

Technical Guide

2016 - LCD TV

Model No. LCD-2016



Circuit Operation and Troubleshoot

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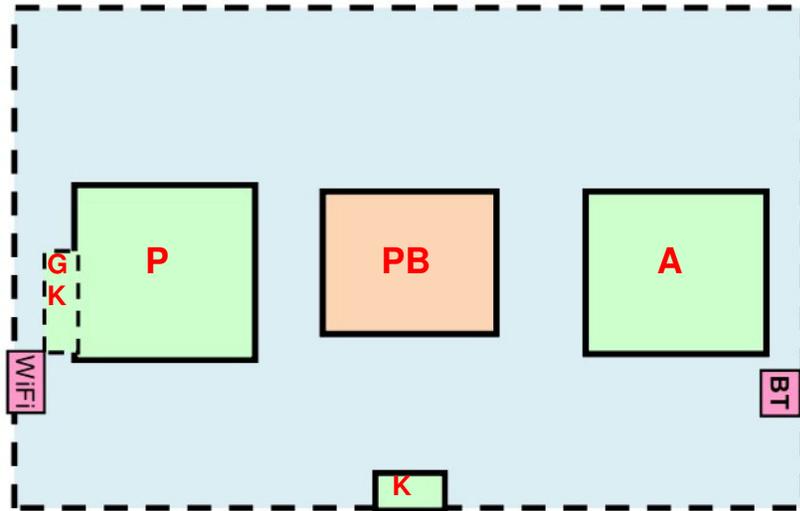
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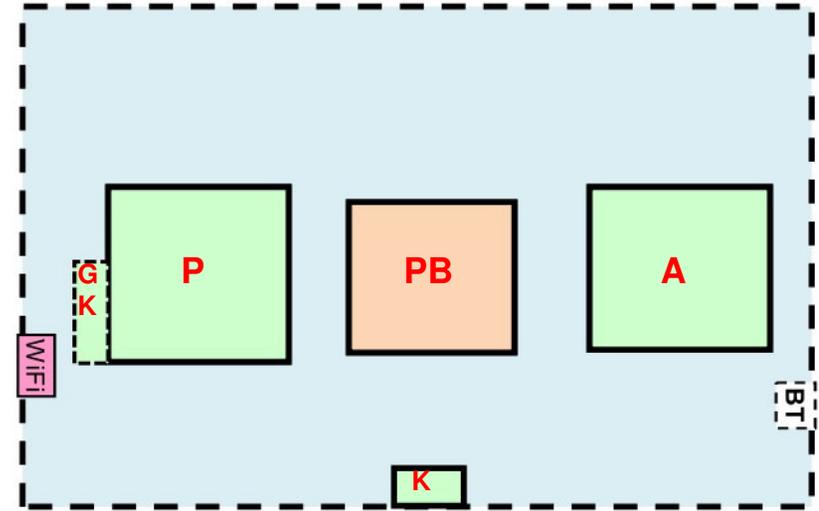
1. Board Layout

Board Layout -1 (DX*** series)

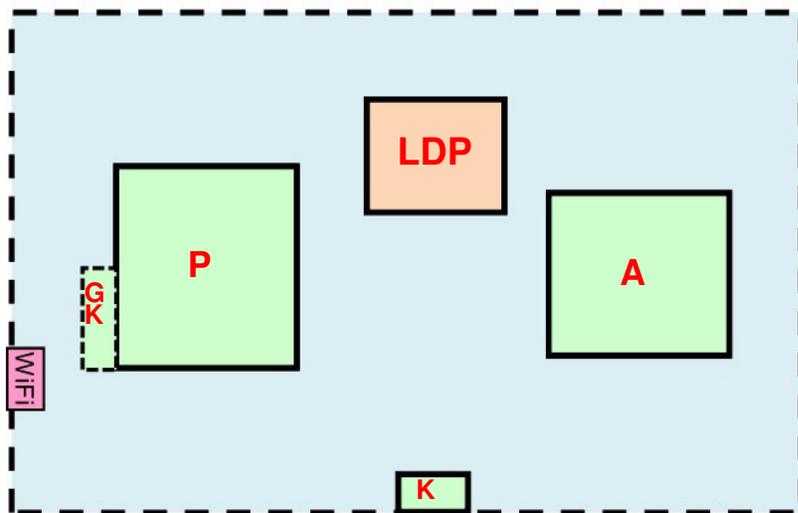
T*-**DX900



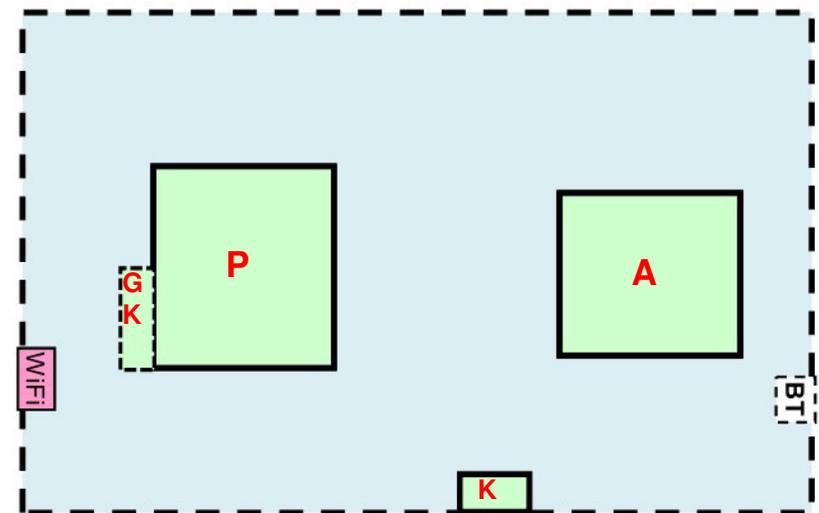
T*-65DX***, TH/TC-55DX***



T*-40DX***



T*-49/50/58DX***, TX-55DX***

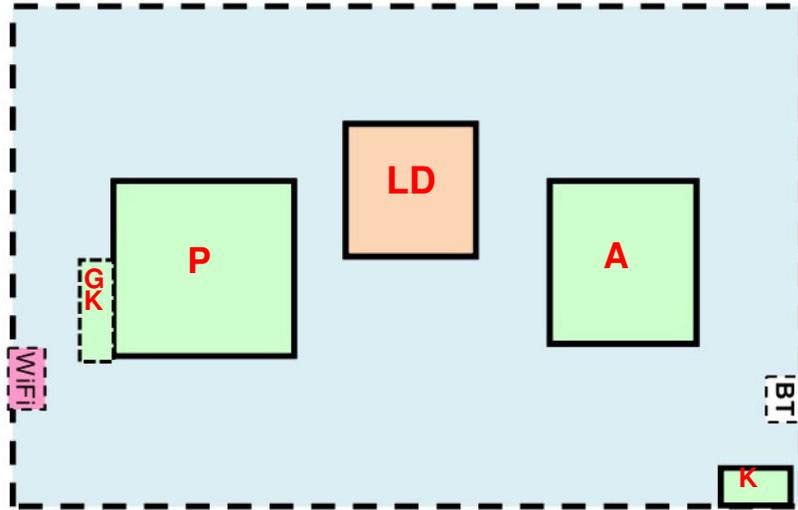


GK board : depend on the model

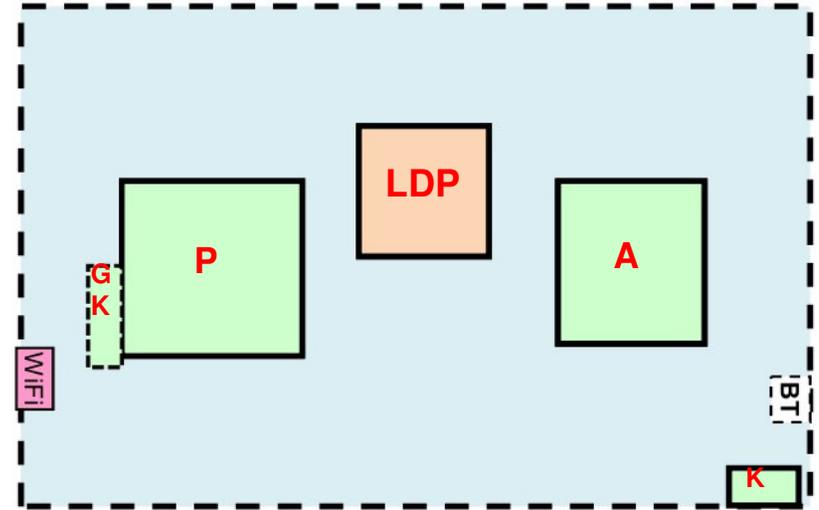
BT : depend on the model and region

Board Layout -2 (D/DS*** series)

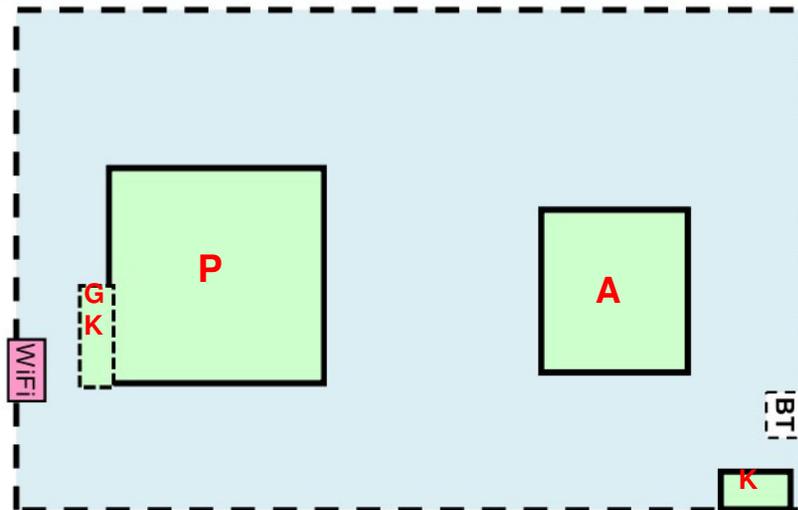
T*-49/43DS***
T*-49/43D***



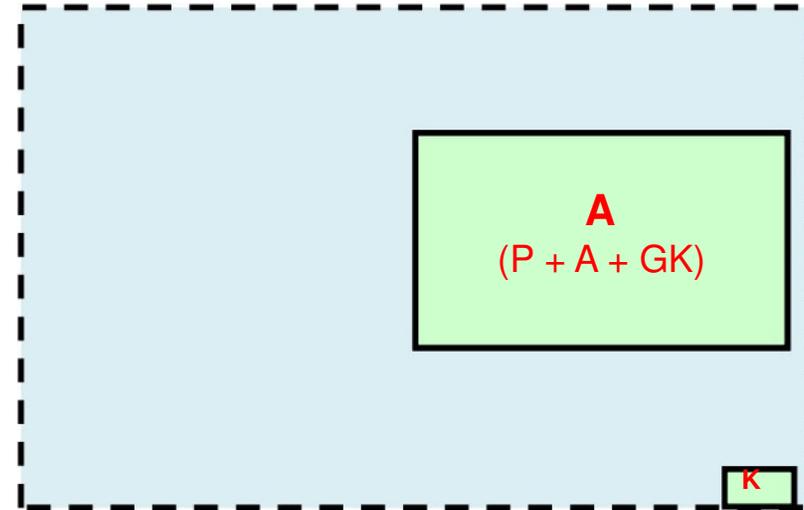
T*-65/55DS***



T*-50/40/32DS***
T*-40/32D***



TH-32D400



WiFi : only DS*** series

BT : only TC-**DS6**, TX-**DS630 series

GK board : depend on the model

Main Board Structure

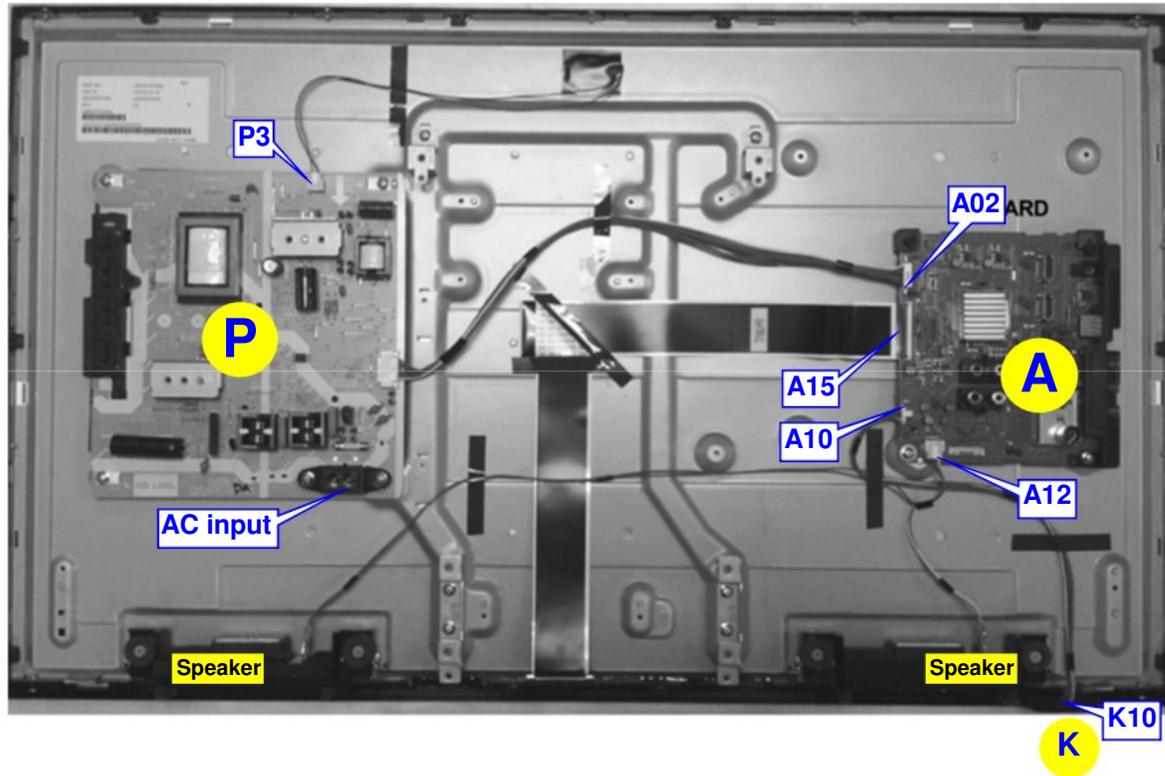
	D4**	DS6**	DX6**/7**/8** (4K)	DX900 (4K)
32inch	A+P /	A+P	---	---
40inch	A+P	A+P	A+P+LDP	---
43inch	A+P+LD	A+P+LD	---	---
49inch	A+P+LD	A+P+LD	A+P	---
50inch	---	A+P	A+P	---
55inch	---	A+P+LDP	A+P , A+P+PB: (only TH-55DX640* , TC-55DX700*)	---
58inch	---	---	A+P	A+P+PB
65inch	---	A+P+LDP	A+P+PB	A+P+PB

Except K, GK boards

Board Layout -1

A+P

(32D400)

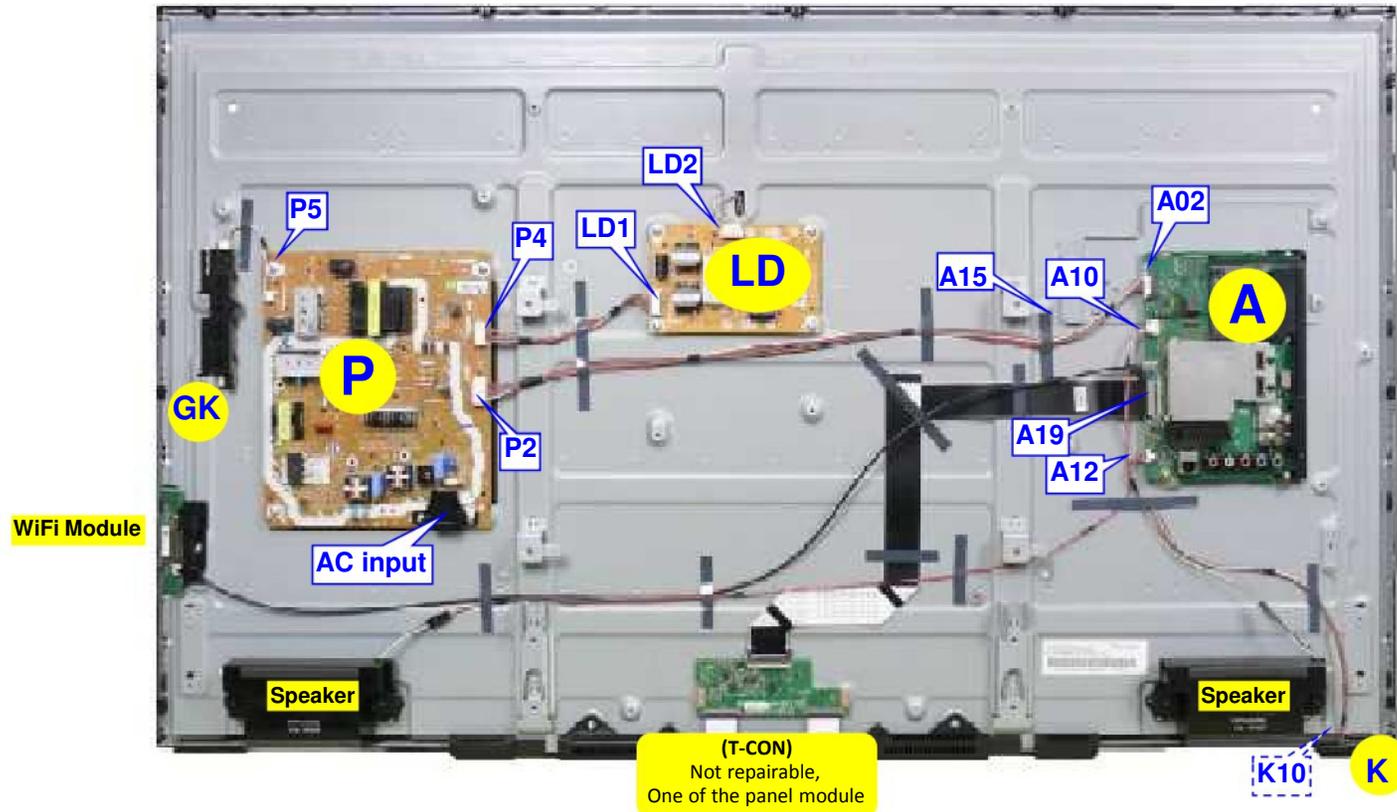


Board Name	Function
A-Board	Main Board
P-Board	Power supply, Backlight Drive, Power key, Control key
K-Board	Remote Receiver, LED

Board Layout -2

A+P+LD/LDP

(49DS630)



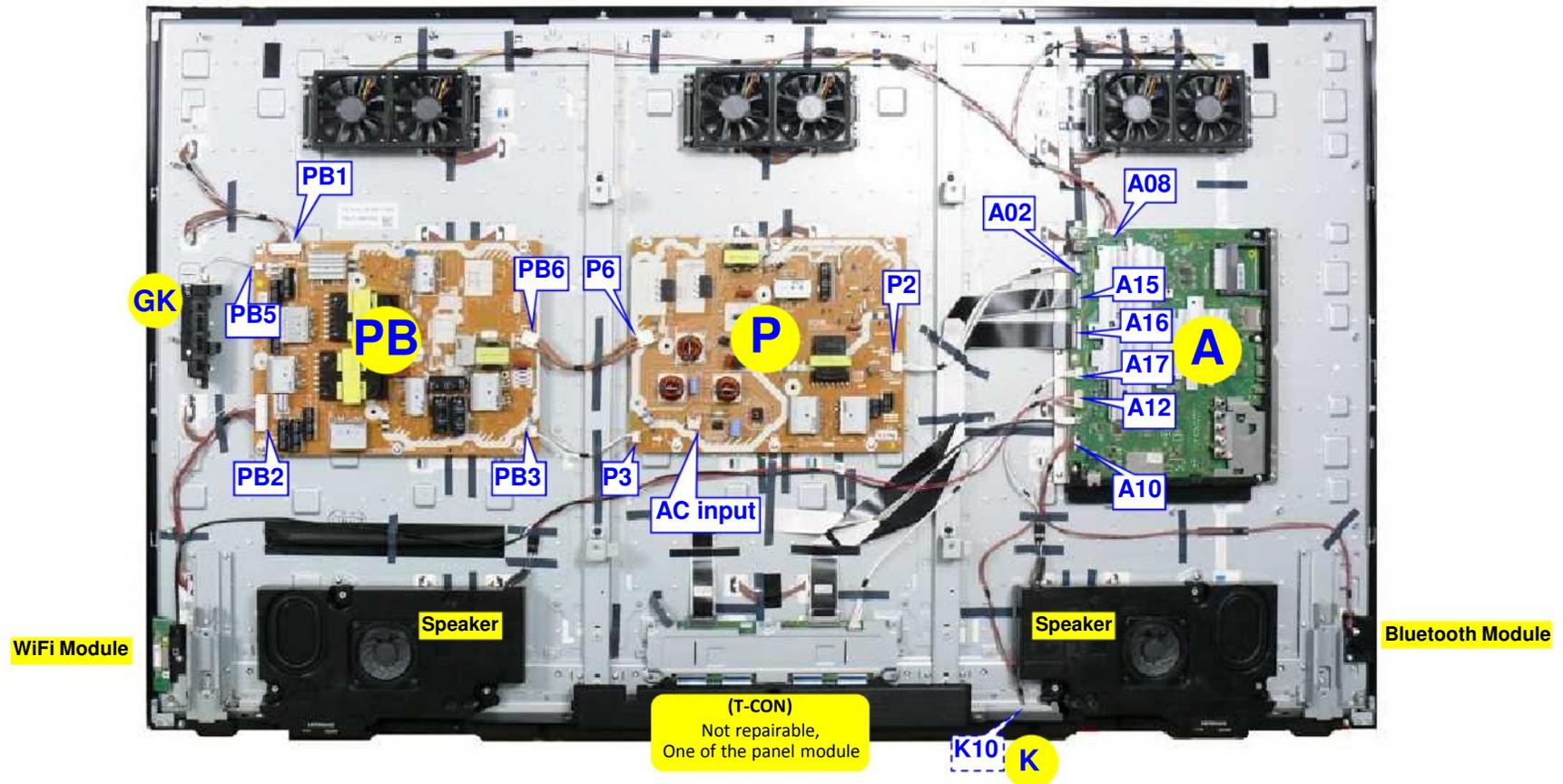
Board Name	Function
A-Board	Main Board
P-Board	Power supply for Signal Process
LD-Board	Power supply for Backlight Drive

Board Name	Function
GK-Board	Key
K-Board	Remote Receiver, Power LED

Board Layout -3

A+P+PB

(65DX900)



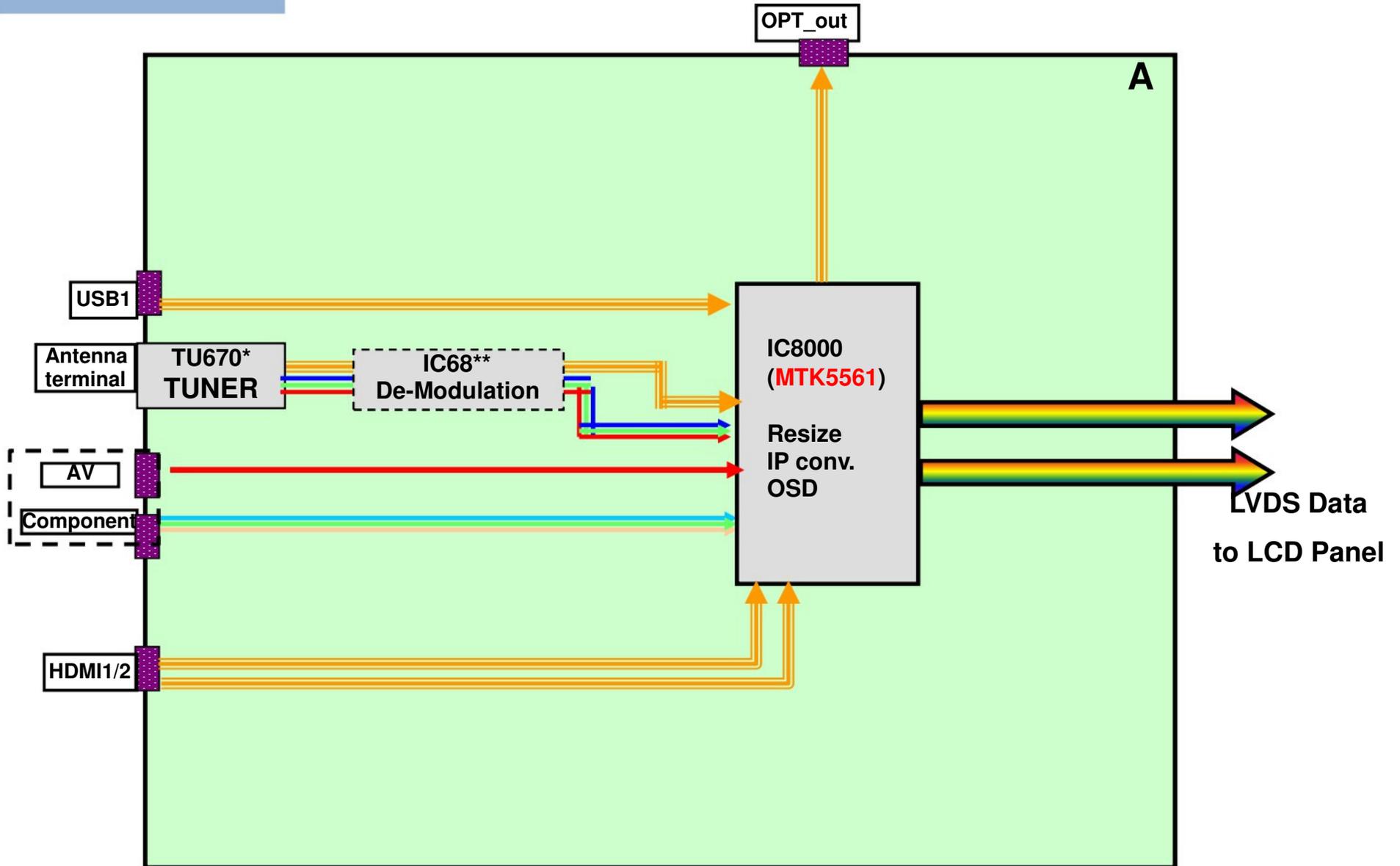
Board Name	Function
A-Board	Main Board
P-Board	Power supply for Signal Process
PB-Board	Power supply for Backlight Drive

Board Name	Function
GK-Board	Key
K-Board	Remote Receiver, Power LED

2. Video Signal Processing

Video/Audio Signal Process - 1

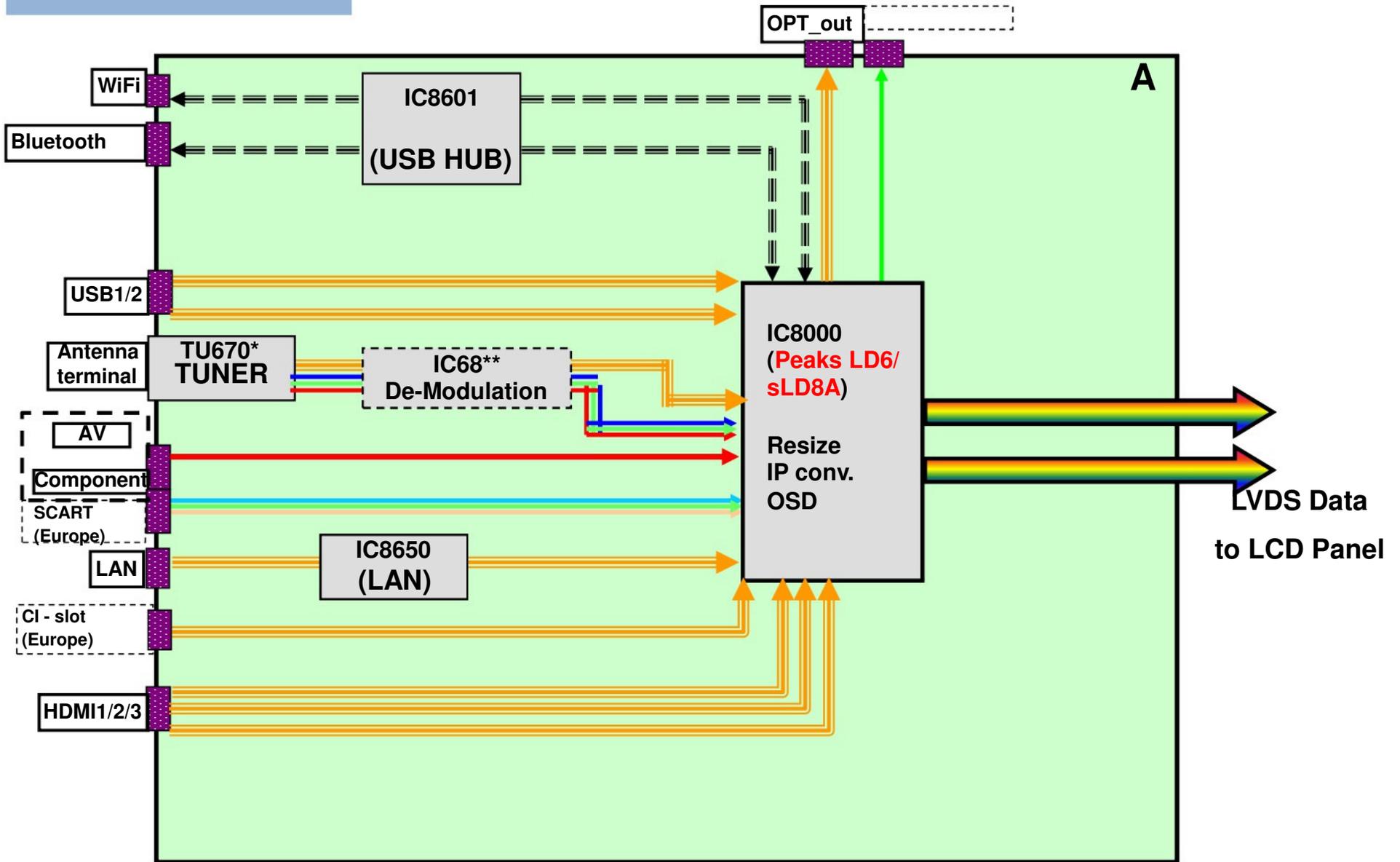
D4** series



The input terminals are different by the models or countries.

Video/Audio Signal Process - 2

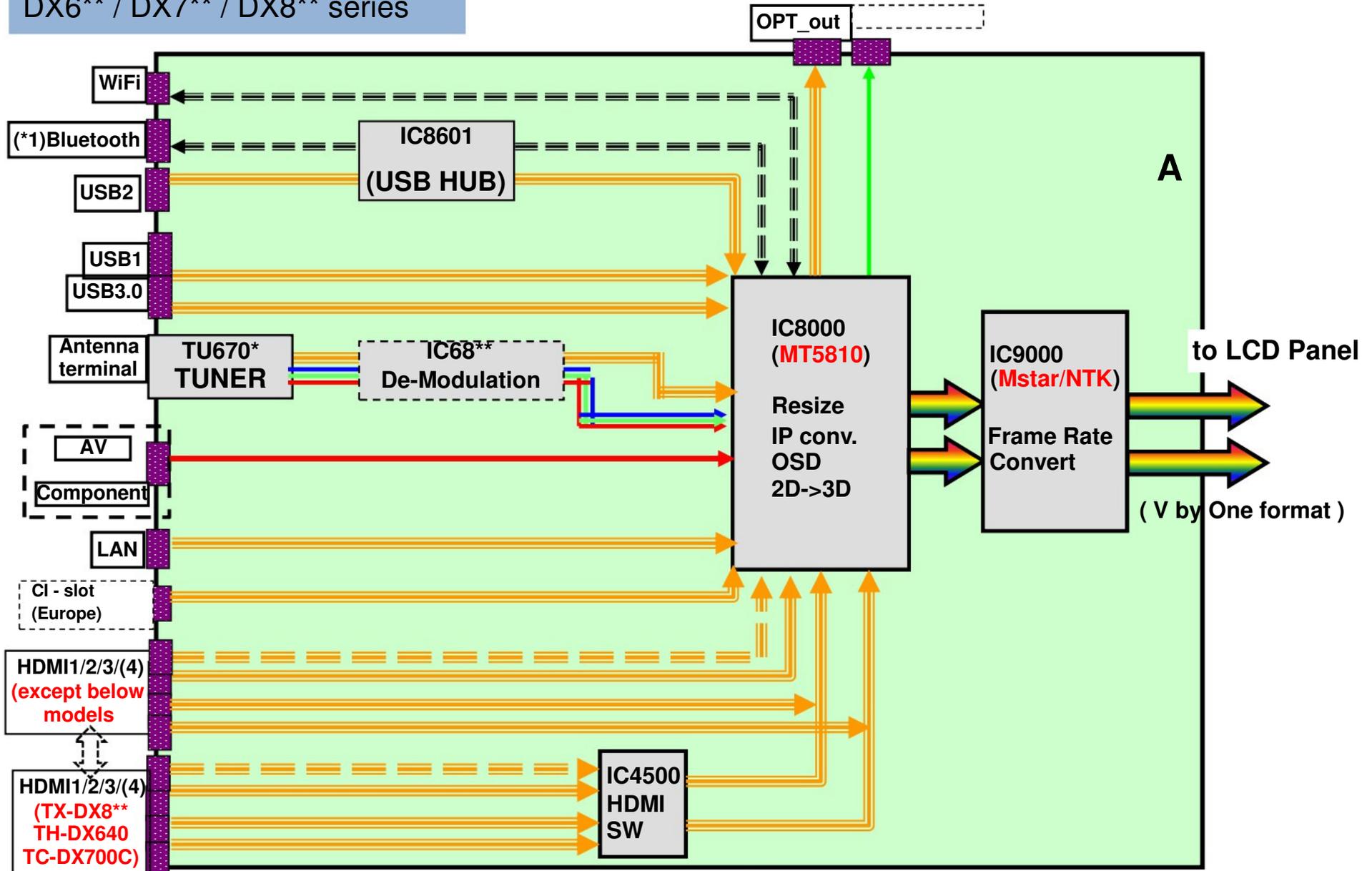
DS6** series



The input terminals are different by the models or countries.

Video/Audio Signal Process - 3

DX6** / DX7** / DX8** series

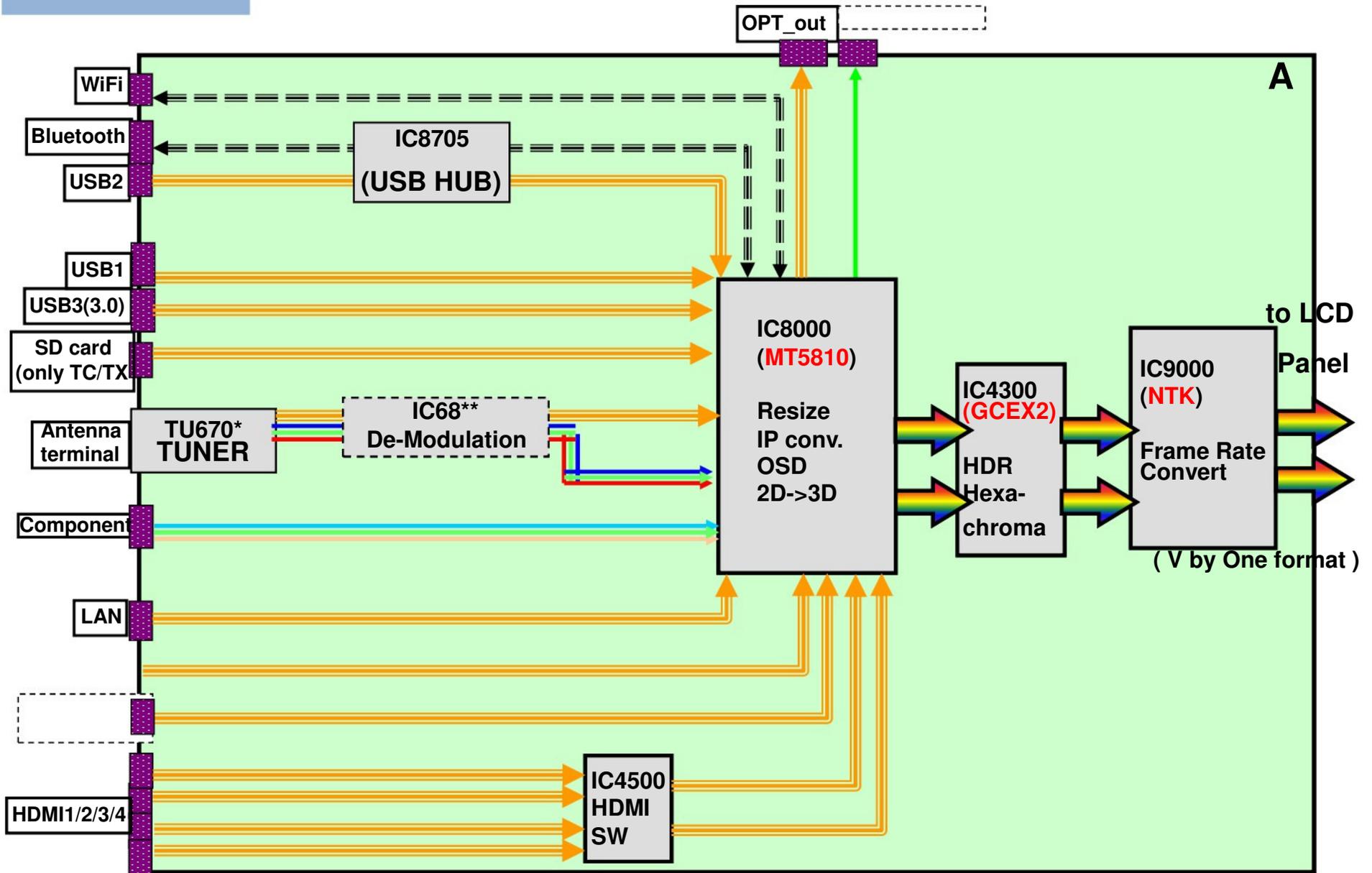


(*1) Bluetooth : only DX9**/7** (except TC-**DX700C)

The input terminals are different by the models or countries.

Video/Audio Signal Process - 4

DX900 series



(*) The input terminals are different by the models or countries.

Video/Audio Signal Process - 5

The main function of the A board is to select and process one of the incoming video signals. IC8601 (or IC8705) is just switches of USB signals. The built in WiFi module is connected by USB type of terminal.

Video input, Component Video Input, HDMI input and the composite video output of the tuner are all connected to IC8000 for selection. The video input signal can be two formats: Video, or Y, Pb, Pr. A comb filter inside IC8000 converts the composite video signal of the main picture to Y and C (luminance and chrominance) signals. The signal is then converted to RGB. At the completion of this process, the format of the composite signal is now the same as a digital 1080i component signal. If the incoming video is in the 480p, 720p, 1080i, and 1080p format, the Y, Pb, and Pr signals undergo A/D (analog to digital) conversion. Finally all picture signals are converted to 1080p.

Digital television reception of the tuner is output in the form of an IF (Intermediate Frequency) signal. The transport stream from the tuner enters the VSB I/F (Interface) section of IC8000 where the video signal is extracted and converted to YUV data. The output is provided to the Video Input I/F for selection. The JPEG data of the SD card enters the JPEG I/F section of IC8000 for conversion into YUV data and output to the Video Input I/F circuit. The video input interface outputs the selected picture data to the video process circuit.

This Video Process section of the IC performs all picture control operations such as brightness, contrast, color, tint, etc. On Screen Display data such as channel numbers, Digital TV closed caption, and picture adjustments are mixed with the video data. If in 3D mode, it converts to the right and left pictures. After the process, LVDS (Low Voltage Differential Signaling) is output to LCD panel module. # IC9000 is the frame rate converting IC for high speed LCD panel. IC4300 adjust the brightness for HDR feature.

Troubleshoot for Video Signal Problem

<LCD Panel Test Mode> :When abnormal picture is displayed, troubleshoot by the test pattern in LCD module.
If the picture is no problem, A board must be defective.
If the picture is also abnormal, LCD panel module must be defective. Just in case, confirm the flat cable connection between A board and T-CON board.

How to enter :

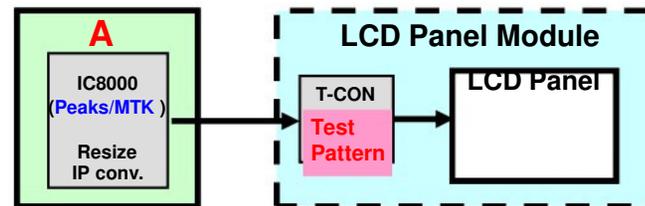
While pressing "volume(-)" button of the TV unit,
press "option/yellow" button of the remote control 3 times within 2 seconds.

How to exit :

Switch off the TV unit

#)The test pattern is created by the circuit in LCD Panel Module(T-CON board).

Some patterns are automatically changed. The patterns are depend on the LCD panel.



Troubleshoot for Video/Audio Signal Problem

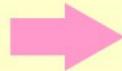
<TV Self Test> : Customers also can check the picture and sound by internal data.

If the picture and sound is no problem, the reason of trouble is mostly not a TV.

How to display :

Menu → HELP → TV Self Test

#) The test pattern and test sound are created by the main IC on the A board.



(OK)

- 1) During this indication "Self Check of Service Mode" is working at the background.
- 2) If NG, indication is shown.
A board defective
- 3) If All OK, it shifts to picture and sound test.



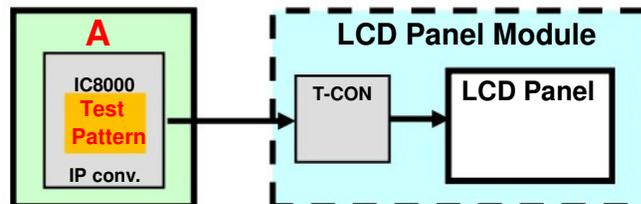
Yes

No

1. Antenna level low
2. Connection mistake
3. Input devices NG
4. Input select mistake

TV unit defective.
(A board, Panel or Speaker)

***) does not apply to D400/410 series**

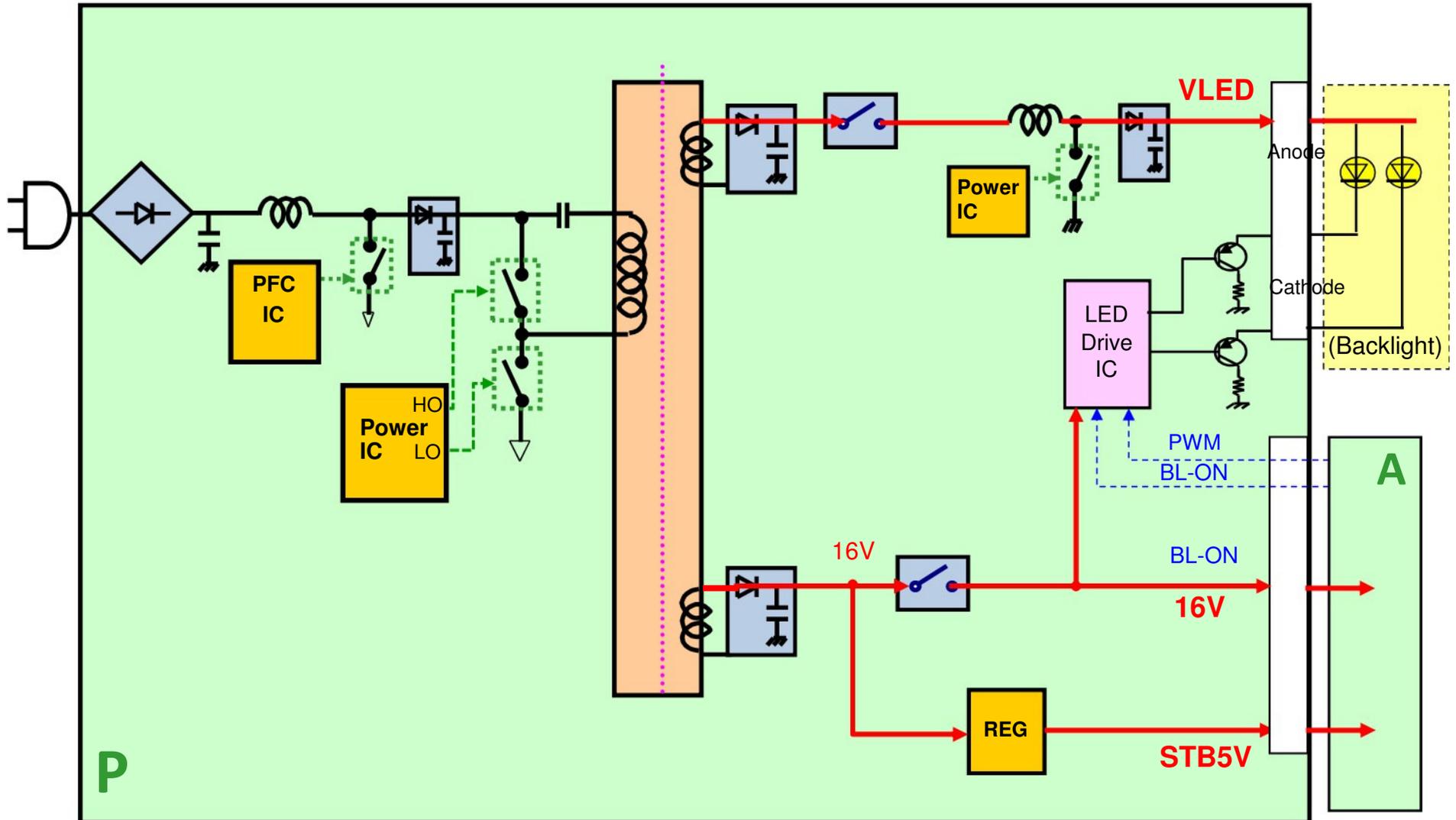


3. Power Supply

3-1. Power Board Structure

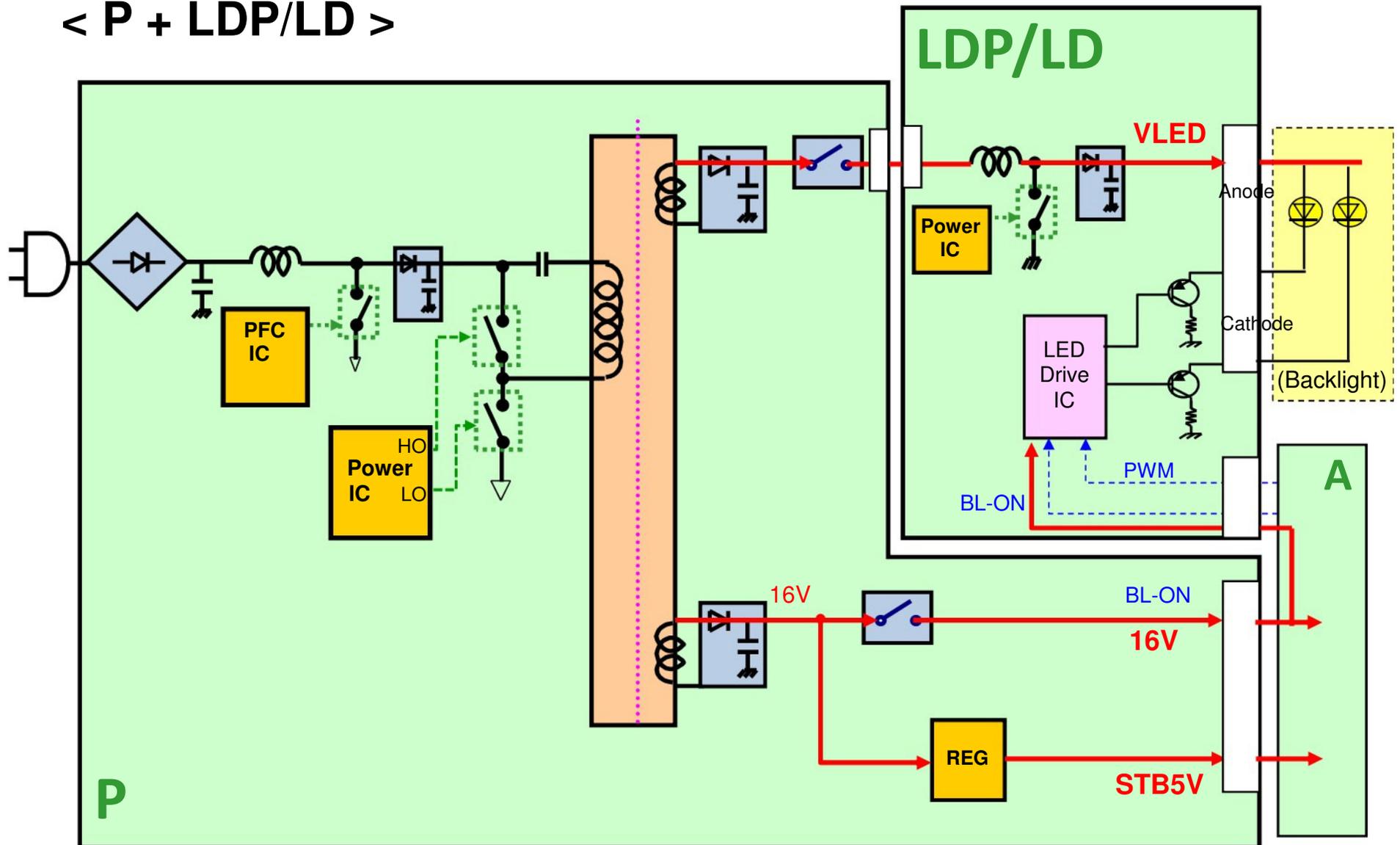
Power Board Structure 1 (P Board only)

< P >



Power Board Structure 2 (P+LDP/LD board)

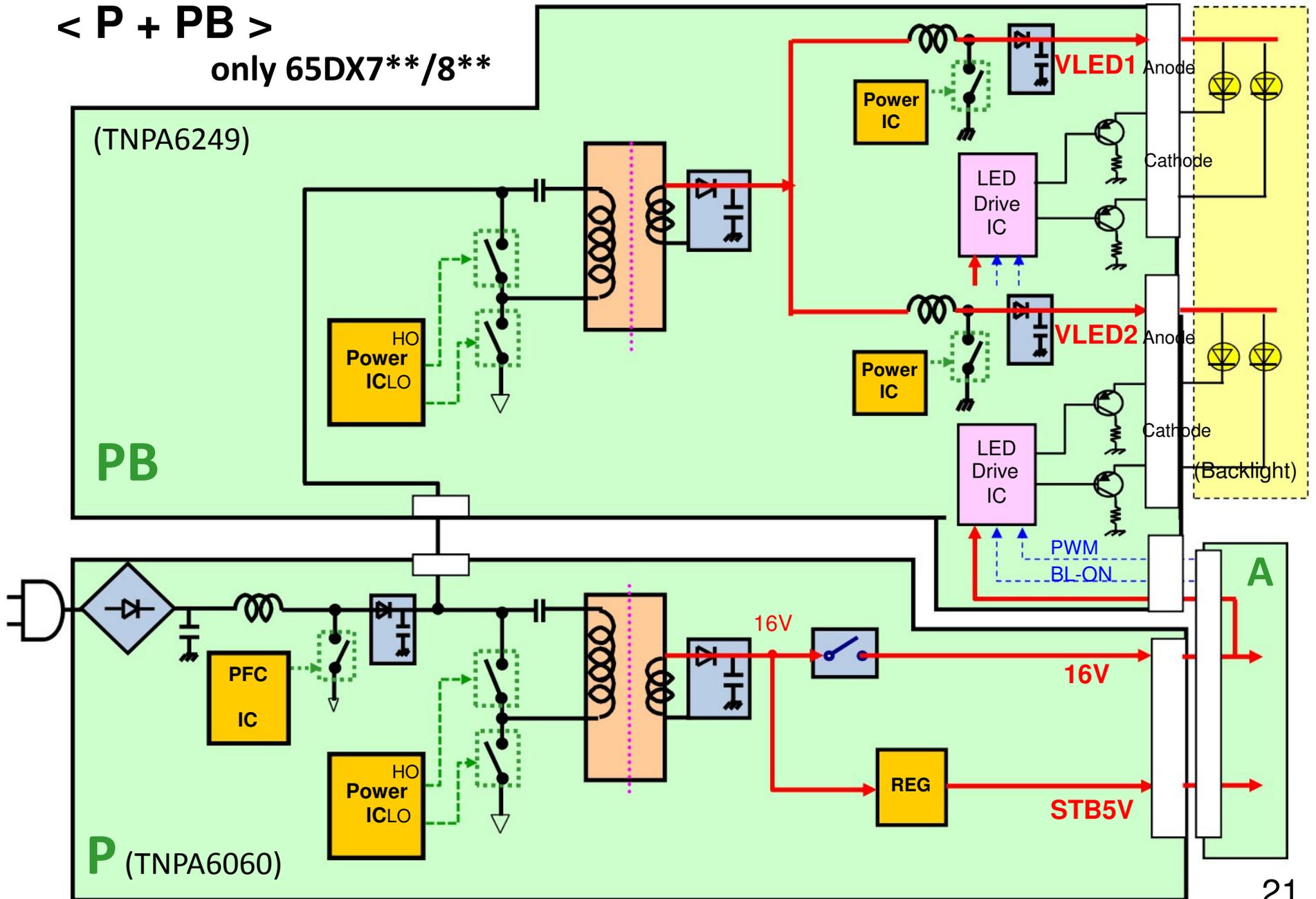
< P + LDP/LD >



Power Board Structure 3 (P+PB board)

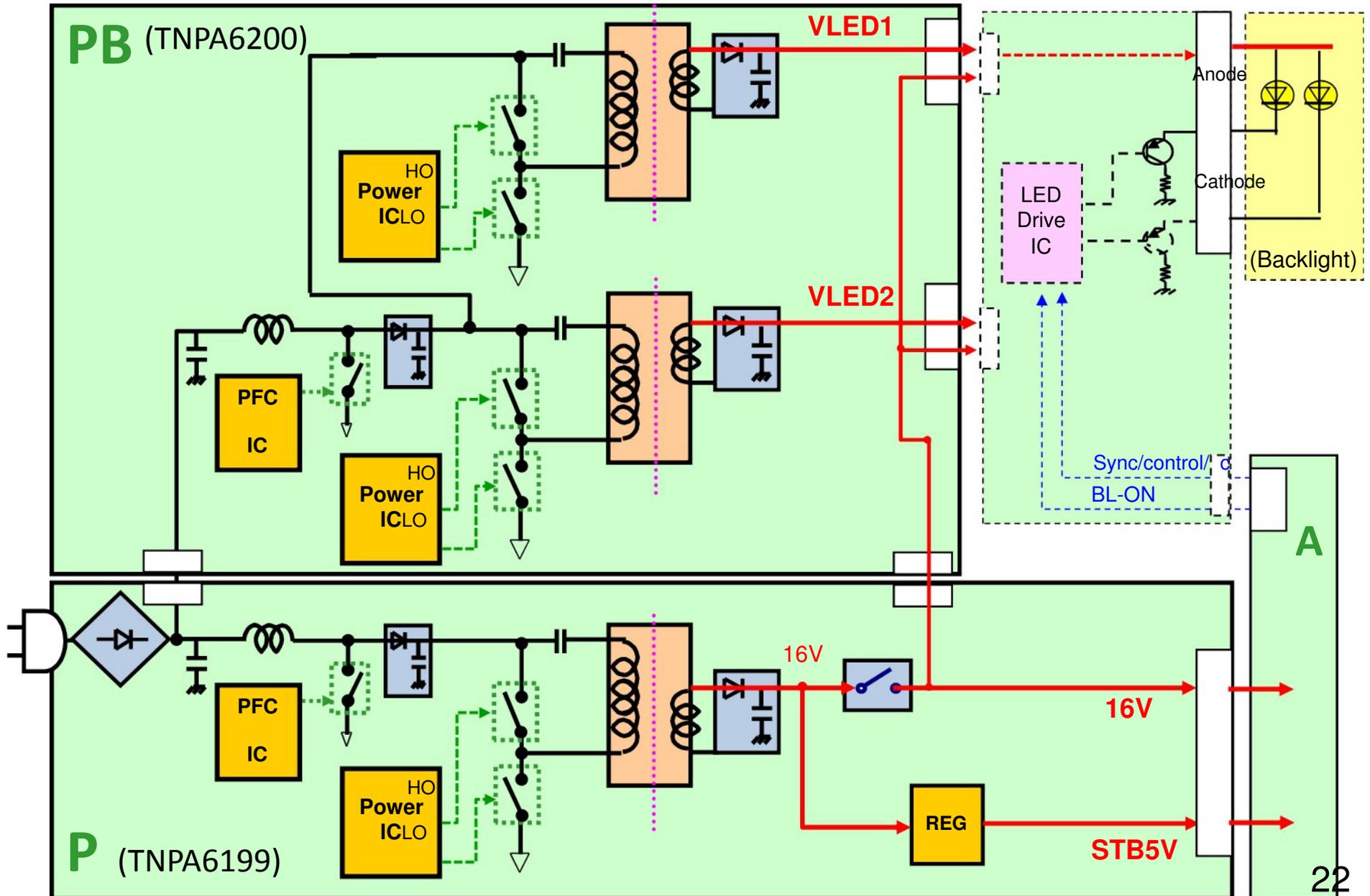
< P + PB >

only 65DX7**/8**



Power Board Structure 4 (P+PB board)

< P + PB > only DX9**



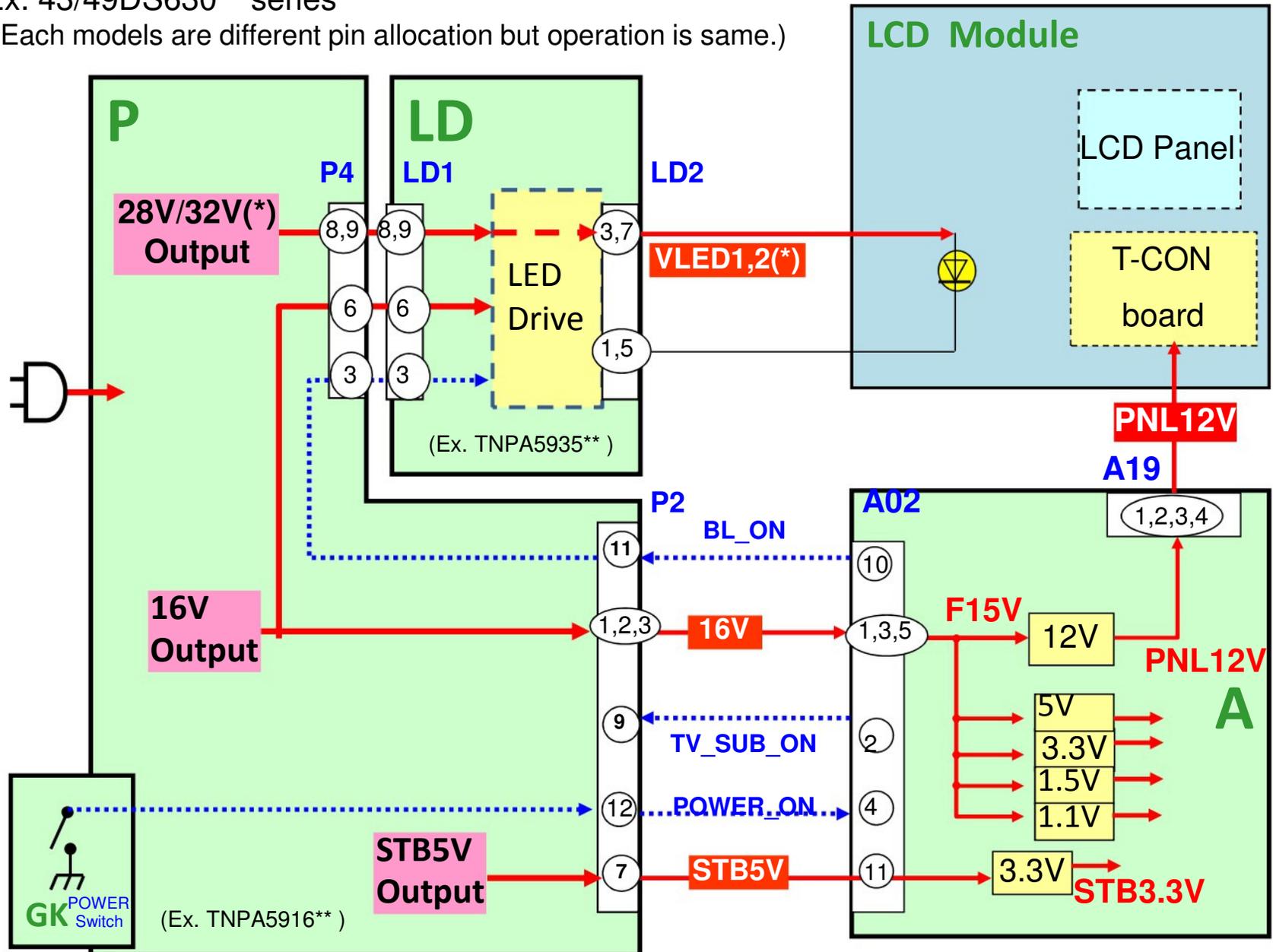
3-2. Stand by / Start up Operation

The explanation is for the case of “Power Board Structure 2 (P+LD/LDP board, 43/49DS630)”, but “P, P+LD/LDP, P+PB” cases have similar start up operation.

Voltage Distribution (A+P+LD Boards)

Ex. 43/49DS630** series

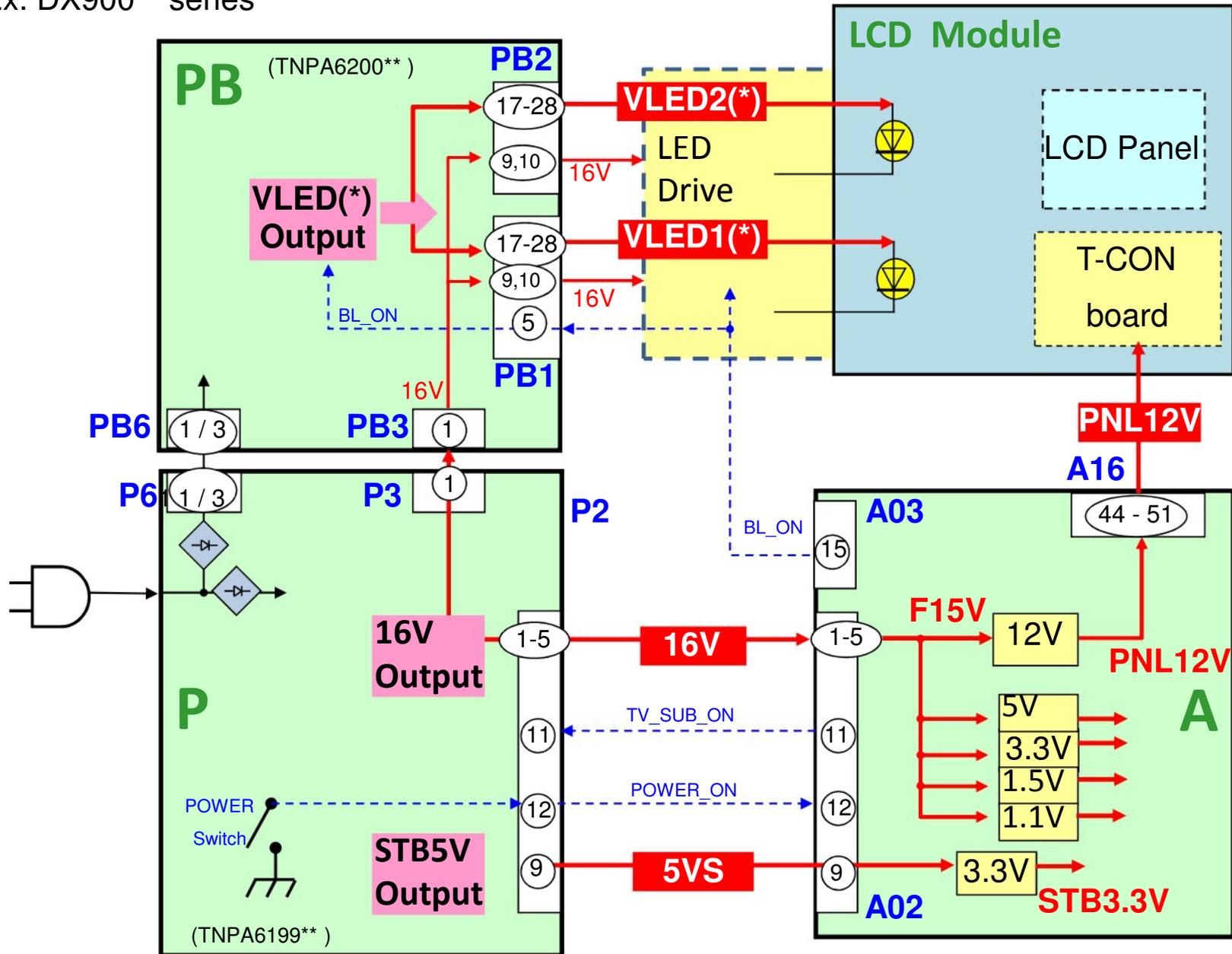
(Each models are different pin allocation but operation is same.)



(*)The DC level is different by the LCD panel.

Reference : Voltage Distribution (A+P+PB Boards)

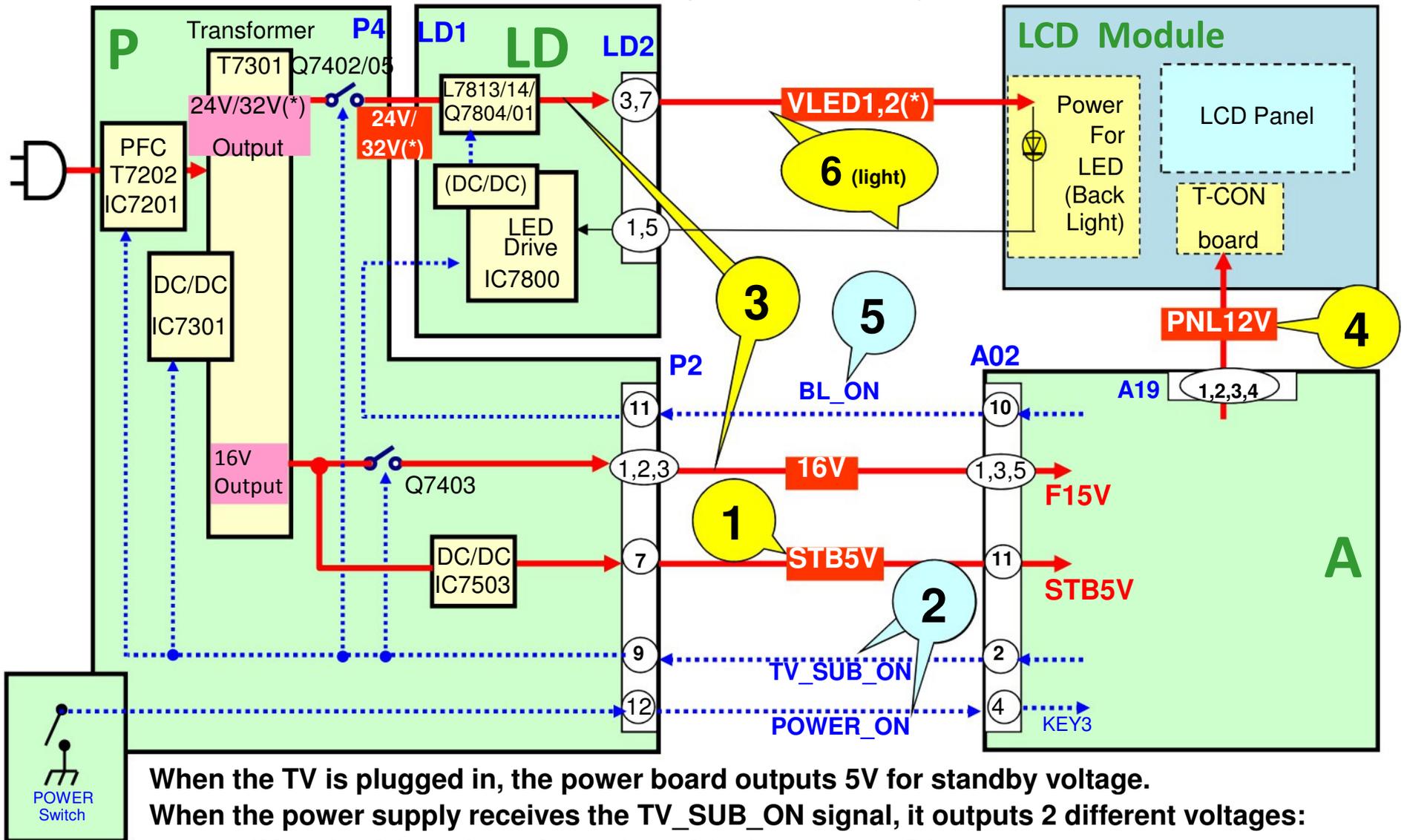
Ex. DX900** series



(*)The DC level is different by the LCD panel.

Start up Operation-1

Ex. 43/49DS630** series (Each models are different pin allocation but operation is same.)

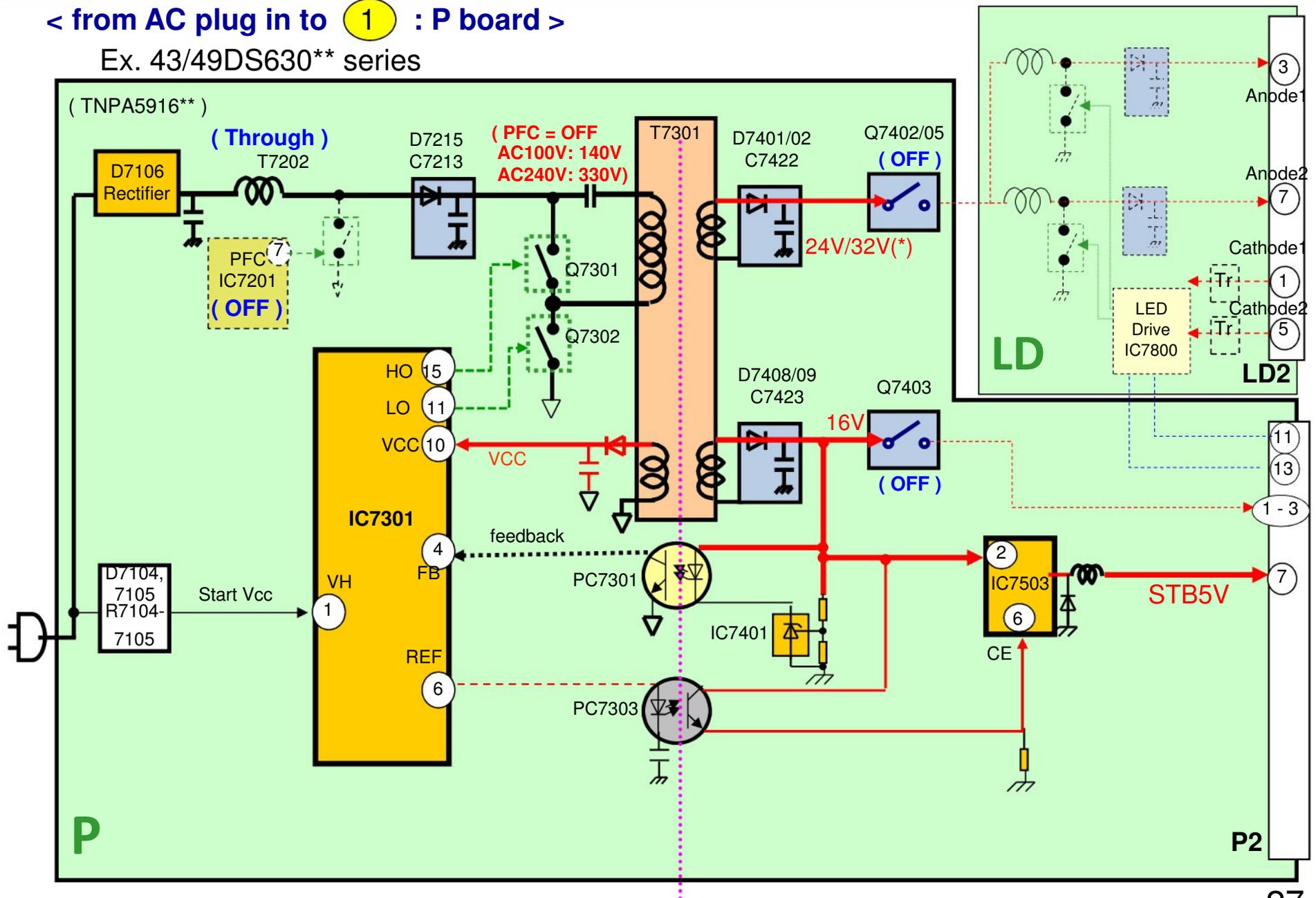


- When the TV is plugged in, the power board outputs 5V for standby voltage.
 When the power supply receives the TV_SUB_ON signal, it outputs 2 different voltages:
- 16V to the A board on pins 1, 2, and 3 of connector P2.
 - 24/32V to the LED backlight board on pins 8,9 of connector P4.
- After A board is ready to display, it outputs Backlight_on command to LD board.

Start up Operation-2

< from AC plug in to ① : P board >

Ex. 43/49DS630** series



Start up Operation-3

< from AC plug in to  : P board >

When the TV is plugged in, the rectifier start to produce DC voltage which leads through PFC circuit directly to the power switches Q7301, Q7302. (PFC circuit IC7201 does not operate at this moment.) Besides this DC voltage is provided also for D7104, D7105 which provide start voltage to pin 1 of power supply IC 7301. When the voltage on pin 1 rise up to predefined value IC7301 starts supplying of switching pulses for Q7301, Q7302. Due to this current starts to lead through winding of T7301 which starts to generate output voltages. One of these voltages VCC is used for power supplying of the IC 7301 to its pin 10.

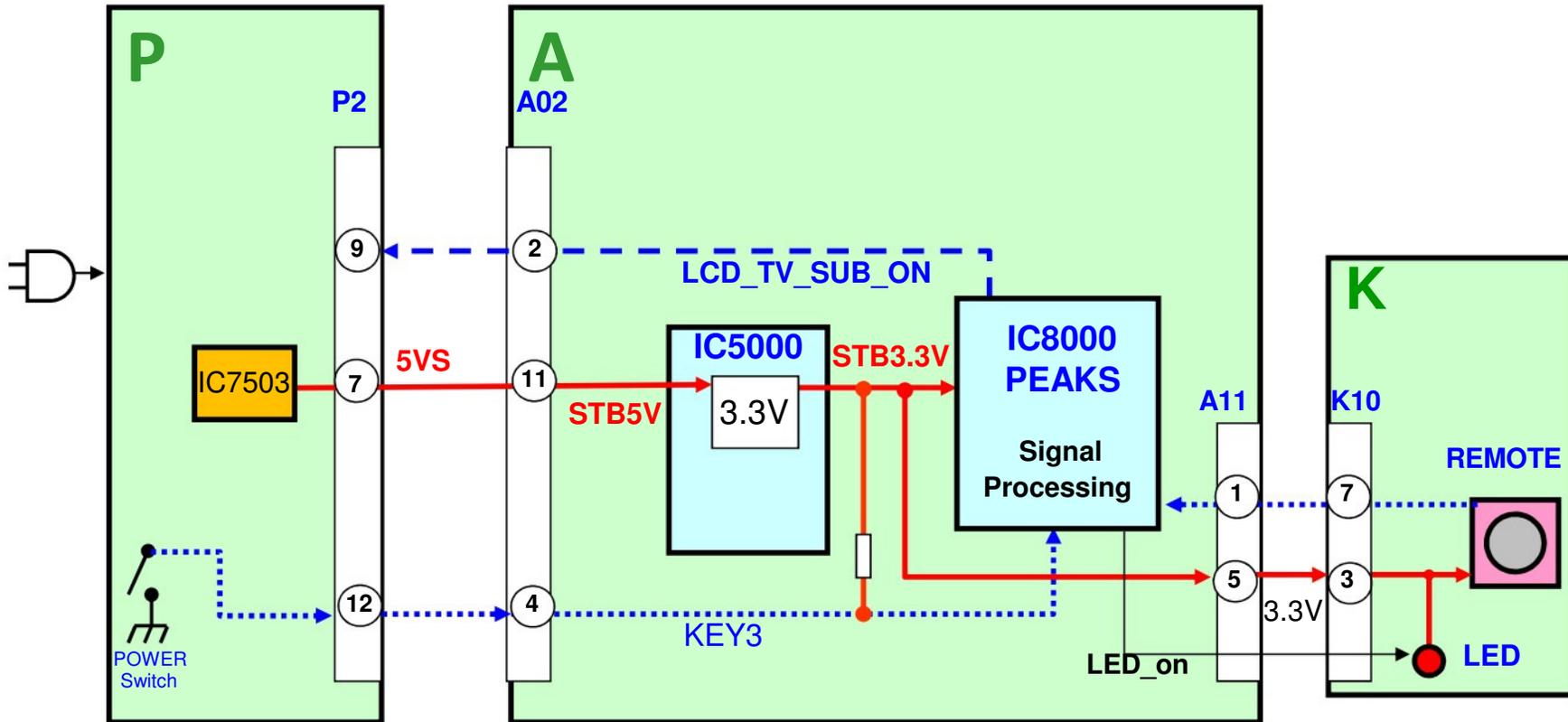
When the power supply starts up, the 16V is providing by D7408,09/C7423. This voltage leads to IC7503, which is 5 volts DCDC converter.

This voltage (STB5V) is supplied to A board via connector P2 pin7. So if the TV is plugged in, STB5V is provided to A board without trigger signal.

Start up Operation-4

< from ① to ② : A board >

Ex. 43/49DS630** series



(Each models are different pin allocation but operation is same.)

	OFF (It can receive only Power SW)	Standby (It can receive Power SW, Remote, Viera Link and so on)
North America	Power LED: OFF	Power LED: OFF
Except North America	Power LED: OFF	Power LED: RED

Start up Operation-5

< from ① to ② : A board >

The STB5V from pin7 of connector P2 is applied to the Analog ASIC (IC5000) for supplying power to the Main CPU/PEAKS (IC8000) on the A board. The Analog ASIC (IC5000) converts the STB5V to STB3.3V. This voltage energize and prepare the microprocessor (CPU) for program execution. The STB3.3V from the Analog ASIC (IC5000) is also applied to the remote control receiver and the power LED on the K board through pin 5/8 of connector A11/K10.

When the Power Switch on, the key3 signal is grounded. (#1)

The IC8000 lights on the RED LED and is ready to power on the TV by receiving the Power switch on, Remote on, Viera Link and so on. This is a standby state.

(#1)Only North America model: Standby after the TV is plugged in. The RED LED is off

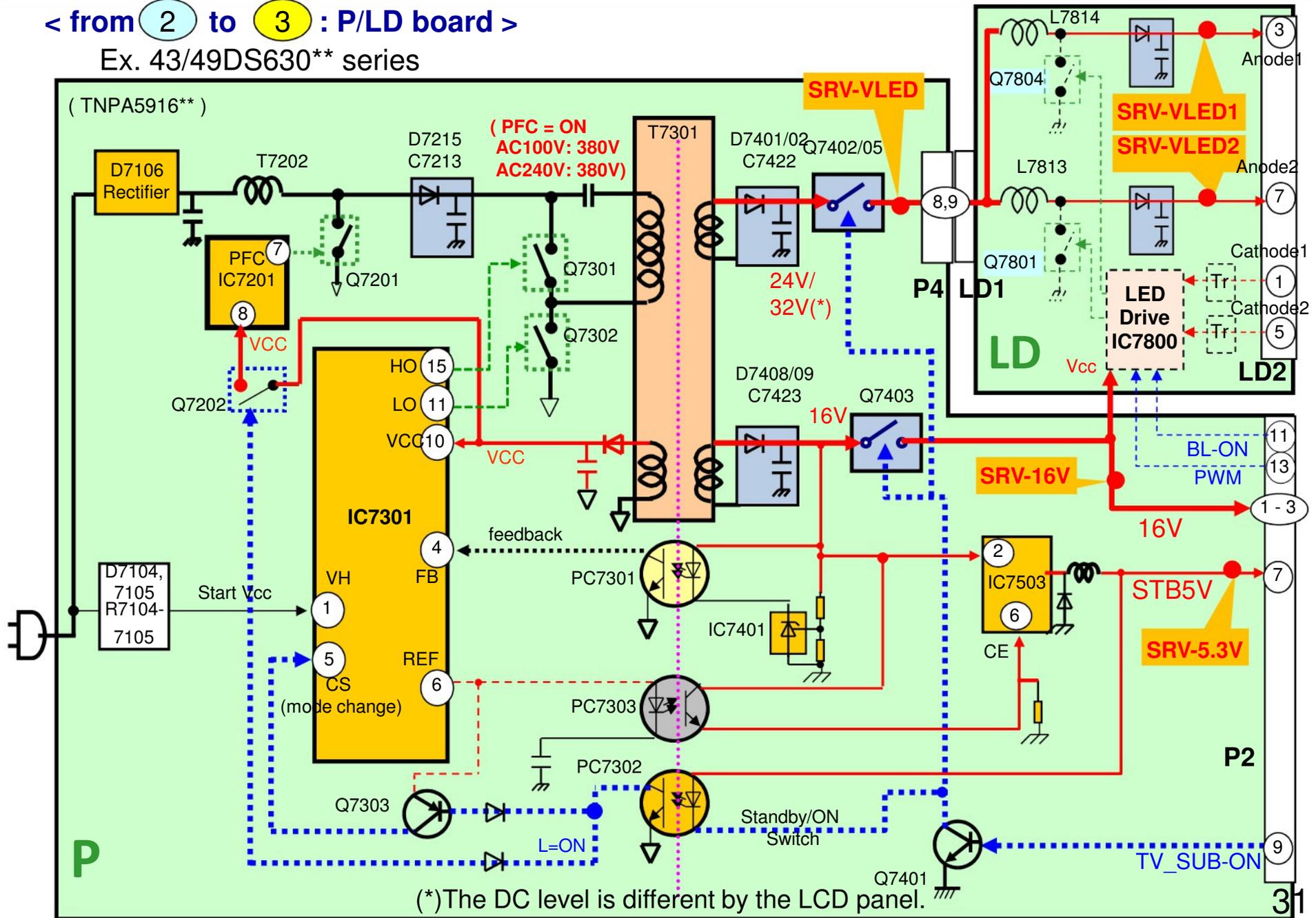
When the power on command coming from the power switch (or remote control) is provided to IC8000 PEAKS, the IC8000 first outputs the “TV_SUB_ON” command. The “TV_SUB_ON” command is provided to power board via pin 9 of connector P2.

(#) Just after transition to Stand-by mode, the TV_SUB_ON(16V) is output for few minutes.
(North America model : 10s)

Start up Operation-6

< from 2 to 3 : P/LD board >

Ex. 43/49DS630** series



Start up Operation-7

< from ② to ③ : P board >

When the power board receives the TV_SUB_ON signal from IC8000 via pin 9 of connector P2, it outputs 2 different voltages:

16V to the A board on pins 1, 2 and 3 of connector P2.

24/32V(*) to the LED backlight board on pins 8,9 of connector P4.

TV_SUB_ON command is carried to the primary side by PC7302. This voltage is passed to Q7303 which provides the mode change signal to pin 5 of IC7301.

Therefore the operation of the IC 7301 changes the switching frequency from standby state to working state and output voltages rise up.

Also, the ON command is connected to the Q7202 which provides power supply VCC of PFC circuit. The PFC starts to operate.

Output voltages from transformer T7301 start rising up until the moment when IC7401 starts to operate. This IC measures the 16V line output in the secondary side. The output of this IC is provided by PC7301 to pin 4 of IC7301. IC7301 adjusts the switching frequency by this feedback signal.

The TV_SUB_ON signal also switches on the Q7402/03/05 to provide output voltages (16V and 24/32V(*)) to other boards. The 24/32V(*) is provided to the LD board for LED Backlight Drive. The 16V is provided to the A board.

(*)The DC level is different by the LCD panel.

Start up Operation-9

< 3 : A board (SUB voltage) >

The 16V(F15V) from the P board via pin1,3 and 5 of connector A02 is applied to Analog ASIC IC5000 and ICs (Voltage regulators) on the A board to generate the SUB-Voltages used for signal processing operation.

: SUB1.1V, 1.5V, 3.3V, 5V and HDMI3.3V, TU1.8V

Each voltage regulators start up by high state of DCDCEN signal which is pull up to F15V. So F15V is provided to A board, each SUB-voltage regulator ICs start output.

Start up Operation-11

< 4 and 5 : A board (PNL voltage) >

The F15V is also used to generate the PNL-Voltage on A board. IC8000 outputs the Panel VCC ON2 signal. IC5500 starts generating the PNL12V by this signal. The PNL12V is provided to T-con circuit of the LCD Module.

< 6 : LD board (backlight drive) >

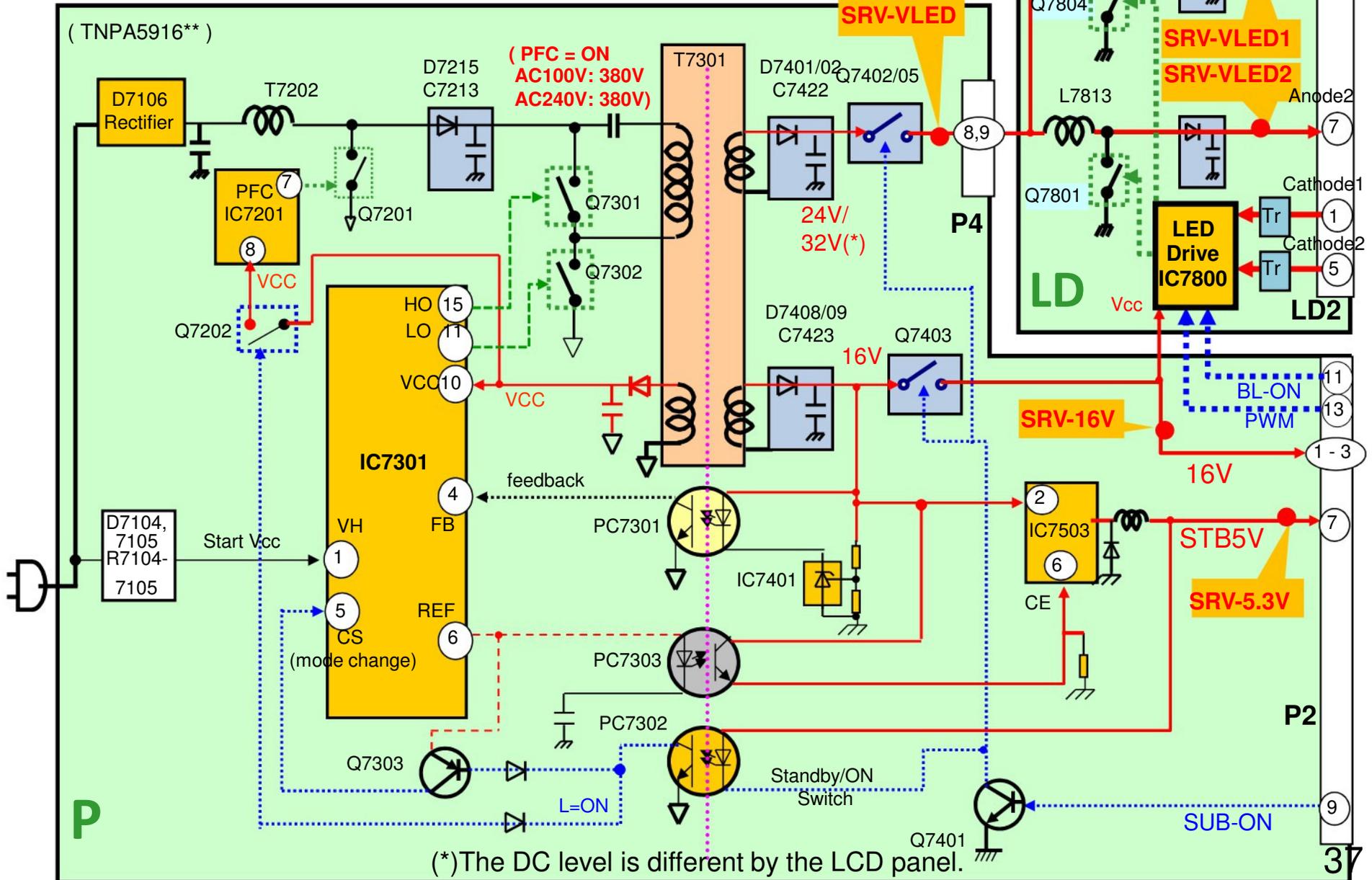
After that, IC8000 outputs the BL_ON command to the LD board through P board. The BL_ON command turns on the IC7800 for LED backlight drive. Then the backlight starts lighting by PWM signals, and LCD panel displays the picture.

If the backlight drive circuit does not work normally, the BL_SOS signal is passed to IC8000. At that time, IC8000 stops outputting the TV_SUB_ON signal and blinks the power LED 1 time.

Start up Operation-12

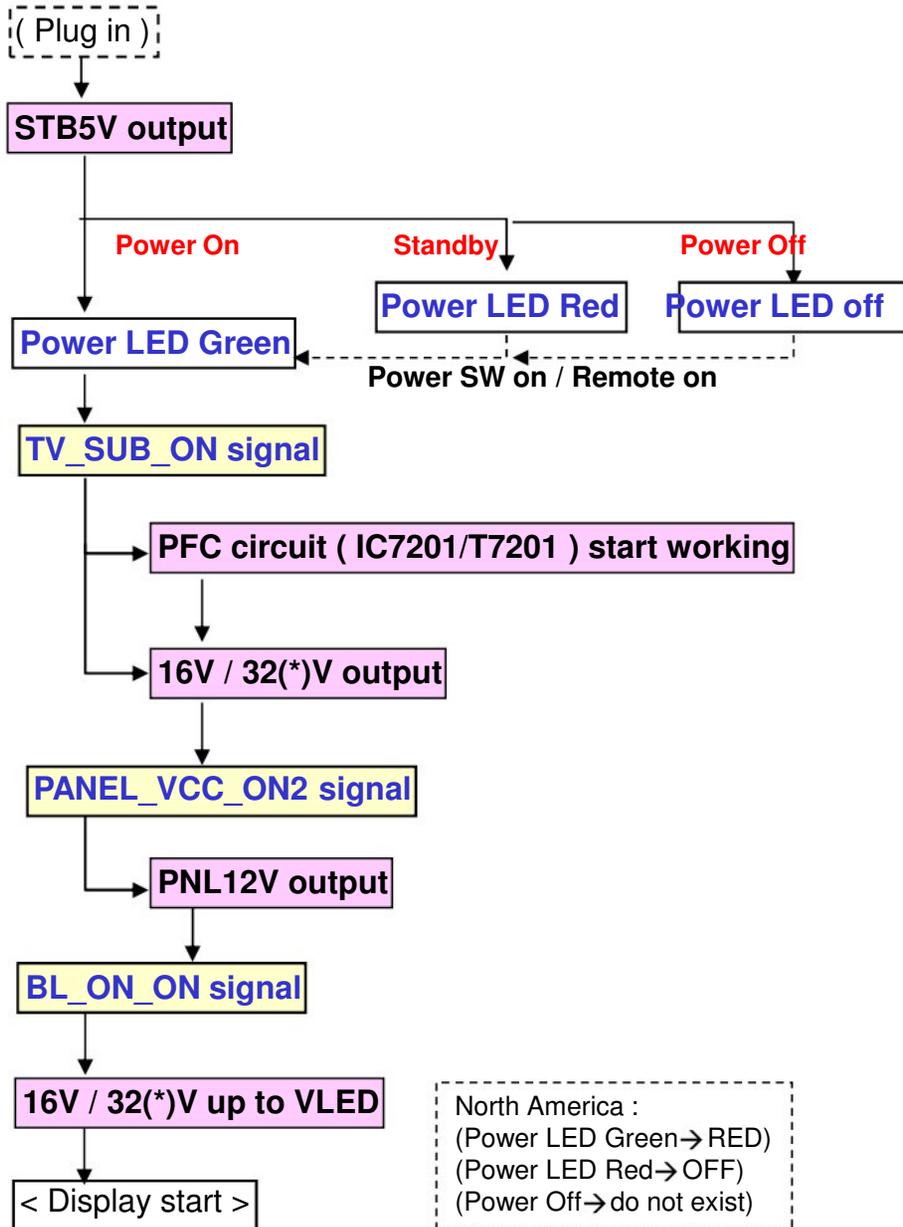
< 6 : LD board (backlight drive) >

Ex. 43/49DS630** series

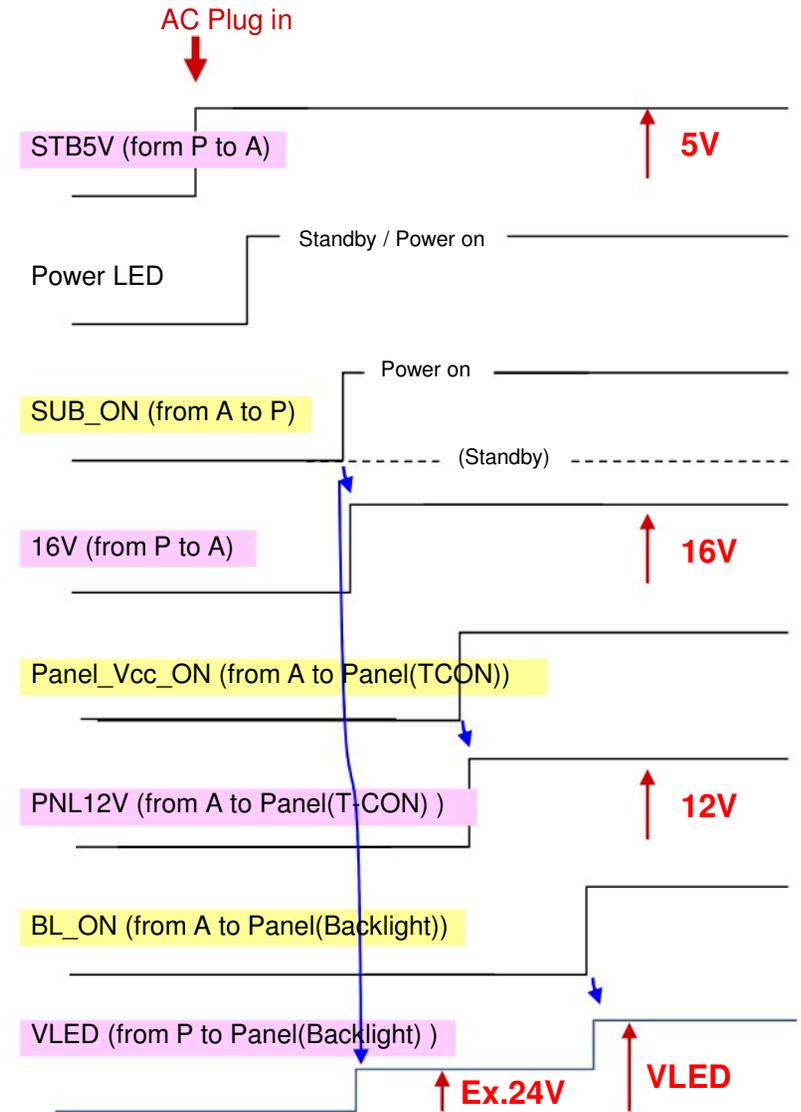


Simple Power On Sequence (D/DS Series)

< DS/D series >

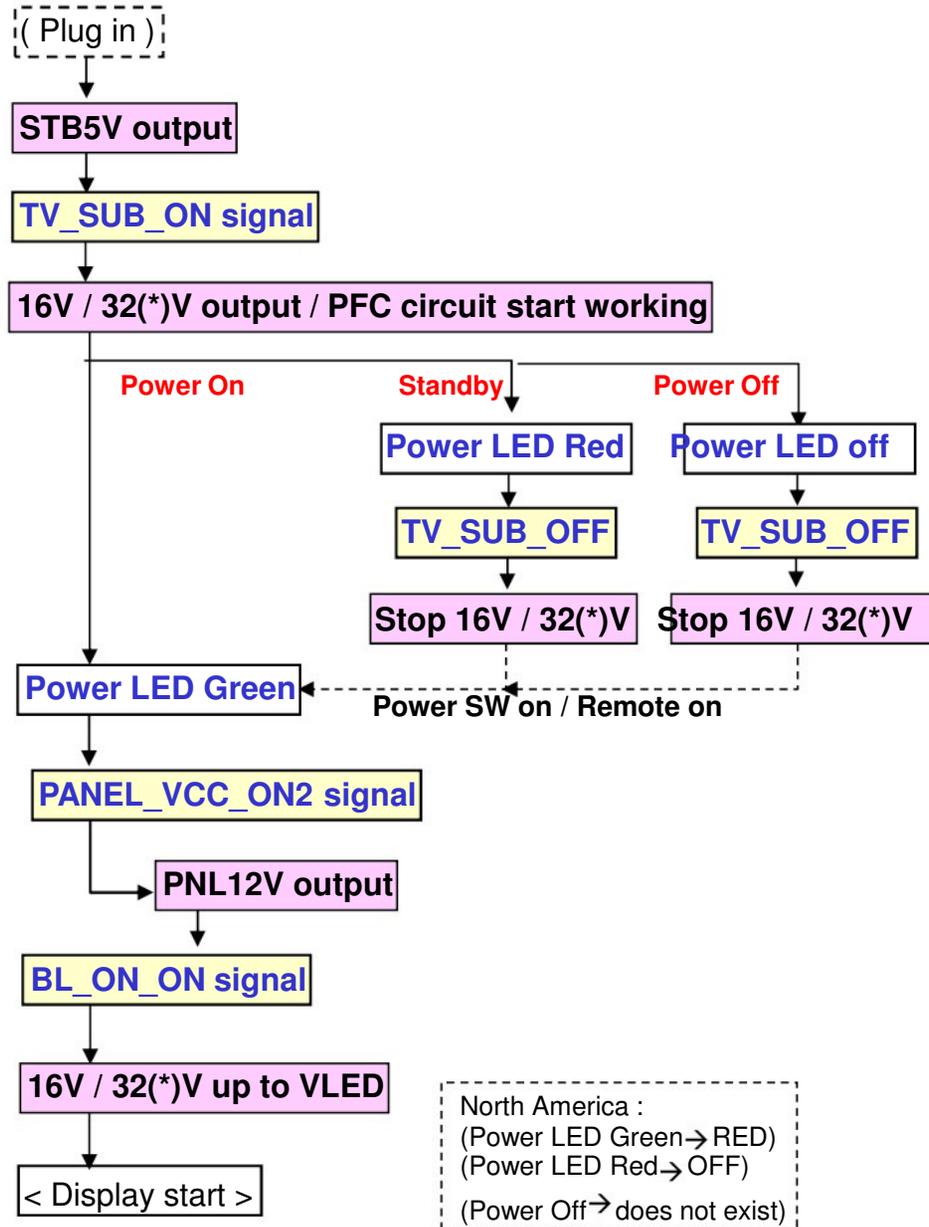


(*) The DC level is different by the LCD panel.

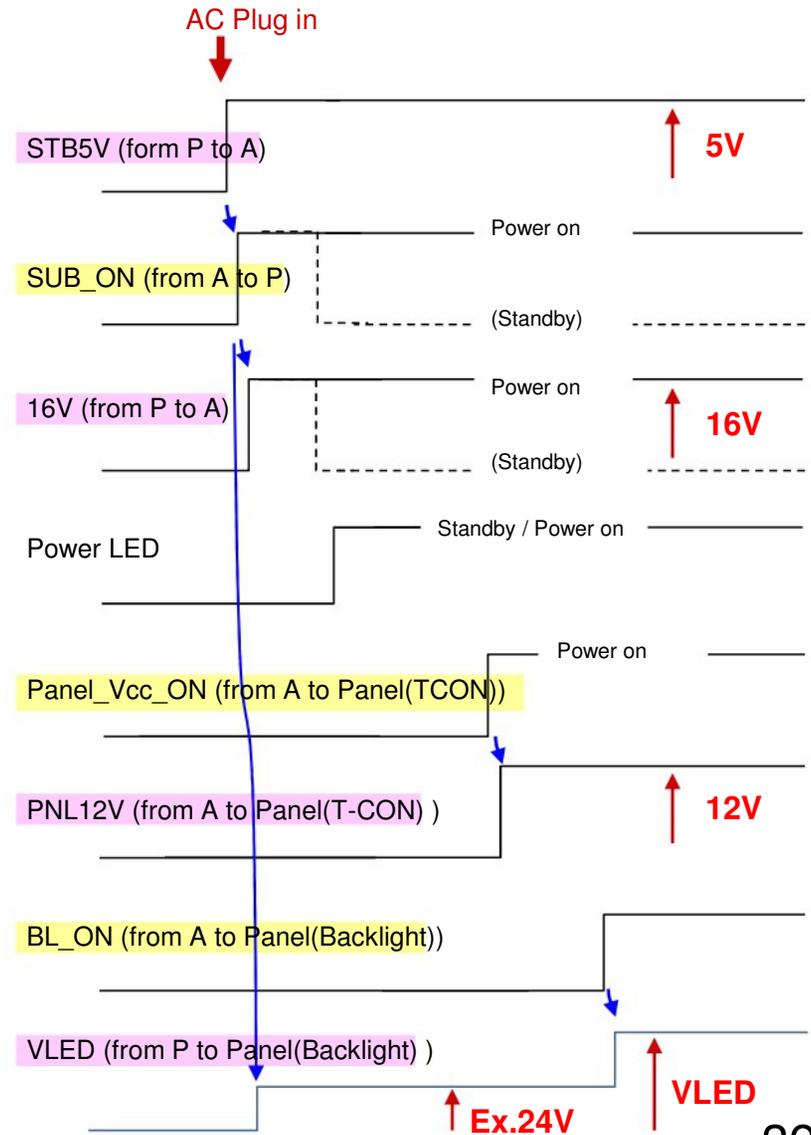


Simple Power On Sequence (DX Series)

< DX series > Also 16V is necessary before Power LED on at first time.

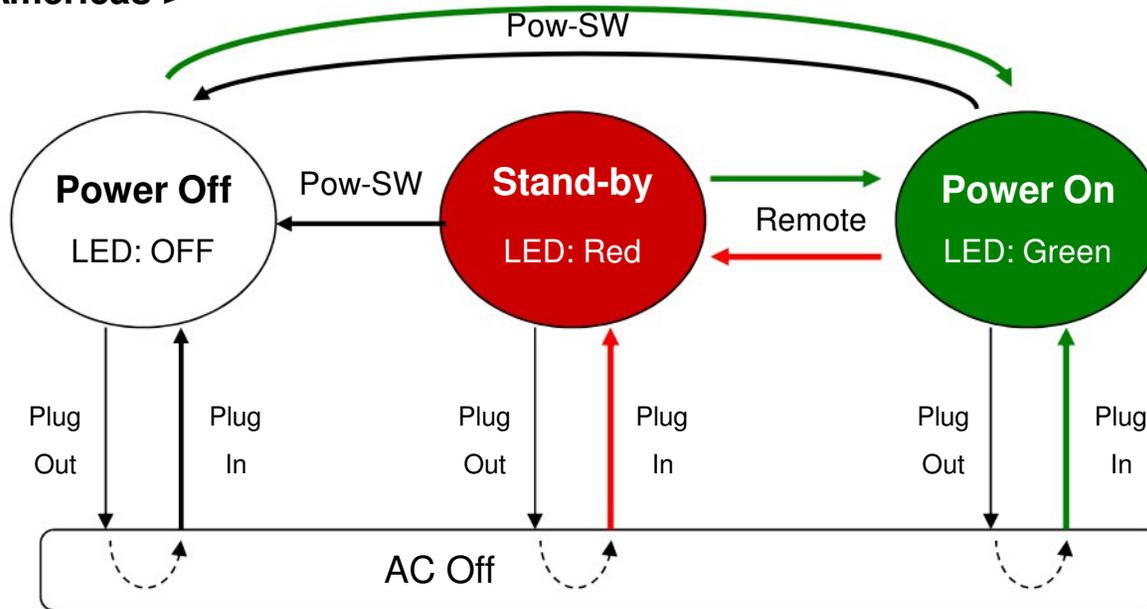


(*) The DC level is different by the LCD panel.

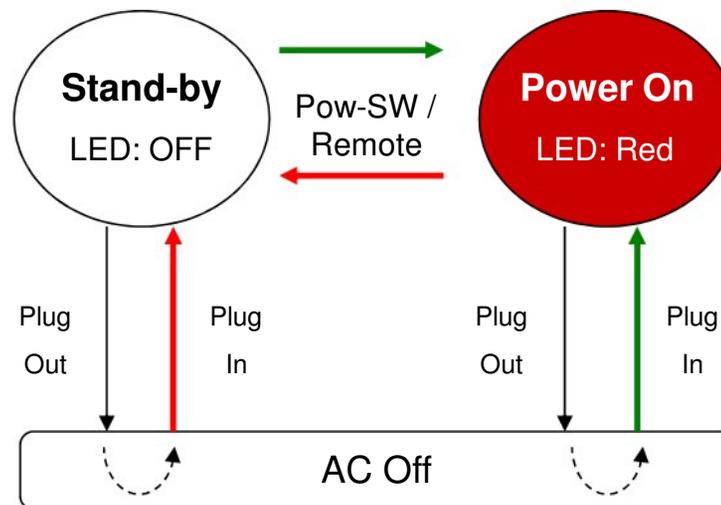


(Reference : State Transition Diagram)

< Except the Americas >



< The Americas >



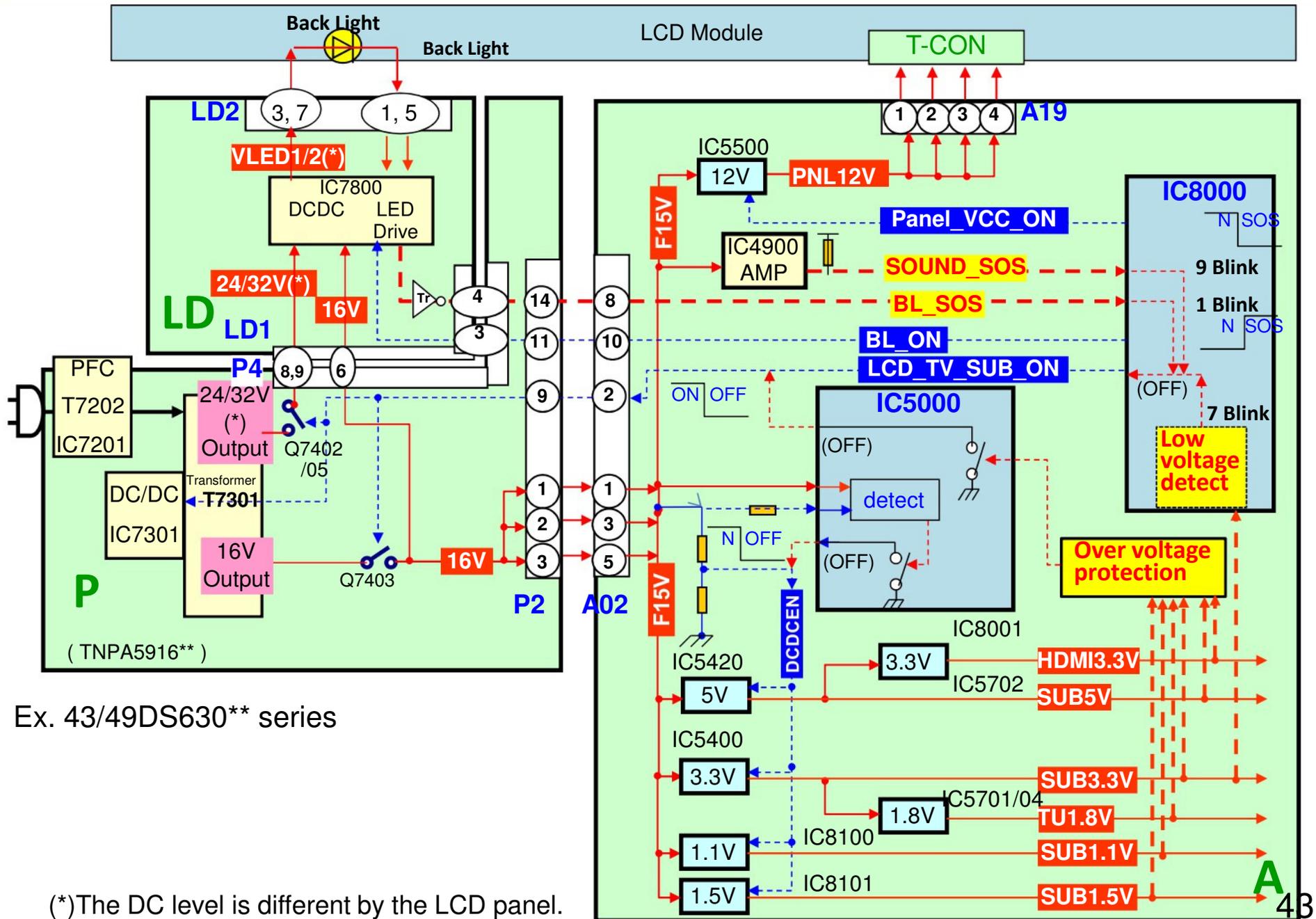
4. SOS Protection Circuit and Troubleshooting (Except 1 time blink)

LED Blinking Summary

When an abnormality occurs in the unit, the “SOS Detect” circuit is triggered and the TV shuts down. Shut down means that turn off the TV_SUB_ON signal. The power LED on the front panel will flash a pattern indicating the circuit that has detected an abnormality.

Detect content	Model name (refer to the model lineup page)	Blinking Time				Estimated Defect Board
		MT5561 (D**)	Peaks LD6 (only Euro DS6**)	Peaks sLD8A (DS**/D**)	MT5810 (DX**)	
BL_SOS (LED driver)		1	1 (occurred several sec later after power on)	1	1	Panel/P
IROM SOS = Power on problem (No F15V/SUB3.3V voltage)		---	quick 1 (occurred soon after power on)	quick 3	---	P/A
IROM SOS = Power on problem (No SUB5V/SUB1.5V/SUB1.1V voltage)			quick 3			P/A
Memory (eMMC) read problem		---	quick 5	---	---	A
No voltage SUB3.3V (after wake up once)		7	7	7	7	A
Audio amplifier: SOUND_SOS		9	9	9	9	A/ Speaker
FRC_SOS (IC9000)		---	---	---	10	A
FAN_SOS		---	---	---	11	Fan/A
Back End SOS (inside of Peaks)		---	12	12	---	A
Emergency SOS		13	13	13	13	A
GCEX_SOS (IC4300)		---	---	---	16	A

Protection Circuit

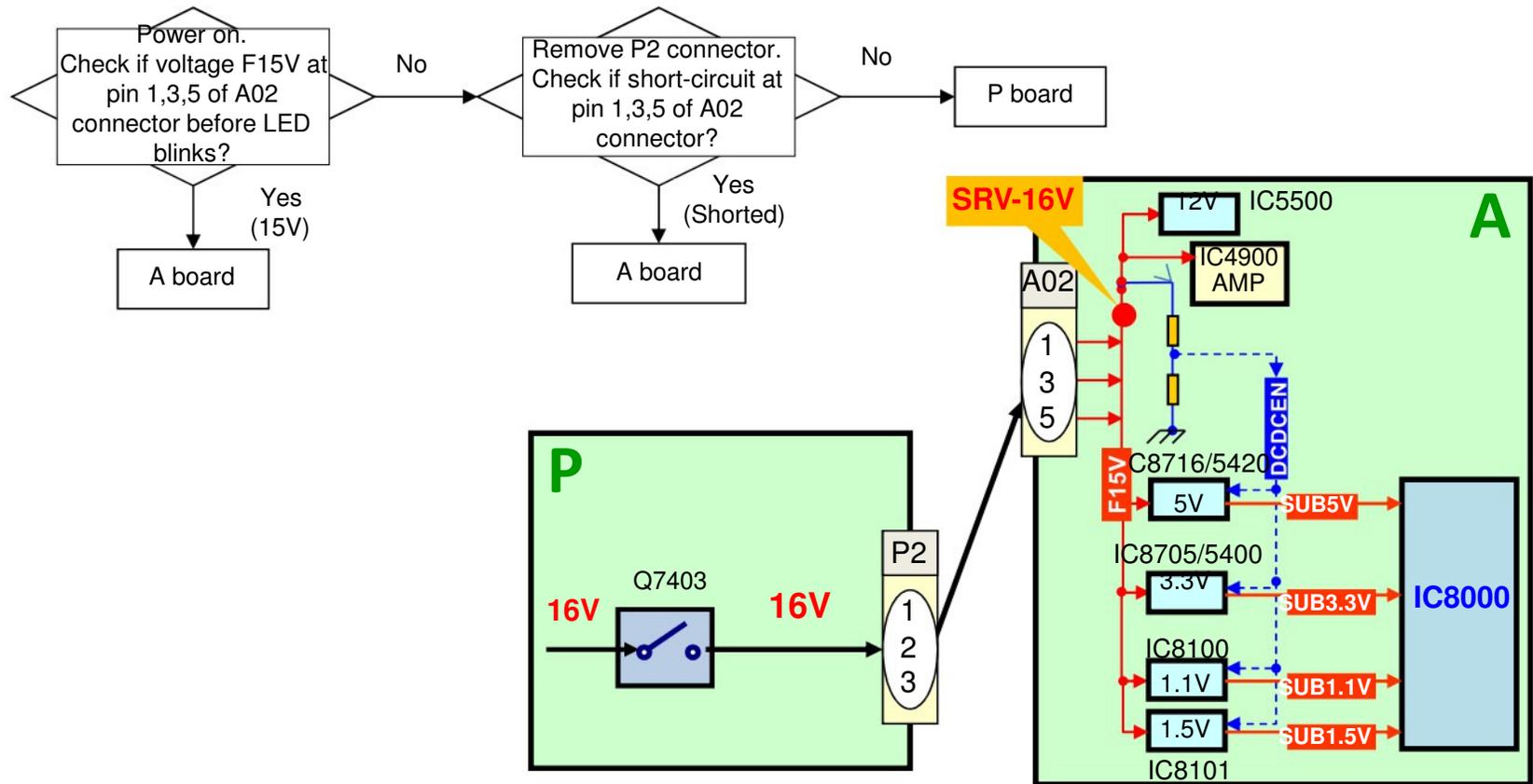


Troubleshooting for LED Blinking (Quick 3 time blink)

LED blinks	Detail error	Board may defect
Quick 3	Power on problem (No F15V/SUB3.3V/SUB1.5V voltage)	P/A

*F15V(16V) is supplied from P board. If the F15V /SUB voltage is not supplied
→ LED blinks 3 times (quick blink).*

Ex. 43/49DS630** series

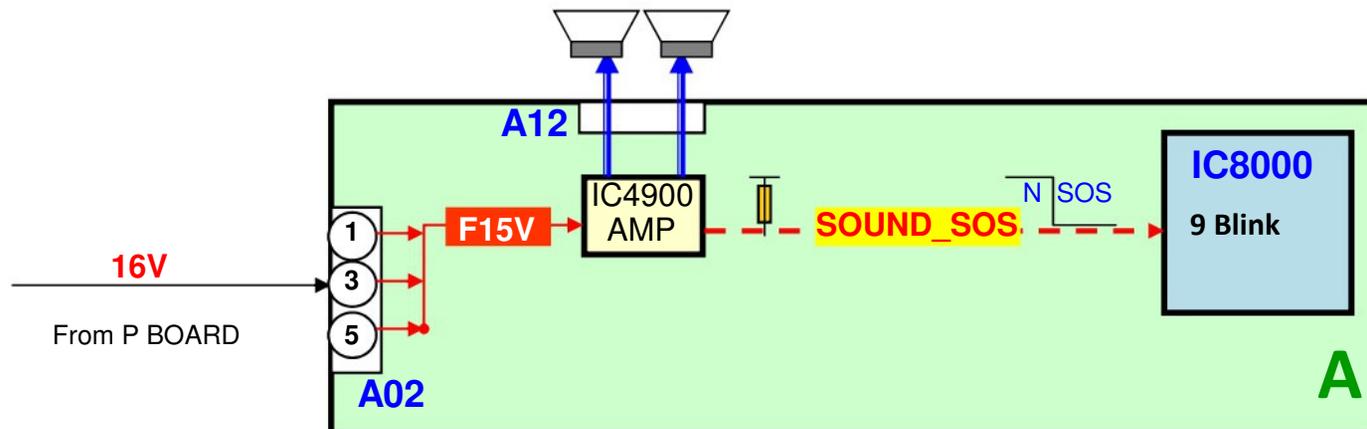
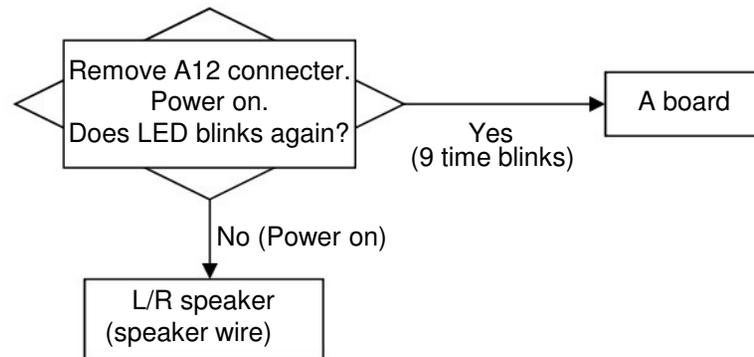


Troubleshooting for LED Blinking (9 time blink)

LED blinks	Detail error	Board may defect
9	Audio amplifier: SOUND_SOS	A/Speaker

Audio amplifier is sourced power F15V from P board. If the amplifier work abnormally (may due to short-circuit or overload), the SOUND_SOS signal will go low level and be detected by IC8001 →LED blinks 9 times.

Ex. 43/49DS630** series

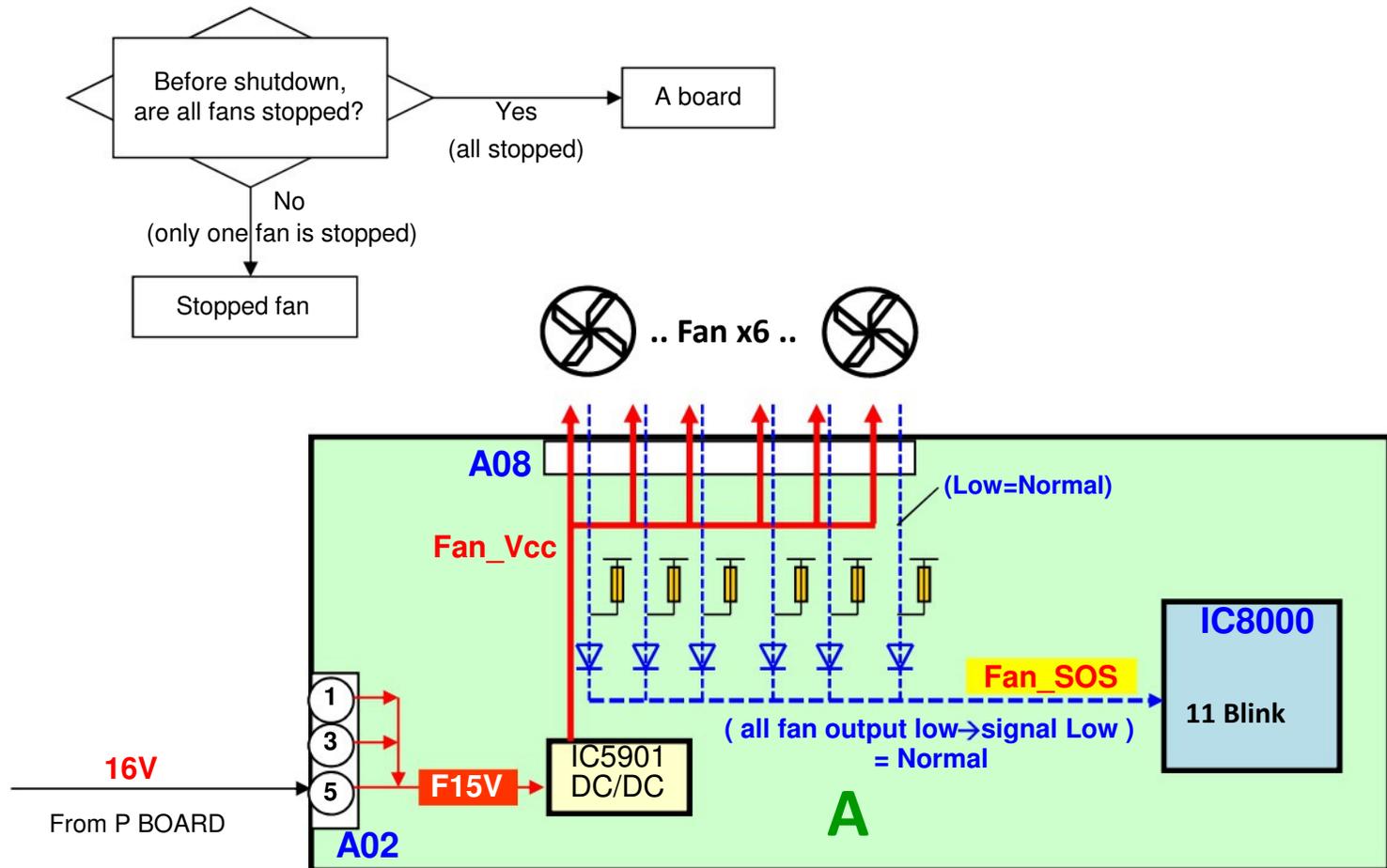


Troubleshooting for LED Blinking (only DX900 : 11 time blink)

LED blinks	Detail error	Board may defect
11	Fan_SOS	Fan/A

*If one of the fan does not work, Fan_SOS signal will go high level and be detected by IC8001
 → LED blinks 11 times.*

only DX9** series



Troubleshooting for LED Blinking (5/7/10/12/13/16 time blink)

LED blinks	Detail error	Board may defect
5 (only Euro DS6**)	Memory (eMMC: IC8903) read problem	A
7	No voltage SUB3.3V detected	A
10 (only DX*** series)	FRC_SOS (Initialization of IC9000)	A
12	Back End SOS (inside of Peaks)	A
13	Emergency SOS	A
16 (only DX9** series)	GCEX_SOS (IC4300)	A

5 blinks - problem with memory access (IC8000 or IC8903)

7 blinks - problem with power line of SUB3.3V.

10 blinks - problem with initialization of FRC IC (IC9000).

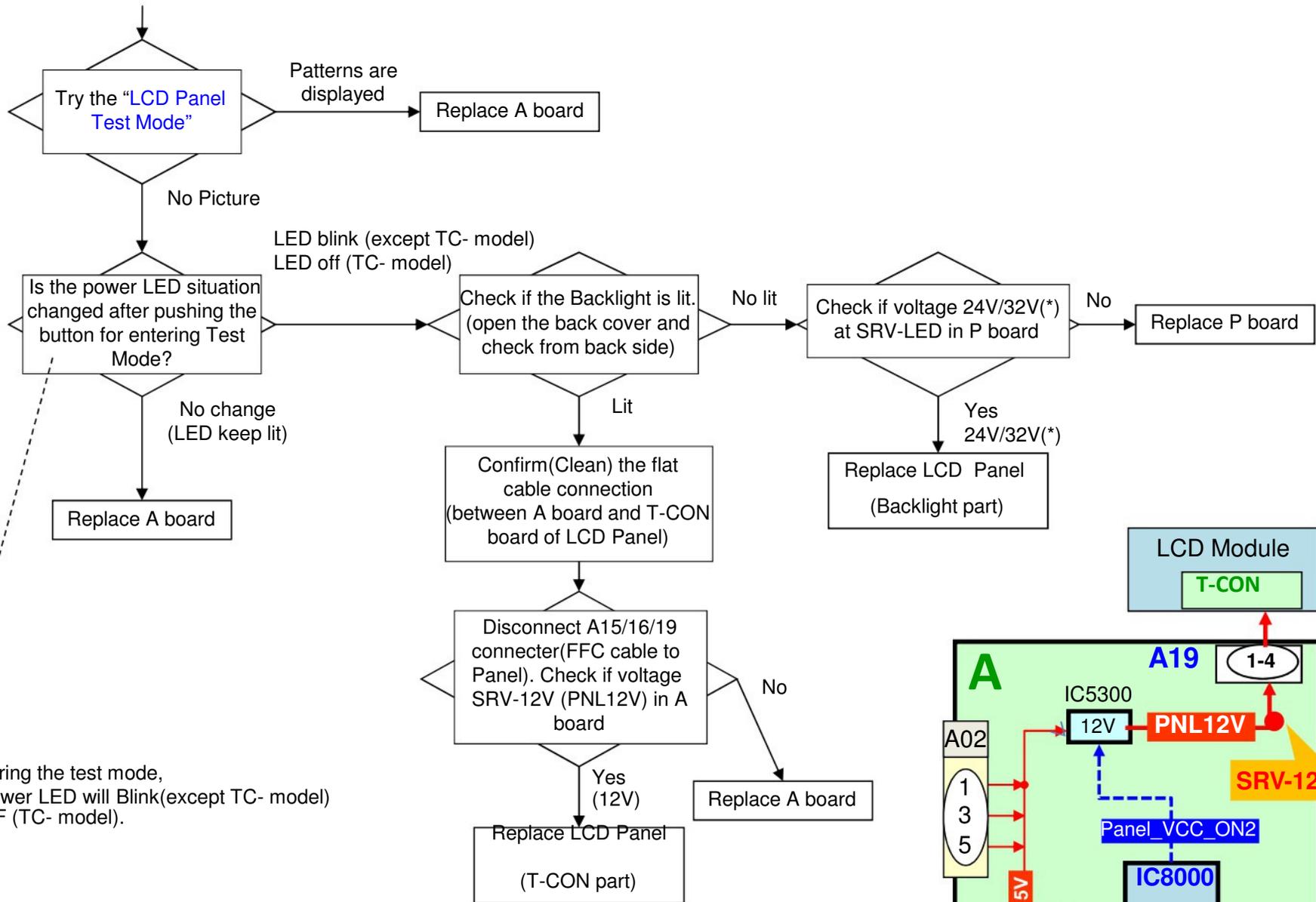
12 and 13 blinks - problem with IC8000 and software item.

16 blinks - problem with initialization of GCEX IC (IC4300).

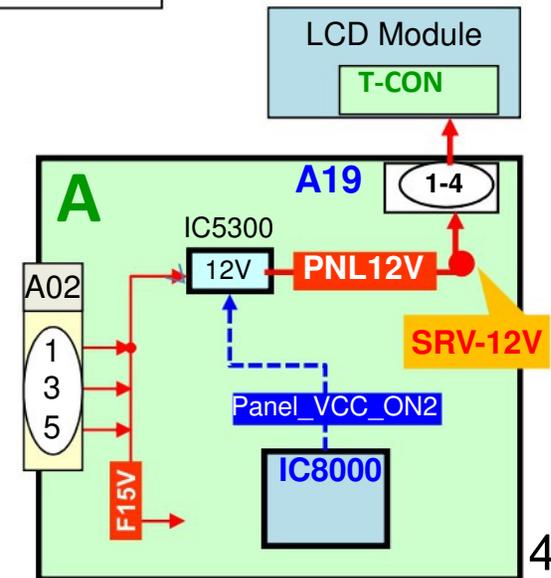
IN THIS CASE – “A” BOARD DEFECT

Troubleshooting for No Picture and No OSD (Power LED is lit = No blinking)

Refer to the block diagram "Troubleshooting for LED Blinking (1 time blink)"



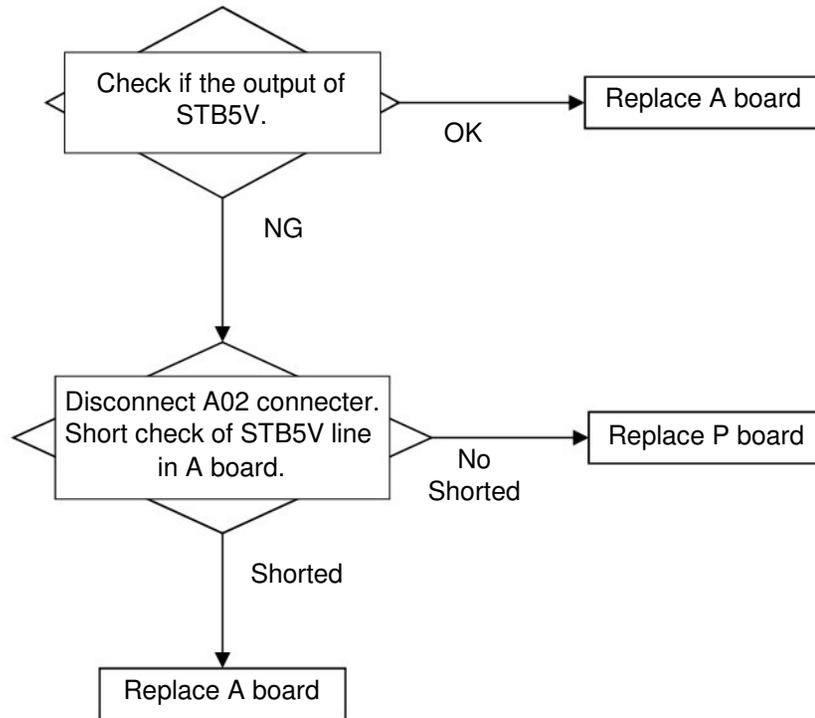
If entering the test mode, the Power LED will Blink (except TC- model) or OFF (TC- model).



(*) The DC level is different by the LCD panel.

Troubleshooting for No Power On (Power LED is off = No blinking)

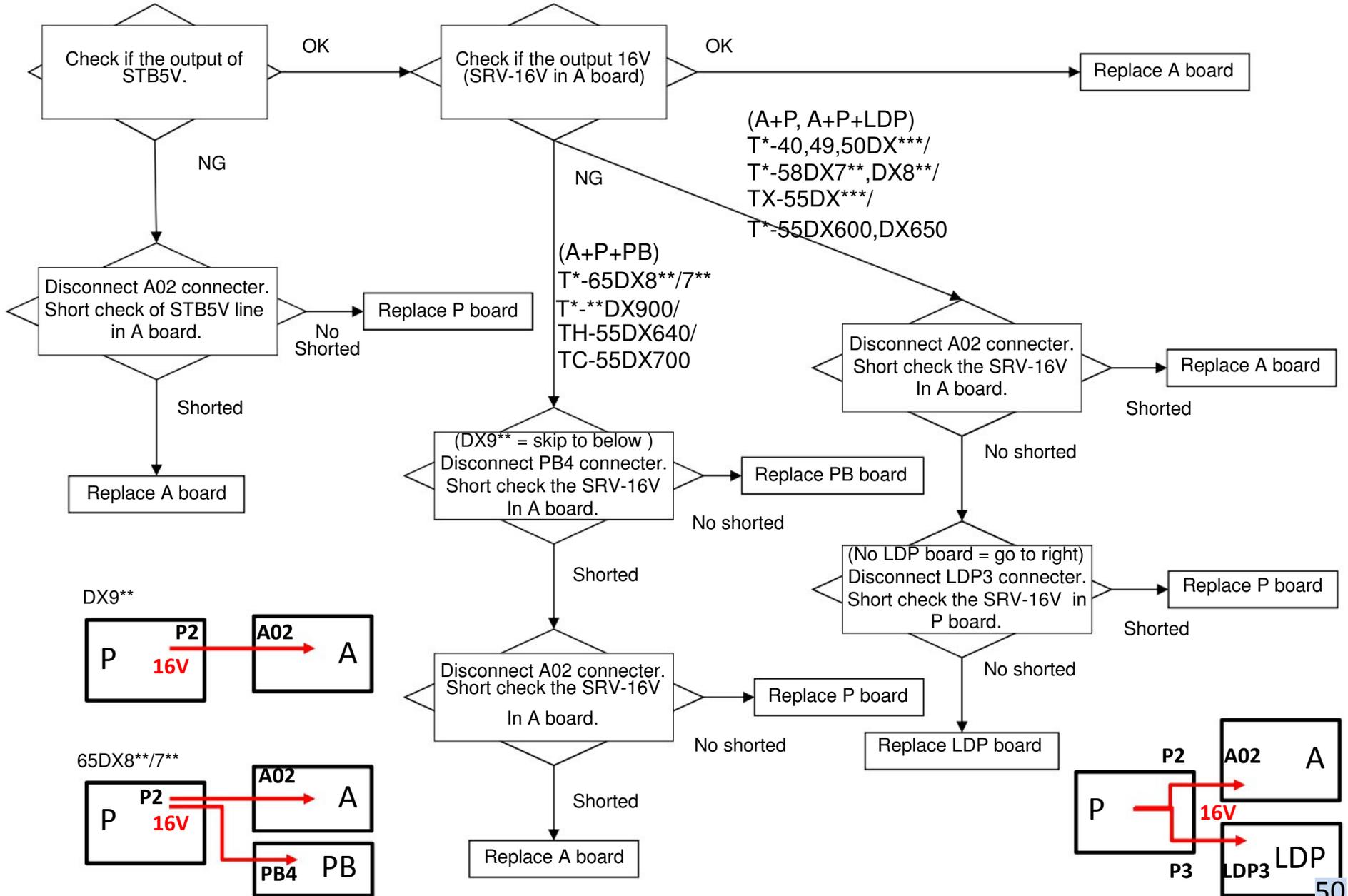
< DS/D series >



Troubleshooting for No Power On (Power LED is off = No blinking)

DX series need both STB5V and 16V before lighting power LED (Refer to Page 39)

< DX series >



5. SOS Protection Circuit and Troubleshooting (1 time blink)

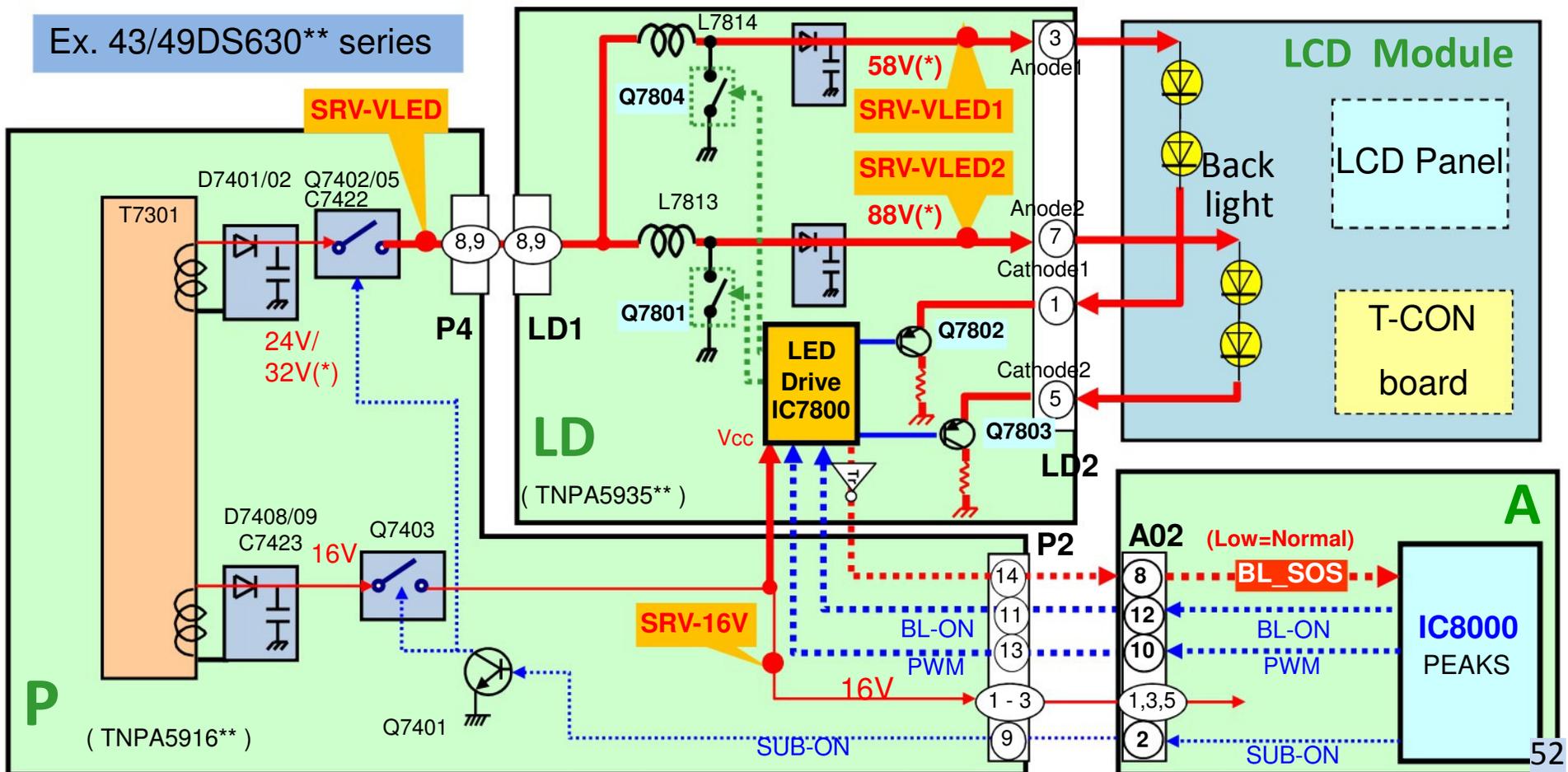
LED blinks	Detail error	Board may defect
1	BL_SOS (LED driver)	Panel / LD / P

If the IC7800 detects

(*)VLED : The DC level is different by the LCD panel.

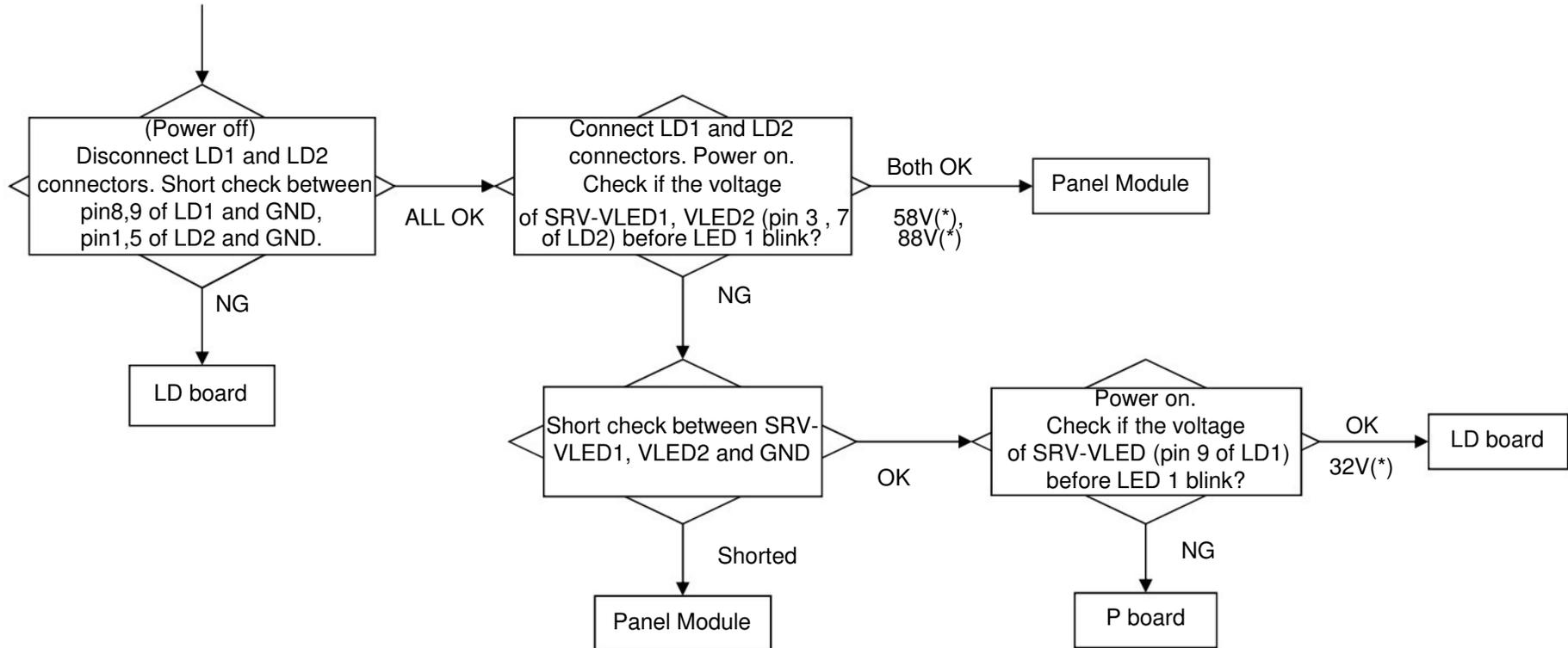
1. abnormal current of backlight LEDs (= Backlight LED broken or Low(No) VLED voltage)
 2. abnormal DC/DC power supply of IC7800 (does not rise up the VLED voltage)
- or the IC7800 does not work (No Vcc or No BL_ON/PWM signal or defect itself),
the IC7800 output BL_SOS signal to IC8001 → LED blink 1 time.

Ex. 43/49DS630** series



Ex. 43/49DS630** series

Refer to the previous page block diagram.

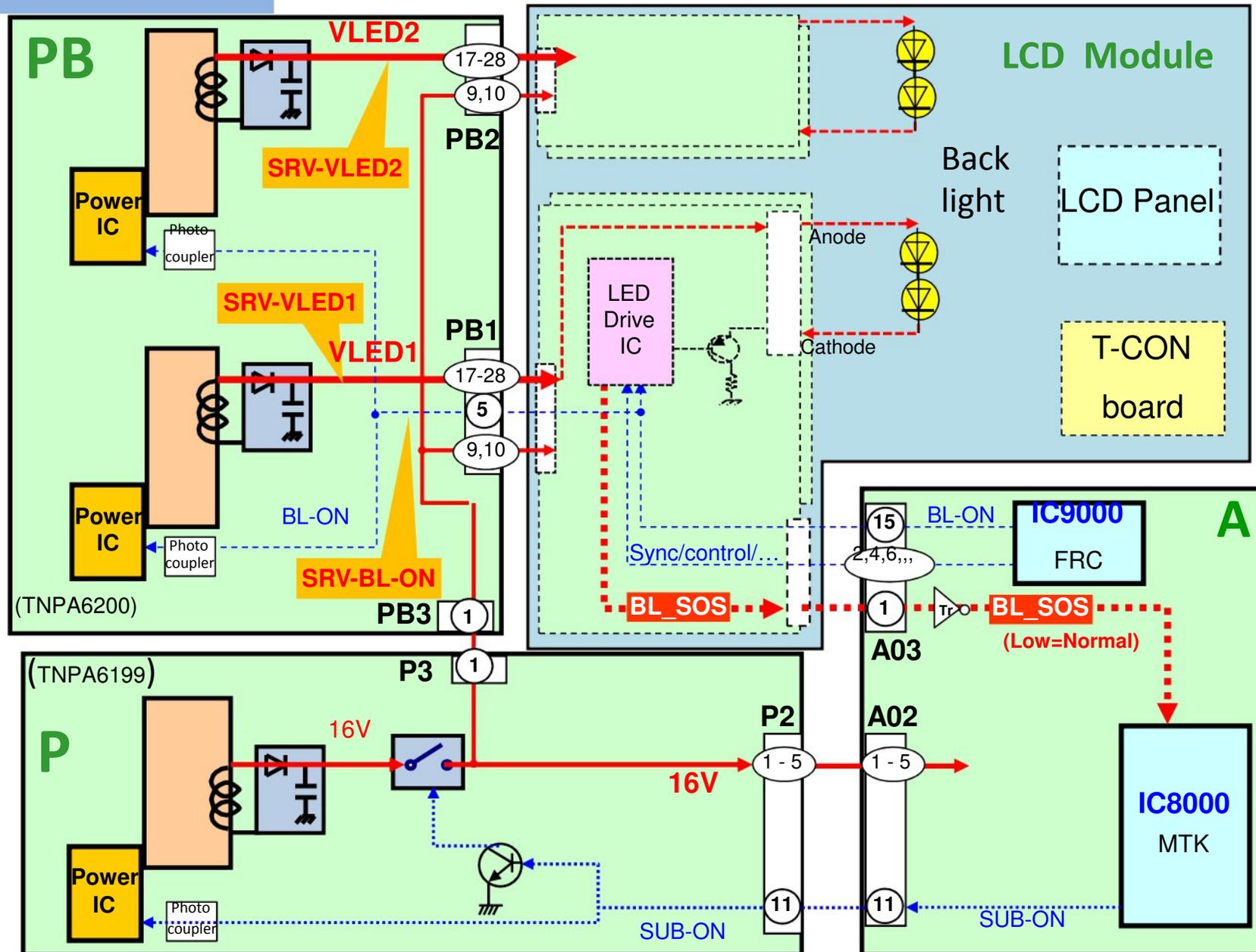


(*)VLED : The DC level is different by the LCD panel.

Troubleshooting for LED Blinking (1 time blink)

<A+P+PB> -1

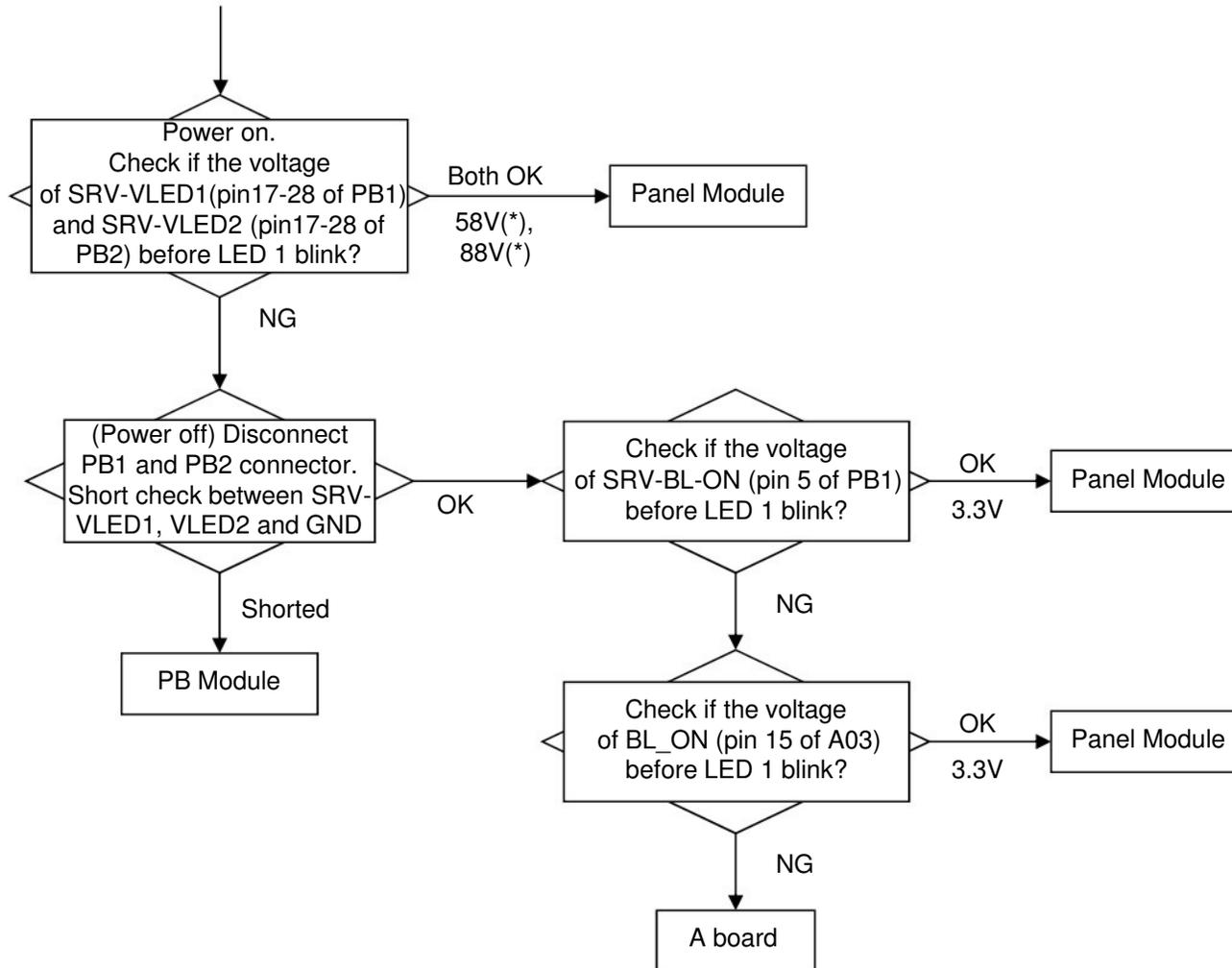
Ex. DX900** series



(*)VI FD : The DC level is different by the LCD panel.

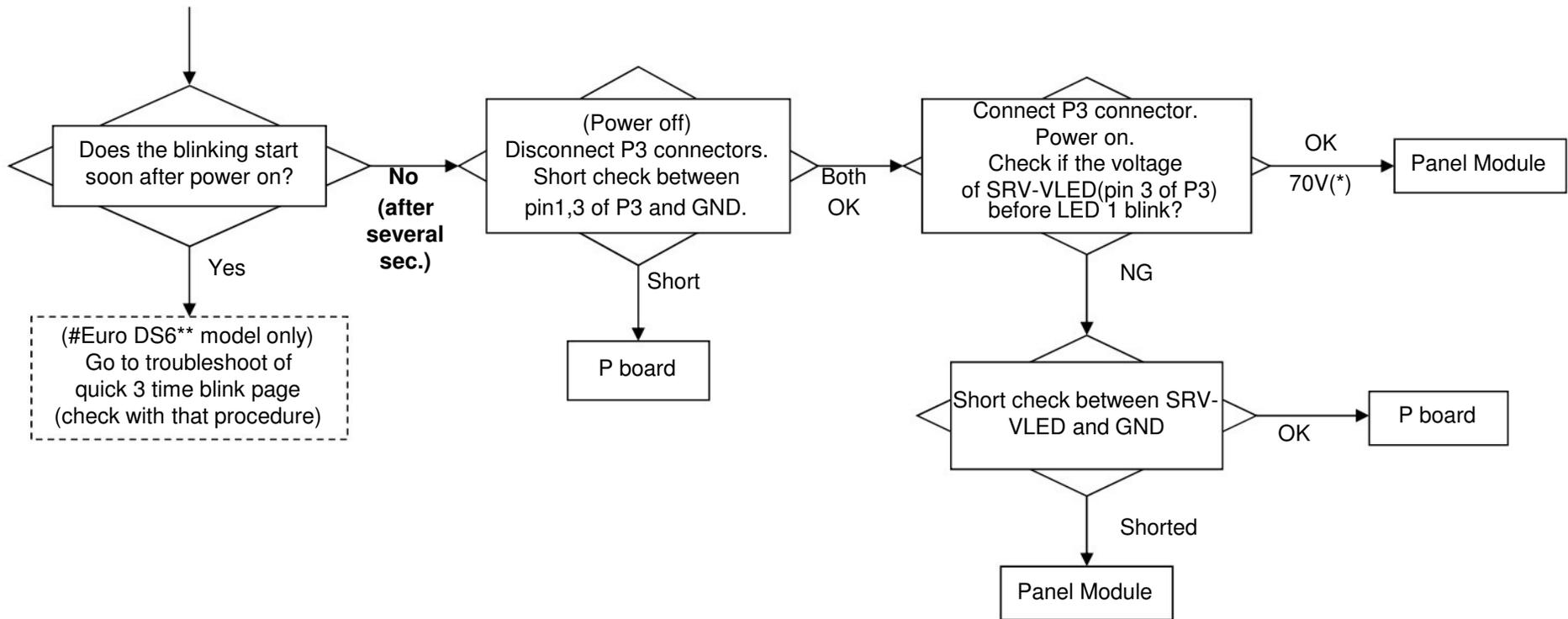
Ex. DX900** series

Refer to the previous page block diagram.



(*)VLED : The DC level is different by the LCD panel.

Ex. 32D400, 32DS600 series



(*)VLED : The DC level is different by the LCD panel.

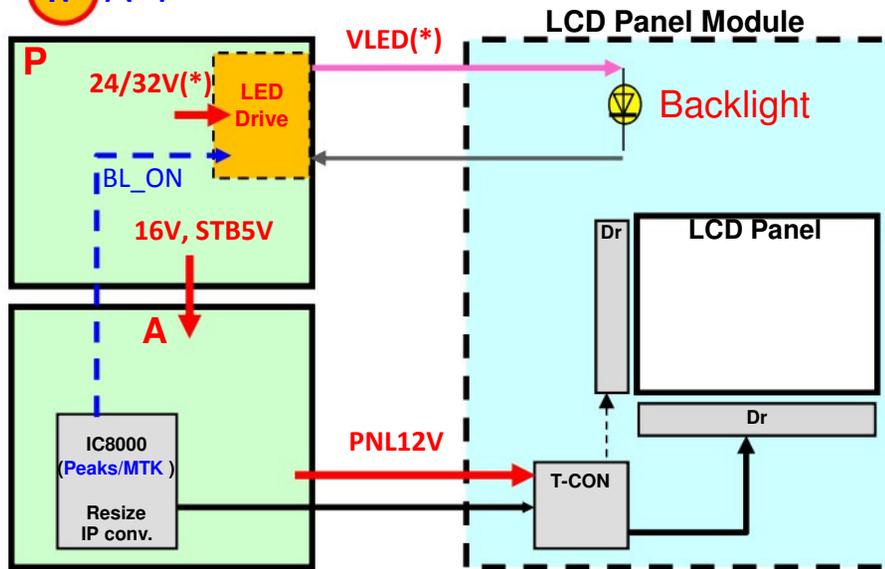
Backlight Drive Structure -1

	D4**	DS4**/5**/6**	DX6**/7**/8** (4K)	DX900 (4K)
24inch	---	A+P ①	---	---
32inch	A+P / (India : 1 Board) ① ④	A+P ①	---	---
40inch	A+P ①	A+P ①	A+P+LDP ②	---
43inch	A+P+LD ②	A+P+LD ②	---	---
49inch	A+P+LD ②	A+P+LD ②	A+P ①	---
50inch	---	A+P ①	A+P ①	---
55inch	---	A+P+LDP ②	A+P , A+P+PB: (only TH-55DX640* , TC-55DX700*)	---
58inch	---	---	A+P ①	A+P+PB ③
65inch	---	A+P+LDP ②	A+P+PB ③	A+P+PB ③

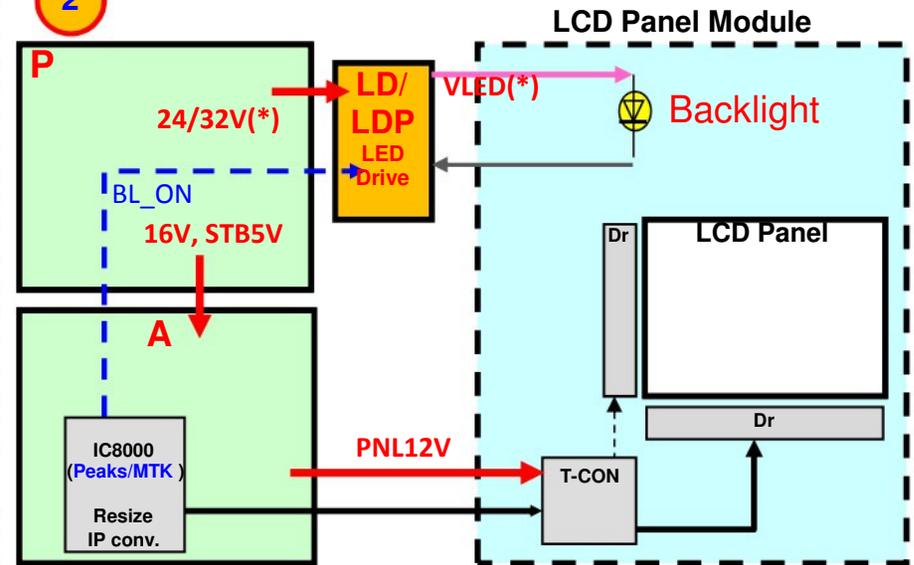
Except K, GK boards

Backlight Drive Structure -2

< 1. A+P >

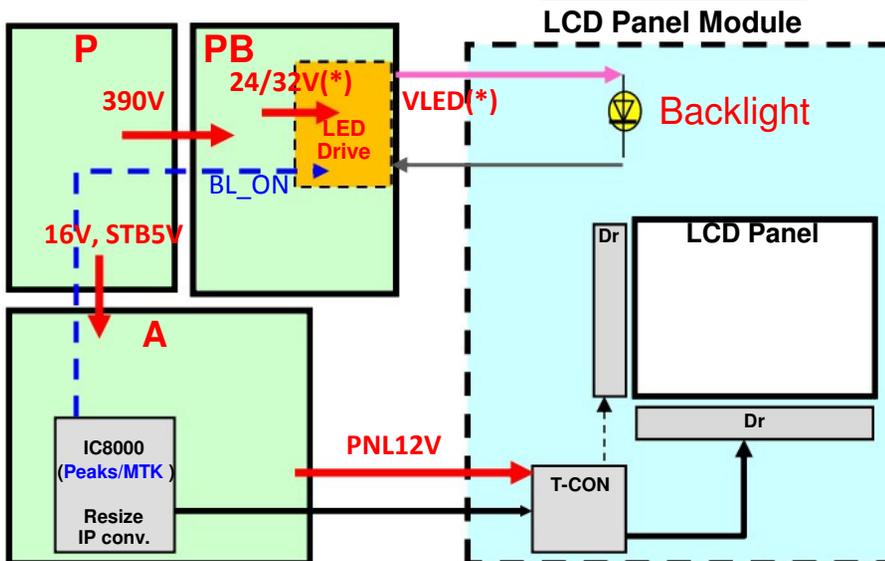


2

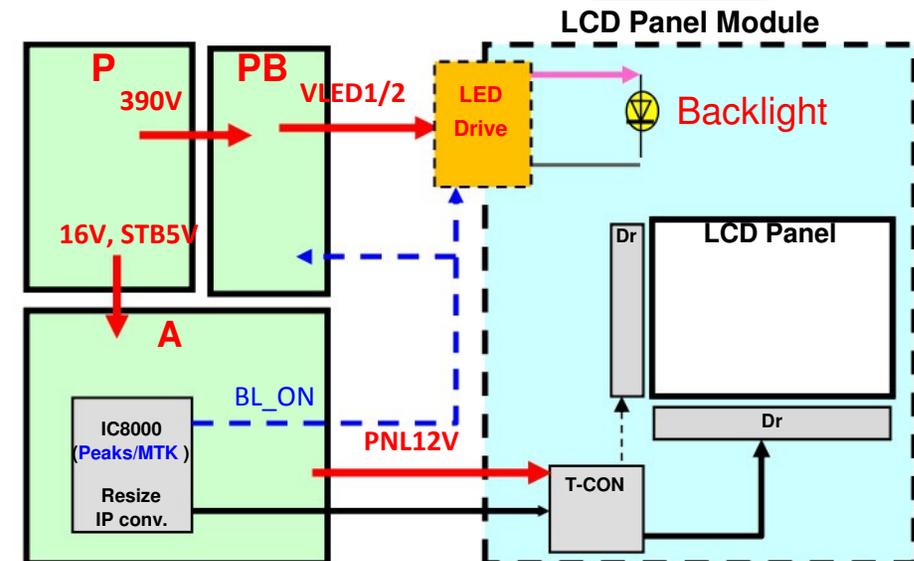


3

(DX6**/7**)



(DX900)



(*)The DC level is different by the LCD panel.