

# TI Solutions for Security X-ray



# Introduction

- Purpose
  - To introduce TI's Front End Solutions for X-ray
- Content
  - X-ray Basics
  - X-ray uses for Security
  - Flat Panel Detectors
  - TI AFE's for Flat Panel Detectors
  - CT for Security x-ray
  - TI DDC's for CT

# X-ray Basics

- X-rays are waves of electromagnetic energy which form part of the electromagnetic spectrum..
- X-rays are approximately 1000 times shorter than the wavelength of light, and are a highly penetrating form of radiation which can pass through many materials that are otherwise opaque –
- X rays will pass uninterrupted through low-density substances such as clothing or skin, whereas higher-density materials, such as bone, will reflect or absorb the X rays because there is less space between the atoms for the waves to pass through.



# X-ray Basics

- Man-made X-rays are produced by a piece of equipment called an X-ray Tube.
- Inside every X-ray tube are two components: the cathode and a metal target called the anode - that both sit inside a vacuum.
- X-ray production involves accelerating electrons in order to collide with the metal target.
- When electrons from the cathode strike the anode, two types of energy are generated: heat and radiation (X-rays).
- In baggage screening, as the x-rays pass through a suitcase, for example, and are then attenuated (weakened) by the different densities of objects inside the bag that they encounter.
- A magnified “shadow” of the suitcase and contents is then shown on the X-ray machine’s computer monitor.

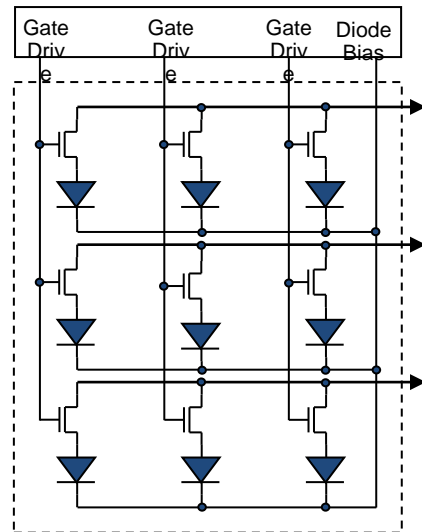
# X-ray uses for Security

- Hand baggage screening
- Hold baggage screening
- Small parcel screening
- Cargo screening
- Portable x-ray
- Passenger screening

# Flat Panel Detectors (FPD)

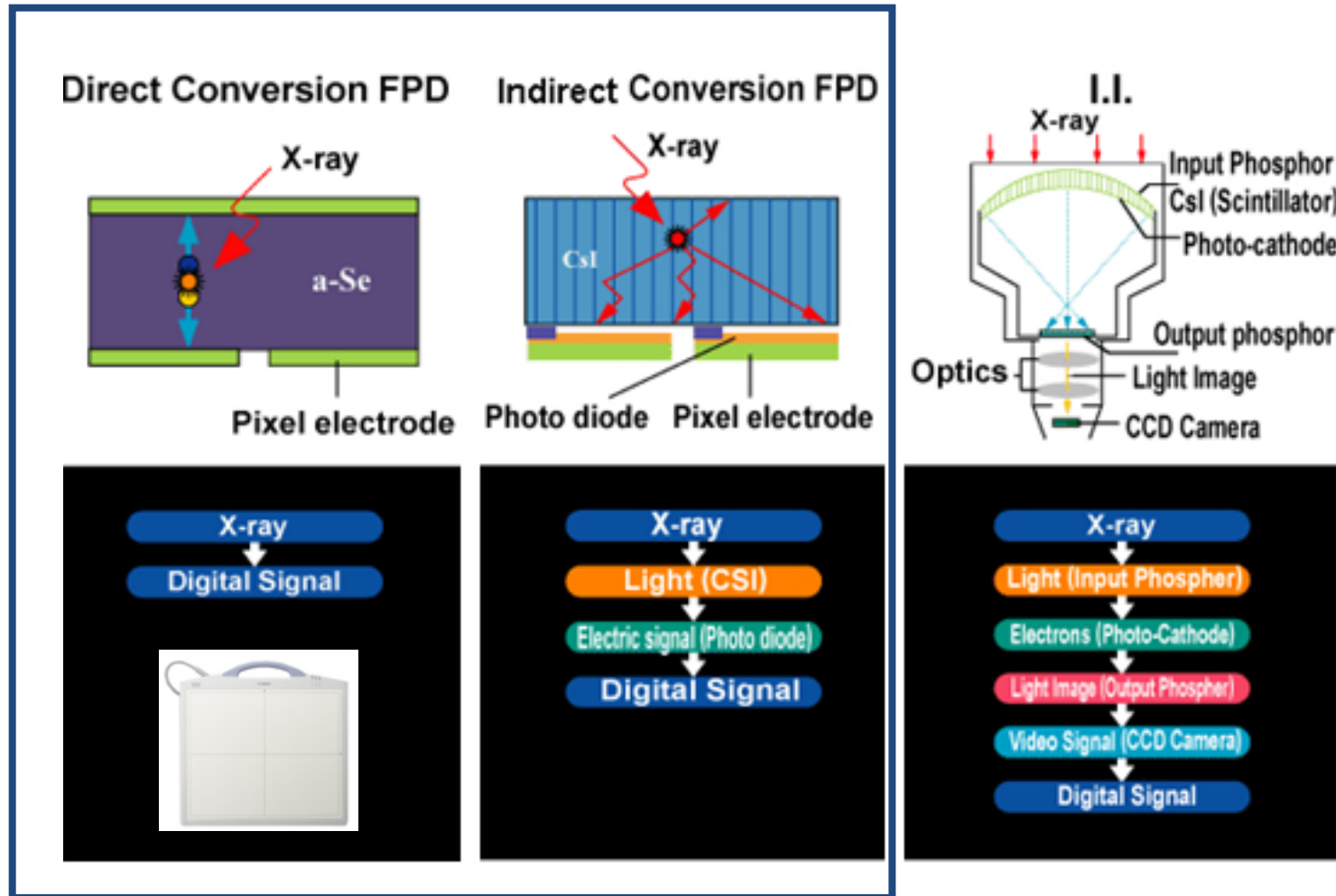
- FPDs leverage liquid crystal display technology to create very large arrays on amorphous silicon.
- Photodiodes in the FPD store the accumulated charge within the capacitance of the diode itself during the capture period
- During the readout period, the thin-film transistors (TFTs) are controlled to multiplex the diodes onto output lines
- The output signals, charge packets from the diodes, are measured by the readout electronics

illustrative  
3 x 3  
flat panel array



multiplexed photodiode  
outputs to readout  
electronics

# DR Radiography System Configuration



Supported by TI AFE



# X-Ray Flat Panel Detector Products

18 bit ADC

ADS8284

18 bit SAR built in buffer

16 bit ADC

ADS8422

16 bit, 4 MSPS

ADS8363

16 bit, 1 MSPS DUAL ADC

Analog Front End

AFE0064

64 channel

Released

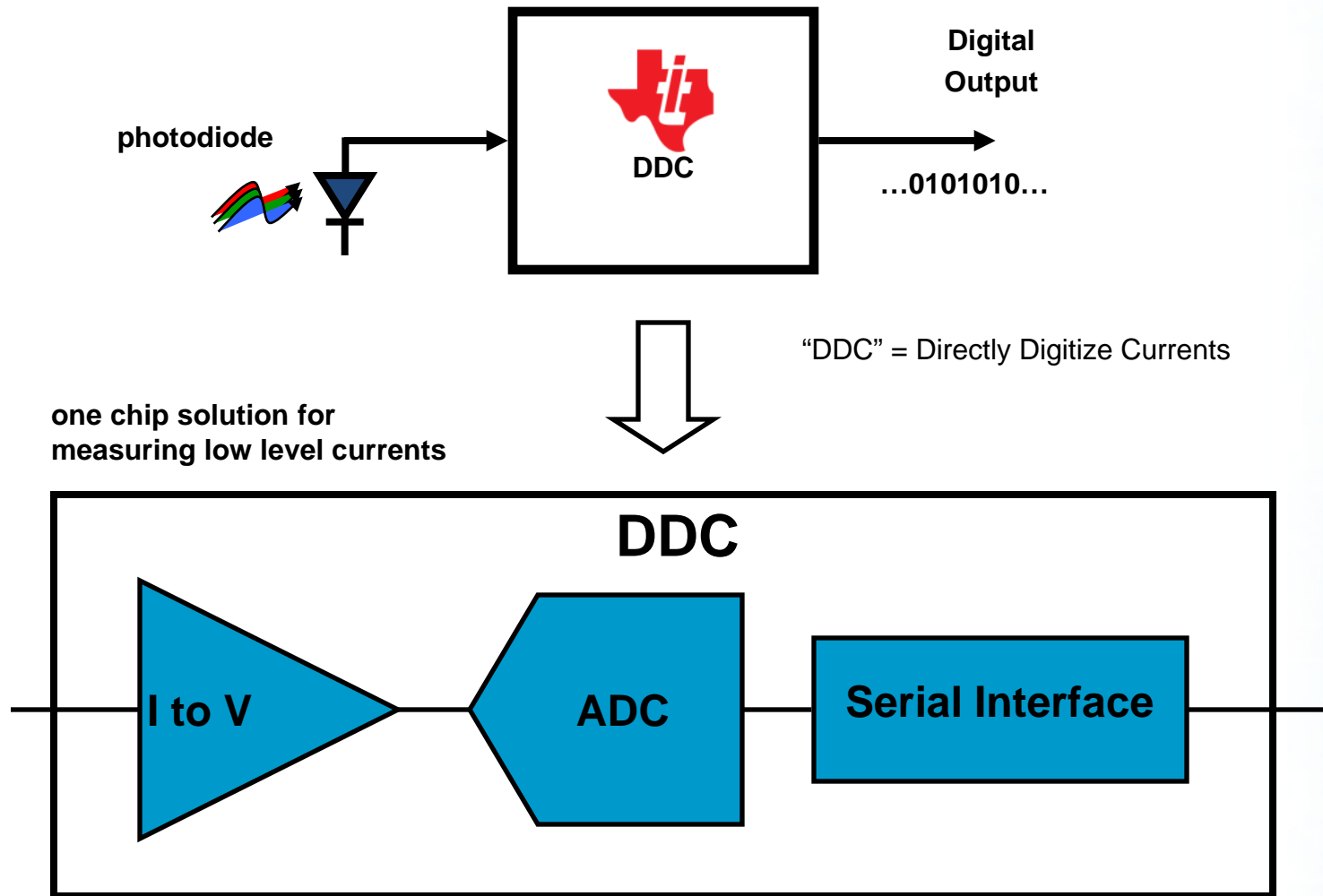
|  | AFE0064                               |
|--|---------------------------------------|
| Number of channels   | 64                                    |
| Input charge range   | 0.13pC to 9.6pC                       |
| Bin 2x, pipeline read  | No                                    |
| Minimum scan time, normal mode   | 28.3us                                |
| Minimum scan time, bin2x mode  | NA                                    |
| Power per channel, full speed  | 2.7mW + external ADC and driver power |
| Noise, with 28pF data line cap, 1.2pC range                            | 820e-                                 |
| Internal ADC   | No                                    |
| Package options  | 128 pin TQFP                          |
| Internal timing generator to generate controls signals (IRST, SHR etc) | No                                    |
| Interface  | Analog output                         |
| Status   | Released to Market                    |



# CT for Security X-ray

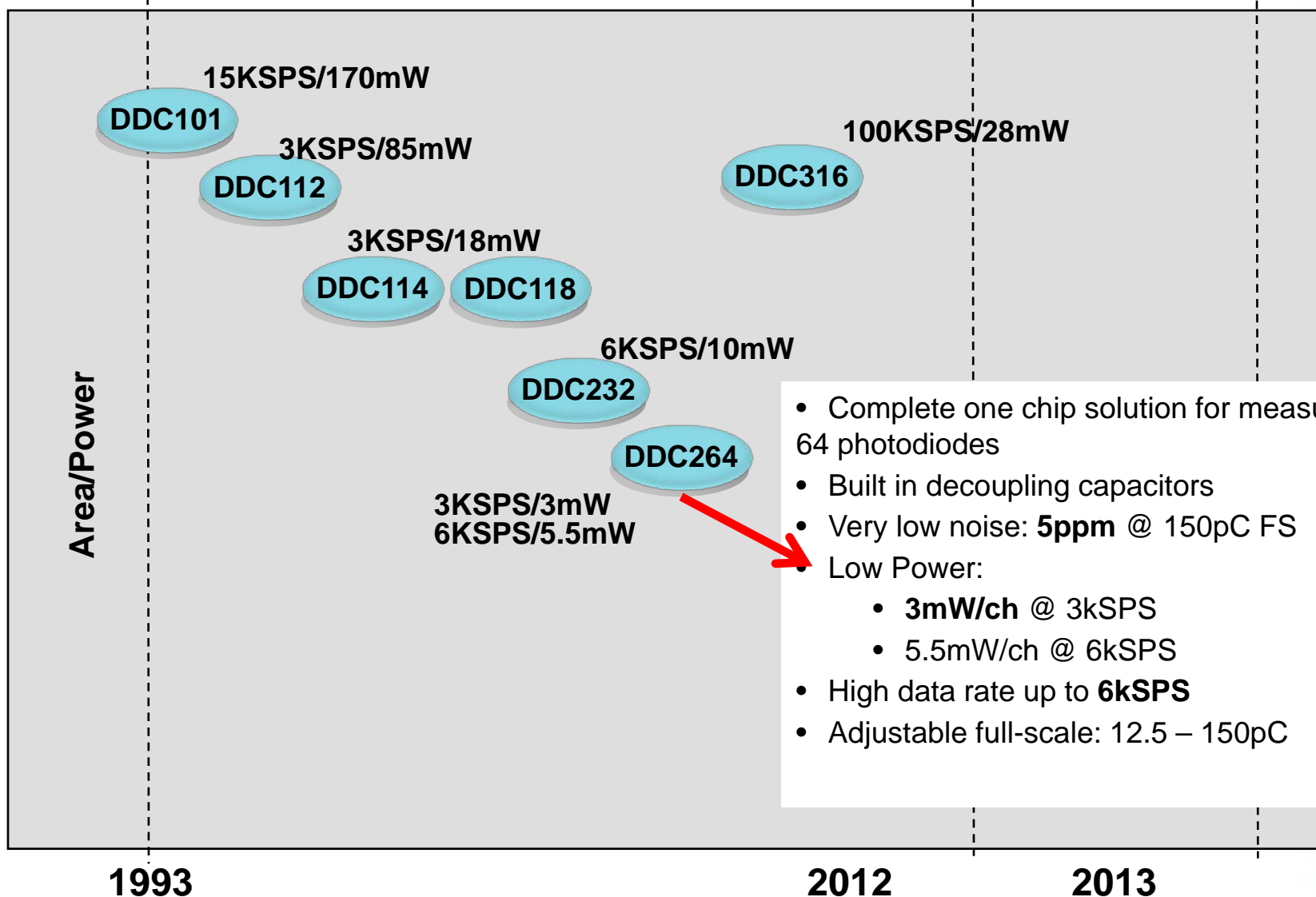
- CT (computed tomography) scanners are sometimes used for more advanced security x-ray screening.
  - In a CT scanner the bag is placed in a cylindrical device.
  - Inside the cylinder is an x-ray source that is mechanically rotated entirely around the bag.
  - The cylinder is also lined with detectors that measure the X-rays that pass through the scanned object at all angles.
  - By collating all the information that is gathered during a full revolution of the X-ray source, a computer can form a three-dimensional model of the irradiated volume of the object and assemble a series of cross-sectional images into a single detailed image.

# Front Ends for Photodiodes and CT



# DDC Roadmap

● Production



# Summary

- TI offers x-ray front end solutions for both flat panel detectors and CT
- To learn more or order samples or evaluation module please visit [http://www.ti.com/solution/x\\_ray\\_baggage\\_scanner](http://www.ti.com/solution/x_ray_baggage_scanner)