MOTOROLA Semiconductor Products Inc.

Schottky TTL

Selector Guide

A BROAD LINE SCHOTTKY FAMILY

- Over 180 LS Devices
- ALS
- FAST
- TTL Compatible Macrocell Arrays
- RAMs
- PROMs

TTL in Perspective

Since its introduction, TTL has become the most popular digital logic family. It has evolved from gold doped saturated logic, to Schottky clamped logic and finally to Advanced Schottky clamped logic. The popularity of TTL stems from its ease of use, low cost, medium-to-high speed operation, and good output drive capability.

Motorola offers three Schottky clamped TTL logic families — LS, ALS, and FAST™. All three families are pin and functionally compatible and can easily be combined in a system to achieve maximum performance at minimum cost.

LS, Low-Power Schottky, is currently the largest and most popular of the three. It is low-cost and provides moderate speed at low power.

ALS, Advanced Low-Power Schottky, offers an improved speed — power product compared to LS as a result of advanced MOSAIC (oxide isolated) processing. Other important features of ALS include improved noise margins, reduced input currents, and superior line driving characteristics.

FAST™, another advanced Schottky TTL line, offers a 20-to-30 percent improvement in speed over standard Schottky logic at about 20 percent of the power. As with ALS, FAST™ offers improved noise margins, reduced input currents and superior line driving characteristics. Additionally, FAST designs incorporate powerdown circuitry on three-state outputs, and buffered outputs on all storage devices. These design improvements provide the logic designer with additional flexibility and more reliable system operation.

TTL Family Comparisons

General Characteristics for Schottky TTL Logic

(ALL MAXIMUM RATINGS)		LS		ALS			FAST		
Characteristic	**Symbol**	**54LSxxx**	**74LSxxx**	**54ALSxxx**	**74ALSxxx**		**54Fxxx**	**74Fxxx**	**Units**
Operating Voltage Range	V_{CC}	5 ± 10%	5 ± 5%	5 ± 10%	5 ± 10%	5 ± 5%	5 ± 10%	5 ± 5%	Vdc
Operating Temperature Range	T_A	−55 to 125	0 to 70	−55 to 125	0 to 70	0 to 70	−55 to 125	0 to 70	°C
Input Current	I_{IN} I_{IH}	20	20	20	20	20	20	20	μA
	I_{IL}	−400	−400	−100	−100	−100	−600	−600	
Output Drive	I_{OH}	−0.4	−0.4	−0.4	−0.4	−0.4	−1.0	−1.0	mA
Standard Output	I_{OL}	4.0	8.0	4.0	8.0	8.0	20	20	mA
	I_{SC}	−20 to −100	−20 to −100	−25 to −150	−25 to −150	−25 to −150	−60 to −150	−60 to −150	mA
Buffer Output	I_{OH}	−12	−15	−12	−15	−15	−12	−15	mA
	I_{OL}	12	24	12	24	24	48	64	mA
	I_{SC}	−40 to −225	−40 to −225	−50 to −225	−50 to −225	−50 to −225	−100 to −225	−100 to −225	mA
Buffer Line Driving Capability: Minimum R_t into 2.5 V		178	84	178	84	84	43	32	Ω
Minimum R_t into 5.0 V		381	189	381	189	189	95	71	Ω

Speed/Power Characteristics for Schottky TTL Logic(1)

(ALL TYPICAL RATINGS)

Characteristic	Symbol	LS	ALS	FAST	Units
Quiescent Supply Current/Gate	I_G	0.4	0.2	1.1	mA
Power/Gate (Quiescent)	P_G	2.0	1.0	5.5	mW
Propagation Delay	t_p	9.0	5.0	3.7	ns
Speed Power Product	—	18	5.0	19.2	pJ
Clock Frequency (D-F/F)	f_{max}	33	35	125	MHz
Clock Frequency (Counter)	f_{max}	40	45	125	MHz

NOTES: 1. Specifications are shown for the following conditions:
a) V_{CC} = 5.0 Vdc (AC);
b) T_A = 25°C
c) C_L = 50 pF for ALS, FAST; 15 pF for LS

FAST is a trademark of Fairchild Camera and Instrument Corporation.
MOSAIC I is a trademark of Motorola Inc.

High Performance ALS-TTL-Compatible Macrocell Arrays

MCA500ALS MCA1300ALS MCA2800ALS

In addition to standard logic lines, Motorola also offers a variety of TTL-compatible Macrocell Arrays. These products provide a means for developing economical custom LSI/VLSI logic circuits. Performance is achieved by the combination of an advanced MOSAIC I (Motorola Oxide-Isolated Self-Aligned Implanted Circuit) oxide isolated bipolar integrated circuit process and a series gated emitter-coupled logic (ECL) macrocell circuit technology. Input and output circuits provide level translation to and from the internal array logic for standard TTL/MOS interface.

Each cell within the arrays contains a number of unconnected transistors and resistors. Stored within a computer are the specifications to automatically interconnect these elements forming SSI/MSI logic cells (rather than simple gates) called macrocells. These macrocells take the form of standard logic blocks such as dual type D flip-flops, dual full adders, quad latches and many other pre-defined "library" functions. Presently, the macrocell library for the ALS-TTL arrays contains more than 80 logic functions.

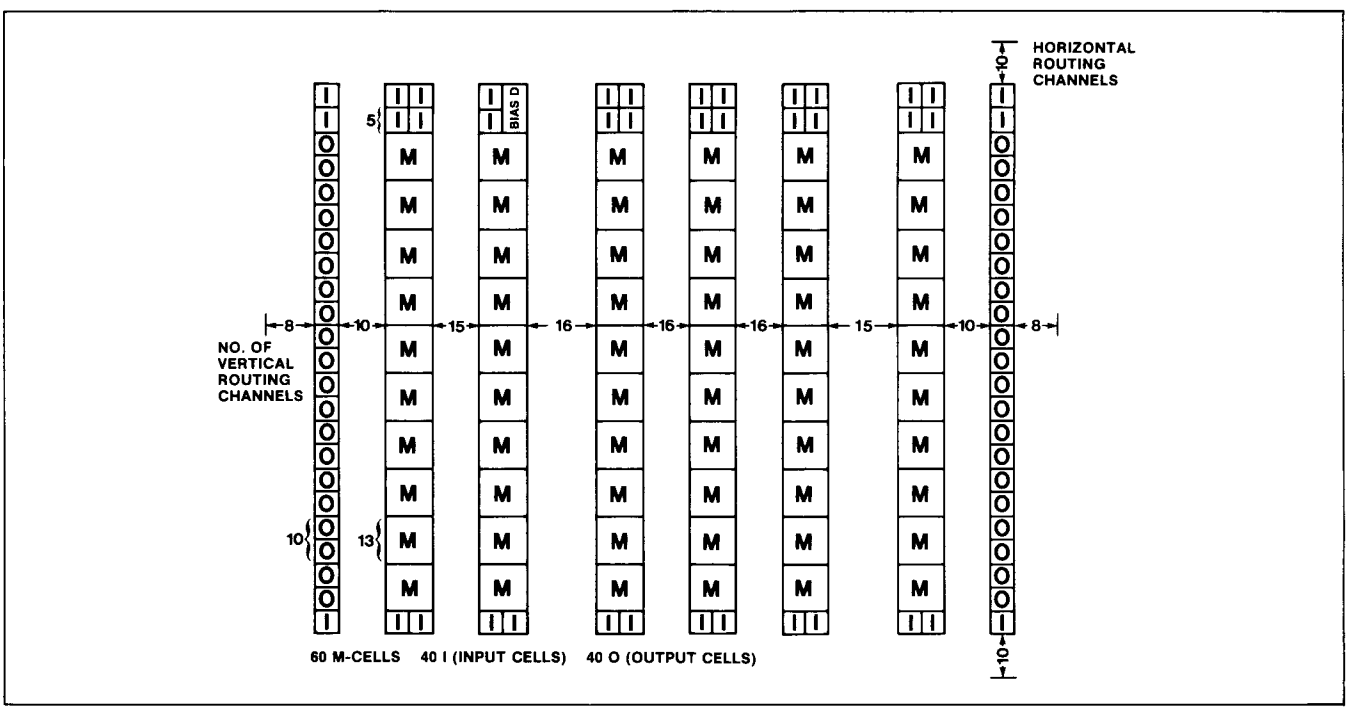
Generating an LSI/VLSI design is simply a matter of selecting the appropriate macrocells and describing the proper interconnection network to implement the design. Motorola's CAD (Computer-Aided-Design) interface provides automatic placement and routing of the cells (interconnection of the cell itself is automatically accomplished when placed), full logic and fault-testing capabilities, AC delay simulations, generation of test tapes and custom metallization to complete the IC processing sequence.

The ability to stockpile fully diffused wafers provides a very fast turnaround time (the time from customer notification of a completed design to delivery of finished parts) of currently nine weeks.

ALS-TTL MCA Selection Chart

	MCA 500ALS	MCA 1300ALS	MCA 2800ALS
Configuration			
Max Gate Equivalent	533	1280	2720
Major Macrocells	24	60	130
I/O Ports	57	76	120
Input/Interface Cells	26	40	
Output Macrocells	24	40	
Performance			
Max Gate Delay (M Cell)	4.0 ns	3.0 ns	1.1 ns
Max Toggle Frequency	80 MHz	80 MHz	125 MHz
Maximum Power Dissipation	1.0 W	1.4 W	2.5 W
Packages			
Dual-In-Line	28, 40, 48	40, 48	—
Chip Carrier	68	68, 84	149PG
Temperature Range	0–70°C	0–70°C	0–70°C
Supply Voltage	5.0 V ±5%	5.0 V ±5%	5.0 V ±5%
Availability	Now	Now	Now

Typical MCA Layout — 1300ALS



Numeric Listing

LS TTL

SN54LS00 Series (−55 to +125°C)
SN74LS00 Series (0 to +70°C)

Suffix: N . . . Plastic (only 74-series)
J . . . Ceramic (54/74 series)

Device	Function	Samples	Pins
LS00	Quad 2-Input NAND Gate	A	14
LS01	Quad 2-Input NAND Gate, Open-Collector	A	14
LS02	Quad 2-Input NOR Gate	A	14
LS03	Quad 2-Input NAND Gate, Open-Collector	A	14
LS04	Hex Inverter	A	14
LS05	Hex Inverter, Open-Collector	A	14
LS08	Quad 2-Input AND Gate	A	14
LS09	Quad 2-Input AND Gate, Open-Collector	A	14
LS10	Triple 3-Input NAND Gate	A	14
LS11	Triple 3-Input AND Gate	A	14
LS12	Triple 3-Input NAND Gate, Open-Collector	A	14
LS13	Dual 4-Input Schmitt Trigger	A	14
LS14	Hex Schmitt Trigger	A	14
LS15	Triple 3-Input AND Gate, Open-Collector	A	14
LS20	Dual 4-Input NAND Gate	A	14
LS21	Dual 4-Input AND Gate	A	14
LS22	Dual 4-Input NAND Gate, Open-Collector	A	14
LS26	Quad 2-Input NAND, High Voltage	A	14
LS27	Triple 3-Input NOR Gate	A	14
LS28	Quad 2-Input NOR Buffer	A	14
LS30	8-Input NAND Gate	A	14
LS32	Quad 2-Input OR Gate	A	14
LS33	Quad 2-Input NOR Buffer, Open-Collector	A	14
LS37	Quad 2-Input NAND Buffer	A	14
LS38	Quad 2-Input NAND Buffer, Open-Collector	A	14
LS40	Dual 4-Input NAND Buffer	A	14
LS42	1-of-10 Decoder	A	16
LS47	BCD to 7-Segment Decoder/Driver, Open-Collector	A	16
LS48	BCD to 7-Segment Decoder/Driver, with Pull-Ups	A	16
LS49	BCD to 7-Segment Decoder/Driver, Open-Collector	A	16
LS51	Dual AND-OR-INVERT Gate	A	14
LS54	3-2-2-3 Input AND-OR-INVERT Gate	A	14
LS55	2-Wide 4-Input AND-OR-INVERT Gate	A	14
LS73A	Dual JK Flip-Flop	A	14
LS74A	Dual D Flip-Flop	A	14
LS75	4-Bit Bi-Stable Latch with Q and $\overline{Q}$	A	16
LS76A	Dual JK Flip-Flop	A	16
LS77	4-Bit Bi-Stable Latch	A	14
LS78A	Dual JK Flip-Flop with Preset	A	14
LS83A	4-Bit Full Adder	A	16
LS85	4-Bit Magnitude Comparator	A	16
LS86	Quad Exclusive OR Gate	A	14

Device	Function	Samples	Pins
LS90	Decade Counter	A	14
LS91	8-Bit Shift Register Serial-In/Serial-Out	A	14
LS92	Divide-By-12 Counter	A	14
LS93	4-Bit Binary Counter	A	14
LS95B	4-Bit Shift Register	A	14
LS107A	Dual JK Flip-Flop with Clear	A	14
LS109A	Dual JK Flip-Flop with Preset	A	16
LS112A	Dual JK Edge-Triggered Flip-Flop	A	16
LS113A	Dual JK Edge-Triggered Flip-Flop	A	14
LS114A	Dual JK Edge-Triggered Flip-Flop	A	14
LS122	Retriggerable Monostable Multivibrator	A	14
LS123	Dual Retriggerable Monostable Multivibrator	A	16
LS125A	Quad Buffer, Low Enable, 3-State	A	14
LS126A	Quad Buffer, High Enable, 3-State	A	14
LS132	Quad 2-Input Schmitt Trigger	A	14
LS133	13-Input NAND Gate	A	16
LS136	Quad Exclusive OR Gate, Open-Collector	A	14
LS137	3-Line to 8-Line Decoder/Demultiplexer	A	16
LS138	1-of-8 Decoder/Demultiplexer	A	16
LS139	Dual 1-of-4 Decoder/Demultiplexer	A	16
LS145	1-of-10 Decoder/Driver, Open-Collector	A	16
LS147	10-Line Decimal to 4-Line Priority Encoder	A	16
LS148	8-Input to 3-Line Priority Encoder	A	16
LS151	8-Input Multiplexer	A	16
LS153	Dual 4-Input Multiplexer	A	16
LS155	Dual 1-of-4 Decoder	A	16
LS156	Dual 1-of-4 Decoder, Open-Collector	A	16
LS157	Quad 2-Input Multiplexer, Non-Inverting	A	16
LS158	Quad 2-Input Multiplexer, Inverting	A	16
LS160	BCD Decade Counter, Asynchronous Reset (9310 Type)	A	16
LS161A	4-Bit Binary Counter, Asynchronous Reset (9316 Type)	A	16
LS162A	BCD Decade Counter, Synchronous Reset	A	16
LS163A	4-Bit Binary Counter, Synchronous Reset	A	16
LS164	8-Bit Serial-In/Parallel-Out Shift Register	A	14
LS165	8-Bit Parallel-In/Serial-Out Shift Register	A	16
LS166	8-Bit Parallel-In/Serial-Out Shift Register	A	16
LS168	Up/Down Decade Counter	A	16
LS169	Up/Down Binary Counter	A	16
LS170	4 x 4 Register File, Open-Collector	A	16
LS173A	4-Bit D Register, 3-State	A	16
LS174	Hex D Flip-Flop with Clear	A	16
LS175	Quad D Flip-Flop with Clear	A	16
LS181	4-Bit ALU	A	24
LS182	Look Ahead Carry Generator	A	16
LS183	Dual Carry/Save Full Adder	A	14
LS190	Up/Down Decade Counter	A	16
LS191	Up/Down Binary Counter	A	16
LS192	Up/Down Decade Counter with Clear	A	16
LS193	Up/Down Binary Counter with Clear	A	16
LS194A	4-Bit Right/Left Shift Register	A	16
LS195A	4-Bit Shift Register (9300 Type)	A	16
LS196	Decade Counter, Asynchronously Presettable	A	14
LS197	4-Bit Binary Counter, Asynchronously Presettable	A	14

A = Announced

Device	Function	Samples	Pins
LS221	Dual One-Shot (Very Stable)	A	16
LS240	Octal Bus/Line Driver, Inverting 3-State	A	20
LS241	Octal Bus/Line Driver, 3-State	A	20
LS242	Quad Bus Transceiver, Inverting, 3-State	A	14
LS243	Quad Bus Transceiver, Non-Inverting, 3-State	A	14
LS244	Octal Driver, Non-Inverting, 3-State	A	20
LS245	Octal Bus Transceiver, Non-Inverting, 3-State	A	20
LS247	BCD to 7-Segment Decoder/Driver, Open-Collector	A	16
LS248	BCD to 7-Segment Decoder/Driver with Pull-Ups	A	16
LS249	BCD to 7-Segment Decoder/Driver, Open-Collector	A	16
LS251	8-Input Multiplexer, 3-State	A	16
LS253	Dual 4-Input Multiplexer, 3-State	A	16
LS256	Dual 4-Bit Addressable Latch	A	16
LS257A	Quad 2-Input Multiplexer, Non-Inverting, 3-State	A	16
LS258A	Quad 2-Input Multiplexer, Inverting 3-State	A	16
LS259	8-Bit Addressable Latch (9334)	A	16
LS260	Dual 5-Input NOR Gate	A	14
LS266	Quad Exclusive NOR Gate, Open-Collector	A	14
LS273	Octal D Flip-Flop with Clear	A	20
LS279	Quad Set/Reset Latch	A	16
LS280	8-Bit Odd/Even Parity Generator/Checker	A	14
LS283	4-Bit Full Adder (Rotated LS83A)	A	16
LS290	Decade Counter (Divide By 2 and 5)	A	14
LS293	4-Bit Binary Counter	A	16
LS295A	4-Bit Shift Register, 3-State	A	14
LS298	Quad 2-Multiplexer, with Output Register	A	16
LS299	8-Bit Shift/Storage Register, 3-State	A	20
LS322A	8-Bit Shift Register with Sign Extend, 3-State	A	20
LS323	8-Bit Shift/Storage Register, 3-State	A	20
LS348	8-Input to 3-Line Priority Encoder, 3-State	A	16
LS352	Dual 4-Multiplexer (Inverting LS153)	A	16
LS353	Dual 4-Multiplexer (3-State LS352)	A	16
LS365A	Hex Buffer, Common Enable, 3-State	A	16
LS366A	Hex Inverter, Common Enable, 3-State	A	16
LS367A	Hex Buffer, 4-Bit and 2-Bit, 3-State	A	16
LS368A	Hex Inverter, 4-Bit and 2-Bit, 3-State	A	16
LS373	Octal Transparent Latch, 3-State	A	20
LS374	Octal D Flip-Flop, 3-State	A	20
LS375	Quad Latch	A	16
LS377	Octal D Flip-Flop with Enable	A	20
LS378	Hex D Flip-Flop with Enable	A	16
LS379	4-Bit D Flip-Flop with Enable	A	16
LS385	Quad 4-Bit Adder/Subtractor	A	20
LS386	2-Input Quad/Exclusive OR Gate	A	14
LS390	Dual Decade Counter	A	16
LS393	Dual 4-Bit Binary Counter	A	14
LS395	4-Bit Shift Register, 3-State	A	16
LS398	Quad 2-Input Multiplexer with Output Register	A	20
LS399	Quad 2-Input Multiplexer with Output Register	A	16

Device	Function	Samples	Pins
LS490	Dual Decade Counter	A	16
LS540	Octal Buffer/Line Driver, 3-State	A	20
LS541	Octal Buffer/Line Driver, 3-State	A	20
LS568	Decade Up/Down Counter, 3-State	A	20
LS569	Binary Up/Down Counter, 3-State	A	20
LS604	16-to-8 Multiplexer, 3-State	A	28
LS605	16-to-8 Multiplexer, Open-Collector	A	28
LS606	16-to-8 Multiplexer, 3-State	A	28
LS607	16-to-8 Multiplexer, Open-Collector	A	28
LS620	Octal Transceiver with Storage, 3-State	A	20
LS621	Octal Transceiver with Storage, Open-Collector	A	20
LS622	Octal Transceiver with Storage, Open-Collector	A	20
LS623	Octal Transceiver with Storage, 3-State	A	20
LS640	Octal Bus Transceiver, Inverting, 3-State	A	20
LS641	Octal Bus Transceiver, Non-Inverting, Open-Collector	A	20
LS642	Octal Bus Transceiver, Inverting, Open-Collector	A	20
LS643	Octal Bus Transceiver, True, Inverting, 3-State	A	20
LS644	Octal Bus Transceiver, True, Inverting, Open-Collector	A	20
LS645	Octal Bus Transceiver, Non-Inverting, 3-State	A	20
LS668	Synchronous 4-Bit Up/Down Decade Counter	A	16
LS669	Synchronous 4-Bit Up/Down Binary Counter	A	16
LS670	4 x 4 Register File, 3-State	A	16
LS673	16-Bit Serial-In/Serial-Out Shift Register, 3-State	A	24
LS674	16-Bit Parallel-In/Serial-Out Shift Register, 3-State	A	24
LS682	8-Bit Magnitude Comparator	A	20
LS683	8-Bit Magnitude Comparator, Open-Collector	A	20
LS684	8-Bit Magnitude Comparator	A	20
LS685	8-Bit Magnitude Comparator, Open-Collector	A	20
LS686	8-Bit Magnitude Comparator with Enable	A	24
LS687	8-Bit Magnitude Comparator with Enable	A	24
LS688	8-Bit Magnitude Comparator	A	20
LS689	8-Bit Magnitude Comparator, Open-Collector	A	20
LS716	Programmable Decade Counter (MC4016)	A	16
LS718	Programmable Binary Counter (MC4018)	A	16
LS724*	Voltage Controlled Multivibrator	A	8
LS748	8-Input to 3-Line Priority Encoder	A	16
LS783*	Synchronous Address Multiplexer (MC6883)	A	40
LS795	Octal Buffer (81LS95), 3-State	A	20
LS796	Octal Buffer (81LS96), 3-State	A	20
LS797	Octal Buffer (81LS97), 3-State	A	20
LS798	Octal Buffer (81LS98), 3-State	A	20
LS848	8-Input to 3-Line Priority Encoder, 3-State	A	16

*74LS only.

FAST TTL

MC54F00 Series (−55 to +125°C)
MC74F00 Series (0 to +70°C)

Suffix: N . . . Plastic (only 74-series)
J . . . Ceramic (54/74 series)

Device	Function	Samples	Pins
F00	Quad 2-Input NAND Gate	A	14
F02	Quad 2-Input NOR Gate	A	14
F04	Hex Inverter	A	14
F08	Quad 2-Input AND Gate	A	14
F10	Triple 3-Input NAND Gate	A	14
F11	Triple 3-Input AND Gate	A	14
F20	Dual 4-Input NAND Gate	A	14
F32	Quad 2-Input OR Gate	A	14
F64	4-2-2-3 Input AND-OR-INVERT Gate	A	14
F74	Dual D Flip-Flop	A	14
F86	Quad Ex/OR Gate	A	14
F109	Dual J-K Flip-Flop w/Preset	A	16
F112	Dual J-K Flip-Flop	2Q84	16
F113	Dual J-K Flip-Flop	2Q84	14
F114	Dual J-K Flip-Flop	2Q84	14
F138	1-of-8 Decoder/Demultiplexer	A	16
F139	Dual 1-of-4 Decoder/Demultiplexer	A	16
F151	8-Input Multiplexer	A	16
F153	Dual 4-Input Multiplexer	A	16
F157	Quad 2-Input Multiplexer	1Q84	16
F158	Quad 2-Input Multiplexer	1Q84	16
F160	BCD Decade Counter, Asynchronous Reset	2Q84	16
F161	4-Bit Binary Counter, Asynchronous Reset	2Q84	16
F162	BCD Decade Counter, Synchronous Reset	2Q84	16
F163	4-Bit Binary Counter, Synchronous Reset	2Q84	16
F168	Up/Down Decade Counter	P	16
F169	Up/Down Binary Counter	P	16
F174	Hex D Flip-Flop	A	16
F175	Quad D Flip-Flop	1Q84	16
F181	4-Bit ALU	P	24
F182	Look Ahead Carry Generator	P	16
F189	64-Bit RAM/3-State	P	16
F190	Up/Down Decade Counter	2Q84	16
F191	Up/Down Binary Counter	2Q84	16
F192	Up/Down Decade Counter with Clear	2Q84	16
F193	Up/Down Binary Counter with Clear	2Q84	16
F194	Universal Shift Register	2Q84	16
F195	4-Bit Shift Register	2Q84	16
F240	Octal Bus/Line Driver/Inverting/3-State	A	20
F241	Octal Bus/Line Driver/3-State	A	20
F242	Quad Bus Transceiver/Inverting/3-State	A	14
F243	Quad Bus Transceiver/Non-Inverting/3-State	A	14
F244	Octal Bus Driver/Non-Inverting/3-State	A	20
F245	Octal Bus Transceiver	A	20
F251	8-Input Multiplexer/3-State	A	16
F253	Dual 4-Input Multiplexer/3-State	A	16
F257	Quad 2-Input Multiplexer/3-State	1Q84	16
F258	Quad 2-Input Multiplexer, Inverting/3-State	1Q84	16
F280	9-Bit Odd/Even Parity Gen/Checker	P	14
F283	4-Bit Full Adder	P	16
F289	64-Bit RAM, Open-Collector	P	16
F299	8-Bit Shift/Store Register	2Q84	20
F323	8-Bit Universal Shift/Storage Register	2Q84	20
F350	4-Bit Shifter/3-State	P	16
F352	Dual 4-Input Multiplexer	A	16
F353	Dual 4-Input Multiplexer/3-State	A	16
F373	Octal Transparent Latch/3-State	A	20
F374	Octal D Flip-Flop/3-State	A	20
F378	Hex Parallel D Register w/Enable	1Q84	16
F379	Quad Parallel Register w/Enable	1Q84	16
F381	4-Bit ALU	P	20
F382	4-Bit ALU	P	20
F521	Octal Comparitor	1Q84	20
F533	Octal Transparent Latch/3-State	A	20
F534	Octal D Flip-Flop/3-State	A	20
F537	1-of-10 Decoder/3-State	P	20
F538	1-of-8 Decoder/3-State	P	20
F539	1-of-4 Decoder/3-State	P	20
F620	Octal Bus Transceiver/Inverting/3-State	P	20
F623	Octal Bus Transceiver/3-State	P	20
F640	Octal Bus Transceiver/Inverting/3-State	P	20
F643	Octal Bus Transceiver/Inverting/True/3-State	P	20
F2960	Error Detection and Correction Unit (EDAC)	1Q84	48
F2961	EDAC Bus Buffer, Inverting	2Q84	24
F2962	EDAC Bus Buffer, Non-Inverting	2Q84	24
F2968	Dynamic Memory Controller	3Q84	48
F2969	Memory Timing Controller w/EDAC	3Q84	48
F2970	Memory Timing Controller w/o EDAC	3Q84	24

A = Announced
P = Planned

ALS TTL

SN54ALS00 Series (−55 to +125°C)
SN74ALS00 Series (0 to +70°C)

Suffix: N . . . Plastic (only 74-series)
J . . . Ceramic (54/74 series)

Device	Function	Samples	Pins
ALS00	Quad 2-Input NAND Gate	A	14
ALS01	Quad 2-Input NAND Gate, Open-Collector	A	14
ALS02	Quad 2-Input NOR Gate	A	14
ALS03	Quad 2-Input NAND Gate, Open-Collector	A	14
ALS04	Hex Inverter	A	14
ALS05	Hex Inverter, Open-Collector	A	14
ALS08	Quad 2-Input AND Gate	A	14
ALS09	Quad 2-Input AND Gate, Open-Collector	A	14
ALS10	Triple 3-Input NAND Gate	A	14
ALS11	Triple 3-Input AND Gate	A	14
ALS12	Triple 3-Input NAND Gate, Open-Collector	A	14
ALS13	Dual 4-Input Schmitt Trigger	P	14
ALS14	Hex Schmitt Trigger	P	14
ALS15	Triple 3-Input NAND Gate, Open-Collector	A	14
ALS20	Dual 4-Input NAND Gate	A	14
ALS21	Dual 4-Input AND Gate	A	14
ALS22	Dual 4-Input NAND Gate, Open-Collector	A	14
ALS27	Triple 3-Input NOR Gate	A	14
ALS28	Quad 2-Input NOR Buffer	A	14
ALS32	Quad 2-Input OR Gate	A	14
ALS33	Quad 2-Input NOR Buffer, Open-Collector	A	14

NUMERIC LISTING (continued)

Device	Function	Samples	Pins
ALS37	Quad 2-Input NAND Buffer	A	14
ALS38	Quad 2-Input NAND Buffer, Open-Collector	A	14
ALS40	Dual 4-Input NAND Buffer	P	14
ALS51	Dual 2-Wide, 2-3-Input AND-OR-INVERT Gate	A	14
ALS55	2-Wide, 4-Input AND-OR-INVERT Gate	A	14
ALS74	Dual D Flip-Flop	A	14
ALS91	8-Bit Serial-In/Serial-Out Shift Register	P	14
ALS109	Dual J-K Flip-Flop w/Preset	P	16
ALS132	Quad 2-Input Schmitt Trigger	P	14
ALS138	1-of-8 Decoder/Demultiplexer	A	16
ALS139	Dual 1-of-4 Decoder/Demultiplexer	A	16
ALS151	8-Input Multiplexer	A	16
ALS153	Dual 4-Input Multiplexer	P	16
ALS157	Quad 2-Input Multiplexer/Non-Inverting	A	16
ALS158	Quad 2-Input Multiplexer/Inverting	A	16
ALS160	BCD Decade Counter/Asynchronous Reset (9310 Type)	A	16
ALS161	4-Bit Binary Counter, Asynchronous Reset (9316 Type)	A	16
ALS162	BCD Decade Counter/Synchronous Reset	A	16
ALS163	4-Bit Binary Counter/Synchronous Reset	A	16
ALS164	8-Bit Serial-In/Parallel-Out Shift Register	P	14
ALS168	4-Bit Up/Down Decade Counter/ Synchronous Reset	P	16
ALS169	4-Bit Up/Down Binary Counter/ Synchronous Reset	P	16
ALS190	Up/Down Decade Counter	A	16
ALS191	Up/Down Binary Counter	A	16
ALS192	Up/Down Decade Counter w/Clear	A	16
ALS193	Up/Down Binary Counter w/Clear	A	16
ALS238	1-of-8 Decoder/Demultiplexer/(Active High)	A	16
ALS239	Dual 1-of-4 Decoder/Demultiplexer/ (Active High)	A	16
ALS240	Octal Bus/Line Driver/Inverting/3-State	A	20
ALS241	Octal Bus/Line Driver/3-State	A	20
ALS242	Quad Bus Transceiver/Inverting/3-State	A	14
ALS243	Quad Bus Transceiver/Non-Inverting/ 3-State	A	14
ALS244	Octal Driver/Non-Inverting/3-State	A	20
ALS245	Octal Bus Transceiver/Non-Inverting/ 3-State	A	20
ALS251	8-Input Multiplexer/3-State	A	16
ALS253	Dual 4-Input Multiplexer/3-State	P	16
ALS257	Quad 2-Input Multiplexer/Non-Inverting/ 3-State	P	16
ALS258	Quad 2-Input Multiplexer/Inverting/3-State	P	16
ALS273	Octal D Flip-Flop w/Clear	A	20
ALS352	Dual 4-Multiplexer/Inverting ALS153	P	16
ALS353	Dual 4-Multiplexer/3-State ALS352	P	16
ALS373	Octal Transparent Latch/3-State	1Q84	20
ALS374	Octal D Flip-Flop/3-State	1Q84	20
ALS377	Octal D Flip-Flop w/Enable	A	20
ALS533	Octal Transparent Latch/Inverting	P	20
ALS534	Octal D-Type Flip-Flop/Inverting	P	20
ALS537	1-of-10 Decoder/3-State	P	20
ALS538	1-of-8 Decoder/3-State	P	20
ALS539	Dual 1-of-4 Decoder/3-State	P	20
ALS540	Octal Buffer/3-State	P	20
ALS541	Octal Buffer/3-State	P	20
ALS560	4-Bit Decade Counter/3-State	A	20
ALS561	4-Bit Binary Counter/3-State	A	20
ALS563	8-Bit Latch/3-State	P	20
ALS564	Octal D Flip-Flop/3-State	P	20
ALS568	Decade Up/Down Counter/3-State	A	20
ALS569	Binary Up/Down Counter/3-State	A	20
ALS573	Octal Transparent Latch/3-State	3Q84	20
ALS574	Octal D Flip-Flop/3-State	3Q84	20

Device	Function	Samples	Pins
ALS575	Octal D Flip-Flop/Synchronous Clear/ 3-State	P	20
ALS576	Octal D Flip-Flop/Inverting/3-State	P	20
ALS577	Octal D Flip-Flop/Inverting/Synchronous Clear/3-State	P	20
ALS580	Octal Transparent Latch/Inverting/3-State	P	20
ALS620	Octal Transceiver w/Storage/3-State	A	20
ALS621	Octal Transceiver w/Storage/ Open-Collector	A	20
ALS622	Octal Transceiver w/ Storage/ Open-Collector	A	20
ALS623	Octal Transceiver w/Storage/3-State	A	20
ALS638	Octal Bus Transceiver/Inverting/3-State	A	20
ALS639	Octal Bus Transceiver/3-State	A	20
ALS640	Octal Bus Transceiver/Inverting/3-State	A	20
ALS641	Octal Bus Transceiver/Non-Inverting/ Open-Collector	A	20
ALS642	Octal Bus Transceiver/Inverting/ Open-Collector	A	20
ALS643	Octal Bus TransceiverTrue/Inverting/3-State	A	20
ALS644	Octal Bus Transceiver/True/Inverting/ Open-Collector	A	20
ALS646	Octal Transceiver/Latch/Multiplexer/ Non-Inverting/3-State	P	24
ALS647	Octal Transceiver/Latch/Multiplexer/ Non-Inverting/Open-Collector	P	24
ALS648	Octal Transceiver/Latch/Multiplexer/ Inverting/3-State	P	24
ALS649	Octal Transceiver/Latch/Multiplexer/ Inverting/Open-Collector	P	24
ALS651	Octal Bus Transceiver/Register/3-State	P	24
ALS652	Octal Bus Transceiver/Register/3-State	P	24
ALS653	Octal Bus Transceiver/Register	P	24
ALS654	Octal Bus Transceiver/Register	P	24
ALS671	Bidirectional Shift Register/Latch/ Multiplexer/3-State	A	20
ALS672	Bidirectional Shift Register/Latch/ Multiplexer/3-State	A	20
ALS690	Decade Counter/Latch/Multiplexer/ Asynchronous Reset/3-State	A	20
ALS691	Binary Counter/Latch/Multiplexer/ Asynchronous Reset/3-State	A	20
ALS692	Decade Counter/Latch/Multiplexer/ Synchronous Reset/3-State	A	20
ALS693	Binary Counter/Latch/Multiplexer/ Synchronous Reset/3-State	A	20
ALS694	Decade Counter/Latch/Multiplexer/ Synchronous/Asynchronous Reset/ 3-State	A	20
ALS695	Binary Counter/Latch/Multiplexer/ Synchronous/Asynchronous Reset/ 3-State	A	20
ALS696	Decade Counter/Register/Multiplexer/ 3-State	P	20
ALS697	Binary Counter/Register/Multiplexer/3-State	P	20
ALS698	Decade Counter/Register/Multiplexer/ 3-State	P	20
ALS699	Binary Counter/Register/Multiplexer/3-State	P	20
ALS790	Error Detection and Correction Circuit	see F2960	
ALS873	Octal Transparent Latch	P	24
ALS874	Octal D Flip-Flop	P	24
ALS876	Octal D Flip-Flop/Inverting	P	24
ALS878	Dual 4-Bit D Flip-Flop/Synchronous Clear/ 3-State	P	24
ALS879	Dual 4-Bit D Flip-Flop/Inverting/ Synchronous Clear/3-State	P	24
ALS880	Octal Transparent Latch/Inverting	P	24

Functional Selection
TTL Memories

MCM27SXX Series PROM
MCM76XXX Series PROM
MCM93XXX Series RAM

***Suffix: D . . . Ceramic DIP**
P . . . Plastic DIP
C . . . 0 to +75°C (Commercial)

***Example: MCM7621DC, MCM27S19APC, etc.**

Bipolar PROMS with 3-State Outputs

Organization	Device	Features	T_{AA} (ns)	Samples	Pins
32 x 8	MCM27S19A		25	1Q84	16
512 x 4	MCM7621		70	A	16
	MCM7621A		60	A	16
512 x 8	MCM7641		70	A	24
	MCM7641A		60	A	24
	MCM7649		60	A	20
	MCM7649A		45	A	20
	MCM27S29A		35	2H84	20
	MCM27S31A		35	2Q84	24
	MCM27S25A	Registered, Asynchronous initialize	30/15*	2Q84	24
	MCM27S27A	Registered, Synchronous initialize	35/20*	2H84	22
1024 x 4	MCM7643		70	A	18
	MCM7643A		50	A	18
1024 x 8	MCM7681		70	A	24
	MCM7681A		50	1Q84	24
	MCM27S181		35	3Q84	24
	MCM27S281	300 mil wide DIP	35	3Q84	24
	MCM27S35A	Registered, Asynchronous initialize	35/20*	2Q84	24
	MCM27S37A	Registered, Synchronous initialize	35/20*	2Q84	24
2048 x 4	MCM7685		70	A	18
	MCM7685A		55	A	18
2048 x 8	MCM76161		70	A	24
	MCM76161A		60	A	24
	MCM27S191		35	2Q84	24
	MCM27S291	300 mil wide DIP	35	1Q84	24
	MCM27S45A	Registered, Asynchronous initialize	35/20*	1Q84	24
	MCM27S47A	Registered, Synchronous initialize	35/20*	1Q84	24
4096 x 4	MCM76165		50	1Q84	20
	MCM76165A		35	1Q84	20

Bipolar RAMs

Organization	Device	Features	T_{AA} (ns)	Samples	Pins
256 x 4	MCM93422	3-State Outputs	45	A	22
	MCM93L422	3-State Outputs	60	A	22
1024 x 1	MCM93415	Open-Collector Outputs	45	A	18
	MCM93425	3-State Outputs	45	A	18

*For Registered PROMs, t_{SA}/t_{PHL} (Address setup time/propagation delay, clock to output)

Abbreviations

S = Synchronous
A = Asynchronous
B = Both Synchronous and Asynchronous

2S = 2-State Output
3S = 3-State Output
OC = Open-Collector Output

P = Planned (See Numeric List for latest availability status.)

Inverters

Description	Type of Output	No.	LS	ALS	FAST
Hex	2S	04	X	X	X
	OC	05	X	X	

AND Gates

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	2S	08	X	X	X
	OC	09	X	X	
Triple 3-Input	2S	11	X	X	X
	OC	15	X	X	
Dual 4-Input	2S	21	X	X	

NAND Gates

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	2S	00	X	X	X
	OC	01	X	X	
	OC	03	X	X	
Quad 2-Input, High Voltage	OC	26	X		
Triple 3-Input	2S	10	X	X	X
	OC	12	X	X	
Dual 4-Input	2S	20	X	X	X
	OC	22	X	X	
8-Input	2S	30	X		
13-Input	2S	133	X		

OR

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	2S	32	X	X	X

NOR

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	2S	2	X	X	X
Triple 3-Input	2S	27	X	X	
Dual 5-Input	2S	260	X		

Exclusive OR

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	2S	86	X		X
	OC	136	X		
	2S	386	X		

Exclusive NOR

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input	OC	266	X		

AND-OR-INVERT Gates

Description	Type of Output	No.	LS	ALS	FAST
Dual 2-Wide, 2-Input/3-Input	2S	51	X	X	
4-Wide, 2-3-2-3-Input	2S	54	X		
2-Wide, 4-Input	2S	55	X	X	
4-Wide, 4-2-2-3-Input	2S	64			X

Schmitt Triggers

Description	Type of Output	No.	LS	ALS	FAST
Dual 4-Input NAND Gate	2S	13	X	P	
Hex, Inverting	2S	14	X	P	
Quad 2-Input NAND Gate	2S	132	X	P	

SSI Flip-Flops

Description	Clock Edge	No.	LS	ALS	FAST
Dual D w/Set & Clear	Pos	74	X	X	X
Dual JK w/Set	Neg	113	X		P
Dual JK w/Clear	Neg	73	X		
	Neg	107	X		
Dual JK w/Set & Clear	Neg	76	X		
	Neg	78	X		
	Neg	112	X		P
	Neg	114	X		P
Dual $J\overline{K}$ w/Set & Clear	Pos	109	X	P	X

Multiplexers

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-to-1, Non-Inverting	2S	157	X	X	P
	3S	257	X	P	P
Quad 2-to-1, Inverting	2S	158	X	X	P
	3S	258	X	P	P
Dual 4-to-1, Non-Inverting	2S	153	X	P	X
	3S	253	X	P	X
Dual 4-to-1, Inverting	2S	352	X	P	X
	3S	353	X	P	X
8-to-1	2S	151	X	P	P
	3S	251	X	P	P
Quad 2-to-1 with Output Register	2S	298	X		
	2S	398	X		
	2S	399	X		

Encoders

Description	Type of Output	No.	LS	ALS	FAST
10- to 4-Line BCD	2S	147	X		
8- to 3-Line Priority Encoder	2S	148	X		
	3S	348	X		
	2S	748	X		
	3S	848	X		

Register Files

Description	Type of Output	No.	LS	ALS	FAST
4 x 4	OC	170	X		
	3S	670	X		

Decoders/Demultiplexers

Description	Output Active	Type of Output	No.	LS	ALS	FAST
Dual 1-of-4	Low	2S	139	X	P	P
	Low	2S	155	X		
	Low	OC	156	X		
	High	2S	239		P	
	Hi/Lo	3S	539		P	P
1-of-8	Low	2S	138	X	P	P
	High	2S	238		P	
	Hi/Lo	3S	538		P	P
1-of-8 with Latch	Low	2S	137	X		
1-of-10	Low	2S	42	X		
	High	3S	537		P	P

Latches

Description	No. of Bits	Type of Output	No.	LS	ALS	FAST
Transparent, Non-Inverting	4	2S	77	X		
	8	3S	373	X	P	P
	8	3S	573		P	
Transparent, Inverting	8	3S	533		P	X
	8	3S	563		P	
	8	3S	580		P	
Transparent, Q and $\overline{Q}$ Outputs	4	2S	75	X		
	4	2S	375	X		
Quad Set-Reset Latch	4	2S	279	X		
Addressable	8	2S	259	X		
Dual 4-Bit Addressable	4	2S	256	X		
Dual 4-Bit Transparent, Non-Inverting	8	3S	873		P	
Dual 4-Bit Transparent, Inverting	8	3S	880		P	

Shift Registers

Description	No. of Bits	Type of Output	Mode*					No.	LS	ALS	FAST
			SR	SL	Hold	Load	Reset				
Serial In-Serial Out	8	2S	X					91	X	P	
Serial In-Parallel Out	8	2S	X				A	164	X	P	
Parallel In-Serial Out	8	2S	X		X	A		165	X		
	8	2S	X		X	S	A	166	X		
	16	3S	X		X	S		674	X		
Parallel In-Parallel Out	4	2S	X			S		95	X		
	4	2S	X	X	X	S	A	194	X		P
	4	2S	X			S	A	195	X		P
	4	3S	X			S		295	X		
	4	3S	X			S	A	395	X		
Parallel In-Parallel Out, Bidirectional	8	3S	X	X	X	S	A	299	X		
	8	3S	X	X	X	S	S	323	X		P
Sign Extended Bidirectional	8	3S	X		X	S	A	322	X		
Serial In-Parallel Out with Storage Register	16	2S/3S	X		X	S	S	673	X		
Parallel In-Parallel Out with Storage Register/Mux	4	3S	X	X	X	S	A	671		X	
	4	3S	X	X	X	S	S	672		X	

* SR = Shift Right
SL = Shift Left

Asynchronous Counters — Negative Edge-Triggered*

Description	Load	Set	Reset	No.	LS	ALS	FAST
Decade (2/5)		X	X	90	X		
	X		X	196	X		
		X	X	290	X		
Dual Decade (2/5)			X	390	X		
Dual Decade		X	X	490	X		
Modulo 12 (2/6)			X	92	X		
4-Bit Binary (2/8)			X	93	X		
	X		X	197	X		
			X	293	X		
Dual 4-Bit Binary			X	393	X		
Divide-By-N (0–9)	X		X	716*	X		
Divide-By-N (0–15)	X		X	718*	X		

*The 716 and 718 are positive edge-triggered.

Display Decoders/Drivers with Open-Collector Outputs*

Description	No.	LS	ALS	FAST
1-of-10	145	X		
BCD-to-7 Segment	47	X		
	48*	X		
	49	X		
	247	X		
	248*	X		
	249	X		

*The 48 and 248 have internal pullup resistors to V_{CC} on their outputs.

Cascadable* Synchronous Counters — Positive Edge-Triggered

Description	Type of Output	Load	Reset	No.	LS	ALS	FAST
Decade	2S	S	A	160	X	X	P
	2S	S	S	162	X	X	P
	3S	B	B	560		X	
Decade,	2S	S		168	X	P	P
Up/Down	2S	A		190	X	X	P
	2S	A	A	192	X	X	P
	3S	S	B	568	X	X	
	2S	S		668	X		
4-Bit Binary	2S	S	A	161	X	X	P
	2S	S	S	163	X	X	P
	3S	B	B	561		X	
4-Bit Binary,	2S	S		169	X	P	P
Up/Down	2S	A		191	X	X	P
	2S	A	A	193	X	X	P
	3S	S	B	569	X	X	
	2S	S		669	X		
Decade with	3S	S	A	690		X	
Latch/Mux	3S	S	S	692		X	
	3S	S	S	694		X	
Decade with	3S	S	A	696		P	
Register/Mux	3S	S	S	698		P	
4-Bit Binary w/	3S	S	A	691		X	
Latch/Mux	3S	S	S	693		X	
	3S	S	S	695		X	
4-Bit Binary w/	3S	S	A	697		P	
Register/Mux	3S	S	S	699		P	

*The 192 and 193 do not provide a clock enable for synchronous cascading.

MSI Flip-Flops/Registers

Description	No. of Bits	Type of Output	Set or Reset	Clock Enable	No.	LS	ALS	FAST
D-Type, Non-Inverting	4	3S	A	X	173	X		
	4	2S		X	377	X	X	
	6	2S	A		174	X		X
	6	2S		X	378	X		P
	8	2S	A		273	X	X	
	8	3S			374	X	P	X
	8	3S			574		P	
	8	3S	S		575		P	
D-Type, Inverting	8	3S			534		P	X
	8	3S			564		P	
	8	3S			576		P	
	8	3S	S		577		P	
D-Type, Q and $\overline{Q}$ Outputs	4	2S	A		175	X		P
	4	2S		X	379	X		P
Dual 4-Bit, Non-Inverting	8	3S	A		874		P	
	8	3S	S		878		P	
Dual 4-Bit, Inverting	8	3S	A		876		P	
	8	3S	S		879		P	
Dual 8-Bit with Multiplexers	16	3S			604	X		
	16	OC			605	X		
	16	3S			606	X		
	16	OC			607	X		

Arithmetic Operators

Description	No.	LS	ALS	FAST
4-Bit Adder	83	X		
	283	X		P
4-Bit ALU	181	X		P
	381			P
	382			P
Look Ahead Carry Generator	182	X		P
Quad 4-Bit Adder/Subtracter	385	X		
Dual Carry/Save Full Adder	183	X		
4-Bit Barrel Shifter	350			P

Magnitude Comparitors

Description	Type of Output	P=Q	P>Q	P<Q	No.	LS	ALS	FAST
4-Bit	2S	X	X	X	85	X		
8-Bit	2S	X	X		682	X		
	OC	X	X		683	X		
	2S	X	X		684	X		
	OC	X	X		685	X		
	2S	X			521			P
8-Bit with	2S	X	X		686	X		
Output	OC	X	X		687	X		
Enable	2S	X			688	X		
	OC	X			689	X		

Parity Generators/Checkers

Description	No.	LS	ALS	FAST
9-Bit Odd/Even Parity Generator/ Checker	280	X		P

Dynamic Memory Support

Description	No.	LS	ALS	Fast
Synchronous Address Multiplexer (MC6883)	783	X		
Error Detection and Correction Circuit (EDAC)	2960			P
EDAC Bus Buffer	2961			P
	2962			P
Dynamic Memory Controller	2968			P
Dynamic Memory Timing Controller with EDAC	2969			P
Dynamic Memory Timing Controller without EDAC	2970			P

VCOs and Multivibrators

Description	No.	LS	ALS	FAST
Retriggerable Monostable Multivibrator	122	X		
Dual 122	123	X		
Precision Non-Retriggerable Monostable Multivibrator	221	X		
Voltage/Crystal Controlled Oscillator	724	X		

Buffers/Line Drivers

Description	Type of Output	No.	LS	ALS	FAST
Quad 2-Input NOR	2S	28	X	X	
	OC	33	X	X	
Quad 2-Input NAND	2S	37	X	X	
	OC	38	X	X	
Dual 4-Input NAND	2S	40	X	P	
Quad, Non-Inverting	3S	125	X		
	3S	126	X		
Hex, Non-Inverting	3S	365	X		
	3S	367	X		
Hex, Inverting	3S	366	X		
	3S	368	X		
Octal, Non-Inverting	3S	241	X	X	X
	3S	244	X	X	X
	3S	541	X	P	
	3S	795	X		
	3S	797	X		
Octal, Inverting	3S	240	X	X	X
	3S	540	X	P	
	3S	796	X		
	3S	798	X		

Transceivers

Description	Type of Output	No.	LS	ALS	FAST
Quad, Non-Inverting	3S	243	X	X	X
Quad, Inverting	3S	242	X	X	X
Octal, Non-Inverting	3S	245	X	X	X
	3S	645	X		
	OC	621	X	X	
	3S	623	X	X	X
	3S/OC	639		X	
	OC	641	X	X	
Octal, Inverting	3S	620	X	X	X
	OC	622	X	X	
	3S/OC	638		X	
	3S	640	X	X	X
	OC	642	X	X	
	3S	643	X	X	X
	OC	644	X	X	
Octal, Non-Inverting with Register/Mux	3S	646		P	
	OC	647		P	
	3S	652		P	
	OC/3S	654		P	
Octal, Inverting with Register/Mux	3S	648		P	
	OC	649		P	
	3S	651		P	
	OC/3S	653		P	

RAM

Description	Type of Output	No.	LS	ALS	FAST
16-by-4	3S	189			P
	OC	289			P

MOTOROLA *Semiconductor Products Inc.*

P.O. BOX 20912 • PHOENIX, ARIZONA 85036 • A SUBSIDIARY OF MOTOROLA INC.

14377-5 PRINTED IN USA 1-84 IMPERIAL LITHO C18890 15,000