

**CN74F161A-X REV 1B0**

 Original Creation Date: 12/16/96  
 Last Update Date: 06/19/97  
 Last Major Revision Date: 04/17/97

**SYNCHRONOUS PRESETTABLE BINARY COUNTER**
**General Description**

The F161A is a high-speed synchronous modulo-16 binary counter. It is synchronously presettable for application in programmable dividers and has two types of Count Enable inputs plus a Terminal Count output for versatility in forming synchronous multi-stage counters. The F161A has an asynchronous Master-Reset input that overrides all other inputs and forces the outputs LOW. The F161A is a high-speed version of the 'F161.

**Industry Part Number**

74F161A

**NS Part Numbers**

74F161ADC

**Prime Die**

M161A

**Processing**
**Quality Conformance Inspection**
**Subgrp Description Temp ( °C)**

|    |                     |     |
|----|---------------------|-----|
| 1  | Static tests at     | +25 |
| 2  | Static tests at     | +70 |
| 3  | Static tests at     | 0   |
| 4  | Dynamic tests at    | +25 |
| 5  | Dynamic tests at    | +70 |
| 6  | Dynamic tests at    | 0   |
| 7  | Functional tests at | +25 |
| 8A | Functional tests at | +70 |
| 8B | Functional tests at | 0   |
| 9  | Switching tests at  | +25 |
| 10 | Switching tests at  | +70 |
| 11 | Switching tests at  | 0   |

**Features**

- Typical Count Frequency of 120 MHz
- Synchronous Counting and Loading
- High-speed Synchronous Expansion
- Guaranteed 4000V Minimum ESD Protection

**(Absolute Maximum Ratings)**

(Note 1)

|   |                                      |
|---|--------------------------------------|
| Storage Temperature                                   | -65 C to +150 C                      |
| Ambient Temperature under Bias                        | -55 C to +125 C                      |
| Junction Temperature under Bias                       | -55 C to +175 C                      |
| Vcc Pin Potential to Ground Pin                       | -0.5V to +7.0V                       |
| Input Voltage<br>(Note 2)                             | -0.5V to +7.0V                       |
| Input Current<br>(Note 2)                             | -30 mA to +5.0mA                     |
| Voltage Applied to Output in HIGH State (with Vcc=0V) |                                      |
| Standard Output                                       | -0.5V to Vcc                         |
| TRI-STATE Output                                      | -0.5V to +5.5V                       |
| Current Applied to Output in LOW State (Max)          | twice the rated I <sub>ol</sub> (mA) |

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: Either voltage limit or current limit is sufficient to protect inputs.

**Recommended Operating Conditions**

|  |                |
|--|----------------|
| Free Air Ambient Temperature<br>Commercial | 0 C to +70 C   |
| Supply Voltage<br>Commercial               | +4.5V to +5.5V |

## Electrical Characteristics

### DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
DC: VCC 4.5V to 5.5V, 0C to +70C

| SYMBOL | PARAMETER                         | CONDITIONS  | NOTES | PIN-NAME | MIN  | MAX  | UNIT | SUB-GROUPS |
|--------|-----------------------------------|---|-------|----------|------|------|------|------------|
| VIH    | Input HIGH Voltage                | Recognized as a HIGH Signal                         | 1     | INPUTS   | 2.0  |      | V    | 1, 2, 3    |
| VIL    | Input LOW Voltage                 | Recognized as a LOW Signal                          | 1     | INPUTS   |      | 0.8  | V    | 1, 2, 3    |
| VCD    | Input Clamp Diode Voltage         | VCC=4.5V, IIN=-18mA                                 | 2, 3  | INPUTS   |      | -1.2 | V    | 1, 2, 3    |
| VOH    | Output HIGH Voltage               | VCC=4.5V, IOH=-1.0mA                                | 2, 3  | OUTPUTS  | 2.5  |      | V    | 1, 2, 3    |
|        |                                   | VCC=4.75V, IOH=-1.0mA                               | 2, 3  | OUTPUTS  | 2.7  |      | V    | 1, 2, 3    |
| VOL    | Output LOW Voltage                | VCC=4.5V, IOL = 20mA                                | 2, 3  | OUTPUTS  |      | 0.5  | V    | 1, 2, 3    |
| IIH    | Input HIGH Current                | VCC=5.5V, VIN=2.7V                                  | 2, 3  | INPUTS   |      | 5.0  | uA   | 1, 2, 3    |
| IBVI   | Input HIGH Current Breakdown Test | VCC=5.5V, VIN=7.0V                                  | 2, 3  | INPUTS   |      | 7.0  | uA   | 1, 2, 3    |
| ICEX   | Output HIGH Leakage Current       | VCC=5.5V, VOUT = VCC                                | 2, 3  | OUTPUTS  |      | 100  | uA   | 1, 2, 3    |
| VID    | Input Leakage Test                | VCC = 0.0V, IID = 1.9uA, All other pins grounded    | 2, 3  | INPUTS   | 4.75 |      | V    | 1, 2, 3    |
| IOD    | Output Leakage Circuit Current    | VCC = 0.0V, VIOD = 150mV, All other pins grounded   | 2, 3  | OUTPUTS  |      | 4.75 | uA   | 1, 2, 3    |
| IIL    | Input LOW Current                 | VCC=5.5V, VIN=0.5V (CEP,CP, $\overline{MR}$ ,P0-P3) | 2, 3  | INPUTS   |      | -0.6 | mA   | 1, 2, 3    |
|        |                                   | VCC=5.5V, VIN=0.5V (CET, $\overline{PE}$ )          | 2, 3  | INPUTS   |      | -1.2 | mA   | 1, 2, 3    |
| IOS    | Output Short-Circuit Current      | VCC=5.5V, VOUT = 0V                                 | 2, 3  | OUTPUTS  | -60  | -150 | mA   | 1, 2, 3    |
| ICC    | Power Supply Current              | VCC=5.5V  | 2, 3  | VCC      |      | 55   | mA   | 1, 2, 3    |

### AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
AC: CL=50pF, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS. Temp Range: 0C to +70C

|         |   |   |      |          |     |     |     |        |
|---------|---|---|------|----------|-----|-----|-----|--------|
| fMAX    | Maximum Shift Frequency                         | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4    |          | 100 |     | MHZ | 9      |
|         |   |   | 4    |          | 90  |     | MHZ | 10, 11 |
| tpLH(1) | Propagation Delay ( $\overline{PE}$ input HIGH) | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3 | CP to Qn | 3.5 | 7.5 | ns  | 9      |

## Electrical Characteristics

### AC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
AC: CL=50pF, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS. Temp Range: 0C to +70C

| SYMBOL     | PARAMETER                            | CONDITIONS                                    | NOTES | PIN-NAME     | MIN  | MAX  | UNIT | SUB-GROUPS   |
|------------|--------------------------------------|---|-------|--------------|------|------|------|--------------|
| tpLH(1)    | Propagation Delay<br>(PE input HIGH) | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>Qn  | 3.5  | 8.5  | ns   | 10, 11       |
| tpHL(1)    | Propagation Delay<br>(PE input HIGH) | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>Qn  | 3.5  | 10.0 | ns   | 9            |
| tpHL(1)    | Propagation Delay<br>(PE input HIGH) | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>Qn  | 3.5  | 11.0 | ns   | 10, 11       |
| tpLH/HL(2) | Propagation Delay<br>(PE input LOW)  | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>Qn  | 4.0  | 8.5  | ns   | 9            |
| tpLH/HL(2) | Propagation Delay<br>(PE input LOW)  | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>Qn  | 4.0  | 9.5  | ns   | 10, 11       |
| tpLH/HL(3) | Propagation Delay                    | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CP to<br>TC  | 5.0  | 14.0 | ns   | 9            |
|            |                                      |   | 2, 3  | CP to<br>TC  | 5.0  | 15.0 | ns   | 10, 11       |
| tpLH/HL(4) | Propagation Delay                    | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | CET to<br>TC | 2.5  | 7.5  | ns   | 9            |
|            |                                      |   | 2, 3  | CET to<br>TC | 2.5  | 8.5  | ns   | 10, 11       |
| tpHL(5)    | Propagation Delay                    | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | MR to<br>Qn  | 5.5  | 12.0 | ns   | 9            |
|            |                                      |   | 2, 3  | MR to<br>Qn  | 5.5  | 13.0 | ns   | 10, 11       |
| tpHL(6)    | Propagation Delay                    | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 2, 3  | MR to<br>TC  | 4.5  | 10.5 | ns   | 9            |
|            |                                      |   | 2, 3  | MR to<br>TC  | 4.5  | 11.5 | ns   | 10, 11       |
| ts (H/L)1  | Setup Time HIGH<br>or LOW            | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | Pn to<br>CP  | 5.0  |      | ns   | 9, 10,<br>11 |
| th (H/L)1  | Hold Time HIGH<br>or LOW             | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | Pn to<br>CP  | 2.0  |      | ns   | 9, 10,<br>11 |
| ts (H) 2   | Setup Time HIGH                      | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | PE to<br>CP  | 11.0 |      | ns   | 9            |
|            |                                      |   | 4     | PE to<br>CP  | 11.5 |      | ns   | 10, 11       |
| ts (L) 2   | Setup Time LOW                       | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | PE to<br>CP  | 8.5  |      | ns   | 9            |
|            |                                      |   | 4     | PE to<br>CP  | 9.5  |      | ns   | 10, 11       |
| th (H) 2   | Hold Time HIGH                       | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | PE to<br>CP  | 2.0  |      | ns   | 9, 10,<br>11 |

## Electrical Characteristics

### AC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS. Temp Range: 0C to +70C

| SYMBOL   | PARAMETER                   | CONDITIONS                                    | NOTES | PIN-NAME                 | MIN  | MAX | UNIT | SUB-GROUPS   |
|----------|-----------------------------|---|-------|--------------------------|------|-----|------|--------------|
| th (L) 2 | Hold Time LOW               | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | $\overline{PE}$ to<br>CP | 0.0  |     | ns   | 9, 10,<br>11 |
| ts (H) 3 | Setup Time HIGH             | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CEP to<br>CP             | 11.0 |     | ns   | 9            |
|          |                             |   | 4     | CEP to<br>CP             | 11.5 |     | ns   | 10, 11       |
| ts (L) 3 | Setup Time LOW              | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CEP to<br>CP             | 5.0  |     | ns   | 9, 10,<br>11 |
| th (H) 3 | Hold Time HIGH              | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CEP to<br>CP             | 0.0  |     | ns   | 9, 10,<br>11 |
| th (L) 3 | Hold Time LOW               | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CEP to<br>CP             | 0.0  |     | ns   | 9, 10,<br>11 |
| tw (H)   | Pulse Width HIGH<br>(Load)  | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CP                       | 5.0  |     | ns   | 9, 10,<br>11 |
| tw (L)   | Pulse Width LOW<br>(Load)   | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CP                       | 5.0  |     | ns   | 9, 10,<br>11 |
| tw (H)   | Pulse Width HIGH<br>(count) | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CP                       | 4.0  |     | ns   | 9, 10,<br>11 |
| tw (L)   | Pulse Width LOW<br>(count)  | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | CP                       | 6.0  |     | ns   | 9            |
|          |                             |   | 4     | CP                       | 7.0  |     | ns   | 10, 11       |
| tw (L)   | Pulse Width LOW             | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | $\overline{MR}$          | 5.0  |     | ns   | 9, 10,<br>11 |
| tREC     | Recovery Time               | VCC=+5.0V @ +25C,<br>VCC=4.5V & 5.5V @ 0/+70C | 4     | $\overline{MR}$ to<br>CP | 6.0  |     | ns   | 9, 10,<br>11 |

Note 1: Guaranteed by applying specific input condition and testing VOL & VOH.

Note 2: Screen tested 100% on each device at +75 C temperature only, subgroups A2 & A10.

Note 3: Sample tested (Method 5005, Table 1) on each MFG. lot at +75C temperature only, subgroups A2 & A10.

Note 4: Guaranteed but not tested.

**Revision History**

| Rev | ECN #    | Rel Date | Originator       | Changes |
|-----|----------|----------|------------------|---------|
| 1B0 | M0001329 | 06/19/97 | Donald B. Miller |         |