Solenoid Protection
Application Overview

Problem/Solution

A solenoid is an electromagnetic device with four basic parts: a coil assembly, frame, armature, and backstop. The coil assembly is constructed by winding magnet wire around a bobbin. The coil assembly, along with the backstop, are placed into a frame and mechanically secured together. The armature is then inserted into the completed solenoid assembly. When the coil is excited with current, a magnetomotive force is created, causing the plunger to be pulled into the coil and to seat on the backstop.

Once the solenoid is energized, the end of travel is detected by the sensor. This sensor can then feed back the position of the armature (status of the lock) to the electronics, thus turning the power to the solenoid off. If the sensor fails or if the armature fails to pull in, the intermittent solenoid will generate excessive heat and fail. This will result in system down-time and maintenance. A PolySwitch device in the circuit can react to this situation and help to protect the circuit from damage.

During normal conditions, (Figures 1 and 2), the coil temperature increases each time the solenoid is cycled. Several actions can cause abnormal operation, such as an object leaning against a PC CD-ROM tray ejector button, causing constant current to be applied (Figure 3). The coil temperature can continue to increase and can eventually burn out the coil wire. As shown in Figure 4, when a PolySwitch device is inserted in the circuit, the PolySwitch device trips at about 120°C, limiting I_{IN} such that the coil temperature gradually drops such that damage to the coil wire is undamaged.

Device Selection

The PolySwitch device is selected by considering the maximum load current to be delivered, the highest ambient temperature, and the maximum permissible time to trip to prevent damage to other components. Depending on these parameters, either a radial-leaded (RUE, RXE, RTE, RHE series) or surface-mount device (SMD, miniSMD series) is typically used.

Figures 1-4