

An Introduction to FST

Prepared by
Fred Zlotnick
ON Semiconductor



ON Semiconductor®

<http://onsemi.com>

APPLICATION NOTE

Fast Switch Technology (FST) was introduced into the marketplace in the early nineties and has become quite popular with the networking and computing design community to solve many specialized problems. Will Booth of Insight Onsite™ claims the market was nearly \$200 M in the year 2000, and expected to continue to grow over the next ten years. FST is the dominant bus switch technology, prevailing over the less popular CBT (Cross Bar Technology). FST is manufactured by ON Semiconductor and several other important suppliers.

FST is very simply logic reduced to switches. Several 3-state devices and buffers/multiplexers are constructed using N-Channel switches instead of logic. The result is the same logic function, with nearly zero delay. Although, this sounds perfect, the FST device has no drive capabilities of its own, but merely passes a signal along, more or less unimpeded.

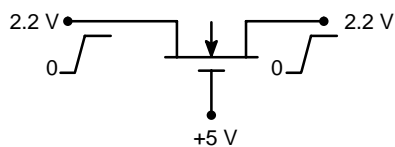


Figure 1.

For those of you who want to understand the why and how of this family, this diagram shows a single N-Channel FET switch, biased at +5.0 V at the gate. A signal will pass through the device, or not, depending upon the bias of the gate. Interestingly, the FET can conduct in either direction and unlike a logic gate the time it takes for a signal to pass

through this gate is close to zero. Another interesting property is this FET, which acts just like a 5.0 V switch, until the voltage reaches close to the supply voltage (V_{cc}). If the voltage on the left were to reach 4.3 volts, the output will be limited to within one V_{ϕ} of supply or approximately 4.3 volts. This would at first seem to be a stumbling block, however, remember that many 5.0 volt circuits are “TTL” compatible and any voltage > 2.2 volts is redundant. For “CMOS” compatible circuits, the input must exceed 3.5 volts, so 4.3 V is not much of a problem. In fact, this phenomenon, called ‘body effect’ can be used to your advantage. If the FST has a $V_{cc}-V_{\phi}$ as its supply, by inserting a diode in series with its supply, then the drop will be ≈ 1.5 V. If one side of the FET were connected to a TTL compatible, 5.0 V device and the other were connected to a standard CMOS device operating at 3.3 V, then the FST device would limit the voltage seen by the CMOS device, but the 3.3 V output would flow unimpeded to the TTL device. This then becomes a nearly perfect logic level translator, with almost zero delay (when turned on).

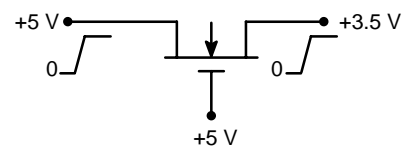
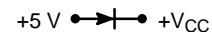



Figure 2.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

JAPAN: ON Semiconductor, Japan Customer Focus Center
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

ON Semiconductor Website: <http://onsemi.com>

For additional information, please contact your local Sales Representative.