National Semiconductor

MICROCIRCUIT DATA SHEET

MNDM54LS169-X REV 1A0

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SYNCHRONOUS BI-DIRECTIONAL MODULO-16 BINARY COUNTER

General Description

The 'LS169 is a fully synchronous 4-stage up/down counter featuring a preset capability for programmable operation, carry lookahead for easy cascading and a U/D input to control the direction of counting. All state changes, whether in counting or parallel-loading, are initiated by the LOW-to-HIGH transition of the clock.

Industry Part Number

54LS169

NS Part Numbers

DM54LS169J/883
DM54LS169W/883

Prime Die

L169

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

(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	-55C to +175C
Vcc Pin Potential to Ground Pin	-0.5V to +7.0V
Input Voltage	-0.5V to +10.0V
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 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=4.5V	1, 3	INPUTS		20	uA	1, 2, 3
IIH 2	Input High Current	VCC=5.5V, VM=2.7V, VINH=4.5V	1, 3	$\overline{CET}$		40	uA	1, 2, 3
IBVI	Input High Current	VCC=5.5V, VM=10.0V, VINH=4.5V	1, 3	INPUTS		100	uA	1, 2, 3
IBVI 2	Input High Current	VCC=5.5V, VM=10.0V, VINH=4.5V	1, 3	$\overline{CET}$		200	uA	1, 2, 3
IIL	Input LOW Current	VCC=5.5V, VM=0.4V, VINH=4.5V	1, 3	DATA	-0.5	-400	uA	1, 2, 3
IIL 2	Input LOW Current	VCC=5.5V, VM=0.4V, VINH=4.5V	1, 3	$\overline{CET}$	-60	-800	uA	1, 2, 3
IIL 3	Input LOW Current $\overline{CEP}$, $\overline{CET}$, U/$\overline{D}$, CP	VCC=5.5V, VM=0.4V, VINH=4.5V	1, 3	INPUTS	-30	-400	uA	1, 2, 3
VOL	Output LOW Voltage	VCC=4.5V, VIL=0.7V, IOL=4.0mA, VINH=4.5V	1, 3	OUTPUTS		0.4	V	1, 2, 3
VOH	Output HIGH Voltage	VCC= 4.5V, VIH=2.0V, IOH=-0.4mA, VIL=0.7V, VINH=4.5V	1, 3	OUTPUTS	2.5		V	1, 2, 3
IOS	Short Circuit Current	VCC=5.5V, VINH=4.5V, VINL=0.0V, VOUT=0.0V	1, 3	OUTPUTS	-20	-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		34	mA	1, 2, 3

Electrical Characteristics

AC PARAMETERS - 15pF

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

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpLH/HL	Propagation Delay	VCC=5.0V	5	CP to Qx		20	ns	9
tpLH/HL 2	Propagation Delay	VCC=5.0V	5	CP to $\overline{TC}$		30	ns	9
tpLH 3	Propagation Delay	VCC=5.0V	5	$\overline{CET}$ to $\overline{TC}$		15	ns	9
tpHL 3	Propagation Delay	VCC=5.0V	5	$\overline{CET}$ to $\overline{TC}$		20	ns	9
tpLH/HL 4	Propagation Delay	VCC=5.0V	5	$\overline{U/D}$ to $\overline{TC}$		25	ns	9
ts (H/L)	Setup Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	5		15		ns	9
th (H/L)	Hold Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	5		5		ns	9
ts (H/L) 2	Setup Time	VCC=5.0V	5	$\overline{PE}$ to CP	20		ns	9
th (H/L) 2	Hold Time	VCC=5.0V	5	$\overline{PE}$ to CP	0		ns	9
ts (H/L) 3	Setup Time	VCC=5.0V	5	$\overline{U/D}$ to CP	25		ns	9
th (H/L) 3	Hold Time	VCC=5.0V	5	$\overline{U/D}$ to CP	0		ns	9
tw (H/L)	Pulse Width	VCC=5.0V	5	CP	20		ns	9
fMAX	Maximum Clock Frequency	VCC=5.0V	5	CP	25		MHZ	9

AC PARAMETERS - 50pF

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

tpLH/HL	Propagation Delay	VCC=5.0V	2, 4	CP to Qx	2	25	ns	9
			2, 4	CP to Qx	2	33	ns	10, 11
tpLH/HL 2	Propagation Delay	VCC=5.0V	2, 4	CP to $\overline{TC}$	2	35	ns	9
			2, 4	CP to $\overline{TC}$	2	46	ns	10, 11

Electrical Characteristics

AC PARAMETERS - 50pF(Continued)

(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 3	Propagation Delay	VCC=5.0V	2, 4	$\overline{CET}$ to $\overline{TC}$	2	20	ns	9
			2, 4	$\overline{CET}$ to $\overline{TC}$	2	26	ns	10, 11
tpHL 3	Propagation Delay	VCC=5.0V	2, 4	$\overline{CET}$ to $\overline{TC}$	2	25	ns	9
			2, 4	$\overline{CET}$ to $\overline{TC}$	2	33	ns	10, 11
tpLH/HL 4	Propagation Delay	VCC=5.0V	2, 4	U/$\overline{D}$ to $\overline{TC}$	2	30	ns	9
			2, 4	U/$\overline{D}$ to $\overline{TC}$	2	39	ns	10, 11
ts (H/L)	Setup Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	2, 4		15		ns	9
ts (H/L)	Setup Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	2, 4		20		ns	10, 11
th (H/L)	Hold Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	2, 4		5		ns	9
th (H/L)	Hold Time Pn/$\overline{CEP}$/$\overline{CET}$ to CP	VCC=5.0V	2, 4		10		ns	10, 11
ts (H/L) 2	Setup Time	VCC=5.0V	2, 4	$\overline{PE}$ to CP	20		ns	9
			2, 4	$\overline{PE}$ to CP	25		ns	10, 11
th (H/L) 2	Hold Time	VCC=5.0V	2, 4	$\overline{PE}$ to CP	0		ns	9
			2, 4	$\overline{PE}$ to CP	5		ns	10, 11
ts (H/L) 3	Setup Time	VCC=5.0V	2, 4	U/$\overline{D}$ to CP	25		ns	9
			2, 4	U/$\overline{D}$ to CP	30		ns	10, 11
th (H/L) 3	Hold Time	VCC=5.0V	2, 4	U/$\overline{D}$ to CP	0		ns	9
			2, 4	U/$\overline{D}$ to CP	5		ns	10, 11
tw (H/L)	Pulse width	VCC=5.0V	2, 4	CP	20		ns	9
			2, 4	CP	25		ns	10, 11
Fmax	Maximum clock frequency	VCC=5.0V	2, 4	CP	25		MHZ	9
			2, 4	CP	20		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.
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. (Design characterization data)

Revision History

Rev	ECN #	Rel Date	Originator	Changes
1A0	M0001760	07/08/98	Linda Collins	Initial MDS release::MNDM54LS169-X Rev. 1A0. Added note 4 to the AC (50pF) notes reference column. Reworded the phrase in note 4 from "and periodically at +125C & -55C, subgroups 10 & 11" to "Subgroups 10 & 11 are guaranteed, not tested".