OVERVIEW

The SM5010 series are crystal oscillator module ICs. They incorporate oscillator and output buffer circuits, employing built-in oscillator capacitors and feedback resistors with excellent frequency response, eliminating the need for external components to form a stable crystal oscillator. There are 7 oscillator configurations available for design and application optimization.

FEATURES

- 7 types of oscillation circuit structure
  - **For fundamental oscillator**
    - 5010A××: Simple structure with low frequency variation
    - 5010B××: Low crystal current type with R_D built-in oscillation circuit
    - 5010CL××: Oscillation stop function built-in
    - 5010DN××: External capacitors, C_G and C_D required
    - 5010EA××: Low current consumption type
  - **For 3rd overtone oscillator**
    - 5010F××: Suitable for round blank
    - 5010H××: External resistor, R_f required
- 2.7 to 5.5V operating supply voltage
- Capacitors C_G, C_D built-in
- Inverter amplifier feedback resistor built-in
- Output duty level
  - TTL level: AK×, BK×, HK×
  - CMOS level: AN×, AH×, BN×, BH×, CL×, DN×, EA×, FN×, FH×, HN×
- Oscillator frequency output (f_O, f_O/2, f_O/4, f_O/8, f_O/16 determined by internal connection)
- Standby function
- Pull-up resistor built-in
- 8-pin SOP (SM5010×××S)
- Chip form (CF5010×××)

SERIES CONFIGURATION

<table>
<thead>
<tr>
<th>Version</th>
<th>Operating supply voltage range [V]</th>
<th>Built-in capacitance</th>
<th>R_D [Ω]</th>
<th>Output current (VDD = 5V) [mA]</th>
<th>Output duty level</th>
<th>Output frequency</th>
<th>INHN input level</th>
<th>Standby mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF5010AN1</td>
<td>2.7 to 5.5</td>
<td>29 29</td>
<td>16</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
</tr>
<tr>
<td>CF5010AN2</td>
<td>4.5 to 5.5</td>
<td>29 29</td>
<td>16</td>
<td>TTL</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
</tr>
<tr>
<td>CF5010AH1</td>
<td>2.7 to 5.5</td>
<td>29 29</td>
<td>4</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
</tr>
<tr>
<td>CF5010BN1</td>
<td>2.7 to 5.5</td>
<td>22 22</td>
<td>820</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
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<tr>
<td>CF5010BK1</td>
<td>4.5 to 5.5</td>
<td>22 22</td>
<td>820</td>
<td>TTL</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
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<tr>
<td>CF5010CH1</td>
<td>2.7 to 5.5</td>
<td>22 22</td>
<td>820</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
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<td>CF5010CL1</td>
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<td>18 18</td>
<td>16</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
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<tr>
<td>CF5010DN1</td>
<td>2.7 to 5.5</td>
<td>– –</td>
<td>820</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>No</td>
<td>High impedance</td>
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<tr>
<td>CF5010EA1</td>
<td>2.7 to 5.5</td>
<td>10 15</td>
<td>820</td>
<td>CMOS</td>
<td>f_O</td>
<td>TTL</td>
<td>Yes</td>
<td>LOW</td>
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1. Package devices have designation SM5010×××S.
### SERIES CONFIGURATION

**For 3rd Overtone Oscillator**

<table>
<thead>
<tr>
<th>Version</th>
<th>Operating supply voltage range [V]</th>
<th>gm ratio</th>
<th>Built-in capacitance</th>
<th>$R_f$ [kΩ]</th>
<th>Output current (V$_{DD}$ = 5V) [mA]</th>
<th>Output duty level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF5010FNA</td>
<td>2.7 to 5.5</td>
<td>1.00</td>
<td>C$_G$ [pF] C$_D$ [pF]</td>
<td>13</td>
<td>15</td>
<td>16</td>
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<tr>
<td>CF5010FNC</td>
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<td></td>
<td></td>
<td>11</td>
<td>17</td>
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<tr>
<td>CF5010FND</td>
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<td></td>
<td>13</td>
<td>17</td>
<td></td>
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<tr>
<td>CF5010FNE</td>
<td>4.5 to 5.5</td>
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<td></td>
<td>8</td>
<td>15</td>
<td>2.2</td>
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<tr>
<td>CF5010FHA</td>
<td>4.5 to 5.5</td>
<td>1.00</td>
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<td>13</td>
<td>15</td>
<td>4</td>
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<tr>
<td>CF5010FHC</td>
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<td>17</td>
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<td>CF5010FHD</td>
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<td>17</td>
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<tr>
<td>CF5010FHE</td>
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<td></td>
<td></td>
<td>8</td>
<td>15</td>
<td></td>
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<tr>
<td>CF5010HN1</td>
<td>4.5 to 5.5</td>
<td>1.17</td>
<td></td>
<td>13</td>
<td>17</td>
<td>200</td>
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<tr>
<td>CF5010HK1</td>
<td>4.5 to 5.5</td>
<td>1.17</td>
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<td>13</td>
<td>17</td>
<td>200</td>
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### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Device</th>
<th>Package</th>
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<tbody>
<tr>
<td>SM5010xxxS</td>
<td>8-pin SOP</td>
</tr>
<tr>
<td>CF5010xxx-1</td>
<td>Chip form</td>
</tr>
</tbody>
</table>

### PACKAGE DIMENSIONS

(Unit: mm)

- 8-pin SOP

![Diagram of package dimensions](image)
PAD LAYOUT
(Unit: µm)

PINOUT
(Top view)

PIN DESCRIPTION and PAD DIMENSIONS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>I/O</th>
<th>Description</th>
<th>Pad dimensions [µm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INHN</td>
<td>I</td>
<td>Output state control input. Standby mode when LOW, pull-up resistor built in. In the case of the 5010CL, the oscillator stops and Power-saving pull-up resistor is built-in to reduce current consumption at standby mode.</td>
<td>195 174.4</td>
</tr>
<tr>
<td>2</td>
<td>XT</td>
<td>I</td>
<td>Amplifier input. Crystal oscillator connection pins.</td>
<td>385 174.4</td>
</tr>
<tr>
<td>3</td>
<td>XTN</td>
<td>O</td>
<td>Amplifier output. Crystal oscillator connected between XT and XTN</td>
<td>575 174.4</td>
</tr>
<tr>
<td>4</td>
<td>VSS</td>
<td>–</td>
<td>Ground</td>
<td>765 174.4</td>
</tr>
<tr>
<td>5</td>
<td>Q</td>
<td>O</td>
<td>Output. Output frequency (f₀, f₀/2, f₀/4, f₀/8, f₀/16) determined by internal connection</td>
<td>757.6 1017.6</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>–</td>
<td>No connection</td>
<td>– –</td>
</tr>
<tr>
<td>7</td>
<td>NC</td>
<td>–</td>
<td>No connection</td>
<td>– –</td>
</tr>
<tr>
<td>8</td>
<td>VDD</td>
<td>–</td>
<td>Supply voltage</td>
<td>165.4 1014.6</td>
</tr>
</tbody>
</table>
BLOCK DIAGRAM

For Fundamental Oscillator

- SM5010 series
- 5010A××, B××, CL×, DN×, EA× series

For 3rd Overtone Oscillator

- SM5010 series
- 5010F××, H×× series
FUNCTIONAL DESCRIPTION

Standby Function

5010AH×, AK×, AN×, BH×, BK×, BN×, DN×, FN×, FH×, HN×, HK× series
When INHN goes LOW, the output on Q becomes high impedance, but internally the oscillator does not stop.

5010CL× series
When INHN goes LOW, the oscillator stops and the oscillator output on Q becomes high impedance.

5010EA× series
When INHN goes LOW, the oscillator stops and the oscillator output on Q becomes LOW.

<table>
<thead>
<tr>
<th>Version</th>
<th>INHN</th>
<th>Q</th>
<th>Oscillator</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH×, AK×, AN×, BH×, BK×, BN×, DN×, FN×, FH×, HN×, HK× series</td>
<td>HIGH (or open)</td>
<td>Any 1f0, 1f0/2, 1f0/4, 1f0/8 or 1f0/16 output frequency</td>
<td>Normal operation</td>
</tr>
<tr>
<td></td>
<td>LOW</td>
<td>High impedance</td>
<td>Normal operation</td>
</tr>
<tr>
<td>CL× series</td>
<td>HIGH (or open)</td>
<td>Any 1f0, 1f0/2, 1f0/4, 1f0/8 or 1f0/16 output frequency</td>
<td>Normal operation</td>
</tr>
<tr>
<td></td>
<td>LOW</td>
<td>High impedance</td>
<td>Stopped</td>
</tr>
<tr>
<td>EA× series</td>
<td>HIGH (or open)</td>
<td>Either 1f0 or 1f0/2 output frequency</td>
<td>Normal operation</td>
</tr>
<tr>
<td></td>
<td>LOW</td>
<td>LOW</td>
<td>Stopped</td>
</tr>
</tbody>
</table>

Power-saving Pull-up Resistor (CL series only)

The INHN pull-up resistance changes in response to the input level (HIGH or LOW). When INHN goes LOW (standby state), the pull-up resistance becomes large to reduce the current consumption during standby.
# SM5010 series

## SPECIFICATIONS

### Absolute Maximum Ratings

$V_{SS} = 0\text{V}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage range</td>
<td>$V_{DD}$</td>
<td>$-0.5$ to $+7.0\text{V}$</td>
<td>$-0.5$ to $V_{DD}$ + 0.5</td>
<td>$V$</td>
</tr>
<tr>
<td>Input voltage range</td>
<td>$V_{IN}$</td>
<td>$-0.5$ to $V_{DD}$ + 0.5</td>
<td>$-0.5$ to $V_{DD}$ + 0.5</td>
<td>$V$</td>
</tr>
<tr>
<td>Output voltage range</td>
<td>$V_{OUT}$</td>
<td>$-0.5$ to $V_{DD}$ + 0.5</td>
<td>$-0.5$ to $V_{DD}$ + 0.5</td>
<td>$V$</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>$T_{opr}$</td>
<td>Chip form</td>
<td>$-40$ to $+85$</td>
<td>$^\circ\text{C}$</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>$T_{stg}$</td>
<td>8-pin SOP</td>
<td>$-65$ to $+150$</td>
<td>$^\circ\text{C}$</td>
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<tr>
<td>Output current</td>
<td>$I_{OUT}$</td>
<td>$AH$, $BH$, $FH$, $EA$, $AN$, $AK$, $BN$, $BK$, $CL$, $DN$, $FN$, $HN$, $HK$</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{D}$</td>
<td>8-pin SOP</td>
<td>500</td>
<td>mW</td>
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</table>

### Recommended Operating Conditions

#### 3V operation

$V_{SS} = 0\text{V}$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Version</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating supply voltage</td>
<td>$V_{DD}$</td>
<td>All version</td>
<td>$2.7$ to $3.6\text{V}$</td>
<td>$V$</td>
<td></td>
</tr>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td>All version</td>
<td>$V_{SS}$ to $V_{DD}$</td>
<td>$V$</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{OPR}$</td>
<td>$5010AN$&lt;</td>
<td>$-10$ to $+70$</td>
<td>$^\circ\text{C}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$5010AH$&lt;</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
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<td>$5010BN$&lt;</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>$5010BH$&lt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$5010CL$&lt;</td>
<td>$-20$ to $+80$</td>
<td>$^\circ\text{C}$</td>
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<tr>
<td></td>
<td></td>
<td>$5010DN1$</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>$5010EA$&lt;</td>
<td>$-10$ to $+70$</td>
<td>$^\circ\text{C}$</td>
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<td></td>
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<td>$5010FN$&lt;</td>
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<tr>
<td>Operating frequency</td>
<td>$f$</td>
<td>$5010AN$&lt;</td>
<td>$2$ to $30$</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$5010AH$&lt;</td>
<td>$2$ to $16$</td>
<td>MHz</td>
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<td></td>
<td></td>
<td>$5010BN$&lt;</td>
<td>$2$ to $30$</td>
<td>MHz</td>
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<tr>
<td></td>
<td></td>
<td>$5010BH$&lt;</td>
<td>$2$ to $16$</td>
<td>MHz</td>
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<td></td>
<td></td>
<td>$5010CL$&lt;</td>
<td>$2$ to $16$</td>
<td>MHz</td>
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<tr>
<td></td>
<td></td>
<td>$5010DN1$</td>
<td>$2$ to $30$</td>
<td>MHz</td>
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</tr>
<tr>
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<td>$5010EA$&lt;</td>
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<td></td>
<td></td>
<td>$5010FN$&lt;</td>
<td>$22$ to $40$</td>
<td>MHz</td>
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</table>
### 5V operation

**V<sub>SS</sub> = 0V**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Version</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Operating supply voltage</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt;</td>
<td>All version</td>
<td></td>
<td>4.5 to 5.5</td>
<td>V</td>
</tr>
<tr>
<td>Input voltage</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>All version</td>
<td>V&lt;sub&gt;SS&lt;/sub&gt; to V&lt;sub&gt;DD&lt;/sub&gt;</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T&lt;sub&gt;OPR&lt;/sub&gt;</td>
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<td></td>
<td>5010AN&lt; &lt;br&gt;5010AK&lt; &lt;br&gt;5010AH&lt; &lt;br&gt;5010BN&lt; &lt;br&gt;5010BK&lt; &lt;br&gt;5010BH&lt; &lt;br&gt;5010CL&lt; &lt;br&gt;5010DN1 &lt;br&gt;5010EA &lt;br&gt;5010FN&lt; &lt;br&gt;5010FH&lt; &lt;br&gt;5010HN1 &lt;br&gt;5010HK1</td>
<td>−40 to +85</td>
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<tr>
<td></td>
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<td>5010EA&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, f = 2 to 30MHz</td>
<td></td>
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<tr>
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<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, f = 2 to 40MHz</td>
<td>−10 to +70</td>
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<td>5010FN&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF, 30MHz ≤ f ≤ 50MHz</td>
<td>−20 to +80</td>
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<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, 50MHz ≤ f ≤ 70MHz</td>
<td>−15 to +75</td>
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<td>5010FH&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, 50MHz ≤ f ≤ 60MHz</td>
<td>−20 to +80</td>
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<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, 50MHz ≤ f ≤ 70MHz</td>
<td>−15 to +75</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>5010HN1</td>
<td></td>
<td>−40 to +85</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010HK1</td>
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<tr>
<td>Operating frequency</td>
<td>f</td>
<td>5010AN&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF</td>
<td>2 to 30</td>
<td>MHz</td>
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<td></td>
<td></td>
<td>5010AK&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF</td>
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<td></td>
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<td>5010AH&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF</td>
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</tr>
<tr>
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<td>5010BN&lt;</td>
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<td>5010BK&lt;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010BH&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>5010CL&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010DN1</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF, T&lt;sub&gt;a&lt;/sub&gt; = −40 to +85°C</td>
<td>2 to 40</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF, T&lt;sub&gt;a&lt;/sub&gt; = −20 to +80°C</td>
<td>30 to 50</td>
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<td></td>
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<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, T&lt;sub&gt;a&lt;/sub&gt; = −15 to +75°C</td>
<td>50 to 70</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010FN&lt;</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF, T&lt;sub&gt;a&lt;/sub&gt; = −20 to +80°C</td>
<td>30 to 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF, T&lt;sub&gt;a&lt;/sub&gt; = −15 to +75°C</td>
<td>50 to 60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010HN1</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 50pF</td>
<td>22 to 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5010HK1</td>
<td>C&lt;sub&gt;L&lt;/sub&gt; ≤ 15pF</td>
<td>22 to 50</td>
<td></td>
</tr>
</tbody>
</table>
### Electrical Characteristics

#### 5010AN✓, BN✓, DN✓ series

3V operation: \(V_{DD} = 2.7\) to 3.6V, \(V_{SS} = 0\)V, \(Ta = -10\) to +70°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>(V_{OH})</td>
<td>Q: Measurement cct 1, (V_{DD} = 2.7V, I_{OH} = 8mA)</td>
<td>min</td>
<td>typ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>(V_{OL})</td>
<td>Q: Measurement cct 2, (V_{DD} = 2.7V, I_{OL} = 8mA)</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>(V_{IH})</td>
<td>INHN</td>
<td>2.0</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>(V_{IL})</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>(I_{Z})</td>
<td>Q: Measurement cct 2, INHN = LOW, (V_{DD} = 3.6V)</td>
<td>(V_{OH} = V_{DD})</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{OL} = V_{SS})</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>(I_{DD})</td>
<td>Measurement cct 3, load cct 1, INHN = open, (C_{L} = 15pF, f = 30MHz)</td>
<td>5010×N1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N2</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N3</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N4</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N5</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>(R_{UP2})</td>
<td>Measurement cct 4</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>(R_{f})</td>
<td>Measurement cct 5</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>(R_{D})</td>
<td>Design value</td>
<td>5010××</td>
<td>690</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>(C_{G})</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>5010××</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>(C_{D})</td>
<td></td>
<td>5010××</td>
<td>20</td>
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</tbody>
</table>

#### 5010AN✓, AK✓, BN✓, BK✓, DN✓ series

5V operation: \(V_{DD} = 4.5\) to 5.5V, \(V_{SS} = 0\)V, \(Ta = -40\) to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>(V_{OH})</td>
<td>Q: Measurement cct 1, (V_{DD} = 4.5V, I_{OH} = 16mA)</td>
<td>3.9</td>
<td>4.2</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>(V_{OL})</td>
<td>Q: Measurement cct 2, (V_{DD} = 4.5V, I_{OL} = 16mA)</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>(V_{IH})</td>
<td>INHN</td>
<td>2.0</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>(V_{IL})</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>(I_{Z})</td>
<td>Q: Measurement cct 2, INHN = LOW, (V_{DD} = 5.5V)</td>
<td>(V_{OH} = V_{DD})</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{OL} = V_{SS})</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>(I_{DD})</td>
<td>Measurement cct 3, load cct 1, INHN = open, (C_{L} = 50pF, f = 30MHz)</td>
<td>5010×N1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N2</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N3</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×N4</td>
<td>–</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>5010×N5</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010×K1</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>(R_{UP2})</td>
<td>Measurement cct 4</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>(R_{f})</td>
<td>Measurement cct 5</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>(R_{D})</td>
<td>Design value</td>
<td>5010××</td>
<td>690</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>(C_{G})</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>5010××</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>(C_{D})</td>
<td></td>
<td>5010××</td>
<td>20</td>
</tr>
</tbody>
</table>
### 5010AH×, BH× series

3V operation: $V_{DD} = 2.7$ to 3.6V, $V_{SS} = 0V$, $Ta = -10$ to $+70^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 2.7V, I_{OH} = 2mA$</td>
<td>min typ max</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 2.7V, I_{OL} = 2mA$</td>
<td>2.0 – –</td>
<td>V</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0 – –</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>– – 0.5</td>
<td>V</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 3.6V$</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{L} = 15pF, f = 16MHz$</td>
<td>5010×H1 – 3 6</td>
<td>mA</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP2}$</td>
<td>Measurement cct 4</td>
<td>40 100 250</td>
<td>kΩ</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>80 200 500</td>
<td>kΩ</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>$R_{D}$</td>
<td>Design value</td>
<td>5010B×× 690 820 940</td>
<td>Ω</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{G}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>$5010A××$ 26 29 32</td>
<td>pF</td>
</tr>
<tr>
<td>CD</td>
<td>$5010B××$ 20 22 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5V operation: $V_{DD} = 4.5$ to 5.5V, $V_{SS} = 0V$, $Ta = -40$ to $+85^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 4.5V, I_{OH} = 4mA$</td>
<td>min typ max</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 4.5V, I_{OL} = 4mA$</td>
<td>– 0.3 0.5</td>
<td>V</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0 – –</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>– – 0.8</td>
<td>V</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 5.5V$</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{L} = 15pF, f = 30MHz$</td>
<td>5010×H1 – 9 18</td>
<td>mA</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP2}$</td>
<td>Measurement cct 4</td>
<td>40 100 250</td>
<td>kΩ</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>80 200 500</td>
<td>kΩ</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>$R_{D}$</td>
<td>Design value</td>
<td>5010B×× 690 820 940</td>
<td>Ω</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{G}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>$5010A××$ 26 29 32</td>
<td>pF</td>
</tr>
<tr>
<td>CD</td>
<td>$5010B××$ 20 22 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 5010CL× series

3V operation: $V_{DD} = 2.7$ to 3.6V, $V_{SS} = 0V$, $Ta = -20$ to +80°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 2.7V$, $I_{OH} = 8mA$</td>
<td>2.2</td>
<td>2.4</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 2.7V$, $I_{OL} = 8mA$</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>$0.7V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 3.6V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{c} = 15pF, f = 30MHz$</td>
<td>5010CL1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL2</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL3</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL4</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL5</td>
<td>–</td>
</tr>
<tr>
<td>Standby current</td>
<td>$I_{ST}$</td>
<td>Measurement cct 6, INHN = LOW</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP1}$</td>
<td>Measurement cct 4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>$R_{UP2}$</td>
<td></td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{G}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>$C_{D}$</td>
<td></td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

5V operation: $V_{DD} = 4.5$ to 5.5V, $V_{SS} = 0V$, $Ta = -40$ to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 4.5V$, $I_{OH} = 16mA$</td>
<td>4.0</td>
<td>4.2</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 4.5V$, $I_{OL} = 16mA$</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>$0.7V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 5.5V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{c} = 50pF, f = 30MHz$</td>
<td>5010CL1</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL2</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL3</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL4</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010CL5</td>
<td>–</td>
</tr>
<tr>
<td>Standby current</td>
<td>$I_{ST}$</td>
<td>Measurement cct 6, INHN = LOW</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP1}$</td>
<td>Measurement cct 4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>$R_{UP2}$</td>
<td></td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{G}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>$C_{D}$</td>
<td></td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>
### 5010EA× series

3V operation: \( V_{DD} = 2.7 \) to 3.6V, \( V_{SS} = 0V \), \( Ta = -10 \) to +70°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>( V_{OH} )</td>
<td>Q: Measurement cct 1, ( V_{DD} = 2.7V ), ( I_{OH} = 2mA )</td>
<td>( V )</td>
<td>2.1</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>( V_{OL} )</td>
<td>Q: Measurement cct 2, ( V_{DD} = 2.7V ), ( I_{OL} = 2mA )</td>
<td>( V )</td>
<td>–</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>( V_{IH} )</td>
<td>INHN</td>
<td>( V )</td>
<td>2.0</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>( V_{IL} )</td>
<td>INHN</td>
<td>( V )</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>( I_{DD} )</td>
<td>Measurement cct 3, load cct 1, INHN = open, ( C_{L} = 15pF ), ( f = 30MHz )</td>
<td>( mA )</td>
<td>5010EA1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5010EA2</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>( R_{UP2} )</td>
<td>Measurement cct 4</td>
<td>( k\Omega )</td>
<td>40</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>( R_{f} )</td>
<td>Measurement cct 5</td>
<td>( k\Omega )</td>
<td>80</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>( R_{D} )</td>
<td>Design value</td>
<td>( \Omega )</td>
<td>690</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>( C_{G} )</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>( pF )</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>( C_{D} )</td>
<td></td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

5V operation: \( V_{DD} = 4.5 \) to 5.5V, \( V_{SS} = 0V \), \( Ta = -40 \) to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>( V_{OH} )</td>
<td>Q: Measurement cct 1, ( V_{DD} = 4.5V ), ( I_{OH} = 3.2mA )</td>
<td>( V )</td>
<td>3.9</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>( V_{OL} )</td>
<td>Q: Measurement cct 2, ( V_{DD} = 4.5V ), ( I_{OL} = 3.2mA )</td>
<td>( V )</td>
<td>–</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>( V_{IH} )</td>
<td>INHN</td>
<td>( V )</td>
<td>2.0</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>( V_{IL} )</td>
<td>INHN</td>
<td>( V )</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>( I_{DD1} )</td>
<td>Measurement cct 3, load cct 1, INHN = open, ( C_{L} = 15pF ), ( f = 30MHz )</td>
<td>( mA )</td>
<td>5010EA1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5010EA2</td>
</tr>
<tr>
<td></td>
<td>( I_{DD2} )</td>
<td>Measurement cct 3, load cct 1, INHN = open, ( C_{L} = 15pF ), ( f = 40MHz )</td>
<td>( mA )</td>
<td>5010EA1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5010EA2</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>( R_{UP2} )</td>
<td>Measurement cct 4</td>
<td>( k\Omega )</td>
<td>40</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>( R_{f} )</td>
<td>Measurement cct 5</td>
<td>( k\Omega )</td>
<td>80</td>
</tr>
<tr>
<td>Oscillator amplifier output resistance</td>
<td>( R_{D} )</td>
<td>Design value</td>
<td>( \Omega )</td>
<td>690</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>( C_{G} )</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>( pF )</td>
<td>9</td>
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<tr>
<td></td>
<td>( C_{D} )</td>
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<td>13</td>
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</table>
### 5010FNx series

3V operation: $V_{DD} = 2.7$ to $3.6V$, $V_{SS} = 0V$, $Ta = -10$ to $+70^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 2.7V$, $I_{OH} = 8mA$</td>
<td>2.2</td>
<td>2.4</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 2.7V$, $I_{OL} = 8mA$</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_Z$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 3.6V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{OL} = V_{SS}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_L = 15pF$</td>
<td>5010FNA, FNC $f = 30MHz$</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FND $f = 40MHz$</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP}$</td>
<td>Measurement cct 4</td>
<td>5010FNA</td>
<td>40</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_i$</td>
<td>Measurement cct 5</td>
<td>5010FNA</td>
<td>3.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FNC</td>
<td>2.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FND</td>
<td>1.87</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_G$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>5010FNA</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FNC</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FND</td>
<td>11.7</td>
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<tr>
<td></td>
<td>$C_D$</td>
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<td>5010FNA</td>
<td>13.5</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5010FND</td>
<td>15.3</td>
</tr>
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</table>
SM5010 series

5V operation: $V_{DD} = 4.5$ to $5.5V$, $V_{SS} = 0V$

$30 \leq f \leq 50MHz$: $Ta = -20$ to $+80^\circ C$, $50 < f \leq 70MHz$: $Ta = -15$ to $+75^\circ C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min</td>
<td>typ</td>
</tr>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 4.5V$, $I_{OH} = 16mA$</td>
<td>3.9</td>
<td>4.2</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 4.5V$, $I_{OL} = 16mA$</td>
<td>–</td>
<td>0.3</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0</td>
<td>–</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{2}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 5.5V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD1}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_L = 15pF$</td>
<td>$5010FNE$, $f = 70MHz$</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>$I_{DD2}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_L = 50pF$</td>
<td>$5010FNA$, $FNC$, $f = 40MHz$</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FND$, $f = 50MHz$</td>
<td>–</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{UP}$</td>
<td>Measurement cct 4</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>$5010FNA$</td>
<td>3.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FNC$</td>
<td>2.63</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>$5010FND$</td>
<td>1.87</td>
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<td></td>
<td></td>
<td></td>
<td>$5010FNE$</td>
<td>1.87</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{G}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>$5010FNA$</td>
<td>11.7</td>
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<td></td>
<td>$C_{D}$</td>
<td></td>
<td>$5010FNC$</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FND$</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FNE$</td>
<td>7.2</td>
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<td></td>
<td></td>
<td></td>
<td>$5010FNA$</td>
<td>13.5</td>
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<td></td>
<td></td>
<td></td>
<td>$5010FNC$</td>
<td>15.3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FND$</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$5010FNE$</td>
<td>13.5</td>
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</tbody>
</table>
### 5010FH× series

5V operation: $V_{DD} = 4.5$ to 5.5V, $V_{SS} = 0$V

$30 \leq f \leq 50$MHz: $Ta = −20$ to +80°C,  $50 < f \leq 60$MHz: $Ta = −15$ to +75°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 4.5V, I_{OH} = 4mA$</td>
<td>3.9</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 4.5V, I_{OL} = 4mA$</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 5.5V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{OL} = V_{SS}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{L} = 15pF$</td>
<td>$f = 40$MHz</td>
<td>13</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$f = 50$MHz</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$f = 60$MHz</td>
<td>17</td>
</tr>
<tr>
<td>INHN pull-up resistance</td>
<td>$R_{LP}$</td>
<td>Measurement cct 4</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>

### 5010HN×, HK× series

5V operation: $V_{DD} = 4.5$ to 5.5V, $V_{SS} = 0$V, $Ta = −40$ to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-level output voltage</td>
<td>$V_{OH}$</td>
<td>Q: Measurement cct 1, $V_{DD} = 4.5V, I_{OH} = 16mA$</td>
<td>3.9</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level output voltage</td>
<td>$V_{OL}$</td>
<td>Q: Measurement cct 2, $V_{DD} = 4.5V, I_{OL} = 16mA$</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>HIGH-level input voltage</td>
<td>$V_{IH}$</td>
<td>INHN</td>
<td>2.0</td>
<td>V</td>
</tr>
<tr>
<td>LOW-level input voltage</td>
<td>$V_{IL}$</td>
<td>INHN</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>Output leakage current</td>
<td>$I_{Z}$</td>
<td>Q: Measurement cct 2, INHN = LOW, $V_{DD} = 5.5V$</td>
<td>$V_{OH} = V_{DD}$</td>
<td>–</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>$V_{OL} = V_{SS}$</td>
<td>–</td>
</tr>
<tr>
<td>Current consumption</td>
<td>$I_{DD1}$</td>
<td>Measurement cct 3, load cct 2, INHN = open, $C_{L} = 15pF, f = 50$MHz</td>
<td>5010HK1</td>
<td>20</td>
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<td>$I_{DD2}$</td>
<td>Measurement cct 3, load cct 1, INHN = open, $C_{L} = 50pF, f = 50$MHz</td>
<td>5010HN1</td>
<td>25</td>
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<tr>
<td>INHN pull-up resistance</td>
<td>$R_{LP}$</td>
<td>Measurement cct 4</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Feedback resistance</td>
<td>$R_{f}$</td>
<td>Measurement cct 5</td>
<td>80</td>
<td>200</td>
</tr>
<tr>
<td>Built-in capacitance</td>
<td>$C_{D}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>11.7</td>
<td>13</td>
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<tr>
<td></td>
<td>$C_{D}$</td>
<td>Design value. A monitor pattern on a wafer is tested.</td>
<td>15.3</td>
<td>17</td>
</tr>
</tbody>
</table>
Switching Characteristics

5010AN×, BN×, DN× series

3V operation/Duty level: CMOS

V_{DD} = 2.7 to 3.6V, V_{SS} = 0V, Ta = −10 to +70°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 1, C_{L} = 15pF</td>
<td>min/typ/max</td>
<td></td>
</tr>
<tr>
<td>Output rise time</td>
<td>t_{r1}</td>
<td>0.1V_{DD} to 0.9V_{DD}</td>
<td>–</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 1, C_{L} = 50pF</td>
<td>–</td>
<td>6.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>t_{f1}</td>
<td>0.9V_{DD} to 0.1V_{DD}</td>
<td>–</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 1, V_{DD} = 3.0V</td>
<td>–</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF, f = 30MHz</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Output duty cycle¹</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, V_{DD} = 3.0V</td>
<td>40</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>60   %</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>t_{PLZ}</td>
<td>Measurement cct 7, load cct 1, V_{DD} = 3.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>100</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>t_{PZL}</td>
<td>Measurement cct 7, load cct 1, V_{DD} = 3.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.

5010AN×, AK×, BN×, BK×, DN× series

5V operation/Duty level: CMOS (5010AN×, BN×, DN1)

V_{DD} = 4.5 to 5.5V, V_{SS} = 0V, Ta = −40 to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 1, C_{L} = 50pF</td>
<td>min/typ/max</td>
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</tr>
<tr>
<td>Output rise time</td>
<td>t_{r1}</td>
<td>0.1V_{DD} to 0.9V_{DD}</td>
<td>–</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>t_{r2}</td>
<td>0.9V_{DD} to 1.0V_{DD}</td>
<td>–</td>
<td>4.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>t_{f1}</td>
<td>0.9V_{DD} to 0.1V_{DD}</td>
<td>–</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>t_{f2}</td>
<td>0.1V_{DD} to 0.9V_{DD}</td>
<td>–</td>
<td>4.0</td>
</tr>
<tr>
<td>Output duty cycle¹</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, V_{DD} = 5.0V</td>
<td>45</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 50pF, f = 30MHz</td>
<td>–</td>
<td>55   %</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>t_{PLZ}</td>
<td>Measurement cct 7, load cct 1, V_{DD} = 5.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 50pF</td>
<td>–</td>
<td>100</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>t_{PZL}</td>
<td>Measurement cct 7, load cct 1, V_{DD} = 5.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 50pF</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.

5V operation/Duty level: TTL (5010×K1, AN2, AN3, AN4, BN2, BN3, BN4, BN5)

V_{DD} = 4.5 to 5.5V, V_{SS} = 0V, Ta = −40 to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 2, C_{L} = 15pF</td>
<td>min/typ/max</td>
<td></td>
</tr>
<tr>
<td>Output rise time</td>
<td>t_{r3}</td>
<td>0.4V to 2.4V</td>
<td>–</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 2, C_{L} = 50pF</td>
<td>–</td>
<td>3.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>t_{f3}</td>
<td>2.4V to 0.4V</td>
<td>–</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measurement cct 6, load cct 2, V_{DD} = 5.0V</td>
<td>45</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF, f = 30MHz</td>
<td>–</td>
<td>55   %</td>
</tr>
<tr>
<td>Output duty cycle¹</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 2, V_{DD} = 5.0V</td>
<td>45</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>55   %</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>t_{PLZ}</td>
<td>Measurement cct 7, load cct 2, V_{DD} = 5.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>100</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>t_{PZL}</td>
<td>Measurement cct 7, load cct 2, V_{DD} = 5.0V</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = 25°C, C_{L} = 15pF</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
SM5010 series

5010AH×, BH× series

3V operation/Duty level: CMOS

\(V_{DD} = 2.7\) to 3.6V, \(V_{SS} = 0V\), \(Ta = -10\) to +70°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(\min)</td>
<td>(\text{typ})</td>
</tr>
<tr>
<td>Output rise time</td>
<td>(t_{r1})</td>
<td>Measurement cct 6, load cct 1, (C_L = 15, \mu\text{F}), (0.1V_{DD}) to 0.9(V_{DD})</td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>Output fall time</td>
<td>(t_{f1})</td>
<td>Measurement cct 6, load cct 1, (C_L = 15, \mu\text{F}), 0.9(V_{DD}) to 0.1(V_{DD})</td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>(D)</td>
<td>Measurement cct 6, load cct 1, (V_{DD} = 3.0V), (Ta = 25°C), (C_L = 15, \mu\text{F}), (f = 16\text{MHz})</td>
<td>40</td>
<td>--</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>(t_{PLZ})</td>
<td>Measurement cct 7, load cct 1, (V_{DD} = 3.0V), (Ta = 25°C), (C_L = 15, \mu\text{F})</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>(t_{PZL})</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.

5V operation/Duty level: CMOS

\(V_{DD} = 4.5\) to 5.5V, \(V_{SS} = 0V\), \(Ta = -40\) to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(\min)</td>
<td>(\text{typ})</td>
</tr>
<tr>
<td>Output rise time</td>
<td>(t_{r1})</td>
<td>Measurement cct 6, load cct 1, (0.1V_{DD}) to 0.9(V_{DD}) (C_L = 15, \mu\text{F})</td>
<td>--</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(t_{r2})</td>
<td>(C_L = 50, \mu\text{F})</td>
<td>--</td>
<td>13</td>
</tr>
<tr>
<td>Output fall time</td>
<td>(t_{f1})</td>
<td>Measurement cct 6, load cct 1, (0.9V_{DD}) to 0.1(V_{DD}) (C_L = 15, \mu\text{F})</td>
<td>--</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>(t_{f2})</td>
<td>(C_L = 50, \mu\text{F})</td>
<td>--</td>
<td>13</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>(D)</td>
<td>Measurement cct 6, load cct 1, (V_{DD} = 5.0V), (Ta = 25°C), (C_L = 15, \mu\text{F}), (f = 30\text{MHz})</td>
<td>45</td>
<td>--</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>(t_{PLZ})</td>
<td>Measurement cct 7, load cct 1, (V_{DD} = 5.0V), (Ta = 25°C), (C_L = 15, \mu\text{F})</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>(t_{PZL})</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
SM5010 series

5010CL× series

3V operation/Duty level: CMOS

\( V_{DD} = 2.7 \) to 3.6V, \( V_{SS} = 0V \), \( Ta = -20 \) to +80°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rate</th>
<th>min</th>
<th>typ</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{11} )</td>
<td>Measurement cct 6, load cct 1, ( 0.1V_{DD} ) to ( 0.9V_{DD} )</td>
<td>CL = 15pF</td>
<td>–</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>( t_{14} )</td>
<td></td>
<td>CL = 30pF</td>
<td>–</td>
<td>3.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{11} )</td>
<td>Measurement cct 6, load cct 1, ( 0.9V_{DD} ) to ( 0.1V_{DD} )</td>
<td>CL = 15pF</td>
<td>–</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>( t_{14} )</td>
<td></td>
<td>CL = 30pF</td>
<td>–</td>
<td>3.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 3.0V ), ( V_{SS} = 0V ), ( Ta = 25°C ), ( CL = 15pF ), ( f = 30MHz )</td>
<td>–</td>
<td>45</td>
<td>–</td>
<td>55</td>
</tr>
<tr>
<td>Output disable delay time(^2)</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 3.0V ), ( V_{SS} = 0V ), ( Ta = 25°C ), ( CL = 15pF )</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
</tr>
<tr>
<td>Output enable delay time(^2)</td>
<td>( t_{PZL} )</td>
<td></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
2. Oscillator stop function is built-in. When \( INHN \) goes LOW, normal output stops. When \( INHN \) goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

5V operation/Duty level: CMOS

\( V_{DD} = 4.5 \) to 5.5V, \( V_{SS} = 0V \), \( Ta = -40 \) to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rate</th>
<th>min</th>
<th>typ</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{11} )</td>
<td>Measurement cct 6, load cct 1, ( 0.1V_{DD} ) to ( 0.9V_{DD} )</td>
<td>CL = 15pF</td>
<td>–</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>( t_{12} )</td>
<td></td>
<td>CL = 50pF</td>
<td>–</td>
<td>4.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{11} )</td>
<td>Measurement cct 6, load cct 1, ( 0.9V_{DD} ) to ( 0.1V_{DD} )</td>
<td>CL = 15pF</td>
<td>–</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>( t_{12} )</td>
<td></td>
<td>CL = 50pF</td>
<td>–</td>
<td>4.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 5.0V ), ( V_{SS} = 0V ), ( Ta = 25°C ), ( CL = 50pF ), ( f = 30MHz )</td>
<td>–</td>
<td>40</td>
<td>–</td>
<td>60</td>
</tr>
<tr>
<td>Output disable delay time(^2)</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 5.0V ), ( V_{SS} = 0V ), ( Ta = 25°C ), ( CL = 15pF )</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
</tr>
<tr>
<td>Output enable delay time(^2)</td>
<td>( t_{PZL} )</td>
<td></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
2. Oscillator stop function is built-in. When \( INHN \) goes LOW, normal output stops. When \( INHN \) goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.
### SM5010 series

#### 5010EA× series

**3V operation/Duty level: CMOS**

$V_{DD} = 2.7$ to 3.6V, $V_{SS} = 0V$, $Ta = −10$ to $+70°C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min</td>
<td>typ</td>
</tr>
<tr>
<td>Output rise time</td>
<td>$t_{r1}$</td>
<td>Measurement cct 6, load cct 1, $C_L = 15pF$, $0.1V_{DD}$ to $0.9V_{DD}$</td>
<td>–</td>
<td>8</td>
</tr>
<tr>
<td>Output fall time</td>
<td>$t_{f1}$</td>
<td>Measurement cct 6, load cct 1, $C_L = 15pF$, $0.9V_{DD}$ to $0.1V_{DD}$</td>
<td>–</td>
<td>8</td>
</tr>
<tr>
<td>Output duty cycle$^1$</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, $V_{DD} = 3.0V$, $Ta = 25°C$, $C_L = 15pF$, $f = 30MHz$</td>
<td>40</td>
<td>–</td>
</tr>
<tr>
<td>Output disable delay time$^2$</td>
<td>$t_{PLZ}$</td>
<td>Measurement cct 7, load cct 1, $V_{DD} = 3.0V$, $Ta = 25°C$, $C_L = 15pF$</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output enable delay time$^2$</td>
<td>$t_{PZL}$</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

#### 5V operation/Duty level: CMOS

$V_{DD} = 4.5$ to 5.5V, $V_{SS} = 0V$, $Ta = −40$ to $+85°C$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min</td>
<td>typ</td>
</tr>
<tr>
<td>Output rise time</td>
<td>$t_{r1}$</td>
<td>Measurement cct 6, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 15pF$</td>
<td>–</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$t_{r2}$</td>
<td>$C_L = 50pF$</td>
<td>–</td>
<td>13</td>
</tr>
<tr>
<td>Output fall time</td>
<td>$t_{f1}$</td>
<td>Measurement cct 6, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15pF$</td>
<td>–</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$t_{f2}$</td>
<td>$C_L = 50pF$</td>
<td>–</td>
<td>13</td>
</tr>
<tr>
<td>Output duty cycle$^1$</td>
<td>Duty1</td>
<td>Measurement cct 6, load cct 1, $V_{DD} = 5.0V$, $Ta = 25°C$, $C_L = 15pF$, $f = 30MHz$</td>
<td>45</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Duty2</td>
<td>$V_{DD} = 5.0V$, $Ta = 25°C$, $C_L = 15pF$, $f = 40MHz$</td>
<td>40</td>
<td>–</td>
</tr>
<tr>
<td>Output disable delay time$^2$</td>
<td>$t_{PLZ}$</td>
<td>Measurement cct 7, load cct 1, $V_{DD} = 5.0V$, $Ta = 25°C$, $C_L = 15pF$</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output enable delay time$^2$</td>
<td>$t_{PZL}$</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.
### 5010FN× series

**3V operation/Duty level: CMOS**

\[ V_{DD} = 2.7 \text{ to } 3.6 \text{V}, \ V_{SS} = 0 \text{V}, \ \text{Ta} = -10 \text{ to } +70^\circ \text{C} \text{ unless otherwise noted.} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{r1} )</td>
<td>Measurement cct 6, load cct 1, ( C_L = 15 \text{pF}, 0.1V_{DD} \text{ to } 0.9V_{DD} )</td>
<td>–</td>
<td>3.0</td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{f1} )</td>
<td>Measurement cct 6, load cct 1, ( C_L = 15 \text{pF}, 0.9V_{DD} \text{ to } 0.1V_{DD} )</td>
<td>–</td>
<td>3.0</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 3.0 \text{V}, \ \text{Ta} = 25^\circ \text{C}, \ C_L = 15 \text{pF}, f = 40 \text{MHz} )</td>
<td>40</td>
<td>–</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 3.0 \text{V}, \ \text{Ta} = 25^\circ \text{C}, \ C_L = 15 \text{pF} )</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>( t_{PZL} )</td>
<td>–</td>
<td>–</td>
<td>100 ns</td>
</tr>
</tbody>
</table>

\(^1\) The duty cycle characteristic is checked the sample chips of each production lot.

### 5V operation/Duty level: CMOS

\[ V_{DD} = 4.5 \text{ to } 5.5 \text{V}, \ V_{SS} = 0 \text{V} \]

\[ 30 \leq f \leq 50 \text{MHz}: \ \text{Ta} = -20 \text{ to } +80^\circ \text{C}, \ \text{50} < f \leq 70 \text{MHz}: \ \text{Ta} = -15 \text{ to } +75^\circ \text{C} \text{ unless otherwise noted.} \]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{r1} )</td>
<td>Measurement cct 6, load cct 1, ( 0.1V_{DD} \text{ to } 0.9V_{DD} )</td>
<td>( C_L = 15 \text{pF} )</td>
<td>–</td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{f1} )</td>
<td>Measurement cct 6, load cct 1, ( 0.9V_{DD} \text{ to } 0.1V_{DD} )</td>
<td>( C_L = 15 \text{pF} )</td>
<td>–</td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 3.0 \text{V}, \ \text{Ta} = 25^\circ \text{C}, \ C_L = 15 \text{pF}, f = 40 \text{MHz} )</td>
<td>45</td>
<td>–</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 5.0 \text{V}, \ \text{Ta} = 25^\circ \text{C}, \ C_L = 15 \text{pF} )</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>( t_{PZL} )</td>
<td>–</td>
<td>–</td>
<td>100 ns</td>
</tr>
</tbody>
</table>

\(^1\) The duty cycle characteristic is checked the sample chips of each production lot.
SM5010 series

**5010FH× series**

5V operation/Duty level: CMOS

\( V_{DD} = 4.5 \) to 5.5V, \( V_{SS} = 0V \)

\( 30 \leq f \leq 50\text{MHz}: Ta = -20 \) to +80°C, \( 50 < f \leq 60\text{MHz}: Ta = -15 \) to +75°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{r1} )</td>
<td>Measurement cct 6, load cct 1, 0.1( V_{DD} ) to 0.9( V_{DD} ) ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>4</td>
<td>8</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>( t_{r2} )</td>
<td>( C_L = 50\text{pF} )</td>
<td>–</td>
<td>11</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{f1} )</td>
<td>Measurement cct 6, load cct 1, 0.9( V_{DD} ) to 0.1( V_{DD} ) ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>4</td>
<td>8</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>( t_{f2} )</td>
<td>( C_L = 50\text{pF} )</td>
<td>–</td>
<td>11</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 5.0V ), ( Ta = 25^\circ\text{C} ), ( C_L = 15\text{pF} )</td>
<td>45</td>
<td>–</td>
<td>55</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( f = 50\text{MHz} )</td>
<td>40</td>
<td>–</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 5.0V ), ( Ta = 25^\circ\text{C} ), ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>ns</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>( t_{PZL} )</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>ns</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.

**5010HN× series**

5V operation/Duty level: CMOS

\( V_{DD} = 4.5 \) to 5.5V, \( V_{SS} = 0V \), \( Ta = -40 \) to +85°C unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>( t_{r1} )</td>
<td>Measurement cct 6, load cct 1, 0.1( V_{DD} ) to 0.9( V_{DD} ) ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>1.5</td>
<td>3.0</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>( t_{r2} )</td>
<td>( C_L = 50\text{pF} )</td>
<td>–</td>
<td>3.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Output fall time</td>
<td>( t_{f1} )</td>
<td>Measurement cct 6, load cct 1, 0.9( V_{DD} ) to 0.1( V_{DD} ) ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>1.5</td>
<td>3.0</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>( t_{f2} )</td>
<td>( C_L = 50\text{pF} )</td>
<td>–</td>
<td>3.0</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Output duty cycle(^1)</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 1, ( V_{DD} = 5.0V ), ( Ta = 25^\circ\text{C} ), ( C_L = 50\text{pF} ) ( f = 50\text{MHz} )</td>
<td>45</td>
<td>–</td>
<td>55</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( f = 60\text{MHz} )</td>
<td>40</td>
<td>–</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>( t_{PLZ} )</td>
<td>Measurement cct 7, load cct 1, ( V_{DD} = 5.0V ), ( Ta = 25^\circ\text{C} ), ( C_L = 15\text{pF} )</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>ns</td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>( t_{PZL} )</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>100</td>
<td>ns</td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.
SM5010 series

5010HK× series

5V operation/Duty level: TTL

$V_{DD} = 4.5\text{ to } 5.5\text{V}, V_{SS} = 0\text{V}, Ta = -40\text{ to } +85^\circ\text{C}$ unless otherwise noted.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>$C_L = 50\text{pF}$</th>
<th>$C_L = 15\text{pF}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output rise time</td>
<td>$t_{\text{r3}}$</td>
<td>Measurement cct 6, load cct 2, 0.4V to 2.4V</td>
<td>$2.0\text{ ns}$</td>
<td>$1.2\text{ ns}$</td>
</tr>
<tr>
<td></td>
<td>$t_{\text{r5}}$</td>
<td>$C_L = 50\text{pF}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output fall time</td>
<td>$t_{\text{f3}}$</td>
<td>Measurement cct 6, load cct 2, 2.4V to 0.4V</td>
<td>$2.0\text{ ns}$</td>
<td>$1.2\text{ ns}$</td>
</tr>
<tr>
<td></td>
<td>$t_{\text{f5}}$</td>
<td>$C_L = 50\text{pF}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output duty cycle¹</td>
<td>Duty</td>
<td>Measurement cct 6, load cct 2, $V_{DD} = 5.0\text{V}, Ta = 25^\circ\text{C}$, $f = 50\text{MHz}$</td>
<td>$45%$</td>
<td>$55%$</td>
</tr>
<tr>
<td>Output disable delay time</td>
<td>$t_{\text{PLZ}}$</td>
<td>Measurement cct 7, load cct 2, $V_{DD} = 5.0\text{V}, Ta = 25^\circ\text{C}$, $C_L = 15\text{pF}$</td>
<td>$100\text{ ns}$</td>
<td></td>
</tr>
<tr>
<td>Output enable delay time</td>
<td>$t_{\text{PZL}}$</td>
<td>$C_L = 15\text{pF}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The duty cycle characteristic is checked the sample chips of each production lot.

Current consumption and Output waveform with NPC’s standard crystal

![Diagram](image)

<table>
<thead>
<tr>
<th>$f$ [MHz]</th>
<th>$R$ [Ω]</th>
<th>$L$ [mH]</th>
<th>$C_a$ [fF]</th>
<th>$C_b$ [pF]</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>17.2</td>
<td>4.36</td>
<td>6.46</td>
<td>2.26</td>
</tr>
<tr>
<td>40</td>
<td>16.8</td>
<td>2.90</td>
<td>5.47</td>
<td>2.08</td>
</tr>
</tbody>
</table>

for Fundamental oscillator

<table>
<thead>
<tr>
<th>$f$ [MHz]</th>
<th>$R$ [Ω]</th>
<th>$L$ [mH]</th>
<th>$C_a$ [fF]</th>
<th>$C_b$ [pF]</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>18.62</td>
<td>16.24</td>
<td>1.733</td>
<td>5.337</td>
</tr>
<tr>
<td>40</td>
<td>20.53</td>
<td>11.34</td>
<td>1.396</td>
<td>3.989</td>
</tr>
<tr>
<td>50</td>
<td>22.17</td>
<td>7.40</td>
<td>1.370</td>
<td>4.105</td>
</tr>
<tr>
<td>60</td>
<td>15.37</td>
<td>3.83</td>
<td>1.836</td>
<td>5.191</td>
</tr>
<tr>
<td>70</td>
<td>25.42</td>
<td>4.18</td>
<td>1.254</td>
<td>5.170</td>
</tr>
</tbody>
</table>

for 3rd overtone oscillator
MEASUREMENT CIRCUITS

**Measurement cct 1**

- **2.0VP, 10MHz sine wave input signal (3V operation)**
- **3.5VP, 10MHz sine wave input signal (5V operation)**
- **C1 : 0.001µF**
- **R1 : 50Ω**
- **R2 : 5010AN, BN, DN, AK, BK**
  - **3V operation:** 263Ω
  - **5V operation:** 245Ω
- **5010FN, HN, HK**
  - **3V operation:** 275Ω
  - **5V operation:** 245Ω
- **5010CL**
  - **3V operation:** 275Ω
  - **5V operation:** 250Ω
- **5010EA, AH, BH, FH**
  - **3V operation:** 1050Ω
  - **5V operation:** 975Ω

**Measurement cct 2**

**Measurement cct 3**

- **2.0VP, 30MHz sine wave input signal (3V operation)**
- **3.5VP, 30MHz sine wave input signal (5V operation)**
- **C1 : 0.001µF**
- **R1 : 50Ω**

**Measurement cct 4**

- **Rpp = Vio / Ir (Vio = 0V)**
- **Rpp = Vio - Vii (Vio = 0.7Vcc)**

**Measurement cct 5**

**Crystal oscillation**
- **C0, C1 : 22pF (5010DNx)**
- **Rfo : 3.0kΩ (5010Hx)**

**Measurement cct 6**

**Measurement cct 7**
Load cct 1

Q output

\[ \text{CL} \]

(Including probe capacitance)

\[ C_L = 15\text{pF} : \text{DUTY} = t_{\text{HD}}, t_1, t_2 \]
\[ C_L = 30\text{pF} : t_4, t_6 \]
\[ C_L = 50\text{pF} : t_2, t_8 \]

Switching Time Measurement Waveform

Output duty level (CMOS)

Output duty level (TTL)

Output duty cycle (CMOS)

Output duty cycle (TTL)
SM5010 series

Output Enable/Disable Delay

INHN

Q output

INHN input waveform $t_r = t_f \leq 10 \text{ns}$

Note (CLx/EAx series only): when the device is in standby, the oscillator stops. When standby is released, the oscillator starts and stable oscillator output occurs after a short delay.
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