

Open-door alarm prevents accidental defrosts

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Laboratory refrigerators and freezers often contain very valuable materials. Some units include overtemperature alarms that typically don't sound until thawing has already damaged the units' contents or sound when no one is around to hear the warning. Rather than a power outage, the most frequent cause of thawing disasters involves a failure on some-

one's part to properly close the freezer's door. This Design Idea describes an alarm that provides a timely open-door warning that can prevent an expensive incident.

A decade ago, a designer would have based this circuit on a type-555 timer IC, but, today, a small microcontroller provides a less expensive approach. The alarm in **Figure 1** detects an open

refrigerator or freezer door by means of a magnetic proximity switch that's available from Radio Shack (www.radio shack.com) as an intrusion-alarm-system component. The circuit allows the door to remain open for a software-selectable interval—in this instance, 20 seconds—before activating a piezoelectric buzzer that conserves battery power by sounding for only 1 second of every 5.

A low-dropout voltage regulator, IC₁, an STMicroelectronics (www.st.com) L4931CZ50, provides 5V regulated power for IC₂, a Microchip (www.micro

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chip.com) PIC10F200. Because IC₂ “sleeps” between door openings and voltage regulator IC₁ consumes little quiescent current, the 9V alkaline battery that powers the circuit offers a projected life of approximately one month. When you activate the buzzer, it consumes approximately 2 mA, a drive current that’s directly available from the microcontroller’s output port. At this current level, only an unencased piezoelectric element provides a sufficiently loud warning. In high-noise environments, you can use a solid-state relay or a logic-level MOSFET to drive the buzzer directly from the 9V battery.

You can attach the normally open switches and their actuation magnets to the refrigerator or freezer using double-sided adhesive-foam tape. The switches are sensitive to magnet orientation and position, making it easy to find a mounting configuration that can detect a door that’s open by as little as 2 mm. Source code for the microcontroller is available for downloading from the online version of this Design Idea at www.edn.com/070201di1.

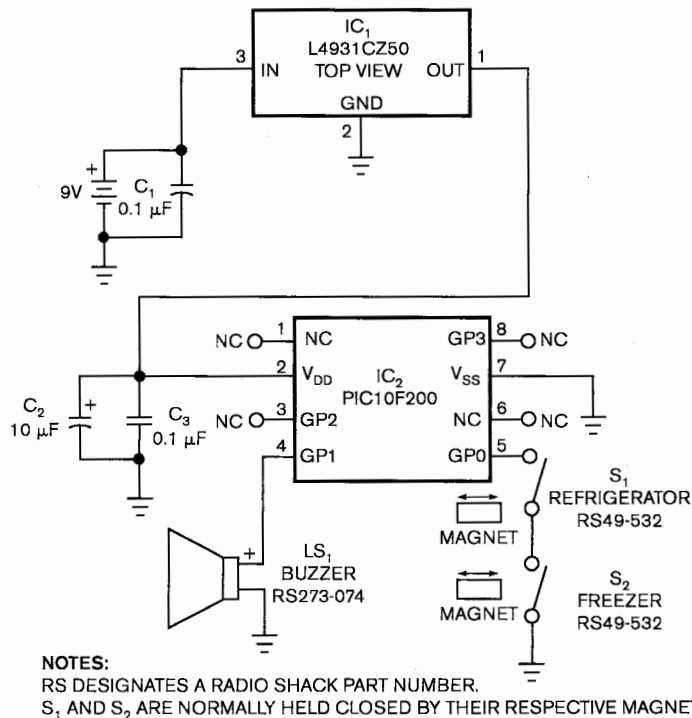


Figure 1 This circuit protects the contents of a laboratory freezer or refrigerator by sounding an alarm when a door opens.