signetics

1024-BIT CAPACITY MULTIPLEXED DYNAMIC SHIFT REGISTERS

SILICON GATE MOS 2500 SERIES

2502
2503
2504

DESCRIPTION

These Signetics 2500 Series 1024-bit multiplexed dynamic shift registers consist of enhancement mode P-channel MOS devices integrated on a single monolithic chip. Due to on-chip multiplexing, the data rate is twice the clock rate.

FEATURES

- 10 MHz TYPICAL DATA RATE
- THREE CONFIGURATIONS–QUAD 256, DUAL 512, SINGLE 1024
- LOW POWER DISSIPATION–40 μW/bit at 1 MHz DATA RATE
- LOW CLOCK CAPACITANCE–140 pF
- TTL, DTL COMPATIBLE
- STANDARD PACKAGES - 8 LEAD TO-99, 8-PIN AND 16-PIN DUAL IN-LINE PACKAGE
- SIGNETICS P-MOS SILICON GATE PROCESS AND SILICONE PACKAGING TECHNOLOGIES

APPLICATIONS

LOW COST SEQUENTIAL ACCESS MEMORIES
LOW COST BUFFER MEMORIES
CRT REFRESH MEMORIES
DELAY LINE MEMORY REPLACEMENT

PROCESS TECHNOLOGY

Use of low threshold *silicon gate technology* allows high speed (10 MHz typical) while reducing power dissipation and clock input capacitance dramatically as compared to conventional technologies.

The use of low voltage circuitry minimizes power dissipation and facilitates interfacing with bipolar integrated circuits.

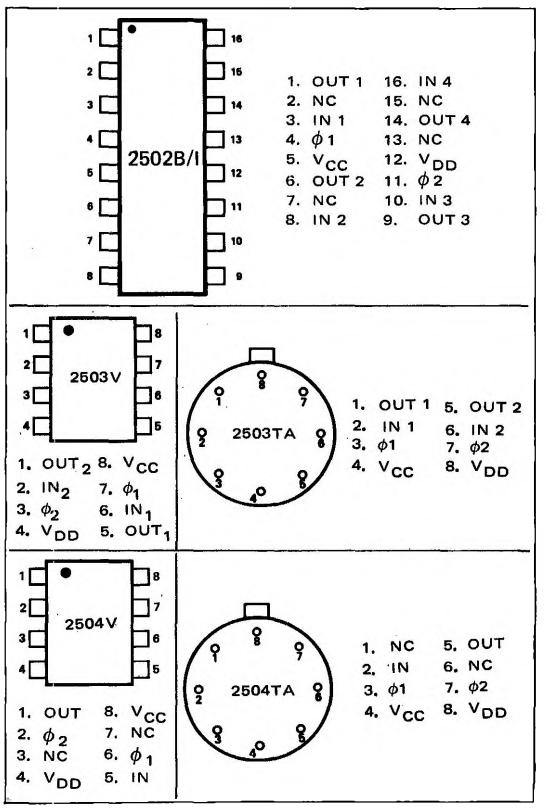
SILICONE PACKAGING

Low cost silicone DIP packaging is implemented and reliability is assured by the use of Signetics unique silicon gate MOS process technology. Unlike the standard metal gate MOS process, the silicon material over the gate oxide passivates the MOS transistors, and the deposited dielectric material over the silicon gate-oxide-substrate structure provides an ion barrier. In addition, Signetics proprietary surface passivation and silicone packaging techniques result in an MOS circuit with inherent high reliability and demonstrating superior moisture resistance, mechanical shock and ionic contamination barriers.

BIPOLAR COMPATIBILITY

The data inputs of these registers can be driven directly by standard bipolar integrated (TTL, DTL, etc.) or by MOS circuits. The bare drain output stage provides driving capability for both MOS and bipolar integrated circuits (one standard TTL load).

PIN CONFIGURATIONS (Top View)



PART IDENTIFICATION TABLE

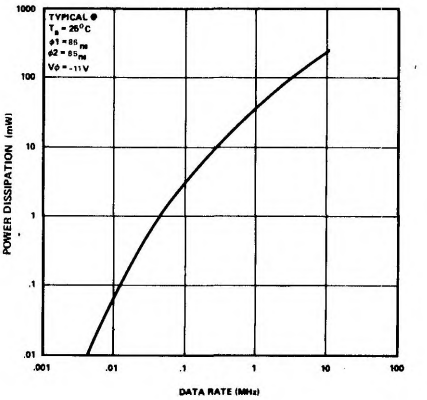
TYPE	FUNCTION	PACKAGE
2502B	Quad 256-bit	16-Pin Silicone DIP
2502I	Quad 256-bit	16-Pin Ceramic DIP
2503TA	Dual 512-bit	TO-99
2503V	Dual 512-bit	8-Pin DIP
2504TA	Single 1024-bit	TO-99
2504V	Single 1024-bit	8-Pin DIP

MAXIMUM SIGNETICS GUARANTEED RATINGS(1)

Operating Ambient Temperature(2)	0°C to +70°C
Storage Temperature	-65°C to + 150°C
Power Dissipation(2) at T_A = 70°C	
TA and V Package	535mW
B Package	640mW
Data and Clock Input Voltages and Supply Voltages with respect to V_{CC}(3)	+0.3V to -20V

NOTES:
1. Stresses above those listed under "Maximum Guaranteed Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other condition above those indicated in the operational sections of this specification is not implied.
2. For operating at elevated temperatures the device must be derated based on a +150°C maximum junction temperature and a thermal resistance of 150°C/W (TA and V package)or 125° C/W (B package).
3. All inputs are protected against static charge.
4. Parameters are valid over operating temperature range unless specified.
5. All voltage measurements are referenced to ground.
6. Manufacturer reserving the right to make design and process changes and improvements.
7. Typical values at +25°C and nominal supply voltages.
8. V_{CC} tolerance is ±5%. Any variation in actual V_{CC} will be tracked directly by V_{IL}, V_{IH} and V_{OH} which are stated for a V_{CC} of exactly 5 volts.
9. When cascading use 140_{ns} minimum to allow data set-up time for driver register.

POWER DISSIPATION VERSUS DATA RATE



DC CHARACTERISTICS

T_A = 0°C to +70°C; V_{DD} = -5V ±5%; V_{CC} = +5V(8) unless otherwise noted. (See Notes 4,5,6,7).

SYMBOL	TEST	MIN	TYP	MAX	UNIT	CONDITIONS
I_{LI}	Input Load Current		10	500	nA	V_{IN} = V_{CC} to V_{DD}, T_A = 25°C
I_{LO}	Output Leakage Current		10	1000	nA	$V_{\phi1}$ = $V_{\phi2}$ = -10V V_{OUT} = 0.0V, T_A = 25°C
I_{LC}	Clock Leakage Current		10	1000	nA	V_{ILC} = −10V T_A = 25°C
I_{DD}	Power Supply Current		15	25	mA	Outputs at logic "0", 4 MHz data rate, ϕ1 = ϕ2 = 85ns continuous operation, V_{ILC} = −12V T_A = 25°C
V_{IL}	Input "Low" Voltage			1.05	V	
V_{IH}	Input "High" Voltage	3.2		5.3	V	
V_{IHC}	Clock Input "High" Voltage	4.0		5.3	V	
V_{ILC}	Clock Input "Low" Voltage	−10		−12	V	

AC CHARACTERISTICS

$T_A = 25°C$, $V_{DD} = -5V \pm 5\%$; $V_{CC} = +5V$ (8) ; $V_{ILC} = -11V$, (See notes 4, 5, 6, 7)

SYMBOL	TEST	MIN	TYP	MAX	UNIT	CONDITIONS
Frequency	Clock Rep Rate	0.0005		4	MHz	
Frequency	Data Rep Rate	0.001		8	MHz	
ϕpw	Clock Pulse Width (9)	85			ns	See note 9
ϕd	Clock Pulse Delay	10			ns	
t_r, t_f	Clock Pulse Transition	10		1000	ns	
t_W	Data Write Time (Setup)	50			ns	
t_{DO}	Data in Overlap	10			ns	
t_a+	Data Out			90	ns	
C_{IN}	Input Capacitance	2.5		5	pF	@ 1 MHz 25 mV p-p
C_{OUT}	Output Capacitance	2.5		5	pF	@ 1 MHz 25 mV p-p
$C\phi$	Clock Capacitance	130		150	pF	@ 1 MHz 25 mV p-p
V_{OL}	Output "Low" Voltage		-0.3		V	R_L=3k, depends on R_L and TTL Gate
V_{OH1}	Output "High" Voltage Driving MOS	3.6	4.0		V	R_L = 5.6k
V_{OH2}	Output "High" Voltage Driving TTL	3.0	3.5		V	R_L = 3k

MULTIPLEXED 4-BIT MOS SHIFT REGISTER

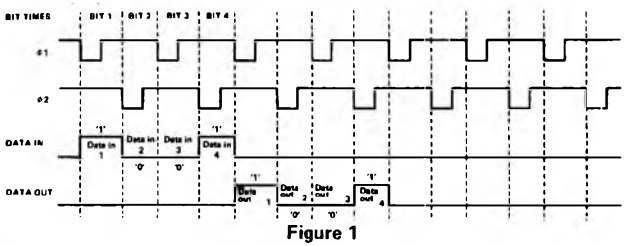


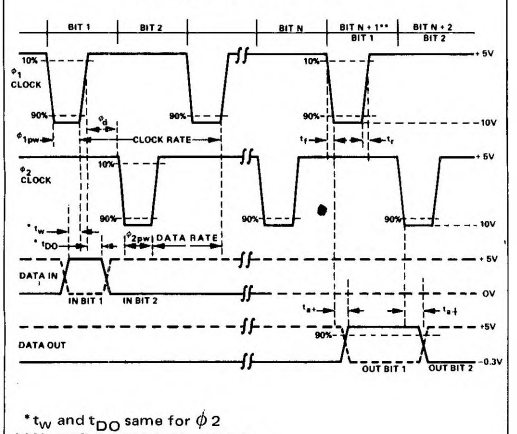
Figure 1

Figure 1 is a simplified illustration of the timing of a 4-bit multiplexed register showing input output relationships with respect to the clock. If data enters the register at ϕ1 time, it exits at ϕ1 time, (beginning on ϕ1's negative going edge and ending on the succeeding ϕ2's negative going edge).

CONDITIONS OF TEST

Input rise and fall times: 10nsec. Output load is 1 TTL gate.

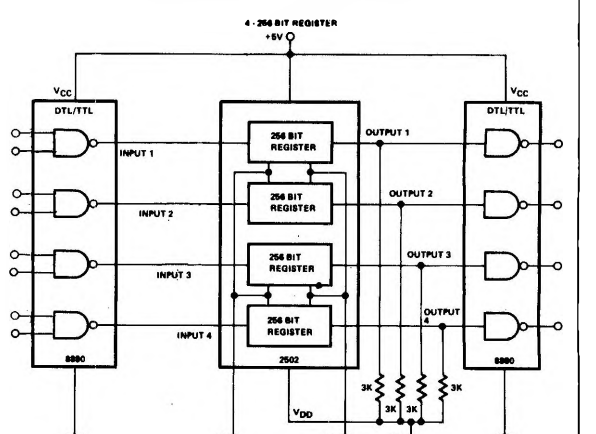
TIMING DIAGRAM



*t_W and t_{DO} same for ϕ2
**N=256 for 2502, N = 512 for 2503, N = 1024 for 2504

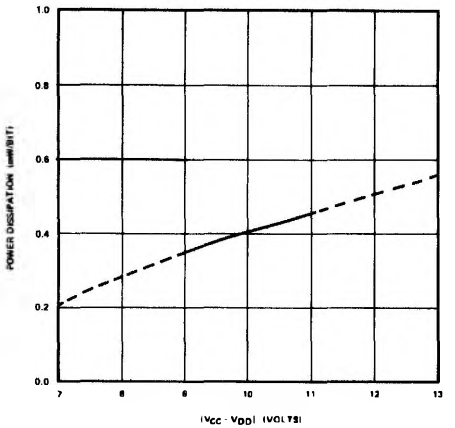
APPLICATIONS INFORMATION

DTL/TTL/MOS INTERFACES

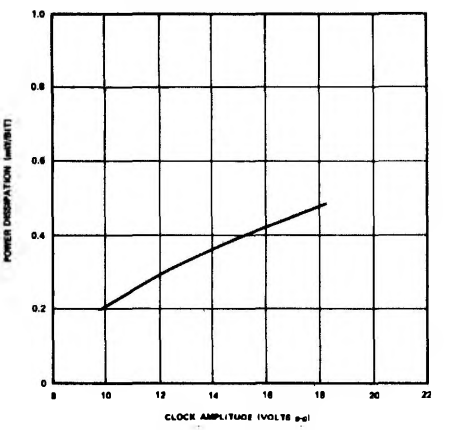


NOTE: When interfacing MOS to MOS output resistors should be 4.7K min

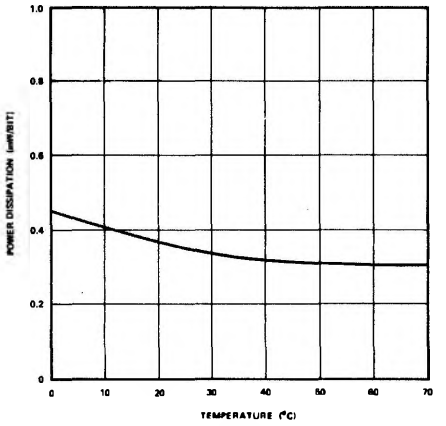
POWER DISSIPATION/BIT VERSUS SUPPLY VOLTAGE



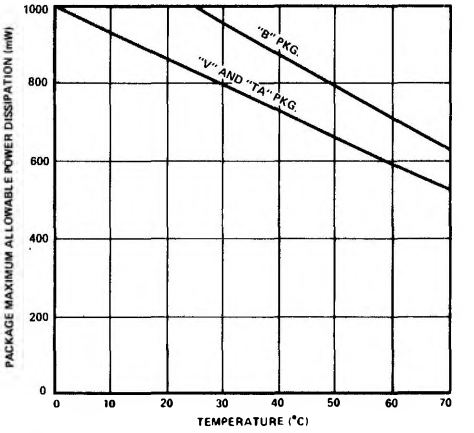
POWER DISSIPATION/BIT VERSUS CLOCK AMPLITUDE



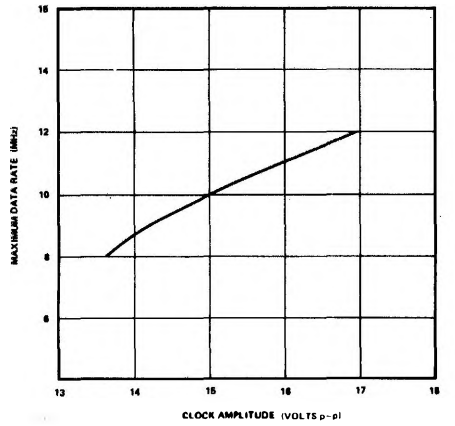
POWER DISSIPATION/BIT VERSUS TEMPERATURE



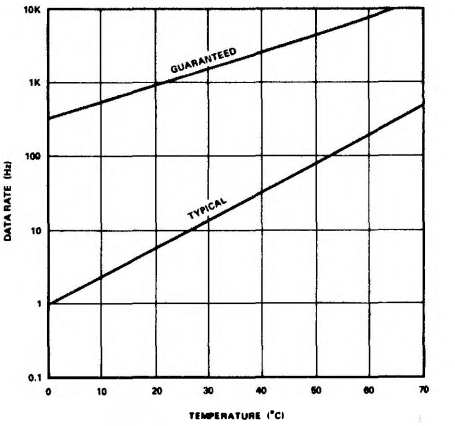
MAXIMUM ALLOWABLE POWER DISSIPATION VERSUS AMBIENT TEMPERATURE



CLOCK AMPLITUDE V_ϕ VERSUS MAXIMUM DATA RATE



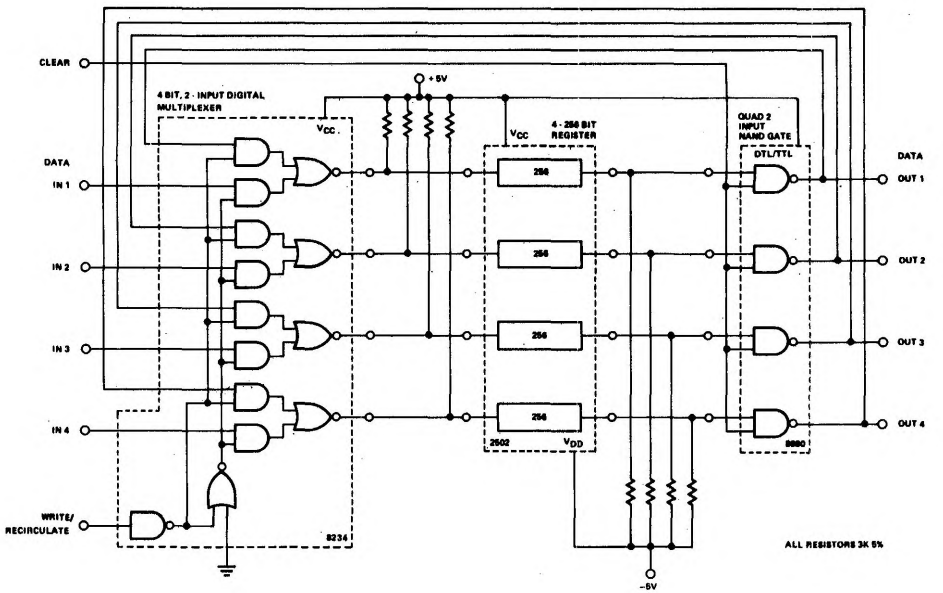
MINIMUM OPERATING DATA RATE VERSUS TEMPERATURE



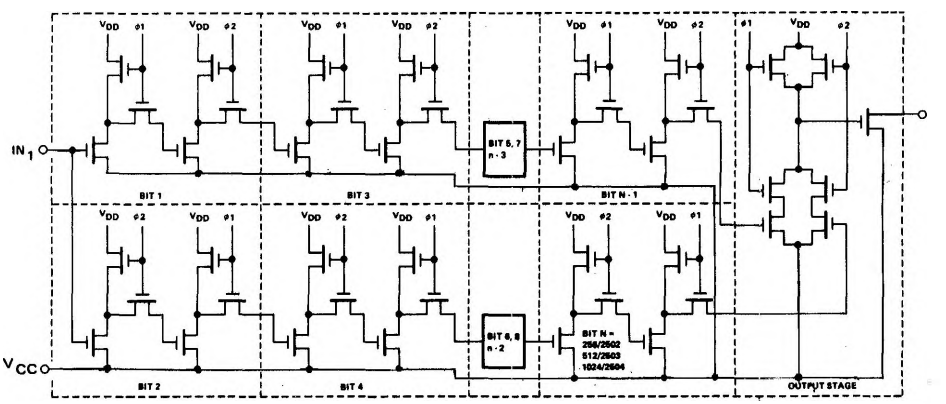
NOTE:
Conditions for Typical Curves; $V_{CC} = +5V, V_{DD} = -5V, \phi_{1PW}$ and $\phi_{2PW} = 85ns$, $V_\phi = +11V$, $T_A = 25°C$, $f_{DATA} = 10MHz$ unless otherwise noted.

APPLICATIONS (Cont'd)

WRITE/RECIRCULATE LOGIC



CIRCUIT SCHEMATIC



NOTES:

1. N = 1024 on 2504
2. N = 512 on 2503 schematic for second register same as above.
3. N = 256 on 2502 schematic for second, third and fourth registers same as above.