



# Wireless Components

Multistandard VIF-PLL

TDA 6930 Version 1.0

Specification August 1999

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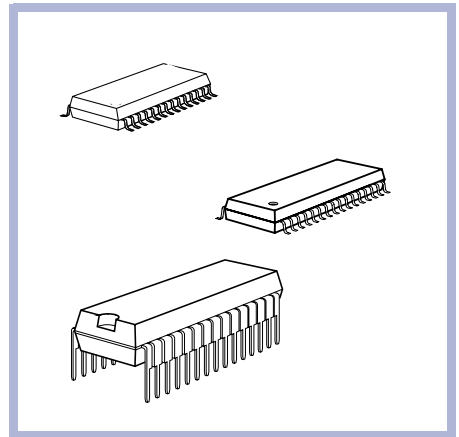
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## Product Info

### General Description

The TDA 6930 is an integrated circuit for high class multistandard TV vision IF signal, sound IF signal and AM-Audio signal processing. FM and NICAM sound IF carriers are converted to their intercarrier frequency. All switching functions are controlled via open collector transistors. Outputs for threshold controlled tuner AGC , digital tuning AFC , DF and AM-AF for all terrestrial standards are available.

### Package



### Features

- FPLL carrier regeneration from sound channel without Nyquist slope for best sound S/N and pulse response
- Choice of 2 VIF / SIF switchable inputs
- intercarrier operation possible
- separate AM-AF demodulator channel without external components
- VCO frequency switchable for L / L'
- digital tuning AFC separate adjustable for L'
- parallel output of DF/Nicam and AM-AF
- L/L' peak white detector VIF-AGC with average controlled response, scrambling save for Canal +
- adjustable tuner AGC
- Low operating voltage of 7.5 V
- precision internal bandgap reference
- Fully ESD protected

### Application

- Television sets
- VTR sets

### Ordering Information

Type	Ordering Code	Package
TDA 6930X	Q67007-A5217 GEG	P-DSO-28
TDA 6931X	Q67007-A5229 GEG	P-DSO-32
TDA 6930S	Q67000-A5180	S-DIP-30

# 1

## Table of Contents

<b>1</b>	<b>Table of Contents</b> .....	1-1
<b>2</b>	<b>Product Description</b> .....	2-1
2.1	Overview .....	2-2
2.2	Features .....	2-2
2.3	Application .....	2-2
2.4	Package Outlines .....	2-3
<b>3</b>	<b>Functional Description</b> .....	3-1
3.1	Pin Configuration .....	3-2
3.2	Pin Definition and Function .....	3-4
3.3	Internal circuits .....	3-5
3.4	Functional Description (P-DSO-32) .....	3-6
3.5	Block Diagram (P-DSO-32) .....	3-9
<b>4</b>	<b>Applications</b> .....	4-1
4.1	Circuits .....	4-2
4.1.1	Application Circuit P-DSO-28 .....	4-2
4.1.2	Application Circuit P-DSO-32 .....	4-3
4.1.3	Application Circuit S-DIP-30 .....	4-4
4.2	Hints .....	4-5
4.2.1	Typical input-filter concept 1 .....	4-6
4.2.2	Typical input-filter concept 2 .....	4-7
4.2.3	Application hints .....	4-8
<b>5</b>	<b>Reference</b> .....	5-1
5.1	Electrical Data .....	5-2
5.1.1	Absolute Maximum Ratings .....	5-2
5.1.2	Operating Range .....	5-3
5.1.3	AC/DC Characteristics .....	5-4
5.2	Electrical Diagramms .....	5-8
5.2.1	Typical VIF AGC voltage characteristic .....	5-8
5.2.2	Typical VIF intermodulation .....	5-8
5.2.3	Typical AM AF S/N .....	5-9
5.2.4	Typical AM Audio THD .....	5-9
5.2.5	Typical DC-current consumption .....	5-10
5.2.6	Typical AF amplitude .....	5-10

# 2 Product Description

## Contents of this Chapter

2.1	Overview . . . . .	2-2
2.2	Features . . . . .	2-2
2.3	Application . . . . .	2-2
2.4	Package Outlines . . . . .	2-3

## 2.1 Overview

The TDA 6930 is an integrated circuit for high class multistandard TV vision IF signal, sound IF signal and AM-Audio signal processing.

FM and NICAM sound IF carriers are converted to their intercarrier frequency. All switching functions are controlled via open collector transistors.

Outputs for threshold controlled tuner AGC , digital tuning AFC , DF and AM-AF for all terrestrial standards are available.

## 2.2 Features

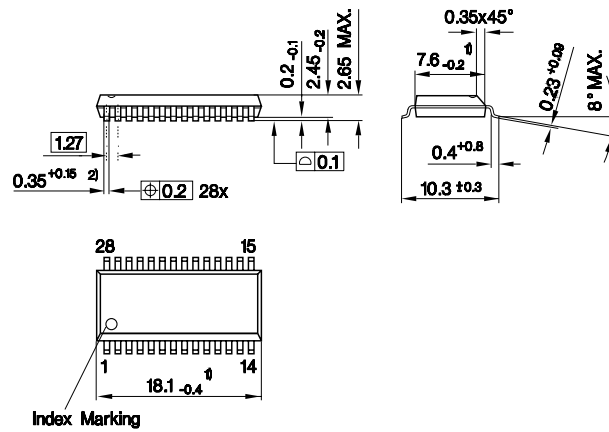
- FPLL carrier regeneration from sound channel without nyquist slope for best sound S/N and pulse response
- Choice of 2 VIF / SIF switchable inputs
- intercarrier operation possible
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- VCO frequency switchable for L / L'
- digital tuning AFC separate adjustable for L'
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- adjustable tuner AGC
- Low operating voltage of 7.5 V
- precision internal bandgap reference
- Fully ESD protected

## 2.3 Application

- Television sets
- VTR sets

## 2.4 Package Outlines

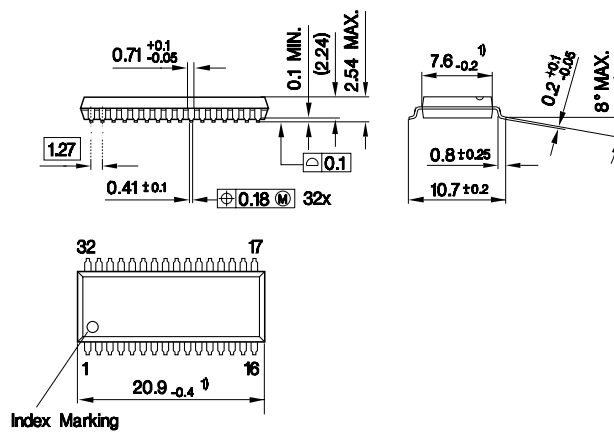
P-DSO-28:



Index Marking

- 1) Does not include plastic or metal protrusion of 0.15 max. per side
- 2) Does not include dambar protrusion of 0.05 max. per side

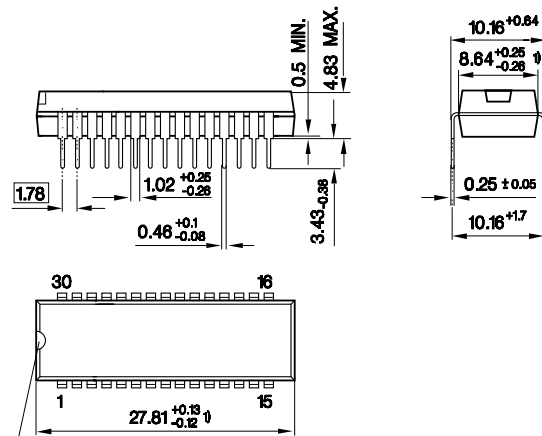
P-DSO-32:



Index Marking

- 1) Does not include mold protrusion of 0.25 max. per side

S-DIP-30:



Index Marking

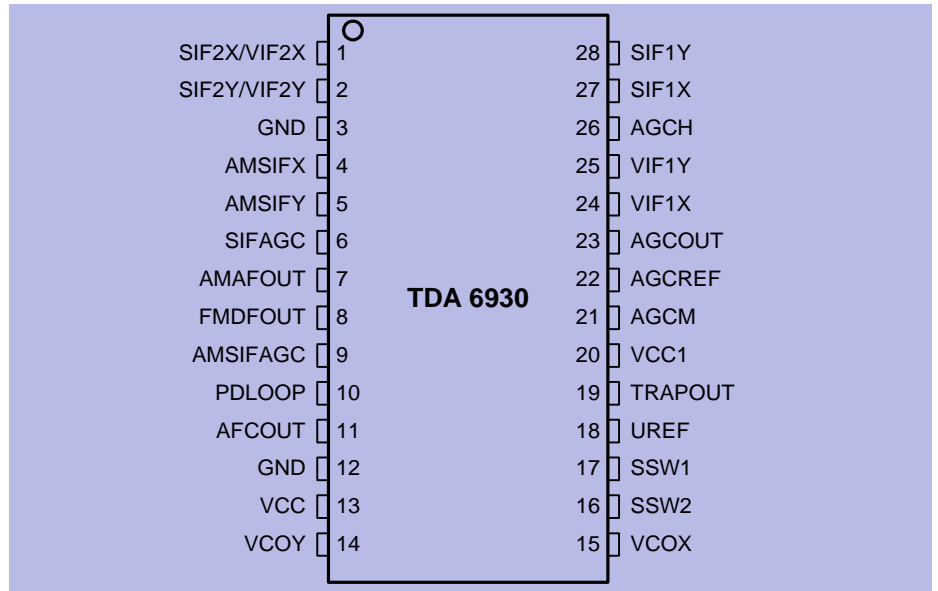
1) Does not include plastic or metal protrusion of 0.25 max. per side

# 3 Functional Description

## Contents of this Chapter

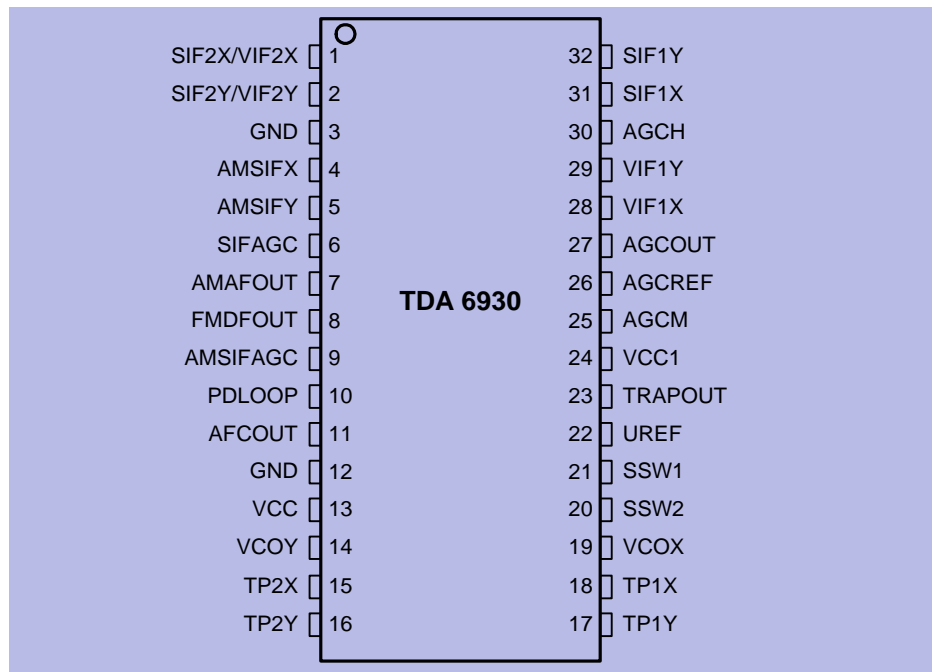
3.1	Pin Configuration .....	3-2
3.2	Pin Definition and Function .....	3-4
3.3	Internal circuits .....	3-5
3.4	Functional Description (P-DSO-32) .....	3-6
3.5	Block Diagram (P-DSO-32) .....	3-9

### 3.1 Pin Configuration



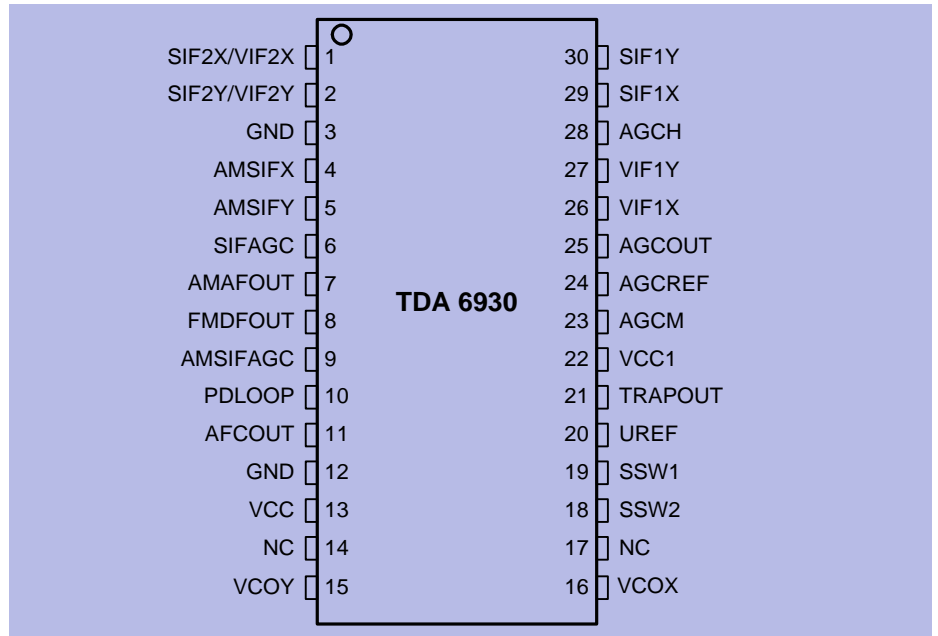
Pin\_config\_1.wmf

Figure 3-1 Pin Configuration P-DSO-28



Pin\_config\_2.wmf

Figure 3-2 Pin Configuration P-DSO-32



Pin\_config\_3.wmf

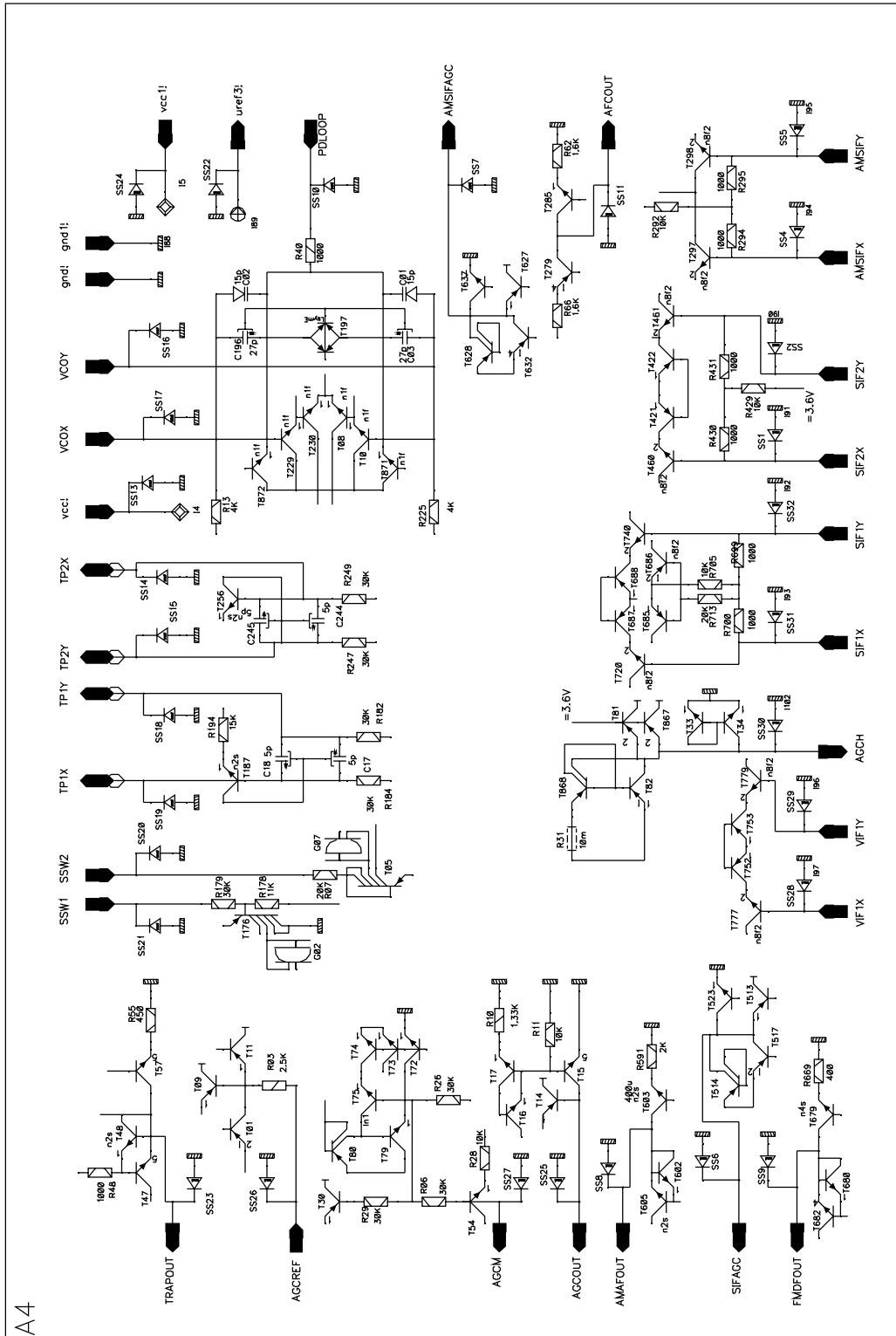
Figure 3-3 Pin Configuration S-DIP-30

### 3.2 Pin Definition and Function

**Table 3-1 Pin Definition and Function**

Symbol	Pin			Description
	P-DSO-28	P-DSO-32	S-DIP-30	
SIF2X/VIF2X	1	1	1	Sound IF2 / Carrier differential input signal
SIF2Y/VIF2Y	2	2	2	Video IF2 / Carrier differential input signal
GND	3	3	3	signal input ground
AMSIFX	4	4	4	AM Sound IF differential input signal
AMSIFY	5	5	5	
SIFAGC	6	6	6	FM Sound IF AGC capacitor
AMAFOUT	7	7	7	AM audio frequency output
FMDFOUT	8	8	8	FM / NICAM differential frequency output
AMSIFAGC	9	9	9	AM Sound IF AGC capacitor
PDLOOP	10	10	10	PLL loop filter
AFCOUT	11	11	11	AFC output
GND	12	12	12	power supply ground
VCC	13	13	13	positive power supply voltage
VCOY	14	14	15	VCO reference circuit for $2 \cdot f_{pc}$
TP2X	-	15	-	Differential low pass capacitor in automatic phase control circuit for video demodulator
TP2Y	-	16	-	
TP1Y	-	17	-	Differential low pass capacitor in automatic phase control circuit for video demodulator
TP1X	-	18	-	
VCOX	15	19	16	VCO reference circuit for $2 \cdot f_{pc}$
SSW2	16	20	18	standard switch
SSW1	17	21	18	
UREF	18	22	20	internal reference voltage capacitor
TRAPOUT	19	23	21	CVBS output signal
VCC1	20	24	22	analog small signal positive power supply voltage
AGCM	21	25	23	AGC average capacitor
AGCREF	22	26	24	tuner AGC takeover adjust
AGCOUT	23	27	25	tuner AGC output
VIF1X	24	28	26	Video IF1 / Carrier differential input signal
VIF1Y	25	29	27	
AGCH	26	30	28	Video IF AGC capacitor
SIF1X	27	31	29	Sound IF1 / Carrier differential input signal
SIF1Y	28	32	30	

### 3.3 Internal circuits



A4

### 3.4 Functional Description (P-DSO-32)

- **Inputs**

The input signal is distributed via the IF-MUX to the according amplifier channels.

**VIF-Mux**

Normally VIF1 is used for video if input ( filter with no sound carrier). A special mode with a secondary VIF input at SIF 2 is available. In this case the carrier recovery gets its input signal in any way from SIF1. For more Information see input selection logic-table in the application circuit section. In the also available Intercarrier mode for low cost application, all signals are transferred together via VIF1 or VIF2 input, depending on input switching logic.

**SIF-Mux**

SIF1 input is used for DF-sound and carrier recovery ( double channel filter ). For L' inverted sideband application SIF2 is used instead.

AMSIF input is used for all AM sound norms with switchable input filter.

- **IF gain controlled amplifier's**

The TDA 6930X incorporates a Video-IF demodulation part (VIF), a AM-sound demodulation part (AMSIF) and a Section for PIC-carrier recovery + FM/NICAM SIF conversion (SIF). Each path has its own four-stage capacitively coupled, gain controlled amplifier.

- **AGC's**

**Tuner AGC**

A delayed tuner AGC voltage is derived from the VIF-AGC via an inverting threshold amplifier ( increasing VIF input voltage decreases the AGCOUT voltage ). Its take over point with positiv control direction is set by means of a external potentiometer.

To avoid regulation oszillation the input has a shared characteristic and the output is clamped to min 0.3 V which prevents for coming into gain control inversion at low regulation voltage levels in several tuner application.

**VIF AGCs**

The AGC for the video-IF-amplifier (VIF) has a peak detector for both kinds of modulation. An additional mean value detector will increase the control current for positive modulation if the input signal decreases more than ca. 15 dB. In this case a hysteresis keeps the high control current until the mean value increases by ca. 10 dB. This and an extremely large sample time prevents from AGC oszillation with critical signals.

**SIF / AMSIF AGC's**

The AGC's for the AM- sound section and PIC-carrier recovery +FM/NICAM section use envelope detectors with extremely low distortion for the SIF amplifiers.

They have a quick charge circuit which increases the charge current by a factor of 1500 if the mean value of the signal increases by more than 10 dB. The time constants of the AGCs can be set by the according external capacitor.

- **FPLL**

#### FPLL carrier Recovery

High performance in terms of FM sound, digital sound and videotext is obtained by means of a combined path for carrier recovery and FM/NICAM SIF (QPT). The input signal for this section is derived from the QPT SIF I/II input to overcome Nyquist slope distortions in all cases. For L'-applications the VCO frequency is switched internally, thus no external tank circuit switching is necessary. Adjustment of the tank circuit (only necessary for the AFC) is achieved by aligning the AFC voltage to a certain value except in L'-mode. In L'-mode the AFC needs to be adjusted via control voltage at pin SSW2.

#### APC

For best video demodulation a phase locked clean carrier is needed. Due to differences in the filter and amplifier characteristics of the amplifier channels it is necessary to align the phase of the recovered carrier to the incoming signal of VIF port . The possible phase control margin of the therefore used APC is +180 ° to -180 °.

For best performance 2 external low pass capacitors are added at the P-DSO-32 package. In this case the APC is extremely stable at carrier zero time and over modulation. This feature is not available in the less than 32 pin packages .

#### VCO

The VCO consists of a temperature compensated stacked symmetrical ECL multivibrator and divider by 2 . The main tank circuit is aligned to twice of the recovery frequency. All internal signals are of symmetrical ECL type. This is necessary for small amplitudes with high temperature stability and low oscillator radiation.

- **Video demodulation + output**

#### Video IF Demodulation

A real synchronous demodulator receives an inphase carrier via the automatic phase control (APC) from the FPLL. Thus, low differential phase and gain, high intermodulation ratio und good impuls response is achieved without any alignment.

- **DF-Mixer / FM sound conversion**

The SIF-Sound/PIC-carrier section gets its input signal from SIF1 except in L'-NICAM mode, then input SIF 2 is active. The SIF- signal is mixed with the 90°-carrier from the FPLL to generate the 2. sound IF at the according output (DF). This output is always active except in Mac standard, there both sound outputs are off.

- AM-Audio Sound demodulation

The AM-sound section uses the envelope detector of the AGC to demodulate the AM sound signal. An optimized special AM-sound demodulator and the envelope detector guarantee an extremely low AF output distortion. In case of L or L' standard the AM-AF output is active, in other standards this output is inactive.

According to the standard switches FM/NICAM and/or AM processing is performed.

- AFC + Adjust

The AFC consists of a high impedance input comparator who gets its control voltage from the loopfilter / VCO charge pump capacitor. Its OTA output voltage swing and gain can be controlled via the necessary external load resistors

The adjust is controlled by norm switch inputs and is only active in L' mode. The operation is performed by controlling the reference input voltage of the AFC comparator.

- Switches

The internal I<sup>2</sup>L norm switch decoding logic is buffered by PNP comparator interfaces with hysteresis.

Therefore the input signal voltage margin at SSW1 and SSW2 is 0 - vcc

- Voltage reference

The reference voltage is performed by a temperature compensated band-gap structure with extremely low noise and high ripple rejection (PSSR). The reference voltage distribution is done by 3 buffer amplifiers with extremely high ripple rejection (PSSR).

### 3.5 Block Diagram (P-DSO-32)

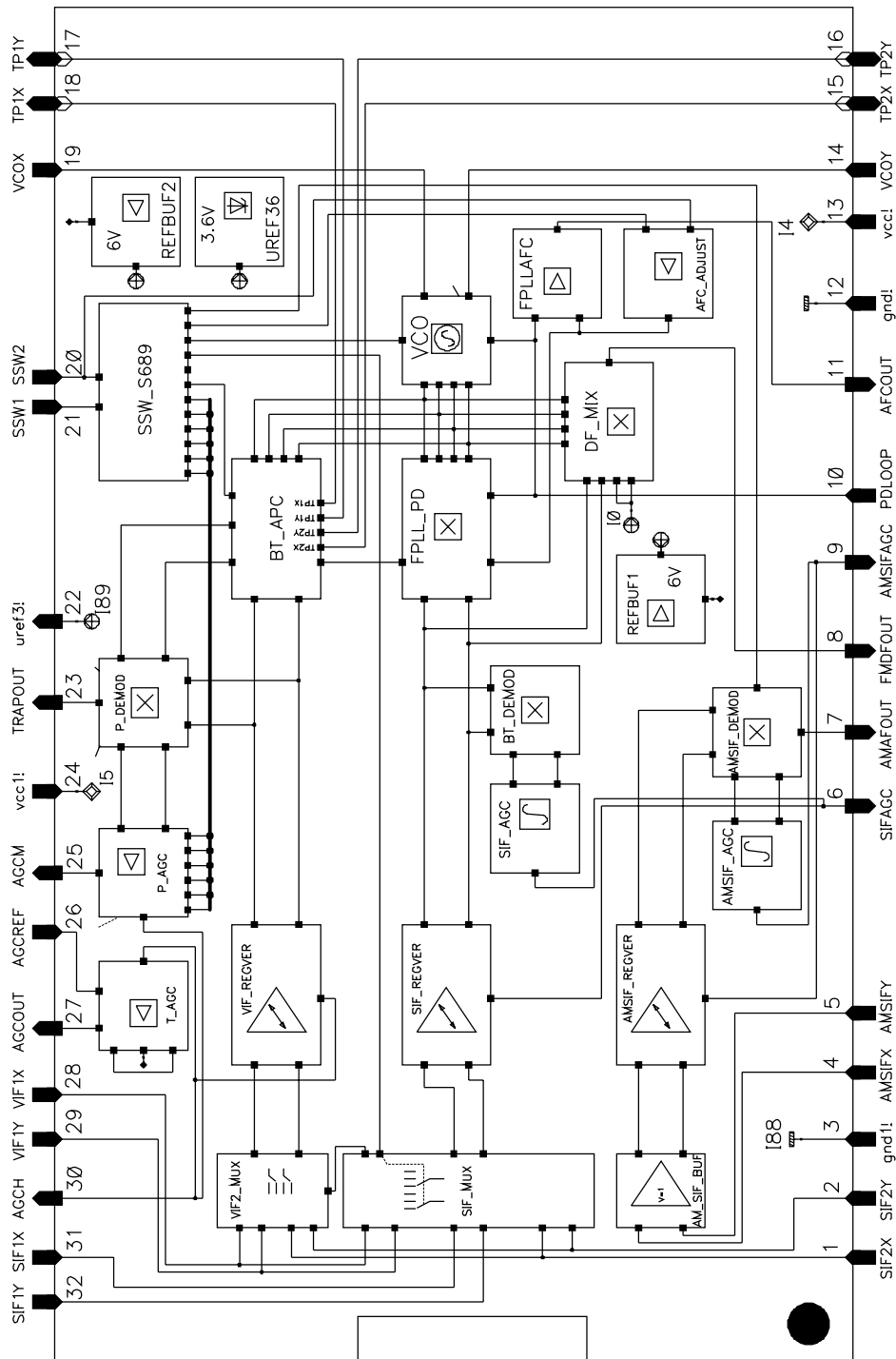


Figure 3-4 Block Diagram (P-DSO-32)

Block.ps

# 4 Applications

## Contents of this Chapter

4.1	Circuits . . . . .	4-2
4.1.1	Application Circuit P-DSO-28 . . . . .	4-2
4.1.2	Application Circuit P-DSO-32 . . . . .	4-3
4.1.3	Application Circuit S-DIP-30 . . . . .	4-4
4.2	Hints . . . . .	4-5
4.2.1	Typical input-filter concept 1 . . . . .	4-6
4.2.2	Typical input-filter concept 2 . . . . .	4-7
4.2.3	Application hints . . . . .	4-8

## 4.1 Circuits

### 4.1.1 Application Circuit P-DSO-28

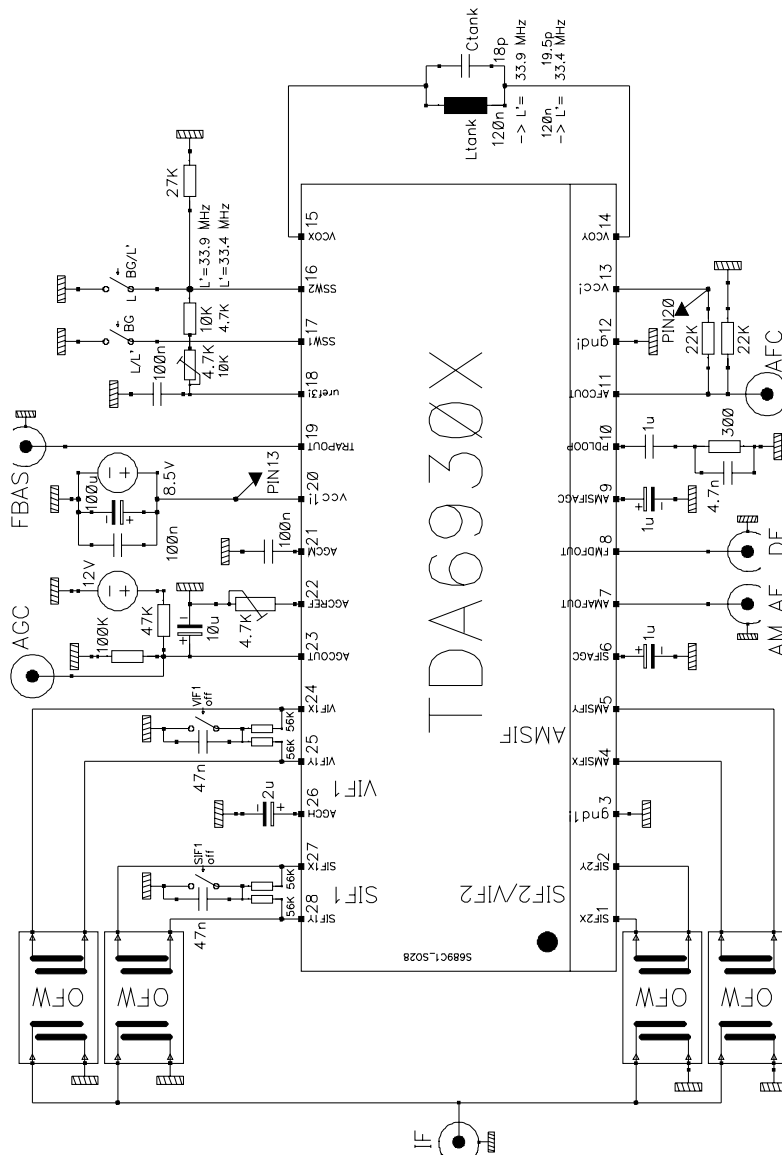
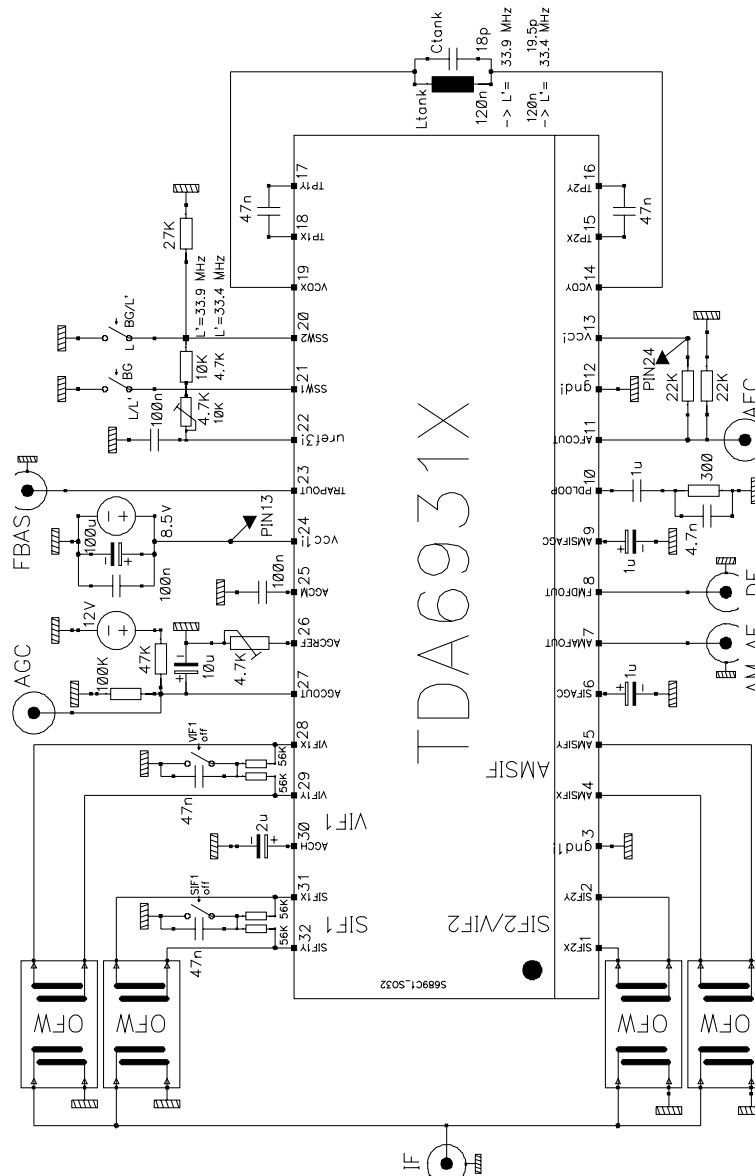


Figure 4-1 Application Circuit P-DSO-28

Apliso28.ps

4.1.2 Application Circuit P-DSO-32



Apilso32.eps

Figure 4-2 Application Circuit P-DSO-32

### 4.1.3 Application Circuit S-DIP-30

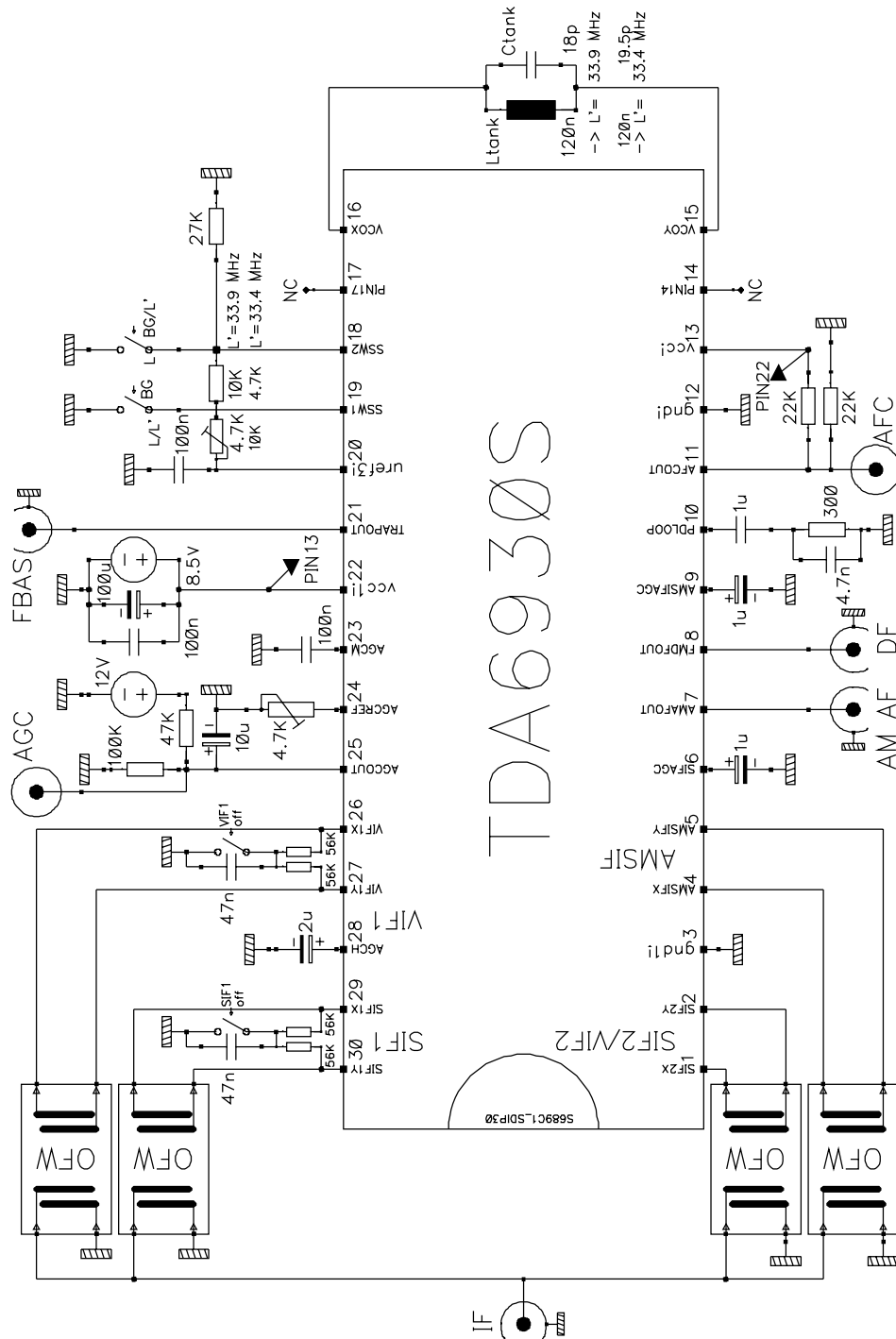


Figure 4-3 Application Circuit S-DIP-30

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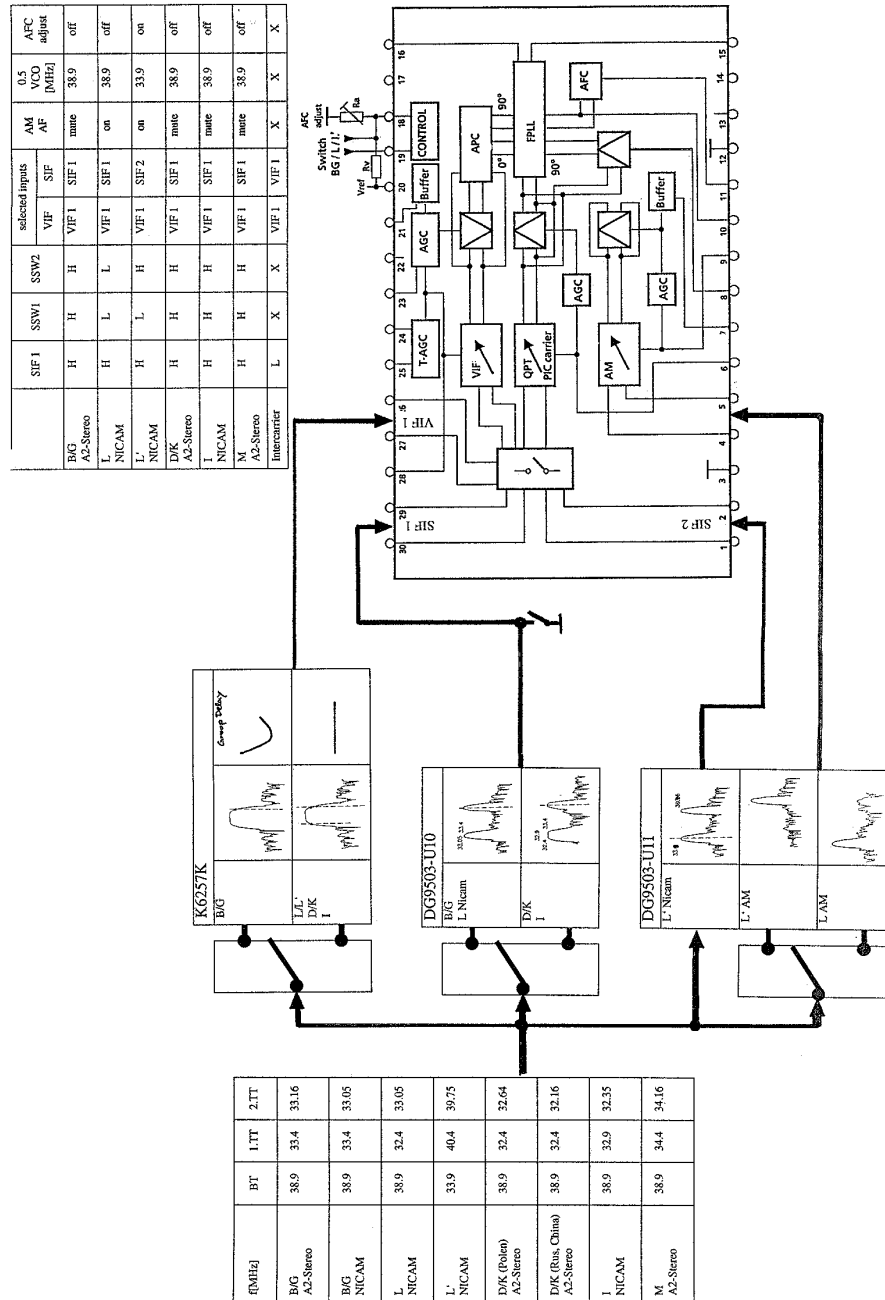
## 4.2 Hints

table1: input selection logic

SIF1	VIF1	SSW1	SSW2	VCO* MHz	selected inputs <sup>2</sup>		modulation	AGC-type / ratio	AM AF	AFC adjust	norm	
					VIF	SIF						
H	H	H	H	38.9	VIF1	SIF1	neg.	syncpeak / 1:83	mute	off		BG
H	H	H	L	38.9	VIF1	SIF1	neg.	syncpeak,average / 1:8300	mute	off		(Mac)
H	H	L	H	33.9	VIF1	SIF2	pos.	whitepeak,average / 1:8300	on	on		L'
H	H	L	L	38.9	VIF1	SIF1	pos.	whitepeak,average / 1:8300	on	off		L
H	L	H	H	38.9	VIF2	SIF1	neg.	syncpeak / 1:83	mute	off		BG
H	L	H	L	38.9	VIF2	SIF1	neg.	syncpeak,average / 1:8300	mute	off		(Mac)
H	L	L	H	33.9	VIF2	SIF1	pos.	whitepeak,average / 1:8300	on	on		L'
H	L	L	L	38.9	VIF2	SIF1	pos.	whitepeak,average / 1:8300	on	off		L
L	H	H	H	38.9	VIF1	VIF1	neg.	syncpeak / 1:83	mute	off	intercarrier	BG
L	H	H	L	38.9	VIF1	VIF1	neg.	syncpeak,average / 1:8300	mute	off	intercarrier	(Mac)
L	H	L	H	33.9	VIF1	VIF1	pos.	whitepeak,average / 1:8300	on	on	intercarrier	L'
L	H	L	L	38.9	VIF1	VIF1	pos.	whitepeak,average / 1:8300	on	off	intercarrier	L
L	L	H	H	38.9	VIF2	VIF2	neg.	syncpeak / 1:83	mute	off	intercarrier	BG
L	L	H	L	38.9	VIF2	VIF2	neg.	syncpeak,average / :8300	mute	off	intercarrier	(Mac)
L	L	L	H	33.9	VIF2	VIF2	pos.	whitepeak,average / 1:8300	on	on	intercarrier	L'
L	L	L	L	38.9	VIF2	VIF2	pos.	whitepeak,average / 1:8300	on	off	intercarrier	L

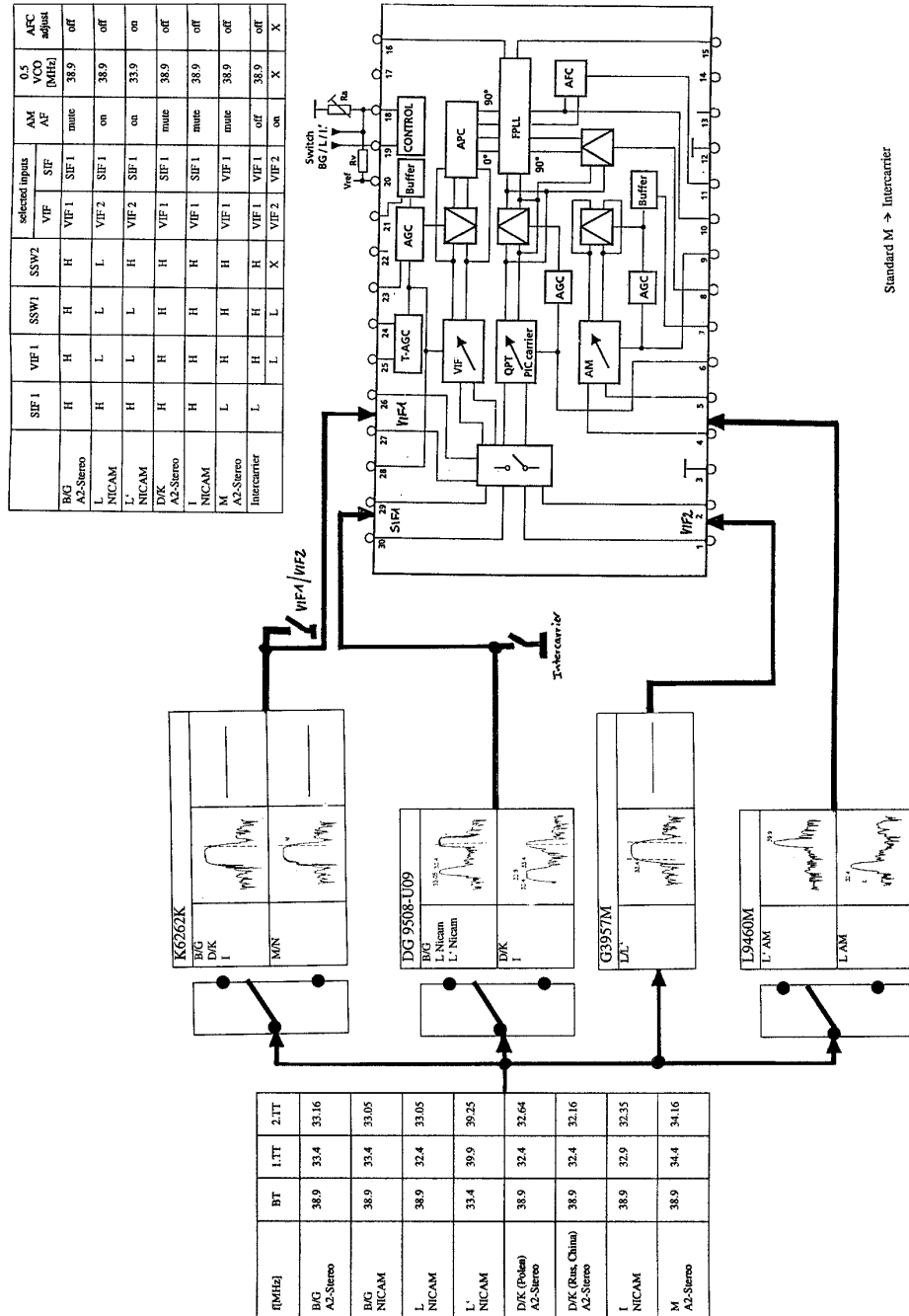
\* ..internal VCO : 2  
 2)..VIF = Vision-IF, SIF=Sound-IF + Carrier  
 S-DIP-30 : SIF1=pin29,30; SIF2=pin1,2; VIF1=pin26,27; VIF2=pin1,2; SSW1=pin19; SSW2=pin18  
 P-DSO-32 : SIF1=pin31,32; SIF2=pin1,2; VIF1=pin28,29; VIF2=pin1,2; SSW1=pin21; SSW2=pin20

### 4.2.1 Typical input-filter concept 1



	selected inputs		SSW2	SSW1	SIF 1	AM AF	0.5 VCO (MHz)	AFC adjust
	VIF	SIF						
B/G A2-Stereo	H	SIF 1	H	H	H	mute	38.9	off
L' NICAM	H	SIF 1	L	L	H	on	38.9	off
L' NICAM	H	SIF 1	H	L	H	on	33.9	on
D/K A2-Stereo	H	SIF 1	H	H	H	mute	38.9	off
I NICAM	H	SIF 1	H	H	H	mute	38.9	off
M A2-Stereo	H	SIF 1	H	H	H	mute	38.9	off
Intercarrier	L	VIF 1	X	X	X	X	X	X

### 4.2.2 Typical input-filter concept 2



Standard M → Intercarrier

### 4.2.3 Application hints

**Table 4-1 AFC adjust and VCO tank circuit dimension 1st VCO\***  
(frequency = 38.9 MHz)

2nd VCO frequency**	Ra	Rb	Lc	Cc
33.4 MHz	10k	4.7k	120nH	19.5pF
33.9 MHz	4.7k	10k	120nH	18pF

\*) internal VCO : 2 frequency for any norm except L'

\*\*\*) internal VCO : 2 frequency for L'

■ **Application note 1 : Adjusting the tank circuit**

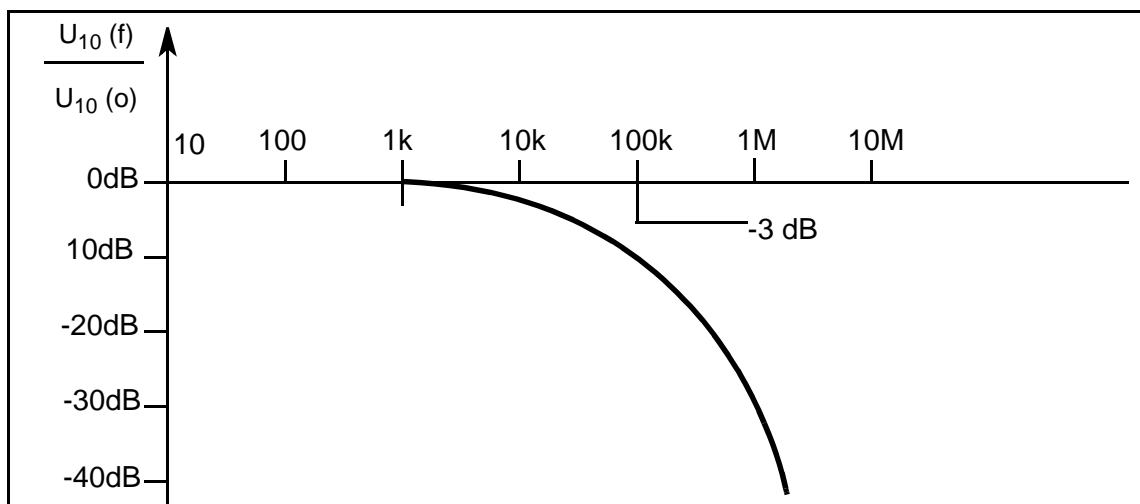
At the desired IF-frequency the AFC-output current has to be zero. Therefore the voltage at that pin will be  $V_s/2$ . This is achieved by adjusting 1st the coil, 2nd Ra for L' mode.

No further alignment e.g. for sound S/N is necessary.

■ **Application note 2 : FPLL, loopfilter response**

Measuring the frequency response of the loop.

The frequency response of the FPLL can be measured at the loopfilter output Pin 10. If a frequency modulated carrier is applied to the Picture carrier input the demodulated signal occurs at Pin 10. Within its bandwidth the FPLL can track modulation frequencies, thus this frequencies can be measured there. The frequency response with the recommended loopfilter can be seen in the picture below.



Designing the frequency response

There should be no overshoot until 20 kHz. The bandwidth has to be high enough to control the distortions generated by the tuner. To reject intercarrier buzz at 250 kHz video modulation the loop filter response at that frequency should be as low as possible.

■ Application note 3 : Equations

Resonance frequency : 
$$f_n = \frac{1}{2\pi} \sqrt{\frac{K_O K_{DI}}{C_{LF}}}$$

Damping factor: 
$$\nu = \pi f_n C_{LF} R_{LF}$$

Phase detector gain: 
$$K_{OI} = 250 \frac{\mu A}{rad}$$

VCO-gain: 
$$K_O = 2\pi \cdot 2 \frac{MHz}{V}$$

with tank circuit: 120 nH || 18 pF

Loopfilter capacitor: 
$$C_{LF} \text{ recommended } C_{LF} = 1\mu$$

Loopfilter resistor: 
$$R_{LF} \text{ recommended } R_{LF} = 120\Omega$$

A second capacitor in parallel with  $R_{LF}$  is recommend to reduce the response at 250 kHz  $C_P = 4.7 \text{ nF}$

Values:

With the recommend tank circuit and loopfilter

VCO range: 
$$\Delta f_{pp} = 4 \text{ MHz}$$

Resonance frequency: 
$$f_n = 9 \text{ kHz}$$

Damping factor: 
$$\nu = 8.5$$

Loop cut off frequency: 
$$f_{-3dB} = 100 \text{ kHz}$$

# 5 Reference

## Contents of this Chapter

5.1	Electrical Data . . . . .	5-2
5.1.1	Absolute Maximum Ratings . . . . .	5-2
5.1.2	Operating Range . . . . .	5-3
5.1.3	AC/DC Characteristics . . . . .	5-4
5.2	Electrical Diagramms . . . . .	5-8
5.2.1	Typical VIF AGC voltage characteristic . . . . .	5-8
5.2.2	Typical VIF intermodulation . . . . .	5-8
5.2.2	Typical VIF intermodulation . . . . .	5-8
5.2.3	Typical AM AF S/N . . . . .	5-9
5.2.4	Typical AM Audio THD . . . . .	5-9
5.2.5	Typical DC-current consumption . . . . .	5-10
5.2.6	Typical AF amplitude . . . . .	5-10

## 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 will result.

**Table 5-1 Absolute Maximum Ratings**

Parameter	Symbol	Limit Values		Unit	Remarks
		min	max		
Supply voltage	$V_{CC}, V_{CC1}$	0	10	V	
Supply voltage (S-DIP-30 only)	$V_{CC}, V_{CC1}$	0	12	V	
Output current ( $R_{Lmin} = 500 \Omega$ )	ITRAPOUT	0	6	mA	
Output current ( $R_{Lmin} = 2 k\Omega$ )	Iuref3!	0	3	mA	
Output current	IAGCOUT	0	25	mA	
Output voltages	VSIFAGC's	0	3.6	V	
Output voltage	VAGCOUT	0	12	V	
Output voltage	VAFCOUT	0	$V_{CC}$	V	
Output voltage	VDFOUT	0	$V_{CC}$	V	
Output voltage	VAFOUT	0	$V_{CC}$	V	
Output voltage	VAGCM	0	$3.6 < V_{CC}$	V	
Output voltage	VTRAPOUT	0	$V_{CC}$	V	
Output voltage	$V_{uref3!}$	0	$7 < V_{CC}$	V	
Input voltage	VAGCREF	0	$3.6 < V_{CC}$	V	
Input voltages	VVIF, SIF	0	$V_{CC}$	V	
Input voltages	VSSW	0	$V_{CC}$	V	
Input voltages	VTP	0	$6 < V_{CC}$	V	
Input voltages	VVCO	0	$4.5 < V_{CC}$	V	
Input voltage	VPDLOOP	0	$6 < V_{CC}$	V	

**Table 5-1 Absolute Maximum Ratings (continued)**

Parameter	Symbol	Limit Values		Unit	Remarks
		min	max		
ESD-voltage all pins HBM ( R=1.5kΩ , C=100pF )	V <sub>ESD</sub>	-4	4	kV	
Junction temperature	T <sub>j</sub>		150	°C	
Storage temperature	T <sub>stg</sub>	- 40	125	°C	
Thermal resistance P-DSO28 (sys-air)	T <sub>thSA</sub>		76	K/W	
Thermal resistance P-DSO32 (sys-air)	T <sub>thSA</sub>		76	K/W	
Thermal resistance S-DIP30 (sys-air)	T <sub>thSA</sub>		57	K/W	

All voltage values are referenced to ground, if not stated otherwise.

### 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 <sub>cc</sub> , V <sub>cc1</sub>	7.5	10	V			
Supply voltage (S-DIP-30 only)	V <sub>cc</sub> , V <sub>cc1</sub>	7.5	12	V			
Tuner AGC supply voltage	V <sub>AGCOUT</sub>	0.6	10	V			
IF-input frequency range VIF, SIF , AMSIF	f <sub>in</sub>	12	60	MHz			
IF-input AC-voltages	V	50 μV <sub>rms</sub>	120 mV <sub>rms</sub>				
Ambient temperature during operation	T <sub>A</sub>	-10	85	°C			

All voltage values are referenced to ground, if not stated otherwise.

### 5.1.3 AC/DC Characteristics

Table 5-3 AC/DC Characteristics with  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 8.5\text{ V}$

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
<b>Power Supply</b>								
Total current consumption	$I_{CC}+I_{CC1}$		90		mA	$R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
Reference voltage	$V_{uref3!}$	5.7	6.0	6.3	V	$R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
Reference voltage	$I_{uref3!}$			2	mA			
<b>Norm switches</b>								
H Level	$V_{SSW}$	2		5	V			
L Level	$V_{SSW}$	0		1	V			
external load at SSW2 if high	$I_{SSW2}$			1	%	of resistor divider current		
<b>IF inputs</b>								
DC level	$V_{IF}$	3.4	3.6	3.8	V	$V_{IF} = 0\text{ V}_{pp}$		
Mono / Intercarrieraktive	$I_{SIF1}$	100		400	$\mu\text{A}$	$R_{Gnd} < 27\text{ k}\Omega$		
2nd. IF input VIF2 aktive	$I_{VIF1}$	100		400	$\mu\text{A}$	$R_{Gnd} < 27\text{ k}\Omega$		
<b>VCO</b>								
Tank circuit, DC level	$V_{VCO}$		2.6		V			
Loopfilter voltage	$V_{PDloop}$	2.3		5	V	dependant on input frequency		
<b>Peak - detector VIF-AGC</b>								
Voltage range	$V_{AGCH}$	0		3.6	V	dependant on input amplitude		
<b>AGC time constant B/G standard</b>								
Charge current	$I_{AGCH}$		1		mA	$V_{AGCH} = 2\text{V}$ , $V_{TRAPOUT} < 1.0\text{V}$		
Discharge current	$I_{AGCH}$		12		$\mu\text{A}$	$V_{AGCH} = 2\text{V}$ , $V_{TRAPOUT} > 2.0\text{V}$		
Charge / discharge ratio	AGCH		83					

**Table 5-3 AC/DC Characteristics with  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 8.5\text{ V}$  (continued)**

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
<b>AGC time constant with L-Standard or Mac Standard</b>								
Charge current	$I_{AGCH}$		1		mA	$V_{AGCH} = 2V$ , $V_{TRAPOUT} > 3.0V$		
Discharge current	$I_{AGCH}$		120		nA	$V_{AGCH}=2V$ , $V_{TRAPOUT} = 2.5V$		
Discharge current ( under average control )	$I_{AGCH}$		100		$\mu\text{A}$	$V_{AGCH} = 2V$ , $V_{TRAPOUT} < 1.0V$		
Charge / discharge ratio	AGCH		8300					
<b>Envelope - detector AGCs</b>								
Voltage range	$V_{SIFAgcs}$	0.2		2.9	V	dependant on input amplitude		
Charge / discharge current	$\pm I_{SIFAgcs}$		1.5		$\mu\text{A}$	$V_{SIFAgcs} = 1.5\text{ V}$		
Quick charge	$I_{SIFAgcs}$		1.5		mA	$V_{SIFAgcs} = 1.5\text{ V}$		
<b>Video output</b>								
Output current	$-I_{Trapout}$		0.84		mA	$V_{AGCM} = V_{sync} + 0.7$ $V_{VIF} = \text{Carrier nomod.}$		
Sync pulse level	$V_{Trapout}$		1.25		V			
White level	$V_{Trapout}$		2.75		V			
<b>AM output</b>								
DC level (L, L')	$V_{AMAFout}$	3.2	3.6	4.0	V	SC nomod.		
DC level (AM inactive )	$V_{AMAFout}$	high impedance						
<b>DF output</b>								
DC level	$V_{FMDFout}$	2.8	3.4	4.0	V			
Output current	$I_{FMDFout}$		2.5		mA	$V_{FMDFout} =$ DC level +0.7V		
<b>AFC output</b>								
Voltage range	$V_{AFCout}$	1V		$V_S - 1V$	V			
Output current	$I_{AFCout}$		250		$\mu\text{A}$	$V_{AFC} = V_{CC} / 2$		
Voltage at centerfrequency	$V_{AFCout}$		$V_{CC} / 2$		V	1:1 $V_{CC}$ divider		
Slope	$I_{AFCout}$		0.7		$\mu\text{A/kHz}$			
AFC - adjust	$V_{SSW2}$	3		5	V	switch at SSW2: high impedance		

Table 5-3 AC/DC Characteristics with  $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC} = 8.5\text{ V}$  (continued)

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
<b>Tuner AGC</b>								
Max. output current max. 1ms	$I_{AGCOUT}$	10	18	30	mA	$V_{AGCOUT} = 4\text{ V}$ $R_{AGCOUT} = 0\ \Omega$		
Min. output current	$I_{AGCOUT}$	0		10	$\mu\text{A}$	$V_{AGCOUT} = V_{CC1}$ $V_{AGCREf} = \text{max}$		
Output short current	$I_{AGCOUT}$	150	200	250	$\mu\text{A}$	$V_{AGCOUT} = 0\text{ V}$ $R_{AGCOUT} = \infty$		
Min. output voltage	$V_{AGCOUT}$	0.2	0.3	0.5	V	$R_{AGCOUT} = \infty$		
<b>IF inputs</b>								
Control range	$\Delta V_{VIF,SIF}$	54	60		dB			
Min. input voltage	$V_{VIF,SIF}$		120	180	$\mu\text{V}_{\text{rms}}$	$V_{\text{Trapout}} = -3\text{ dB}$		
AGC range	$\Delta V_{AMSIF}$	54	60		dB			
Min. input voltage	$V_{AMSIF}$		120	180	$\mu\text{V}_{\text{rms}}$	$V_{AMAFout} = -3\text{ dB}$		
<b>Video output , VIF OFW G1962M sound shelf -20 dB</b>								
Signal level	$V_{\text{Trapout}}$	1.25	1.5	1.75	$V_{\text{pp}}$	B/G norm		
Video bandwidth	$f_{-1\text{dB}}$	7	8		MHz	$V_{\text{Trapout}} = -1\text{ dB}$		
Differential Gain	DG		4		%	$R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
Differential Phase	DP		1.5		deg	$R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
Intermodulation $f_1 = 4.52\text{MHz}$ , PC modulated from black to white, $f_2 = 5.50\text{ MHz}$ , SC -13 dB to unmodulated PC	@IM		62		dB	$f = 980\text{ KHz}$ Levels at Trapout $f_1 = -2.0\text{ dB}$ $f_2 = -13\text{ dB}$ $R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
Intermodulation $f_1 = 4.4\text{MHz}$ , -13.2 dB to PC sync level, -10 dB to PC modulated from black to white, $f_2 = 5.50\text{ MHz}$ , SC -7 dB to unmodulated PC	@IM		69		dB	$f = 1.1\text{ MHz}$ Levels at IF input $f_1 = -13.2\text{dB}$ to sync $f_2 = -27\text{ dB}$ to PC $R_L > 1\text{M}\Omega, C_L < 1.5\text{pf}$		
S/N CCIR Unified WTD		60	65		dB	$V_{IF} = \text{max.}$		
S/N CCIR 567 Unweighted		55	59		dB	black & white		
residual vision carrier	$V_{\text{Trapout}}$		500		$\mu\text{V}_{\text{rms}}$	$R_L > 1\text{M}, f = 38.9\text{MHz}$		
residual VCO carrier	$V_{\text{Trapout}}$		350		$\mu\text{V}_{\text{rms}}$	$R_L > 1\text{M}, f = 77.8\text{MHz}$		

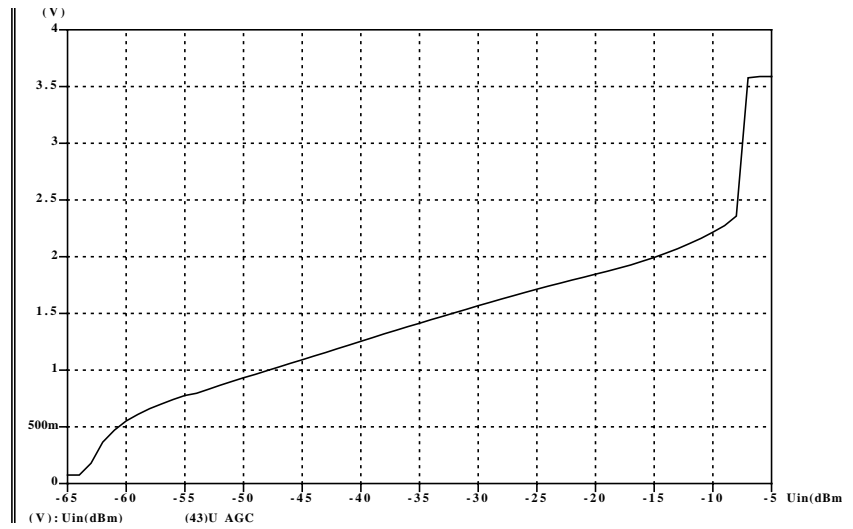
**Table 5-3 AC/DC Characteristics with  $T_A$  25 °C,  $V_{CC}$  = 8.5 V (continued)**

	Symbol	Limit Values			Unit	Test Conditions	L	Item
		min	typ	max				
<b>DF output</b>								
Signal level Input wideband trans- former coupled	$V_{FMD\text{Fout}}$		100		$\text{mV}_{\text{rms}}$	SC / PC= -13 dB PC nomod.		
Output current	$I_{FMD\text{Fout}}$		2.5		mA	$V_{FMD\text{Fout}}$ = DC level +0.7V		
S/N CCIR WTD			58		dB	PIC=FubK Pattern $V_{IF}$ = max.		
<b>AM output : no picture carrier , AM SIF OFW L9453M</b>								
Signal level	$V_{AMA\text{Fout}}$	700	900	1100	$\text{mV}_{\text{rms}}$	m = 80% , 1kHz		
THD total			0.25	0.5	%	m = 30% , 1kHz		
THD total			0.35	1.0	%	m = 80% , 1kHz		
S/N Quasi Peak CCIR WTD			60		dB	m = 80% , 1kHz $V_{AMA\text{Fout}}$ = +3 dB		
<b>AM output : picture carrier FubK modulation, AM SIF OFW L9453M</b>								
Signal level	$V_{AMA\text{Fout}}$	700	900	1100	$\text{mV}_{\text{rms}}$	m = 80% , 1kHz		
THD 2 x fo			0.1	0.25	%	m = 30% , 1kHz		
THD total			1.5	2.0	%	m = 30% , 1kHz		
THD 2 x fo			0.2	0.5	%	m = 80% , 1kHz		
THD total			0.7	1.5	%	m = 80% , 1kHz		
S/N Quasi Peak CCIR WTD			45		dB	m = 80% , 1kHz $V_{AMA\text{Fout}}$ = +3 dB		

## 5.2 Electrical Diagramms

### 5.2.1 Typical VIF AGC voltage characteristic

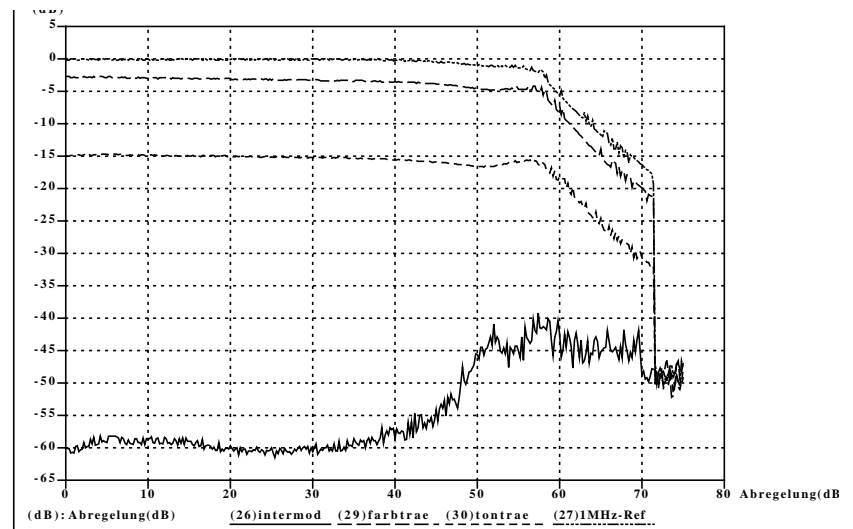
as a function of input signal



zflagc.eps

### 5.2.2 Typical VIF intermodulation

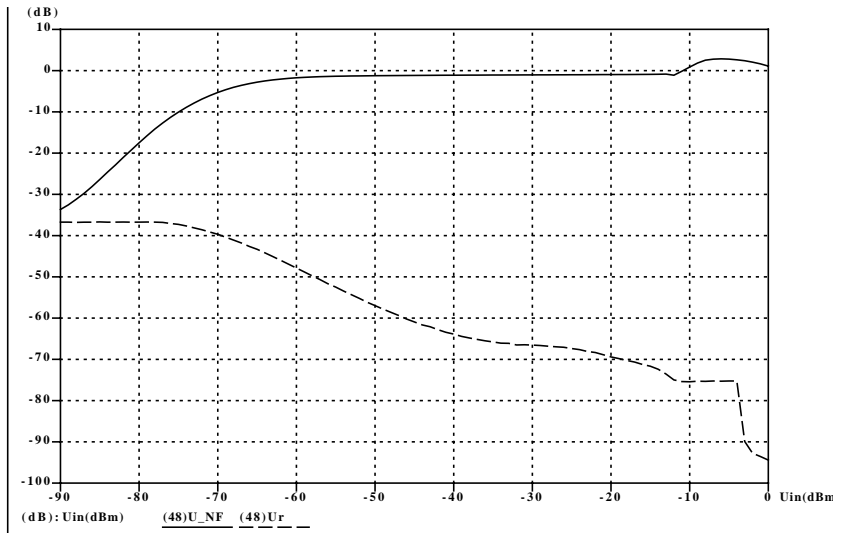
as a function of input signal



Intermod.eps

### 5.2.3 Typical AM AF S/N

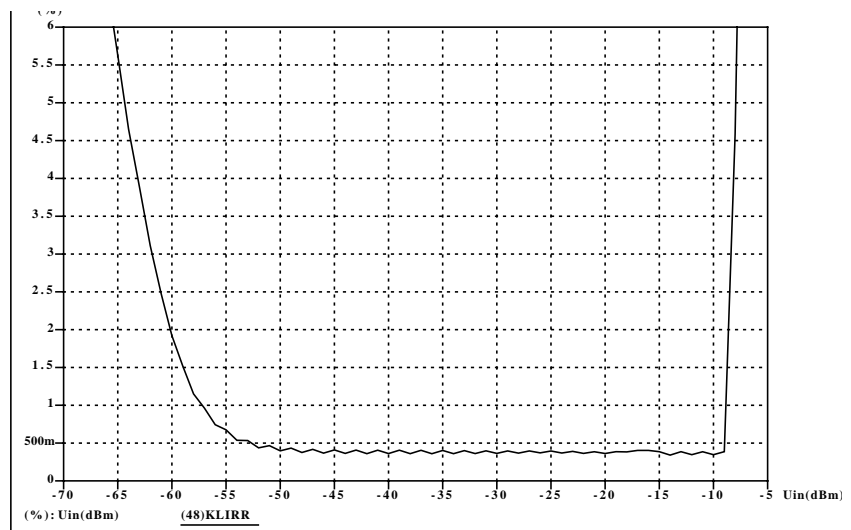
as a function of input signal



Amnfsn.eps

### 5.2.4 Typical AM Audio THD

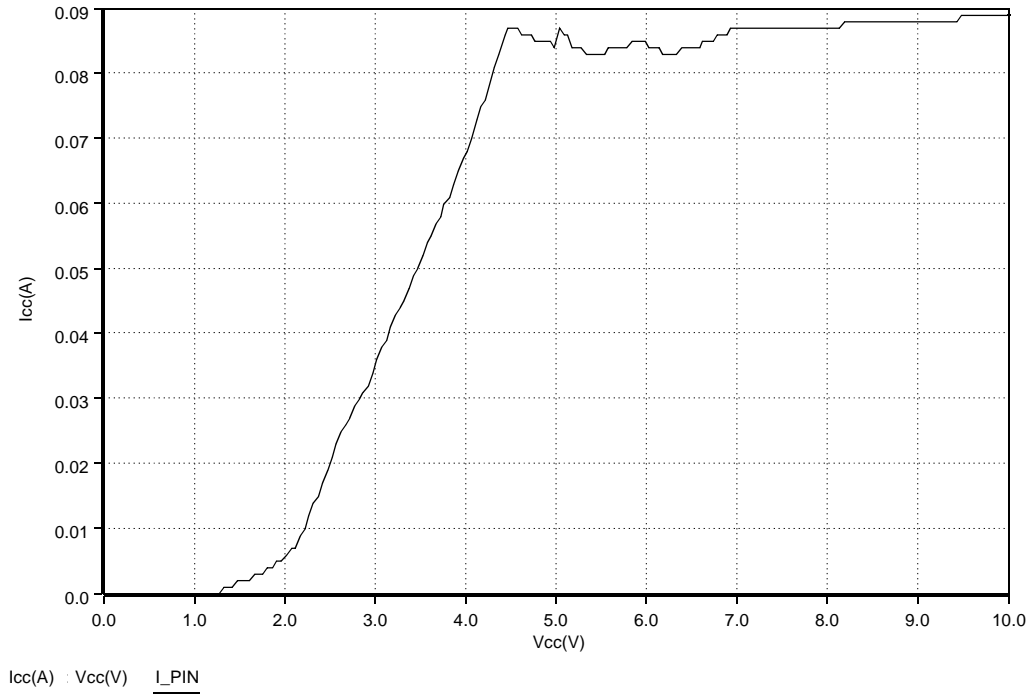
as a function of input signal : m=80%



nflk1rrf.eps

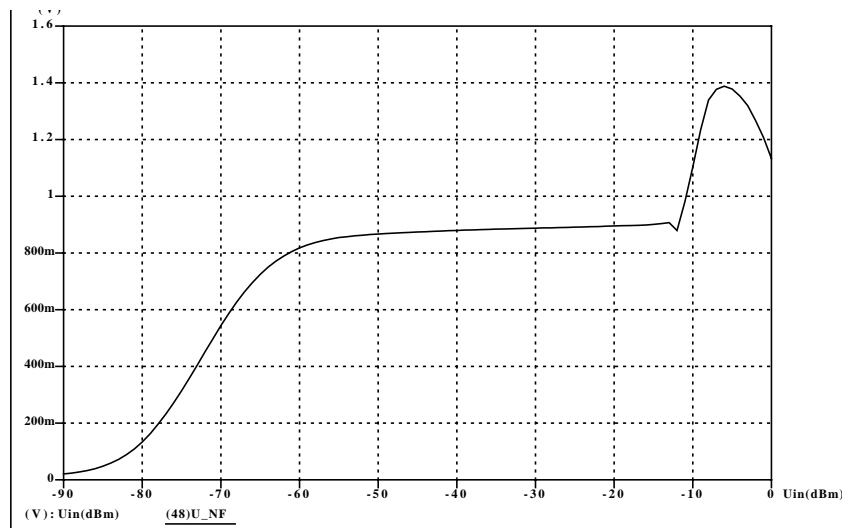
### 5.2.5 Typical DC-current consumption

as a function of VCC



### 5.2.6 Typical AF amplitude

as a function of input signal m=80%



nfpegel.eps