

MM54C173/MM74C173 TRI-STATE® Quad D Flip-Flop

General Description

The MM54C173/MM74C173 TRI-STATE quad D flip-flop is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. The four D-type flip-flops operate synchronously from a common clock. The TRI-STATE output allows the device to be used in bus-organized systems.

The outputs are placed in the TRI-STATE mode when either of the two output disable pins are in the logic "1" level. The input disable allows the flip-flops to remain in their present states without disrupting the clock. If either of the two input disables are taken to a logic "1" level, the Q outputs are fed back to the inputs and in this manner the flip-flops do not change state.

Clearing is enabled by taking the input to a logic "1" level. Clocking occurs on the positive-going transition.

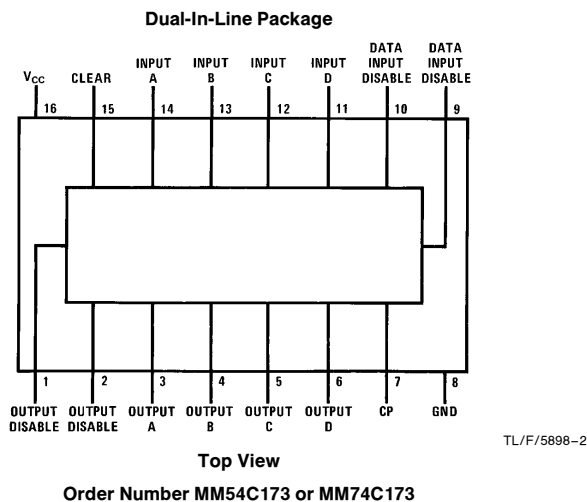
Features

- Supply voltage range 3V to 15V
- Tenth power TTL compatible Drive 2 LPTTL loads
- High noise immunity 0.45 V_{CC} (typ.)
- Low power
- Medium speed operation
- High impedance TRI-STATE
- Input disable without gating the clock

Applications

- Automotive
- Data terminals
- Instrumentation
- Medical electronics
- Alarm systems
- Industrial electronics
- Remote metering
- Computers

Connection Diagram



Truth Table

(Both Output Disables Low)

t_n	t_{n+1}	
Data Input Disable	Data Input	Output
Logic "1" on One or Both Inputs	X	Q_n
Logic "0" on Both Inputs	1	1
Logic "0" on Both Inputs	0	0

TRI-STATE® is a registered trademark of National Semiconductor Corporation.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Pin $-0.3V$ to $V_{CC} + 0.3V$

Operating Temperature Range

MM54C173 $-55^{\circ}C$ to $+125^{\circ}C$

MM74C173 $-40^{\circ}C$ to $+85^{\circ}C$

Storage Temperature Range $-65^{\circ}C$ to $+150^{\circ}C$

Maximum V_{CC} Voltage

18V

Power Dissipation (P_D)

Dual-In-Line

700 mW

Small Outline

500 mW

Operating V_{CC} Range

3V to 15V

Lead Temperature (Soldering, 10 seconds)

260°C

DC Electrical Characteristics Min/Max limits apply across temperature range unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V$		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current		-1.0	0.005		μA
I_{OZ}	Output Current in High Impedance State	$V_{CC} = 15V, V_O = 15V$ $V_{CC} = 15V, V_O = 0V$	-1.0	0.001 0.001	1.0	μA μA
I_{CC}	Supply Current	$V_{CC} = 15V$		0.05	300	mA
LOW POWER TTL/CMOS INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.5V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V, I_O = -360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = -360 \mu A$	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V, I_O = 360 \mu A$ 74C, $V_{CC} = 4.75V, I_O = 360 \mu A$			0.4 0.4	V V
t_{pd0}, t_{pd1}	Propagation Delay Time to a Logical "0" or Logical "1" from Clock	$V_{CC} = 5V, C_L = 50 pF,$ $T_A = 25^{\circ}C$		500		ns
OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current	$V_{CC} = 5V, V_{IN(0)} = 0V$ $T_A = 25^{\circ}C, V_{OUT} = 0V$	-1.75			mA
I_{SOURCE}	Output Source Current	$V_{CC} = 10V, V_{IN(0)} = 0V$ $T_A = 25^{\circ}C, V_{OUT} = 0V$	-8.0			mA
I_{SINK}	Output Sink Current	$V_{CC} = 5V, V_{IN(1)} = 5V$ $T_A = 25^{\circ}C, V_{OUT} = V_{CC}$	1.75			mA
I_{SINK}	Output Sink Current	$V_{CC} = 10V, V_{IN(1)} = 10V$ $T_A = 25^{\circ}C, V_{OUT} = V_{CC}$	8.0			mA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

AC Electrical Characteristics* $T_A = 25^\circ\text{C}$, $C_L = 50\text{ pF}$, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0}, t_{pd1}	Propagation Delay Time to a Logical "0" or Logical "1" from Clock to Output	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		220 80	400 200	ns
t_S	Input Data Set-up Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		40 15	80 30	ns
t_H	Input Data Hold Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		0 0	0 0	ns
t_S	Input Disable Set-up Time, $t_{S\text{ DISS}}$	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		100 35	200 70	ns
t_H	Input Disable Hold Time, $t_{H\text{ DISS}}$	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		0 0	0 0	ns
t_{1H}, t_{0H}	Delay from Output Disable to High Impedance State (from Logical "1" or Logical "0" Level)	$V_{CC} = 5\text{V}, R_L = 10\text{k}$ $V_{CC} = 10\text{V}, R_L = 10\text{k}$		170 70	340 140	ns
t_{H1}	Delay from Output Disable to Logical "1" Level (from High Impedance State)	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		170 70	340 140	ns
t_{H0}	Delay from Output Disable to Logical "0" Level (from High Impedance State)	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		170 70	340 140	ns
t_{pd0}, t_{pd1}	Propagation Delay from Clear to Output	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		240 90	490 180	ns
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	3 7.0	4 12		MHz
t_W	Minimum Clear Pulse Width	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		150 70		ns
t_r, t_f	Maximum Clock Rise and Fall Time	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$	10 5			μs
C_{IN}	Input Capacitance	(Note 2)		5		pF
C_{PD}	Power Dissipation Capacitance	(Note 3)				

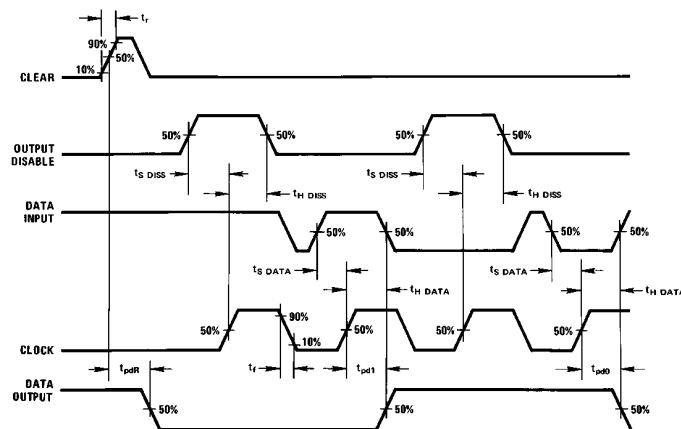
*AC Parameters are guaranteed by DC correlated testing.

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Capacitance is guaranteed by periodic testing.

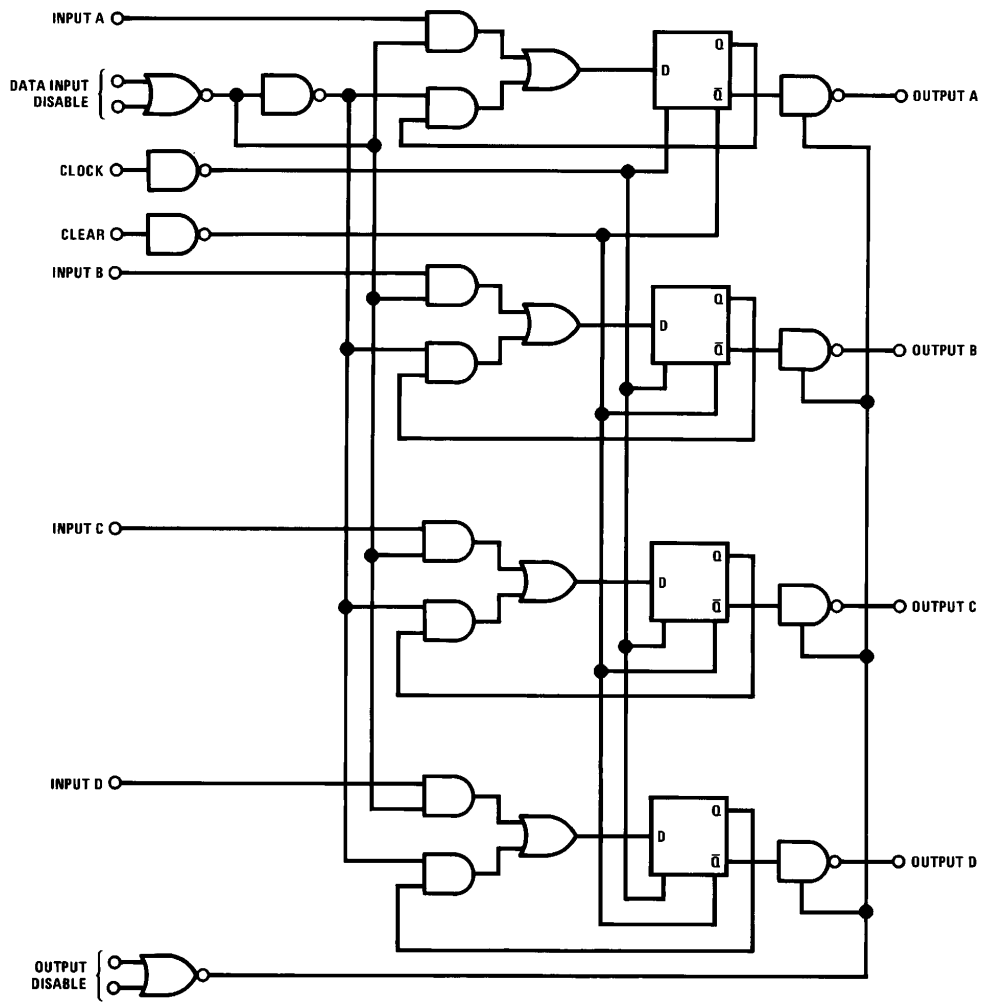
Note 3: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note AN-90.

Switching Time Waveforms



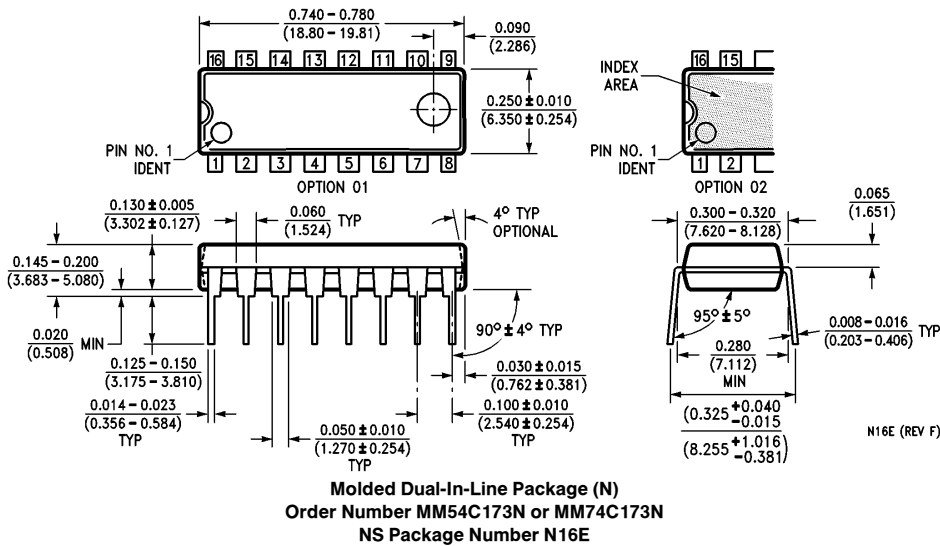
TL/F/5898-3

Logic Diagram



TL/F/5898-1

J16A (REV L)

Physical Dimensions inches (millimeters) (Continued)**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
 1111 West Bardin Road
 Arlington, TX 76017
 Tel: 1(800) 272-9959
 Fax: 1(800) 737-7018

National Semiconductor Europe
 Fax: (+49) 0-180-530 85 86
 Email: cnjwge@tevm2.nsc.com
 Deutsch Tel: (+49) 0-180-530 85 85
 English Tel: (+49) 0-180-532 78 32
 Français Tel: (+49) 0-180-532 93 58
 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
 13th Floor, Straight Block,
 Ocean Centre, 5 Canton Rd.
 Tsimshatsui, Kowloon
 Hong Kong
 Tel: (852) 2737-1600
 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
 Tel: 81-043-299-2309
 Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.