HSP9520/HSP9521
ISP9520/ISP9521

March 1993

Multilevel Pipeline Register

Features

- Four 8-Bit Registers
- Hold, Transfer and Load Instructions
- Single 4-Stage or Dual-2 Stage Pipelining
- All Register Contents Available at Output
- Fully TTL Compatible
- Three-State Outputs
- High Speed, Low Power CMOS
- Available in 24 Pin Dual-In-Line and SOIC Packages

Applications

- Array Processor
- Digital Signal Processor
- A/D Buffer
- Telecommunication
- Byte Wide Shift Register
- Mainframe Computers

Description

These devices are multilevel pipeline registers implemented using a low power CMOS process. They are pin for pin compatible replacements for industry standard multilevel pipeline registers such as the L29C520 and L29C521. The HSP9520 and HSP5921 are direct replacements for the AM29520/21 and WS59520/21.

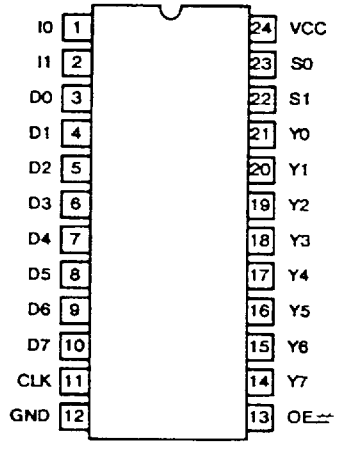
They consist of four 8-bit registers which are dual ported. They can be configured as a single four level pipeline or a dual two level pipeline. A single 8-bit input is provided, and the pipelining configuration is determined by the instruction code input to the I0 and I1 inputs (see instruction control).

The contents of any of the four registers is selectable at the multiplexed outputs through the use of the S0 and S1 multiplexer control inputs (see register select). The output is 8-bits wide and is three-stated through the use of the OE# input.

The '9520 and '9521 differ only in the way data is loaded into and between the registers in dual two-level operation. In the '9520, when data is loaded into the first level the existing data in the first level is moved to the second level. In the '9521, loading the first level simply causes the current data to be overwritten. Transfer of data to the second level is achieved using the single four level mode (I1, I0 = '0'). This instruction also causes the first level to be loaded. The HOLD instruction (I1, I0 = '1') provides a means of holding the countents of all registers.

Pinout

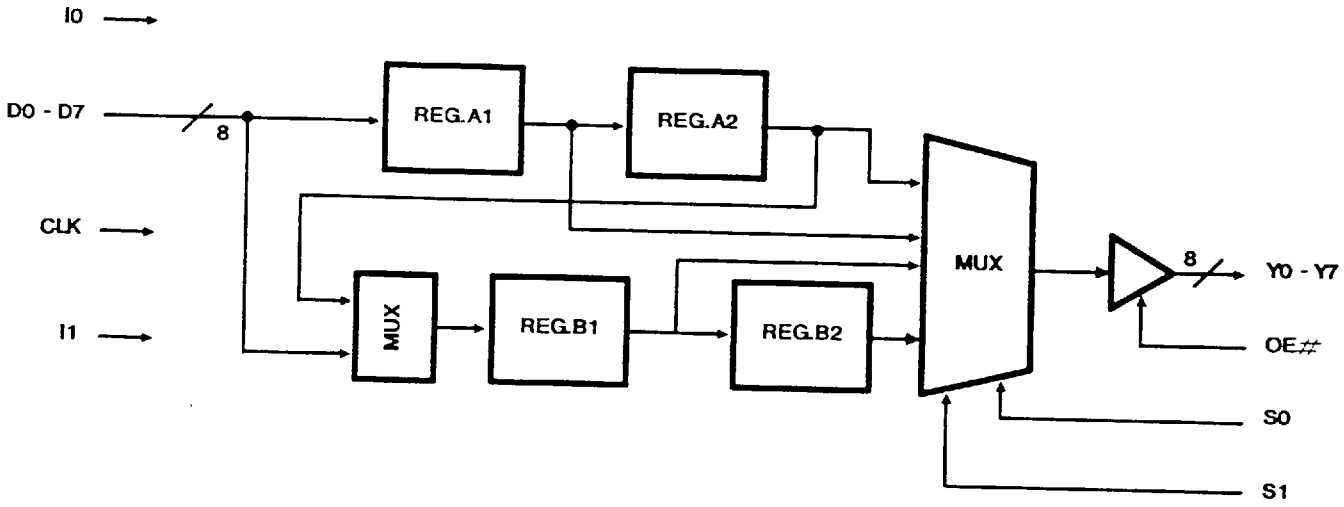
HSP9520/HSP9521 (24 PIN SOIC)
'9520/'9521 (24 PIN DIP)
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Proper I.C. handling procedures should be followed.

File Number 2811.3

Block Diagram



Pin Descriptions

NAME	DIP PIN	TYPE	DESCRIPTION
V_{CC}	24		The +5V power supply pin. A 0.1µF capacitor between the V_{CC} and GND pin is recommended.
GND	12		The device ground.
CLK	11	I	Input Clock. Data is latched on the low to high transition of this clock signal. Input setup and hold times with respect to the clock must be met for proper operation.
D0-7	3-10	I	Data Input Port. These inputs are used to supply the 8 bits of data which will be latched into the selected register on the next rising clock edge.
Y0-7	21-14	O	Data Output Port. This 8-bit port provides the output data from the four internal registers. They are provided in a multiplexed fashion, and are controlled via the multiplexer control inputs (S0 and S1).
I0, I1	1, 2	I	Instruction Control Inputs. These inputs are used to provide the instruction code which determines the internal register pipeline configuration. Refer to the Instruction Control Table for the specific codes and their associated configurations.
S0, S1	23, 22	I	Multiplexer Control Inputs. These inputs select which of the four internal registers' contents will be available at the output port. Refer to the Register Select Table for the codes to select each register.
OE#	13	I	Output Enable. This input controls the state of the output port (Y0-Y7). A LOW on this control line enables the port for ouput. When OE# is HIGH, the output drivers are in the high impedance state. Internal latching or transfer of data is not affected by this pin.

Specifications HSP9520/HSP9521

Absolute Maximum Ratings

Supply Voltage ..... +8.0V
Input or Output Voltage Applied ..... GND -0.5V to V_{CC} +0.5V
Storage Temperature Range ..... -65°C to +150°C
Junction Temperature ..... +150°C
Lead Temperature (Soldering, Ten Seconds) ..... +300°C

Operating Conditions

Operating Voltage Range ..... +4.75V to +5.25V
Operating Temperature Range ..... 0°C to +70°C
Reliability Information
θ_{ja} ..... 51.4°C/W (DIP), 77.0W/°C (SOIC)
θ_{jc} ..... 22.3°C/W (DIP), 23.2W/°C (SOIC)
Maximum Package Power Dissipation ..... 1.5W (DIP), 1.0W (SOIC)

D.C. Electrical Specifications (V_{CC} = 5.0V ± 5%, T_A = 0°C to +70°C)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS
Logical One Input Voltage	V_{IH}	2.0	-	V	V_{CC} = 5.25V
Logical Zero Input Voltage	V_{IL}	-	0.8	V	V_{CC} = 4.75V
Output HIGH Voltage	V_{OH}	2.4	-	V	I_{OH} = -6.5mA, V_{CC} = 4.75V
Output LOW Voltage	V_{OL}	-	0.5	V	I_{OL} = +20.0mA, V_{CC} = 4.75V
Input Leakage Current	I_I	-10	10	µA	V_{IN} = V_{CC} or GND, V_{CC} = 5.25V
Output Leakage Current	I_O	-10	10	µA	V_{OUT} = V_{CC} or GND V_{CC} = 5.25V
Standby Power Supply Current	I_{CCSB}	-	500	µA	V_{IN} = V_{CC} or GND V_{CC} = 5.25V Outputs Open
Operating Power Supply Current	I_{CCOP}	-	12	mA	f = 5.0MHz, V_{IN} = V_{CC} or GND V_{CC} = 5.25V, Ouputs Open, Note 1

Capacitance (T_A = +25°C, Note 3)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS
Input Capacitance	CIN	-	12	pF	FREQ = 1 MHz, V_{CC} = Open, all measurements are referenced to device ground.
Output Capacitance	CO	-	12	pF	

A.C. Electrical Specifications (V_{CC} = 5.0V ± 5%, T_A = 0°C to +70°C, Note 2)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS (Note 2)
Clock to Data Out	T_{PD}	-	21	ns	
Mux Select to Data Out	T_{SELD}	-	20	ns	
Input Setup Time (D0-7/I0-7)	T_S	10	-	ns	
Input Hold Time (D0-7/I0-7)	T_H	3	-	ns	
Output Enable Time	T_{ENA}	-	20	ns	
Output Disable Time	T_{DIS}	-	13	ns	Note 3
Clock Pulse Width	T_{PW}	10	-	ns	

NOTES:

1. Power supply current is proportional to frequency. Typical rating for I_{CCOP} is 2.4mA/MHz.
2. A.C. Testing is performed as follows: Input levels: 0V and 3.0V, Timing reference levels = 1.5V, Input rise and fall times driven at 1ns/V, Output load C_L = 40pF.
3. Controlled by design or process parameters and not directly tested. Characterized upon initial design and after major design and/or process changes.

Absolute Maximum Ratings

Supply Voltage ..... +8.0V
Input or Output Voltage Applied ..... GND -0.5V to V_{CC} +0.5V
Storage Temperature Range ..... -65°C to +150°C
Junction Temperature ..... +150°C
Lead Temperature (Soldering, Ten Seconds) ..... +300°C

Operating Conditions

Operating Voltage Range ..... +4.75V to +5.25V
Operating Temperature Range ..... 0°C to +70°C
Reliability Information
θ_{ja} ..... 51.4°C/W
θ_{jc} ..... 22.3°C/W
Maximum Package Power Dissipation 1.5W

D.C. Electrical Specifications (V_{CC} = 5.0V ± 5%, T_A = 0°C to +70°C)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS
Logical One Input Voltage	V_{IH}	2.0	-	V	V_{CC} = 5.25V
Logical Zero Input Voltage	V_{IL}	-	0.8	V	V_{CC} = 4.75V
Output HIGH Voltage	V_{OH}	2.4	-	V	I_{OH} = -2.0mA, V_{CC} = 4.75V
Output LOW Voltage	V_{OL}	-	0.5	V	I_{OL} = +12.0mA, V_{CC} = 4.75V
Input Leakage Current	I_I	-10	10	µA	V_{IN} = GND or V_{CC}, V_{CC} = 5.25V
Output Leakage Current	I_O	-10	10	µA	V_{OUT} = V_{CC} or GND V_{CC} = 5.25V
Standby Power Supply Current	I_{CCSB}	-	500	µA	V_{IN} = V_{CC} or GND V_{CC} = 5.25V Outputs Open
Operating Power Supply Current	I_{CCOP}	-	12	mA	f = 5.0MHz, V_{IN} = V_{CC} or GND V_{CC} = 5.25V, Ouputs Open, Note 1

Capacitance (T_A = +25°C, Note 3)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS
Input Capacitance	CIN	-	12	pF	FREQ = 1MHz, V_{CC} = Open, all measurements are referenced to device ground.
Output Capacitance	CO	-	12	pF	

A.C. Electrical Specifications (V_{CC} = 5.0V ± 5%, T_A = 0°C to +70°C Note 2)

PARAMETER	SYMBOL	MIN	MAX	UNITS	TEST CONDITIONS (Note 2)
Clock to Data Out	T_{PD}	-	25	ns	
Mux Select to Data Out	T_{SELD}	-	25	ns	
Input Setup Time (D0-7, I0-1)	T_S	15	-	ns	
Input Hold Time (D0-7, I0-1)	T_H	3	-	ns	
Output Enable Time	T_{ENA}	-	25	ns	
Output Disable Time	T_{DIS}	-	20	ns	Note 3
Clock Pulse Width	T_{PW}	13	-	ns	

NOTES:

1. Power supply current is proportional to frequency. Typical rating is 2.4mA/MHz.
2. A.C. Testing is performed as follows: Input levels: 0V and 3.0V, Timing reference levels = 1.5V, Input rise and fall times driven at 1ns/V, Output load C_L = 40pF.
3. Controlled by design or process parameters and not directly tested. Characterized upon initial design and after major design and/or process changes.

Timing Waveform

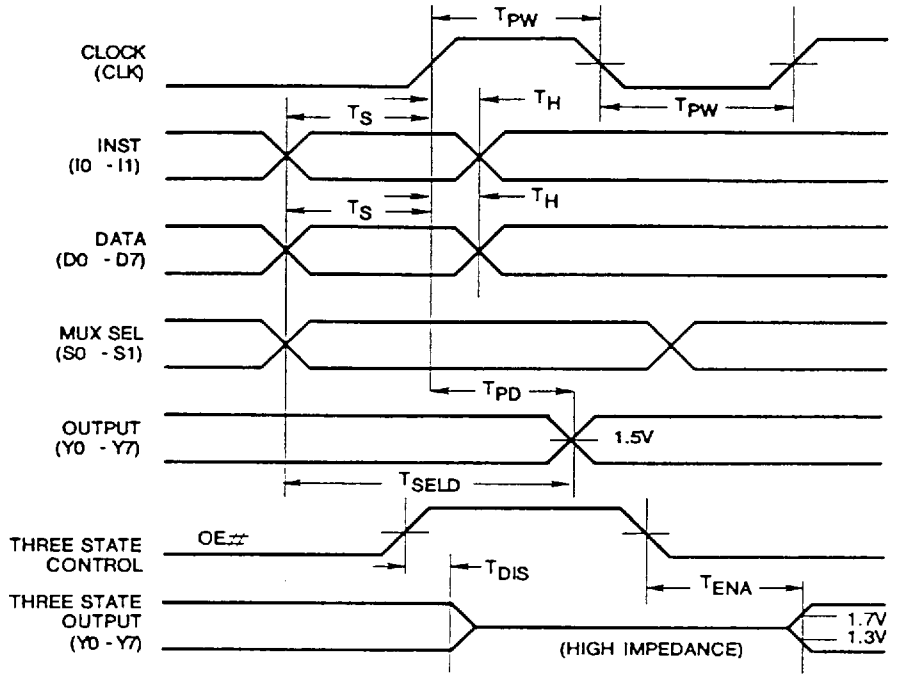


TABLE 1. INSTRUCTION CONTROL

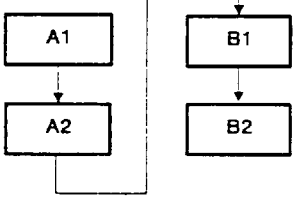
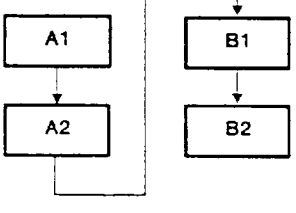
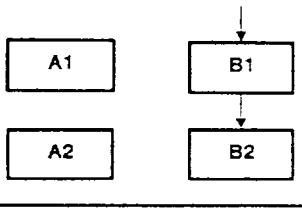
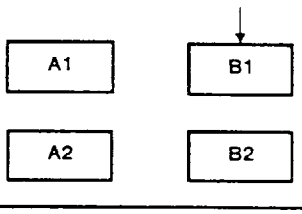
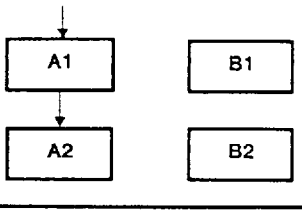
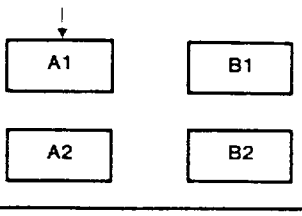
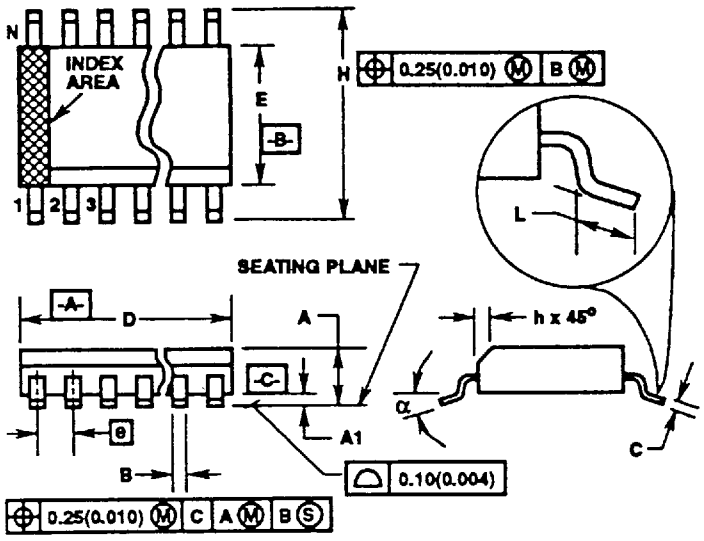
I1	I0	'9520	'9521
0	0		
0	1		
1	0		
1	1	ALL REGISTERS HOLD	ALL REGISTERS HOLD

TABLE 2. REGISTER SELECT

S1	S0	'9520 OR '9521
0	0	B2
0	1	B1
1	0	A2
1	1	A1

Packaging



M24.3 (JEDEC MS-013-AD)
24 LEAD WIDE BODY SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.0926	0.1043	2.35	2.65	-
A1	0.0040	0.0118	0.10	0.30	-
B	0.013	0.020	0.33	0.51	9
C	0.0091	0.0125	0.23	0.32	-
D	0.5985	0.6141	15.20	15.60	3
E	0.2914	0.2992	7.40	7.60	4
e	0.05 BSC		1.27 BSC		-
H	0.394	0.419	10.00	10.65	-
h	0.010	0.029	0.25	0.75	5
L	0.016	0.050	0.40	1.27	6
N	24		24		7
α	0°	8°	0°	8°	-

NOTES:

1. Refer to applicable symbol list.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
4. Dimension "E" does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.
5. The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
6. "L" is the length of terminal for soldering to a substrate.
7. "N" is the number of terminal positions.
8. Terminal numbers are shown for reference only.
9. The lead width "B", as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch)
10. Controlling dimension: Millimeter. Converted inch dimensions are not necessarily exact.

Packaging (Continued)

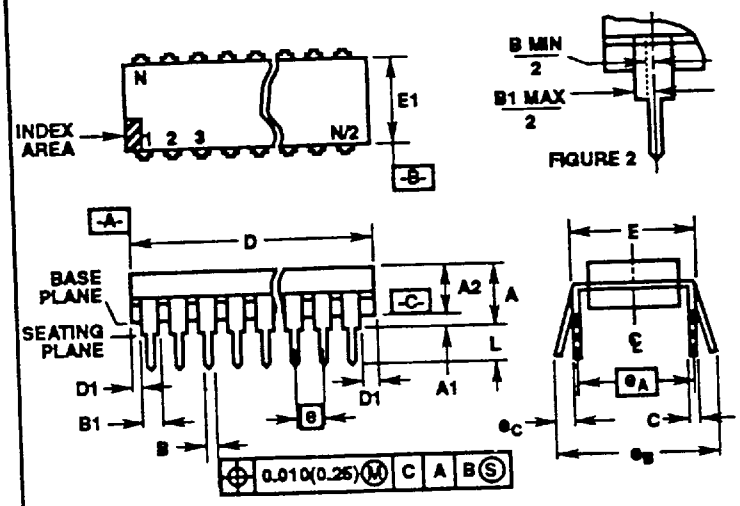


FIGURE 1

FIGURE 2

E24.3 (JEDEC MS-001-AF)
24 LEAD NARROW BODY DUAL-IN-LINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.210	-	5.33	4
A1	0.015	-	0.39	-	4
A2	0.115	0.195	2.93	4.95	-
B	0.014	0.022	0.356	0.558	-
B1	0.045	0.070	1.15	1.77	9
C	0.008	0.015	0.204	0.381	-
D	1.125	1.275	28.60	32.30	5
D1	0.005	-	0.13	-	-
E	0.300	0.325	7.62	8.25	6
E1	0.240	0.280	6.10	7.11	5
e	0.100 BSC		2.54 BSC		-
e_A	0.300 BSC		7.62 BSC		6
e_B	-	0.430	-	10.92	7
L	0.115	0.160	2.93	4.06	4
N	24		24		8

NOTES:

1. Controlling Dimensions: Inch. In case of conflict between English and Metric dimensions, the inch dimensions control.
2. Dimensioning and tolerancing per ANSI Y14.5M-1982.
3. Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication No. 95.
4. Dimensions A, A1 and L are measured with the package seated in JEDEC seating plane gauge GS-3.
5. D and E1 dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 inch (0.25mm).
6. E and e_A are measured with the leads constrained to be perpendicular to plane C.
7. e_B and e_C are measured at the lead tips with the leads unconstrained. e_C must be zero or greater.
8. N is the maximum number of terminal positions.
9. Corner leads (1, N, N/2 and N/2 + 1) may be configured as shown in Figure 2.