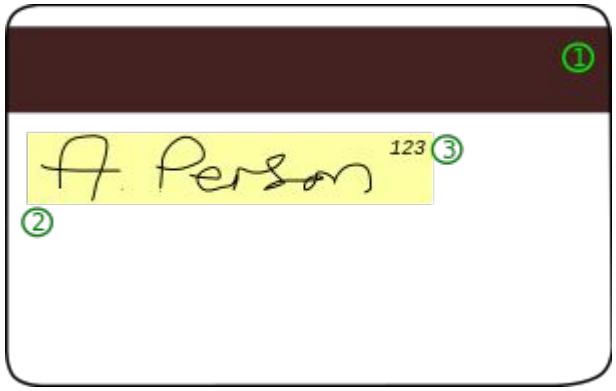


Magstripes and chip & pin

Conor Patrick

Courtesy of Wikipedia for most of the images

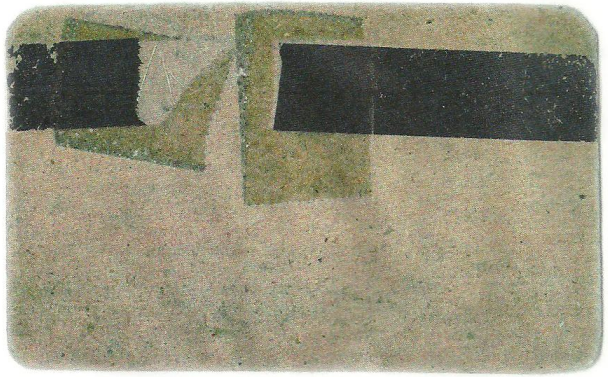
Outline

- Go over Mag stripe
- Chip and pin
- Emulating Mag stripe
- Emulating Chip and pin *
- Demo / use card reader/writer

- P.S. U2F Zero on Amazon now

History

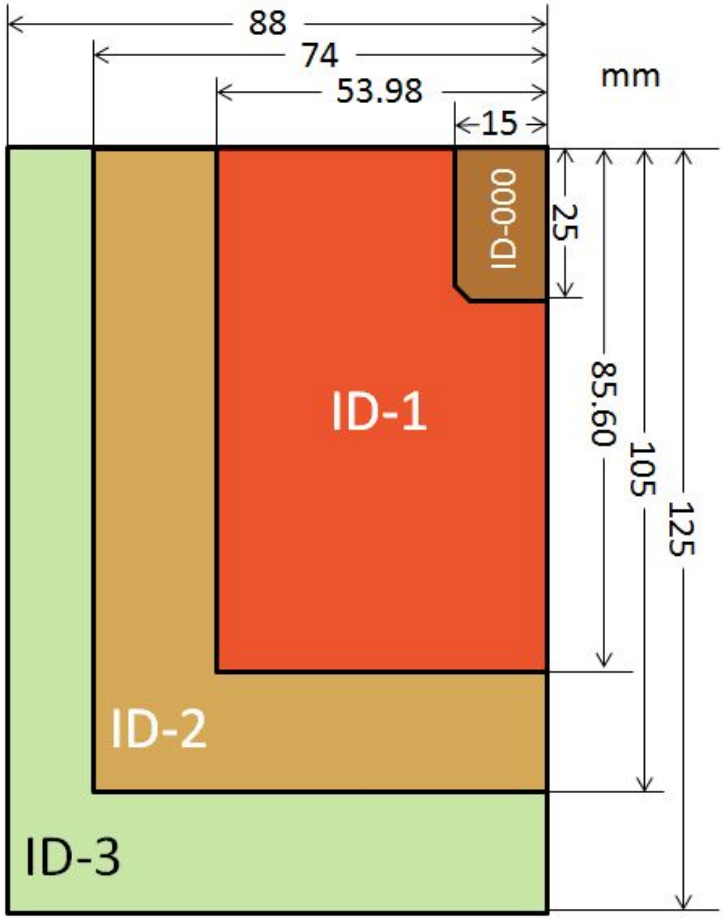
- IBM engineer Forrest Parry invented mag stripe card.



- ISO makes all the standards later on

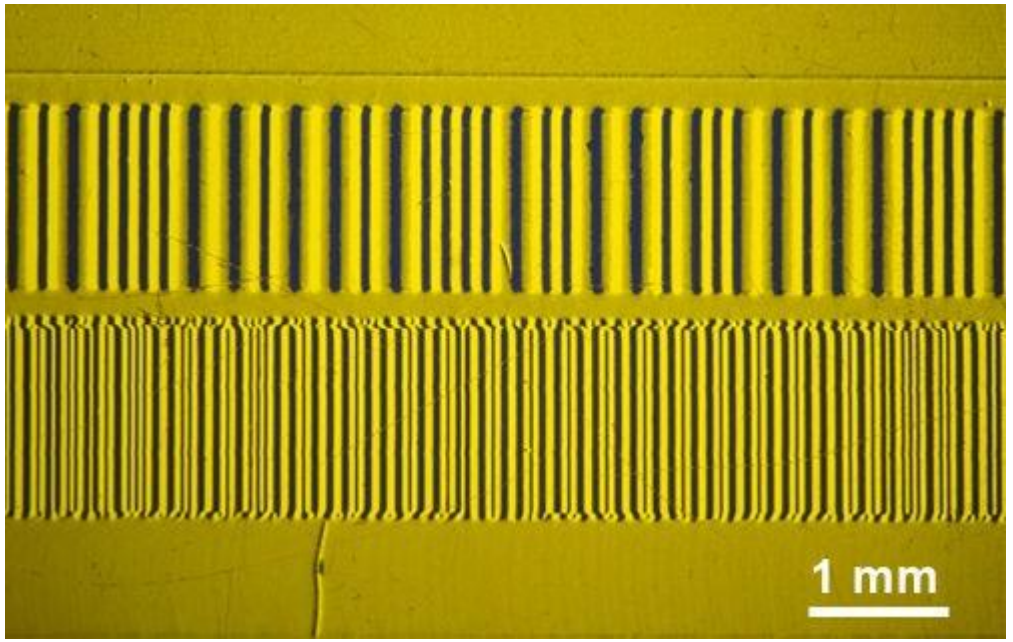
History (ISO)

ISO/IEC **7810** - Physical



History (ISO)

ISO/IEC **7811** - Recording bits



History (ISO)

ISO/IEC **7812** - Identification numbers

- Issuer Identification Numbers (IINs)
  - Managed by American Bankers Association

MII digit value	Issuer category
0	ISO/TC 68 and other industry assignments
1	Airlines
2	Airlines, financial and other future industry assignments
3	Travel and entertainment
4	Banking and financial
5	Banking and financial
6	Merchandising and banking/financial
7	Petroleum and other future industry assignments
8	Healthcare, telecommunications and other future industry assignments
9	For assignment by national standards bodies

History (ISO)

ISO/IEC **7813** - Numbers for financial transactions

- Outlines 3 tracks
- Tracks 1,3 have 210 bits/inch, 2 has 75 bits/inch

Track 1 example:

%B4815881002861896^YATES/EUGENE JOHN^37829821000123456789?

Track 2 example:

5095700000000

Track 3 is never used.

History (ISO)

ISO/IEC **8583** - Transaction messages

Is Magstripe secure?

- Maybe used to be
- But no

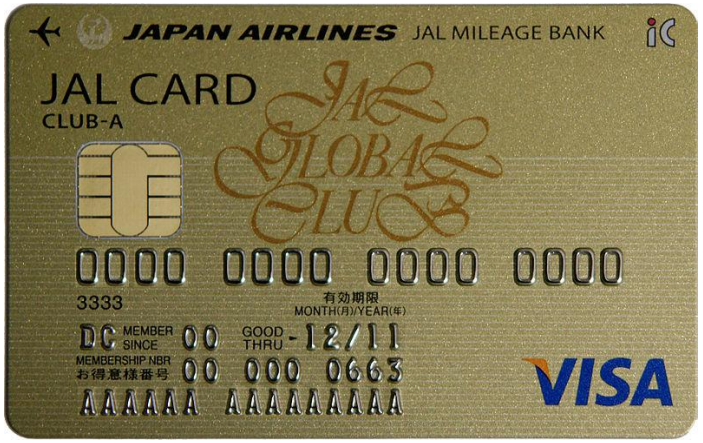
- Is largely why credit card data breaches are so big

Chip and Pin (EMV)

EMV = Europay, Mastercard, Visa (the creators)

ISO 7816 (contact)

ISO 14443 (contactless)



Chip and Pin (EMV)

3 methods of authenticating:

Static data authentication

- Just a static signature from card issuer over card data.
  - Provides data integrity but not security!

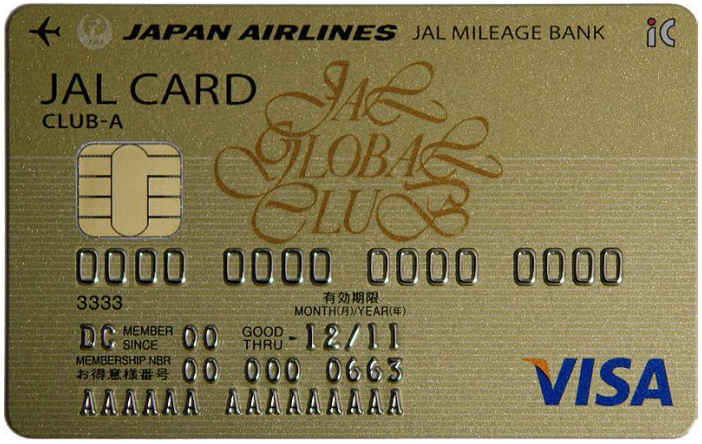
Dynamic data authentication

- Challenge response
  - Secure!

Combined *

- Challenge response and card attestation
  - More secure but will likely be unused.

Why bother with chip and pin?



2 are required:

Static data authentication

- Just a static signature from card issuer over card data.
  - Provides data integrity but not security!

Dynamic data authentication

- Challenge response
  - Secure!

Combined *

- Challenge response and card attestation
  - More secure but will likely be unused.

Emulating mag stripe

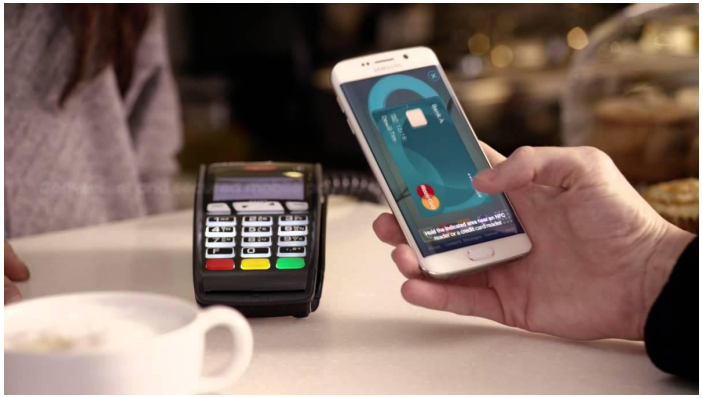
Goal: Make a card sized device that can emulate any mag stripe

Why?

- Convenient
- Would be cool to have my own “smart” card

Other works

- Commercial options: Coin, Swyp, Etc
- Samsung Pay



- Magspoof (Samy Kamkar’s project)

My Design goals

Emulate two tracks successfully

- Improves upon Magspoof and Samsung Pay

Fit in a 54 x 86 x 0.8 mm box (card size)

Be cheap and reliable

- Improves upon the commercial crap

Critical path: Emulating a magnetic strip

How exactly are magnetic stripes encoded?

How is it clocked?

What is the strength of the magnets?

Critical path: Emulating a magnetic strip

How exactly are magnetic stripes encoded?

How is it clocked?

Silicon Labs AN148

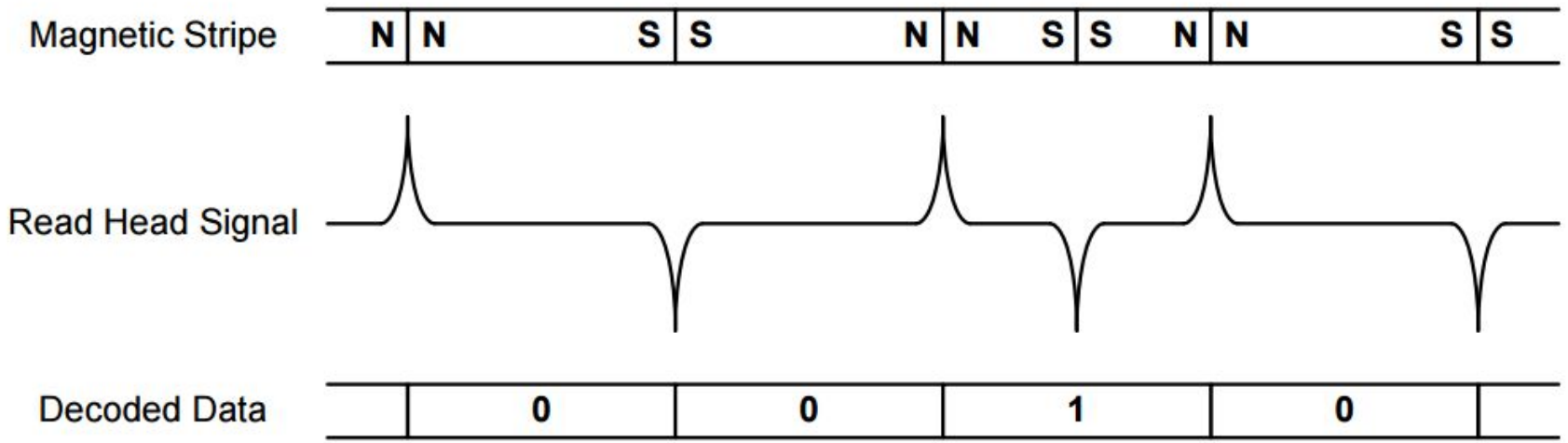


Figure 1. Magnetic Stripe Encoding

What is the strength of the magnets? → Based on a “reference card” in ISOs...

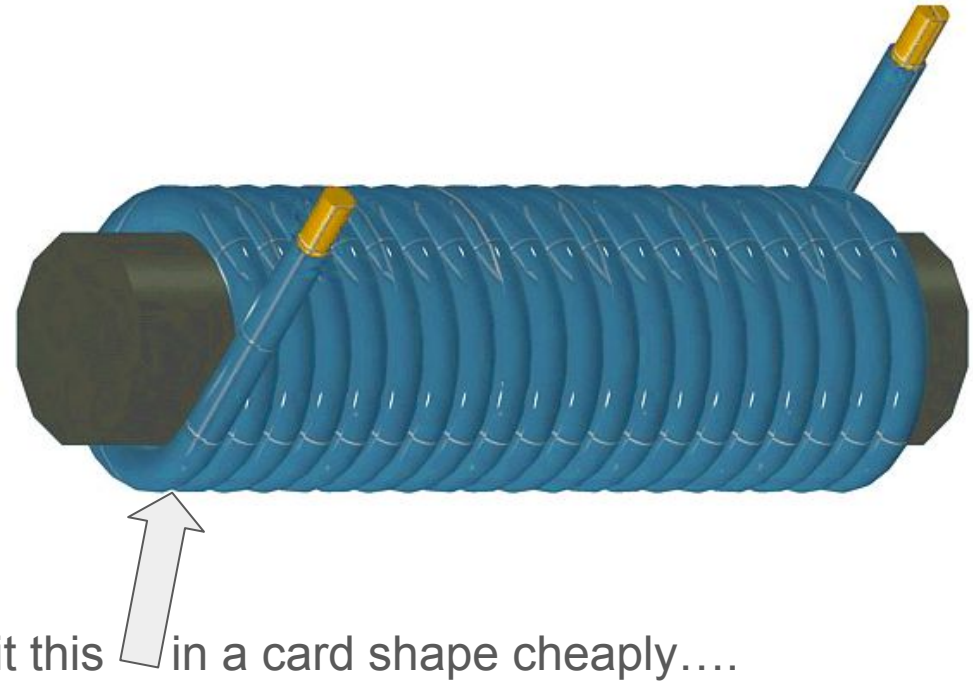
Critical path: Emulating a magnetic strip

→ How do you control a magnetic field?

Critical path: Emulating a magnetic strip

→ How do you control a magnetic field?

A current and a wire. ***B ~ I * N / L***



→ How do you fit this in a card shape cheaply….

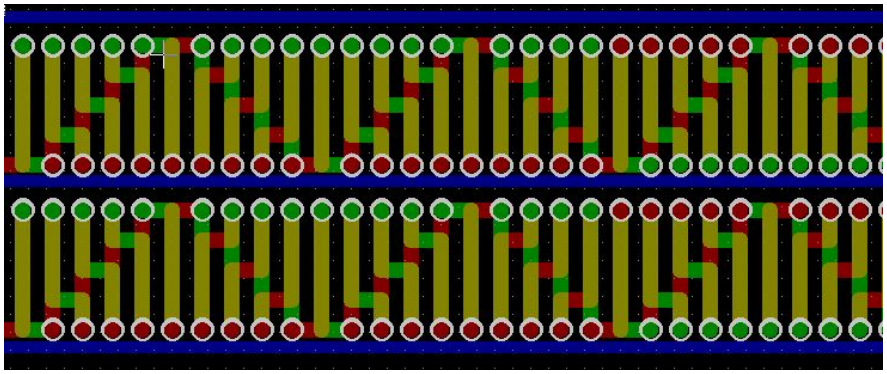
Options for potential solenoids/inductors

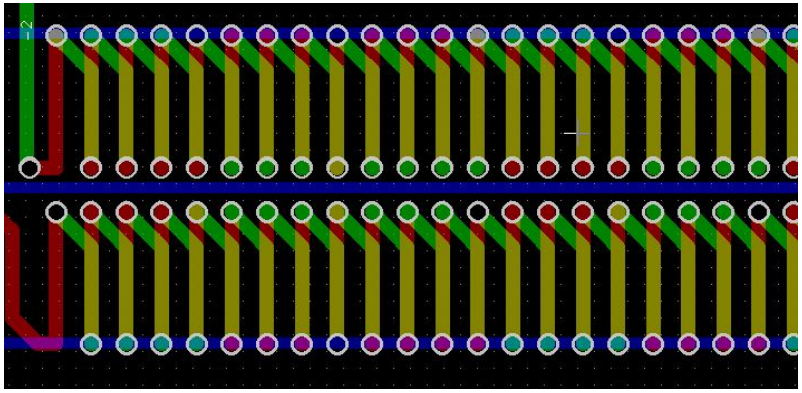
- Couldn’t find anything on digikey, mouser, etc.
  - Anyone know anything??

- There are vendors on Alibaba
  - Can make a batch of custom solenoids to fit dimensions
  - $50-150

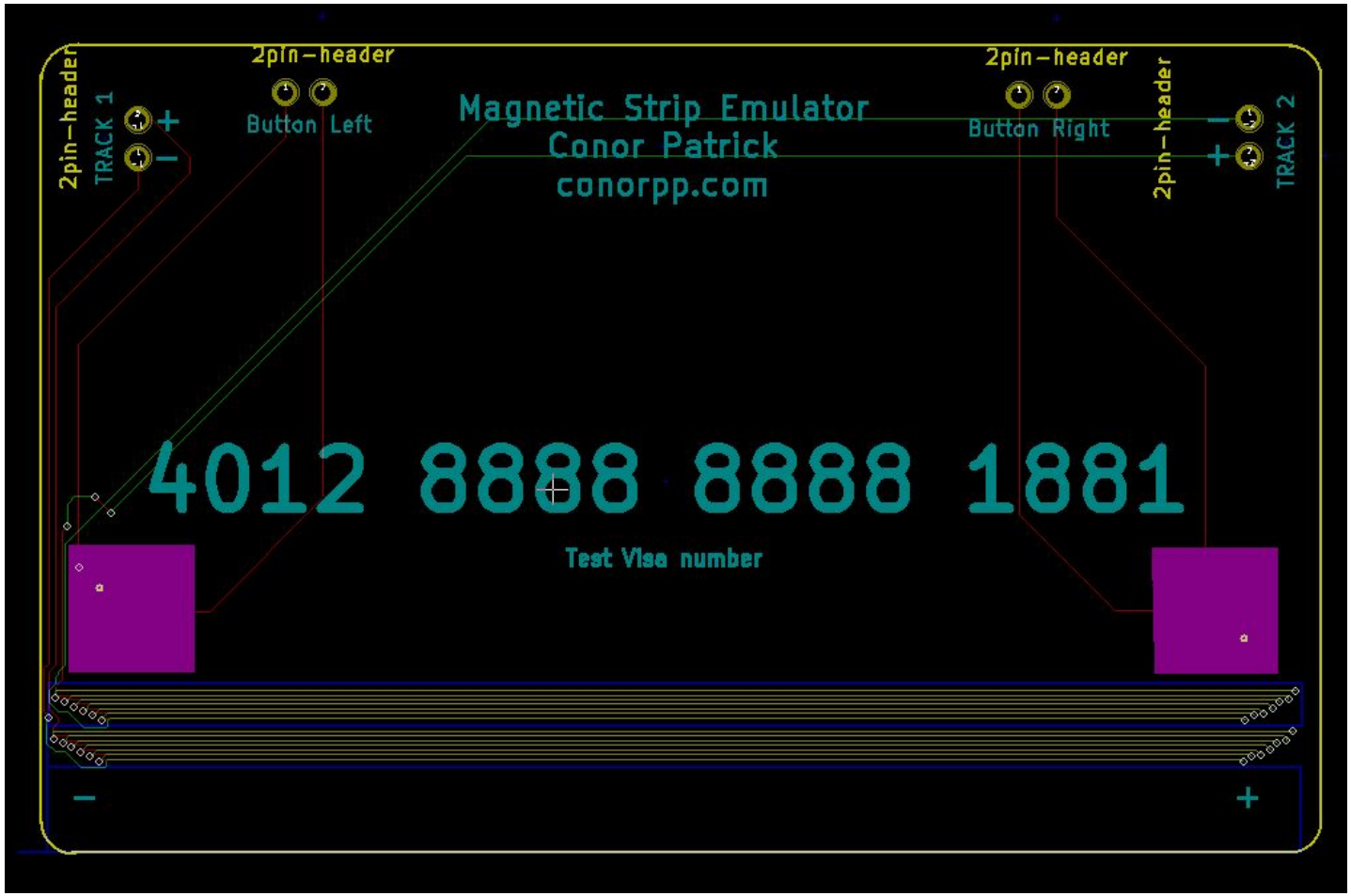
- 2 layer PCB can make a coil with traces
  - No extra cost
  - May not be reliable.

Starting with PCB





Starting with PCB: Limited results… next attempt?



Anyone good at Physics? Simulators? Help.

Demo

- Also have extra PCBs and parts if anyone wants a set up

- Also have blanks if anyone wants to duplicate a card