

74LV573
Octal D-type transparent latch (3-State)

Supersedes data of 1997 Jun 06 IC24 Data Handbook

## FEATURES

- Wide operating voltage: 1.0 to 5.5 V
- Optimized for Low Voltage applications: 1.0 V to 3.6 V
- Accepts TTL input levels between $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ and $\mathrm{V}_{\mathrm{CC}}=3.6 \mathrm{~V}$
- Typical $\mathrm{V}_{\text {OLP }}$ (output ground bounce) $<0.8 \mathrm{~V}$ at $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$,
$\mathrm{T}_{\text {amb }}=25^{\circ} \mathrm{C}$
- Typical $\mathrm{V}_{\mathrm{OHV}}$ (output $\mathrm{V}_{\mathrm{OH}}$ undershoot) $>2 \mathrm{~V}$ at $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$,
$\mathrm{T}_{\text {amb }}=25^{\circ} \mathrm{C}$
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors/microcomputer
- Common 3-State output enable input
- Output capability: bus driver
- ICC category: MSI


## DESCRIPTION

The 74LV573 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC/HCT573.

The 74LV573 is an octal D-type transparent latch featuring separate D-type inputs for each latch and 3-State outputs for bus oriented applications. A latch enable (LE) input and an output enable (OE) input are common to all internal latches.

The '573' consists of eight D-type transparent latches with 3-State true outputs. When LE is HIGH, data at the $D_{n}$ inputs enters the latches. In this condition the latches are transparent, i.e., a latch output will change each time its corresponding D-input changes.

When LE is LOW the latches store the information that was present at the D-inputs a set-up time preceding the HIGH-to-LOW transition of LE. When OE is LOW, the contents of the eight latches are available at the outputs. When $\overline{O E}$ is HIGH, the outputs go to the high impedance OFF-state. Operation of the $\overline{\mathrm{OE}}$ input does not affect the state of the latches.

The ' 573 ' is functionally identical to the ' 563 ' and the ' 373 ', but the 563 ' has inverted outputs and the ' 373 ' has a different pin arrangement.

## QUICK REFERENCE DATA

GND $=0 \mathrm{~V} ; \mathrm{T}_{\mathrm{amb}}=25^{\circ} \mathrm{C} ; \mathrm{t}_{\mathrm{r}}=\mathrm{t}_{\mathrm{f}} \leq 2.5 \mathrm{~ns}$

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | UNIT |
| :---: | :---: | :---: | :---: | :---: |
| tehL $^{\text {/tPLH }}$ | Propagation delay Dn to Qn LE to Qn | $\begin{aligned} & C_{\mathrm{L}}=15 \mathrm{pF} \\ & \mathrm{~V}_{\mathrm{CC}}=3.3 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 12 \\ & 13 \end{aligned}$ | ns |
| $\mathrm{C}_{1}$ | Input capacitance |  | 3.5 | pF |
| $\mathrm{C}_{\text {PD }}$ | Power dissipation capacitance per latch | Notes 1, 2 | 26 | pF |

## NOTES:

1. $C_{P D}$ is used to determine the dynamic power dissipation ( $\mathrm{P}_{\mathrm{D}}$ in $\mu \mathrm{W}$ )
$P_{D}=C_{P D} \times V_{C C}{ }^{2} \times f_{i}+\sum\left(C_{L} \times V_{C C}{ }^{2} \times f_{0}\right)$ where:
$\mathrm{f}_{\mathrm{i}}=$ input frequency in $\mathrm{MHz} ; \mathrm{C}_{\mathrm{L}}=$ output load capacity in pF ;
$\mathrm{f}_{\mathrm{O}}=$ output frequency in MHz; $\mathrm{V}_{\mathrm{CC}}=$ supply voltage in V ;
$\sum\left(C_{L} \times V_{C C}{ }^{2} \times f_{0}\right)=$ sum of the outputs.
2. The condition is $\mathrm{V}_{\mathrm{I}}=\mathrm{GND}$ to $\mathrm{V}_{\mathrm{CC}}$.

## ORDERING AND PACKAGE INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH <br> AMERICA | NORTH AMERICA | PKG. DWG. \# |
| :--- | :---: | :---: | :---: | :---: |
| 20-Pin Plastic DIL | $-40^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$ | 74 LV 573 N | 74 LV 573 N | SOT146-1 |
| 20-Pin Plastic SO | $-40^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$ | 74 LV 573 D | 74 LV 573 D | SOT163-1 |
| 20-Pin Plastic SSOP Type II | $-40^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$ | 74 LV 573 DB | 74 LV 573 DB | SOT339-1 |
| 20-Pin Plastic TSSOP Type I | $-40^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$ | 74 LV 573 PW | 74 LV 573 PW DH | SOT360-1 |

## PIN DESCRIPTION

| PIN NUMBER | SYMBOL | FUNCTION |
| :--- | :--- | :--- |
| 1 | OE | Output enabled input (active LOW) |
| $2,3,4,5$, <br> $6,7,8,9$ | D0-D7 | Data inputs |
| $19,18,17,16$, <br> $15,14,13,12$ | Q0-Q7 | Data outputs |
| 10 | GND | Ground (0V) |
| 11 | LE | Latch enable input (active HIGH) |
| 20 | VCC | Positive supply voltage |

## FUNCTION TABLE

| OPERATING MODES |  | INPUTS |  |  | $\begin{array}{c}\text { INTERNAL } \\ \end{array}$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |$)$

H = HIGH voltage level
h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition
L = LOW voltage level
I = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition
Z = High impedance OFF-state

## PIN CONFIGURATION



LOGIC SYMBOL



FUNCTIONAL DIAGRAM


## LOGIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS ${ }^{1,2}$

In accordance with the Absolute Maximum Rating System (IEC 134)
Voltages are referenced to GND (ground $=0 \mathrm{~V}$ )

| SYMBOL | PARAMETER | CONDITIONS | RATING | UNIT |
| :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{\mathrm{CC}}$ | DC supply voltage |  | -0.5 to +7.0 | V |
| $\pm{ }_{\text {IK }}$ | DC input diode current | $\mathrm{V}_{1}<-0.5$ or $\mathrm{V}_{1}>\mathrm{V}_{\mathrm{CC}}+0.5 \mathrm{~V}$ | 20 | mA |
| $\pm{ }_{\text {l }}$ | DC output diode current | $\mathrm{V}_{\mathrm{O}}<-0.5$ or $\mathrm{V}_{\mathrm{O}}>\mathrm{V}_{\mathrm{CC}}+0.5 \mathrm{~V}$ | 50 | mA |
| $\pm \mathrm{O}$ | DC output source or sink current - bus driver outputs | $-0.5 \mathrm{~V}<\mathrm{V}_{\mathrm{O}}<\mathrm{V}_{\mathrm{CC}}+0.5 \mathrm{~V}$ | 35 | mA |
| $\begin{gathered} \pm \mathrm{I}_{\mathrm{GND}}, \\ \pm \mathrm{I}_{\mathrm{CC}} \end{gathered}$ | DC $\mathrm{V}_{\mathrm{CC}}$ or GND current for types with -bus driver outputs |  | 70 | mA |
| $\mathrm{T}_{\text {stg }}$ | Storage temperature range |  | -65 to +150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{P}_{\text {tot }}$ | ```Power dissipation per package -plastic DIL -plastic mini-pack (SO) -plastic shrink mini-pack (SSOP and TSSOP)``` | for temperature range: -40 to $+125^{\circ} \mathrm{C}$ above $+70^{\circ} \mathrm{C}$ derate linearly with $12 \mathrm{~mW} / \mathrm{K}$ above $+70^{\circ} \mathrm{C}$ derate linearly with $8 \mathrm{~mW} / \mathrm{K}$ above $+60^{\circ} \mathrm{C}$ derate linearly with $5.5 \mathrm{~mW} / \mathrm{K}$ | $\begin{aligned} & 750 \\ & 500 \\ & 400 \end{aligned}$ | mW |

NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP. | MAX | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{\text {CC }}$ | DC supply voltage | See Note 1 | 1.0 | 3.3 | 5.5 | V |
| $\mathrm{V}_{1}$ | Input voltage |  | 0 | - | $\mathrm{V}_{\mathrm{CC}}$ | V |
| $\mathrm{V}_{\mathrm{O}}$ | Output voltage |  | 0 | - | $\mathrm{V}_{\mathrm{CC}}$ | V |
| Tamb | Operating ambient temperature range in free air | See DC and AC characteristics | $\begin{aligned} & \hline-40 \\ & -40 \end{aligned}$ |  | $\begin{gathered} +85 \\ +125 \end{gathered}$ | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{tr}_{\mathrm{r}} \mathrm{t}_{\mathrm{f}}$ | Input rise and fall times | $\begin{aligned} & \hline \mathrm{V}_{\mathrm{CC}}=1.0 \mathrm{~V} \text { to } 2.0 \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{CC}}=2.0 \mathrm{~V} \text { to } 2.7 \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{CC}}=2.7 \mathrm{~V} \text { to } 3.6 \mathrm{~V} \\ & \mathrm{~V}_{\mathrm{CC}}=3.6 \mathrm{~V} \text { to } 5.5 \mathrm{~V} \end{aligned}$ | - | - | $\begin{gathered} 500 \\ 200 \\ 100 \\ 50 \\ \hline \end{gathered}$ | ns/V |

## NOTE:

1. The LV is guaranteed to function down to $\mathrm{V}_{\mathrm{CC}}=1.0 \mathrm{~V}$ (input levels GND or $\mathrm{V}_{\mathrm{CC}}$ ); DC characteristics are guaranteed from $\mathrm{V}_{\mathrm{CC}}=1.2 \mathrm{~V}$ to $\mathrm{V}_{\mathrm{CC}}=5.5 \mathrm{~V}$.

## DC CHARACTERISTICS FOR THE LV FAMILY

Over recommended operating conditions voltages are referenced to GND (ground = OV)

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS |  |  |  |  | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |  |  | $-40^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$ |  |  |
|  |  |  | MIN | TYP ${ }^{1}$ | MAX | MIN | MAX |  |
| $\mathrm{V}_{\mathrm{IH}}$ | HIGH level Input voltage | $\mathrm{V}_{\mathrm{CC}}=1.2 \mathrm{~V}$ | 0.9 |  |  | 0.9 |  | V |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.0 \mathrm{~V}$ | 1.4 |  |  | 1.4 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.7$ to 3.6 V | 2.0 |  |  | 2.0 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5$ to 5.5 V | $0.7 * V_{\text {CC }}$ |  |  | $0.7{ }^{*} \mathrm{~V}_{\text {CC }}$ |  |  |
| $V_{\text {IL }}$ | LOW level Input voltage | $\mathrm{V}_{C C}=1.2 \mathrm{~V}$ |  |  | 0.3 |  | 0.3 | V |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.0 \mathrm{~V}$ |  |  | 0.6 |  | 0.6 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.7$ to 3.6 V |  |  | 0.8 |  | 0.8 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5$ to 5.5 |  |  | $0.3 * V_{\text {CC }}$ |  | $0.3 * V_{C C}$ |  |
| $\mathrm{V}_{\mathrm{OH}}$ | HIGH level output voltage; all outputs | $\mathrm{V}_{\mathrm{CC}}=1.2 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}} ;-\mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ |  | 1.2 |  |  |  | V |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}} ;-\mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ | 1.8 | 2.0 |  | 1.8 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL} ;}-\mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ | 2.5 | 2.7 |  | 2.5 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=3.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$ - $-\mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ | 2.8 | 3.0 |  | 2.8 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {IH }}$ or $\mathrm{V}_{\text {IL; }}-\mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ | 4.3 | 4.5 |  | 4.3 |  |  |
|  | HIGH level output voltage; BUS driver outputs | $\mathrm{V}_{\mathrm{CC}}=3.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {IH }}$ or $\mathrm{V}_{\mathrm{IL}} ;-\mathrm{l}_{\mathrm{O}}=8 \mathrm{~mA}$ | 2.40 | 2.82 |  | 2.20 |  |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}} ;-\mathrm{l}_{\mathrm{O}}=16 \mathrm{~mA}$ | 3.60 | 4.20 |  | 3.50 |  |  |
| $\mathrm{V}_{\mathrm{OL}}$ | LOW level output voltage; all outputs | $\mathrm{V}_{\mathrm{CC}}=1.2 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$ I $\mathrm{I}=100 \mu \mathrm{~A}$ |  | 0 |  |  |  | V |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}} ; \mathrm{l}_{\mathrm{O}}=100 \mu \mathrm{~A}$ |  | 0 | 0.2 |  | 0.2 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}}$ I $\mathrm{I}_{\mathrm{O}}=100 \mu \mathrm{~A}$ |  | 0 | 0.2 |  | 0.2 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=3.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}}$ or $\mathrm{V}_{\mathrm{IL}} ; \mathrm{I}_{\mathrm{O}}=100 \mu \mathrm{~A}$ |  | 0 | 0.2 |  | 0.2 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {IH }}$ or $\mathrm{V}_{\mathrm{IL} ;} \mathrm{I} \mathrm{I}=100 \mu \mathrm{~A}$ |  | 0 | 0.2 |  | 0.2 |  |
|  | LOW level output voltage; BUS driver outputs | $\mathrm{V}_{\mathrm{CC}}=3.0 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {IH }}$ or $\mathrm{V}_{\text {IL; }} \mathrm{I} \mathrm{I}=8 \mathrm{~mA}$ |  | 0.20 | 0.40 |  | 0.50 |  |
|  |  | $\mathrm{V}_{\mathrm{CC}}=4.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {IH }}$ or $\mathrm{V}_{\text {IL }}$ I $\mathrm{IO}=16 \mathrm{~mA}$ |  | 0.35 | 0.55 |  | 0.65 |  |
| 1 | Input leakage current | $\mathrm{V}_{\mathrm{CC}}=5.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\text {CC }}$ or GND |  |  | 1.0 |  | 1.0 | $\mu \mathrm{A}$ |
| loz | 3-State output OFF-state current | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=5.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{IH}} \text { or } \mathrm{V}_{\mathrm{IL}} \\ & \mathrm{~V}_{\mathrm{O}}=\mathrm{V}_{\mathrm{CC}} \text { or } \mathrm{GND} \end{aligned}$ |  |  | 5 |  | 10 | $\mu \mathrm{A}$ |
| $I_{\text {cc }}$ | Quiescent supply current; MSI | $\mathrm{V}_{\mathrm{CC}}=5.5 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{CC}}$ or GND; $\mathrm{I}_{\mathrm{O}}=0$ |  |  | 20.0 |  | 160 | $\mu \mathrm{A}$ |
| $\Delta_{\text {l }} \mathrm{Cc}$ | Additional quiescent supply current per input | $\mathrm{V}_{\mathrm{CC}}=2.7 \mathrm{~V}$ to $3.6 \mathrm{~V} ; \mathrm{V}_{\mathrm{I}}=\mathrm{V}_{\mathrm{CC}}-0.6 \mathrm{~V}$ |  |  | 500 |  | 850 | $\mu \mathrm{A}$ |

## NOTE:

1. All typical values are measured at $\mathrm{T}_{\mathrm{amb}}=25^{\circ} \mathrm{C}$.

## AC CHARACTERISTICS

$G N D=0 \mathrm{~V} ; \mathrm{t}_{\mathrm{r}}=\mathrm{t}_{\mathrm{f}} \leq 2.5 \mathrm{~ns} ; \mathrm{C}_{\mathrm{L}}=50 \mathrm{pF} ; \mathrm{R}_{\mathrm{L}}=1 \mathrm{~K} \Omega$

| SYMBOL | PARAMETER | WAVEFORM | CONDITION | $\begin{gathered} \text { LIMITS } \\ -40 \text { to }+85{ }^{\circ} \mathrm{C} \end{gathered}$ |  |  | $\begin{array}{\|c\|} \hline \text { LIMITS } \\ -40 \text { to }+125^{\circ} \mathrm{C} \end{array}$ |  | UNIT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{V}_{\mathrm{Cc}}(\mathrm{V})$ | MIN | TYP | MAX | MIN | MAX |  |
| tPHLIPLH | Propagation delay Dn to Qn | Figures 1, 5 | 1.2 | - | 75 | - | - | - | ns |
|  |  |  | 2.0 | - | 26 | 39 | - | 49 |  |
|  |  |  | 2.7 | - | 19 | 29 | - | 36 |  |
|  |  |  | 3.0 to 3.6 | - | $14^{2}$ | 23 | - | 29 |  |
|  |  |  | 4.5 to 5.5 | - | - | 19 | - | 24 |  |
| $\mathrm{t}_{\text {PhLItPLH }}$ | Propagation delay LE to Qn | Figures 2, 5 | 1.2 | - | 80 | - | - | - | ns |
|  |  |  | 2.0 | - | 27 | 43 | - | 53 |  |
|  |  |  | 2.7 | - | 20 | 31 | - | 34 |  |
|  |  |  | 3.0 to 3.6 | - | $15^{2}$ | 25 | - | 31 |  |
|  |  |  | 4.5 to 5.5 | - | - | 21 | - | 26 |  |
| tPzH/PPZL | 3-State output enable time OE to Qn | Figures 3, 5 | 1.2 | - | 70 | - | - | - | ns |
|  |  |  | 2.0 | - | 24 | 37 | - | 48 |  |
|  |  |  | 2.7 | - | 18 | 28 | - | 35 |  |
|  |  |  | 3.0 to 3.6 | - | $13^{2}$ | 22 | - | 28 |  |
|  |  |  | 4.5 to 5.5 | - | - | 18 | - | 23 |  |
| tPhztPLZ | 3-State output disable time OE to Qn | Figures 3, 5 | 1.2 | - | 80 | - | - | - | ns |
|  |  |  | 2.0 | - | 29 | 39 | - | 48 |  |
|  |  |  | 2.7 | - | 22 | 29 | - | 36 |  |
|  |  |  | 3.0 to 3.6 | - | $17^{2}$ | 24 | - | 29 |  |
|  |  |  | 4.5 to 5.5 | - | - | 20 | - | 24 |  |
| tw | LE pulse width HIGH | Figure 2 | 2.0 | 34 | 9 | - | 41 | - | ns |
|  |  |  | 2.7 | 25 | 6 | - | 30 | - |  |
|  |  |  | 3.0 to 3.6 | 20 | $5^{2}$ | - | 24 | - |  |
| $t_{\text {su }}$ | Setup time Dn to LE | Figure 4 | 1.2 | - | 25 | - | - | - | ns |
|  |  |  | 2.0 | 17 | 9 | - | 20 | - |  |
|  |  |  | 2.7 | 13 | 6 | - | 15 | - |  |
|  |  |  | 3.0 to 3.6 | 10 | $5^{2}$ | - | 12 | - |  |
| $t_{h}$ | Hold time Dn to LE | Figure 4 | 1.2 | - | 5 | - | - | - | ns |
|  |  |  | 2.0 | 8 | 2 | - | 8 | - |  |
|  |  |  | 2.7 | 8 | 2 | - | 8 | - |  |
|  |  |  | 3.0 to 3.6 | 8 | $1^{2}$ | - | 8 | - |  |

## NOTES:

All typical values are measured at $T_{a m b}=25^{\circ} \mathrm{C}$

1. Typical values are measured at $\mathrm{V}_{\mathrm{CC}}=3.3 \mathrm{~V}$

## AC WAVEFORMS

$\mathrm{V}_{\mathrm{M}}=1.5 \mathrm{~V}$ at $\mathrm{V}_{\mathrm{CC}} \geq 2.7 \mathrm{~V}$ and $\leq 3.6 \mathrm{~V}$
$\mathrm{V}_{\mathrm{M}}=0.5^{*} \mathrm{~V}_{\mathrm{CC}}$ at $\mathrm{V}_{\mathrm{CC}}<2.7 \mathrm{~V}$ and $\geq 4.5 \mathrm{~V}$
$\mathrm{V}_{\mathrm{OL}}$ and $\mathrm{V}_{\mathrm{OH}}$ are the typical output voltage drop that occur with the output load.
$\mathrm{V}_{\mathrm{X}}=\mathrm{V}_{\mathrm{OL}}+0.3 \mathrm{~V}$ at $\mathrm{V}_{\mathrm{CC}} \geq 2.7 \mathrm{~V}$ and $\leq 3.6 \mathrm{~V}$
$\mathrm{V}_{\mathrm{X}}=\mathrm{V}_{\mathrm{OL}}+0.1 \mathrm{~V}_{\mathrm{CC}}$ at $\mathrm{V}_{\mathrm{CC}}<2.7 \mathrm{~V}$ and $\geq 4.5 \mathrm{~V}$
$\mathrm{V}_{\mathrm{Y}}=\mathrm{V}_{\mathrm{OH}}-0.3 \mathrm{~V}$ at $\mathrm{V}_{\mathrm{CC}} \geq 2.7 \mathrm{~V}$ and $\leq 3.6 \mathrm{~V}$
$\mathrm{V}_{\mathrm{Y}}=\mathrm{V}_{\mathrm{OH}}-0.1 \mathrm{~V}_{\mathrm{CC}}$ at $\mathrm{V}_{\mathrm{CC}}<2.7 \mathrm{~V}$ and $\geq 4.5 \mathrm{~V}$


Figure 1. Data input $\left(D_{n}\right)$ to output $\left(Q_{n}\right)$ propagation delays and the output transition times


Figure 2. Latch enable input (LE) pulse width, the latch enable input to output $\left(Q_{n}\right)$ propagation delays and the output transition times.


Figure 3. 3-State enable and disable times


Figure 4. Data set-up and hold times for the $D_{n}$ input to the LE input

## NOTE:

The shaded areas indicate when the input is permitted to change for predictable output performance.

## TEST CIRCUIT



Figure 5. Load circuitry for switching times


DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | $\underset{\max .}{A}$ | $A_{1}$ min. | $\mathrm{A}_{2}$ $\max .$ | b | $\mathrm{b}_{1}$ | c | $\mathrm{D}^{(1)}$ | $E^{(1)}$ | e | $e_{1}$ | L | $\mathrm{M}_{\mathrm{E}}$ | $\mathbf{M}_{\mathrm{H}}$ | w | $\mathbf{z a x}^{(1)}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| mm | 4.2 | 0.51 | 3.2 | $\begin{aligned} & 1.73 \\ & 1.30 \end{aligned}$ | $\begin{aligned} & 0.53 \\ & 0.38 \end{aligned}$ | $\begin{aligned} & 0.36 \\ & 0.23 \end{aligned}$ | $\begin{aligned} & 26.92 \\ & 26.54 \end{aligned}$ | $\begin{aligned} & 6.40 \\ & 6.22 \end{aligned}$ | 2.54 | 7.62 | $\begin{aligned} & 3.60 \\ & 3.05 \end{aligned}$ | $\begin{aligned} & 8.25 \\ & 7.80 \end{aligned}$ | $\begin{gathered} 10.0 \\ 8.3 \end{gathered}$ | 0.254 | 2.0 |
| inches | 0.17 | 0.020 | 0.13 | $\begin{aligned} & 0.068 \\ & 0.051 \end{aligned}$ | $\begin{aligned} & 0.021 \\ & 0.015 \end{aligned}$ | $\begin{aligned} & 0.014 \\ & 0.009 \end{aligned}$ | $\begin{aligned} & 1.060 \\ & 1.045 \end{aligned}$ | $\begin{aligned} & 0.25 \\ & 0.24 \end{aligned}$ | 0.10 | 0.30 | $\begin{aligned} & 0.14 \\ & 0.12 \end{aligned}$ | $\begin{aligned} & 0.32 \\ & 0.31 \end{aligned}$ | $\begin{aligned} & 0.39 \\ & 0.33 \end{aligned}$ | 0.01 | 0.078 |

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES |  |  | EUROPEAN PROJECTION | ISSUE DATE |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | IEC | JEDEC | EIAJ |  |  |
| SOT146-1 |  |  | SC603 | - ¢ | $\begin{aligned} & 92-11-17 \\ & 95-05-24 \end{aligned}$ |



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | $\underset{\max }{\mathrm{A}}$ | $\mathrm{A}_{1}$ | $\mathrm{A}_{2}$ | $\mathrm{A}_{3}$ | $\mathrm{b}_{\mathrm{p}}$ | c | $\mathrm{D}^{(1)}$ | $E^{(1)}$ | e | $\mathrm{H}_{\mathrm{E}}$ | L | $L_{p}$ | Q | v | w | y | $Z^{(1)}$ | $\theta$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| mm | 2.65 | $\begin{aligned} & 0.30 \\ & 0.10 \end{aligned}$ | $\begin{aligned} & 2.45 \\ & 2.25 \end{aligned}$ | 0.25 | $\begin{aligned} & 0.49 \\ & 0.36 \end{aligned}$ | $\begin{aligned} & 0.32 \\ & 0.23 \end{aligned}$ | $\begin{aligned} & 13.0 \\ & 12.6 \end{aligned}$ | $\begin{aligned} & 7.6 \\ & 7.4 \end{aligned}$ | 1.27 | $\begin{aligned} & 10.65 \\ & 10.00 \end{aligned}$ | 1.4 | $\begin{aligned} & 1.1 \\ & 0.4 \end{aligned}$ | $\begin{aligned} & 1.1 \\ & 1.0 \end{aligned}$ | 0.25 | 0.25 | 0.1 | 0.9 0.4 | $\begin{aligned} & 8^{0} \\ & 0^{\circ} \end{aligned}$ |
| inches | 0.10 | $\begin{aligned} & 0.012 \\ & 0.004 \end{aligned}$ | $\begin{aligned} & 0.096 \\ & 0.089 \end{aligned}$ | 0.01 | $\begin{aligned} & 0.019 \\ & 0.014 \end{aligned}$ | $\begin{aligned} & 0.013 \\ & 0.009 \end{aligned}$ | $\begin{aligned} & 0.51 \\ & 0.49 \end{aligned}$ | $\begin{aligned} & 0.30 \\ & 0.29 \\ & \hline \end{aligned}$ | 0.050 | $\begin{aligned} & 0.42 \\ & 0.39 \end{aligned}$ | 0.055 | $\begin{aligned} & 0.043 \\ & 0.016 \end{aligned}$ | $\begin{aligned} & 0.043 \\ & 0.039 \end{aligned}$ | 0.01 | 0.01 | 0.004 | $\begin{aligned} & 0.035 \\ & 0.016 \end{aligned}$ |  |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES |  |  | EUROPEAN PROJECTION | ISSUE DATE |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | IEC | JEDEC | EIAJ |  |  |
| SOT163-1 | 075E04 | MS-013AC |  | - ¢ | $\begin{aligned} & -92-11-17 \\ & 95-01-24 \end{aligned}$ |



DIMENSIONS (mm are the original dimensions)

| UNIT | $\begin{gathered} \mathrm{A} \\ \text { max. } \end{gathered}$ | $\mathrm{A}_{1}$ | $\mathrm{A}_{2}$ | $\mathrm{A}_{3}$ | $\mathrm{b}_{\mathrm{p}}$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $\mathrm{H}_{\mathrm{E}}$ | L | $L_{p}$ | Q | v | w | y | $\mathbf{Z}^{(1)}$ | $\theta$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| mm | 2.0 | $0.21$ | $\begin{aligned} & 1.80 \\ & 1.65 \end{aligned}$ | 0.25 | $\begin{aligned} & 0.38 \\ & 0.25 \end{aligned}$ | $\begin{aligned} & 0.20 \\ & 0.09 \end{aligned}$ | $\begin{aligned} & \hline 7.4 \\ & 7.0 \end{aligned}$ | $\begin{aligned} & \hline 5.4 \\ & 5.2 \end{aligned}$ | 0.65 | $\begin{aligned} & 7.9 \\ & 7.6 \end{aligned}$ | 1.25 | $\begin{aligned} & 1.03 \\ & 0.63 \end{aligned}$ | $\begin{aligned} & \hline 0.9 \\ & 0.7 \end{aligned}$ | 0.2 | 0.13 | 0.1 | $\begin{aligned} & 0.9 \\ & 0.5 \end{aligned}$ | $8^{\circ}$ $0^{\circ}$ |

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

| OUTLINE <br> VERSION | REFERENCES |  |  |  | EUROPEAN <br> PROJECTION | ISSUE DATE |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | IEC | JEDEC | EIAJ |  |  |  |
| SOT339-1 |  | MO-150AE |  |  | $-93-09-08$ |  |



DIMENSIONS ( mm are the original dimensions)

| UNIT | $\mathbf{A}$ | $\mathbf{A}_{\mathbf{1}}$ | $\mathbf{A}_{\mathbf{2}}$ | $\mathbf{A}_{\mathbf{3}}$ | $\mathbf{b}_{\mathbf{p}}$ | $\mathbf{c}$ | $\mathbf{D}^{(1)}$ | $\mathbf{E}^{(2)}$ | $\mathbf{e}$ | $\mathbf{H}_{\mathbf{E}}$ | $\mathbf{L}$ | $\mathbf{L}_{\mathbf{p}}$ | $\mathbf{Q}$ | $\mathbf{v}$ | $\mathbf{w}$ | $\mathbf{y}$ | $\mathbf{Z}^{(1)}$ | $\boldsymbol{\theta}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| mm | 1.10 | 0.15 | 0.95 | 0.25 | 0.30 | 0.2 | 6.6 | 4.5 | 0.65 | 6.6 | 1.0 | 0.75 | 0.4 | 0.2 | 0.13 | 0.1 | 0.5 | $8^{\circ}$ |
|  | 0.80 | 0.25 | 0.19 | 0.1 | 6.4 | 4.3 | 0.6 | 6.2 | 1.0 | 0.50 | 0.3 |  | 0.2 | $0^{\circ}$ |  |  |  |  |

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE <br> VERSION | REFERENCES |  |  |  | EUROPEAN | ISSUE DATE |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | IEC | JEDEC | EIAJ |  |  |  |
| SOT360-1 |  | MO-153AC |  |  | $-93-06-16$ |  |

## DEFINITIONS

| Data Sheet Identification | Product Status | Definition |
| :---: | :---: | :--- |
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Philips Semiconductors
811 East Arques Avenue
P.O. Box 3409

Sunnyvale, California 94088-3409
Telephone 800-234-7381
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