

## Mono FM Sound Demodulator for TV Systems

### Description

The U2861B is an alignment-free FM sound IF demodulator for all TV standards from 4.5 MHz up to 6.5 MHz (standard M, N, B/G, I, D/K). The circuit includes two

switchable audio inputs and volume control. With a supply voltage of 5 V, the U2861B is suitable for TV, VCR and Multimedia applications.

### Features

- Completely alignment-free
- PLL demodulator for FM intercarrier sound IF signals (mono)
- Two audio switches
- Very few external components
- Volume control by DC voltage
- Supply voltage: 5 V; low power consumption

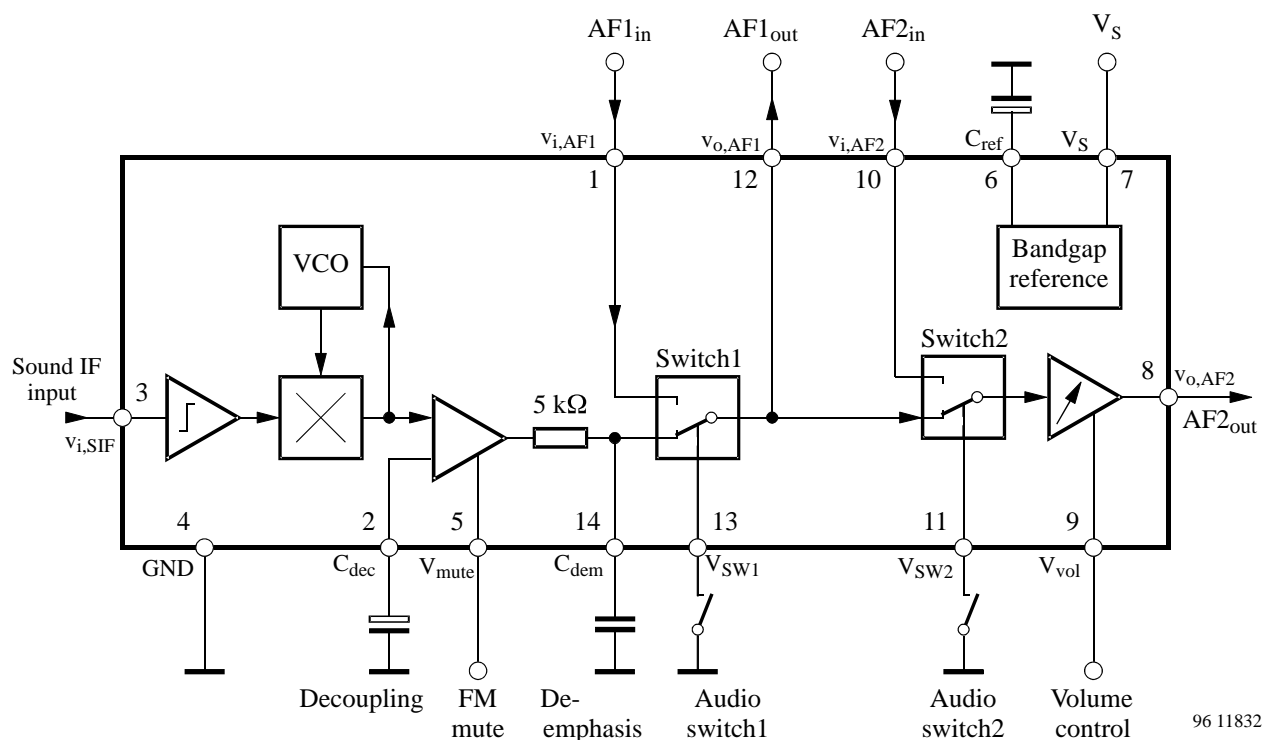


Figure 1. Block diagram

### Ordering Information

Extended Type Number	Package	Remarks
U2861B – M	DIP14	
U2861B – MFPG3	SO14	taped on reel

## Circuit Description

### Sound IF Limiter Amplifier

The intercarrier signal coming from the sound filter is fed to a 7-stage limiter amplifier. This guarantees high input sensitivity and excellent AM suppression.

### PLL – FM Demodulator

The alignment-free “Phase-Locked-Loop” (PLL) FM demodulator covers a wide frequency range of 4.5 MHz up to 6.5 MHz with excellent noise performance. Due to the fact that the voltage-to-frequency characteristic is linear, a low harmonic distortion can be achieved. The free-running frequency of the internal VCO circuit is about 5.5 MHz.

The demodulated FM signal is led via de-emphasis and buffered to Pin 12. The de-emphasis low pass filter consists of an internal 5-kΩ series resistor and an external capacitor at Pin 14. The FM muting is possible by switching Pin 5 to ground.

### Pin Description

Pin	Symbol	Function
1	$v_{i,AF1}$	Audio input 1 (e.g. AM signal)
2	$C_{dec}$	Decoupling capacitor
3	$v_{i,SIF}$	FM sound IF input
4	GND	Ground
5	$V_{mute}$	FM mute switch
6	$C_{ref}$	Internal reference voltage
7	$V_s$	Supply voltage
8	$v_{o,AF2}$	Switched audio output 2
9	$V_{vol}$	Volume control
10	$v_{i,AF2}$	Audio input 2 (e.g. from SCART)
11	$V_{SW2}$	Audio switch 2
12	$v_{o,AF1}$	Switched audio output 1
13	$V_{SW1}$	Audio switch 1
14	$C_{dem}$	De-emphasis and mute switch

### Audio Switch 1

The first audio switch (Pin 13) has inputs for the demodulated FM signal and the external AF1 signal from Pin 1. For multistandard purposes, it is possible to handle internal FM and external AM audio signals. The output of switch1 is also permanently available at Pin 12 (e. g. for SCART interface).

### Audio Switch 2 and Volume Control

The second audio switch (Pin 11) has inputs for the audio signal from switch 1 and the external AF2 signal at Pin 10. The switched AF signal is fed to volume control. The output voltage can be controlled by a DC voltage at Pin 9.

### Internal Voltage Stabilizer

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

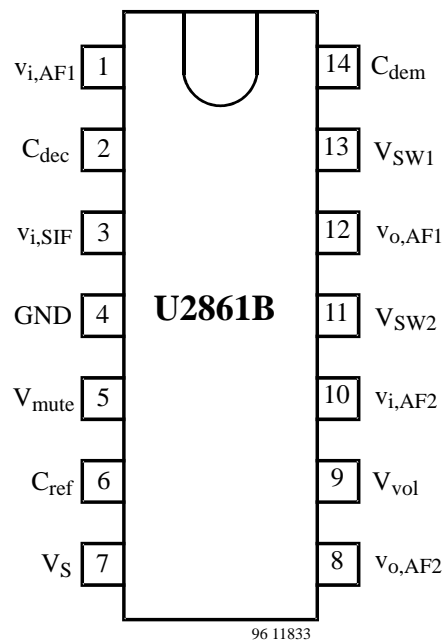


Figure 2. Pinning

## Absolute Maximum Values

Reference point Pin 4, unless otherwise specified

Parameters	Symbol	Value	Unit
Supply voltage DIP14 package SO14 package	$V_s$	9.0	V
Pin 7		6.0	V
Supply current	$I_s$	25	mA
Power dissipation	$P$	$V_s = 9\text{ V}$ (DIP14 only)	225
		$V_s = 6\text{ V}$	150
Output currents	$I_{out}$	1.0	mA
External voltages	$V_{ext}$	Pin 1, 2, 3, 5, 6, 8, 9, 10, 12, 13, 14	+ 4.5
		Pin 11	+ 12.0
Ambient temperature	$T_{amb}$	-10 to +85	°C
Junction temperature	$T_j$	+125	°C
Storage temperature	$T_{stg}$	-25 to +125	°C
Electrostatic handling *) all pins	$V_{ESD}$	+/- 200 V	V

\*) equivalent to discharge a 200-pF capacitor through a 0-Ω resistor

## Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient when soldered to PCB	$R_{thJA}$	DIP14 package	90
		SO14 package	140

## Electrical Characteristic

$V_s = +5\text{ V}$ ,  $T_{amb} = +25^\circ\text{C}$ ; reference point Pin 4, unless otherwise specified

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>DC supply: (Pin 7)</b>						
Supply voltage DIP14 package SO14 package	$V_s$		4.5 4.5	5.0 5.0	9.0 6.0	V V
Supply current	$I_s$			20	25	mA
<b>FM sound IF input: (Pin 3)</b>						
Input limiting voltage, RMS value	$v_{i,SIF}$	AF output signal at pin 8 and pin12: -3 dB			150	$\mu\text{V}_{\text{RMS}}$
DC input voltage	$V_{\text{DC}}$			1.7		V
Input resistance	$R_{\text{in}}$	See note 1		600	750	$\Omega$
Input capacitance	$C_{\text{in}}$	See note 1		1.5		pF
<b>FM – PLL:</b>						
Free-running frequency	$f_{\text{vco}}$			5.5		MHz
Oscillator drift (free running) as function of temperature	$\Delta f_{\text{vco}}$	$\Delta T = 55^\circ\text{C}$		500		kHz
Oscillator shift (free running) as function of supply voltage	$\Delta f_{\text{vco}}$	$4.5\text{ V} < V_s < V_{s,\text{max}}$		200		kHz
Capture range of PLL	$\Delta f_{\text{cap}}$		$\pm 1.4$	$\pm 1.9$		MHz
Holding range of PLL	$\Delta f_{\text{hold}}$		$\pm 2.0$	$\pm 2.5$		MHz
<b>Decoupling capacitor: (Pin 2)</b>						
Value of decoupling capacitor	$C_{\text{dec}}$			2.2		$\mu\text{F}$
<b>De-emphasis capacitor: (Pin 14)</b>						
Value of de-emphasis capacitor	$C_{\text{dem}}$	$\tau = 50\mu\text{s}$		10		nF
<b>Audio output 2: (Pin 8)</b>						
DC output voltage	$V_{\text{DC}}$			2.2		V
Output resistance	$R_{\text{out}}$			130		$\Omega$
AC output peak current	$i_{\text{AC}}$				$\pm 1.0$	mA
DC output current	$I_{\text{DC}}$				-1.2	mA
AF output voltage, RMS value	$v_{o,\text{AF2}}$	$v_{\text{in}} = 10\text{ mV}$ , $f = 5.5\text{ MHz}$ , FM-dev. = 27 kHz, $f_{\text{mod}} = 1\text{ kHz}$		500		$\text{mV}_{\text{RMS}}$
Total harmonic distortion	THD	$v_{\text{in}} = 10\text{ mV}$ , $f = 5.5\text{ MHz}$ , FM-dev. = 27 kHz, $f_{\text{mod}} = 1\text{ kHz}$		0.1	0.5	%
AM suppression	$a_{\text{AM}}$	$v_{\text{in}} = 10\text{ mV}$ , $f = 5.5\text{ MHz}$ , $f_{\text{mod}} = 1\text{ kHz}$ , <u>reference signal:</u> FM-dev. = 27 kHz <u>test signal:</u> $m = 30\%$	42	60		dB
Supply voltage ripple rejection	RR	$V_{\text{RR}} < 200\text{ mV}$ , $f = 70\text{ Hz}$		30		dB

## Electrical Characteristics

$V_s = +5\text{ V}$ ,  $T_{amb} = +25^\circ\text{C}$ ; reference point Pin 4, unless otherwise specified

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Audio input 1: (Pin 1)</b>						
Input resistance	$R_{in}$			50		$k\Omega$
Internal DC bias voltage	$V_{DC}$			3.0		V
AF1 input signal	$V_{i,AF1}$				900	$mV_{RMS}$
<b>Mode selection audio switch 1: (Pin 13)</b>						
Control voltage for: FM demodulated signal External signal AF1	$V_{sw1}$	See note 2	2.0 0		4.5 0.8	V V
Switching current	$I_{sw1}$				70	$\mu\text{A}$
<b>Audio input 2: (Pin 10)</b>						
Input resistance	$R_{in}$			50		$k\Omega$
Internal DC bias voltage	$V_{DC}$			3.0		V
AF2 input signal	$V_{i,AF2}$				900	$mV_{RMS}$
<b>Audio output 1: (Pin 12)</b>						
DC output voltage	$V_{DC}$			2.3		V
AF output voltage	$V_{o,AF}$			500		$mV_{RMS}$
Output resistance	$R_{out}$			130		$\Omega$
<b>Mode selection audio switch 2: (Pin 11)</b>						
Control voltage for: External signal AF2 Signal from switch1 Signal from switch1	$V_{sw}$	See note 3	0 4.0	2.8	1.5 12.0	V V V
Switching current	$I_{sw}$				60	$\mu\text{A}$
<b>Volume control: (Pin 9)</b>						
AF control range	$\Delta\text{AF}$			80		dB
Control voltage: minimal volume maximal volume	$V_{vol}$		0	4	4.5	V V
<b>Mute switch: (Pin 5)</b>						
Control voltage for "mute off"	$V_{mute}$	AF "on"	2.1	2.9	4.5	V
Control voltage for "mute on"	$V_{mute}$	AF "off"	0		1.5	V

### Notes:

- This parameter is given as an application information and is not tested during production.
- Without control voltage at Pin 13, the internal FM demodulated
- Without control voltage at Pin 11, the audio signal from switch1 is automatically selected..  
With  $V_{11} < 1.5$  or  $V_{11} > 4.0$  V input Pin 10 is selected.
- Without control voltage at Pin 5, the mute function is not active.

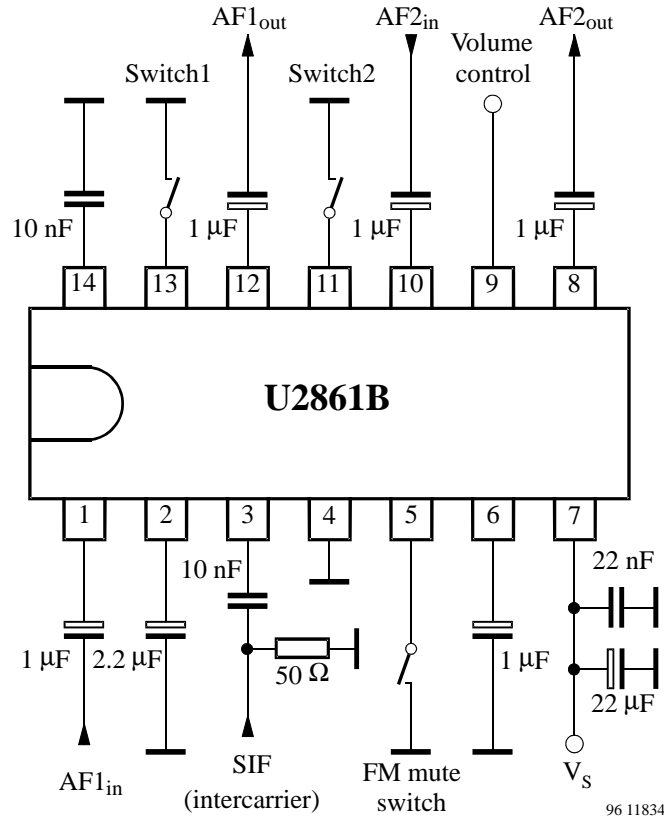


Figure 3. Test circuit

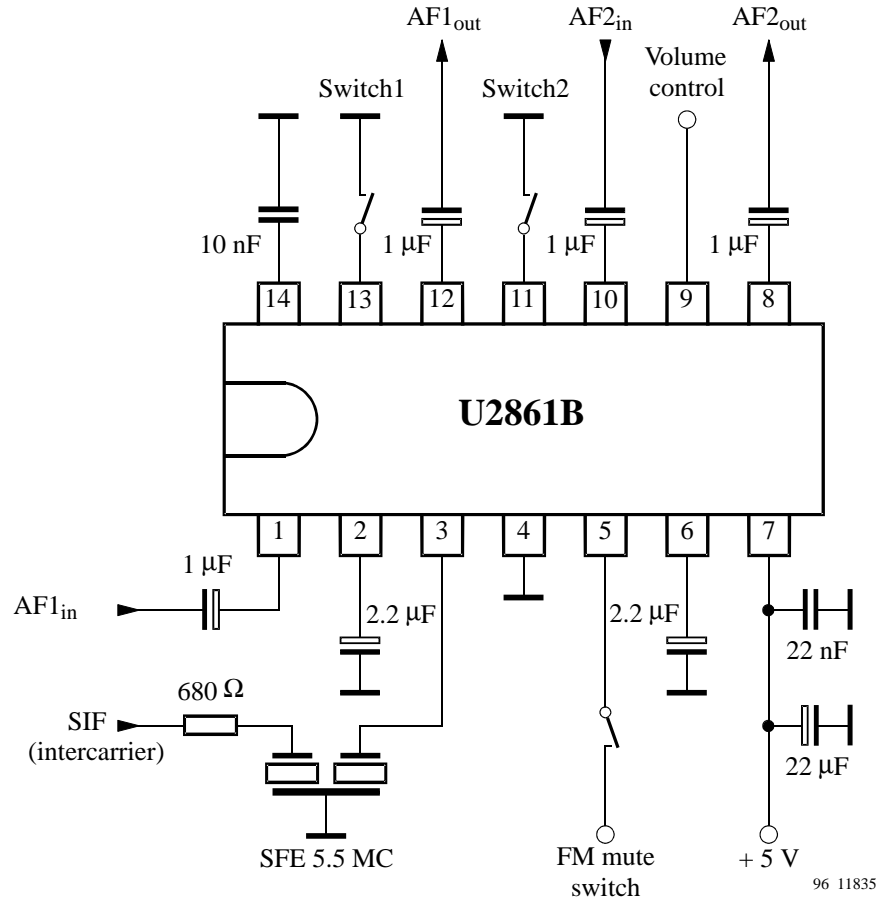


Figure 4. Basic application circuit

## Internal Pin Configuration

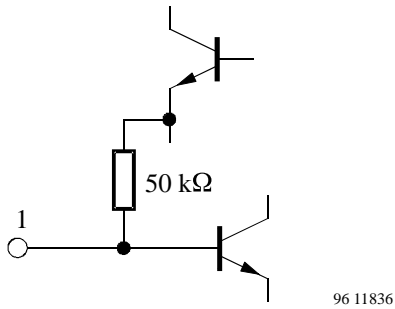


Figure 5. Audio input 1 (Pin 1)

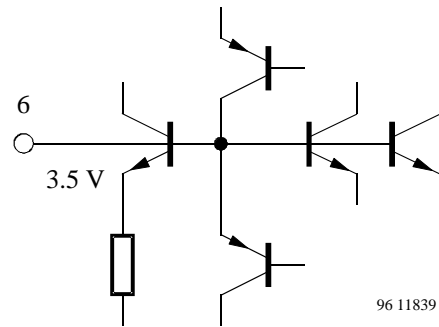


Figure 8. Internal reference voltage (Pin 6)

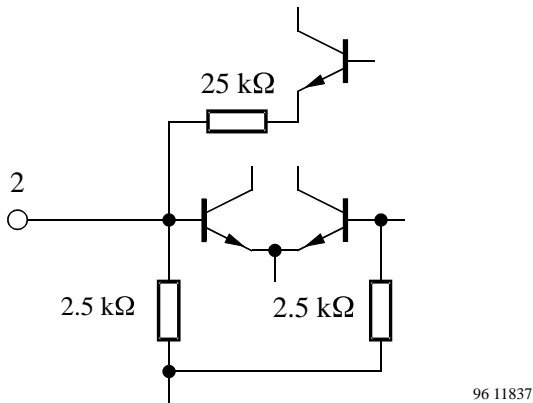


Figure 6. Decoupling capacitor (Pin 2)

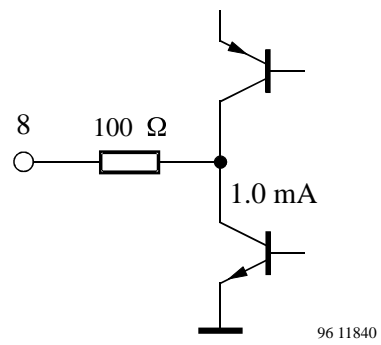


Figure 9. Audio output 2 (Pin 8)

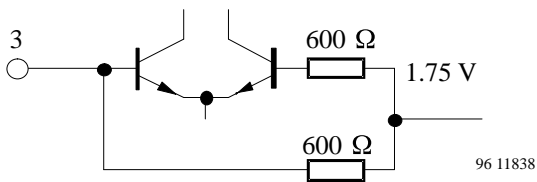


Figure 7. FM sound IF input (Pin 3)

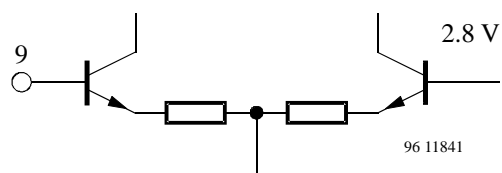


Figure 10. Volume control (Pin 9)



**Internal Pin Configuration (continued)**

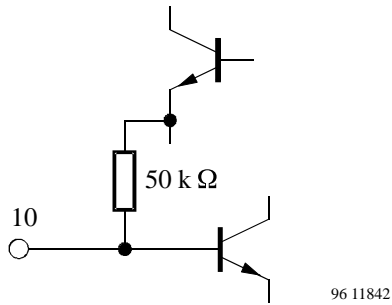


Figure 11. Audio input 2 (Pin 10)

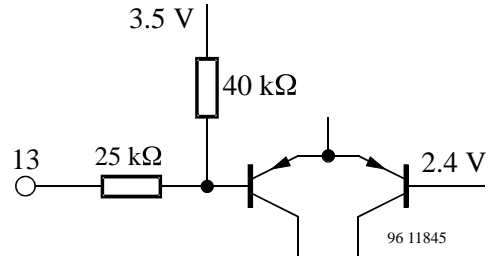


Figure 14. Switch 1 (Pin 13)

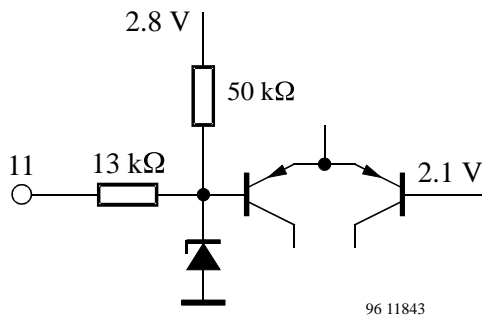


Figure 12. Audio switch 2 (Pin 11)

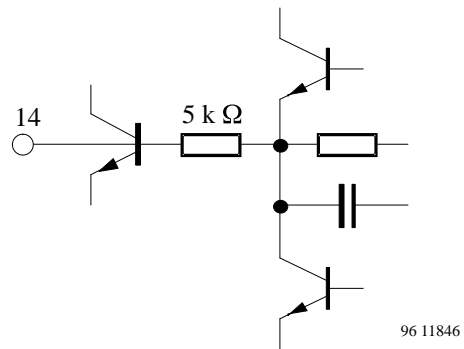


Figure 15. De-emphasis (Pin 14)

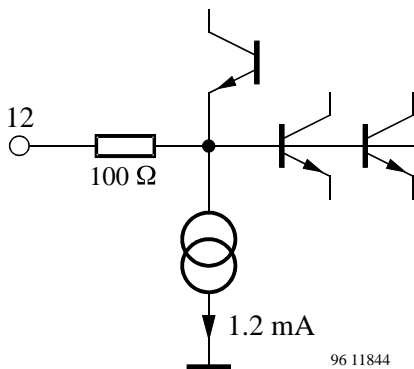


Figure 13. Audio output 2 (Pin 12)

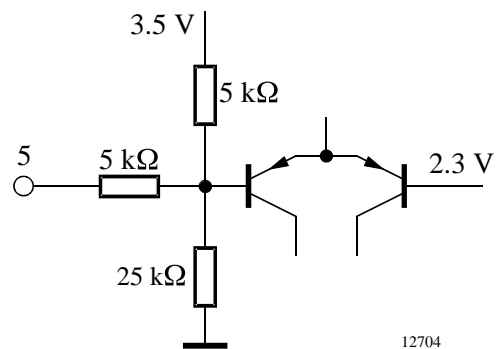
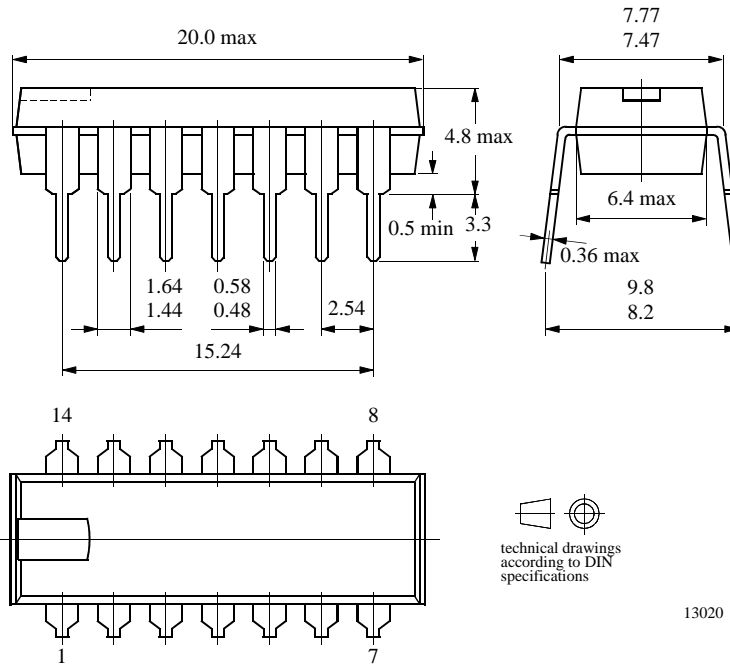


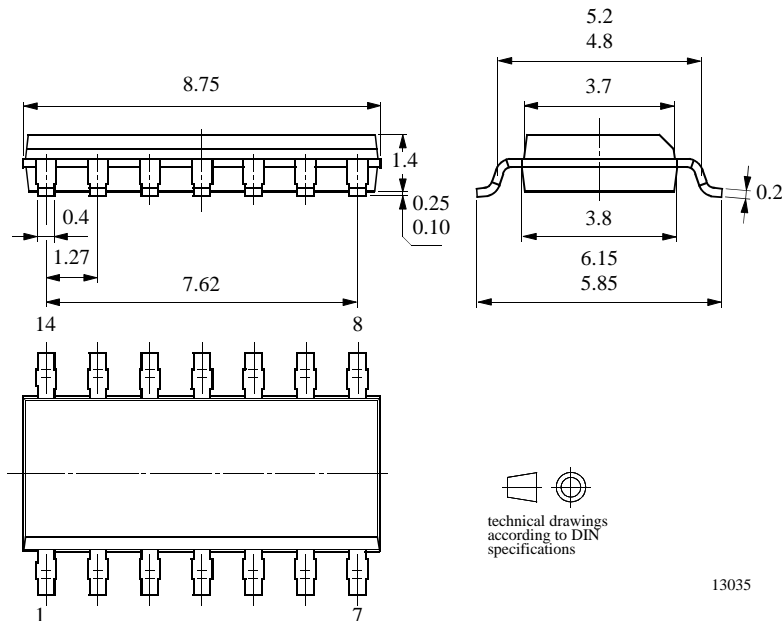
Figure 16. Mute switch (Pin 5)

## Package Information

Package DIP14  
Dimensions in mm



Package SO14  
Dimensions in mm



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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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