DIALER TELEPHONE CIRCUIT

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1.Introduction to the Automatic Dialer

Since the 68HC705 is memory mapped and uses a block of memory to access I/O, it seemed to be a good choice for this application, but limited addressing modes and a reduced instruction set makes it difficult to program to do even simple task. The 68HC11 would have been a much better choice.

A common anode seven segment was selected because it is better to sink than to source, and since the 68HC705 can source only 10mA through port B, not nearly enough to drive the display without significantly reducing resistance and possibly incorporating external circuitry.

Due to the fact that the MT8880 was such an out-of-date part and room for growth seemed limited with such a device, I selected the MC34010. Although the MC34010 had one major disadvantage, much timing considerations had to be thought out. I stuck with the MC34010 because it offered substantially more versatility.

Hardware Requirements

To install the Dialer Telephone Circuit successfully, a user will need the following:

1. A telephone line.
2. A 5-volt power supply with a floating ground.

Caution: An earth ground connection will create damaging feedback in the circuit.

3. Jumpers to connect the power supply

How to Use the Dialer

Use proper grounding techniques when handling the Dialer circuit board to guard against potentially damaging electrostatic discharge (ESD). The Dialer was designed to operate with a 5 volt power supply to power the micro-controller circuitry. If the micro-controller is not in use and you simply wish to manually dial with the device, simply disconnect the 5 volt power supply and dial. Make sure the device is still plugged into the phone line.

Introduction to the Automatic dialer

Storing a phone number:

To store a phone number, connect +5 volt to Vcc and the floating ground of the power supply to the ground of the circuit. These terminals are clearly marked on the board. When power is properly applied, the seven segment display will light up all segments on reset to indicate that all is well. The reset button is clearly marked on the board. To input the phone number a user wishes to store simply start typing in your numbers. Press the # key to initiate the storing routine and press a digit from 0-9 to store the number in that location. If a user makes an error while typing in your number simply press reset to clear the buffer and start again.

Dialing a stored phone number :

The Dialer can dial one of up to ten previously stored telephone numbers (identified as 0-9) of up to 15 digits each. This feature is useful for connecting to a frequently called phone number without having to dial the digits individually. To put the dialer off hook so the number is sent across the phone line press the button marked SW and listen for the dial tone through the speaker provided. Note, the speaker is not mandatory if you have a telephone already connected to the line. The SW switch is similar to the hook switch on your telephone. To dial, first press the digit of the location where you first stored the phone number and then press the star (*) key to initiate the recall feature.

2. *Electronic Telephone Circuit MC34010 Operation Features*

The Electronic Telephone Circuit (MC 34010) can provide all basic telephone applications and functions in a single chip. Included in one chip is a Dual Tone Modified Frequency dialer, a tone ringer, a speech network and a line voltage regulator or DC line interface. The tone ringer is capable of driving piezoelectric transducers and maintains EIA RS-470 impedance signature specifications. The speech network provides two to four-wire conversion with adjustable sidetone, utilizing an electret transmitter or microphone. A built-in regulator makes sure the circuit provides stable operation over a wide range of loop lengths. The Electronic Telephone Circuit (MC34010) has built in technology to provide low voltage operation,

thus, making it suitable for portable use with batteries and also for use in networks whereby parallel telephone connections are common. A standard telephone in parallel can sometimes receive line voltages below 2.5 volts, making the MC34010 an applicable circuit to use in such a situation. The surrounding circuits can maintain specified performance with instantaneous input voltage as low as 1.4 volts.

Physically, the MC34010 circuit provides a microprocessor interface port for automatic dialing features, the major application of this circuit in the project. A low cost ceramic resonator is used with the DTMF (Dual Tone Modified Frequency) generator because the DTMF dialer or DTMF Keypad are intended to work with a 500 kHz frequency from which row and column tones from the keypad are synthesized. The frequency synthesis techniques of this circuit are very accurate.

Speech Circuitry and Line Voltage Regulator

The circuit design of the speech network portion of the telephone circuit can be quite complex and will not be elaborated upon in a document of this scope. Briefly, the speech network provides the two to four-wire interface between the instrument's transmitter and receiver and the phone line. A microphone can be used in this circuit design, although one will not be incorporated in order to keep the project within the scope of the course.

A line voltage regulator is required with this circuit. This is due to the fact that line current changes when different parts of the circuit are active. The DC line interface circuit determines the DC input characteristic of the

telephone circuit. At input voltages of less than 3 volts, the electronic telephone circuit draws only the speech and dialer bias current through the voltage regulator. As input voltage increases, a constant current (dummy load) is switched off when the DTMF dialer is activated to reduce line current transients.

Keypad Interface & DTMF Synthesizer

A Dual Tone Modified Frequency Dialer is required to dial the numbers. The keypad interface is designed to function with contact resistances up to 1 kΩ and leakage resistance as low as 150 kΩ. A keypad with interface comparators activates the DTMF row and column tone generators when a row and column input are connected through a single pole, single throw keypad. Single tones may be initiated by depressing two keys in the same row or column. The programmable counters employ a novel design to produce non-integer frequency ratios. The various DTMF tones are synthesized with frequency division errors less than +/- 0.16%. Consequently, a cheap ceramic resonator is used as the DTMF frequency reference instead of a quartz crystal. The row and column digital-to-analog converters produce 16-step approximations of sinusoidal waveforms. Feedback through the feedback terminal is coupled through a capacitor to reduce the DTMF output impedance to approximately 2 kΩ to satisfy return loss specifications. This is required to reduce the output impedance to tip and ring when tone dialing.

Tone Ringer

The fundamental operation of the Tone Ringer will be explained even though the ringer was not included in the design. The tone ringer generates a square wave output to drive the piezo sound element when the AC line voltage exceeds a predetermined threshold level. When the average current in the tone ringer exceeds the threshold level, the Tone Ringer 's Output commences driving the piezo transducer. As a result hysteresis is produced between the tone ringer 's on and off thresholds. The output frequency of the Tone Ringer Output terminal alternates between fo/8 and fo/10 at a warble rate of fo/640 where fo is the ringer oscillator frequency. Note, the volume of the ring can be changed by simply adding a potentiometer or variable resistor in front of the piezo -transducer used to do the ringing.

Micro-Controller Unit Interface

The micro-controller connects the keypad and DTMF sections of the Electronic Telephone Circuit through the micro-controller unit interface for storing and retrieving numbers to be dialed. This is the main application in the Dialer Telephone Circuit design and software programming. Each button on a 12 or 16 number keypad is represented by a four-bit code. This four-bit code is used to load the counters in the ETC to generate the appropriate row and column tones. The code is transferred serially to or from the micro-controller one bit at a time when the ETC is clocked by the

MCU (micro-controller unit). The memory-out-serial-in and memory-out - serial-out terminals on the microcontroller will not be used to accomplish this task since the ETC handles four-bit codes and the micro-controller would be sending eight-bit codes. Data will be transferred through the I/O (input/output) terminal under (DD) data direction control. In the manual dialing mode, DD is a logic zero and the four-bit code from the key pad is fed to the DTMF generator by the digital multiplexer and also output on the I/O terminal through the four-bit shift register. The data sequence on the I/O terminal is Bit3,Bit2,Bit1 and Bit0 respectively and is transferred on the negative transition of the clock input (CL low). In this mode the shift register load enable circuit cycles the register between the load and the read mode such that multiple read cycles are required to output data from the ETC and reload the register for the second look.

The six micro-controller interface lines (DP,TO low, MS, DD, I/O and CL low) are connected directly to port C. The DP line (depressed push button) is connected to port C (PC3), a polled interrupt line, to signal the micro-controller to begin a read data sequence when storing a number into memory.