

# Lehigh University Center for Optical Technologies **AM - OLED Flexible Displays**

## OBJECTIVE

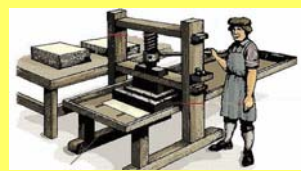
To develop high performance polysilicon TFT technology on flexible metal foil substrate and to demonstrate Active Matrix Organic Light Emitting Diode Displays with integrated column drivers

## AM-OLED Layout

- Several Dies each with TFT circuits, discrete TFTs and process test structures.
- AM-OLED display; 3 inch diagonal display has an active pixel design.
- Each Array has 640 x 480 pixels, each pixel being 105 x 110 microns.
- Integrated column shift registers: Half bit static design

## Flexible Display Advantages

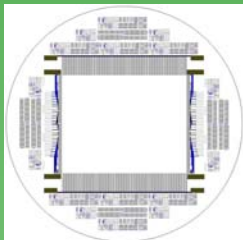
- Lower weight (important for mobile applications).
- Sturdy, strong (broken displays rank #1 in mobile device failure).
- Potential for substantial cost reduction through Roll-to-Roll processing.



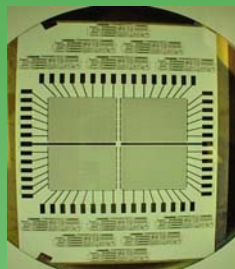
## Metal Foils

- Metal foils are readily compatible with low or high temperature standard CMOS processing, suitable for high performance polysilicon TFT integrated systems.
- Metal foils can be used as a common power supply terminal to OLED pixels resulting in higher pixel aperture & fabrication yield, and superior display uniformity
- Metals are impervious to moisture offering longer OLED lifetimes than plastics.
- Better thermal dissipation than plastics.

## Display Layout Full VGA

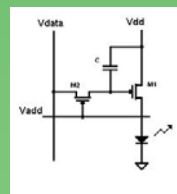


## Display Layout & Finished Quartz Wafer (1/4 VGA)



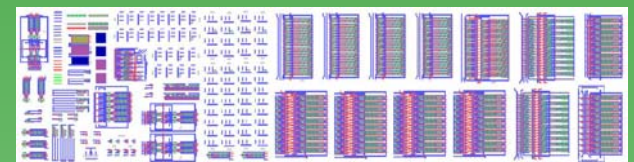
## Display Architecture: Two-TFT Pixel

- Advantages:
  - Simple proven benchmark design
  - Easy to control
- Disadvantages:
  - Display non-uniformity due to device parameter variations



## Test Die:

- Stand-Alone Single Gate, Double Gate, Triple Gate NMOS and PMOS TFT's
- 13 Shift Register Implementations
- Test Circuits for Row Drivers, Column Drivers and General Purpose Circuits
- Test Structures for Fabrication monitoring



## Three Data Driving Configurations



VGA Display



Flex-Connect



32 Output DOT Matrix Driver



320 Output DOT Matrix Driver



320 Output Display Driver

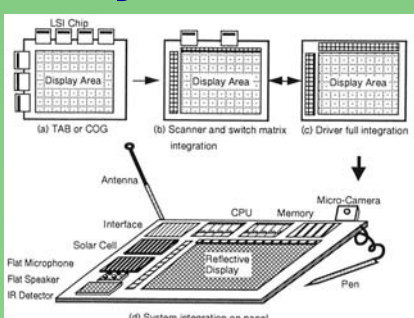


Timing and Data Controller



ADC and Transmitter Board

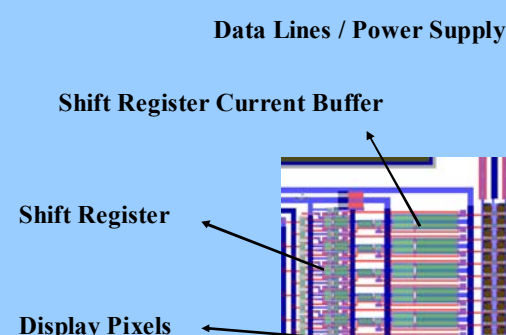
## System On a Flexible Panel



Performance of Thin Film Transistors enables display drivers and other system components to be integrated on a flexible metal foil.

High Reliability, Low Cost, Light Weight

## Integrated Shift Register



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