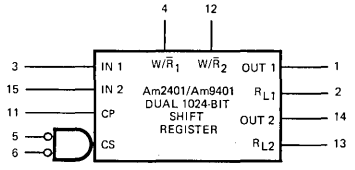
Am9401/Am2401

Dual 1024-Bit Dynamic Shift Register

Distinctive Characteristics

- Single +5V power supply
- High speed – 2MHz min.
- Single phase TTL clock
- Low clock capacitance – 7.0pF max.
- Low Power 315 mW max. @ 2MHz
  40 μW/bit typ. @ 2 MHz
- Chip select, write, and recirculate logic on chip
- 100% reliability assurance testing in accordance with MIL-STD-883

LOGIC SYMBOL



V_{CC} = Pin 16
GND = Pin 8

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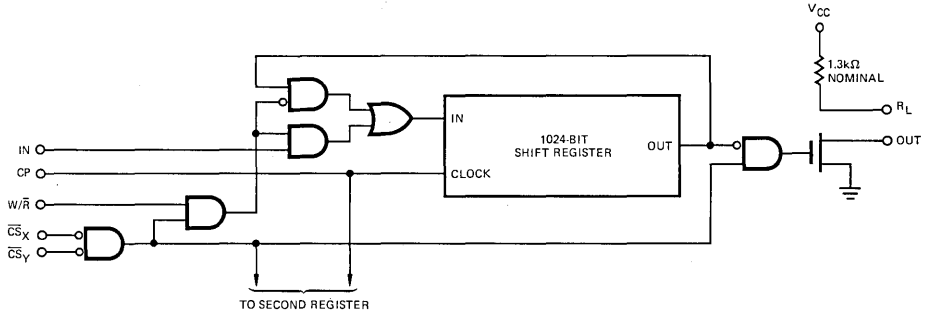
FUNCTIONAL DESCRIPTION

The Am9401 is a dual 1024-bit dynamic shift register built using ion-implanted, N-channel, silicon gate MOS technology. The device operates from a single +5 volt power supply and all inputs and outputs, including the clock, are directly TTL compatible. Data is entered into the register on the LOW-to-HIGH transition of the clock input. New data appears on the output following the HIGH-to-LOW clock transition. There are two chip select inputs, $\overline{CS}_X$ and $\overline{CS}_Y$; if either is HIGH then the data in both registers recirculates and the outputs go to a HIGH impedance OFF state. If both chip selects are LOW, then the outputs will be LOW for LOW data and OFF for HIGH data (similar to TTL open collectors). When the chip is selected, the write-recirculate lines control the entry of new data. If W/$\overline{R}$ is HIGH new data is written into the corresponding register; if W/$\overline{R}$ is LOW, the data on the output is recirculated. An internal pull-up resistor to V_{CC} is provided at R_L. This point may be connected to the output to establish the HIGH logic level. Many register outputs may be connected together with the R_L connected only once. The Am9401 is a high performance plug-in replacement for the Am2401.

LOGIC BLOCK DIAGRAM



Note: Only one register shown.

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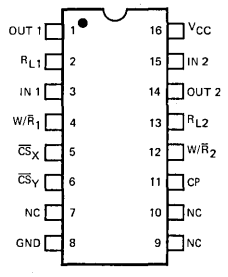
ORDERING INFORMATION

Package Type	Temperature Range	Order Number	Order Number
16-Pin Molded DIP	0°C to +70°C	AM9401PC	P2401
16-Pin Hermetic DIP	0°C to +70°C	AM9401DC	C2401
16-Pin Hermetic DIP	–55°C to +125°C	AM9401DM	

CONNECTION DIAGRAM

Top View



Note: Pin 1 is marked for orientation.

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MAXIMUM RATINGS (Above which the useful life may be impaired)

Storage Temperature	−65°C to +160°C
Temperature (Ambient) Under Bias	−55°C to +125°C
Power Dissipation	1W
Voltage on Any Pin	−0.5V to +7.0V

OPERATING RANGE

Part Number	Ambient Temperature	V_{CC}
Am9401, 2401PC, DC	0°C to +70°C	5.0V ± 5%
Am9401DM	−55°C to +125°C	5.0V ± 5%

ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Parameters	Description	Conditions		Am2401 Min.	Am2401 Typ. (Note 1)	Am2401 Max.	Am9401 Min.	Am9401 Typ.	Am9401 Max.	Units
I_{LI}	Input Leakage Current	V_{IN} = 5.25V				10			10	µA
I_{LO}	Output Leakage Current	V_{OUT} = 5.25V				100			100	µA
I_{CC}	V_{CC} Current	V_{CC} = MAX. 80% Duty Cycle	T_A = 25°C			70			50	mA
			T_A = 0°C to +70°C			80			60	
			T_A = −55°C to +125°C					50	80	
V_{IH}	Input HIGH Level			2.2			2.2			Volts
V_{IL}	Input LOW Level			−0.3		0.65	−0.3		0.65	Volts
I_{OL}	Output LOW Current	V_{OL} = 0.45V		6.3	10		6.3			mA
V_{OL}	Output LOW Voltage	I_{OL} = 1.6mA, R_L connected				0.45			0.45	Volts
V_{OH}	Output HIGH Voltage	I_{OH} = −1mA, R_L connected		2.4		V_{CC}	2.4		V_{CC}	Volts
R_L	Internal Load Resistor			0.5	1.5	3.0	0.5		3.0	kΩ

Note: 1. Typical values are at 25°C and V_{CC} = 5.0V.

SWITCHING CHARACTERISTICS OVER OPERATING RANGE

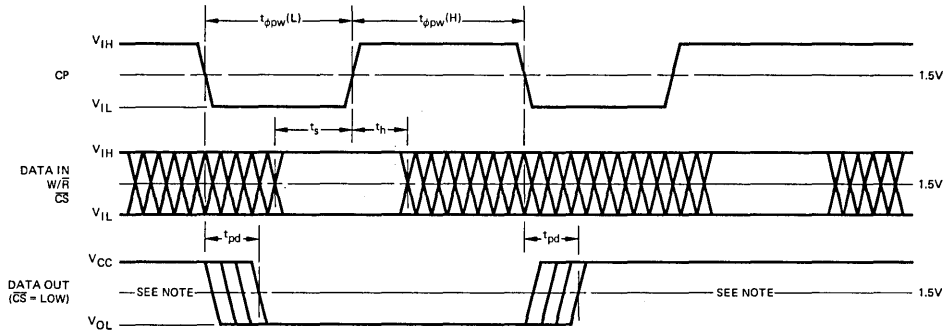
Parameters	Description	Conditions	Am2401 Min.	Am2401 Typ. (Note 1)	Am2401 Max.	Am9401 Min.	Am9401 Typ.	Am9401 Max.	Units
f_{max}	Maximum Data and Clock Rate				1.0			2.0	MHz
f_{min}	Minimum Data and Clock Rate	T_A = 25°C	1.0			1.0			kHz
		T_A = 0°C to +70°C	25			25			
		T_A = −55°C to +125°C				100			
$t_{\phi pw}(L)$	Clock LOW Time	T_A = 0°C to +70°C	0.8		10	0.4		10	µs
		T_A = −55°C to +125°C						9	
$t_{\phi pw}(H)$	Clock HIGH Time	T_A = 25°C	0.2		1000	0.1		1000	µs
		T_A = 0°C to +70°C	0.2		40	0.1		40	
		T_A = −55°C to +125°C				0.1		1.0	
t_r, t_f	Clock Rise and Fall Times				50			50	ns
t_s	Data and Control Set-Up Time		200			80			ns
t_h	Data and Control Hold Time		150			150			ns
t_{pd}	Delay, Clock or Chip Select to Output	R_L connected (Note 2) C_L = 100pF, Load = 1 TTL gate		250	500		160	320 Note 2	ns

Note: 2. C_L = 20pF for Am9401. The capacitive load is limited primarily by the internal load register.

CAPACITANCE (T_A = 25°C)

Parameters	Description	Conditions	Am2401 Min.	Am2401 Typ.	Am2401 Max.	Am9401 Min.	Am9401 Typ.	Am9401 Max.	Units
C_{IN}	Capacitance, All Data Inputs	f = 1 MHz, V_{IN} = 250 mV All Pins at R_L Ground		4.0	7.0		4.0	7.0	pF
C_ϕ	Capacitance, Clock Input			4.0	7.0		4.0	7.0	pF
C_{OUT}	Capacitance, Data Output			10	14		5.0	10	pF

SWITCHING WAVEFORMS



Note: HIGH level on output is established by externally connected load resistor.

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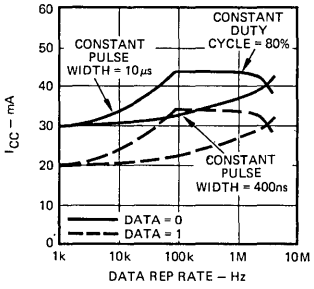
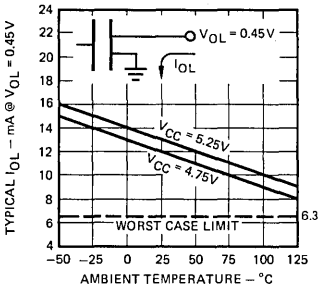
TYPICAL PERFORMANCE CHARACTERISTICS

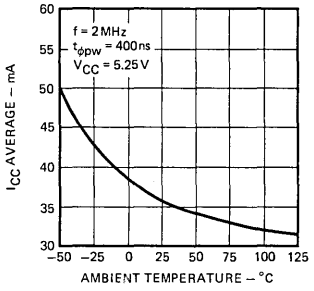
Power Supply Current (I_{CC}) Versus Data Rep. Rate



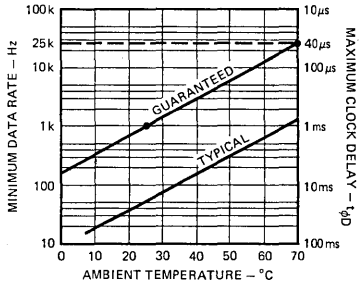
Temperature Dependence of Output LOW Level Sink Capability



Power Supply Current (I_{CC}) Versus Ambient Temperature (0°C)



Minimum Data Rate and Maximum Clock Delay Versus Ambient Temperature



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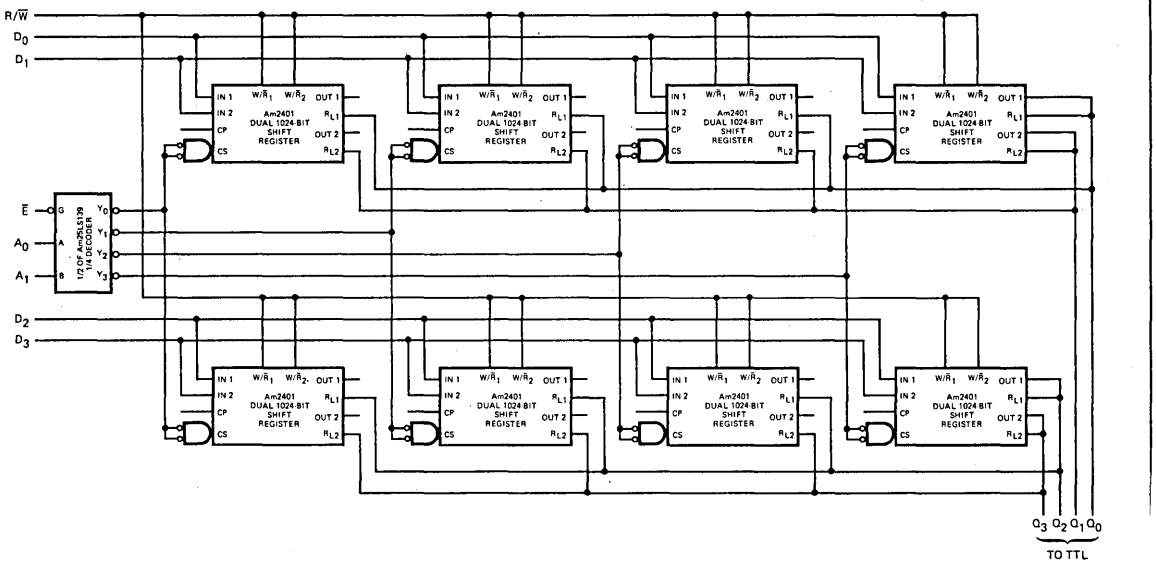
TRUTH TABLE

W/$\overline{R}$	$\overline{CS}_X$	$\overline{CS}_Y$	D_{IN}	DATA ENTERED	OUTPUT	OPERATION
X	X	H	X	D_{IN} (t-1024)	OFF	Deselected, Recirculate
X	H	X	X	D_{IN} (t-1024)	OFF	Deselected, Recirculate
H	L	L	L	LOW	D_{IN} (t-1024)	Read, Write
H	L	L	H	HIGH	D_{IN} (t-1024)	Read, Write
L	L	L	X	D_{IN} (t-1024)	D_{IN} (t-1024)	Read, Recirculate

APPLICATIONS



4k x 4 REGISTER ARRAY

Eight Am2401's form this 16k register array. Data inputs (D_0-D_3) and data outputs (Q_0-Q_3) may be connected directly to TTL. Note that the load resistors are only connected once to each line. A pair of devices (a 1k x 4 section) is selected by address bits A_0 and A_1. The data in the selected devices are read out and, if R/$\overline{W}$ is LOW, updated with new data. All clock lines are driven from TTL levels.

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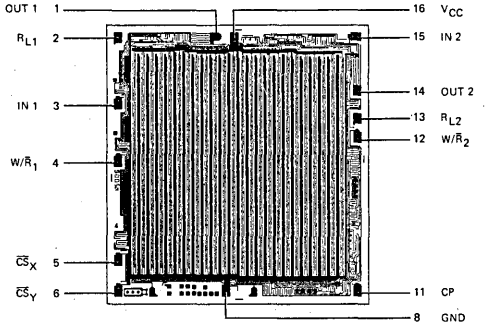
Metallization and Pad Layout



DIE SIZE 0.133" X 0.142"