National Semiconductor

MILITARY DATA SHEET

MN54AC161-X REV 1A0

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Synchronous Presettable Binary Counter

General Description

The AC161 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 AC161 has an asynchronous Master Reset input that overrides all other inputs and forces the outputs LOW.

Industry Part Number

54AC161

NS Part Numbers

54AC161DMQB
54AC161FMQB
54AC161LMQB

Prime Die

Z161

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (^{o}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)
  - AC161: 5962-89561

(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 TM 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: -55 C to 125 C. 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, VIL=0.9V, VIH=2.1V, IOL=12.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=3.0V, VIL=0.9V, VIH=2.1V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=4.5V, VIL=1.35V, VIH=3.15V, IOL=24.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=4.5V, VIL=1.35V, VIH=3.15V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=5.5V, VIL=1.65V, VIH=3.85V, IOL=24.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=5.5V, VIL=1.65V, VIH=3.85V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
VIOL	Dynamic Output Current LOW	VCC=5.5V, VIL=1.65V, VIH=3.85V, IOL=50.0mA	1, 2, 5	OUTPUT		1.65	V	1, 2, 3
VOH	High level output voltage	VCC=3.0V, VIL=0.9V, VIH=2.1V, IOL=-50.0uA	1, 2	OUTPUT	2.90		V	1, 2, 3
		VCC=3.0V, VIL=0.9V, VIH=2.1V, IOH=-12.0mA	1, 2	OUTPUT	2.56		V	1
			1, 2	OUTPUT	2.40		V	2, 3
		VCC=4.5V, VIL=1.35V, VIH=3.15V, IOH=-24.0mA	1, 2	OUTPUT	3.86		V	1
			1, 2	OUTPUT	3.70		V	2, 3
		VCC=4.5V, VIL=1.35V, VIH=3.15V, IOL=-50.0uA	1, 2	OUTPUT	4.40		V	1, 2, 3
		VCC=5.5V, VIL=1.65V, VIH=3.85V, IOH=-24.0mA	1, 2	OUTPUT	4.86		V	1
			1, 2	OUTPUT	4.70		V	2, 3
		VCC=5.5V, VIL=1.65V, VIH=3.85V, IOH=-50.0uA	1, 2	OUTPUT	5.40		V	1, 2, 3
VIOH	Dynamic Output Current HIGH	VCC=5.5V, VIL=1.65V, VIH=3.85V, IOH=-50.0mA	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
ICCH	Supply Current	VCC=5.5V	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: -55 C to 125 C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
ICCL	Supply Current	VCC=5.5V	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, TRISE=3.0ns, TFALL=3.0ns, Temp Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

tpLH(1)	Propagation Delay	VCC=3.0V	3, 4	CP to QN $\overline{PE}$=HIGH	1.0	12.0	ns	9
			3, 4	CP to QN $\overline{PE}$=HIGH	1.0	14.0	ns	10, 11
tpHL(1)	Propagation Delay	VCC=3.0V	3, 4	CP to QN $\overline{PE}$=HIGH	1.0	12.0	ns	9
			3, 4	CP to QN $\overline{PE}$=HIGH	1.0	14.0	ns	10, 11
tpLH(2)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn $\overline{PE}$= LOW	1.0	12.0	ns	9
			3, 4	CP to Qn $\overline{PE}$= LOW	1.0	14.0	ns	10, 11
tpHL(2)	Propagation Delay	VCC=3.0V	3, 4	CP to Qn $\overline{PE}$= LOW	1.0	12.0	ns	9
			3, 4	CP to Qn $\overline{PE}$= LOW	1.0	14.0	ns	10, 11
tpLH(3)	Propagation Delay	VCC=3.0V	3, 4	CP to TC	3.0	14.0	ns	9
			3, 4	CP to TC	3.0	18.0	ns	10, 11
tpHL(3)	Propagation Delay	VCC=3.0V	3, 4	CP to TC	3.0	14.0	ns	9
			3, 4	CP to TC	3.0	17.5	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, TRISE=3.0ns, TFALL=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=3.0V	3, 4	CET to TC	1.0	10.0	ns	9
			3, 4	CET to TC	1.0	13.0	ns	10, 11
tpHL(4)	Propagation Delay	VCC=3.0V	3, 4	CET to TC	1.0	11.5	ns	9
			3, 4	CET to TC	1.0	13.5	ns	10, 11
tpHL(5)	Propagation Delay	VCC=3.0V	3, 4	$\overline{MR}$ to Qn	1.0	11.5	ns	9
			3, 4	$\overline{MR}$ to Qn	1.0	14.5	ns	10, 11
tpHL(6)	Propagation Delay	VCC=3.0V	3, 4	$\overline{MR}$ to TC	1.0	15.0	ns	9
			3, 4	$\overline{MR}$ to TC	1.0	18.5	ns	10, 11
ts(H/L)(1)	Setup Time HIGH or LOW	VCC=3.0V	6	Pn to CP	11.0		ns	9
			6	Pn to CP	16.0		ns	10, 11
th(H/L)(1)	Hold Time HIGH or LOW	VCC=3.0V	6	Pn to CP	0.0		ns	9
			6	Pn to CP	0.5		ns	10, 11
ts(H/L)(2)	Setup Time HIGH or LOW	VCC=3.0V	6	$\overline{PE}$ to CP	11.5		ns	9
			6	$\overline{PE}$ to CP	15.0		ns	10, 11
th(H/L)(2)	Hold Time HIGH or LOW	VCC=3.0V	6	$\overline{PE}$ to CP	-1.5		ns	9
			6	$\overline{PE}$ to CP	-1.0		ns	10, 11
ts(H/L)(3)	Setup Time HIGH or LOW	VCC=3.0V	6	CEP or CET to CP	6.0		ns	9
			6	CEP or CET to CP	7.5		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, TRISE=3.0ns, TFALL=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
th(H/L)(3)	Hold Time HIGH or LOW	VCC=3.0V	6	CEP or CET to CP	1.0		ns	9
			6	CEP or CET to CP	2.0		ns	10, 11
tw(H/L)(1)	Clock Pulse Width	VCC=3.0V	6	CP $\overline{PE}$= LOW	5.0		ns	9, 10, 11
tw(H/L)(2)	Clock Pulse Width	VCC=3.0V	6	CP $\overline{PE}$= HIGH	5.0		ns	9, 10, 11
tw(H)(3)	Pulse Width	VCC=3.0V	6	$\overline{MR}$	5.0		ns	9, 10, 11
trec(1)	Recovery Time	VCC=3.0V	6	$\overline{MR}$ to CP	1.5		ns	9, 10, 11
Fmax(1)	Maximum Count Frequency	VCC=3.0V	6	CP	70		MHz	9
			6	CP	55		MHz	10, 11
tpLH(7)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn $\overline{PE}$=HIGH	1.5	8.5	ns	9
			3, 4, 7	CP to Qn $\overline{PE}$=HIGH	1.5	10.0	ns	10, 11
tpHL(7)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn $\overline{PE}$=HIGH	1.5	8.5	ns	9
			3, 4, 7	CP to Qn $\overline{PE}$=HIGH	1.5	10.0	ns	10, 11
tpLH(8)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn $\overline{PE}$=LOW	1.5	8.5	ns	9
			3, 4, 7	CP to Qn $\overline{PE}$=LOW	1.5	10.0	ns	10, 11
tpHL(8)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Qn $\overline{PE}$=LOW	1.5	8.5	ns	9
			3, 4, 7	CP to Qn $\overline{PE}$=LOW	1.5	10.0	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=3.0ns, TFALL=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(9)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to TC	3.0	10.0	ns	9
			3, 4, 7	CP to TC	3.0	13.0	ns	10, 11
tpHL(9)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to TC	3.0	10.5	ns	9
			3, 4, 7	CP to TC	3.0	13.0	ns	10, 11
tpLH(10)	Propagation Delay	VCC=4.5V	3, 4, 7	CET to TC	1.5	6.5	ns	9
			3, 4, 7	CET to TC	1.5	8.5	ns	10, 11
tpHL(10)	Propagation Delay	VCC=4.5V	3, 4, 7	CET to TC	1.5	8.5	ns	9
			3, 4, 7	CET to TC	1.5	10.5	ns	10, 11
tpHL(11)	Propagation Delay	VCC=4.5V	3, 4, 7	$\overline{MR}$ to Qn	1.5	8.5	ns	9
			3, 4, 7	$\overline{MR}$ to Qn	1.5	10.5	ns	10, 11
tpHL(12)	Propagation Delay	VCC=4.5V	3, 4, 7	$\overline{MR}$ to TC	1.5	11.5	ns	9
			3, 4, 7	$\overline{MR}$ to TC	1.5	14.0	ns	10, 11
ts(H/L)(4)	Setup Time HIGH or LOW	VCC=4.5V	6	Pn to CP	7.5		ns	9
			6	Pn to CP	10.5		ns	10, 11
th(H/L)(4)	Hold Time HIGH or LOW	VCC=4.5V	6	Pn to CP	1.5		ns	9, 10, 11
ts(H/L)(5)	Setup Time HIGH or LOW	VCC=4.5V	6	$\overline{PE}$ to CP	7.5		ns	9
			6	$\overline{PE}$ to CP	10.5		ns	10, 11
th(H/L)(5)	Hold Time HIGH or LOW	VCC=4.5V	6	$\overline{PE}$ to CP	-0.5		ns	9
			6	$\overline{PE}$ to CP	0.0		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=3.0ns, TFALL=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
ts(H/L)(6)	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)(6)	Hold Time HIGH or LOW	VCC=4.5V	6	CEP or CET to CP	2.0		ns	9, 10, 11
tw(H/L)(4)	Clock Pulse Width	VCC=4.5V	6	CP $\overline{PE}$= LOW	5.0		ns	9, 10, 11
tw(H/L)(5)	Clock Pulse Width	VCC=4.5V	6	CP $\overline{PE}$= HIGH	5.0		ns	9, 10, 11
tw(L)(6)	Clock Pulse Width	VCC=4.5V	6	$\overline{MR}$	5.0		ns	9, 10, 11
trec(2)	Recovery Time	VCC=4.5V	6	$\overline{MR}$ to CP	1.5		ns	9
			6	$\overline{MR}$ to CP	2.0		ns	10, 11
Fmax(2)	Maximum Count Frequency	VCC=4.5V	6	CP	95		MHz	9
			6	CP	80		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).
Note 7: +25C & +125C MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MIN. LIMITS.