M66320P/FP

12-BIT SHIFT REGISTER WITH OUTPUT LATCH

DESCRIPTION

The M66320P/FP is an integrated circuit for a 12-bit serial-in parallel-out shift register with an output latch. The device can be used as a pre-driver to drive a printer head. Each output pin is capable of driving two LSTTLs.

Use of CMOS design allows the M66320P/FP to reduced power dissipation considerably compared to bipolar or Bi-CMOS products.

The M66320 can also be used as a serial-to-parallel data converter or for microcomputer peripheral equipment.

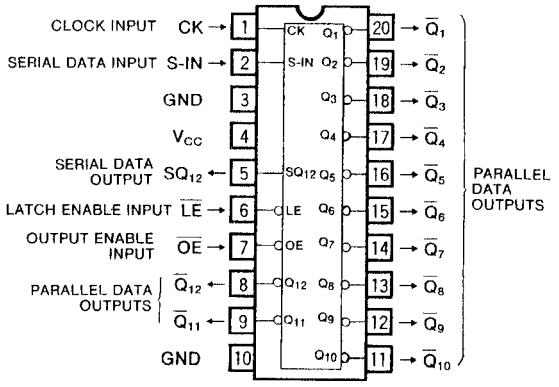
FEATURES

- Low power dissipation 100μW/package maximum (V_{CC}=5V, T_a=25℃, when input is open)
- Schmitt input (CK, $\overline{LE}$)
- Wide operating temperature range T_a=−40~85℃

APPLICATION

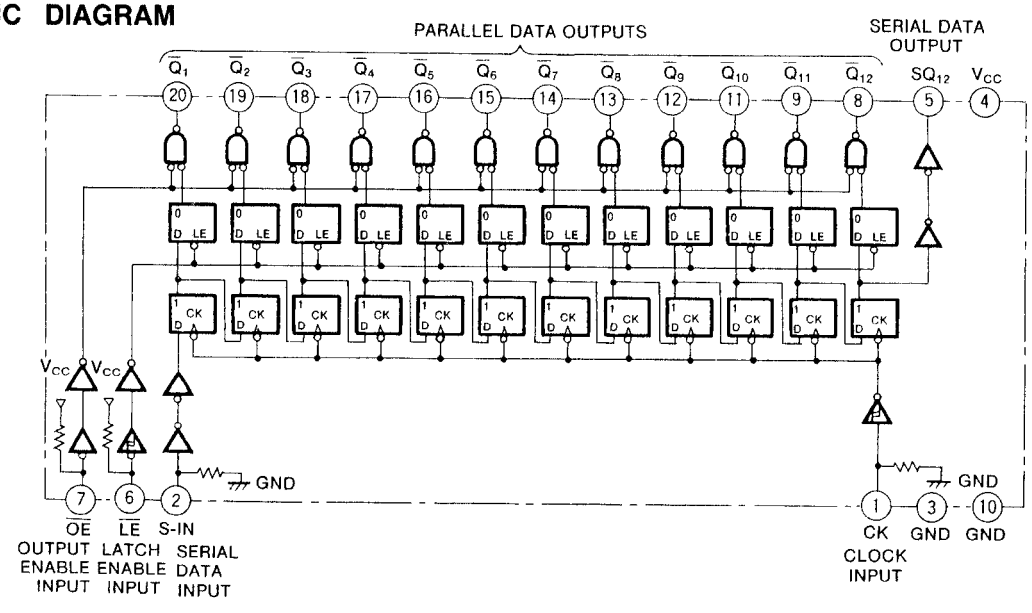
Pre-driver for printer head pins.

PIN CONFIGURATION (TOP VIEW)



Outline 20P4
20P2N-A

LOGIC DIAGRAM



12-BIT SHIFT REGISTER WITH OUTPUT LATCH

FUNCTION

Use of a silicon-gate CMOS process allows the M66320 to maintain low power dissipation and high noise margin characteristics.

Each bit of the shift register consists of a shift flip-flop and a latch connected to the output. Shift operation takes place when the clock input changes from low-to high-level. The serial data input S-IN is the data input of the first-stage shift register, and the data S-IN shifts the shift register when CK is applied. When the S-IN is high-level, the high-level data shifts and, when the S-IN is low-level, the low-level data shifts.

The inverted data of the shift register is output to $\overline{Q_1}$~$\overline{Q_{12}}$. If the latch enable input $\overline{LE}$ is set to low-level, the contents of the shift register are latched. To expand the number of bits, use the serial data output SQ_{12} to which the content of the 12th-bit shift register is output. If the output enable input $\overline{OE}$ is set to high-level, $\overline{Q_1}$~$\overline{Q_{12}}$ becomes high-level. In this case, the content of the 12th-bit shift register is output to SQ_{12}. The shift operation is not affected even if the $\overline{OE}$ changes.

FUNCTION TABLE (Note 1)

Inputs				Parallel outputs												Serial output
CK	$\overline{LE}$	S-IN	$\overline{OE}$	$\overline{Q_1}$	$\overline{Q_2}$	$\overline{Q_3}$	$\overline{Q_4}$	$\overline{Q_5}$	$\overline{Q_6}$	$\overline{Q_7}$	$\overline{Q_8}$	$\overline{Q_9}$	$\overline{Q_{10}}$	$\overline{Q_{11}}$	$\overline{Q_{12}}$	SQ_{12}
↑	H	H	L	L	$\overline{Q_1}^0$	$\overline{Q_2}^0$	$\overline{Q_3}^0$	$\overline{Q_4}^0$	$\overline{Q_5}^0$	$\overline{Q_6}^0$	$\overline{Q_7}^0$	$\overline{Q_8}^0$	$\overline{Q_9}^0$	$\overline{Q_{10}}^0$	$\overline{Q_{11}}^0$	q_{11}^0
↑	H	L	L	H	$\overline{Q_1}^0$	$\overline{Q_2}^0$	$\overline{Q_3}^0$	$\overline{Q_4}^0$	$\overline{Q_5}^0$	$\overline{Q_6}^0$	$\overline{Q_7}^0$	$\overline{Q_8}^0$	$\overline{Q_9}^0$	$\overline{Q_{10}}^0$	$\overline{Q_{11}}^0$	q_{11}^0
X	L	X	L	$\overline{Q_1}^0$	$\overline{Q_2}^0$	$\overline{Q_3}^0$	$\overline{Q_4}^0$	$\overline{Q_5}^0$	$\overline{Q_6}^0$	$\overline{Q_7}^0$	$\overline{Q_8}^0$	$\overline{Q_9}^0$	$\overline{Q_{10}}^0$	$\overline{Q_{11}}^0$	$\overline{Q_{12}}^0$	q_{12}
X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	q_{12}

Note 1 : ↑ : Change from low-to high-level
$\overline{Q}^0$: Output state $\overline{Q}$ before clock input changed
X : Irrevant
q^0 : The content of shift register before clock changed
q : The content of shift register

ABSOLUTE MAXIMUM RATINGS (T_a=−40~+85℃, unless otherwise noted)

Symbol	Parameter		Conditions	Ratings	Unit
V_{CC}	Supply voltage			−0.5~+7.0	V
V_I	Input voltage			−0.5~V_{CC}+0.5	V
V_O	Output voltage			−0.5~V_{CC}+0.5	V
I_{IK}	Input protection diode current		V_I<0V	−20	mA
			V_I>V_{CC}	20	
I_{OK}	Output parasitic diode current		V_O<0V	−20	mA
			V_O>V_{CC}	20	
I_O	Output current	$\overline{Q_1}$~$\overline{Q_{12}}$, SQ_{12}		±3	mA
I_{CC}	Supply/GND current		V_{CC}, GND	±20	mA
P_d	Power dissipation		(Note 2)	500	mW
Tstg	Storage temperature range			−65~+150	℃

Note 2 : For M66320FP, a derating of 7mW/℃ should be made when Ta≧75℃

RECOMMENDED OPERATING CONDITIONS (T_a=−40~+85℃)

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
V_{CC}	Supply voltage	4.5	5	5.5	V
V_I	Input voltage	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	V
Topr	Operating temprature range	−40		+85	℃
t_r, t_f	Input rise time, fall time S-IN, $\overline{OE}$	0		500	ns

ELECTRICAL CHARACTERISTICS (V_{CC}=4.5V~5.5V, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits					Unit
				T_a=25℃			T_a=−40~+85℃		
				Min	Typ	Max	Min	Max	
V_{IH}	High-level input voltage S-IN, $\overline{OE}$	V_O=0.1V, V_{CC}−0.1V $\lvert I_O \rvert$ = 20μA		0.70×V_{CC}			0.70×V_{CC}		V
V_{IL}	Low-level input voltage S-IN, $\overline{OE}$	V_O=0.1V, V_{CC}−0.1V $\lvert I_O \rvert$ =20μA				0.30×V_{CC}		0.30×V_{CC}	V
V_{T+}	Positive threshold voltage CK, $\overline{LE}$	V_O=0.1V, V_{CC}−0.1V $\lvert I_O \rvert$ = 20μA		0.35×V_{CC}		0.8×V_{CC}	0.35×V_{CC}	0.8×V_{CC}	V
V_{T-}	Negative threshold voltage CK, $\overline{LE}$	V_O=0.1V, V_{CC}−0.1V $\lvert I_O \rvert$ = 20μA		0.2×V_{CC}		0.65×V_{CC}	0.2×V_{CC}	0.65×V_{CC}	V
V_{OH}	High-level output voltage $\overline{Q_1}$~$\overline{Q_{12}}$, SQ_{12}	V_I=V_{T+}, V_{T-} V_{CC}=4.5V	I_{OH}=−20μA	V_{CC}−0.1			V_{CC}−0.1		V
			I_{OH}=−1.0mA	4.1			4.0		
V_{OL}	Low-level output voltage $\overline{Q_1}$~$\overline{Q_{12}}$, SQ_{12}	V_I=V_{T+}, V_{T-} V_{CC}=4.5V	I_{OL}=20μA			0.1		0.1	V
			I_{OL}=1.0mA			0.4		0.5	
I_{CC}	Static supply current	When input is open, V_{CC}=5.5V				20.0		200.0	μA
		V_I=V_{CC}, GND, V_{CC}=5.5V				1.5		2.2	mA

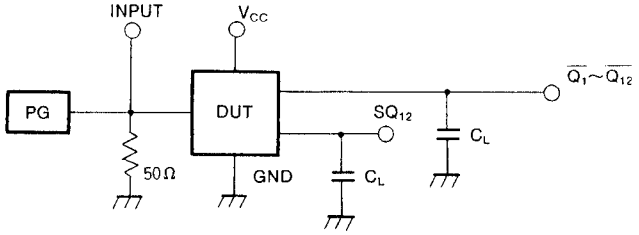
SWITCHING CHARACTERISTICS (V_{CC}=5V)

Symbol	Parameter	Test conditions	Limits					Unit
			T_a=25℃			T_a=−40~+85℃		
			Min	Typ	Max	Min	Max	
f_{max}	Maximum repetitive frequency	C_L=15pF (Note 3)	3			2.5		MHz
t_{PLH}	Low-to high-level and high-to low-level output propagation time from CK to SQ_{12}				300		400	ns
t_{PHL}					300		400	ns
t_{PLH}	Low-to high-level and high-to low-level output propagation time from CK to $\overline{Q_1}$~$\overline{Q_{12}}$				300		400	ns
t_{PHL}					300		400	ns
t_{PLH}	Low-to high-level and high-to low-level output propagation time from $\overline{OE}$ to $\overline{Q_1}$~$\overline{Q_{12}}$				300		400	ns
t_{PHL}					300		400	ns
t_{PLH}	Low-to high-level and high-to low-level output propagation time from $\overline{LE}$ to $\overline{Q_1}$~$\overline{Q_{12}}$				300		400	ns
t_{PHL}					300		400	ns

TIMING REQUIREMENTS (V_{CC}= 5 V)

Symbol	Parameter	Test conditions	Limits					Unit
			T_a=25℃			T_a=−40~+85℃		
			Min	Typ	Max	Min	Max	
t_w	CK pulse width		160			200		ns
t_{su}	S-IN setup time with respect to CK		80			100		ns
t_h	S-IN hold time with respect to CK		80			100		ns

Note 3 : Test circuit



(1) The pulse generator (PG) has the following characteristics (10%~90%) : t_r=6ns, t_f=6ns
(2) The capacitance C_L includes stray wiring capacitance and the probe input capacitance.

TIMING DIAGRAM