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Speech Store with Integrated Sequencer

Even on its own, a digital speech store is a practical aid, the project becomes even more interesting if a sequencer and a “Roger peep” are integrated. A micro controller is responsible for controlling the system, as in the original version [1].

1. Circuit description

The circuit diagram of the speech store with the sequencer is shown in Fig. 1. The main elements of the speech store have already been described in [1], so they are merely summarised here.

The IC ISD 2560 speech memory stores a maximum of 1 minutes speech and can play this back as often as desired. The contents of the memory are still retained even if the power fails. When the change over switch is operated, the system changes from receive to playback, or vice versa. The external analogue wiring of the IC is for filter functions, and for matching the level to the microphone input of the transceiver.

The complete control system, both for the speech store module and to the exterior, through the sequencer is operated by the AT90S2313-10PC micro controller.

The integrated sequence control serves to guarantee when the transceiver, or any additional equipment, such as a power amplifier or a masthead preamplifier, is switched on or off.

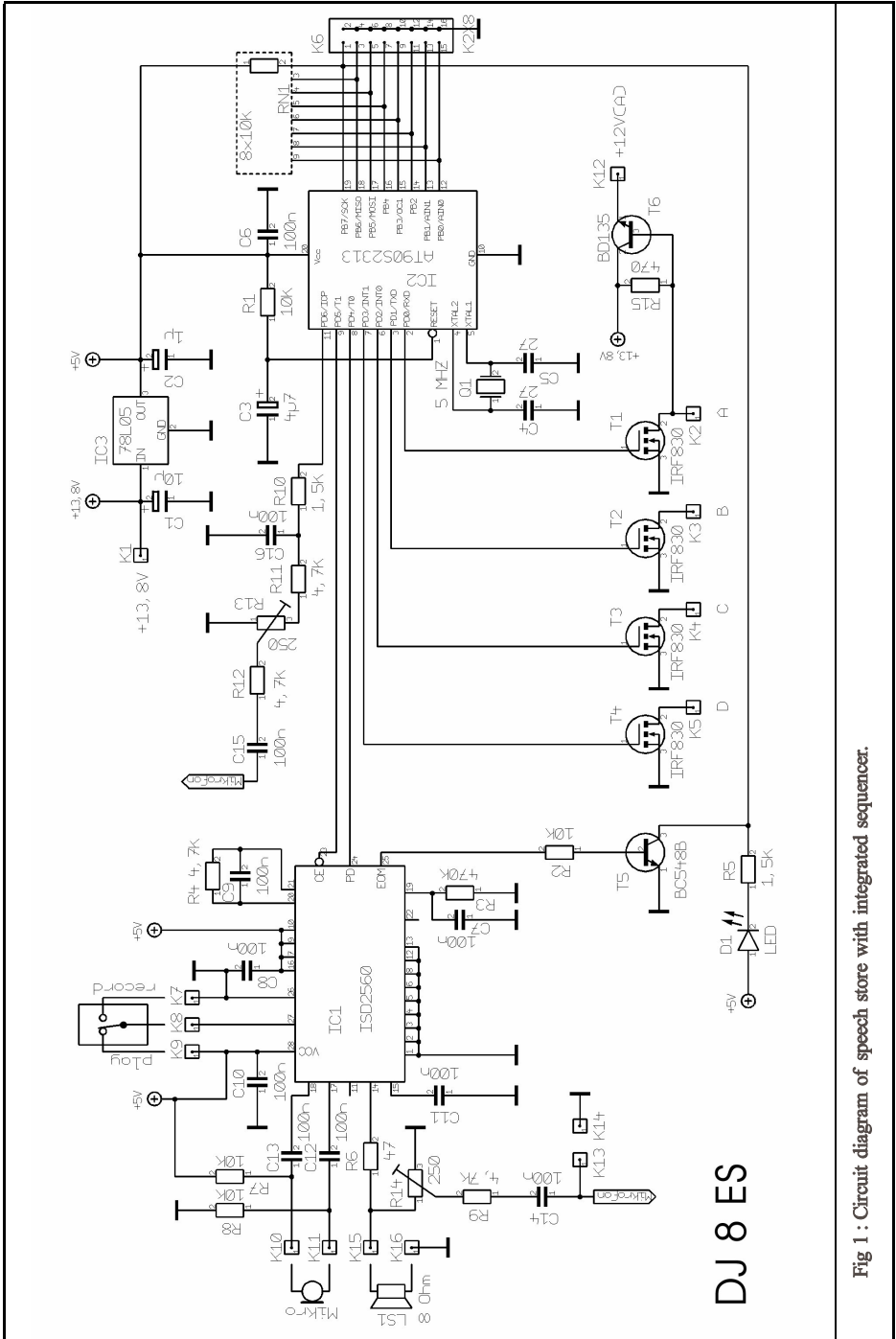
When the PTT key is activated, circuit outputs A to D are activated in a precisely co-ordinated timing sequence, and are de-activated again once the key is released. The power MOSFETs T1 to T4 are used to provide suitable amplification for the switching signals which control the PTT connection of the transceiver, the power amplifier, the antenna relay, etc.

The time cycle of 50ms, for the switching sequence of the sequencer, is derived from the crystal frequency (Q=5 MHz) through the software. The diagram in Fig. 3 makes the time sequence of the switching procedures clear.

The microphone PTT key is connected to port PB7 of the micro controller (IC2, Pin 19).

If desired, the function of a “Roger peep” can be selected through connections PB3 and PB4, as follows:

Roger Pip	PB4	PB3
no	Jumper	Jumper
pip	Jumper	-
cancelled	-	Jumper
"k"	-	-



DJ 8 ES

Fig 1 : Circuit diagram of speech store with integrated sequencer.



Fig 2 : Completed speech store in an aluminium case as produced by Frank Peter Richter, DL5HAT.

The circuit also offers the option of remotely powering an antenna amplifier though the download or through a separate cable. An operating voltage of 12V DC is available for the masthead pre-amplifier to do this, by means of the T6 (BD 135) transistor.

The “all stations call” key at port PB6 (IC2, Pin 18) of the micro controller initiates the transmission of an individual sequence, both for the initial reception of the “all stations call”, and for the play-back.

The “all stations loop” key PB5 (IC2, Pin 17) initiates an endless loop. By means of a jumper, the pause length of 5, 10, 15 or 20 seconds can be set between two calls. In the intervals, the PTT connection is always inactive and the transceiver switches to reception.

The “Stop” key PB4 (IC2, Pin 16) interrupts the endless loop or any other sequence. Thus an “all stations call” in progress can be interrupted at any time.

The “Stop” key also activates the ending of speech input.

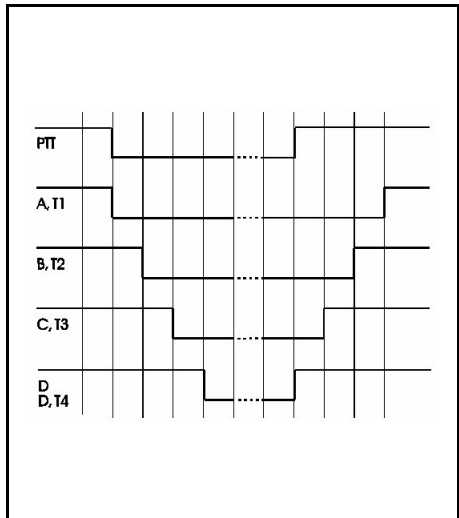


Fig 3 : Timing diagram showing the displacement of each signal.

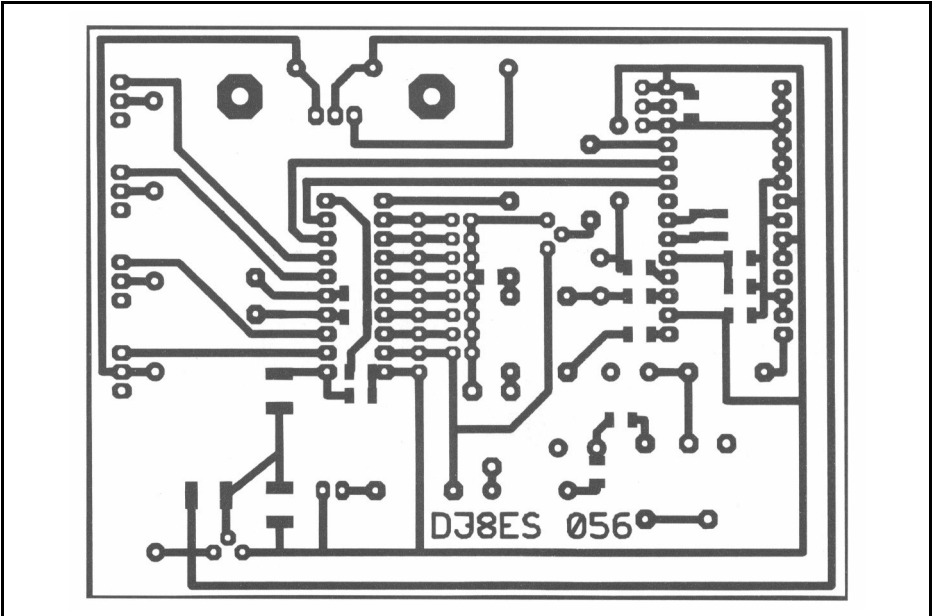


Fig 4 : PCB layout for the speech store.

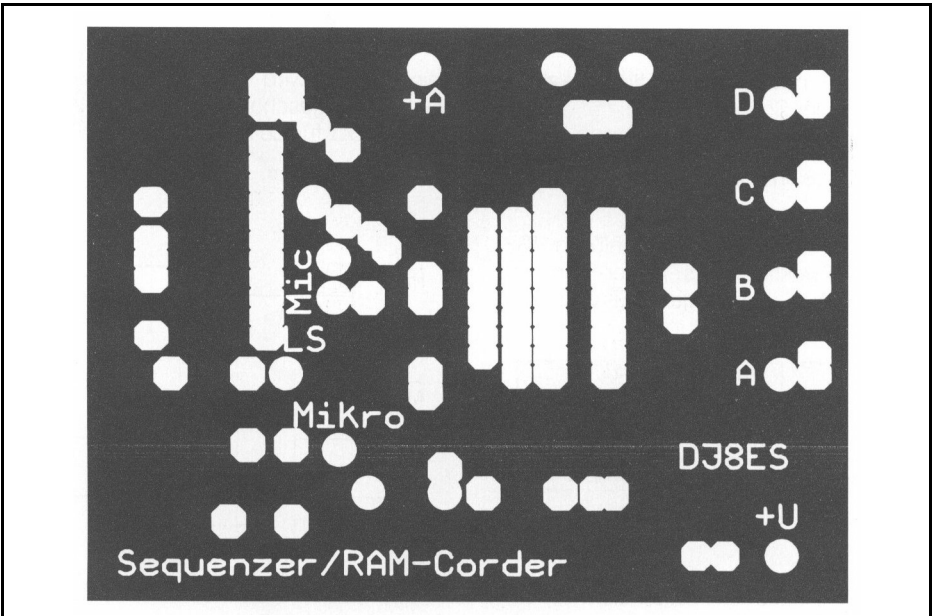


Fig 5 : Ground plane side of PCB.

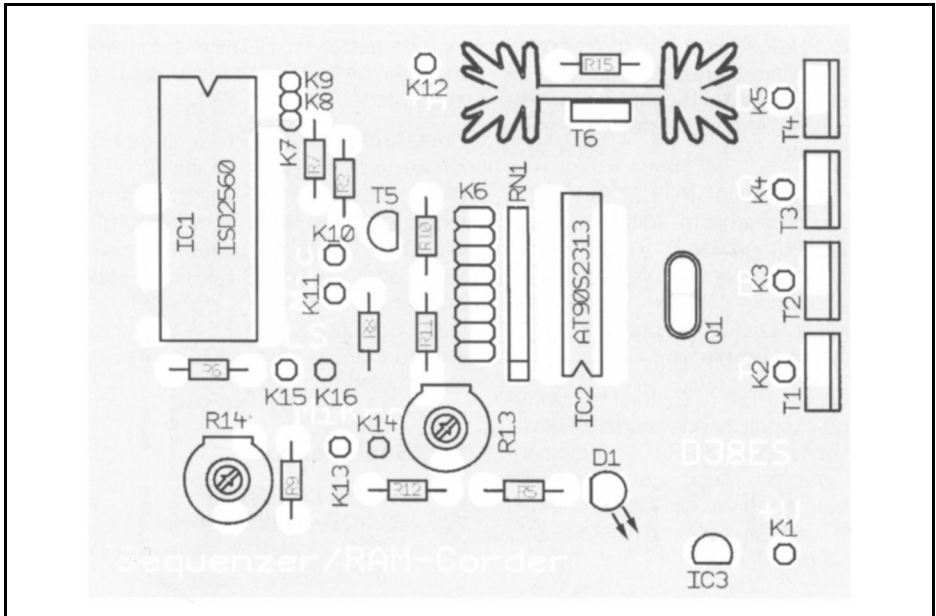


Fig 6 : Component layout for the speech store.

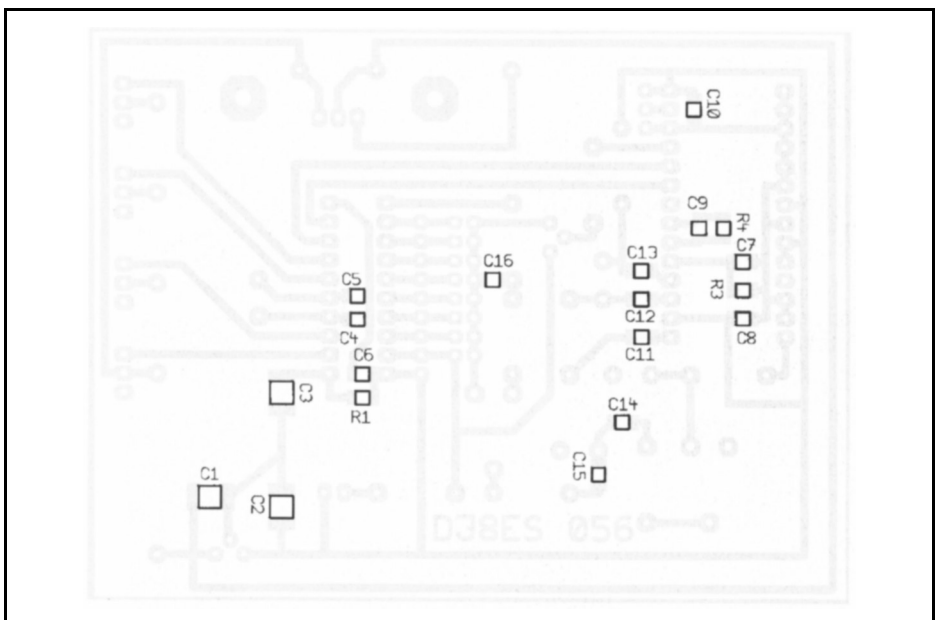


Fig 7 : Layout of SMD components.

**2.****Assembly instructions**

The speech store with sequencer is assembled on a double sided copper coated epoxy printed circuit board (Figs. 4 and 5) with dimensions of 100 mm x 75 mm. The fully coated side is an earthing surface. The earth connections are soldered in accordance with the components drawing (Fig. 6).

The two IC sockets and all the other components, with the exception of the speech store (IC1) and the micro-controller (IC2), are inserted and soldered in accordance with the components drawing, Fig. 6.

Mounting of the SMD components on the foil side is shown in Fig. 7. The inputs and outputs are fed using 1mm solder studs. The selection of the delay (waiting time) and "all stations loop" can be made by means of jumpers.

The T6 (BD135) transistor should be insulated, using a mica washer (and heat conducting paste).

The micro controller and the speech memory IC are not inserted until later on. First the function of the 5V voltage regulator is tested with a digital multimeter. To do this, the supply voltage of +12V DC, or better 13.8V DC, is applied and the stabilised voltage of +5V is measured at IC 1 (Pin 20) and IC 2 (Pin 28). Only now can the two ICs be inserted into their bases.

2.1. Component list

1 x Printed circuit board DJ8ES056
 IC1 ISD 2560, speech memory IC
 IC2 AT90S2313-10PC,
 micro controller
 IC3 78L05, voltage regulator
 T1-T4 IRF830, power MOSFET
 T5BC548B, transistor
 T6BD135, transistor
 Q1 Crystal 5.0000 MHz
 R13,14 Trimmer 250Ω, RM 5/10mm,

horizontal
 R15 470Ω/0.6W, RM 10mm
 RN1 Resistance array 8x10kΩ
 1 x Loudspeaker 0.5W/8Ω
 1 x Electret microphone
 1 x LED red, low current
 1 x IC holder, 20pin
 1 x IC holder, 28pin
 1 x Post strip, 2x8pin
 1 x Heat sink PR-32/25,4
 1 x Change over switch, 1pin,
 On/On
 4 x Hand actuated auxiliary switch
 15x Soldering stud 1mm
 Resistors 1/4W, RM 10mm:
 1 x 47Ω
 3 x 4.7kΩ
 2 x 1.5kΩ
 3 x 10kΩ

SMD resistors, 1206:

R1 10kΩ
 R3 470kΩ
 R4 4.7kΩ

SMD capacitors:

C1 10μ/25V; SMD tantalum
 C2 1μ/16V; SMD tantalum
 C3 4.7μF/16V; SMD tantalum
 C4,5 27pF, ceram. SMD 1206
 11x 100nF, ceram. SMD 1206

3.**Putting into operation**

Once the circuit has been assembled, the functioning of the voltage regulator checked and the ICs inserted, the equipment can be put into operation.

The waiting time for the "all stations loop" and the audio level for the unit are set at trimmer R14 or R13 for the "Roger peep". The audio output should drive the transceiver to full output, but should just not over modulate it (key word - bandwidth)! This audio output is applied parallel to the microphone at the microphone jack of the transceiver.

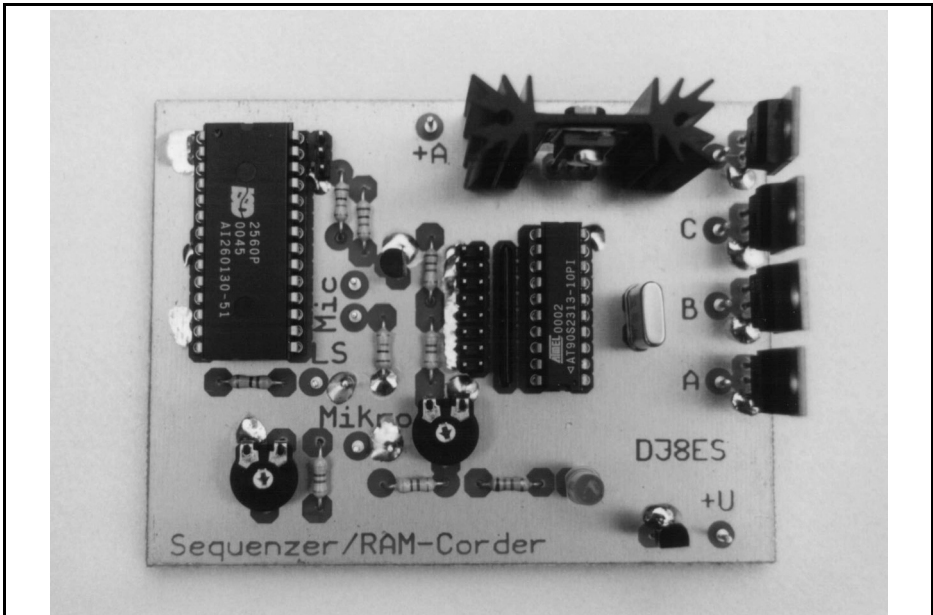


Fig 8 : Photograph of completed printed circuit board for the speech store.

The current consumption of the unit with +12 V (13.8 V) supply, in the various operating conditions is as follows: zero signal current 10mA, when PTT key is pressed 40mA and during an “all stations call” and /or when “all stations loop” is activated approximately 70mA.

The sequencer is connected into the microphone line. To do this, the PTT line should be modified. The PTT contact on the microphone controls the circuit and thus ensures that the station components are switched on and off at the correct times. The control outputs can be wired up, for example, as follows:

- A Antenna relay and/or preamplifier
- B Power amplifier
- C Transverter
- D Transceiver

If you don't want to test the functioning of the sequencer in practical operation straight away, you can initially wire up the outputs A to D with light emitting diodes (1k Ω to +12 V). The time se-

quence and thus the functioning of the switching outputs is visible.

In order to make and / or save an “all stations call”, proceed as follows:

- Switch in “Record” position
- Start recording using “all stations call” key
- Speak text (all stations call) into microphone
- End recording using “Stop” key

The LED lights during the recording. The maximum recording time is 1 Minute.

Note: In recording mode, no radio equipment should be connected, otherwise the transceiver automatically switches to transmission through the PTT connection when the “all stations call” key is pressed.

In playback mode (switch in “Play” position) pressing the key can be selected



Fig 9 : Rear view of the completed unit.

to bring about a single “all stations call” or an “all stations loop” (endless loop). The desired pause length between two calls can be set individually:

Pause	PB1	PB0
5sec	Jumper	-
10sec	Jumper	-
15sec	-	Jumper
20sec	-	-

During the pause, the PTT connection goes to “high” and the transceiver switches to reception.

The “Stop” key interrupts the endless loop or other sequences.

Finally, once again my sincere thanks to Frank Peter Richter, DL5HAT, for developing and testing the software for the speech memory with the integrated sequencer and the “Roger peep”.

4.

Literature references

[1] Wolfgang Schneider, DJ8ES: Digital Speech Memories for Radio Applications, VHF Communications, issue 2/2001 pp 87 - 91

[2] Wolfgang Schneider, DJ8ES: Micro controlled: Sequence Control (Sequencer) with Roger Peep, *Funkamateure* 49 (2000)