

Features

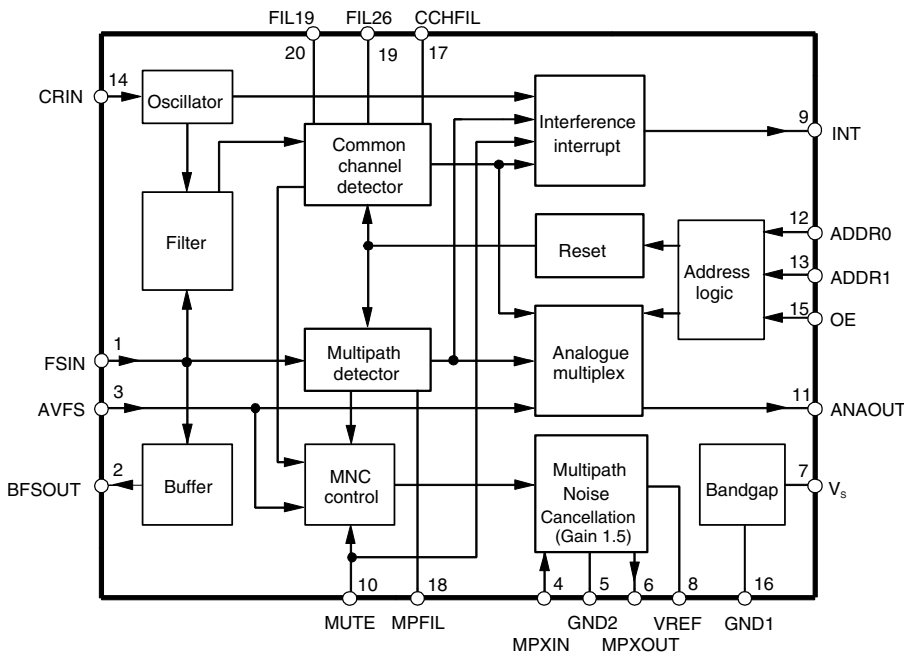
- Preparation of the fieldstrength signal
- Detection of multipath and common channel interferences
- Evaluation of the receiving conditions by microcomputer
- Interrupt output for abruptly occurring interferences
- Suitable for analog as well as digital processing
- Mute function controllable by microcomputer
- Multipath noise cancellation
- Only few external components necessary

Description

The U4275B is a bipolar integrated receiving conditions analyser as well as multipath noise cancellation circuit. It is designed for high-performance car radio applications.

Block Diagram

Figure 1.



Ordering Information

| Extended Type Number | Package | Remarks |
|----------------------|--------------|------------------|
| U4275B-MFL | SO20 plastic | |
| U4275B-MFLG3 | SO20 plastic | Taped and reeled |



FM Receiving Condition Analyzer and Multipath Noise Cancellation IC

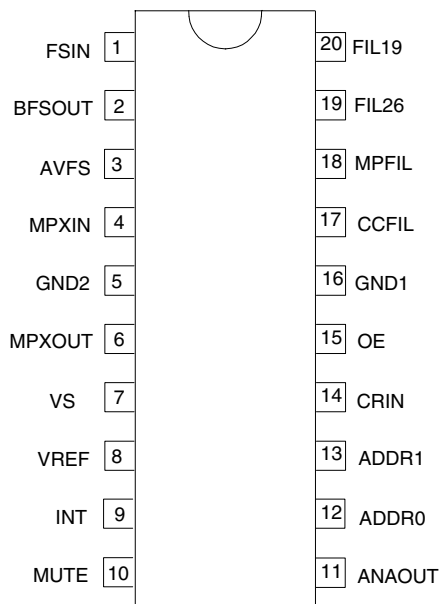
U4275B

Rev. A3, 16-Oct-01



Pin Configuration

Figure 2. Pinning SO20

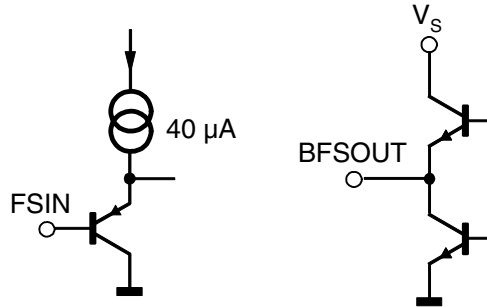


Pin Description

| Pin | Symbol | Function |
|-----|--------|-------------------------------------|
| 1 | FSIN | Fieldstrength input |
| 2 | BFSOUT | Buffered fieldstrength output |
| 3 | AVFS | Average of fieldstrength signal |
| 4 | MPXIN | Multiplex input signal |
| 5 | GND2 | Analog ground |
| 6 | MPXOUT | Multiplex output signal |
| 7 | VS | Supply voltage |
| 8 | VREF | Reference voltage |
| 9 | INT | Interrupt output |
| 10 | MUTE | External mute input |
| 11 | ANAOUT | Analog multiplex output |
| 12 | ADDR0 | Address 0 for analog multiplexer |
| 13 | ADDR1 | Address 1 for analog multiplexer |
| 14 | CRIN | Ceramic resonator input (456 kHz) |
| 15 | OE | Output enable for ANAOUT |
| 16 | GND1 | Ground |
| 17 | CCFIL | Filter for common channel detection |
| 18 | MPFIL | Filter for multipath detection |
| 19 | FIL26 | Filter for 26-kHz detection |
| 20 | FIL19 | Filter for 19-kHz-Pilot detection |

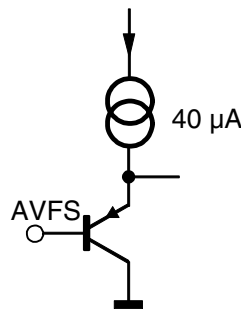
FSIN / BFSOUT

All information about reception conditions is derived from the fieldstrength voltage. The fieldstrength voltage at FSIN is initially buffered so as not to impair the characteristics of the IF IC and is available at BFSOUT.



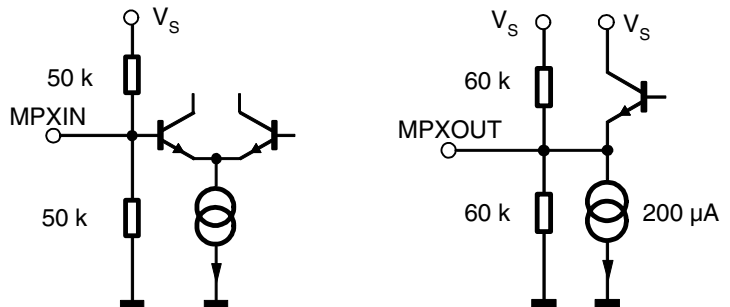
AVFS

The fieldstrength signal at buffer output BFSOUT is averaged over time and applied to input AVFS via an RC low-pass filter with a large time constant.



MPXIN / MPXOUT

The MPX signal is fed directly from the FM demodulator to input MPXIN and is available amplified by a factor of 1.5 at MPXOUT. The MPX signal is blanked out in the event of multipath interference or when MUTE is activated externally in the circuit part MNC (Multipath Noise Canceller). In all other cases, the MPX signal passes through the IC unchanged.

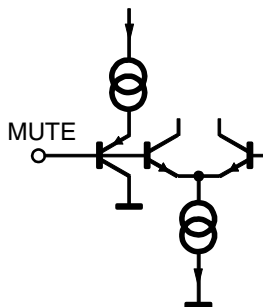


GND2

GND2 is the reference potential for the MPX signal. GND2 should be connected directly with the ground terminal of the IF FM demodulator to ensure a high signal-to-noise ratio of the MPX signal.

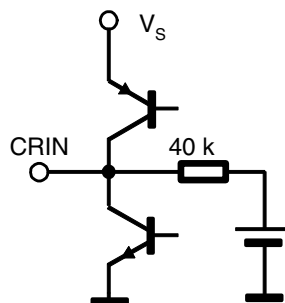
MUTE

The function unit MNC can be controlled externally via this pin. Blanking occurs when the voltage at the MUTE pin falls below 1 V. A voltage in the range $V_S/2 > 1$ V defines the switching threshold as from which multipath interference is signalled at pin INT.



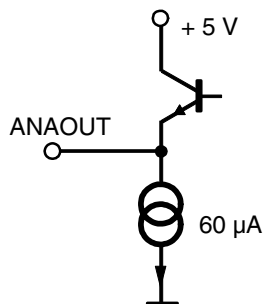
CRIN

The internal one-pin oscillator is connected to CRIN with a 456-kHz ceramic resonator. The 456-kHz reference frequency is used for calibrating the filters and generating pulses at INT.



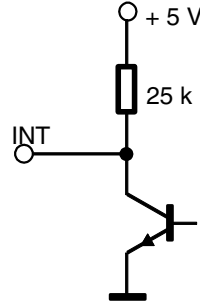
ANAOUT

Analyzer output. DC values are available at this pin that characterize the respective reception situation. The output voltage is limited to max. 5 V. ANAOUT is a multiplex output, i.e. the value for the fieldstrength, level of multipath interference or level of common channel interference is applied to this output depending on addressing. ANAOUT can be switched to the high-impedance state by means of OE.



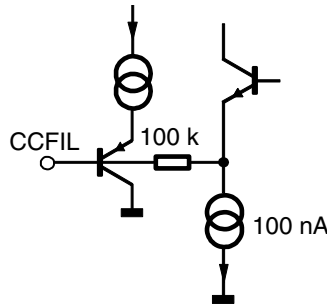
INT

Certain types of abruptly occurring interferences with reception require a fast reaction by the receiver. INT signals such events to other circuit parts by means of 40- μ s-wide pulses (low active). The output voltage is limited to 5 V to permit direct activation of a system controller. A monoblend function can thus be activated on simple receivers. On antenna-diversity receivers, INT can activate switchover between antennas.



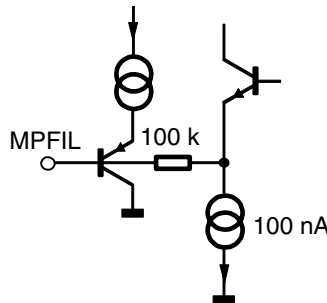
CCFIL

This controller element detects the absolute value of occurring common channel interference. This information is stored in a capacitor which must be connected externally to CGFIL. The capacitor voltage can be selected by the system controller which is then available via ANAOUT.



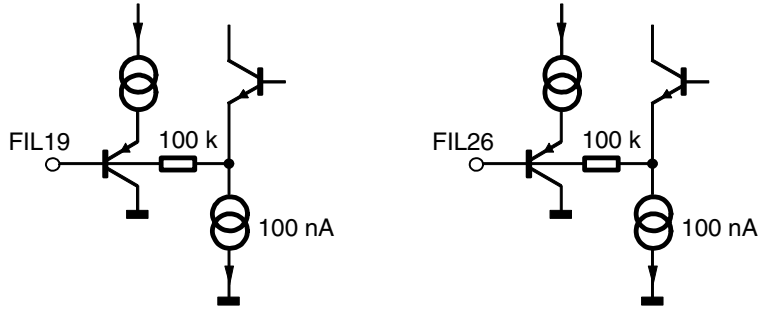
MPFIL

This controller element detects the absolute value of occurring multipath interference. This information is stored in a capacitor which must be connected externally to MPFIL. The capacitor voltage can be interrogated by the system controller via ANAOUT.



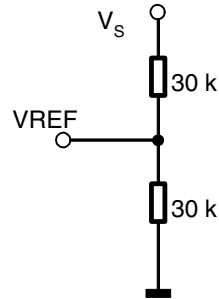
FIL19 / FIL26

In order to differentiate the various types of interferences, the amplitudes of a few spectral components of the fieldstrength signal are determined and filtered in FIL19 and FIL26 for further processing.



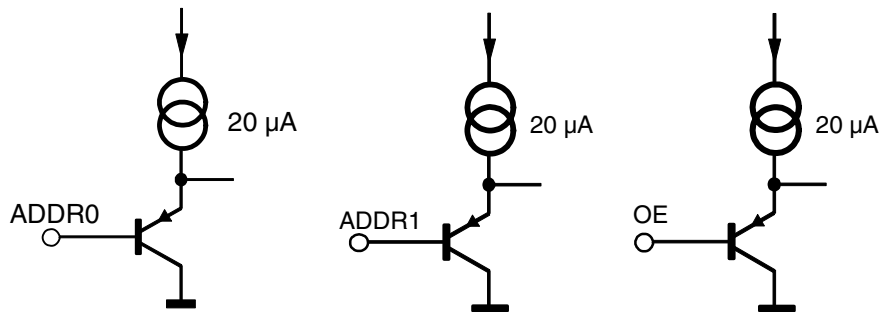
VREF

IF Mute is activated, the reference voltage VREF will apply to the output MPXOUT. A capacitor of 100 nF should be connected at VREF for filtering.



ADDR0 / ADDR1 / OE

The desired output variable at ANAOUT is selected via the address lines ADDR0 and ADDR1 and switched to the output via the enable input OE. For assignment, see table next page.



| No | OE | ADDR1 | ADDR0 | ANAOUT |
|----|----|-------|-------|---|
| 0 | L | L | L | Internal reference voltage Additional reset of the analog voltages for signal level, multipath, common channel |
| 1 | L | L | H | Signal level |
| 2 | L | H | L | Multipath |
| 3 | L | H | H | Common channel |
| 4 | H | X | X | High impedance off-state |

Functional Description

Interference with FM reception can be triggered by various causes, such as multipath reception, adjacent and insufficient field strength. At the same time, multipath reception is responsible for the most frequently occurring types of interference. In order to suppress this interference systematically, it is first necessary to analyze the received signal so that it is possible to derive the type of interference at any time. The circuit U4275B analyzes the FM reception conditions and makes the data available. This data can be requested by a system controller and evaluated (see figure 1). It is thus possible to introduce measures for optimizing reception - possibly tailored to individual types of interference.

Acoustically relevant multipath interference, since it requires a short reaction time, is suppressed directly by the circuit via a Multipath Noise Cancellation (MNC) function.

The U4275B can be used both in conventional receivers and in receivers with digital signal processing. Furthermore, it is designed so that it can activate switchover between antennas on antenna-diversity receivers. The integrated circuit can be connected in cascade without much wiring for tuner-diversity receivers.

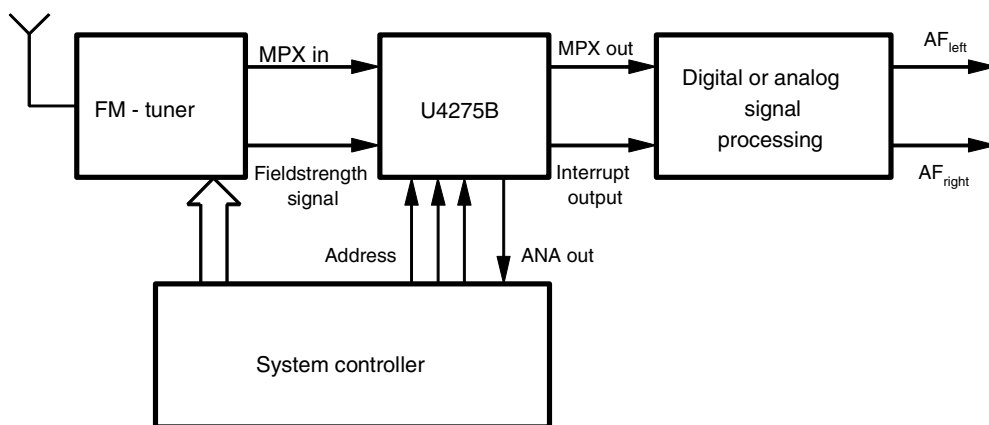
The field strength voltage of the IF amplifier provides all the information about the reception conditions. The following demands are placed on the field strength output of the IF amplifier:

1. A linear characteristic, i.e. the output voltage must be proportional to the logarithm of the IF voltage in the range of RF levels encountered in practice.
Deviations from linearity lead to a different evaluation of interference signals of the same intensity of the signal levels are different.
2. The "signal level" output has to react to extremely fast dips in the field strength.
Total field strength failures lasting 500 ns and occurring a voltage dip to approx. 0 V at the field strength output.

Restrictions

The field strength voltage becomes increasingly noisy in the range of low RF levels (< 30 dB μ V). The noise prevents reliable detection of interference. Therefore, only the average field strength value can be evaluated over a relatively large time constant in this range. The pilot signal component in the receive signal is an important basis for quality assessment. Multipath detection and common channel detection therefore function only in the case of stereo transmitters.

Figure 3. System block diagram



Multipath Detector

Typical multipath interference is characterized by fast, modulation-dependent field strength dips, as shown in figure 2. The multipath detector detects these field strength dips and evaluates them in accordance with the level of anticipated acoustic interference.

In the case of acoustically relevant interference, it operates the interrupt output INT and the MNC function as a reaction to the interference. If the acoustic effects of interference can be reduced by monobland, only pulses will appear at output INT. In the case of stronger interference, interference suppression takes place by means of the Multipath Noise Cancellation (MNC) function. The multipath interference also generates a voltage proportional to the interference level at MPFIL. The capacitor connected there is responsible for storing the information to give the system controller sufficient time to read out the value at ANAOUT. The capacitor at MPFIL is discharged again slowly with a long time constant. The corresponding addressing at ADDR0, ADDR1 and OE to permit a rapid assessment when the station is changed.

Multipath Noise Cancellation (MNC)

Extremely strong multipath interference remains audible in spite of the monobland function. The remaining interference is reduced still further by the MNC circuit if the output MPXOUT is connected to a reference voltage for a few microseconds while the interference is still occurring.

In order to eliminate the possibility of malfunctions, activation of the MNC depends on the following conditions:

- The average field strength must exceed a certain value so that the noise in the field strength signal does not cause the MNC to respond at low RF voltages and
- the field strength dip must not be caused by adjacent-channel interference. Blanking will otherwise make the modulation of the adjacent channel audibly. The information for this purpose is derived from the common channel detector.

The MNC function can also be activated externally via the MUTE pin (low active). The circuit can therefore also be used as a fast high performance mute stage.

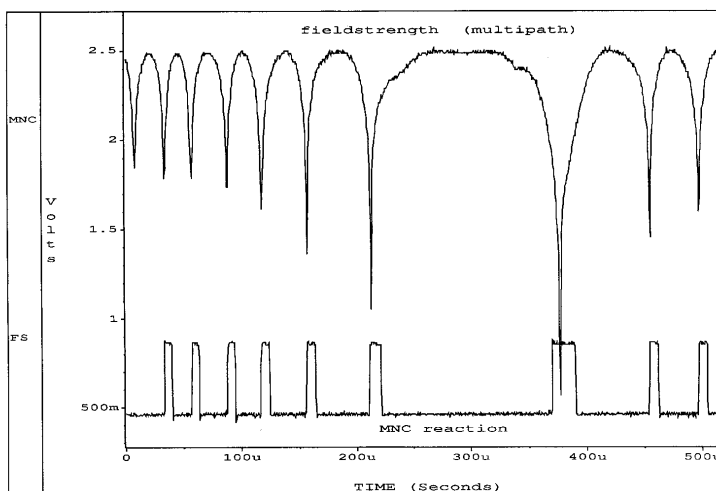
Common Channel Detector

The common channel detector evaluates the spectral composition of the field strength signal to distinguish common channel interference from other types of interference. This is a particularly difficult task, since weak multipath interference results in a spectrum of the field strength signal that is similar to that of common channel interference. The pilot signal portion of the field strength signal serves as a reference variable to permit a clear distinction to be made. A voltage proportional to the interference is generated at the filter

input CCFIL in the case of common channel interference. The external capacitor is responsible for storing the information to give the system controller sufficient time to read out the value at ANAOUT. The capacitor is discharged again slowly at CCFIL, with a long time constant. The capacitor can also be discharged rapidly via corresponding addressment when stations are changed.

The common channel detector is blocked for further 20 ms after the detectors are reset to prevent transitory phenomena in the selective filters from causing an indicating error.

Figure 4.



Absolute Maximum Ratings

Reference point Pin1b, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---------------|------------|------|
| Supply voltage Pin 7 | V_S | 10 | V |
| Supply current Pin 7 | I_S | t.b.d. | mA |
| Ambient temperature range | T_{amb} | -30 to +85 | °C |
| Storage temperature range | T_{stg} | t.b.d. | °C |
| Junction temperature | T_j | t.b.d. | °C |
| Electrostatic handling (MIL standard 883 C) | $\pm V_{ESD}$ | 2000 | V |

Thermal Resistance

| Parameter | Symbol | Value | Unit |
|------------------|------------|--------|------|
| Junction ambient | R_{thJA} | t.b.d. | K/W |

Electrical Characteristics

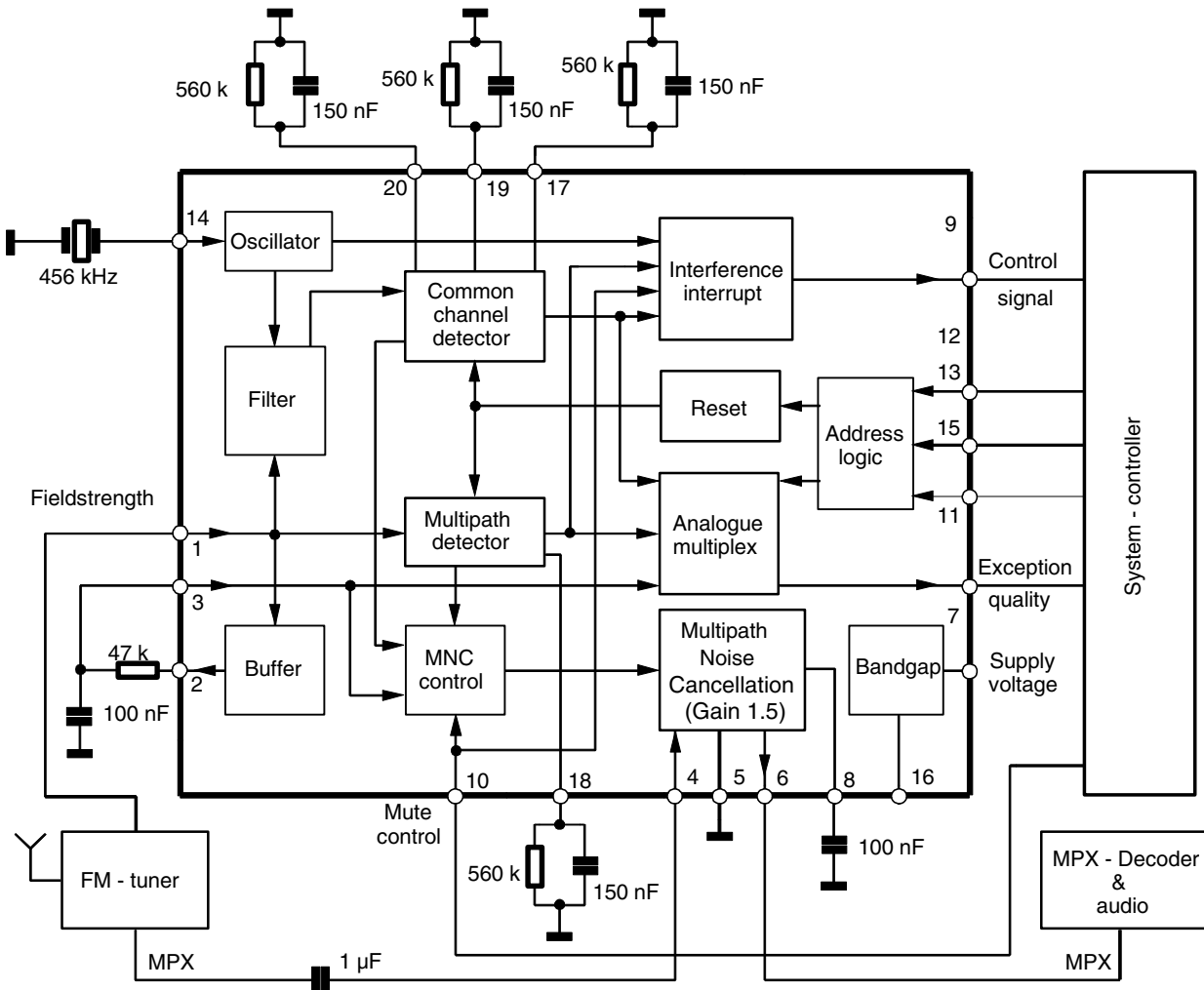
$T_{amb} = 25^{\circ}\text{C}$, $V_S = 8.5\text{ V}$, unless otherwise specified

| No. | Parameters | Test Conditions | Pin | Symbol | Min. | Typ. | Max. | Unit | Type* |
|-------------------------------------|--------------------|--|---------------|--------------|-------|---------|-------|---------------|-------|
| | Supply voltage | | 7 | V_S | 8 | 8.5 | 10 | V | |
| | Supply current | | 7 | I_S | 6 | 8 | 10 | mA | |
| Fieldstrength | | | | | | | | | |
| | Input voltage | | 1 | V_i | 0 | | 5.0 | V | |
| | Output voltage | R_{load} / C_{load} | 2 | V_{out} | 50 | | 5000 | mV | |
| | Bandwidth | | 2 | BW | 100 | | | kHz | |
| | Input voltage | | 3 | V | 0 | | 5 | V | |
| Multipath noise cancellation | | | | | | | | | |
| | MPX input voltage | | 4 | V_{MPXIN} | | | 350 | VRMS | |
| | MPX output voltage | $R_L = 10\text{ k}\Omega$ | 6 | V_{MPXOUT} | | | 525 | VRMS | |
| | THD | $R_L = 10\text{ k}\Omega$ $V_{MPXIN} = 350\text{ mV}$ | 6 | | | 0.06 | 0.2 | % | |
| | Bandwidth | $R_L = 10\text{ k}\Omega$ | 6 | | 100 | | | kHz | |
| | Noise figure | | | | | | | | |
| | Mute depth | $R_L = 10\text{ k}\Omega$ | 6 | | 75 | 82 | | dB | |
| | Gain | $R_L = 10\text{ k}\Omega$ | 6 | G | | 3.5 | | dB | |
| Address logic | | | | | | | | | |
| | Input voltage | High | 12, 13, 15 | V_{IN} | 0 | | 1 | V | |
| | | Low | 13, 13, 15 | V_{IN} | 3 | | V_S | V | |
| | Input current | Low | 12 | I_{IN} | | | 1 | μA | |
| | | High | 12 | I_{IN} | | | 0.5 | μA | |
| Interrupt output INT | | | | | | | | | |
| | Output voltage | Low, $R_L = \infty$ | 9 | V_{INT} | 0 | | 0.3 | V | |
| | | High $R_L = \infty$ | 9 | V_{INT} | 4.75 | | 5.25 | V | |
| Reference voltage VREF | | | | | | | | | |
| | Output voltage | | 8 | V_{REF} | | $V_S/2$ | | V | |
| Analog multiplex output | | | | | | | | | |
| | Output voltage | $R_L = 10\text{ k}\Omega$ | 11 | V_{ANA} | 0.200 | | 5.2 | V | |
| Oscillator | | | | | | | | | |
| | Input voltage | | 14 | V_{OSC} | 50 | | | mVRMS | |
| Mute | | | | | | | | | |
| | Input voltage | Low | 10 | V_{MUTE} | 0 | | 1 | V | |
| | | High | 10 | V_{MUTE} | 3 | | V_S | V | |

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Application Circuit

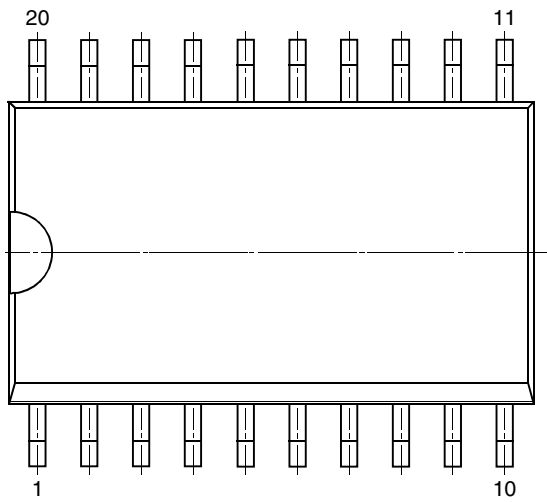
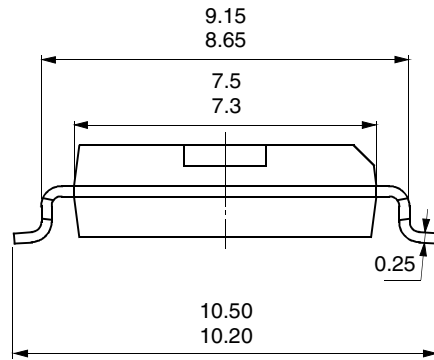
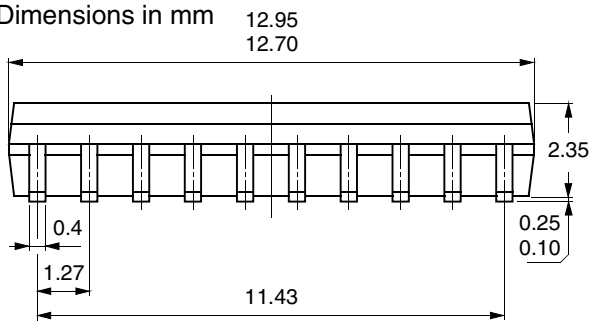
Figure 5.




Package Information

Package SO20

Dimensions in mm




 technical drawings
 according to DIN
 specifications

Ozone Depleting Substances Policy Statement

It is the policy of **Atmel Germany 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.

Atmel Germany 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.

Atmel Germany GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.



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