National Semiconductor

MICROCIRCUIT DATA SHEET

MN54F192-X REV 2A0

Original Creation Date: 03/28/96
Last Update Date: 06/16/98
Last Major Revision Date: 05/12/98

UP/DOWN DECADE COUNTER WITH SEPARATE UP/DOWN CLOCKS

General Description

The F192 is an up/down BCD decade (8421) counter. Separate Count Up and Count Down Clocks are used, and in either counting mode the circuits operate synchronously. The outputs change state synchronously with the LOW-to-HIGH transitions on the clock inputs.

Separate Terminal Count Up and Terminal Count Down outputs are used as the clocks for a subsequent stage without extra logic, thus simplifying multistage counter designs. Individual preset inputs allow the circuit to be used as a programmable counter. Both the Parallel Load ($\overline{PL}$) and the Master Reset (MR) inputs asynchronously override the clocks.

Industry Part Number

54F192

NS Part Numbers

54F192DM
54F192DMQB
54F192FMQB

Prime Die

M192

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

(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)	-30mA to +5.0 mA
Voltage Applied to Output in HIGH State (with Vcc=0V)	
Standard Output	-0.5V to Vcc
TRI-STATE Output	-0.5V to +5.5V

Note 1: Absolute maximum ratings are 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 PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: VCC 4.5V to 5.5V, -55 C to 125 C

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
IIH	Input High Current	VCC=5.5V, VM=2.7V, VINH=5.5V	1, 3	INPUTS		20	uA	1, 2, 3
IBVI	Input High Current	VCC=5.5V, VM=7.0V, VINH=5.5V	1, 3	INPUTS		100	uA	1, 2, 3
IIL	Input LOW Current	VCC=5.5V, VM=0.5V, VINL=0.0V, VINH=5.5V	1, 3	OTHER		-0.6	mA	1, 2, 3
IIL2	Input LOW Current	VCC=5.5V, VM=0.5V, VINH=5.5V	1, 3	CPD, CPU INPUTS		-1.8	mA	1, 2, 3
VOL	Output LOW Voltage	VCC=4.5V, VIL=0.8V, VIH=2.0V, IOL=20mA, VINH=5.5V, VINL=0.0V	1, 3	OUTPUTS		0.5	V	1, 2, 3
VOH	Output HIGH Voltage	VCC=4.5V, VIL=0.8V, VINH=5.5V, VIH=2.0V, IOH=-1.0mA	1, 3	OUTPUTS	2.5		V	1, 2, 3
IOS	Short-Circuit Current	VCC=5.5V, VINH=5.5V, VINL=0.0V, VM=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 PARAMETERS

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

tpLH(1)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{PL}$ to Qn	5.0	11.0	ns	9
			2, 4	$\overline{PL}$ to Qn	5.0	13.5	ns	10, 11
tpHL(1)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{PL}$ to Qn	5.5	13.0	ns	9
			2, 4	$\overline{PL}$ to Qn	5.5	15.0	ns	10, 11
tpLH(2)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	CPU or CPD to Qn	4.0	8.5	ns	9
			2, 4	CPU or CPD to Qn	4.0	10.0	ns	10, 11

Electrical Characteristics

AC PARAMETERS(Continued)

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpHL(2)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	CPU or CPD to Qn	5.5	12.5	ns	9
			2, 4	CPU or CPD to Qn	5.5	14.0	ns	10, 11
tpLH(3)	Propagation Delay CPn to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		4.0	9.0	ns	9
tpLH(3)	Propagation Delay CPn to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		4.0	10.5	ns	10, 11
tpHL(3)	Propagation Delay CPn to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		3.5	8.0	ns	9
tpHL(3)	Propagation Delay CPn to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		3.5	9.5	ns	10, 11
tpHL(4)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to Qn	5.5	14.5	ns	9
			2, 4	MR to Qn	5.5	16.0	ns	10, 11
tpLH(5)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	Pn to Qn	3.0	7.0	ns	9
			2, 4	Pn to Qn	3.0	8.5	ns	10, 11
tpHL(5)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	Pn to Qn	6.0	14.5	ns	9
			2, 4	Pn to Qn	6.0	16.5	ns	10, 11
tpLH(6)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	Pn to $\overline{TCU}$/$\overline{TCD}$	6.0	14.5	ns	9
			2, 4	Pn to $\overline{TCU}$/$\overline{TCD}$	6.0	16.5	ns	10, 11
tpHL(6)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	Pn to $\overline{TCU}$/$\overline{TCD}$	5.5	14.0	ns	9
			2, 4	Pn to $\overline{TCU}$/$\overline{TCD}$	5.5	16.5	ns	10, 11
tpLH(7)	Propagation Delay $\overline{PL}$ to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		7.0	15.5	ns	9
tpLH(7)	Propagation Delay $\overline{PL}$ to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		7.0	18.5	ns	10, 11
tpHL(7)	Propagation Delay $\overline{PL}$ to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		7.0	14.5	ns	9

Electrical Characteristics

AC PARAMETERS(Continued)

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpHL(7)	Propagation Delay $\overline{PL}$ to $\overline{TCU}$ or $\overline{TCD}$	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4		7.0	17.5	ns	10, 11
tpLH(8)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to $\overline{TCU}$	6.0	13.5	ns	9
			2, 4	MR to $\overline{TCU}$	6.0	15.0	ns	10, 11
tpHL(8)	Propagation Delay	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to $\overline{TCD}$	6.0	14.5	ns	9
			2, 4	MR to $\overline{TCD}$	6.0	16.0	ns	10, 11
ts(H/L)	Setup Time (High or Low)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	5	Pn to $\overline{PL}$	4.5		ns	9
			5	Pn to $\overline{PL}$	6.0		ns	10, 11
th(H/L)	Hold Time (High or Low)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	5	Pn to $\overline{PL}$	2.0		ns	9, 10, 11
tw(L)	Pulse Width (Low)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	5	$\overline{PL}$	6.0		ns	9
			5	$\overline{PL}$	7.5		ns	10, 11
tw (L)	Pulse Width (Low)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C TR/TF=1.0ns	5	CPU or CPD	5.0		ns	9
			5	CPU or CPD	7.0		ns	10, 11
tw (H)	Pulse Width (High)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C TR/TF=1.0ns	5	MR	6.0		ns	9, 10, 11
tw (L)	Pulse Width (Low)	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C TR/TF=1.0ns	5	CPn(chg-dir)	10.0		ns	9
			5	CPn(chg-dir)	12.0		ns	10, 11
tREC	Recovery Time	VCC=5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	5	MR to CPU or CPD	4.0		ns	9
			5	MR to CPU or CPD	4.5		ns	10, 11
		VCC= 5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C	5	$\overline{PL}$ to CPU or CPD	6.0		ns	9
			5	$\overline{PL}$ to CPU or CPD	8.0		ns	10, 11

Electrical Characteristics

AC PARAMETERS(Continued)

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
fMAX	Maximum CLock Frequency	VCC= 5.0V @ 25C, VCC=4.5V & 5.5V @ -55/125C TR/TF=1.0ns	5		100		MHZ	9
			5		75		MHZ	10, 11

Note 1: Screen tested 100% on each device at -55C, +25C & +125C temperature, subgroups A1, 2, 3, 7 & 8.
Note 2: Screen tested 100% on each device at +25C temperature only, subgroup A9.
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, & periodically at +125C & -55C temperature, subgroups 10 & 11.
Note 5: Guaranteed but not tested. (DESIGN CHARACTERIZATION DATA)

Revision History

Rev	ECN #	Rel Date	Originator	Changes
2A0	M0002891	06/16/98	Linda Collins	New update: MN54F192-X Rev. 2A0. Changed tH (L) in the AC electricals test symbol section to tH (H/L). Changed Hold Time (Low) in the AC Parameter column to Hold Time (High or Low).

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