# DN74LS290 N74LS290

## Decade Counters

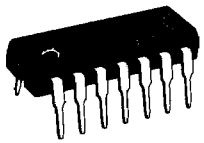
### ■ Description

DN74LS290 is an asynchronous decade counter with a direct-coupled reset input and nine direct-coupled set inputs.

### ■ Features

- Direct-coupled reset input
- Nine direct-coupled set inputs
- Capability for independent use as binary and quinary counters
- High-speed counting ($f_{max}$ = 42MHz typical)
- Wide operating temperature range (Ta = −20 to +75°C)

P-1

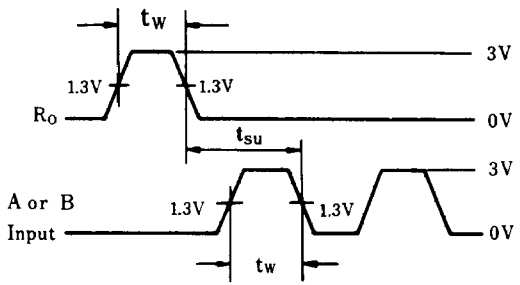


14-pin plastic DIL package

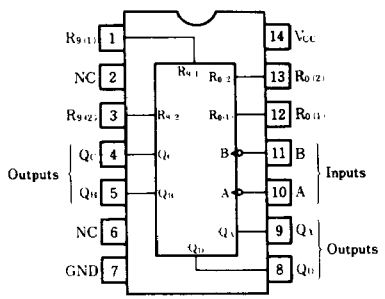
P-4

14-pin Panaflat package (SO-14D)

### ■ Timing definition




Pin configuration (top view)




### ■ Absolute maximum ratings

| Parameter | | Sym. | Rating | | Unit |
|---|---|---|---|---|---|
| Input voltage | R | $V_I$ | −0.5 | 7.0 | V |
| | A, B | | −0.5 | 5.5 | |

* Refer to the family ratings for other parameters.

### ■ Recommended operating conditions

| Parameter | | Sym | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply voltage | | $V_{CC}$ | 4.75 | 5.00 | 5.25 | V |
| Output current | | $I_{OH}$ | | | −400 | μA |
| | | $I_{OL}$ | | | 8 | mA |
| Operating temperature range | | Topr | −20 | 25 | 75 | ℃ |
| Count frequency | A input | $f_{count}$ | 0 | | 32 | MHz |
| | B input | | 0 | | 16 | MHz |
| Pulse width | A input | $t_w$ | 15 | | | ns |
| | B input | | 30 | | | ns |
| | Reset input | | 15 | | | ns |
| Set-up time | | $t_{su}$ | 25 | | | ns |

## ■ DC characteristics ($Ta = -20 \sim +75℃$)

| Parameter | | Sym | Test conditions | | Min | Typ* | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Input voltage | | $V_{IH}$ | | | 2.0 | | | V |
| | | $V_{IL}$ | | | | | 0.8 | V |
| Output voltage** | | $V_{OH}$ | $V_{CC}=4.75V$, $V_{IH}=2V$<br>$V_{IL}=0.8V$, $I_{OH}=-400\mu A$ | | 2.7 | 3.4 | | V |
| | | $V_{OL1}$ | $V_{CC}=4.75V$<br>$V_{IH}=2V$<br>$V_{IL}=0.8V$ | $I_{OL}=4mA$ | | 0.25 | 0.4 | V |
| | | $V_{OL2}$ | | $I_{OL}=8mA$ | | 0.35 | 0.5 | V |
| Input current | Any Reset | $I_{IH}$ | $V_{CC}=5.25V$<br>$V_I=2.7V$ | | | | 20 | $\mu A$ |
| | A input | | | | | | 40 | $\mu A$ |
| | B input | | | | | | 80 | $\mu A$ |
| | Any Reset | $I_{IL}$ | $V_{CC}=5.25V$<br>$V_I=0.4V$ | | | | −0.4 | mA |
| | A input | | | | | | −2.4 | mA |
| | B input | | | | | | −3.2 | mA |
| | Any Reset | $I_I$ | $V_{CC}=5.25V$ | $V_I=7V$ | | | 0.1 | mA |
| | A input | | | $V_I=5.5V$ | | | 0.2 | mA |
| | B input | | | | | | 0.4 | mA |
| Output short circuit current*** | | $I_{OS}$ | $V_O=0V$<br>$V_{CC}=5.25$ | | −15 | | −100 | mA |
| Input clamp voltage | | $V_{IK}$ | $V_{CC}=4.75V$<br>$I_I=-18mA$ | | | | −1.5 | V |
| Supply current**** | | $I_{CC}$ | $V_{CC}=5.25V$ | | | 9 | 15 | mA |

* When constant at $V_{CC}$ = 5V, Ta = 25°C.

** When testing $Q_A$ output, a current to which the rated upper limit value for the $I_{IL}$ of the B input has been added is applied to the specified $I_{OL}$.

*** Only one output at a time short circuited to GND. Also, short circuit time to GND within 1 second.

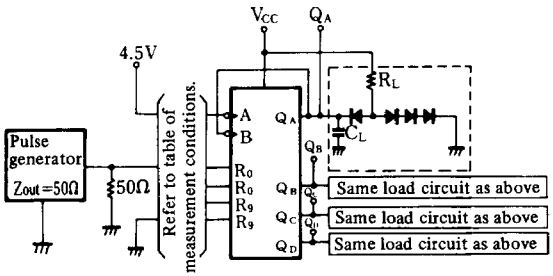
**** $I_{CC}$ is measured with all outputs open and all inputs except both $R_O$ inputs grounded; 4.5V applied momentarily to both $R_O$ inputs, following which they are grounded.

## ■ Switching characteristics ($V_{CC}=5V$, $Ta=25℃$)

| Parameter | Sym | Inputs | Outputs | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Maximum count frequency | $f_{max}$ | A | $Q_A$ | $R_L=2k\Omega$<br>$C_L=15pF$ | 32 | 42 | | MHz |
| | | B | $Q_B$ | | 16 | | | MHz |
| Propagation delay time | $t_{PLH}$ | A | $Q_A$ | | | 10 | 16 | ns |
| | $t_{PHL}$ | | | | | 12 | 18 | ns |
| | $t_{PLH}$ | A | $Q_D$ | | | 32 | 48 | ns |
| | $t_{PHL}$ | | | | | 34 | 50 | ns |
| | $t_{PLH}$ | B | $Q_B$ | | | 10 | 16 | ns |
| | $t_{PHL}$ | | | | | 14 | 21 | ns |
| | $t_{PLH}$ | B | $Q_C$ | | | 21 | 32 | ns |
| | $t_{PHL}$ | | | | | 23 | 35 | ns |
| | $t_{PLH}$ | B | $Q_D$ | | | 21 | 32 | ns |
| | $t_{PHL}$ | | | | | 23 | 35 | ns |
| | $t_{PHL}$ | Set-to-0 | $Q_A \sim Q_D$ | | | 26 | 40 | ns |
| | $t_{PLH}$ | Set-to-9 | $Q_A$, $Q_D$ | | | 20 | 30 | ns |
| | $t_{PHL}$ | | $Q_B$, $Q_C$ | | | 26 | 40 | ns |

※ Switching parameter measurement information

### 1. Measurement circuit




1. $C_L$ includes probe and tool floating capacitance.
2. Diodes are all MA161.

### 2. Table of measurement conditions

| Parameter | Input / Output | Inputs A | Inputs B | Inputs $R_0$ | Inputs $R_9$ | Outputs $Q_A$ | Outputs $Q_B$ | Outputs $Q_C$ | Outputs $Q_D$ |
|---|---|---|---|---|---|---|---|---|---|
| $f_{max}$ | A →Q | IN | to $Q_A$ | GND | GND | OUT | OUT | OUT | OUT |
| | B**→Q | 4.5V | IN | GND | GND | | OUT | OUT | OUT |
| $t_{PLH}$ $t_{PHL}$ | A →$Q_A$ | IN | to $Q_A$ | GND | GND | OUT | | | |
| | A →$Q_D$ | IN | to $Q_A$ | GND | GND | | | | OUT |
| | B**→$Q_B$ | 4.5V | IN | GND | GND | | OUT | | |
| | B**→$Q_C$ | 4.5V | IN | GND | GND | | | OUT | |
| | B**→$Q_D$ | 4.5V | IN | GND | GND | | | | OUT |
| | $R_0$ →Q*** | IN* | to $Q_A$ | IN | GND | OUT | OUT | OUT | OUT |
| | $R_9$ →Q*** | IN* | to $Q_A$ | GND | IN | OUT | OUT | OUT | OUT |

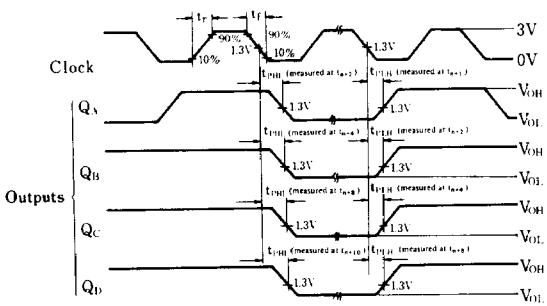
* Applied for initialization.

** For characteristic measurement from B input, $Q_A$ and B are disconnected and pulse is applied to B input.

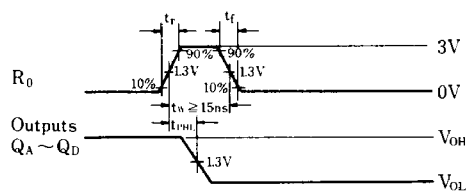
*** Measured for each terminal; 4.5V applied to terminals to which input pulse is not applied.

### 3.Waveforms

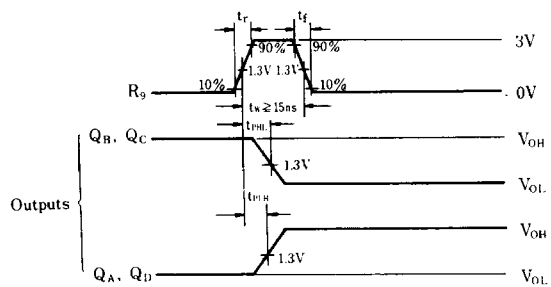
Waveforms-1 $f_{max}$, $t_{PLH}$, $t_{PHL}$ (Clock → Q)




Waveforms-2 $t_{PHL}$ ($R_0$ → Q)




Waveforms-3 $t_{PLH}$, $t_{PHL}$ ($R_9$ → Q)




Notes
1. Input waveform: $t_r \leqq 15ns$, $t_f \leqq 6ns$,
   PRR = 1MHz, duty cycle = 50%.
2. Pulse generator output impedance: $Z_{out} = 50$ ohms.
3. $t_n$ is the bit time when all outputs are LOW.

Notes 1. $t_r \leqq 15ns$, $t_f \leqq 5ns$

## ■ Logic diagram