SERIAL INPUT/16-BIT PARALLEL OUTPUT PERIPHERAL DRIVER

FEATURES

- **High Voltage Outputs 15V**
- **High Output Current Sink Capability ..... 60 mA**
- **Low Standby Power ..... 20 mW**
- **High-Speed Operation ..... 3 MHz**
- **16 Parallel Outputs**
- **Cascading Possible for Longer Data Words**

APPLICATIONS

- **Incandescent Lamp Driver**
- **Thermal Printhead Driver**
- **LED Bar-Graph Driver**
- **High Current, Microprocessor Serial Port Extender**
- **Relay/Solenoid Driver**
- **Tungsten Lamp Driver**
- **SCR Gate Driver**

GENERAL DESCRIPTION

The TC9404 is a serial input/16-bit parallel output shift register. High output power MOS switching transistors make the TC9404 an ideal interface circuit between microprocessor I/O ports and high current/voltage peripherals. The CMOS construction limits quiescent power dissipation to 20 mW.

The TC9404 common-source, open-drain MOS outputs sustain 15V in the OFF state and maintain leakage currents under 100 µA. The 16 parallel outputs continuously sink 60 mA ($V_{SAT} \leq 0.5V$).

Successive connection of serial data outputs to serial data inputs makes longer length serial-to-parallel conversions possible. Device cascading makes the TC9404 an ideal thermal printhead or high-resolution LED bar-graph driver.

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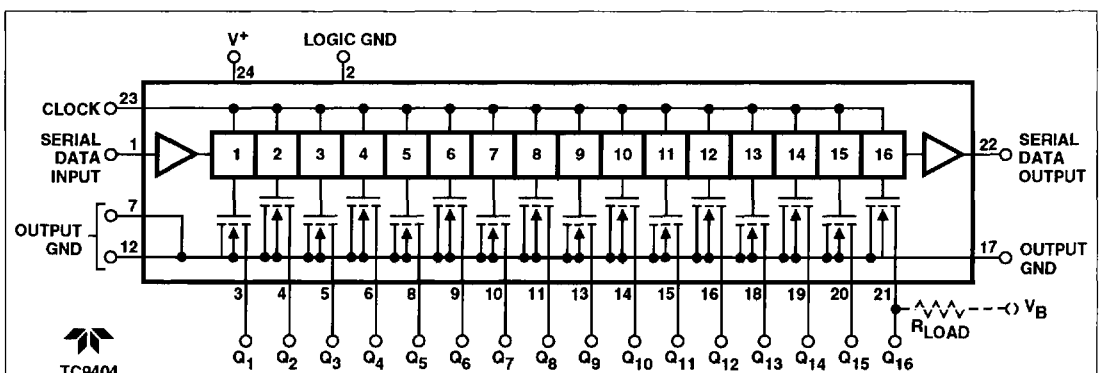
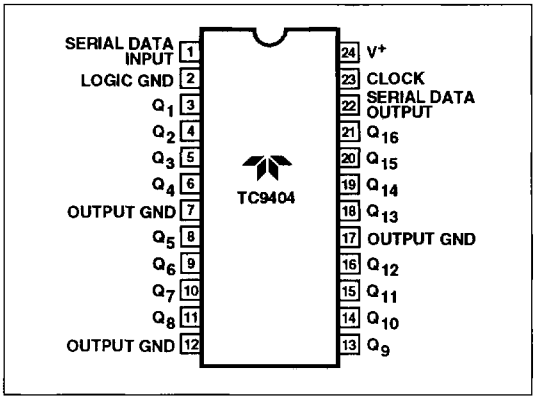
SIMPLIFIED SCHEMATIC



NOTE: Logic "1" serial data input bit turns output NMOS on.

TC9404

PIN CONFIGURATION



ORDERING INFORMATION

Part No.	Package	Temperature Range	Output Voltage
TC9404CPG	24-Pin Plastic DIP	0°C to +70°C	15V
TC9404IJG	24-Pin CerDIP	–25°C to +85°C	15V
TC9404MJG	24-Pin CerDIP	–55°C to +125°C	15V

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V^+ to Logic Ground) 7V
Digital Logic Input Voltage 5.5V
Parallel Output Drain Voltage 22V
Parallel Output Drain Current ..... 80 mA
Logic Ground to Output Ground
  Potential Difference ..... 100 mV
Package Power Dissipation
  CerDIP ..... 1W @ +85°C
  CerDIP ..... 0.4W @ +125°C
  Plastic Package ..... 1W @ +70°C
Operating Temperature
  CerDIP (IJ) ..... $-25°C \le T_A \le +85°C$
  CerDIP (MJ) ..... $-55°C \le T_A \le +125°C$
  Plastic Package(CP) ..... $0°C \le T_A \le +70°C$
Storage Temperature ..... $-65°C \le T_A \le +150°C$
Lead Temperature (Soldering, 60 sec) ..... +300°C

Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS: V_S = 5V, 0°C ≤ T_A ≤ +70°C for TC9404CPG and –25°C ≤ T_A ≤ +85°C for TC9404IJG, and –55°C to +125°C for TC9404MJG, unless otherwise stated.

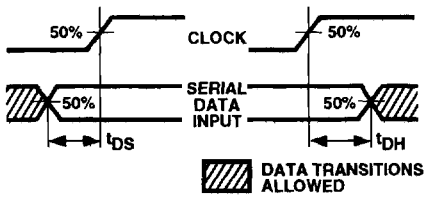
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Output						
V_{SAT}	Output ON Voltage	I_O = 60 mA V_S = 4.75V	—	0.35	0.5	V
V_B	Output OFF Voltage		—	—	15	V
I/O	Output Sink Current	V_{SAT} ≤0.5V (Note 1)	60	—	—	mA
I_{OX}	Output Leakage Current	V_S = 4.75V, V_B = 15V	—	—	100	µA
V_{OH}	Serial Output Logic "1" Voltage	I_{OH} = 400 µA I_{OH} = 10 µA	2.4 4.5	— —	— —	V V
V_{OL}	Serial Output Logic "0" Voltage	I_{OL} = 5 mA	—	—	0.4	V
Input						
V_{INH}	Logic "1" Input Voltage	V_S = 5.25V	3.3	—	—	V
V_{INL}	Logic "0" Input Voltage	V_S = 5.25V	—	—	0.8	V
I_{INH}	Logic "1" Input Current	V_S = 5.25V	—	—	20	V
I_{INL}	Logic "0" Input Current	V_{INL} = 0.4V V_S = 5.25V	—	—	400	µA
C_{IN}	Input Capacitance	V_{INL} = 0V	—	15	—	µA
Timing						
t_{DH}	Serial Input Data Hold Time		20	0	—	ns
t_{DS}	Serial Input Data Set-Up Time		100	70	—	ns
t_{CP}	Clock Frequency		3	5	—	MHz
t_{PW}	Clock Pulse Width		150	100	—	ns
t_{PLH}	Parallel Output Low-to-High Transition Time	V_B = 15V R_L = 330Ω C_L = 25 pF	—	—	150	ns
t_{PHL}	Parallel Output High-to-Low Transition Time	V_B = 15V R_L = 330Ω C_L = 25 pF	—	—	150	ns
t_{SLH}	Serial Output Low-to-High Transition Time	I_{OH} = 400 µA C_L = 25 pF	—	—	150	ns
t_{SHL}	Serial Output High-to-Low Transition Time	I_{OL} = 5 mA C_L = 25 pF	—	—	75	ns
Power						
V_S	Operating Supply Voltage		4.75	5	5.25	V
I_S	Quiescent Power Supply	V_S = 5.25V f_C = 0 Hz V_{IHL} = 0V I_O = 0 mA Pin 22 Open	—	1	4	mA

NOTE 1. Maintain chip temperature ≤150°C.

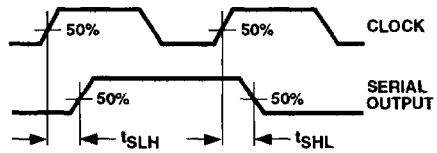
TC9404

TIMING DIAGRAMS

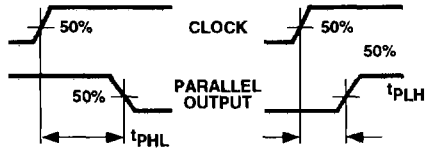
a) Serial Input Data Hold and Set-Up Times



b) Serial Output Transition Times



c) Parallel Output Transition Times



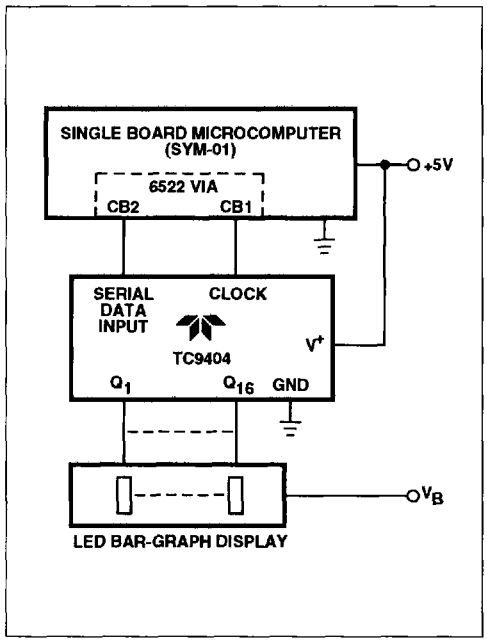
FUNCTION TABLE

Data Input		Parallel Outputs			
D_N	Clock Input	Q_1	Q_2	Q_3	...Q_{16}
X	L	$\overline{D_1}$	$\overline{D_2}$	$\overline{D_3}$	...$\overline{D_{16}}$
H	↓	L*	$\overline{D_1}$	$\overline{D_2}$	...$\overline{D_{15}}$
L	↓	H*	$\overline{D_1}$	$\overline{D_2}$	$\overline{D_{15}}$

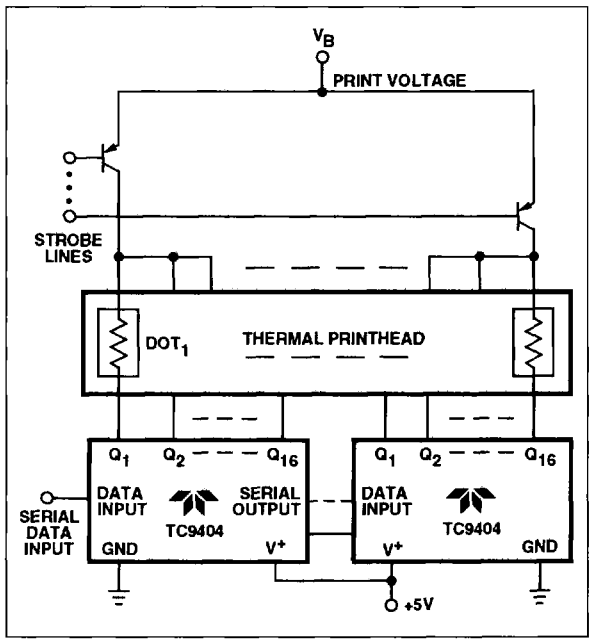
L = Logic 0
H = Logic 1
L* = Output NMOS ON
H* = Output NMOS OFF
X = Don't Care
↓ = Transition from Low-to-High
D_1, D_2, ...D_{16} = Data inputs at clock time T_{-N}.
Data is inverted at the parallel outputs.

APPLICATIONS

Microprocessor-Controlled LED
Bar-Graph Display



Thermal Printhead Driver



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