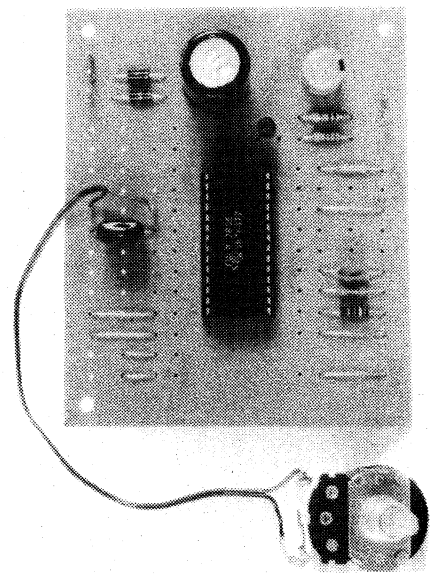
Create your own sound effects

by GREG SWAIN

Would you like to create steam train sound effects for your model railroad? Or how about an electronic siren, or the sound of a propeller driven airplane, or even a phaser gun? In this article, we give you some simple sound effects circuits based on the recently released SN76477 from Texas Instruments.



Creating your own sound effects is easy with this general purpose board.

Actually, I'm not too sure what a phasor gun is supposed to sound like. However, the noise generated by the space war/phasor gun sound synthesiser circuit which we built up from TI's application notes is certainly quite weird. Listening to it, one can readily imagine an outer space battle between starships using esoteric weapons.

By varying a single control pot, various "Space War" sound effects can be generated. Wind the pot right down, and the output sounds just like an electronic siren.

But it's with the model train enthusiasts that we're betting this project will really hit the spot. The simple circuit shown can realistically simulate the "chuffing" sound of a steam train or, by varying the control pot, the sound of a propeller driven aircraft. Best of all it should only cost a few dollars to build.

All the circuits described are based on the Texas Instruments SN76477 complex sound generator chip. This is a 28-pin bipolar I^2L device which provides noise, tone and low frequency based complex sounds. The device is programmed to produce specific sound effects by means of external components, either resistors, capacitors or direct links to a +5V rail or to earth.

A wide variety of sounds can thus be generated by the SN76477 simply by varying the external component connections to the device. With this in mind, we have taken a somewhat unusual approach with this particular project.

What we have done is to produce a general purpose printed circuit board (code number 78n6, 104 x 84mm) which will accommodate the SN76477 device and its associated audio amplifier and power supply. Then, by adding appropriate components to the board, readers may build whichever sound synthesiser suits their requirements.

The circuit which we have chosen to feature is the steam train/propeller plane sound synthesiser. However, by referring to the accompanying table, readers can just as easily construct the siren/space war sound synthesiser or the gunshot/explosion synthesiser — all on the same pcb!

More about building these circuits later on.

Perhaps the main advantage of the general purpose board is that it will also allow readers to experiment with the chip to create their own special sound effects. You could for example, use the circuits given as a starting point and by adding components or varying component values, synthesise new sounds.

In order to provide a guide to those readers who do wish to experiment further, it may be as well at this point to take a look at the internal circuitry of the SN76477 device. A brief guide on how each of the various chip functions can be controlled or disabled will also be provided.

Fig. 1 shows the block diagram of the SN76477. As you can see, its essential components include a super low frequency (SLF) oscillator, a voltage control oscillator (VCO), a noise oscillator (actually a clock), a noise generator and noise filter, a mixer, and an envelope generator and modulator circuit. Also contained within the chip are various logic circuits for envelope selection from the mixer (envelope logic) and for short duration sounds.

The SLF is normally operated at a frequency somewhere between 0.1 and 30Hz. The actual frequency is determined by the SLF control resistor on pin

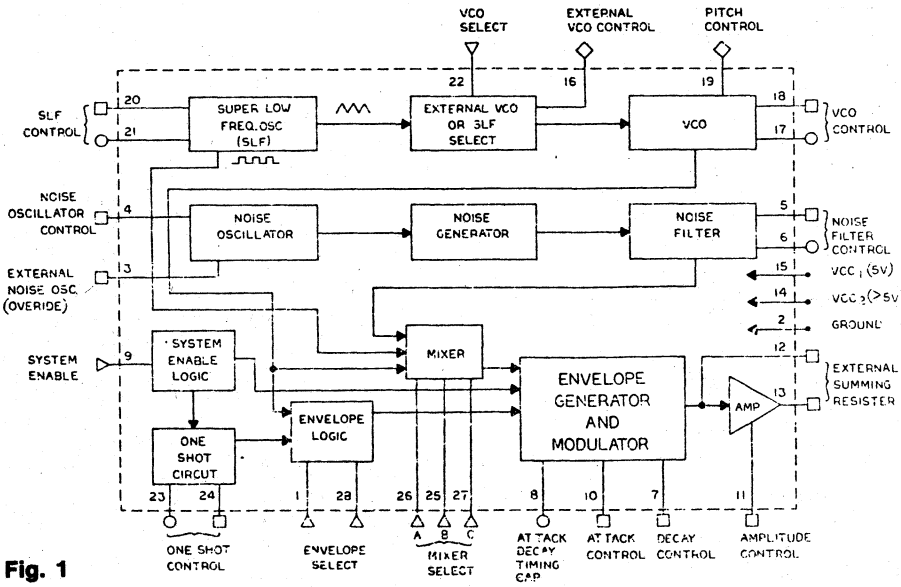


Fig. 1

20 of the device and the capacitor on pin 21. Increasing either of these components decreases the SLF frequency.

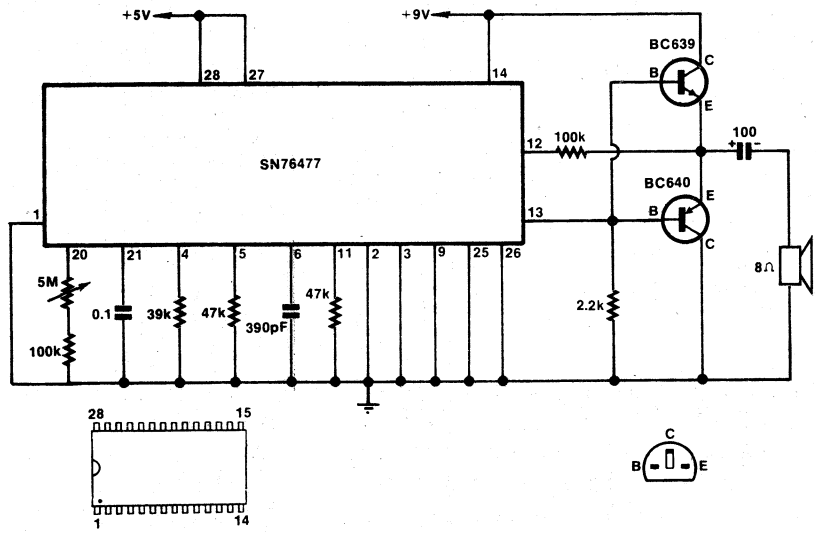
The SLF feeds a 50 per cent duty cycle square wave to the mixer, and a triangle wave to the external VCO/SLF select logic. This triangular waveform is fed straight through to control the VCO when pin 22 is high (taken to +5V). Alternatively, the VCO can be controlled by an external oscillator connected to pin 16. The higher the voltage, the lower the frequency of the VCO.

The range of the VCO, that is the maximum frequency to the minimum frequency (corresponding to the minimum control voltage and the maximum control voltage respectively), is internally set at approximately 10:1. By adjusting the VCO control resistor (pin 18) and capacitor (pin 17), the minimum VCO frequency can be determined according to the following equation: VCO frequency (Hz) = 0.64/RC, where R is the resistance in ohms, and C is the capacitance in farads.

(Note: the above equation can also be used to set the SLF frequency.)

A pitch control (pin 19) can be used to vary the duty cycle of the VCO output to produce different "tones". If no adjustment is desired, then a 50 per cent duty cycle can be obtained by leaving pin 19 high (+5V). Output from the VCO is fed to both the mixer and the envelope select logic.

The block labelled noise oscillator is actually an on-chip clock which controls the rate of the noise generator. The latter generates noise in the form of a long pseudo-random binary sequence which is filtered to reduce high frequency content, and then fed to the mixer.



TRAIN/PROPELLER PLANE SOUND SYNTHESISER

2/MS/-

Use the circuit above to create sound effects for your model railroad.

Pins 5 and 6 are the noise filter control inputs. Increasing the RC time constant on these pins reduces the high frequency content of the noise waveform.

It should be noted that the noise oscillator requires a 39k resistor to ground at pin 4. This value should not be adjusted unless, of course, the noise generator circuitry is not required, in which case it may be deleted. Pin 3 is an automatic override of pin 4 for connection of an external clock.

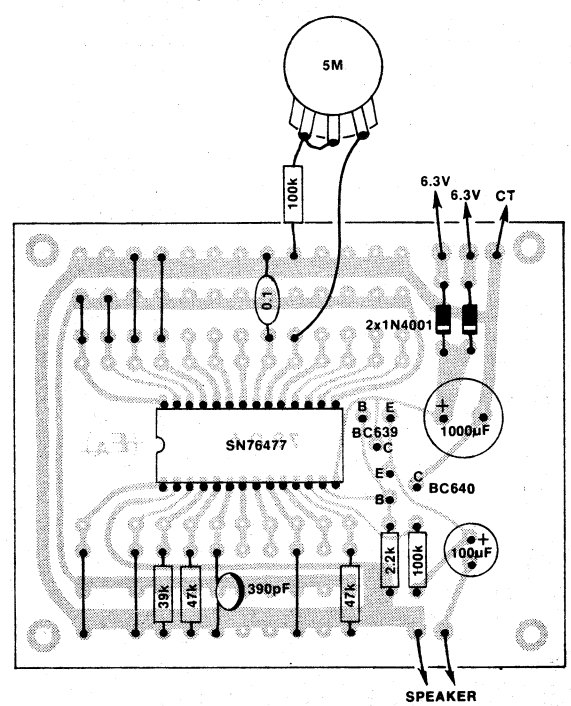
The mixer logic selects one, or a combination of, the inputs from the SLF, VCO and noise filter, and feeds the resultant waveform to the envelope generator and modulator. Mixing takes place according to the following truth table:

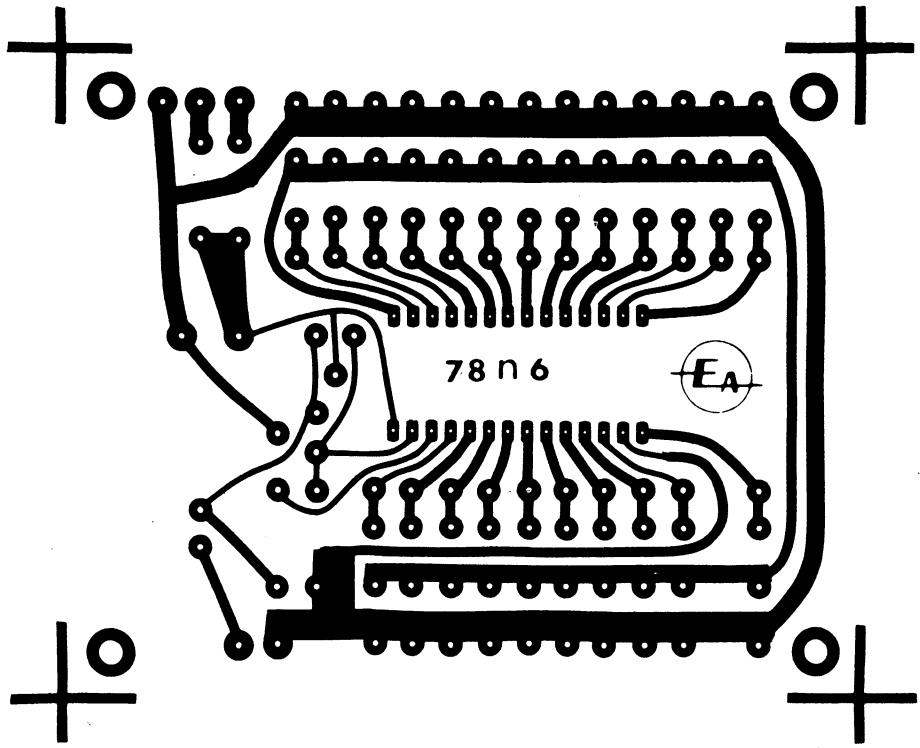
Pin 27	Pin 25	Pin 26	Output
0	0	0	VCO
0	0	1	SLF
0	1	0	Noise
0	1	1	VCO/Noise
1	0	0	SLF/Noise
1	0	1	SLF/VCO/Noise
1	1	0	SLF/VCO
1	1	1	Inhibit

where 0 denotes connection to earth and 1 denotes connection to +5V.

PIN	GUNSHOT/EXPLOSION	SIREN/SPACE WAR
1	+5V	+5V
3	earth	—
4	39k to earth	—
5	330k/68k to earth	—
6	390pF to earth	—
7	680k to earth	—
8	0.68uF to earth	—
9	22k to +5V, momentary contact switch to earth	earth
10	3.3k to earth	—
11	47k to earth	150k to earth
16	—	—
17	—	0.22uF to earth
18	—	3.9k to earth
19	—	+5V
20	—	200k pot to earth
21	—	1uF to earth
22	—	+5V
23	0.01uF to earth	—
24	330k to earth	—
25	+5V	earth
26	earth	earth
27	earth	earth
28	earth	earth

Follow the wiring diagram below when wiring up the steam train/prop plane sound circuit.





Here is an actual size reproduction of the PCB pattern.

The system enable logic provides an enable/inhibit function for the chip output. When pin 9 is low, the output is enabled; when pin 9 is high, the output is inhibited.

Pin 9 also controls the one-shot logic for momentary sounds, such as gunshots and explosions. The one-shot logic is triggered by the trailing edge of a pulse, that is when pin 9 is taken from a high to a low logic level. This may be accomplished by means of a momentary contact switch, or by a square wave input at pin 9.

The duration of the one-shot is determined by the RC time constant at pins 23 and 24. The maximum duration that can be achieved is around two seconds.

About the only parts of the circuit that we haven't considered so far are the envelope select logic, the attack and decay control logic, and the on-chip amplifier. We will now consider each of these in turn.

Pins 1 and 28 control the envelope select logic, which determines the envelope for the output from the mixer, according to the following table:

Pin 1	Pin 28	Output
0	0	VCO
0	1	Mixer only
1	0	One-shot
1	1	VCO with one-shot

Attack and decay of the one-shot envelope is determined by the attack control resistor (pin 10), the decay control resistor (pin 7), and the attack/decay timing capacitor (pin 8). The attack time in seconds is simply the RC time constant of the attack control resistor and the attack/decay timing capacitor.

Similarly, the decay time is the RC time constant of the decay control resistor and the attack/decay timing capacitor.

The on-chip amplifier is designed to interface with additional amplifier stages. It requires an external summing resistor (10k) from pin 12 to pin 13, and is designed to provide a low impedance output. The gain of the amplifier may be varied by a resistor on pin 11.

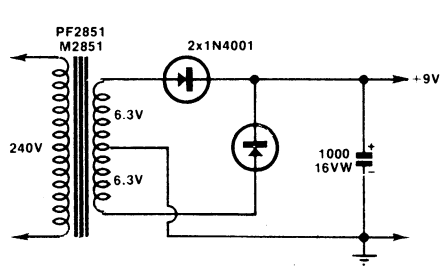
Power supply requirements for the SN76477 are straightforward. The device is designed to accept a 9VDC supply (either battery or mains derived) to pin 14, and to regulate this down to 5V to supply the various on-chip functions. This regulated voltage also appears on pin 15 of the device. Pin 2 is the supply earth.

So much then for the internal workings of the SN76477 sound generator IC. Let's now turn our attention to building some simple circuits, and the way in which we have implemented the general purpose pc board.

As may be seen, the pattern has been designed so that the IC occupies a central position on the board. Running down either side of the IC are the +5V and earth rails, the latter the one nearest to the edge of the board. Solder pads are provided at regular intervals, so that chip programming is simply a matter of inserting the appropriate components between the IC pins and the +5V or earth rails to achieve the desired sound.

Note that we have made use of the regulated +5V appearing at pin 15 of the IC to provide the +5V rail.

We have also made provision on the board for a simple audio amplifier and for the power supply components. The audio amplifier is one suggested in TI's application notes and contains just two transistors (a BC639 and a BC640), employed here as a complementary pair. This arrangement should provide sufficient power output for most purposes.



This simple circuit can be used to power the sound synthesiser.

However, there is nothing to stop you from feeding the chip output into a more powerful amplifier system if you so wish. Just connect a 10k resistor between pins 12 and 13 as described previously, and feed the IC output from pin 13 directly into your amplifier. Input signal levels into the amplifier can be adjusted by the gain resistor on pin 11.

Another option is to use a 9V battery in place of our mains power supply. This should preferably be bypassed with a 100uF electrolytic capacitor, which can be soldered onto the board in place of the 1000uF unit used in the mains supply.

Very few additional components are required to program the chip to build the steam train/propeller plane sound synthesiser — just four resistors, two capacitors, a pot and a few wire links in fact. The way in which we wired up the board is shown in the component overlay diagram.

What if you want to build the siren/spacer war sound synthesiser, or the gunshot/explosion synthesiser? For both cases, just refer to the accompanying table and program the IC accordingly.

One final note, and that concerns availability of the SN76477 IC. The device used in this project was an advance sample supplied through Texas Instruments' local office and, at the time of writting, not generally available in Australia. However, TI has assured us that sufficient stocks will be imported and made available to dealers by the time this article appears in print.

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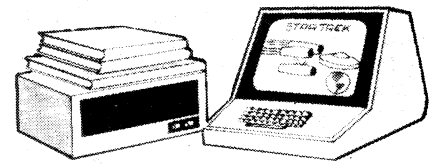
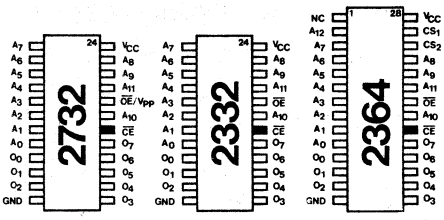


32k & 64k ROMs

Intel Corporation has announced its release of 32k and 64k bit mask programmed ROMs, with a matching pin-compatible 32k bit EPROM coming shortly. The devices form part of a new range of edge-enabled, high density, single 5V supply ROMs specifically designed to meet the needs of microcomputer program storage.

The mask-programmed devices have type numbers 2332 and 2364 respectively, and are organised as 4096 x 8 and 8192 x 8 to provide optimum matching



for byte-organised systems. They provide 300 ns maximum access time and are directly TTL compatible on all inputs and outputs.

They also feature a separate output enabling function to eliminate bus contention problems.

Pin compatible with the 2332 will be the new 32k bit EPROM, the 2732, again organised as 8192 x 8 bits.

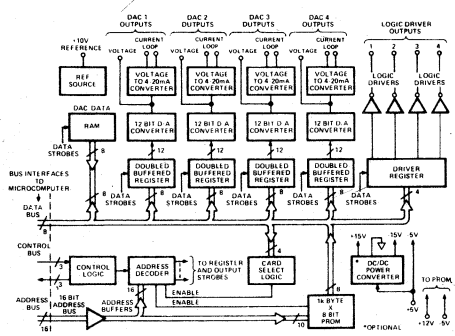
Edge enabling is used to provide faster access time and lower power consumption than fully static operation. Typical currents from the single 5V supply are 20mA when active and 9mA during standby.

Further information on the new devices is available from AJF Systems & Components, 29 Devlin Street, Ryde, NSW.

Analog interface

Analog Devices, Inc. has produced a new analog output interface subsystem specifically designed to form part of a microcomputer using the Intel SBC-80 board. Called the RTI-1201, the subsystem provides four 12-bit digital-to-analog output channels with either voltage or current output, and four digital output channels with 300mA, 30V drive capability.

Each of the digital-to-analog conversion channels may be used as either a 12-bit channel requiring two bytes of



input data, or as an 8-bit channel requiring a single byte. Each channel has its own latch registers, while there is a separate parallel RAM to allow the processor to "read back" the data currently in the DAC registers.

Analog Devices will shortly be marketing similar units for Texas Instruments and Motorola systems.

Further information is available from the Australian agents, who are Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065.

Octal CMOS latches

National Semiconductor has developed CMOS versions of the 20-pin octal microprocessor interfacing devices now becoming industry standard. The CMOS devices incorporate a new feature: the ability to drive highly capacitive loads, and to drive a standard TTL load.

The MM74C373 is an 8-bit latch, while the MM74C374 is an 8-bit positive edge-triggered latch.

Both devices will operate from supply voltages between 3 and 15 volts, and have a low Tristate off current of about 5 nanoamps. Typical output source current capability is 20mA.

The improved output capability is due to the use of an NPN emitter follower in the output stage, along with a P-Channel FET.

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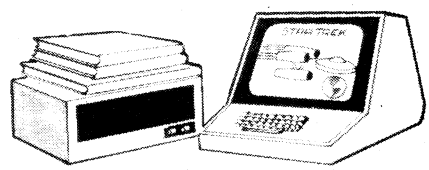


New FDC chip

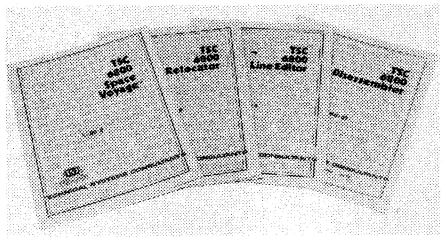
Western Digital Corporation has announced a new floppy disc controller/formatter chip, the FD1791. This is described as the "end result" of the established FD1771 and FD1781 products. It provides for both single and double density modes of operation, with IBM 3740 compatibility in single density mode (FM) and System 34 compatibility in double density mode (MFM).

The FD1791 offers all of the features of the FD1771, together with the added functions necessary to read, write and format a double density diskette. These include address mark detection, FM and MFM encode and decode logic, window extension, and write precompensation.

Price of the FD1791 in 1-24 quantities is $62.00 plus tax. It will be available from Daneva Control Pty Ltd in Melbourne, E&M Electronics in Sydney, Baltec Systems in Brisbane, Rogers Electronics in Adelaide and Micro Controls in Perth. Further information is available from Michael Mote, Daneva Control Pty Ltd, 70 Bay Road, Sandringham, Victoria 3191. Telephone (03) 598 9207.

Low cost software

The range of microcomputer software produced by Technical Systems Consultants, Inc of Indiana is now available in Australia from Southwest Technical Products Australia. The range includes programs for the M6800, the 6502 and the 8080. Primarily they come as full assembler listings, with hex code and comments, although longer programs are also



available in cassette or paper tape hex dump form.

The programs available include utility software like a disassembler, a relocator, a micro BASIC, a text editor and a mnemonic assembler; maths and diagnostics routines; and games such as "Space Voyage" and "Battleship". The prices have been kept as low as possible to make them attractive to the hobbyist.

Enquiries to Southwest Technical Products Australia, P.O. Box 380, Darlinghurst NSW 2010.

IEC/IEEE interface

An LSI chip designed to perform most basic functions required for the IEC 66C002 and IEEE 488-1975 bus interfacing systems is available from Philips. The device, known as the HEF4738V, is made using the LOCMOS process and has inputs fully compatible with 4000-series CMOS. The only IEC function not provided is the controller (C) function.

The HEF4738V comes in a 40-pin DIL package, and operates from any supply voltage between 4.5 and 12.5V. To connect digital instruments and programmable equipment to an IEC/IEEE bus it is only necessary to provide the device with inverting bus transceivers, level converters and multiplexers.

Further information is available from the components and materials division of Philips Industries, 67 Mars Road, Lane Cove NSW.

Miniature cassette

A low cost miniature digital cassette transport operating from a single 12V DC supply is now available from MACE. The type MD3 measures only 83 x 53 x 52mm and weighs only 160g, making it small enough to be mounted directly on a PCB. Data storage capacity is 480 kilobits, with 400 bits per inch and a data transfer rate of 1500 bits/second. Start and stop times are 30ms, and rewind takes 50s.

The unit has a fast forward search mode and sensing for beginning and end of tape, cassette presence, cassette side and file protect. When supplied with the M3C custom programmed one chip microcontroller (in a 40-pin DIL package) the unit is 8080 and 6800 bus compatible.

Further information from Measuring and Control Equipment Co Pty Ltd, PO Box 78, Epping, NSW 2121. Telephone (02) 86 4060.

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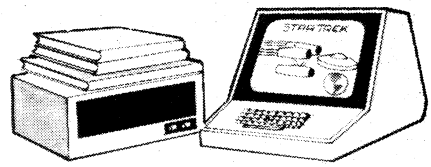


Intel's 16-bit micro

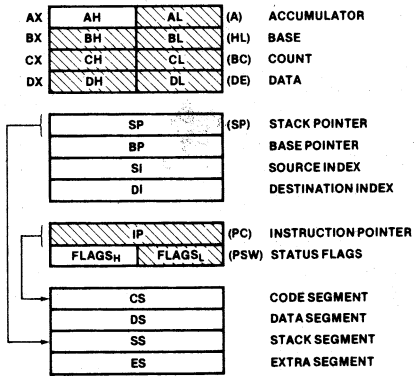
The new 8086 16-bit microprocessor from Intel Corporation has been designed to extend the existing 8080 family into the high performance 16-bit area. It has attributes of both 8 and 16-bit processors. For example it executes the full set of 8080A/8085 8-bit instructions, and is therefore software compatible with the 8-bit processors, while offering a powerful set of 16-bit instructions as well.

The added features include 8-bit and 16-bit arithmetic, both signed and unsigned, including multiply and divide, efficient interruptible byte-string operations, and improved bit manipulation. There are also mechanisms for re-entrant code, position independent code and dynamically relocatable programs.

An important feature of the 8086 is its ability to directly address up to one megabyte of memory — 1,048,576 bytes, using 20-bit addresses. The addressing scheme used can allocate within this memory space four functional segments, each of up to 64 kilobytes, and each associated with a separate indexing register. The segments are designated for code, stack, data and alternate data.

16-bit operands can be located on both even and odd byte — address boundaries, and are not constrained as in some other 16-bit processors.

The 8086 has 24 operand addressing modes. It has 14 internal 16-bit registers, including the four segment index registers.



Here are the 8086's internal registers, with those shared by the 8080 shaded.

The device is in a standard 40-pin DIL package, with data and address information multiplexed on a common 16-bit bus. However execution speed and memory utilisation are kept high by an instruction stream queuing mechanism, whereby instruction fetching effectively occurs simultaneously with execution.

In effect, the 8086 consists of two processors, one performing instruction execution and the other bus interfacing and instruction fetching. Whenever the execution processor is not communicating with the memory bus, the bus interfacing processor is able to fetch instruction bytes and place them into a 6-byte "queue" in an on-board FIFO (first-in first-out buffer). The bus interfacing processor thus keeps the execution processor continuously "stoked up" with instructions, and does this by making use of normally unutilised bus periods.

Intel claims that this gives the 8086 a potential 10-fold increase in performance over the 8080.

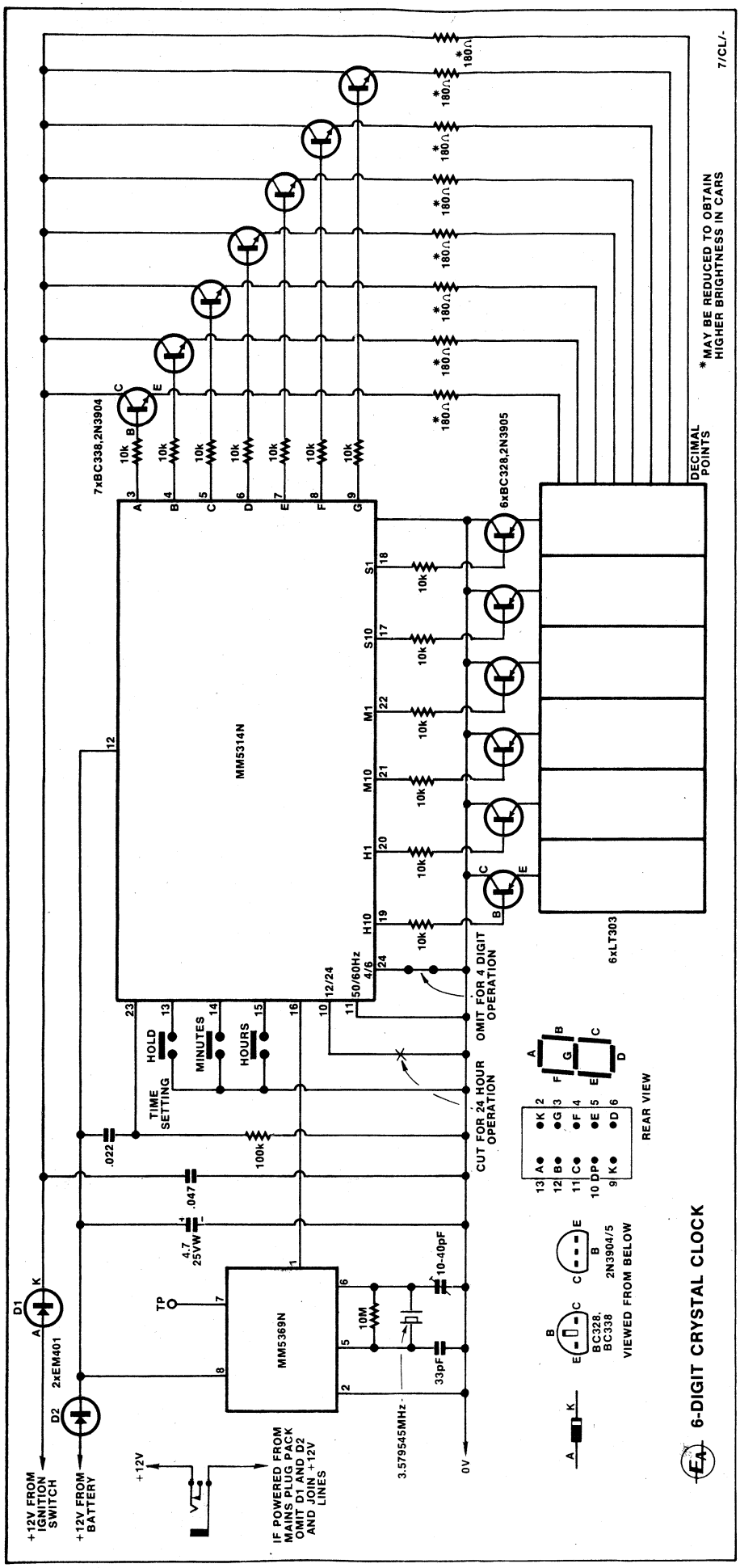
Further information on the 8086 is available from Intel agents Warburton Franki, who have offices in most states.

Display/keybd chip

A new single-chip controller for display and keyboard interfacing has been announced by Matrox Electronic Systems. The MTXA1 is described as a general purpose programmable alphanumeric display and keyboard interface device, suitable for use with any 8-bit microprocessor. It will drive up to 32 5 x 7 dot matrix alphanumeric LED displays, and also scan up to 64 keys.

The MTXA1 comes in a 40-pin DIL package and operates from a single +5V power supply, drawing only 60mA. It includes a character generator for the 64 character set of 6-bit ASCII, and also has its own internal 32 x 8 refresh RAM. All timing for the display refresh and keyboard scanning is controlled by an on-chip clock oscillator, using an external crystal or LC tuned circuit.

The controller can execute a total of 22 instructions for display and keyboard manipulation. The commands have a



an economical timebase.

Thirteen transistors are required to interface the 5314 with the six seven-segment displays. It is possible for the 5314 to drive these displays directly but brightness is low and liable to be inconsistent between digits and segments.

The 5314 chip will drive common-anode or common-cathode seven-segment displays, albeit with different interfacing circuitry. We have chosen to use common cathode readouts. This entails using NPN segment driver transistors and PNP digit drivers, all working as emitter-followers which means that they do not saturate when conducting.

One advantage of using the common-cathode readouts specified is that no links are required on the display PCB.

Separate positive power supply lines power the circuit. Both lines have series diodes to protect against polarity reversal when installed in a car. One line powers the two ICs and is connected all the time. The other powers the readouts and is connected via the ignition switch (when installed in a car) so that the display is blanked when the ignition key is removed.

There is another method of blanking the display available with the 5314. Pin 1 is the "output enable" control. When connected to the negative supply the segment driver outputs are blanked, thus turning off the display.

The problem with using the "output enable" control to blank the display (which would require at least one extra transistor) is that it does not blank the decimal points — in fact, because the multiplex operation stops, both the decimal point LEDs are energized continuously and draw an appreciable current.

Because the digit and segment drivers are emitter-followers they all require 10k current-limiting base resistors. These are not to protect the transistors or the 5314 chip, but to prevent the 5314 chip from driving the LED displays directly, via the base-emitter junctions of the transistors, when the positive supply for the displays is turned off.

With the 10k resistors installed, the total current drain of the circuit drops to less than 10 milliamps when the display is blanked. This is virtually the current drain of the 5314 chip alone and is considerably below the current drain that would result if the 10k resistors were omitted.

It may be thought that the 10k limiting resistors would not have been required had we used common-anode LED displays with the segment and driver transistors operating in common-emitter mode (where they saturate). However, in this configuration, each segment driver transistor requires a voltage divider in the base circuit. This would mean that one extra

At left is the complete circuit of the digital clock.

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AmZ8000 Evaluation from R&D Electronics

Santa Clara, CA ... June 4 ... Advanced Micro Computers has introduced the AMC 96/4016, an AmZ8000 Evaluation Board. This product is a fully assembled and tested microprocessor evaluation unit that integrates the necessary on-board software and hardware resources to explore and use the features of the AmZ8000.

In its basic configuration, the AMC 96/4016 incorporates the AmZ8000 16-bit microprocessor; 8k bytes of RAM; 24 parallel I/O lines; two RS232C serial I/O ports; 12k bytes of EPROM/ROM sockets; system clock and resident monitor.

For further information contact R & D Electronics, 257 Burwood Highway, Burwood, Vic 3125. Phone (03) 288 8232.

MICRO Comparisons

Royel Micro Systems Pty Ltd can now supply reprints of two interesting studies on the relative virtues of different microprocessors. The 6500, 8080, 6800 and Z-80 units are covered in the surveys.

Parameters considered include required memory, processing speed, die size, package capability, address modes, internal registers and many more.

The 14 pages of information are designed to help the electronic systems engineer to make the right decisions when designing micro systems, and facilitate selection based on both performance and versatility as well as cost.

Further information from Royel Micro Systems Pty Ltd, 27 Normanby Rd, Notting Hill, Victoria 3168. Telephone (03) 543 5122, or Sydney (02) 709 5293.

Logic Shop

Following hot on the heels of their Melbourne opening, The Logic Shop Pty Ltd has just opened its Sydney store at 91 Regent Street, Chippendale, with Andrew McIntosh as manager.

Like the Melbourne store, the Printerm, Compucolor and Qume daisy-wheel printer feature among the equipment on display, together with the TLS 900 Video Display Terminal, Sendata Acoustic Coupler series, Texas Instruments high speed printers and Houston Instrument models.

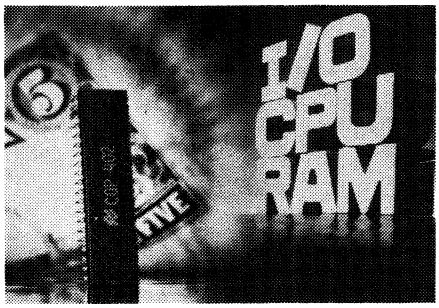
New from National Semiconductor Corp.

Santa Clara, CA — National Semiconductor Corp is now in production with two low cost, four-bit control oriented processors.

Designated the COP402 and COP402M, the 40-pin devices are ROM-less members of National's COPS Microcontroller family, fabricated using N-channel MOS technology.

Each device contains a CPU, RAM and I/O, and is similar to the COP420, except that the read-only-memory (ROM) has been removed. Pins have been added to output the ROM address and to input ROM data.

Both microcontrollers have 64 x 4 bits of on-board random access memory (RAM), and are capable of addressing up to 1k x 8 bits of external data memory. They are designed to operate with up to 1k x 8 bits of external program memory, either ROM or programmable ROM (PROM), for storage of instructions, program data or ROM addressing data.



The COP402/402M devices are aimed at such applications as clocks, timers, lab instruments, radio controllers, appliance controllers, programmable sequencers, scales, cash registers, calculators, microcontroller computational elements, toys, games, and automotive computers.

AND MORE . . .

National Semiconductor Corp has developed the industry's first family of truly microprocessor compatible analog-todigital converters.

The 20-pin dual-in-line ADC0801, ADC0802, ADC0803 and ADC0804 are CMOS, eight-bit, successive approximation converters which use a modified potentiometric ladder similar to the standard 256R approach, and require no external interface logic to operate them with microprocessors.

For total microprocessor compatibility, the ADC0801 family is configured to allow operation with the standard control bus of the 8080 uP derivatives. TRISTATE output latches directly drive the data bus. These A/Ds appear like memory locations or I/O ports to the microprocessor and no interfacing logic is needed.

Microcomputer News & Products

Single-chip Micro has Tiny-Basic

Santa Clara, CA – A revolutionary new 8-bit single-chip microcomputer that speaks in a high-level Basic-like language rather than machine language has been developed by National Semiconductor Corporation.

Designated the INS8073, the microcomputer is the newest member of National's Series 70 of bus-oriented single-chip 8-bit devices and executes a high-level language called NSC Tiny Basic directly on-chip.

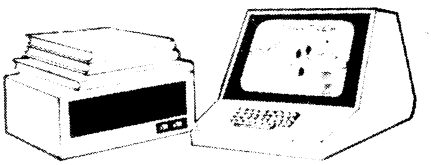
The 40-pin INS8073 incorporates both on-chip RAM (64 bytes of scratchpad memory) and on-chip ROM (2.5k bytes on which the NSC Tiny Basic interpreter is stored). In addition the device contains an 8-bit arithmetic logic unit, an 8-bit accumulator, an 8-bit extension register, plus four internal 16-bit registers.

The INS8073 has 16 address lines and eight data lines, allowing easy system expansion using standard peripherals. Separate Read and Write strobe outputs from the INS8073 indicate when valid input/output data are present on the 8-bit data bus. The remaining I/O lines are dedicated to initialisation, bus management, interrupt request, I/O cycle extension, and software controlled I/O.

Although the execution time of the INS8073 using NSC Tiny Basic directly in the production system is slower than that obtained using optimised machine languages, the vast majority of applications of single-chip microcomputers is not very time critical. Some control oriented jobs such as instrumentation and process control can be performed at a 10th of the speed of most present generation single-chip microcomputers.

Enquiries to NS Electronics, PO Box 89, Bayswater, Vic 3153.

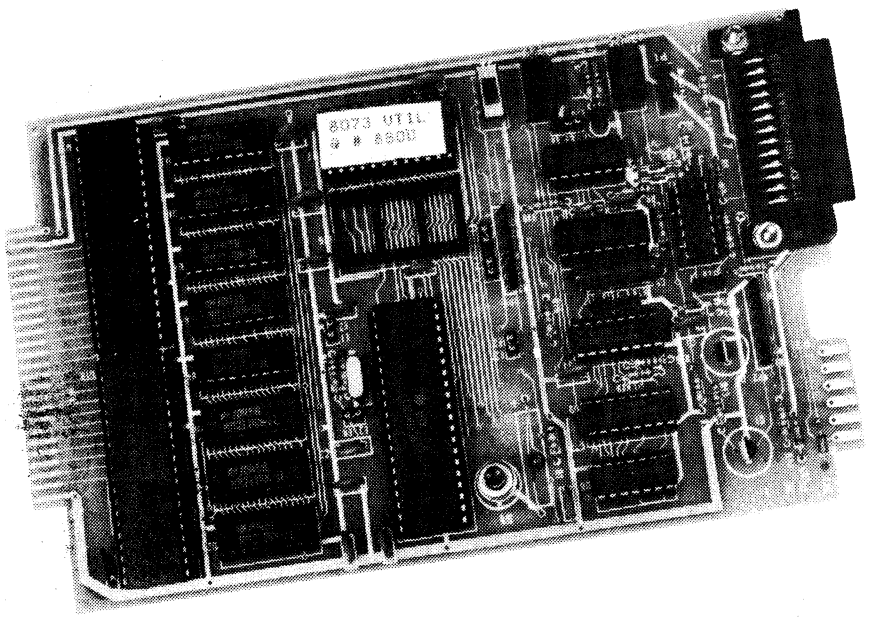
Microcomputer News & Products



Single-board computer with Tiny Basic

Radio Despatch Service now has available an INS-8073 based single-board computer from the Digi-Key Corporation. The 8073 is a National microcomputer chip which directly executes a version of Tiny Basic adapted for industrial control and program development. Digi-Key's 125mm × 175mm demonstrator board offers an unusually comprehensive set of features for these applications.

Because the INS-8073 is a complete microcomputer on a single chip, the minimum demonstrator system consists of only nine integrated circuits. Together they provide 1K of RAM in addition to the 64 bytes of memory on the computer chip itself, a programmer for 2716 EPROMs, a 20mA current loop Teletype interface, an RS232C interface, and complete decoding for a fully expanded system.



Space is provided on the board for additional RAM in the form of 2114 1K × 4 bit chips, for a total of 4K of programmable memory. Also on the board are sockets for two 2716 EPROMs for the user's own applications programs (4K total). Addition of an 8225 programmable peripheral interface and an 8154 RAM/IO chip provide a total of five 8-bit parallel ports which can be programmed for input, output or bi-directional communication. As a bonus, the 8154 device also provides 128 bytes of RAM for use by assembly language programs.

A fully operational system requires only the board itself, a source of power (+5V, −12V and +25V) and a serial video terminal or teletype. Once a program is developed it can be written into a 2716 EPROM using the on-board programmer and any specialised devices required by a particular application easily interfaced via the 40 parallel I/O lines.

Read Only Memory on the microcomputer chip itself contains the NSC Tiny Basic interpreter. Programs written in NSC Tiny Basic eliminate the need for an Editor, assembler and Monitor programs, all of which consume large amounts of memory.

Tiny Basic is a simplified version of Basic, but it provides all the functions required for industrial control uses and the development and testing of controller programs. Twenty-six variable names are supported each representing a 16-bit signed integer. There are no fractions or floating point operations. Numeric constants may be expressed in either decimal or hexadecimal, and the standard relational and arithmetic operators are provided. Also provided are logical operators (AND, OR and NOT) which perform the designated operation bit by bit on 16 bit arguments.

Input and output operations are well supported, as are the interrupt facilities provided by the system. Assembly language programs can be LINKed to Basic programs for use where speed of execution is critical. Programs are relocatable, and a number of programs may reside in memory at the same time, each allocated memory by the command NEW (address), where (address) is the location in memory where the first line of the new program will be stored.

The use of Tiny Basic rather than assembly language provides obvious advantages when it comes to writing and checking programs. The power and simplicity of the language combined with the built-in editing and debugging capabilities making it suitable for every stage of program development and use, and the single-board computer itself is designed so that it may be used alone to develop programs then incorporated into other equipment as a controller board.

The standard computer board costs $260 plus tax, with the operating manual a further $15. Sole importers are Semtech Pty Ltd, 1 Johnston Lane, Lane Cove, NSW, 2066. Radio Despatch Service is at 869 George St, Sydney, 2000.

A personal computer from IBM

IBM has made its long-awaited entry into the personal computer market. Announcing its first "personal" computer in New York in August, the company illustrated how far it has moved from its traditional market – the new machine is priced at around $1500 for a basic system.

So far, the small computer field has been dominated by companies such as Apple, Tandy and Commodore. Last year over 10 million personal computers were shipped in the United States alone, and the size of the market has tempted many large-scale computer manufacturers to consider entering the field.

IBM's personal computer marks a new level of performance with its use of a

Micronews Continued ►