National Semiconductor

MILITARY DATA SHEET

MN54F190-X REV 1A0

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UP/DOWN DECADE COUNTER WITH PRESET AND RIPPLE CLOCK

General Description

The F190 is a reversible BCD (8421) decade counter featuring synchronous counting and asynchronous presetting. The preset feature allows the F190 to be used in programmable deviders. The Count Enable input, the Terminal Count output and the Ripple Clock output make possible a variety of methods of implementing multistage counters. In the counting modes, state changes are initiated by the rising edge of the clock.

Industry Part Number

54F190

NS Part Numbers

54F190DMQB
54F190FMQB
54F190LMQB

Prime Die

M190

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

- High-speed-125 MHZ Typical Count Frequency
- Synchronous Counting
- Asynchronous Parallel Load
- Cascadable

(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)

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, -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	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(1)	Input LOW Current	VCC=5.5V, VM=0.5V, VINL=0.0V, VINH=5.5V	1, 3	OTHER		-0.6	mA	1, 2, 3
VOL	Output LOW Voltage	VCC=4.5V, VIL=0.8V, VIH=2.0V, IOL=20mA	1, 3	OUTPUTS		0.5	V	1, 2, 3
VOH	Output High Voltage	VCC=4.5V, VIL=0.8V, VINH=5.5, VIH=2.0V, VINL=0.0V, IOH=-1.0mA	1, 3	OUTPUTS	2.5		V	1, 2, 3
IOS	Output 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	Power Supply Current	VCC=5.5V, VINL=0.0V	1, 3	VCC		55	mA	1, 2, 3
ICEX	Output High Leakage Current	VCC=5.5V, VINL=0.0V	1, 3	Outputs		250	uA	1, 2, 3
IIL(2)	Input LOW Current	VCC=5.5V, VM=0.5V, VINH=5.5V	1, 3	$\overline{CE}$		-1.8	mA	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	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to Qn	3.0	7.5	ns	9
			2, 4	CP to Qn	3.0	9.5	ns	10, 11
tpHL(1)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to Qn	5.0	11.0	ns	9
			2, 4	CP to Qn	5.0	13.5	ns	10, 11
tpLH(2)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to TC	6.0	13.0	ns	9
			2, 4	CP to TC	6.0	16.5	ns	10, 11
tpHL(2)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to TC	5.0	11.0	ns	9
			2, 4	CP to TC	5.0	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
tpLH(3)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to $\overline{RC}$	3.0	7.5	ns	9
			2, 4	CP to $\overline{RC}$	3.0	9.5	ns	10, 11
tpHL(3)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	CP to $\overline{RC}$	3.0	7.0	ns	9
			2, 4	CP to $\overline{RC}$	3.0	9.0	ns	10, 11
tpLH(4)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	Pn to Qn	3.0	7.0	ns	9
			2, 4	Pn to Qn	3.0	9.0	ns	10, 11
tpHL(4)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	Pn to Qn	6.0	13.0	ns	9
			2, 4	Pn to Qn	6.0	16.0	ns	10, 11
tpLH(5)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{CE}$ to $\overline{RC}$	3.0	7.0	ns	9
			2, 4	$\overline{CE}$ to $\overline{RC}$	3.0	9.0	ns	10, 11
tpHL(5)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{CE}$ to $\overline{RC}$	3.0	7.0	ns	9
			2, 4	$\overline{CE}$ to $\overline{RC}$	3.0	9.0	ns	10, 11
tpLH(6)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{PL}$ to Qn	5.0	11.0	ns	9
			2, 4	$\overline{PL}$ to Qn	5.0	13.0	ns	10, 11
tpHL(6)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{PL}$ to Qn	5.5	12.0	ns	9
			2, 4	$\overline{PL}$ to Qn	5.5	14.5	ns	10, 11
tpLH(7)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	U/D to $\overline{RC}$	7.0	18.0	ns	9
			2, 4	U/D to $\overline{RC}$	7.0	22.0	ns	10, 11
tpHL(7)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	U/D to $\overline{RC}$	5.5	12.0	ns	9
			2, 4	U/D to $\overline{RC}$	5.5	14.0	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
tpLH(8)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{U}$/D to TC	4.0	10.0	ns	9
			2, 4	$\overline{U}$/D to TC	4.0	13.5	ns	10, 11
tpHL(8)	Propagation Delay	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	2, 4	$\overline{U}$/D to TC	4.0	10.0	ns	9
			2, 4	$\overline{U}$/D to TC	4.0	12.5	ns	10, 11
ts(H/L)(1)	Setup Time HIGH or LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	$\overline{U}$/D to CP	12.0		ns	9, 10, 11
th(H/L)(1)	Hold Time HIGH or LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	$\overline{U}$/D to CP	0		ns	9, 10, 11
ts(H/L)(2)	Setup Time HIGH or LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	Pn to $\overline{PL}$	4.5		ns	9
			5	Pn to $\overline{PL}$	6.0		ns	10, 11
th(H/L)(2)	Hold Time HIGH or LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	Pn to $\overline{PL}$	2.0		ns	9, 10, 11
ts(L)(3)	Setup Time LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	$\overline{CE}$ to CP	10.0		ns	9
			5	$\overline{CE}$ to CP	10.5		ns	10, 11
th(L)(3)	Hold Time LOW	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	$\overline{CE}$ to CP	0		ns	9, 10, 11
tw(L)	Pulse Width	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C TR=1.0ns, TF=1.0ns	5	$\overline{PL}$	6.0		ns	9
			5	$\overline{PL}$	8.5		ns	10, 11
tw (L)	Pulse Width	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C TR=1.0ns, TF=1.0ns	5	CP	5.0		ns	9
			5	CP	7.0		ns	10, 11
tREC	Recovery Time	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C	5	$\overline{PL}$ to CP	6.0		ns	9
			5	$\overline{PL}$ to CP	7.5		ns	10, 11
fMAX(1)	Maximum Clock Frequency	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C TR=1.0ns, TF=1.0ns	5	Q0, Q1, Q2, Q3	100		MHZ	9
			5	Q0, Q1, Q2, Q3	75		MHZ	10, 11
fMAX(2)	Maximum Clock Frequency	VCC=5.5V @25C, VCC=4.5 & 5.5V @ -55C/125C TR=1.0ns, TF=1.0ns	5	$\overline{RC}$	75		MHZ	9
			5	$\overline{RC}$	50		MHZ	10, 11

(Continued)

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.
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)