National Semiconductor

MICROCIRCUIT DATA SHEET

MN54AC74-X REV 1B0

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Dual D-Type Positive Edge-Triggered Flip-Flop

General Description

The AC74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q,$\overline{Q}$) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshhold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.

Asynchronous Inputs:

LOW Inputs to $\overline{Sd}$ (Set) sets Q to HIGH level.

LOW Inputs to $\overline{Cd}$ (Clear) sets Q to LOW level.

Clear and Set are independent of clock.

Simultaneous LOW on $\overline{CD}$ and $\overline{SD}$ makes both Q and $\overline{Q}$ HIGH.

Industry Part Number

54AC74

NS Part Numbers

54AC74DMQB
54AC74FMQB
54AC74LMQB

Prime Die

Z074

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

- Icc reduced by 50%
- Output source/sink 24 mA
- Standard Military Drawing (SMD)
  - AC74:5962-88520

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage (Vcc)	-0.5V to + 7.0V
DC Input Diode Current (Iik)	
Vi = -0.5V	-20 mA
Vi = Vcc +0.5V	+20 mA
DC Input Voltage (Vi)	-0.5V to Vcc +0.5V
DC Output Diode Current (Iok)	
Vo = -0.5V	-20 mA
Vo = Vcc +0.5V	+20 mA
DC Output Voltage (Vo)	-0.5V to Vcc +0.5V
DC Output Source or Sink Current (Io)	$\pm$50 mA
DC Vcc or Ground Current per Output Pin (Icc or Ignd)	$\pm$50 mA
Storage Temperature (Tstg)	-65 C to +150 C
Junction Temperature (Tj)	175 C

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT TM circuits outside databook specifications.

Recommended Operating Conditions

Supply Voltage (Vcc)	2.0V to 6.0V
Input Voltage (Vi)	0V to Vcc
Output Voltage (Vo)	0V to Vcc
Operating Temperature (Ta)	-55 C to +125 C
Minimum Input Edge Rate (Delta V/Delta t)	
AC Devices	
Vin from 30% to 70% of Vcc	
Vcc @ 3.0V, 4.5V, 5.5V	125 mV/ns

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: VCC=3.0V to 5.5V, Temperature Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
IIH	High level input current	VCC=5.5V, VM=5.5V	1, 2	INPUT		0.1	uA	1
			1, 2	INPUT		1.0	uA	2, 3
IIL	Low level input current	VCC=5.5V, VM=0.0V	1, 2	INPUT		-0.1	uA	1
			1, 2	INPUT		-1.0	uA	2, 3
VOL	Low level output voltage	VCC=3.0V, VIL=0.9V, VINH=3.0V, VIH=2.1V, IOL=12.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=3.0V, VIL=0.9V, VINH=3.0, VIH=2.1V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=4.5V, VIL=1.35V, VINH=4.5V, VIH=3.15V, IOL=24.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85, IOL=24.0mA	1, 2	OUTPUT		.36	V	1
			1, 2	OUTPUT		.50	V	2, 3
		VCC=4.5V, VIL=1.35V, VINH=4.5V, VIH=3.15V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
		VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85V, IOL=50.0uA	1, 2	OUTPUT		.10	V	1, 2, 3
VIOL	Dynamic Output Current LOW	VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85V, IOL=50.0mA	1, 2, 5	OUTPUT		1.65	V	1, 2, 3
VOH	High Level Output Voltage	VCC=3.0V, VINH=3.0V, VIH=2.1V, VIL=0.9V, IOH=-12.0mA	1, 2	OUTPUT	2.56		V	1
			1, 2	OUTPUT	2.40		V	2, 3
		VCC=3.0V, VIL=0.9V, VINH=3.0V, VIH=2.1V, IOH=-50.0uA	1, 2	OUTPUT	2.90		V	1, 2, 3
		VCC=4.5V, VIL=1.35V, VINH=4.5V, VIH=3.15V, IOH=-50.0uA	1, 2	OUTPUT	4.40		V	1, 2, 3
		VCC=4.5V, VINH=4.5V, VIH=3.15V, VIL=1.35V, IOH=-24.0mA	1, 2	OUTPUT	3.86		V	1
			1, 2	OUTPUT	3.70		V	2, 3
		VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85V, IOH=-24.0mA	1, 2	OUTPUT	4.86		V	1
			1, 2	OUTPUT	4.70		V	2, 3
		VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85V, IOH=-50.0uA	1, 2	OUTPUT	5.40		V	1, 2, 3
VIOH	Dynamic Output Current HIGH	VCC=5.5V, VIL=1.65V, VINH=5.5V, VIH=3.85V, IOH=-50.0mA	1, 2, 5	OUTPUT	3.85		V	1, 2, 3
ICCH	Supply Current	VCC=5.5V, VINL=0.0V	1, 2	VCC		2.0	uA	1
			1, 2	VCC		40	uA	2, 3

Electrical Characteristics

DC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: VCC=3.0V to 5.5V, Temperature Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 3 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
ICCL	Supply Current	VCC=5.5V, VINH=5.5V, VINL=0.0V	1, 2	VCC		2.0	uA	1
			1, 2	VCC		40	uA	2, 3

AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: CL=50pf, RL=500 ohms, TRISE=3.0ns, TFALL=3.0ns, Temp Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

tpLH(1)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Q/$\overline{Q}$	3.0	10.0	ns	9
			3, 4, 7	CP to Q/$\overline{Q}$	3.0	12.0	ns	10, 11
tpHL(1)	Propagation Delay	VCC=4.5V	3, 4, 7	CP to Q/$\overline{Q}$	3.0	8.5	ns	9
			3, 4, 7	CP to Q/$\overline{Q}$	3.0	10.0	ns	10, 11
tpLH(2)	Propagation Delay	VCC=4.5V	3, 4, 7	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.5	9.0	ns	9
			3, 4, 7	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.5	9.5	ns	10, 11
tpHL(2)	Propagation Delay	VCC=4.5V	3, 4, 7	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.5	9.5	ns	9
			3, 4, 7	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.5	10.5	ns	10, 11
ts(H)(1)	Set Up Time HIGH	VCC=4.5V	6	D to CP	3.0		ns	9
			6	D to CP	4.0		ns	10, 11
ts(L)(1)	Set Up Time or LOW	VCC=4.5V	6	D to CP	3.0		ns	9
			6	D to CP	4.0		ns	10, 11
th(H/L)(1)	Hold Time, HIGH or LOW	VCC=4.5V	6	D to CP	0.5		ns	9, 10, 11
tw(H/L)(1)	Pulse Width	VCC=4.5V	6	CP Pulse Width	5.0		ns	9, 10, 11
tw (L)(1)	Pulse Width	VCC=4.5V	6	$\overline{CD/SD}$	5.0		ns	9
			6	$\overline{CD/SD}$	5.5		ns	10, 11
trec(1)	Recovery Time	VCC=4.5V	6	$\overline{CD/SD}$ to CP	0.5		ns	9, 10, 11
FMAX(1)	Maximum Clock Frequency	VCC=4.5V	6	CP	95		MHZ	9, 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, TRISE=3.0ns, TFALL=3.0ns, Temp Range: -55C to 125C. NOTE: -55C TEMPERATURE, SUBGROUP 11 IS GUARANTEED BUT NOT TESTED.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tpLH(3)	Propagation Delay	VCC=3.0V	3, 4	CP to Q/$\overline{Q}$	3.0	13.5	ns	9
			3, 4	CP to Q/$\overline{Q}$	3.0	17.5	ns	10, 11
tpHL(3)	Propagation Delay	VCC=3.0V	3, 4	CP to Q/$\overline{Q}$	3.0	11.0	ns	9
			3, 4	CP to Q/$\overline{Q}$	3.0	13.5	ns	10, 11
tpLH(4)	Propagation Delay	VCC=3.0V	3, 4	$\overline{CD/SD}$ to Q/Q	1.0	11.0	ns	9
			3, 4	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.0	13.0	ns	10, 11
tpHL(4)	Propagation Delay	VCC=3.0V	3, 4	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.0	12.0	ns	9
			3, 4	$\overline{CD/SD}$ to Q/$\overline{Q}$	1.0	14.0	ns	10, 11
ts(H/L)(2)	Setup Time HIGH or LOW	VCC=3.0V	6	D to CP	4.0		ns	9
			6	D to CP	5.0		ns	10, 11
th(H/L)(2)	Hold Time	VCC=3.0V	6	D to CP	0.5		ns	9, 10, 11
tw(H/L)(2)	Pulse Width	VCC=3.0V	6	CP Pulse Width	5.0		ns	9
			6	CP Pulse Width	5.5		ns	10, 11
tw(L)(2)	Pulse Width	VCC=3.0V	6	$\overline{CD/SD}$	6.0		ns	9
			6	$\overline{CD/SD}$	8.0		ns	10, 11
trec(2)	Pulse Width	VCC=3.0V	6	$\overline{CD/SD}$ to CP	0.5		ns	9, 10, 11
FMAX(2)	Maximum Clock Frequency	VCC=3.0V	6	CP	85		MHz	9
			6	CP	70		MHz	10, 11

Note 1: SCREEN TESTED 100% ON EACH DEVICE AT +25C & +125C TEMPERATURE, SUBGROUPS 1, 2, 7, & 8.
Note 2: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A1, 2, 7, & 8.
Note 3: SCREEN TESTED 100% ON EACH DEVICE AT +25C TEMPERATURE ONLY SUBGROUP A9.
Note 4: SAMPLE TESTED (METHOD 5005, TABLE 1) ON EACH MFG. LOT AT +25C & +125C TEMPERATURE, SUBGROUPS A9 & 10.
Note 5: TRANSMISSION LINE DRIVING TEST, GUARDBAND LIMITS SET FOR +25C, 2 MSEC DURATION MAX.
Note 6: GUARANTEED BUT NOT TESTED (DESIGN CHARACTERIZATION DATA).
Note 7: +25C & +125C MIN LIMITS GUARANTEED FOR 5.5V BY GUARDBANDING 4.5V MIN. LIMITS.