Dual-Channel FM Sound Demodulator for TV Systems

Description

The U2860B is a dual-channel FM sound demodulator realized with TEMIC Semiconductors' advanced bipolar process. All TV FM standards, from 4.5 up to 6.5 MHz (standard M, B/G, I, D/K) can be processed with high performance. The circuit is alignment-free and has a minimum number of external components. With 5 V supply voltage, the U2860B is suitable for TV, VCR and multimedia applications.

Features

- Two alignment-free PLL FM demodulators, automatic lock in on the received sound carrier frequency
- Mono and dual channel application
- Sound IF inputs provided for ceramic filters
- Automatic mute for 2nd sound channel (squelch)
- Mute function for both sound channels
- 5 V supply voltage, low power consumption
- Few external components

Block Diagram

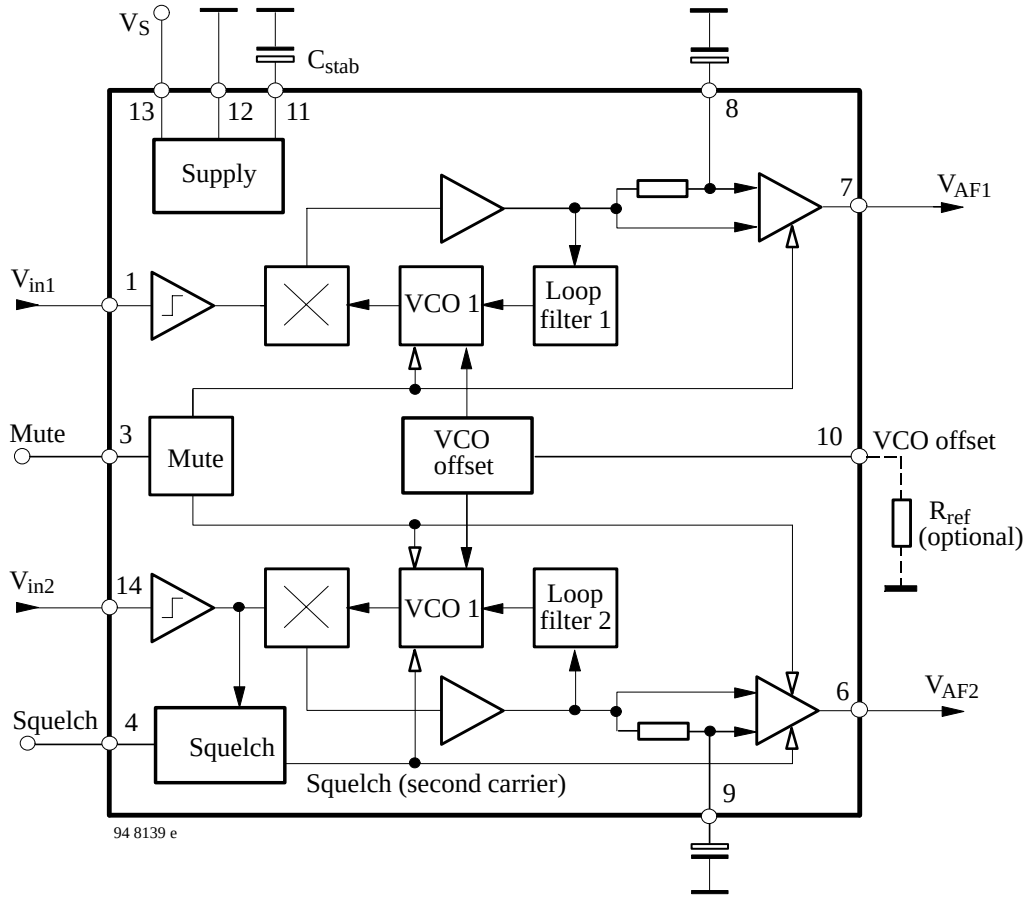

Figure 1. Block diagram

Ordering Information

Extended Type Number	Package	Remarks
U2860B-B	DIP14	
U2860B-BFP	SO14	taped

Circuit Description

The U2860B includes two identical sound IF channels. Each consists of a limiter amplifier, PLL FM demodulator and AF amplifier. Additionally, this circuit contains a squelch function, mute switch and internal voltage regulation.

Limiter Amplifiers

The intercarrier signals are fed through external ceramic bandpass filters to a 7-stage limiter amplifier. This guarantees high input sensitivity and excellent AM suppression.

PLL FM Demodulators

The alignment-free “Phase Locked Loop” (PLL) demodulator covers a wide frequency range of 4.5 MHz up to 6.5 MHz with low noise performance. The linear voltage to frequency characteristic results in low harmonic distortion. The free-running frequency of the internal VCO circuit is about 5.5 MHz. For this frequency, the input sensitivity and VCO locking is optimal. An additional external resistor at Pin 10 allows a frequency shift of ±1 MHz via an internal offset current. With this option, it is possible to shift the optimum conditions to the upper frequency (6.5 MHz) or to the lower frequency (4.5 MHz). The offset current acts simultaneously on both VCO circuits. If no resistor is connected, the offset current is disabled.

Audio Amplifiers

The demodulated signals are amplified to 500 mVrms with low output impedance at the audio outputs (Pin 6 and Pin 7). AC decoupling at Pin 8 and Pin 9 of the audio amplifiers leads to high common mode rejection.

Squelch Function

For channel 2 the audio output amplifier and VCO2 is muted automatically (squelch) when the second sound carrier is not present. This avoids a wrong identification for stereo and dual sound in the stereo decoder. Therefore, with mono sound, there is no output signal at Pin 6. The automatic squelch function can be disabled by switching Pin 4 to ground.

Mute Switch

Simultaneously muting of both circuits is possible by switching Pin 3 to ground.

Internal Voltage Stabilizer

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

Pin Description

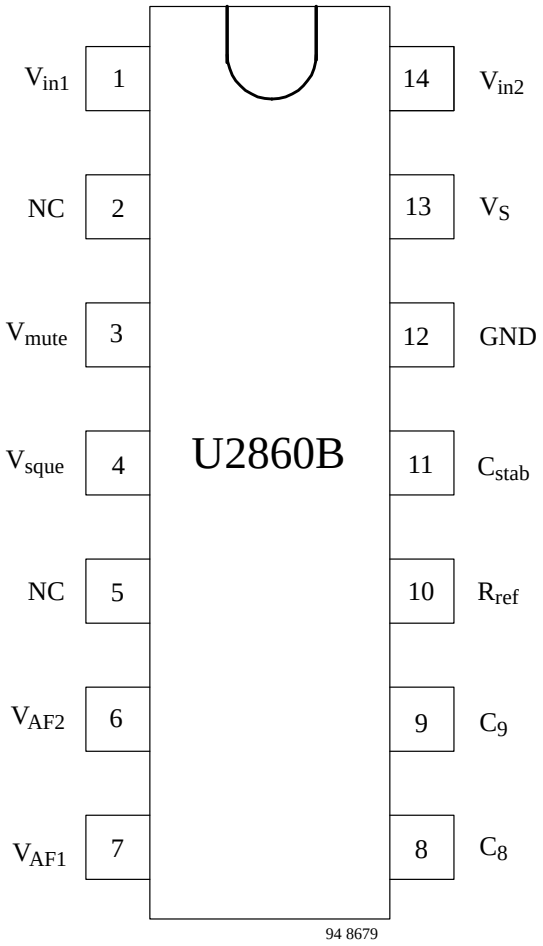

Figure 2. Connection diagram

Pin	Symbol	Function
1	V_{in1}	Intercarrier input of sound channel 1 (5.5 MHz)
2	NC	Not connected
3	V_{mute}	Mute for sound channel 1+2 “on/off”
4	V_{sque}	Automatic mute for 2nd sound channel (squelch) “on/off”
5	NC	Not connected
6	V_{AF2}	Audio output AF2 of sound channel 2
7	V_{AF1}	Audio output AF1 of sound channel 1
8	C_8	Decoupling capacitor for sound channel 1
9	C_9	Decoupling capacitor for sound channel 2
10	R_{ref}	VCO offset of the free-running frequency
11	C_{stab}	Internal supply voltage stabilization
12	GND	Ground
13	V_S	Supply voltage
14	V_{in2}	Intercarrier input of sound channel 2 (5.74 MHz)

Maximum Ratings

Reference point Pin 12, unless otherwise specified

Parameters		Symbol	Value	Unit
Supply voltage	Pin 13	V_S	9.0	V
Supply current	Pin 13	I_S	33	mA
Power dissipation V_S = +9 V		P	300	mW
Output currents	Pin 6, 7	I_{out}	±1.5	mA
External voltages	Pin 1, 14	V_{ext}	2.0	V
	Pin 3, 4	V_{ext}	V_S	V
	Pin 6, 7, 8, 9, 10, 11	V_{ext}	4.5 V	V
Junction temperature		T_j	+125	°C
Storage temperature		T_{stg}	–25 to +125	°C
Electrostatic handling *) all pins		V_{ESD}	±200	V

*) Machine model in accordance with ESD S5.2 standard

Operating Range

Parameters	Symbol	Value	Unit
Supply voltage range Pin 13	V_S	4.5 to 9.0	V
Ambient temperature	T_{amb}	0 to +85	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient when soldered to PCB	R_{thJA}	90	K/W

Electrical Characteristics

V_S = 5 V, T_{amb} = 25°C, reference point Pin 12, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
DC-supply	Pin 13					
Supply voltage range		V_S	4.5	5.0	9.0	V
Supply current		I_S		27	33	mA
Intercarrier input 1	Pin 1					
DC input voltage		V_{DC}		1.75		V
Input resistance	See note 1	R_{in}		680	750	Ω
Input limiting voltage	Input signal v_{in}: f = 5.5 MHz output signal AF1: $v_{AF1} \Rightarrow$ –3 dB	v_{lim}			150	µV
Intercarrier input 2	Pin 14					
DC input voltage		V_{DC}		1.75		V
Input resistance	See note 1	R_{in}		680	750	Ω
Input limiting voltage	Input signal v_{in}: f = 5.74 MHz output signal AF2: $v_{AF2} \Rightarrow$ –3 dB	v_{lim}			150	µV
Input signal for automatic second sound carrier “mute off” (squelch)	Audio output AF2 active	v_{in}	> 0.7	1.0	< 1.5	mV
FM demodulators, internal VCO’s	Pin 10					
Free-running frequency		f_{VCO}		5.5		MHz
Oscillator drift (free-running) as function of temperature	ΔT = 55°C	Δf_{VCO}		500		kHz
Oscillator shift (free-running) as function of supply voltage	4.5 V < V_S < 5.5 V	Δf_{VCO}		200		kHz
Adjustment range of free-running frequencies	By external resistor R_{ref} at Pin 10	Δf_{adj}	±1			MHz
Adjustment resistance for free-running frequencies		R_{ref}	15	22	30	kΩ

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
FM demodulators, internal VCO's Pin 10						
Steepness of free-running frequency adjustment	Resistor R_{ref} at Pin 10	S		200		kHz/kΩ
Capture range of PLL's		Δf_{cap}	±1.4	±1.9		MHz
Holding range of PLL's		Δf_{hold}	±2.0	±3.0		MHz
Audio outputs, AF1 (Pin 7) **and AF2** (Pin 6)						
DC output voltage		V_{DC}		2.2		V
DC output current		I_{DC}		1.0	–1.3	mA
Output resistance	See note 1	R_{out}		150		Ω
AC output peak current		i_{AC}			±1.0	mA
AF output voltage, RMS value	v_{in} = 10 mV, f = 5.5 MHz, FM-dev. = 27 kHz, f_{mod} = 1 kHz	v_{AF}		500		mV
Difference between the output signals		Δv_{AF}			±1	dB
Total harmonic distortion	v_{in} = 10 mV, f = 5.5 MHz, FM-dev. = 27 kHz, f_{mod} = 1 kHz	THD		0.1	0.5	%
AM suppression	v_{in} = 10 mV, f = 5.5 MHz, f_{mod} = 1 kHz, reference signal: FM-dev. = 50 kHz test signal: m = 30%	α_{AM}	46	66		dB
Crosstalk attenuation between the AF outputs	f = 50 Hz to 12.5 kHz	α_{att}		70		dB
Supply voltage ripple rejection	V_{RR} < 200 mV, f = 70 Hz	RR		24		dB
Mute switch Pin 3						
Control voltage - muteoff - mute on	AF outputs active AF outputs not active	V_{mute}	2.0 0		V_S 0.8	V V
Control current		I_{mute}		150		µA
Squelch function Pin 4						
Control voltage for automatic mute-2nd carrier "off" automatic mute-2nd carrier "on"		V_{sque}	0 2.0		0.8 V_S	V V
Control current		I_{sque}		150		µA

Notes

1.) This parameter is given as an application information and not measured during final testing.

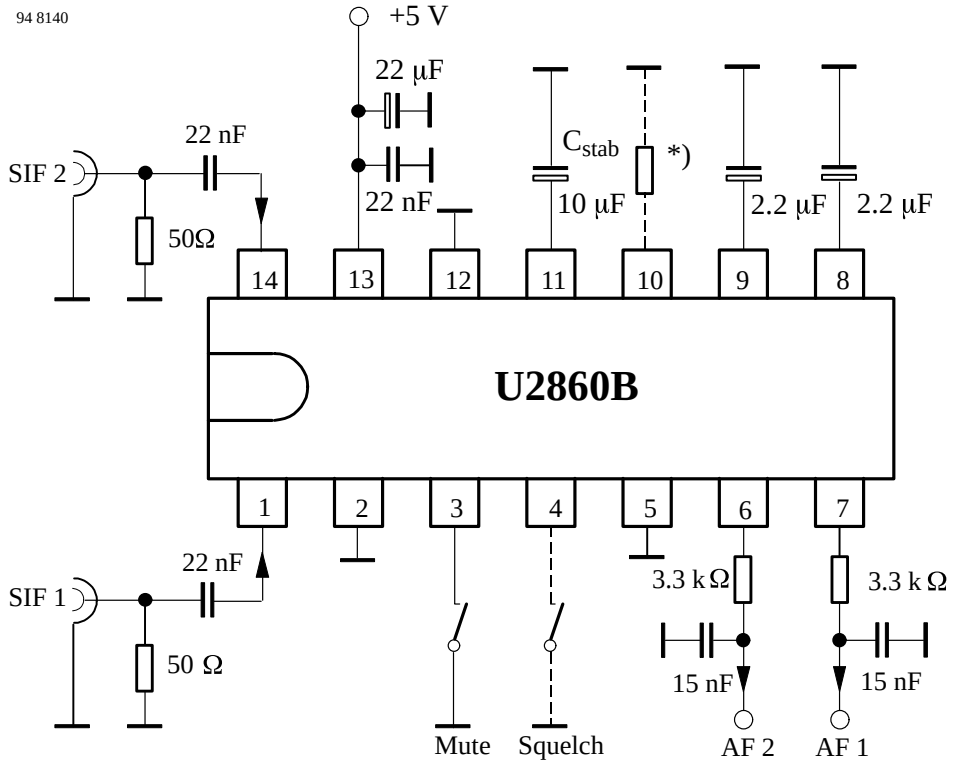

Figure 3. Test circuit

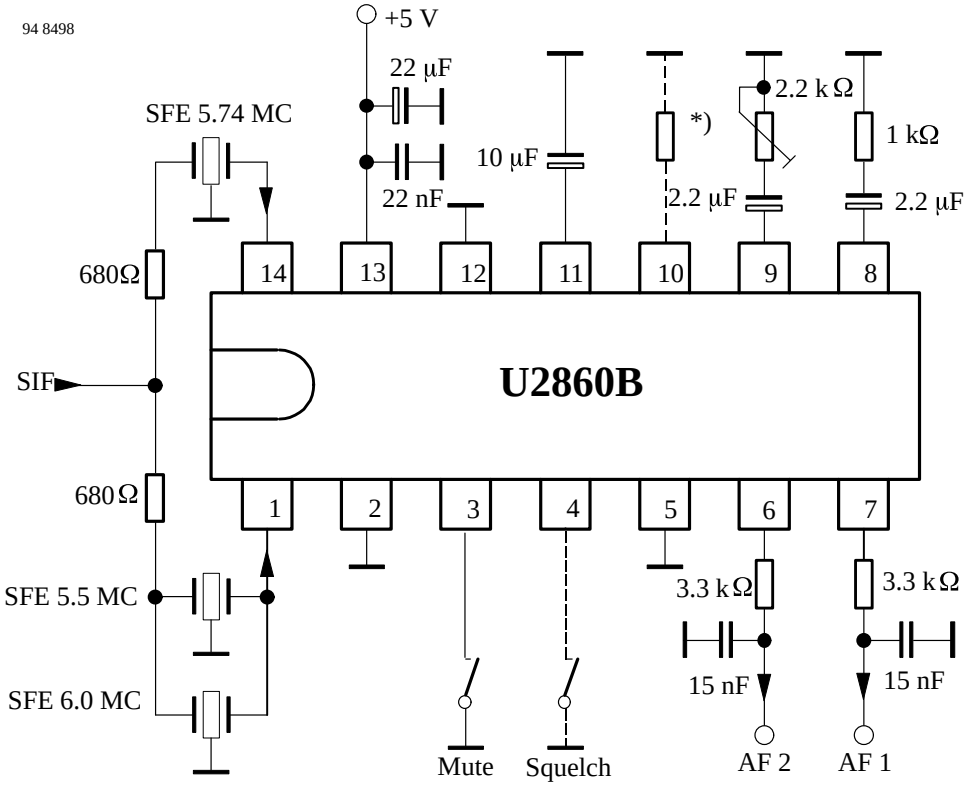

Figure 4. Application circuit

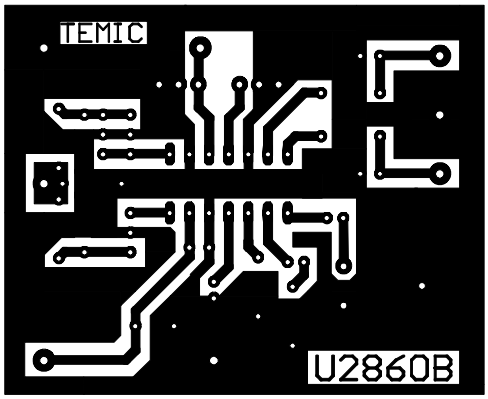

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Figure 5. PCB layout (test/application circuit)

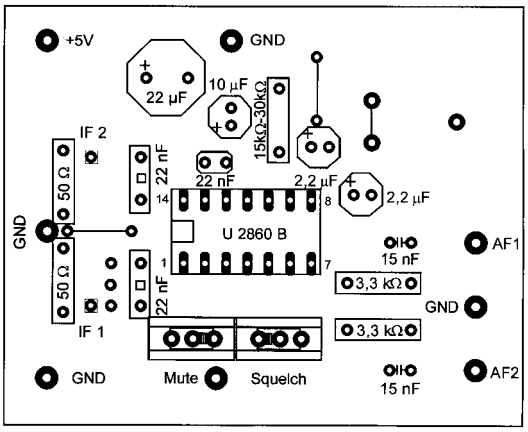

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Figure 6. Component layout (test circuit)

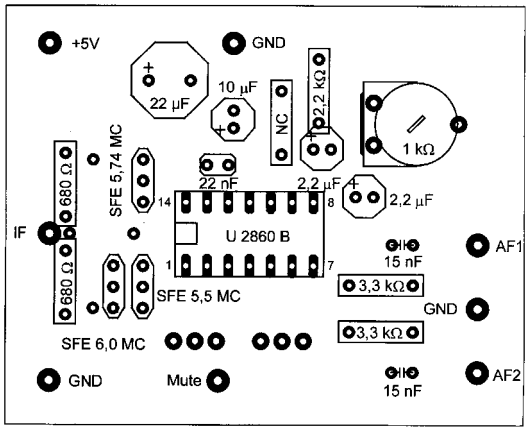

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Figure 7. Component layout (application circuit)

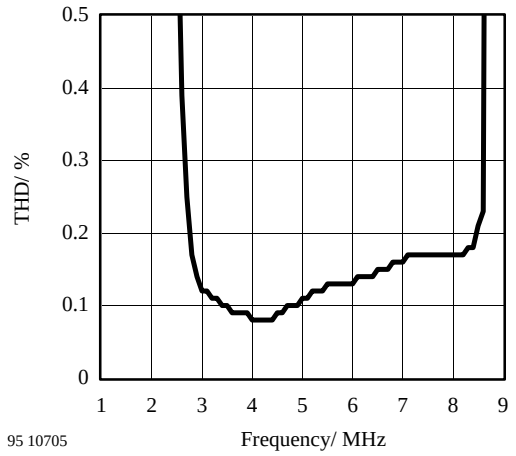


Figure 8. Total harmonic distortion

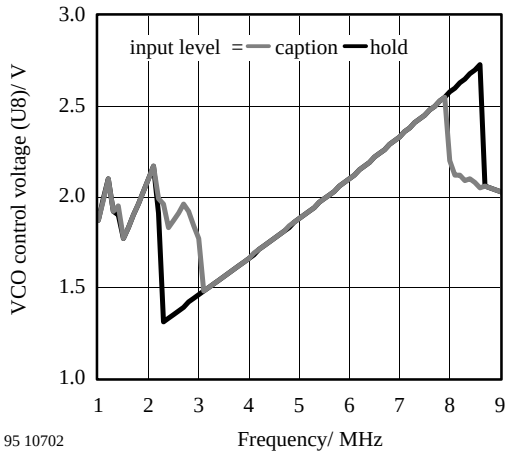


Figure 11. Capture and hold range

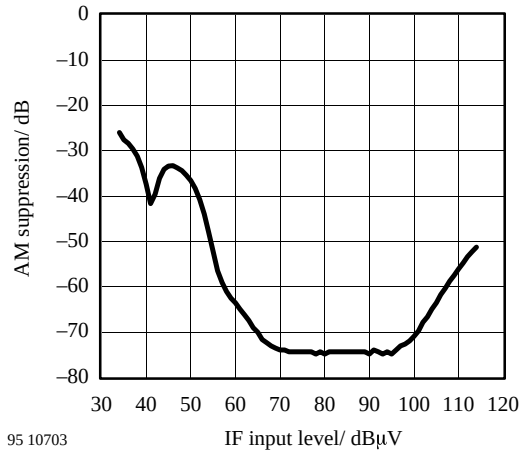


Figure 9. AM suppression

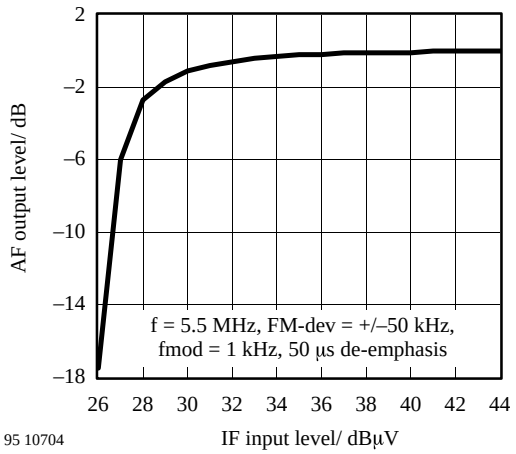


Figure 12. Limiter characteristics

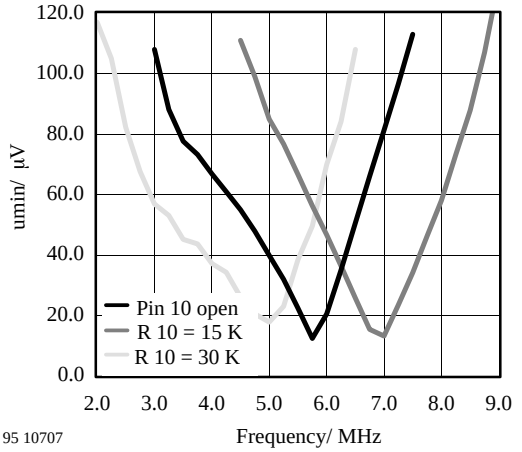


Figure 10. VCO free-running frequency

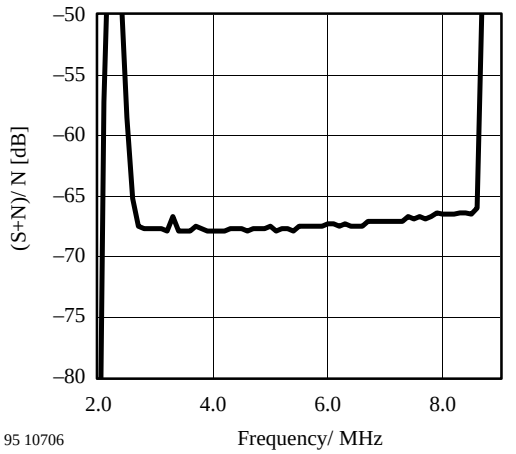


Figure 13. Signal to noise ratio

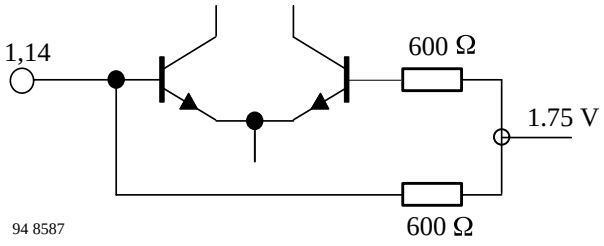


Figure 14. SIF inputs

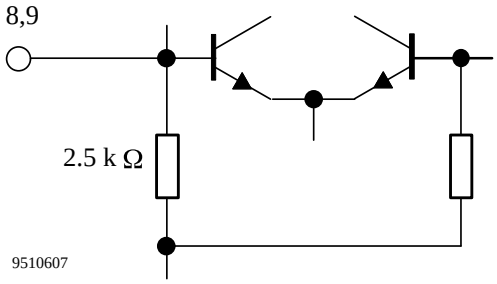


Figure 17. Decoupling capacitor

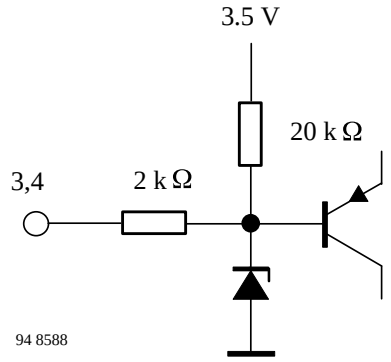


Figure 15. Mute switch/squelch switch

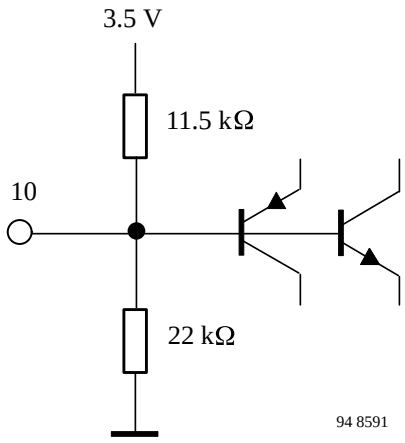


Figure 18. VCO offset (reference resistor)

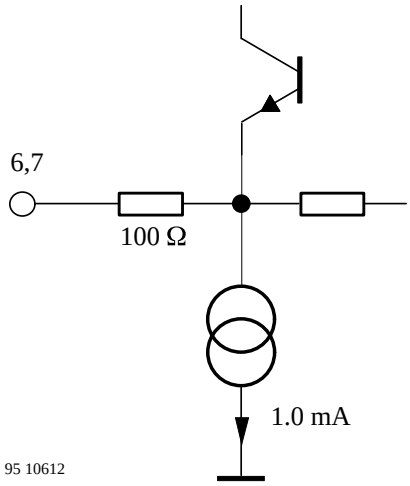


Figure 16. Audio outputs

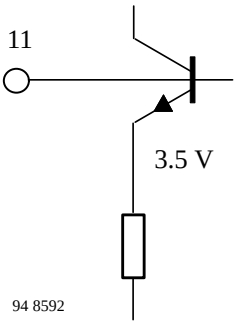
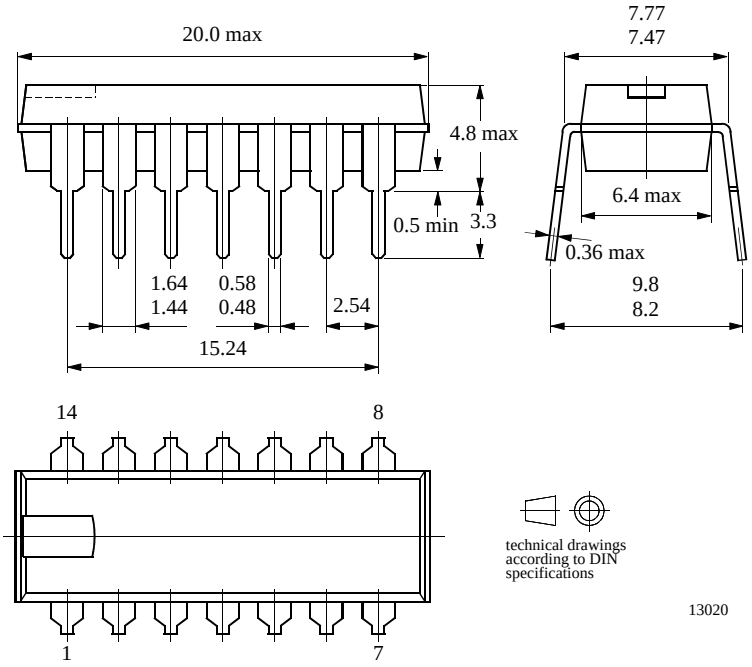


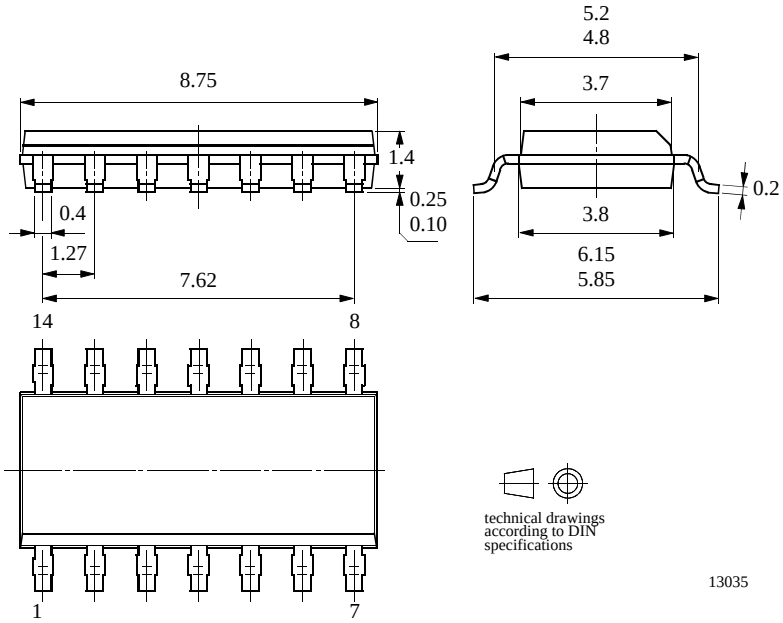
Figure 19. Internal supply voltage stabilization

Package Information

Package DIP14
Dimensions in mm



Package SO14
Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC Semiconductor 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 Semiconductor GmbH 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 Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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