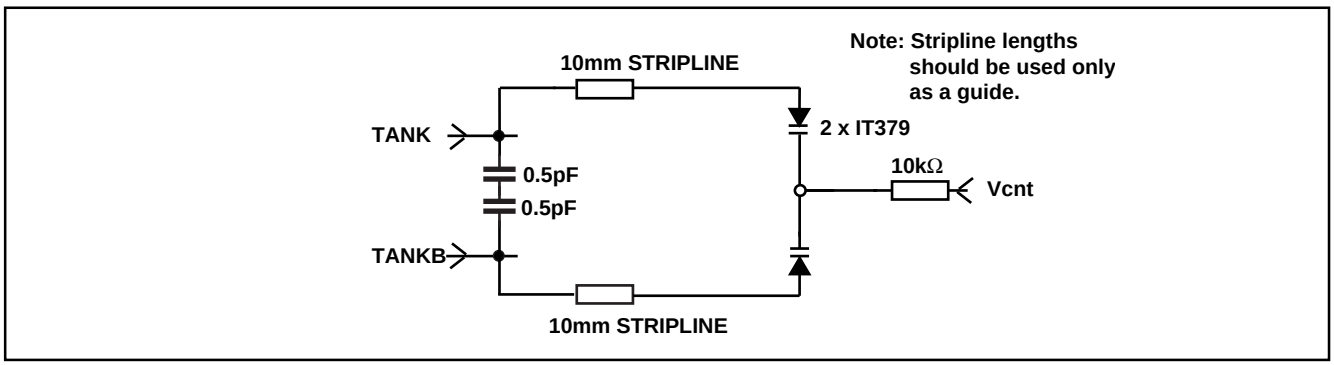

Figure 4 VCO application circuit

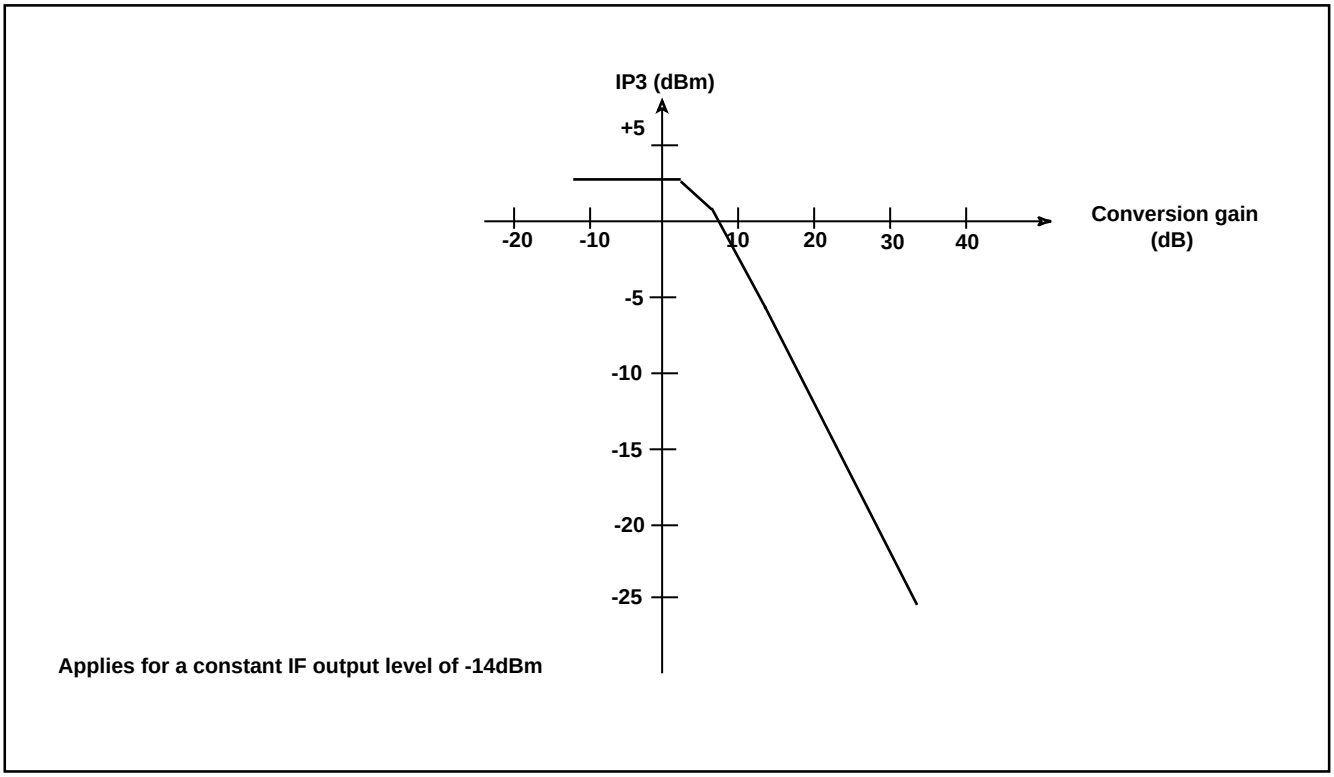

Figure 5 IP3 variation with gain setting (minimum)

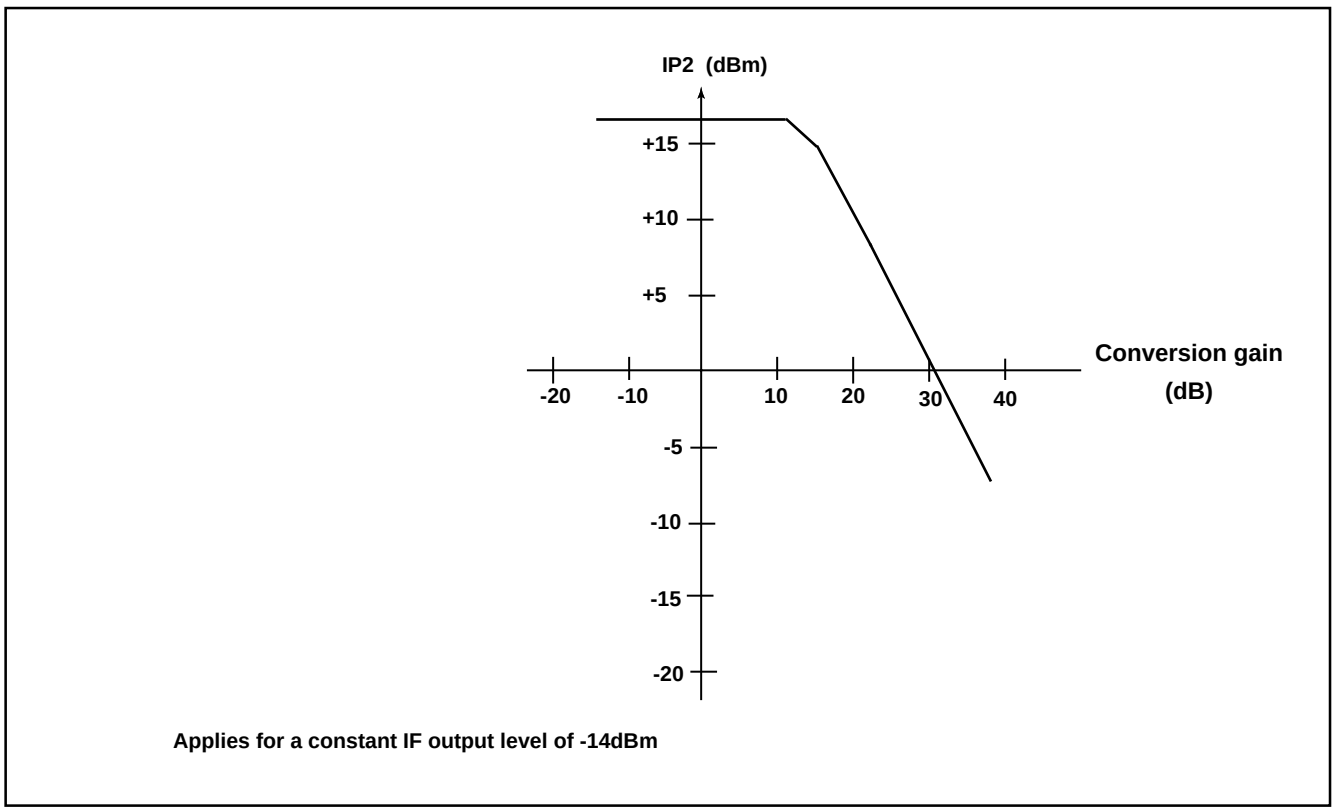

Figure 6 IP2 variation with gain setting (minimum)

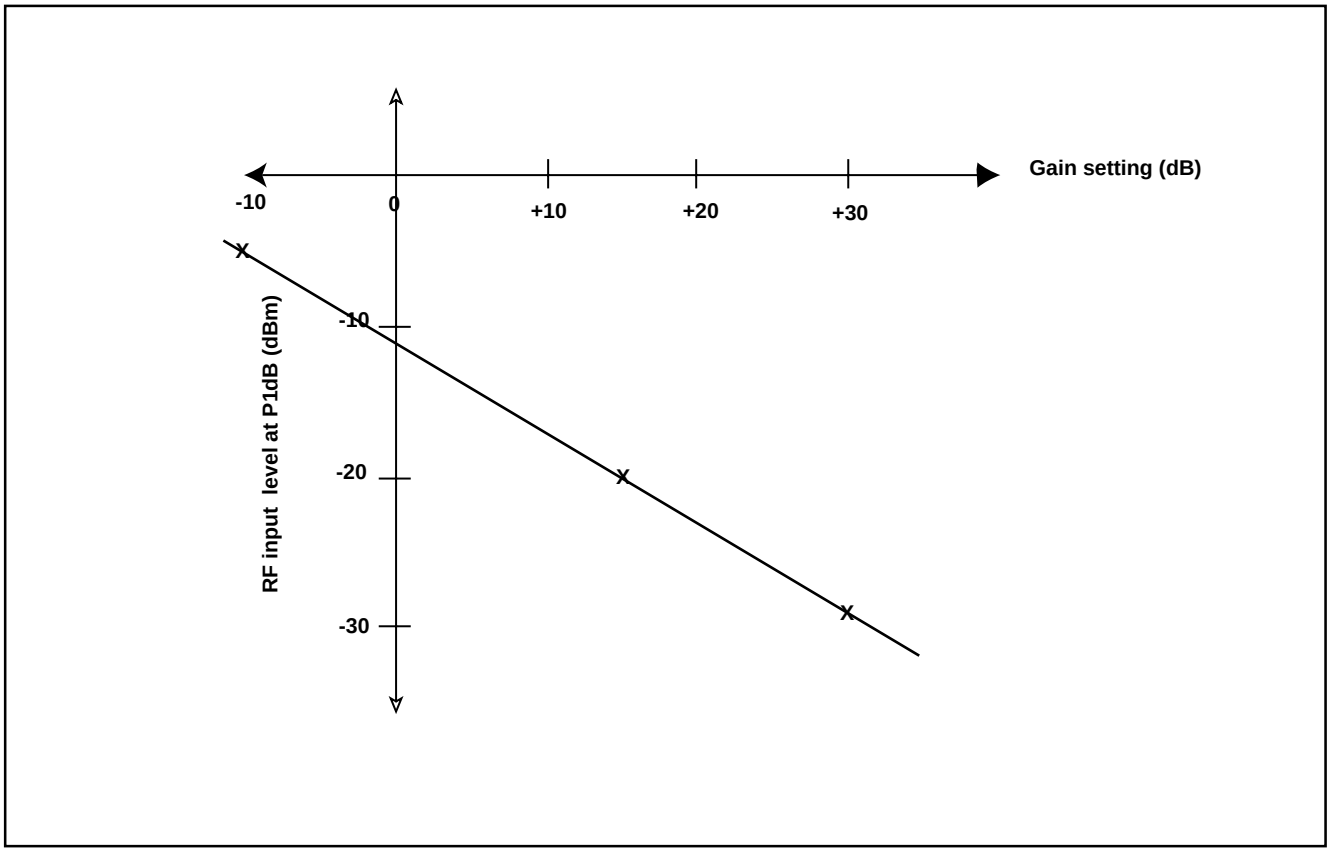

Figure 7 P1dB with gain setting (typical)

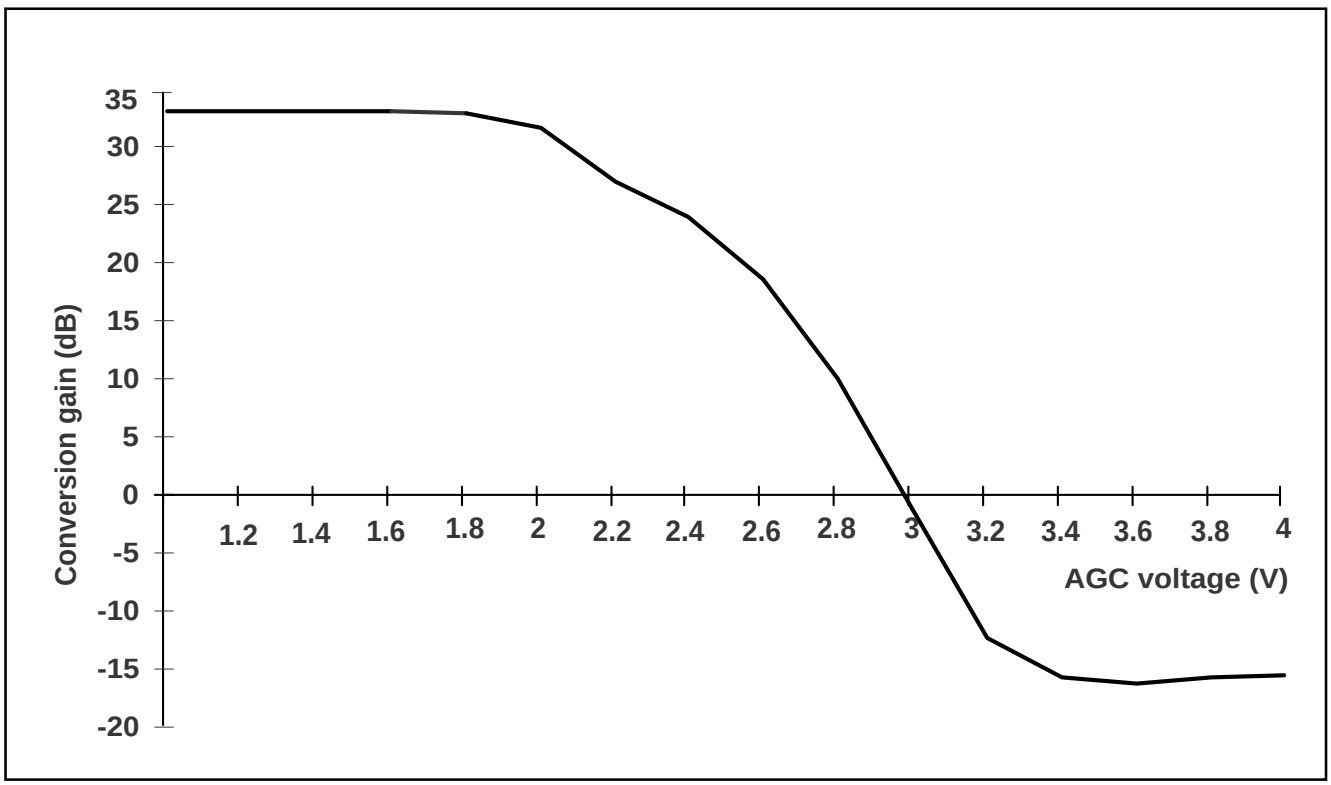

Figure 8 Gain variation with AGC voltage (typical)

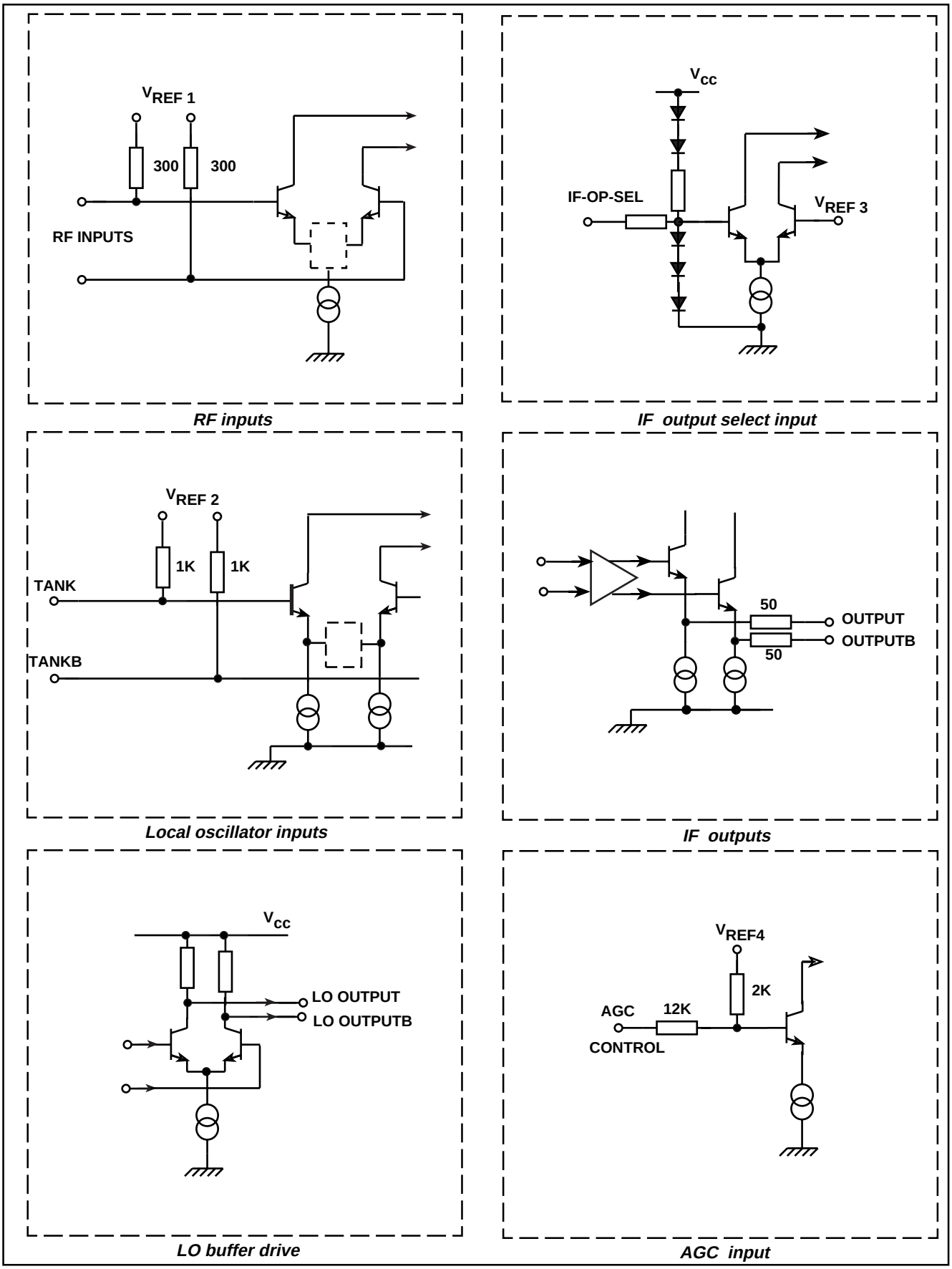

Figure 9 Input/Output interface circuits

ELECTRICAL CHARACTERISTICS

These characteristics are guaranteed by either production test or design. They apply within the specified ambient temperature and supply voltage unless otherwise stated.
T_{AMB} = -20°C to + 80°C, V_{CC}= + 4·75V to 5·25V.
IF = 479.5MHz; IF bandwidth up to 54MHz maximum. RF input frequency = 950MHz - 2150MHz.

Characteristic	Pin	Value			Units	Conditions
		Min	Typ	Max		
Supply Current, I_{CC}	4,5,14		80	115	mA	
RF input Noise figure	2,3		16		dB	@ T_{amb} = 27°C at maximum gain
Variation of Noise Figure with AGC setting				1	dB/dB	
Conversion gain						AGC bandwidth 100kHz
minimum AGC gain			-15	-5	dB	AGC = 4.0V
maximum AGC gain		25	33		dB	AGC = 1.0V
						AGC = self bias (2.4V)
Gain inband ripple		-0.5		+0.5	dB	Channel bandwidth 27MHz
Gain variation across RF input range		-2		+2	dB	
Gain imbalance between IF outputs	10, 15	-2		+2	dB	All outputs equally loaded
RF input impedance, single ended	2,3		50		Ω	@ T_{amb} = 27°C
RF input return loss	2,3		12		dB	Input unmatched @ T_{amb} = 27°C
RF input IP2	2,3	12	14		dBm	See note 2
RF input IP3	2,3	-1	1		dBm	See note 2
RF input IP3 variation with gain						See Figure. 5
Input referred 1dB gain compression						See Figure. 7
Two tone IM2 distortions with		-31	-33		dBc	See note 2
Two tone IM3 distortions		-36	-40		dBc	See note 2
LO tuning range	6,7	1430		2630	MHz	Varactor tuned from 1V to 23V. Application circuit as in Figure 4.
LO phase noise	6,7		-68		dBc/Hz	SSB at 10kHz offset, application circuit as in Figure 4.

ELECTRICAL CHARACTERISTICS

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IF = 479.5MHz; IF bandwidth up to 54MHz maximum. RF input frequency = 950MHz -2150MHz.

Characteristic	Pin	Value			Units	Conditions
		Min	Typ	Max		
LO leakage to RF input	2,3,6,7			-30	dBm	
LO leakage to IF outputs	6,7,10,11					
	14,15			-10	dBm	Maximum conversion gain
LO output drive	12, 13	92			dBμV	Differential into 100Ω NB, synthesiser should be driven differentially
LO output impedance	12, 13		100		Ω	Differential
LO output return loss	12, 13	8			dB	
AGC gain control slope variation	16					Monotonic from V_{EE} to $V_{CC.}$ See Figure. 8
AGC control input current	16	-250		250	μA	
Output select low voltage	9			0.7	V	O/P 2 enabled, O/P 1 disabled
Output select high voltage	9	V_{CC}-0.7			V	O/P 1 enabled, O/P 2 disabled
Output select low current	9			-50	μA	
Output select high current	9			200	μA	
IF output 1 & 2	10, 15					Output in enabled and disabled state
Output impedance			50		Ω	Single ended
Return loss		12			dB	
IF output 1 to 2 isolation	10, 15	30			dB	

Notes:

1. All dBm units refer to a 50Ω system
2. Applies for any two carriers within band at -19dBm, and with AGC set for +5dB conversion gain.

ABSOLUTE MAXIMUM RATINGS

All voltages are referred to V_{EE} = 0V (pins 1, 8, 11)

Parameter	Pin	Value		Units	Conditions
		Min	Max		
Supply voltages V_{CC}	4,5,14	-0.3	7	V	Transient
RF input voltage	2,3		2.5	Vp-p	
RF input DC offset	2,3	-0.3	V_{CC}+0.3	V	
Tank inputs DC offset	6,7	-0.3	V_{CC}+0.3	V	
LO output drive DC offset	12, 13	-0.3	V_{CC}+0.3	V	
IF-OP-SEL input DC offset	9	-0.3	V_{CC}+0.3	V	
IF outputs 1 and 2 DC offset	10, 15	-0.3	V_{CC}+0.3	V	
AGC Control input DC offset	16	-0.3	V_{CC}+0.3	V	
Storage temperature		-55	+150	°C	
Junction temperature			+150	°C	
MP16 thermal resistance					
Chip to ambient			111	°C/W	
Chip to case			41	C/W	
Power consumption at V_{CC}=5.25V			580	mW	
ESD protection	ALL	1.75		kV	Mil std 883 latest revision method 3015 class 1.

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