LogiSwitch NoBounce IC Application Examples

By Michael H. Pelkey, Founder & CEO, LogiSwitch LLC

Overview

Eliminating the inconvenience of contact bounce is only the beginning for LogiSwitch. This section will show some of the advantages of using LogiSwitch NoBounce™ debouncer chips in modern applications. The LogiSwitch Handshake feature brings a new dimension to switch service processing.

Please note that some of the real-time advantages shown in these applications are only possible with the unique LogiSwitch handshake protocol. Use of the handshake protocol is covered in detail in the IC User Guide and the Bounce-Free Switch User Guide.

First and Foremost: Polled Routines ***Without the Polling!***

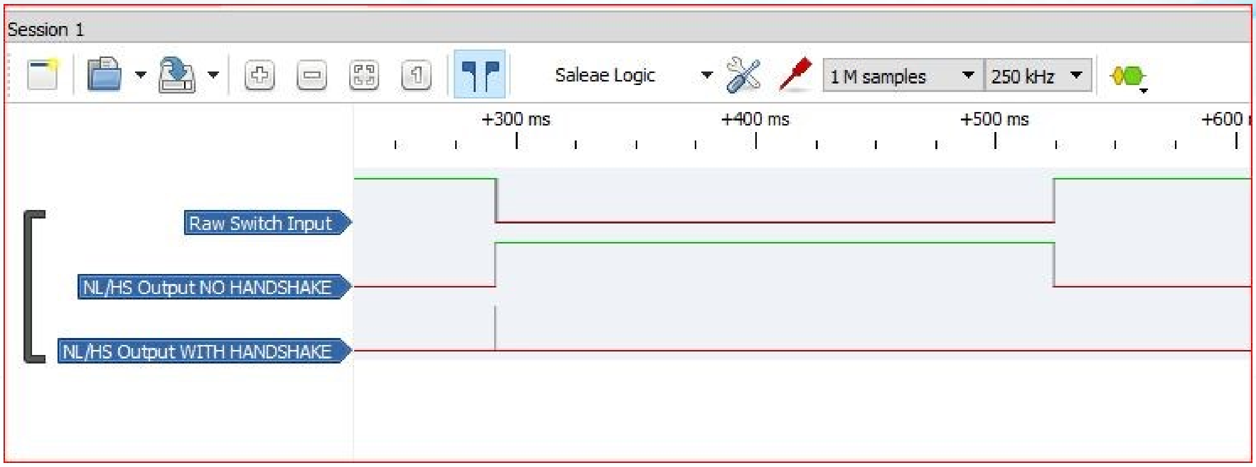
Polling is a notorious time sink. It does nothing but wait for an event to happen. Doing nothing in this case means putting tens or hundreds of thousands of instructions on hold, often for the irrelevant reason of someone still having his/her finger on a pushbutton. Polling is a way to assure that your code will not repeat, as it would of course if you were to attempt to leave a switch service routine while the switch is still activated. Legacy switch handling offers two choices: either give up your program's responsiveness by the simpler method of polling or implement your switch service routines with more complicated interrupt methods. LogiSwitch provides a very simple third alternative: pass switch service control to the program, where it is perfectly relevant and perfectly simple. All LogiSwitch devices include NL/HS (Normally

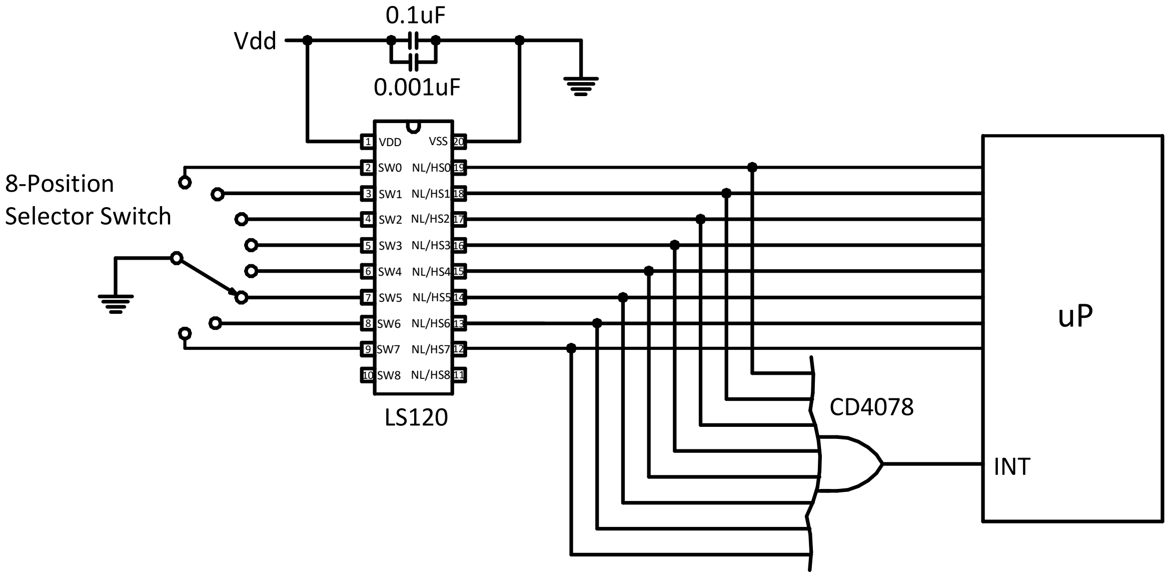
Low/Handshake) pins which incorporate the LogiSwitch request/acknowledge-based handshake protocol for snappy, poll-free switch service.

The handshake hardware requires nothing more than the same single pin/line that would be required in legacy applications. The line is configured in a wired-OR configuration so both the LogiSwitch device and the host computer, to which it is connected, can communicate open-drain low-level signaling from each of their ends. The line is pulled up by an internal resistor in the LogiSwitch device. The NL/HS line is driven high (LogiSwitch output turned off with the internal pull-up resistor holding the output high) to start a cycle. The embedded processor program in the host is in input mode to receive service requests. When the host reads a high level from the LogiSwitch device on the common NL/HS line, it reconfigures itself as an output and acknowledges (ACKs) the request with a 5 µs low level pulse on the line. The LogiSwitch device sees the ACK and latches out its own low level on the common line to terminate the cycle. Note that all debouncing activity continues to take place in the background so a new cycle is not allowed to take place until the switch has been released and debounced. Also note that the cycle will terminate as normal upon release of the switch in the event the program does not send an ACK.

Bring Real Response to Your Switch Service Routines

This logic analyzer capture demonstrates how snappy your switch service routines will be using the LogiSwitch handshake. Less than 5 µs is spent in the cycle when using the handshake compared to the reasonably typical 220 ms wait time the switch may be active as shown in the “no handshake” waveform. Sluggish switch service routines, especially noticeable when the switch action is designed to occur after the switch is released, are never necessary with the LogiSwitch devices.



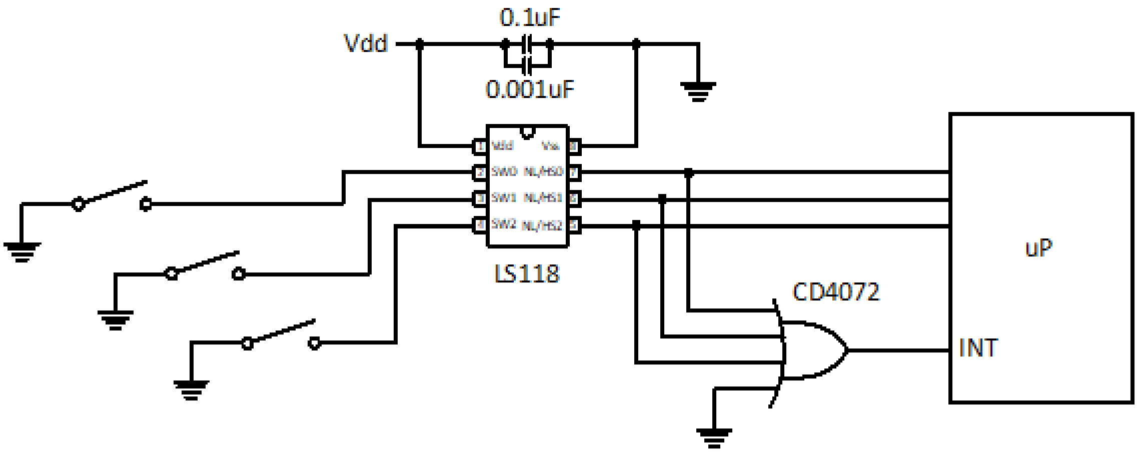


Debouncing an 8-Position Selector Switch with Interrupt-On-Change

All interrupts evoked by pin change can only be guaranteed to work as intended with a proper hardware-debounced signal. This circuit allows interrupt-on-change for any user-selected general purpose I/O pins. If your design requires an interrupt on position change of a selector switch, the above circuit may be employed. The ISR for each interrupt must utilize the handshake on the appropriate channel to clear the CD4078 OR gate so the transition to the next position can generate another interrupt. Please note that the unused input pins of the CD4078

OR gate must be tied to ground for proper operation of the circuit as shown (not relevant in the circuit shown). Unused pins of the LS118 may be left open as shown.

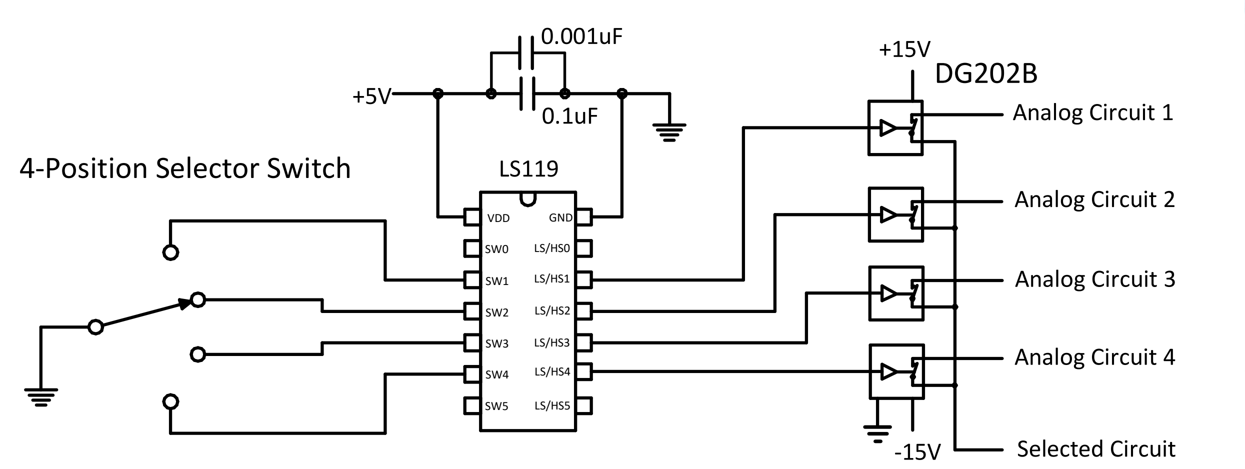
Note that it is the handshake that makes it possible to create a separate interrupt for each change of switch position with this circuit.



Interrupt Controller for Random Switches

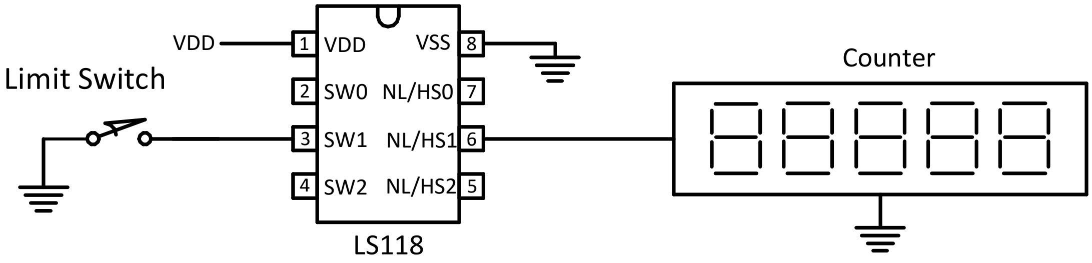
Some embedded processors provide only a selected number of pins with the capability of generating interrupts, such as the interrupt-on-change feature on the upper 4 bits of Port B on some 8-bit PIC processors.

The circuit shown above may be used to generate an external interrupt when one of any number of switches is activated using the general purpose I/O pins of the designer’s choice. The vectored ISR must send a 5 μs pulse back to the NL/HS pin of the LogiSwitch device to clear the INT for the next switch closure. For greater than three switch inputs use a CD4078 8-input OR gate and an LS119 or LS120. Note that all unused OR gate inputs must be tied to ground for proper operation.



Selector Switching for Audio Circuits

The multi-channel LS100 Series may be used to eliminate the switching noise encountered with analog audio circuits. The circuit shown above will cleanly switch circuits of up to +/- 15 V and 30ma using the Vishay DG202B Quad CMOS Analog Switch. Note that the LogiSwitch Handshake is not used in this circuit.



Limit Switch to Electronic Counter

Use the NL/HS output of a LogiSwitch device to debounce a limit switch used to index a counter on each activation in this application. Any LogiSwitch NoBounce device will assure a single transition for each switch activation for guaranteed count accuracy.

About the Author

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Mike is a serial inventor and serial entrepreneur who has a broad background in designing, using, and manufacturing electronic systems and equipment. In his younger years, Mike pioneered the sport of BASE Jumping.

Prior to founding LogiSwitch, Mike was an Automation Engineer at Jaxx Manufacturing where he designed and built assembly and metalworking machines to increase production rates, such as automatic screwdrivers, optical cut to length machines, and a variety of machines, jigs and fixtures to automate printed circuit assembly operations.

Mike's 40+ year career goes back to the early days of the microprocessor where he was the lead engineer for the first microprocessor-based product in the numerical control industry a Z-axis controller called the Micro-Z. Mike also developed the world's first networked cash register in the mid-1970s, and he founded Macrotech International Corporation, which was a major manufacturer of board-level computer products in the late-1970s and early-1980s.