



MILITARY DATA SHEET

MN54ACTQ821-X REV 1A0

Original Creation Date: 07/16/96
Last Update Date: 09/11/96
Last Major Revision Date: 07/16/96

10-Bit D-Type Flip-Flop with TRI-STATE Outputs

General Description

The ACTQ821 is a 10-bit D Flip-flop with non-inverting TRI-STATE outputs arranged in a broadside pinout. The ACTQ821 utilizes 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 performance.

Industry Part Number

54ACTQ821

Prime Die

D821

NS Part Numbers

54ACTQ821DMQB
54ACTQ821FMQB
54ACTQ821LMQB

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

- Guaranteed simultaneous switching noise level and dynamic threshold performance
- Guranteed pin-to-pin skew AC performance
- Non-inverting TRI-STATE outputs for bus interfacing
- 4 kV minimum ESD immunity
- Outputs source/sink 24 mA
- Functionally identical to the AM29821

(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) | -0.5 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: All commercial packaging is not recommended for application 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, VM=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, VM=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, VIL=0.8V, IOL=24.0mA, VIH=2.0V | 1, 2 | OUTPUT | | .36 | V | 1 |
| | | | 1, 2 | OUTPUT | | .50 | V | 2, 3 |
| | | VCC=4.5V, VIL=0.8V, IOL=50.0uA, VIH=2.0V | 1, 2 | OUTPUT | | .10 | V | 1, 2, 3 |
| | | | 1, 2 | OUTPUT | | .36 | V | 1 |
| | | VCC=5.5V, VIL=0.8V, IOL=24.0mA, VIH=2.0V | 1, 2 | OUTPUT | | .50 | V | 2, 3 |
| VCC=5.5V, VIL=0.8V, IOL=50.0uA, VIH=2.0V | 1, 2 | OUTPUT | | .10 | V | 1, 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, VIL=0.8V, IOH=-24.0mA, VIH=2.0V | 1, 2 | OUTPUT | 3.86 | | V | 1 |
| | | | 1, 2 | OUTPUT | 3.70 | | V | 2, 3 |
| | | VCC=4.5V, VIL=0.8V, IOH=-50.0uA, VIH=2.0V | 1, 2 | OUTPUT | 4.40 | | V | 1, 2, 3 |
| | | | 1, 2 | OUTPUT | 4.86 | | V | 1 |
| | | VCC=5.5V, VIL=0.8V, IOH=-24.0mA, VIH=2.0V | 1, 2 | OUTPUT | 4.70 | | V | 2, 3 |
| VCC=5.5V, VIL=0.8V, IOH=-50.0uA, VIH=2.0V | 1, 2 | OUTPUT | 5.40 | | V | 1, 2, 3 | | |
| VIOH | Dynamic Output Current HIGH | VCC=5.5V, VIH=5.5V, VIL=0.0V, IOH=-50.0mA | 1, 2, 5 | OUTPUT | 3.85 | | V | 1, 2, 3 |
| ICCH | Supply Current | VCC=5.5V | 1, 2 | VCC | | 8.0 | uA | 1 |
| | | | 1, 2 | VCC | | 160 | uA | 2, 3 |
| ICCL | Supply Current | VCC=5.5V | 1, 2 | VCC | | 8.0 | uA | 1 |
| | | | 1, 2 | VCC | | 160 | uA | 2, 3 |
| IC CZ | Supply Current | VCC=5.5V | 1, 2 | VCC | | 8.0 | uA | 1 |
| | | | 1, 2 | VCC | | 160 | uA | 2, 3 |
| ICCT | Supply Current | VCC=5.5V, VIHT=VCC-2.1V | 1, 2 | VCC | | 1.0 | mA | 1 |
| | | | 1, 2 | VCC | | 1.6 | mA | 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 |
|--------|------------------------------------------|--------------------------------|-------|----------|-----|-------|------|------------|
| IOZH | Maximum TRI-STATE Leakage Current | VCC=4.5V, VIH=2.2V, VM=4.5V | 1, 2 | OUTPUTS | | 0.5 | uA | 1 |
| | | | 1, 2 | OUTPUTS | | 10.0 | uA | 2, 3 |
| | | VCC=5.5V, VIH=2.0V, VM=5.5V | 1, 2 | OUTPUTS | | 0.5 | uA | 1 |
| | | | 1, 2 | OUTPUTS | | 10.0 | uA | 2, 3 |
| IOZL | Maximum TRI-STATE Leakage Current | VCC=4.5V, VIH=2.0V, VM=5.5V | 1, 2 | OUTPUTS | | -0.5 | uA | 1 |
| | | | 1, 2 | OUTPUTS | | -10.0 | uA | 2, 3 |
| | | VCC=5.5V, VIH=2.0V, VM=5.5V | 1, 2 | OUTPUTS | | -0.5 | uA | 1 |
| | | | 1, 2 | OUTPUTS | | -10.0 | uA | 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 |
| 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 |

Electrical Characteristics

AC PARAMETERS

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

AC: CL=50 pf, RL=500 OHMS, TR/TF=3.0ns, Temp range: -55C to +125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

| SYMBOL | PARAMETER | CONDITIONS | NOTES | PIN-NAME | MIN | MAX | UNIT | SUB-GROUPS |
|---------|-------------------------|------------|---------|-----------------------|-----|------|------|------------|
| tpLH | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP to On | 2.5 | 9.5 | ns | 9 |
| | | | 3, 4, 7 | CP to On | 2.5 | 11.5 | ns | 10, 11 |
| tpHL | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP to On | 2.5 | 9.5 | ns | 9 |
| | | | 3, 4, 7 | CP to On | 2.5 | 11.5 | ns | 10, 11 |
| tpZH | Output Enable Time | VCC=4.5V | 3, 4, 7 | \overline{OE} to On | 2.5 | 11.0 | ns | 9 |
| | | | 3, 4, 7 | \overline{OE} to On | 2.5 | 13.0 | ns | 10, 11 |
| tpZL | Output Enable Time | VCC=4.5V | 3, 4, 7 | \overline{OE} to On | 2.5 | 11.0 | ns | 9 |
| | | | 3, 4, 7 | \overline{OE} to On | 2.5 | 13.0 | ns | 10, 11 |
| tpHZ | Output Disable Time | VCC=4.5V | 3, 4, 7 | \overline{OE} to On | 1.0 | 8.5 | ns | 9 |
| | | | 3, 4, 7 | \overline{OE} to On | 1.0 | 9.0 | ns | 10, 11 |
| tpLZ | Output Disable Time | VCC=4.5V | 3, 4, 7 | \overline{OE} to On | 1.0 | 8.5 | ns | 9 |
| | | | 3, 4, 7 | \overline{OE} to On | 1.0 | 9.0 | ns | 10, 11 |
| ts(H/L) | Setup Time HIGH or LOW | VCC=4.5V | 6 | Dn to CP | 3.0 | | ns | 9, 10, 11 |
| th(H/L) | Hold Time HIGH or LOW | VCC=4.5V | 6 | Dn to CP | 2.0 | | ns | 9, 10, 11 |
| tw(H/L) | Pulse Width | VCC=4.5V | 6 | CP | 4.0 | | ns | 9, 10, 11 |
| fmax | Maximum Clock Frequency | | 6 | CP | 95 | | Mhz | 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 MIN. 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.