# Flip-flop: T unclocked




## 1 Description

This device is an implementation of an unclocked T flip-flop without override controls. For a version with the override controls, use the device "T unclocked full".

### 1.1 Pins

This device has three pins:

| *pin* | *type* | *description* |
|---|---|---|
| T | input | T input |
| Q | output | Q output |
| notQ | output | notQ output |

### 1.2 Parameters

The initial value of *Q* must be defined because the device is either holding or toggling at *t=0*.

The value of the *stepped_mode* flag determines whether the device operates in *stepped* or *ramped* mode.
In *stepped* mode (the default for ideal logical signals), the outputs are represented as stepped signals, where changes in value are observed as vertical steps at the time they occur. In *ramped* mode, the value transitions of the outputs are seen as ramps between $t-\Delta t$ and $t$.

| *parameter* | *description* |
|---|---|
| Q_ini | initial value of Q |
| stepped_mode | =1 to indicate stepped mode (default)<br>=0 to indicate ramped mode |

### 1.3 Input

The input pin may be connected to any control signal.

Numerical input values are automatically interpreted as logical values by this device, as follows:

| *input* | *converted logical value* | *logical value representation* |
|---|---|---|
| value > 0 | true | 1 |
| value ≤ 0 | false | 0 |

## 1.4 Output

The outputs are *Q* and its logical inverse *notQ*. Their representation as *stepped* or *ramped* signals is determined by the value given to the parameter *stepped_mode*.

The numerical representation of the output logical values is:

| *output logical value* | *output numerical value* |
|---|---|
| true | 1 |
| false | 0 |

## 1.5 Representation

The implementation of the model can be inspected by opening the device's subcircuit.

The model applies the following logic for determining its state:

| *rule sequence* | *action* | *output* |
|---|---|---|
| if T>0<br>else<br>endif | toggling<br>holding | Q(t) = not Q(t-dt)<br>Q(t) = Q(t-dt) |
| if at t=0 | use Q_ini | Q(0) = Q_ini |