1. **Functional Description**
   - 2-Input AND Gate

2. **Features**
   1. AEC-Q100 (Rev. H) (Note 1)
   2. Wide operating temperature range: $T_{opr} = -40$ to $125 \, ^\circ C$ (Note 2)
   3. High speed operation: $t_{pd} = 4.2 \, ns$ (typ.) ($V_{CC} = 5.0 \, V$, $C_L = 15 \, pF$)
   4. Low power dissipation: $I_{CC} = 2.0 \, \mu A$ (max) ($T_a = 25 \, ^\circ C$)
   5. Compatible with TTL outputs: $V_{IL} = 0.8 \, V$ (max)
   
   $V_{IH} = 2.0 \, V$ (min)
   6. 5.5 V tolerant inputs
   7. Balanced Propagation Delay: $t_{PLH} \approx t_{PHL}$

   **Note 1:** This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

   **Note 2:** For devices with the ordering part number ending in J(CT. $T_{opr} = -40$ to $85 \, ^\circ C$ for the other devices.

3. **Packaging**
4. Marking and Pin Assignment

![Part No. (or abbreviation code)](image)

Marking

![Pin Assignment (Top view)](image)

Pin Assignment (Top view)

5. IEC Logic Symbol

IN A & OUT Y

IN B

6. Truth Table

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_{A} = 25^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Note</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>$V_{CC}$</td>
<td></td>
<td>-0.5 to 7.0</td>
<td>V</td>
</tr>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td></td>
<td>-0.5 to 7.0</td>
<td>V</td>
</tr>
<tr>
<td>DC output voltage</td>
<td>$V_{OUT}$</td>
<td></td>
<td>-0.5 to $V_{CC} + 0.5$</td>
<td>V</td>
</tr>
<tr>
<td>Input diode current</td>
<td>$I_{IK}$</td>
<td></td>
<td>-20</td>
<td>mA</td>
</tr>
<tr>
<td>Output diode current</td>
<td>$I_{OK}$</td>
<td>(Note 1)</td>
<td>±20</td>
<td>mA</td>
</tr>
<tr>
<td>DC output current</td>
<td>$I_{OUT}$</td>
<td></td>
<td>±25</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{CC}$/ground current</td>
<td>$I_{CC}$</td>
<td></td>
<td>±50</td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{D}$</td>
<td></td>
<td>200</td>
<td>mW</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td></td>
<td>-65 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$
### 8. Operating Ranges (Note)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Note</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>$V_{CC}$</td>
<td></td>
<td>4.5 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td></td>
<td>0 to 5.5</td>
<td></td>
</tr>
<tr>
<td>Output voltage</td>
<td>$V_{OUT}$</td>
<td></td>
<td>0 to $V_{CC}$</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{opr}$</td>
<td>(Note 1)</td>
<td>-40 to 125</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Note 2)</td>
<td>-40 to 85</td>
<td></td>
</tr>
<tr>
<td>Input rise and fall time</td>
<td>$dt/dv$</td>
<td></td>
<td>0 to 20</td>
<td>ns/V</td>
</tr>
</tbody>
</table>

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either $V_{CC}$ or GND.

Note 1: For devices with the ordering part number ending in J(CT).

Note 2: For devices except those with the ordering part number ending in J(CT).

### 9. Electrical Characteristics

#### 9.1. DC Characteristics (Unless otherwise specified, $T_a = 25 ^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level input voltage</td>
<td>$V_{IH}$</td>
<td>—</td>
<td>4.5 to 5.5</td>
<td>2.0</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Low-level input voltage</td>
<td>$V_{IL}$</td>
<td>—</td>
<td>4.5 to 5.5</td>
<td>—</td>
<td>—</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td>High-level output voltage</td>
<td>$V_{OH}$</td>
<td>$V_{IN} = V_{IH}$</td>
<td>$I_{OH} = 50 \mu A$</td>
<td>4.5</td>
<td>4.4</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$I_{OH} = -50 \mu A$</td>
<td>4.5</td>
<td>3.94</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Low-level output voltage</td>
<td>$V_{OL}$</td>
<td>$V_{IN} = V_{IH}$ or $V_{IL}$</td>
<td>$I_{OL} = 50 \mu A$</td>
<td>4.5</td>
<td>—</td>
<td>0.0</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$I_{OL} = 8 m A$</td>
<td>4.5</td>
<td>—</td>
<td>0.36</td>
<td>V</td>
</tr>
<tr>
<td>Input leakage current</td>
<td>$I_{IN}$</td>
<td>$V_{IN} = 5.5 V$ or GND</td>
<td>0 to 5.5</td>
<td>—</td>
<td>—</td>
<td>±0.1</td>
<td>mA</td>
</tr>
<tr>
<td>Quiescent supply current</td>
<td>$I_{CC}$</td>
<td>$V_{IN} = V_{CC}$ or GND</td>
<td>5.5</td>
<td>—</td>
<td>—</td>
<td>2.0</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td>$I_{CCT}$</td>
<td>Per input: $V_{IN} = 3.4 V$</td>
<td>5.5</td>
<td>—</td>
<td>—</td>
<td>1.35</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other input: $V_{CC}$ or GND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

#### 9.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to 85 °C)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level input voltage</td>
<td>$V_{IH}$</td>
<td>—</td>
<td>4.5 to 5.5</td>
<td>2.0</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Low-level input voltage</td>
<td>$V_{IL}$</td>
<td>—</td>
<td>4.5 to 5.5</td>
<td>—</td>
<td>—</td>
<td>0.8</td>
</tr>
<tr>
<td>High-level output voltage</td>
<td>$V_{OH}$</td>
<td>$V_{IN} = V_{IH}$</td>
<td>$I_{OH} = -8 mA$</td>
<td>4.5</td>
<td>3.90</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$I_{OH} = -50 \mu A$</td>
<td>4.5</td>
<td>3.80</td>
<td>—</td>
</tr>
<tr>
<td>Low-level output voltage</td>
<td>$V_{OL}$</td>
<td>$V_{IN} = V_{IH}$ or $V_{IL}$</td>
<td>$I_{OL} = 50 \mu A$</td>
<td>4.5</td>
<td>—</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$I_{OL} = 8 m A$</td>
<td>4.5</td>
<td>—</td>
<td>0.44</td>
</tr>
<tr>
<td>Input leakage current</td>
<td>$I_{IN}$</td>
<td>$V_{IN} = 5.5 V$ or GND</td>
<td>0 to 5.5</td>
<td>—</td>
<td>±1.0</td>
<td>µA</td>
</tr>
<tr>
<td>Quiescent supply current</td>
<td>$I_{CC}$</td>
<td>$V_{IN} = V_{CC}$ or GND</td>
<td>5.5</td>
<td>—</td>
<td>20.0</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td>$I_{CCT}$</td>
<td>Per input: $V_{IN} = 3.4 V$</td>
<td>5.5</td>
<td>—</td>
<td>1.50</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other input: $V_{CC}$ or GND</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
### 9.3. DC Characteristics (Note) (Unless otherwise specified, $T_a = -40$ to $125 \, ^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-level input voltage</td>
<td>$V_{IH}$</td>
<td>$V_{IN} = V_{IH}$</td>
<td>4.5 to 5.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Low-level input voltage</td>
<td>$V_{IL}$</td>
<td>$V_{IN} = V_{IH}$ or $V_{IL}$</td>
<td>4.5 to 5.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>High-level output voltage</td>
<td>$V_{OH}$</td>
<td>$I_{OH} = 50 , \mu A$</td>
<td>4.5</td>
<td>4.4</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.5</td>
<td>3.70</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Low-level output voltage</td>
<td>$V_{OL}$</td>
<td>$I_{OL} = 8 , mA$</td>
<td>4.5</td>
<td>0.55</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Input leakage current</td>
<td>$I_{IN}$</td>
<td>$V_{IN} = 5.5 , V$ or GND</td>
<td>0 to 5.5</td>
<td></td>
<td>±2.0</td>
<td>µA</td>
</tr>
<tr>
<td>Quiescent supply current</td>
<td>$I_{CC}$</td>
<td>$V_{IN} = V_{CC}$ or GND</td>
<td>5.5</td>
<td></td>
<td>40.0</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td>$I_{CCT}$</td>
<td>Per input: $V_{IN} = 3.4 , V$ Other input: $V_{CC}$ or GND</td>
<td>5.5</td>
<td></td>
<td>1.50</td>
<td>mA</td>
</tr>
</tbody>
</table>

Note: For devices with the ordering part number ending in J(CT).
9.4. AC Characteristics (Unless otherwise specified, $T_a = 25^\circ C$, Input: $t_r = t_f = 3$ ns)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Note</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>$C_L$ (pF)</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation delay time</td>
<td>$t_{PLH}, t_{PHL}$</td>
<td>—</td>
<td></td>
<td>5.0 ± 0.5</td>
<td>15</td>
<td>—</td>
<td>4.2</td>
<td>6.2</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>—</td>
<td>6.5</td>
<td>9.0</td>
<td></td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{IN}$</td>
<td>—</td>
<td></td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>10</td>
<td>—</td>
<td>pF</td>
</tr>
<tr>
<td>Power dissipation capacitance</td>
<td>$C_{PD}$</td>
<td>(Note 1)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>17</td>
<td>—</td>
<td>—</td>
<td>pF</td>
</tr>
</tbody>
</table>

Note 1: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

9.5. AC Characteristics
(Unless otherwise specified, $T_a = -40$ to 85 $^\circ C$, Input: $t_r = t_f = 3$ ns)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>$C_L$ (pF)</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation delay time</td>
<td>$t_{PLH}, t_{PHL}$</td>
<td>—</td>
<td>5.0 ± 0.5</td>
<td>15</td>
<td>1.0</td>
<td>7.1</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>1.0</td>
<td>10.3</td>
<td></td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{IN}$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>—</td>
<td>pF</td>
</tr>
</tbody>
</table>

9.6. AC Characteristics (Note)
(Unless otherwise specified, $T_a = -40$ to 125 $^\circ C$, Input: $t_r = t_f = 3$ ns)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>$V_{CC}$ (V)</th>
<th>$C_L$ (pF)</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagation delay time</td>
<td>$t_{PLH}, t_{PHL}$</td>
<td>—</td>
<td>5.0 ± 0.5</td>
<td>15</td>
<td>1.0</td>
<td>8.0</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>1.0</td>
<td>11.5</td>
<td></td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{IN}$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>—</td>
<td>pF</td>
</tr>
</tbody>
</table>

Note: For devices with the ordering part number ending in J(CT).

9.7. Internal Equivalent Circuit
Weight: 14 mg (typ.)

<table>
<thead>
<tr>
<th>Package Name(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JEDEC: SOT-25</td>
</tr>
<tr>
<td>Nickname: SMV</td>
</tr>
</tbody>
</table>
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