LSVR Series Vandal-Resistant NoBounce Switch Datasheet

Description

The LSVR vandal-resistant series of pushbutton, LED illuminated switches have built-in NoBounce™ technology to eliminate switch bounce while providing additional features to enhance the system design. These switches have compact built-in switch debounce electronics and include an industry-standard 6-pin IDC interface for a more reliable physical connection interface.

Features

- Vandal-resistant IP67 pushbutton switch with ring LED
- All outputs bounce-free
- Reliable two-circuit debounce circuit – no delay on make or break
- Both momentary and latched outputs – active high, active low, and toggle
- LogiSwitch Ultra-High-Speed Handshake Protocol eliminates time-wasting polling
- Six-pin IDC interface – two momentary outputs and one latched output with LED control
- Cost competitive with legacy vandal-resistant IP67 pushbutton switches
- Available in 19 mm and 22 mm sizes and red and green LED colors

These full featured switches fit the same form factor of conventional vandal-resistant switches with the added benefits of many more features enabling efficient interfacing to today's high performance electronic systems. The LSVR series switches incorporate LogiSwitch's proprietary NoBounce technology and come with three separate clean, debounced outputs, including two momentary selections: normally high (low when pressed) or handshake and a latched (push-on/push-off) selection.

Specifications

Drill hole diameter LSVR19		19 mm (3/4 inch)
Drill hole diameter LSVR22		22 mm (7/8 inch)
Absolute maximum voltage		5.5 Volts
Recommended voltage		3.3 Vdc – 5.0 Vdc
V+ positive supply		2.3 Vdc – 5.0 Vdc
Operating temperature range		-40 °C – +85 °C
Mechanical life		500,000 activations
Panel thickness		Up to 11.22 mm (7/16 inch)
Operating pressure		1.5 N – 2.5 N
Operating stroke		3.18 mm (1/8 inch)

Electrical Characteristics

Parameter	**Symbol**	**Conditions**			**Unit**
		Min	**Typ**	**Max**	
Operating Supply	**Vcc**	2.5		5.5	V
	Icc (Vcc = 3.0 V)	1.0		1,550	uA

Output Drive Current:

Pin	Min	Typ	Max	Voltage
NH		25 mA		2.5 - 5.0
TG		25 mA		2.5 - 5.0
NL	25 µA	100 µA	200 µA	3.3
	25 µA	140 µA	300 µA	5.0

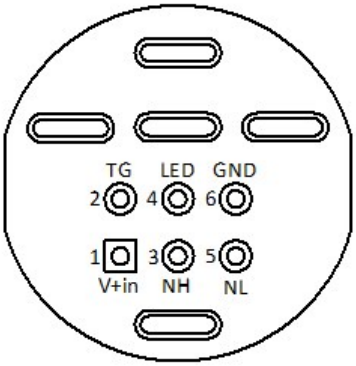
NOTE: Recommended Supply Voltage: 3.3 V- 5.0V for acceptable LED illumination

6-Pin IDC Pin Description

Pin #	Name	Description
1	V+IN	Positive Supply Input - 2.3 – 5.0 Vdc
2	TG	LATCHED Output - Push-on/Push-off Operation - Powers up in the High State
3	NH	MOMENTARY Output - Low when Pressed
4	LED	LED On/Off Control - Low = Illumination On
5	NL	MOMENTARY Output with Handshake - High when Pressed
6	GND	Negative Supply Pin 0 Vdc

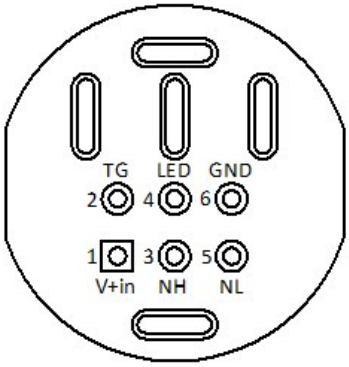
IDC Connector Pinout

Switch pins with horizontal orientation.



IDC Connector Pinout

Switch pins with vertical orientation.



The LSVR NoBounce switch will appear as shown in one of the two images above. The IDC connector pins are identical for both orientations.

The interface is designed to function as a 6-pin IDC connector if desired, or the individual pins may be selected. All implementations will require the V+in, Gnd, at least one of the three output pins (NH, NL, TG), and optionally the LED on/off control pin.

For wiring with individual wires, utilize a minimum size of 22awg wires terminated with TE 175265-1 receptacles or equivalent.

For use with the 6-pin IDC cable, the LSVR NoBounce Switch fits a 2.54 mm Pitch, 2 Row, 6 Pins F/F IDC Connector Flat Ribbon Cable.

Note that for a minimal use of one output plus LED control, four LSVR device pins need to be connected, leaving only two pins unconnected. The 6-pin ribbon cable offers a simple and clean implementation with only two unused cable wires.

Power Supply and LED On/Off Control

1. Power Supply Input Pins: note that the LSVR circuit is protected against reverse plugging by a P-channel MOSFET in series with the positive supply. This circuit prevents current from flowing into the LSVR switch in the event of a backward installation of the IDC connector.
2. A minimum voltage of 3.3 Vdc is recommended for acceptable illumination intensity of the ring LED. Absolute maximum voltage is 5.5 Vdc. A supply voltage of 2.3 Vdc to 5.0 Vdc is required for the switch circuit.
3. Momentary Outputs: the bounce-free NH output pin is high when idle and low when pressed. The bounce-free NL output pin is low when idle and pulled-up high when the switch is pressed.
4. LED On/Off Control: a low level on this pin illuminates the ring LED. This pin may be actuated by a low level from a logic device or by simply shorting the pin to GND.

Output Selection

The LSVR NoBounce Switch offers the designer three separate fully debounced output selections: NL, NH, and TG, as described below. The LSVR switch design performs immediate debouncing without the usual on-delay and off-delay required by other devices. Three separate outputs are available for use as needed: Momentary Active High Output, Momentary Active Low Output, and Latched Output.

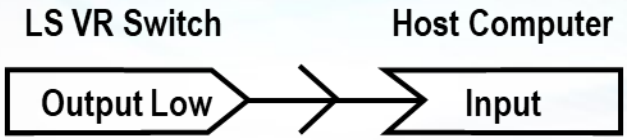
1. NL Output. Pin 5 of the LSVR interface provides a normally low output. This output goes high when the switch is actuated and back low when it is released. This is also the pin that provides the LogiSwitch proprietary “handshake protocol” option as described in the next section.
2. NH Output. Pin 3 of the LSVR interface provides a normally high output. This output goes low when the switch is activated and back high when it is released.
3. TG Output. Pin 2 of the LSVR interface is the Toggle output. It changes state on each activation of the switch. The TG output may be used to fashion your LSVR switch into a “Latched” or “Push On/Push Off” switch if your application requires it. The NL output pin incorporates the LogiSwitch handshake protocol as described in the following section. The TG output initializes to the high state on power-up.

The LogiSwitch Handshake Option

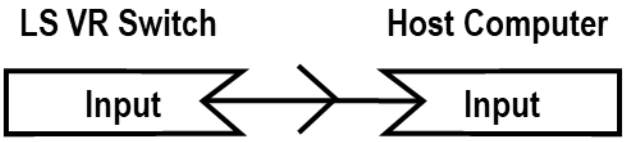
Rather than poll the switch status waiting for the switch to be released, the handshake option provides a simple mechanism to end the software switch service routine when the program no longer needs it rather than waiting in a time-wasting loop for the switch release. The amount of time the switch remains pressed is rarely relevant to the program.

The LogiSwitch handshake works as follows:

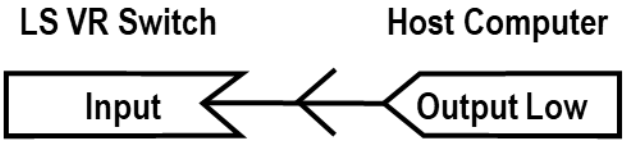
1. Initially the LSVR Switch is in output mode and outputting a low level to the host to indicate it is idle. The Host is in Input mode looking for the switch to go active.



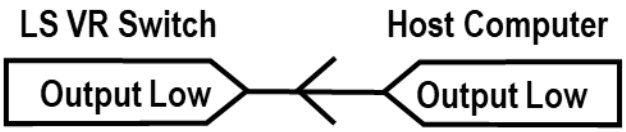
2. When the switch is pressed the LSVR switches to the input mode. A pull-up resistor on the LSVR pulls the pin high when in input mode. The host computer sees that high level in an I/O read operation. Note that both the LSVR switch and the host computer are in input mode at this point.



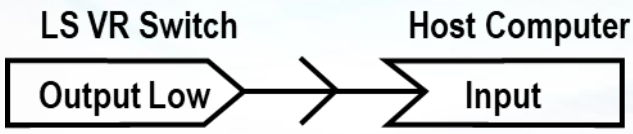
3. The host switches its I/O pin to the output mode and transmits a 5 us low handshake pulse to the LSVR to acknowledge acceptance of the switch service request.



4. When the LSVR switch sees the low-level handshake pulse issued by the host computer it switches from input to output mode and latches a low level on the line from the switch side. Note that both the LSVR switch and the host computer are in output mode and both are issuing a low output at this point.



5. The host computer is through executing the service request from the switch and can now go about its business executing code without a need to poll the switch status to determine when it is released. The LSVR switch is still busy in the background monitoring the status of the switch in order to deal with debouncing the switch input when it is released. Once this debouncing is complete the LSVR switch can initiate another switch service request as required.



6. The host computer can switch back to input mode any time to start another cycle as required after it has issued the 5 us low handshake pulse. Note that the two devices have switched to the idle modes shown above.

Output Waveforms

Logic Analyzer Capture of the NL, NH, and TG outputs of LSVR Switch

The above waveform shows the logic analyzer capture of the first switch cycle after power-up. Note that the TG pin powers up in the high state and changes state with each switch closure.

NL Output Acknowledged by Host with Handshake

The above waveform shows the logic analyzer capture of the cycle when the host computer responds with a 5 us low level handshake pulse. Note that the switch is released after approximately 200 ms in this example of the first cycle shown. The handshake feature of the LSVR switch eliminates the need to poll the switch output for release and can go back to work immediately after issuing the 5 us low pulse.

Test for Switch - a Service Request in the Main Loop

If the NL/HS line is high, the switch has become active. If not, continue with the main loop until the next time through.

Okay, it is active. To acknowledge that we have received the request, we will send a pulse back to the LogiSwitch device.

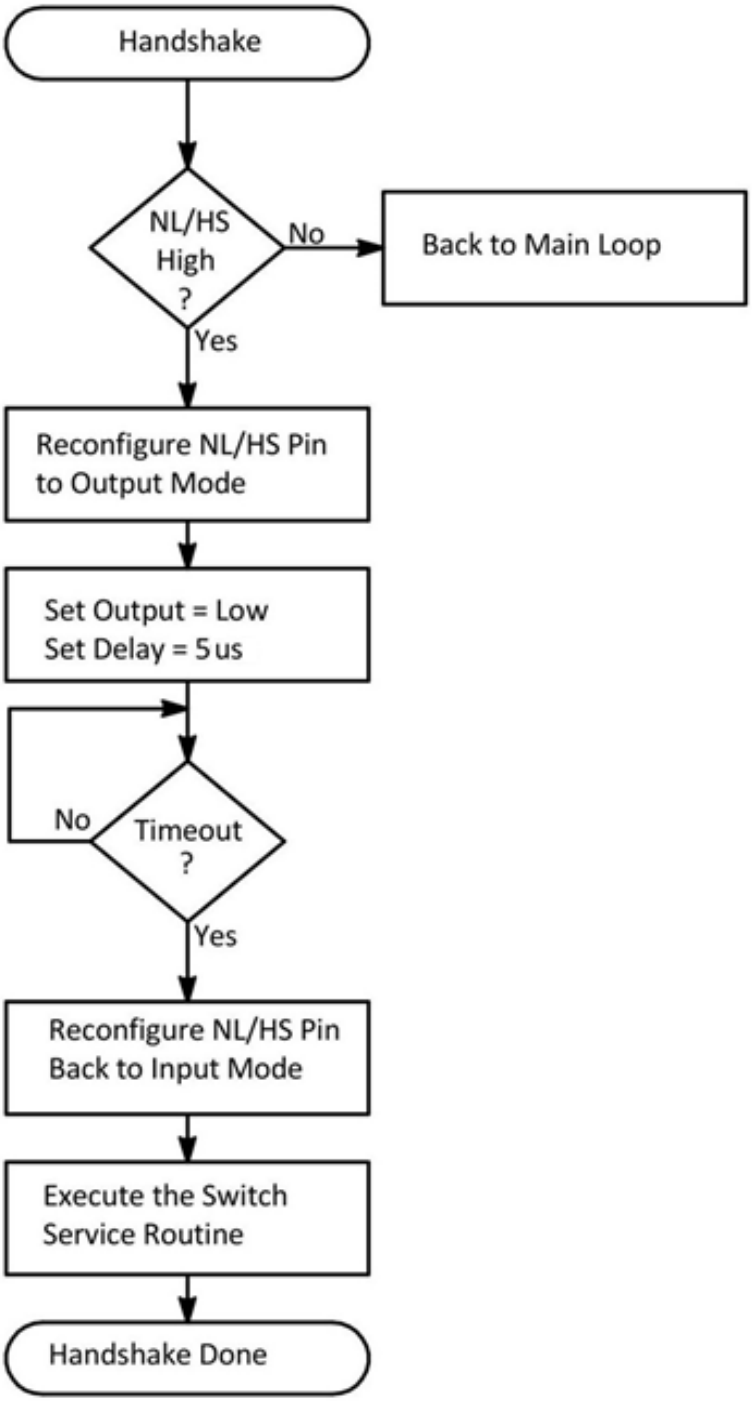
First, we set the NL/HS pin to output mode, then make it low.

Now we set a 5 µs delay to allow time for the LogiSwitch device to recognize our acknowledgement.

Has the delay timed out yet?

Timeout done. Now we want to go back to input mode. The LogiSwitch device has already seen the acknowledge pulse and has latched the line out low to end the cycle without the need for release of the switch. Note that another cycle will not be initialized until the switch has been released and its output debounced.

Now we are all done with this cycle. We can execute our switch service routine and go back to executing code in the main loop. The LogiSwitch device will determine when the switch has been released and debounced, so the next switch cycle may be initiated.



Software – Implementing the Handshake with an Arduino

The following few lines of code for an Arduino Uno demonstrate the simplicity of a host computer interface using the LogiSwitch handshake.

```
// ********************************************************************************
// This code snippet for Arduino Uno demonstrates the single-pin handshake
// protocol of the LS1xx Series Switch Debouncer ICs for Embedded Processors
// ********************************************************************************
int NL_HS = 8;                                  // Define the pin(s)
void setup () {                                 // Start with REQ_ACK configured to Input Mode
   pinMode (NL_HS, INPUT);
}
//*********************************************************************************
void loop() {
// Place this code at the appropriate place in the main loop...
   pinMode (NL_HS, INPUT);                      // Set NL/HS pin to input mode
   if (digitalRead (NL_HS) == HIGH)             // Request from switch?
  {
     pinMode (NL_HS, OUTPUT);                   // Yes, respond with handshake
     digitalWrite (NL_HS,LOW);                  // Acknowledge with a 5 µs low pulse
     delayMicroseconds(5);
     pinMode (NL_HS,INPUT);                     // Back to input mode
     delayMicroseconds(5);
// Place switch service routine or function call here...
   }
```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