

# Peripheral Isolation in Notebook Computers Using QuickSwitch®

Notebook computer systems can normally operate between two and three hours from their internal battery packs. However, it is possible to extend the battery operating time even further by taking advantage of several power saving features provided by the notebook computer system. These power saving features include switching the computer to a standby mode after a period of inactivity, for example when the keyboard is not being used. During the standby mode, the power saving feature typically turns the notebook computer's LCD off and reduces the CPU's operating speed. Additional power can be saved by

disconnecting any peripheral equipment not being used, for example disconnecting printers. Also, some notebook computer manufacturers have experienced difficulty resuming normal operation after returning from the power saving mode when peripherals are left attached. The cause of this difficulty is that the attached peripheral can not guarantee that it will not disturb the bus when the notebook computer system returns to normal operating mode from the power saving mode, i.e., the attached peripheral can not guarantee that it will not draw current from the bus.

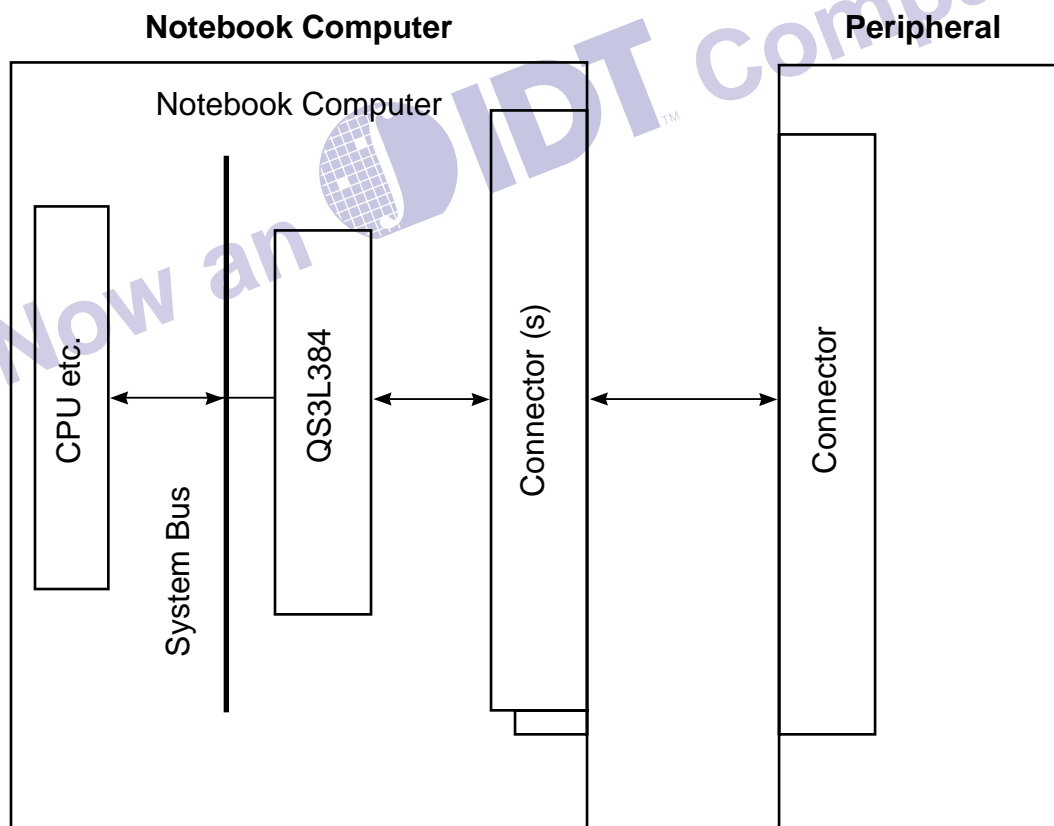


Figure 1. QS3L384 QuickSwitch as a Peripheral Isolator

A solution to this problem is to place QuickSwitch bus switch devices, such as the QS3L384 from Quality Semiconductor, Inc., between the notebook computer and its I/O connectors. An example of this is shown in Figure 1. The QS3L384 serves as a solid state relay to connect the peripheral to the notebook computer. Each QS3L384 provides connection for ten signal lines.

The QS3L384 QuickSwitch devices (Figure 2) serve as isolating switches that consume very low quiescent power supply current (0.2 $\mu$ A Typical, 3.0 $\mu$ A Maximum). When they are on, they directly connect the notebook computer and its I/O connectors with an on resistance of 5 ohms. When on, these devices act "just like a wire". Like a wire, they introduce negligible delay (maximum 250ps for 50pF load) in the data path and are inherently bidirectional.

It is the off state of the QS3L384 QuickSwitch that is most interesting for peripheral isolation applications. When it is off, it presents low (6pF) capacitance and a few nanoamperes of leakage to either side of the switch. It is a normally off device, and is off when no power is applied. Since the QS3L384 uses only N channel switches and no P channel devices, there are no diodes to  $V_{CC}$  and no current flows when any of the inputs are taken

above  $V_{CC}$ . This means that no current flows into the QS3L384 when it is powered down while connected to an active bus. The QS3L384 will also remain off during power up until commanded to turn on by asserting the enable lines. Once the notebook computer has returned to the normal operating mode, the peripheral can be connected to the notebook computer by activating the QS3L384 enables.

## Summary

Battery powered, low current consuming devices are becoming more prevalent with many products migrating from relatively large, bulky home and office use to the hand-held, portable environment. One of the most significant bottle-necks in this migration path is the power consuming nature of the electronic components used to build these portable devices. The QS3L384 (one of the 14 members of the QuickSwitch family) is aiding in this migration by providing low power (typical 0.2 $\mu$ A  $I_{CC}$ ), low on resistance (5 ohms), high-speed (250ps prop delays) multi-pole switches. Since the QuickSwitch family of devices is inherently bidirectional and introduces no additional timing skew or noise, they can replace traditional buffers and transceivers in certain system designs to reduce propagation delay, noise, control complexity and power dissipation.

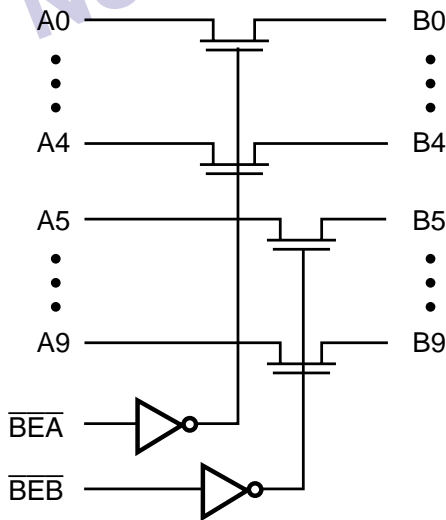


Figure 2. QS3L384 QuickSwitch

Table 1. Pin Description

Name	I/O	Function
A9-A0	I/O	Bus A
B9-B0	I/O	Bus B
$\overline{BEA}$ , $\overline{BEB}$	I	Bus Switch Enable

Table 2. Function Table

BEA	BEB	B4-B0	B9-B5	Function
H	H	Hi-Z	Hi-Z	Disconnect
L	H	A4-A0	Hi-Z	Connect
H	L	Hi-Z	A9-A5	Connect
L	L	A4-A0	A9-A5	Connect