National Semiconductor

February 1992

# DM74LS197 Presettable Binary Counters

General Description

The 'LS197 ripple counter contains divide-by-two and divide-by-eight sections which can be combined to form a modulo-16 binary counter. State changes are initiated by the falling edge of the clock. The 'LS197 has a Master Reset ($\overline{MR}$) input which overrides all other inputs and asynchronously forces all outputs LOW. A Parallel Load input ($\overline{PL}$) overrides clocked operations and asynchronously loads the data on the Parallel Data inputs (P_n) into the flip-flops. This preset feature makes the circuit usable as a programmable counter. The circuit can also be used as a 4-bit latch, loading data from the Parallel Data inputs when $\overline{PL}$ is LOW and storing the data when $\overline{PL}$ is HIGH. For detail specifications and functional description, please refer to the 'LS196 data sheet.

Features

- High counting rates—Typically 70 MHz
- Asynchronous preset
- Asynchronous master reset

Connection Diagram

Dual-In-Line Package

```
        PL  ─┤ 1      14 ├─ Vcc
        Q2  ─┤ 2      13 ├─ MR
        P2  ─┤ 3      12 ├─ Q3
        P0  ─┤ 4      11 ├─ P3
        Q0  ─┤ 5      10 ├─ P1
        CP1 ─┤ 6       9 ├─ Q1
        GND ─┤ 7       8 ├─ CP0
```
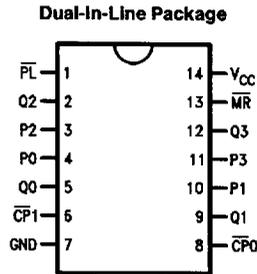
TL/F/10180–1

Order Number DM74LS197M or DM74LS197N
See NS Package Number M14A or N14A

Pin Names	Description
$\overline{CP0}$	÷2 Section Clock Input (Active Falling Edge)
$\overline{CP1}$	÷8 Section Clock Input (Active Falling Edge)
$\overline{MR}$	Asynchronous Master Reset Input (Active LOW)
P0–P3	Parallel Data Inputs
$\overline{PL}$	Asynchronous Parallel Load Input (Active LOW)
Q0	÷2 Section Output*
Q1–Q3	÷8 Section Outputs

*Q0 output is guaranteed to drive the full rated fan-out plus the $\overline{CP}1$ input.

Mode Select Table

Inputs			Response
$\overline{MR}$	$\overline{PL}$	CP	
L	X	X	Qn Forced LOW
H	L	X	Pn → Qn
H	H	⟍	Count Up

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings (Note)

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

Supply Voltage	7V
Input Voltage	7V
Operating Free Air Temperature Range	
DM74LS	0°C to +70°C
Storage Temperature Range	−65°C to +150°C

Note: *The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the "Electrical Characteristics" table are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.*

Recommended Operating Conditions

Symbol	Parameter	DM74LS197			Units
		Min	Nom	Max	
V_{CC}	Supply Voltage	4.75	5	5.25	V
V_{IH}	High Level Input Voltage	2			V
V_{IL}	Low Level Input Voltage			0.8	V
I_{OH}	High Level Output Voltage			−0.4	mA
I_{OL}	Low Level Output Current			8	mA
T_A	Free Air Operating Temperature	0		70	°C

Electrical Characteristics over recommended operating free air temperature range (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ (Note 1)	Max	Units
V_I	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.5	V
V_{OH}	High Level Output Voltage	V_{CC} = Min, I_{OH} = Max, V_{IL} = Max	2.7	3.4		V
V_{OL}	Low Level Output Voltage	V_{CC} = Min, I_{OL} = Max, V_{IH} = Min		0.35	0.5	V
		I_{OL} = 4 mA, V_{CC} = Min		0.25	0.4	
I_I	Input Current @ Max Input Voltage	V_{CC} = Max, V_I = 7V			0.1	mA
I_{IH}	High Level Input Current	V_{CC} = Max, V_I = 2.7V			20	µA
I_{IL}	Low Level Input Current	V_{CC} = Max, V_I = 0.4V			−0.4	mA
I_{OS}	Short Circuit Output Current	V_{CC} = Max (Note 2)	−20		−100	mA
I_{CC}	Supply Current	V_{CC} = Max			27	mA

Note 1: All typicals are at V_{CC} = 5V, T_A = 25°C.

Note 2: Not more than one output should be shorted at a time, and the duration should not exceed one second.

## Switching Characteristics

$V_{CC} = +5.0V$, $T_A = +25°C$

Symbol	Parameter	$R_L = 2\,k\Omega$ $C_L = 15\,pF$		Units
		Min	Max	
f_{MAX}	Max CLK Frequency	55		MHz
t_{PLH} t_{PHL}	Propagation Delay $\overline{CP0}$ to Q0		15 15	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{CP1}$ to Q2		34 34	ns
t_{PLH} t_{PHL}	Propagation Delay P2 to Q2		27 44	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{PL}$ to Q2		39 45	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{CP1}$ to Q1		15 17	ns
t_{PLH} t_{PHL}	Propagation Delay $\overline{CP1}$ to Q3		55 63	ns
t_{PHL}	Propagation Delay $\overline{MR}$ to Q3		42	ns

Logic Diagram

TL/F/10180–4

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Logic Symbol

PL PO P1 P2 P3
1 4 10 3 11

8 — CP0

6 — CP1

MR Q0 Q1 Q2 Q3
13 5 9 2 12

V_CC = Pin 14
GND = Pin 7
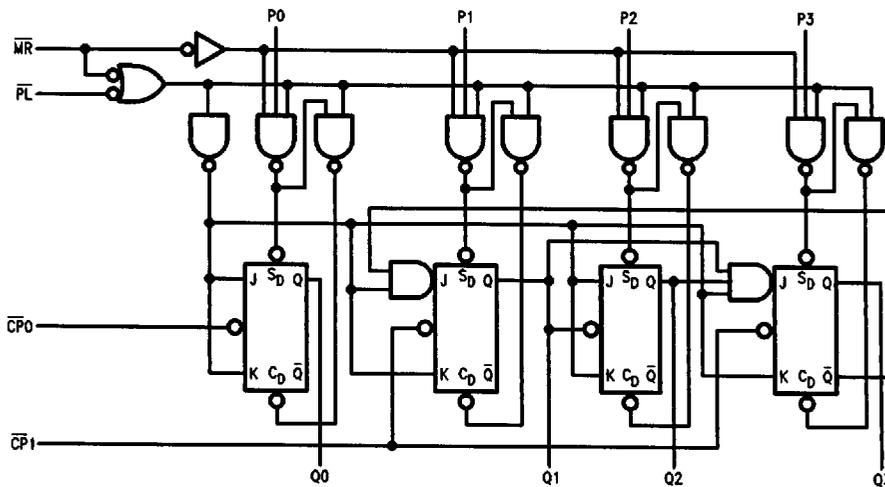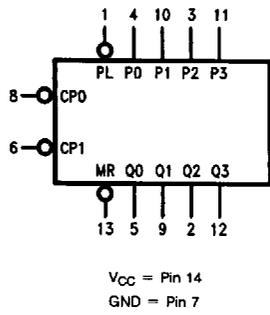
TL/F/10180–2

÷16 State Diagram

```
 0 → 1 → 2 → 3 → 4
 ↑               ↓
15               5
 ↑               ↓
14               6
 ↑               ↓
13               7
 ↑               ↓
12 ← 11 ← 10 ← 9 ← 8
```

TL/F/10180–3
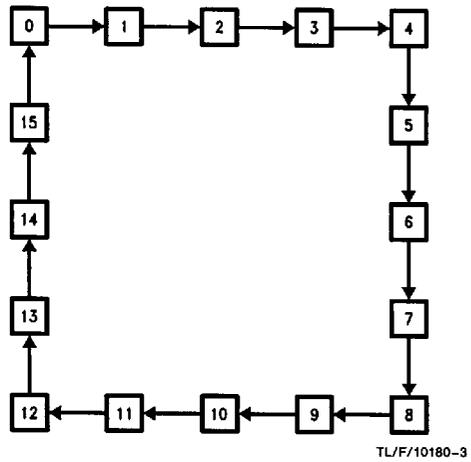
Physical Dimensions inches (millimeters)
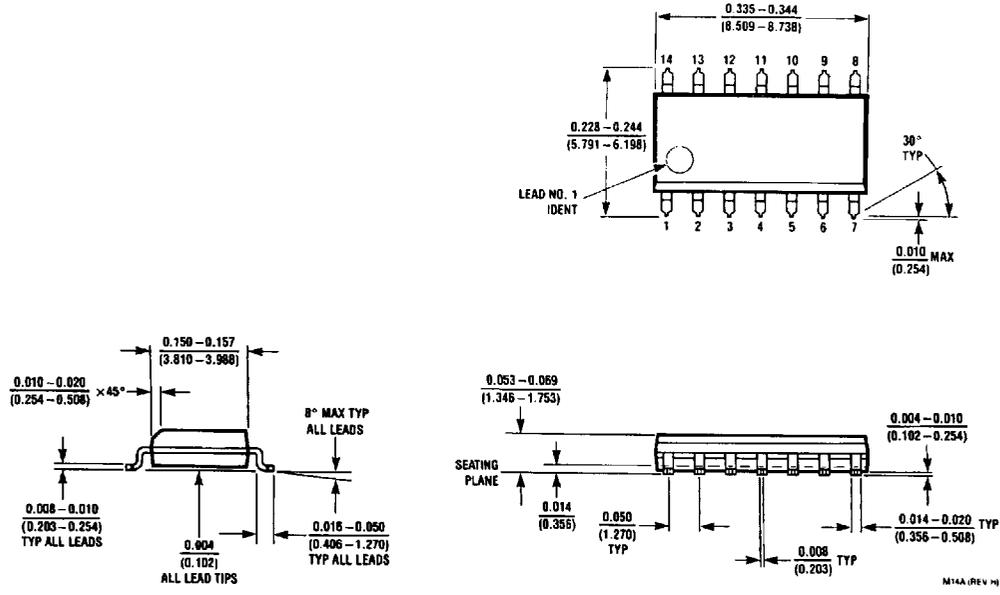
14-Lead Small Outline Molded Package (M)
Order Number DM74LS197M
NS Package Number M14A

0.335 – 0.344
(8.509 – 8.738)

0.228 – 0.244
(5.791 – 6.198)

LEAD NO. 1
IDENT

30°
TYP

0.010 MAX
(0.254)

0.150 – 0.157
(3.810 – 3.988)

0.010 – 0.020
(0.254 – 0.508) × 45°

8° MAX TYP
ALL LEADS

0.008 – 0.010
(0.203 – 0.254)
TYP ALL LEADS

0.004
(0.102)
ALL LEAD TIPS

0.016 – 0.050
(0.406 – 1.270)
TYP ALL LEADS

0.053 – 0.069
(1.346 – 1.753)

SEATING
PLANE

0.014
(0.356)

0.050
(1.270)
TYP

0.004 – 0.010
(0.102 – 0.254)

0.014 – 0.020 TYP
(0.356 – 0.508)

0.008 TYP
(0.203)

M14A (REV H)

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Physical Dimensions inches (millimeters) (Continued)

OPTION 1

OPTION 02
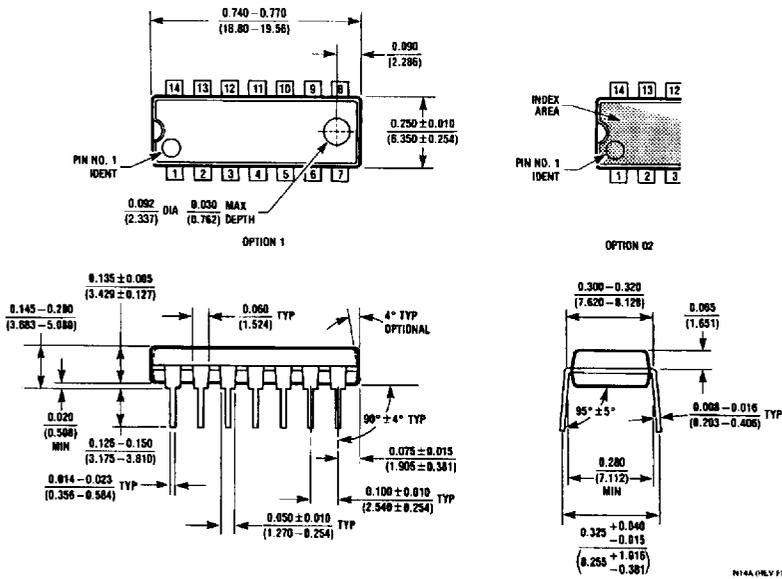
14-Lead Molded Dual-In-Line Package (N)
Order Number DM74LS197N
NS Package Number N14A

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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.