

Video IF Amplifier with FPLL Demodulation

Description

The U 4460 BG is an integrated bipolar circuit for video IF (VIF) signal processing in TV/VCR and multimedia applications.

The circuit processes all TV video IF signals with negative modulation (e.g. B/G standard).

Features

- Active carrier generation by FPLL principle (frequency-phase-locked-loop) for true synchronous demodulation
- Very linear video demodulation, good pulse response and excellent intermodulation figures
- VCO is operating on picture carrier frequency
- Alignment-free AFC, no external reference circuit
- VIF-AGC with peak sync detection

- Tuner AGC with adjustable take over point
- 5V supply voltage; low power consumption
- Relevant pinning is compatible with the TDA 4474 /71 video-/sound IF combination

Package:

28 pin shrink-dual-inline-plastic (SDIP28)

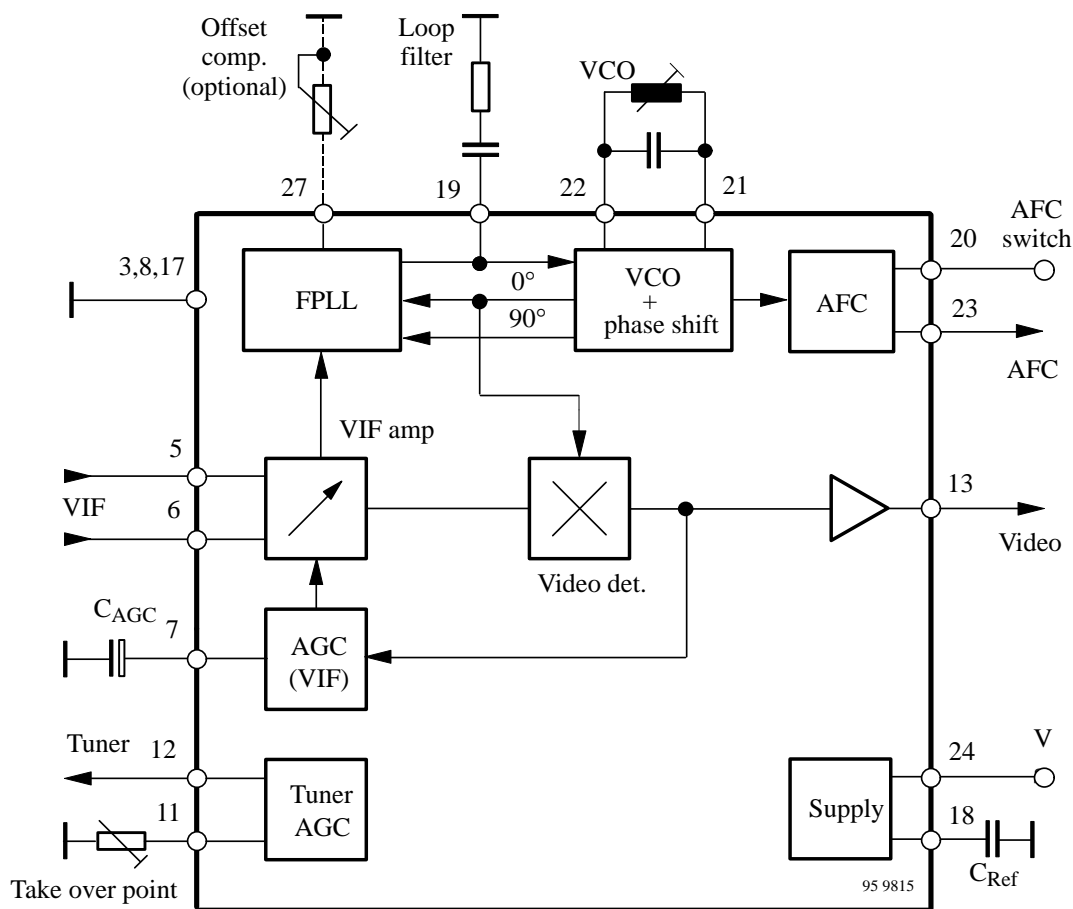


Figure 1. Block diagram

Pin description

Pin	Symbol	Function
1	n.c.	not connected
2	n.c.	not connected
3	GND	Ground
4	n.c.	not connected
5, 6	$V_{i,VIF}$	VIF input (symmetrical)
7	C_{AGC}	VIF-AGC (time constant)
8	GND	Ground
9	n.c.	not connected
10	n.c.	not connected
11	R_{top}	Take over point, tuner AGC
12	I_{tun}	Tuner AGC output current
13	$V_{o,vid}$	Video output
14	n.c.	not connected
15	n.c.	not connected
16	n.c.	not connected
17	GND	Ground
18	C_{ref}	Internal reference voltage
19	LF	Loop filter
20	n.c.	AFC switch
21, 22	V_{vco}	VCO circuit
23	V_{AFC}	AFC output
24	V_s	Supply voltage
25	n.c.	not connected
26	n.c.	not connected
27	R_{comp}	Offset compensation
28	n.c.	not connected

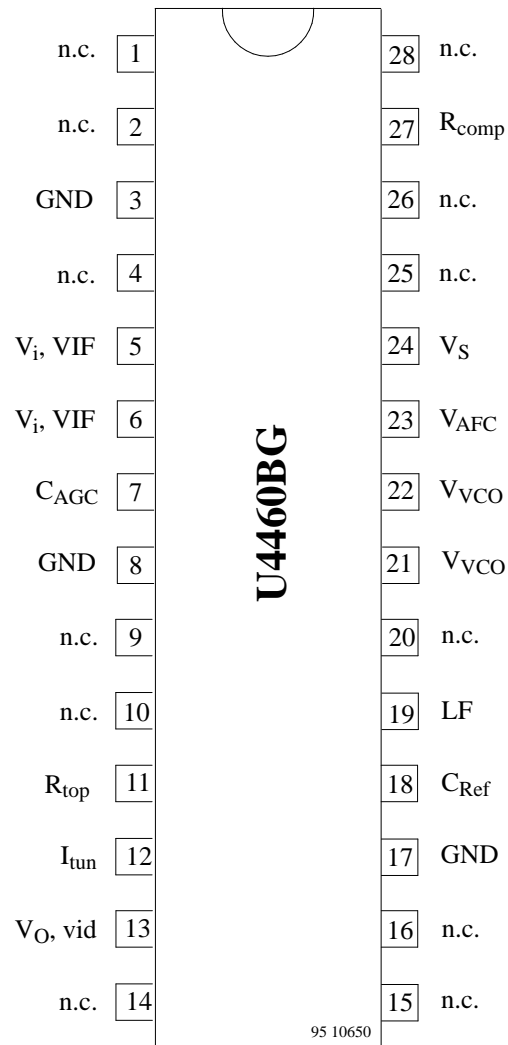


Figure 2. Pin configuration

Circuit description

Vision IF amplifier

The video IF signal (VIF) is fed through a SAW filter to the VIF input (Pin 5–6). The VIF amplifier consists of three AC-coupled amplifier stages. Each differential amplifier is gain controlled by the automatic gain control (VIF-AGC). Output signal of the VIF amplifier is applied to the FPLL carrier generation and the video demodulator.

VIF-AGC and adjustable tuner AGC

At Pin 7 the VIF-AGC charges/discharges the AGC capacitor to generate a control voltage for setting gain of VIF amplifier and tuner in order to keep the video output signal at a constant level. Therefore the sync level of the

demodulated video signal is the criterion for a fast charge/discharge of the AGC capacitor.

The control voltage (AGC voltage at Pin 7) is transferred to an internal control signal and fed to the tuner AGC to generate the tuner AGC current at Pin 12 (open collector output). Take over point of the tuner AGC can be adjusted at Pin 11 by a potentiometer or an external DC voltage (from interface circuit or microprocessor).

FPLL, VCO and AFC

The FPLL circuit (frequency phase locked loop) consists of a frequency and phase detector to generate control voltage for the VCO tuning. In the locked mode the VCO is controlled by the phase detector and in unlocked mode the frequency detector is superimposed. The VCO operates with an external resonance circuit (L and C parallel) and is controlled by internal varicaps. The VCO control voltage is also converted to a current and represents the AFC output signal at Pin 23.

A practicable VCO alignment of the external coil is the adjustment to zero AFC output current at Pin 23. At centre frequency the AFC output current is equal to zero. The optional potentiometer at Pin 27 allows an offset compensation of the VCO phase for improved sound quality (fine adjustment). Without a potentiometer (open circuit at Pin 27) this offset compensation is not active.

The oscillator signal passes a phase shifter and supplies the in-phase signal (0) and the quadrature signal (90) of the generated picture carrier.

Video demodulation and amplifier

The video IF signal, which is applied from the gain controlled IF amplifier, is multiplied with the inphase component of the VCO signal. The video demodulator is designed for low distortion and large bandwidth. The demodulator output signal passes an integrated low pass filter for attenuation of the residual vision carrier and is fed to the video amplifier. The video amplifier is realized by an operational amplifier with internal feedback and 8 MHz bandwidth (-3dB). The video signal is fed to VIF-AGC and to the video output buffer. This amplifier with 6dB gain offers easy adaption of the sound trap. For nominal video IF modulation the video output signal at Pin 13 is 2 V (peak to peak value).

Internal voltage stabilizer

The internal bandgap reference ensures constant performance independant of supply voltage and temperature.

Absolute maximum values

Reference point pin 3 (8, 17), unless otherwise specified

Parameters	Symbol	Value	Unit
Supply voltage Pin 24	V_s	9.0	V
Supply current Pin 24	I_s	85	mA
Power dissipation, $V_s = +9\text{ V}$	P	765	mW
Output currents Pin 13	I_{out}	5	mA
External voltages Pin 5, 6, 7, 11, 13, 18, 19, 27	V_{ext}	+ 4.5	V
Pin 20,21		+ 3.5	V
Pin 12		+ 13.5	V
Pin 20,23		V_s	V
Junction temperature	T_{junc}	+125	°C
Storage temperature	T_{stor}	-25 to +125	°C
Electrostatic handling *) all pins	V_{ESD}	t.b.f.	V

*) Equivalent to discharging a 200 pF capacitor through a 0 resistor

Operating range

Parameters	Symbol	Value	Unit
Supply voltage range Pin25	V_s	4.5 to 9.0	V
Ambient temperature	T_{amb}	0 to +85	°C

Thermal resistance

Parameters	Symbol	Value	Unit
Thermal resistance: junction–ambient when soldered to PCB	R_{thja}	55	K/W

Electrical Characteristics

$V_s = +5V$, $T_{amb} = +25^\circ C$; reference point pin 3 (8, 17), unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
DC–supply: Pin 24						
Supply voltage		V_s	4.5	5.0	9.0	V
Supply current:		I_s		75	85	mA
VIF–input: Pins 5–6						
Input sensitivity, RMS value	for FPLL locked	v_{in}		80	120	μV
Input impedance	see note 1	R_{in}		1.2		k
Input capacitance	see note 1	C_{in}		2		pF
VIF–AGC: Pin 7						
IF gain control range		G_v	60	65		dB
AGC capacitor		C_{AGC}		2.2		μF
Switching voltage: VCR mode	see note 2	V_{sw}		4.0		V
Switching current: VCR mode	see note 2	I_{sw}		50		A
Tuner–AGC: Pins 11, 12 see note 3						
Available tuner–AGC current		I_{tun}	1	2	4	mA
Allowable output voltage		V_{out}	0.3		13.5	V
IF slip – tuner AGC	current I_{tun} : 10% to 90%	G_{IF}		8	10	dB
IF input signal for minimum take over point	$R_{top} = 10\text{ k}$ ($V_{top} = 4.5\text{ V}$)	v_{in}			4	mV
IF input signal for maximum take over point	$R_{top} = 0$ ($V_{top} = 0.8\text{ V}$)	v_{in}	40			mV
Variation of the take over point by temperature	$T_{amb} = 55^\circ C$ VIF–AGC: $G_v = 46\text{ dB}$	v_{in}		2	3	dB
FPLL and VCO: Pins 19, 21, 22, 27						
Max. oscillator frequency	for carrier generation	f_{vco}	70			MHz
Vision carrier capture range	$f_{vco} = 38.9\text{ MHz}$ $C_{vco} = 6.8\text{ pF}$	f_{cap}	1.5	2		MHz
Oscillator drift (free running) as function of temperature	see note 4 $T_{amb} = 55^\circ C$, $C_{vco} = 6.8\text{ pF}$, $f_{vco} = 38.9\text{ MHz}$	f/T			–0.3	%

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Video output: Pin 13						
Output current –source –sink		I_{out}	2		5 3	mA
Output resistance	see note 1	R_{out}			100	
Video output signal	peak to peak value	$v_{o,vid}$	1.8	2.0	2.2	V
Sync level		V_{sync}		1.2		V
Zero carrier level (neg. modulation) (= ultra white level)	$V_7 = 3\text{ V}$	V_{DC}		3.4		V
Supply voltage influence on the ultra white level		V/V		1		%/V
Video bandwidth (–3dB)	$R_L\ 1\text{ k}, C_L\ 50\text{ pF}$	B	6	8		MHz
Video frequency response over the AGC range		B			2.0	dB
Differential gain error		DG		2	5	%
Differential phase error		DP		2	5	deg
Intermodulation 1.07MHz	see note 5	IM	52	60		dB
Video signal to noise ratio	weighted , CCIR–567	S/N	56	60		dB
Residual vision carrier fundamental wave 38.9 MHz and second harmonic 77.8 MHz		v_{res1}		2	10	mV
Lower limiting level	below sync level	V_{lim1}		400		mV
Upper limiting level	above ultra white level	V_{lim2}		600		mV
Ripple rejection	pin 24/pin 13; see note 1	RR	35			dB
AFC output: Pin 23						
Control slope		I_f		0.7		A/kHz
Frequency drift by temperature	related to the picture carrier frequency			0.25	0.6	%
Output voltage upper limit lower limit		V_{AFC}	$V_s-0.4$		0.4	V
Output current		I_{AFC}		0.2		mA

Notes:

1. This parameter is given as an application information and not tested during production.
2. In VCR mode" the VIF–and SIF path is switched off.
3. Adjustment of turn over point (delayed tuner AGC) with external resistor R_{top} or external voltage V_{top} possible.
4. The oscillator drift is related to the picture carrier frequency, at external temperature–compensated LC circuit
5. $(1.07) = 20\log(4.43\text{ MHz component}/1.07\text{ MHz component})$;
 (1.07) value related to black–white signal
 input signal conditions: picture carrier 0 dB
 colour carrier –6 dB
 sound carrier –24 dB

*) External L/C circuit (VCO: 38.9 MHz) with TOKO coil 7KN (9 turns, 0.12mm)

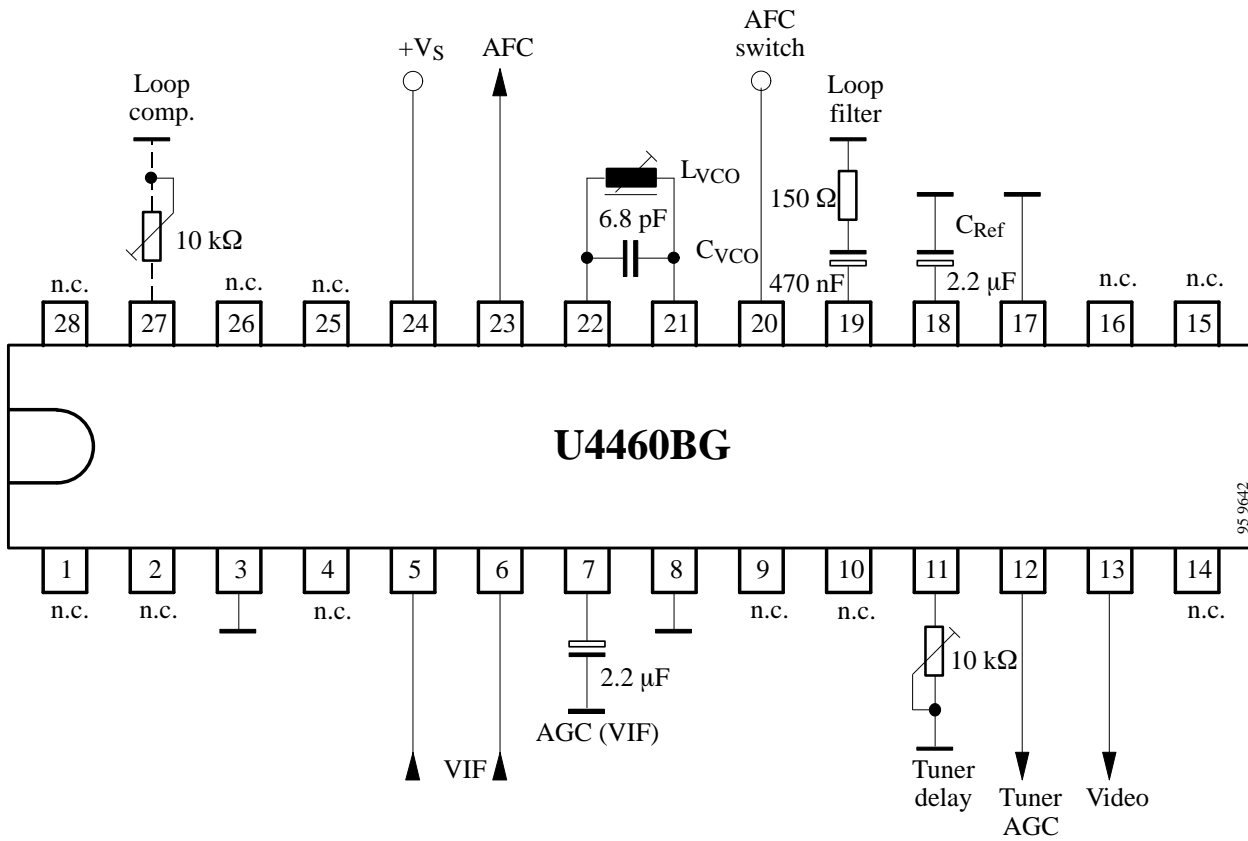


Figure 3. Test circuit

Internal Pin Configuration

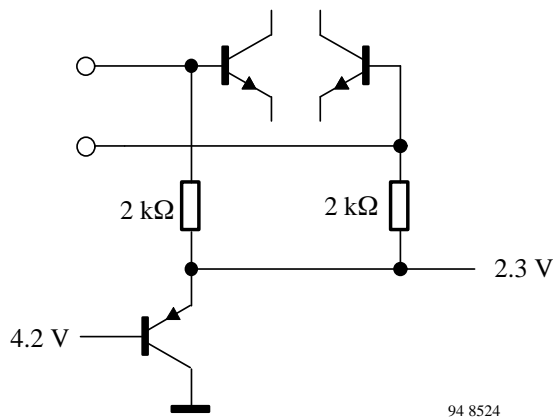


Figure 4. Video IF input (Pin 5-6)

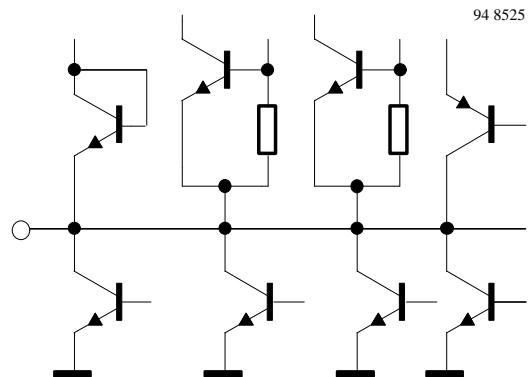


Figure 5. VIF-AGC time constant (Pin 7)

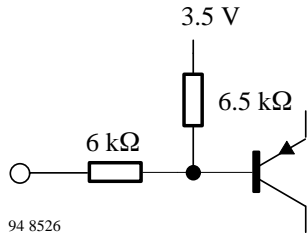


Figure 6. Tuner AGC – take over point (Pin 11)

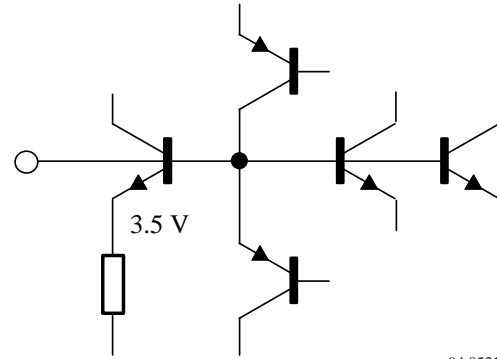


Figure 9. Internal reference voltage (Pin 18)

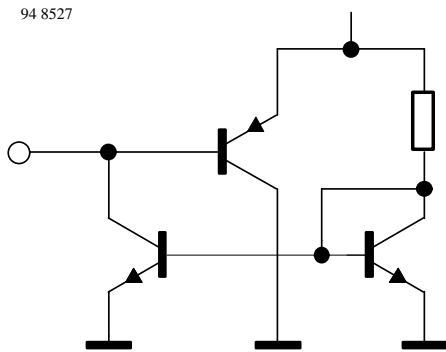


Figure 7. Tuner AGC – output (Pin 12)

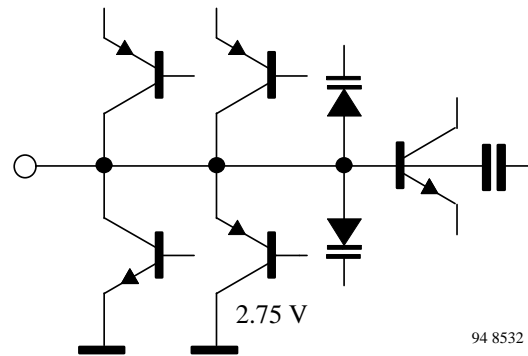


Figure 10. Loop filter (Pin 19)

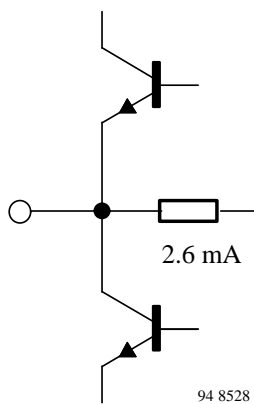


Figure 8. Video output (Pin 13)

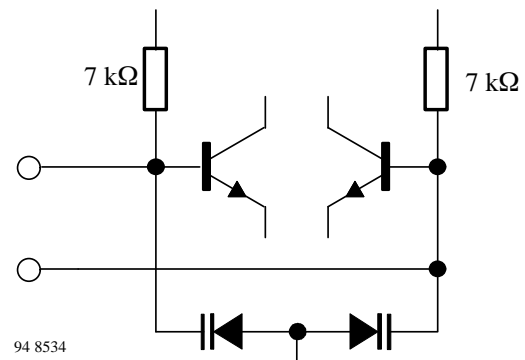


Figure 11. VCO (Pin 21–22)

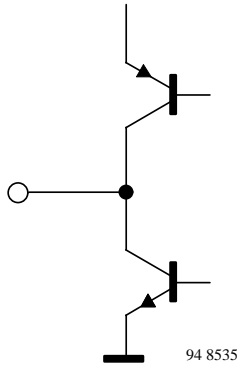


Figure 12. AFC output (Pin 23)

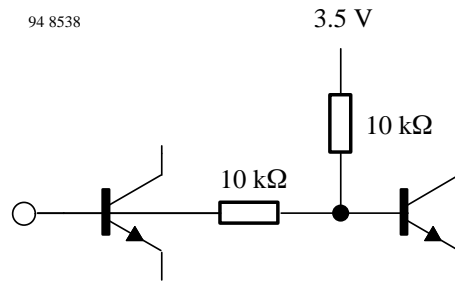


Figure 13. VCO offset compensation (Pin 27)

Dimensions in mm

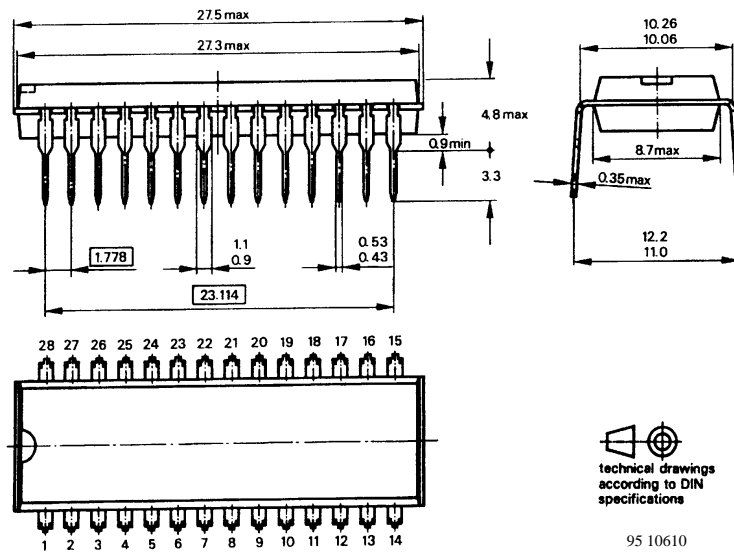


Figure 14. 28 pin shrink-dual-inline-plastic (SDIP28)

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It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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