

Description of EUT and general notes

Device is a low-speed USB peripheral which reads the status of 4 switch inputs (provided via 3.5mm jack sockets), and presents this status to a PC or other USB enabled host via the USB port. USB is a differential bus with slew-rate-limited data paths.

PCB is 2-layer, 1.6mm, UL rated with extensive ground filling. A solid ground track surrounds the board, with regular connections from the upper to lower ground planes. Extensive decoupling is used, and power supplies are filtered as necessary.

Device screening is common-mode (ie to 0V provided via USB bus) as 3.5mm “screen” connections must be at digital ground. Screen of USB connector and any associated back panel of enclosure is connected to USB screen. Digital ground and USB screen are capacitively coupled only, in order to aid transient dissipation.

The peripheral is based around a single PIC16C745 microcontroller from Microchip inc. This processor requires an external 6MHz clock, which, in this design, is provided by a 3-terminal resonator. Drivers for this resonator are slew-rate-limited, and the ground path is to a pin which is adjacent to the driver pins. This 6MHz clock is multiplied within the microcontroller to 24MHz which is required in order to derive USB timings.

The switch inputs are presented to the microcontroller via 3.5mm jack sockets. External switches, which are available from a number of commercial sources, operate to switch the “tip” of the jack to the “screen”. In this design, the “screen” of the connector is held at ground potential, thus offering reduced emissions, especially in the case of external switches which use screened cabling. The “tip” of the jack connector is pulled up to 5V via total of 11K resistance.

Switch inputs are coupled to the processor via an RC network, which serves, in association with internal protection in the microcontroller, to offer transient and discharge protection. This RC network also acts as a filter to reduce any noise which may be present on the 5V line of the device (the weak pull-ups are between the microcontroller and the network).

The microcontroller decodes the switch inputs and presents the resultant data to the host PC via the USB connector. This transaction occurs every 10ms.