

8-bit serial input and output shift register

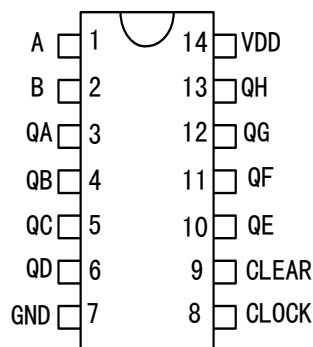
- AND-Gated (Enable/Disable) Serial Inputs
- Fully Buffered Clock and Serial Inputs
- Direct Clear
- Package Options Include Plastic Small-Outline (D) and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPS

DESCRIPTION

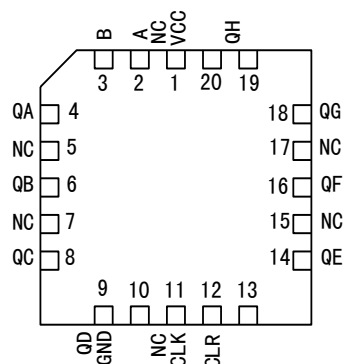
These 8-bit shift registers feature AND-gated serial inputs and an asynchronous clear (CLR) input. The gated serial (A and B) inputs permit complete control over incoming data; a low at either input inhibits entry of the new data and resets the first flip-flop to the low level at the next clock (CLK) pulse. A high-level input enables the other input, which then determines the state of the first flip-flop. Data at the serial inputs can be changed while CLK is high or low, provided the minimum setup time requirements are met. Clocking occurs on the low-to-high-level transition of CLK.

The 54HC164 is characterized for operation over the full military temperature range of -55°C to 125°C . The 74HC164 is characterized for operation from -40°C to 85°C .

54HC164...J OR W PACKAGE
74HC164...D OR N PACKAGE



54HC164...FK PACKAGE (TOP VIEW)



NC=NO internal connection

FUNCTION TABLE

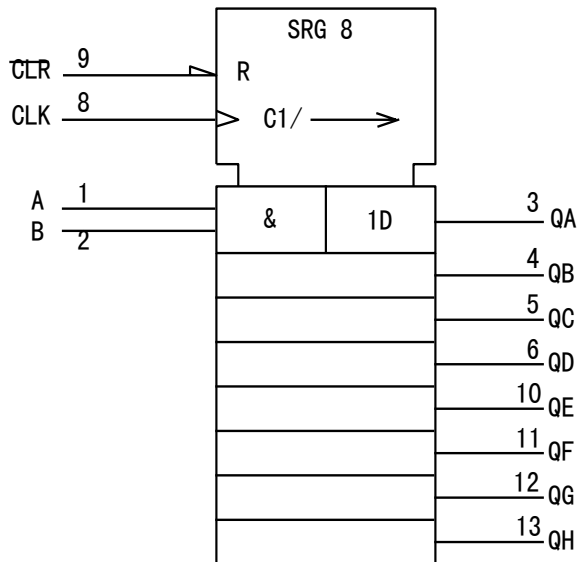
| INPUTS | | | | OUTPUTS | | |
|--------|-----|---|---|---------|---------|-----|
| CLR | CLK | A | B | QA | QB...QH | |
| L | X | X | X | L | L | L |
| H | L | X | X | QA0 | QB0 | QH0 |
| H | ↑ | H | H | H | QAn | QGn |
| H | ↑ | L | X | L | QAn | QGn |
| H | ↑ | X | L | L | QAn | QGn |

QA0, QB0, QH0=the level of QA, QB, or QH, respectively, before the indicated steady-state input conditions were established

QAn, QGn=the level of QA or QG before the most recent ↑ transition of

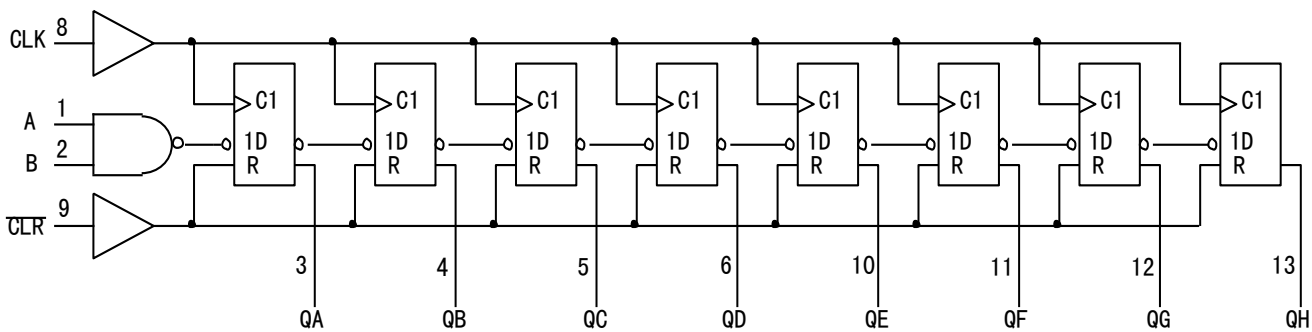
CLK: indicates a 1-bit shift

LOGIC SYMBOL



- This symbol is in accordance with ANS/IEEE Std 91-1984 and IEC publication 617-12.
- Pin numbers shown are for the D, J, N, and W packages.

LOGIC DIAGRAM (positive logic)



Pin numbers shown are for the D, J, N and W packages.

RECOMMENDED OPERATING CONDITIONS

| | | 54HC164 | | | 74HC164 | | | UNIT |
|--|-----------------------|---------|-----|-----------------|---------|-----|-----------------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | | 2 | 5 | 6 | 2 | 5 | 6 | |
| V _{IH} High-level input voltage | V _{CC} =2V | 1.5 | - | - | 1.5 | - | - | |
| | V _{CC} =4.5V | 3.15 | - | - | 3.15 | - | - | |
| | V _{CC} =6V | 4.2 | - | - | 4.2 | - | - | |
| V _{IL} Low-level input voltage | V _{CC} =2V | 0 | - | 0.5 | 0 | - | 0.5 | |
| | V _{CC} =4.5V | 0 | - | 1.35 | 0 | - | 1.35 | |
| | V _{CC} =6V | 0 | - | 1.8 | 0 | - | 1.8 | |
| V _I Input voltage | | 0 | - | V _{CC} | | 0 | V _{CC} | V |
| V _O Output voltage | | 0 | - | V _{CC} | | 0 | V _{CC} | V |
| t _T Input transition (rise and fall) time | V _{CC} =2V | 0 | - | 1000 | 0 | - | 1000 | ns |
| | V _{CC} =4.5V | 0 | - | 500 | 0 | - | 500 | |
| | V _{CC} =6V | 0 | - | 400 | 0 | - | 400 | |
| T _A Operating free-air temperature | | -55 | - | 125 | -40 | - | 85 | °C |

T If this device is used in the threshold region (from V_{IL} max=0.5V to V_{IH} min=1.5V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at tt=1000ns and V_{CC}=2V does not damage the device; however, functionally, the CLK inputs are not ensured while in the shift, count, or toggle operating modes.

Electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A =25°C | | | 54HC164 | | 74HC164 | | UNIT | |
|-----------------|---|-------------------------|----------------------|-------|-------|---------|-------|---------|-------|------|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | | |
| V _{OH} | V _I =V _{IH} or V _{IL} | I _{OH} =-20uA | 2V | 1.9 | 1.998 | - | 1.9 | - | 1.9 | - | V |
| | | | 4.5V | 4.4 | 4.499 | - | 4.4 | - | 4.4 | - | |
| | | 6V | 5.9 | 5.999 | - | 5.9 | - | 5.9 | - | | |
| | | I _{OH} =-4mA | 4.5V | 3.98 | 4.3 | - | 3.7 | - | 3.84 | - | |
| | | I _{OH} =-5.2mA | 6V | 5.48 | 5.8 | - | 5.2 | - | 5.34 | - | |
| V _{OL} | V _I =V _{IH} or V _{IL} | I _{OL} =20uA | 2V | - | 0.002 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 4.5V | - | 0.001 | 0.1 | - | 0.1 | - | 0.1 | |
| | | | 6V | - | 0.001 | 0.1 | - | 0.1 | - | 0.1 | |
| | | I _{OL} =4mA | 4.5V | - | 0.17 | 0.26 | - | 0.4 | - | 0.33 | |
| | | I _{OL} =5.2mA | 6V | - | 0.15 | 0.26 | - | 0.4 | - | 0.33 | |
| I _I | V _I =V _{CC} or 0 | 6V | - | ±0.1 | ±100 | - | ±1000 | - | ±1000 | nA | |
| I _{CC} | V _I =V _{CC} or 0, I _O =0 | 6V | - | - | 8 | - | 160 | - | 80 | uA | |
| C _I | | 2V to 6V | - | 3 | 10 | - | 10 | - | 10 | pF | |

Timing requirements over recommended operating free-air temperature range (unless otherwise noted)

| | | VCC | T _A =25°C | | 54HC164 | | 74HC164 | | UNIT |
|--|-----------------|------|----------------------|-----|---------|-----|---------|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| f _{clock} Clock frequency | | 2V | 0 | 6 | 0 | 4.2 | 0 | 5 | MHz |
| | | 4.5V | 0 | 31 | 0 | 21 | 0 | 25 | |
| | | 6V | 0 | 36 | 0 | 25 | 0 | 28 | |
| t _w Pulse duration | CLR low | 2V | 100 | - | 150 | - | 125 | - | ns |
| | | 4.5V | 20 | - | 30 | - | 25 | - | |
| | | 6V | 17 | - | 25 | - | 21 | - | |
| | CLK high or low | 2V | 80 | - | 120 | - | 100 | - | |
| | | 4.5V | 16 | - | 24 | - | 20 | - | |
| | | 6V | 14 | - | 20 | - | 18 | - | |
| t _{su} Setup time before CLK ↑ | Data | 2V | 100 | - | 150 | - | 125 | - | ns |
| | | 4.5V | 20 | - | 30 | - | 25 | - | |
| | | 6V | 17 | - | 25 | - | 21 | - | |
| | CLR inactive | 2V | 100 | - | 150 | - | 125 | - | |
| | | 4.5V | 20 | - | 30 | - | 25 | - | |
| | | 6V | 17 | - | 25 | - | 21 | - | |
| t _h Hold time, data after CLK ↑ | 2V | 5 | - | 5 | - | 5 | - | ns | |
| | 4.5V | 5 | - | 5 | - | 5 | - | | |
| | 6V | 5 | - | 5 | - | 5 | - | | |

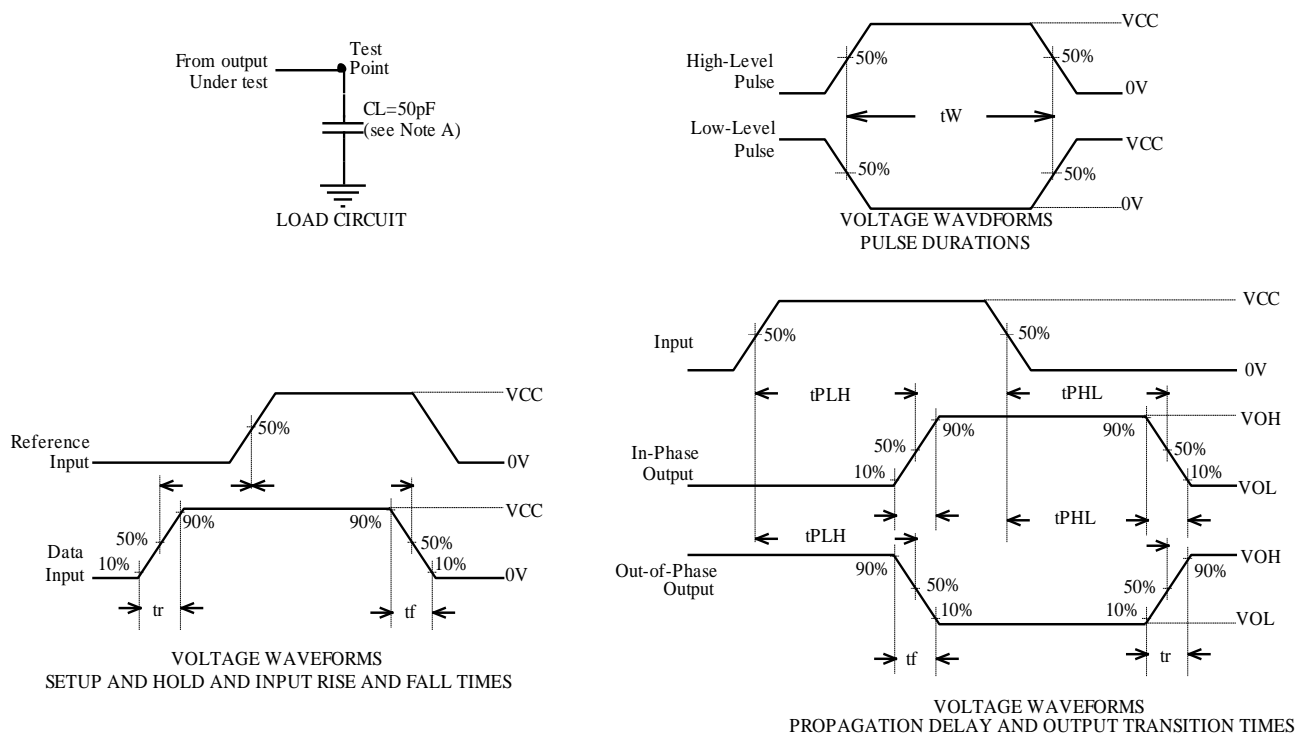
Switching characteristics over recommended operating free-air temperature rang, C_L=50pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | VCC | T _A =25°C | | | 54HC164 | | 74HC164 | | UNIT |
|------------------|--------------|-------------|------|----------------------|-----|-----|---------|-----|---------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| f _{max} | | | 2V | 6 | 10 | - | 4.2 | - | 5 | - | MHz |
| | | | 4.5V | 31 | 54 | - | 21 | - | 25 | - | |
| | | | 6V | 36 | 62 | - | 25 | - | 28 | - | |
| t _{PHL} | CLR | Any Q | 2V | - | 140 | 205 | - | 295 | - | 255 | ns |
| | | | 4.5V | - | 28 | 41 | - | 59 | - | 51 | |
| | | | 6V | - | 24 | 35 | - | 51 | - | 46 | |
| t _{pd} | CLK | Any Q | 2V | - | 115 | 175 | - | 265 | - | 220 | ns |
| | | | 4.5V | - | 23 | 35 | - | 53 | - | 44 | |
| | | | 6V | - | 20 | 30 | - | 45 | - | 38 | |
| t _t | | | 2V | - | 38 | 75 | - | 110 | - | 95 | ns |
| | | | 4.5V | - | 8 | 15 | - | 22 | - | 19 | |
| | | | 6V | - | 6 | 13 | - | 19 | - | 16 | |

Operating characteristics, $T_A=25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|-----------------------------------|-----------------|-----|------|
| Cpd Power dissipation capacitance | No load | 135 | pF |

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and test-fixture capacitance.

B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $\text{PRR} \leq 1\text{MHz}$, $Z_0 = 50\ \Omega$, $t_r = 6\text{ns}$, $t_f = 6\text{ns}$.

C. For clock inputs, f_{max} is measured when the input duty cycle is 50%

D. The outputs are measured one at a time with one input transition per measurement.

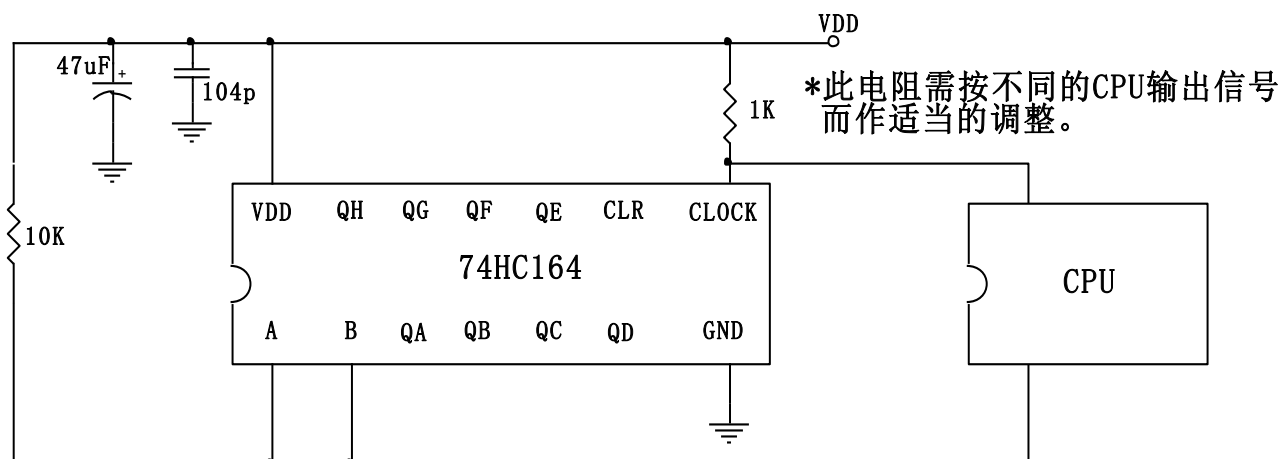
E. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

PAD ASSIGNMENT

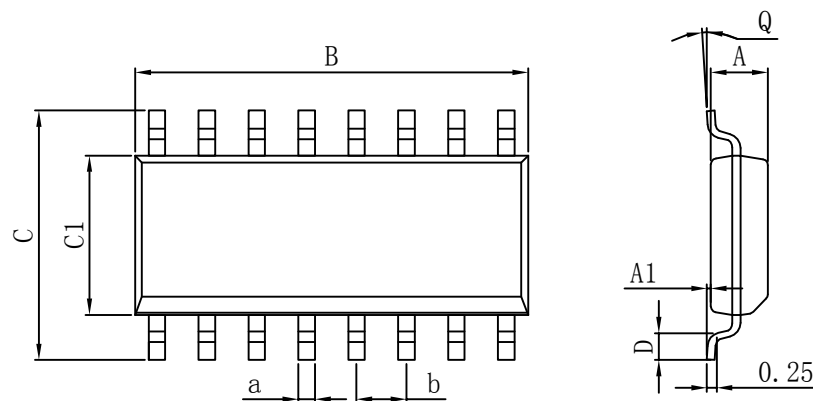
| Pad No | Pad Name | X | Y |
|--------|----------|---------|---------|
| 1 | A | -242.00 | -53.50 |
| 2 | B | -250.00 | 252.00 |
| 3 | QA | -135.00 | -188.50 |
| 4 | QB | 0.00 | -188.50 |
| 5 | QC | 115.00 | -188.50 |
| 6 | QD | 252.00 | -188.50 |
| 7 | GND | 252.00 | -73.50 |
| 8 | CLOCK | 241.85 | 41.50 |
| 9 | CLEAR | 252.00 | 180.50 |
| 10 | QE | 137.00 | 190.50 |
| 11 | QF | 2.00 | 190.50 |
| 12 | QG | -113.00 | 190.50 |
| 13 | QH | -250.00 | 190.50 |
| 14 | VDD | -250.00 | 61.50 |

附图:



封装外形

SOP14



| Dimensions In Millimeters | | | | | |
|---------------------------|-------|-------|----------|-----------|-------|
| Symbol : | Min : | Max : | Symbol : | Min : | Max : |
| A | 4.520 | 4.620 | D | 0.400 | 0.950 |
| A1 | 0.100 | 0.250 | Q | 0° | 8° |
| B | 8.500 | 9.000 | a | 0.420TYP | |
| C | 5.800 | 6.250 | b | 1.270 TYP | |
| C1 | 3.800 | 4.000 | | | |