PDP System Overview

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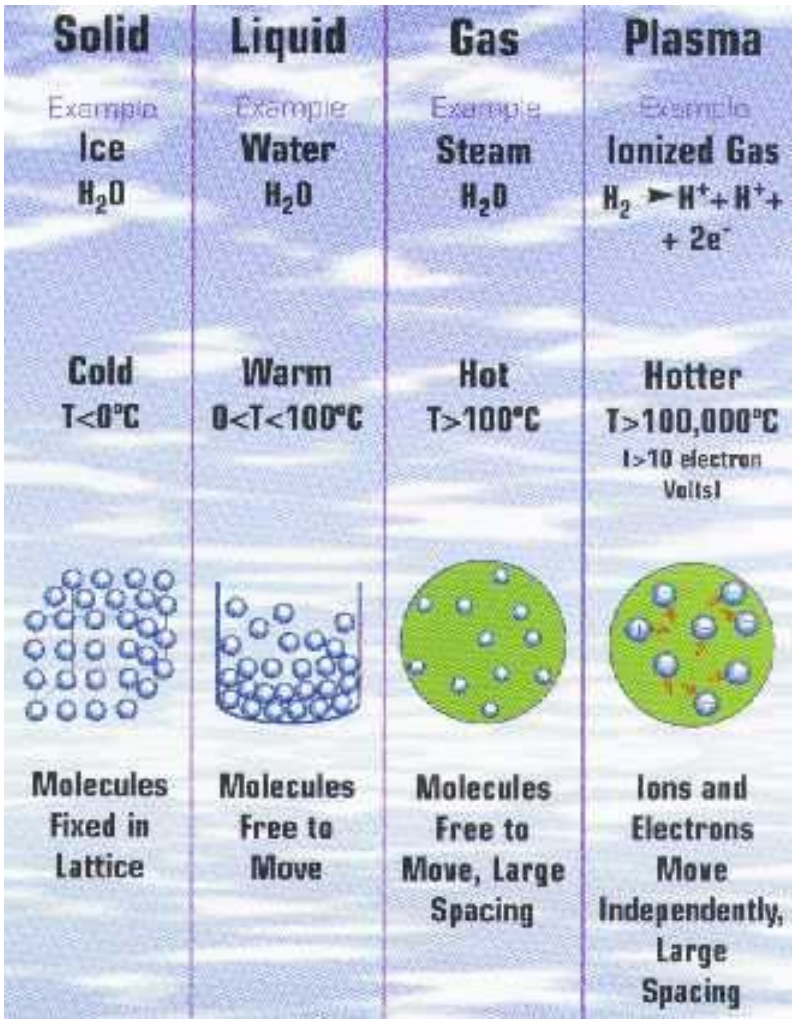
PDP System Overview

- What is Plasma
- PDP History
- Applications of PDP
- Discharge Physics of PDP
- Process Technology of PDP
- Driving Technology of PDP
- Electronics System of PDP
- Performance Improvement
- Video Signal Processing
- PDP vs. LCD

What is Plasma?

The Fourth State of Matter



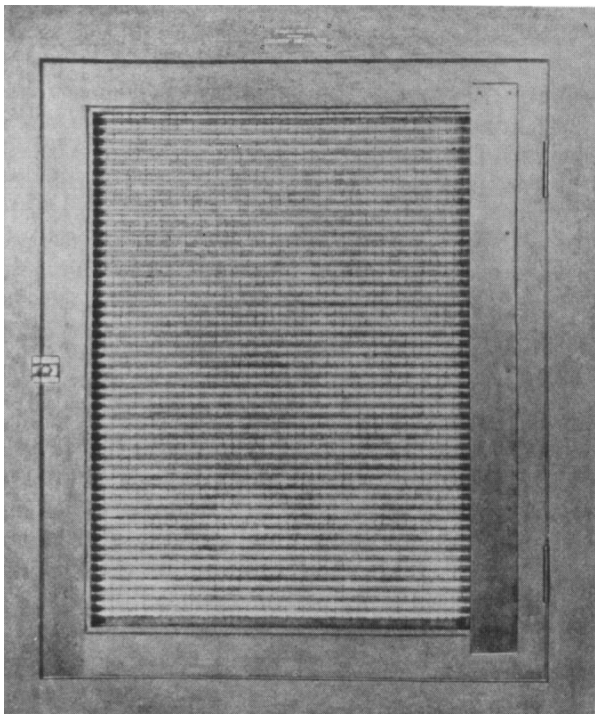
- *Plasma consists of a collection of free-moving electrons and ions.*
- *Energy is needed to strip electrons from atoms to make plasma. The energy can be of various origins: thermal, electrical, or light (ultraviolet light or intense visible light from a laser).*
- *With insufficient sustaining power, plasmas recombine into neutral gas.*

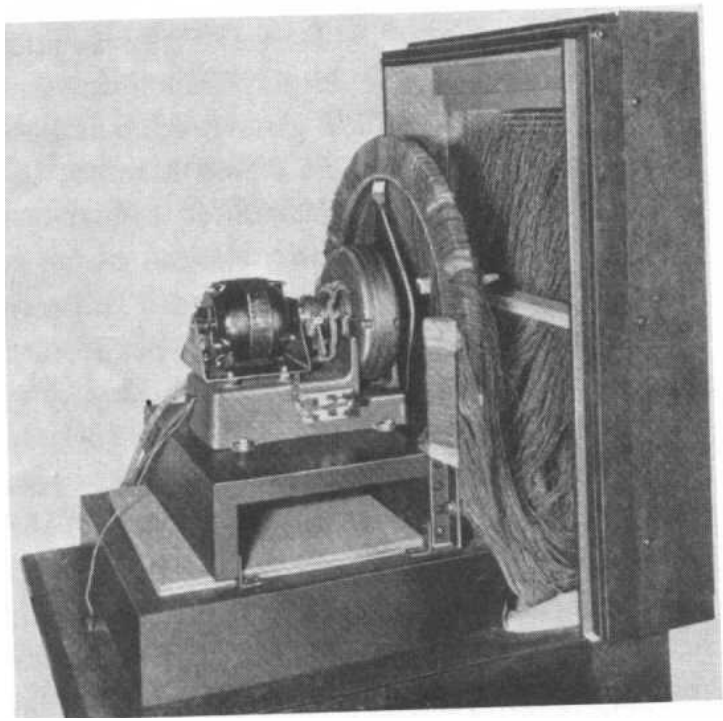
PDP History

History

	PDP	Other Display
19C	1675 Jean Picard discover Gas Discharge phenomena **1838 Michael Faraday Gas Discharge experiment**	**1888 Liquid crystal discovered** **1897 Braun Tube invented**
~ '1960	**'27 Bell TV image demo. by gas discharge** '54 Burroughs invents DC-PDP(NIXIE) **'64 Illinois univ. Invented AC-PDP** Owens-Illinois produce AC-PDP '66 Phillps TV image demo. by DC-PDP	**'29 CRT TV imaging** '36 EL phenomena discovered '53 Japan TV broadcasting started '57 Japan Color-CRT commercialized '60 Japan Color-TV broadcasting started '69 powder EL TV imaging
'1970	**'70 NHK start PDP research program** *Japanese maker start PDP research program*	**'72 LCD calculator commercialized** '78 Orange color EL commercialized
'1980	'80s Laptop PC adopt monochrome PDP(10") '88 Fujitsu 20", commercialized 3-color PDP(stock)	'82 monochrome small LCD TV commercialized '84 color small LCD TV commercialized '89 10" STN LCD replaced PDP in the Notebook PC application
'1990	'93 SAMSUNG color PDP Program Start **'92 Fujitsu commercialized 21",260k color VGA** '94 Japan PDP consortium started '95 Matsushita commercialized 26" DC-PDP '96 Korea government select PDP as a G7 project **'96 Fujitsu commercialized 42" AC-PDP** '98 LG demonstrates 60", Fujitsu invent ALiS '99 Plasmaco demonstrates 60" '00 Japan government select PDP as a G8 project	**'90 Active Matrix LCD commercialized** '91 Japan Hi-vision test broadcasting started '92 Multicolor thin film EL developed '94 21" Active Matrix LCD developed

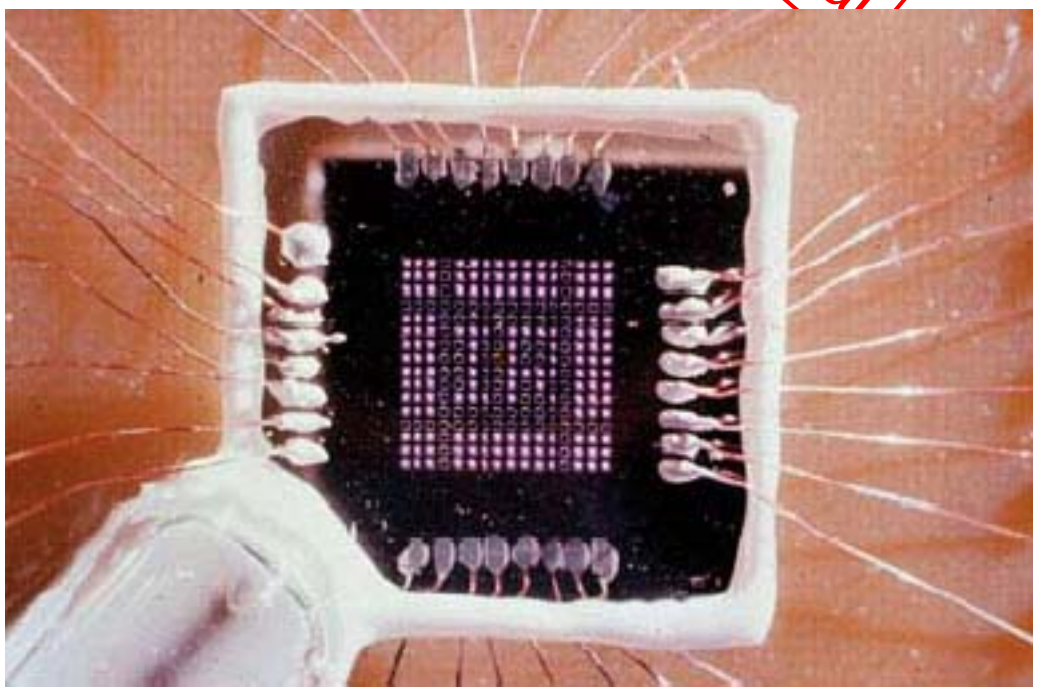
The Early Plasma TV at Bell System





The early gas-discharge TV developed by Bell System in 1927.
Drive electronics consisting of a motor-driven distributor.

The Early PDP Prototype at UI



AC-PDP Inventor Prof. H.G. Slottow at the University of Illinois operating early prototype constructed by Dr. R. L. Johnson.

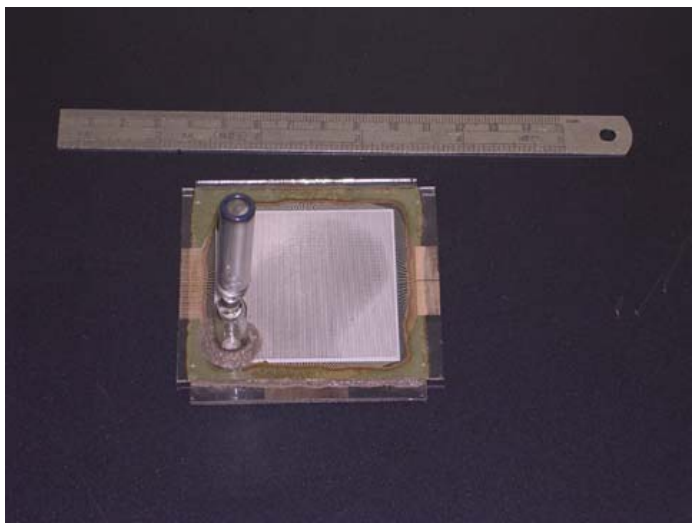
The Early Large PDP Device by Photonics

Courtesy of Photonics

The Early Large PDP Device by NHK

Courtesy of NHK

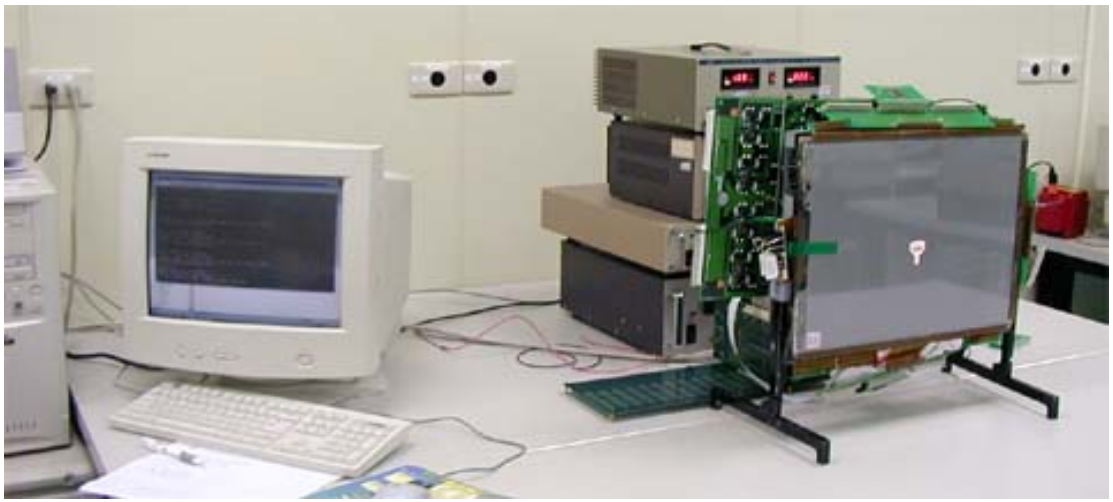
The 1st PDP Prototype at CPT



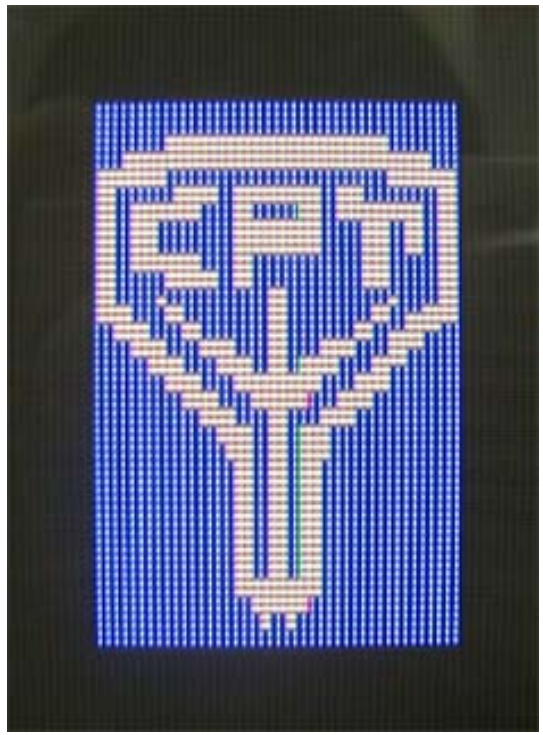
The first PDP test panel developed by CPT in 1998.

The equivalent 64x64-pixel PDP panel for driving emulation at CPT in 1999.

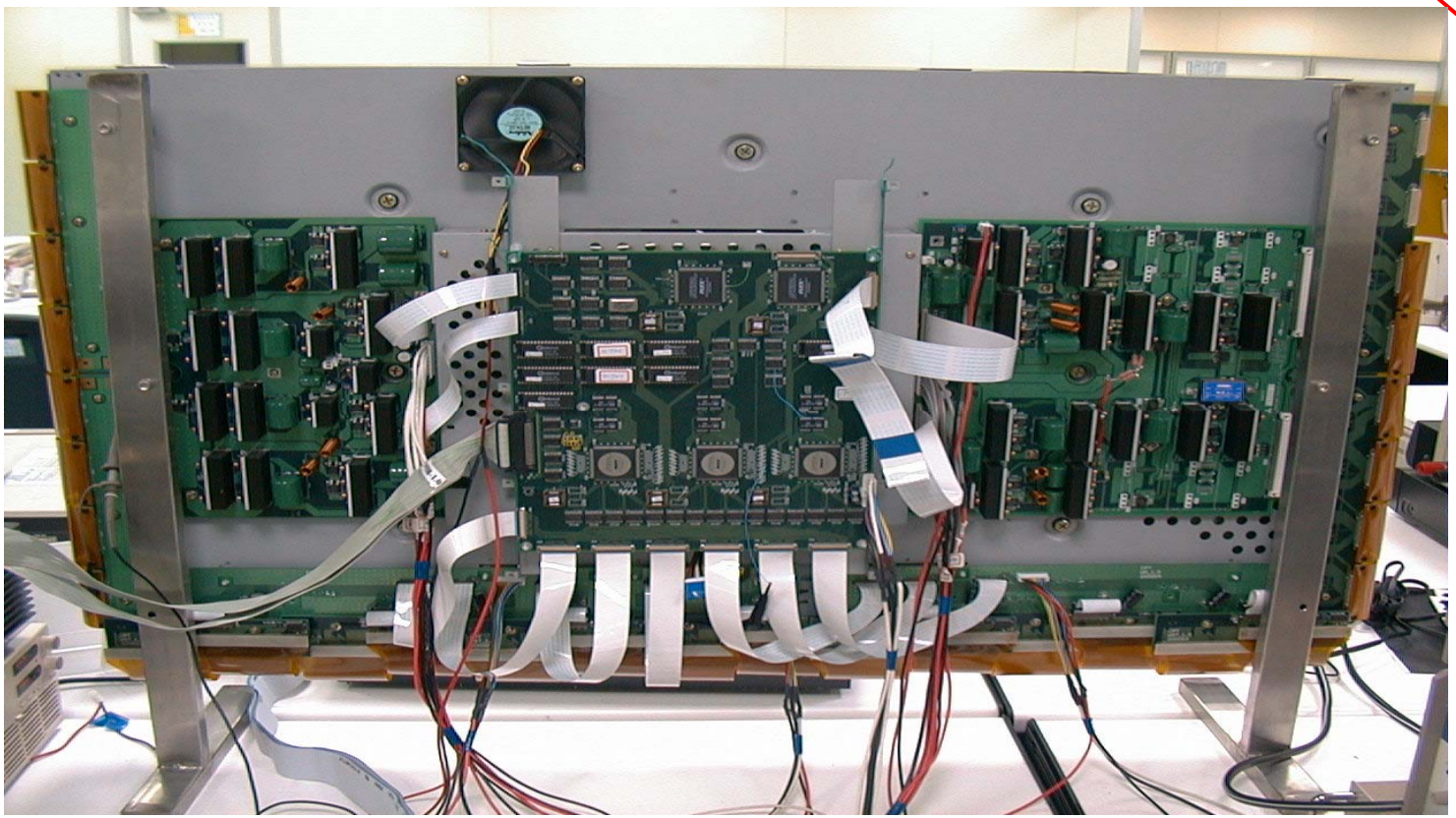
The 1st Light-Up PDP Prototype at CPT



The first light-up 21” PDP panel developed by CPT in 2000.03.



The 1st 46” PDP Prototype at CPT

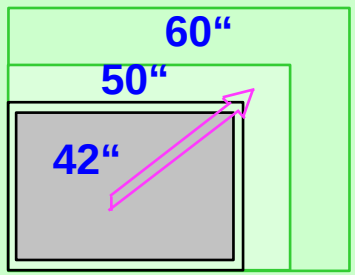


The electronics outlook of the experimental PDP module developed by CPT in 2000.07.

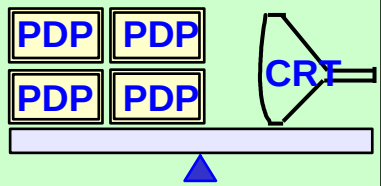
Applications of PDP

Why PDP?

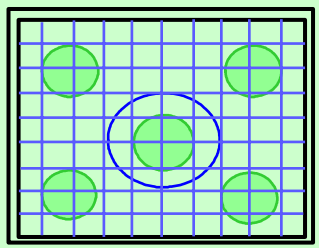
Large



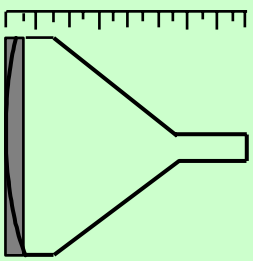
Light



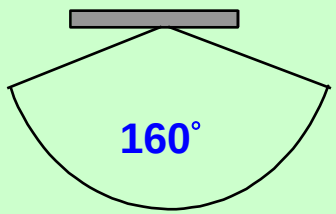
No Deformation



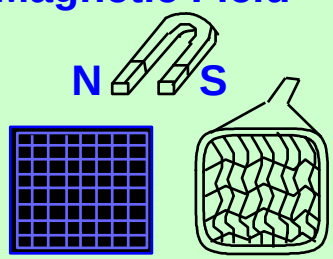
Thin 100mm



Wide View Angle

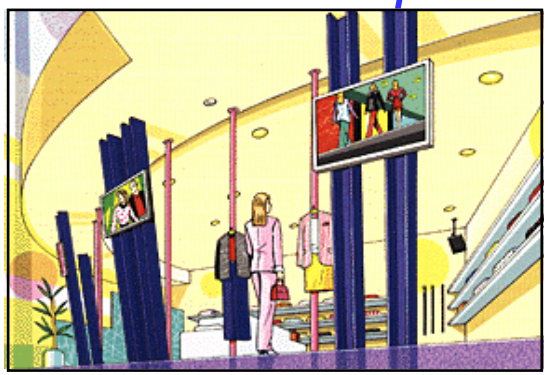


No Influence of Magnetic Field

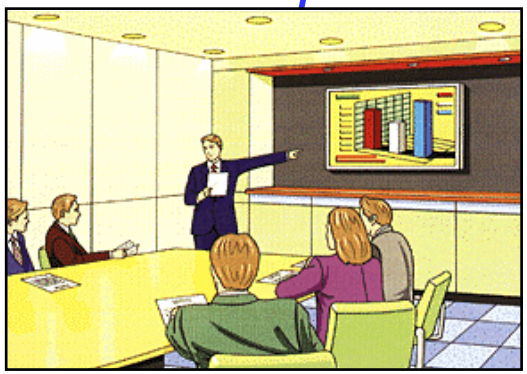


Enjoy Your Life With PDP

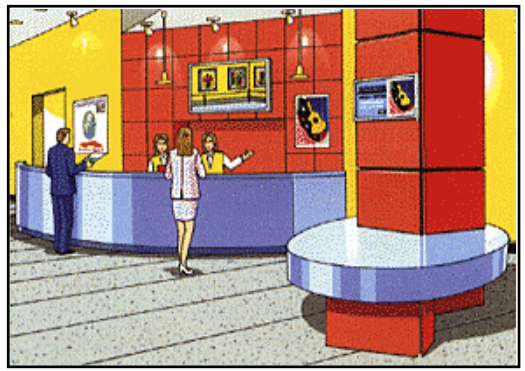
Commercial Space



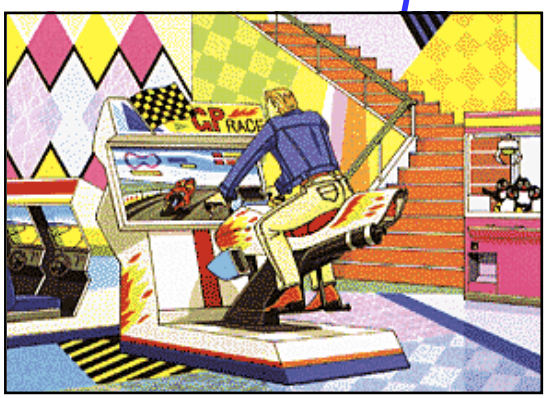
Office Space



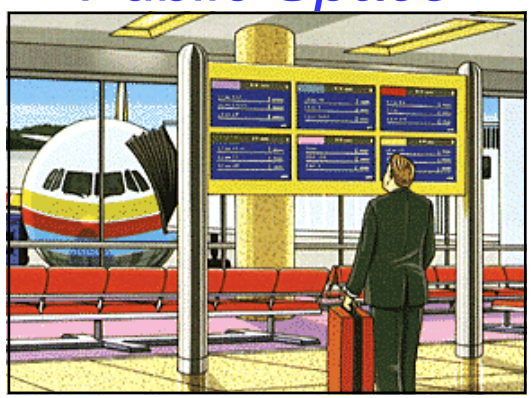
Financial



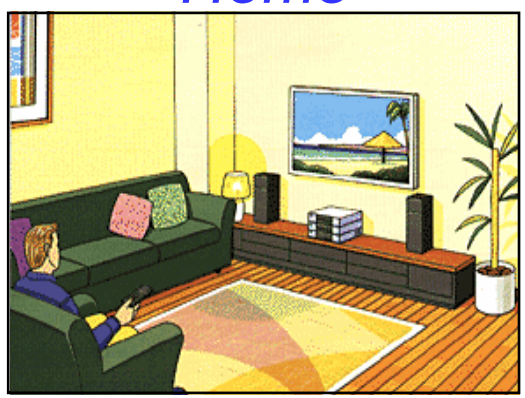
Amusement Space



Public Space

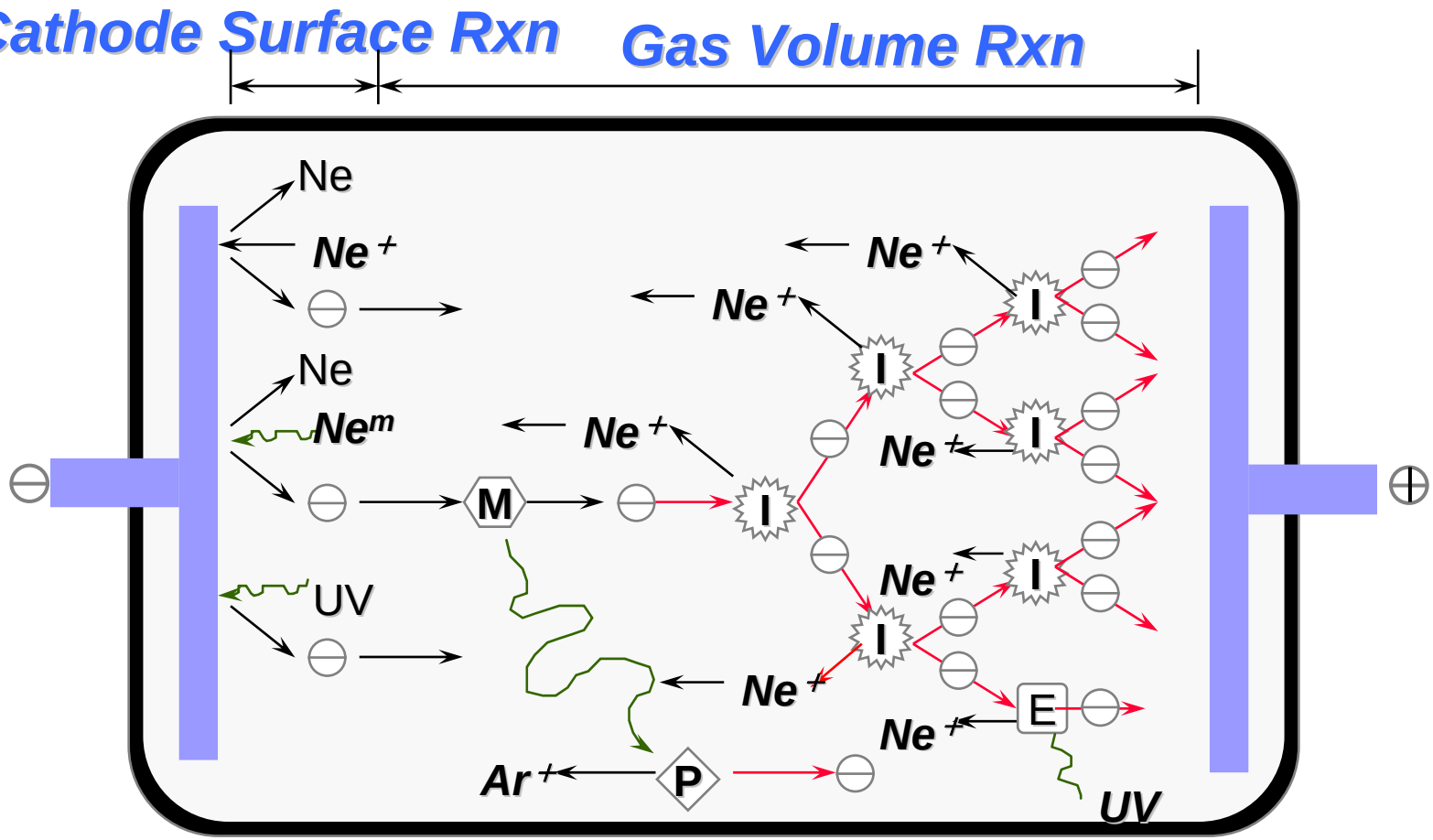


Home



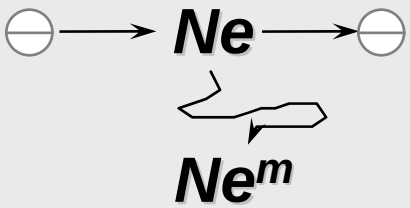
Discharge Physics of PDP

Gas Discharge Physics

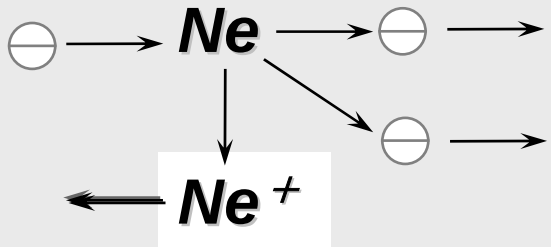


Gas Volume Reaction

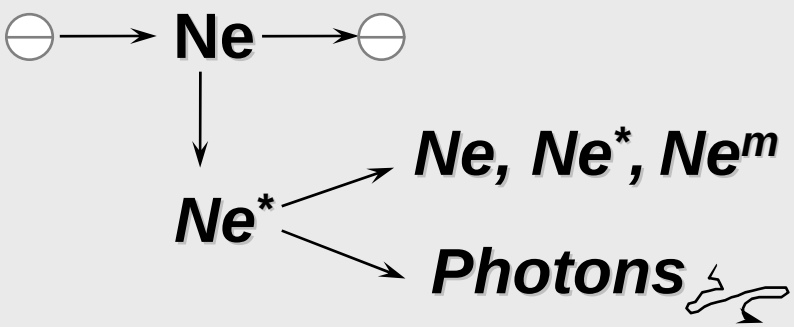
Metastable Generation



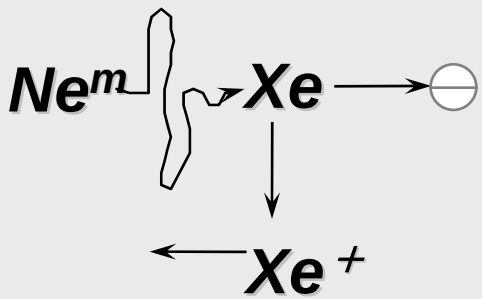
Ionization



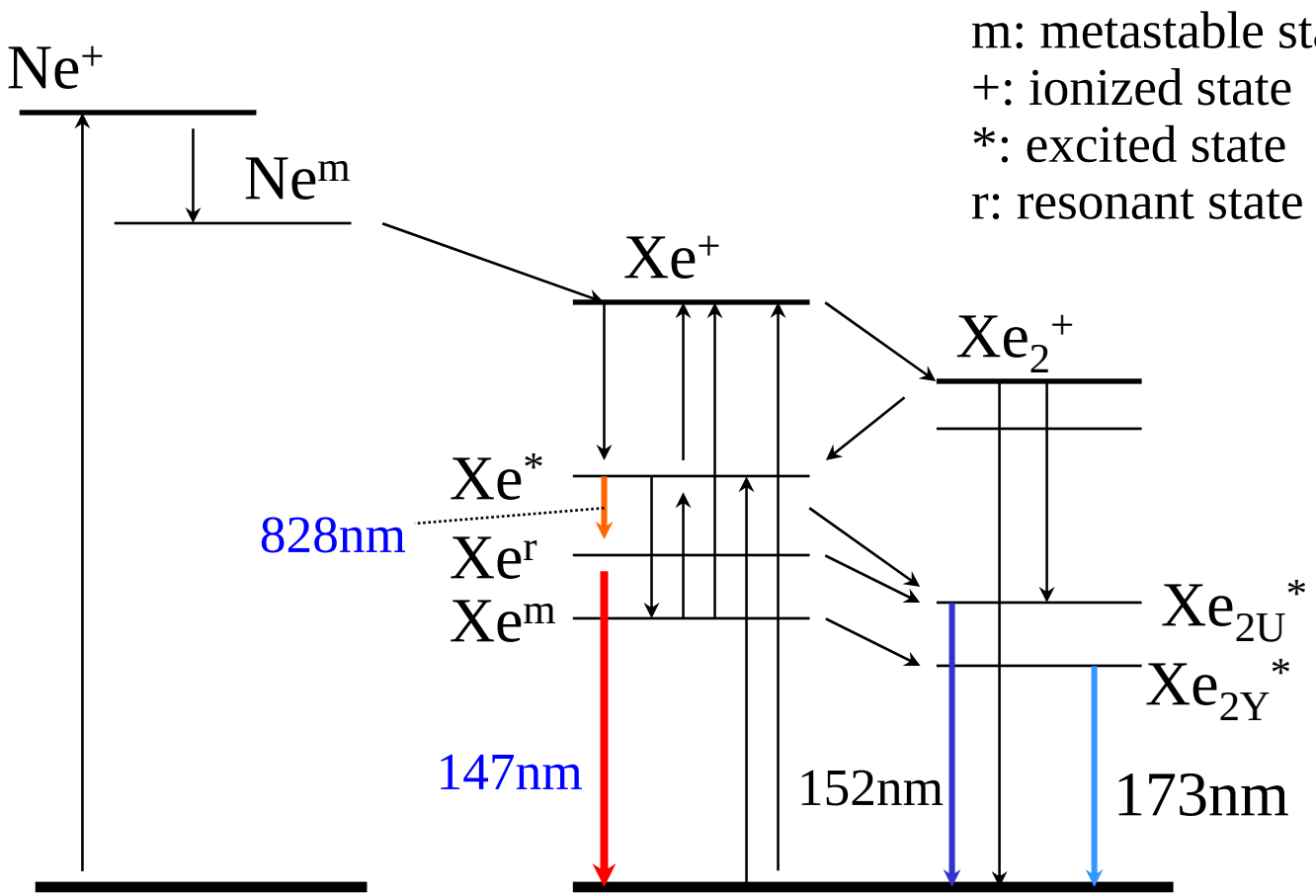
Excitation



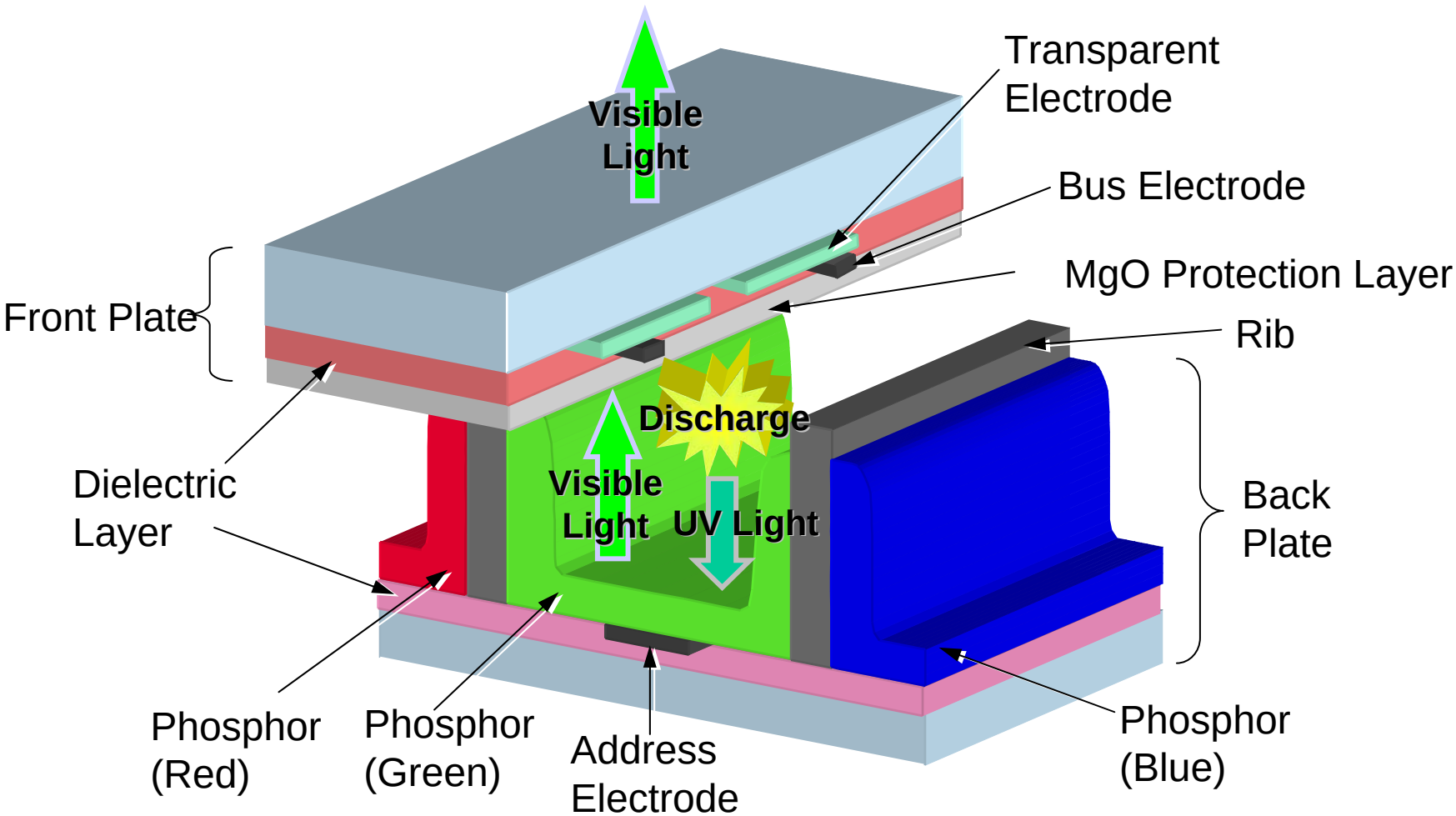
Penning Ionization



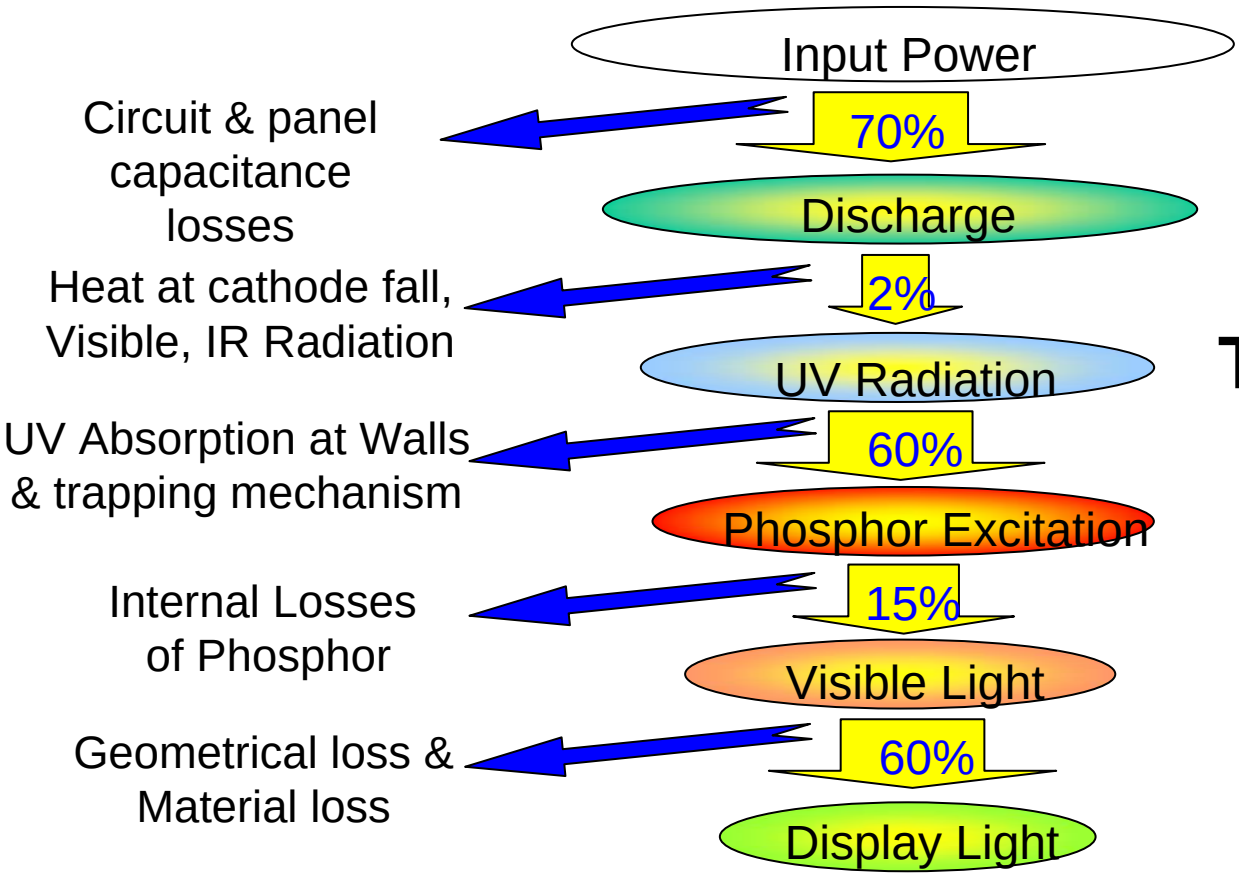
Ne-Xe Energy Level



Luminescence Mechanism



Total Efficiency of PDP

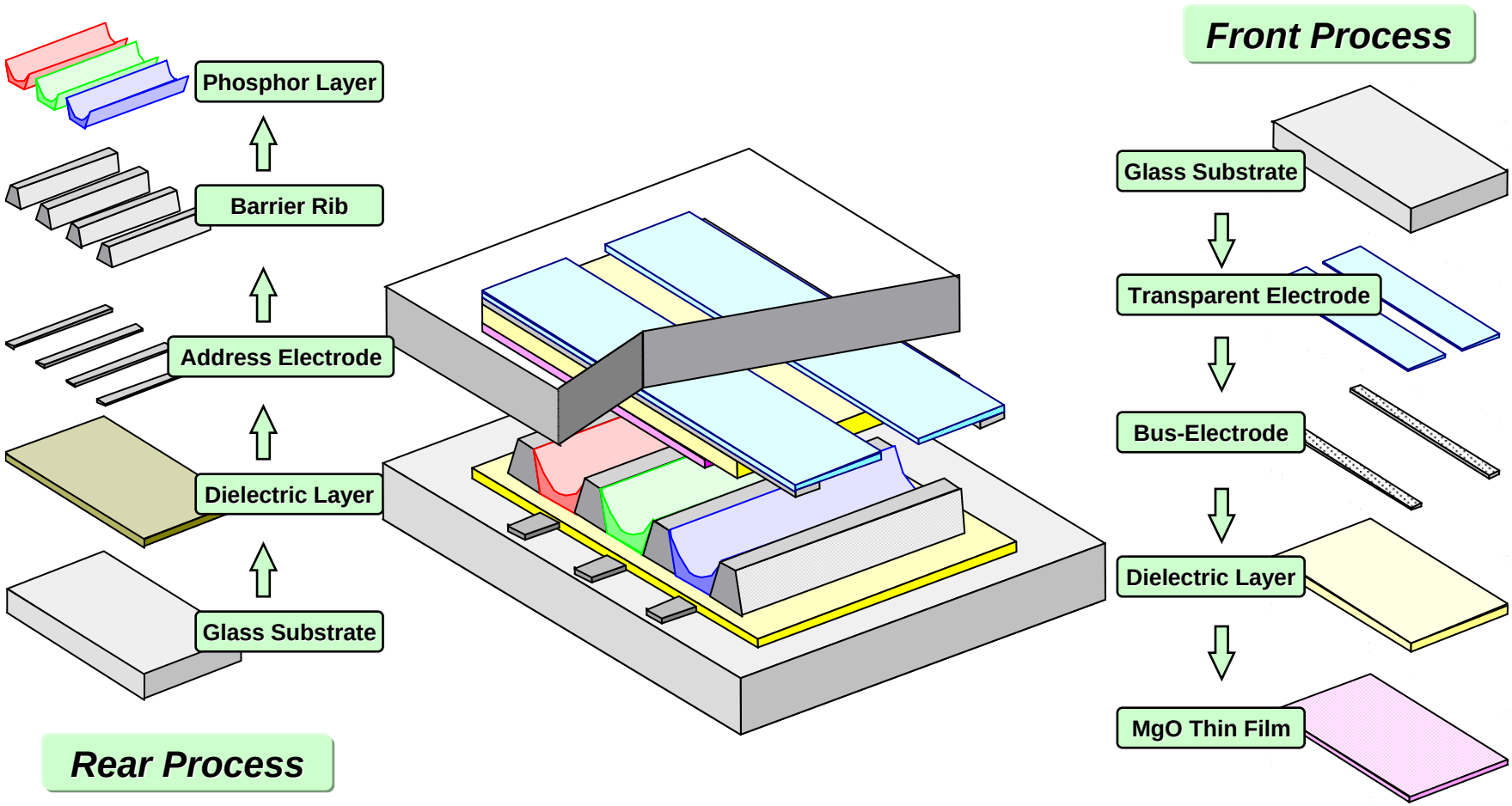


Total Efficiency of PDP=0.08%

1.0~1.8 lm/W

Process Technology of PDP

PDP Process



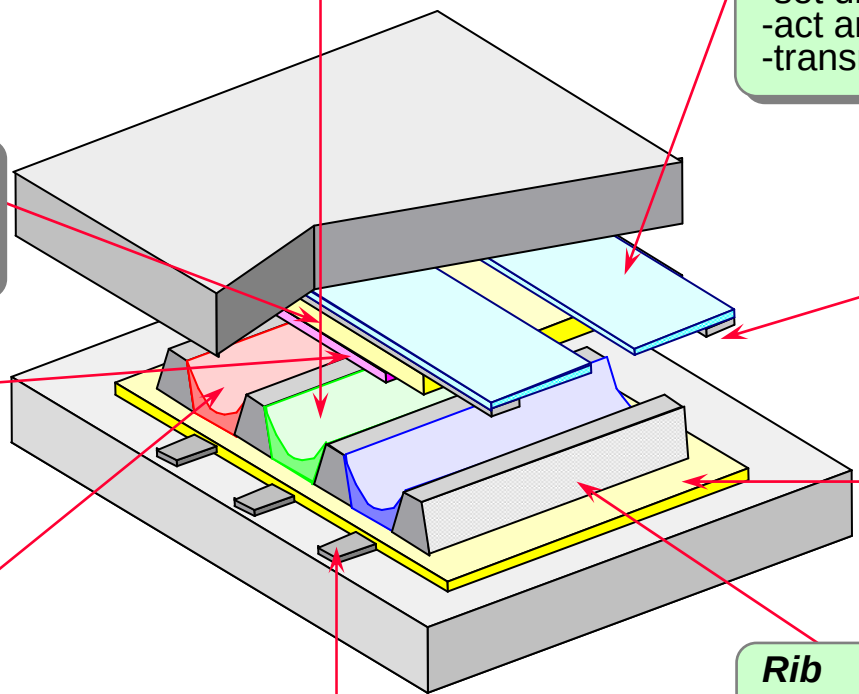
AC-PDP Structure

Gas
-maintain discharge
-produce VUV

Dielectric Layer
- limit current
-transmit visible light
-wall charge accumulation

MgO Thin Film
-2nd electron emission
-anti-sputtering
-transmit visible light

Phosphor Layer
-emit visible light
by VUV absorbing



Address Electrode
-input data signal

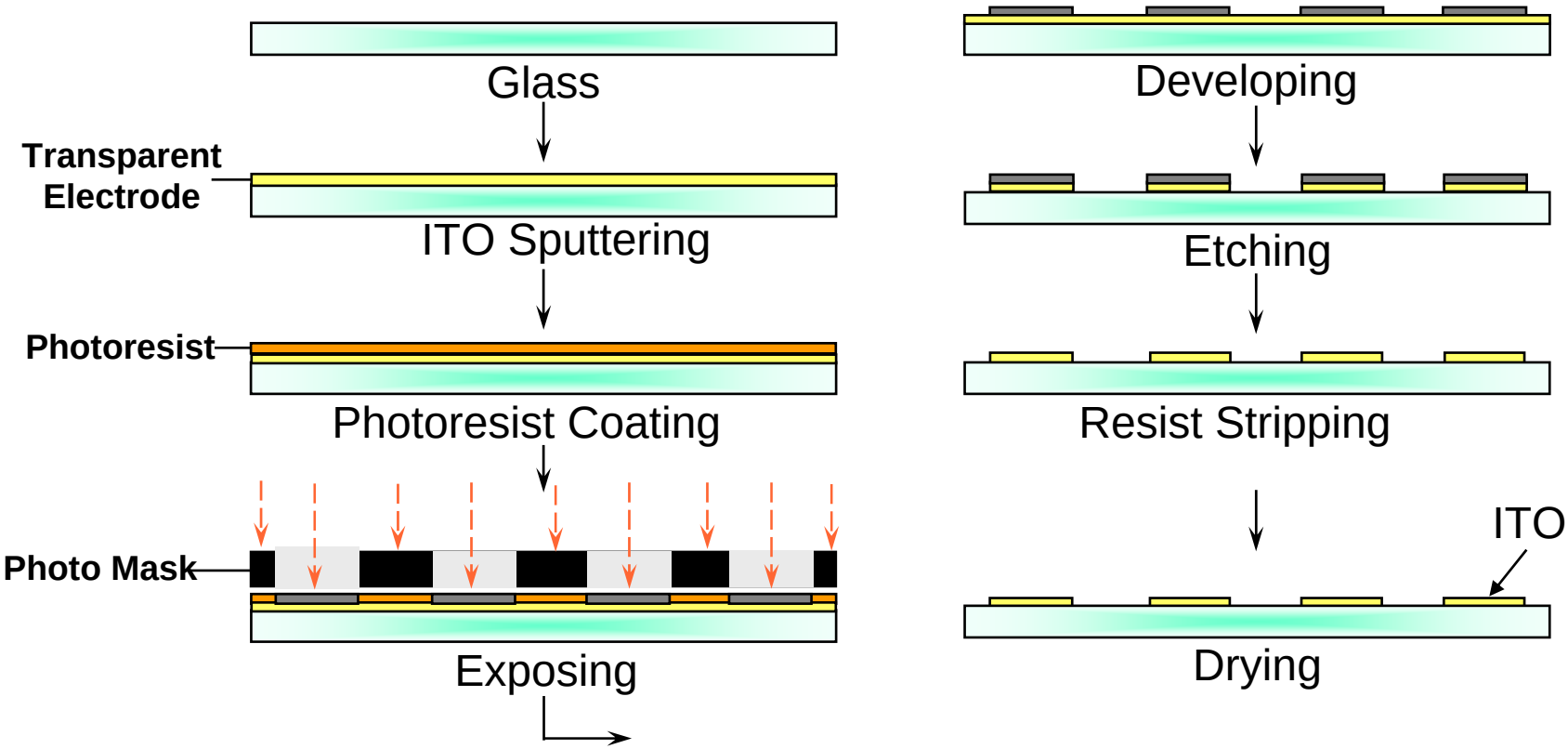
Transparent Electrode
-set discharge gap
-act an effective discharge area
-transmit visible light

Bus Electrode
-current path
-prevent voltage drop

Dielectric Layer
- limit current
-anti-sandblasting
-reflect visible light

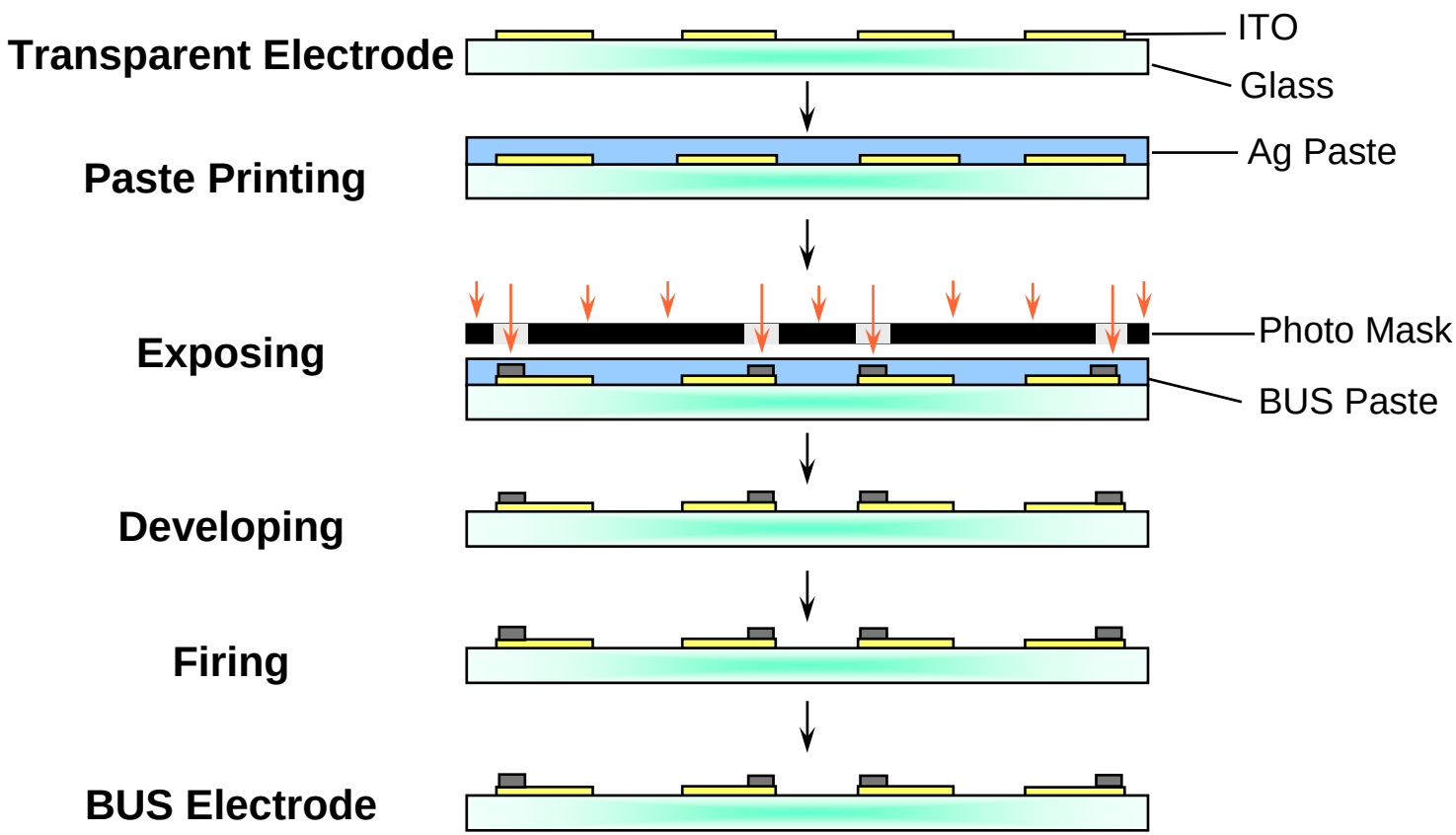
Rib
-separate R,G,B cell
-provide discharge space
-keep phosphor shape

ITO Process

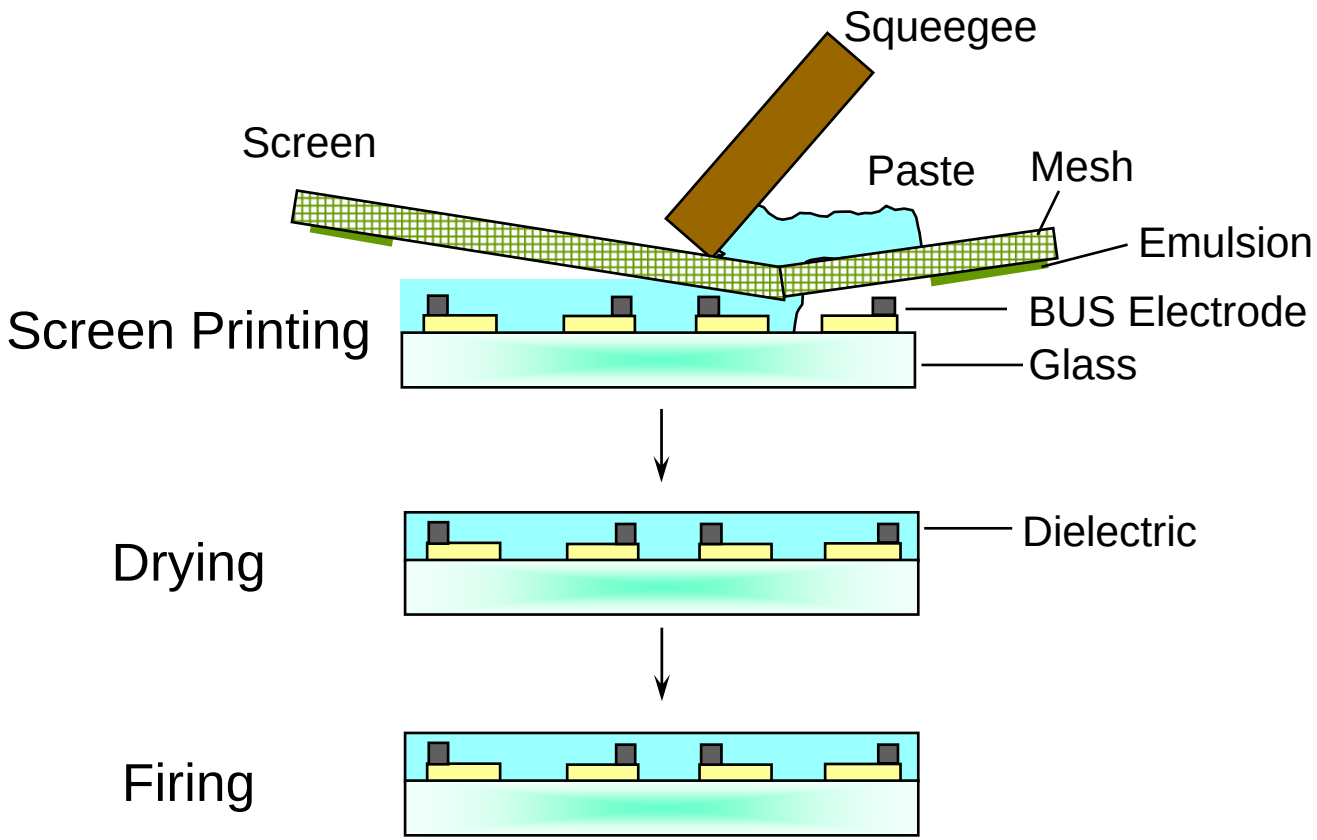


Bus Electrode Process

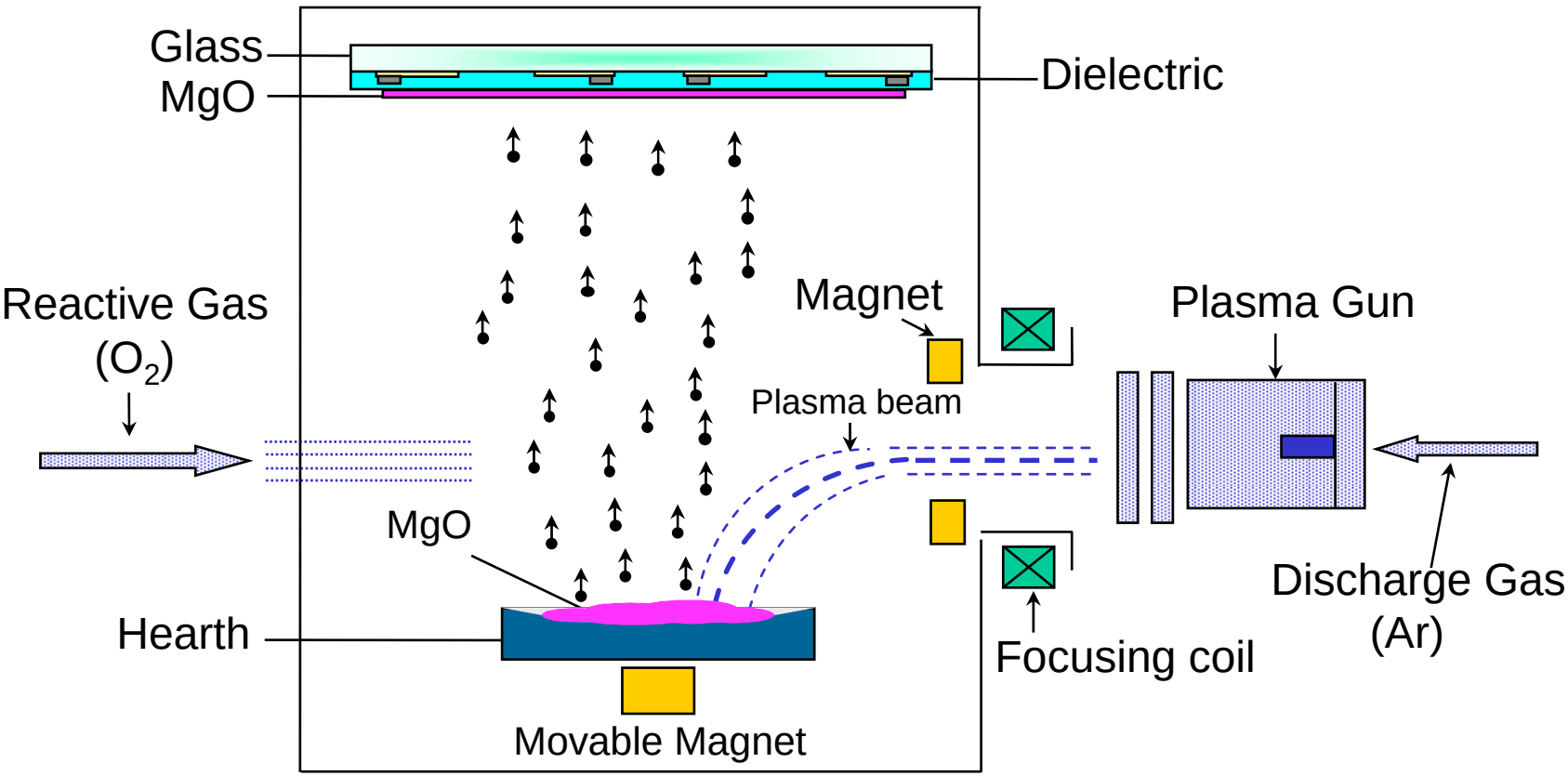
Photo paste



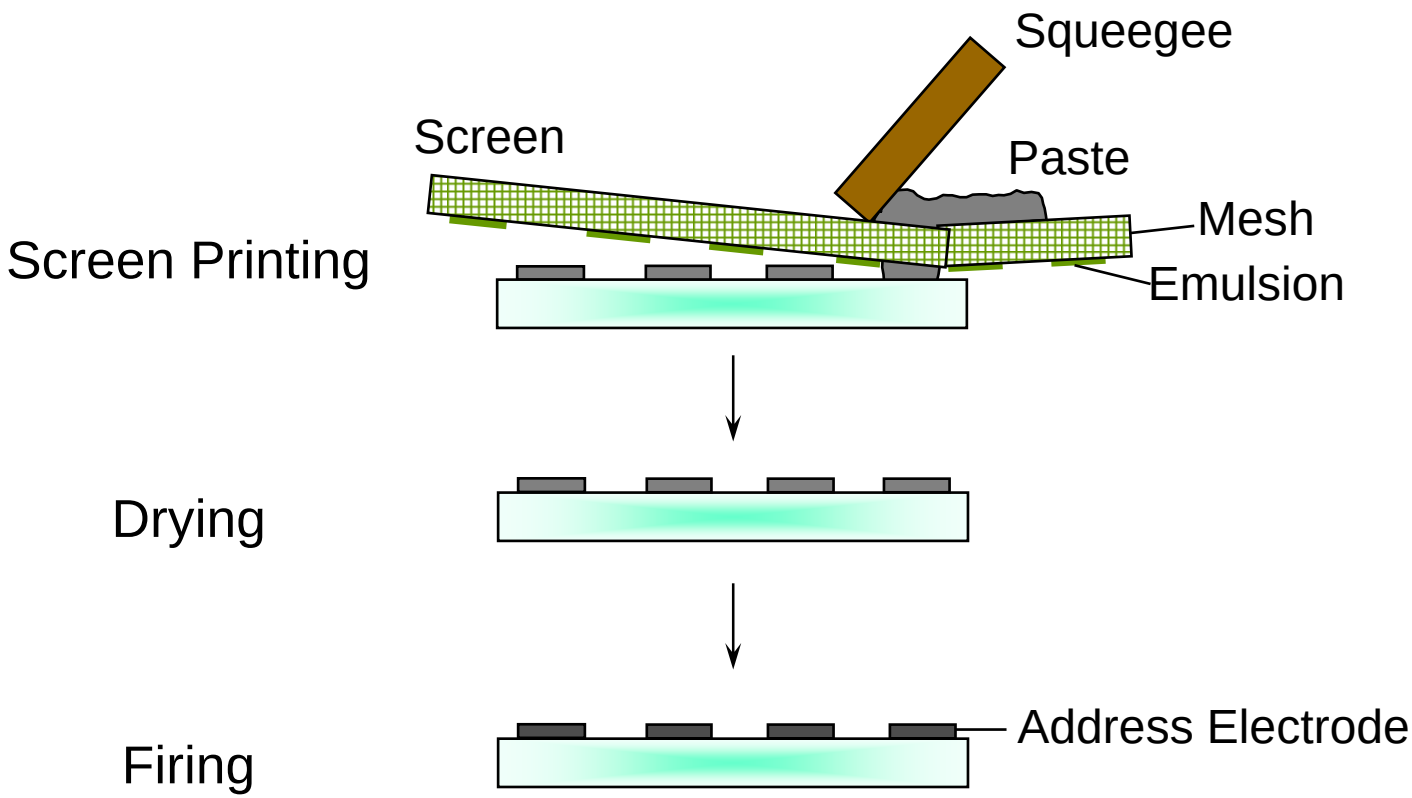
Dielectric Process



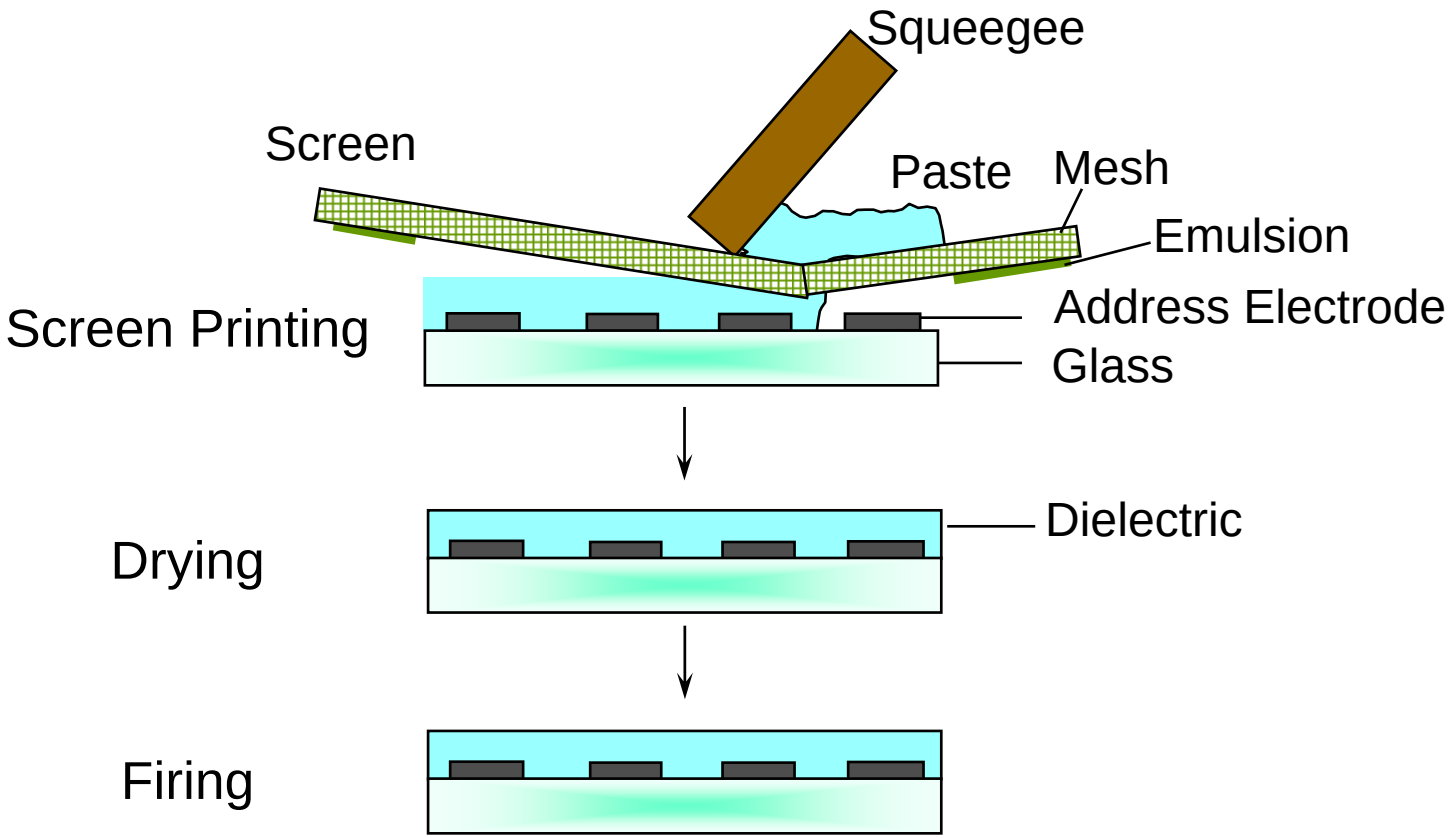
MgO Protection Layer



Address Electrode Process

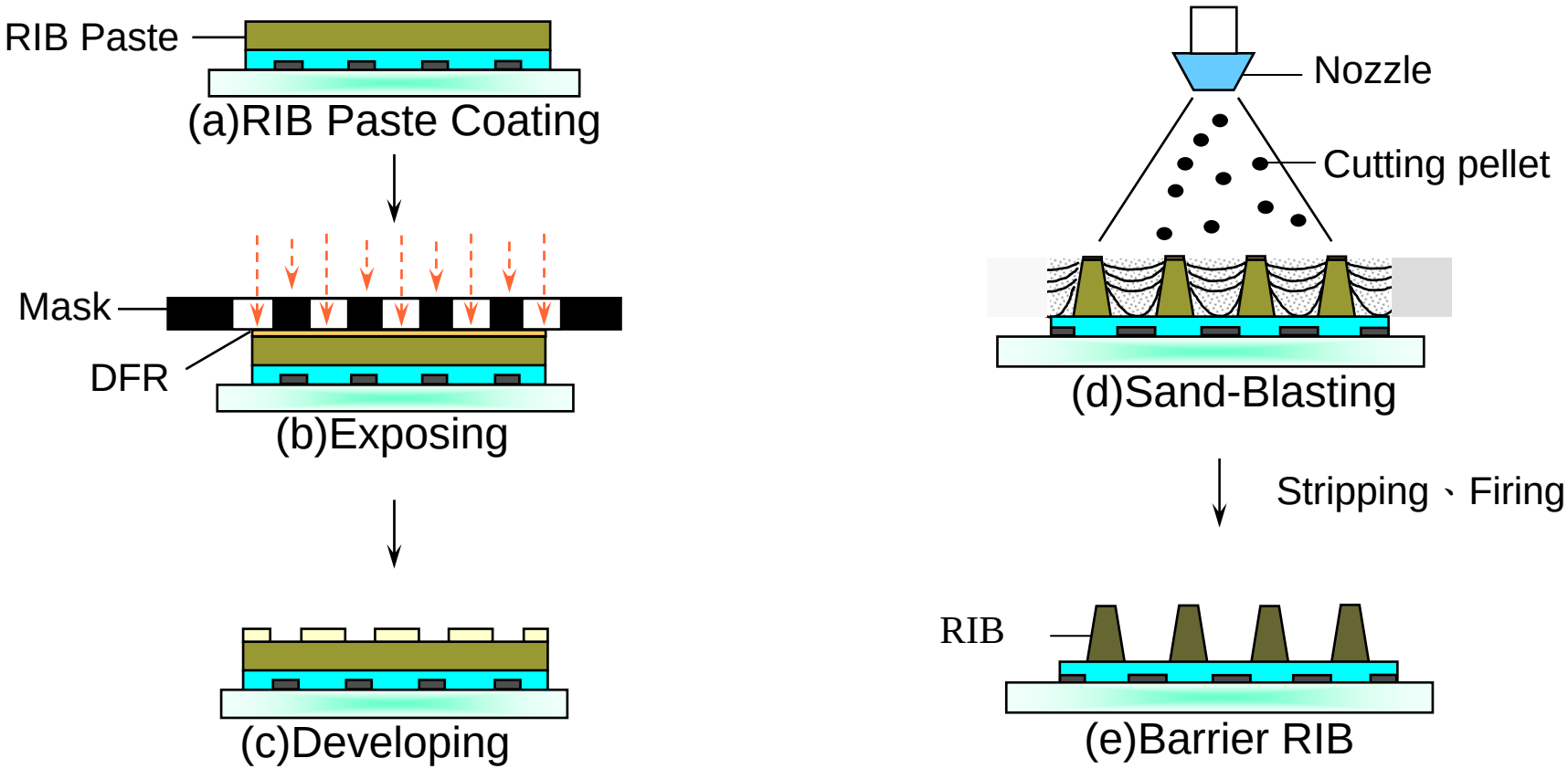


Dielectric Process



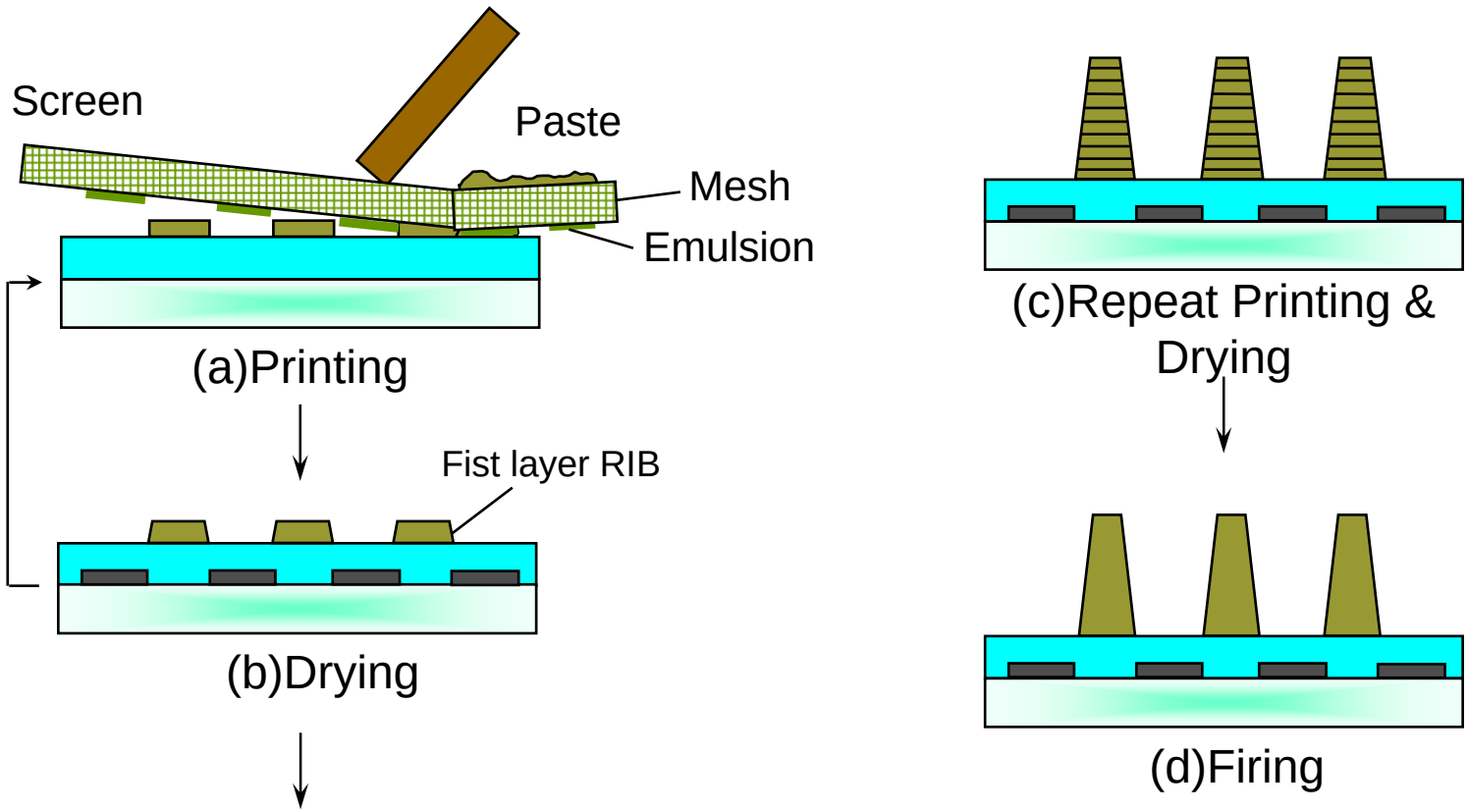
Rib Process

Sand-Blasting

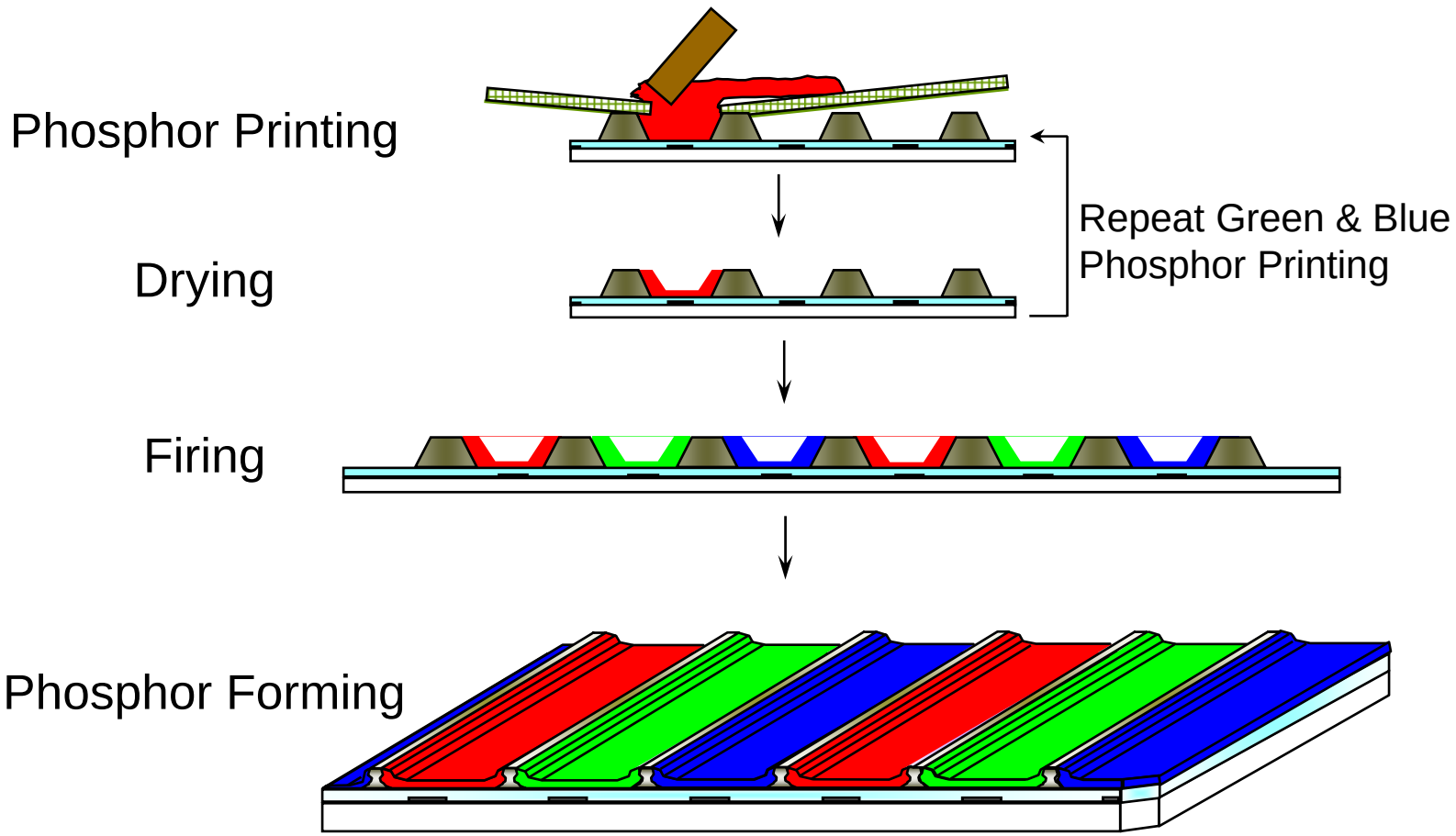


Rib Process

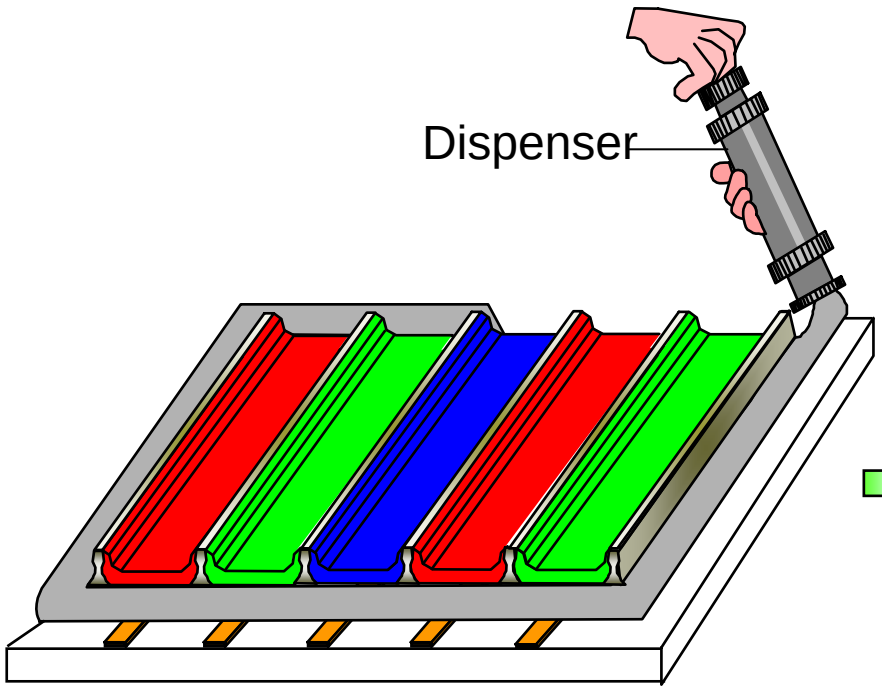
Screen Printing



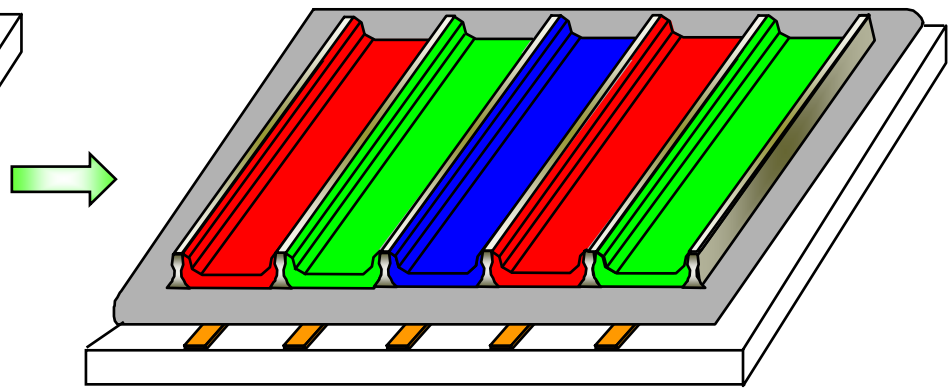
Phosphor Process



Sealing Process

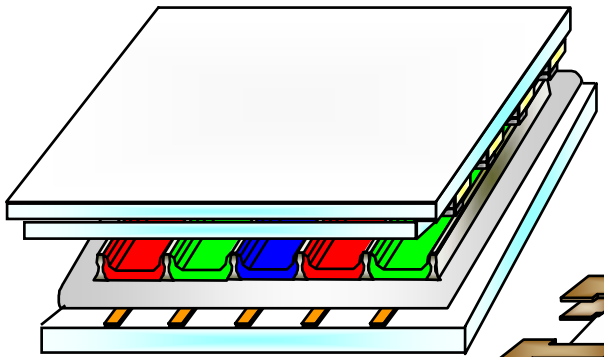


(a) Frit Dispensing

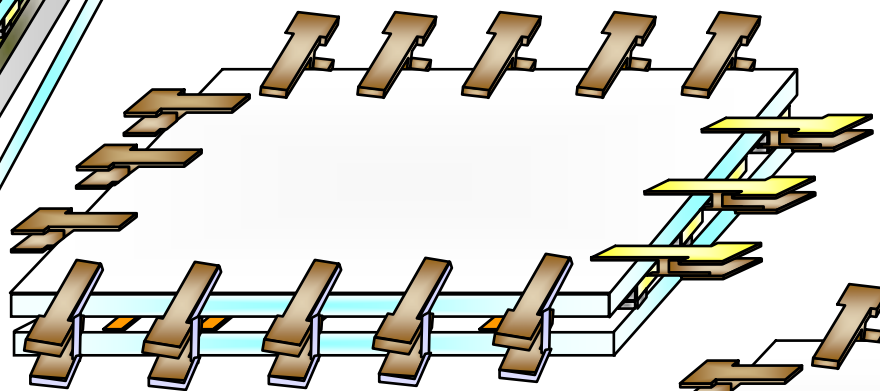


(b) Drying & Prebaking

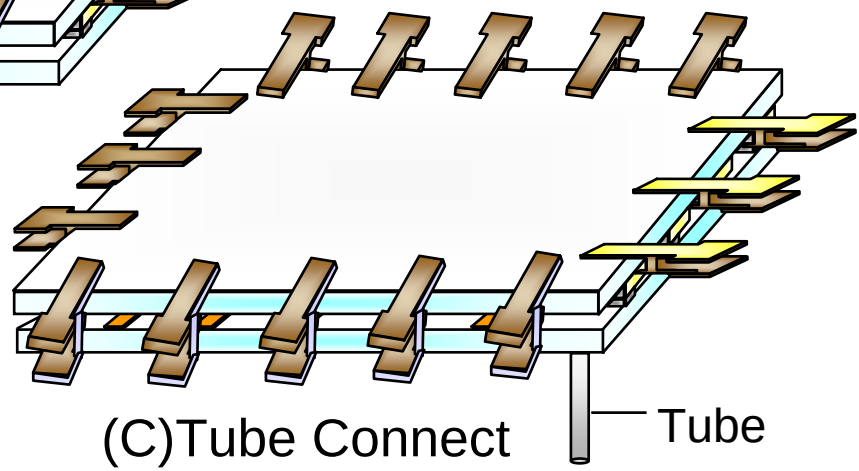
Panel Assembly



(a)Assembly

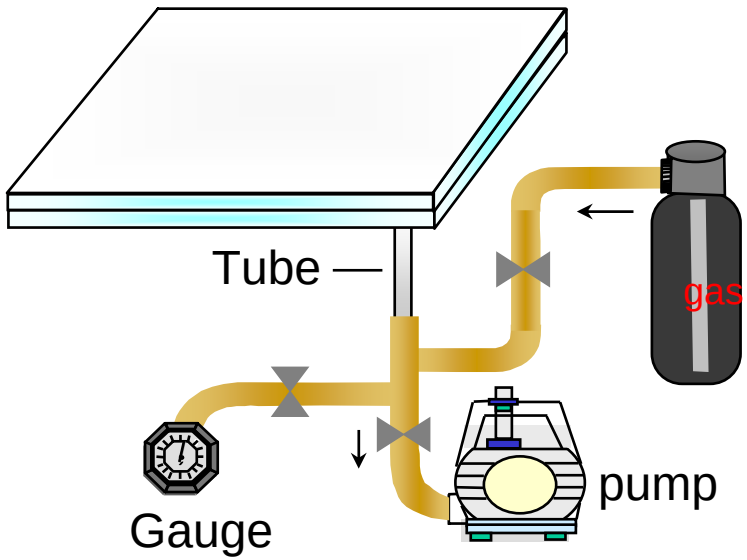


(b)Fixed Clip

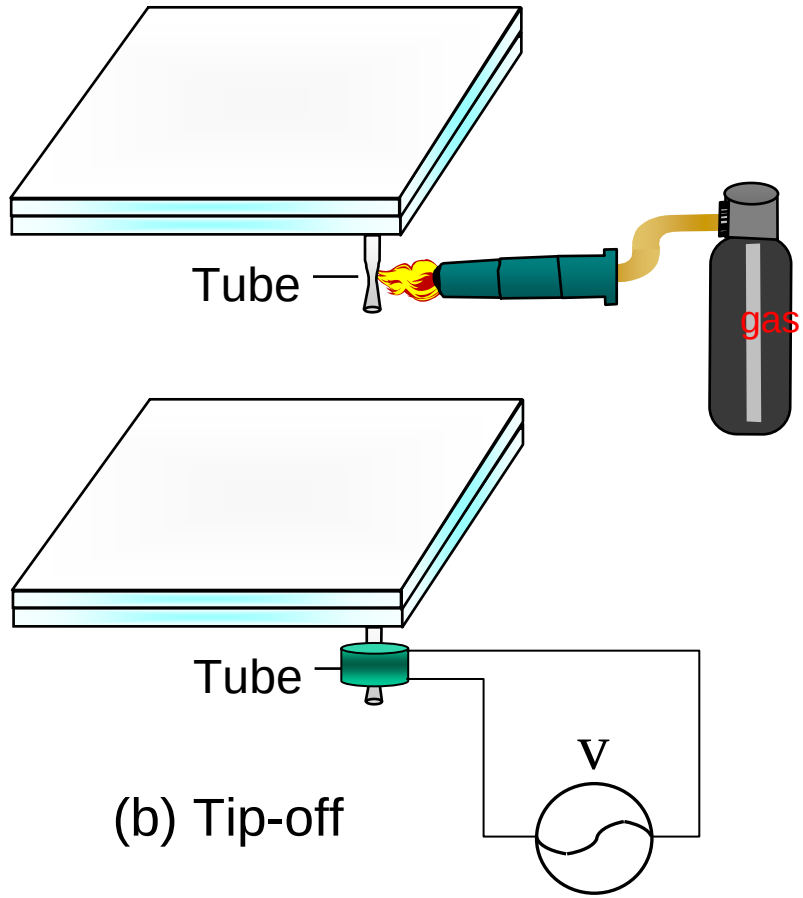


(C)Tube Connect

Sealing & Exhausting



(a) Exhausting & Gas Filling

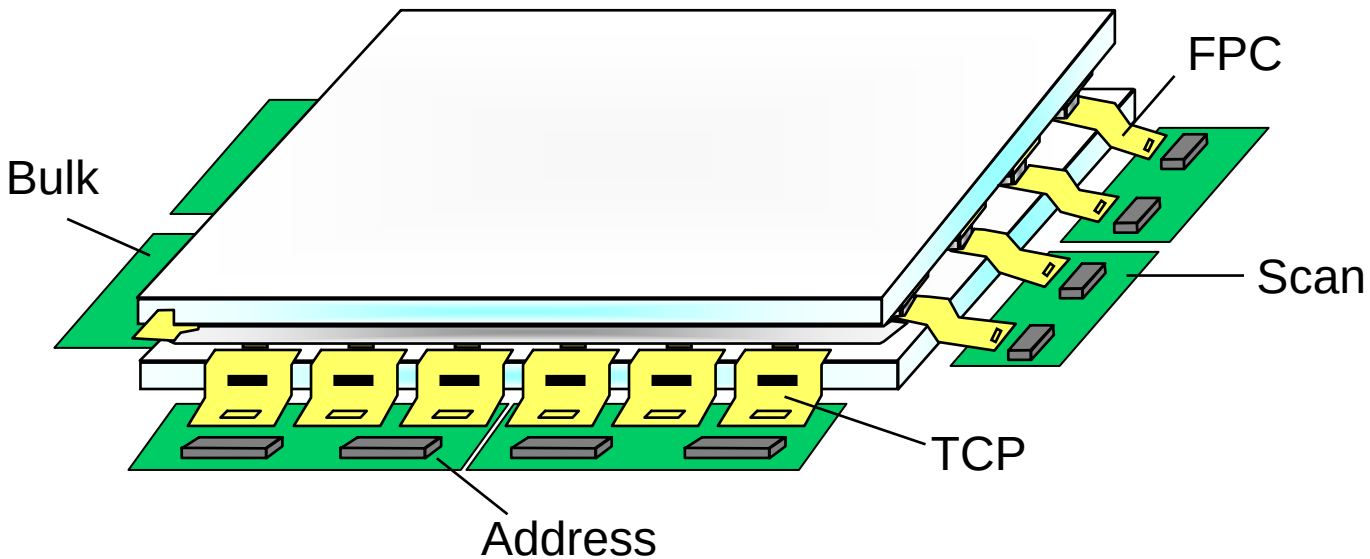


(b) Tip-off

Aging & Testing

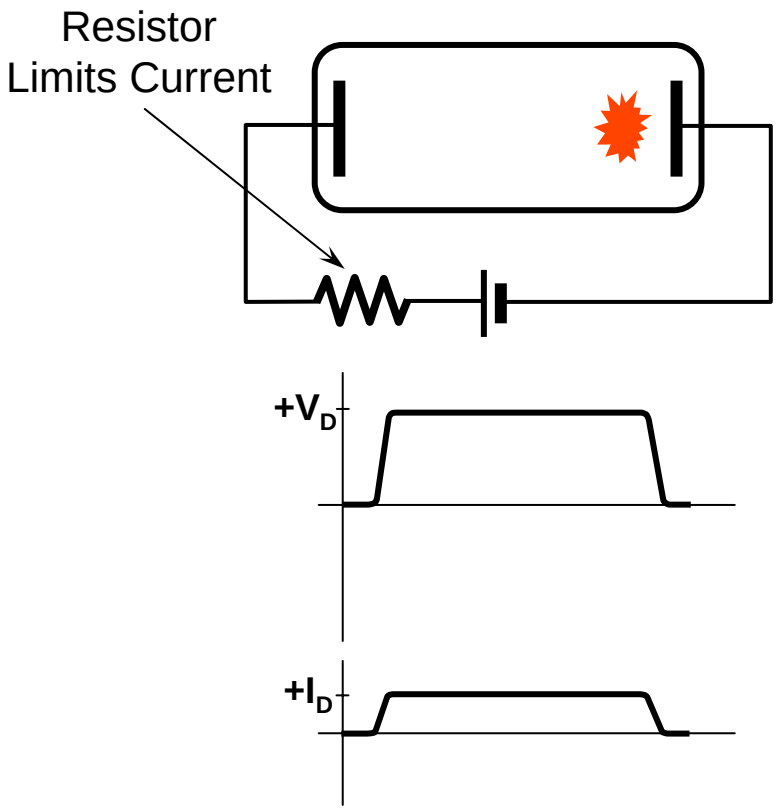
- Panel stabilizing
- Panel quality checking
- Performance checking
- Error discharge(OW & IW) checking

FPC Bonding

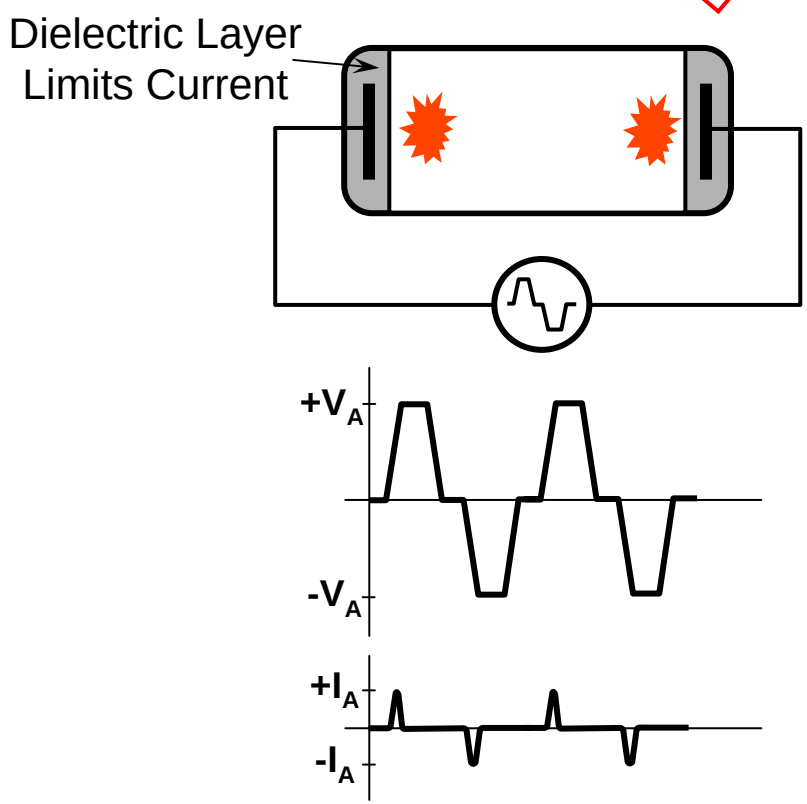


Driving Technology of PDP

DC & AC Discharge

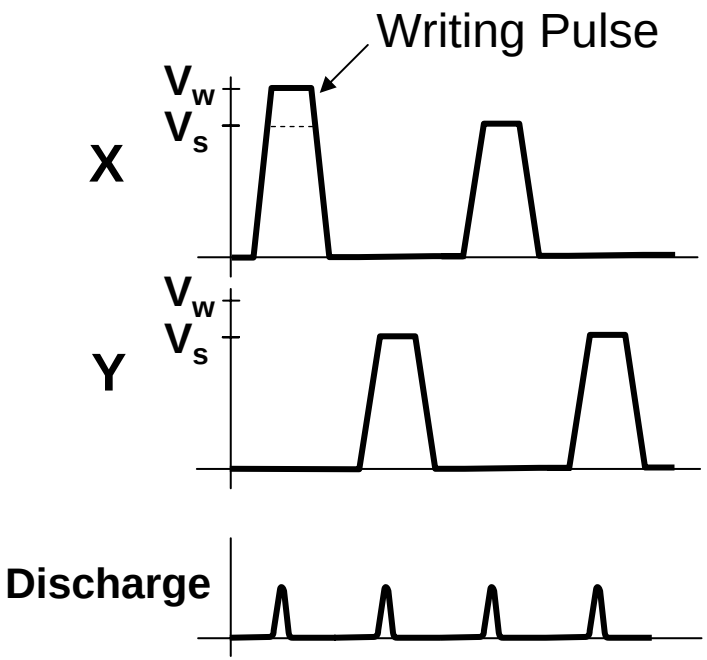


DC Discharge

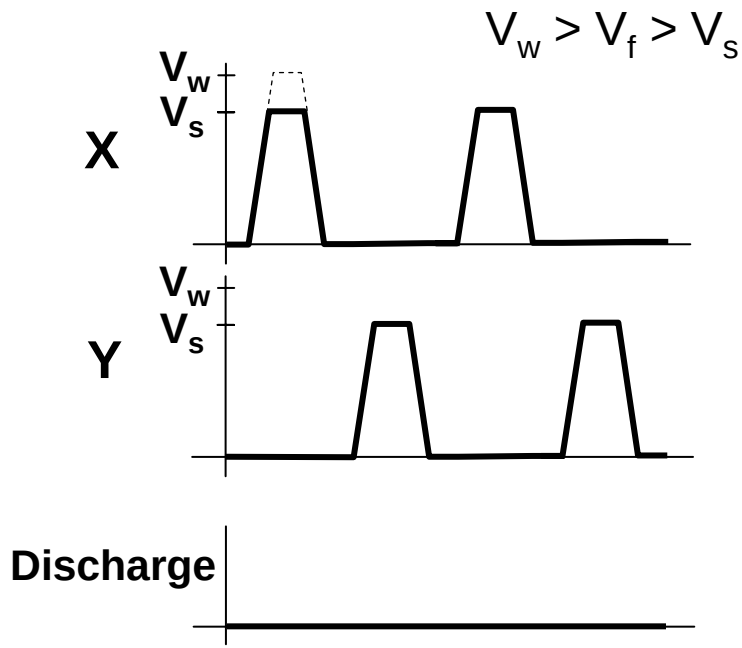


AC Discharge

Memory Effect

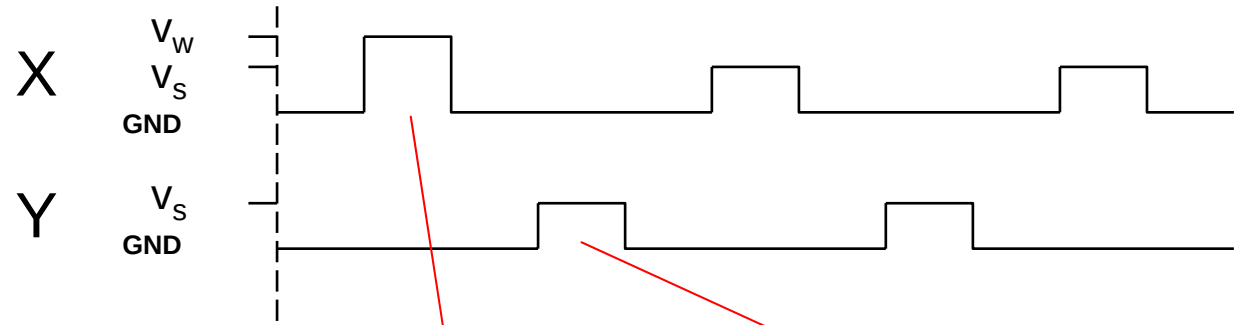


With Writing Pulse – ON state



Without Writing Pulse – OFF state

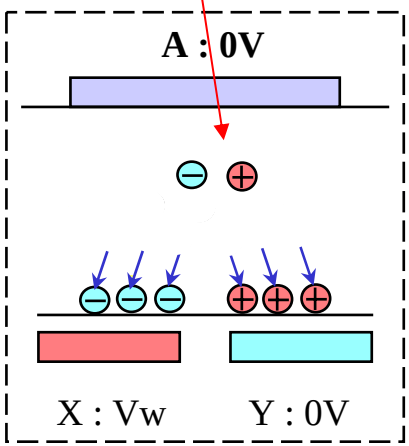
Wall Charge

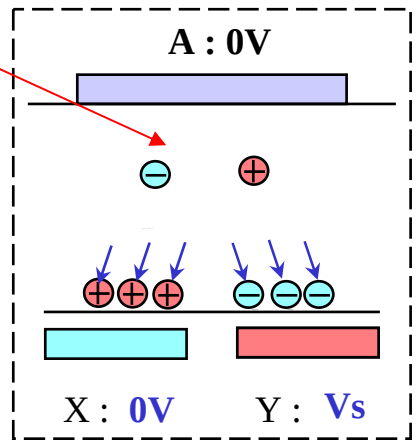


V_f : Firing Voltage

V_w : Writing Voltage

V_s : Sustain Voltage





$V_w > V_f$

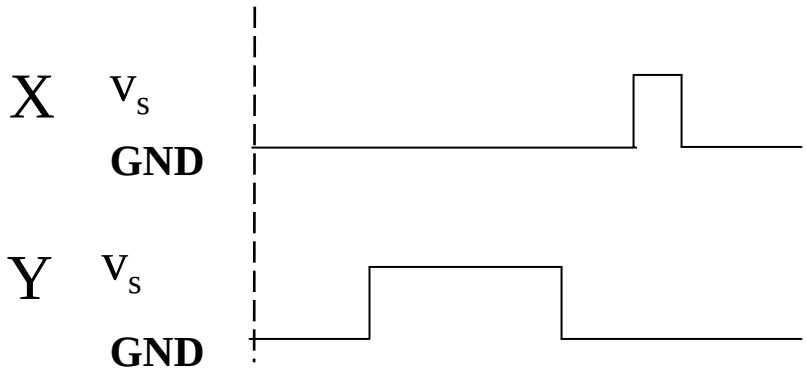
$\Longrightarrow$ Priming Discharge

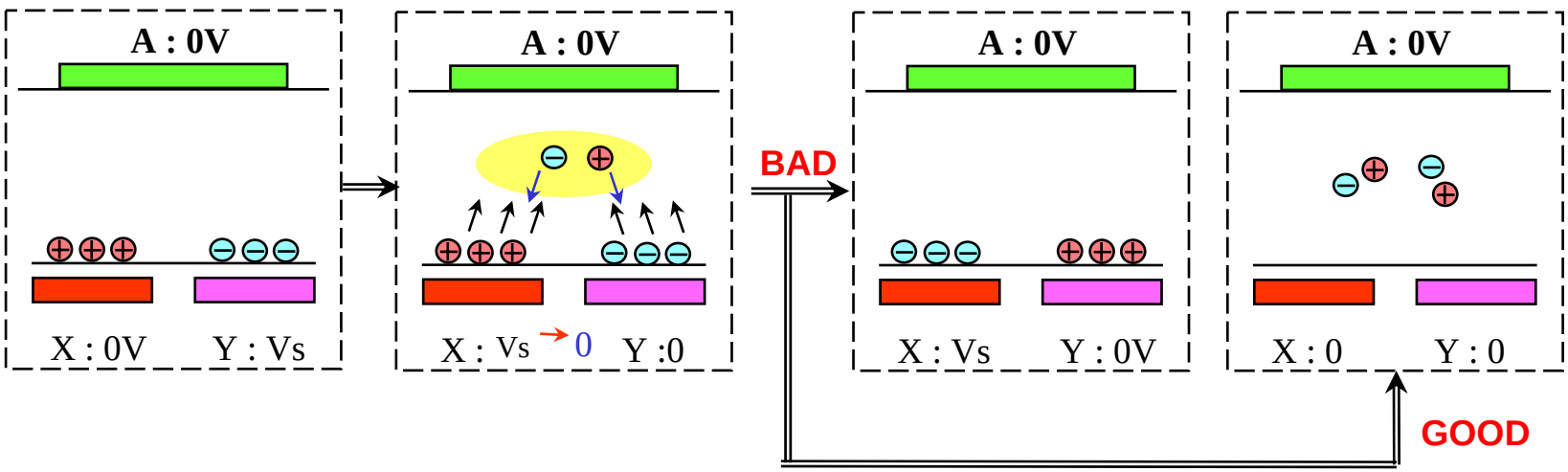
$V_s < V_f$

$\Rightarrow$ $V_s + V_{wall} > V_f$

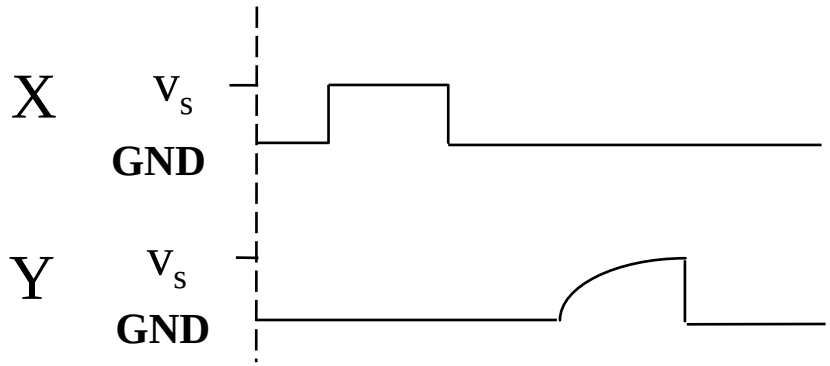
$\Rightarrow$ Discharge

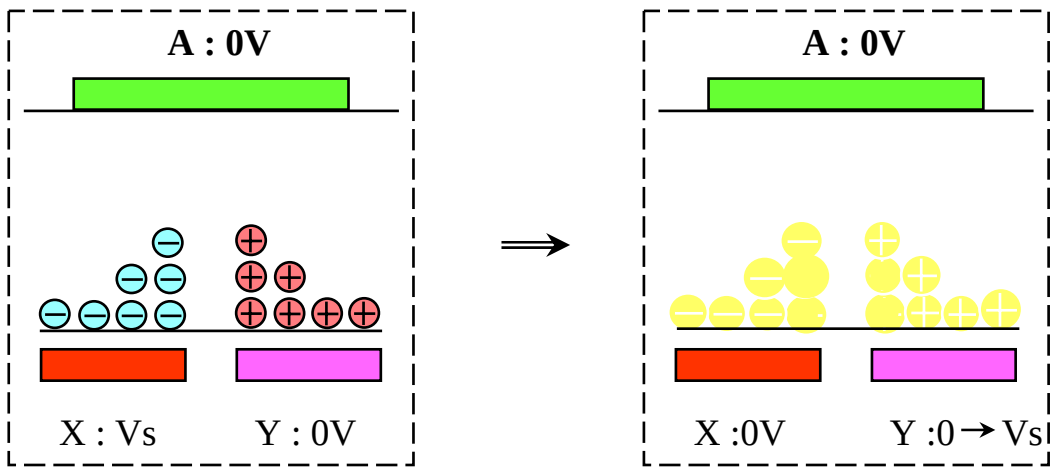
Narrow Erase Pulse



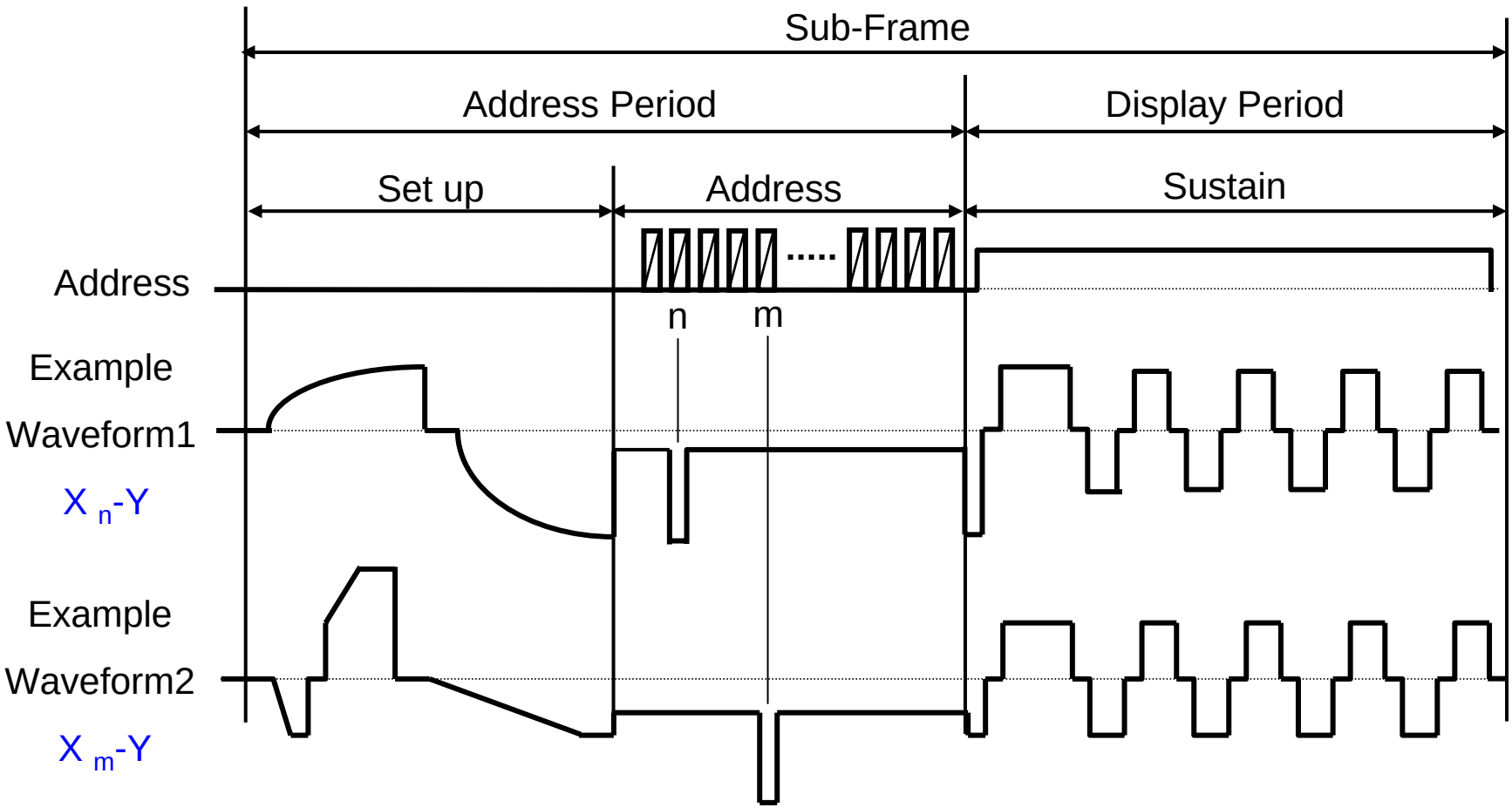


Exponential Erase Pulse

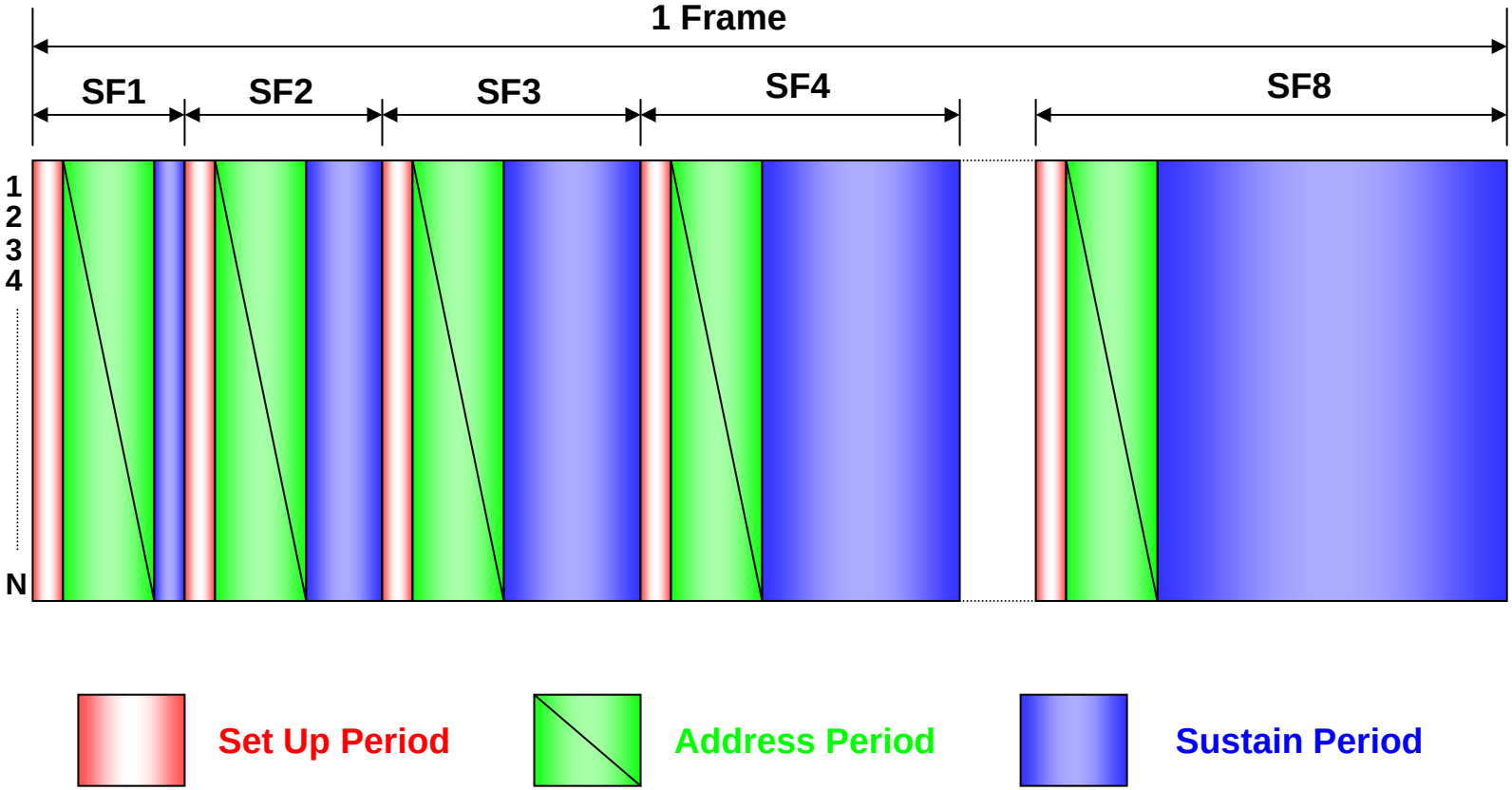




Driving Waveform of ADS

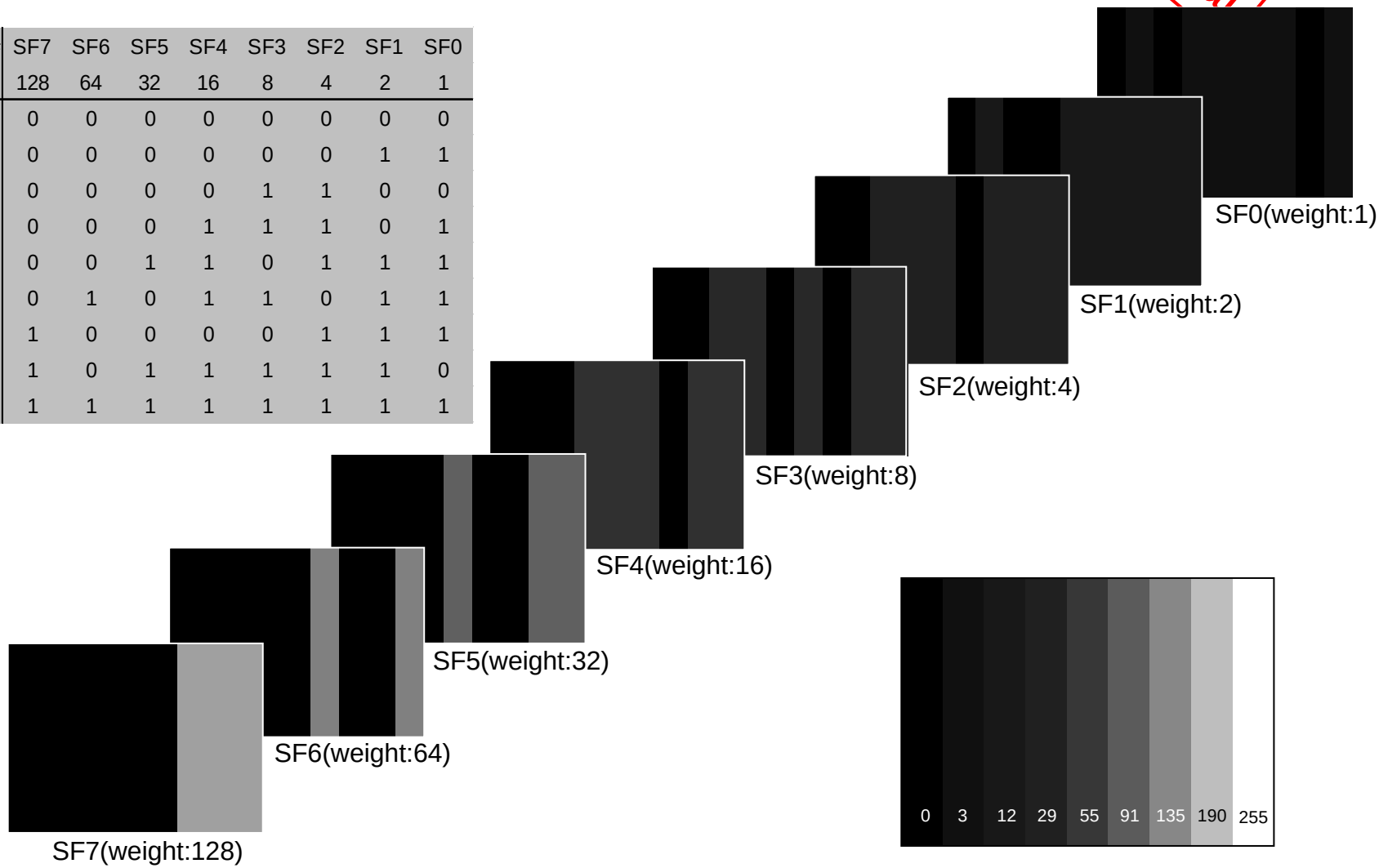


Gray Level by ADS



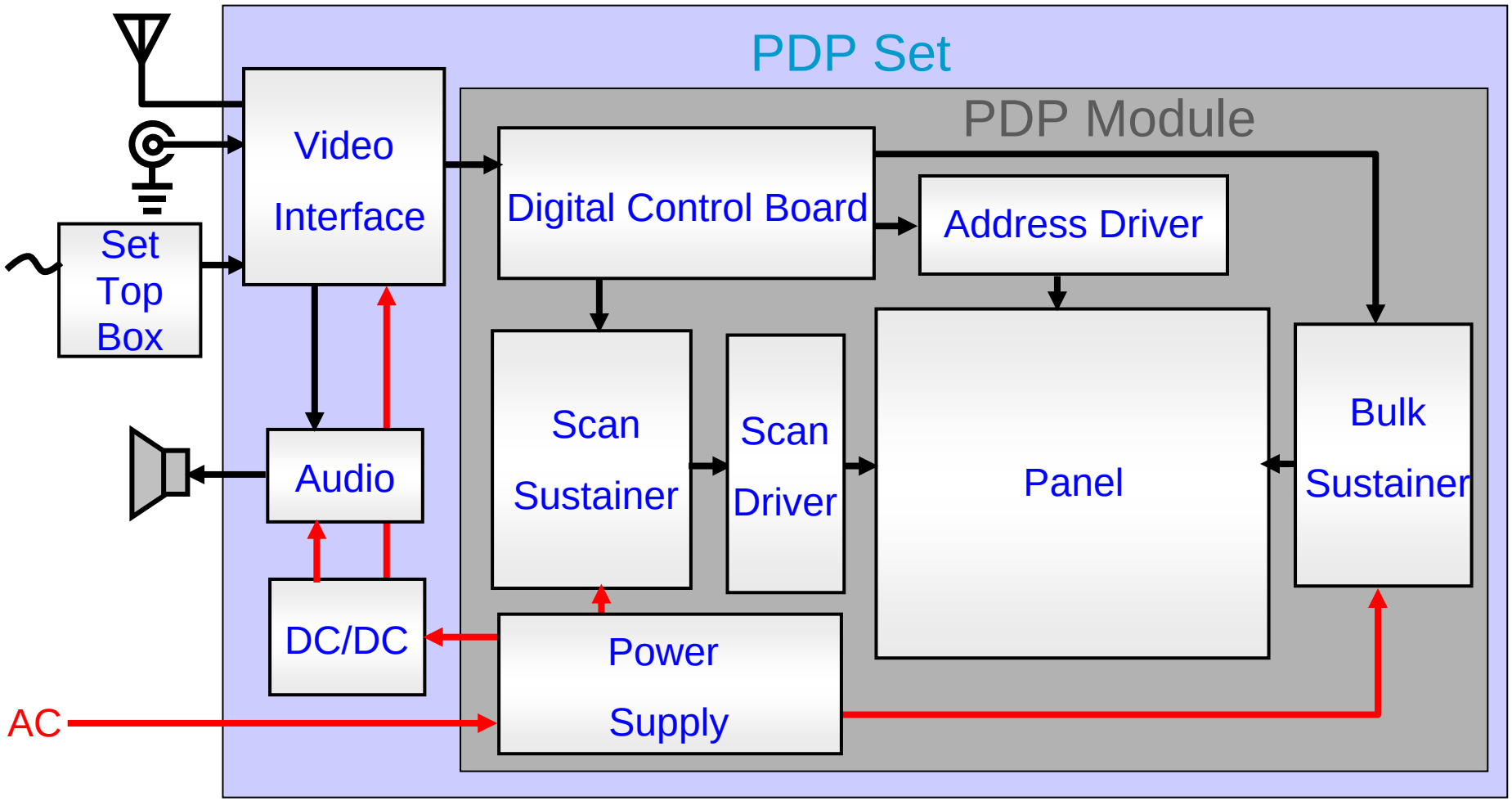
Integration of Weighted Grey-Level

Sub-Field #	SF7	SF6	SF5	SF4	SF3	SF2	SF1	SF0
Weight	128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	1	1
12	0	0	0	0	1	1	0	0
29	0	0	0	1	1	1	0	1
55	0	0	1	1	0	1	1	1
91	0	1	0	1	1	0	1	1
135	1	0	0	0	0	1	1	1
190	1	0	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

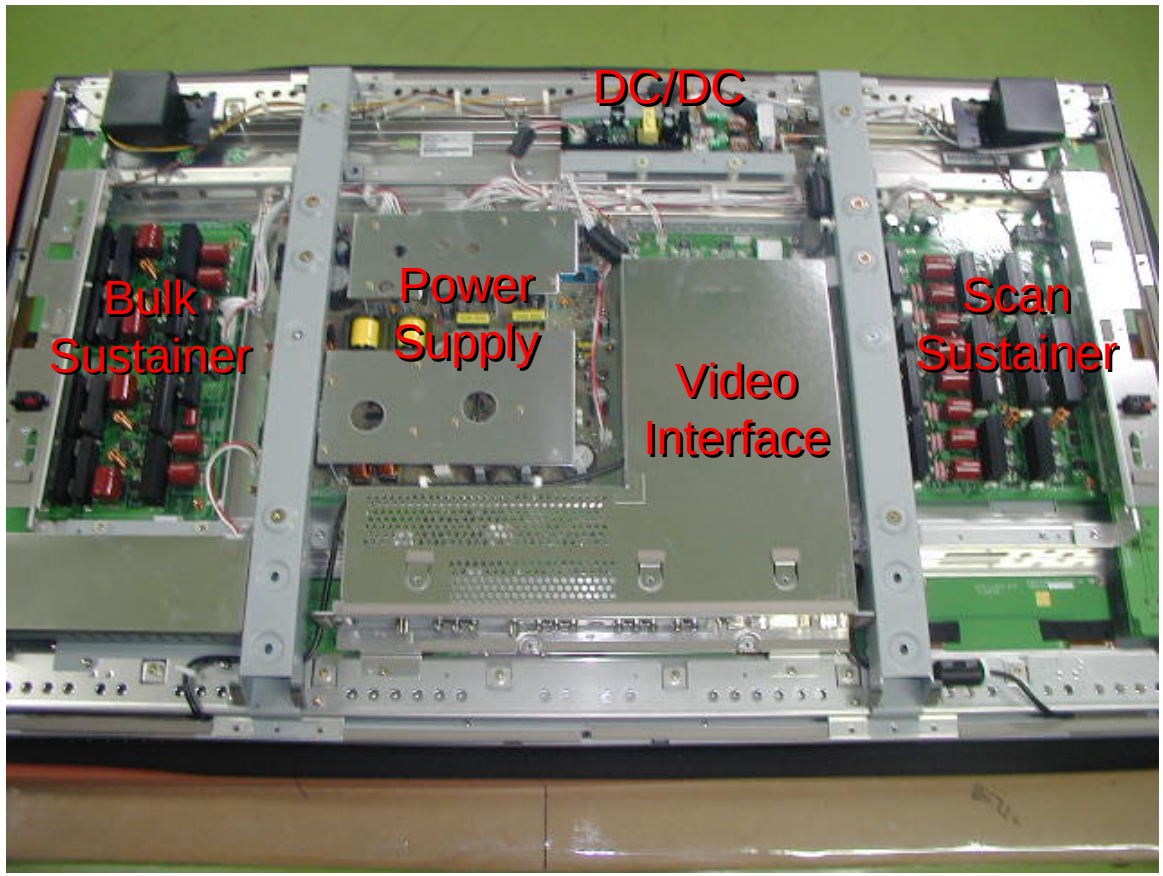


Electronics System of PDP

Block Diagram of PDP TV Set

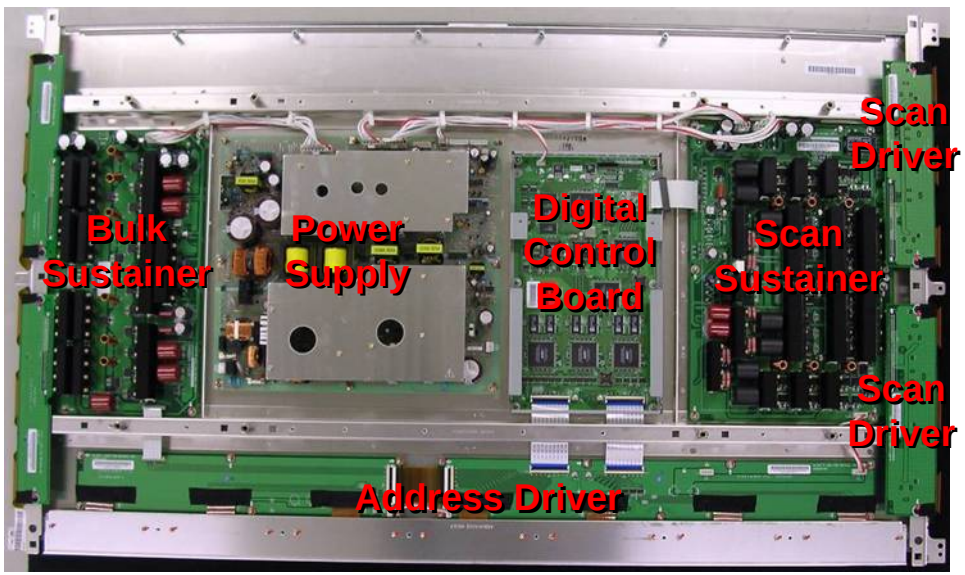


Inside View of PDP TV Set

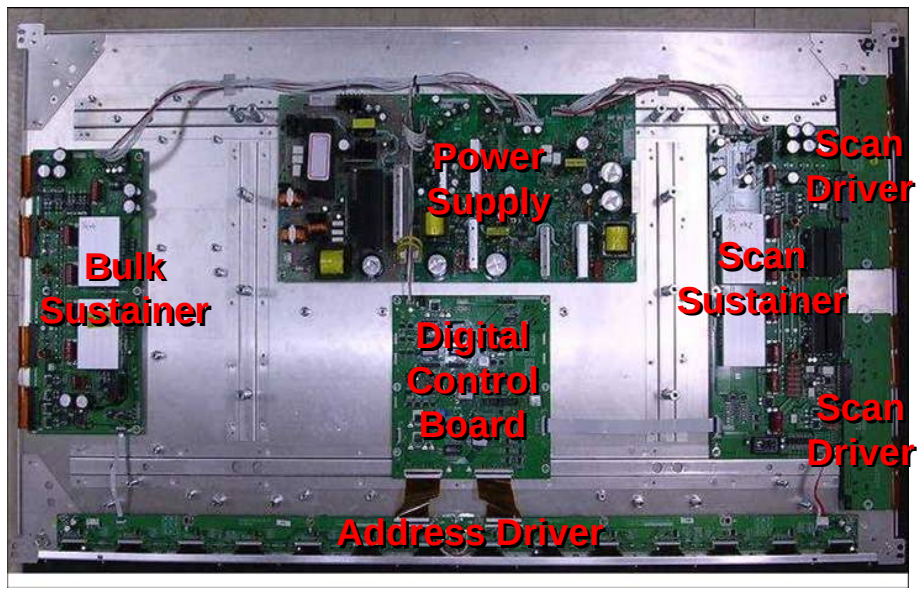


CPT PDP Set
Model:46WV1 (2002.10.~)

Electronics Outlook of Commercial PDP VGA Module

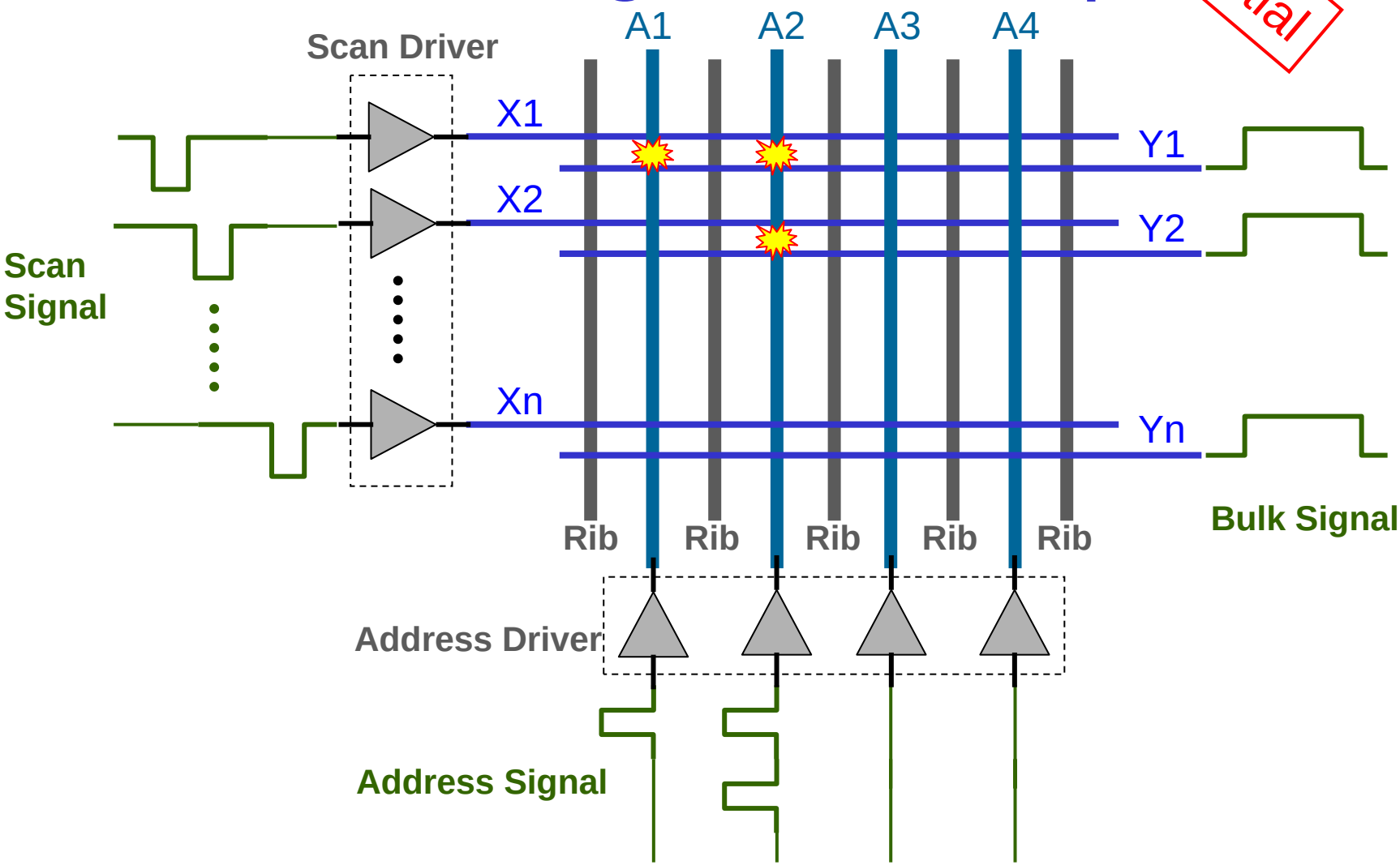


CPT 46WVA
(2002.10.~)

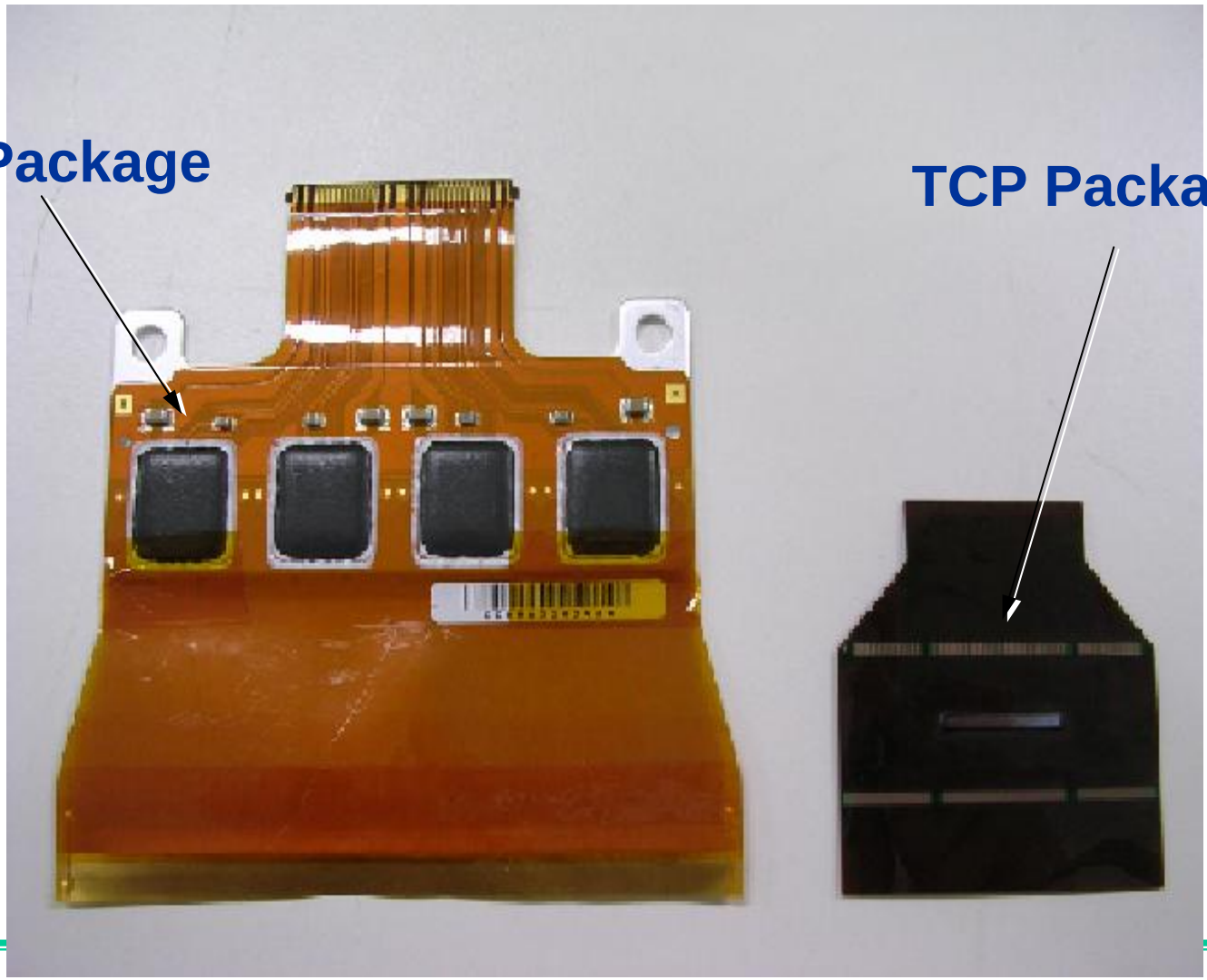


CPT 46WVC
(2004.07.~)

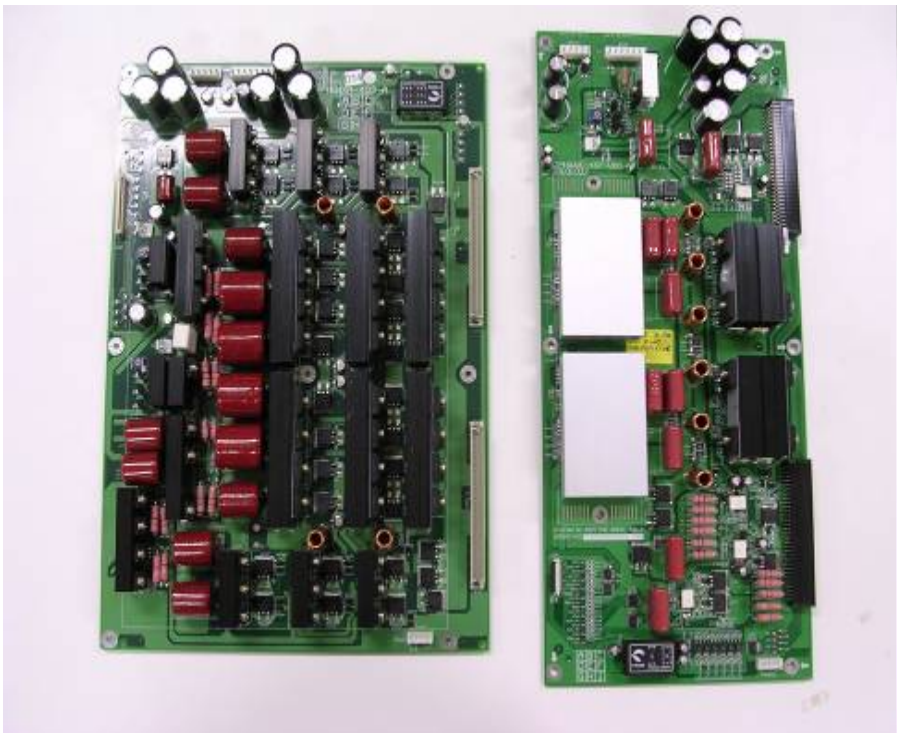
Scanning Technique

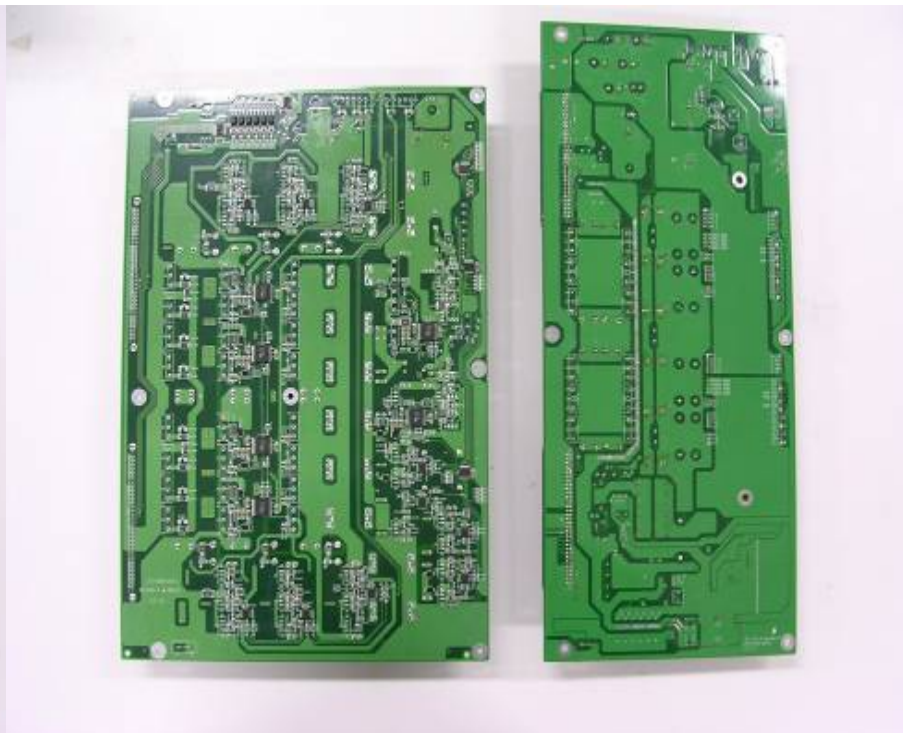


The Address Driver IC



Sustainer Outlook

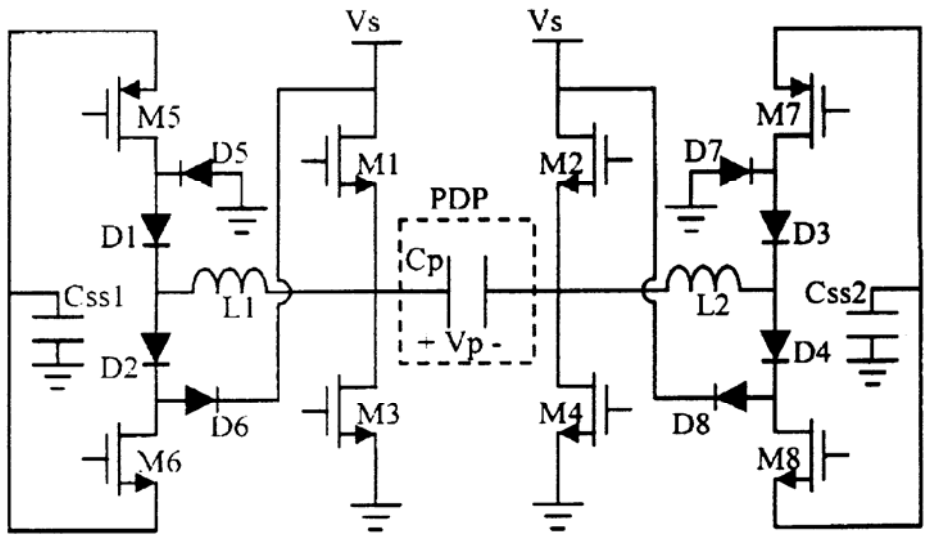




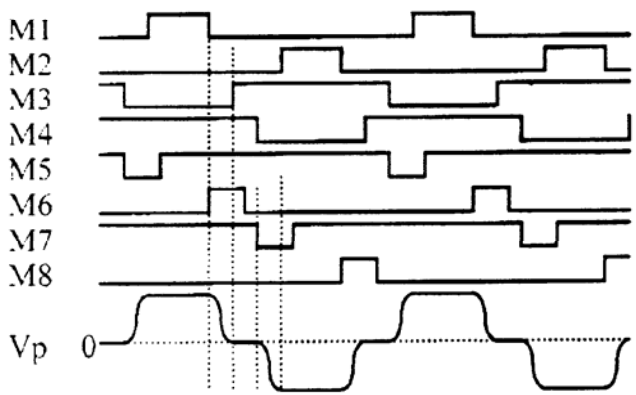
Modulized Switching Element

Single-Side SMT

Spirits of Sustainer



(a)



(b)

Function:

- Providing Driving Waveform
- Energy Recovery

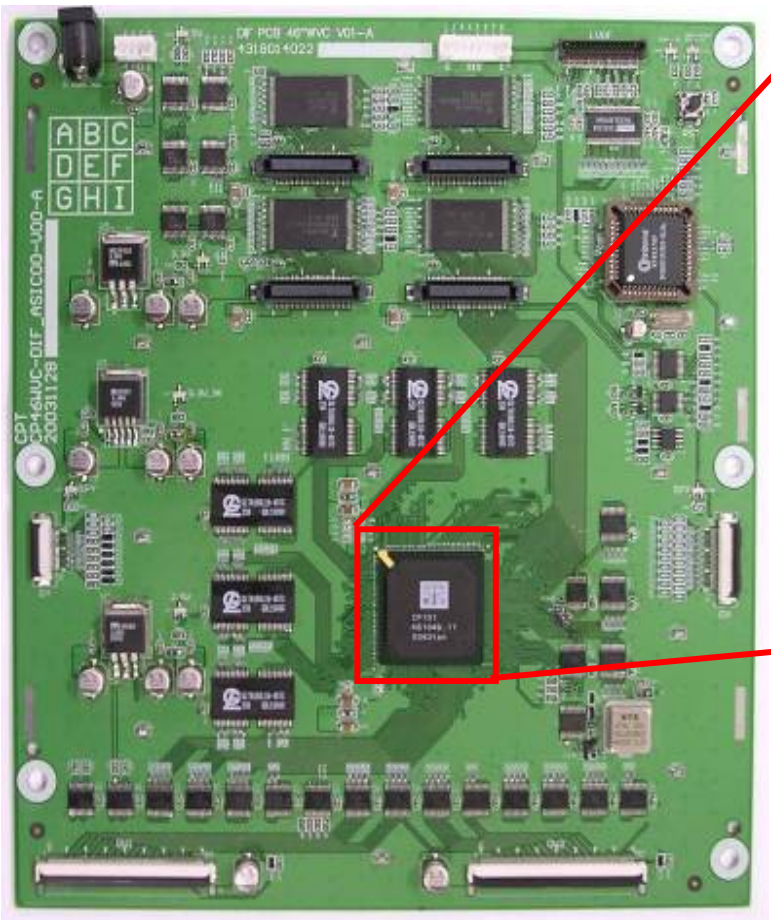
Power Electronics:

- Power Device
- MOS Driver
- Level Shifter
- Soft Switching

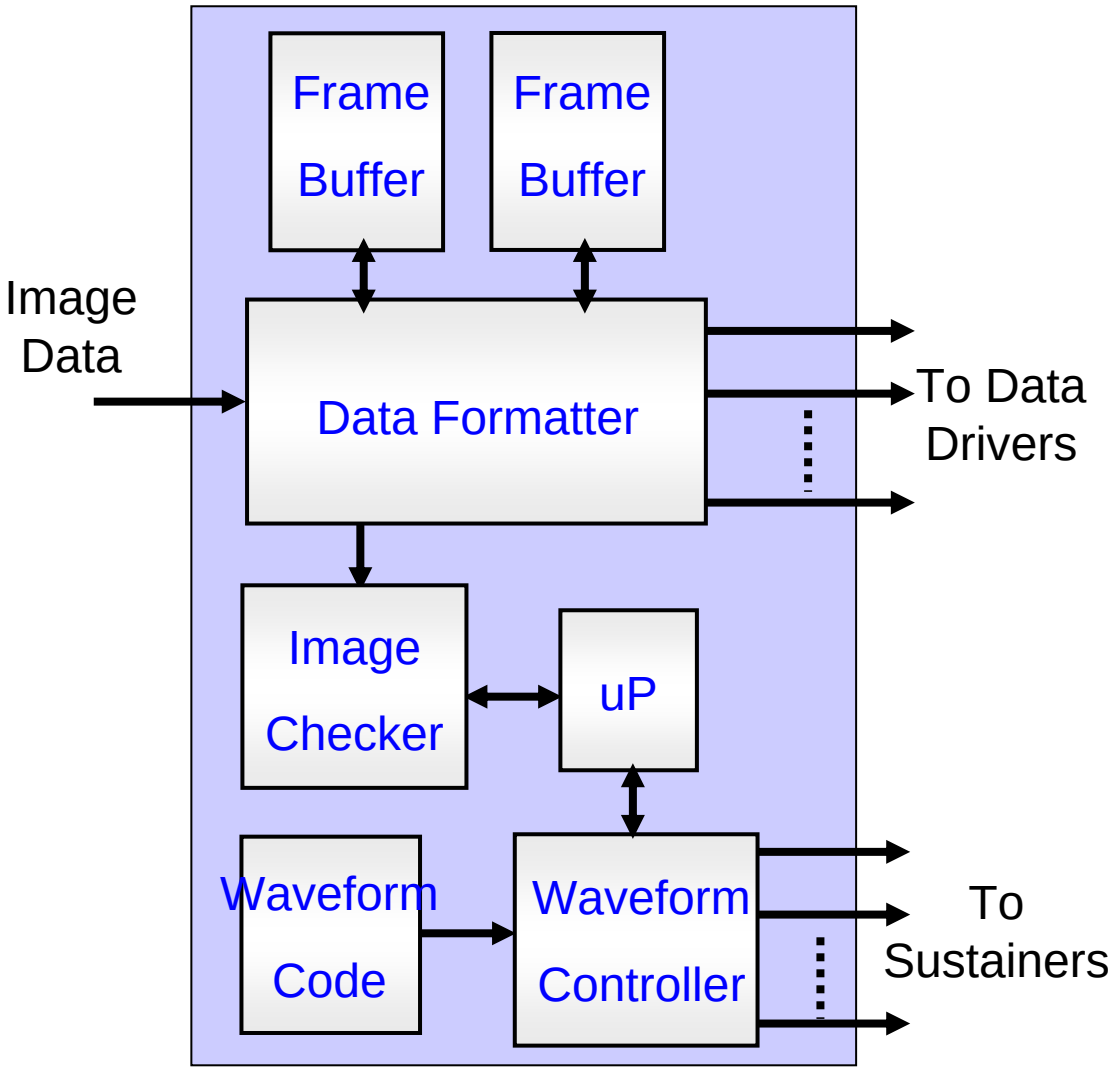
Thermal Stress

Electrical Stress

Digital Control Board and ASIC



Spirits of Digital Control Board



Function:

- Image Processing
- Control Signal Generation
- Automatic Power Control

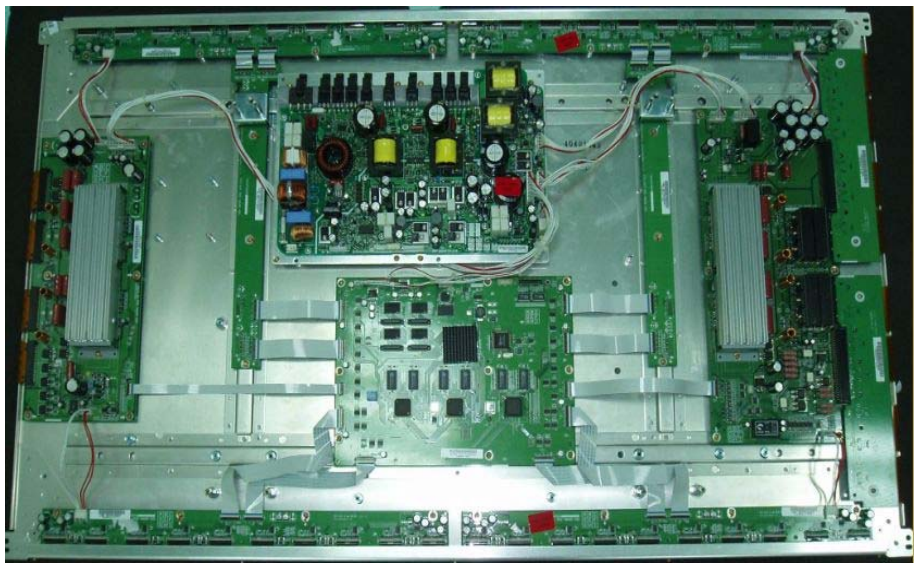
Digital Electronics:

- VHDL
- FPGA Design
- ASIC
- Microprocessor

Performance Improvement

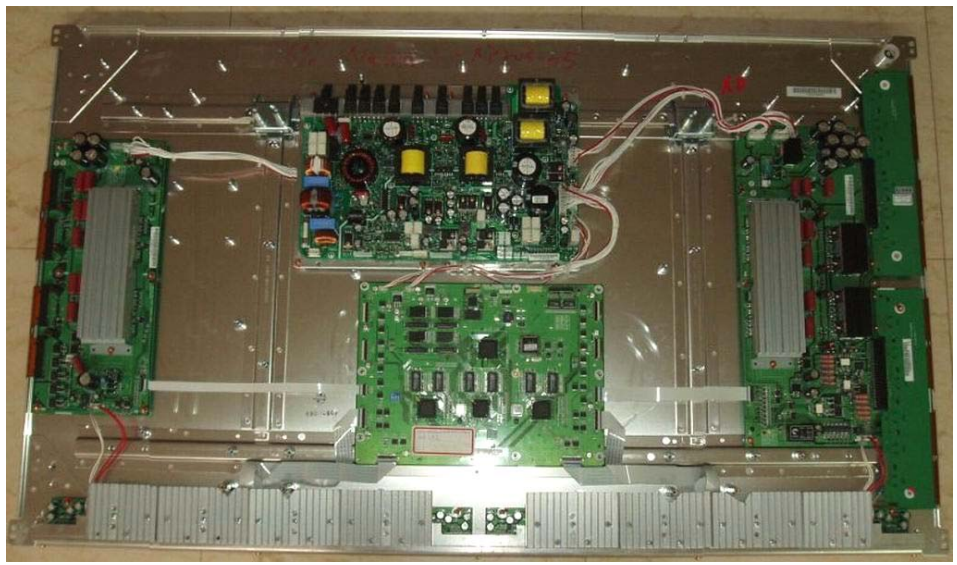
Single Scan

Electronics Outlook of Commercial PDP XGA Module



CPT 46WXB
(2004.12.~)

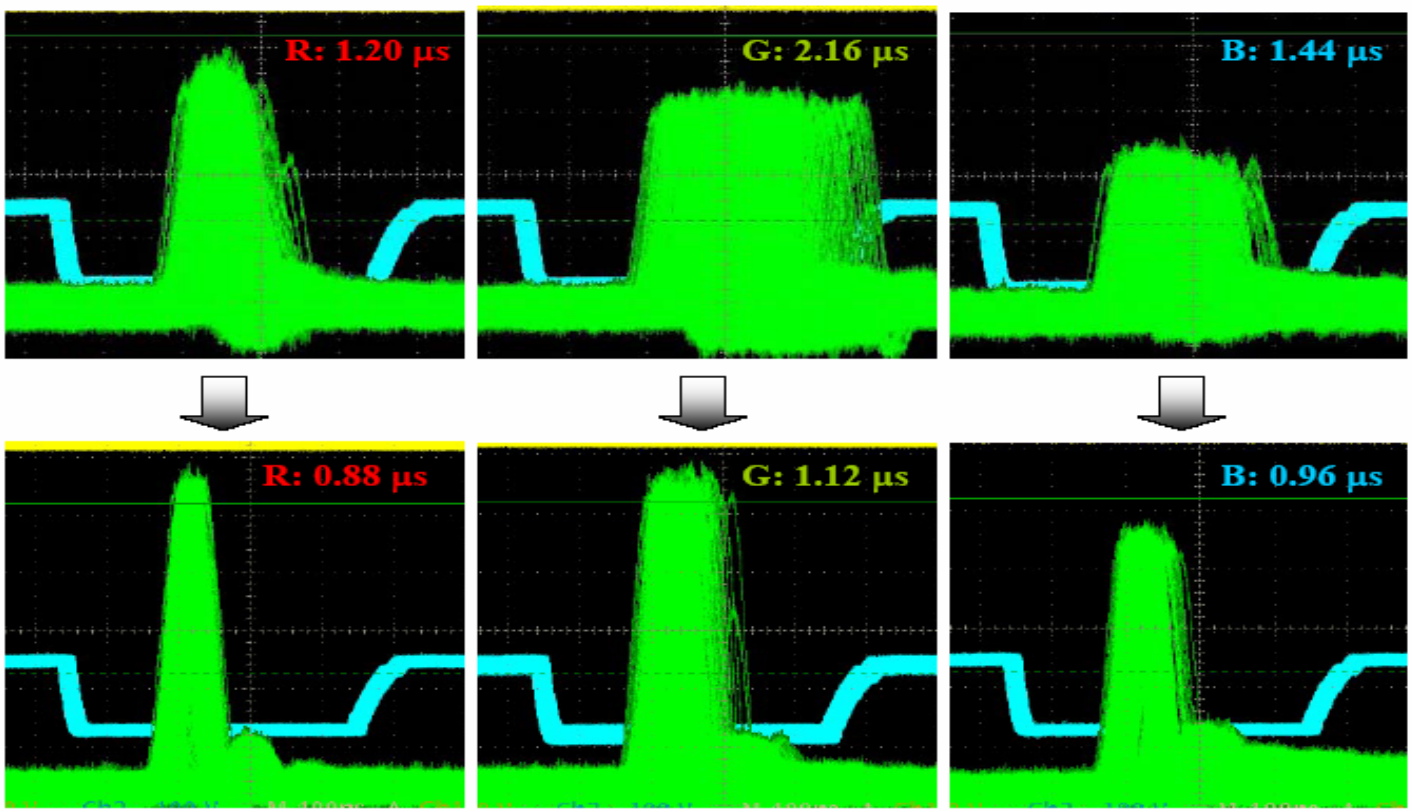
Dual Scan



CPT 46WXD
(2005.05.~)

Single Scan

High Speed Addressing

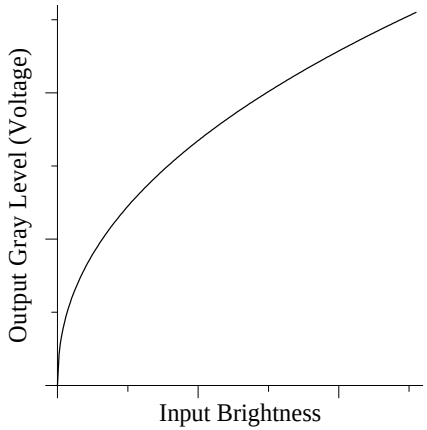


- High speed addressing brought single scan capability and cost reduction.

Nature Gray Level

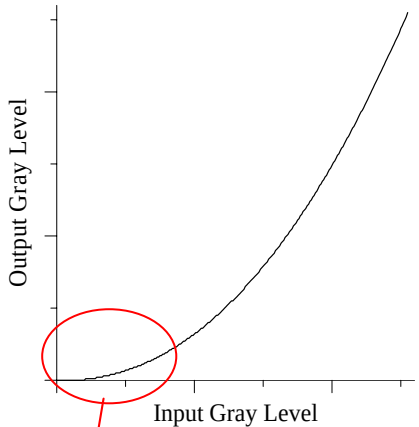
Gray Level Contouring

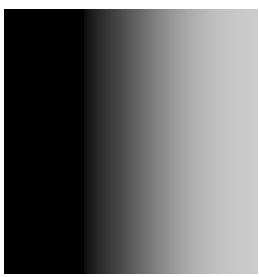
Video Signal Characteristics



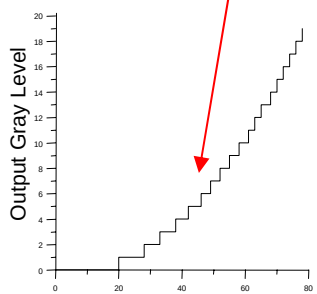
×

Display Characteristics

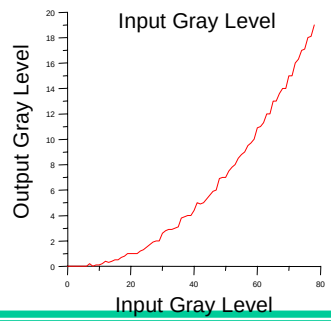


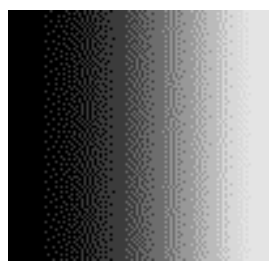


Conventional
8-bit Gamma
Look-Up Table



CPT Proprietary
De-Contouring
Gamma Correction



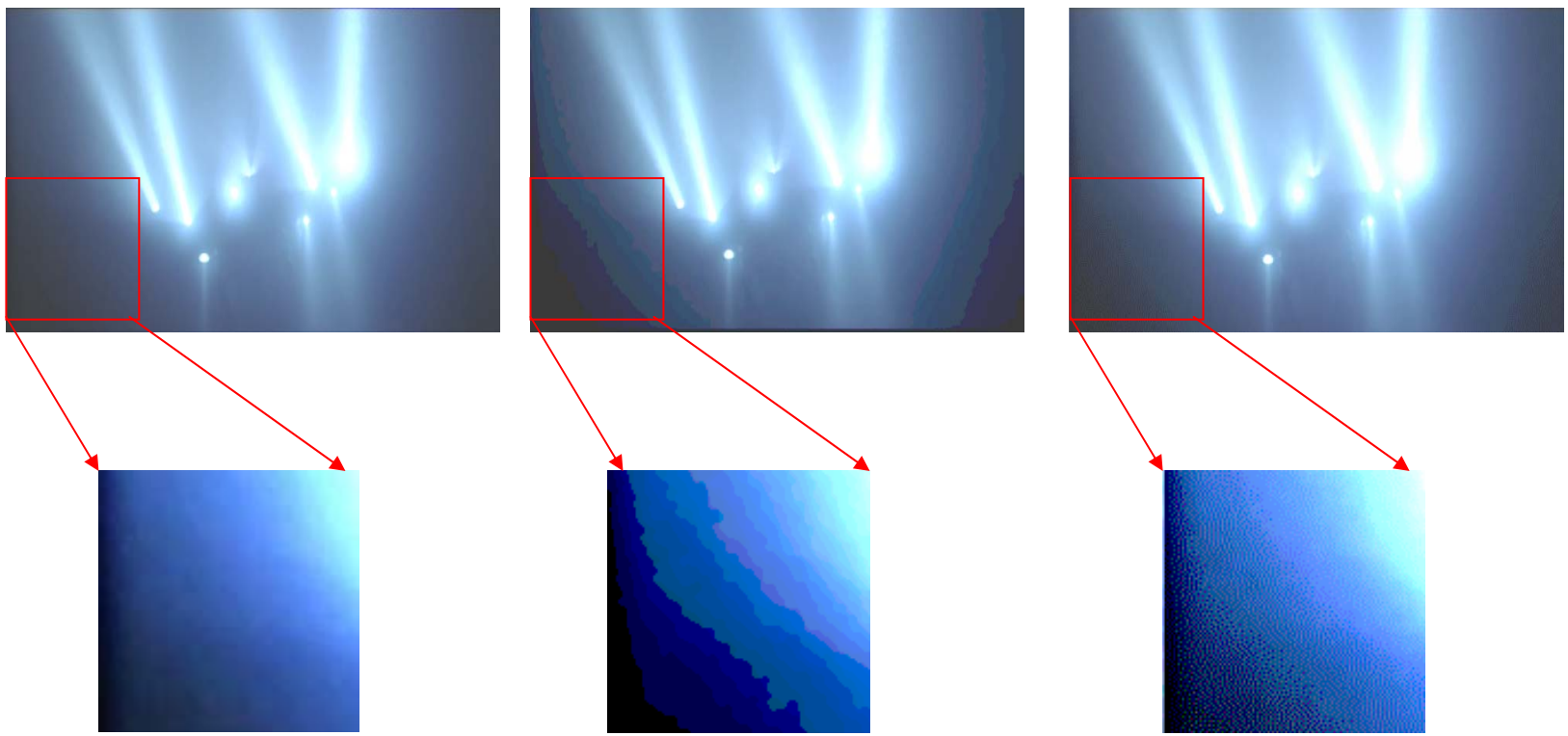


De-Contouring Technology

Original
CRT Image

Gamma Corrected
by Conventional Way

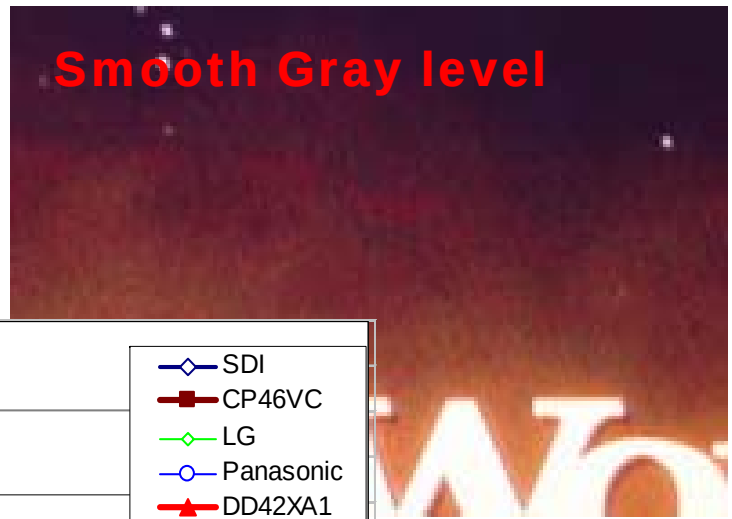
Gamma Corrected by CPT
De-contouring Technology

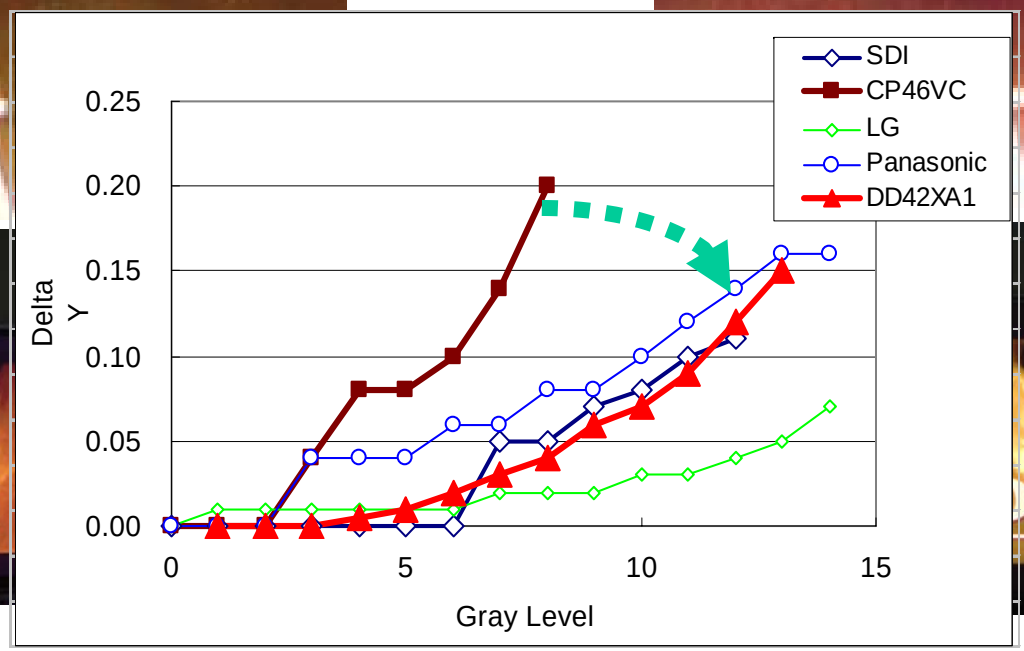


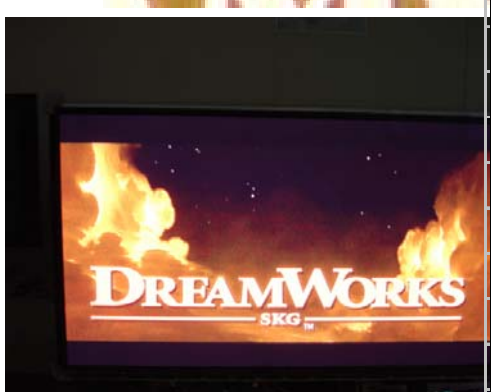
Low Gray Level Performance

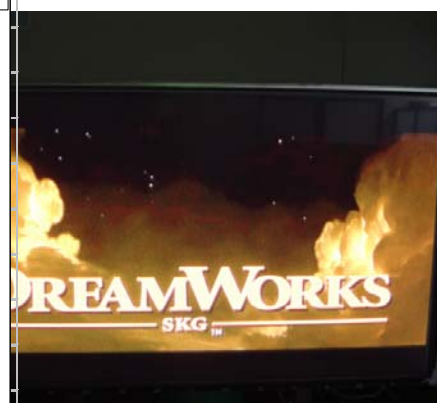
CP46VC

DD42XA1



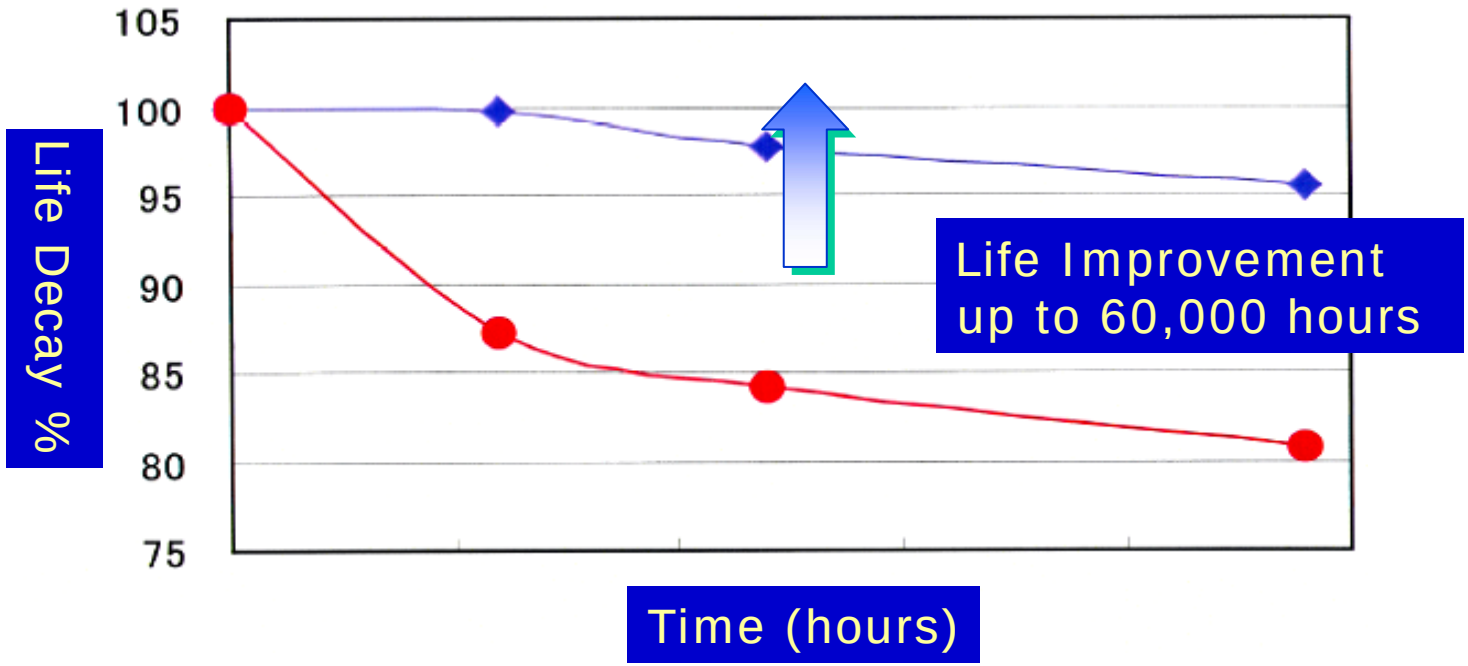






Life Time Improvement

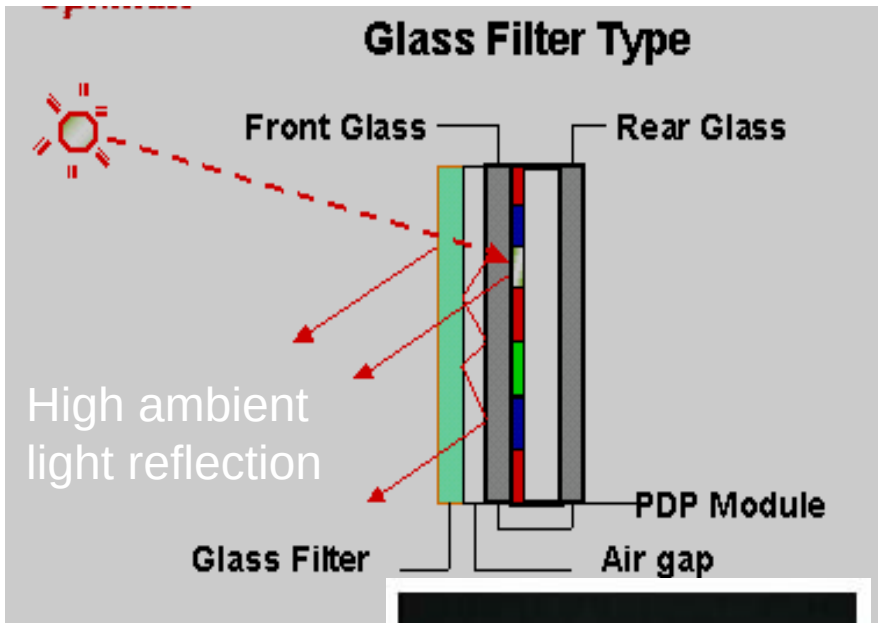
Lifetime Improvement

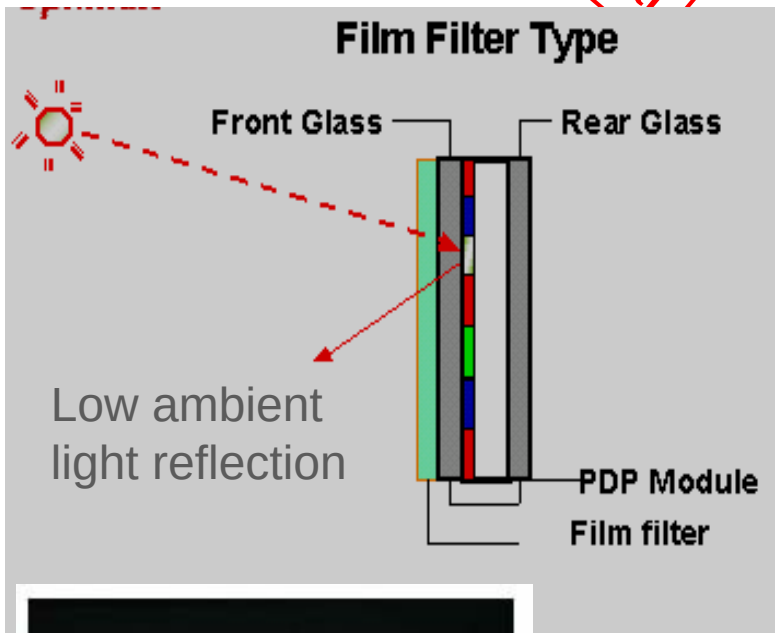


- **60, 000 hours life improvement by:**
  - **Phosphor material improvement**
  - **Structure design improvement**
  - **Circuit and waveform design improvement**

Reflective Light Reduction

Film Filter Application

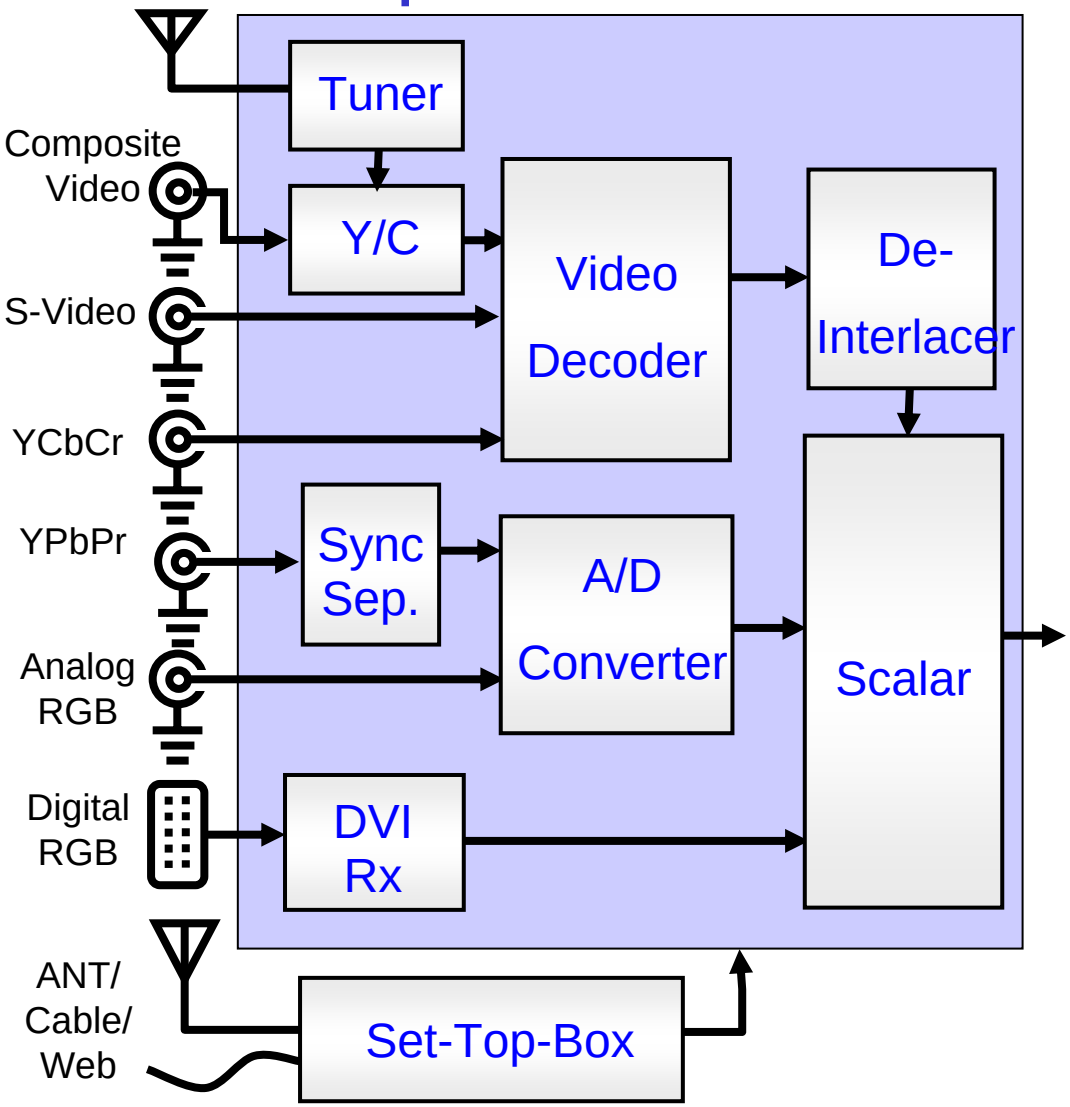




- **Great image performance by film Filter application**

Video Signal Processing

Spirits of Video Interface



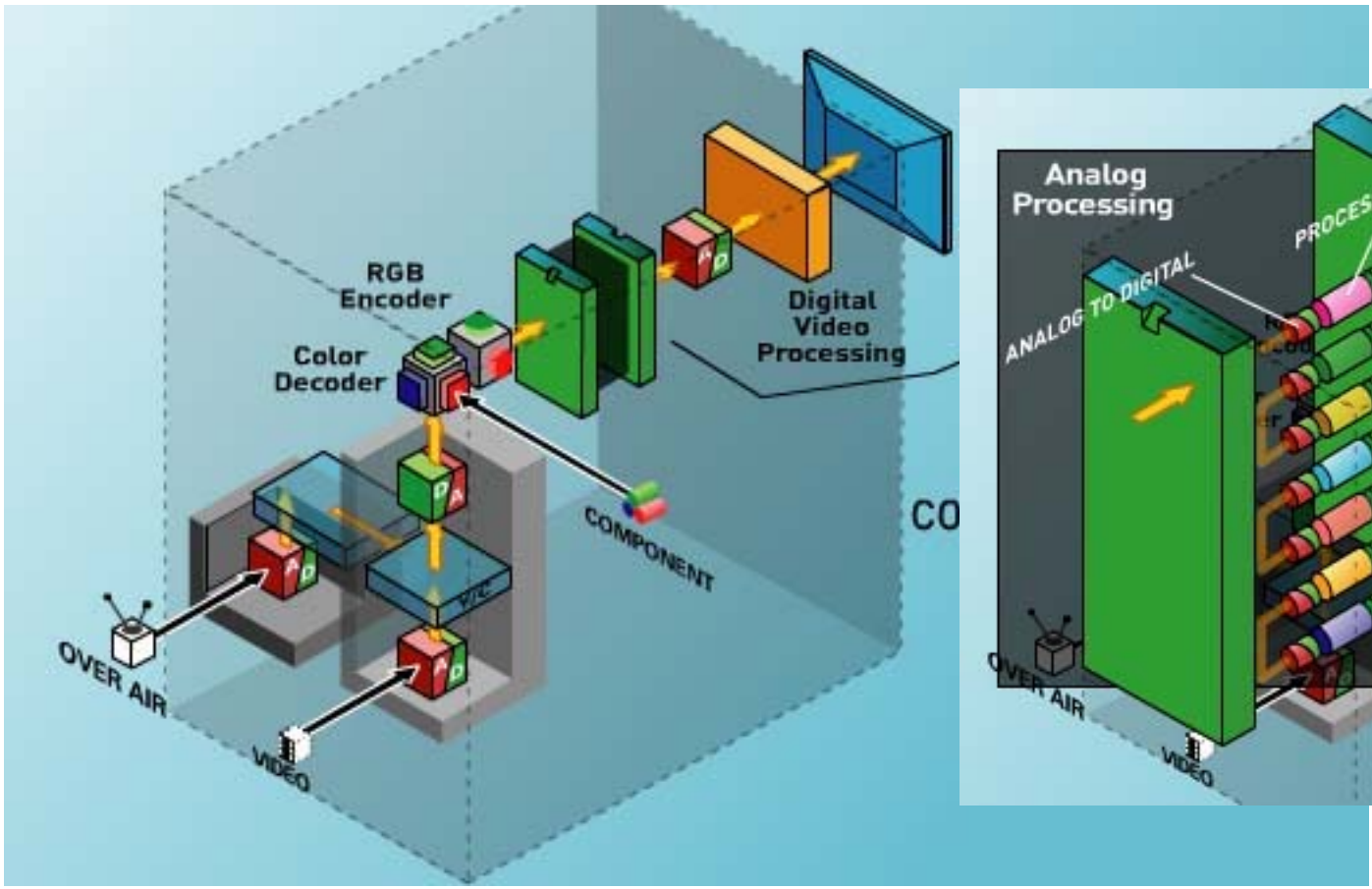
Function:

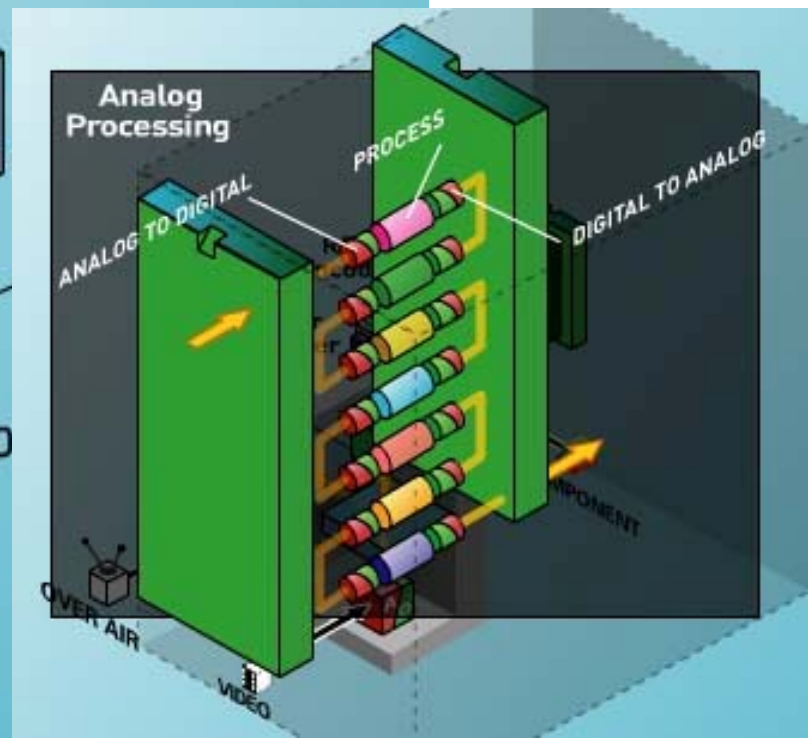
- Video Decoding
- De-Interlace/3:2 Pull Down
- Y-C Separation
- A/D Conversion
- Color Space Transform
- Scaling
- Gamma Correction

Application Electronics:

- Video Signal Processing
- Audio Signal Processing
- MPEG Decoding
- Tuner

Featured Video Processing Engine





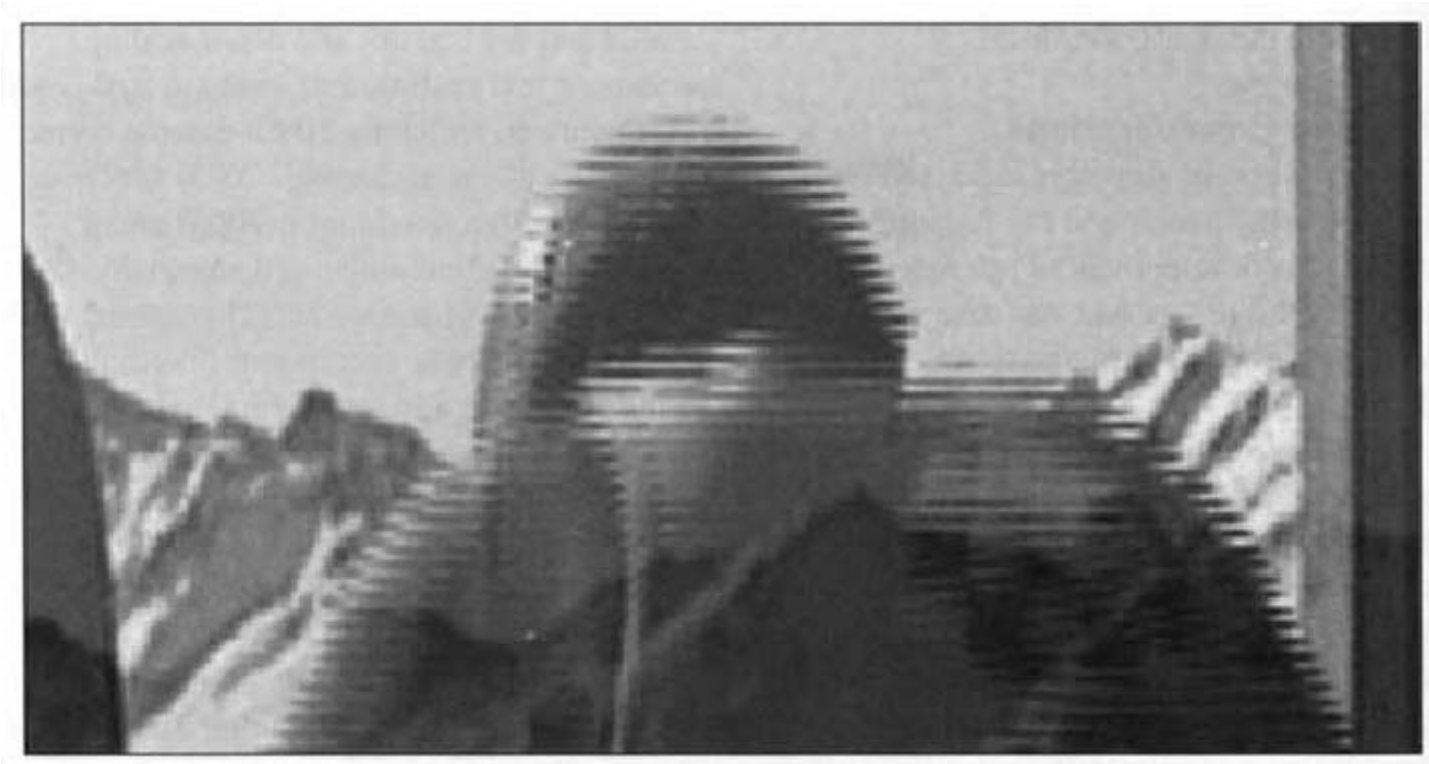
Courtesy of Pioneer

De-Interlacing

Weave

Single-Field Interpolation

De-Interlacing



Feathering – defect caused by weaving two adjacent fast-moving fields

Chroma Up-Sampling Error

Correct

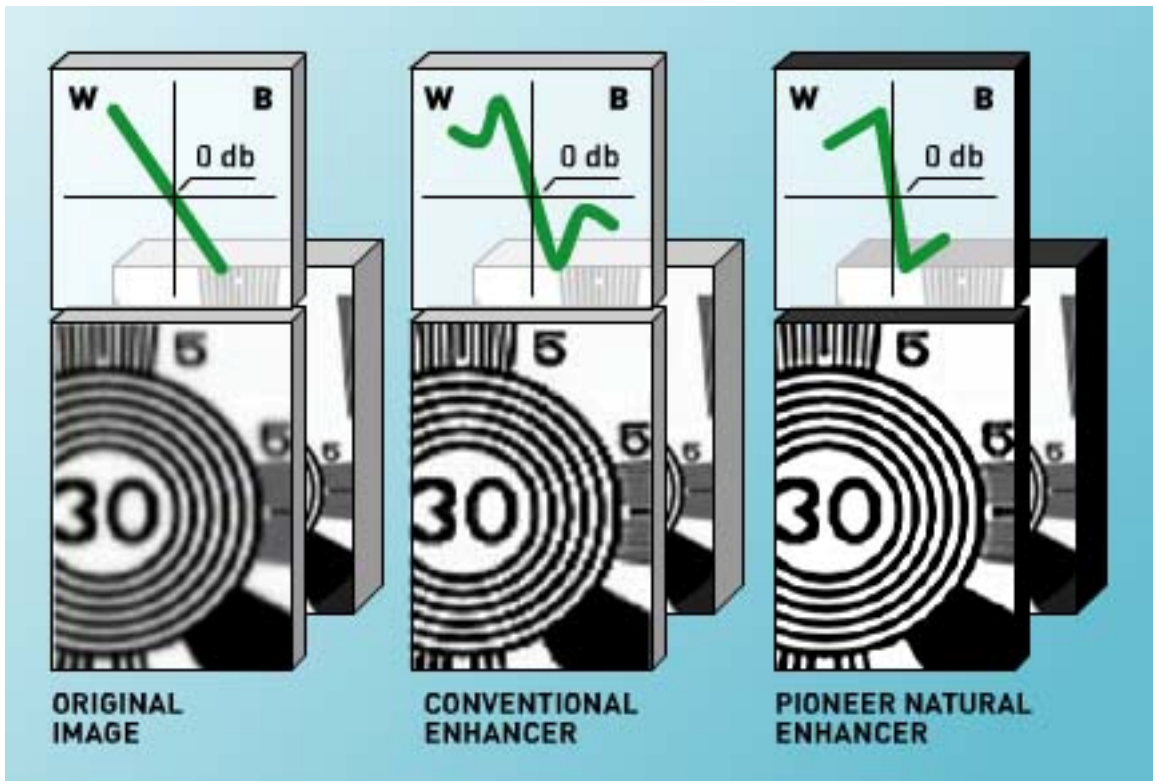
Incorrect

Sharpness Enhancement

Without Enhancement

With Enhancement

Natural Enhancer of PIONEER



Courtesy of Pioneer

Dynamic Range Extension

Without Extension

With Extension

Tuner with Teletext function

PDP vs. LCD

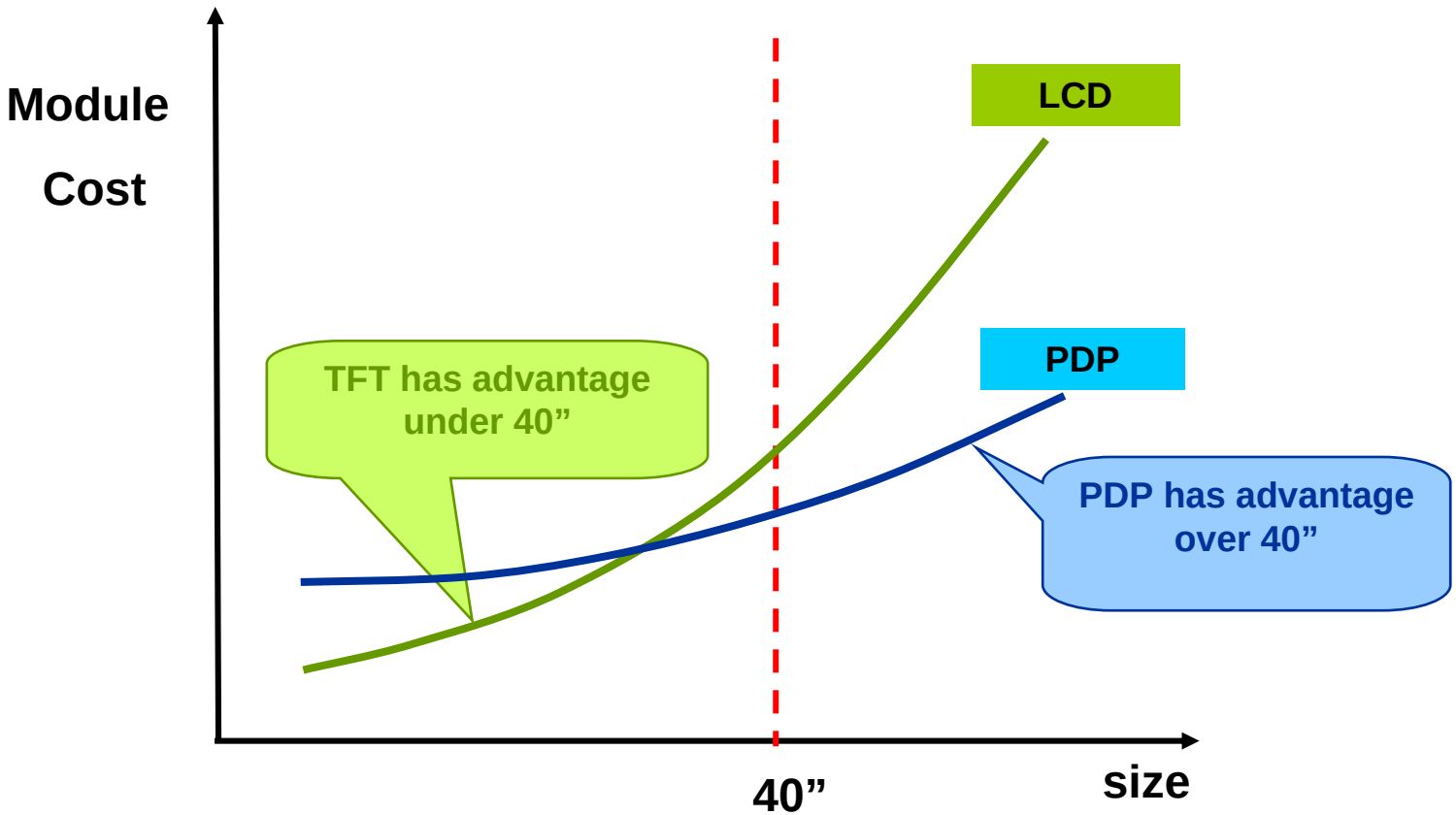
Confidential

製程特性与產品效能比较

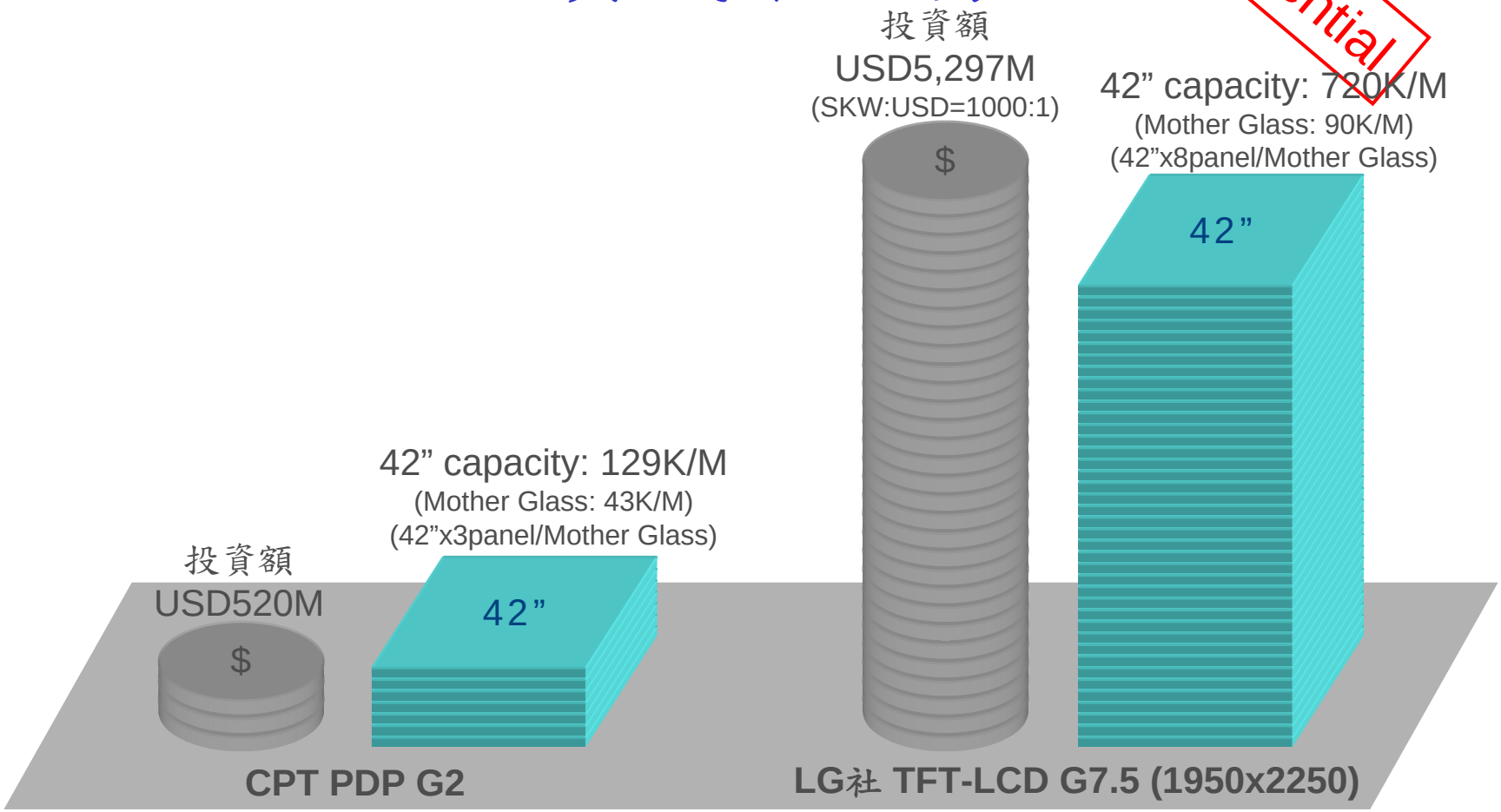
比较项目	LCD模块	PDP模块
成本结构	面板(50%) 背光(35%) 电路(15%)	面板(20%) 機構(15%) 电路(65%)
无尘室等级	10到100	1千到1万
制程程序总计	140	80
耗电量(動畫平均)	319瓦(45寸)	300瓦(46寸)
半衰期	6万小时	6万小时
分辨率	符合高清 电视规格	符合高清 电视规格

- PDP模块在结构上与集成电路和电子元件产业关系深厚，而LCD模块则几乎纯粹仰仗面板制程技术，因此其元件成本之降价空间相当有限。
- LCD模块在成本结构上，有八成以上(面板與背光部份)會隨尺寸增大而增加，而PDP模块僅約佔不到四成。因此尺寸愈大，LCD成本之增加愈吃重。

Cost Comparison of PDP and LCD TV



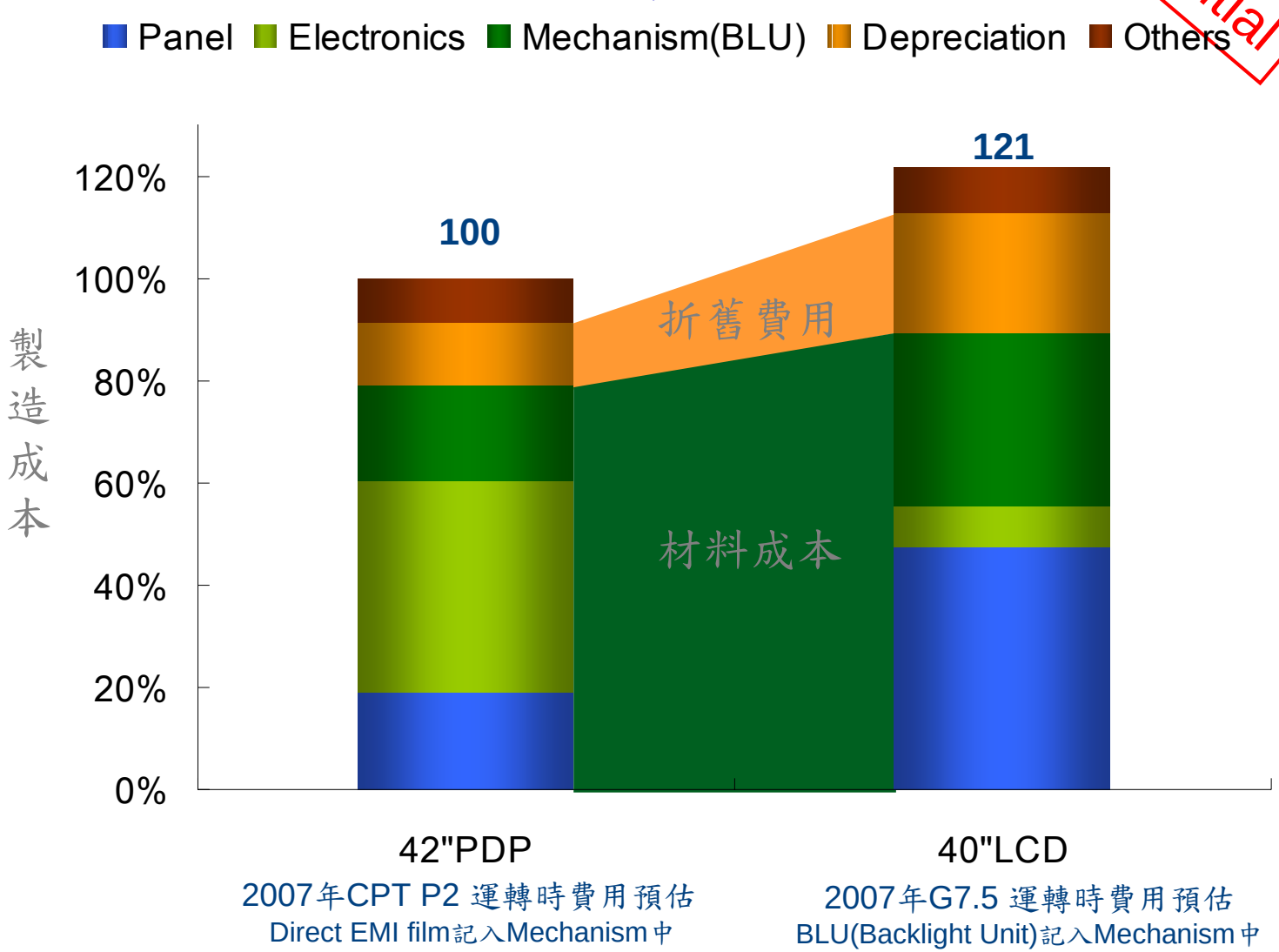
投資成本优势



單位投資額:USD56/panel(六年折舊換算) **USD102/panel(六年折舊換算)**

- 以相同等級產出規模、同尺寸產品而言，建構PDP 面板廠是具有優異的成本優勢，僅約需LCD 面板廠的55%資本支出金額。

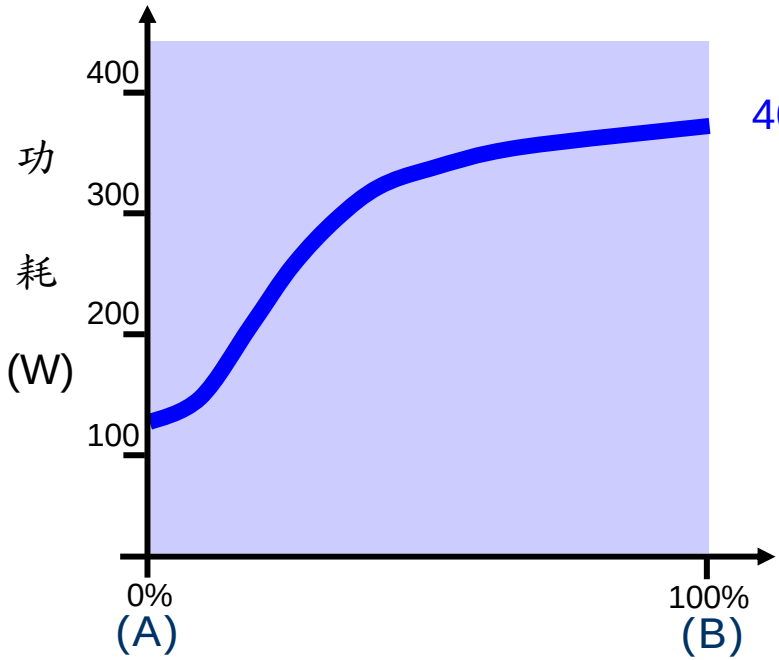
PDP與LCD製造成本比較



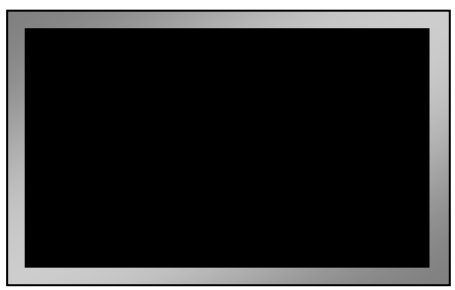
2007年CPT P2 運轉時費用預估
Direct EMI film記入Mechanism中

2007年G7.5 運轉時費用預估
BLU(Backlight Unit)記入Mechanism中

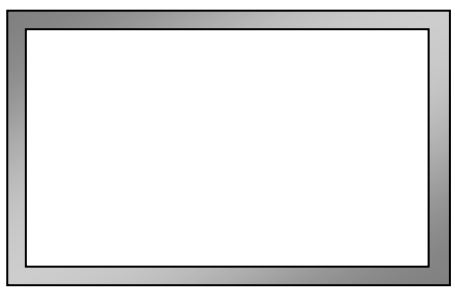
耗電分析



46“PDP動態功耗



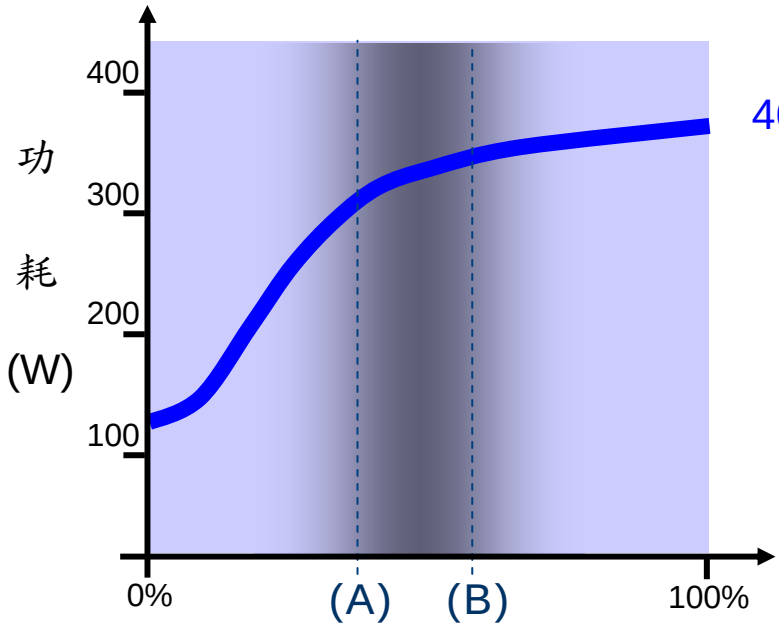
(A)全黑影像 APL=0%



(B)全白影像 APL=100%

●PDP功耗與影像的信息(APL)有關,耗電量與螢光體發光的面積及亮度成正比.

耗電分析-新聞節目



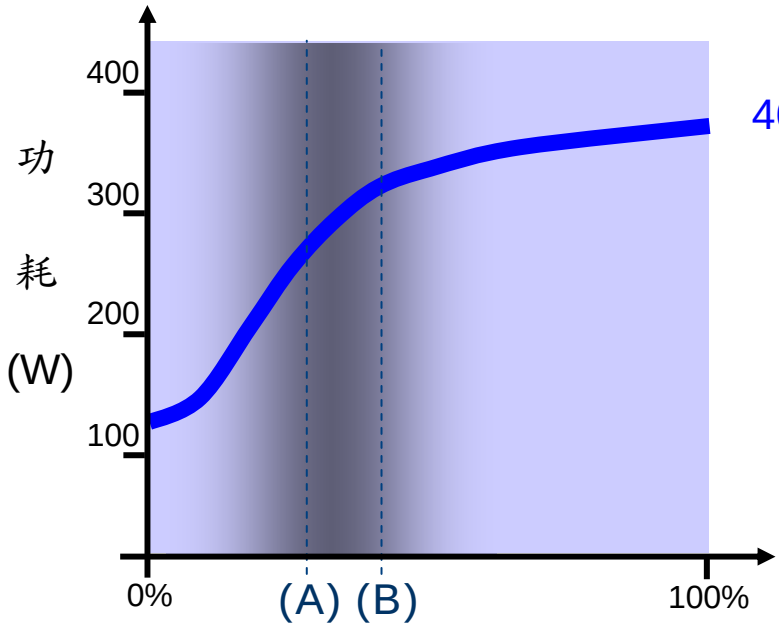
46“PDP動態功耗

(A)APL較低的新聞影像

(B)APL較高的新聞影像

- 一般新聞節目的影像信息， APL大多落在30%~55%之間。

耗電分析-体育節目



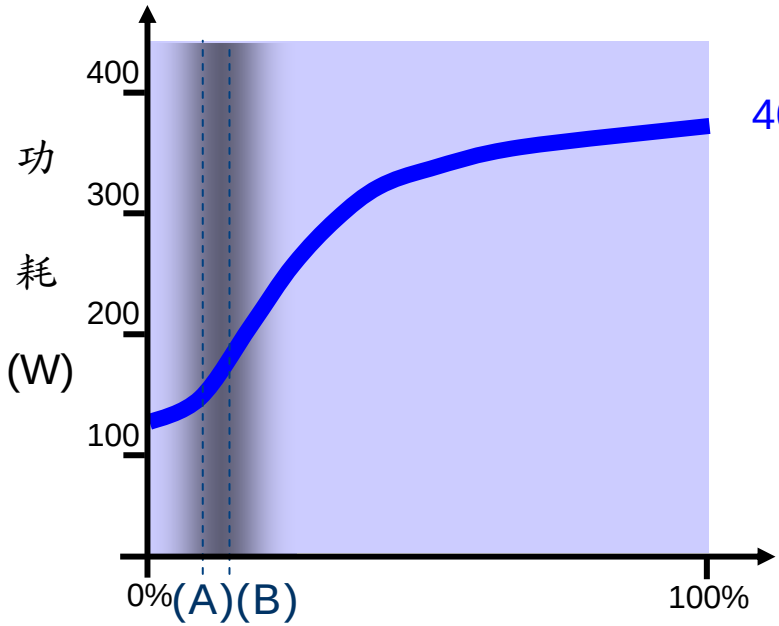
46“PDP動態功耗

(A)APL較低的体育節目影像

(B)APL較高的体育節目影像

- 一般体育節目的影像信息， APL大多落在10%~50%之間。

耗電分析-電影節目



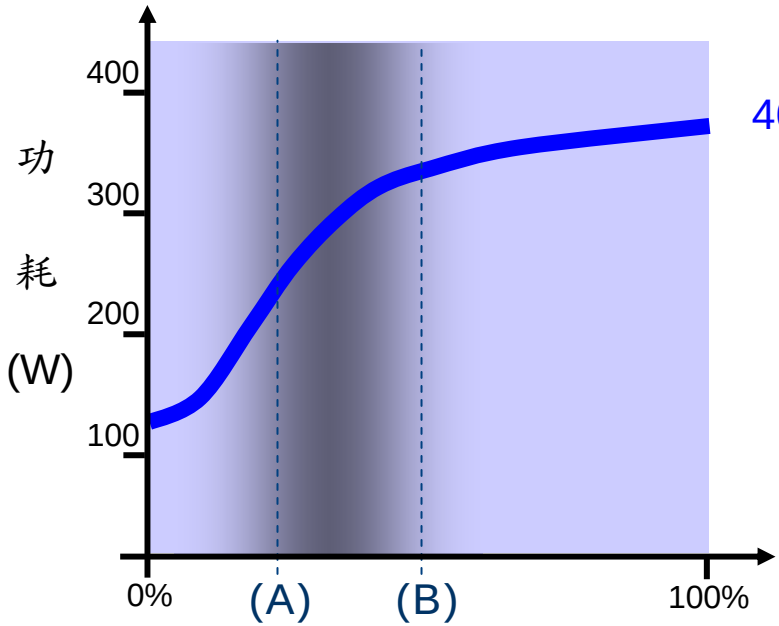
46“PDP動態功耗

(A)一般的電影節目影像

(B)一般的電影節目影像

- 一般電影節目的影像信息， APL大多落在5%~25%之間。

耗電分析-連續劇



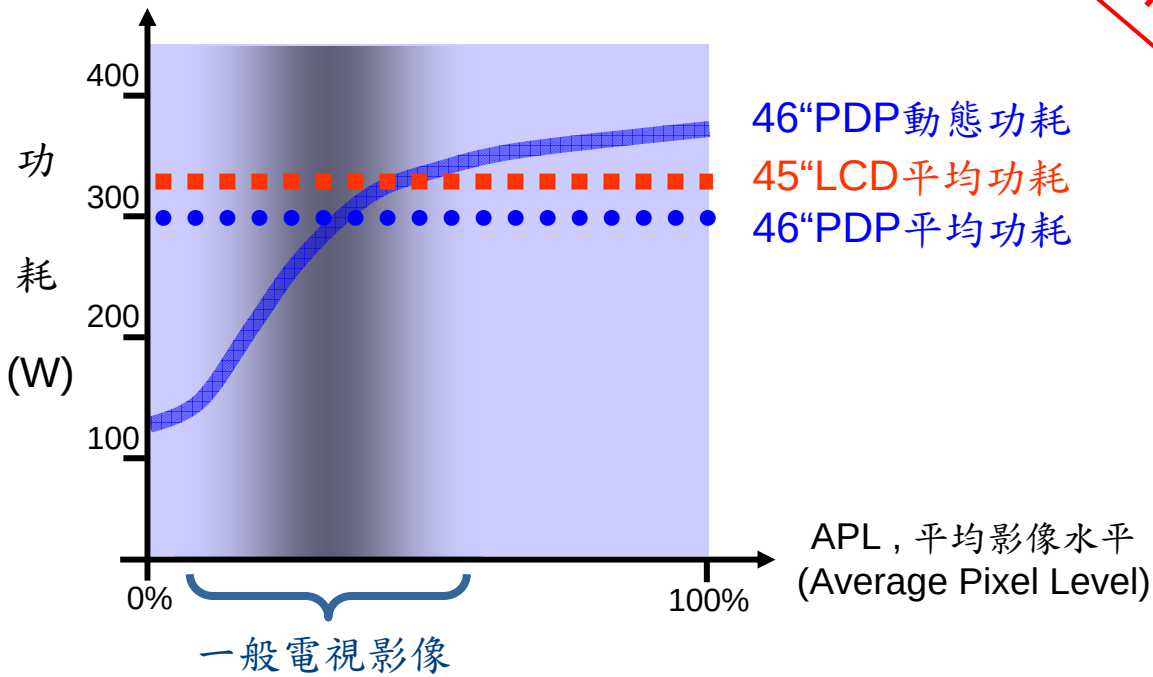
46“PDP動態功耗

(A)APL較低的連續劇影像

(B)APL較高的連續劇影像

●一般連續劇節目的影像信息， APL大多落在15%~45%之間。

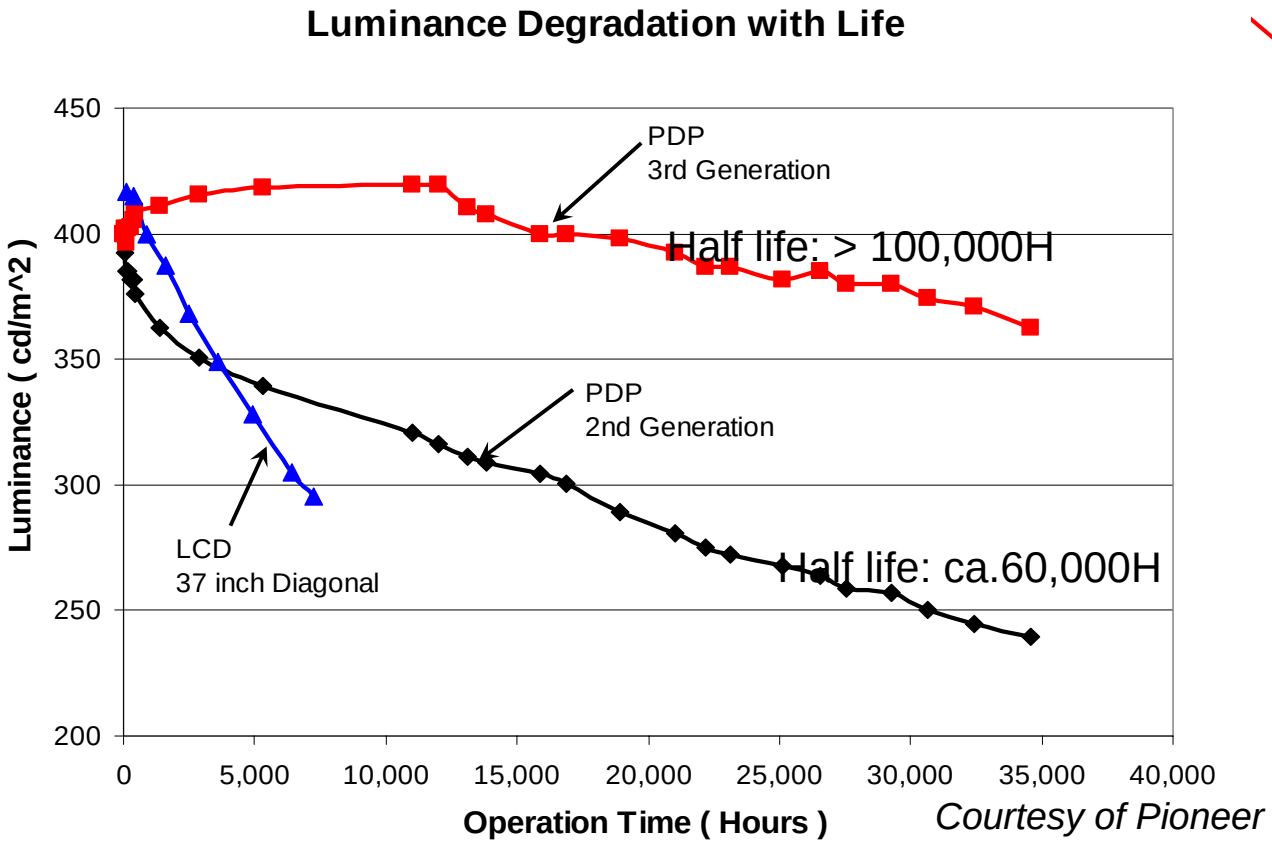
耗電分析-比LCD省電



- 一般電視影像APL 大多落在10%~50%之間，CPT 46” PDP平均功耗約300W。
- LCD功耗與APL無關，不論什麼影像，功耗變化不大。S社 45”LCD功耗約319W。

✓年耗电量不同于额定耗电量，是设想实际收看情况计算出来的。
在年耗电量方面，只要屏幕大小相同，PDP电视就与液晶电视相當。

使用寿命



- PDP在一般TV觀賞模式時,螢光體會隨影像信息,時而被激發,時而在鬆弛,現市售产品半衰期已可达6万小时,即使每天使用8小時,半衰期已可超過10年。
- LCD TV只要電源打開,背光模組中冷陰極管的螢光體就處於被激發的狀態,亮度衰退的速度比PDP更嚴重.

環境光與對比

一般賣場之環境光照度
多設計在500 lux 以上,
過強的外光反射,
會讓PDP濛上一層薄霧的感覺.

→賣場上,LCD對比優於PDP

模擬賣場環境之畫質比較

一般家庭客廳之環境光照度
多設計在100~150 lux 左右,
PDP自發光的特性可充分發揮,
讓PDP展現絕佳的對比效果.

→客廳裏,PDP對比優於LCD

模擬客廳環境之畫質比較

性能價格比優勢之維持

- 一般TV觀賞模式時，於相同使用基準下，同尺寸PDP TV的用電成本低於LCD TV。
- 以相同等級產出規模、同尺寸產品而言，建構一座PDP 面板廠是具有優異的成本優勢，僅約需LCD 面板廠的50%資本支出金額。
- 根據绝大多数的证券及产业分析师皆一致指出 —
- 在40 吋以上的電視市場，LCD TV 從上游的投資效益到下游產品價格的競爭力，PDP TV 目前仍較佔上風。即使LCD第七代全产能开出，每寸制造成本还是比PDP TV约高出20% 。

Welcome to Join PDP's World!

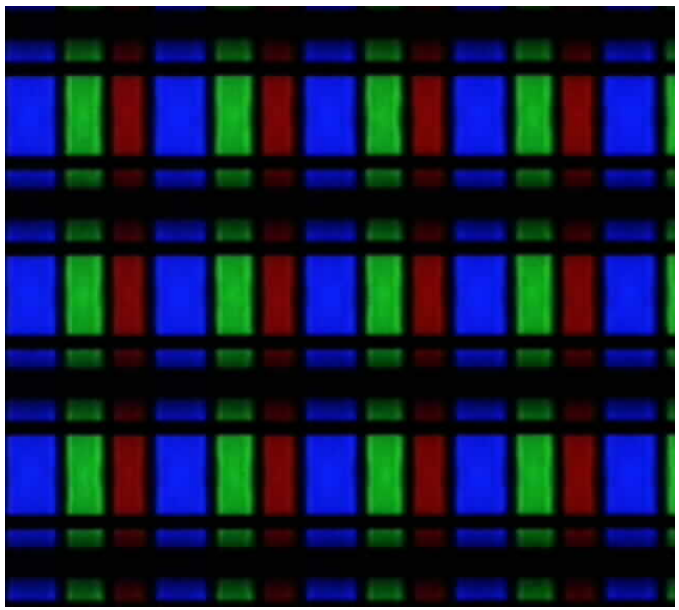
Q & A

Supplementary

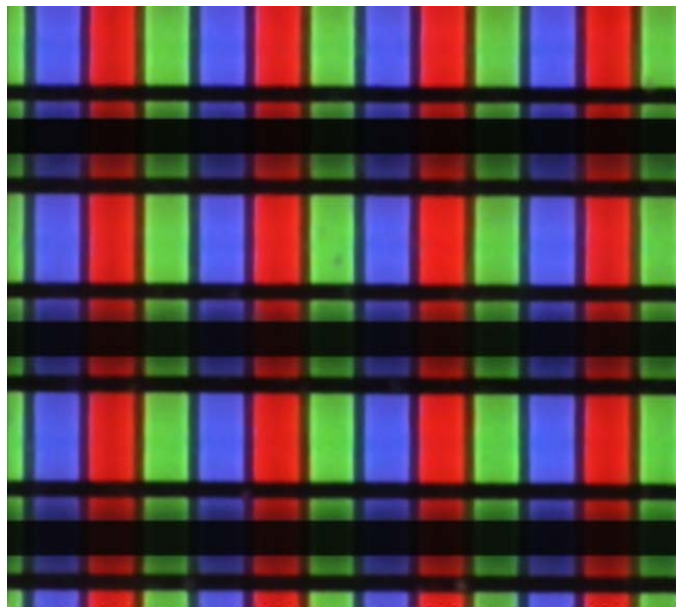
Other PDP Technologies

Asymmetric Pixel Design

Matsushita
Asymmetric Pixel



Conventional
Symmetric Pixel



Delta Arrangement Cell

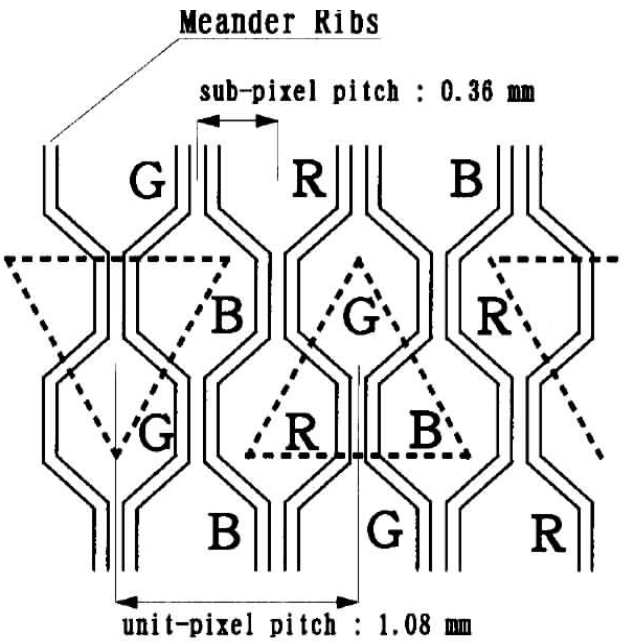
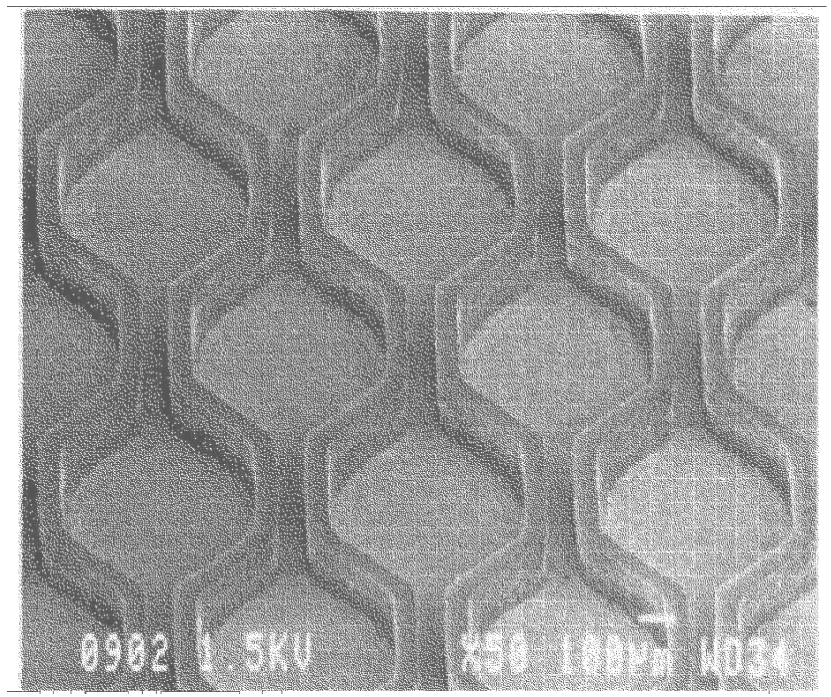
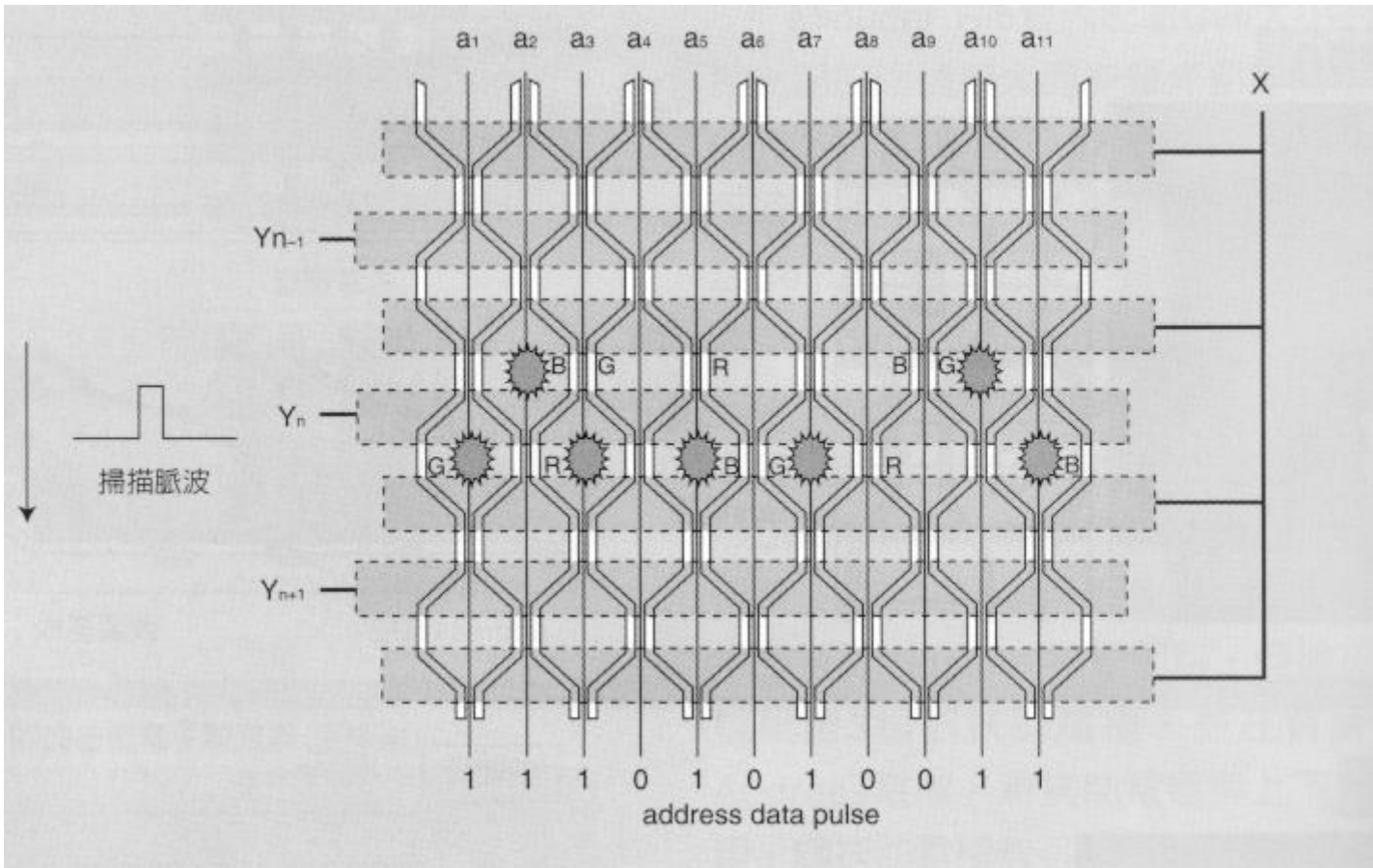


Fig. 1. Schematic of pixels

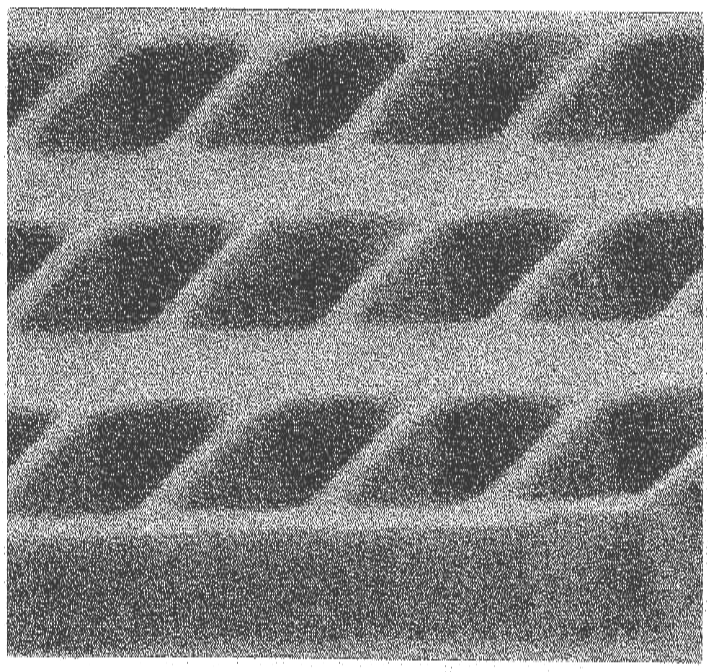


Delta Arrangement Cell

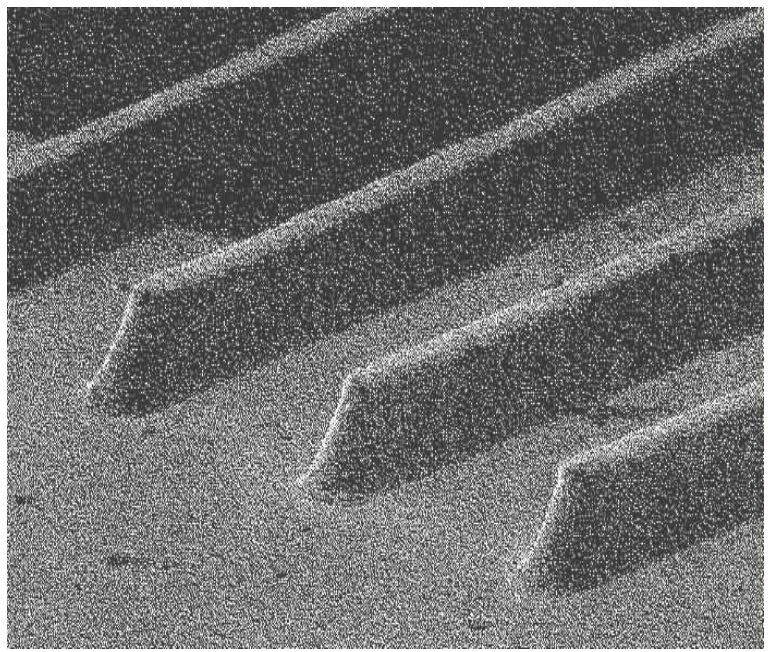


Waffle Structure

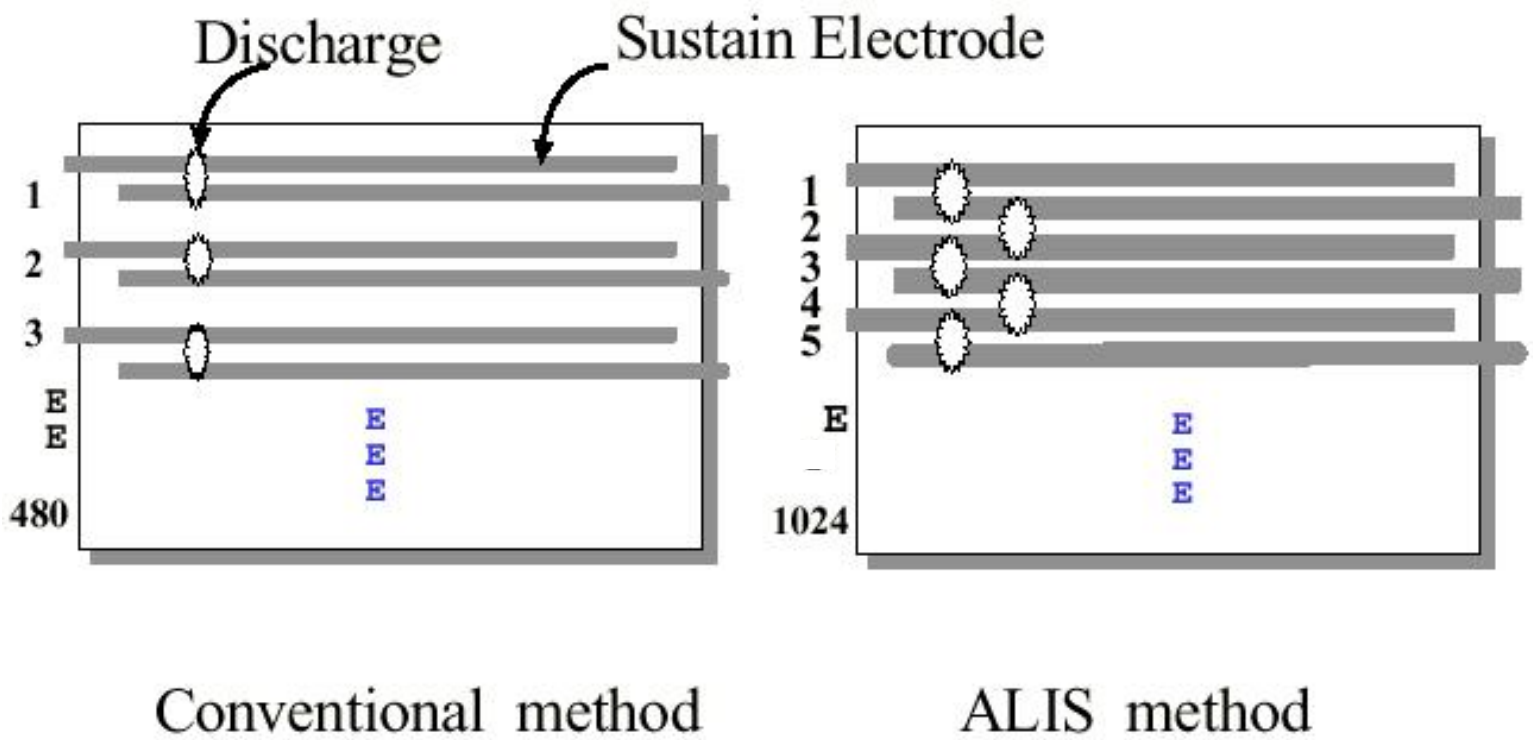
Pioneer Waffle Rib



Conventional Stripe Rib



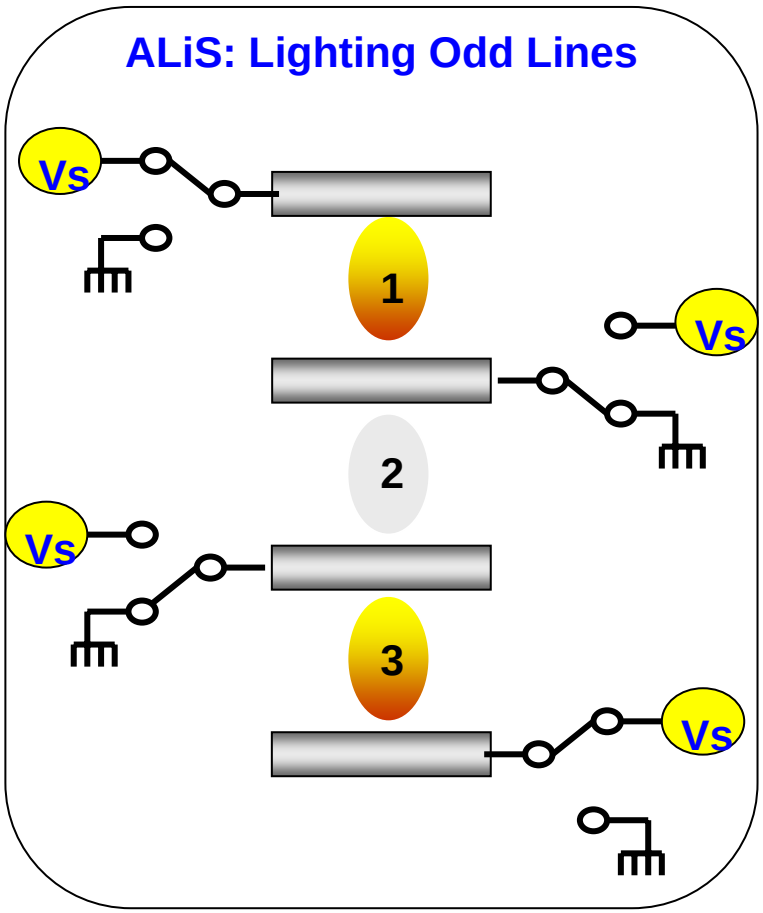
Fujitsu ALiS

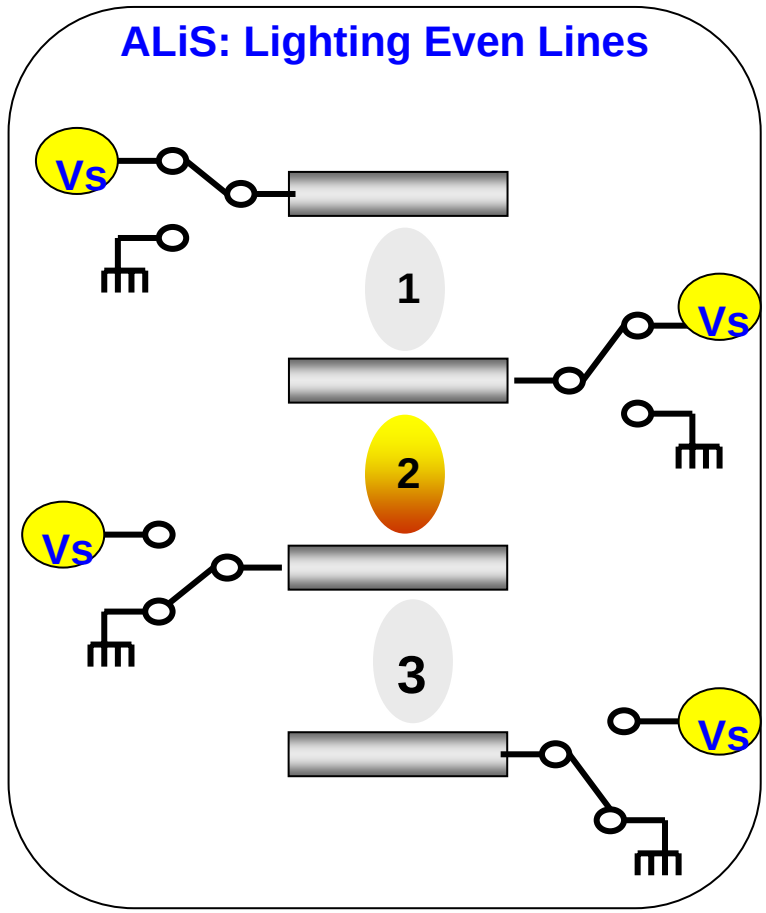


Conventional method

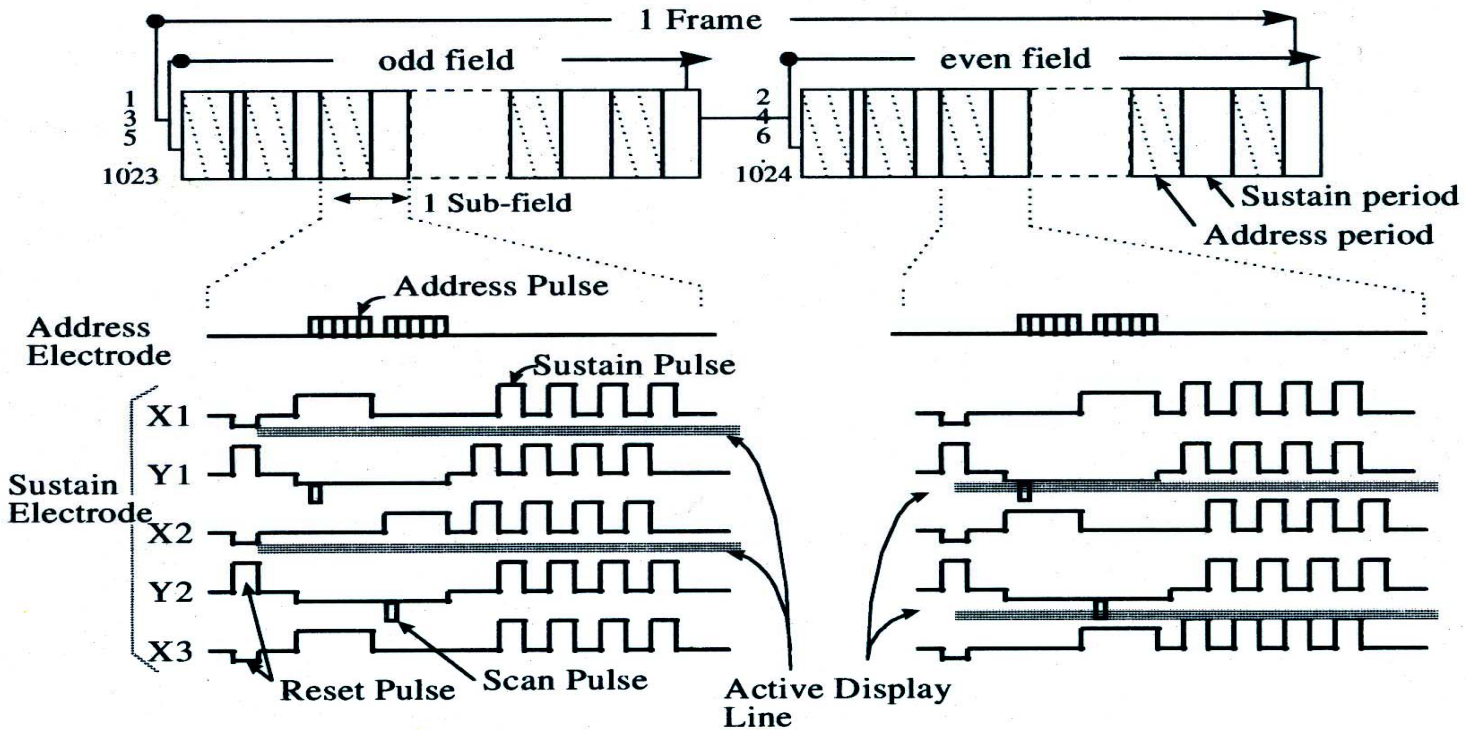
ALIS method

Basic Operation of ALiS





ALiS Waveform



Driving sequence and waveform

The End