


Microcontroller drives piezoelectric buzzer at high voltage through one pin

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 A previous Design Idea demonstrates how you can use a microcontroller to drive a piezoelectric buzzer at a high alternating voltage through a four-MOSFET circuit that interfaces to

two of its I/O pins (**Reference 1**). This expanded Design Idea provides a modification of the previous circuit to save one of the I/O pins of the microcontroller. Q_4 's gate connects to Q_2 's drain rather than a second I/O pin (**Figure 1**).

The microcontroller turns on Q_2 by applying a high logic level to the I/O pin, pulling Node A down to a low logic level. This action turns on Q_3 and turns off Q_4 . The voltage on Node B becomes 15V, and Q_1 turns off. The voltage across the piezoelectric element is now 15V.

The microcontroller then toggles the I/O pin low, turning off Q_2 . Q_1 is also off, so Node A slowly rises to a high logic level through pullup resistor R_1 . When the voltage on Node A reaches

the switching threshold of the inverter comprising the Q_3 and Q_4 pair, Q_3 quickly turns off and Q_4 quickly turns on. The consequently low logic level on Node B turns on Q_1 and speeds the increase of Node A's voltage. The 15V across the piezoelectric buzzer is now of the opposite polarity.

R_2 weakens the coupling between the output and the input of Q_4 due to the presence of the piezoelectric element. A value of 330Ω for R_2 is usually sufficient to suppress high-frequency oscillations that the feedback causes. The drained power from the supply increases if you use low values for R_1 . Using excessively large values for R_1 also increases power dissipation by prolonging the switching of the transistors and associated shoot-through currents. The optimum value for R_1 is approximately 1 k Ω .

Saving an I/O pin with this design involves the trade-off of increased power consumption. The circuit's power consumption is thus one order of magnitude greater than the circuit described in the previous Design Idea. **EDN**

REFERENCE

1 Ozbek, Mehmet Efe, "Microcontroller drives piezoelectric buzzer at high voltage," *EDN*, March 1, 2012, pg 44, <http://bit.ly/JyzLpz>.

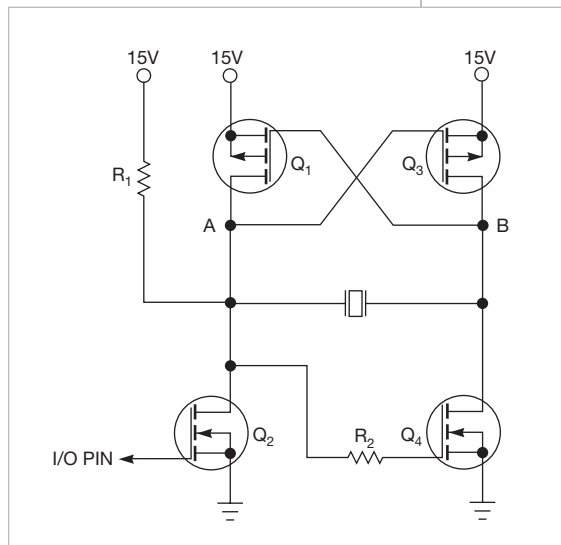


Figure 1 One microprocessor I/O pin drives this circuit to generate an alternating voltage across the piezoelectric buzzer.