



## MICROCIRCUIT DATA SHEET

**MV54ACT163-X REV 0A0**

Original Creation Date: 09/29/97

Last Update Date: 08/18/99

Last Major Revision Date: 09/29/97

### Synchronous Presettable Binary Counter

#### General Description

The ACT163 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 multistage counters. The ACT163 has a Synchronous ResetInput that overrides counting and parallel loading and allows the outputs to be simultaneously reset on the rising edge of the clock.

#### Industry Part Number

54ACT163

#### Prime Die

J163

#### NS Part Numbers

54ACT163E-QMLV\*  
54ACT163ERQMLV\*  
54ACT163J-QMLV\*\*  
54ACT163JRQMLV\*\*  
54ACT163W-QMLV\*\*\*  
54ACT163WRQMLV\*\*\*

#### Controlling Document

5962-91723

#### Processing

MIL-STD-883, Method 5004

#### Quality Conformance Inspection

MIL-STD-883, Method 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**

- Synchronous Counting and loading
- High-speed synchronous expansion
- Typical count rate 125 MHz
- Outputs source/sink 24 mA
- ACT163 has TTL-Compatible inputs
- Standard Military Drawing (SMD)
  - ACT163: 5962-9172301V2A\*, VEA\*\*, VFA\*\*\*
  - ACT163: 5962R9172301V2A\*, VEA\*\*, VFA\*\*\*

## (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    |
| Junction Temperature (Tj)                             |                    |
| CDIP                                                  | 175 C              |
| Thermal Resistance, junction-to-case (jc)             | see MIL-STD 1835   |
| Maximum Power Dissipation (pd)                        | 500 mW             |
| Lead temperature (soldering, 10 seconds)              | +300 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 TM circuits outside databook specifications.

## Recommended Operating Conditions

|                                           |                 |
|-------------------------------------------|-----------------|
| 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) |                 |
| ACT Devices                               |                 |
| Vin from 0.8V to 2.0V                     |                 |
| Vcc @ 4.5V, 5.5V                          | 125 mV/ns       |
| Maximum low Level Input Voltage (Vil)     | 0.8 V           |
| Minimum High Level Input Voltage (Vih)    |                 |
| (Note 1)                                  | 3.0 V           |
| Maximum High Level output Current (Ioh)   | -24 mA          |
| Maximum Low Level Output Current (Iol)    | +24 mA          |

Note 1: For dynamic operation, a  $V_{ih}$  level between 2.0V and 3.0V may be recognized by this device as a high logic level input. For static operation, a  $V_{ih}$  greater than or equal to 2.0V will be recognized by this device as a high logic level input. Users are cautioned to verify that this will not affect their system.

## Electrical Characteristics

### DC PARAMETER

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

DC: VCC 4.5V to 5.5V, Temp. Range: -55C to 125C.

| SYMBOL | PARAMETER                   | CONDITIONS                                | NOTES   | PIN-NAME | MIN  | MAX | UNIT | SUB-GROUPS |
|--------|-----------------------------|-------------------------------------------|---------|----------|------|-----|------|------------|
| VOL    | Low Level Output Voltage    | VCC=4.5V, IOL=50.0uA, VIL=0.8V, VIH=3.0V  | 1, 5, 8 | OUTPUT   |      | .10 | V    | 1, 2, 3    |
|        |                             | VCC=5.5V, IOL=50.0uA, VIL=0.8V, VIH=3.0V  | 1, 5, 8 | OUTPUT   |      | .10 | V    | 1, 2, 3    |
|        |                             | VCC=4.5V, IOL=24.0mA, VIL=0.8V, VIH=3.0V  | 1, 5, 8 | OUTPUT   |      | .40 | V    | 1, 3       |
|        |                             |                                           | 1, 5, 8 | OUTPUT   |      | .50 | V    | 2          |
|        |                             | VCC=5.5V, IOL=24.0mA, VIL=0.8V, VIH=3.0V  | 1, 5, 8 | OUTPUT   |      | .40 | V    | 1, 3       |
|        |                             |                                           | 1, 5, 8 | OUTPUT   |      | .50 | V    | 2          |
| VOH    | High Level Output Voltage   | VCC=4.5V, IOH=-50.0uA, VIL=0.8V, VIH=3.0V | 1, 5, 8 | OUTPUT   | 4.40 |     | V    | 1, 2, 3    |
|        |                             | VCC=5.5V, IOH=-50.0uA, VIL=0.8V, VIH=3.0V | 1, 5, 8 | OUTPUT   | 5.40 |     | V    | 1, 2, 3    |
|        |                             | VCC=4.5V, IOH=-24.0mA, VIL=0.8V, VIH=3.0V | 1, 5, 8 | OUTPUT   | 3.70 |     | V    | 1, 2, 3    |
|        |                             | VCC=5.5V, IOH=-24.0mA, VIL=0.8V, VIH=3.0V | 1, 5, 8 | OUTPUT   | 4.70 |     | V    | 1, 2, 3    |
| ICCH   | Supply Current Outputs High | VCC=5.5V, VIH=5.5V                        | 1, 2, 8 | VCC      |      | 100 | nA   | 1          |
|        |                             |                                           | 1, 2, 8 | VCC      |      | 40  | uA   | 2          |
| ICCL   | Supply Current Outputs Low  | VCC=5.5V, VIL=0.0V                        | 1, 2, 8 | VCC      |      | 100 | nA   | 1          |
|        |                             |                                           | 1, 2, 8 | VCC      |      | 40  | uA   | 2          |
| ICCF   | Supply Current Functional   | VCC=5.5V, VIL=0.0V                        | 1, 2, 8 | VCC      |      | 100 | nA   | 1          |
|        |                             |                                           | 1, 2, 8 | VCC      |      | 40  | uA   | 2          |
| ICCT   | Supply Current              | VCC=5.5V, VINH=3.4V                       | 1, 5, 8 | VCC      |      | 1.0 | mA   | 1, 2       |
|        |                             |                                           | 1, 5, 8 | VCC      |      | 1.6 | mA   | 3          |
| IIH    | High Level Input Current    | VCC=5.5V, VIH=5.5V                        | 1, 2, 8 | INPUT    |      | 0.1 | uA   | 1          |
|        |                             |                                           | 1, 2, 8 | INPUT    |      | 1.0 | uA   | 2          |

## Electrical Characteristics

### DC PARAMETER(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.

| SYMBOL | PARAMETER                    | CONDITIONS                                | NOTES      | PIN-NAME | MIN   | MAX  | UNIT | SUB-GROUPS |
|--------|------------------------------|-------------------------------------------|------------|----------|-------|------|------|------------|
| IIL    | Low Level Input Current      | VCC=5.5V, VIL=0.0V                        | 1, 2, 8    | INPUT    |       | -0.1 | uA   | 1          |
|        |                              |                                           | 1, 2, 8    | INPUT    |       | -1.0 | uA   | 2          |
| VIC+   | Positive Input Clamp Voltage | VCC=0.0V, IM=1.0mA                        | 10, 11     | INPUT    | 0.40  | 1.5  | V    | 1          |
| VIC-   | Negative Input Clamp Voltage | VCC=0pen, IM=-1.0mA                       | 10, 11     | INPUT    | -0.40 | -1.5 | V    | 1          |
| VIOL   | Dynamic output current LOW   | VCC=5.5V, IOL=50.0mA, VIL=0.0V, VIH=5.5V  | 1, 5, 8, 9 | OUTPUT   |       | 1.65 | V    | 1, 2, 3    |
| VIOH   | Dynamic output current HIGH  | VCC=5.5V, IOH=-50.0mA, VIL=0.0V, VIH=5.5V | 1, 5, 8, 9 | OUTPUT   | 3.85  |      | V    | 1, 2, 3    |

### AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)  
AC: CL=50pF, RL=500 OHMS, TRISE/TFALL=3.0nS, Temp range: -55C to 125C.

|         |                   |          |         |                 |     |      |    |       |
|---------|-------------------|----------|---------|-----------------|-----|------|----|-------|
| tpLH(1) | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP - Qn (COUNT) | 1.5 | 9.5  | ns | 9, 11 |
|         |                   |          | 3, 4, 7 | CP - Qn (COUNT) | 1.5 | 10.5 | ns | 10    |
| tpHL(1) | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP - Qn (COUNT) | 1.5 | 9.5  | ns | 9, 11 |
|         |                   |          | 3, 4, 7 | CP - Qn (COUNT) | 1.5 | 10.5 | ns | 10    |
| tpLH(2) | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP - Qn (LOAD)  | 1.5 | 9.0  | ns | 9, 11 |
|         |                   |          | 3, 4, 7 | CP - Qn (LOAD)  | 1.5 | 10.0 | ns | 10    |
| tpHL(2) | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP - Qn (LOAD)  | 1.5 | 8.5  | ns | 9, 11 |
|         |                   |          | 3, 4, 7 | CP - Qn (LOAD)  | 1.5 | 9.5  | ns | 10    |
| tpLH(3) | Propagation Delay | VCC=4.5V | 3, 4, 7 | CP - TC         | 1.5 | 11.0 | ns | 9, 11 |
|         |                   |          | 3, 4, 7 | CP - TC         | 1.5 | 12.5 | ns | 10    |

## Electrical Characteristics

### AC PARAMETERS(Continued)

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

AC: CL=50pF, RL=500 OHMS, TRISE/TFALL=3.0nS, Temp range: -55C to 125C.

| SYMBOL     | PARAMETER                       | CONDITIONS | NOTES   | PIN-NAME      | MIN  | MAX  | UNIT | SUB-GROUPS |
|------------|---------------------------------|------------|---------|---------------|------|------|------|------------|
| tpHL(3)    | Propagation Delay               | VCC=4.5V   | 3, 4, 7 | CP - TC       | 1.5  | 12.0 | ns   | 9, 11      |
|            |                                 |            | 3, 4, 7 | CP - TC       | 1.5  | 13.0 | ns   | 10         |
| tpLH(4)    | Propagation Delay               | VCC=4.5V   | 3, 4, 7 | CET to TC     | 1.5  | 8.5  | ns   | 9, 11      |
|            |                                 |            | 3, 4, 7 | CET to TC     | 1.5  | 9.5  | ns   | 10         |
| tpHL(4)    | Propagation Delay               | VCC=4.5V   | 3, 4, 7 | CET to TC     | 1.5  | 9.0  | ns   | 9, 11      |
|            |                                 |            | 3, 4, 7 | CET to TC     | 1.5  | 9.5  | ns   | 10         |
| Fmax(1)    | Maximum Count Frequency         | VCC=4.5V   | 6       | CP            | 100  |      | Mhz  | 9          |
|            |                                 |            | 6       | CP            | 90   |      | Mhz  | 10, 11     |
| tw(H/L)(1) | Clock Pulse Width (HIGH or LOW) | VCC=4.5V   | 6       | CP (COUNT)    | 5.0  |      | ns   | 9, 10, 11  |
| tw(H/L)(2) | Clock Pulse Width (HIGH or LOW) | VCC=4.5V   | 6       | CP (LOAD)     | 5.0  |      | ns   | 9, 10, 11  |
| ts(H/L)(1) | Setup Time (HIGH or LOW)        | VCC=4.5V   | 6       | Pn to CP      | 10.0 |      | ns   | 9          |
|            |                                 |            | 6       | Pn to CP      | 13.5 |      | ns   | 10, 11     |
| th(H/L)(1) | Hold Time (HIGH or LOW)         | VCC=4.5V   | 6       | Pn to CP      | 0.5  |      | ns   | 9, 10, 11  |
| ts(H/L)(2) | Setup Time (HIGH or LOW)        | VCC=4.5V   | 6       | SR to CP      | 10.0 |      | ns   | 9          |
|            |                                 |            | 6       | SR to CP      | 13.5 |      | ns   | 10, 11     |
| th(H/L)(2) | Hold Time (HIGH or LOW)         | VCC=4.5V   | 6       | SR to CP      | 0.0  |      | ns   | 9, 10, 11  |
| ts(H/L)(3) | Setup Time (HIGH or LOW)        | VCC=4.5V   | 6       | PE to CP      | 8.5  |      | ns   | 9          |
|            |                                 |            | 6       | PE to CP      | 11.5 |      | ns   | 10, 11     |
| th(H/L)(3) | Hold Time (HIGH or LOW)         | VCC=4.5V   | 6       | PE to CP      | 0.0  |      | ns   | 9, 10, 11  |
| ts(H/L)(4) | Setup Time (HIGH or LOW)        | VCC=4.5V   | 6       | CET or CEP-CP | 5.5  |      | ns   | 9          |
|            |                                 |            | 6       | CET or CEP-CP | 7.0  |      | ns   | 10, 11     |

## Electrical Characteristics

### AC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)  
AC: CL=50pF, RL=500 OHMS, TRISE/TFALL=3.0nS, Temp range: -55C to 125C.

| SYMBOL     | PARAMETER               | CONDITIONS | NOTES | PIN-NAME      | MIN | MAX | UNIT | SUB-GROUPS |
|------------|-------------------------|------------|-------|---------------|-----|-----|------|------------|
| th(H/L)(4) | Hold Time (HIGH or LOW) | VCC=4.5V   | 6     | CET or CEP-CP | 0.0 |     | ns   | 9          |
|            |                         |            | 6     | CET or CEP-CP | 0.5 |     | ns   | 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 & -55C TEMPERATURE, SUBGROUPS A9 & 10 & 11.
- Note 5: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C, +125C & -55C TEMPERATURE, SUBGROUPS A1, 2, 3, 7 & 8.
- Note 6: DESIGN CHARACTERIZATION DATA ONLY.
- Note 7: MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MINIMUM LIMITS.
- Note 8: GENERAL NOTE DUE TO THE INTERNAL NOISE PROBLEMS THIS COMPONENT CANNOT MEET THE THRESHOLD LIMITS REQUIRED PER MIL-STD-883, TEST METHOD 5005, FOR VIH (VIH = 2.0V + 20 PERCENT). FOR FUNCTIONAL TESTS, USE VIH = 3.0V + 5 PERCENT FOR ALL INPUTS. THE VIL LIMIT (0.8V - 50 PERCENT) REMAINS UNCHANGED. USERS ARE CAUTIONED TO VERIFY THAT THIS CHANGE WILL NOT AFFECT THEIR SYSTEMS.
- Note 9: TRANSMISSION LINE DRIVING TEST, GUARDBANDED LIMITS SET FOR +25 C, 2 MSEC DURATION MAX.
- Note 10: SCREEN TESTED 100% ON EACH DEVICE AT +25C TEMPERATURE ONLY, SUBGROUP A1.
- Note 11: SAMPLE TESTED (METHOD 5005, TABLE 1) AT +25C TEMPERATURE ONLY, SUBGROUP A1.



## Revision History

| Rev | ECN #    | Rel Date | Originator    | Changes             |
|-----|----------|----------|---------------|---------------------|
| 0A0 | M0003403 | 08/18/99 | Linda Collins | Initial MDS Release |