

## DM54LS378/DM74LS378 Parallel D Register with Enable

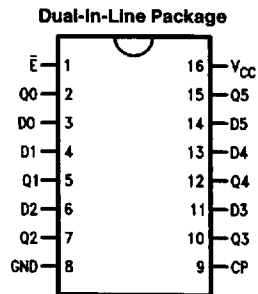
### General Description

The 'LS378 is a 6-bit register with a buffered common enable. This device is similar to the 'LS174, but with common Enable rather than common Master Reset.

### Features

- 6-bit high speed parallel register
- Positive edge-triggered D-type inputs
- Fully buffered common clock and enable inputs
- Input clamp diodes limit high speed termination effects
- Full TTL and CMOS compatible

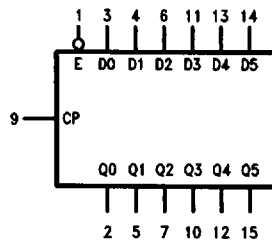
### Connection Diagram



TL/F/9832-1

**Order Number DM54LS378E, DM54LS378J,  
DM74LS378M, DM74LS378N or DM54LS378N**  
See NS Package Number E20A, J16A,  
M16A, N16E or W16A

### Logic Symbol



TL/F/9832-2

V<sub>CC</sub> = Pin 16  
GND = Pin 8

| Pin Names | Description                            |
|-----------|--|
| $\bar{E}$ | Enable Input (Active LOW)              |
| D0-D5     | Data Inputs                            |
| CP        | Clock Pulse Input (Active Rising Edge) |
| Q0-Q5     | Flip-Flop Outputs                      |

DM54LS378/DM74LS378 Parallel D Register with Enable

## 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 |                 |
| DM54LS                               | -54°C to +125°C |
| 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                             | DM54LS378 |     |      | DM74LS378 |     |      | Units |
|--------------------|---------------------------------------|-----------|-----|------|-----------|-----|------|-------|
|                    |                                       | Min       | Nom | Max  | Min       | Nom | Max  |       |
| V <sub>CC</sub>    | Supply Voltage                        | 4.5       | 5   | 5.5  | 4.75      | 5   | 5.25 | V     |
| V <sub>IH</sub>    | High Level Input Voltage              | 2         |     |      | 2         |     |      | V     |
| V <sub>IL</sub>    | Low Level Input Voltage               |           |     | 0.7  |           |     | 0.8  | V     |
| I <sub>OH</sub>    | High Level Output Current             |           |     | -0.4 |           |     | -0.4 | mA    |
| I <sub>OL</sub>    | Low Level Output Current              |           |     | 4    |           |     | 8    | mA    |
| T <sub>A</sub>     | Free Air Operating Temperature        | -55       |     | 125  | 0         |     | 70   | °C    |
| t <sub>s</sub> (H) | Setup Time HIGH, D <sub>n</sub> to CP | 20        |     |      | 20        |     |      | ns    |
| t <sub>h</sub> (H) | Hold Time HIGH, D <sub>n</sub> to CP  | 5.0       |     |      | 5.0       |     |      | ns    |
| t <sub>s</sub> (L) | Setup Time LOW, D <sub>n</sub> to CP  | 20        |     |      | 20        |     |      | ns    |
| t <sub>h</sub> (L) | Hold Time LOW, D <sub>n</sub> to CP   | 5.0       |     |      | 5.0       |     |      | ns    |
| t <sub>s</sub> (H) | Setup Time HIGH, $\bar{E}$ to CP      | 30        |     |      | 30        |     |      | ns    |
| t <sub>h</sub> (H) | Hold Time HIGH, $\bar{E}$ to CP       | 5.0       |     |      | 5.0       |     |      | ns    |
| t <sub>s</sub> (L) | Setup Time LOW, $\bar{E}$ to CP       | 30        |     |      | 30        |     |      | ns    |
| t <sub>h</sub> (L) | Hold Time LOW, $\bar{E}$ to CP        | 5.0       |     |      | 5.0       |     |      | ns    |
| t <sub>w</sub> (H) | CP Pulse Width HIGH                   | 20        |     |      | 20        |     |      | ns    |

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

| Symbol          | Parameter                         | Conditions   | Min          | Typ (Note 1) | Max  | Units |
|-----------------|-----------------------------------|--|--------------|--------------|------|-------|
| V <sub>I</sub>  | Input Clamp Voltage               | V <sub>CC</sub> = Min, I <sub>I</sub> = -18 mA                           |              |              | -1.5 | V     |
| V <sub>OH</sub> | High Level Output Voltage         | V <sub>CC</sub> = Min, I <sub>OH</sub> = Max,<br>V <sub>IL</sub> = Max   | DM54<br>2.5  | 3.4          |      | V     |
| V <sub>OL</sub> | Low Level Output Voltage          | V <sub>CC</sub> = Min, I <sub>OL</sub> = Max,<br>V <sub>IH</sub> = Min   | DM54         |              | 0.4  | V     |
|                 |                                   |  | DM74         | 0.35         | 0.5  |       |
|                 |                                   | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = Min                            | DM74         | 0.25         | 0.4  |       |
| I <sub>I</sub>  | Input Current @ Max Input Voltage | V <sub>CC</sub> = Max, V <sub>I</sub> = 7V<br>V <sub>I</sub> = 10V       | DM74<br>DM54 |              | 0.1  | mA    |
| I <sub>IH</sub> | High Level Input Current          | V <sub>CC</sub> = Max, V <sub>I</sub> = 2.7V                             |              |              | 20.0 | μA    |
| I <sub>IL</sub> | Low Level Input Current           | V <sub>CC</sub> = Max, V <sub>I</sub> = 0.4V                             |              |              | -0.4 | mA    |
| I <sub>OS</sub> | Short Circuit Output Current      | V <sub>CC</sub> = Max (Note 2)   | DM54         | -20          | -100 | mA    |
|                 |                                   |  | DM74         | -20          | -100 |       |
| I <sub>CC</sub> | Supply Current                    | V <sub>CC</sub> = Max, D <sub>n</sub> , $\bar{E}$ = GND, CP = $\swarrow$ |              |              | 22   | mA    |

Note 1: All typicals are at V<sub>CC</sub> = 5V, T<sub>A</sub> = 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

$V_{CC} = +5.0V, T_A = +25^\circ C$

| Symbol           | Parameter                                 | 2 k $\Omega$ , C <sub>L</sub> = 15 pF |     | Units |
|------------------|---|---------------------------------------|-----|-------|
|                  |   | Min                                   | Max |       |
| f <sub>max</sub> | Maximum Clock Frequency                   | 30                                    |     | MHz   |
| t <sub>PLH</sub> | Propagation Delay<br>CP to Q <sub>n</sub> |                                       | 27  | ns    |
| t <sub>PHL</sub> |   |                                       | 27  |       |

## Functional Description

The 'LS378 consists of eight edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Enable ( $\bar{E}$ ) inputs are common to all flip-flops.

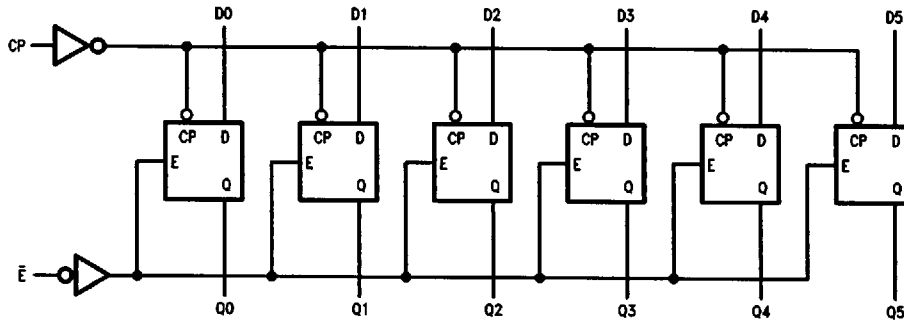
When the  $\bar{E}$  input is LOW, new data is entered into the register on the LOW-to-HIGH transition of the CP input. When the  $\bar{E}$  input is HIGH the register will retain the present data independent of the CP input.

## Truth Table

| Inputs    |    |                | Output         |
|-----------|----|----------------|----------------|
| $\bar{E}$ | CP | D <sub>n</sub> | Q <sub>n</sub> |
| H         | —  | X              | No change      |
| L         | —  | H              | H              |
| L         | —  | L              | L              |

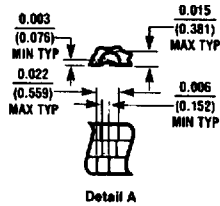
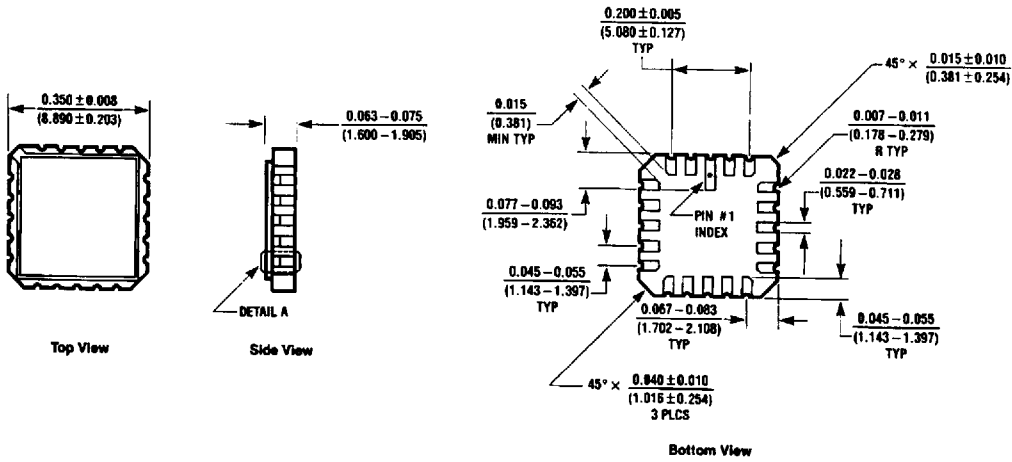
H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

## Logic Diagram



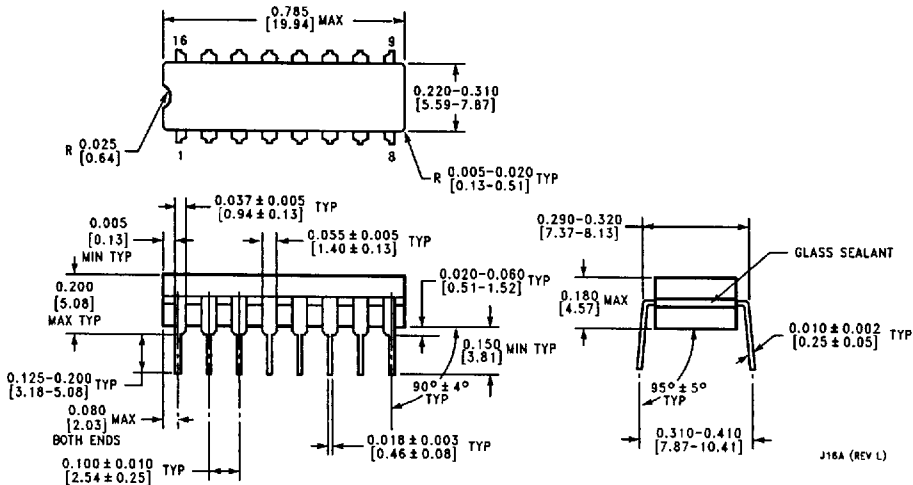
TL/F/9832-3

**Physical Dimensions** inches (millimeters)



**20 Terminal Ceramic Leadless Chip Carrier (E)**  
 Order Number DM54LS378E  
 NS Package Number E20A

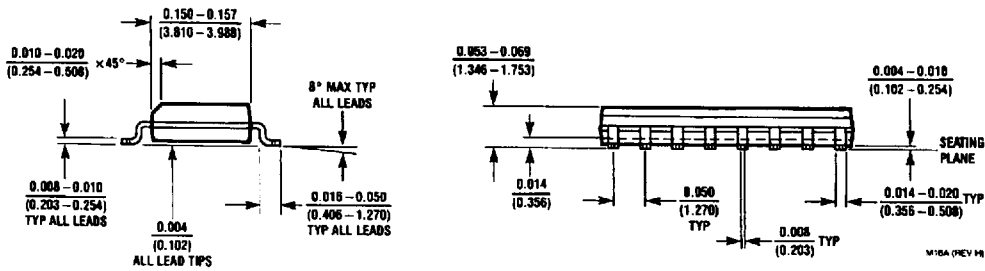
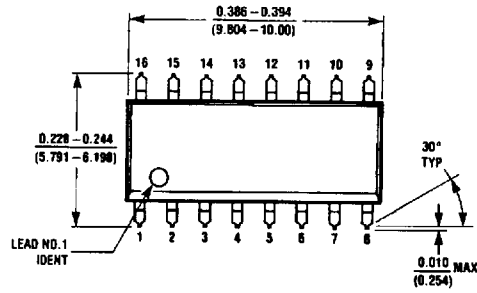
E20A (REV D)



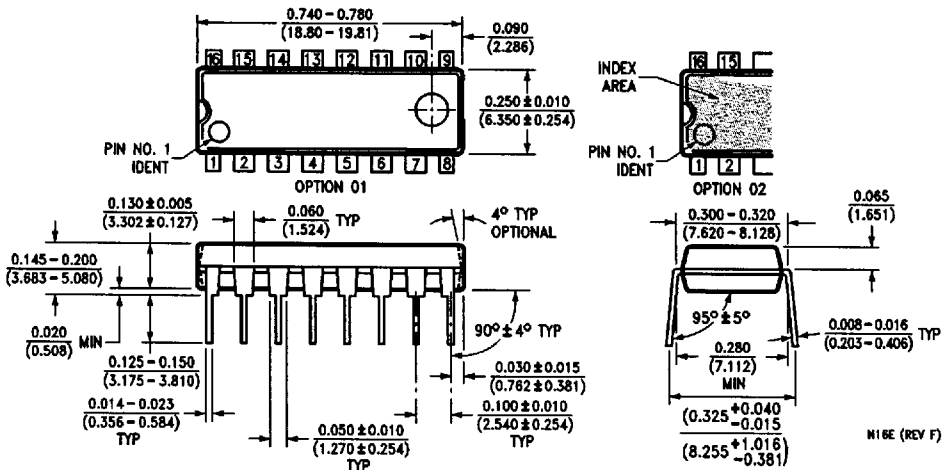
**16-Lead Ceramic Dual-In-Line Package (J)**  
 Order Number DM54LS378J  
 NS Package Number J16A

J16A (REV L)

**Physical Dimensions** inches (millimeters) (Continued)

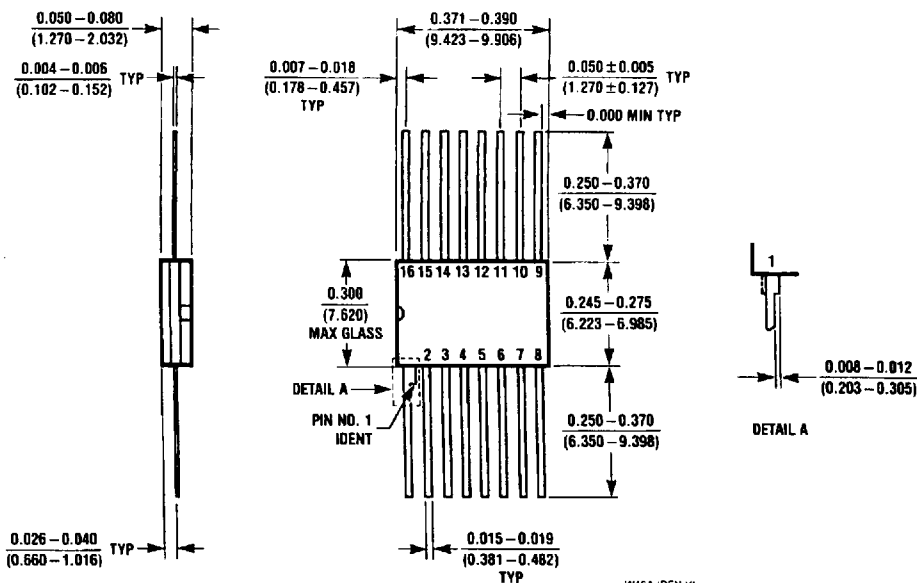


**16-Lead Small Outline Molded Package (M)**  
**Order Number DM74LS378M**  
**NS Package Number M16A**



**16-Lead Molded Dual-In-Line Package (N)**  
**Order Number DM74LS378N**  
**NS Package Number N16E**

**Physical Dimensions** inches (millimeters) (Continued)



**16-Lead Ceramic Flat Package (W)**  
**Order Number DM54LS378W**  
**NS Package Number W16A**

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