



MICROCIRCUIT DATA SHEET

MN54AC163-X REV 2A0

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Synchronous Presettable Binary Counter

General Description

The AC163 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 AC163 has a Synchronous Reset input that overrides counting and parallel loading and allows the outputs to be simultaneously reset on the rising edge of the clock.

Industry Part Number

54AC163

Prime Die

Z163

NS Part Numbers

54AC163DMQB

54AC163FMQB

54AC163LMQB

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

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

Features

- Icc reduced by 50%
- Synchronous counting and loading
- High-speed synchronous expansion
- Typical count rate of 125 MHZ
- Outputs source/sink 24 mA
- Standard Military Drawing (SMD)
- AC163: 5962-89582

(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)	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

Supply Voltage (Vcc)	2.0V to 6.0V
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)	
AC Devices	
Vin from 30% to 70% of Vcc	
Vcc @ 3.0V, 4.5V, 5.5V	125 mV/ns

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 DC: VCC=3.0V 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=3.0V, VIH=2.1V, VIL=0.9V, IOL=12.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=3.0V, VINH=3.0V, VIH=2.1V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
			1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=5.5V, VINH=5.5V, VIH=3.85V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
			1, 2	OUTPUT		.36	V	1
		VCC=4.5V, VINH=4.5V, VINL=0.0V, VIH=3.15V, VIL=1.35V, IOL=24.0mA	1, 2	OUTPUT		.50	V	2, 3
			1, 2	OUTPUT		.36	V	1
VCC=5.5V, VINH=5.5V, VINL=0.0V, VIH=3.85V, VIL=1.65V, IOL=24.0mA	1, 2	OUTPUT		.36	V	1		
	1, 2	OUTPUT		.50	V	2, 3		
VIOLOW	Dynamic Output Current LOW	VCC=5.5V, VINL=0.0V, VIH=3.85V, VIL=1.65V, IOL=50.0mA	1, 2, 5	OUTPUT		1.65	V	1, 2, 3
VOH	High level output voltage	VCC=3.0V, VINH=3.0V, VIH=2.1V, IOL=50.0uA	1, 2	OUTPUT	2.90		V	1, 2, 3
			1, 2	OUTPUT	4.40		V	1, 2, 3
		VCC=4.5V, VINH=4.5V, VIH=3.15V, IOH=-50.0uA	1, 2	OUTPUT	4.40		V	1, 2, 3
			1, 2	OUTPUT	5.40		V	1, 2, 3
		VCC=5.5V, VINH=5.5V, VIH=3.85V, IOH=-50.0uA	1, 2	OUTPUT	5.40		V	1, 2, 3
			1, 2	OUTPUT	2.56		V	1
		VCC=3.0V, VINH=3.0V, VINL=0.0V, VIH=2.1V, IOH=-12.0mA, VIL=0.9V	1, 2	OUTPUT	2.40		V	2, 3
			1, 2	OUTPUT	2.40		V	2, 3
VCC=4.5V, VINH=4.5V, VINL=0.0V, VIH=3.15V, IOH=-24.0mA, VIL=1.35V	1, 2	OUTPUT	3.86		V	1		
	1, 2	OUTPUT	3.70		V	2, 3		
VCC=5.5V, VINH=5.5V, VINL=0.0V, VIH=3.85V, IOH=-24.0mA, VIL=1.65V	1, 2	OUTPUT	4.86		V	1		
	1, 2	OUTPUT	4.7		V	2, 3		
VIOHIGH	Dynamic Output Current HIGH	VCC=5.5V, VINL=0.0V, VIH=3.85V, IOH=-50.0mA	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
ICCH	Supply Current Outputs HIGH	VCC=5.5V, VINH=5.5V, VINL=0.0V	1, 2	VCC		4	uA	1
			1, 2	VCC		80	uA	2, 3

Electrical Characteristics

DC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
 DC: VCC=3.0V 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
ICCL	Supply Current Outputs LOW	VCC=5.5V, VINL=0.0V	1, 2	VCC		4	uA	1
			1, 2	VCC		80	uA	2, 3

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(1)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn Cnt Mode	1.5	8.0	ns	9
			3, 4, 7	CP to Qn Cnt Mode	1.5	9.5	ns	10, 11
tpHL(1)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn Cnt Mode	1.5	8.0	ns	9
			3, 4, 7	CP to Qn Cnt Mode	1.5	9.5	ns	10, 11
tpLH(2)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn Load Mode	1.5	7.5	ns	9
			3, 4, 7	CP to Qn Load Mode	1.5	9.0	ns	10, 11
tpHL(2)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn Load Mode	1.5	7.0	ns	9
			3, 4, 7	CP to Qn Load Mode	1.5	8.5	ns	10, 11
tpLH(3)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to TC	1.5	9.5	ns	9
			3, 4, 7	CP to TC	1.5	11.0	ns	10, 11
tpHL(3)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to TC	1.5	10.0	ns	9
			3, 4, 7	CP to TC	1.5	11.0	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, tr=3.0ns, 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(4)	Propagation Delay	VCC=4.5V	3, 4, 7	CET to TC	1.5	6.0	ns	9
			3, 4, 7	CET to TC	1.5	7.5	ns	10, 11
tpHL(4)	Propagation Delay	VCC=4.5V	3, 4, 7	CET to TC	1.5	7.5	ns	9
			3, 4, 7	CET to TC	1.5	9.0	ns	10, 11
ts(H/L)(1)	Setup Time HIGH or LOW	VCC=4.5V	6	SR to CP	9.5		ns	9
			6	SR to CP	12.0		ns	10, 11
th(H/L)(1)	Hold Time HIGH or LOW	VCC=4.5V	6	SR to CP	0.0		ns	9, 10, 11
ts(H/L)(2)	Setup Time HIGH or LOW	VCC=4.5V	6	Pn to CP	8.5		ns	9
			6	Pn to CP	11.0		ns	10, 11
th(H/L)(2)	Hold Time HIGH or LOW	VCC=4.5V	6	Pn to CP	0.0		ns	9, 10, 11
ts(H/L)(3)	Hold Time HIGH or LOW	VCC=4.5V	6	PE to CP	8.0		ns	9
			6	PE to CP	9.5		ns	10, 11
th(H/L)(3)	Hold Time HIGH or LOW	VCC=4.5V	6	PE to CP	-0.5		ns	9
			6	PE to CP	0.0		ns	10, 11
ts(H/L)(4)	Setup Time HIGH or LOW	VCC=4.5V	6	CEP or CET to CP	4.5		ns	9
			6	CEP or CET to CP	5.5		ns	10, 11
th(H/L)(4)	Hold Time HIGH or LOW	VCC=4.5V	6	CEP or CET to CP	0.0		ns	9
			6	CEP or CET to CP	0.5		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, tr=3.0ns, 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
tw(H/L) (1)	Clock Pulse Width	VCC=4.5V	6	CP Pulse W Cnt Mod	5.0		ns	9, 10, 11
tw(H/L) (2)	Clock Pulse Width	VCC=4.5V	6	CP Pulse W Ld Mode	5.0		ns	9, 10, 11
Fmax (1)	Maximum Clock Frequency	VCC=4.5V	6		95		MHz	9
			6		90		MHz	10, 11
tpLH (5)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn Count mod	1.0	11.0	ns	9
			3, 4	CP to Qn Count mod	1.0	13.5	ns	10, 11
tpHL (5)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn Cnt Mode	1.0	10.5	ns	9
			3, 4	CP to Qn Cnt Mode	1.0	12.5	ns	10, 11
tpLH (6)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn Load Mode	1.0	10.5	ns	9
			3, 4	CP to Qn Load Mode	1.0	12.5	ns	10, 11
tpHL (6)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn Load Mode	1.0	9.5	ns	9
			3, 4	CP to Qn Load Mode	1.0	12.0	ns	10, 11
tpLH (7)	Propagation Delay	VCC=3.0V	3, 4	CP to TC	1.0	13.5	ns	9
			3, 4	CP to TC	1.0	16.5	ns	10, 11
tpHL (7)	Propagation Delay	VCC=3.0V	3, 4	CP to TC	1.0	12.5	ns	9
			3, 4	CP to TC	1.0	15.0	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, tr=3.0ns, 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(8)	Propagation Delay	VCC=3.0V	3, 4	CET to TC	1.0	9.0	ns	9
			3, 4	CET to TC	1.0	11.0	ns	10, 11
tpHL(8)	Propagation Delay	VCC=3.0V	3, 4	CET to TC	1.0	10.5	ns	9
			3, 4	CET to TC	1.0	12.0	ns	10, 11
ts(H/L)(5)	Set-Up Time HIGH or LOW	VCC=3.0V	6	SR to CP	14.0		ns	9
			6	SR to CP	17.0		ns	10, 11
th(H/L)(5)	Hold Time (HIGH or LOW)	VCC=3.0V	6	SR to CP	-1.0		ns	9
			6	SR to CP	-0.5		ns	10, 11
ts(H/L)(6)	Set-up Time HIGH or LOW	VCC=3.0V	6	Pn to CP	13.5		ns	9
			6	Pn to CP	17.0		ns	10, 11
th(H/L)(6)	Hold Time HIGH or LOW	VCC=3.0V	6	Pn to CP	-1.0		ns	9
			6	Pn to CP	-0.5		ns	10, 11
ts(H/L)(7)	Set-up Time HIGH or LOW	VCC=3.0V	6	PE to CP	12.5		ns	9
			6	PE to CP	16.0		ns	10, 11
th(H/L)(7)	Hold Time HIGH or LOW	VCC=3.0V	6	PE to CP	-1.5		ns	9
			6	PE to CP	-0.5		ns	10, 11
ts(H/L)(8)	Set-up Time HIGH or LOW	VCC=3.0V	6	CEP or CET to CP	6.5		ns	9
			6	CEP or CET to CP	8.0		ns	10, 11
th(H/L)(8)	Hold Time HIGH or LOW	VCC=3.0V	6	CEP or CET to CP	0.0		ns	9, 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, tr=3.0ns, 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
tw(H/L) (3)	Clock Pulse Width	VCC=3.0V	6	CP Pulse W. Cnt Md	5.0		ns	9, 10, 11
tw(H/L) (4)	Clock Pulse Width	VCC=3.0V	6	CP Pulse W. Cnt Md	5.0		ns	9, 10, 11
Fmax (2)	Maximum Clock Frequency	VCC=3.0V	6		70		MHz	9
			6		55		MHz	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, GUARDBAND LIMITS SET FOR +25C, 2 MSEC DURATION MAX.

Note 6: GUARANTEED BUT NOT TESTED (DESIGN CHARACTERIZATION DATA).