1. General description

The 74AVC2T45 is a dual-bit, dual-supply transceiver that enables bidirectional level translation. It features two data input-output ports (nA and nB), a direction control input (DIR) and dual-supply pins ($V_{CC(A)}$ and $V_{CC(B)}$). Both $V_{CC(A)}$ and $V_{CC(B)}$ can be supplied at any voltage between 0.8 V and 3.6 V making the device suitable for translating between any of the low voltage nodes (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V and 3.3 V). Pins nA and DIR are referenced to $V_{CC(A)}$ and pins nB are referenced to $V_{CC(B)}$. A HIGH on DIR allows transmission from nA to nB and a LOW on DIR allows transmission from nB to nA.

The device is fully specified for partial power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing any damaging backflow current through the device when it is powered down. In Suspend mode when either $V_{CC(A)}$ or $V_{CC(B)}$ are at GND level, both A and B are in the high-impedance OFF-state.

2. Features and benefits

- Wide supply voltage range:
  - $V_{CC(A)}$: 0.8 V to 3.6 V
  - $V_{CC(B)}$: 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - JESD8-12 (0.8 V to 1.3 V)
  - JESD8-11 (0.9 V to 1.65 V)
  - JESD8-7 (1.2 V to 1.95 V)
  - JESD8-5 (1.8 V to 2.7 V)
  - JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F Class 3B exceeds 8000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101C exceeds 1000 V
- Maximum data rates:
  - 500 Mbit/s (1.8 V to 3.3 V translation)
  - 320 Mbit/s (<1.8 V to 3.3 V translation)
  - 320 Mbit/s (translate to 2.5 V or 1.8 V)
  - 280 Mbit/s (translate to 1.5 V)
  - 240 Mbit/s (translate to 1.2 V)
- Suspend mode
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of $V_{CC}$
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C
3. Ordering information

Table 1. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Temperature range</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>74AVC2T45DP</td>
<td>TSSOP8</td>
<td>-40 °C to +125 °C</td>
<td>plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm</td>
<td>SOT505-2</td>
<td></td>
</tr>
<tr>
<td>74AVC2T45DC</td>
<td>VSSOP8</td>
<td>-40 °C to +125 °C</td>
<td>plastic very thin shrink small outline package; 8 leads; body width 2.3 mm</td>
<td>SOT765-1</td>
<td></td>
</tr>
<tr>
<td>74AVC2T45GT</td>
<td>XSON8</td>
<td>-40 °C to +125 °C</td>
<td>plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm</td>
<td>SOT833-1</td>
<td></td>
</tr>
<tr>
<td>74AVC2T45GF</td>
<td>XSON8</td>
<td>-40 °C to +125 °C</td>
<td>extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1 x 0.5 mm</td>
<td>SOT1089</td>
<td></td>
</tr>
<tr>
<td>74AVC2T45GN</td>
<td>XSON8</td>
<td>-40 °C to +125 °C</td>
<td>extremely thin small outline package; no leads; 8 terminals; body 1.2 x 1.0 x 0.35 mm</td>
<td>SOT1116</td>
<td></td>
</tr>
<tr>
<td>74AVC2T45GS</td>
<td>XSON8</td>
<td>-40 °C to +125 °C</td>
<td>extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1.0 x 0.35 mm</td>
<td>SOT1203</td>
<td></td>
</tr>
</tbody>
</table>

4. Marking

Table 2. Marking

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>74AVC2T45DP</td>
<td>B45</td>
</tr>
<tr>
<td>74AVC2T45DC</td>
<td>B45</td>
</tr>
<tr>
<td>74AVC2T45GT</td>
<td>B45</td>
</tr>
<tr>
<td>74AVC2T45GF</td>
<td>B5</td>
</tr>
<tr>
<td>74AVC2T45GN</td>
<td>B5</td>
</tr>
<tr>
<td>74AVC2T45GS</td>
<td>B5</td>
</tr>
</tbody>
</table>

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

Fig. 1. Logic symbol

Fig. 2. Logic diagram
6. Pinning information

6.1. Pinning

![Fig. 3. Pin configuration SOT505-2 and SOT765-1](image)

![Fig. 4. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203](image)

6.2. Pin description

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC}(A)</td>
<td>1</td>
<td>supply voltage A (referenced to pins 1A, 2A and DIR)</td>
</tr>
<tr>
<td>1A</td>
<td>2</td>
<td>data input or output</td>
</tr>
<tr>
<td>2A</td>
<td>3</td>
<td>data input or output</td>
</tr>
<tr>
<td>GND</td>
<td>4</td>
<td>ground (0 V)</td>
</tr>
<tr>
<td>DIR</td>
<td>5</td>
<td>direction control</td>
</tr>
<tr>
<td>2B</td>
<td>6</td>
<td>data input or output</td>
</tr>
<tr>
<td>1B</td>
<td>7</td>
<td>data input or output</td>
</tr>
<tr>
<td>V_{CC}(B)</td>
<td>8</td>
<td>supply voltage B (referenced to pins 1B and 2B)</td>
</tr>
</tbody>
</table>

7. Functional description

Table 4. Function table

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Input</th>
<th>Input/output [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC}(A), V_{CC}(B)</td>
<td>DIR [2]</td>
<td>nA = nB, input</td>
</tr>
<tr>
<td>0.8 V to 3.6 V</td>
<td>L</td>
<td>nA = nB</td>
</tr>
<tr>
<td>0.8 V to 3.6 V</td>
<td>H</td>
<td>input</td>
</tr>
<tr>
<td>GND [3]</td>
<td>X</td>
<td>Z</td>
</tr>
</tbody>
</table>

[1] The input circuit of the data I/O is always active.
[2] The DIR input circuit is referenced to V_{CC}(A).
[3] If at least one of V_{CC}(A) or V_{CC}(B) is at GND level, the device goes into Suspend mode.
8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC(A)}</td>
<td>supply voltage A</td>
<td>-0.5</td>
<td>+4.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V_{CC(B)}</td>
<td>supply voltage B</td>
<td>-0.5</td>
<td>+4.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I_{IK}</td>
<td>input clamping current</td>
<td>V_I &lt; 0 V</td>
<td>-50</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>V_I</td>
<td>input voltage</td>
<td>[1]</td>
<td>-0.5</td>
<td>+4.6</td>
<td>V</td>
</tr>
<tr>
<td>I_{OK}</td>
<td>output clamping current</td>
<td>V_O &lt; 0 V</td>
<td>-50</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>V_O</td>
<td>output voltage</td>
<td>Active mode</td>
<td>[1][2][3]</td>
<td>0.5 V</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suspend or 3-state mode</td>
<td>[1]</td>
<td>-0.5</td>
<td>+4.6</td>
</tr>
<tr>
<td>I_O</td>
<td>output current</td>
<td>V_O = 0 V to V_{CCO}</td>
<td>-</td>
<td>±50</td>
<td>mA</td>
</tr>
<tr>
<td>I_{CC}</td>
<td>supply current</td>
<td>I_{CC(A)} or I_{CC(B)}</td>
<td>-</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>I_{GND}</td>
<td>ground current</td>
<td>-100</td>
<td>-</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>T_{stg}</td>
<td>storage temperature</td>
<td>-65</td>
<td>+150</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>T_{amb} = -40 °C to +125 °C</td>
<td>250</td>
<td>mW</td>
<td></td>
</tr>
</tbody>
</table>

[1] The minimum input voltage rating and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] V_{CCO} is the supply voltage associated with the output port.
[3] V_{CCO} < 0.5 V should not exceed 4.6 V.
[4] For TSSOP8 package: above 55 °C the value of P_{tot} derates linearly at 2.5 mW/K.
   For VSSOP8 package: above 110 °C the value of P_{tot} derates linearly with 8 mW/K.
   For XSON8 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC(A)}</td>
<td>supply voltage A</td>
<td>0.8</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V_{CC(B)}</td>
<td>supply voltage B</td>
<td>0.8</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V_I</td>
<td>input voltage</td>
<td>0</td>
<td>3.6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V_O</td>
<td>output voltage</td>
<td>Active mode</td>
<td>[1]</td>
<td>0</td>
<td>V_{CCO}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suspend or 3-state mode</td>
<td>0</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>T_{amb}</td>
<td>ambient temperature</td>
<td>-40</td>
<td>+125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Δt/ΔV</td>
<td>input transition rise and fall rate</td>
<td>V_{CCI} = 0.8 V to 3.6 V</td>
<td>[2]</td>
<td>5</td>
<td>ns/V</td>
</tr>
</tbody>
</table>

[1] V_{CCO} is the supply voltage associated with the output port.
[2] V_{CCI} is the supply voltage associated with the input port.
10. Static characteristics

Table 7. Typical static characteristics at $T_{\text{amb}} = 25 \, ^\circ\text{C}$

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
</table>
| $V_{OH}$ | HIGH-level output voltage        | $V_i = V_{IH} \text{ or } V_{IL}; I_O = -1.5 \text{ mA};$  
$V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V}$ | -   | 0.69 | -   | V    |
| $V_{OL}$ | LOW-level output voltage         | $V_i = V_{IH} \text{ or } V_{IL}; I_O = 1.5 \text{ mA};$  
$V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V}$ | -   | 0.07 | -   | V    |
| $I_i$ | input leakage current           | DIR input; $V_i = 0 \text{ V or } 3.6 \text{ V};$  
$V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$ | -   | $\pm 0.025$ | $\pm 0.25$ | $\mu$A |
| $I_{OZ}$ | OFF-state output current        | A or B port; $V_O = 0 \text{ V or } V_{CCO};$  
$V_{CC(A)} = V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$ | -   | 0.5  | 2.5  | $\mu$A |
| $I_{OFF}$ | power-off leakage current       | A port; $V_i = V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC(A)} = 0 \text{ V};$  
$V_{CC(B)} = 0.8 \text{ V to } 3.6 \text{ V}$ | -   | $\pm 0.1$ | $\pm 1$ | $\mu$A |
|        |                                  | B port; $V_i = V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC(B)} = 0 \text{ V};$  
$V_{CC(A)} = 0.8 \text{ V to } 3.6 \text{ V}$ | -   | $\pm 0.1$ | $\pm 1$ | $\mu$A |
| $C_I$ | input capacitance                | DIR input; $V_i = 0 \text{ V or } 3.3 \text{ V};$  
$V_{CC(A)} = V_{CC(B)} = 3.3 \text{ V}$ | -   | 1.0  | -    | pF   |
| $C_{IO}$ | input/output capacitance        | A and B port; Suspend mode;  
$V_O = V_{CCO} \text{ or } GND; V_{CC(A)} = V_{CC(B)} = 3.3 \text{ V}$ | -   | 4.0  | -    | pF   |

[1] For I/O ports, the parameter $I_{OZ}$ includes the input leakage current.
[2] $V_{CCO}$ is the supply voltage associated with the output port.

Table 8. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>-40 °C to +85 °C</th>
<th>-40 °C to +125 °C</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>$V_{IH}$</td>
<td>HIGH-level input voltage</td>
<td>data input</td>
<td>0.70 $V_{CCI}$</td>
<td>-</td>
<td>0.70 $V_{CCI}$</td>
</tr>
<tr>
<td>$V_{CCI}$ = 0.8 V</td>
<td></td>
<td></td>
<td>0.70 $V_{CCI}$</td>
<td>-</td>
<td>0.70 $V_{CCI}$</td>
</tr>
<tr>
<td>$V_{CCI}$ = 1.1 V to 1.95 V</td>
<td></td>
<td></td>
<td>0.65 $V_{CCI}$</td>
<td>-</td>
<td>0.65 $V_{CCI}$</td>
</tr>
<tr>
<td>$V_{CCI}$ = 2.3 V to 2.7 V</td>
<td></td>
<td></td>
<td>1.6</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>$V_{CCI}$ = 3.0 V to 3.6 V</td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>DIR input</td>
<td></td>
<td></td>
<td>-</td>
<td>0.30 $V_{CCI}$</td>
<td>-</td>
</tr>
<tr>
<td>$V_{CC(A)} = 0.8 V$</td>
<td></td>
<td></td>
<td>0.70 $V_{CC(A)}$</td>
<td>-</td>
<td>0.70 $V_{CC(A)}$</td>
</tr>
<tr>
<td>$V_{CC(A)} = 1.1 V to 1.95 V$</td>
<td></td>
<td></td>
<td>0.65 $V_{CC(A)}$</td>
<td>-</td>
<td>0.65 $V_{CC(A)}$</td>
</tr>
<tr>
<td>$V_{CC(A)} = 2.3 V to 2.7 V$</td>
<td></td>
<td></td>
<td>1.6</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>$V_{CC(A)} = 3.0 V to 3.6 V$</td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

| $V_{IL}$ | LOW-level input voltage        | data input                                                               | -       | 0.30 $V_{CCI}$ | -    | 0.30 $V_{CCI}$ | V    |
| $V_{CCI}$ = 0.8 V |                                |                                                                           | -       | 0.35 $V_{CCI}$ | -    | 0.35 $V_{CCI}$ | V    |
| $V_{CCI}$ = 1.1 V to 1.95 V |                                |                                                                           | -       | 0.7     | -    | 0.7     | V    |
| $V_{CCI}$ = 2.3 V to 2.7 V |                                |                                                                           | -       | 0.9     | -    | 0.9     | V    |
| $V_{CCI}$ = 3.0 V to 3.6 V |                                |                                                                           | -       | 0.9     | -    | 0.9     | V    |
| DIR input |                                |                                                                           | -       | 0.30 $V_{CC(A)}$ | -    | 0.30 $V_{CC(A)}$ | V    |
| $V_{CC(A)} = 0.8 V$ |                                |                                                                           | -       | 0.35 $V_{CC(A)}$ | -    | 0.35 $V_{CC(A)}$ | V    |
| $V_{CC(A)} = 1.1 V to 1.95 V$ |                                |                                                                           | -       | 0.7     | -    | 0.7     | V    |
| $V_{CC(A)} = 2.3 V to 2.7 V$ |                                |                                                                           | -       | 0.9     | -    | 0.9     | V    |
| $V_{CC(A)} = 3.0 V to 3.6 V$ |                                |                                                                           | -       | 0.9     | -    | 0.9     | V    |
### Symbol  Parameter               Conditions                                      | -40 °C to +85 °C | -40 °C to +125 °C | Unit |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{OH}</td>
<td>HIGH-level output voltage</td>
<td>V_{I} = V_{IH} or V_{IL}</td>
<td>Min (0.1)</td>
<td>Min (0.1)</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -100 μA; V_{CC(A)} = V_{CC(B)} = 0.8 V to 3.6 V</td>
<td></td>
<td>0.1</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -3 mA; V_{CC(A)} = V_{CC(B)} = 1.1 V</td>
<td></td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -6 mA; V_{CC(A)} = V_{CC(B)} = 1.4 V</td>
<td></td>
<td>1.05</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -8 mA; V_{CC(A)} = V_{CC(B)} = 1.65 V</td>
<td></td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -9 mA; V_{CC(A)} = V_{CC(B)} = 2.3 V</td>
<td></td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>I_{O} = -12 mA; V_{CC(A)} = V_{CC(B)} = 3.0 V</td>
<td></td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>V_{OL}</td>
<td>LOW-level output voltage</td>
<td>V_{I} = V_{IH} or V_{IL}</td>
<td>Min (-0.1)</td>
<td>Min (-0.1)</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 100 μA; V_{CC(A)} = V_{CC(B)} = 0.8 V to 3.6 V</td>
<td></td>
<td>-</td>
<td>-0.1</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 3 mA; V_{CC(A)} = V_{CC(B)} = 1.1 V</td>
<td></td>
<td>0.25</td>
<td>-0.25</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 6 mA; V_{CC(A)} = V_{CC(B)} = 1.4 V</td>
<td></td>
<td>0.35</td>
<td>-0.35</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 8 mA; V_{CC(A)} = V_{CC(B)} = 1.65 V</td>
<td></td>
<td>0.45</td>
<td>-0.45</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 9 mA; V_{CC(A)} = V_{CC(B)} = 2.3 V</td>
<td></td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>I_{O} = 12 mA; V_{CC(A)} = V_{CC(B)} = 3.0 V</td>
<td></td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>I_{I}  input leakage current</td>
<td>DIR input; V_{I} = 0 V or 3.6 V; V_{CC(A)} = V_{CC(B)} = 0.8 V to 3.6 V</td>
<td></td>
<td>±1</td>
<td>±1.5</td>
</tr>
<tr>
<td>I_{OZ} OFF-state output current</td>
<td>A or B port; V_{O} = 0 V or V_{CCO}; V_{CC(A)} = V_{CC} = 3.6 V</td>
<td></td>
<td>5</td>
<td>±7.5</td>
</tr>
<tr>
<td>I_{OFF} power-off leakage current</td>
<td>A port; V_{I} or V_{O} = 0 V to 3.6 V; V_{CC(A)} = 0 V; V_{CC} = 0.8 V to 3.6 V</td>
<td></td>
<td>±5</td>
<td>±35</td>
</tr>
<tr>
<td></td>
<td>B port; V_{I} or V_{O} = 0 V to 3.6 V; V_{CC} = 0 V; V_{CC(A)} = 0.8 V to 3.6 V</td>
<td></td>
<td>±5</td>
<td>±35</td>
</tr>
<tr>
<td>I_{CC} supply current</td>
<td>A port; V_{I} = 0 V or V_{CCI}; I_{O} = 0 A</td>
<td>V_{CC(A)} = 0.8 V to 3.6 V; V_{CC(B)} = 0.8 V to 3.6 V</td>
<td>Min (8)</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{CC} = 3.6 V; V_{CC(B)} = 0 V</td>
<td>-8</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{CC} = 0 V; V_{CC} = 3.6 V</td>
<td>-2</td>
<td>-8</td>
</tr>
<tr>
<td></td>
<td>B port; V_{I} = 0 V or V_{CCI}; I_{O} = 0 A</td>
<td>V_{CC(A)} = 0.8 V to 3.6 V; V_{CC(B)} = 0.8 V to 3.6 V</td>
<td>Min (8)</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{CC} = 3.6 V; V_{CC(B)} = 0 V</td>
<td>-2</td>
<td>-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V_{CC} = 0 V; V_{CC} = 3.6 V</td>
<td>-8</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td>A plus B port (I_{CCI} = I_{CC(B)}); I_{O} = 0 A; V_{I} = 0 V or V_{CCI}; V_{CC(A)} = 0.8 V to 3.6 V; V_{CC(B)} = 0.8 V to 3.6 V</td>
<td></td>
<td>16</td>
<td>23</td>
</tr>
</tbody>
</table>

[1] V_{CCI} is the supply voltage associated with the data input port.
[2] V_{CCO} is the supply voltage associated with the output port.
[3] For I/O ports, the parameter I_{OZ} includes the input leakage current.
11. Dynamic characteristics

Table 9. Typical dynamic characteristics at $V_{CC(A)} = 0.8$ V and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>$V_{CC(B)}$</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.8 V</td>
<td>1.2 V</td>
</tr>
<tr>
<td>$t_{pd}$</td>
<td>propagation delay</td>
<td>A to B</td>
<td>[1]</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B to A</td>
<td>[1]</td>
<td>15.5</td>
</tr>
<tr>
<td>$t_{dis}$</td>
<td>disable time</td>
<td>DIR to A</td>
<td>[2]</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR to B</td>
<td>[2]</td>
<td>11.7</td>
</tr>
<tr>
<td>$t_{en}$</td>
<td>enable time</td>
<td>DIR to A</td>
<td>[3]</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR to B</td>
<td>[3]</td>
<td>27.7</td>
</tr>
</tbody>
</table>

[1] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$
[2] $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$
[3] $t_{en}$ is the same as $t_{PZL}$ and $t_{PZH}$

Table 10. Typical dynamic characteristics at $V_{CC(B)} = 0.8$ V and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>$V_{CC(A)}$</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.8 V</td>
<td>1.2 V</td>
</tr>
<tr>
<td>$t_{pd}$</td>
<td>propagation delay</td>
<td>A to B</td>
<td>[1]</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B to A</td>
<td>[1]</td>
<td>15.5</td>
</tr>
<tr>
<td>$t_{dis}$</td>
<td>disable time</td>
<td>DIR to A</td>
<td>[2]</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR to B</td>
<td>[2]</td>
<td>11.7</td>
</tr>
<tr>
<td>$t_{en}$</td>
<td>enable time</td>
<td>DIR to A</td>
<td>[3]</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIR to B</td>
<td>[3]</td>
<td>27.7</td>
</tr>
</tbody>
</table>

[1] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$
[2] $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$
[3] $t_{en}$ is a calculated value using the formula shown in Section 12.4

Table 11. Typical power dissipation capacitance at $V_{CC(A)} = V_{CC(B)}$ and $T_{amb} = 25$ °C

Voltages are referenced to GND (ground = 0 V).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>$V_{CC(A)}$ and $V_{CC(B)}$</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.8 V</td>
<td>1.2 V</td>
</tr>
<tr>
<td>$C_{PD}$</td>
<td>power dissipation capacitance</td>
<td>[1][2]</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A port: (direction A to B); B port: (direction B to A)</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

[1] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$$

Where:

- $f_i$ = input frequency in MHz;
- $f_o$ = output frequency in MHz;
- $C_L$ = load capacitance in pF;
- $V_{CC}$ = supply voltage in V;
- $N$ = number of inputs switching;
- $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

[2] $f_i = 10$ MHz; $V_i = GND$ to $V_{CC}$; $t_i = t_f = 1$ ns; $C_L = 0$ pF; $R_L = \Omega$. 
### Table 12. Dynamic characteristics for temperature range -40 °C to +85 °C

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>$V_{CC(B)}$</th>
<th>1.2 V ± 0.1 V</th>
<th>1.5 V ± 0.1 V</th>
<th>1.8 V ± 0.15 V</th>
<th>2.5 V ± 0.2 V</th>
<th>3.3 V ± 0.3 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td></td>
<td>A to B</td>
<td>propagation delay</td>
<td>$t_{pd}$</td>
<td>[1]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>1.0</td>
<td>9.0</td>
<td>0.7</td>
<td>6.8</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>1.0</td>
<td>8.0</td>
<td>0.7</td>
<td>5.4</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>1.0</td>
<td>7.7</td>
<td>0.6</td>
<td>5.1</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>1.0</td>
<td>7.2</td>
<td>0.5</td>
<td>4.7</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>1.0</td>
<td>7.1</td>
<td>0.5</td>
<td>4.5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>B to A</td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>1.0</td>
<td>9.0</td>
<td>0.8</td>
<td>8.0</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>1.0</td>
<td>6.8</td>
<td>0.8</td>
<td>5.4</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>1.0</td>
<td>6.1</td>
<td>0.7</td>
<td>4.6</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>1.0</td>
<td>5.7</td>
<td>0.6</td>
<td>3.8</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>1.0</td>
<td>6.1</td>
<td>0.6</td>
<td>3.6</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>DIR to A</td>
<td>disable time</td>
<td>$t_{dis}$</td>
<td>[2]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>2.2</td>
<td>8.8</td>
<td>2.2</td>
<td>8.8</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>1.6</td>
<td>6.3</td>
<td>1.6</td>
<td>6.3</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>1.6</td>
<td>5.5</td>
<td>1.6</td>
<td>5.5</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>1.5</td>
<td>4.2</td>
<td>1.5</td>
<td>4.2</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>1.5</td>
<td>4.7</td>
<td>1.5</td>
<td>4.7</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>DIR to B</td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>2.2</td>
<td>8.4</td>
<td>1.8</td>
<td>6.7</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>2.0</td>
<td>7.6</td>
<td>1.8</td>
<td>5.9</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>1.8</td>
<td>7.7</td>
<td>1.8</td>
<td>5.7</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>1.7</td>
<td>7.3</td>
<td>2.0</td>
<td>5.2</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>1.7</td>
<td>7.2</td>
<td>0.7</td>
<td>5.5</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>DIR to A</td>
<td>enable time</td>
<td>$t_{en}$</td>
<td>[3][4]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>-</td>
<td>17.4</td>
<td>14.7</td>
<td>14.6</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>-</td>
<td>14.4</td>
<td>11.3</td>
<td>11.1</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>-</td>
<td>13.8</td>
<td>10.3</td>
<td>10.2</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>-</td>
<td>13.0</td>
<td>9.0</td>
<td>8.5</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>-</td>
<td>13.3</td>
<td>9.1</td>
<td>8.6</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>DIR to B</td>
<td></td>
<td>$V_{CC(A)} = 1.1$ V to 1.3 V</td>
<td>-</td>
<td>17.8</td>
<td>15.6</td>
<td>14.9</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.4$ V to 1.6 V</td>
<td>-</td>
<td>14.3</td>
<td>11.7</td>
<td>10.9</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 1.65$ V to 1.95 V</td>
<td>-</td>
<td>13.2</td>
<td>10.6</td>
<td>9.8</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 2.3$ V to 2.7 V</td>
<td>-</td>
<td>11.4</td>
<td>8.9</td>
<td>8.1</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{CC(A)} = 3.0$ V to 3.6 V</td>
<td>-</td>
<td>11.8</td>
<td>9.2</td>
<td>8.4</td>
<td>7.5</td>
</tr>
</tbody>
</table>

[1] $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$
[2] $t_{dis}$ is the same as $t_{PLZ}$ and $t_{PHZ}$
[3] $t_{en}$ is the same as $t_{PLH}$ and $t_{PLZ}$
[4] $t_{en}$ is a calculated value using the formula shown in Section 12.4
Table 13. Dynamic characteristics for temperature range -40 °C to +125 °C
Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7; for wave forms see Fig. 5 and Fig. 6.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>( V_{CC(A)} )</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{pd} )</td>
<td>propagation delay</td>
<td>A to B</td>
<td>1.2 V ± 0.1 V</td>
<td>1.5 V ± 0.1 V</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.1 V to 1.3 V</td>
<td>1.0</td>
<td>9.9</td>
<td>0.7</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.4 V to 1.6 V</td>
<td>1.0</td>
<td>8.8</td>
<td>0.7</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.65 V to 1.95 V</td>
<td>1.0</td>
<td>8.5</td>
<td>0.6</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 2.3 V to 2.7 V</td>
<td>1.0</td>
<td>8.0</td>
<td>0.5</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 3.0 V to 3.6 V</td>
<td>1.0</td>
<td>7.9</td>
<td>0.5</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.1 V to 1.3 V</td>
<td>1.0</td>
<td>9.9</td>
<td>0.8</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.4 V to 1.6 V</td>
<td>1.0</td>
<td>7.5</td>
<td>0.8</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 1.65 V to 1.95 V</td>
<td>1.0</td>
<td>6.8</td>
<td>0.7</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 2.3 V to 2.7 V</td>
<td>1.0</td>
<td>6.3</td>
<td>0.6</td>
</tr>
<tr>
<td>( V_{CC(A)} )</td>
<td>= 3.0 V to 3.6 V</td>
<td>1.0</td>
<td>6.8</td>
<td>0.6</td>
</tr>
</tbody>
</table>

| \( V_{CC(A)} \) | = 1.1 V to 1.3 V | 2.2 | 9.7 | 2.2 | 9.7 | 2.2 | 9.7 | 2.2 | 9.7 | 9.7 | ns |
| \( V_{CC(A)} \) | = 1.4 V to 1.6 V | 1.6 | 7.0 | 1.6 | 7.0 | 1.6 | 7.0 | 1.6 | 7.0 | 7.0 | ns |
| \( V_{CC(A)} \) | = 1.65 V to 1.95 V | 1.6 | 6.1 | 1.6 | 6.1 | 1.6 | 6.1 | 1.6 | 6.1 | 6.1 | ns |
| \( V_{CC(A)} \) | = 2.3 V to 2.7 V | 1.5 | 4.7 | 1.5 | 4.7 | 1.5 | 4.7 | 1.5 | 4.7 | 4.7 | ns |
| \( V_{CC(A)} \) | = 3.0 V to 3.6 V | 1.5 | 5.2 | 1.5 | 5.2 | 1.5 | 5.2 | 1.5 | 5.2 | 5.2 | ns |

| \( V_{CC(A)} \) | = 1.1 V to 1.3 V | 2.2 | 9.2 | 2.1 | 9.2 | 2.0 | 9.2 | 2.0 | 9.2 | 9.2 | ns |
| \( V_{CC(A)} \) | = 1.4 V to 1.6 V | 2.0 | 8.3 | 1.8 | 6.5 | 1.6 | 6.6 | 1.2 | 6.2 | 6.2 | ns |
| \( V_{CC(A)} \) | = 1.65 V to 1.95 V | 1.8 | 8.5 | 1.8 | 6.3 | 1.4 | 6.4 | 1.0 | 6.0 | 6.0 | ns |
| \( V_{CC(A)} \) | = 2.3 V to 2.7 V | 1.7 | 8.0 | 2.0 | 5.8 | 1.5 | 5.7 | 0.6 | 4.7 | 1.1 | 4.7 | ns |
| \( V_{CC(A)} \) | = 3.0 V to 3.6 V | 1.7 | 7.9 | 0.7 | 6.1 | 0.6 | 6.1 | 0.7 | 4.6 | 1.7 | 5.2 | ns |

| \( V_{CC(A)} \) | = 1.1 V to 1.3 V | - | 19.1 | - | 16.2 | - | 16.1 | - | 14.9 | - | 15.9 | ns |
| \( V_{CC(A)} \) | = 1.4 V to 1.6 V | - | 15.8 | - | 12.5 | - | 12.3 | - | 10.5 | - | 11.1 | ns |
| \( V_{CC(A)} \) | = 1.65 V to 1.95 V | - | 15.3 | - | 11.4 | - | 11.3 | - | 9.3 | - | 9.9 | ns |
| \( V_{CC(A)} \) | = 2.3 V to 2.7 V | - | 14.3 | - | 10.0 | - | 9.5 | - | 8.0 | - | 8.4 | ns |
| \( V_{CC(A)} \) | = 3.0 V to 3.6 V | - | 14.7 | - | 10.1 | - | 9.6 | - | 7.5 | - | 7.9 | ns |

| \( V_{CC(A)} \) | = 1.1 V to 1.3 V | - | 19.6 | - | 17.2 | - | 16.5 | - | 16.0 | - | 16.5 | ns |
| \( V_{CC(A)} \) | = 1.4 V to 1.6 V | - | 15.8 | - | 13.0 | - | 12.1 | - | 11.1 | - | 10.9 | ns |
| \( V_{CC(A)} \) | = 1.65 V to 1.95 V | - | 14.6 | - | 11.8 | - | 10.9 | - | 9.9 | - | 9.6 | ns |
| \( V_{CC(A)} \) | = 2.3 V to 2.7 V | - | 12.7 | - | 9.9 | - | 9.0 | - | 8.0 | - | 7.6 | ns |
| \( V_{CC(A)} \) | = 3.0 V to 3.6 V | - | 13.1 | - | 10.2 | - | 9.3 | - | 8.3 | - | 7.9 | ns |

[1] \( t_{pd} \) is the same as \( t_{PLH} \) and \( t_{PHL} \)
[2] \( t_{dis} \) is the same as \( t_{PLZ} \) and \( t_{PHZ} \)
[3] \( t_{en} \) is the same as \( t_{P2L} \) and \( t_{P2H} \)
[4] \( t_{ten} \) is a calculated value using the formula shown in Section 12.4
11.1. Waveforms and test circuit

Measurement points are given in Table 14. V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 5. The data input (nA, nB) to output (nB, nA) propagation delay times

Measurement points are given in Table 14. V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 6. Enable and disable times

Table 14. Measurement points

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{CC(A)}, V_{CC(B)}</td>
<td>V_{M}</td>
<td>V_{M}</td>
</tr>
<tr>
<td>1.1 V to 1.6 V</td>
<td>0.5V_{CCI}</td>
<td>0.5V_{CCO}</td>
</tr>
<tr>
<td>1.65 V to 2.7 V</td>
<td>0.5V_{CCI}</td>
<td>0.5V_{CCO}</td>
</tr>
<tr>
<td>3.0 V to 3.6 V</td>
<td>0.5V_{CCI}</td>
<td>0.5V_{CCO}</td>
</tr>
</tbody>
</table>

[1] V_{CCI} is the supply voltage associated with the data input port.
[2] V_{CCO} is the supply voltage associated with the output port.
Test data is given in Table 15.

- \( R_L \) = Load resistance.
- \( C_L \) = Load capacitance including jig and probe capacitance.
- \( R_T \) = Termination resistance.
- \( V_{EXT} \) = External voltage for measuring switching times.

**Fig. 7. Test circuit for measuring switching times**

**Table 15. Test data**

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>Input ( V_{CCI} )</th>
<th>( \Delta t/\Delta V ) [2]</th>
<th>Load ( C_L, R_L )</th>
<th>( V_{EXT} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 V to 1.6 V</td>
<td>( V_{CCI} ) ≤ 1.0 ns/V</td>
<td>15 pF</td>
<td>2 kΩ</td>
<td>open</td>
</tr>
<tr>
<td>1.65 V to 2.7 V</td>
<td>( V_{CCI} ) ≤ 1.0 ns/V</td>
<td>15 pF</td>
<td>2 kΩ</td>
<td>open</td>
</tr>
<tr>
<td>3.0 V to 3.6 V</td>
<td>( V_{CCI} ) ≤ 1.0 ns/V</td>
<td>15 pF</td>
<td>2 kΩ</td>
<td>open</td>
</tr>
</tbody>
</table>

[1] \( V_{CCI} \) is the supply voltage associated with the data input port.

[2] \( dV/dt \geq 1.0 \text{ V/ns} \)

[3] \( V_{CCO} \) is the supply voltage associated with the output port.
12. Application information

12.1. Unidirectional logic level-shifting application

The circuit given in Fig. 8 is an example of the 74AVC2T45 being used in an unidirectional logic level-shifting application.

![Fig. 8. Unidirectional logic level-shifting application](image)

### Table 16. Unidirectional logic level-shifting application

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VCC(A)</td>
<td>VCC1</td>
<td>supply voltage of system-1 (0.8 V to 3.6 V)</td>
</tr>
<tr>
<td>2</td>
<td>1A</td>
<td>OUT1</td>
<td>output level depends on VCC1 voltage</td>
</tr>
<tr>
<td>3</td>
<td>2A</td>
<td>OUT2</td>
<td>output level depends on VCC1 voltage</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>GND</td>
<td>device GND</td>
</tr>
<tr>
<td>5</td>
<td>DIR</td>
<td>DIR</td>
<td>the GND (LOW level) determines B port to A port direction</td>
</tr>
<tr>
<td>6</td>
<td>2B</td>
<td>IN2</td>
<td>input threshold value depends on VCC2 voltage</td>
</tr>
<tr>
<td>7</td>
<td>1B</td>
<td>IN1</td>
<td>input threshold value depends on VCC2 voltage</td>
</tr>
<tr>
<td>8</td>
<td>VCC(B)</td>
<td>VCC2</td>
<td>supply voltage of system-2 (0.8 V to 3.6 V)</td>
</tr>
</tbody>
</table>
12.2. Bidirectional logic level-shifting application

Fig. 9 shows the 74AVC2T45 being used in a bidirectional logic level-shifting application. Since the device does not have an output enable (OE) pin, the system designer should take precautions to avoid bus contention between system-1 and system-2 when changing directions.

System-1 and system-2 must use the same conditions, i.e., both pull-up or both pull-down.

Table 17 gives a sequence that will illustrate data transmission from system-1 to system-2 and then from system-2 to system-1.

Table 17. Bidirectional logic level-shifting application

<table>
<thead>
<tr>
<th>State</th>
<th>DIR CTRL</th>
<th>I/O-1</th>
<th>I/O-2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H</td>
<td>output</td>
<td>input</td>
<td>system-1 data to system-2</td>
</tr>
<tr>
<td>2</td>
<td>H</td>
<td>Z</td>
<td>Z</td>
<td>system-2 is getting ready to send data to system-1. I/O-1 and I/O-2 are disabled. The bus-line state depends on the pull-up or pull-down.</td>
</tr>
<tr>
<td>3</td>
<td>L</td>
<td>Z</td>
<td>Z</td>
<td>DIR bit is set LOW. I/O-1 and I/O-2 still are disabled. The bus-line state depends on the pull-up or pull-down.</td>
</tr>
<tr>
<td>4</td>
<td>L</td>
<td>input</td>
<td>output</td>
<td>system-2 data to system-1</td>
</tr>
</tbody>
</table>

System-1 and system-2 must use the same conditions, i.e., both pull-up or both pull-down.
12.3. Power-up considerations

The device is designed such that no special power-up sequence is required other than GND being applied first.

Table 18. Typical total supply current (I_{CC(A)} + I_{CC(B)})

<table>
<thead>
<tr>
<th>V_{CC(A)}</th>
<th>0 V</th>
<th>0.8 V</th>
<th>1.2 V</th>
<th>1.5 V</th>
<th>1.8 V</th>
<th>2.5 V</th>
<th>3.3 V</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 V</td>
<td>0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>μA</td>
</tr>
<tr>
<td>0.8 V</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.7</td>
<td>2.3</td>
<td>μA</td>
</tr>
<tr>
<td>1.2 V</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>1.4</td>
<td>μA</td>
</tr>
<tr>
<td>1.5 V</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.9</td>
<td>μA</td>
</tr>
<tr>
<td>1.8 V</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.5</td>
<td>μA</td>
</tr>
<tr>
<td>2.5 V</td>
<td>0.1</td>
<td>0.7</td>
<td>0.3</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>μA</td>
</tr>
<tr>
<td>3.3 V</td>
<td>0.1</td>
<td>2.3</td>
<td>1.4</td>
<td>0.9</td>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
<td>μA</td>
</tr>
</tbody>
</table>

12.4. Enable times

The enable times for the 74AVC2T45 are calculated from the following formulas:

- \( t_{en\ (DIR\ to\ nA)} = t_{dis\ (DIR\ to\ nB)} + t_{pd\ (nB\ to\ nA)} \)
- \( t_{en\ (DIR\ to\ nB)} = t_{dis\ (DIR\ to\ nA)} + t_{pd\ (nA\ to\ nB)} \)

In a bidirectional application, these enable times provide the maximum delay from the time the DIR bit is switched until an output is expected. For example, if the 74AVC2T45 initially is transmitting from A to B, then the DIR bit is switched, the B port of the device must be disabled before presenting it with an input. After the B port has been disabled, an input signal applied to it appears on the corresponding A port after the specified propagation delay.
13. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm  SOT505-2

![Package outline diagram](image)

**DIMENSIONS** (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A&lt;sub&gt;max.&lt;/sub&gt;</th>
<th>A&lt;sub&gt;1&lt;/sub&gt;</th>
<th>A&lt;sub&gt;2&lt;/sub&gt;</th>
<th>A&lt;sub&gt;3&lt;/sub&gt;</th>
<th>b&lt;sub&gt;p&lt;/sub&gt;</th>
<th>c</th>
<th>D&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>E&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>e</th>
<th>H&lt;sub&gt;E&lt;/sub&gt;</th>
<th>L</th>
<th>L&lt;sub&gt;p&lt;/sub&gt;</th>
<th>v</th>
<th>w</th>
<th>y</th>
<th>Z&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>θ</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1.1</td>
<td>0.15</td>
<td>0.95</td>
<td>0.25</td>
<td>0.38</td>
<td>0.22</td>
<td>0.18</td>
<td>3.1</td>
<td>3.1</td>
<td>0.65</td>
<td>4.1</td>
<td>3.9</td>
<td>0.5</td>
<td>0.47</td>
<td>0.33</td>
<td>0.2</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td>0.75</td>
<td></td>
<td></td>
<td>0.08</td>
<td></td>
<td></td>
<td>2.9</td>
<td></td>
<td></td>
<td>0.70</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
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</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>OUTLINE VERSION</th>
<th>REFERENCES</th>
<th>EUROPEAN PROJECTION</th>
<th>ISSUE DATE</th>
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<tbody>
<tr>
<td>SOT505-2</td>
<td>IEC</td>
<td>JEDEC</td>
<td>JEITA</td>
</tr>
</tbody>
</table>

Fig. 10. Package outline SOT505-2 (TSSOP8)
VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

Dimensions (mm are the original dimensions)

<table>
<thead>
<tr>
<th>Unit</th>
<th>A</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>bP</th>
<th>c</th>
<th>D(1)</th>
<th>E(2)</th>
<th>e</th>
<th>HE</th>
<th>L</th>
<th>LP</th>
<th>Q</th>
<th>v</th>
<th>w</th>
<th>y</th>
<th>Z(1)</th>
<th>θ</th>
</tr>
</thead>
<tbody>
<tr>
<td>max</td>
<td>0.15</td>
<td>0.85</td>
<td>0.27</td>
<td>0.23</td>
<td>2.1</td>
<td>2.4</td>
<td>3.2</td>
<td>0.40</td>
<td>0.21</td>
<td>0.4</td>
<td>8°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nom</td>
<td>0.00</td>
<td>0.60</td>
<td>0.12</td>
<td>0.08</td>
<td>1.9</td>
<td>2.2</td>
<td>3.0</td>
<td>0.15</td>
<td>0.19</td>
<td>0.1</td>
<td>0°</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>0.08</td>
<td>0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Fig. 11. Package outline SOT765-1 (VSSOP8)
XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

**DIMENSIONS** (mm are the original dimensions)

<table>
<thead>
<tr>
<th>UNIT</th>
<th>A(1) max</th>
<th>A1 max</th>
<th>b</th>
<th>D</th>
<th>E</th>
<th>e</th>
<th>L</th>
<th>L1</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>0.5</td>
<td>0.04</td>
<td>0.25</td>
<td>2.0</td>
<td>1.05</td>
<td>0.6</td>
<td>0.35</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.17</td>
<td>1.9</td>
<td>0.95</td>
<td>0.5</td>
<td>0.27</td>
<td>0.32</td>
</tr>
</tbody>
</table>

**Notes**
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

**Fig. 12.** Package outline SOT833-1 (XSON8)
XSON8: extremely thin small outline package; no leads;
8 terminals; body 1.35 x 1 x 0.5 mm

Table:

<table>
<thead>
<tr>
<th>Unit</th>
<th>A(1)</th>
<th>A1</th>
<th>b</th>
<th>D</th>
<th>E</th>
<th>e1</th>
<th>L</th>
<th>L1</th>
</tr>
</thead>
<tbody>
<tr>
<td>max</td>
<td>0.5</td>
<td>0.04</td>
<td>0.20</td>
<td>1.40</td>
<td>1.05</td>
<td>0.35</td>
<td>0.40</td>
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</tr>
<tr>
<td>mm nom</td>
<td>0.15</td>
<td>1.35</td>
<td>1.00</td>
<td>0.55</td>
<td>0.36</td>
<td>0.30</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>0.12</td>
<td>1.30</td>
<td>0.95</td>
<td>0.27</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

Fig. 13. Package outline SOT1089 (XSON8)
XSON8: extremely thin small outline package; no leads; 8 terminals; body 1.2 x 1.0 x 0.35 mm

Fig. 14. Package outline SOT1116 (XSON8)
XSON8: extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1.0 x 0.35 mm

Fig. 15. Package outline SOT1203 (XSON8)
14. Abbreviations

Table 19. Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>CDM</td>
<td>Charged Device Model</td>
</tr>
<tr>
<td>DUT</td>
<td>Device Under Test</td>
</tr>
<tr>
<td>ESD</td>
<td>ElectroStatic Discharge</td>
</tr>
<tr>
<td>HBM</td>
<td>Human Body Model</td>
</tr>
<tr>
<td>MM</td>
<td>Machine Model</td>
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15. Revision history

Table 20. Revision history

<table>
<thead>
<tr>
<th>Document ID</th>
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<th>Change notice</th>
<th>Supersedes</th>
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<td>74AVC2T45 v.3</td>
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<td>20090129</td>
<td>Product data sheet</td>
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16. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective [short]</td>
<td>Development</td>
<td>This document contains data from the definitive specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short]</td>
<td>Qualification</td>
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</tr>
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<td>Production</td>
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</table>

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term "short data sheet" is explained in section "Definitions".

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Contents

1. General description ...................................................... 1
2. Features and benefits .................................................. 1
3. Ordering information .................................................... 2
4. Marking ........................................................................ 2
5. Functional diagram ....................................................... 2
6. Pinning information ...................................................... 3
6.1. Pinning ....................................................................... 3
6.2. Pin description ............................................................. 3
7. Functional description ..................................................... 3
8. Limiting values .............................................................. 4
9. Recommended operating conditions .............................. 4
10. Static characteristics ................................................... 5
11. Dynamic characteristics ................................................... 7
11.1. Waveforms and test circuit ........................................... 10
12. Application information ............................................... 12
12.1. Unidirectional logic level-shifting application ............. 12
12.2. Bidirectional logic level-shifting application ............... 13
12.3. Power-up considerations ............................................. 14
12.4. Enable times ............................................................ 14
13. Package outline .......................................................... 15
14. Abbreviations ............................................................ 21
15. Revision history .......................................................... 21
16. Legal information ........................................................ 22

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