



# Single Chip 2-Wire Intercom CMOS Integrated Circuit

## Key Features

- ❑ Line/speech circuit and signalling on one 14 pin CMOS chip
- ❑ Only 2 wires needed for power supply, signalling and speech
- ❑ Soft clipping to avoid harsh distortion
- ❑ Fully integrated 2/4 wire conversion
- ❑ Side tone cancellation
- ❑ Low noise
- ❑ Signalling with FSK modem
- ❑ Low standby power consumption allows parallel operation of up to 25 terminals on a bus pair with central supply
- ❑ Parallel operation of up to 70 terminals if supplied locally
- ❑ Controllable via simple  $\mu\text{C}$  interface
- ❑ Very few external components

## Application

Entrance telephone system, intercom and data transmission, alarm systems, toy phone

## General Description

The AS2507 is a CMOS integrated circuit that contains all the functions needed to build a 2-wire intercom network.

The device incorporates 2/4-wire conversion (hybrid), soft clipping for high speech quality, FSK modem and a simple interface to a microcontroller.

The signalling mode is selectable between FSK modulation and burst mode.

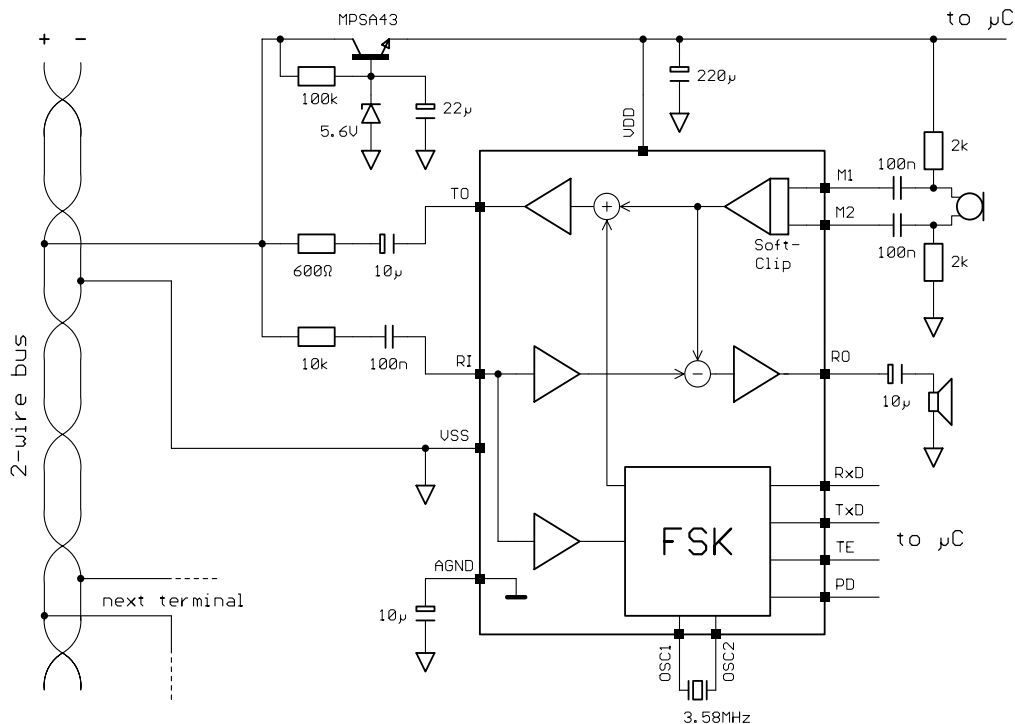
The low standby current (typ. 2 mA) allows several devices to listen to the 2-wire line.

The speech circuit is designed for compatibility with commonly used handset (150 $\Omega$  earpiece and electret microphone) with receive gain of -6 dB and transmit gain of 32 dB (relative to line).

## Package

Available in 14 pin DIP and 16 pin SOIC

## Block Diagram



**Pin description**

<b>Pin # DIP 14</b>	<b>Pin # SO 16</b>	<b>Symbol</b>	<b>Function</b>
7	7	M1	<b>M</b> icrophone Input <b>1</b> Differential input for the microphone (electret)
6	6	M2	<b>M</b> icrophone Input <b>2</b> Differential input for the microphone (electret)
2	2	RI	<b>R</b> ecieve <b>I</b> nput Input for ac-separated receive signal
4	4	RO	<b>R</b> ecieve <b>O</b> utput to Handset Output for driving a dynamic earpiece with an impedance from 150Ω to 300Ω
14	15 16	VDD	<b>V</b> oltage <b>D</b> rain <b>D</b> rain Positive Power Supply
9	9 10	VSS	<b>V</b> oltage <b>S</b> ource <b>S</b> ource Negative Power Supply
8	8	AGND	<b>A</b> nalogue <b>G</b> round Signal ground for the internal amplifiers
11	12	OSC1	<b>O</b> scillator Output <b>1</b> Output to ceramic resonator 3.58MHz.
12	13	OSC2	<b>O</b> scillator Input <b>2</b> Input for ceramic resonator 3.58MHz.
5	5	PD	<b>P</b> ower <b>D</b> own Input Active high, i.e. a high level on this pin will power down the analogue signal path.
10	11	RxD	<b>R</b> ecieve <b>D</b> ata Output Output of the FSK demodulator
13	14	TxD	<b>T</b> ransmit <b>D</b> ata Input Input for the FSK modulator
1	1	TE	<b>T</b> ransmit <b>E</b> nable Input for enabling transmit data

## Functional Description

The AS2507 is a CMOS integrated circuit that incorporates a speech circuit and a FSK modem. It is intended to be used as line-powered interface on a 2-wire intercom bus.

### Standby Condition

During standby operation (PD=High) only the FSK demodulator is active to provide the companion microcontroller with all signalling information on the 2-wire bus. The low power consumption (typical 2mA) and a high input and output impedance in standby mode allow the parallel operation of many terminals on each bus pair.

### 2/4-Wire Conversion

The AS2507 has a built-in side tone cancellation circuit. The transmit signal is attenuated by 6 dB over the 600Ω resistor (ac impedance) and subtracted from the receive signal at the receive input (RI). This configuration allows the selection of the required ac impedance and yet maintaining a good side tone cancellation.

### AC Impedance

The ac impedance is determined by an external resistor at the TO output (typical 600Ω).

### Transmit Path

The gain of the transmit path from the microphone inputs (M1/M2) to the transmit output (TO) is set to 32 dB. The soft clip level is set to 0.5V<sub>PEAK</sub> at TO. In standby the output impedance is 60kΩ.

### Receive Path

The gain of the receive path from the receive input (RI) to the receive output (RO) is set to -6dB. The receive input is internally biased to AGND with a 500kΩ resistor.

### FSK Modulator

Two signalling modes are provided, namely FSK and burst mode. The signalling mode and the signalling can be controlled by a microcontroller using the TE and TXD inputs as follows:

TE	TXD	MODE
0	0	IDLE, no transmission
0	1	TEST, for testing only
1	0	SPACE ("0") 18.645 kHz
1	1	MARK ("1") 22.375 kHz

### FSK Demodulator

Also the demodulator provides two modes for detection as follows:

Signal on line	RXD
IDLE, no transmission	1
SPACE ("0") 18.645 kHz	0
MARK ("1") 22.375 kHz	1

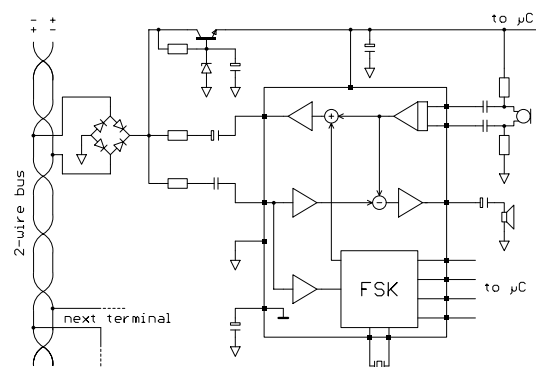
The demodulator consists out of a bandpass filter to attenuate interfering speech signals and a period counter. The RxD output is updated after each valid period or a counter overflow.

### Transmission Protocol

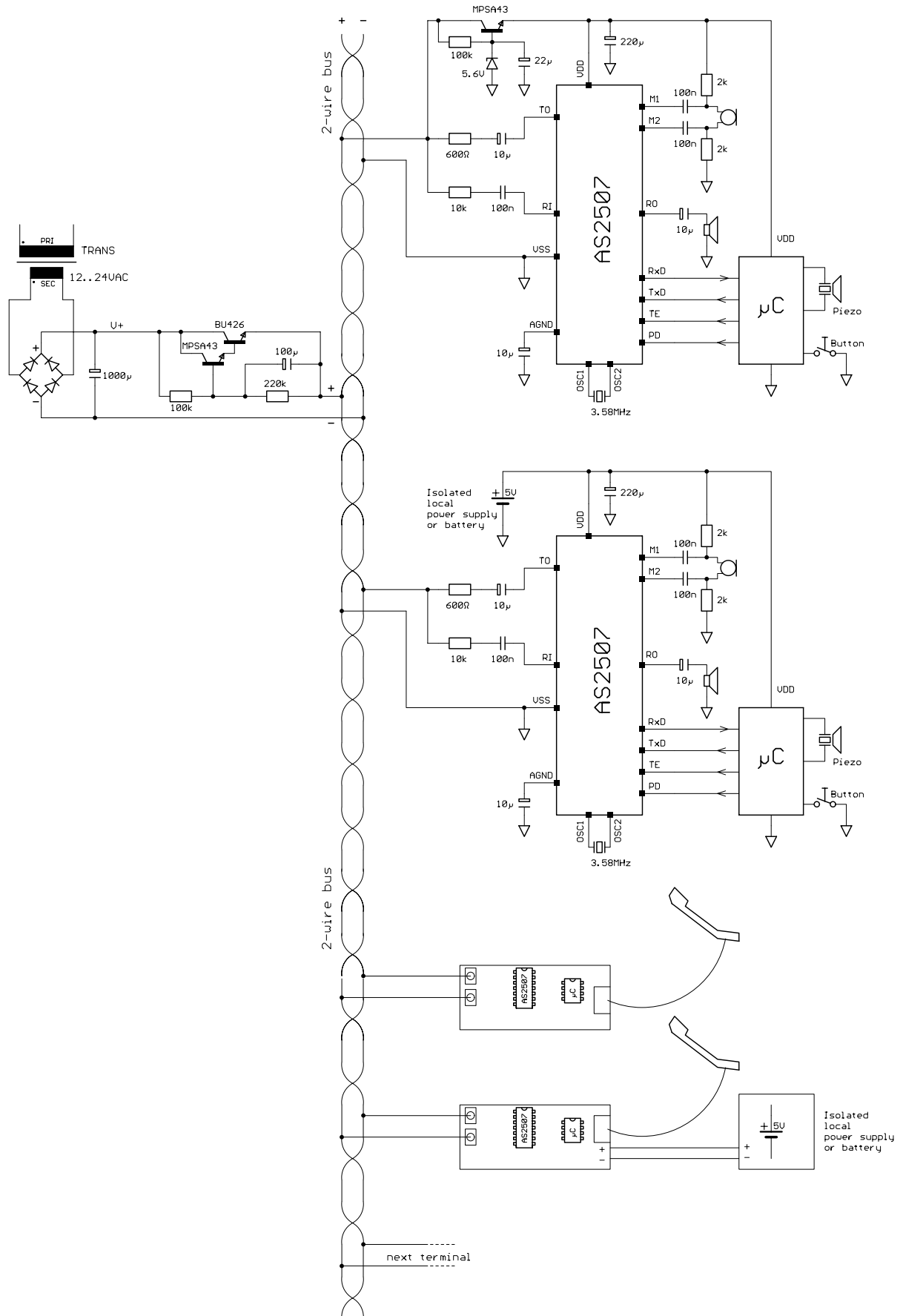
In order to assure a safe data transmission, data framing is recommended. Each frame should consist out of a preamble (e.g. FF<sub>hex</sub>), a header (e.g. AA<sub>hex</sub>), data bytes and checksum.

### Independence of bus polarity

Centrally supplied terminals can be connected to the 2-wire bus independent from polarity. In this case a rectifier bridge, known from telephony, is recommended since the DC-supply current will bias the diodes.



**Typical 2-Wire Intercom Application**



## **Electrical characteristics**

Electrical characteristics are measured with the Test Circuit application. Typical mean values will not be tested.

### **Absolute maximum ratings**

Positive Supply Voltage	-0.3V ≤ V <sub>DD</sub> ≤ 7V
Input Current	± 25mA
Analogue Input Voltage	-0.3V ≤ V <sub>in</sub> ≤ V <sub>DD</sub> +0.3V
Digital Input Voltage	-0.3V ≤ V <sub>in</sub> ≤ V <sub>DD</sub> +0.3V
Electrostatic Discharge (HBM 1.5kΩ-100pF)	± 1000V
Storage Temperature	-65°C to +125°C

### **Recommended operating conditions**

Supply Voltage (V <sub>DD</sub> )	5V ±10%
Oscillator Frequency	3.58 MHz
Operating Temperature	-10°C to +60°C

### **DC characteristics**

V<sub>DD</sub>=5V, f=1kHz, unless other specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I <sub>DDS</sub>	Supply Current	Standby Mode PD=High, V <sub>DD</sub> =2.5V		2	3	mA
I <sub>DDO</sub>	Supply Current	Operating Mode PD=Low, V <sub>DD</sub> =2.5V		5	6	mA
V <sub>IL</sub>	Digital Input Voltage LOW		V <sub>SS</sub>		0.1 V <sub>DD</sub>	V
V <sub>IH</sub>	Digital Input Voltage HIGH		0.9 V <sub>DD</sub>		V <sub>DD</sub>	V

**Transmit characteristics**

VDD=5V, f=1kHz, unless other specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
ATX	Transmit Gain M1/M2 → TO	V <sub>TO</sub> =0.25V <sub>RMS</sub>	+30.0	+32.0	+34.0	dB
THD	Distortion	V <sub>TO</sub> =0.25V <sub>RMS</sub>			2	%
VNO	Noise Output Voltage TO	T <sub>AMP</sub> =25°C			-60	dBmp
VAGC1	Soft Clip Level M1/M2 → TO at TO			0.5		VP
Z <sub>out-TO</sub>	Output Impedance with PD=High at TO	PD=High T <sub>AMP</sub> =25°C	60			kΩ

**Receive characteristics**

VDD=5V, f=1kHz, unless other specified

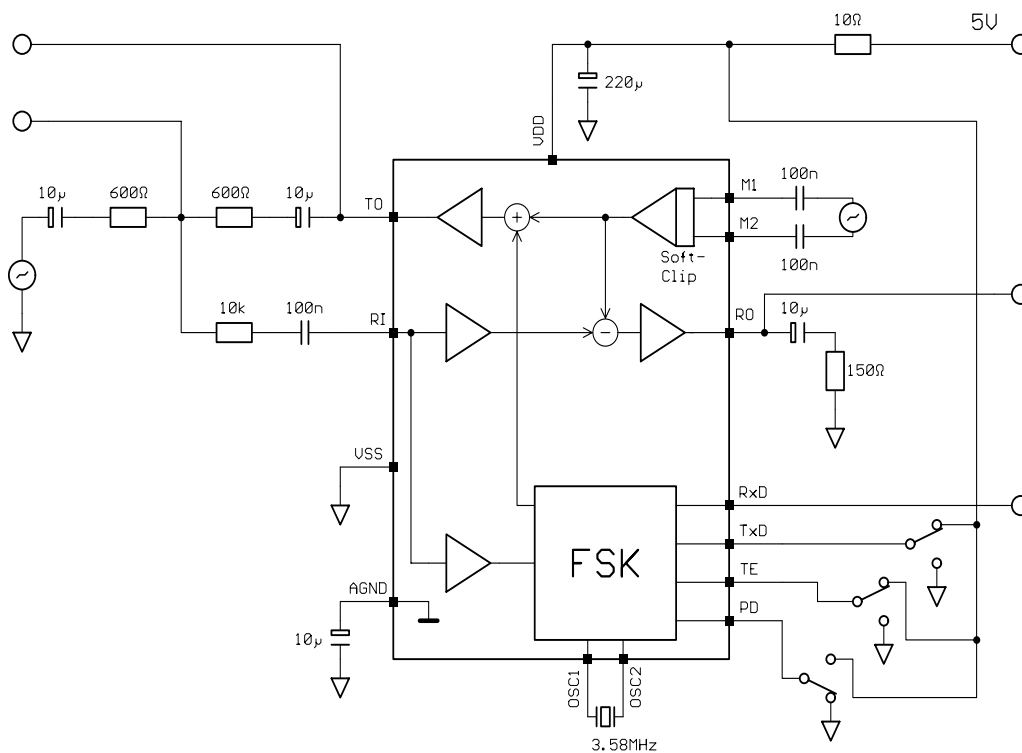
Symbol	Parameter	Conditions	Min	Typ	Max	Units
ARX	Receive Gain RI → RO	V <sub>RI</sub> =0.25V <sub>RMS</sub>	-8.0	-6.0	-4.0	dB
THD	Distortion	V <sub>RI</sub> =0.25V <sub>RMS</sub>			2	%
VNO	Noise Output Voltage RO	T <sub>AMP</sub> =25°C			-60	dBmp
ST	Sidetone	V <sub>RI</sub> =0.25V <sub>RMS</sub>		24		dB
Z <sub>In-RI</sub>	Input Impedance RI			500		kΩ

**FSK characteristics**

VDD=5V, f=1kHz, unless other specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
f <sub>MARK</sub>	MARK Frequency	TE=High TxD=High fosc=3.579545MHz		22375		Hz
f <sub>SPACE</sub>	SPACE Frequency	TE=High TxD=Low fosc=3.579545MHz		18645		Hz
f <sub>ΔMARK</sub>	Valid input frequency range MARK	TE=Low		22375 ±447		Hz
f <sub>ΔSPACE</sub>	Valid input frequency range SPACE	TE=Low		18645 ±372		Hz
VR <sub>Imin</sub>	Minimum Receive Input Voltage Detection Level	TE=Low			100	mVp
V <sub>TO</sub>	Tone Output Level	TE=High	600			mVp
AVB	Attenuation at 4kHz Input Bandpass Filter			35		dB

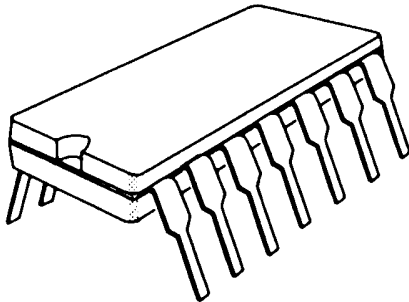
**Test circuit**



### Packaging

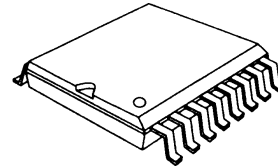
The device is available in the packages outlined below (not to scale). For exact mechanical package dimensions please see AMS<sub>AG</sub> packaging information.

14-pin plastic DIP (suffix P)



Max. Body Length 20.19mm / 795mil  
 Max. Body Width 7.11mm / 280mil  
 Pitch 2.54mm / 100mil

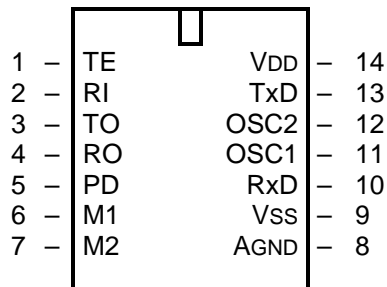
16-pin plastic SOICw (suffix T)



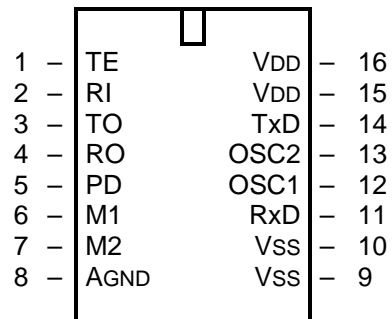
Max. Body Length 10.5mm / 414mil  
 Max. Body Width 7.6mm / 300mil  
 Pitch 1.27mm / 50mil

### Pin-out

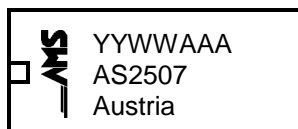
DIP14 (suffix P)



SO16w (suffix T)



### Marking



YY year of production  
 WW calendar week of production  
 AAA AMS<sub>AG</sub> assembly ID



## Ordering information

Number	Package	Description
AS2507 P	DIP14	plastic dual inline package - 14 leads (suffix P)
AS2507 T	SO16w	plastic small outline package - 16 leads (suffix T)

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