

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 Second Sound Channel (Squelch)
- Mute Function for Both Sound Channels
- 5-V Supply Voltage, Low-power Consumption
- Few External Components

Description

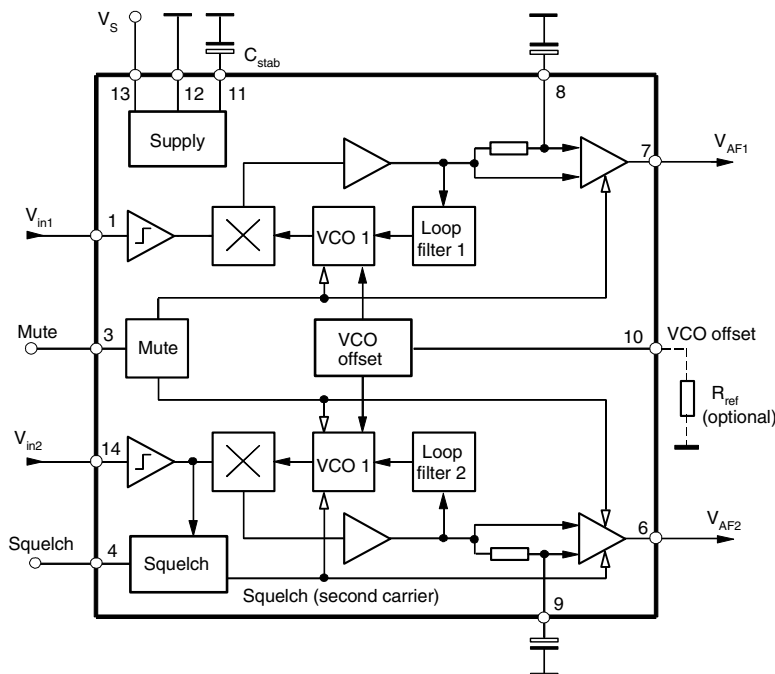
The U2860B-M is a dual-channel FM sound demodulator realized with Atmel's advanced bipolar process. All TV FM standards, from 4.5 MHz up to 6.5 MHz (standard M, B/G, I, D/K) can be processed with high performance. The circuit is alignment-free and has a minimum number of external components. With 5 V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



Dual-Channel FM Sound Demodulator for TV Systems

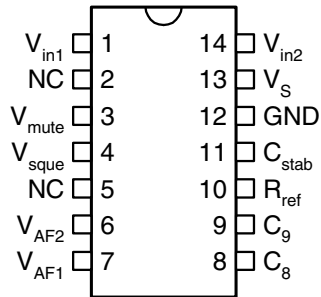
U2860B-M

Figure 1. Block Diagram



Pin Configuration

Figure 2. Pinning



Pin Description

Pin	Symbol	Function
1	V_{in1}	Inter-carrier 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}	Inter-carrier input of sound channel 2 (5.74 MHz)

Circuit Description

The U2860B-M 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

Simultaneous 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.

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 12, unless otherwise specified.

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

Notes: 1. Machine model in accordance with ESD S5.2 standard.

Thermal Resistance

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

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	$^{\circ}$ C

Electrical Characteristics

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

Parameters	Test Conditions	Pin	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 ⁽¹⁾			R_{in}		680	750	Ω
Input limiting voltage	Input signal v_{in} : $f = 5.5\text{ MHz}$ output signal AF1: $V_{AF1} = -3\text{ dB}$		V_{lim}			150	μV
Intercarrier Input 2, Pin 14							
DC input voltage			V_{DC}		1.75		V
Input resistance ⁽¹⁾			R_{in}		680	750	Ω
Input limiting voltage	Input signal v_{in} : $f = 5.74\text{ MHz}$ output signal AF2: $V_{AF2} = -3\text{ dB}$		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	$\Delta T = 55^\circ\text{C}$		Δf_{VCO}		500		kHz
Oscillator shift (free-running) as function of supply voltage	$4.5\text{ V} < V_S < 5.5\text{ V}$		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	k Ω
FM Demodulators, Internal VCO's (Pin 10)							
Steepness of free-running frequency adjustment	Resistor R_{ref} at pin 10		S		200		kHz/k Ω
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 ⁽¹⁾			R_{out}		150		Ω
AC output peak current			i_{AC}			± 1.0	mA

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

Electrical Characteristics (Continued)

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

Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit
AF output voltage, RMS value	$v_{\text{in}} = 10\text{ mV}$ $f = 5.5\text{ MHz}$ FM-dev. = 27 kHz $f_{\text{mod}} = 1\text{ kHz}$		V_{AF}		500		mV
Difference between the output signals			ΔV_{AF}			± 1	dB
Total harmonic distortion	$v_{\text{in}} = 10\text{ mV}$ $f = 5.5\text{ MHz}$ FM-dev. = 27 kHz $f_{\text{mod}} = 1\text{ kHz}$		THD		0.1	0.5	%
AM suppression	$v_{\text{in}} = 10\text{ mV}$ $f = 5.5\text{ MHz}$ $f_{\text{mod}} = 1\text{ kHz}$ reference signal: FM-dev. = 50 kHz test signal: m = 30%		α_{AM}	46	66		dB
Crosstalk attenuation between the AF outputs	$f = 50\text{ Hz to } 12.5\text{ kHz}$		α_{att}		70		dB
Supply voltage ripple rejection	$V_{\text{RR}} < 200\text{ mV}$, $f = 70\text{ Hz}$		RR		24		dB
Mute Switch (Pin 3)							
Control voltage - mute off - 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 - on			V_{sque}	0 2.0		0.8 V_S	V V
Control current			I_{sque}		150		μA

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

Figure 3. Total Harmonic Distortion

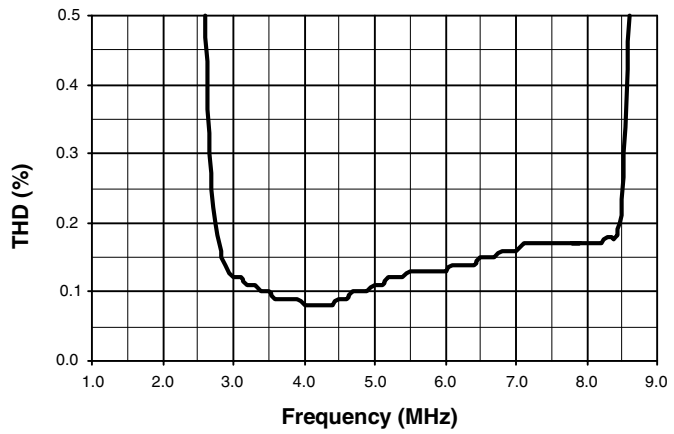


Figure 4. AM Suppression

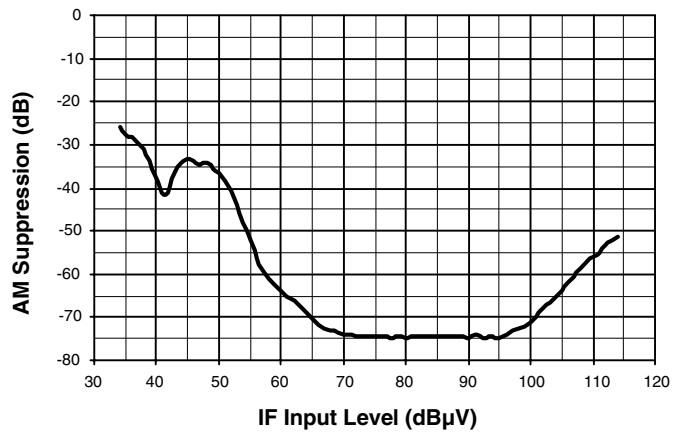


Figure 5. VCO Free-running Frequency

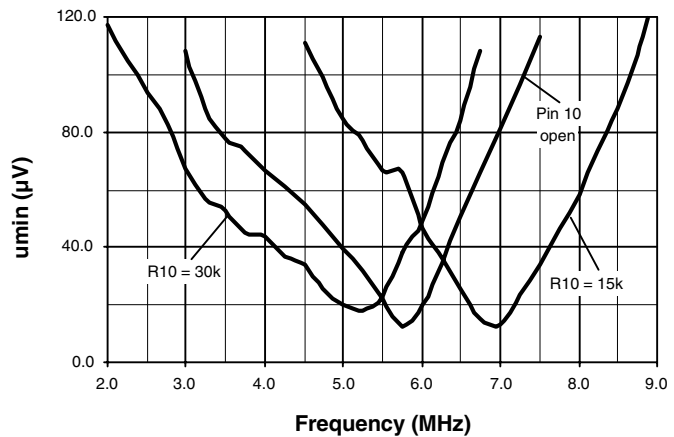


Figure 6. Capture and Hold Range

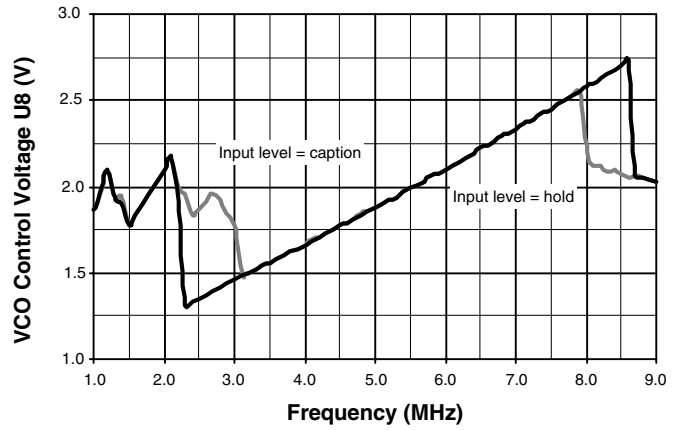


Figure 7. Limiter Characteristics

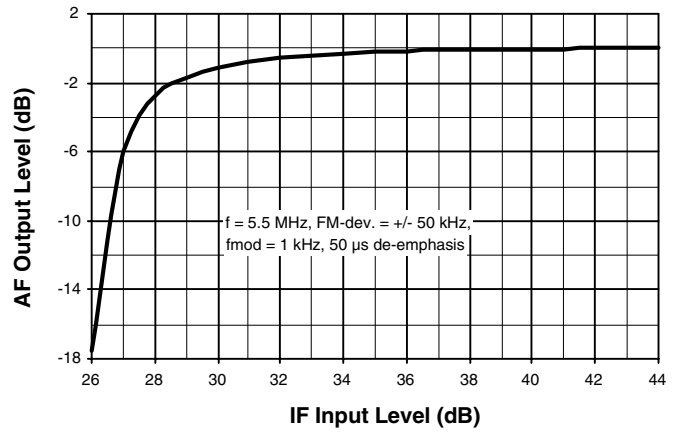


Figure 8. Signal-to-noise Ratio

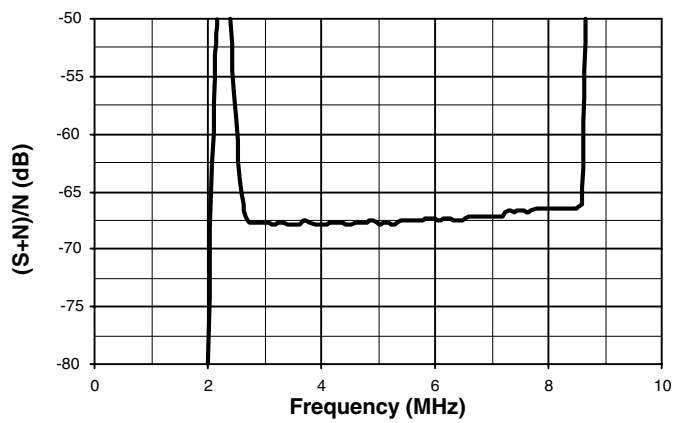


Figure 9. SIF Inputs

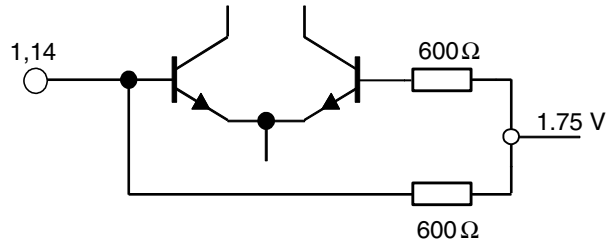


Figure 10. Mute Switch/Squelch Switch

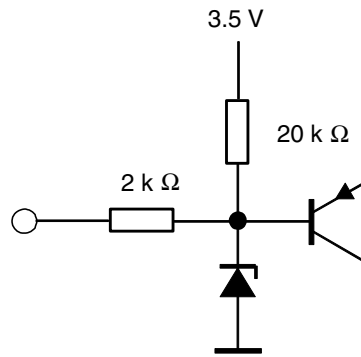


Figure 11. Audio Outputs

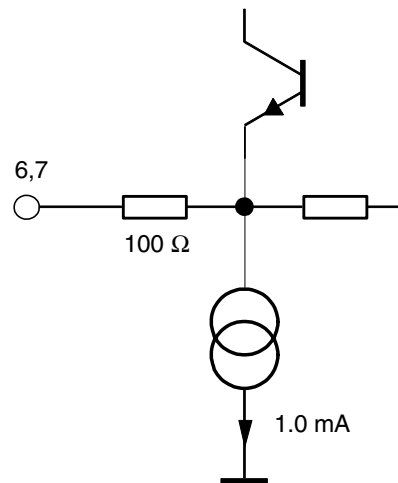


Figure 12. Decoupling Capacitor

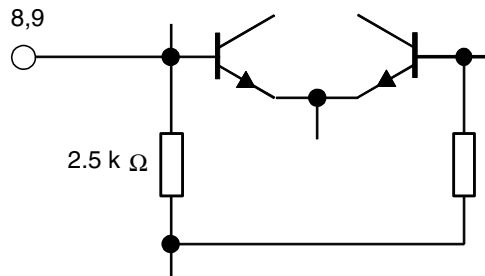


Figure 13. VCO Offset (Reference Resistor)

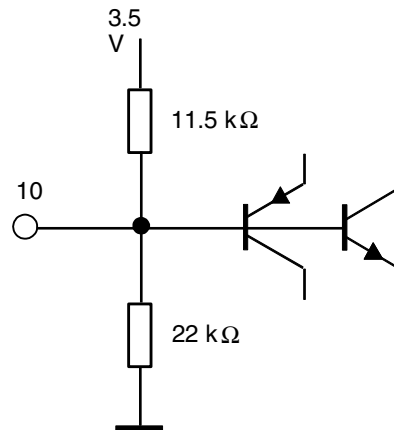


Figure 14. Internal Supply Voltage Stabilization

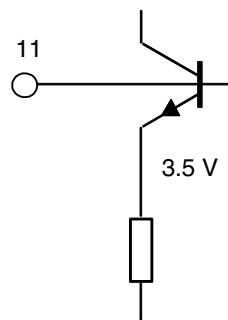


Figure 15. Test Circuit

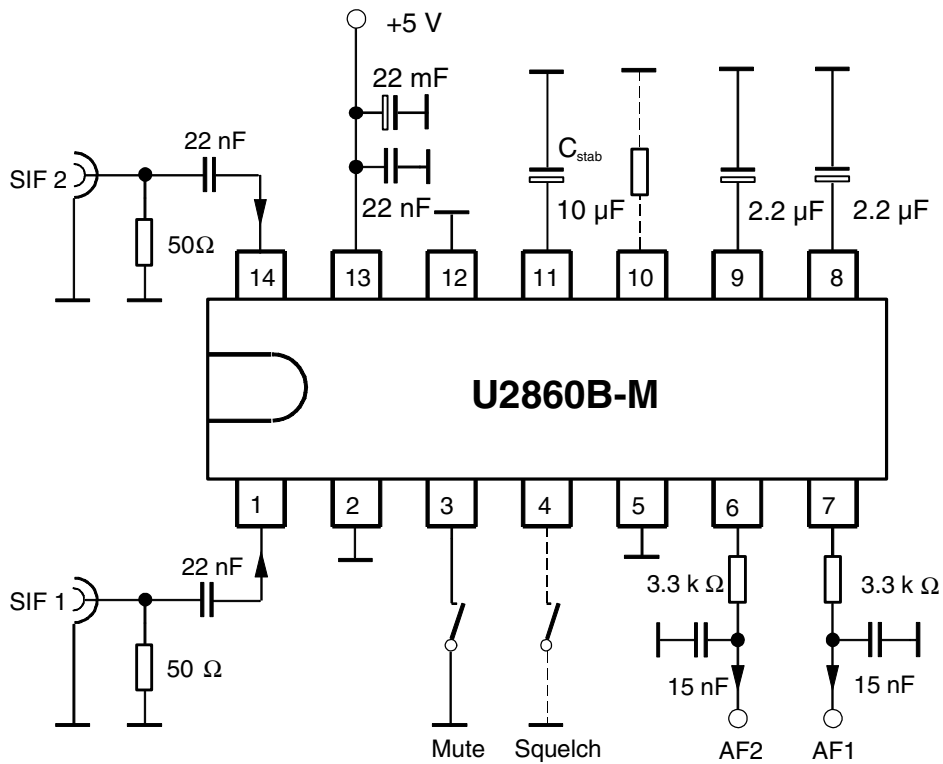


Figure 16. Application Circuit

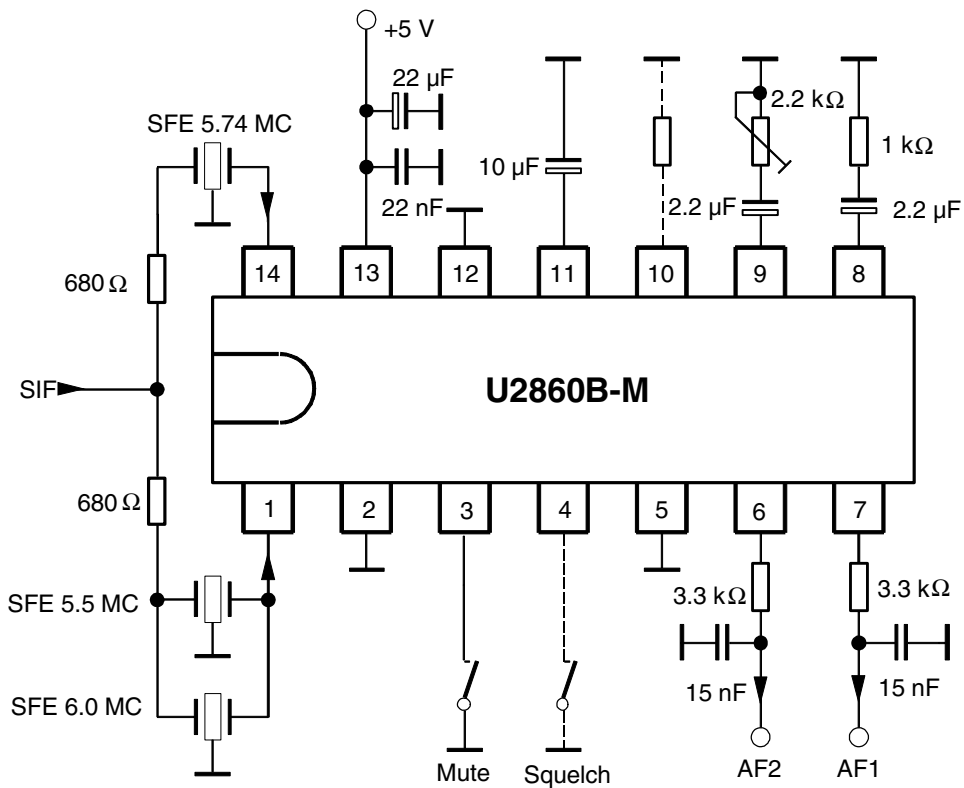


Figure 17. PCB Layout (Test/Application Circuit)

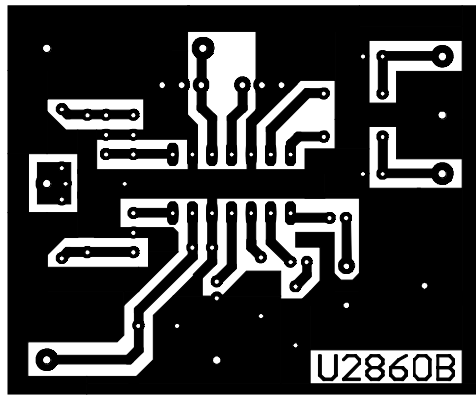


Figure 18. Component Layout (Test Circuit)

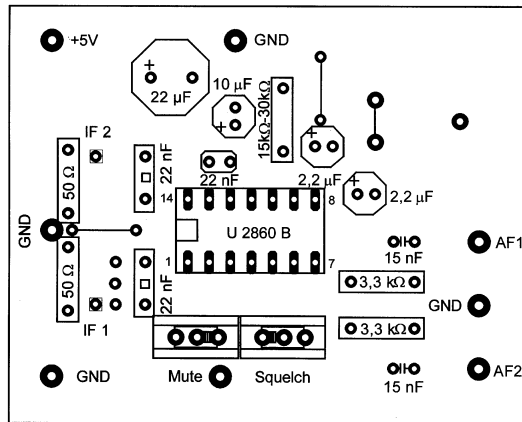
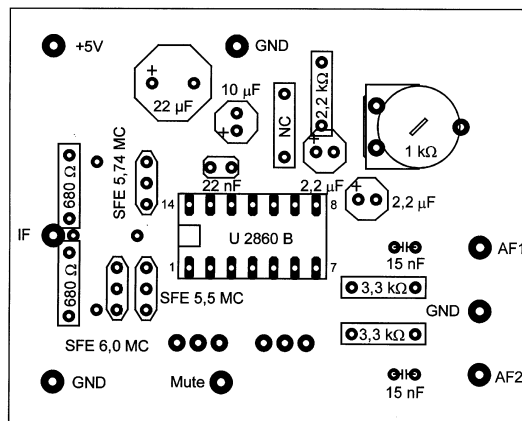


Figure 19. Component Layout (Application Circuit)

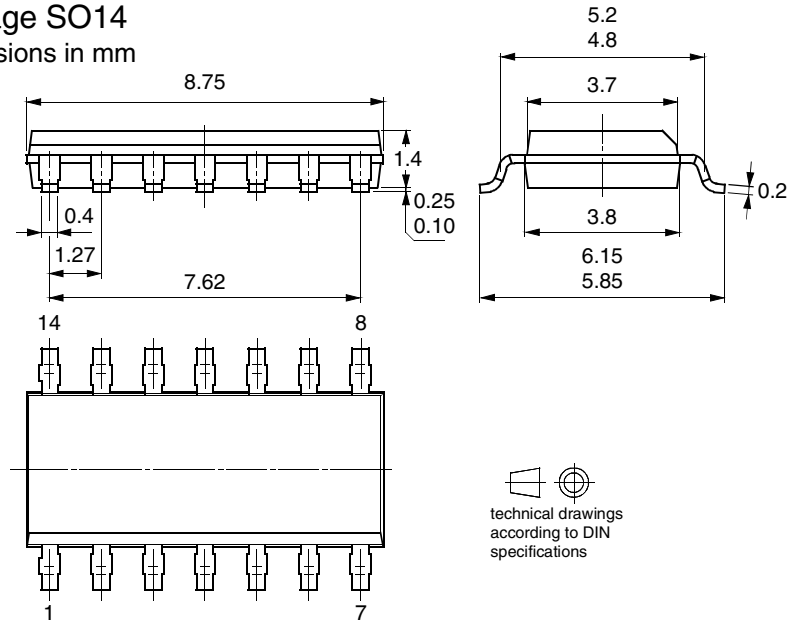


Ordering Information

Extended Type Number	Package	Remarks
U2860B-MFP	SO14	Tube
U2860B-MFPG3	SO14	Taped and reeled

Package Information

Package SO14
Dimensions in mm





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