Overview

**TV Front-End Design with ICs TDA 6900/6920/6930**

Three new ICs from Siemens for TV front-ends feature a level of integration that goes well beyond the state of the art. Designers can thus cut costs while increasing functionality.

For TV front-ends, Siemens now offers three matching ICs which cover the full range of video/audio IF processing, demodulation and crossbar switching functions plus stereo and audio processing (**figure 1**). The new chips are:

- the TDA 6930 multistandard video/audio IF stage,
- the TDA 6920 video switch, and
- the TDA 6900 multistandard FM-IF/TV stereo decoder and audio processor.

A front-end system based on these three ICs matches the TUA 6010 single-chip tuner and processes all TV signals found in multistandard applications. The internal interfaces of the chips also match. The TDA 6900 and TDA 6920 are controlled by an I^2C Bus. Two ports are available in the TDA 6900 to control the TDA 6930 and its SAW circuitry. The SAW filters were developed in cooperation with Siemens Matsushita Components.

The three chips can support three full SCART jacks and an S-VHS jack as well as another satellite signal source inside the TV set. Interfaces for other signal processing blocks such as teletext, PIP, equalizers or surround sound are also provided. A key design aim was to reduce the number of external components and tuning operations to a minimum. All three ICs have been implemented in the same bipolar technology with a transit frequency of 4 GHz and thus have the same basic electrical parameters and resistance to ESD.
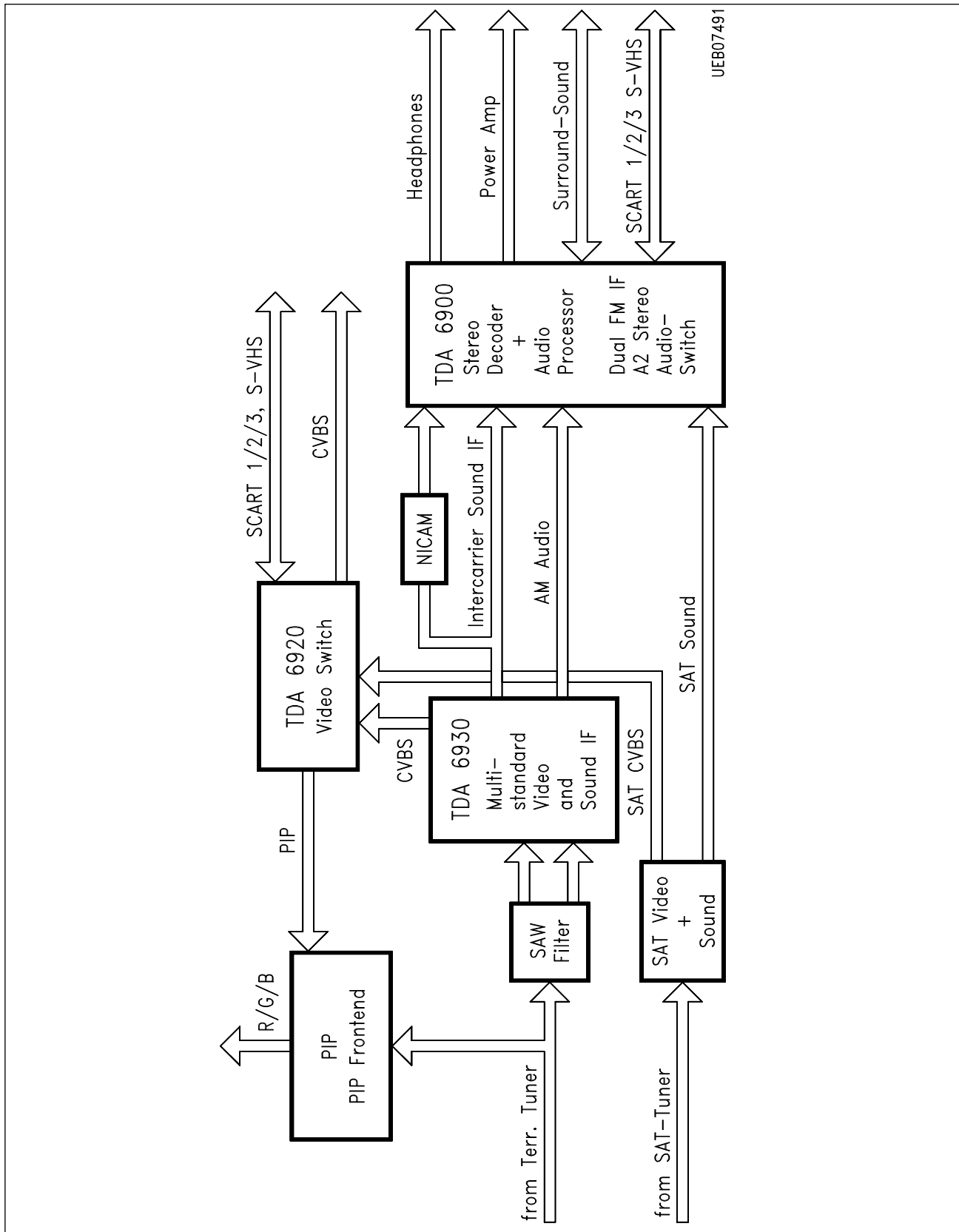
Figure 1
**Functional Diagram of the TV Front-End Concept**

VAKAT

SIEMENS

Stereo Decoder and Audio Processor

TDA 6900 S

Preliminary Data

Features

- High decoding performance of mono/stereo/dual sound
- $2 \times$ FM demodulator on chip
- Interface to NICAM and
- Surround sound
- Compared to digital systems
  - Improved S/N ratio
  - Extended control range
  - Smoother sound control
- 5 Stereo and 1 mono AF input
- 3 Stereo SCART outputs
- Quasi stereo and stereo base width expansion
- Independent headphone control
- I^2C Bus controlled system
- Power-down mode available
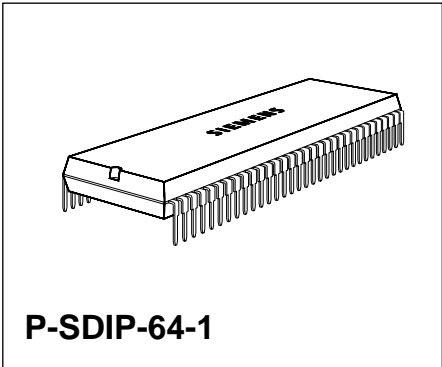
P-SDIP-64-1

Type	Ordering Code	Package
▼ TDA 6900 S	Q67000-A5196	P-SDIP-64-1

▼ New type

Pin Definitions and Functions

Pin No.	Function
1	AF output FM 2
2	Input AF amplifier FM 2
3	Deemphasis left
4	Deemphasis right
5	SCART input 1 left
6	SCART input 1 right
7	SCART input 2 left
8	SCART input 2 right
9	SCART input 3 left
10	SCART input 3 right
11	SCART input 4 left
12	SCART input 4 right
13	SCART input 5 left
14	SCART input 5 right
15	AF input mono
16	SCART output 1 left
17	SCART output 1 right
18	SCART output 2 left
19	SCART output 2 right
20	SCART output 3 left
21	SCART output 3 right
22	Ground
23	AF output left
24	AF input audioprocessor left
25	AF output right
26	AF input audioprocessor right

Pin Definitions and Functions (cont'd)

Pin No.	Function
27	Capacitor loudness left
28	Capacitor loudness right
29	Capacitor quasi-St 1
30	Capacitor quasi-St 2
31	RC network bass left
32	RC network bass left
33	RC network bass right
34	RC network bass right
35	Capacitor treble left
36	Capacitor treble right
37	AF output left (loudspeaker)
38	AF output right (loudspeaker)
39	AF output left (headphones)
40	AF output right (headphones)
41	Pilot tone filter input
42	Pilot tone filter output
43	Identification tone output
44	Identification decoder input
45	Capacitor identification decoder 1
46	Capacitor identification decoder 2
47	7 MHz Crystal oscillator
48	Port output 2
49	Port output 1
50	I^2C Bus SCL
51	I^2C Bus SDA
52	$+ V_S$

Pin Definitions and Functions (cont'd)

Pin No.	Function
53	FM IF input 22
54	FM IF input 21
55	IF-bias 2
56	IF-bias 1
57	FM IF input 11
58	FM IF input 12
59	FM IF input 13
60	FM IF input 14
61	Ground FM IF
62	Bias for AF operating point
63	Input AF amplifier FM 1
64	AF output FM 1
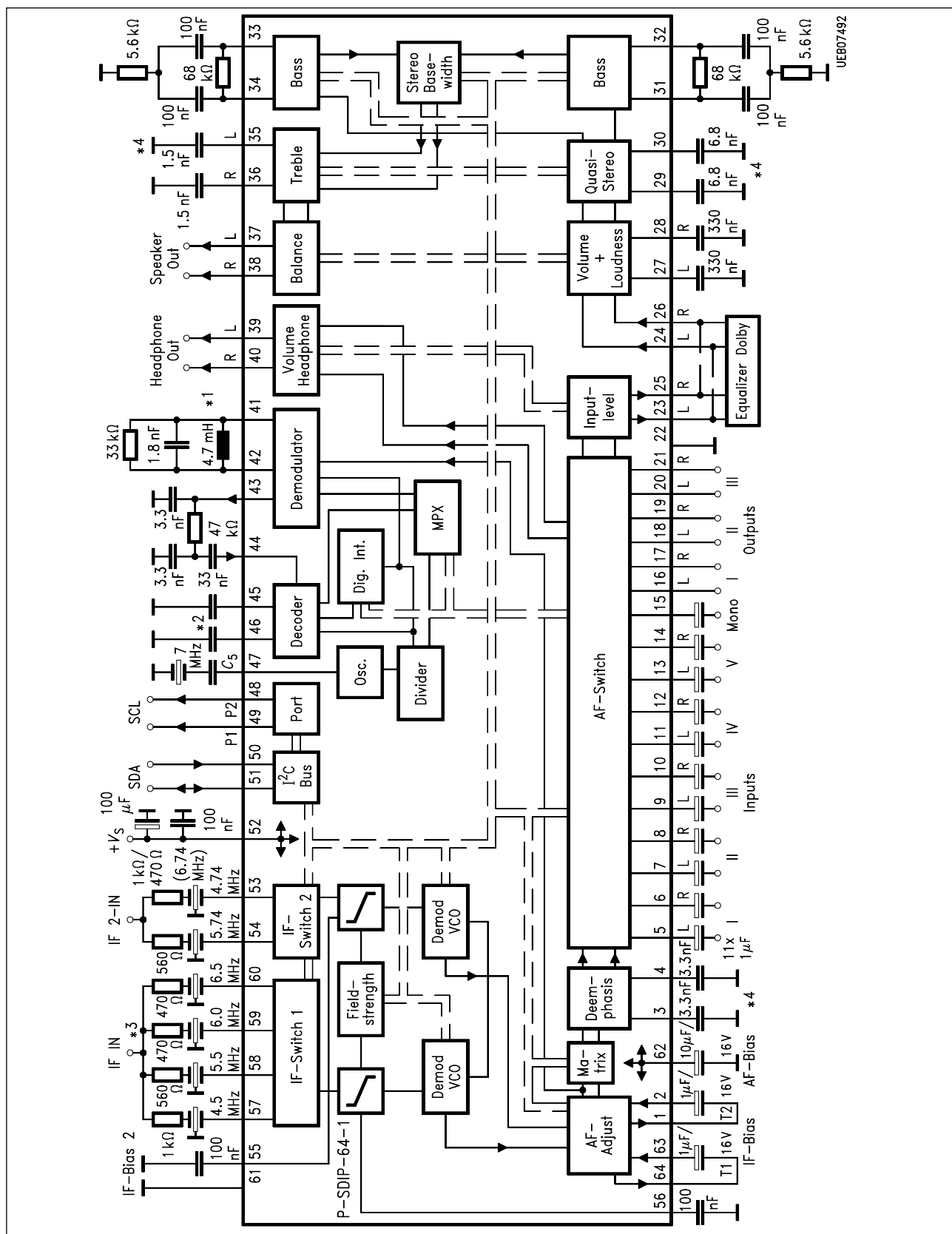
Figure 1
Block Diagram

Function and Application

The TDA 6900 S is a complete system for stereo TV-sound, controlled via I^2C Bus. The device can be divided into four functional blocks:

1. Sound IF Section

    a) Input source selectors
    b) Two FM limiter amplifiers
    c) Multi-standard application for sound standards M, B/G, I, and D/K
    d) Two alignmentfree PLL FM demodulators
    e) Programmable field strength dependent mute control for 2nd sound carrier

2. TV-Identification-Signal-Decoder

    a) Multi-standard operation for G-standard and Korean-standard[1]
    b) Active pilot tone filter
    c) Incoherent pilot tone demodulator
    d) Phase independent filter with very narrow bandwidth for identification signal decoding
    e) Digital integrator for extremely low decoding error rate (no additional software necessary)
    f) Cyclical scanning multiplexer of stereo- or dual sound identification
    g) Synchronization with 7 MHz low cost crystal[1]

3. Stereo Signal Processing with High Quality (better than DIN 45500; suitable for NICAM and CD)

    a) Matrix for G-standard and Korean-standard with I^2C Bus controlled crosstalk- and level adjustment
    b) Five stereo AF inputs and one mono input for L-standard
    c) Three stereo SCART outputs
    d) Random switching of all inputs to all outputs with level matching stage and attached to it a clipping detector for loudspeaker path
    e) Independent mute for every output pair (Speaker output with zero cross detector)
    f) Interface for Equalizer or surroundsound in front of volume control
    g) Bass- and treble control (+ 16 / – 14 dB; 2 dB steps) with clipping detector
    h) Quasi stereo and stereo basewidth expansion
    i) Volume control with programmable bass loudness independent of tone control
    j) Balance attenuator with 1.25 dB steps
    k) Stereo headphones signal section with independent Ch1/Ch2 switch and volume control (1.25 dB steps)

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[1] For Korean Standard a different application circuit has to be used.

4. Control

a) I^{2}C Bus interface with Listen/Talk function according to the Fast Bus Specification
b) Control of the IF section
c) Control of the audio processor
d) Control of the identification signal decoder
e) Reading of the identification signal decoder, clipping detectors, and field strength detector
f) Two switch outputs
g) Standby mode (Power down) allows using of the SCART plugs during standby
h) Test modes

Operating Range

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

Parameter	Symbol	Limit Values		Unit
		min.	**max.**	
Supply voltage	V_S	8.5	13.2	V
Ambient temperature	T_A	0	70	°C
Input frequency range	f_I	0.01	20	kHz

AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

$V_S = 8.5$ V; $T_A = 25$ °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	**typ.**	**max.**		
Current consumption	I_S	90	120	150	mA	
Current consumption standby mode	I_{Sstb}	40	45	60	mA	

PLL FM Demodulators

Signal to noise ratio	$S/N_{AF\,out}$		68		dB	CCIR 468 QUASIPK; WTD; Deemph = 50 µs
Distortion	$dis_{AF\,out}$		0.01	0.1	%	

AF Switch

Crosstalk attenuation	a_{SW}	80			dB	

AC/DC Characteristics

V_S = 8.5 V; T_A = 25 °C

Parameter	Symbol	Limit Values			Unit	Test Conditions
		min.	typ.	max.		

General Audio Data

Parameter	Symbol	min.	typ.	max.	Unit	Test Conditions
Distortion	k		0.1		%	V_{in} = 2 Vrms; f = 1 kHz
Noise voltage AF sw.	V_{NSW}			10	µVrms	
Noise voltage speaker	V_{NSP}			15	µVrms	$Gain_{Bal}$ = 0 dB

Package Outlines

P-SDIP-64-1

(Plastic Shrink Dual Inline Package)

0.51 min.

5.08 max.

19.05 +0.7

17.02 ± 0.25 1)

1.78

1.3 max.

0.46 ± 0.1

⊕ 0.25 Ⓜ 64x

3.43 -0.4

0.25 ± 0.05

19.05 +1.7

64

33

1

57.7 +0.2 -0.3 1)

32
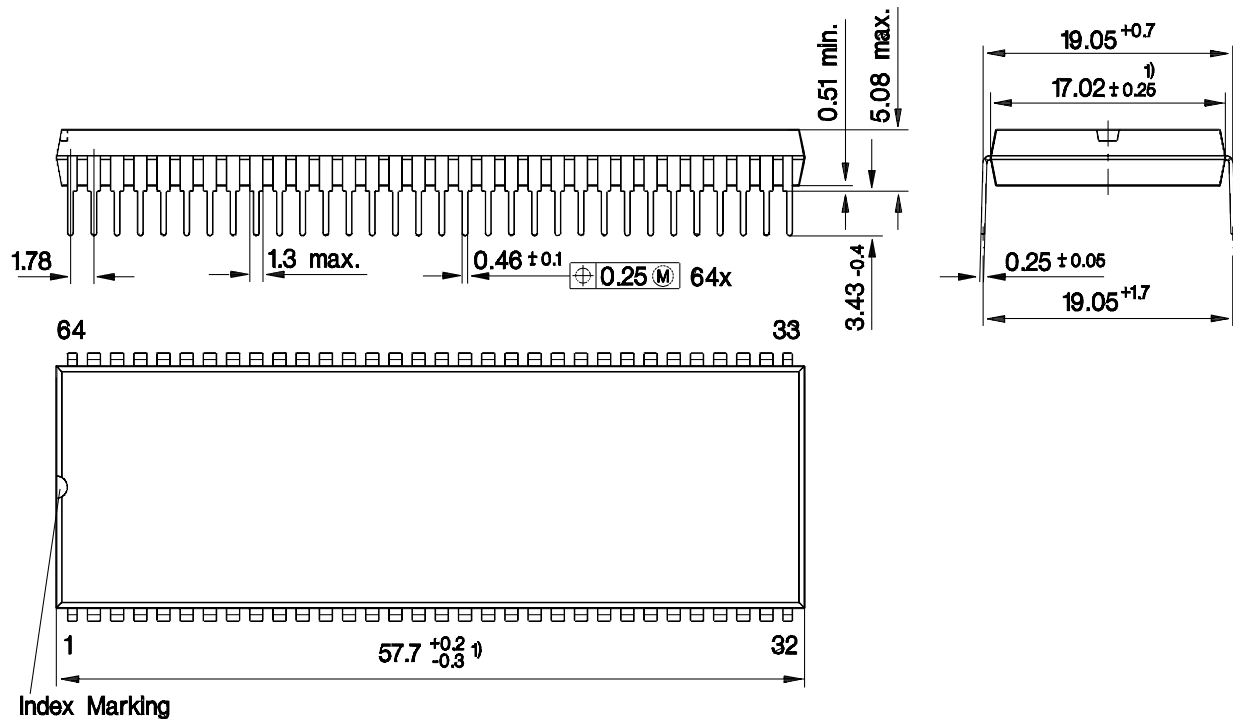
Index Marking

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

GPD05570

Sorts of Packing
Package outlines for tubes, trays etc. are contained in our
Data Book "Package Information".

Dimensions in mm

SIEMENS

7 × 5 Video Matrix Switch   TDA 6920 X

Preliminary Data

Features

- Fast I^2C Bus controlled (max. 400 kHz)
- Cascadable (2-bus addresses)
- 7 CVBS inputs, 5 outputs, 3 inputs with clamp disable by bus
- 1 input selectable as Y-input (S-VHS)
- 1 additional C-input (S-VHS)
- Y+C operation for S-VHS, selected by bus
- Fully ESD protected
- – 60 dB max. crosstalk at 5 MHz
- Low operating voltage of 7.5 V
- 5 V operation is possible with reduced output signals of max. 2 Vpp
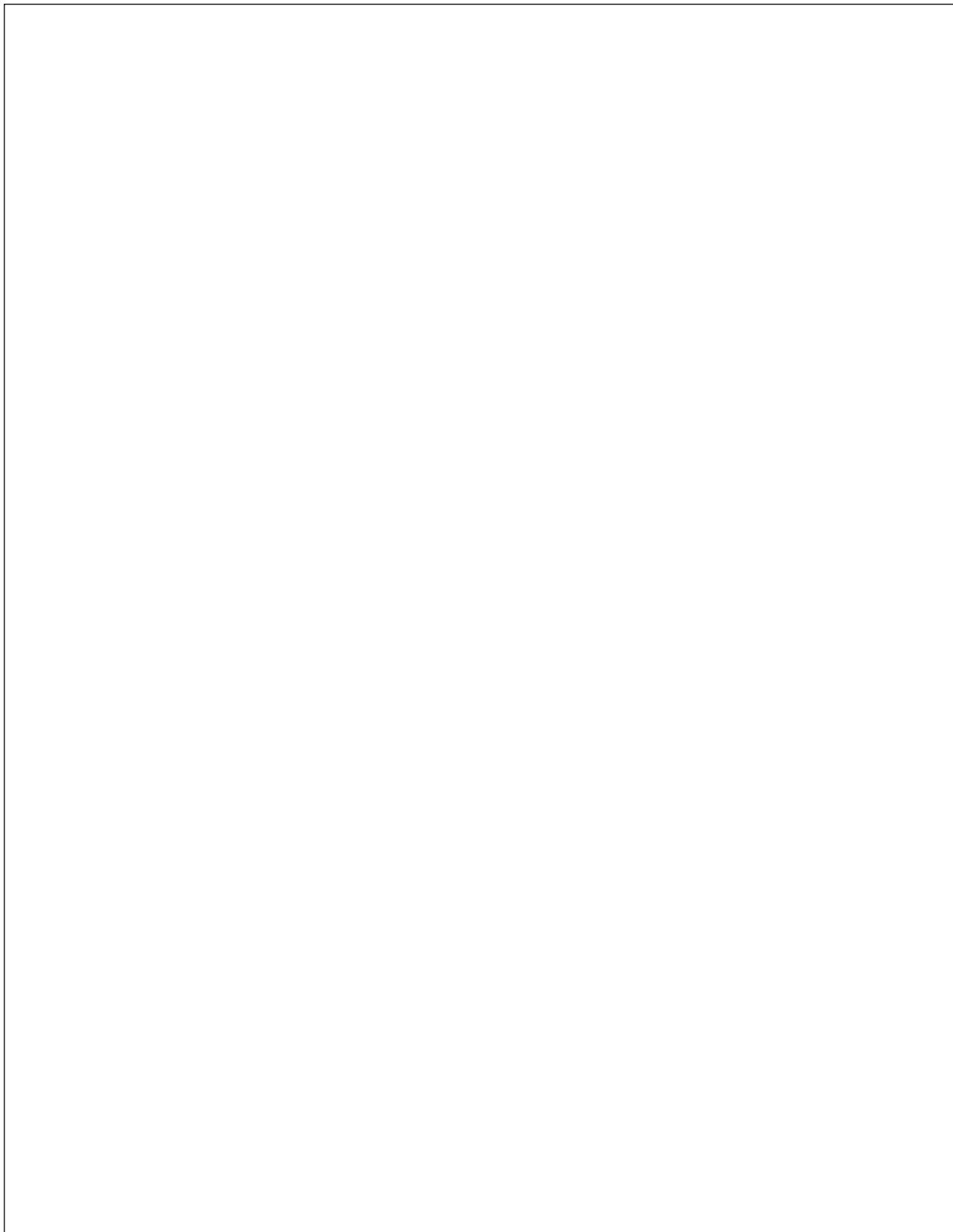- 15 MHz minimum bandwidth
- Noise insensitive clamping inputs
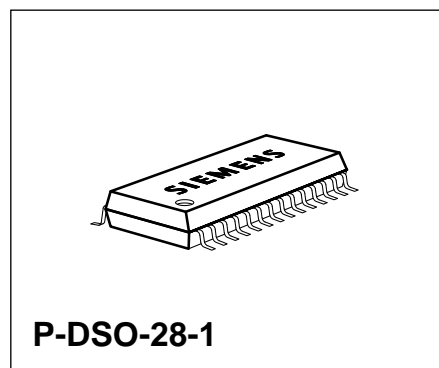
P-DSO-28-1

Type	Ordering Code	Package
▼ TDA 6920 X	Q67007-A5225	P-DSO-28-1

▼ New type

Pin Definitions and Functions

Pin No.	Function
1	PIC carrier / QPT SIF II input a
2	PIC carrier / QPT SIF II input b
3	Ground SIF
4	AM SIF input a
5	AM SIF input b
6	AGC voltage PIC carrier / QPT
7	AM-AF output
8	DF output
9	AGC voltage AM
10	FPLL-loop filter
11	AFC output
12	Ground
13	Supply voltage V_{S1}
14	VCO tank circuit a
15	VCO tank circuit b
16	Standard switch SSW 1 / AFC adjust
17	Standard switch SSW 2
18	Reference voltage
19	Video output
20	Supply voltage V_{S2} (VIF section)
21	Mean value AGC voltage
22	Tuner AGC threshold
23	Tuner AGC output
24	Video IF input a
25	Video IF input b
26	Main AGC voltage
27	PIC carrier / QPT SIF I input a / switch SIF I/II off
28	PIC carrier / QPT SIF I input b / switch SIF I/II off

Figure 1
Block Diagram

Function and Application

The TDA 6920 switches 7 video input sources to 5 outputs. Each output can be switched to only one input, but one input can be switched to all outputs. The C-input may be combined with one CVBS input as Y for Y+C (S-VHS) operation. Y+C operation is selected by bus.

Operating Range

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

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Supply voltage	V_{27}	7.5	13.2	V
Absolute minimum supply voltage (only usable with reduced output signals of max. 2 Vpp)	V_{27}	4.5		V
Video-input frequency range – 3 dB	$f_{in\,28,\,2\,...\,14}$	0	20	MHz
Video-input AC-voltage (color)	V_{28}		1.0	Vpp
Video-input AC-voltage (Y, CVBS)	$V_{2\,...\,14}$		1.7	Vpp
Video-output AC-voltage	$V_{18\,...\,26}$		3.4	Vpp
Input source-impedance (clamping)	$R_{2\,...\,14}$		500	Ω
Ambient temperature during operation	T_A	0	70	°C

All voltages are referenced to ground, if not stated otherwise.

AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed in the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

DC Characteristics

V_{CC} = 8.5 V; T_A = 25 °C

Parameter	Symbol	Limit Values			Unit
		min.	typ.	max.	
Total current consumption	I_{27}		42		mA
Output DC voltage (clamping)	$V_{18 \ldots 26}$		1.8		V
Output current	$I_{18 \ldots 26}$		1.0		mA
Input DC voltage	V_{28}		1.8		V
Input DC voltage (clamping)	$V_{2 \ldots 14}$		1.8		V
Input DC voltage (non-clamping)	$V_{4, 6, 8}$		2.4		V
Input current (clamping)	$I_{2 \ldots 14}$		0.33		µA

AC Characteristics

V_{CC} = 8.5 V; T_A = 25 °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Video bandwidth	$P_{out/in-3\,dB}$		20		MHz	
Video gain	V_{out}/V_{in}		2.0			
Crosstalk (0 … 5 MHz)	A		– 65		dB	Inputs 75 Ω to ground
Input AC-voltage	V_{28}		0.75		Vpp	Sinus
Input AC-voltage	$V_{2 \ldots 14}$		1		Vpp	
Output AC-voltage	$V_{18 \ldots 26}$		2		Vpp	
I^{2}C Bus clock	$f_{in\ 15, 16}$		400		kHz	

AC Characteristics (cont'd)

$V_{CC} = 8.5$ V; $T_A = 25$ °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Output linearity	$DG_{18\ldots26}$		0.2		%	$R_L = \infty$
Input resistance (non-clamping)	$R_{28,\,4,\,6,\,8}$		50		kΩ	
Input source- impedance (clamping)	$R_{2\ldots14}$			500	Ω	
Output dyn. impedance	$R_{18\ldots26}$		50		Ω	
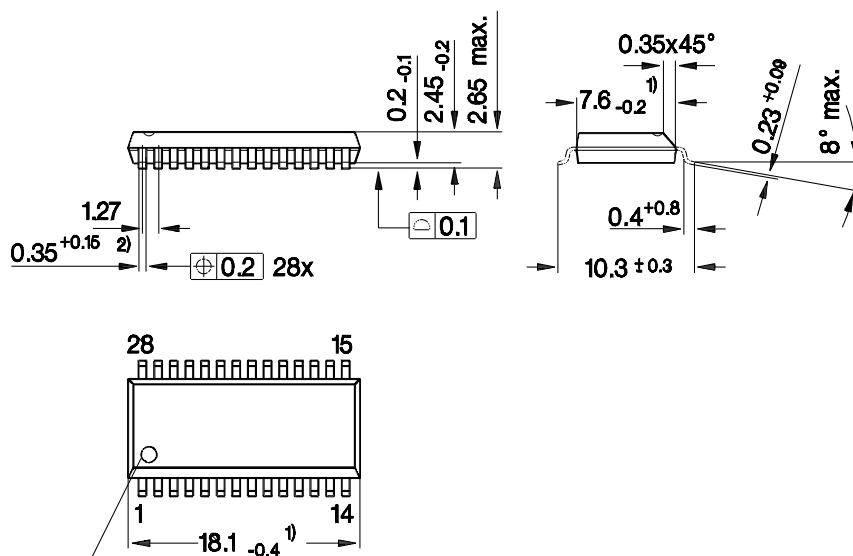
Figure 2
Application Circuit

Package Outlines

P-DSO-28-1
(Plastic Dual Small Outline Package)

0.2 -0.1
2.45 -0.2
2.65 max.

0.35x45°
1)
7.6 -0.2
0.23 +0.09
8° max.

1.27
0.35 +0.15 2)
⊕ 0.2 28x
▱ 0.1

0.4 +0.8
10.3 ± 0.3

28   15

1   14

18.1 -0.4 1)

Index Marking

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

GPS05123

Sorts of Packing
Package outlines for tubes, trays etc. are contained in our
Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm

SIEMENS

Multistandard Video and Sound IF

Preliminary Data

TDA 6930 X

Features

- Multistandard application for all terrestrial standards
- FPLL video demodulator
- Delayed tuner AGC voltage output
- AFC signal output
- Quasi parallel sound
- Separated sound channels for AM/FM
- High sound performance
- Excellent picture quality at receipt of TTX
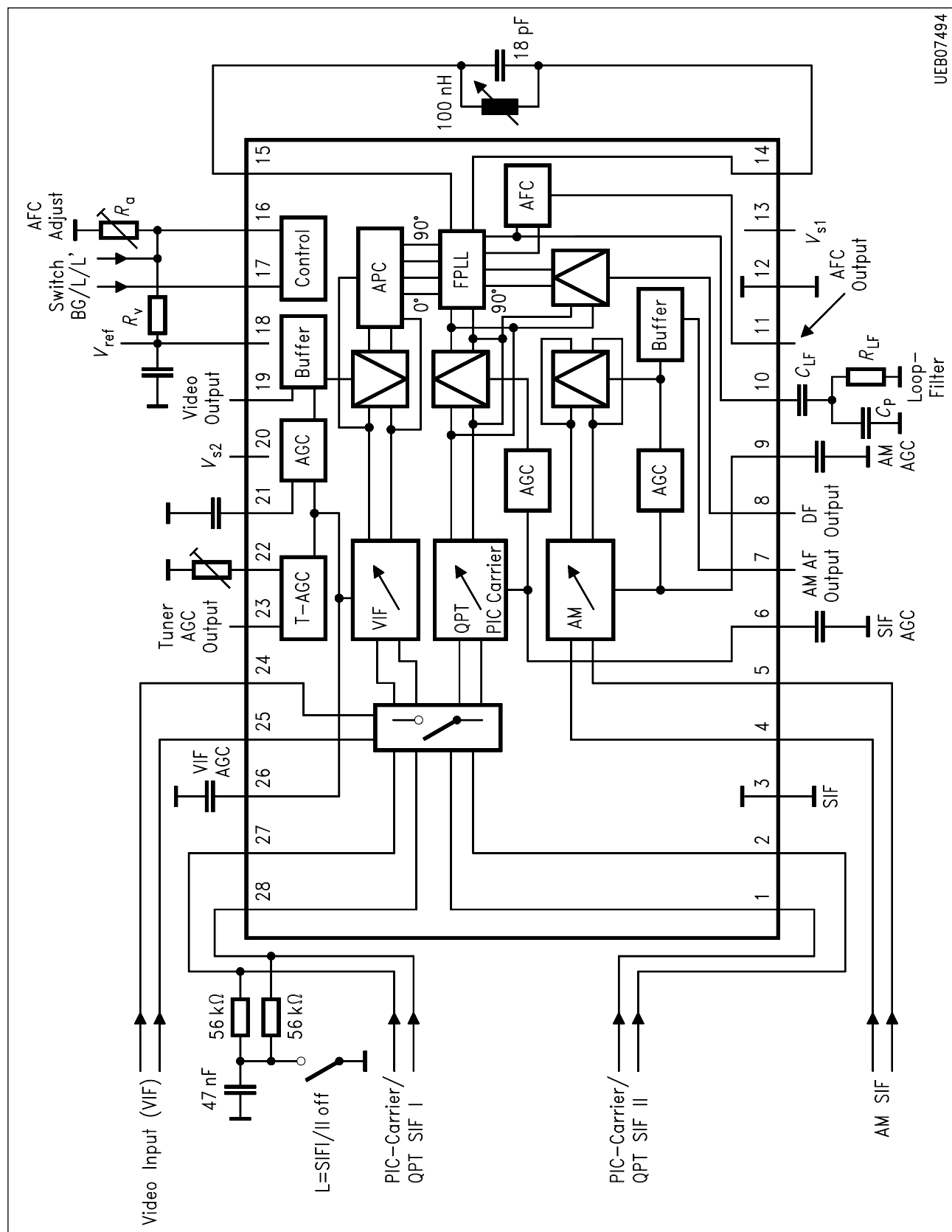- Suitable for NICAM in all countries
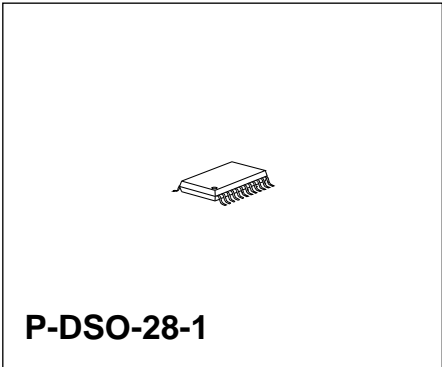
P-DSO-28-1

Type	Ordering Code	Package
▼ TDA 6930 X	Q67007-A5217	P-DSO-28-1

▼ New type

Pin Definitions and Functions

Pin No.	Function
1	PIC carrier / QPT SIF II input a
2	PIC carrier / QPT SIF II input b
3	Ground SIF
4	AM SIF input a
5	AM SIF input b
6	AGC voltage PIC carrier / QPT
7	AM-AF output
8	DF output
9	AGC voltage AM
10	FPLL-loop filter
11	AFC output
12	Ground
13	Supply voltage V_{S1}
14	VCO tank circuit a
15	VCO tank circuit b
16	Standard switch SSW 1 / AFC adjust
17	Standard switch SSW 2
18	Reference voltage
19	Video output
20	Supply voltage V_{S2} (VIF section)
21	Mean value AGC voltage
22	Tuner AGC threshold
23	Tuner AGC output
24	Video IF input a
25	Video IF input b
26	Main AGC voltage
27	PIC carrier / QPT SIF I input a / switch SIF I/II off
28	PIC carrier / QPT SIF I input b / switch SIF I/II off

Figure 1
Block Diagram

Function and Application

TDA 6930 X provides high class multistandard TV IF processing. It demodulates positive or negative video IF signals, demodulates AM sound IF signals, and converts FM or NICAM sound IF carriers to their intercarrier frequency.

Signals for tuner AGC and AFC are also available. The tuner AGC threshold is set by means of a potentiometer, all other functions can be switched by open collector transistors.

The TDA 6930 X is suitable for application in television receivers or video tape recorders for any terrestrial standard.

Circuit Description

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

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 15 dB. A hysteresis keeps the high control current until the mean value increases by ca. 10 dB.

The AGCs for the AM sound section and PIC carrier recovery + FM/NICAM section use envelope detectors. 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.

A delayed tuner AGC voltage with positive control direction is derived from the VIF-AGC via a threshold amplifier. Its take over point is set by means of an external potentiometer.

The time constants of the AGCs can be set by the according external capacitor.

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 19.

Video IF Demodulation

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

Sound Demodulation / Conversion

The AM sound section uses the envelope detector of the AGC to demodulate the AM sound signal. In case of L or L' standard the AM-AF output is active, in other standards this output is inactive.

The QPT-sound/PIC-carrier section gets its input signal from QPT SIF I except in L'-NICAM mode, then input QPT SIF II is active.

The QPT signal is mixed with the $90°$-carrier from the FPLL to generate the 2nd sound IF at the according output (DF). This output is always active except on Mac standard where both sound outputs are off.

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

Operating Range

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

Parameter	Symbol	Limit Values min.	Limit Values max.	Unit
Supply voltage	$V_{13/20}$	7.5	10	V
Supply voltage tuner AGC	V_{23}	0.6	10	V
IF frequency range	f_{IF}	12	60	MHz
Ambient temperature during operation	T_A	0	70	°C

AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

$V_S = 8.5$ V; $T_A = 0$ °C to 70 °C

Parameter	Symbol	Limit Values min.	Limit Values typ.	Limit Values max.	Unit	Test Condition
Total current	$-I_{13+20}$		83		mA	

Video Output

Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
Output current	$-I_{19}$		0.84		mA	
Output signal	V_{19}		1.5		Vpp	

AM Output

Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
DC level (AM inactive)	V_7		High impedance			
Output signal	V_7		800		mVrms	m = 80 %
THD			0.3		%	m = 0.3

AC/DC Characteristics (cont'd)

$V_S = 8.5$ V; $T_A = 0$ °C to 70 °C

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	**typ.**	**max.**		

DF Output

Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
Output current	I_8		2.5		mA	
Signal level	V_8		100		mVrms	SC/PC = − 13 dB PC unmod.

AFC Output

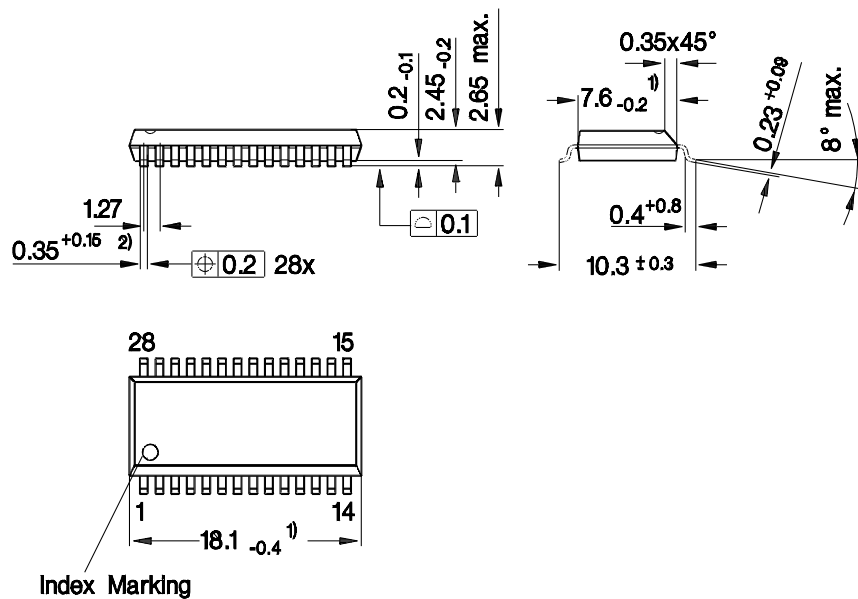| Parameter	Symbol	min.	typ.	max.	Unit	Test Condition
Slope	$I_{11/kHz}$		0.7		µA/kHz	
AFC adjust	V_{16}	3		5	V	Switch at pin 16: high z (R_V/R_a)
AFC adjust reference	V_{18}		6		V	
IF control range	$\Delta V_{1/2,\ 24/25,\ 27/28}$		60		dB	
Video bandwidth	B_{19}			8	MHz	$f - 3$ dB

Figure 2
Application Circuit

Package Outlines

P-DSO-28-1
(Plastic Dual Small Outline Package)

Index Marking

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2) Does not include dambar protrusion

GPS05123

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