Austria Mikro Systeme International AG

Application Note AN2701: AS2507 Two wire intercom applications

1. Scope

This application note describes basic applications for 2-wire intercom solutions with central and/or local supply using the AS2507 circuit.
It also includes hints for interfacing the AS2507 to a 5V- microcontroller.

2. Key Features

- ⇒ Speech, data transmission and remote DC supply over the same 2-wire bus
- ⇒ simple connection without repeater of up to ≈60 terminals with local supply, ≈25 terminals with central supply
- ⇒ Central supply, local supply or combinations of both can be accommodated
- ⇒ Only 4 bit interface required for connecting the AS2507 to a microcontroller
- ⇒ Only 2mA current consumption in listening mode
- ⇒ Only 5 mA current consumption in active (speech) mode
- ⇒ Very few external components necessary

3. Table of Contents

4. Other applicable documents and papers

[1] Data Sheet AS2507: Single Chip 2-Wire Intercom CMOS Integrated Circuit

5. Further applications

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6. Revision status

AN2701 application note (this document):	Rev.: A01
AN2701a schematic:	Rev.: A00
AN2701b schematic:	Rev.: A00
AN2701c schematic:	Rev.: A00
AN2701 demo board schematic	Rev.: A00
DB2701 demo board layout	Rev.: A00
DB2701CS central supply unit layout	Rev.: A01

6.1 Revision History

Rev. A01 : a summary table for all modes (pt. 7.2) has been added

7. General description

The AS2507 is a CMOS Integrated Circuit, intended for use in 2-wire intercom speech and data networks.
It includes 2/4 wire conversion, soft clipping (to prevent distortion) in transmit direction, a FSK modem and a 4-bit interface to a microcontroller.
AC impedance is adjustable by an external resistor (typ. 600Ω).
Each AS2507-module can be configured for either local or remote power supply. On the 2-wire bus, combinations of modules using either local or remote supply are possible.
Depending on cable length and type of supply, up to ≈60 terminals can be connected on the bus without the need of inserting a repeater.
Both 3-wire (single ended microphone) and 4-wire handsets can be connected.

The AS2507 is available in 14 pin DIP and 16 pin SOIC package.

7.1 Functional description

Remark: Component names refer to schematics AN2701a..c, unless otherwise noted.

M1/M2 are the microphone inputs, the amplified transmitted signal is output on TO and fed to the 2-wire bus via C1 (AC decoupling) and R1 (Reference AC impedance).

The receiving signal from the 2-wire bus is fed into RI via R2 (protection) and C2 (AC decoupling) , the Handset earpiece is connected at RO. C8 is used for AC decoupling. If necessary, a series resistor can be added (⇒pt.16.1: R11 of DB2701) to reduce the sound pressure on the handset earpiece.

A low cost,. 3.58MHz ceramic resonator (X1) is connected at OSC1/2 to generate internal timings and to operate the FSK modem.

AGND is the DC bias level for the analogue circuit (typ. VDD/2).

The 4 bit interface to the external µC (see also : truth table on AN2701a,b) are:
RxD: (o/p): output of the FSK receiver
PD: (i/p): Power down; when high the AS2507 is in power-down/listening mode
TE: (i/p): Transmit Enable: switches the FSK modulator ON and OFF
TxD: (i/p): Transmit enable: switches between LOW and HIGH FSK frequency

7.2 Mode settings:

The following table summarizes the various modes and describes, which parts of the IC are active:

Mode:	Intercom	Send data: LOW	send data: HIGH	power down	test mode
PD =	0	0	0	1	0
TE =	0	1	1	x	0
TxD =	0	0	1	x	1
Speech: Transmit	active	active	active	off	active
Speech: Receive	active	active	active	off	muted [1,2)]
FSK-Receiver	active	active	active	active	active
FSK-Transmitter	off	on: 18.65kHz[2)]	on: 22.38kHz[2)]	off	off
current consumption[3)]	IDDO	IDDO	IDDO	IDDS	IDDO

1) Test mode is intended for company-internal production test to measure the FSK receiver input filter characteristics (a 15...25kHz elliptic $4^{th}/2^{nd}$ order switched capacitor bandpass filter): the filter input is connected to RI (=2-wire bus) and the filter output is connected to RO.
2) assuming a 3.58MHz ceramic resonator or crystal (see datasheet). Both FSK frequencies and filter passband will shift linearly with oscillation frequency. The recommended range for the crystal/ ceramic resonator is 2...4MHz.
3) For values of IDDO (operating current) and IDDS (standby current) please refer to AS2507 datasheet.

8. AS2507 configurations:

The following schematics, AN2701a..c, show possible configurations for the AS2507 on the 2-wire bus:

8.1 AN2701a..c circuit description

8.1.1 Local supply (AN2701a):

For local supply configuration, each module is powered by a separate, isolated 5V DC power supply or 4,5V battery.
Current consumption is typ. 5mA operating , typ. 2mA in standby [1] for the AS2507
+ the current consumption of the selected µC
+ the current consumption of external loads.

The local supply should have very low ripple to ensure a noise-free microphone supply (R3,R4). If the ripple rejection is not sufficient, an extra microphone power supply filter (such as R6/C7 of AN2701b) can be added.

No DC current flows on the 2-wire bus, since both Tx and Rx signals are decoupled (C1,C2).

The parasitic AC impedance of this configuration is higher than for central supply, since no 5V-regulator or central supply circuit is required (see. Pt. 9.4.2).
Therefore, up to ≈60 local supply modules can be connected to the bus without repeater (see Pt.10).

The local supply configuration should be used, when high current loads, such as lamps, relays , etc... are to be switched on and off , since the central supply configuration cannot support high load currents.

8.1.2 Central supply (AN2701b):

The benefit of central supply configuration is, that no local power supply or battery is required for the connected modules, simplifying the installation at remote locations, where no local power is available.

However, large load currents cannot be drawn from the 2-wire bus, therefore this configuration is ideal for simple intercom applications, which don´t have to switch high current loads, such as relays or lamps.

In addition to AN2701a, a high AC input impedance 5V-regulator (Q1,D1,R5,C9,C10; see pt. 13.1 for design considerations) must be added for each terminal.
Furthermore, a high AC output impedance central supply circuit (= electronic inductor) must be installed once on the bus to support all connected terminals with DC current.
For design considerations of the central supply, please refer to pt. 14.2.

Due to the additional parasitic AC impedance of the 5V regulators and the central supply circuit, the maximum number of connected terminals will be lower (≈25) as for local supply configuration (see pt..10).

8.1.3 Mixed configurations (AN2701c):

It is certainly possible to combine both local and central supply modules on the 2-wire bus. This way, the configuration, which suites best to the required application can be chosen.

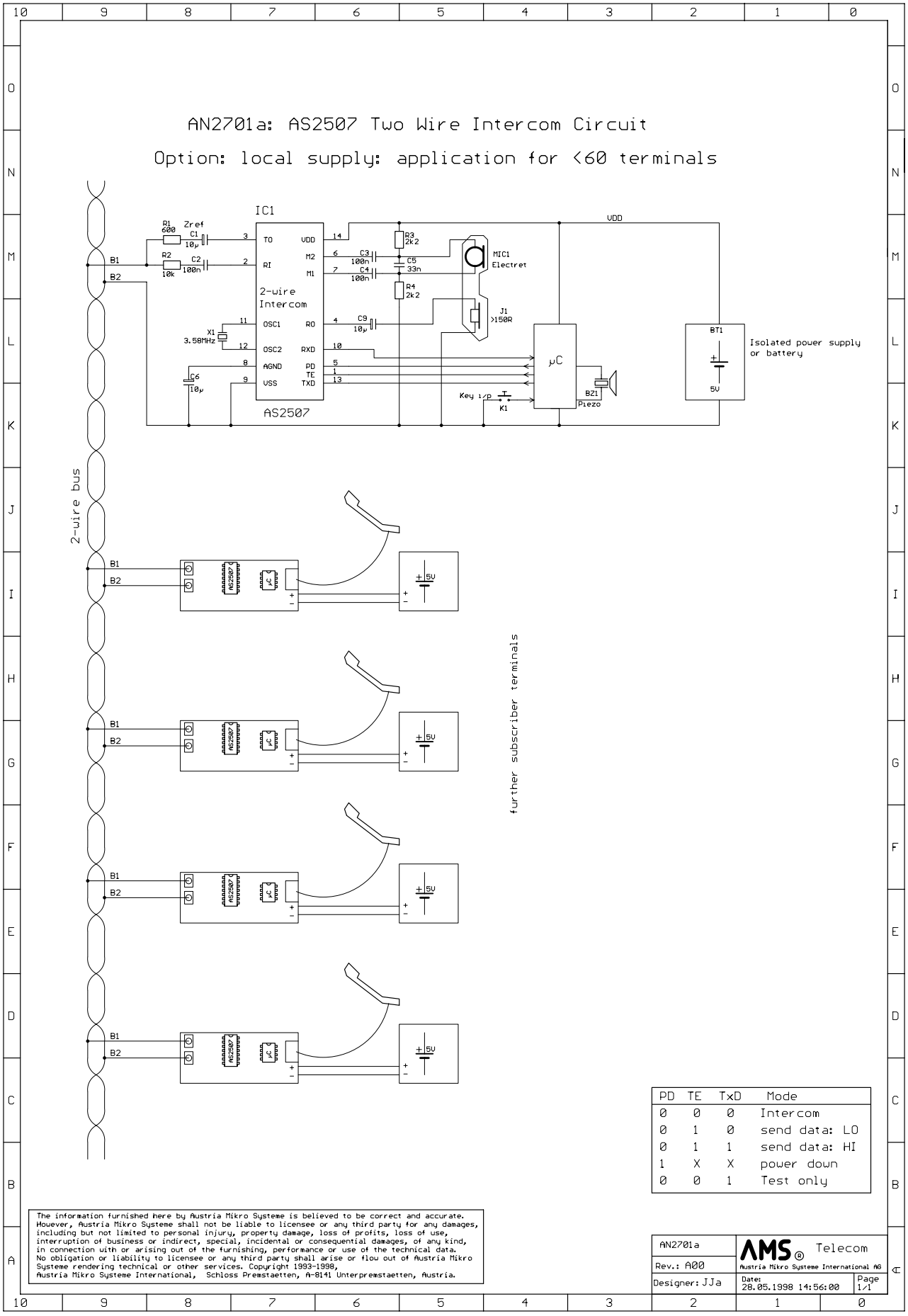
For example, at entrance intercom applications, the main door station including (high current) door opener and master CPU may be a local supply configuration, while the terminals installed in each flat may be central supply units.
For maximum number of connected terminals, please refer to pt.10.

8.1.4 Polarity-independent connection:

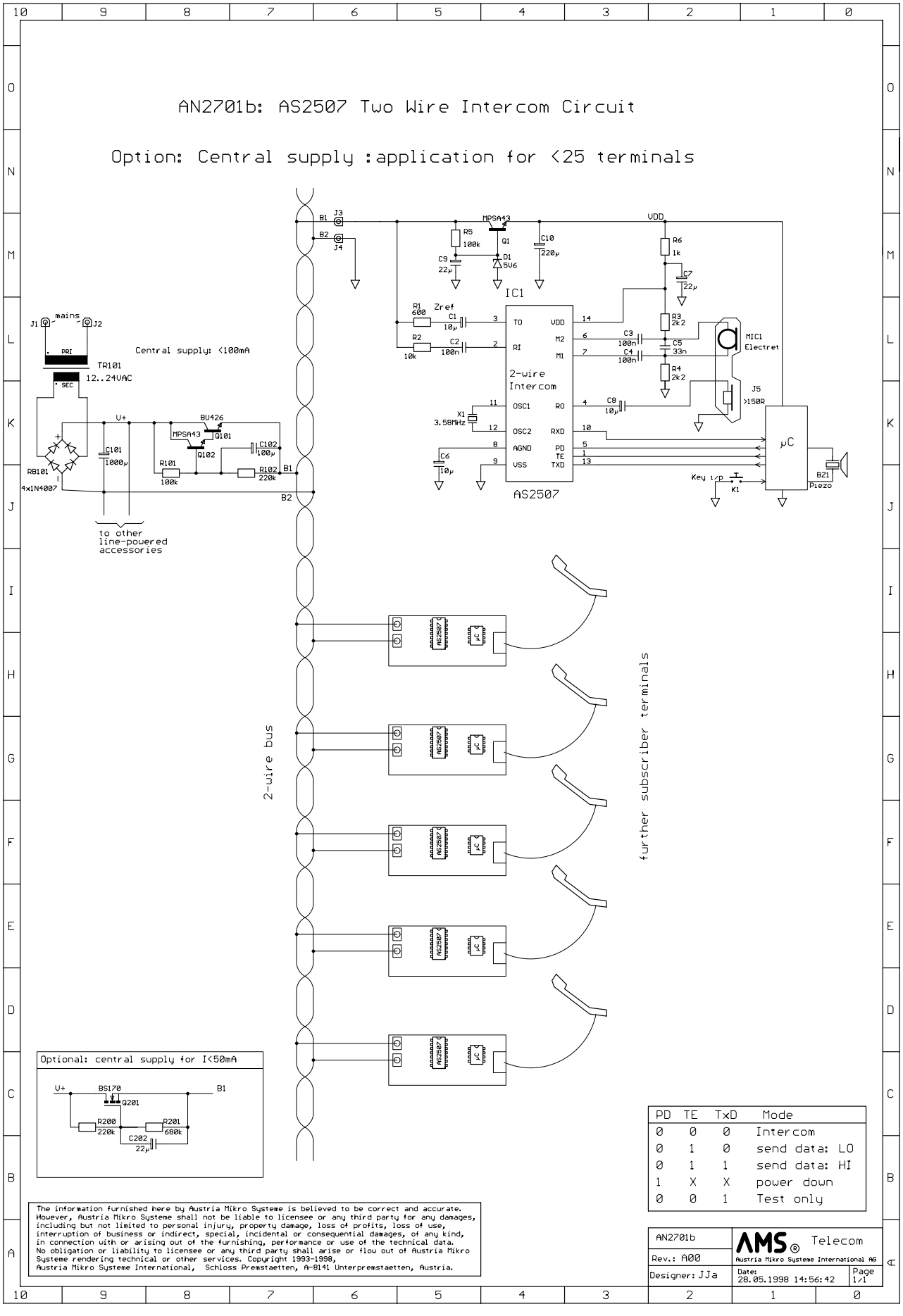
Central supply terminals can be connected on the 2-wire bus independent of polarity, when a diode bridge is added between the bus and the intercom-terminal (⇒pt.16: D2...D5 on DB2701 demoboard).

Remark: this bridge can only be installed with central supply terminals, since the DC-supply current will bias the diodes. Local supply terminals do not bias the diodes, since they don't draw any DC current from the bus.

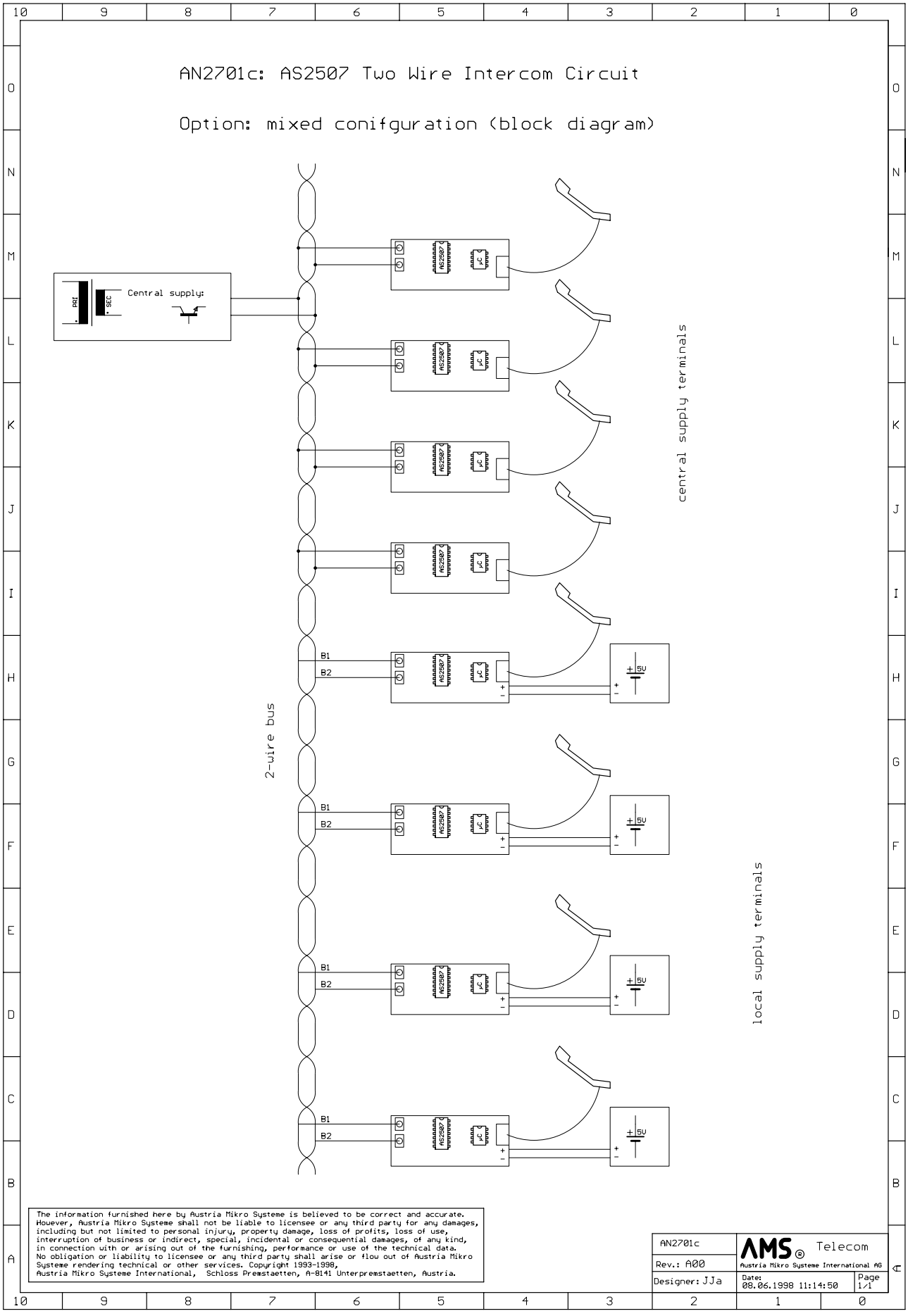
8.2 Application schematic AN2701a: Local Supply



8.3 Application Schematic AN2701b: Central Supply:



8.4 Application block schematic: AN2701c: mixed configuration



9. AS2507: AC signal flow block schematic:

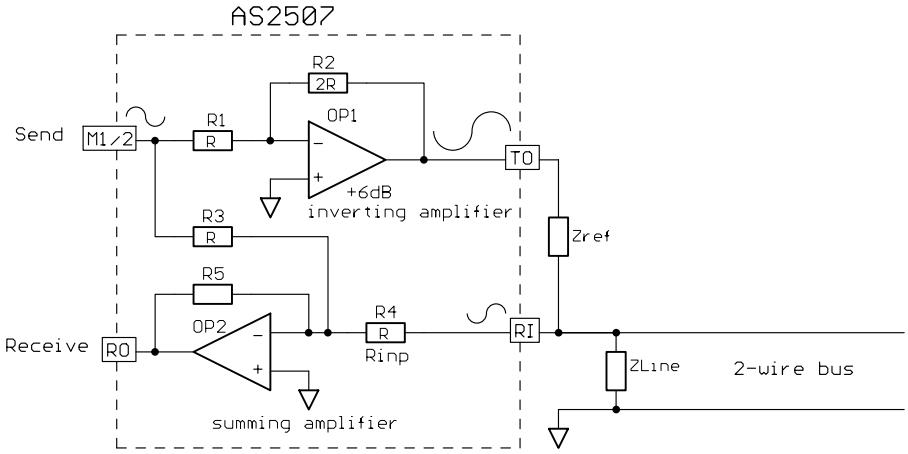


Fig. 1: simplified AC signal flow block schematic

FIG. 1 SHOWS THE SIMPLIFIED SCHEMATIC OF THE INTERNAL 2/4-WIRE CONVERSION CIRCUIT
Remark: component names in this chapter refer to Fig.1:

9.1 Sending direction

The microphone signal from pins M1 and M2 is amplified (not shown) and fed to the inverting amplifier, OP1. R2= 2*R1, so the total gain of OP1 is 6dB. The maximum output on TO is ≈1.8Vpp, limited by soft clip (s/c ; not shown).

9.2 Receiving direction

The signal from the 2-wire bus is fed into pin RI and amplified by OP2. Input resistance (R4) is about 500kΩ. The load on the receive o/p (RO), usually the handset earpiece, should be >150Ω.

9.3 AC impedance

AC impedance is set by the external resistor (Z_{ref}), connected between TO o/p and 2-wire bus. The typical value for this resistor is 600Ω (see R1 on demoboard schematic).

With ideal matching($Z_{ref} = Z_{line}$), the maximum transmit signal on the 2-wire bus is $V_{TO}/2 \approx 900$mVpp.

9.4 Sidetone cancellation

Sidetone cancellation depends on the matching of Z_{ref} / Z_{line} . Maximum sidetone cancellation occurs, when Z_{ref} / Z_{line} =1.

9.4.1 Principle:

OP2 is connected as a summing amplifier, with the Tx and Rx signal as equal weighted inputs (R3=R4).
The transmit input signal is amplified by 6dB, therefore the output signal of OP1 is180° out of phase, with double amplitude (see waveforms on Fig.1).
With ideal matching ($Z_{ref} = Z_{line}$), the signal at the Rx input (RI) is half the signal of TO. Consequently, it has the same amplitude as the Tx signal before amplification, but is 180° out of phase. Both signals cancel each other and the Receive o/p (RO) will be 0.

In practical use, this case only occurs, when only 2 terminals with local supply are connected with a short 2-wire cable.
In fact, ideal sidetone cancellation is not even desired, since there should always be some part of the transmitted speech audible in the earpiece to avoid the feeling of a “dead” line to the speaking person.
For this purpose it may be necessary to “artificially” deteriorate the matching in order to get less sidetone cancellation. This can be simply achieved by adding a “dummy load” (see Fig.2), which is simply a RC-network in parallel anywhere on the 2-wire bus. The purpose of the capacitor is to decouple the resistor from DC-

current. By varying the resistor, the impedance mismatch can be adjusted and consequently, the sidetone cancellation can be lowered (see pt. 10.1 for calculation examples).

9.5 Parasitic bus impedances:

In practical use, there are always additional parasitic impedances present at the bus, which will influence impedance matching and consequently, sidetone cancellation:

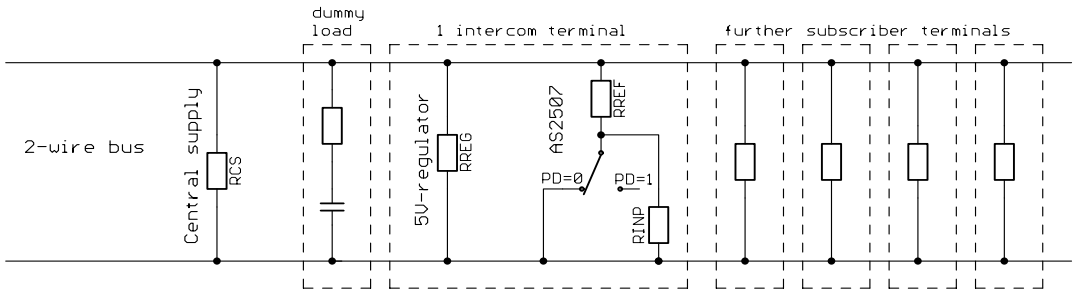


Fig. 2: parasitic impedances on the 2-wire bus

Fig. 2 shows, which impedances must be considered, when designing a 2-wire intercom system:

9.5.1 Central supply:

For systems using remote (central) supply, the AC impedance of this circuit must be considered, especially when many modules are supplied, since the impedance will decrease with increasing load current. Furthermore, the full frequency range up to 22kHz must be checked to guarantee adequate high AC impedance for the FSK modem, operating at 18/22kHz.
Typical values for the bipolar darlington central supply unit, used in AN2701b are

>20kΩ for 20mA load current
>8 kΩ for 60mA load current
>4 kΩ for 100mA load current.

9.5.2 5V-regulator:

The main consideration for this regulator is the AC input impedance in standby listening mode (PD=1), since each connected regulator will be in parallel on the 2-wire bus.
All non-selected terminals will be in standby listening mode, while usually 2 terminals will be in active speech mode.
The discrete 5V regulator Q1, shown in AN2701b, has >30kΩ input resistance for load currents of ≈5mA (typ. for AS2701 speech mode without µC). In standby listening mode (typ .2mA w/o µC), the input resistance is >50kΩ.
Again, the input impedance must be checked over the full frequency range up to 22 kHz.

Integrated 5-V regulators, such as 78L05, may also be used. The input impedance of these regulators is typ. 30...100kΩ for small load currents, but it must be considered, that they usually require ≈3.5mA standby current.

9.5.3 AS2507:

In standby listening mode (PD=1), the input resistance R_{INP} is ≈60 kΩ, while in speech mode (PD=0) the AC impedance is R_{REF} (typ. 600 Ω). Therefore, for ideal matching, only 2 terminals can be in speech mode at the same time.

9.5.4 2-wire bus cable impedance:

This parameter is not shown in Fig.2, however, for short distances (<100m) and adequate cable diameter (e.g. twisted pair 0.6mm diameter telephone cable) it is almost negligible (≈12Ω ; 3,6nF /100m). Since the calculation will become very complex, when cable impedances are included, all further calculations do **NOT** include cable impedances to simplify and more clearly illustrate the considerations.

9.5.5 **Dummy load (optional)**:

The purpose of the dummy load is to “artificially” deteriorate the sidetone cancellation by mismatching the bus. See pt. 9.4.1 for further details

9.5.6 **Total AC impedance on the 2-wire bus**:

The total AC impedance on the 2-wire bus is a parallel connection of:

- The central supply AC output impedance (depending on load current, 4...20kΩ; for central supply applications only)
- The AC input impedance of all connected 5V-regulators (depending on mode, 30...50kΩ; for central supply applications only)
- The input impedance of all connected AS2507 circuits in standby listening mode: ≈60kΩ
- The AC impedance of the (optional) dummy load
- The AC impedance of each terminal in speech mode (external resistor; typ. 600Ω)

10. Calculating the maximum number of modules on the 2-wire bus:

The following constraints are limiting the maximum number of terminals on the 2-wire bus:

10.1 Maximum parasitic impedance on the 2-wire bus:

For good sidetone cancellation, the parasitic impedance (which is a parallel connection of all impedances mentioned in pt. 9.5) should be ≈1...2 kΩ (not including the terminals in speech mode).
To ensure safe FSK detection, the minimum signal level at the RI input must be considered. The FSK transmission level is 800mVp [1].
With 2 terminals in speech mode (each 600Ω) and a parasitic impedance of 1kΩ*) at the 2-wire bus , the FSK Reception level on the RI input is

$$U_{FSK,RI} = \frac{800mV \bullet (600\Omega // 1k\Omega)}{600\Omega + (600\Omega // 1k\Omega)} = \underline{\underline{308mV}}$$

Which is still well above the minimum detection level of 100mVp [1].

*) *(see also pt. 9.5.4): not including the complex cable impedance; for simple calculation, the parasitic impedance is considered as a parallel ohmic impedance on the 2-wire bus.*

10.2 Maximum current drive capability of the central supply

Depending on the design of the central supply, the AC output impedance must be considered for the estimated maximum load current. Due to the inherent characteristics of transistors, the AC impedance will decrease with load current (see pt. 9.5.1)

10.3 Maximum current consumption of each central supply terminal

Together with the maximum current drive capability of the central supply (see pt. 10.2), the maximum number of connected central supply terminals depends on the current consumption of each terminal, especially in standby listening mode, since the majority of connected terminals will be in this mode. The AS2507 consumes only 2mA in standby, therefore a microcontroller should be chosen, which consumes only very little current in standby.

10.4 Calculation example: local supply (AN2701a)

Each terminal (except the 2 terminals in speech mode) has an input impedance of≈60kΩ. Assuming a parasitic bus impedance not lower than 1kΩ, when only local supply terminals are connected on the 2-wire bus, the total number of terminals can theoretically be as high as

$$n = \frac{60k\Omega}{1k\Omega} = \underline{\underline{60}}$$

10.5 Calculation example: central supply (AN2701b)

For this configuration, the following impedances must be considered:

- Central supply o/p impedance (4...20kΩ ; see. pt. 9.5.1)
- For each terminal: AS2507 standby i/p impedance (typ. 60kΩ; see pt. 10.4)
- For each terminal: 5V-regulator i/p impedance (typ. >50kΩ; see pt. 9.5.2)

Each terminal has therefore an input impedance of 60kΩ // 50kΩ ≈ 27kΩ. Without the impedance of the central supply, the number of terminals would be 27 (n = 27kΩ / 1kΩ) for ≥1kΩ parasitic impedance. However, the AC impedance of the central supply must also be considered, so the total number of terminals will be less than 27.
Assuming 25 terminals , a standby current of 2mA for each non-active terminal and 5mA operating current for each active terminal, the current supported from the central supply must be

23 * 2mA + 2 * 5mA = 56mA..

At this load current, the AC o/p impedance of the central supply is ≈8kΩ (see pt. 9.5.1).
In total, the parasitic bus impedance for 25 connected terminals is

$$R_{AC} = \frac{27k\Omega}{25} \; // \; 8k\Omega = \underline{\underline{950\Omega}}$$

..which is slightly below 1kΩ, but still acceptable.
Therefore, the maximum number of terminals using central supply will be ≈25 for the given application. If , in total, less terminals are to be connected, some tradeoffs in AC impedance of both 5V-regulator or central supply can be allowed by using other (low cost) transistor types with lower AC impedance. In this case, the same impedance calculations as above should be repeated with the actual values of the modified circuits.

10.6 Calculation example: mixed supply (AN2701c)

For mixed supply applications using a combination of local and central supply modules, the same constraints as with the two examples above apply. As a calculation hint, the following points should be remembered:

- Parasitic AC impedance on the 2-wire bus should be 1...2kΩ for good sidetone performance
- Local supply terminals will NOT draw any current from the central supply
- Central supply impedance changes with current, therefore it must be calculated for a given load current
- For each connected local supply terminal, assume ≈60kΩ input impedance
- For each connected central supply terminal, assume ≈27kΩ input impedance

11. Test setup: How to measure bus impedances:

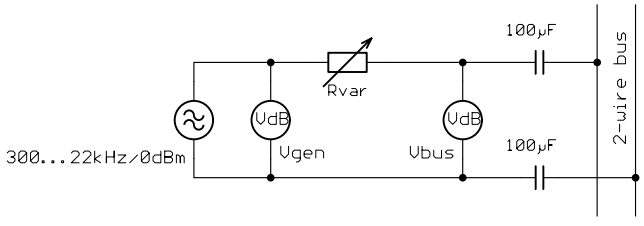


Fig. 3: Test setup for bus impedance measurement

The following components/tools are required to measure the bus impedance:

- A low ohmic o/p sinewave signal generator: V_{OUT}=0dBm; f= 300...22kHz
- one (or two) True rms AC voltmeters, preferably with dB-scale
- two non-pol. Caps: ≥100µF
- a variable resistor: value = about the range of the expected bus impedance

11.1 Implementation of the bus impedance measurement

- Set the frequency generator to 300Hz; V_{GEN} = 0dBm (≈ 2Vpp)
- Tune R_{VAR} , until $V_{BUS} = V_{GEN}/2$ (respectively $V_{BUS} = V_{GEN} – 6dB$)
- Measure R_{VAR}: The bus impedance $\underline{Z}_{BUS}$ = the value of R_{VAR}
- Repeat the measurement for further frequencies up to 22kHz

11.2 Quick functional check to estimate safe speech and FSK transmission

Required tool: True rms AC voltmeter:

- Make sure, all terminals are connected to the 2-wire bus and in standby
- Put the furthermost located terminal into FSK transmission mode (continuous LOW = space)
- Put one terminal, located as far away as possible from the sending terminal into active mode
- Measure the FSK level on the 2-wire bus at the second terminal
- Compare the reading with the calculated value; make sure it is well above the minimum detection level

12. Option: Connecting a 3-wire (single ended microphone) handset:

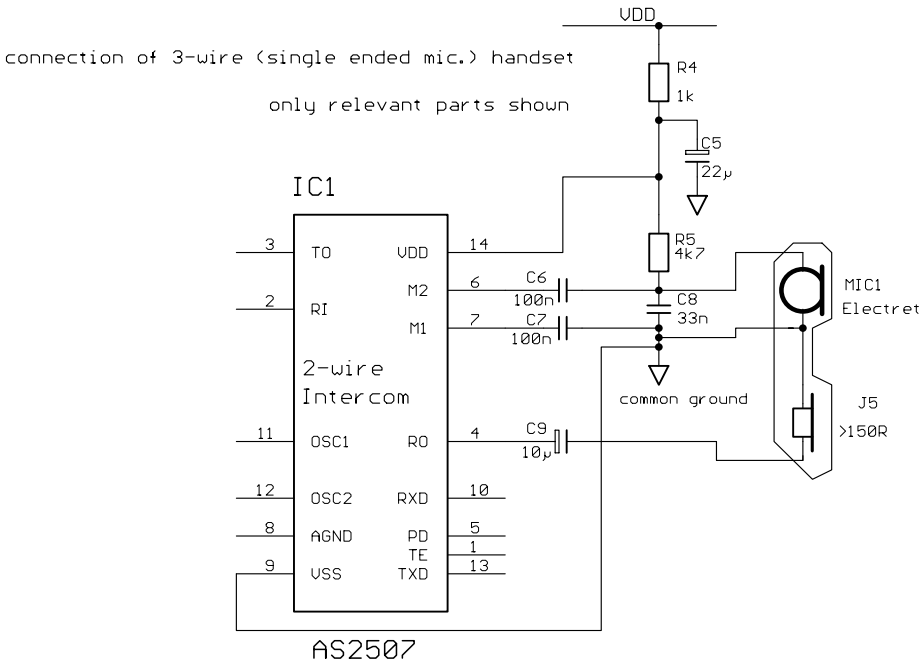


Fig. 4: Application using a 3-wire handset

Some applications may require the use of a 3-wire handset, using a single ended microphone. For this purpose, the handset should be connected as shown in Fig.4. On the DB2701 demoboard, the following changes must be performed:

- Change R4 (low side microphone supply feeding resistor) to 0Ω
- Change R5 (high side microphone supply feeding resistor) to 4k7

With this change, the AS2507 microphone amplifier is connected as a single ended input (M1 is grounded), therefore it will be more sensitive to noise at V_{SS}. In the layout of this circuit, a short, low ohmic connection between all components on the “common ground” node is essential for good, low noise performance.

13. Option: How to connect a piezo ringer

Most intercom applications may require some kind of audible signaling, like a piezo ringer or loudspeaker. Fig. 5 shows a simple differential bridge booster, using a common low-cost 4049 hex inverting buffer. The bridge amplifier allows to operate the piezo at 10Vpp, using the single +5V (V_{DD}) source. This way, adequate piezo ringer volume can be generated.

This circuit is especially suitable for central supply applications, where usually only one regulated DC source (V_{DD}) is available.

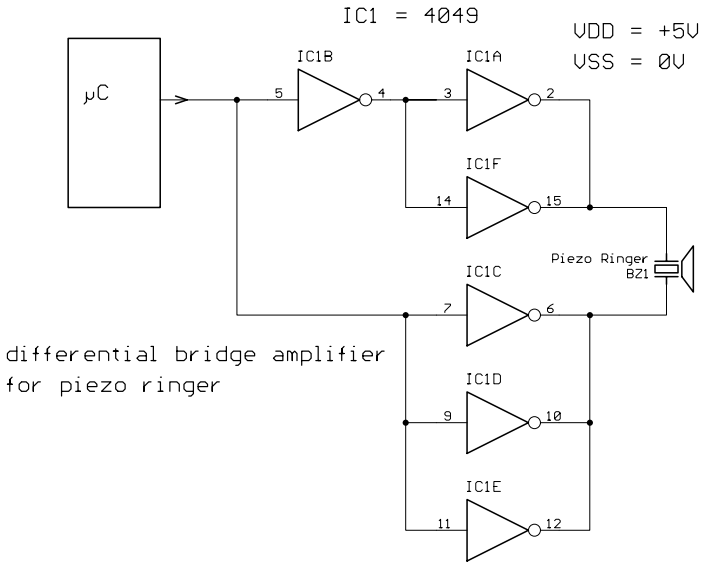
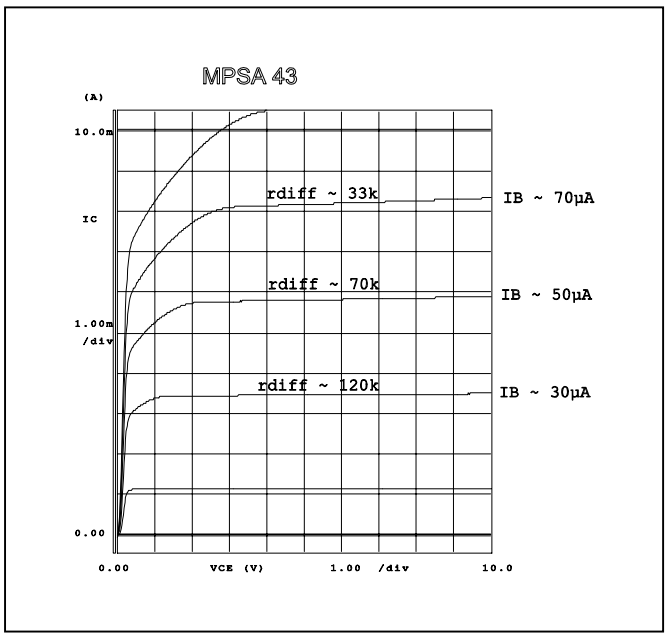


Fig. 5: Enhancement of piezo ringer volume by using a simple low-cost bridge booster

14. Selecting proper transistor types:

14.1 Considerations for the discrete 5V-regulator:



The circuit should incorporate low DC resistance to be able to draw the required DC supply current as well as high dynamic or AC-resistance (rdiff). Especially the dynamic resistance of the 5V-regulator should be as high as possible, since each module is connected in parallel to the 2-wire bus. Consequently, the more modules are connected at the bus, the lower the parasitic parallel impedance will be.
Hence, the maximum number of modules on the 2-wire bus depends to a high degree on the AC impedance of the 5V-regulator.
In general, high voltage transistors (such as MPSA43, 2N5551, ...) show a higher rdiff (ΔUCE / ΔIC) as low voltage types.
For a comparative selection, the U_{CE}/I_C-curve should be as flat as possible for the required collector current (see graph).

Fig. 6: U_{CE}/I_C- characteristics of MPSA43

14.2 Considerations for the Central supply circuit:

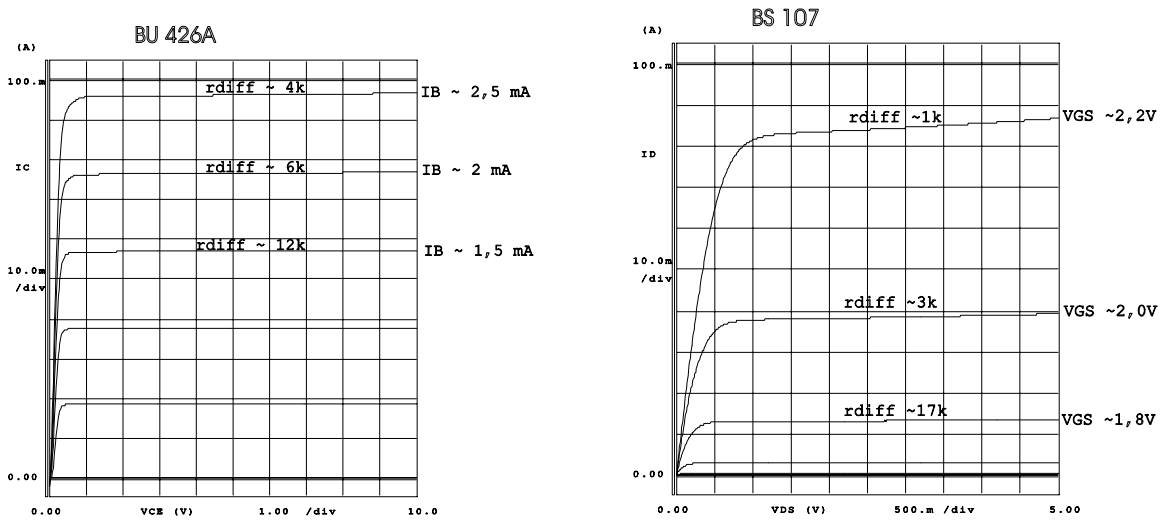


Fig. 7: U_{CE}/I_C- characteristics of BU426A and BS 107

The U_{CE}/I_C-curve should also be as flat as possible for the transistor(s) chosen for the central supply circuit.
However, since the central supply must support all connected terminals, the collector (or drain-) current is much higher than the current for the 5V-regulator.
The considered range is about 50...100mA, depending on the number of connected terminals, while the 5V-regulator has to draw only about 2..3mA standby and <10mA operating current, depending on µC current consumption.
Again, high voltage, high power transistors (such as BU426, BUX48,BUW12, etc...), have shown reasonable high rdiff for collector currents around 100mA.
For currents of ≈ 50mA or less, small signal / high voltage VMOS-Fet´s , such as BS107 are also suitable. In this case however, the maximum power dissipation of the chosen type must be considered. If necessary, a heatsink must be added.

15. Data Transmission:

The AS2507 uses the same 2-wire bus for both speech and data transmission. For data transmission an 18/22 kHz FSK Modem is used. Two types of data transmission are possible:

- FSK transmission and
- Burst mode transmission.

FSK transmission uses both FSK frequencies for sending, while burst mode transmission only transmits bursts of 18kHz.

15.1 Burst mode transmission

Fig. 8 shows the typical waveforms of a burst mode data transmission at 600 and 2400 baud:
The digital inputs, PD and TxD are LOW (see AN2701x schematics: truth table: “send data: LO”), while TE is switched between LOW and HIGH.

Remark: the same action is performed, when the button K1 is pressed on the demoboard, with DIP-Switches PD and TxD in “off” position).

The upper curve is the signal at the 2-wire bus (respectively the signal at the RI input), while the lower curve shows the output of the FSK-receiver: RxD.
Both curves are shown as an envelope signal, representing an overlay of 100 readings.
Per default (no signal on line), the RxD o/p is HIGH.

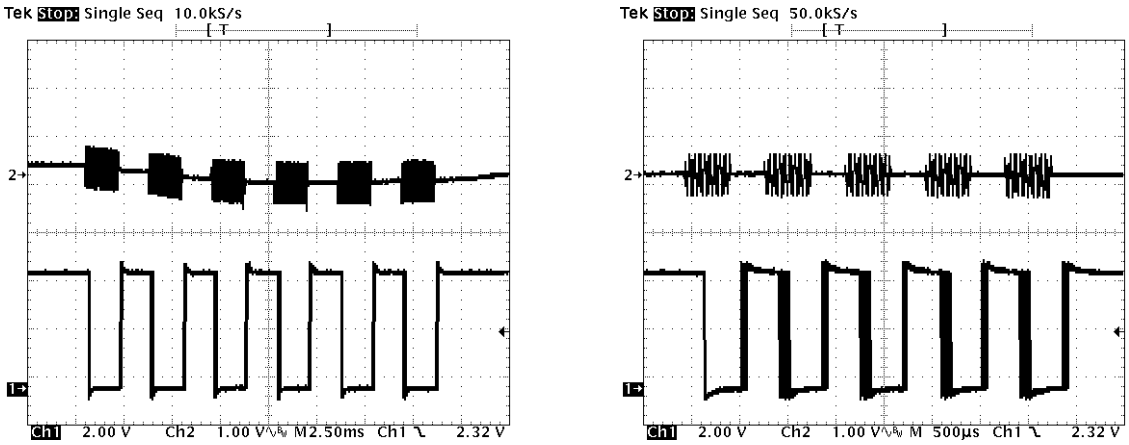


Fig. 8: Data transmission waveforms (bus and RxD signal) in burst mode: left:600baud, right 2400baud

The jitter at the RxD output results from variable detection time of the FSK receiver. Therefore, for data transmission a baud rate should be chosen, which allows error-free data transmission despite the expected jitter on the RxD signal. As shown in Fig.8, a 600baud signal shows almost negligible jitter. Even at 2400 baud, safe data transmission is possible.

15.2 FSK data transmission

When the digital inputs are configured as

- PD = LOW
- TE = HIGH
- TxD =switched between LOW and HIGH (see AN2701x schematics: truth table: “send data: LO” ⇒”send data: HI”),

the AS2507 generates two frequencies (18kHz for LOW, 22kHz for HIGH), enabling true FSK data transmission.
Fig. 9 shows the typical waveforms of a FSK data transmission at 600 and 2400 baud. Again, the upper curve is the signal at the 2-wire bus (respectively the signal at the RI input) and the lower curve shows the output on RxD.

Both curves are shown as an envelope signal, representing an overlay of 100 readings.

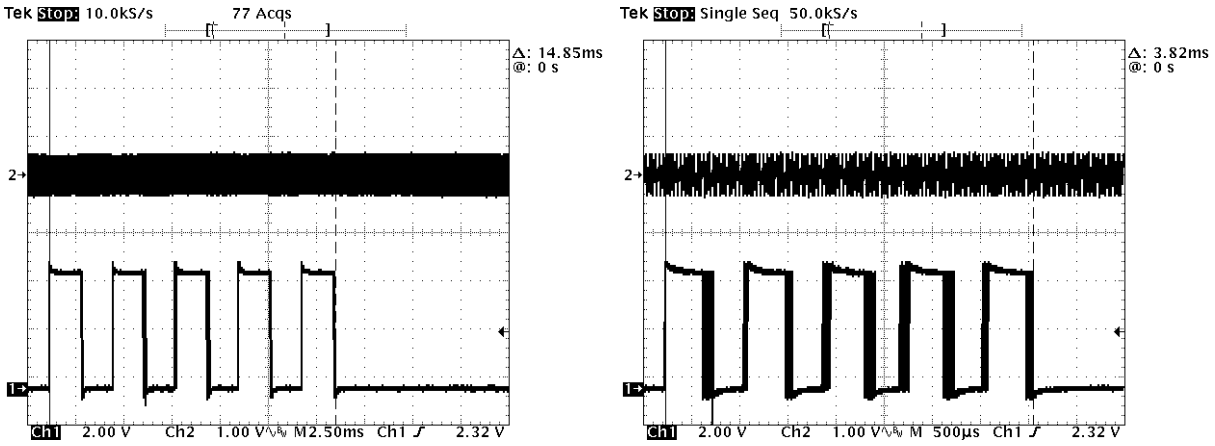


Fig. 9: Data transmission waveforms (bus and RxD signal) in FSK mode: left:600baud, right 2400baud

The expected jitter is in the same range as with burst mode data transmission (see Fig.8).

15.3 Data transmission hints

Only one speech transmission channel can be active at the same time, but it is possible to do speech and data transmission simultaneously.

During data transmission, speech transmission is also active.

Although the FSK frequencies are certainly not audible, the data rate (e.g. 2400 baud) is folded into the speech band and therefore generates an audible signal.

Consequently, continuous data transmission during speech transmission is not advised, since it generates audible noise. During speech, only necessary signaling (e.g. addressing, on-hook / off-hook, door-opening, etc...) should be transmitted, which usually requires just a few milliseconds.

Since all connected terminals will be in standby listening mode, each terminal must have its own unique address. One terminal (for example, the main door station) may be assigned as master, while the other terminals are assigned as slaves. All signaling should go to/from the master.
This way can be easily assured, that no bus conflicts can occur.

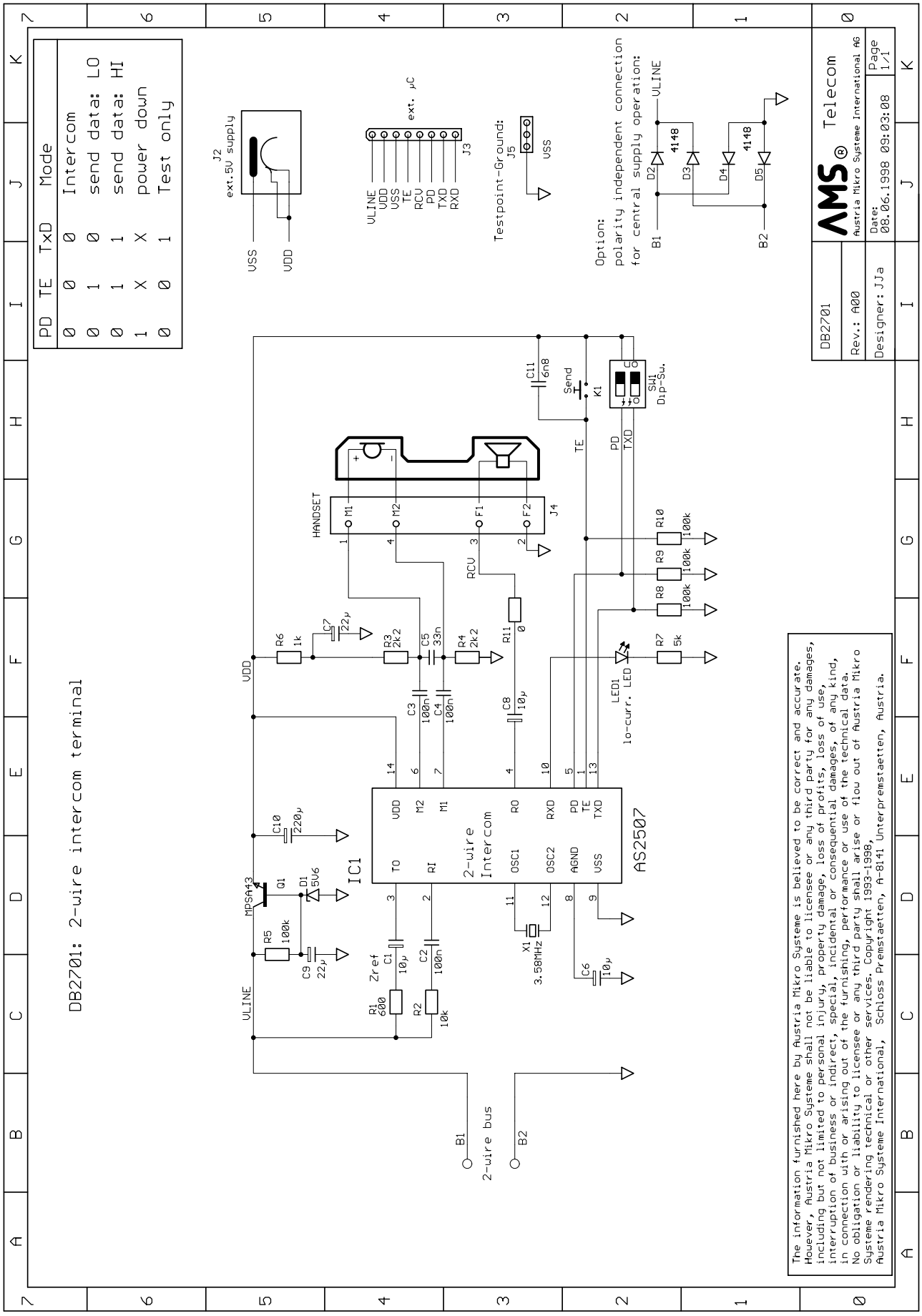
In central supply applications, while load currents are being switched, large voltage dips may be present at the 2-wire bus, since the central supply cannot support high AC current.
When, at the same time data is being transmitted, transmission errors may occur. Therefore, it should be avoided by software, that data is transmitted during load switching.

Since both FSK transmitter and FSK receiver are active at the same time, the local echo (RxD signal of the transmitting module) can be used to check the status on the bus and to verify that the transmission was successful.

Additionally, data transmission between terminals should always be performed using software handshake protocols.

16. DB2701 Demo board ;

16.1 schematic:



The DB2701 demoboard can be used for both local and central supply applications. It includes a DC connector for external +5V supply and an on-board discrete 5V regulator for central supply operation.

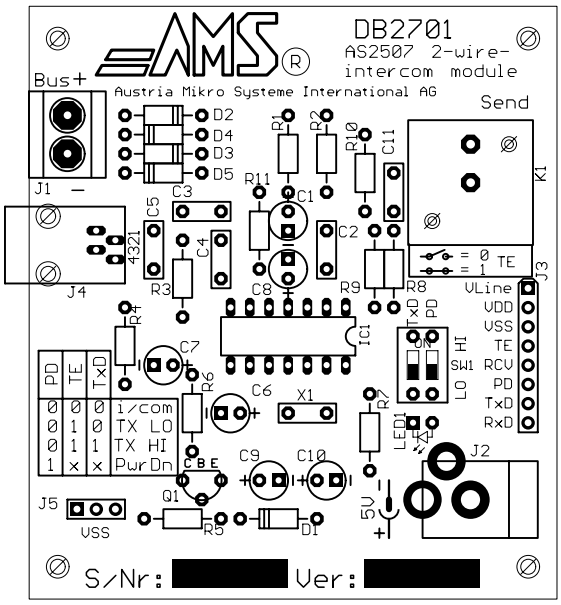
For speech transmission, a 4-pin modular connector is provided to connect a telephone 3- or 4-wire handset.

The 2-wire bus can be connected at a 2-pin PCB terminal block.

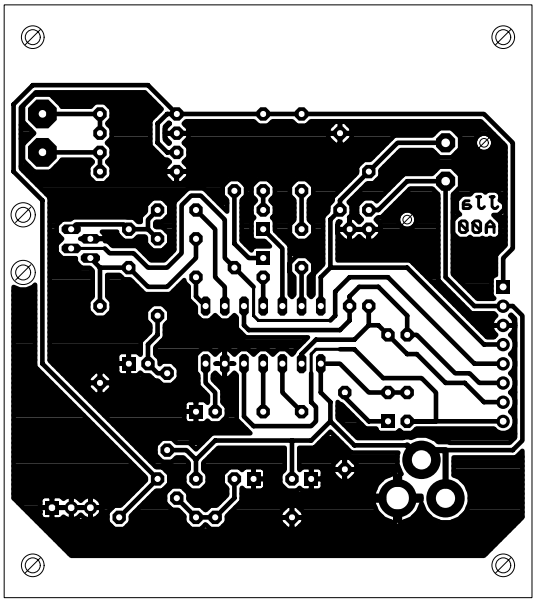
For data transmission, a pushbutton, two DIP-switches and a LED are provided for easy testing and verification purposes without external microcontroller.

All necessary signals to connect an external µC-PCB are provided with an 8-pin SIP connector.
Note: On the DB2701 demoboard, pin #1 is not installed to prevent accidental overvoltage damage to the IC, when pins #1 (V_{line}; typ >10VDC) and #2 (VDD; max 7V !) are short circuited, (e.g. by probe tips).

16.2 Demo board DB2701: Component print

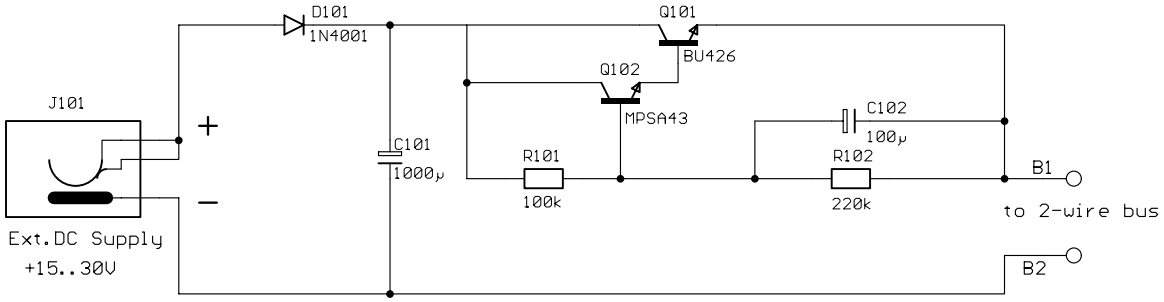


16.3 Demo board DB2701: Solder side:



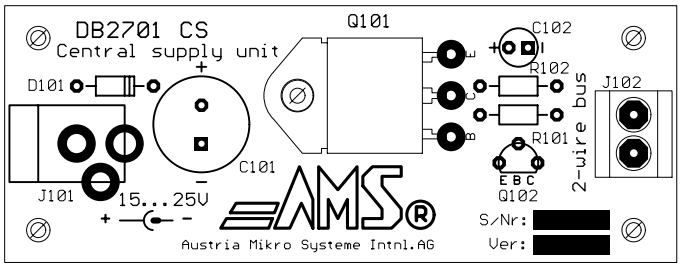
17. Demo board DB2701CS: central supply unit:

17.1 schematic:

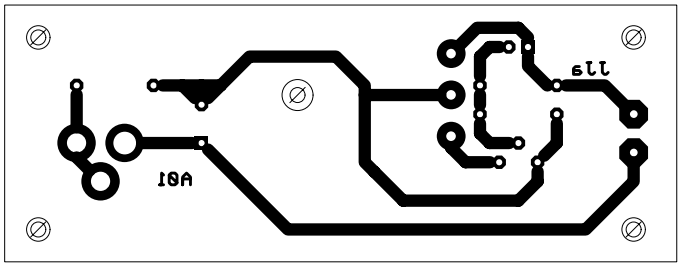


The central supply includes a DC connector for external +15...+30V DC supply, a diode (D101) for polarity reversal protection and a darlington high current / high AC output impedance “electronic inductor”.
It can support 100mA load current (more than 25 central supply terminals) without the need of a heatsink.

17.2 Demo board DB2701CS: central supply unit: Component print:



17.3 Demo board DB2701CS: central supply unit: solder side



18. Operating hints & Precautions

- The AS2507 circuit might get damaged by overvoltage, when Pins 1&2 (Line voltage and VDD) on the SIP connector J3 are accidentally short circuited. To prevent this, pin #1 of J3 is intentionally not installed on the demoboard (see pt. 16.1).
- Without central supply (pure local supply operation), the diode bridge for polarity independent connection must be removed, because there is no DC bias voltage on the bus. On the demoboard, remove diodes D2...D5 and replace D2 + D5 by wire bridges (see. pt. 8.1.4).
- Central supply terminals may also be connected without diode bridge, but when the bus is accidentally connected with reverse polarity, there is a low ohmic connection over Anode D1 ⇒ Cathode D1 ⇒ Base Q1 ⇒ Collector Q1 at the bus. Without current limitation by the external DC power supply, these two components may get damaged.
  Another possibility is to install at least D2. In this case, no overcurrent can flow with reversed polarity.
- The DB2701CS central supply circuit does NOT have current limitation. Consequently, the 2-wire bus is initially not short-circuit proof. Therefore the external DC power supply should have measures for current limiting or overcurrent shutdown.
- When the TE-pin (#4 of J3) is to be driven by external logic, capacitor C11 (in parallel to key K1) should be removed (capacitive load !).

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