AccessionIndex: TCD-SCSS-T.20251003.001
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Accession By: Dr.Brian Coghlan
Object name: Early calculator chips
Vintage: 1971
Synopsis: Integrated circuits for early desktop and hand-held calculators.

Description:
In January, 1971, Mostek's released the first "calculator-on-a-chip" product, the MK6010 [1][2][3], a nail-biting adventure for the then small company. From [4]:

The Chip

Mostek engineers had to make history. By 1970 the microcomputer circuit industry was involved in a heated race to develop smaller circuits and reduce the number of circuits contained in calculators. Those in the industry knew that one day a single-chip calculator would be invented. The only questions remaining were when and by whom?

The answer came in November, 1970 from a group of supercharged engineers who worked for a little-known custom circuit design company in Dallas-the Mostek Corporation. How could this industry infant (50 employees) come up with the design of the decade, set the electronic world on its ear and beat the giants of the industry in both the United States and Japan at their own game?

According to those who did it, the answer was simple. Mostek had to do it to stay alive as a company. *"Business had just absolutely cratered,"* said Dave Leonard who, as part of a four-man design team designed the first single-chip calculator. *"Our total billings in December, 1970, for example was $50,000. That was engineering fees for work done on a custom circuit."*

The future of the company was uncertain in May, 1970 when Berry Cash, vice-president for marketing, visited the Tokyo offices of the Nippon Calculating Machine Company. A month before, Canon, Inc. had introduced a *"pocket-sized"* calculator which used three circuits and weighed 1.8 pounds. Nippon wanted to introduce a model that was smaller, lighter and less expensive to produce. And, Nippon wanted Mostek to put the calculator's circuit on a single-chip. Nippon agreed to let Mostek work on the idea and signed a contract which called for Mostek to begin supplying the circuits by mid-November.

The Mostek design group set to work on the circuit and decided to do what no other company had done before-to design a calculator circuit which fit on a single-chip. According to Leonard, the group gained their motivation from the fact that Nippon had agreed to buy 60,000 copies of their circuit for $30 each. *"The company needed that money,"* said Leonard, *"and it needed that product. That fact had a very positive influence on our work."* Dietrich Erdmann, now vice-president of Mostek International, had done some initial work on the logic system with Japanese engineers earlier in the year. Gaynell Lockhart took over the logic design job from Erdmann. Both he and Leonard had experience in calculator circuits with another company. The race began!

The group had allocated six weeks to design the layout for the circuit. But the first circuit design failed preliminary testing and instead of six weeks, the effort took three months. By the time the second design passed the initial tests and was ready for production, October had arrived. Time was literally running out for Mostek and the design team was working almost around the clock to finalize the design for production. By the time the chip was ready for production, November had arrived and the design team decided to speed up the process by putting Richard Petty, the layout engineer, engineering ruby and other plans on a plane for California where he would hand carry the plans to a contractor for mask production. Petty would then fly to Mostek's production facility in Worcester, Mass. where the chip was to be made.

In mid-November it was time for Petty to come home with the final product. *"About 10 one evening, we set up for testing and waited for Petty to walk in the door,"* Leonard said. About 10 to 15 people had gathered, including Le Kepley, a young test engineer who had been asked to help with the test. Petty walked in with the finished product and the testers hooked the chip to a calculator. *"We punched the `Clear' button and it cleared,"* said Kepley. *"We added and it added; we subtracted and it subtracted; and then everyone started plugging numbers into it-adding, subtracting, multiplying and dividing. The whole thing was incredible,"* said Kepley. A cheer went up and then applause. For Mostek as a company, it was the Super Bowl World Series and Triple Crown rolled into one.

The MK6010 was followed by the MK5013P, MK5014P and MK5015 [5]. The latter were used, for example, in the 1972 Commodore CBM US-121P 12-digit desktop calculator that provided 5/4 rounding, a memory function and an electronic printer.

Many calculator chip cores were flexible enough to engender a multiplicity of derived calculator cores. Moreover, most calculator chip cores included a mask programmable ROM, so that one core could result in numerous chip types that were different only in the ROM contents, sometimes yielding surprisingly inventive products, see [6]. Furthermore, a few calculator cores were repurposed to create special device types. For example, the Texas Instruments TMS0117 [7] and National Semiconductor MM57109 [8] were decimal arithmetic units derived from calculator cores. Both were intended to act as coprocessors, and indeed were used by Brian Coghlan and his colleague Graeme Taylor to construct two really useful machines [9].

Many thanks to Brian Coghlan for donating these items.

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Some of the items below may be more properly part of other categories of this catalog,
but are listed here for convenience.

Accession Index	Object with Identification
TCD-SCSS-T.20251003.001	Early calculator chips. Integrated circuits for early desktop and hand-held calculators. 1971.
TCD-SCSS-T.20251003.001.01	Mostek MK5013P calculator-on-a-chip. 1971.
TCD-SCSS-T.20251003.001.02	Mostek MK5014P calculator-on-a-chip. 1971.
TCD-SCSS-T.20251003.001.03	Texas Instruments TMS0117 arithmetic processor. 1973.
TCD-SCSS-T.20251003.001.04	NatSemi MM57109FAN/N ‘number cruncher’. 1977.
TCD-SCSS-T.20251002.001	Fairchild resistor-transistor (RTL) chips. First digital logic family to be produced as monolithic integrated circuits.
TCD-SCSS-T.20250916.001	Intel 4004 microprocessor and associated chips. The first commercially successful microprocessor. 1971.
TCD-SCSS-T.20250918.001	Intel 8008 microprocessor and associated chips. Intel’s first and very early 8-bit microprocessor.
TCD-SCSS-T.20250918.003	Intel 8080 microprocessor and associated chips. Intel’s second and very successful early 8-bit microprocessor. 1972.
TCD-SCSS-T.20250918.004	Intel 8086 microprocessor and associated chips. Intel’s very successful early 16-bit microprocessor. 1978.
TCD-SCSS-T.20250918.005	Intel MCS-48 microcontrollers and associated chips. Intel’s 8048, 8035 and 8748 microcontroller series. 1976.
TCD-SCSS-T.20250918.006	Intel MCS-48 microcontrollers and associated chips. Intel’s 8051, 8052, 8751, 8752, 8031 and 8032 and 8044 microcontroller series. 1980.
TCD-SCSS-T.20250918.007	Zilog Z80 microprocessor and associated chips. Zilog’s Z80 superset of the Intel 8080 microprocessor. 1976.
TCD-SCSS-T.20250919.001	Motorola MC14500 microprocessor and associated chips. A very interesting 1-bit microprocessor designed for industrial control applications. 1977.
TCD-SCSS-T.20250919.003	MOS Technology 6500 microprocessor and associated chips. A highly successful early 8-bit microprocessor family. 1975.
TCD-SCSS-T.20250919.005	Motorola 6800 microprocessor and associated chips. An early big-endian 8-bit microprocessor. 1974.
TCD-SCSS-T.20250919.007	Motorola 68000 microprocessor and associated chips. A complex instruction set big-endian 32-bit microprocessor. 1979.
TCD-SCSS-T.20250921.001	Signetics 2650 microprocessor. An early 8-bit microprocessor designed by John Kessler modelled on the IBM 1130. 1975.
TCD-SCSS-T.20250921.003	Signetics 8X300. An early 8-bit microprocessor designed by SMS for signal processing. 1975.
TCD-SCSS-T.20250922.001	Intel C3000 bit-slice chipset. Intel’s bipolar microcoded bit-slice processor. 1973.
TCD-SCSS-T.20250922.002	AMD 2900 bit-slice chipset. AMD’s very successful bipolar microcoded bit-slice processor. 1975.
TCD-SCSS-T.20250922.003	Monolithic Memories 6700 bit-slice chipset. A bipolar

	microcoded bit-slice processor. 1974.
TCD-SCSS-T.20251001.001	InMOS Transputers and associated chips. Very interesting parallel processing chips comprising RISC-style stack-oriented CPU, memory, 20Mbps serial links and a realtime embedded kernel based on CSP process calculus. 1984.
TCD-SCSS-T.20251002.001	Fairchild resistor-transistor (RTL) chips. First digital logic family to be produced as monolithic integrated circuits.
TCD-SCSS-T.20251002.002	Motorola diode-transistor (DTL) chips. Second generation of monolithic digital logic integrated circuits. 1962.
TCD-SCSS-T.20251002.003	Texas Instruments 7400 series transistor-transistor (TTL) chips. Medium-scale-integration (MSI) logic. 1963.
TCD-SCSS-T.20251002.004	UV-erasable programmable read-only memory (EPROM) chips. Non-volatile memory for software and data storage. 1971.
TCD-SCSS-T.20251002.005	Static random-access memory (SRAM) chips. Memory that does not require regular refresh.
TCD-SCSS-T.20251002.006	Dynamic random-access memory (DRAM) chips. Memory that requires regular refresh. 1970.
TCD-SCSS-T.20251002.007	Miscellaneous digital computer and logic chips. Sundry monolithic digital integrated circuits that are not members of the other chip families in this catalog. 197x.
TCD-SCSS-T.20251002.008	Miscellaneous analog chips. Sundry monolithic and hybrid analog integrated circuits. 197x.
TCD-SCSS-T.20251002.009	Programmable logic chips. PAL, GAL, etc, integrated circuits that provide programmable logic. 1978.
TCD-SCSS-T.20251005.001	Fairchild PPS25 microprocessor and associated chips. Fairchild’s first and very early 4-bit microprocessor. 1971.
TCD-SCSS-T.20251005.002	Fairchild F8 microprocessor and associated chips. Fairchild’s earliest 8-bit microprocessor. 1975.
TCD-SCSS-T.20251006.001	National Semiconductor’s COP microprocessors and associated chips. NatSemi’s earliest microprocessors. 197x.
TCD-SCSS-T.20251006.002	National Semiconductor’s SC/MP microprocessors and associated chips. NatSemi’s earliest 8-bit microprocessors. 1976.
TCD-SCSS-T.20251006.003	National Semiconductor’s 32000 series microprocessors and associated chips. NatSemi’s 32-bit microprocessors, the first with virtual memory. 1981.

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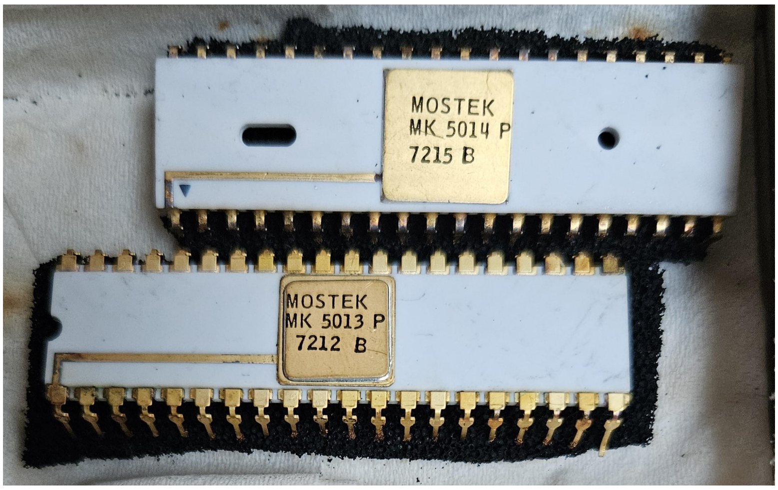

Figure 1: Mostek MK5013 and MK5014 front view

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Figure 2: Texas Instrument TMS0117 front view.

Figure 3: National Semiconductor MM57109 front view.