

## **Background**

### Sleep Foundation

- When you sleep an extra 10 hours to compensate for sleeping only 6 hours a night for up to two weeks, your reaction times and ability to focus is worse than if you had pulled an all-nighter
- It's pretty much impossible to catch up on sleep

### What is Sensory Adaptation?

- Sensory adaptation occurs when your brain becomes adjusted to a stimulus that remains the same

### Piezo Actuator Background

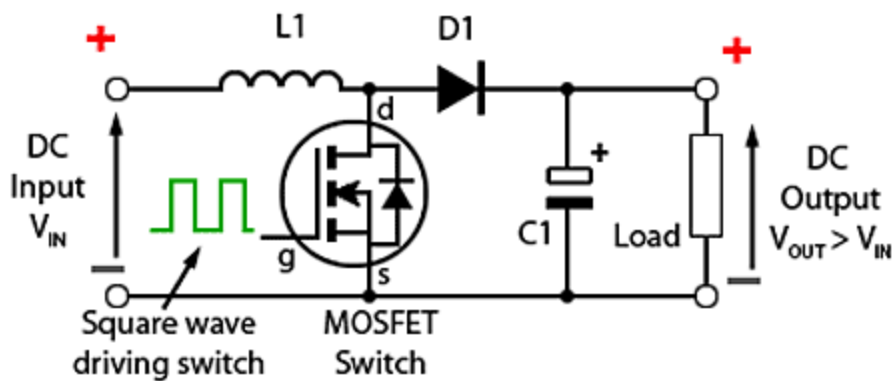
- Layering increases flexibility, allows greater deflection
- Parallel electrical configuration of ceramic layers ensures high sensitivity to input
- Varnish layer electrically insulates surface, protects from humidity, dust and other hazards
- White stripe identifies positive surface
- Solderable electrode bonded between plates
- Thickness tolerance for part without applied coatings

### Arduino Nano Background

- Printed circuit board (PCB) size 18x45 mm
- Weight: 7 grams
- This will connect to the piezo actuator and allow it to work by coding
- Connects to the Arduino Web Editor for writing code

### What is a Boost Converter?

- More practical to use than more of the power source (many batteries, multiple arduinos, etc.)
- Output voltage is equal to or greater than its input voltage
- 



### **Problem**

#### ChildMind Sleep Deprivation

- According to a 2010 large-scale study published in *The Journal of Adolescent Health*, 8% of US high school students get the [recommended amount of sleep](#).
- 23% get six hours of sleep on an average school night and 10% get only 5 hours.
- Dr. Mary Carskadon, a professor of psychiatry at Brown University and director of chronobiology and sleep research at Bradley Hospital in Providence, Rhode Island evaluated teens and half of them were so tired in the morning they exhibited the same symptoms as patients with narcolepsy

#### National Sleep Foundation

- Sleep deprivation can:
  - limit ability to learn and concentrate

- make driving more dangerous

### Harvard Health

- “Chronic sleep problems affect 50% to 80% of patients in a typical psychiatric practice, compared with 10% to 18% of adults in the general U.S. population”
- “Sleep problems are particularly common in patients with anxiety, depression, bipolar disorder, and ADHD”
- Disruptions in sleep cause impaired thinking and emotions because of the neurotransmitters they affect

National Research Council (US) and Institute of Medicine (US) Forum on Adolescence; Graham MG, editor. Sleep Needs, Patterns, and Difficulties of Adolescents: Summary of a Workshop. Washington (DC): National Academies Press (US); 2000. ADOLESCENT SLEEP PATTERNS AND DAYTIME SLEEPINESS. Available from:

<https://www.ncbi.nlm.nih.gov/books/NBK222804/>

- Teenagers require more sleep than they’re getting because of bus and school start times
  - Younger children get roughly the same amount of sleep during the week than they do on weekends but teenagers have a large disparity
  - Teenagers’ sleep needs don’t change but the circumstances allowing them to sleep do

### **Solution**

[Sleep.org](https://www.sleep.org/)

- Citrus can boost serotonin production
  - Reduces norepinephrine levels

#### [Why Peppermint Wakes You Up](#)

- Peppermint slows the release of cortisol
- Menthol stimulates hippocampus

Princing, McKenna. “When Sounds Trigger Rage, Anxiety--or Tingly Euphoria.” Right as Rain by UW Medicine, 9 Sept. 2019,

[rightasrain.uwmedicine.org/mind/stress/when-sounds-trigger-rage-anxiety-or-tingly-euphoria](https://rightasrain.uwmedicine.org/mind/stress/when-sounds-trigger-rage-anxiety-or-tingly-euphoria).

- Misophonia occurs when certain sounds trigger intense negative emotions
- Opposite of ASMR, where sounds have a relaxing effect for many people, often used as a sleep aid
- Could use this to support hypothesis

#### [What Makes an Apple Watch Vibrate](#)

- Haptic technology is a physical reaction to feedback on the device
  - Video games use this (controller shakes when in-game player takes a hit)
- Motors are called actuators

#### [Design Your Apple Watch](#)

- Design ideas

#### [Datasheet for Haptic Vibration Motor](#)

- Ultra-thin PiezoHapt actuator
- Used for wearable devices among others

