

## Absolute Maximum Ratings(Note 2)

| Supply Voltage | 7 V |
| :--- | ---: |
| Input Voltage | 7 V |
| Operating Free Air Temperature Range | $0^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$ |
| Storage Temperature Range | $-65^{\circ} \mathrm{C}$ to $+150^{\circ} \mathrm{C}$ |

Note 2: The "Absolute Maximum Ratings" are those values beyond which he safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrica Characteristics tables are not guaranteed at the absolute maximum ratings The "Recommended Operating Conditions" table will define the conditions or actual device operation.

## Recommended Operating Conditions

| Symbol | Parameter |  | Min | Nom | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{\text {CC }}$ | Supply Voltage |  | 4.75 | 5 | 5.25 | V |
| $\mathrm{V}_{\mathrm{IH}}$ | HIGH Level Input Voltage |  | 2 |  |  | V |
| $\mathrm{V}_{\text {IL }}$ | LOW Level Input Voltage |  |  |  | 0.8 | V |
| $\mathrm{I}_{\mathrm{OH}}$ | HIGH Level Output Current |  |  |  | -0.4 | mA |
| ${ }_{\text {OL }}$ | LOW Level Output Current |  |  |  | 8 | mA |
| $\mathrm{f}_{\mathrm{CLK}}$ | Clock Frequency (Note 3) |  | 0 |  | 25 | MHz |
| $\mathrm{f}_{\text {CLK }}$ | Clock Frequency (Note 4) |  | 0 |  | 20 | MHz |
| $t_{W}$ | Pulse Width <br> (Note 3) | Clock HIGH | 18 |  |  | ns |
|  |  | Preset LOW | 15 |  |  |  |
|  |  | Clear LOW | 15 |  |  |  |
| $t_{\text {w }}$ | Pulse Width (Note 4) | Clock HIGH | 25 |  |  | ns |
|  |  | Preset LOW | 20 |  |  |  |
|  |  | Clear LOW | 20 |  |  |  |
| $\mathrm{t}_{\mathrm{SU}}$ | Setup Time (Note 3)(Note 5) | Data HIGH | $30 \uparrow$ |  |  | ns |
|  |  | Data LOW | $20 \uparrow$ |  |  |  |
| $\mathrm{t}_{\mathrm{SU}}$ | Setup Time <br> (Note 5)(Note 4) | Data HIGH | $35 \uparrow$ |  |  | ns |
|  |  | Data LOW | $25 \uparrow$ |  |  |  |
| $\mathrm{t}_{\mathrm{H}}$ | Hold Time (Note 6) |  | $0 \uparrow$ |  |  | ns |
| $\mathrm{T}_{\text {A }}$ | Free Air Operating Temperature |  | 0 |  | 70 | ${ }^{\circ} \mathrm{C}$ |

$C_{L}=15 \mathrm{pF}, \mathrm{R}_{\mathrm{L}}=2 \mathrm{k} \Omega, \mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=5 \mathrm{~V}$
Note 4: $\mathrm{C}_{\mathrm{L}}=50 \mathrm{pF}, \mathrm{R}_{\mathrm{L}}=2 \mathrm{k} \Omega, \mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=5 \mathrm{~V}$.
Note 5: The symbol ( $\uparrow$ ) indicates the rising edge of the clock pulse is used for reference.
Note 6: $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$ and $\mathrm{V}_{\mathrm{CC}}=5 \mathrm{~V}$.

## Electrical Characteristics

| Symbol | Parameter | Conditions |  | Min | $\begin{gathered} \text { Typ } \\ \text { (Note 7) } \end{gathered}$ | Max | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{V}_{1}$ | Input Clamp Voltage | $\mathrm{V}_{\mathrm{CC}}=\mathrm{Min}, \mathrm{I}_{\mathrm{I}}=-18 \mathrm{~mA}$ |  |  |  | -1.5 | V |
| $\mathrm{V}_{\mathrm{OH}}$ | HIGH Level Output Voltage | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=\operatorname{Min}, \mathrm{I}_{\mathrm{OH}}=\mathrm{Max} \\ & \mathrm{~V}_{\mathrm{IL}}=\mathrm{Max}, \mathrm{~V}_{\mathrm{IH}}=\operatorname{Min} \end{aligned}$ |  | 2.7 | 3.4 |  | V |
| $\mathrm{V}_{\text {OL }}$ | LOW Level Output Voltage | $\begin{aligned} & \mathrm{v}_{\mathrm{CC}}=\operatorname{Min}, \mathrm{I}_{\mathrm{OL}}=\mathrm{Max} \\ & \mathrm{~V}_{\mathrm{IL}}=\mathrm{Max}, \mathrm{~V}_{\mathrm{IH}}=\mathrm{Min} \end{aligned}$ |  |  | 0.35 | 0.5 | V |
|  |  | $\mathrm{l}_{\mathrm{OL}}=4 \mathrm{~mA}, \mathrm{~V}_{\mathrm{CC}}=\mathrm{Min}$ |  |  | 0.25 | 0.4 |  |
| 1 | Input Current @ Max Input Voltage | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=\mathrm{Max} \\ & \mathrm{~V}_{\mathrm{I}}=7 \mathrm{~V} \end{aligned}$ | J, $\overline{\mathrm{K}}$ |  |  | 0.1 | mA |
|  |  |  | Clock |  |  | 0.1 |  |
|  |  |  | Preset |  |  | 0.2 |  |
|  |  |  | Clear |  |  | 0.2 |  |
| $\mathrm{I}_{\mathrm{IH}}$ | HIGH Level Input Current | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=\mathrm{Max} \\ & \mathrm{~V}_{\mathrm{I}}=2.7 \mathrm{~V} \end{aligned}$ | J, $\overline{\mathrm{K}}$ |  |  | 20 | $\mu \mathrm{A}$ |
|  |  |  | Clock |  |  | 20 |  |
|  |  |  | Preset |  |  | 40 |  |
|  |  |  | Clear |  |  | 40 |  |
| ILL | LOW Level Input Current | $\begin{aligned} & \mathrm{V}_{\mathrm{CC}}=\mathrm{Max} \\ & \mathrm{~V}_{\mathrm{I}}=0.4 \mathrm{~V} \end{aligned}$ | J, $\overline{\mathrm{K}}$ |  |  | -0.4 | mA |
|  |  |  | Clock |  |  | -0.4 |  |
|  |  |  | Preset |  |  | -0.8 |  |
|  |  |  | Clear |  |  | -0.8 |  |
| los | Short Circuit Output Current | $\mathrm{V}_{\text {CC }}=\mathrm{Max}$ (Note 8) |  | -20 |  | -100 | mA |
| $\mathrm{I}_{\mathrm{Cc}}$ | Supply Current | $\mathrm{V}_{\text {CC }}=\mathrm{Max}$ (Note 9) |  |  | 4 | 8 | mA |

Note 7: All typicals are at $\mathrm{V}_{\mathrm{CC}}=5 \mathrm{~V}, \mathrm{~T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.
Note 8: Not more than one output should be shorted at a time, and the duration should not exceed one second. For devices, with feedback from the outputs, where shorting the outputs to ground may cause the outputs to change logic state an equivalent test may be performed where $\mathrm{V}_{\mathrm{O}}=2.125 \mathrm{~V}$ with the minimum and maximum limits reduced by one half from their stated values. This is very useful when using automatic test equipment.
Note 9 : $I_{C C}$ is measured with all outputs OPEN, with CLOCK grounded after setting the $Q$ and $\bar{Q}$ outputs HIGH in turn.

## Switching Characteristics

at $\mathrm{V}_{\mathrm{CC}}=5 \mathrm{~V}$ and $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$

| Symbol | Parameter | From (Input) To (Output) | $\mathrm{R}_{\mathrm{L}}=\mathbf{2} \mathrm{k} \Omega$ |  |  |  | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{C}_{\mathrm{L}}=15 \mathrm{pF}$ |  | $\mathrm{C}_{\mathrm{L}}=\mathbf{5 0} \mathrm{pF}$ |  |  |
|  |  |  | Min | Max | Min | Max |  |
| $\mathrm{f}_{\text {MAX }}$ | Maximum Clock Frequency |  | 25 |  | 20 |  | MHz |
| $\mathrm{t}_{\text {PLH }}$ | Propagation Delay Time LOW-to-HIGH Level Output | $\begin{aligned} & \text { Clock to } \\ & \text { Q or } \bar{Q} \end{aligned}$ |  | 25 |  | 35 | ns |
| $\overline{t_{\text {PHL }}}$ | Propagation Delay Time HIGH-to-LOW Level Output | $\begin{aligned} & \text { Clock to } \\ & Q \text { or } \bar{Q} \end{aligned}$ |  | 30 |  | 35 | ns |
| $\overline{t_{\text {PLH }}}$ | Propagation Delay Time LOW-to-HIGH Level Output | $\begin{aligned} & \text { Clear } \\ & \text { to } \overline{\mathrm{Q}} \end{aligned}$ |  | 25 |  | 35 | ns |
| ${ }_{\text {t }}$ | Propagation Delay Time HIGH-to-LOW Level Output | $\begin{aligned} & \hline \text { Clear } \\ & \text { to } Q \end{aligned}$ |  | 30 |  | 35 | ns |
| $\mathrm{t}_{\text {PLH }}$ | Propagation Delay Time LOW-to-HIGH Level Output | Preset to Q |  | 25 |  | 35 | ns |
| $\overline{\mathrm{t}_{\text {PHL }}}$ | Propagation Delay Time HIGH-to-LOW Level Output | $\begin{aligned} & \text { Preset } \\ & \text { to } \bar{Q} \end{aligned}$ |  | 30 |  | 35 | ns |



Physical Dimensions inches (millimeters) unless otherwise noted (Continued)


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