

# M54995P/FP

## Bi-CMOS 8-BIT SERIAL-INPUT LATCHED DRIVER

### DESCRIPTION

The M54995 is a semiconductor integrated circuit consisting of 8 stages of CMOS shift registers and latches with serial inputs and serial or parallel outputs. It is based on Bi-CMOS process technology, and has 8 bipolar drivers at the parallel outputs.

### FEATURES

- Serial input and serial or parallel output
- Serial output enables cascade connection
- Built-in latch for each stage
- Enable input provides output control
- Low supply current (standby current  $I_{CC} \leq 10\mu A$ )
- Serial I/O level is compatible with typical CMOS devices
- Driver features: High withstand voltage ( $BV_{CEO} \geq 30V$ )
- Wide operating temperature range  $T_a = -20 - +75^\circ C$

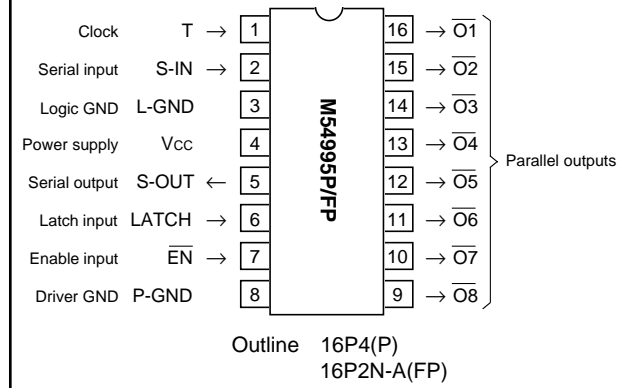
### APPLICATION

Dot drivers for thermal print heads. Serial/parallel conversion. Drivers for relays and solenoids.

### FUNCTION

The M54995 consists of 8 stages of D-type flip flops connected to 8 latches. Data is input to serial input S-IN, and clock pulses are input to clock input T. When the clock changes from low to high, the input data enters the first shift register and data already in the shift registers is shifted sequentially. The serial output S-OUT is used to connect multiple M54995 to expand the number of parallel outputs. S-OUT is connected to S-IN

### PIN CONFIGURATION (TOP VIEW)



of the next stage.

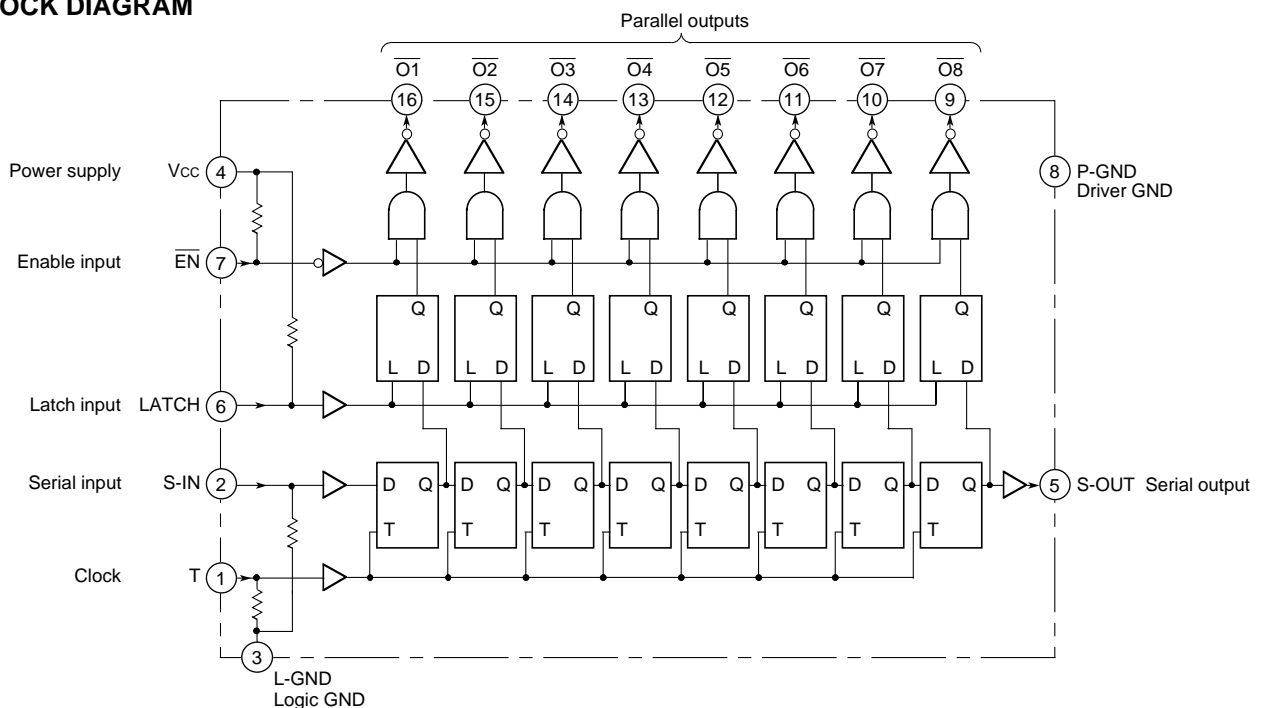
For parallel output. When the clock pulse changes from low to high, latch input (LATCH) is high and output enable input ( $\overline{EN}$ ) is low the serial input data at S-IN appears at output  $\overline{O1}$  and the other data already present is shifted sequentially to outputs  $\overline{O2}$  through  $\overline{O8}$ .

The parallel outputs are inverted.

When the latch input is held low, the latch retains the stored data. When the  $\overline{EN}$  input is high, outputs  $\overline{O1}$  through  $\overline{O8}$  all turn off. As the internal logic is unstable when the power is turned on, the  $\overline{EN}$  input should be kept high (setting outputs  $\overline{O1}$  through  $\overline{O8}$  off) until input data is set and the internal logic is initialized.

L-GND is the GND of CMOS logic circuit and P-GND is the GND of output driver circuits  $\overline{O1}$  through  $\overline{O8}$  which employ bipolar transistors capable of large drive currents.

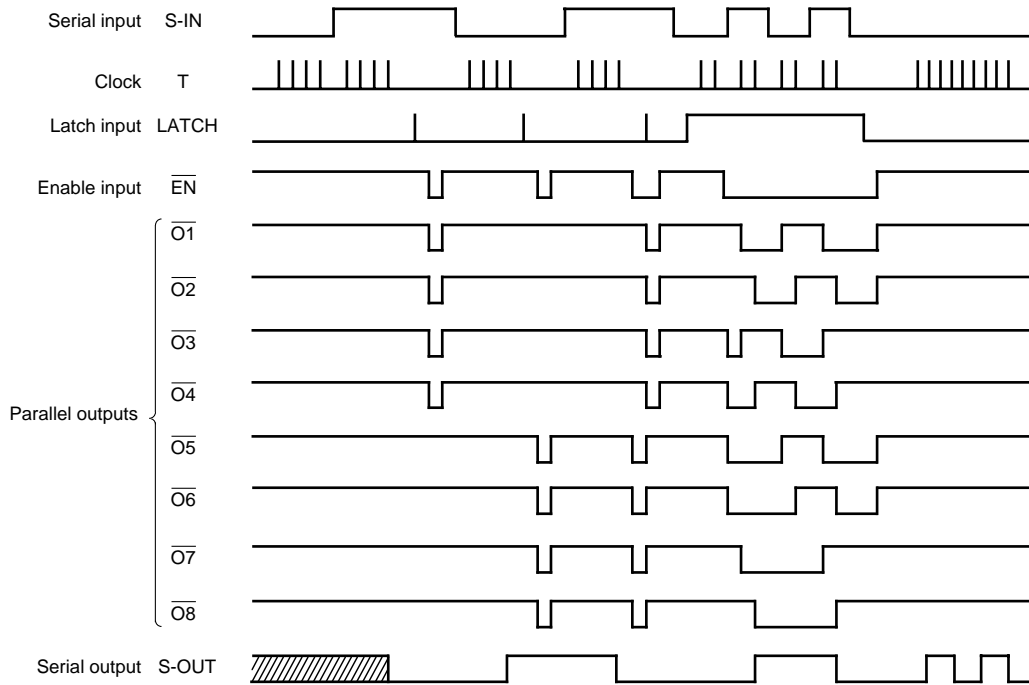
### BLOCK DIAGRAM



# M54995P/FP

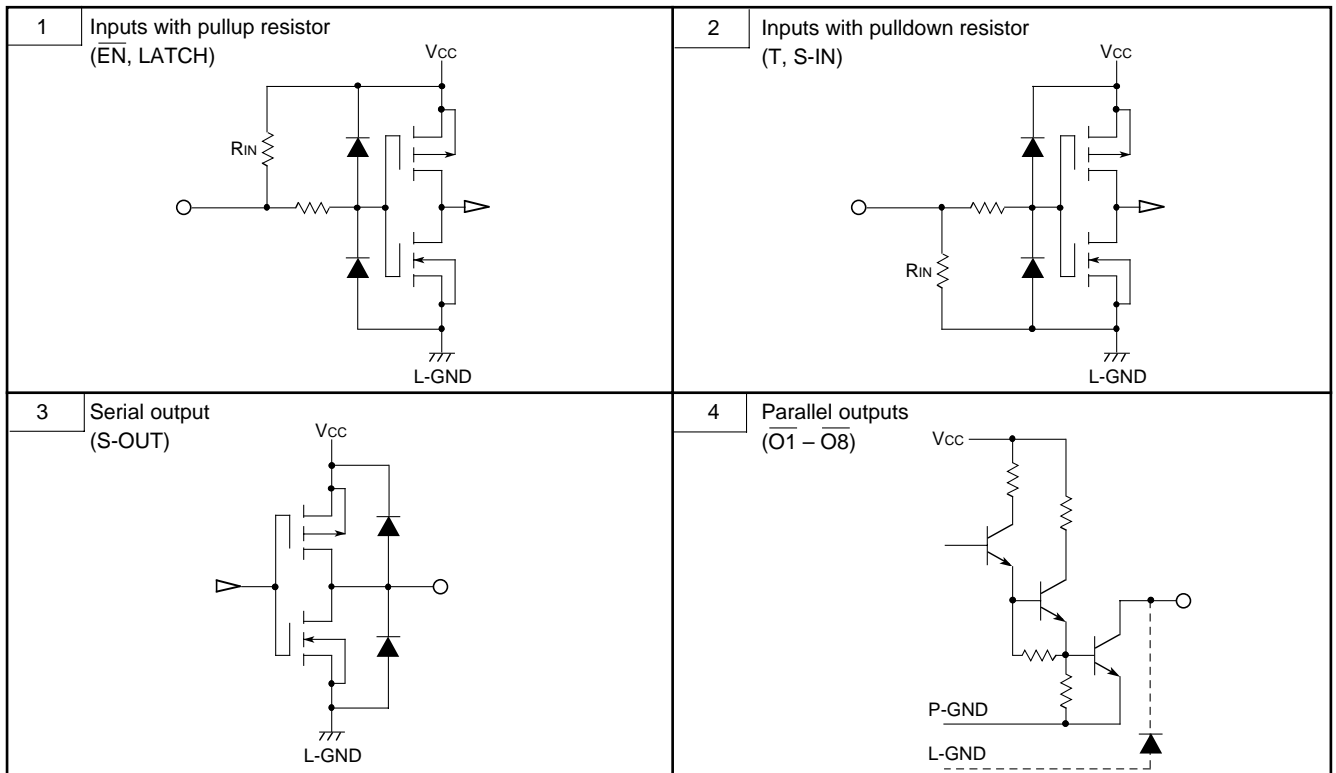
## BI-CMOS 8-BIT SERIAL-INPUT LATCHED DRIVER

### TIMING CHART



\*The state of the shaded part is unstable.

### INPUT/OUTPUT CIRCUIT DIAGRAM



**M54995P/FP**

Bi-CMOS 8-BIT SERIAL-INPUT LATCHED DRIVER

**ABSOLUTE MAXIMUM RATINGS** (T<sub>a</sub>=-20 to 75°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit	
V <sub>cc</sub>	Supply voltage		-0.5 – +8	V	
V <sub>i</sub>	Input voltage		-0.5 – V <sub>cc</sub> +0.5	V	
V <sub>o</sub>	Output voltage	S-OUT	-0.5 – V <sub>cc</sub> +0.5	V	
		$\overline{O1} - \overline{O8}$ : OFF	-0.5 – 30		
I <sub>o</sub>	Output current	$\overline{O1} - \overline{O8}$ : ON	60	mA	
P <sub>d</sub>	Power dissipation	T <sub>a</sub> =25°C	M54995P	1.25	W
			M54995FP	0.8	
T <sub>opr</sub>	Operating temperature		-20 – 75	°C	
T <sub>stg</sub>	Storage temperature		-55 – 125	°C	

**RECOMMENDED OPERATING DONDITION**

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
V <sub>cc</sub>	Supply voltage		4	5	6	V
V <sub>o</sub>	Output apply voltage	$\overline{O1} - \overline{O8}$ : OFF			30	V
I <sub>o</sub>	Output current (per circuit)	$\overline{O1} - \overline{O8}$ : ON			50	mA

**ELECTRICAL CHARACTERISTICS** (T<sub>a</sub>=25°C, V<sub>cc</sub>=5V, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min.	Typ.	Max.	
V <sub>IH</sub>	High-level input voltage		T <sub>a</sub> =20 – 75°C, V <sub>cc</sub> =4 – 6V	0.7V <sub>cc</sub>		V <sub>cc</sub>	V
V <sub>IL</sub>	Low-level input voltage			0		0.3V <sub>cc</sub>	V
I <sub>IH</sub>	High-level input current	S-IN, T	V <sub>IH</sub> =5V		100	μA	
I <sub>IL</sub>	Low-level input current	$\overline{EN}$ , LATCH	V <sub>IL</sub> =0V		-100	μA	
R <sub>IN</sub>	Input resistance			50		kΩ	
V <sub>OH</sub>	High-level output voltage	S-OUT	I <sub>o</sub>  ≤1μA	4.9		V	
V <sub>OL</sub>	Low-level output voltage	S-OUT				0.1	V
I <sub>OH</sub>	High-level output current	S-OUT	V <sub>OH</sub> =4.5V	-100		μA	
I <sub>OL</sub>	Low-level output current	S-OUT	V <sub>OL</sub> =0.4V	400		μA	
V <sub>OL1</sub>	Low-level output voltage	$\overline{O1} - \overline{O8}$	I <sub>OL</sub> =50mA		0.5	V	
			I <sub>OL</sub> =60mA		0.6	V	
I <sub>OLK</sub>	Output leak current	$\overline{O1} - \overline{O8}$	V <sub>o</sub> =30V		50	μA	
I <sub>CC1</sub>	Supply current		Input: open, All driver outputs: OFF		10	μA	
I <sub>CC2</sub>			One driver output is ON.		3	mA	

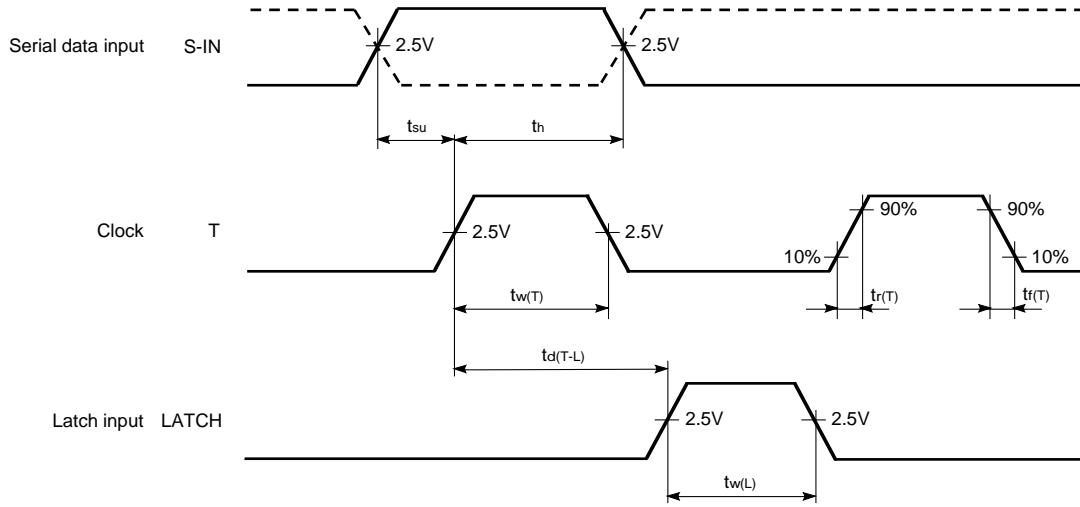
**TIMING REQUIREMENTS** (T<sub>a</sub>=-20 to 75°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
f <sub>(T)</sub>	Clock frequency	Input duty cycle: 40 – 60%			2	MHz
t <sub>w(T)</sub>	Clock pulse width		200			ns
t <sub>w(L)</sub>	Latch pulse width		200			ns
t <sub>su</sub>	Data setup time		100			ns
t <sub>h</sub>	Data hold time		100			ns
t <sub>d(T-L)</sub>	Clock-latch time		400			ns
t <sub>r(T)</sub>	Clock pulse rise time				500	ns
t <sub>f(T)</sub>	Clock pulse fall time				500	ns

# M54995P/FP

## Bi-CMOS 8-BIT SERIAL-INPUT LATCHED DRIVER

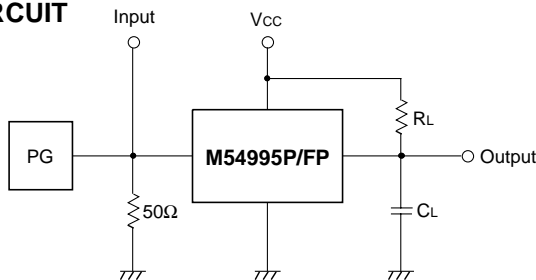
### TIMING CHART



### SWITCHING CHARACTERISTICS (T<sub>a</sub>=25°C, V<sub>CC</sub>=5V, unless otherwise noted)

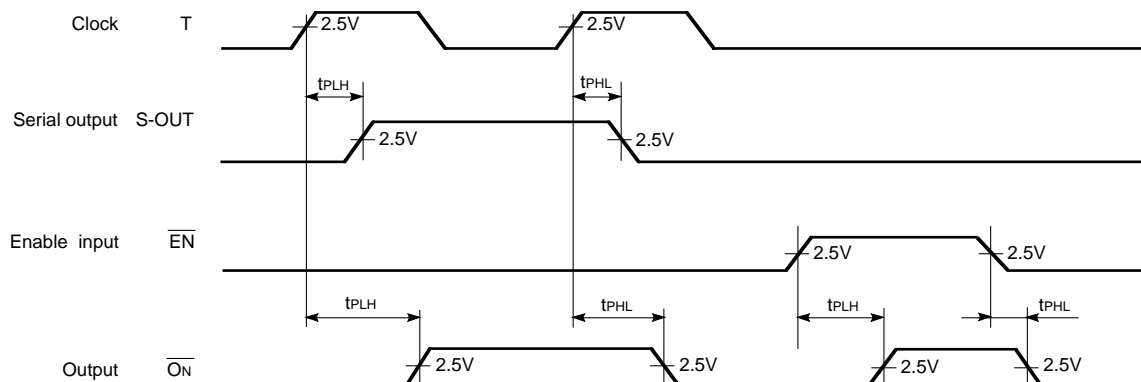
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
t <sub>PLH</sub>	Low-to-high-level output propagation time From input T to output S-OUT	V <sub>IH</sub> =5V V <sub>IL</sub> =0V R <sub>L</sub> (S-OUT)=∞ R <sub>L</sub> ( $\overline{ON}$ )=100Ω (N=1-8) C <sub>L</sub> =15pF			0.3	μs
t <sub>PHL</sub>	High-to-low-level output propagation time From input T to output S-OUT				0.3	μs
t <sub>PLH</sub>	Low-to-high-level output propagation time From input T to output $\overline{ON}$				10	μs
t <sub>PHL</sub>	High-to-low-level output propagation time From input T to output $\overline{ON}$				5	μs
t <sub>PLH</sub>	Low-to-high-level output propagation time From input $\overline{EN}$ to output $\overline{ON}$				10	μs
t <sub>PHL</sub>	High-to-low-level output propagation time From input $\overline{EN}$ to output $\overline{ON}$				5	μs

### TEST CIRCUIT



- The input waveform: t<sub>r</sub> ≤ 20ns, t<sub>f</sub> ≤ 20ns
- The capacitance C<sub>L</sub> includes the wiring stray capacitance and probe input capacitance.

### TIMING CHART



# M54995P/FP

## Bi-CMOS 8-BIT SERIAL-INPUT LATCHED DRIVER

### TYPICAL CHARACTERISTICS (T<sub>a</sub>=25°C, V<sub>CC</sub>=5V, unless otherwise noted)

