



ELECTRONICS, INC.  
 44 FARRAND STREET  
 BLOOMFIELD, NJ 07003  
 (973) 748-5089  
<http://www.nteinc.com>

## NTE74193 Integrated Circuit TTL – Synchronous 4–Bit Up/Down Counter

**Description:**

The NTE74193 is a synchronous 4–bit binary reversible up/down counter in a 16–Lead plastic DIP type package having the complexity of 55 equivalent gates. Synchronous operation is provided by having all flip–flops clocked simultaneously so that the outputs change coincident with each other when so instructed by the steering logic. This mode of operation eliminates the output counting spikes normally associated with asynchronous (ripple clock) counters.

The outputs of the four master–slave flip–flops are triggered by a low–to–high transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high.

This counter is fully programmable; that is, each output may be preset to either level by entering the desired data of the data inputs while the load input is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counter to be used as a modulo–N divider by simply modifying the count length with the preset inputs.

A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. The clear, count, and load inputs are buffered to lower the drive requirements. This reduces the number of clock drivers, etc., required for long words.

This device was designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up–counting and down–counting functions. The borrow output produces a pulse equal in width to the count–up input when an overflow condition exists. The counter can then be easily cascaded by feeding the borrow and carry outputs to the count–down and count–up inputs respectively of the succeeding counter.

**Features:**

- Cascading Circuitry Provided Internally
- Synchronous Operation
- Individual Preset to Each Flip–Flop
- Fully Independent Clear Input

**Absolute Maximum Ratings:** (Note 1)

Supply Voltage, $V_{CC}$ .....	7V
DC Input Voltage, $V_{IN}$ .....	5.5V
Power Dissipation, $P_D$ .....	325mW
Operating Temperature Range, $T_A$ .....	0°C to +70°C
Storage Temperature Range, $T_{stg}$ .....	–65°C to +150°C

Note 1. Unless otherwise specified, all voltages are referenced to GND.

**Recommended Operating Conditions:**

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$	4.75	5.0	5.25	V
High-Level Output Current	$I_{OH}$	–	–	–0.4	mA
Low-Level Output Current	$I_{OL}$	–	–	16	mA
Clock Frequency	$f_{clock}$	0	–	25	MHz
Width of Any Input Pulse	$t_w$	20	–	–	ns
Data Setup Time	$t_{su}$	20	–	–	ns
Data Hold Time, High or Low	$t_h$	0	–	–	ns
LOAD Hold Time	$t_h$	3	–	–	ns
Operating Temperature Range	$T_A$	0	–	+70	°C

**Electrical Characteristics:** (Note 2, Note 3)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
High-Level Input Voltage	$V_{IH}$		2	–	–	V
Low-Level Input Voltage	$V_{IL}$		–	–	0.8	V
Input Clamp Voltage	$V_{IK}$	$V_{CC} = \text{MIN}, I_I = -12\text{mA}$	–	–	–1.5	V
High Level Output Voltage	$V_{OH}$	$V_{CC} = \text{MIN}, V_{IH} = 2\text{V}, V_{IL} = 0.8\text{V}, I_{OH} = -0.4\text{mA}$	2.4	3.4	–	V
Low Level Output Voltage	$V_{OL}$	$V_{CC} = \text{MIN}, V_{IH} = 2\text{V}, V_{IL} = 0.8\text{V}, I_{OL} = 16\text{mA}$	–	0.2	0.4	V
Input Current	$I_I$	$V_{CC} = \text{MAX}, V_I = 5.5\text{V}$	–	–	1	mA
High Level Input Current	$I_{IH}$	$V_{CC} = \text{MAX}, V_I = 2.4\text{V}$	–	–	40	$\mu\text{A}$
Low Level Input Current	$I_{IL}$	$V_{CC} = \text{MAX}, V_I = 0.4\text{V}$	–	–	–1.6	mA
Short-Circuit Output Current	$I_{OS}$	$V_{CC} = \text{MAX}, \text{Note 4}$	–18	–	–65	mA
Supply Current	$I_{CC}$	$V_{CC} = \text{MAX}, \text{Note 5}$	–	65	102	mA

Note 2. For conditions shown as MIN or MAX, use the appropriate value specified under “Recommended Operation Conditions”.

Note 3. All typical values are at  $V_{CC} = 5\text{V}, T_A = +25^\circ\text{C}$ .

Note 4. Not more than one output should be shorted at a time.

Note 5.  $I_{CC}$  is measured with all outputs open, clear and load inputs grounded, and all other inputs at 4.5V.

**Switching Characteristics:** ( $V_{CC} = 5\text{V}, T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Clock Frequency	$f_{max}$	$R_L = 400\Omega, C_L = 15\text{pF}$	25	32	–	MHz
Propagation Delay Time (From UP Input to Any $\overline{CO}$ Output)	$t_{PLH}$		–	17	26	ns
	$t_{PHL}$		–	16	24	ns
Propagation Delay Time (From DOWN Input to $\overline{BO}$ Output)	$t_{PLH}$		–	16	24	ns
	$t_{PHL}$		–	16	24	ns
Propagation Delay Time (From UP or DOWN Input to Q Output)	$t_{PLH}$		–	25	38	ns
	$t_{PHL}$		–	31	47	ns
Propagation Delay Time (From LOAD Input to Q Output)	$t_{PLH}$		–	27	40	ns
	$t_{PHL}$		–	29	40	ns
Propagation Delay Time (From CLR Input to Q Output)	$t_{PHL}$		–	22	35	ns

### Pin Connection Diagram

