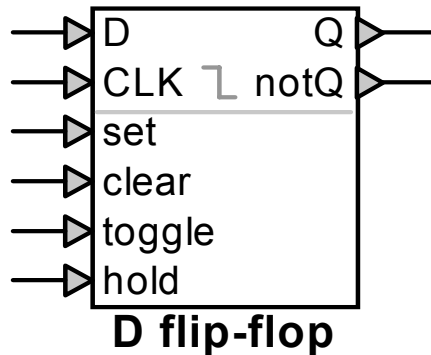


# Flip-flop: D falling-clock full-override



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## 1 Description

This device is an implementation of a D flip-flop with falling-edge clock and full override controls. For a simple version without the override controls, use the device "D falling-clock".

### 1.1 Pins

This device has eight pins:

<i>pin</i>	<i>type</i>	<i>description</i>
D	input	D input
CLK	input	falling-edge clock
set	input	set override
clear	input	clear override
toggle	input	toggle override
hold	input	hold override
Q	output	Q output
notQ	output	notQ output

### 1.2 Parameters

The initial value of Q must be defined if the device is possibly holding or toggling at  $t=0$ . When the device operates in clearing or setting mode at  $t=0$ , the initial value is ignored.

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  $t$ .

<i>parameter</i>	<i>description</i>
Q_ini	initial value of Q if holding or toggling at t=0
stepped_mode	=1 to indicate stepped mode (default) =0 to indicate ramped mode

### 1.3 Input

The input pins may be connected to any control signals.

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

<i>input</i>	<i>converted logical value</i>	<i>logical value representation</i>
value > 0	true	1
value ≤ 0	false	0

### 1.4 Output

The outputs are Q and its logical inverse *not*Q. 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:

<i>output logical value</i>	<i>output numerical value</i>
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:

<i>rule sequence</i>	<i>action</i>	<i>output</i>
if set>0	setting	$Q(t) = 1$
else if clear>0	clearing	$Q(t) = 0$
else if toggle>0	toggling	$Q(t) = \text{not } Q(t-dt)$
else if hold>0	holding	$Q(t) = Q(t-dt)$
else if not triggering	holding	$Q(t) = Q(t-dt)$
else	passing	$Q(t) = (D(t)>0)$
endif		
if holding at t=0	use Q_ini	$Q(0) = Q\_ini$
if toggling at t=0	use Q_ini	$Q(0) = Q\_ini$

where triggering occurs on a falling edge on the clock signal.