Wireless Components

3-Band TV Tuner IC

TUA1030 Version 1.1

Specification January 2002

preliminary

Revision History: Current Version: TUA1030, preliminary specification, January 2002		
Previous Version:Data Sheet **TUA1030, target specification, March 2001**		
Page (in previous Version)	Page (in current Version)	Subjects (major changes since last revision)
all	all	status to preliminary
div	div	pinning corrected, some tbf's replaced by data
5-18, 5-19	5-18, 5-19	new definition of thermal properties

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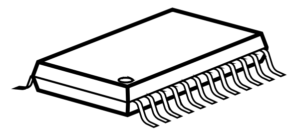
Product Info

General Description

The **TUA1030** is a 5 V mixer/oscillator for analog and digital TV and VCR tuners.

Package



Features

General

- Suitable for PAL/NTSC and **D**igital **V**ideo **B**roadcasting
- Electronic bandswitch
- Local oscillator buffer for external PLL
- Full ESD protection

Mixer/Oscillator

- High impedance mixer input (common emitter) for LOW band
- Low impedance mixer input (common base) for MID and HIGH band
- 2 pin oscillator for LOW band
- 2 pin oscillator for MID band
- 4 pin oscillator for HIGH band

IF-Amplifier

- IF preamplifier with unsymmetrical 75 Ω output
- External IF filter at the mixer outputs

Application

- The IC is suitable for PAL and NTSC tuners in TV- and VCR-sets or set-top receivers for analog TV and **D**igital **V**ideo **B**roadcasting.

Ordering Information

Type	Ordering Code	Package
TUA1030	Q67031-A1189	P-TSSOP-24-1

1 Table of Contents

2 Product Description

Contents of this Chapter

2.1 Overview

The **TUA1030** is a mixer/oscillator/IF-amplifier IC suitable for 3-band tuners.

The device includes three double balanced mixers and oscillators for LOW, MID and HIGH band respectively and an IF amplifier. Two pins are available at the mixer output / IF amplifier input to enable IF filtering for improved signal handling.

The LOW, MID and HIGH bands are selected and switched by the SW0 and SW1 inputs

2.2 Features

General

- Suitable for PAL/NTSC and **D**igital **V**ideo **B**roadcasting
- Full ESD protection

Mixer/Oscillator

- High impedance mixer input (common emitter) for LOW band
- Low impedance mixer input (common base) for MID and HIGH band
- 2 pin oscillator for LOW band
- 2 pin oscillator for MID band
- 4 pin oscillator for HIGH band

IF-Amplifier

- IF preamplifier with unsymmetrical 75 Ω output

2.3 Application

- The IC is suitable for PAL and NTSC tuners in TV- and VCR-sets or set-top receivers for analog TV and **D**igital **V**ideo **B**roadcasting.

Recommended band limits in MHz:

Table 2-1 NTSC tuners

	RF input		Oscillator	
	min	max	min	max
LOW	55.25	127.25	101	173
MID	133.25	361.25	179	407
HIGH	367.25	801.25	413	847

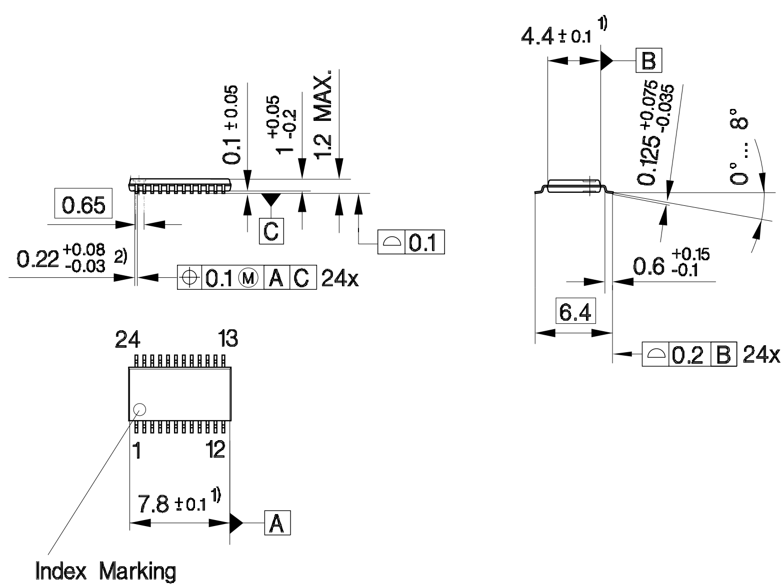
Table 2-2 PAL tuners

	RF input		Oscillator	
	min	max	min	max
LOW	44.25	154.25	83.15	193.15
MID	161.25	439.25	200.15	478.15
HIGH	447.25	863.25	486.15	902.15

Note: Tuning margin of ± 3 MHz not included.

2.4 Package Outlines

P-TSSOP-24-1

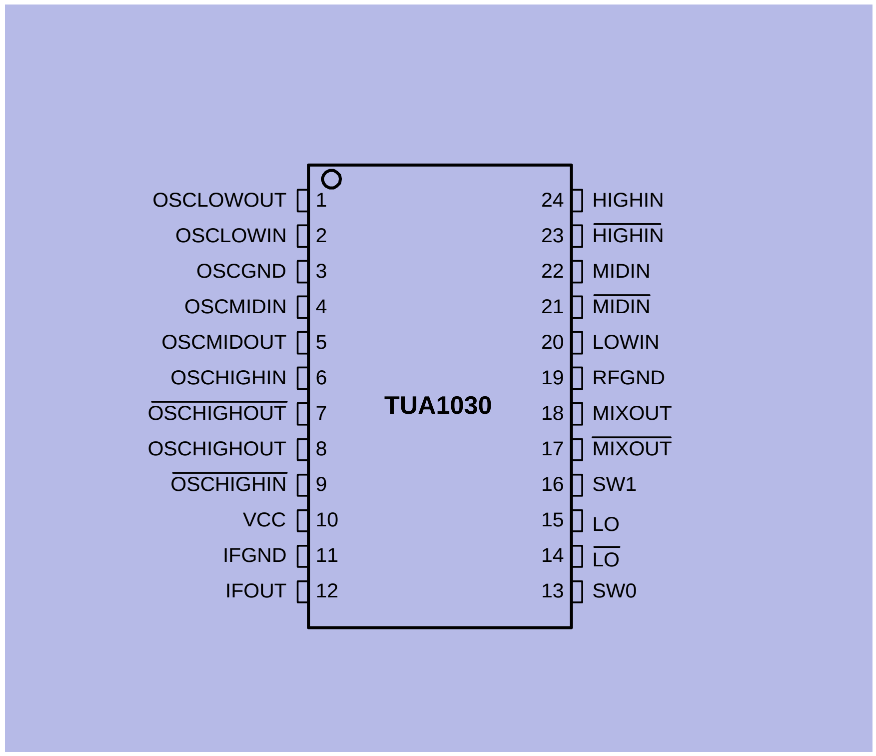


1) Does not include plastic or metal protrusion of 0.15 max. per side
2) Does not include dambar protrusion of 0.08 max. per side

3 Functional Description

Contents of this Chapter

3.1 Pin Configuration



Pin Config

3.2 Pin Definition and Function

Table 3-1 Pin Definition and Function

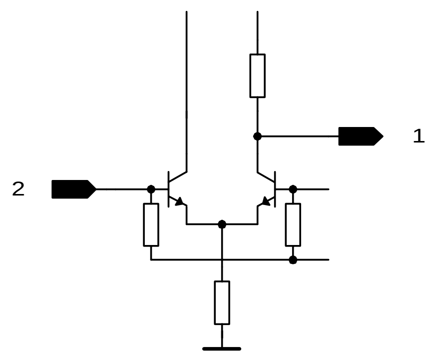
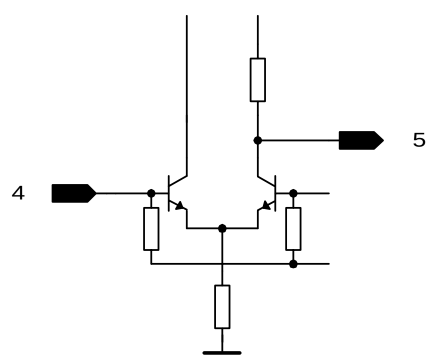
Pin No.	Symbol	Equivalent I/O-Schematic	Average DC voltage		
			LOW	**MID**	**HIGH**
1	OSCLOWOUT		2.2 V		
2	OSCLOWIN		1.5 V		
3	OSCGND	oscillator ground	0.0 V	0.0 V	0.0 V
4	OSCMIDIN			1.5 V	
5	OSCMIDOUT			2.2 V	

Table 3-1 Pin Definition and Function (continued)

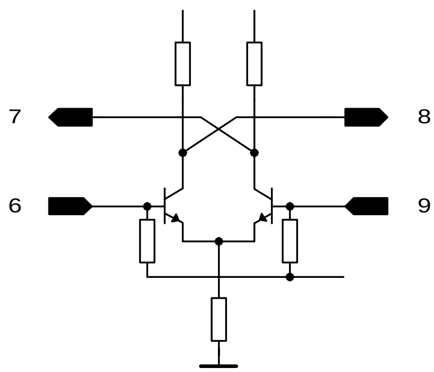
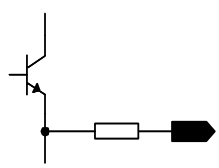
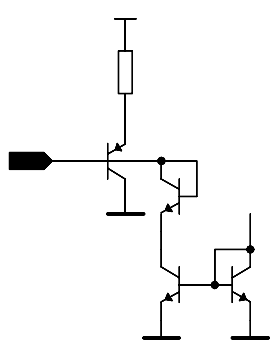
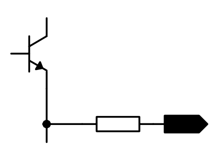
Pin No.	Symbol	Equivalent I/O-Schematic	Average DC voltage LOW	MID	HIGH
6	OSCHIGHIN				1.8 V
7	$\overline{\text{OSCHIGOUT}}$				2.2 V
8	OSCHIGOUT				2.2 V
9	$\overline{\text{OSCHIGHIN}}$				1.8 V
10	VCC	supply voltage	5.0 V	5.0 V	5.0 V
11	IFGND	IF ground	0.0 V	0.0 V	0.0 V
12	IFOUT		2.1 V	2.1 V	2.1 V
13	SW0		3 V to V_{CC}	0 V to 1.5 V	0 V to 1.5 V
14	$\overline{\text{LO}}$		2.5 V	2.5 V	2.5 V
15	LO		2.5 V	2.5 V	2.5 V

Table 3-1 Pin Definition and Function (continued)

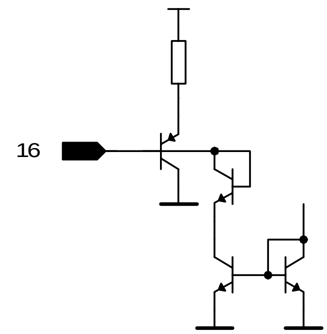
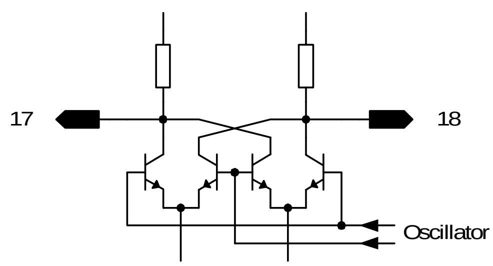
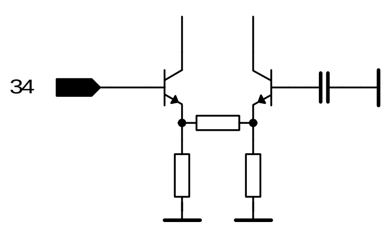
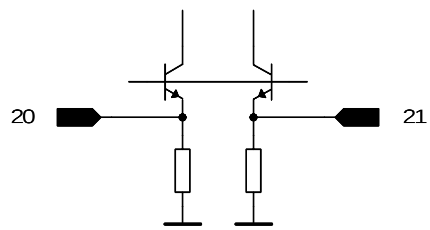
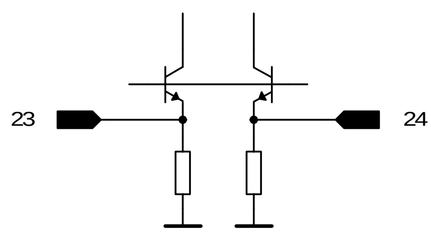
Pin No.	Symbol	Equivalent I/O-Schematic	Average DC voltage LOW	Average DC voltage MID	Average DC voltage HIGH
16	SW1		0 V to 1.5 V	3 V to V_{CC}	0 V to 1.5 V
17	$\overline{\text{MIXOUT}}$		4.0 V	4.0 V	4.0 V
18	MIXOUT		4.0 V	4.0 V	4.0 V
19	RFGND	IF ground	0.0 V	0.0 V	0.0 V
20	LOWIN		1.9 V		

Table 3-1 Pin Definition and Function (continued)

Pin No.	Symbol	Equivalent I/O-Schematic	Average DC voltage LOW	MID	HIGH
21	$\overline{\text{MIDIN}}$			0.75 V	0.75 V
22	MIDIN			0.75 V	0.75 V
23	$\overline{\text{HIGHIN}}$			0.75 V	0.75 V
24	HIGHIN			0.75 V	0.75 V

3.3 Block Diagram

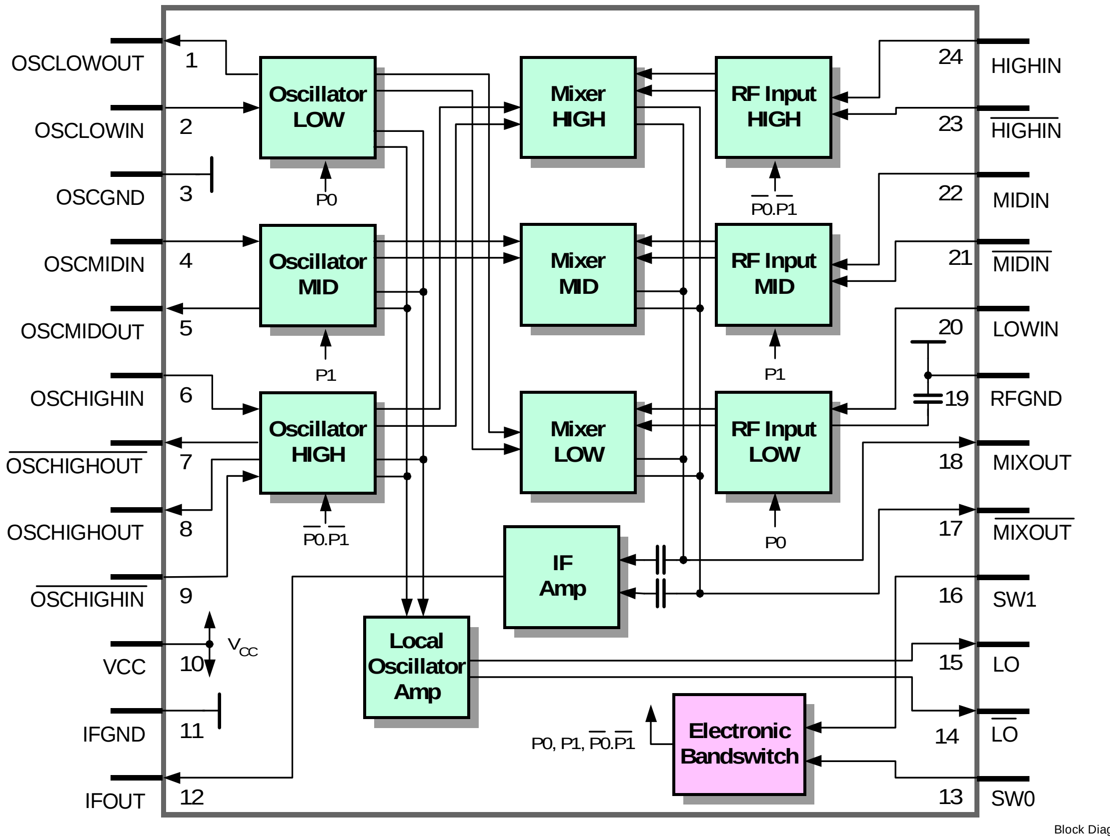


Figure 3-1 Block Diagram

3.4 Circuit Description

The **TUA1030** is a mixer/oscillator/IF-amplifier IC suitable for 3-band tuners.

The device includes three balanced mixers (one mixer with an unbalanced high-impedance input and two mixers with a balanced low-impedance input), two 2-pin asymmetrical oscillators for the LOW and the MID band, one 4-pin symmetrical oscillator for the HIGH band, an IF amplifier, a reference voltage, and a band switch. Two pins are available at the mixer output / IF amplifier input to enable IF filtering for improved signal handling.

The LOW, MID and HIGH bands are selected and switched by the SW0 and SW1 inputs

4 Applications

Contents of this Chapter

4.1 Circuits

4.1.1 Application Circuit for NTSC

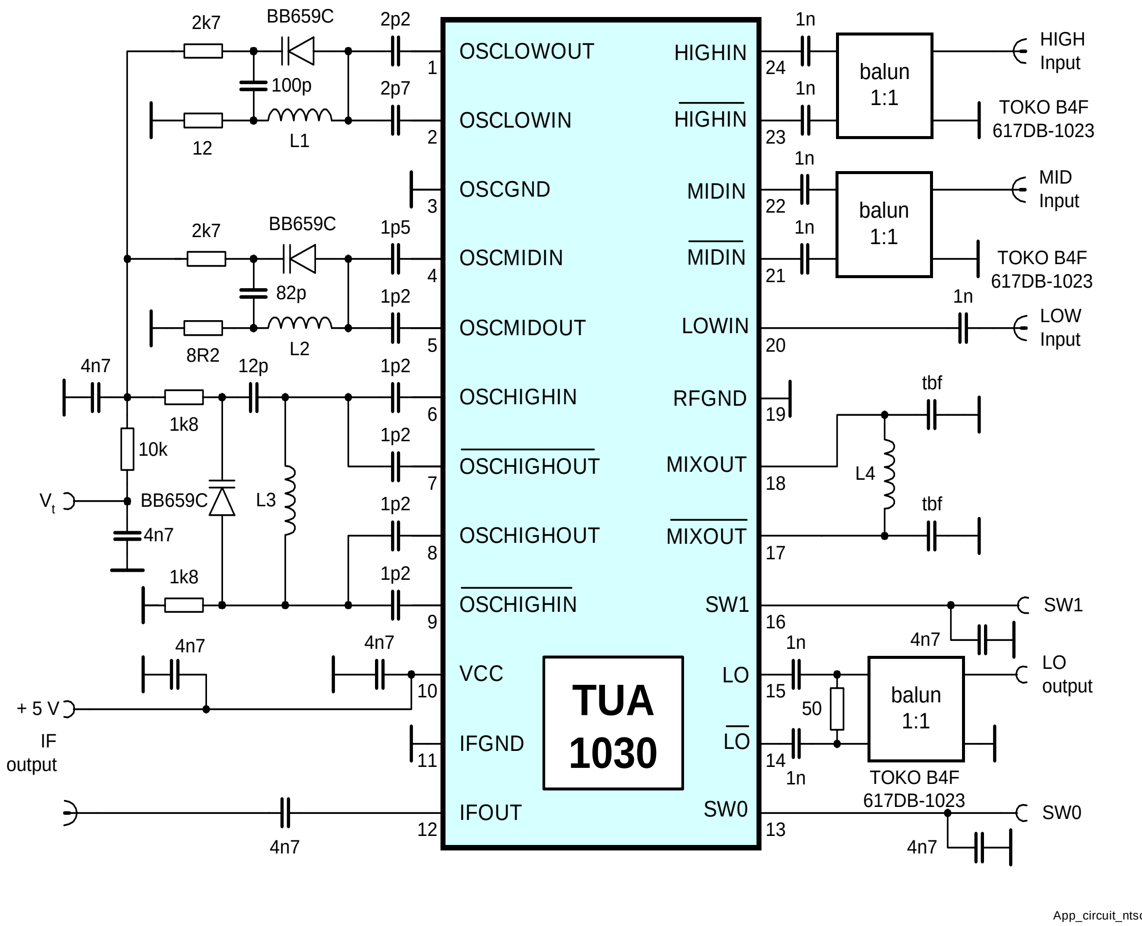
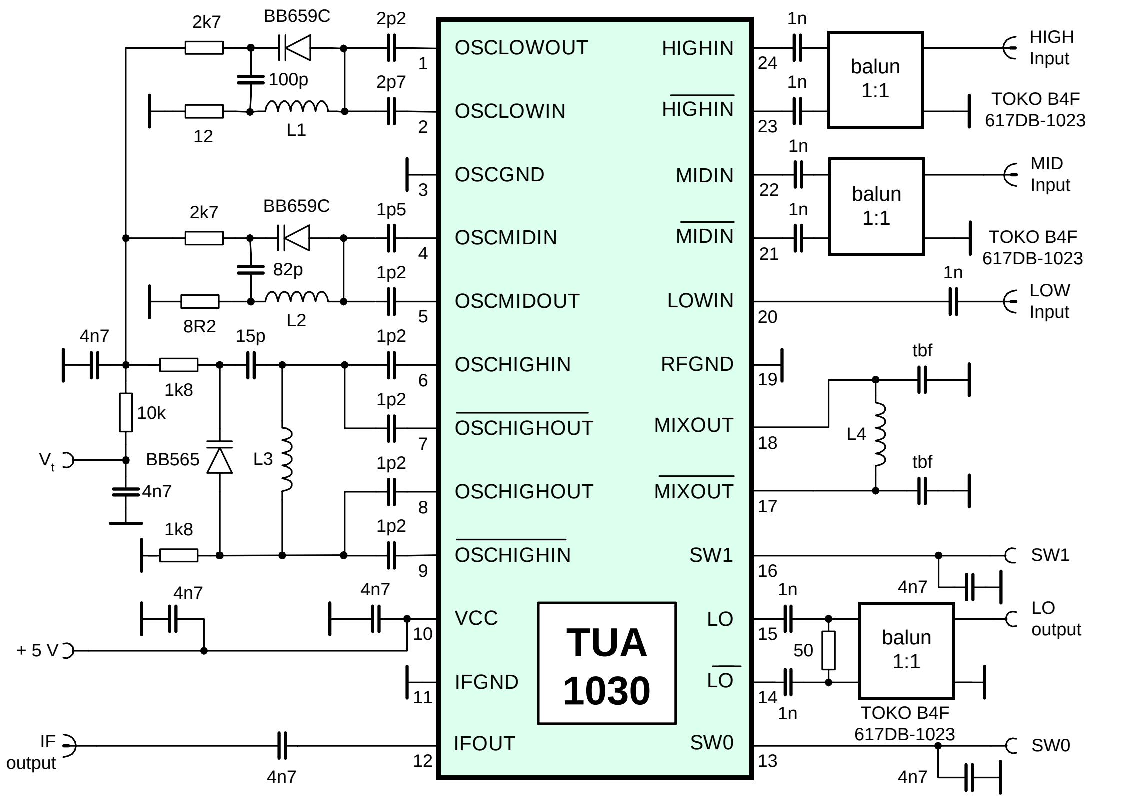


Figure 4-1 Application Circuit for NTSC

Recommended band limits in MHz				
	RF input		Oscillator	
	min	max	min	max
LOW	55.25	127.25	101	173
MID	133.25	361.25	179	407
HIGH	367.25	801.25	413	847

Coils			
	turns	∅	wire ∅
L1	8.5	3.2 mm	0.5 mm
L2	3.5	2.5 mm	0.5 mm
L3	1.5	2.4 mm	0.5 mm
L4	12.5	3.5 mm	0.3 mm

4.1.2 Application Circuit for PAL



App_circuit

Figure 4-2 Application Circuit for PAL

Recommended band limits in MHz				
	RF input		Oscillator	
	min	max	min	max
LOW	44.25	154.25	83.15	193.15
MID	161.25	439.25	200.15	478.15
HIGH	447.25	863.25	486.15	902.15

Coils			
	turns	∅	wire ∅
L1	8.5	3.2 mm	0.5 mm
L2	2.5	3 mm	0.5 mm
L3	1.5	2.4 mm	0.5 mm
L4	14.5	4 mm	0.3 mm

5 Reference

Contents of this Chapter

5.1 Electrical Data

5.1.1 Absolute Maximum Ratings

WARNING

The maximum ratings may not be exceeded under any circumstances, not even momentarily and individually, as permanent damage to the IC may result.

Table 5-1 Absolute Maximum Ratings, ambient temperature T_{AMB}= -10°C ... + 85°C

Parameter[1]	Symbol	Limit Values min	Limit Values max	Unit	Remarks
Supply voltage	V_{CC}	-0.3	6	V	
Ambient temperature	T_A	-10	T_{Amax} 2).	°C	
Storage temperature	T_{Stg}	-40	+125	°C	
Junction temperature	T_J		+ 125	°C	
Temperature difference junction to case[3]	T_{JC}		2	K	
Mixer-Oscillator					
Mix inputs LOW band	V_{LOW}	-0.3	3	V	
Mix inputs MID band	V_{MID}		2	V	
	I_{MID}	-5	6	mA	
Mix inputs HIGH band	V_{HIGH}		2	V	
	I_{HIGH}	-5	6	mA	
VCO base voltage	V_B	-0.3	3	V	LOW, MID and HIGH band oscillators
VCO collector voltage	V_C		6	V	LOW, MID and HIGH band oscillators
ESD-Protection[4]					
all pins	V_{ESD}		2	kV	

1). All values are referred to ground (pin), unless stated otherwise. Currents with a positive sign flow into the pin and currents with a negative sign flow out of the pin.

2). The maximum ambient temperature depends on the mounting conditions of the package. Any application mounting must guarantee not to exceed the maximum junction temperature of 125 °C. As reference the temperature difference junction to case is given.

3). Referred to top center of package.

4). According to EIA/JESD22-A114-B (HBM in-circuit test), as a single device in-circuit contact discharge test.

5.1.2 Operating Range

Within the operating range the IC operates as described in the circuit description. The AC / DC characteristic limits are not guaranteed.

Table 5-2 Operating Range

Parameter	Symbol	Limit Values		Unit	Test Conditions	L	Item
		min	max				
Supply voltage	V_{CC}	+4.5	+5.5	V			
LOW mixer input frequency range	f_{MIXL}	30	200	MHz			
MID and HIGH band mixer input frequency range	$f_{MIXM/H}$	130	900	MHz			
LOW oscillator frequency range	f_{OL}	65	250	MHz			
MID band oscillator frequency range	f_{OM}	165	530	MHz			
HIGH band oscillator frequency range	f_{OH}	400	950	MHz			
Ambient temperature	T_{AMB}	-10	T_{Amax} 1).	°C			

1). see 5.1.1 Absolute Maximum Ratings on page 19

5.1.3 AC/DC Characteristics

Table 5-3 AC/DC Characteristics with T_{AMB} = 25 °C, V_{CC} = 5 V

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
Supply								
Supply voltage	V_{CC}	4.5	5	5.5	V			
Current consumption	I_{CC}		48		mA	LOW band		
	I_{CC}		50		mA	MID band		
	I_{CC}		41		mA	HIGH band		
Analog Part								
LOW band mixer mode (SW0 = 1, SW1 = 0, including IF amplifier)								
RF frequency	f_{RF}	44.25		161.25	MHz	picture carrier 1).		
Voltage gain	G_V	18	21	24	dB	f_{RF} = 44.25 MHz, see 5.3.1 on page 30		
	G_V	18	21	24	dB	f_{RF} = 161.25 MHz, see 5.3.1 on page 30		
Noise figure	NF		8	10	dB	f_{RF} = 50 MHz, see 5.3.3 on page 31, see 5.3.4 on page 31		
Output voltage causing 0.3% of crossmodulation in channel	V_O	108	111		dBµV	f_{RF} = 44.25 MHz, see 5.3.6 on page 32		
	V_O	108	111		dBµV	f_{RF} = 161.25 MHz, see 5.3.6 on page 32		
Output voltage causing 1.1 kHz incidental FM	V_O	108	111		dBµV	f_{RF} = 44.25 MHz 2).		
	V_O	108	111		dBµV	f_{RF} = 161.25 MHz 2.)		
750 Hz Pulling	V_i	88			dBµV	f_{RF} = 154.25 MHz 3).		
Channel S02 beat	INT_{S02}	57	60		dBc	V_{RFpix} = 115 dBµV at IF output 4).		
Channel A-5 beat	INT_{A-5}	57	60		dBc	V_{RFpix} = 115 dBµV at IF output 5).		
Channel CH6 color beat	INT_{CH6}	63	66		dBc	V_{RFpix} = 80 dBµV V_{RFsnd} = 80 dBµV 6).		

Table 5-3 AC/DC Characteristics with T_{AMB} = 25 °C, V_{CC} = 5 V (continued)								
	Symbol	**Limit Values**			**Unit**	**Test Conditions**	**L**	**Item**
		min	typ	max				
Input conductance	g_i		1		mS	f_{RF} = 44.25 MHz, see 5.2.1 on page 27		
	g_i		1		mS	f_{RF} = 161.25 MHz, see 5.2.1 on page 27		
Input capacitance	C_i		1		pF	f_{RF} = 44.25 to 161.25 MHz, see 5.2.1 on page 27		
MID band mixer mode (SW0 = 0, SW1 =1, including IF amplifier)								
RF frequency	f_{RF}	157		454.25		picture carrier [1.)]		
Voltage gain	G_V	28	31	34	dB	f_{RF} = 157 MHz, see 5.3.2 on page 30		
	G_V	28	31	34	dB	f_{RF} = 454.25 MHz, see 5.3.2 on page 30		
Noise figure (not corrected for image)	NF		6	8	dB	f_{RF} = 157 MHz, see 5.3.5 on page 32		
	NF		6	8	dB	f_{RF} = 300 MHz, see 5.3.5 on page 32		
Output voltage causing 0.3% of crossmodulation in channel	V_O	108	111		dBµV	f_{RF} = 157 MHz, see 5.3.7 on page 33		
	V_O	108	111		dBµV	f_{RF} = 454.25 MHz, see 5.3.7 on page 33		
Output voltage causing 1.1 kHz incidental FM	V_O	108	111		dBµV	f_{RF} = 157MHz [2.)]		
	V_O	108	111		dBµV	f_{RF} = 454.25 MHz [2.)]		
N+5 - 1 MHz pulling	N+5 - 1 MHz	77	80		dBµV	f_{RFw} = 443 MHz, f_{OSC} = 481.9 MHz, f_{RFu} = 482 MHz [7).]		
750 Hz Pulling	V_i	78			dBµV	f_{RF} = 439.25 MHz [3.)]		
Input impedance $Z_i = (R_S + j\omega L_S)$	R_S		35		Ω	f_{RF} = 157 MHz, see 5.2.2 on page 27		
	R_S		35		Ω	f_{RF} = 454.25 MHz, see 5.2.2 on page 27		
	L_S		8		nH	f_{RF} = 157 MHz, see 5.2.2 on page 27		
	L_S		8		nH	f_{RF} = 454.25 MHz, see 5.2.2 on page 27		

Table 5-3 AC/DC Characteristics with T_{AMB} = 25 °C, V_{CC} = 5 V (continued)								
	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
HIGH band mixer mode (SW0 = 0, SW1 = 0, including IF amplifier)								
RF frequency	f_{RF}	443		863.25		picture carrier 1.)		
Voltage gain	G_V	28	31	34	dB	f_{RF} = 443 MHz, see 5.3.2 on page 30		
	G_V	28	31	34	dB	f_{RF} = 863.25 MHz, see 5.3.2 on page 30		
Noise figure (not corrected for image)	NF		6	8	dB	f_{RF} = 443.25 MHz, see 5.3.5 on page 32		
	NF		7	9	dB	f_{RF} = 863.25 MHz, see 5.3.5 on page 32		
Output voltage causing 0.3% of crossmodulation in channel	V_O	108	111		dBµV	f_{RF} = 443.25 MHz, see 5.3.7 on page 33		
	V_O	108	111		dBµV	f_{RF} = 863.25 MHz, see 5.3.7 on page 33		
Output voltage causing 1.1 kHz incidental FM	V_O	108	111		dBµV	f_{RF} = 443.25 MHz 2.)		
	V_O	108	111		dBµV	f_{RF} = 863.25 MHz 2.)		
N+5 - 1 MHz pulling	N+5 - 1 MHz	77	80		dBµV	f_{RFw} = 863.25 MHz, f_{OSC} = 902.15 MHz, f_{RFu} = 902.25 MHz 7.)		
750 Hz Pulling	V_i	78			dBµV	f_{RF} = 855.25 MHz 3.)		
Input impedance $Z_i = (R_S + j\omega L_S)$	R_S		35		Ω	f_{RF} = 443 MHz, see 5.2.2 on page 27		
	R_S		35		Ω	f_{RF} = 863.25 MHz, see 5.2.2 on page 27		
	L_S		8		nH	f_{RF} = 443 MHz, see 5.2.2 on page 27		
	L_S		8		nH	f_{RF} = 863.25 MHz, see 5.2.2 on page 27		
LOW band oscillator, see Chapter 4								
Oscillator frequency	f_{OSC}	83.15		207	MHz	8).		
Oscillator frequency shift	$\Delta f_{OSC(V)}$		20	70	kHz	ΔV_{CC} = 5 % 9).		
	$\Delta f_{OSC(V)}$		110		kHz	ΔV_{CC} = 10 % 9.)		

Table 5-3 AC/DC Characteristics with T_{AMB} = 25 °C, V_{CC} = 5 V (continued)

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
Oscillator frequency drift	$\Delta f_{OSC(T)}$		800	1000	kHz	ΔT = 25 °C, with compensation [10].		
Oscillator frequency drift	$\Delta f_{OSC(t)}$		500	700	kHz	5 s to 15 min after switch on [11].		
Phase noise, carrier to noise sideband	Φ_{OSC}	87	92		dBc/Hz	±10 kHz frequency offset, worst case in frequency range		
	Φ_{OSC}	107	112		dBc/Hz	±100 kHz frequency offset, worst case in frequency range		
Ripple susceptibility of V_P (peak-to-peak value)	RSC	15	20		mV	4.75 V < VP < 5.25 V, worst case in frequency range, ripple frequency 500 kHz [12].		
MID band oscillator, see Chapter 4								
Oscillator frequency	f_{OSC}	195.7		500	MHz	[8.)]		
Oscillator frequency shift	$\Delta f_{OSC(V)}$		20	70	kHz	ΔV_{CC} = 5 % [9.)]		
	$\Delta f_{OSC(V)}$		110		kHz	ΔV_{CC} = 10 % [9.)]		
Oscillator frequency drift	$\Delta f_{OSC(T)}$		800	1000	kHz	ΔT = 25 °C; with compensation [10.)]		
Oscillator frequency drift	$\Delta f_{OSC(t)}$		500	700	kHz	5 s to 15 min after switch on [11.)]		
Phase noise, carrier to noise sideband	Φ_{OSC}	85	90		dBc/Hz	±10 kHz frequency offset, worst case in frequency range		
	Φ_{OSC}	105	110		dBc/Hz	±100 kHz frequency offset, worst case in frequency range		
Ripple susceptibility of V_P (peak-to-peak value)	RSC	15	20		mV	4.75 < VP < 5.25 V, worst case in frequency range, ripple frequency 500 kHz [12.)]		
HIGH band oscillator, see Chapter 4								
Oscillator frequency	f_{OSC}	481.9		902.15	MHz	[8.)]		
Oscillator frequency shift	$\Delta f_{OSC(V)}$		20	70	kHz	ΔV_{CC} = 5 % [9.)]		
	$\Delta f_{OSC(V)}$		300		kHz	ΔV_{CC} = 10 % [9.)]		
Oscillator frequency drift	$\Delta f_{OSC(T)}$		1100	1500	kHz	ΔT = 25 °C; with compensation [10.)]		
Oscillator frequency drift	$\Delta f_{OSC(t)}$		600	900	kHz	5 s to 15 min after switch on [11)].		

Table 5-3 AC/DC Characteristics with T_{AMB} = 25 °C, V_{CC} = 5 V (continued)

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
Phase noise, carrier to noise sideband	Φ_{OSC}	85	90		dBc/Hz	±10 kHz frequency offset, worst case in frequency range		
	Φ_{OSC}	105	110		dBc/Hz	±100 kHz frequency offset, worst case in frequency range		
Ripple susceptibility of V_P (peak-to-peak value)	RSC	15	20		mV	4.75 < VP < 5.25 V, worst case in frequency range, ripple frequency 500 kHz [14.)]		
IF amplifier								
Mixer output impedance Y_o= Gs+ jωC_s	R_i		3		kΩ	at 36 MHz, see 5.2.4 on page 28		
	C_i		4		pF	at 36 MHz, see 5.2.4 on page 28		
Output impedance Z_o = (R_s + jωL_s)	R_S			80	Ω	at 36 MHz, see 5.2.5 on page 29		
	L_S		7		nH	at 36 MHz, see 5.2.5 on page 29		
LO output								
Output admittance YLO (Gp//Cp)	Gp		tbf		mS	at 83.15 MHz		
	Gp		tbf		mS	at 902.15 MHz		
	Cp		tbf		pF			
Output voltage into 50 Ω resistor	V_{LO}	80	91	100	dBµV			
Spurious signal at LO output referred to LO output signal	S_{RF}			-10	dB			
Band switch inputs SW0 and SW1								
LOW level input voltage	V_{SWL}	0		1.5	V			
HIGH level input voltage	V_{SWH}	3		V_{CC}	V			
Input current	I_{SW}			10	µA			

■ This value is only guaranteed in lab.

1). The RF frequency range is defined by the oscillator frequency range and the intermediate frequency (IF).

2). This is the level of the RF unwanted signal (50% amplitude modulated with 1kHz) that causes a 1.1 kHz FM modulation of the local oscillator and thus of the wanted signal; V_{wanted} = 100 dBµV; $f_{unwanted}$ = f_{wanted} + 5.5 MHz.

3). This is the level of the RF signal (100% amplitude modulated with 11.89 kHz) that causes a 750 Hz frequency deviation on the oscillator signal producing sidebands 30 dB below the level of the oscillator signal.

4). Channel S02 beat is the interfering product of f_{RFpix}, f_{IF} and f_{OSC} of channel S02, f_{BEAT} = 37.35 MHz. The possible mechanisms are f_{OSC} - 2 x f_{IF} or 2 x f_{RFpix} - f_{OSC}.

5). Channel A-5 beat is the interfering product of $f_{RFpix,}$ f_{IF} and f_{OSC} of channel A-5; f_{BEAT}= 45.5 MHz. The possible mechanisms are: f_{OSC} - 2 x f_{IF} or 2 x f_{RFpix} - f_{OSC}.

6). Channel 6 beat is the interfering product of f_{RFpix} + f_{RFsnd} - f_{OSC} of channel 6 at 42 MHz.

7). N+5 -1 MHz is defined as the input level of channel N+5, at frequency 1 MHz lower, causing FM sidebands 30 dB below the wanted carrier.

8). Limits are related to the tank circuit used in the application board (see Chapter 4). Frequency bands may be adjusted by the choice of external components.

9). The frequency shift is defined as a change in oscillator frequency when the supply voltage varies from V_{CC} = 5 to 4.75 V (4.5 V) or from V_{CC} = 5 to 5.25 V (5.5 V). The oscillator is free running during this measurement.

10). The frequency drift is defined as a change in oscillator frequency when the ambient temperature varies from T_{amb} = 25 to 50 °C or from T_{amb} = 25 to 0 °C. The oscillator is free running during this measurement.

11). The switch-on drift is defined as a change in oscillator frequency between 5 s and 15 min after switch-on. The oscillator is free running during this measurement.

12). The supply ripple susceptibility is measured in the application board (see Chapter 4), using a spectrum analyser connected to the IF output. An unmodulated RF signal is applied to the test board RF input. A sinewave signal with a frequency of 500 kHz is superposed onto the supply voltage (see 5.3.8 on page 33). The amplitude of this ripple is adjusted to bring the 500 kHz sidebands around the IF carrier to a level of 53.5 dBc with respect to the carrier.

5.1.4 Band Selection

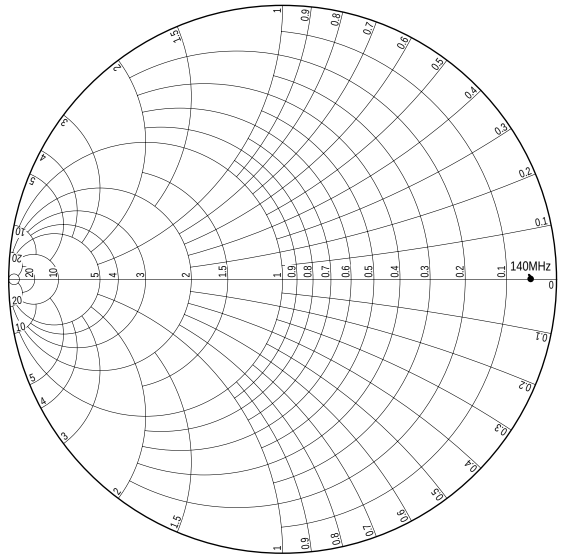
Table 5-4 Internal band selection	Table 5-5	Table 5-6
Band	**SW0**	**SW1**
LOW	+ 5 V	0 V or open
MID	0 V or open	+ 5 V
HIGH [1).]	0 V or open	0 V or open

1). This is the default mode at power-on.

5.2 Electrical Diagrams

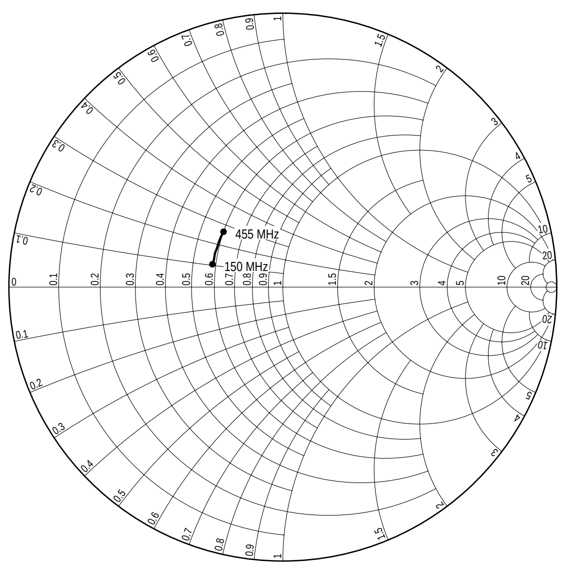
5.2.1 Input admittance (S11) of the LOW band mixer

40 to 170 MHz, Y_0 = 20mS



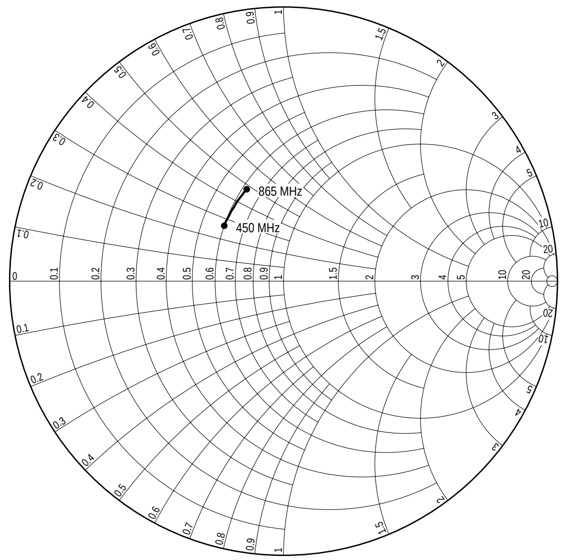
5.2.2 Input impedance (S11) of the MID band mixer

150 to 455 MHz, Z_0 = 50 Ω



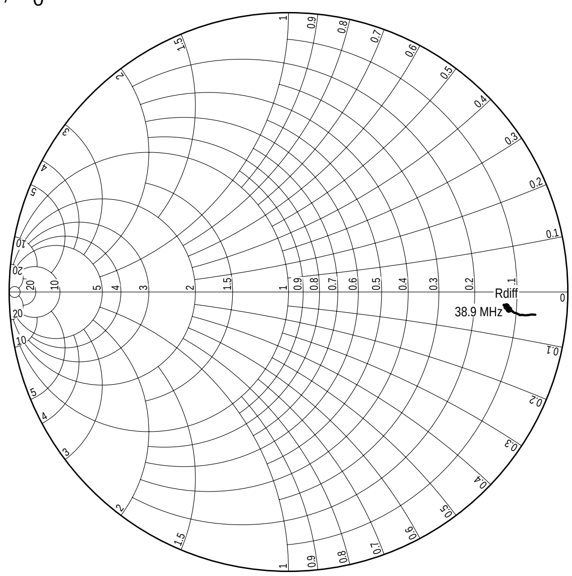
5.2.3 Input impedance (S11) of the HIGH band mixer

450 to 865 MHz, $Z_0 = 50\ \Omega$



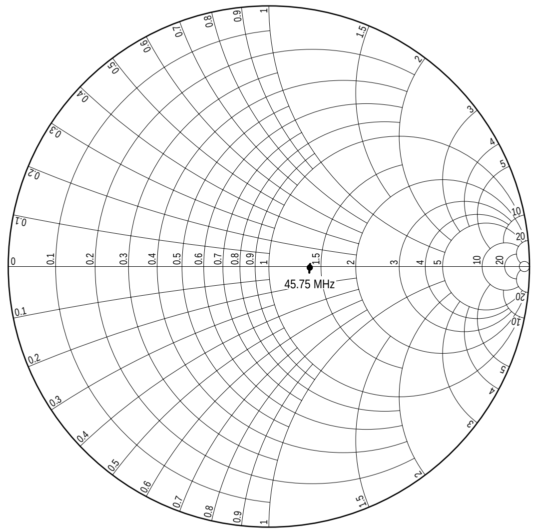
5.2.4 Output admittance (S22) of the of the Mixer output

30 to 50 MHz, $Y_0 = 20mS$



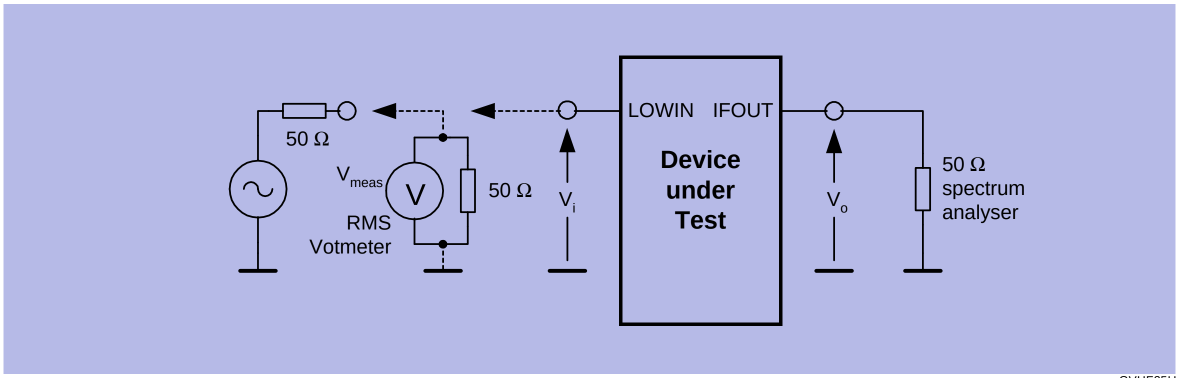
5.2.5 Output impedance (S22) of the IF output

$Z_0 = 50\ \Omega$



5.3 Measurement Circuits

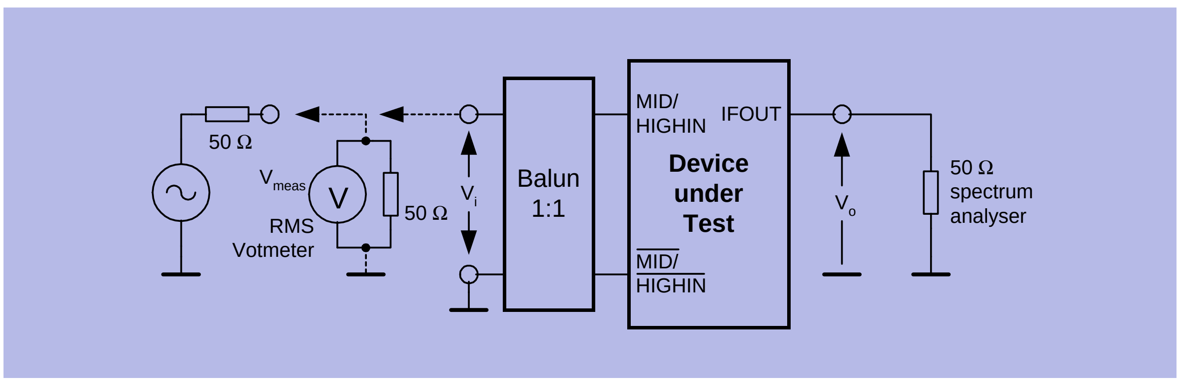
5.3.1 Gain (G_V) measurement in LOW band



GVHF25U

- Z_i >> 50 Ω => V_i = 2 x V_{meas} = 80 dBµV
- $V_i = V_{meas}$ + 6dB = 80 dBµV
- $G_V = 20 \log(V_0 / V_i)$

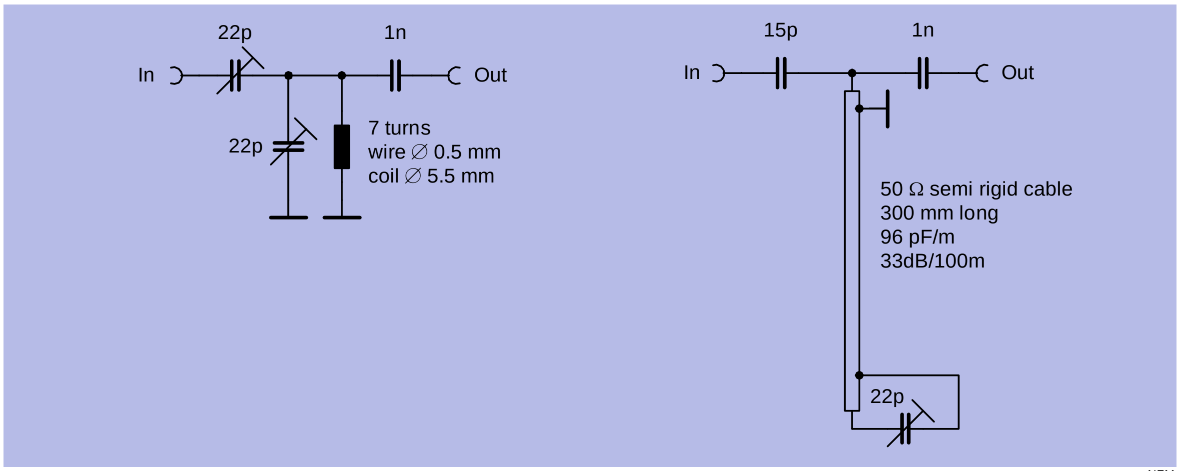
5.3.2 Gain (G_V) measurement in MID and HIGH bands



GUHF25U

- $V_i = V_{meas}$ = 70 dBµV
- $G_V = 20 \log(V_0 / V_i)$ + 1 dB (1 dB = insertion loss of balun)

5.3.3 Matching circuit for optimum noise figure in LOW band



NFM

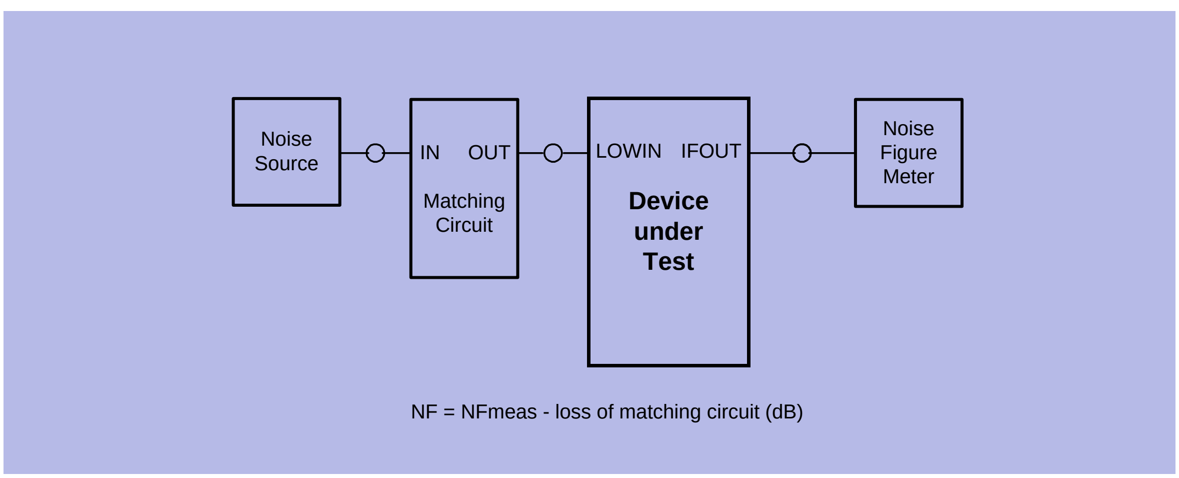
For f_{RF} = 50 MHz

- loss = 0 dB
- image suppression = 16 dB

For f_{RF} = 150 MHz

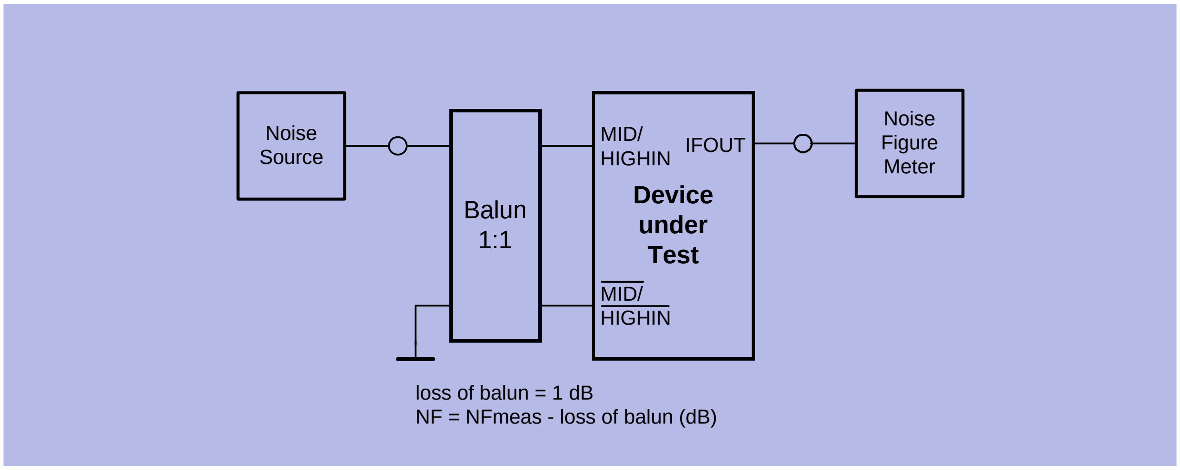
- loss = 1.4 dB
- image suppression = 13 dB

5.3.4 Noise figure (NF) measurement in LOW band



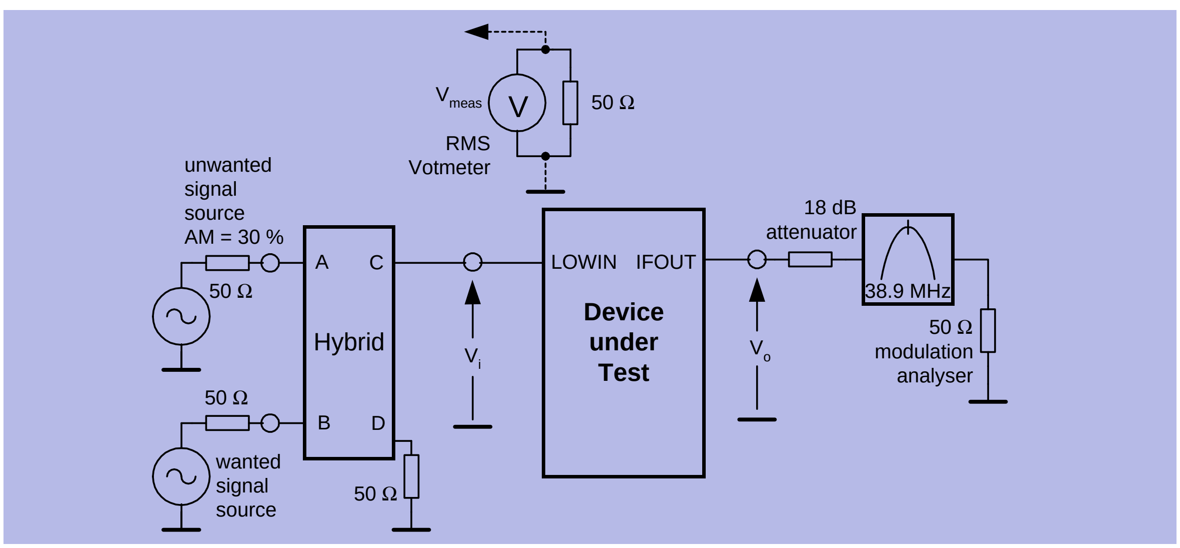
NFVHF25U

5.3.5 Noise figure (NF) measurement in MID and HIGH bands



NFUHF25U

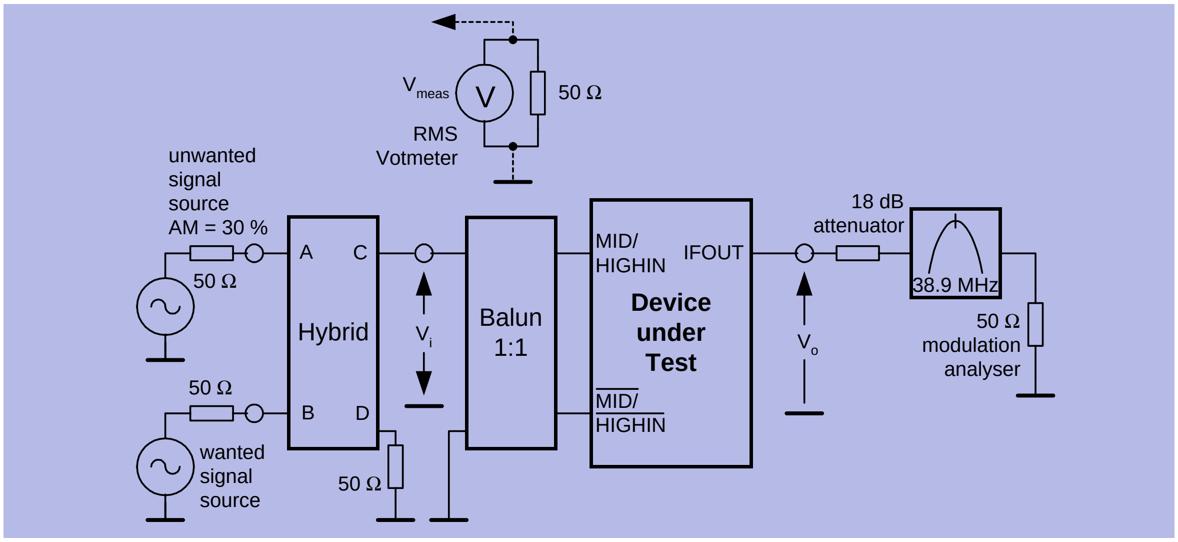
5.3.6 Cross modulation measurement in LOW band



XVHF25U

- Z_i >> 50 Ω => V_i = 2 x V_{meas}
- wanted output signal at f_{pix}, V_o = 100 dBµV
- unwanted output signal at f_{snd}

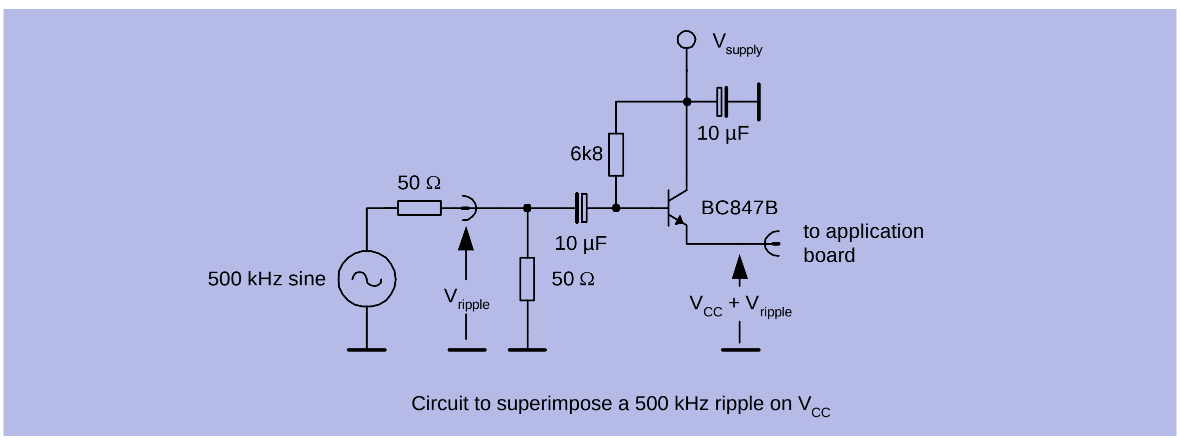
5.3.7 Cross modulation measurement in MID and HIGH bands



XUHF25U

- wanted output signal at f_{pix}, V_o = 100 dBµV
- unwanted output signal at f_{snd}

5.3.8 Ripple susceptibility measurement



RIP