National Semiconductor

MILITARY DATA SHEET

MN54F402-X REV 1A0

Original Creation Date: 05/02/96
Last Update Date: 07/30/96
Last Major Revision Date: 05/02/96

SERIAL DATA POLYNOMIAL GENERATOR/CHECKER

General Description

The F402 expandable Serial Data Polynomial generator/checker is an expandable version of the F401. It provides an advanced tool for the implementation of the most widely used error detection scheme in serial digital handling systems. A 4-bit control input selects one-of-six generator polynomials. The list of polynomials includes CRC-16, CRC-CCITT and Ethernet, as well as three other standard polynomials (56th order, 48th order, 32nd order). Individual clear and preset inputs are provided for floppy disk and other applications. The Error output indicates whether or not a transmission error has occurred. The CWG Control input inhibits feedback during check word transmission. The F402 is compatible with Advanced Schotty TTL (FAST) devices and is fully compatible with all TTL families.

Industry Part Number

54F402

NS Part Numbers

54F402DMQB
54F402FMQB
54F402LMQB

Prime Die

M402

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

- Guaranteed 30 MHZ Data Rate
- Six Selectabl Polynomials
- Other Polynomials Available
- Separate Preset and Clear Controls
- Expandable
- Automatic Right Justification
- Error Output Open Collector
- Typical Applications
  - Floppy and Other Disk Storage Systems
  - Digital Cassette and Cartridge Systems
  - Data Communication Systems

(Absolute Maximum Ratings)
(Note 1)

Storage Temperature	-65C to +150C
Ambient Temperature under Bias	-55C to +125C
Junction Temperature under Bias	-55C to +175C
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 +5.0 mA
Voltage Applied to Output is 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 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, 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	VCC=5.5V, VM=0.5V, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		-400	uA	1, 2, 3
VOL (1)	Output LOW Voltage	VCC=4.5V, VIL=0.7V, IOL=8mA, VIH=2.0V, VINH=5.5V, VINL=0.0V	1, 3	OUTPUTS (Pin 9)		0.4	V	1, 2, 3
VOL (2)	Output LOW Voltage	VCC=4.5V, VIL=0.7V, IOL=4mA, VIH=2.0V, VINH=5.5V, VINL=0.0V	1, 3	OUTPUTS PINS 10,11		0.4	V	1, 2, 3
VOH	Output HIGH Voltage	VCC=4.5V, VIH=2.0V, IOH=-2.0mA, VIL=0.7V, VINH=5.5, VINL=0.0V	1, 3	OUTPUTS PINS 10,11	2.4		V	1, 2, 3
IOS	Short-Circuit Current	VCC=5.5V, VINH=5.5V, VM=0.0V, VINL=0.0V	1, 3	OUTPUTS PINS 10,11	-20	-100	mA	1, 2, 3
VCD	Input Clamp Diode Voltage	VCC=4.5V, IM=-18mA, VINH=5.5V, VINL=0.0V	1, 3	INPUTS		-1.5	mA	1, 2, 3
ICC	Supply Current	VCC=5.5V, VINH=5.5V	1, 3	VCC		165	mA	1, 2, 3
ICEX	Output HIGH Leakage Current	VCC=5.5V, VINH=5.5V, VINL=0.0V, VM=5.5V	1, 3	OUTPUTS		10	mA	1, 2, 3
IOH	Open Collector, Output OFF Leakage Test	VCC=4.5V, VM=4.5V, VINH=5.5V, VINL=0.0V	1, 3	OUTPUT (Pin 9)		250	uA	1, 2, 3

AC PARAMETERS

(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=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to D/CW	8.5	19.0	ns	9
			2, 4	CP to D/CW	7.5	26.5	ns	10, 11
tpHL(1)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to D/CW	10.5	23.0	ns	9
			2, 4	CP to D/CW	9.5	26.5	ns	10, 11
tpLH(2)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to RO	8.0	17.0	ns	9
			2, 4	CP to RO	7.0	26.0	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=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 @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to RO	8.0	18.0	ns	9
			2, 4	CP to RO	7.0	22.5	ns	10, 11
tpLH(3)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to $\overline{ER}$	15.5	33.0	ns	9
			2, 4	CP to $\overline{ER}$	14.0	38.5	ns	10, 11
tpHL(3)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CP to $\overline{ER}$	8.5	18.5	ns	9
			2, 4	CP to $\overline{ER}$	7.5	23.5	ns	10, 11
tpLH(4)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{P}$ to D/CW	11.0	23.5	ns	9
			2, 4	$\overline{P}$ to D/CW	10.0	31.0	ns	10, 11
tpHL(4)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{P}$ to D/CW	11.5	24.5	ns	9
			2, 4	$\overline{P}$ to D/CW	10.5	32.0	ns	10, 11
tpLH(5)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{P}$ to RO	9.5	20.5	ns	9
			2, 4	$\overline{P}$ to RO	8.5	31.5	ns	10, 11
tpHL(5)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	$\overline{P}$ to $\overline{ER}$	10.0	21.5	ns	9
			2, 4	$\overline{P}$ to $\overline{ER}$	9.0	26.0	ns	10, 11
tpLH(6)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to D/CW	10.5	23.0	ns	9
			2, 4	MR to D/CW	9.5	29.0	ns	10, 11
tpHL(6)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to D/CW	11.0	24.0	ns	9
			2, 4	MR to D/CW	10.0	28.5	ns	10, 11
tpHL(7)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to RO	9.0	19.5	ns	9
			2, 4	MR to RO	8.0	23.5	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=2.5ns, TF=2.5ns SEE AC FIGS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpLH(7)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	MR to $\overline{ER}$	16.5	35.5	ns	9
			2, 4	MR to $\overline{ER}$	14.5	39.0	ns	10, 11
tpLH(8)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	D to D/CW	6.0	13.5	ns	9
			2, 4	D to D/CW	5.0	19.5	ns	10, 11
tpHL(8)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	D to D/CW	7.5	16.0	ns	9
			2, 4	D to D/CW	6.5	20.0	ns	10, 11
tpLH(9)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CWG to D/CW	6.5	14.0	ns	9
			2, 4	CWG to D/CW	5.5	21.5	ns	10, 11
tpHL(9)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	CWG to D/CW	7.0	15.5	ns	9
			2, 4	CWG to D/CW	6.0	21.5	ns	10, 11
tpLH(10)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	SN to D/CW	11.5	24.5	ns	9
			2, 4	SN to D/CW	9.0	29.0	ns	10, 11
tpHL(10)	Propagation Delay	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	2, 4	SN to D/CW	9.5	20.0	ns	9
			2, 4	SN to D/CW	8.5	25.0	ns	10, 11
ts(H/L)(1)	Setup Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	SEI to CP	4.5		ns	9
			5	SEI to CP	6.0		ns	10, 11
th(H/L)(1)	Hold Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	SEI to CP	0		ns	9
			5	SEI to CP	1.0		ns	10, 11
ts(H/L)(2)	Setup Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	RFB to CP	11.0		ns	9
			5	RFB to CP	14.0		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=2.5ns, TF=2.5ns SEE AC FIGS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
th(H/L)(2)	Hold Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	RFB to CP	0		ns	9, 10, 11
ts(H/L)(3)	Setup Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	SI to CP	13.5		ns	9
			5	SI to CP	16.0		ns	10, 11
th(H/L)(3)	Hold Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	SI to CP	0		ns	9, 10, 11
ts(H/L)(4)	Setup Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	D to CP	9.0		ns	9
			5	D to CP	11.5		ns	10, 11
th(H/L)(4)	Hold Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	D to CP	0		ns	9, 10, 11
ts(H)(5)	Setup Time HIGH	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	CWG to CP	7.0		ns	9
			5	CWG to CP	9.0		ns	10, 11
ts(L)(5)	Setup Time LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	CWG to CP	5.5		ns	9
			5	CWG to CP	8.0		ns	10, 11
th(H/L)(5)	Hold Time HIGH or LOW	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	CWG to CP	0		ns	9, 10, 11
tw(H)(1)	Pulse Width	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	CP	4.0		ns	9
			5	CP	7.0		ns	10, 11
tw(L)(1)	Pulse Width	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	CP	4.0		ns	9
			5	CP	5.0		ns	10, 11
tw(H)(2)	Pulse Width	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	MR	4.0		ns	9
			5	MR	7.0		ns	10, 11
tw(L)(2)	Pulse Width	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	$\overline{P}$	4.0		ns	9
			5	$\overline{P}$	5.0		ns	10, 11
tREC(1)	Recovery Time	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	MR to CP	3.0		ns	9
			5	MR to CP	4.0		ns	10, 11
tREC(2)	Recovery Time	VCC=5.0V @25, VCC=4.5V & 5.5V @ -55/125C	5	$\overline{P}$ to CP	5.0		ns	9
			5	$\overline{P}$ to CP	6.5		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=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 @25, VCC=4.5V & 5.5V @ -55/125C	5		30		MHZ	1, 2, 3

Note 1: Screen tested 100% on each device at -55 C, +25 C & +125 C temperature, Subgroups A1, 2, 3, 7 & 8.
Note 2: Screen tested 100% on each device at +25 C temperature only, Subgroup A9.
Note 3: Sample tested (Method 5005, Table 1) on each MFG. lot at +25 C, +125 C & -55 C temp., Subgroups A1, 2, 3, 7 & 8.
Note 4: Sample Tested (Method 5005, Table 1) on each MFG. lot at +25 C Subgroup A9, & periodically at +125 C & -55 C temp., Subgroups 10 & 11.
Note 5: Not tested at +25C, +125C, or -55C Temperature. (DESIGN CHARACTERIZATION DATA).