

**MN54ACTQ02-X REV 2A0**

Original Creation Date: 07/11/96  
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 Last Major Revision Date: 03/02/99

**Quad 2-Input NOR Gate**

**General Description**

The ACTQ02 contains four, 2-input NOR gates.

The ACTQ utilize NSC Quiet Series technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series TM features GTO TM output control and undershoot corrector in addition to a split ground bus for superior CMOS performance.

**Industry Part Number**

54ACTQ02

**NS Part Numbers**

54ACTQ02DMQB\*  
 54ACTQ02FMQB\*\*  
 54ACTQ02LMQB\*\*\*

**Prime Die**

D002

**Controlling Document**

5962-92181

**Processing**

MIL-STD-883, Method 5004

**Quality Conformance Inspection**

MIL-STD-883 5005

| Subgrp | Description         | Temp ( °C) |
|--------|---------------------|------------|
| 1      | Static tests at     | +25 C      |
| 2      | Static tests at     | +125 C     |
| 3      | Static tests at     | -55 C      |
| 4      | Dynamic tests at    | +25 C      |
| 5      | Dynamic tests at    | +125 C     |
| 6      | Dynamic tests at    | -55 C      |
| 7      | Functional tests at | +25 C      |
| 8A     | Functional tests at | +125 C     |
| 8B     | Functional tests at | -55 C      |
| 9      | Switching tests at  | +25 C      |
| 10     | Switching tests at  | +125 C     |
| 11     | Switching tests at  | -55 C      |

**Features**

- Icc reduced by 50%
- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Improved latch-up immunity
- Minimum 4kV ESD protection
- Outputs source/sink 24 mA
- ACTQ02 has TTL-compatible inputs
- Standard Military Drawing (SMD)
- ACTQ2: 5962-9218101MCA\*, MDA\*\*, M2A\*\*\*

**(Absolute Maximum Ratings)**

(Note 1)

|   |                    |
|---|--------------------|
| Supply Voltage (Vcc)                                  | -0.5V to +7.0V     |
| DC Input Diode Current (Iik)                          |                    |
| Vi = -0.5V  | -20 mA             |
| Vi = Vcc +0.5V  | +20 mA             |
| DC Input Voltage (Vi)                                 | -0.5V to Vcc +0.5V |
| DC Output Diode Current (Iok)                         |                    |
| Vo = -0.5V  | -20 mA             |
| Vo = Vcc +0.5V  | +20 mA             |
| DC Output Voltage (Vo)                                | -0.5V to Vcc +0.5V |
| DC Output Source or Sink Current (Io)                 | ±50 mA             |
| DC Vcc or Ground Current per Output Pin (Icc or Ignd) | ±50 mA             |
| Storage Temperature (Tstg)                            | -65 C to +150 C    |
| DC Latch-Up Source or Sink Current                    | ±300 mA            |
| Junction Temperature (Tj)                             |                    |
| CDIP  | 175 C              |

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

**Recommended Operating Conditions**

(Note 1)

|   |                 |
|---|-----------------|
| Supply Voltage (Vcc)                      | 4.5V to 5.5V    |
| Input Voltage (Vi)                        | 0V to Vcc       |
| Output Voltage (Vo)                       | 0V to Vcc       |
| Operating Temperature (Ta)                | -55 C to +125 C |
| Minimum Input Edge Rate (Delta V/Delta t) |                 |
| ACTQ Devices                              |                 |
| Vin from 0.8V to 2.0V                     |                 |
| Vcc @ 4.5V, 5.5V                          | 125 mV/ns       |

Note 1: PLCC packaging is not recommended for applications requiring greater than 2000 temperature cycles from -40C to + 125C.

## Electrical Characteristics

### DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)

DC: VCC 4.5V to 5.5V, Temp. Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

| SYMBOL | PARAMETER                   | CONDITIONS                                | NOTES   | PIN-NAME | MIN  | MAX  | UNIT | SUB-GROUPS |
|--------|-----------------------------|---|---------|----------|------|------|------|------------|
| IIH    | High Level Input Current    | VCC=5.5V, VIH=5.5V                        | 1, 2    | INPUT    |      | 0.1  | uA   | 1          |
|        |                             |   | 1, 2    | INPUT    |      | 1.0  | uA   | 2, 3       |
| IIL    | Low Level Input Current     | VCC=5.5V, VIL=0.0V                        | 1, 2    | INPUT    |      | -0.1 | uA   | 1          |
|        |                             |   | 1, 2    | INPUT    |      | -1.0 | uA   | 2, 3       |
| VOL    | Low Level Output Voltage    | VCC=4.5V, VIH=2.0V, VIL=0.8V, IOL=50.0uA  | 1, 2    | OUTPUT   |      | .10  | V    | 1, 2, 3    |
|        |                             | VCC=5.5V, VIH=2.0V, VIL=0.8V, IOL=50.0uA  | 1, 2    | OUTPUT   |      | .10  | V    | 1, 2, 3    |
|        |                             | VCC=4.5V, VIH=2.0V, VIL=0.8V, IOL=24.0mA  | 1, 2    | OUTPUT   |      | .36  | V    | 1          |
|        |                             |   | 1, 2    | OUTPUT   |      | .50  | V    | 2, 3       |
|        |                             | VCC=5.5V, VIH=2.0V, VIL=0.8V, IOL=24.0mA  | 1, 2    | OUTPUT   |      | .36  | V    | 1          |
|        |                             |   | 1, 2    | OUTPUT   |      | .50  | V    | 2, 3       |
| VIOL   | Dynamic Output Current Low  | VCC=5.5V, VIH=5.5V, VIL=0.0V, IOL=50.0mA  | 1, 2, 5 | OUTPUT   |      | 1.65 | V    | 1, 2, 3    |
| VOH    | High Level Output Voltage   | VCC=4.5V, VIH=2.0V, VIL=0.8V, IOL=-50.0uA | 1, 2    | OUTPUT   | 4.40 |      | V    | 1, 2, 3    |
|        |                             | VCC=5.5V, VIH=2.0V, VIL=0.8V, IOL=-50.0uA | 1, 2    | OUTPUT   | 5.40 |      | V    | 1, 2, 3    |
|        |                             | VCC=4.5V, VIH=2.0V, VIL=0.8V, IOL=-24.0mA | 1, 2    | OUTPUT   | 3.86 |      | V    | 1          |
|        |                             |   | 1, 2    | OUTPUT   | 3.70 |      | V    | 2, 3       |
|        |                             | VCC=5.5V, VIH=2.0V, VIL=0.8V, IOL=-24.0mA | 1, 2    | OUTPUT   | 4.86 |      | V    | 1          |
|        |                             |   | 1, 2    | OUTPUT   | 4.70 |      | V    | 2, 3       |
| VIOH   | Dynamic Output Current High | VCC=5.5V, VIH=5.5V, VIL=0.0V, IOL=-50.0mA | 1, 2, 5 | OUTPUT   | 3.85 |      | V    | 1, 2, 3    |
| ICCH   | Positive Supply Current     | VCC=5.5V, VIH=5.5V                        | 1, 2    | VCC      |      | 2.0  | uA   | 1          |
|        |                             |   | 1, 2    | VCC      |      | 40   | uA   | 2, 3       |
| ICCL   | Negative Supply Current     | VCC=5.5V, VIH=0.0V                        | 1, 2    | VCC      |      | 2.0  | uA   | 1          |
|        |                             |   | 1, 2    | VCC      |      | 40   | uA   | 2, 3       |
| ICCT   | Supply Current              | VCC=5.5V, VIH=3.4V                        | 1, 2    | VCC      |      | 1.0  | mA   | 1          |
|        |                             |   | 1, 2    | VCC      |      | 1.6  | mA   | 2, 3       |
| VIKL   |                             | VCC=4.5V, IKL=-18mA                       | 1, 2    | INPUT    |      | -1.2 | V    | 1, 2, 3    |
| VIKH   |                             | VCC=4.5V, IKH=18mA                        | 1, 2    | INPUT    |      | 5.7  | V    | 1, 2, 3    |

## Electrical Characteristics

### DC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 DC: VCC 4.5V to 5.5V, Temp. Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

| SYMBOL | PARAMETER                                | CONDITIONS                     | NOTES | PIN-NAME | MIN | MAX         | UNIT | SUB-GROUPS |
|--------|--|--------------------------------|-------|----------|-----|-------------|------|------------|
| VILD   | Maximum Low Level Dynamic Input Voltage  | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 9  | INPUT    |     | 0.8         | V    | 4          |
| VIHD   | Minimum High Level Dynamic Input Voltage | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 9  | INPUT    | 2.2 |             | V    | 4          |
| VOLP   | Quiet Output Maximum Dynamic VOL         | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 8  | OUTPUT   |     | 1.5         | V    | 4          |
| VOLV   | Quiet Output Minimum Dynamic VOL         | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 8  | OUTPUT   |     | -1.2        | V    | 4          |
| VOHV   | Quiet Output Minimum Dynamic VOH         | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 10 | OUTPUT   |     | VOH<br>-1.0 | V    | 4          |
| VOHP   | Quiet Output Maximum Dynamic VOH         | VCC=5.0V, LOAD 50pF / 500 OHMS | 6, 10 | OUTPUT   |     | VOH<br>+1.0 | V    | 4          |

### AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 AC: CL=50pF, RL=500 OHMS, TR=3.0ns & TF=3.0ns, Temp range: -55C to +125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

|       |                       |          |         |                          |     |     |    |           |
|-------|-----------------------|----------|---------|--------------------------|-----|-----|----|-----------|
| tpLH  | Propagation Delay     | VCC=4.5V | 3, 4, 7 | An/Bn to $\bar{O}n$      | 1.5 | 8.5 | ns | 9         |
|       |                       |          | 3, 4, 7 | An/Bn to $\bar{O}n$      | 1.5 | 9.5 | ns | 10, 11    |
| tpHL  | Propagation Delay     | VCC=4.5V | 3, 4, 7 | An/Bn to $\bar{O}n$      | 1.5 | 8.5 | ns | 9         |
|       |                       |          | 3, 4, 7 | An/Bn to $\bar{O}n$      | 1.5 | 9.5 | ns | 10, 11    |
| tOSLH | OUTPUT to OUTPUT Skew | VCC=4.5V | 6       | $\bar{O}n$ to $\bar{O}n$ |     | 1.0 | ns | 9, 10, 11 |
| tOSHL | OUTPUT to OUTPUT Skew | VCC=4.5V | 6       | $\bar{O}n$ to $\bar{O}n$ |     | 1.0 | ns | 9, 10, 11 |

- Note 1: SCREEN TESTED 100% ON EACH DEVICE AT +25C & +125C TEMPERATURE, SUBGROUPS 1, 2, 7, & 8.  
 Note 2: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A1, 2, 7, & 8.  
 Note 3: SCREEN TESTED 100% ON EACH DEVICE AT +25C TEMPERATURE ONLY SUBGROUP A9.  
 Note 4: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A9 & 10.  
 Note 5: TRANSMISSION LINE DRIVING TEST, GUARDBANDED LIMITS SET FOR +25C, 2 MSEC DURATION MAX.  
 Note 6: GUARANTEED BUT NOT TESTED. (DESIGN CHARACTERIZATION DATA)  
 Note 7: +25C & +125C MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MINIMUM LIMITS.

**(Continued)**

- Note 8: MAX NUMBER OF OUTPUTS DEFINED AS (N). DATA INPUTS ARE DRIVEN 0V TO 3V. ONE OUTPUT @ VOL.
- Note 9: MAX NUMBER OF DATA INPUTS (N) SWITCHING. (N-1) INPUTS SWITCHING 0V TO 3V. INPUT-UNDER-TEST SWITCHING 3V TO THRESHOLD (VILD), 0V TO THRESHOLD (VIHD), FREQ= 1 MHZ.
- Note 10: MAXIMUM NUMBERS OF OUTPUTS DEFINED AS (N). DATA INPUTS ARE DRIVEN 0V TO 3V. ONE OUTPUT @ VOH.

**Revision History**

| Rev | ECN #    | Rel Date | Originator    | Changes  |
|-----|----------|----------|---------------|--|
| 2A0 | M0003289 | 04/27/99 | Linda Collins | Added VOHV and VOHP. Added note 10. Changed the VIOH test conditions from VIH=2.0V to VIH=5.5V and VIL=0.8V to VIL=0.0V. |