National Semiconductor

MICROCIRCUIT DATA SHEET

MNDM54LS502-X REV 1A0

Original Creation Date: 04/20/98
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8 - BIT SUCCESSIVE APPROXIMATION REGISTER

General Description

The 'LS502 is an 8-bit register with the interchange logic necessary to perform serial-to-parallel conversion and provide an active LOW Conversion Complete (CC) signal coincident with storage of the eighth bit. An active LOW Start (S) input performs synchronous initialization which forces Q7 LOW and all others HIGH. Subsequent clocks shift Q7 LOW signal downstream which simultaneously backfills the register such that the first serial data (D input) bit is stored in Q7, the second bit in Q6, the third in Q5, etc. The serial input data is also synchronized by an auxilliary flip-flop and brought out on QD.

Designed primarily for use in the successive approximate technique for analog-to-digital conversion, the 'LS502 can also be used as a serial-to-parallel conversion ring counter and as the storage and control element in recursive digital routines.

Industry Part Number

54LS502

NS Part Numbers

DM54LS502J/883*
DM54LS502W/883**

Prime Die

L502

Controlling Document

5962-9080001MEA*, MFA**

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°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

- LOW power Schottky version of 2502
- Storage and control for successive approximation A to D conversion
- Performs serial - to - parallel conversion

(Absolute Maximum Ratings)

(Note 1)

Storage Temperature	-65 C to +150 C
Ambient Temperature under Bias	-55 C to +125 C
Input Voltage	-0.5V to +10.0V
VCC Pin Potential to Ground Pin	-0.5V to +7.0V
Junction Temperature under Bias	-55 C to +175 C
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.

Recommended Operating Conditions

Free Air Ambient Temperature Military	-55 C to +125 C
Supply Voltage Military	+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=4.5V	1, 3	INPUTS		20.0	uA	1, 2, 3
IBVI	Input High Current Breakdown Test	VCC=5.5V, VM=10.0V, VINH=4.5V	1, 3	INPUTS		0.1	mA	1, 2, 3
IIL	Input LOW Current	VCC=5.5V, VM=0.4V, VINH=4.5V	1, 3	INPUTS	-0.06	-1.2	mA	1, 2, 3
VOL	Output LOW Voltage	VCC=4.5V, IOL=4.0mA, VINH=4.5V	1, 3	OUTPUTS		0.4	V	1, 2, 3
VOH	High Level Output Voltage	VCC=4.5V, VIH=2.0V, IOH=-0.4mA, VINH=4.5V, VIL=0.7V	1, 3	OUTPUTS	2.5		V	1, 2, 3
IOS	Short Circuit Output Current	VCC=5.5V, VINH=4.5V, VOUT=0.0V, VINL=0.0V	1, 3	OUTPUT	-20.0	-100	mA	1, 2, 3
VCD	Input Clamp Diode Voltage	VCC=4.5V, IM=-18mA, VINH=4.5V	1, 3	INPUTS		-1.5	V	1, 2, 3
ICC	Supply Current	VCC=5.5V, VINL=0.0V	1, 3	VCC		65.0	mA	1, 2, 3

AC PARAMETER - 15pF

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=15pF Temp range: +25C

tpLH	Propagation Delay	VCC=5.0V	5	CP to Qn or $\overline{CC}$		35.0	ns	9
tpHL	Propagation Delay	VCC=5.0V	5	CP to Qn or $\overline{CC}$		25.0	ns	9
ts (H/L)	Setup Time	VCC=5.0V	5	$\overline{S}$ to CP	5.0		ns	9
th (H/L)	Hold Time	VCC=5.0V	5	$\overline{S}$ to CP	5.0		ns	9
ts (H/L) 2	Setup Time	VCC=5.0V	5	D to CP	5.0		ns	9
th (H/L) 2	Hold Time	VCC=5.0V	5	D to CP	5.0		ns	9
tw (H/L)	Pulse Width	VCC=5.0V	5	CP	20.0		ns	9
fMAX	Maximum Clock Frequency	VCC=5.0V	5	CP	25.0		MHZ	9

Electrical Characteristics

AC PARAMETER - 50pF

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=50pF, RL=2K ohms Temp range: -55C to +125C

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpLH	Propagation Delay	VCC=5.0V	2, 4	CP to Qn or $\overline{CC}$	2.0	40.0	ns	9
			2, 4	CP to Qn or $\overline{CC}$	2.0	52.0	ns	10, 11
tpHL	Propagation Delay	VCC=5.0V	2, 4	CP to Qn or $\overline{CC}$	2.0	30.0	ns	9
			2, 4	CP to Qn or $\overline{CC}$	2.0	39.0	ns	10, 11
ts (H/L)	Setup Time	VCC=5.0V	2, 4	$\overline{S}$ to CP	5.0		ns	9
			2, 4	$\overline{S}$ to CP	10.0		ns	10, 11
th (H/L)	Hold Time	VCC=5.0V	2, 4	$\overline{S}$ to CP	5.0		ns	9
			2, 4	$\overline{S}$ to CP	10.0		ns	10, 11
ts (H/L) 2	SetupTime	VCC=5.0V	2, 4	D to CP	5.0		ns	9
			2, 4	D to CP	10.0		ns	10, 11
th (H/L) 2	Hold Time	VCC=5.0V	2, 4	D to CP	5.0		ns	9
			2, 4	D to CP	10.0		ns	10, 11
tw (H/L)	Pulse Width	VCC=5.0V	2, 4	CP	20.0		ns	9
			2, 4	CP	25.0		ns	10, 11
fMAX	Clock Frequency	VCC=5.5V	2, 4	CP	25.0		MHZ	9
			2, 4	CP	20.0		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. Subgroups 10 & 11 are guaranteed, not tested.
Note 5: Guaranteed, not tested.

Revision History

Rev	ECN #	Rel Date	Originator	Changes
1A0	M0002904	08/24/98	Linda Collins	Initial MDS release:MNDM54LS502-X Rev. 1A0. Changed note 5 (Guaranteed, not tested) in the AC 50pF notes reference column to note 2 (Screen tested 100% at +25C, subgroup 9) & to note 4 (Sample tested at +25C, subgroup 9. Subgroups 10 & 11 are guaranteed, not tested). Changed note 2 in the AC 15pF notes reference column to note 5. Reworded the phrase in note 4 from 'and periodically at +125C & -55C, subgroups 10 & 11' to 'Subgroups 10 & 11 are guaranteed, not tested'.