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31 January 1978

MEMORANDUM FOR: Mr. Charles C. Swanson
Director
Operations Division,
Office of Export Administration
Department of Commerce

SUBJECT : Soviet and East European Production
of Selected Integrated Circuits

1. Attached, per your request, is an assessment of the status of production of selected categories of integrated circuits in the USSR and Eastern Europe.

2. The attachment was prepared [

] If you have any further questions, he may be reached or []

Office of Economic Research

Attachment:
as stated

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ATTACHMENT

31 January 1978

Soviet and East European Production of
Selected Integrated Circuits

Question: What is Bloc position in CMOS, STTL, ECL, and MSI logic?

USSR

The USSR is the leading producer of logic integrated circuits (ICs) among the East European countries. Most of the Soviet output of these circuits continues to be made up of small-scale integration (SSI) devices of DTL and standard TTL types. However, since about 1975, output of more advanced logic circuits of ECL and CMOS types has been increasing, although their share in total output is still believed to be quite small. Schottky TTL (STTL) remains a negligible factor in the total Soviet IC product mix.

Some TTL, ECL, and CMOS logic devices which have been described in Soviet catalogs and technical journals have technical characteristics that would classify these devices as medium-scale integration (MSI). In addition, the intelligence community has acquired samples of Soviet devices for standard TTL (1973) and CMOS (1976), that we would classify as MSI density. Further, some PMOS and CMOS devices have been acquired since 1973, that we would classify as large-scale

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ER M 78-10070

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integration (LSI). The acquired LSI devices were used in electronic watches and calculators.

In every case, the Soviet MSI and LSI devices were inferior to their closest US counterparts. Specifically, Soviet samples were deficient in electrical performance, design, and in other technical aspects that reflect poor quality control in manufacturing. The highest quality LSI device (PMOS, metal gate) was contained in a scientific calculator manufactured in 1977 and was rated by US experts as comparable to US 1970 state-of-the-art. Indeed, the LSI circuit was identified as a copy of an early US device.

Our best judgement is that the USSR currently produces (in unknown quantities) TTL, CMOS, and ECL devices at MSI density levels. There is no evidence of Soviet production of Schottky TTL at the MSI level. In fact, the Soviets first mentioned Schottky devices in a catalog in 1977. And, the types mentioned are small-scale integration STTL types, not MSI: a dual 4-Input NAND Gate (type K531LB1) and a Quad 2-Input NAND Gate (type K531LB3).

The fact that the above Schottky devices are mentioned in a catalog does not permit us to conclude that they are in production. Since 1969, when they first became available, Soviet IC catalogs have proven to be a very uncertain indicator of production. We know that some ICs listed in earlier catalogs have never entered production, and that it is not uncommon for the USSR to list devices well

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(a year or more) before they are actually put into production. Also, it is known that the USSR produces ICs which have never appeared in catalogs -- including some that are used in commercial equipment.

Eastern Europe

In Eastern Europe, the leading producers of logic ICs are Czechoslovakia, East Germany, Poland and, most recently Hungary. All of these countries claim to be producing standard TTL in MSI density. Levels of production are not known. The claims of Poland and Hungary are believable since much of their current IC production technology has been acquired from the West.

Czechoslovakia is the only country to claim production of Schottky TTL. The Czechs announced that several STTL devices were to enter production in 1976. The Czech claims are the only information available.

There is no evidence that any of the East European countries are manufacturing ECL or CMOS logic devices of MSI or LSI complexity.

Question: What is the Bloc position in PMOS shift registers between the present (256 bits and 2MHz) and proposed cutoffs (1024 bits and 4MHz), and in NMOS registers below the proposed cutoffs?

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USSR

The USSR has not identified any of its shift registers as either PMOS or NMOS. The only MOS shift registers which the Soviets carry in current catalogs appear to be CMOS types. The highest bit count given is 90 bits. There are two such devices the K1IR442, a 90-bit dynamic shift register, and the K186IR5, a 90-bit quasi-static shift register. We have not been able to acquire any samples of Soviet shift registers, bipolar or MOS.

Eastern Europe

Czechoslovakia announced, in March 1976, that three MOS shift registers were under development:

MHB1032 - static shift register 1X32 bits

MHB4032 - static shift register 4X32 bits

MHB2100 - dynamic shift register 2X100 bits.

These devices were to be introduced into production during the 6th Five Year Plan (1976-1980). We cannot verify that they have gone into production.

No other East European country has claimed development or production of MOS shift registers equal to the Soviet and Czech devices. We have not been able to acquire any East European shift registers for technical evaluation.

Question: What is the Bloc position in 741 and 748 type operational amplifiers (Op Amp)?

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USSR

According to recent Soviet catalogs the Soviet Op Amp K140UD7 is equal to the MH741C. Also, the K1UT402, with a gain factor of 35,000 to 200,000, appears to be comparable to the 741. However, these are very recent listings (catalogs for 1976 and 1977 respectively), and their availability is unknown. Several samples of Soviet operational amplifiers have been evaluated to date; all were early to mid-1960s level of technology and quite backward by US standards. Finally, Soviet users of such amplifiers have been openly critical of the quality and low performance of Soviet-made devices.

Eastern Europe

Czechoslovakia claimed that native equivalents for the 741 and 748 would enter production in 1977. We have no information to verify that such production has begun. East Germany lists two operational amplifiers which may be in the range of the 748 and 741: the A109 with a minimum gain of 15,000, and the B109 with a minimum gain of 25,000. Recent catalogs on Polish, Hungarian, and Bulgarian amplifiers are not available. There is no hard evidence with which to judge the quality and performance of East European operational amplifiers.

Question: What is the Bloc position in custom ICs for television, with particular attention to synthesizers for television tuners.

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USSR

The USSR has added a number of ICs in recent catalogs which appear to be designed for television receivers. However, a number of these ICs are hybrid rather than monolithic. One monolithic type specifically designed for TV is the K174UR2, a IF picture amplifier, said to be comparable to the TDA440 produced by Telefunken. Bulgaria, Czechoslovakia, East Germany, and Poland include in their catalogs, a number of ICs which are specified for TV applications.

Despite catalog references, we doubt that ICs designed especially for radio/TV application are widely available. We note, for example, that many of the same types of devices listed in catalogs continue to be imported into Eastern Europe by countries that claim to be producing them. Also, the USSR, which has the widest listing, as recently as 1977 was seeking a turn-key plant to produce, among others, the same kind of ICs for radio/TV receivers that they claim to be producing. Moreover, one of the types to be produced by the sought-for plant was a type Czechoslovakia claims to be producing.

Question: What is the Bloc position in IC memories? Discuss in terms of MOS and bipolar (with specific mention of TTL and ECL), static and dynamic, RAM and ROM. For ROM, distinguish between mask-programmed (i.e., factory programmed) and field-programmed. For field-programmable, discuss electrically alterable, electrically programmable UV-erasable, and one-time electrically programmable.

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USSR

The USSR currently lists several MOS RAMs and ROMs, and Bipolar RAMs in their current IC catalogs. The various types are given below.

<u>DEVICE</u>	<u>TYPE</u>	<u>TECHNOLOGY</u>
<u>RAMS</u>		
K176RM1	16 bit static	CMOS
K185RU1	16 bit	MOS 1/
K507RM1	256 bit	MOS 1/
K176RU1	256 bit static	CMOS
527RU1	256 bit static	CMOS
K505RU2	1K bit	MOS 1/
K507RU1	1K bit dynamic	MOS 1/
<u>ROMS</u>		
K519RE1	128 bit 2/	MOS 1/
K519RE2	156 bit 2/	MOS 1/
K5YAP011	2K 1/ 3/	MOS 1/

BIPOLAR

<u>RAMS</u>		
K500RU401	16 bit 1/	ECL
K500RU40	64 bit 1/	ECL
K155RU1	16 bit 1/	TTL
K155RU2	64 bit 1/	TTL

1/ Not further identified.

2/ Electrically reprogrammable and partial decoding.

3/ Probably factory programmed.

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Eastern Europe

Among the East European countries, East Germany, Bulgaria, and Czechoslovakia list a few memory ICs in their catalogs. These are shown in the tabulation below:

	<u>Device</u>	<u>BIPOLAR</u> <u>Type</u>	<u>Technology</u>	<u>Device</u>	<u>MOS</u> <u>Type</u>	<u>Technology</u>
<u>Bulgaria</u>				<u>RAM</u>		
				CM8001	256 bit dynamic	PMOS
				CM8002	256 bit static	PMOS
				<u>ROM</u>		
			CM7600	2K	PMOS	
<u>Czechoslovakia</u>	<u>RAM</u>					
	MH7489	64 bit	TTL			
	MH74S201	256 bit	STTL			
	<u>ROM</u>					
	MH74188	256 bit	TTL			
	MH74528D	1K	STTL			
<u>East Germany</u>	<u>RAM</u>			<u>RAM</u>		
	D181C	16 bit	TTL	U352D	64 bit dynamic	PMOS
				U253D	1K dynamic	PMOS
				<u>ROM</u>		
			U501D	2K static	PMOS (possibly mis-	

Of all the above types (USSR and Eastern Europe), we believe that only the Soviet K155RU2 (64 bit RAM, TTL) is currently in series production. Scale of production is not known. The Bulgarian and East German MOS devices listed above are said to be part of a microprocessor kit that is claimed to be available in Bulgarian and East German reports. We have been unable to purchase either or both of these microprocessors, or any of their component parts, despite repeated attempts. Moreover, we note that these types of Western devices remain high on the shopping lists of all of these countries -- especially the technology and equipment to manufacture them. Hence, we believe that few of the devices listed above are available in quantity throughout East Europe and the USSR.

In summary, our current assessment of Soviet production of the specific classes of devices specified is as follows:

CLASS OF DEVICE

LEVEL OF OUTPUT

Logic

TTL/MSI
ECL/MSI
STTL/MSI
CMOS/MSI

medium to high
low to medium
laboratory
small to medium

Shift Registers

PMOS/1024 bits at 4MHz
NMOS/1024 bits at 4MHz

laboratory
laboratory

Operational Amplifiers

741/gain 200,000
748/gain 150,000

laboratory
laboratory

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<u>CLASS OF DEVICE (continued)</u>	<u>LEVEL OF OUTPUT (continued)</u>
<u>* Custom TV ICs</u>	
All types (monolithic)	small to medium
<u>* Memory</u>	
MOS:	
4K dynamic RAMS	laboratory
8K ROMS	laboratory
Bipolar:	
1K RAMS	laboratory
1K field programmable ROMS	laboratory

Including Eastern European producers.