PDP design
and
Thermal issue
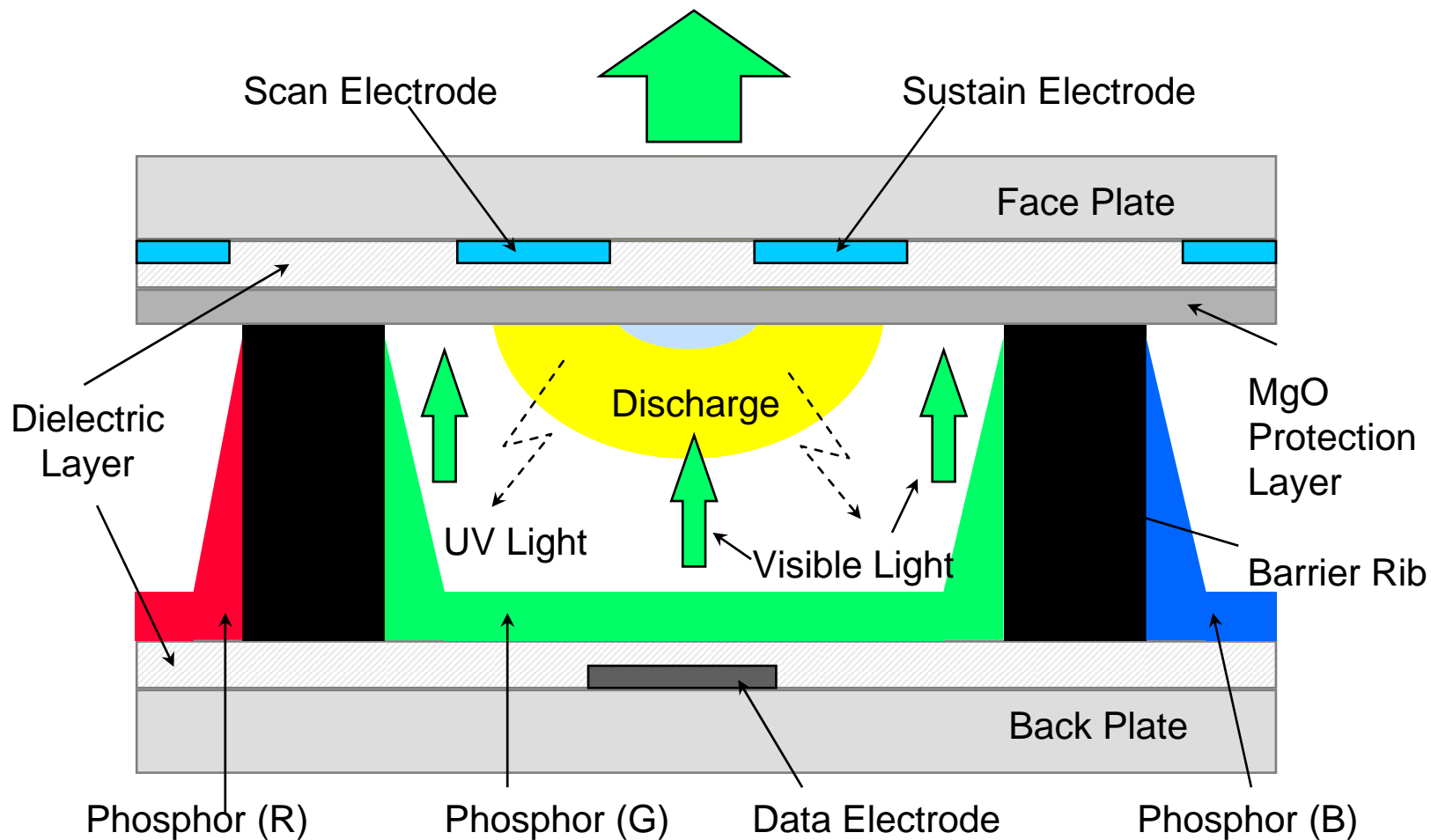
michaellin@ddmccn.com

linchue@mail.cptt.com.tw
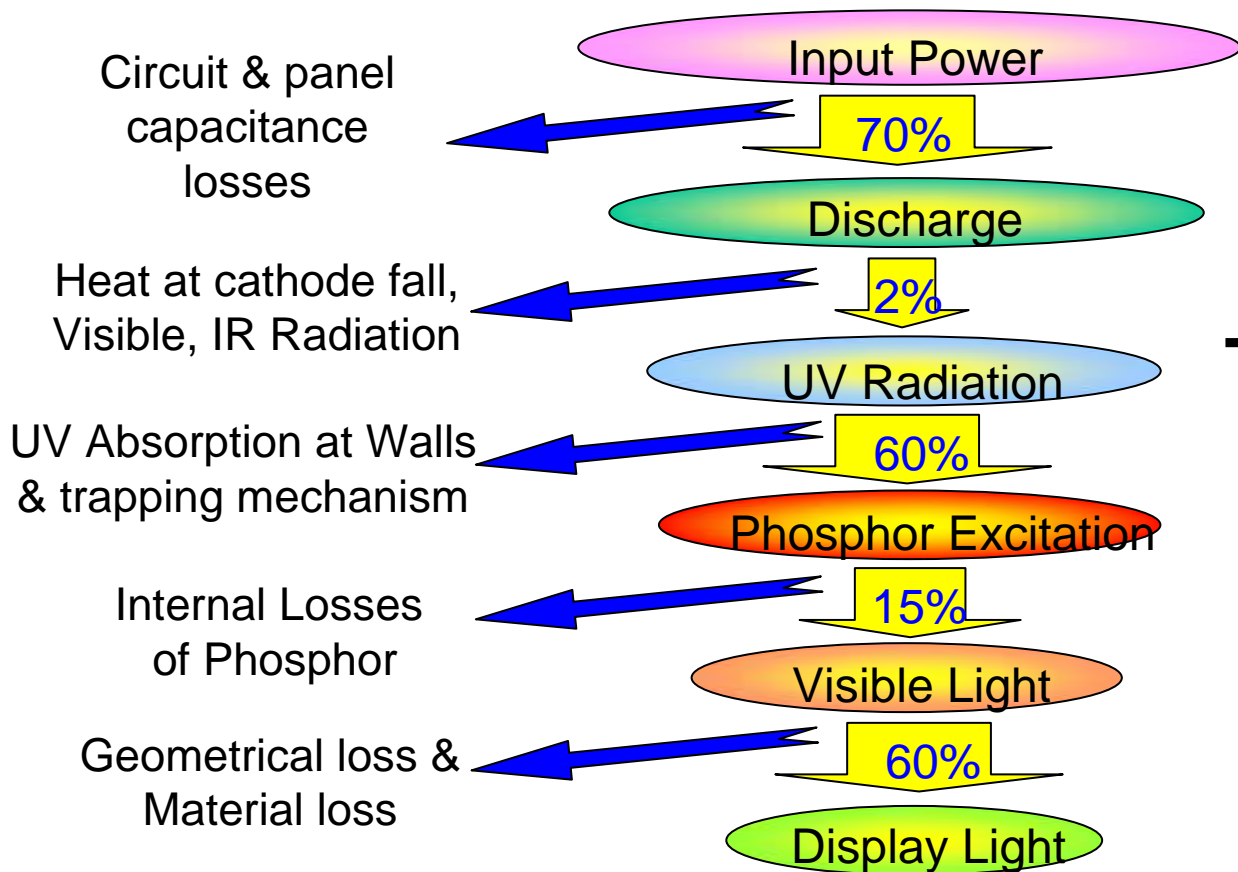
Institute of Applied Mechanics,
National Taiwan University

PDP panel structure

Scan Electrode · Sustain Electrode

Face Plate

Discharge

UV Light · Visible Light

Dielectric Layer

MgO Protection Layer

Barrier Rib

Back Plate

Phosphor (R) · Phosphor (G) · Data Electrode · Phosphor (B)

Total Efficiency of PDP

Circuit & panel capacitance losses

Heat at cathode fall, Visible, IR Radiation

UV Absorption at Walls & trapping mechanism

Internal Losses of Phosphor

Geometrical loss & Material loss

Input Power
70%
Discharge
2%
UV Radiation
60%
Phosphor Excitation
15%
Visible Light
60%
Display Light

Total Efficiency of PDP=0.15%

2.0 lm/W

Main PDP TV parts

Backcover

Frame

Video circuit
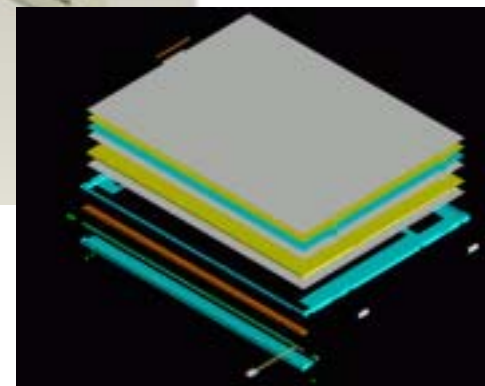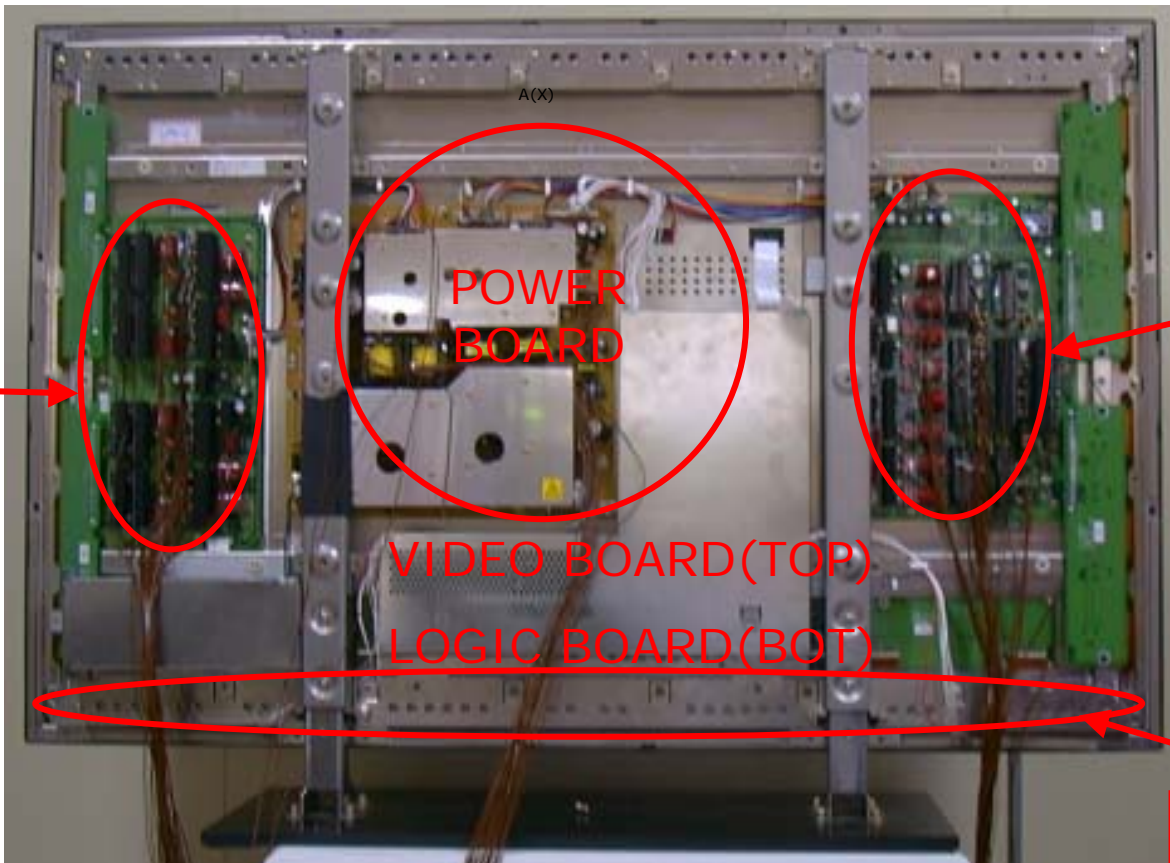
PDP module
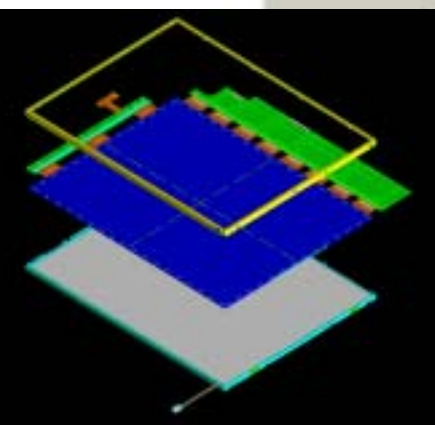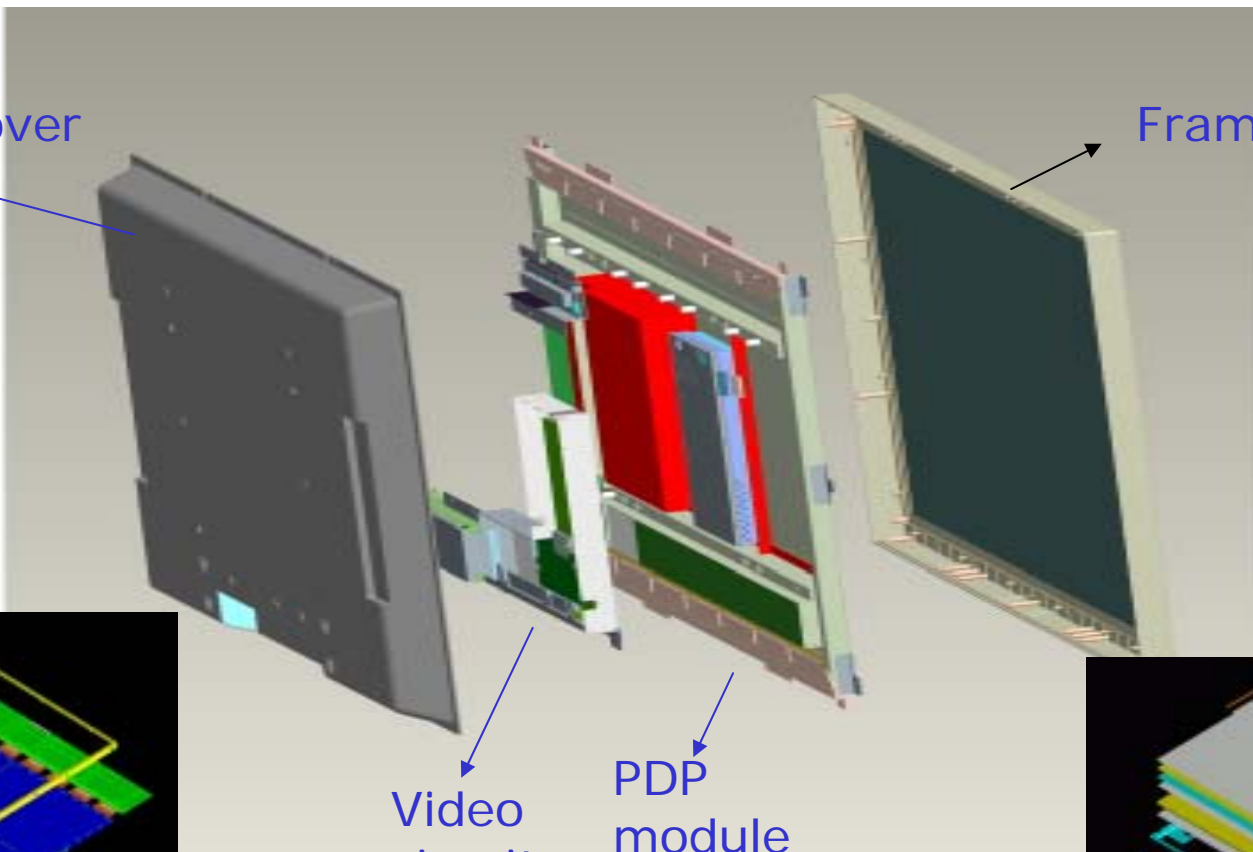
TFT module

TFT backlight

The heat source of PDP

Y SUSTAIN BOARD

POWER BOARD

X SUSTAIN BOARD
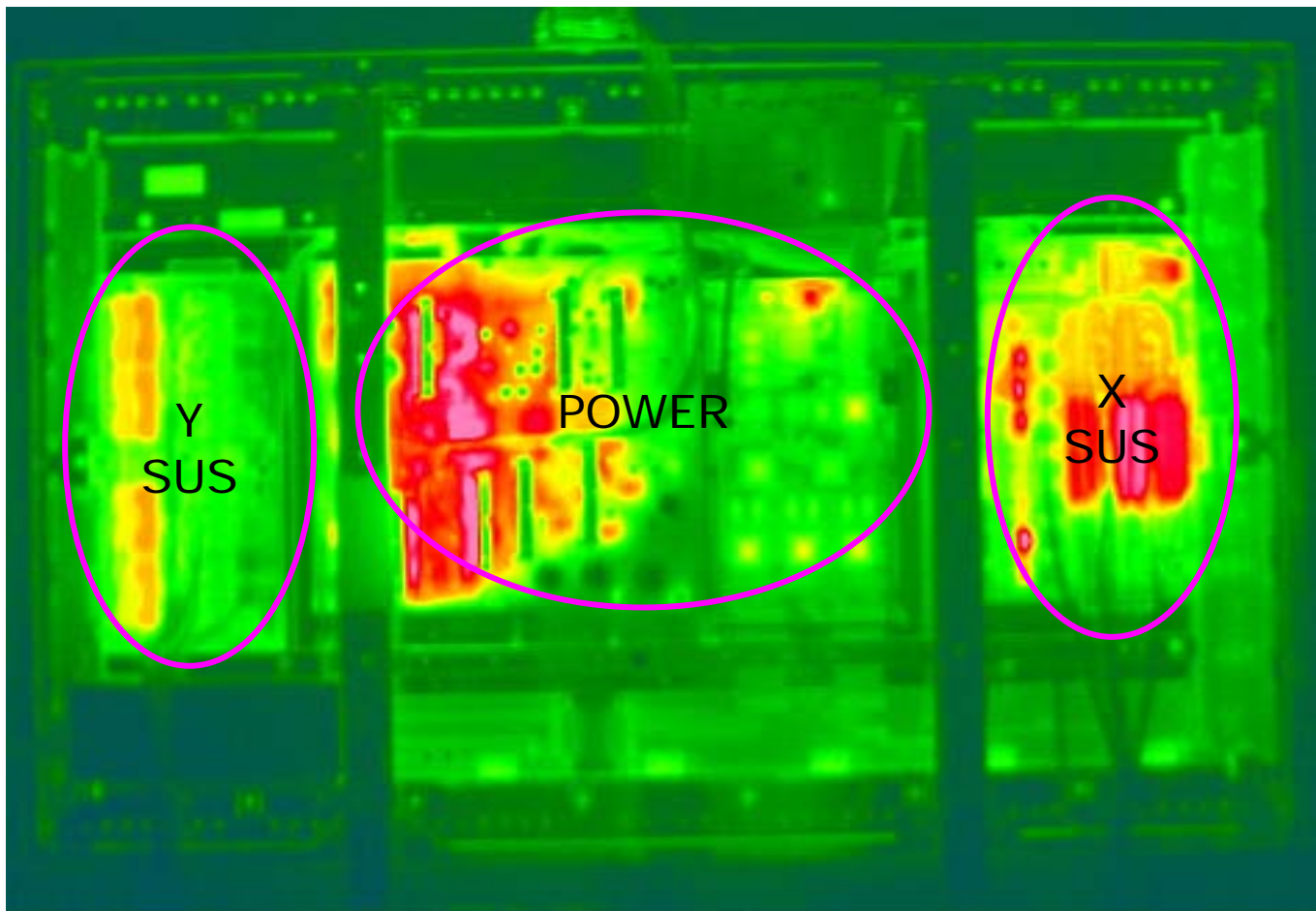
VIDEO BOARD(TOP)

LOGIC BOARD(BOT)

DATA BUFFER BOARD

A(X)

Temp. distribution - panel
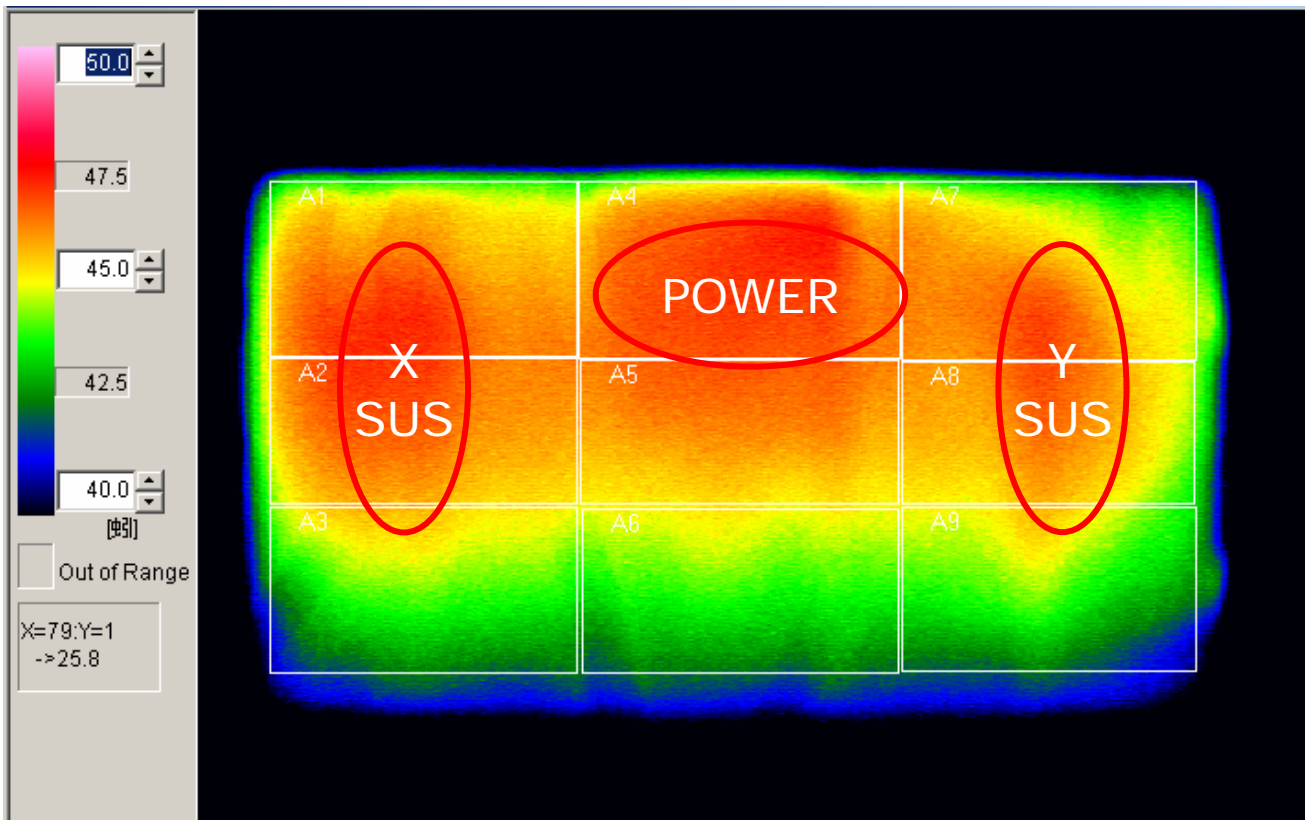
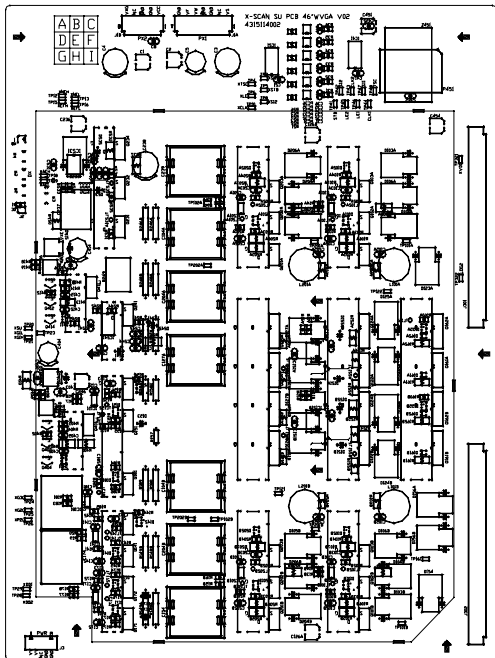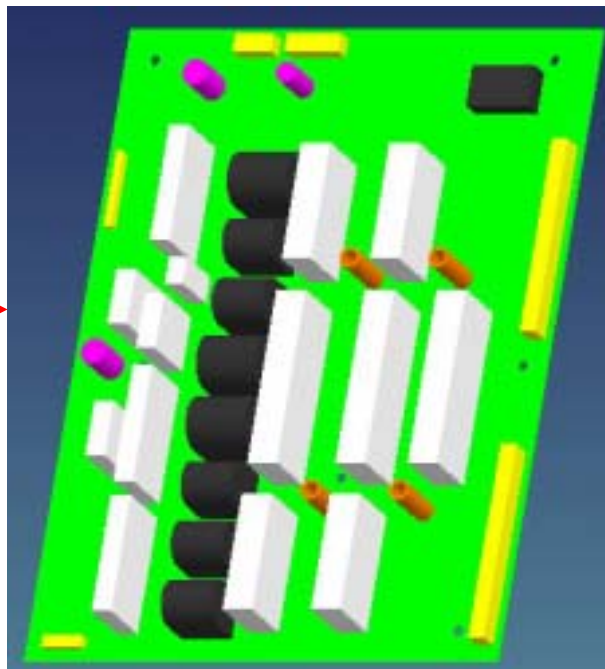| Area	A1	A2	A3	A4	A5	A6	A7	A8	A9
Avg. T ( )	45.4	46.1	43.8	46.4	45.9	43.7	45.3	45.6	43.5
Highest T ( )	47.6	47.4	46	47.5	47.2	45.5	47.2	47	46

Temp. distribution - circuit

Thermal issue on Sustain driving circuit and Power supply

X Sustain

Electrical Design
- Protel

Mechanical Design
-Pro/E
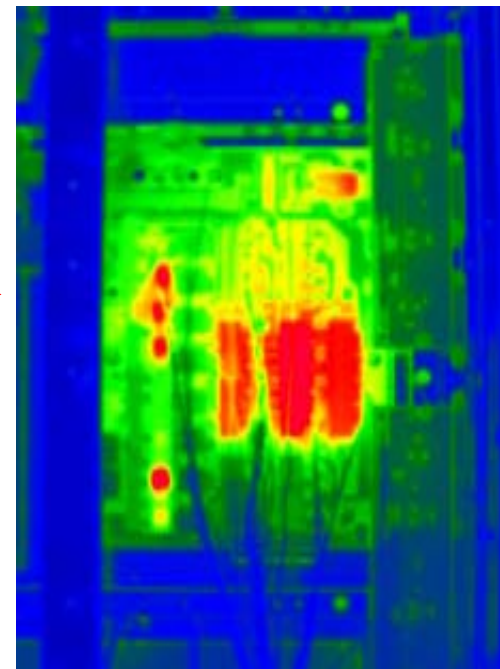
Thermal Simulation
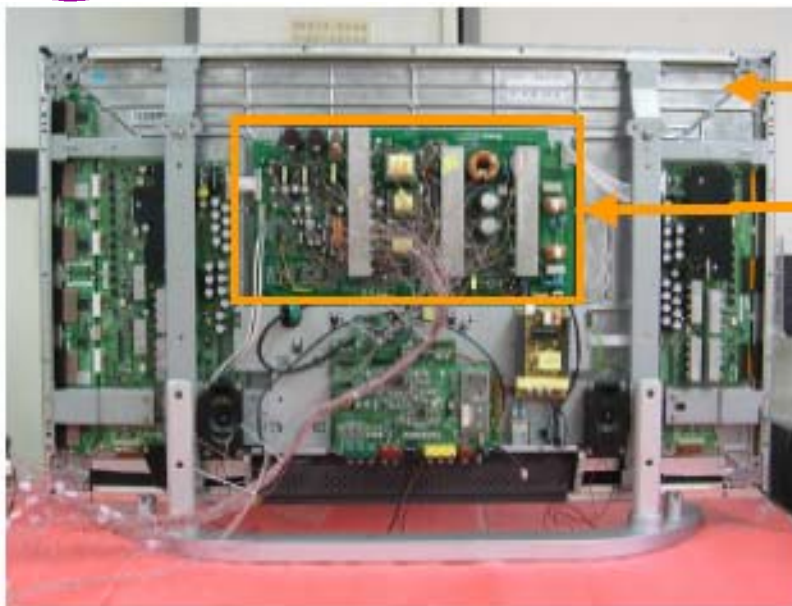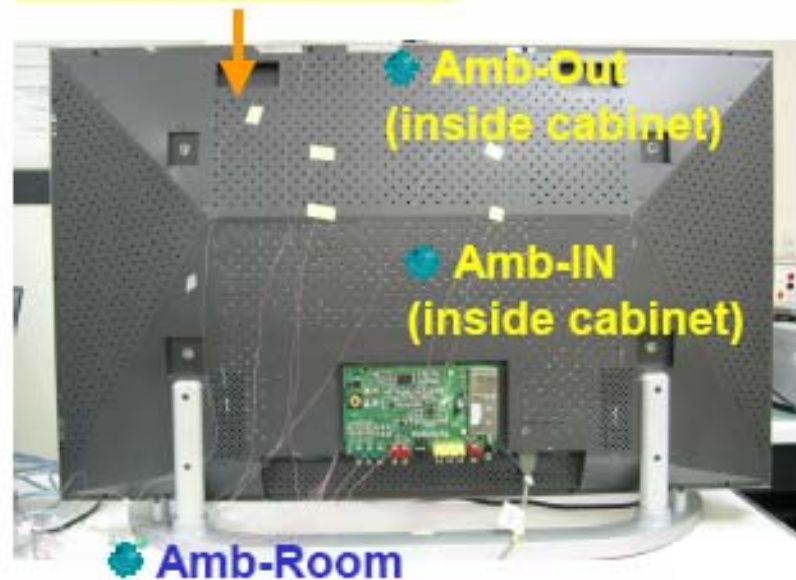- Flotherm   ICE Pack

42" PDP

Power Supply
445mmx245mmx47mm

Back Cabinet

Amb-Out
(inside cabinet)

Amb-IN
(inside cabinet)

Amb-Room

Test Condition :

• Input Power 378W @ 110Vac

• PDP Pattern – Snow Window

Dummy load and real load testing

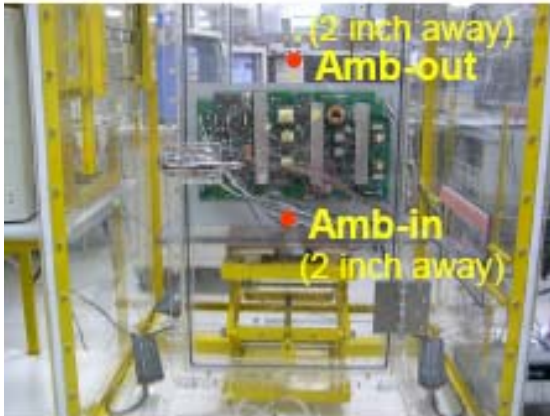

Output Power Control by DC Load

Output Power Control by PDP Pattern

Component temperature measurement

Temperature Control at 55°C in the Chamber

PSU in Free Convection Chamber (@ 55°C amb.)

PSU in Free Convection Chamber with a Cover (@ 55°C amb.)

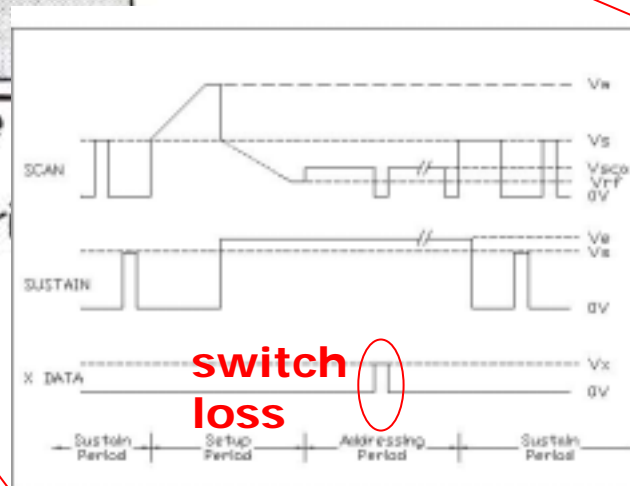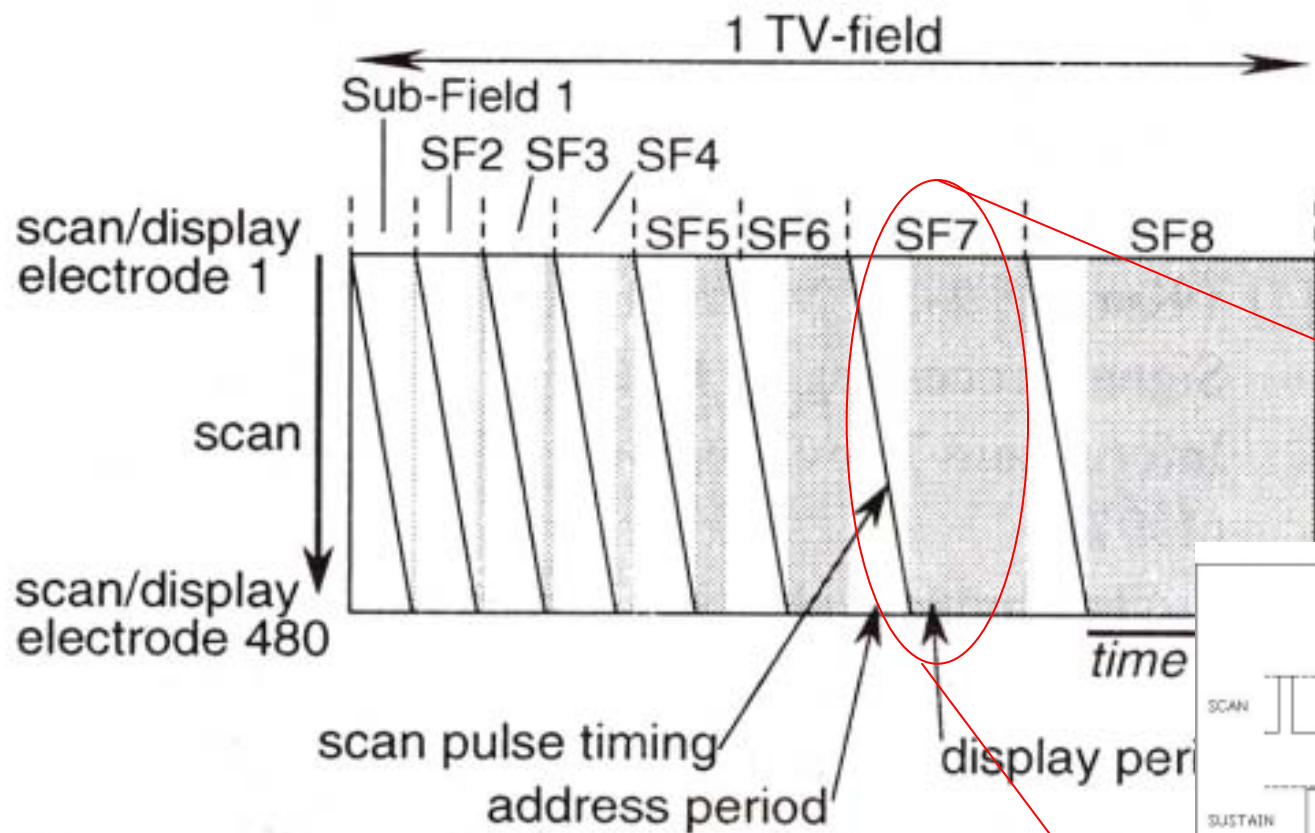- to simulate the back cabinet

Test Condition :
• Input Power 378W @ 110Vac
• PDP Pattern – Snow Window
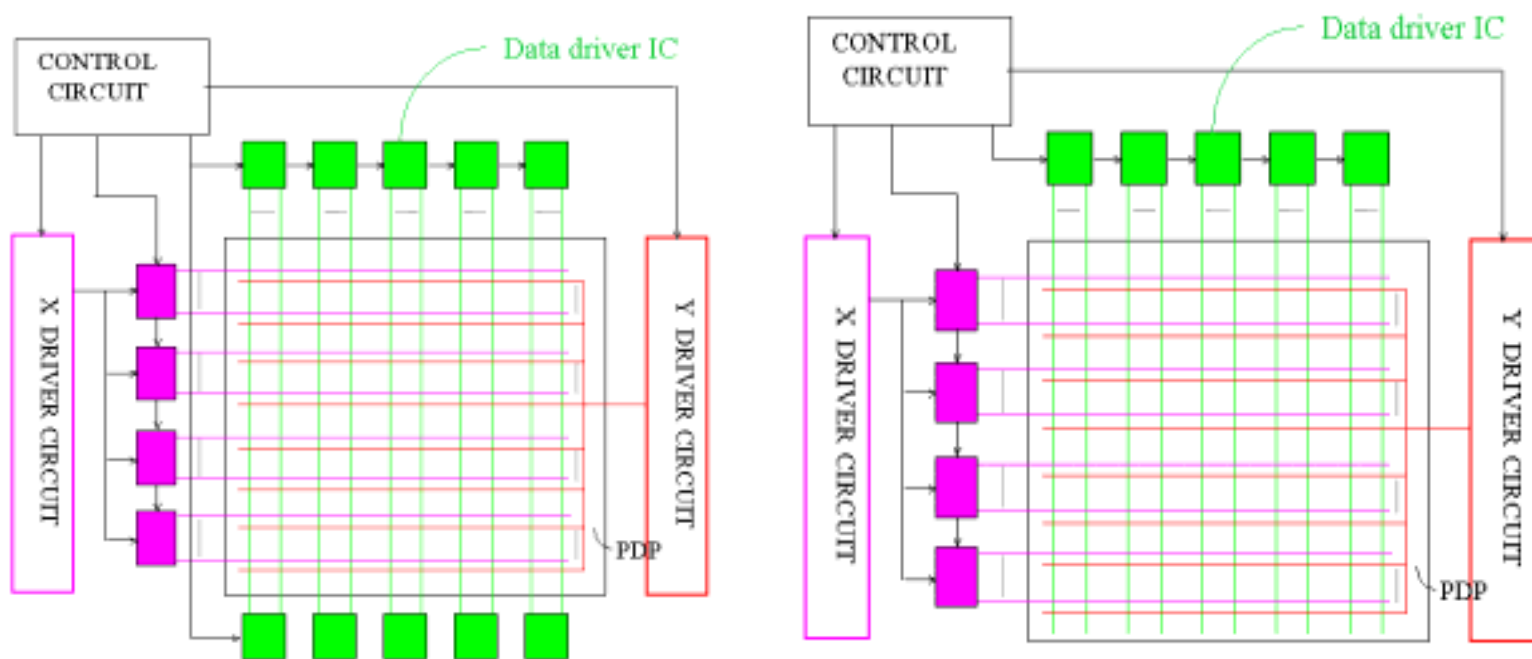
Thermal issue on

Data driver IC

PDP driving scheme

Higher driver IC loading
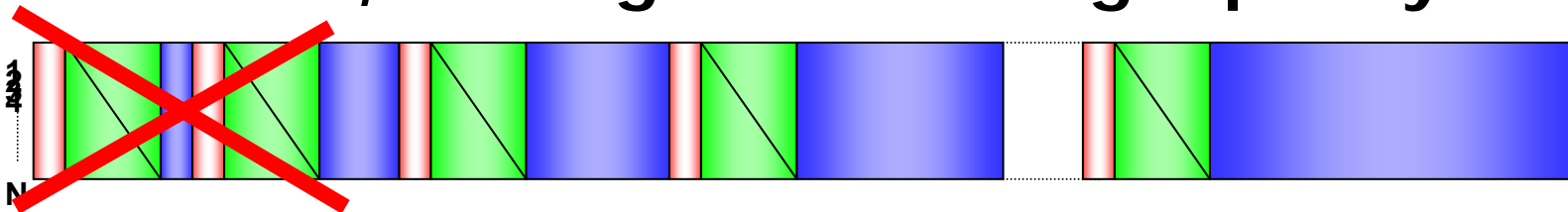

Dual scan driving ➡ **Single scan driving**
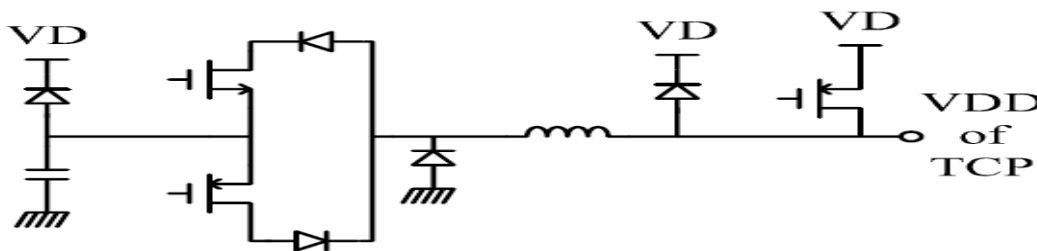
Cost down, but heat?

Solutions for Data IC thermal issue

- **Image processing: reduce scan times, however, it brings worse image quality**
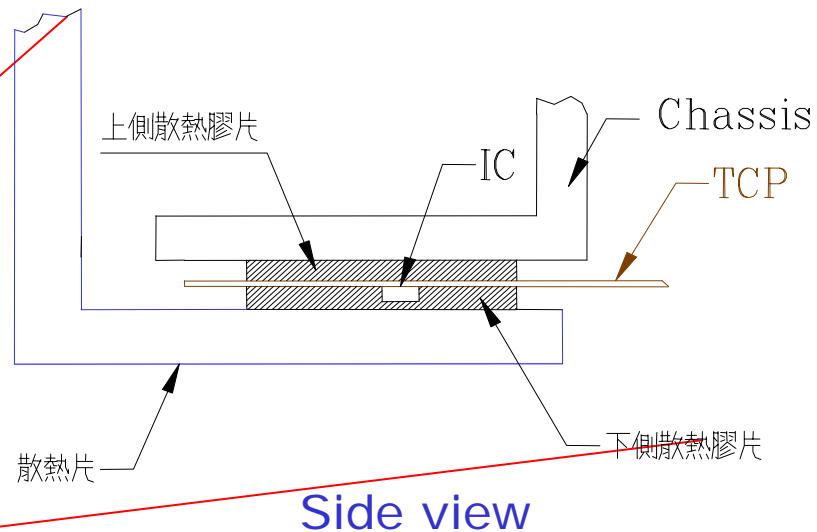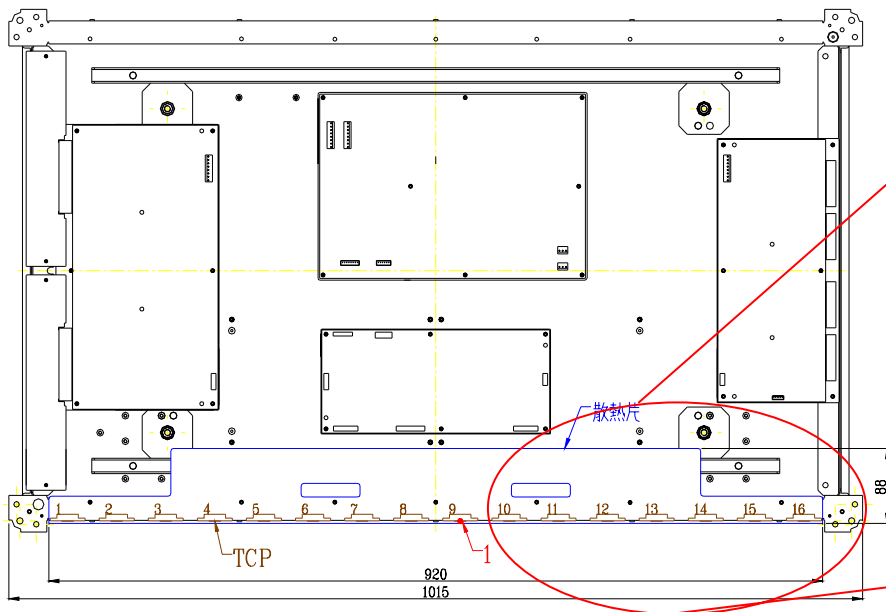
- **Energy recovery circuit: get the energy back by circuit design, however, it increases cost**

- **Mechanical design: increase radiator area and thermal pad conductive coefficient**

Radiator for Data driver IC

上側散熱膠片

Chassis

IC

TCP

散熱片

下側散熱膠片

Side view

Fourier's Law $\quad q = -kA \dfrac{\partial T}{\partial X}$

80"
The World's
Largest
Plasma TV

Samsung 80" Plasma Panel – CES Las Vegas 2004

SDI 102″PDP @SID2005