TEMIC
Semiconductors

U2309B

VHF/ UHF-Tuner-IC

Description

This tuner IC requires a power supply of 9 V and performs the function of three separate oscillators an mixers, SAWF-driver, L.O.-output and tri-state band switch. Additional to TV-tuner application this IC is usable for DAB (Digital Audio Broadcast) tuners.

Features

- 9 V supply voltage
- Frequency range from 48 to 860 MHz
- Band A: balanced high impedance mixer input and amplitude controlled oscillator
- Band B + C: balanced low impedance mixer input and symmetrical oscillator
- Balanced L. O.-outputs for prescalers or PLL
- SAW filter driver with low impedance output
- Voltage regulator for stable operating characteristics
- ESD protection on all pins except oscillator pins and RF-inputs

Benefits

- The integration of 3 bands and the small SSO28 package allows to design very small and economical 3-band tuners with high performance.

Block Diagram

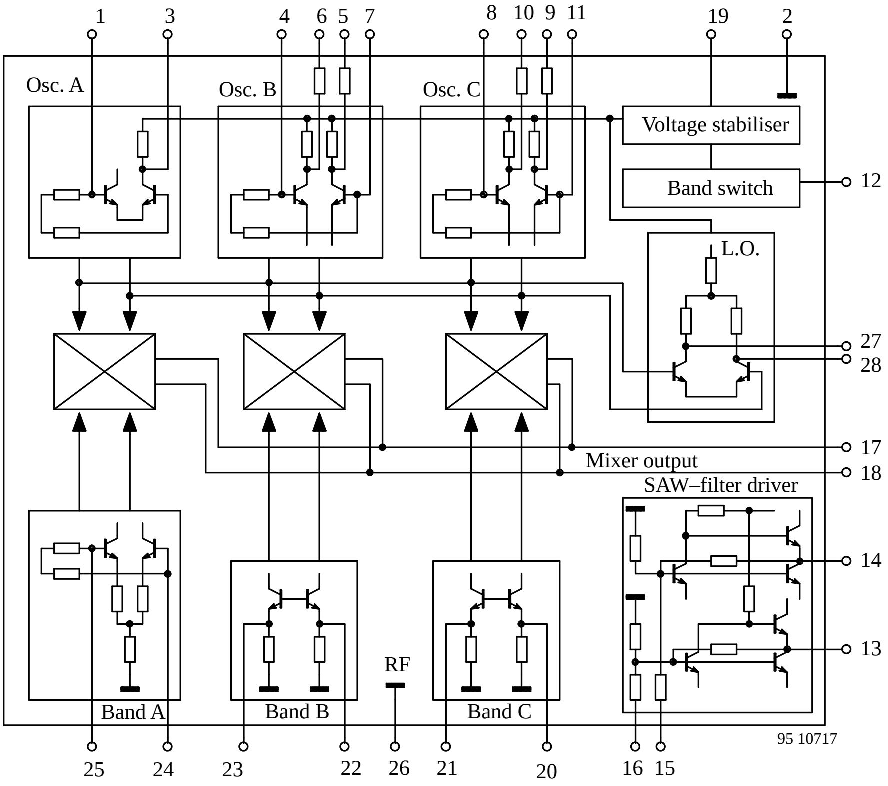
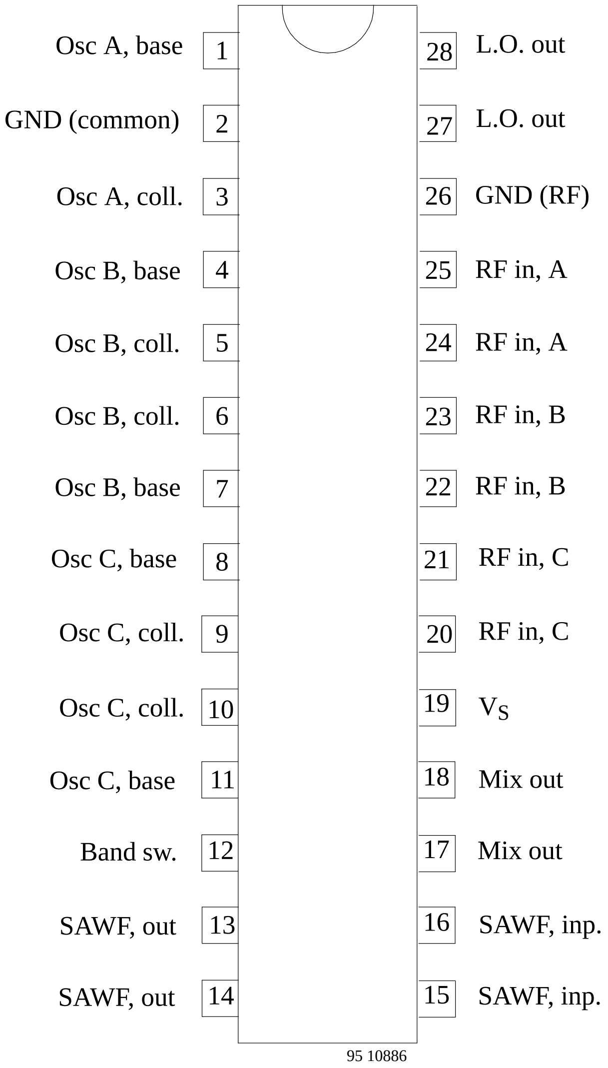


Figure 1. Block diagram

Pin Description



Pin	Symbol	Function
1	Osc A, base	Oscillator band A, base
2	GND (common)	Ground, common
3	Osc A, coll.	Oscillator band A, collector
4, 7	Osc B, base	Oscillator band B, bases
5, 6	Osc B, coll.	Oscillator band B, collectors
8, 11	Osc C, base	Oscillator band C, bases
9, 10	Osc C, coll.	Oscillator band C, collectors
12	Band sw.	Tri-state band switch
13, 14	SAWF, out	SAW filter driver outputs
15, 16	SAWF, inp.	SAW filter driver inputs
17, 18	Mix out	Mixer outputs, open collector
19	V_S	Supply voltage V_s
20, 21	RF in, C	RF inputs, band C
22, 23	RF in, B	RF inputs, band B
24, 25	RF in, A	RF inputs, band A
26	GND (RF)	Ground, RF part
27, 28	L.O. out	L.O.-outputs

Ordering Information

Extended Type Number	Package	Remarks
U2309B-FLG3	SO28	Taped and reeled
U2309B-FSG3	SSO28	Taped and reeled

Absolute Maximum Ratings

All voltages are referred to GND, Pin 2

Parameters		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pin 19	V_S			10.5	V
RF inputs	Pin (20-25)				5.0	V
IF outputs	Pin 17-18				10.5	V
Tri-state switch voltage	Pin 12	ViTRI			10.5	V
Junction temperature		T_j			125	°C
Storage temperature		T_{stg}	–40		125	°C

Operating Range

All voltages are referred to GND, Pin 2

Parameters	Test Conditions / Pins	Symbol	Min	Typ	Max	Unit
Supply voltage	Pin 17-19	V_S	8.1	9	9.9	V
Ambient temperature		T_{amb}	–25		75	°C

Thermal Resistance

Parameters	Symbol	Typ	Unit
Junction ambient Package SO28 soldered to PCB Package SSO28 soldered to PCB (see layout page 5)	R_{thJA}	 70 128	K/W

Electrical Characteristics

Test conditions (unless otherwise specified): V_s = 9 V. T_{amb} = 25 °C. Reference point Pin 2

Parameters	Test Conditions / Pins	Symbol	Min	Typ	Max	Unit
Supply voltage	Pin 17-19	V_S	8.1	9.0	9.9	V
Supply current	Pin 17-19	I_S		42	50	mA
Band switch						
Voltage band A	Pin 12	VSWA	0	0	1.0	V
Voltage band B	Pin 12	VSWB	1.6	2.0	2.4	V
Voltage band C	Pin 12	VSWC	3.4	4.0	5.0	V
Switching current	VSW = 5 V Pin 12	ISW			100	µA
L. O .-output						
L. O. level each output	RL = 50 Ohm Pin 27, 28	PLO	–25		–17	dBm
SAW filter driver fi = 36 MHz						
Input impedance	Pin 15, 16	ZiSAW		450		Ohm
Output impedance	Pin 13, 14	ZoSAW		70		Ohm
Voltage gain	Pin 15, 16 → 13, 14	GvSAW		17		dB

Electrical Characteristics (continued)

Parameters	Test Conditions / Pins	Symbol	Min	Typ	Max	Unit
Band A						
Input frequency range	Pin 24	fiA	48		170	MHz
Input impedance	Figure 3 Pin 24	S11A				
Gain (note 4)	Pin I/P to O/P	GA		28		dB
Noise figure DSB (note 2)	Pin I/P to O/P fiA = 50 MHz fiA = 150 MHz	 NF NF		 11.5 12		 dB dB
Input level for (note 3):	Each carrier					
IM3 (interm. of 3rd order	fiA = 71 MHz Pin I/P	ViA		–23		dBm
IM2 (interm. of 2nd order)	fiA = 71 MHz Pin I/P	ViA		–22		dBm
Band B (note 1)						
Input frequency range	Pin 22, 23	fiA	170		470	MHz
Input impedance	Pin 22, 23	S11B		see Fig. 3		
Gain (note 4)	Pin I/P to O/P	GB		32		dB
Noise figure DSB (note 2)	Pin I/P to O/P fiB = 200 MHz fiB = 450 MHz	 NF NF		 9.5 10		 dB dB
Input level for (note 3):	Each carrier					
IM3 (interm. of 3rd order)	fiB = 300 MHz Pin I/P	ViB		–28		dBm
Band C (note 1)						
Input frequency range	Pin 20, 21	fiC	470		860	MHz
Input impedance	Figure 3 Pin 20, 21	S11C				
Gain	Pin I/P to O/P	GC		32		dB
Noise figure DSB (note 2)	Pin I/P to O/P fiC = 500 MHZ fiC = 800 MHz	 NF NF		 10.5 11.5		 dB dB
Input level for IM3 (interm. of 3rd order, note 3)	Each carrier fiC = 600 MHz Pin I/P	ViC		–28		dBm

Notes

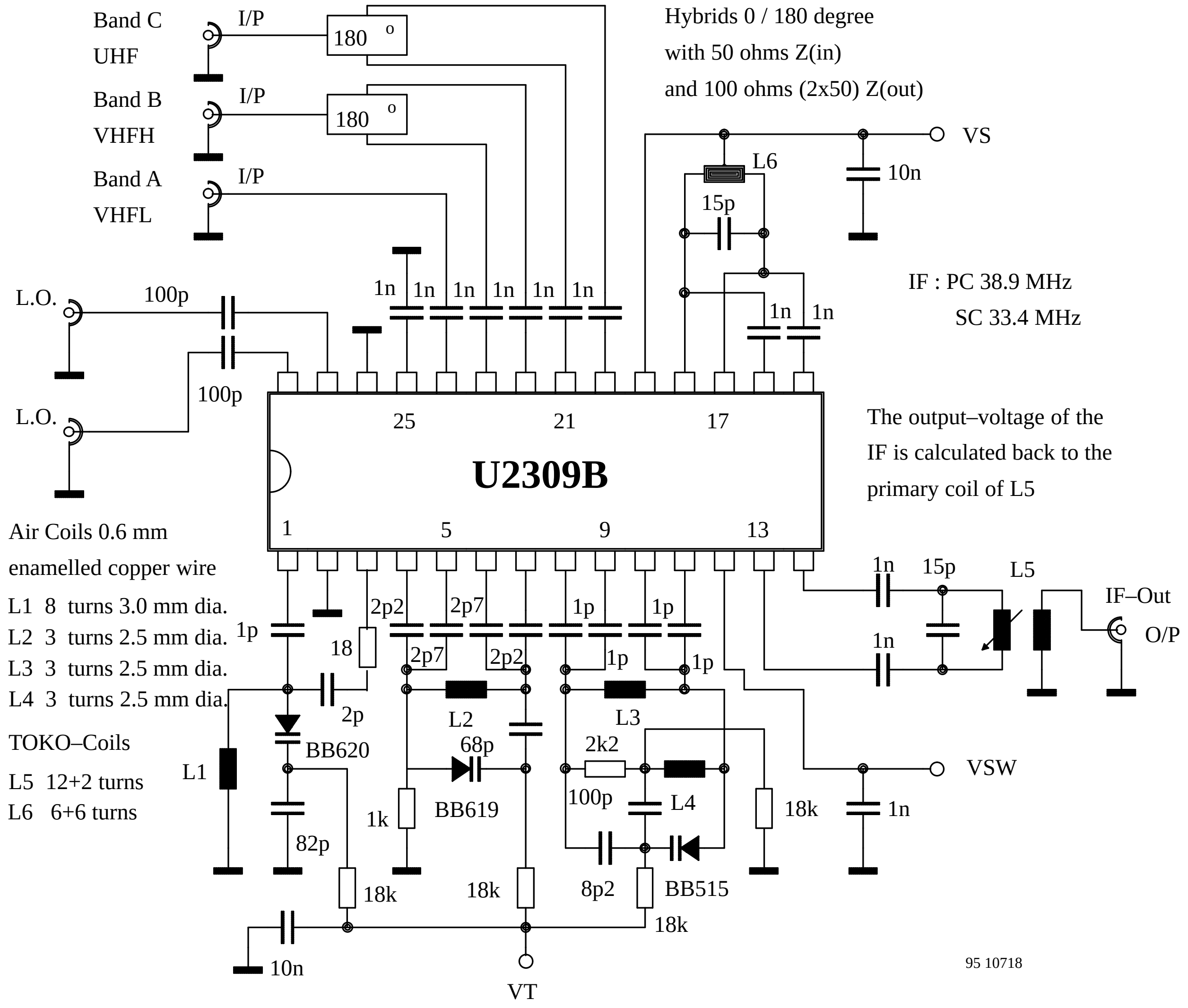
1) The RF inputs B and C are symmetrical driven by means of a hybrid for 180° phase shifting, consequently the source impedance is 100 Ω. All other impedance for RF tests is 50 Ω.

2) The noise figure (NF) is the value for double-side-band measurement.

3) The intermodulation test (2-carrier-method) which is made on IF-centre is in reference to a signal-to-IM ratio of 60 dB.

4) Gain is the ratio of the voltage at the primary coil of L5 to the available voltage at the input.

Test and Principle Application Circuit



Hybrids 0 / 180 degree
with 50 ohms Z(in)
and 100 ohms (2x50) Z(out)

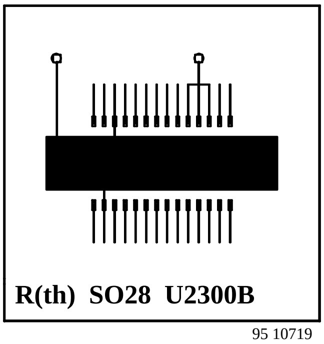
The output–voltage of the IF is calculated back to the primary coil of L5

Air Coils 0.6 mm
enamelled copper wire
L1 8 turns 3.0 mm dia.
L2 3 turns 2.5 mm dia.
L3 3 turns 2.5 mm dia.
L4 3 turns 2.5 mm dia.

TOKO–Coils
L5 12+2 turns
L6 6+6 turns

Figure 2. Test and principle application circuit

PCB for the R_{thJA}-Measurement



Material: 35 µm one-sided Cu-coated epoxy PCB, 40 mm × 40 mm × 1.5 mm

Figure 3. PCB for the R_{thJA}-measurement

Input Impedance Mixer Band A (S11A), B and C (S11B/C)

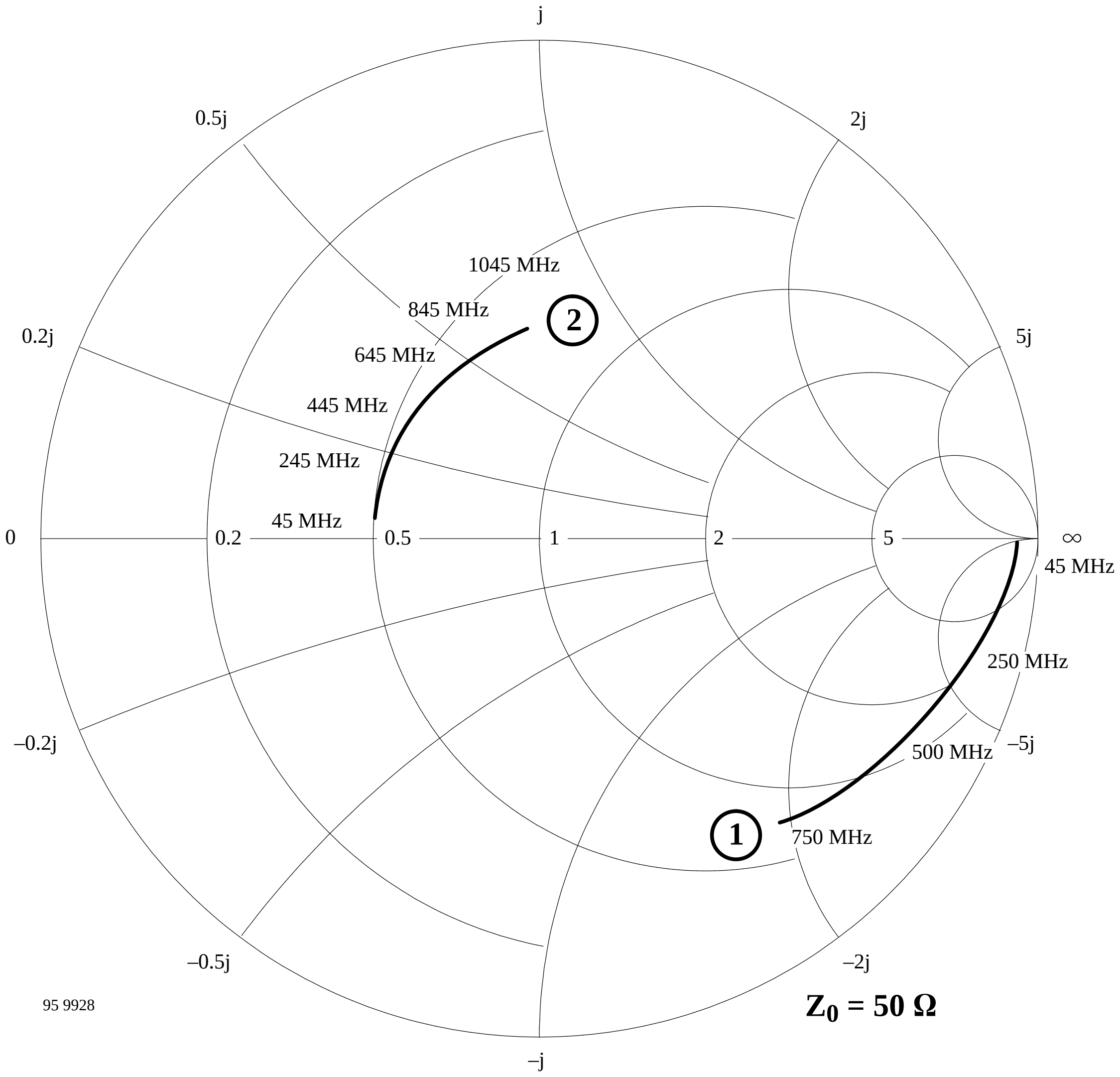


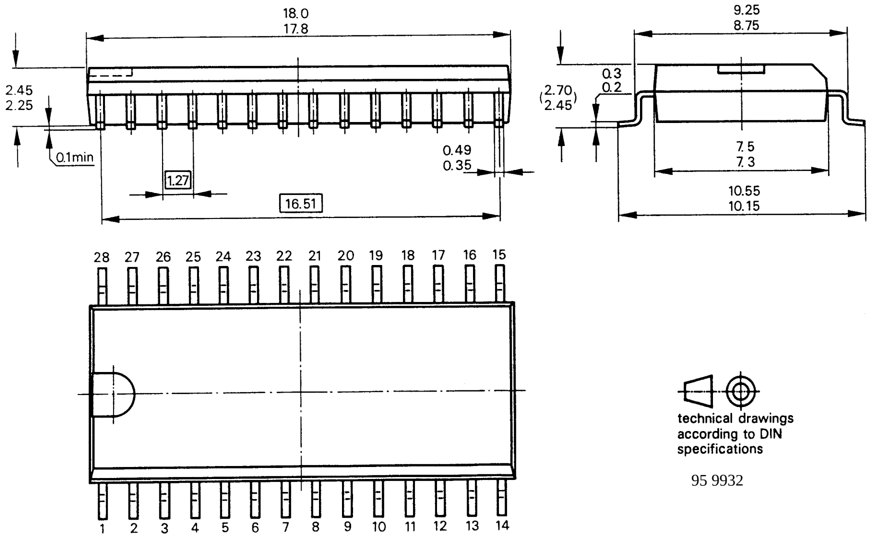
Figure 4. Input impedance mixer band A (S11A), B and C (S11B/C)

1) **VHF-low**
Normalised to 50 Ω, measuring range 45 MHz to 750 MHz.

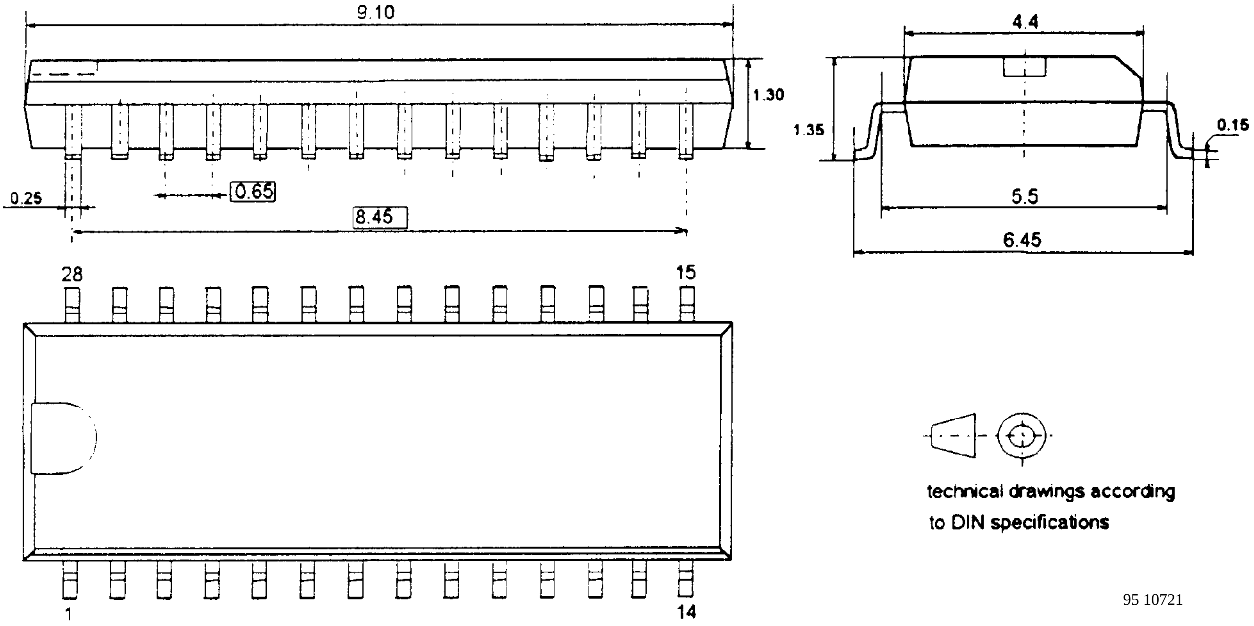
2) **VHF-high and UHF**
Normalised to 50 Ω, measuring range 45 MHz to 1045 MHz. Both inputs are driven symmetrical.
The output impedance of hybrid is 100 Ω,the measured levels are then calculated in reference to 50 Ω.

Dimensions in mm:

Package: SO28



Package: SSO28



Ozone Depleting Substances Policy Statement

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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