

These worksheets can be used to teach students how to determine the bit pattern needed to illuminate each LED in a charlieplex arrangement.

The worksheets should be presented in this order.

Multiplexed6  
Charlieplex6  
Charlieplex12  
Charlieplex20

Important points:

Multiplexing:

- Requires more signals than charlieplexing.
- LEDs are arranged in a matrix of rows and columns. The number of signals required is the number of rows plus the number of columns. A 5 by 6 matrix would contain 30 LEDs and require 11 signals.
- An entire column may be illuminated at once, This limits the number of columns in a display. The time each column is illuminated is  $1/(\text{number of columns})$ .

Charlieplexing:

- Requires fewer lines/signals than multiplexing but only 1 LED can be illuminated at a time.
- N signals will control  $N(N-1)$  LEDs.
- There is an upper limit on the number of LEDs that can be piratically managed with charlieplexing. At any instant just one LED can be illuminated. Each LED is only on for  $1/(\text{number of LEDs})$ . As the number of LEDs in a display increases the display will become dimmer.

References:

APPLICATION NOTE 1880

Charlieplexing - Reduced Pin-Count LED Display Multiplexing

[http://www.maxim-ic.com/appnotes.cfm/an\\_pk/1880](http://www.maxim-ic.com/appnotes.cfm/an_pk/1880)