



## 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: 5V
- Pb-free Package, which is Compliant with Requirements of RoHS

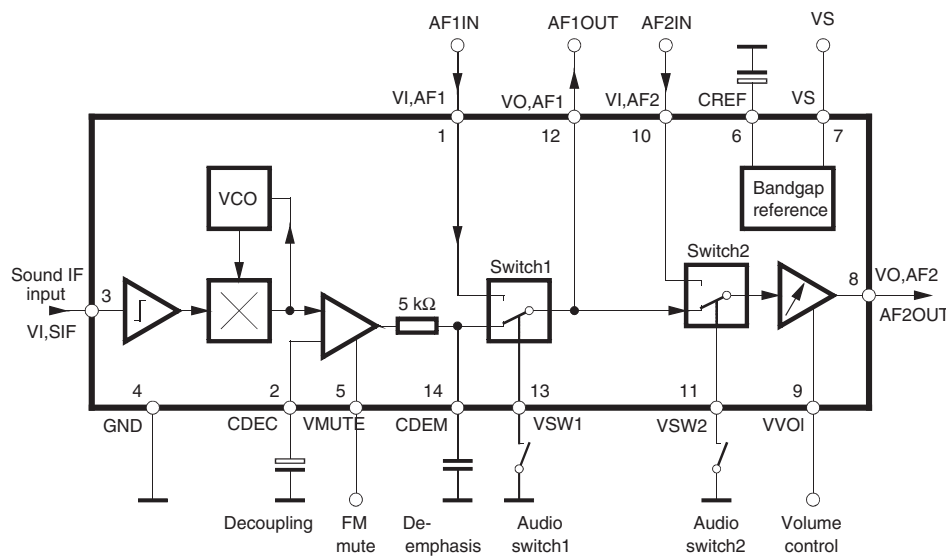


## Mono FM Sound Demodulator for TV Systems

### 1. 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 5V, the U2861B is suitable for TV, VCR and Multimedia applications.

Figure 1-1. Block Diagram



## 2. 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.

### 2.1 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-k $\Omega$  series resistor and an external capacitor at pin 14. The FM muting is possible by switching pin 5 to ground.

### 2.2 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).

### 2.3 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.

### 2.4 Internal Voltage Stabilizer

The internal band-gap reference ensures constant performance independent of supply voltage and temperature.

## 3. Pin Configuration

Figure 3-1. Pinning

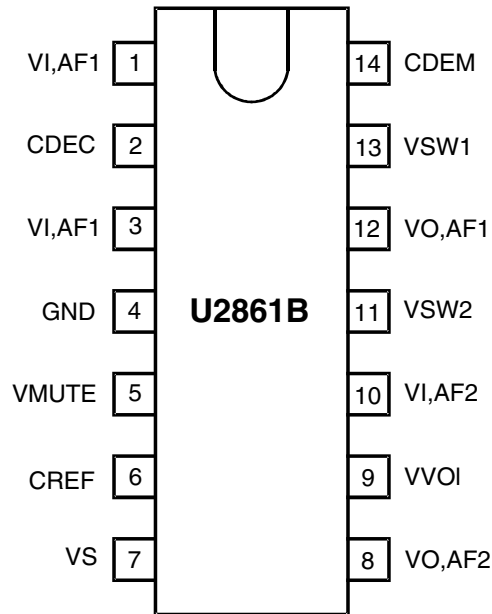


Table 3-1. Pin Description

| Pin | Symbol | Function                         |
|-----|--------|----------------------------------|
| 1   | VI,AF1 | Audio input 1 (e.g., AM signal)  |
| 2   | CDEC   | Decoupling capacitor             |
| 3   | VI,SIF | FM sound IF input                |
| 4   | GND    | Ground                           |
| 5   | VMUTE  | FM mute switch                   |
| 6   | CREF   | Internal reference voltage       |
| 7   | VS     | Supply voltage                   |
| 8   | VO,AF2 | Switched audio output 2          |
| 9   | VVOL   | Volume control                   |
| 10  | VI,AF2 | Audio input 2 (e.g., from SCART) |
| 11  | VSW2   | Audio switch 2                   |
| 12  | VO,AF1 | Switched audio output 1          |
| 13  | VSW1   | Audio switch 1                   |
| 14  | CDEM   | De-emphasis and mute switch      |

## 4. Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Reference point pin 4, unless otherwise specified.

| Parameters                              | Pin                                    | Symbol    | Value       | Unit |
|---|--|-----------|-------------|------|
| Supply voltage<br>SO14 package          | 7                                      | $V_S$     | 6.0         | V    |
| Supply current                          | 7                                      | $I_S$     | 25          | mA   |
| Power dissipation<br>$V_S = 6\text{ V}$ |  | P         | 150         | mW   |
| Output currents                         | 8, 12                                  | $I_{out}$ | 1.0         | mA   |
| External voltages                       | 1, 2, 3, 5, 6, 8, 9,<br>10, 12, 13, 14 | $V_{ext}$ | +4.5        | V    |
|   | 11                                     |           | +12.0       | V    |
| Junction temperature                    |  | $T_j$     | +125        | °C   |
| Storage temperature                     |  | $T_{stg}$ | -25 to +125 | °C   |
| Electrostatic handling <sup>(1)</sup>   | All                                    | $V_{ESD}$ | ±200        | V    |

Note: 1. Equivalent to discharging a 200-pF capacitor through a 0-Ω resistor

## 5. Thermal Resistance

| Parameters  | Symbol     | Value | Unit |
|---|------------|-------|------|
| Junction ambient when soldered to PCB<br>SO14 package | $R_{thJA}$ | 140   | K/W  |

## 6. Electrical Characteristics

$V_S = +5V$ ,  $T_{amb} = +25^\circ C$ ; reference point pin 4, unless otherwise specified.

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

- Notes:
1. This parameter is given as application information and is not tested during production.
  2. Without external control voltage at pin 13, the internal FM is demodulated.
  3. Without control voltage at pin 11, the audio signal from switch 1 is automatically selected.  
With  $V_{11} < 1.5$  or  $V_{11} > 4.0V$  input pin 10 is selected.

## 6. Electrical Characteristics (Continued)

$V_S = +5V$ ,  $T_{amb} = +25^\circ C$ ; reference point pin 4, unless otherwise specified.

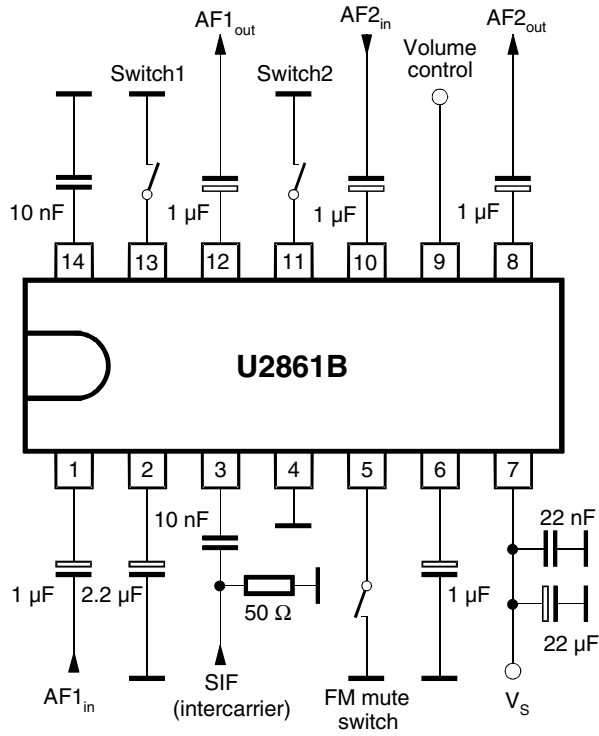
| Parameters  | Test Conditions | Symbol      | Min.     | Typ. | Max.        | Unit        |
|---|-----------------|-------------|----------|------|-------------|-------------|
| <b>Audio Input 1 (Pin 1)</b>  |                 |             |          |      |             |             |
| Input resistance  |                 | $R_{in}$    |          | 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:<br>FM demodulated signal<br>External signal AF1                        | (2)             | $V_{sw1}$   | 2.0<br>0 |      | 4.5<br>0.8  | V<br>V      |
| Switching current   |                 | $I_{sw1}$   |          |      | 70          | $\mu A$     |
| <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:<br>External signal AF2<br>Signal from switch 1<br>Signal from switch 1 | (3)             | $V_{sw}$    | 0<br>4.0 | 2.8  | 1.5<br>12.0 | V<br>V<br>V |
| Switching current   |                 | $I_{sw}$    |          |      | 60          | $\mu A$     |
| <b>Volume Control (Pin 9)</b>   |                 |             |          |      |             |             |
| AF control range  |                 | $\Delta AF$ |          | 80   |             | dB          |
| Control voltage:<br>Minimal volume<br>Maximal volume  |                 | $V_{vol}$   | 0        | 4    | 4.5         | V<br>V      |
| <b>Mute Switch (Pin 5)</b>  |                 |             |          |      |             |             |
| Control voltage for "mute off"  | AF "on"         | $V_{mute}$  | 2.1      | 2.9  | 4.5         | V           |
| Control voltage for "mute on"   | AF "off"        | $V_{mute}$  | 0        |      | 1.5         | V           |

Notes: 1. This parameter is given as application information and is not tested during production.

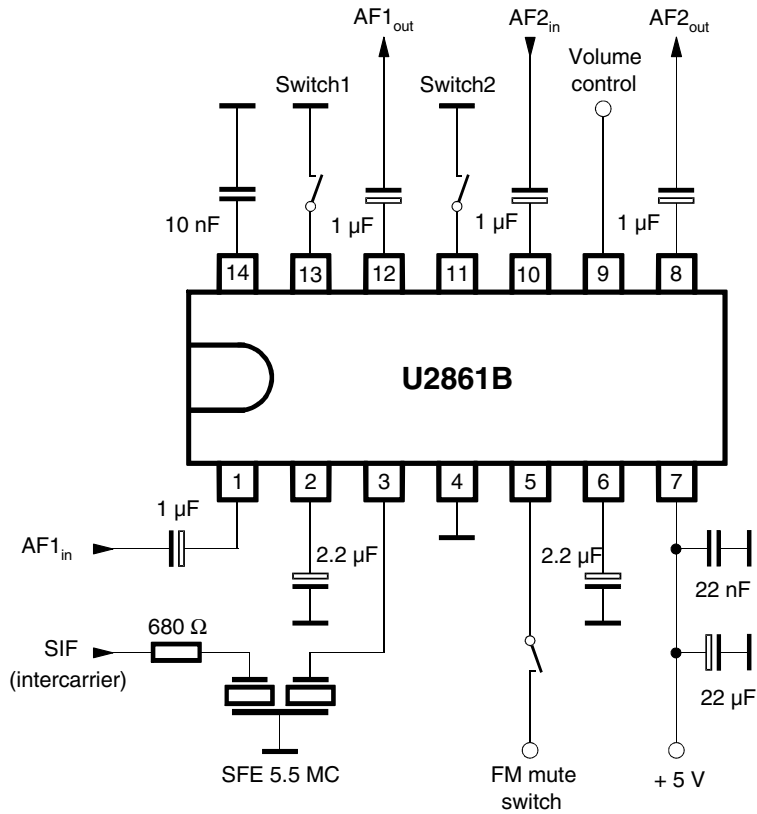
2. Without external control voltage at pin 13, the internal FM is demodulated.

3. Without control voltage at pin 11, the audio signal from switch 1 is automatically selected.  
With  $V_{11} < 1.5$  or  $V_{11} > 4.0V$  input pin 10 is selected.

**Figure 6-1.** Test Circuit



**Figure 6-2.** Basic Application Circuit



## 7. Internal Pin Configuration

Figure 7-1. Audio Input 1 (Pin 1)

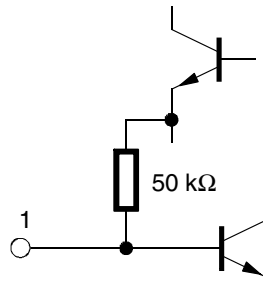


Figure 7-2. Decoupling Capacitor (Pin 2)

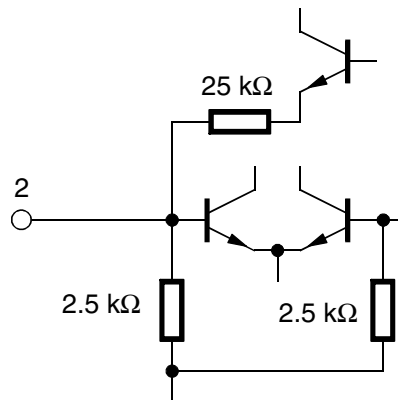


Figure 7-3. FM Sound IF Input (Pin 3)

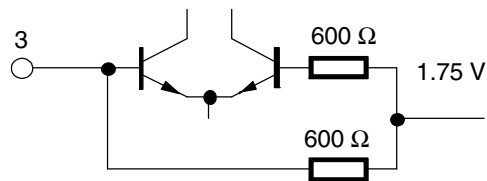


Figure 7-4. Internal Reference Voltage (Pin 6)

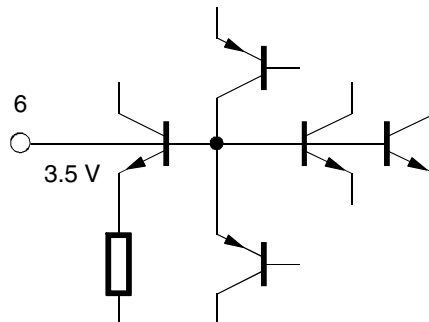




Figure 7-5. Audio Output 2 (Pin 8)

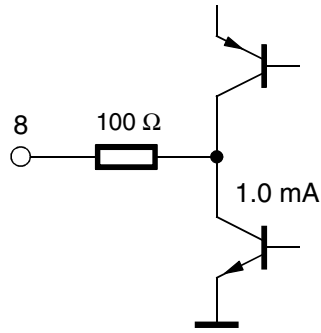


Figure 7-6. Volume Control (Pin 9)

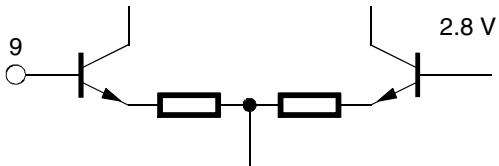


Figure 7-7. Audio Input 2 (Pin 10)

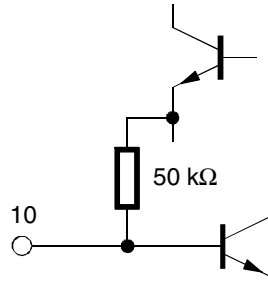
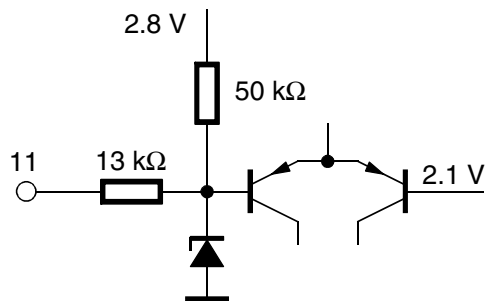
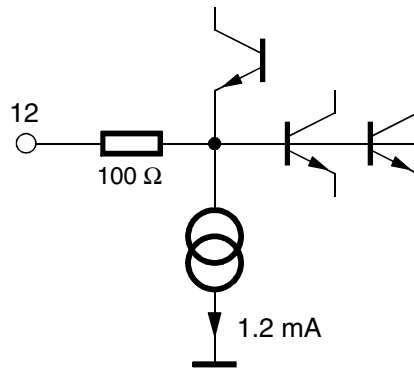


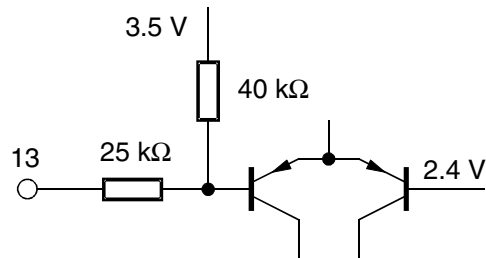
Figure 7-8. Audio Switch 2 (Pin 11)



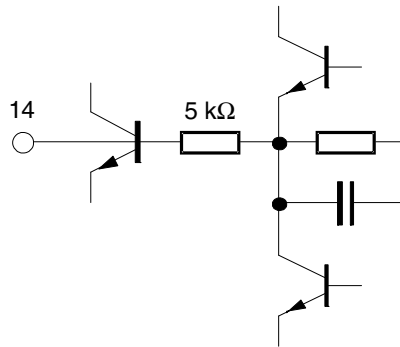
**Figure 7-9.** Audio Output 2 (Pin 12)



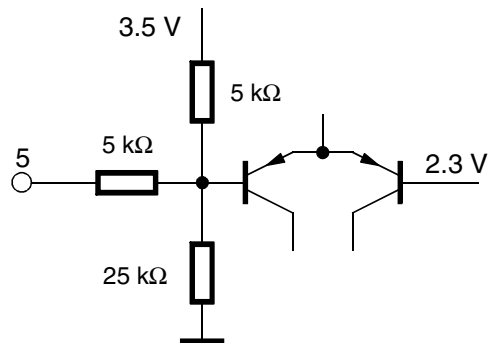
**Figure 7-10.** Switch 1 (Pin 13)



**Figure 7-11.** De-emphasis (Pin 14)



**Figure 7-12.** Mute switch (Pin 5)

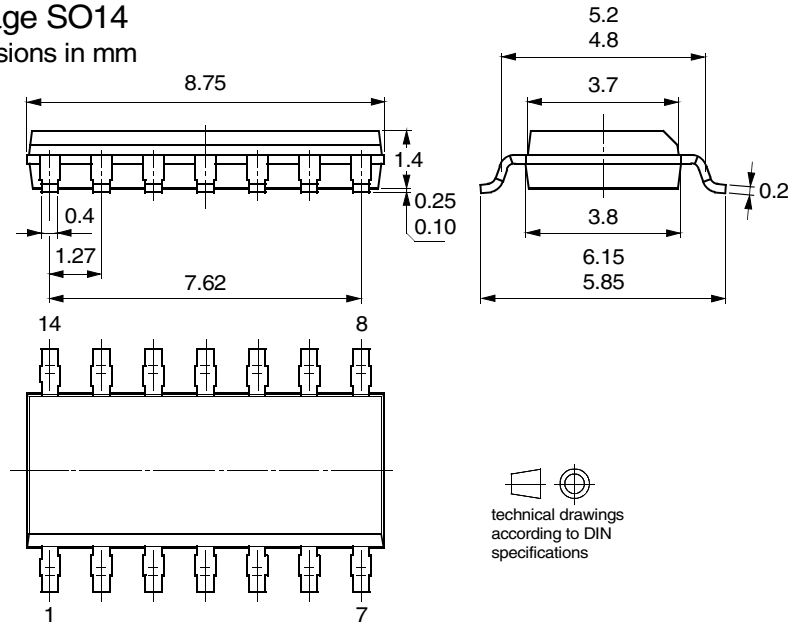


## 8. Ordering Information

| Extended Type Number | Package       | Remarks          | Standard Package Quantity |
|----------------------|---------------|------------------|---------------------------|
| U2861B-MFPG3Y        | SO14, Pb-free | Taped and reeled | 4,000                     |
| U2861B-MFPY          | SO14, Pb-free | Tube             | 3,100                     |

## 9. Package Information

Package SO14  
Dimensions in mm





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