

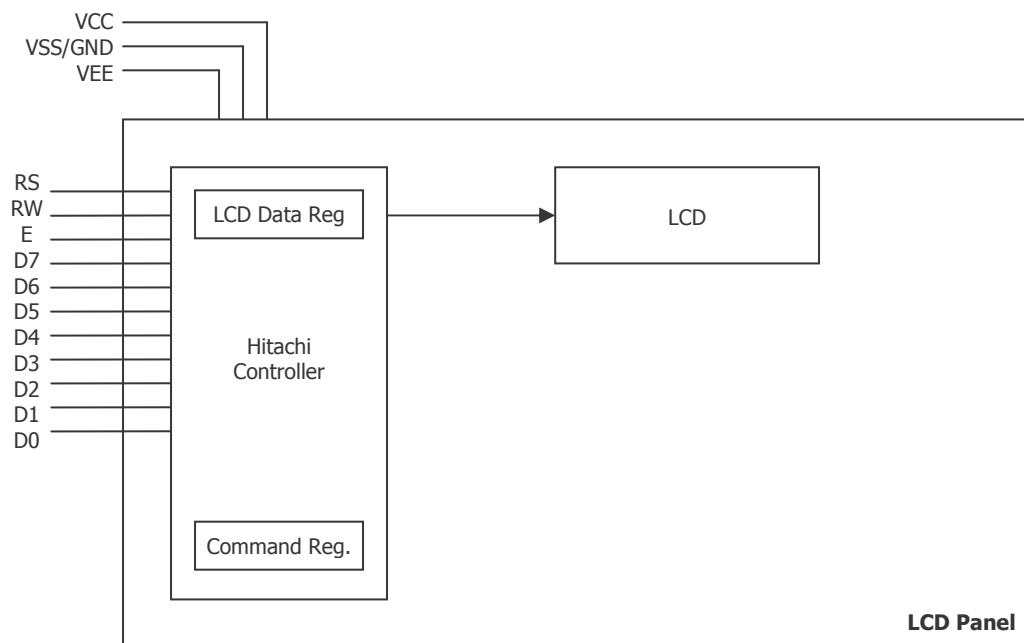
## Lab Week 9 – Device Drivers

Week 8 – Sound output

Week 9 – LCD

Most LCD panels use a standard Hitachi controller (chipset). Fairly universal – other LCD panels usually have a similar interface

PortF is mapped in a read-only direction.



RS, RW, E are control signals

D7-D0 – data signals ASCII or control bytes

4-bit data mode: move ASCII in 2 writes (D7:D4)

8-bit mode: move ASCII in 1 write (D7-D0 are all used)

### How are the pins actually used?

Establishment of control signals (RS)

RW is held low

E goes high

Write data to D7:D0

E goes low and character is outputted

It is after the high, but before the low that you have to stabilize the data byte that you're sending to the controller

The Hitachi chipset is falling edge sampled.

Some ports have strobe behavior that generate an edge when the port is written to.

RS0

RS1

RW0            initial set

RW1            (may be able to reduce this)

E0

Eq

Fox 11: 16x2

Chipset handles displays 40 characters wide

### **LCD Panel Initialization**

Function Set 8-bit

Function Set 8-bit

Function Set 8-bit

Function Set 4-bit (in an 8-bit environment, this would be 8-bits)

(Now everything must be run in 4-bit mode)

RS: LCD0 / D0 / Bit 0 of a byte with STAA

E: LCD1 / D1 / Bit 1 of a byte with STAA

D7-D4: Bits 7-4 of a stored byte

LCDINI – initialize the LCD display panel

LCDSND – send one 8-bit encoded value on to the port