National Semiconductor

MILITARY DATA SHEET

MN54F160A-X REV 1A0

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SYNCHRONOUS PRESETTABLE BCD DECADE COUNTER

General Description

The F160A is a high-speed synchronous decade counter operating in the BCD (8421) sequence. 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 F160A has an asynchronous Master Reset Input that overrides all other inputs and forces the outputs LOW. The F160A is a high speed version of the F160.

Industry Part Number

54F160A

NS Part Numbers

54F160ADMQB
54F160AFMQB
54F160ALMQB

Prime Die

M160A

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

- Synchronous Counting and Loading
- High-Speed Synchronous Expansion
- Typical Count Rate of 120 MHZ

(Absolute Maximum Ratings)

(Note 1)

Storage Temperature	-65 C to +150 C
Ambient Temperature under Bias	-55 C to +125 C
Junction Temperature under Bias	-55 C to +175 C
Vcc Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage (Note 2)	-0.5V to +7.0V
Input Current (Note 2)	-30 mA to +5.0mA
Voltage Applied to Output in HIGH State (with Vcc=0V)	
Standard Output	-0.5V to Vcc
TRI-STATE Output	-0.5V to +5.5V
Current Applied to Output in LOW State (Max)	twice the rated Iol(mA)
ESD Last Passing Voltage (Min)	4000V

Note 1: Absolute Maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.
Note 2: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Free Air Ambient Temperature	
Commercial	0 C to +70 C
Military	-55 C to +125 C
Supply Voltage	
Military	+4.5V to +5.5V
Commercial	+4.5V to +5.5V

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
IIH	Input High Current	VCC=5.5V, VM=2.7V, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		20	uA	1, 2, 3
IBVI	Input High Current	VCC=5.5V, VM=7.0V, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		100	uA	1, 2, 3
IIL	Input LOW Current $\overline{MR}$, CP, CEP, Pn	VCC=5.5V, VM=0.5V, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		-0.6	mA	1, 2, 3
IIL2	Input LOW Current CET, $\overline{PE}$	VCC=5.5V, VM=0.5V, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		-1.2	mA	1, 2, 3
VOL	Output LOW Voltage	VCC=4.5V, VIH=2.0V, IOL=20mA, VINH=5.5V, VIL=0.8V, VINL=0.0V	1, 3	OUTPUTS		0.5	V	1, 2, 3
VOH	Output HIGH Voltage	VCC=4.5V, VIL=0.8V, IOH=-1.0mA, VIH=2.0V, VINH=5.5V, VINL=0.0V	1, 3	OUTPUTS	2.5		V	1, 2, 3
IOS	Short Circuit Current	VCC=5.5V, VINH=5.5V, VM=0.0V, VINL=0.0V	1, 3	OUTPUTS	-60	-150	mA	1, 2, 3
VCD	Input Clamp Diode Voltage	VCC=4.5V, IM=-18mA, VINH=5.5V	1, 3	INPUTS		-1.2	V	1, 2, 3
ICC	Supply Current	VCC=5.5V, VINL=0.0V, VINH=5.5V	1, 3	VCC		55	mA	1, 2, 3
ICEX	Output HIGH Leakage Current	VCC=5.5V, VINL=0.0V, VINH=5.5V, VM=5.5V	1, 3	OUTPUTS		250	uA	1, 2, 3

AC PARAMETER

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

tpLH(1)	Propagation Delay CP to Qn $\overline{PE}$=(High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		3.5	7.5	ns	9
tpLH(1)	Propagation Delay CP to Qn $\overline{PE}$=(High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		3.5	9.0	ns	10, 11
tpHL(1)	Propagation Delay CP to Qn $\overline{PE}$=(High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		3.5	10.0	ns	9
tpHL(1)	Propagation Delay CP to Qn $\overline{PE}$=(High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		3.5	11.5	ns	10, 11
tpLH(2)	Propagation Delay CP to Qn $\overline{PE}$=(LOW)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		4.0	8.5	ns	9
tpLH(2)	Propagation Delay CP to Qn $\overline{PE}$=(LOW)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		4.0	10.0	ns	10, 11
tpHL(2)	Propagation Delay CP to Qn $\overline{PE}$=(LOW)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		4.0	8.5	ns	9

Electrical Characteristics

AC PARAMETER(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpHL(2)	Propagation Delay CP to Qn $\overline{PE}$=(LOW)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4		4.0	10.0	ns	10, 11
tpLH(3)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	CP to TC	5.0	14.0	ns	9
			2, 4	CP to TC	5.0	16.5	ns	10, 11
tpHL(3)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	CP to TC	5.0	14.0	ns	9
			2, 4	CP to TC	5.0	15.5	ns	10, 11
tpLH(4)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	CET to TC	2.5	7.5	ns	9
			2, 4	CET to TC	2.5	9.0	ns	10, 11
tpHL(4)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	CET to TC	2.5	7.5	ns	9
			2, 4	CET to TC	2.5	9.0	ns	10, 11
tpHL(5)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	$\overline{MR}$ to Qn	5.5	12.5	ns	9
			2, 4	$\overline{MR}$ to Qn	5.5	14.0	ns	10, 11
tpHL(6)	Propagation Delay	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	2, 4	$\overline{MR}$ to TC	4.5	10.5	ns	9
			2, 4	$\overline{MR}$ to TC	4.5	12.5	ns	10, 11
ts(H/L)(1)	Setup Time (HIGH or LOW)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	Pn to CP	5.0		ns	9
			5	Pn to CP	5.5		ns	10, 11
th(H/L)(1)	Hold Time (High or Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	Pn to CP	2.0		ns	9
			5	Pn to CP	2.5		ns	10, 11
ts(H)(2)	Setup Time (High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	$\overline{PE}$ to CP	11.0		ns	9
			5	$\overline{PE}$ to CP	13.5		ns	10, 11

Electrical Characteristics

AC PARAMETER(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=50pf, RL=500 OHMS, TR=2.5ns, TF=2.5ns SEE AC FIGS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
ts(L)(2)	Setup Time (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	$\overline{PE}$ to CP	8.5		ns	9
			5	$\overline{PE}$ to CP	10.5		ns	10, 11
th(H)(2)	Hold Time (High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	$\overline{PE}$ to CP	2.0		ns	9, 10, 11
th(L)(2)	Hold Time (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	$\overline{PE}$ to CP	0		ns	9, 10, 11
ts(H)(3)	Setup Time (High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	CEP or CET to CP	11.0		ns	9
			5	CEP or CET to CP	13.0		ns	10, 11
ts(L)(3)	Setup Time (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	CEP or CET to CP	5.0		ns	9
			5	CEP or CET to CP	6.0		ns	10, 11
th(H/L)(3)	Setup Time (High or Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	CEP or CET to CP	0		ns	9, 10, 11
tw(H)(1)	Pulse Width (High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	CP	5.0		ns	9, 10, 11
tw(L)(1)	Pulse Width (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	$\overline{PE}$=(LOW)	5.0		ns	9, 10, 11
tw(H)(2)	Pulse Width (High)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	CP	4.0		ns	9
			5	CP	5.0		ns	10, 11
tw(L)(2)	Pulse Width (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	$\overline{PE}$=(High)	6.0		ns	9
			5	$\overline{PE}$=(High)	8.0		ns	10, 11
tw(L)(3)	Pulse Width (Low)	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	$\overline{MR}$	5.0		ns	9, 10, 11
tREC	Recovery Time	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C	5	$\overline{MR}$ to CP	6.0		ns	9, 10, 11
fMAX	Maximum Count Frequency	VCC=5.0V @25C, VCC=4.5V & 5.5V @-55/125C, TR/TF=1.0ns	5	CP	100		MHz	9
			5	CP	75		MHZ	10, 11

Note 1: Screen tested 100% on each device at +25C, +125C & -55C temperature, subgroups A1,2, 3, 7 & 8.
Note 2: Screen tested 100% on each device at +25C temperature only, subgroup A9.

(Continued)

Note 3: Sample tested (Method 5005, Table 1) on each MFG. lot at +25C, +125C & -55C temperature, subgroups A1, 2, 3, 7 & 8.
Note 4: Sample tested (Method 5005, Table 1) on each MFG. lot at +25C subgroup A9, and periodically at +125C & -55C temperature, subgroups 10 & 11.
Note 5: Guaranteed but not tested. (DESIGN CHARACTERIZATION DATA)

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