



## Wireless Components

Multistandard VIF-PLL

TDA 6930 Version 1.0

Specification August 1999

|                                                 |                                 |                                              |
|-------------------------------------------------|---------------------------------|----------------------------------------------|
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|                                                 |                                 |                                              |

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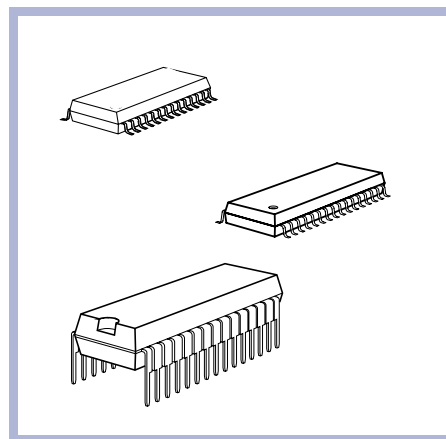
## Product Info

### 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 |

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# 2

## Product Description

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## 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

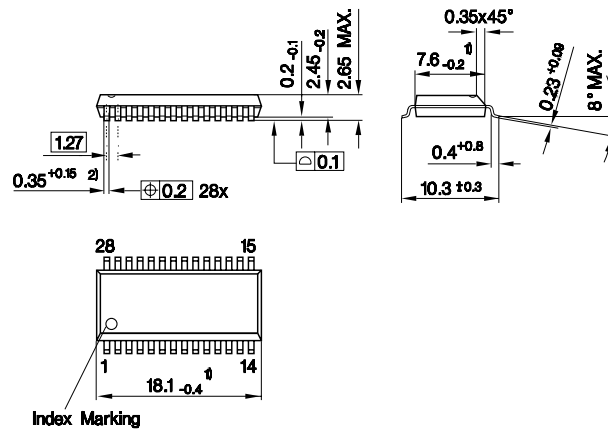
- FPLL carrier regeneration from sound channel without nyquist slope for best sound S/N and pulse response
- Choice of 2 VIF / SIF switchable inputs
- intercarrier operation possible
- separate AM-AF demodulator channel without external components
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- adjustable tuner AGC
- Low operating voltage of 7.5 V
- precision internal bandgap reference
- Fully ESD protected

## 2.3 Application

- Television sets
- VTR sets

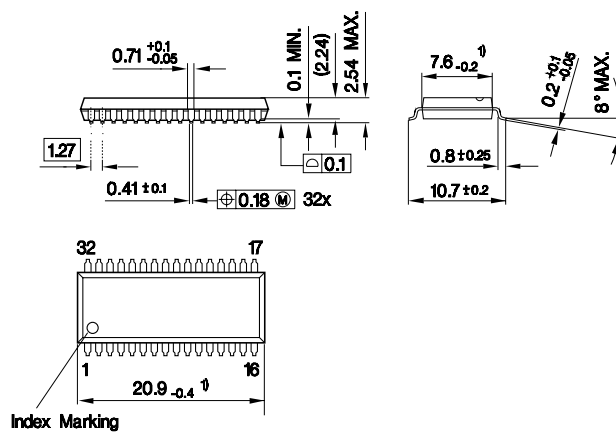
## 2.4 Package Outlines

P-DSO-28:



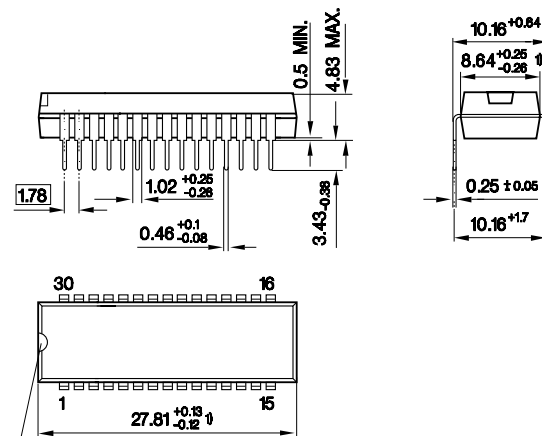
- 1) Does not include plastic or metal protrusion of 0.15 max. per side
- 2) Does not include dambar protrusion of 0.05 max. per side

P-DSO-32:



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

S-DIP-30:



Index Marking

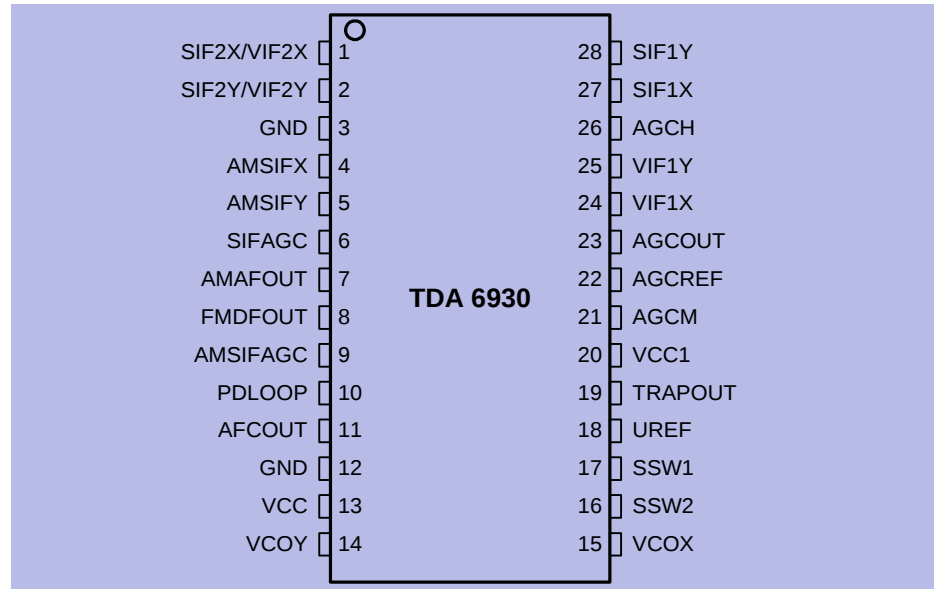
1) Does not include plastic or metal protrusion of 0.25 max. per side

# 3 Functional Description

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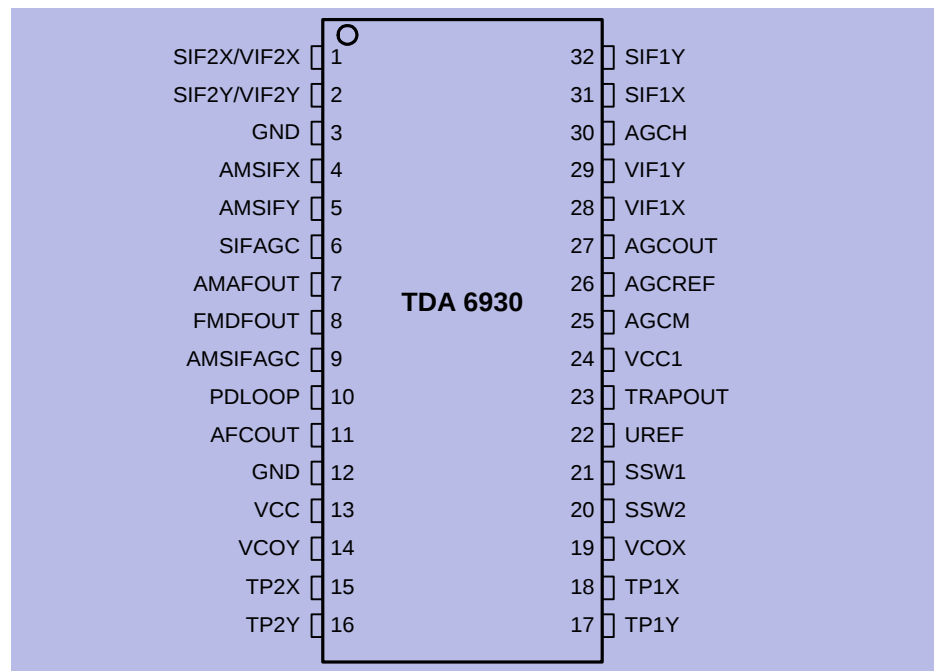
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### 3.1 Pin Configuration



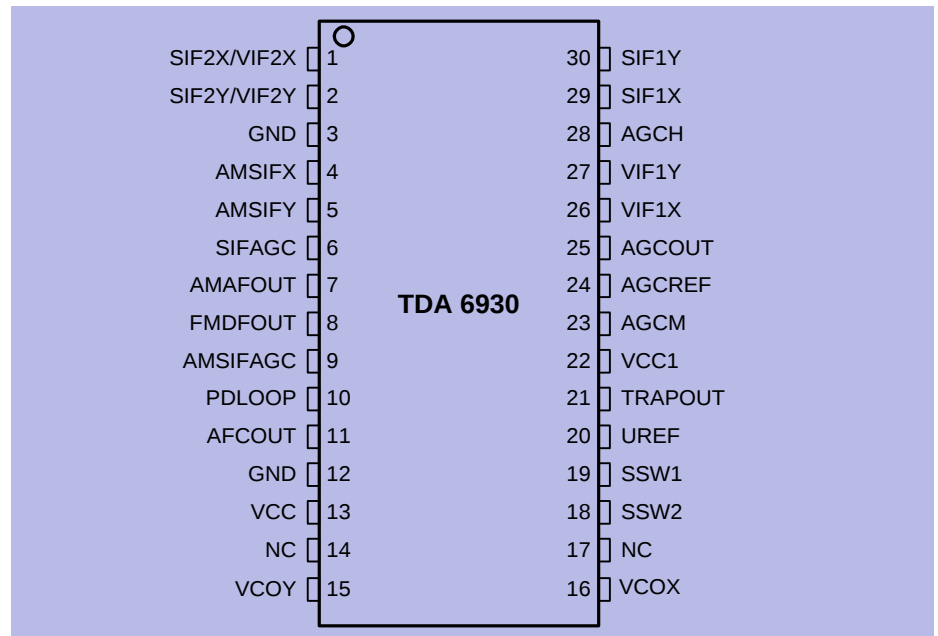
Pin\_config\_1.wmf

Figure 3-1 Pin Configuration P-DSO-28



Pin\_config\_2.wmf

Figure 3-2 Pin Configuration P-DSO-32



Pin\_config\_3.wmf

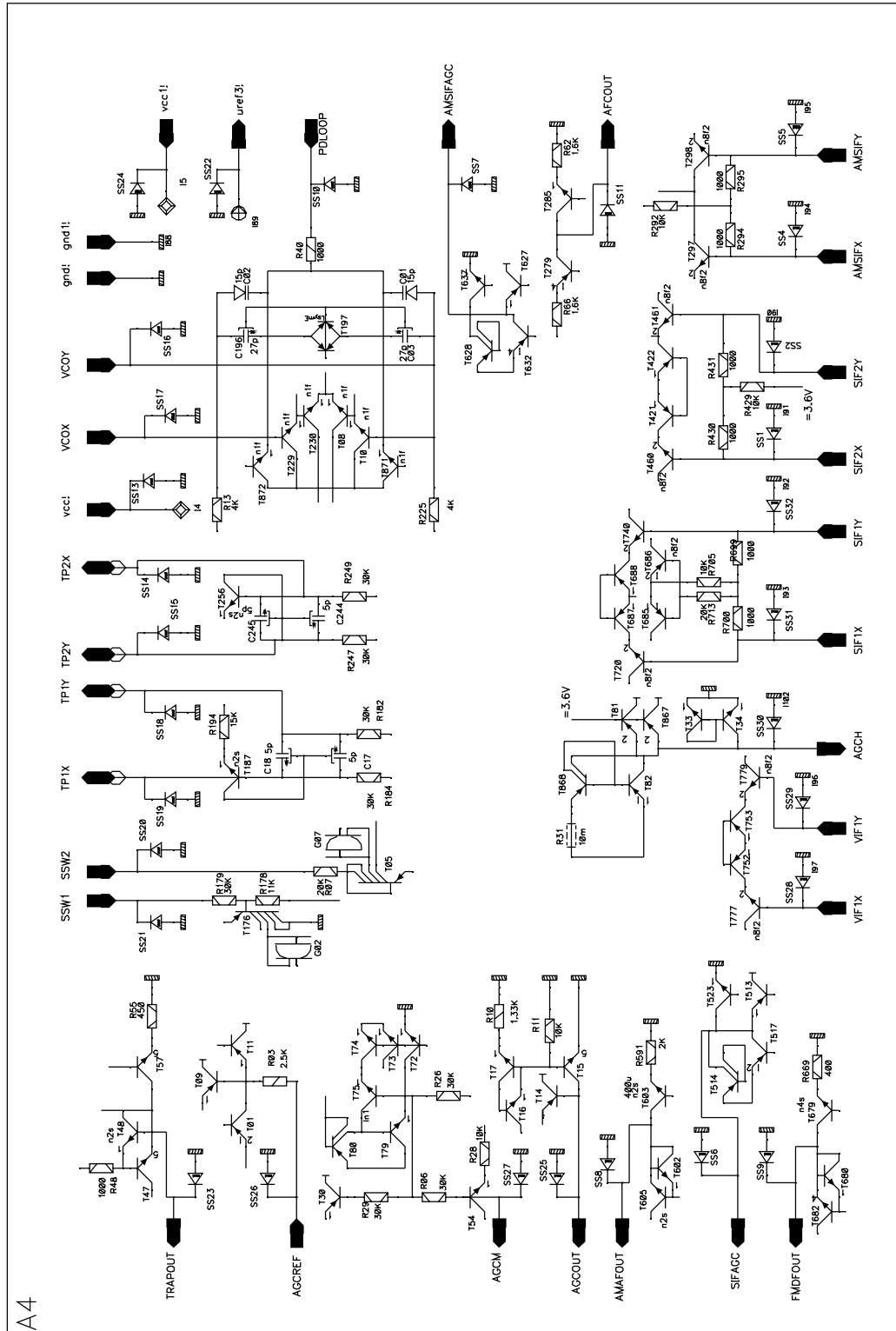
Figure 3-3 Pin Configuration S-DIP-30

## 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<br>Video IF2 / Carrier differential input signal |
| SIF2Y/VIF2Y | 2        | 2        | 2        |                                                                                                |
| 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 $2*f_{pc}$                                                           |
| 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 $2*f_{pc}$                                                           |
| 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



### 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 destortion 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  $+180^\circ$  to  $-180^\circ$ .

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  $90^\circ$ -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)

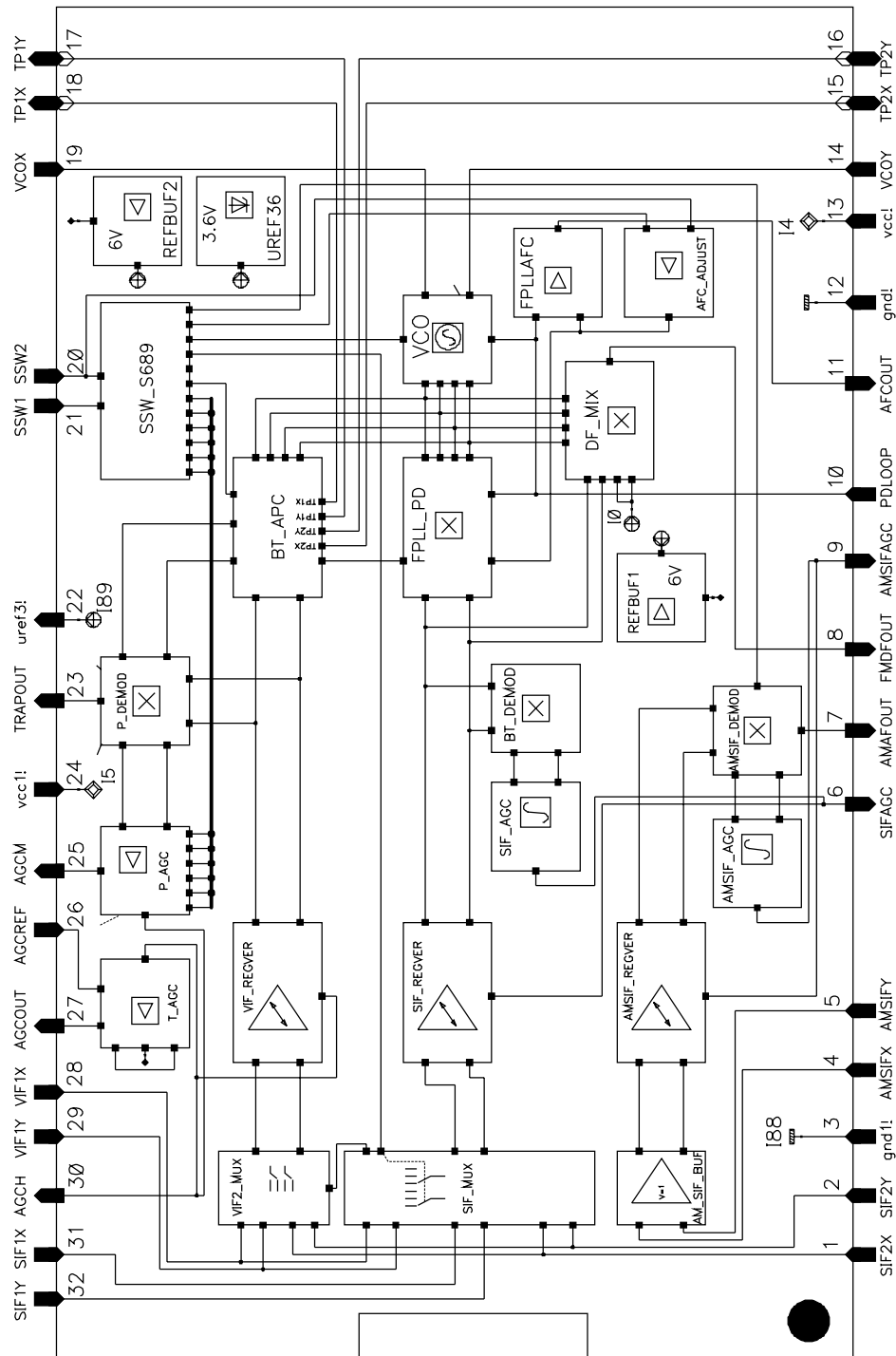


Figure 3-4 Block Diagram (P-DSO-32)

Block.ps

# 4 Applications

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## 4.1 Circuits

### 4.1.1 Application Circuit P-DSO-28

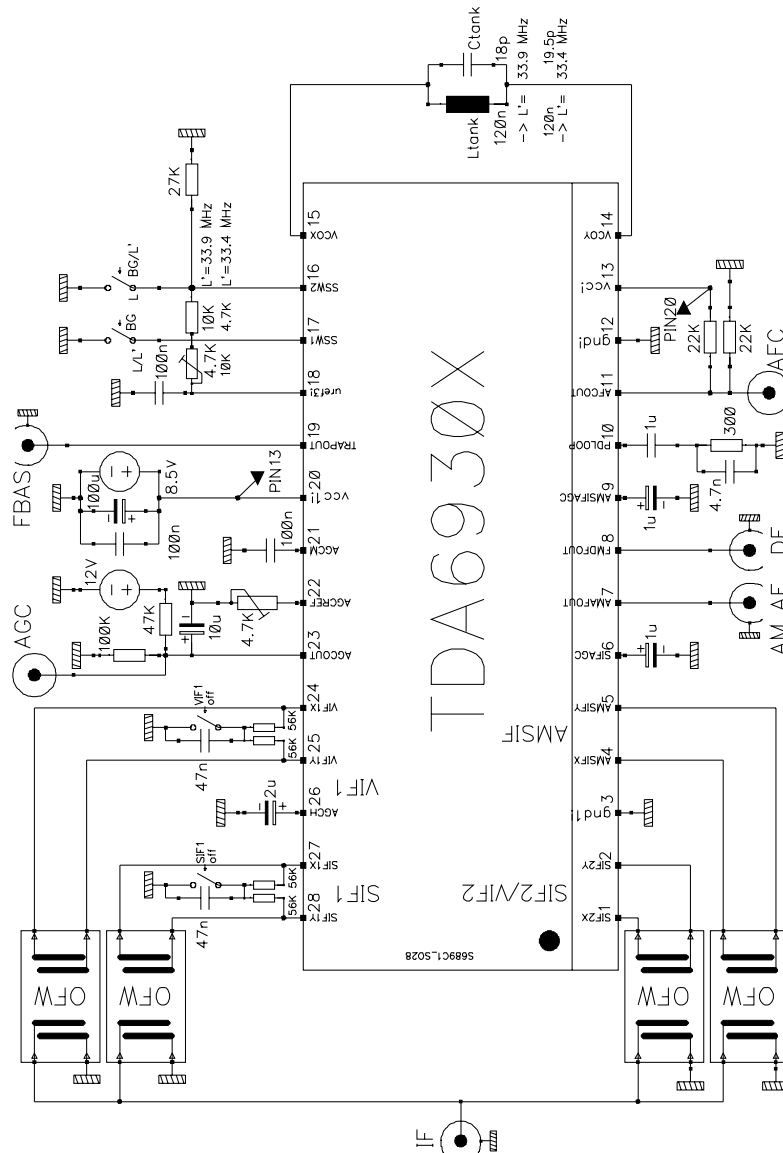


Figure 4-1 Application Circuit P-DSO-28

Apliso28.ps

### 4.1.2 Application Circuit P-DSO-32

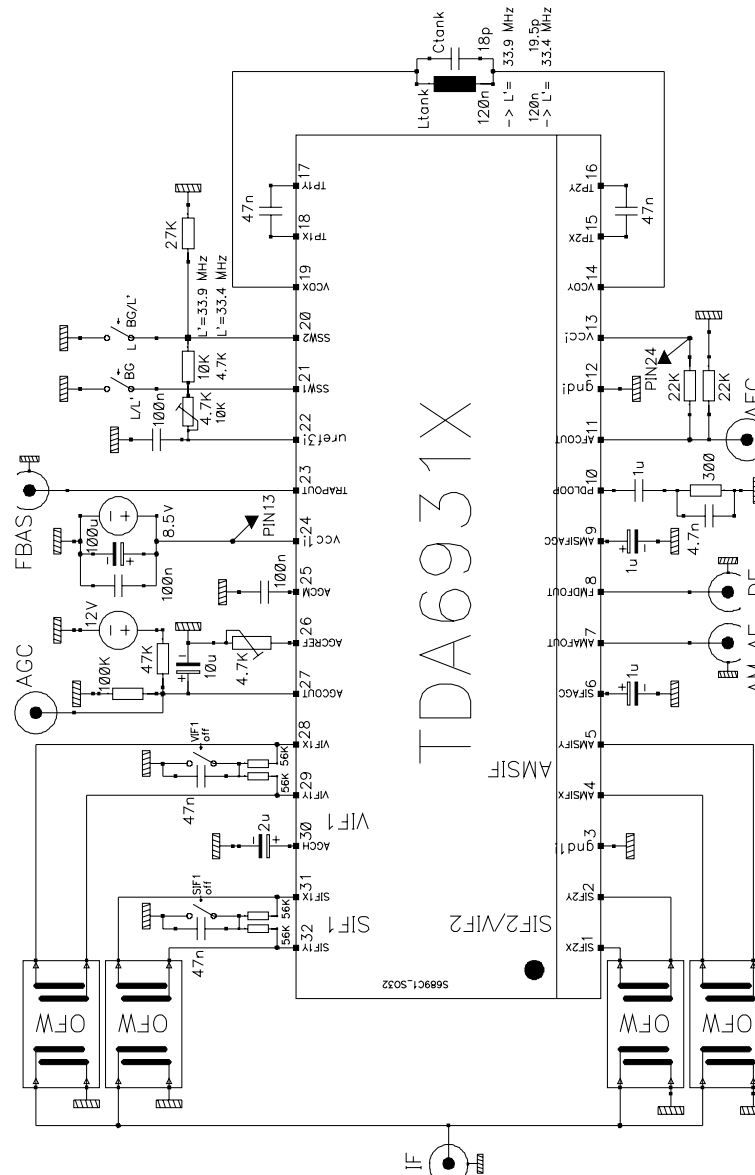


Figure 4-2 Application Circuit P-DSO-32

Apllso32.eps

### 4.1.3 Application Circuit S-DIP-30

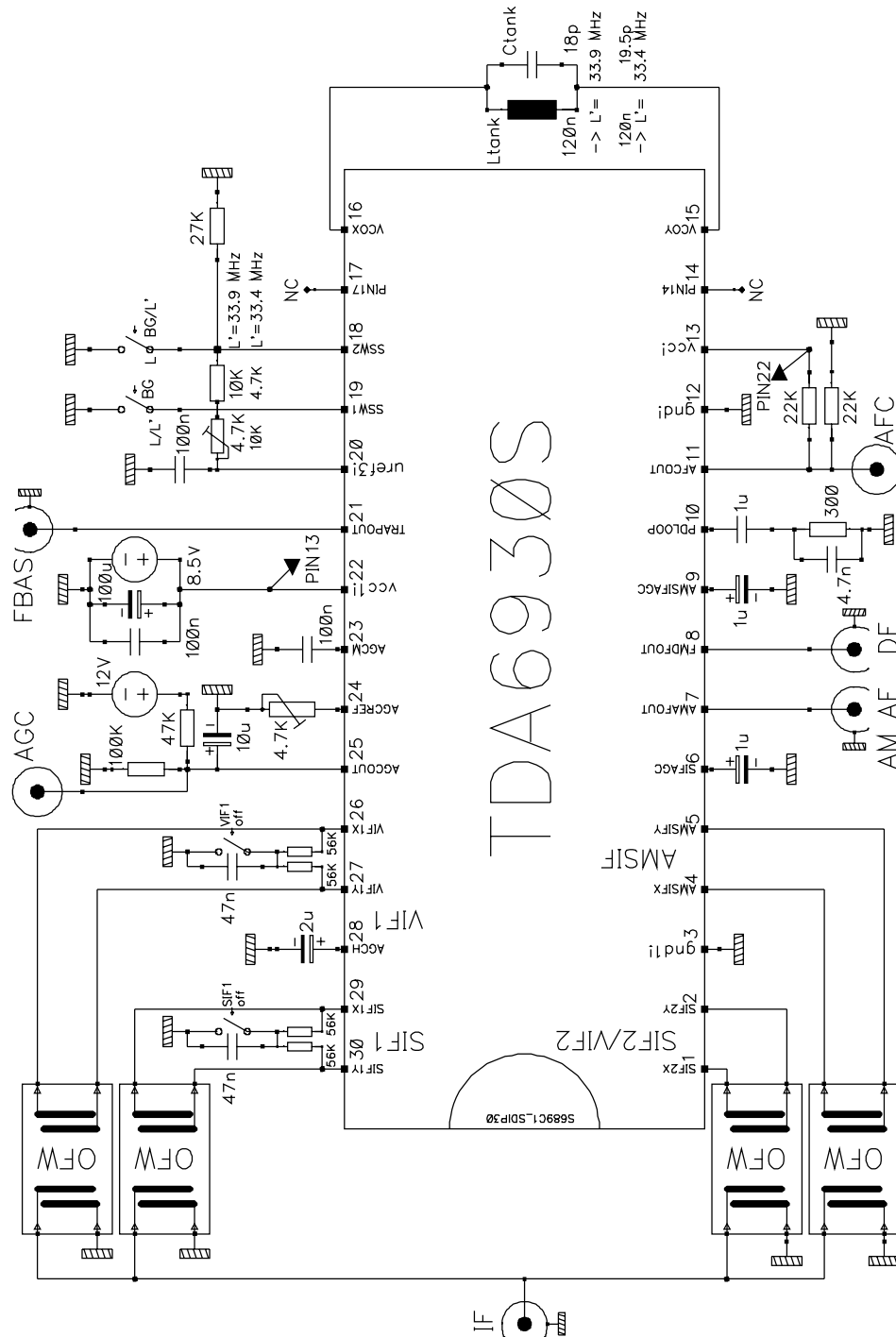


Figure 4-3 Application Circuit S-DIP-30

AplIso32.eps

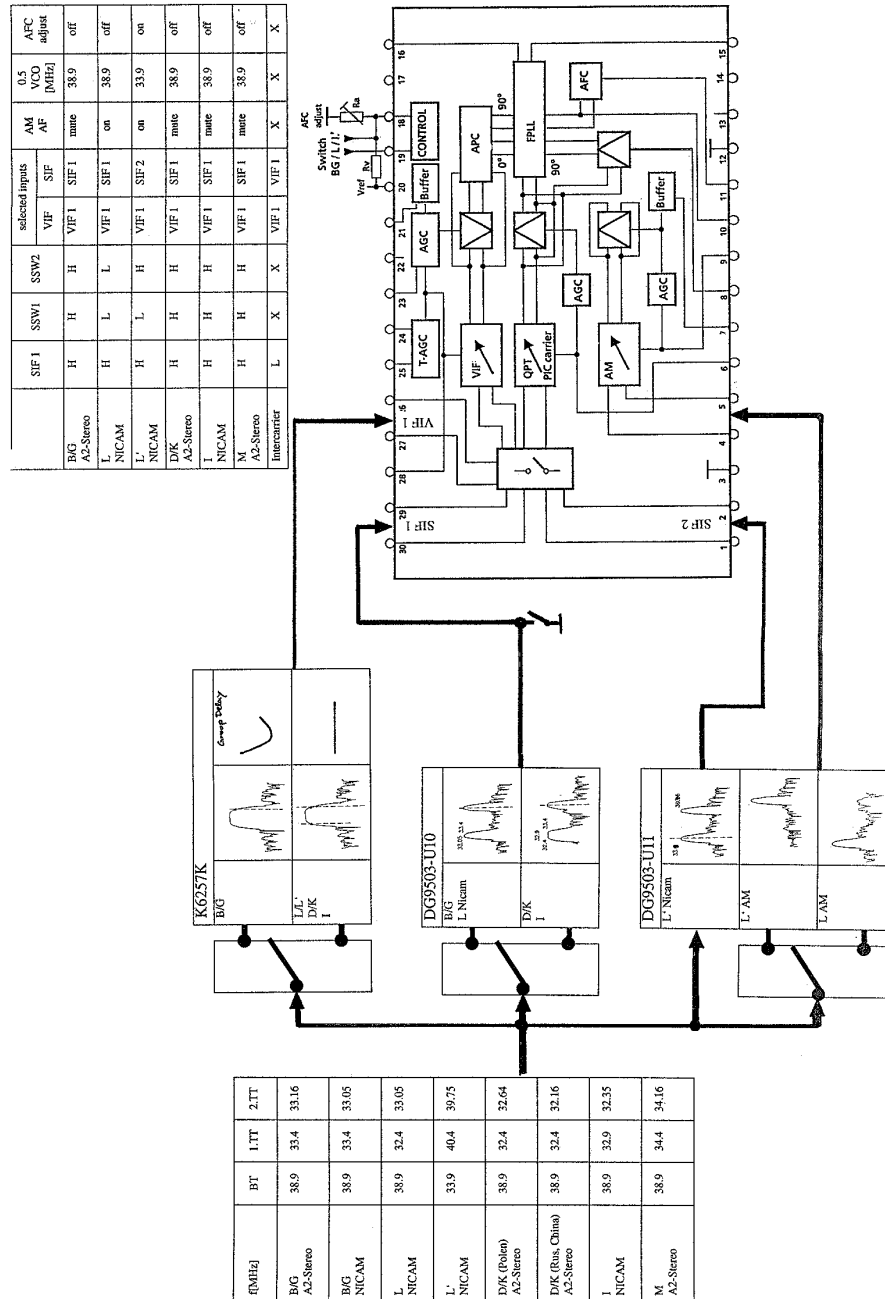
## 4.2 Hints

table1: input selection logic

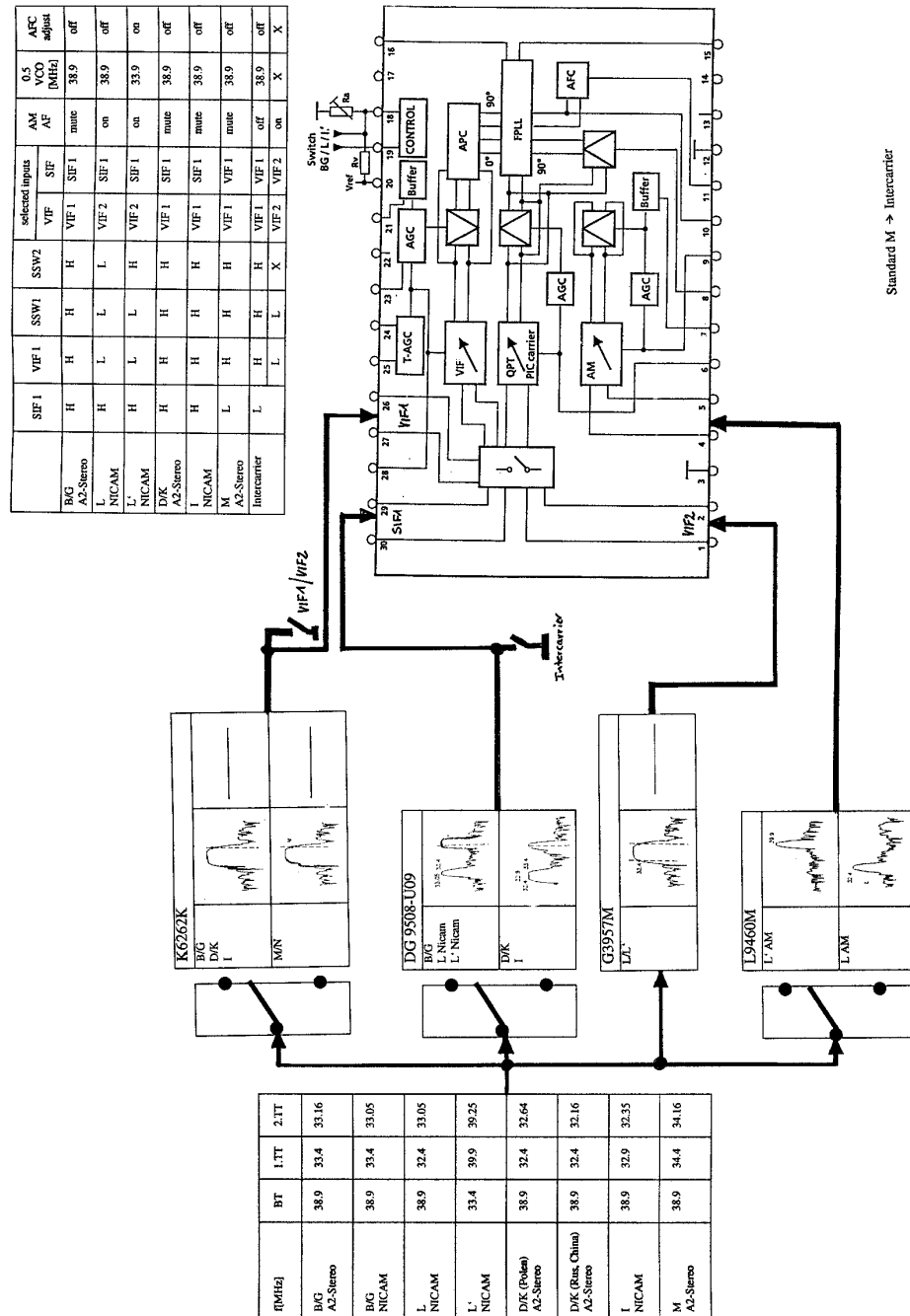
| SIF1 | VIF1 | SSW1 | SSW2 | VCO*<br>MHz | selected inputs <sup>2</sup> |      | modulation | AGC-type / ratio            | AM<br>AF | AFC<br>adjust | norm         |       |
|------|------|------|------|-------------|------------------------------|------|------------|-----------------------------|----------|---------------|--------------|-------|
|      |      |      |      |             | 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=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



## 4.2.2 Typical input-filter concept 2



Grundig1.tif

### 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

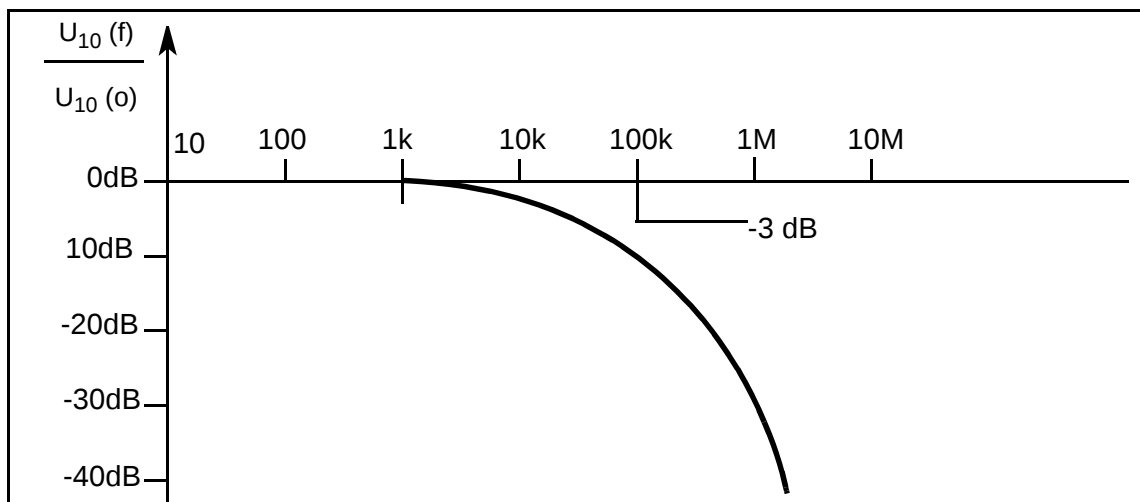
At the desired IF-frequency the AFC-output current has to be zero. Therefore the voltage at that pin will be  $V_s/2$ . This is achieved by adjusting 1st the coil, 2nd Ra for L' mode.

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

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

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

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

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

with tank circuit: 120 nH || 18 pF

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

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

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

Values:

With the recommended tank circuit and loopfilter

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

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

$$\text{Damping factor: } \nu = 8.5$$

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

# 5

## Reference

### Contents of this Chapter

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## 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<br>HBM ( R=1.5k $\Omega$ , 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<br>VIF, SIF , AMSIF | f <sub>in</sub>                    | 12                        | 60                    | MHz  |                 |   |      |
| IF-input AC-voltages                         | V                                  | 50 $\mu$ V <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  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 8.5\text{ V}$

|                                | Symbol                            | Limit Values |     |     | Unit | Test Conditions                                        | L | Item |
|--------------------------------|-----------------------------------|--------------|-----|-----|------|--------------------------------------------------------|---|------|
|                                |                                   | min          | typ | max |      |                                                        |   |      |
| Power Supply                   |                                   |              |     |     |      |                                                        |   |      |
| Total current consumption      | I <sub>CC</sub> +I <sub>CC1</sub> |              | 90  |     | mA   | R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf              |   |      |
| Reference voltage              | V <sub>uref3!</sub>               | 5.7          | 6.0 | 6.3 | V    | R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf              |   |      |
| Reference voltage              | I <sub>uref3!</sub>               |              |     | 2   | mA   |                                                        |   |      |
| Norm switches                  |                                   |              |     |     |      |                                                        |   |      |
| H Level                        | V <sub>SSW</sub>                  | 2            |     | 5   | V    |                                                        |   |      |
| L Level                        | V <sub>SSW</sub>                  | 0            |     | 1   | V    |                                                        |   |      |
| external load at SSW2 if high  | I <sub>SSW2</sub>                 |              |     | 1   | %    | of resistor divider current                            |   |      |
| IF inputs                      |                                   |              |     |     |      |                                                        |   |      |
| DC level                       | V <sub>IF</sub>                   | 3.4          | 3.6 | 3.8 | V    | V <sub>IF</sub> = 0 V <sub>pp</sub>                    |   |      |
| Mono / Intercarrieractive      | I <sub>SIF1</sub>                 | 100          |     | 400 | μA   | R <sub>Gnd</sub> < 27 kΩ                               |   |      |
| 2nd. IF input VIF2 aktive      | I <sub>VIF1</sub>                 | 100          |     | 400 | μA   | R <sub>Gnd</sub> < 27 kΩ                               |   |      |
| VCO                            |                                   |              |     |     |      |                                                        |   |      |
| Tank circuit, DC level         | V <sub>VCO</sub>                  |              | 2.6 |     | V    |                                                        |   |      |
| Loopfilter voltage             | V <sub>PDloop</sub>               | 2.3          |     | 5   | V    | dependant on input frequency                           |   |      |
| Peak - detector VIF-AGC        |                                   |              |     |     |      |                                                        |   |      |
| Voltage range                  | V <sub>AGCH</sub>                 | 0            |     | 3.6 | V    | dependant on input amplitude                           |   |      |
| AGC time constant B/G standard |                                   |              |     |     |      |                                                        |   |      |
| Charge current                 | I <sub>AGCH</sub>                 |              | 1   |     | mA   | V <sub>AGCH</sub> = 2V,<br>V <sub>TRAPOUT</sub> < 1.0V |   |      |
| Discharge current              | I <sub>AGCH</sub>                 |              | 12  |     | μA   | V <sub>AGCH</sub> = 2V,<br>V <sub>TRAPOUT</sub> > 2.0V |   |      |
| Charge / discharge ratio       | AGCH                              |              | 83  |     |      |                                                        |   |      |

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                |        |                                                                    |   |      |
| AGC time constant with L-Standard or Mac Standard |                        |                |                        |                    |        |                                                                    |   |      |
| Charge current                                    | I <sub>AGCH</sub>      |                | 1                      |                    | mA     | V <sub>AGCH</sub> = 2V,<br>V <sub>TRAPOUT</sub> > 3.0V             |   |      |
| Discharge current                                 | I <sub>AGCH</sub>      |                | 120                    |                    | nA     | V <sub>AGCH</sub> =2V,<br>V <sub>TRAPOUT</sub> = 2.5V              |   |      |
| Discharge current<br>( under average control )    | I <sub>AGCH</sub>      |                | 100                    |                    | μA     | V <sub>AGCH</sub> = 2V,<br>V <sub>TRAPOUT</sub> < 1.0V             |   |      |
| Charge / discharge ratio                          | AGCH                   |                | 8300                   |                    |        |                                                                    |   |      |
| Envelope - detector AGCs                          |                        |                |                        |                    |        |                                                                    |   |      |
| Voltage range                                     | V <sub>SIFAgcs</sub>   | 0.2            |                        | 2.9                | V      | dependant on input<br>amplitude                                    |   |      |
| Charge / discharge current                        | ± I <sub>SIFAgcs</sub> |                | 1.5                    |                    | μA     | V <sub>SIFAgcs</sub> = 1.5 V                                       |   |      |
| Quick charge                                      | I <sub>SIFAgcs</sub>   |                | 1.5                    |                    | mA     | V <sub>SIFAgcs</sub> = 1.5 V                                       |   |      |
| Video output                                      |                        |                |                        |                    |        |                                                                    |   |      |
| Output current                                    | - I <sub>Trapout</sub> |                | 0.84                   |                    | mA     | V <sub>AGCM</sub> = Vsync +0.7<br>V <sub>VIF</sub> =Carrier nomod. |   |      |
| Sync pulse level                                  | V <sub>Trapout</sub>   |                | 1.25                   |                    | V      |                                                                    |   |      |
| White level                                       | V <sub>Trapout</sub>   |                | 2.75                   |                    | V      |                                                                    |   |      |
| AM output                                         |                        |                |                        |                    |        |                                                                    |   |      |
| DC level (L, L')                                  | V <sub>AMAFout</sub>   | 3.2            | 3.6                    | 4.0                | V      | SC <sub>nomod.</sub>                                               |   |      |
| DC level (AM inactive )                           | V <sub>AMAFout</sub>   | high impedance |                        |                    |        |                                                                    |   |      |
| DF output                                         |                        |                |                        |                    |        |                                                                    |   |      |
| DC level                                          | V <sub>FMDFout</sub>   | 2.8            | 3.4                    | 4.0                | V      |                                                                    |   |      |
| Output current                                    | I <sub>FMDFout</sub>   |                | 2.5                    |                    | mA     | V <sub>FMDFout</sub> =<br>DC level +0.7V                           |   |      |
| AFC output                                        |                        |                |                        |                    |        |                                                                    |   |      |
| Voltage range                                     | V <sub>AFCout</sub>    | 1V             |                        | V <sub>S</sub> -1V | V      |                                                                    |   |      |
| Output current                                    | I <sub>AFCout</sub>    |                | 250                    |                    | μA     | V <sub>AFC</sub> = V <sub>cc</sub> / 2                             |   |      |
| Voltage at centerfrequency                        | V <sub>AFCout</sub>    |                | V <sub>cc</sub> /<br>2 |                    | V      | 1:1 V <sub>cc</sub> divider                                        |   |      |
| Slope                                             | I <sub>AFCout</sub>    |                | 0.7                    |                    | μA/kHz |                                                                    |   |      |
| AFC - adjust                                      | V <sub>SSW2</sub>      | 3              |                        | 5                  | V      | switch at SSW2:<br>high impedance                                  |   |      |

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  |                   |                                                                                                                                                   |   |      |
| Tuner AGC                                                                                                                                                                   |                        |              |          |      |                   |                                                                                                                                                   |   |      |
| Max. output current<br>max. 1ms                                                                                                                                             | I <sub>AGCOUT</sub>    | 10           | 18       | 30   | mA                | V <sub>AGCOUT</sub> = 4V<br>R <sub>AGCOUT</sub> = 0 Ω                                                                                             |   |      |
| Min. output current                                                                                                                                                         | I <sub>AGCOUT</sub>    | 0            |          | 10   | μA                | V <sub>AGCOUT</sub> = VCC1<br>V <sub>AGCREF</sub> = max                                                                                           |   |      |
| Output short current                                                                                                                                                        | I <sub>AGCOUT</sub>    | 150          | 200      | 250  | μA                | V <sub>AGCOUT</sub> = 0 V<br>R <sub>AGCOUT</sub> = ∞                                                                                              |   |      |
| Min. output voltage                                                                                                                                                         | V <sub>AGCOUT</sub>    | 0.2          | 0.3      | 0.5  | V                 | R <sub>AGCOUT</sub> = ∞                                                                                                                           |   |      |
| IF inputs                                                                                                                                                                   |                        |              |          |      |                   |                                                                                                                                                   |   |      |
| Control range                                                                                                                                                               | Δ V <sub>VIF,SIF</sub> | 54           | 60       |      | dB                |                                                                                                                                                   |   |      |
| Min. input voltage                                                                                                                                                          | V <sub>VIF,SIF</sub>   |              | 120      | 180  | μV <sub>rms</sub> | V <sub>Trapout</sub> = -3 dB                                                                                                                      |   |      |
| AGC range                                                                                                                                                                   | Δ V <sub>AMSIF</sub>   | 54           | 60       |      | dB                |                                                                                                                                                   |   |      |
| Min. input voltage                                                                                                                                                          | V <sub>AMSIF</sub>     |              | 120      | 180  | μV <sub>rms</sub> | V <sub>AMAFout</sub> = -3 dB                                                                                                                      |   |      |
| Video output , VIF OFW G1962M sound shelf -20 dB                                                                                                                            |                        |              |          |      |                   |                                                                                                                                                   |   |      |
| Signal level                                                                                                                                                                | V <sub>Trapout</sub>   | 1.25         | 1.5      | 1.75 | V <sub>pp</sub>   | B/G norm                                                                                                                                          |   |      |
| Video bandwidth                                                                                                                                                             | f <sub>-1dB</sub>      | 7            | 8        |      | MHz               | V <sub>Trapout</sub> = -1 dB                                                                                                                      |   |      |
| Differential Gain                                                                                                                                                           | DG                     |              | 4        |      | %                 | R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf                                                                                                         |   |      |
| Differential Phase                                                                                                                                                          | DP                     |              | 1.5      |      | deg               | R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf                                                                                                         |   |      |
| Intermodulation<br>f <sub>1</sub> = 4.52MHz, PC modulated from black to white,<br>f <sub>2</sub> = 5.50 MHz, SC -13 dB to unmodulated PC                                    | @IM                    |              | 62       |      | dB                | f = 980 KHz<br>Levels at Trapout<br>f <sub>1</sub> = - 2.0 dB<br>f <sub>2</sub> = - 13 dB<br>R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf            |   |      |
| Intermodulation<br>f <sub>1</sub> = 4.4MHz, -13.2 dB to PC sync level, -10 dB to PC modulated from black to white,<br>f <sub>2</sub> = 5.50 MHz, SC -7 dB to unmodulated PC | @IM                    |              | 69       |      | dB                | f = 1.1 MHz<br>Levels at IF input<br>f <sub>1</sub> =-13.2dB to sync<br>f <sub>2</sub> =-27 dB to PC<br>R <sub>L</sub> >1MΩ,C <sub>L</sub> <1.5pf |   |      |
| S/N CCIR Unified WTD<br>S/N CCIR 567 Unweighted                                                                                                                             |                        | 60<br>55     | 65<br>59 |      | dB<br>dB          | V <sub>IF</sub> = max.<br>black & white                                                                                                           |   |      |
| residual vision carrier                                                                                                                                                     | V <sub>Trapout</sub>   |              | 500      |      | μV <sub>rms</sub> | R <sub>L</sub> >1M,f=38.9MHz                                                                                                                      |   |      |
| residual VCO carrier                                                                                                                                                        | V <sub>Trapout</sub>   |              | 350      |      | μV <sub>rms</sub> | R <sub>L</sub> >1M,f=77.8MHz                                                                                                                      |   |      |

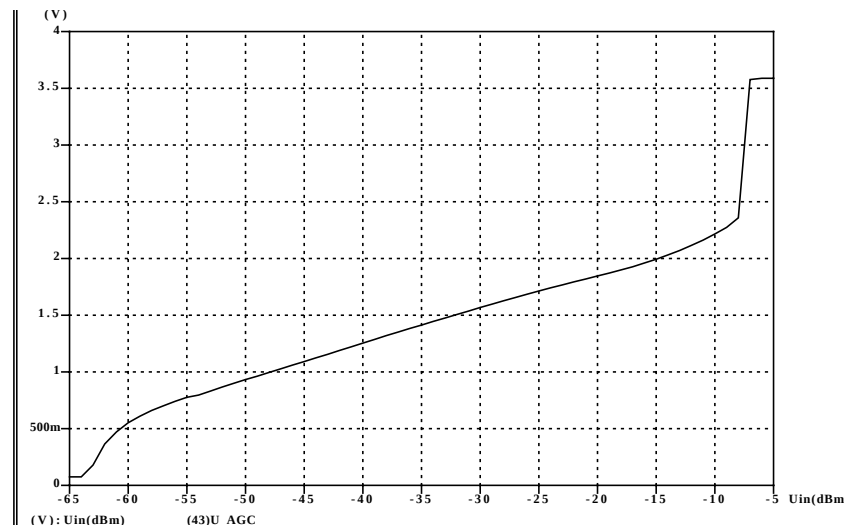
Table 5-3 AC/DC Characteristics with  $T_A$  25 °C,  $V_{CC}$  = 8.5 V (continued)

|                                                                | Symbol               | Limit Values |      |      | Unit              | Test Conditions                                | L | Item |
|----------------------------------------------------------------|----------------------|--------------|------|------|-------------------|------------------------------------------------|---|------|
|                                                                |                      | min          | typ  | max  |                   |                                                |   |      |
| DF output                                                      |                      |              |      |      |                   |                                                |   |      |
| Signal level<br>Input wideband trans-<br>former coupled        | V <sub>FMDFout</sub> |              | 100  |      | mV <sub>rms</sub> | SC / PC= -13 dB PC<br>nomod.                   |   |      |
| Output current                                                 | I <sub>FMDFout</sub> |              | 2.5  |      | mA                | V <sub>FMDFout</sub> =<br>DC level +0.7V       |   |      |
| S/N<br>CCIR WTD                                                |                      |              | 58   |      | dB                | PIC=FubK Pattern<br>V <sub>IF</sub> = max.     |   |      |
| AM output : no picture carrier , AM SIF OFW L9453M             |                      |              |      |      |                   |                                                |   |      |
| Signal level                                                   | V <sub>AMAFout</sub> | 700          | 900  | 1100 | mV <sub>rms</sub> | m = 80% , 1kHz                                 |   |      |
| THD total                                                      |                      |              | 0.25 | 0.5  | %                 | m = 30% , 1kHz                                 |   |      |
| THD total                                                      |                      |              | 0.35 | 1.0  | %                 | m = 80% , 1kHz                                 |   |      |
| S/N<br>Quasi Peak CCIR WTD                                     |                      |              | 60   |      | dB                | m = 80% , 1kHz<br>V <sub>AMAFout</sub> = +3 dB |   |      |
| AM output : picture carrier FubK modulation, AM SIF OFW L9453M |                      |              |      |      |                   |                                                |   |      |
| Signal level                                                   | V <sub>AMAFout</sub> | 700          | 900  | 1100 | mV <sub>rms</sub> | 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<br>Quasi Peak CCIR WTD                                     |                      |              | 45   |      | dB                | m = 80% , 1kHz<br>V <sub>AMAFout</sub> = +3 dB |   |      |

## 5.2 Electrical Diagramms

### 5.2.1 Typical VIF AGC voltage characteristic

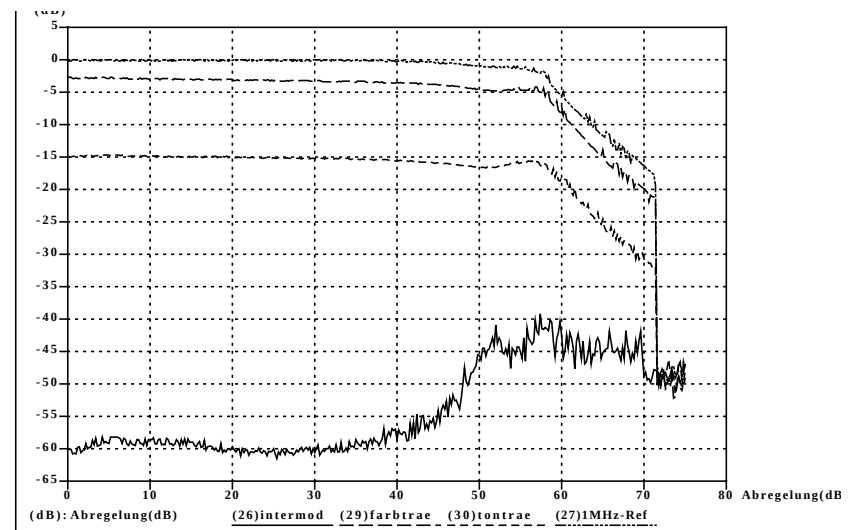
as a function of input signal



pzagc.eps

### 5.2.2 Typical VIF intermodulation

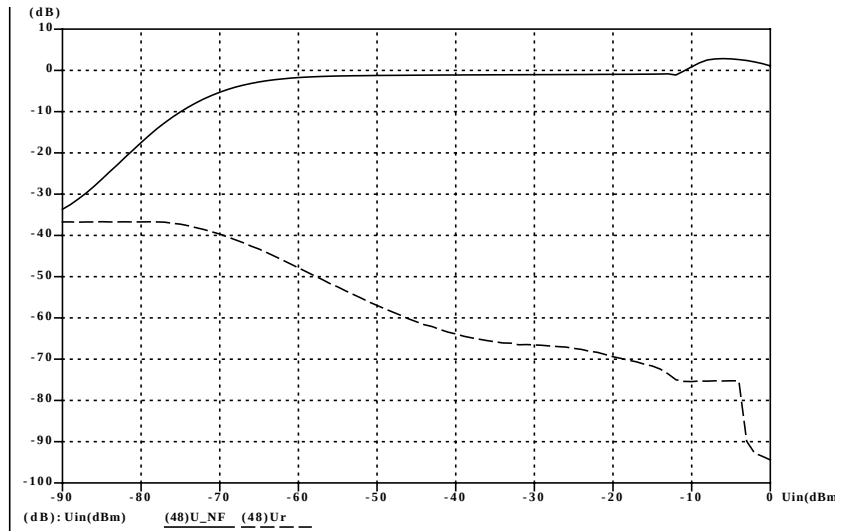
as a function of input signal



Intermod.eps

### 5.2.3 Typical AM AF S/N

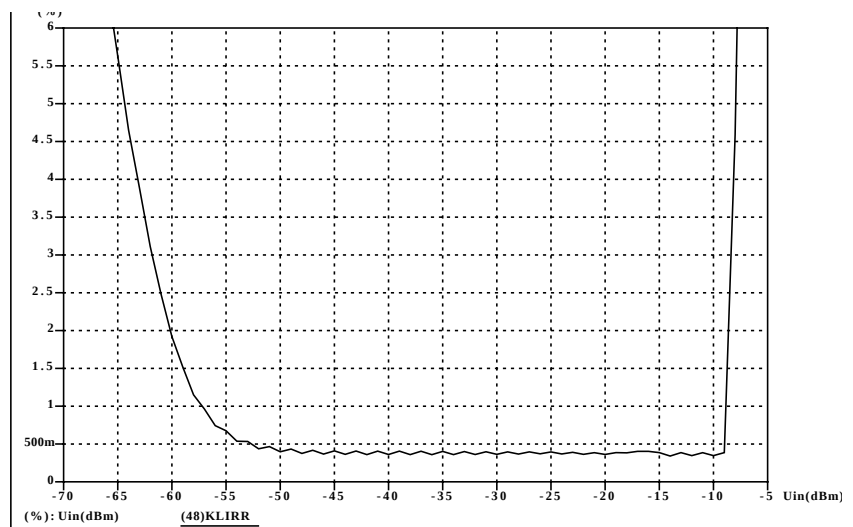
as a function of input signal



Amnfsn.eps

### 5.2.4 Typical AM Audio THD

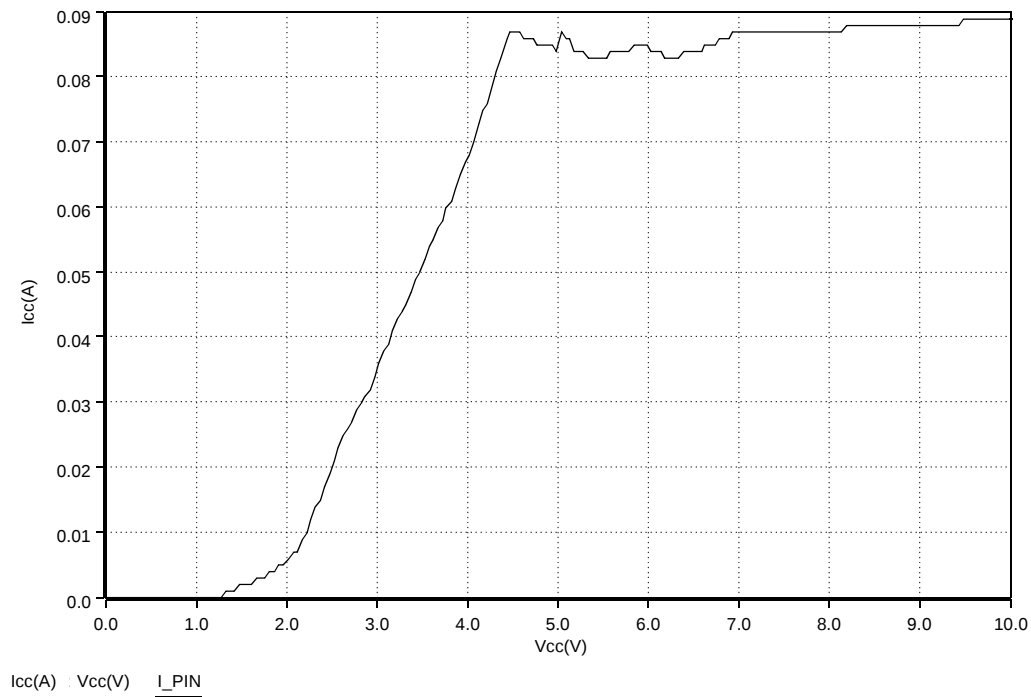
as a function of input signal :  $m=80\%$



nflklrrf.eps

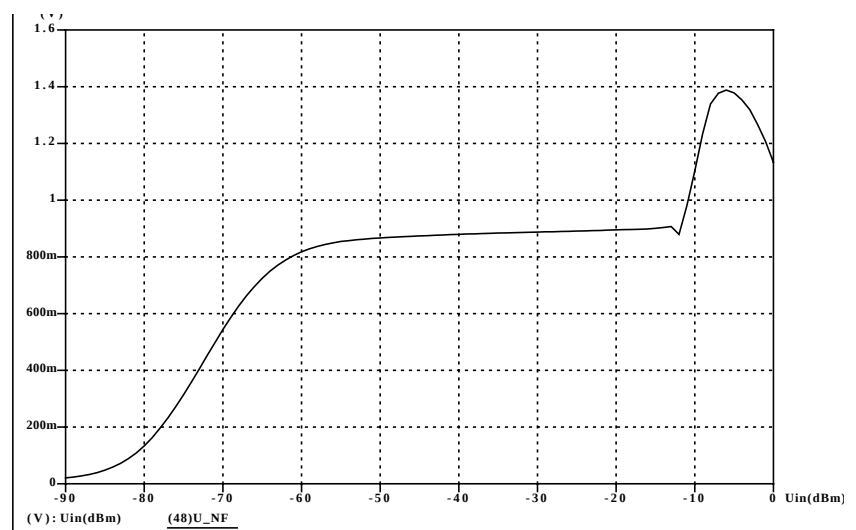
## 5.2.5 Typical DC-current consumption

as a function of VCC



## 5.2.6 Typical AF amplitude

as a function of input signal m=80%



nfpegel.eps