
External gate doubles counter speed

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The counting rate of a standard synchronous up/down binary or decade counter can be doubled without altering the clock frequency. A single external gate does the trick for the count-up or the count-down mode.

The ability to double the counting rate is useful for applications where a counter must be advanced at twice the normal rate, as in racing the digits to set a digital-clock stage. The extra gate can also be used to halve the counting rate, depending on the logic level of the controlling signal.

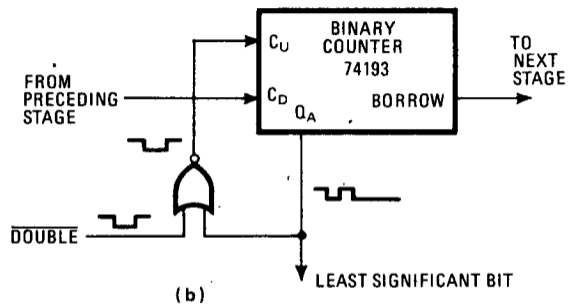
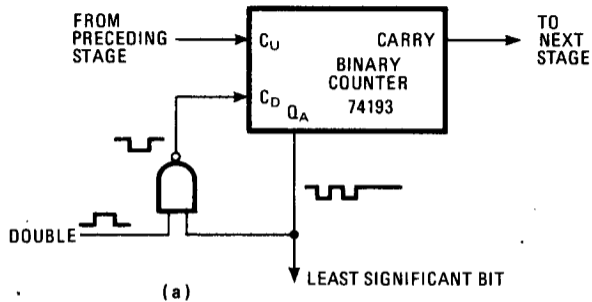
Both the decade counter (for example, a type 74192) and the binary counter (for example, a type 74193) have two clock lines—one for the count-up mode, and the other for the count-down mode. The clock input that is not being used is usually tied to the supply line. For ei-

ther type of counter, there is a counting flip-flop for each output bit.

By sensing the counter's least significant output bit and lowering the alternate-clock input at the proper time, the least significant bit is kept static, and the second counter flip-flop receives all the primary clock pulses. In addition, the state of the least significant bit locks out the alternate-clock input from the other counting flip-flops. For an up-counter, the least significant bit must be high; for a down-counter, it must be low.

The circuit of (a) shows a type 74193 binary counter connected for the count-up mode. The alternate-clock input, in this case the count-down input (C_D), is controlled by a NAND gate. When the DOUBLE input goes high, the C_D input is brought low as soon as the least significant bit is high. The least significant bit remains high until the DOUBLE input returns to the low level. Meanwhile, the count frequency appears to double.

The circuit of (b) is for the count-down mode. It is similar to the one for the count-up mode, but an OR gate is used instead and the DOUBLE control signal must be inverted. The CARRY and BORROW outputs of the counter operate normally so that the doubled counting rate may be carried to the next stage. □



Twice as fast. External gate can double or halve the counting rate of either a decade or binary up/down counter, depending on the logic level of the control signal. The actual clock frequency remains the same. Here, the operating speed of a binary counter is doubled for both the count-up mode (a) and the count-down mode (b). The counter's unused alternate-clock input goes to the controlling logic signal.