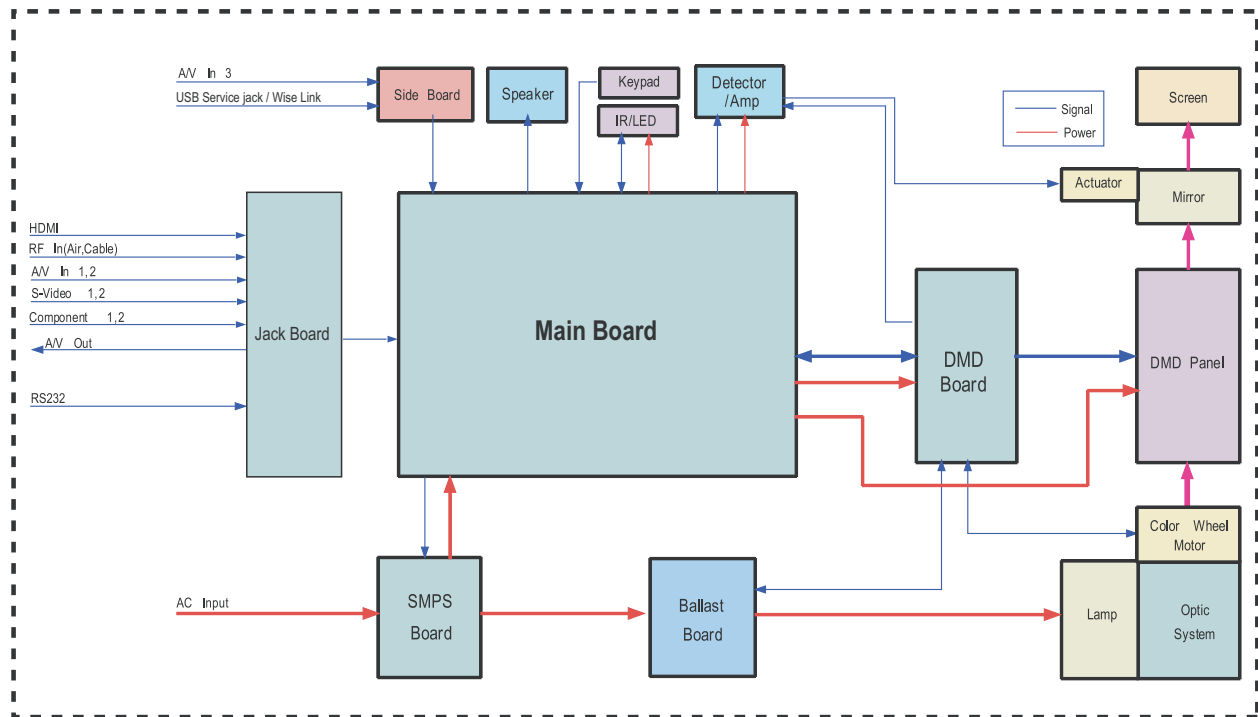# 13. Circuit Description

13-1 Overall Block Description

The DLP TV is largely divided into: Power part, Engine part and Main + Rear parts.
The ass'y that consists of the DMD board, Detect (Actuator) board, lamp, ballast and optical devices is called the Engine.
The main + rear board parts receive the AV signals to output voice signals and process the remote control signals.
The engine part displays the video data on the screen, which is generated in the main + rear boards.

The AV signals are input through the main and rear boards. CXD3815 processes the MUX and decoding while S5H2201 processes the CPU functions, MPEG and I2S.
Finally, the improved DNIe image is sent to the DMD engine board.

The final data by DNIe is processed in DDP3021 of the DMD board to display the image on the DMD panel. This image is created by the light of the lamp through the color wheel which is enlarged and projected onto the screen.
This is the DLP of the L6,L7,L8,K2 or K3 type that the actuator operates additionally during this process.

The power terminal generates the DC power needed for the product and sends it to the analog board. The analog board supplies the power to the digital and DMD boards.
In the meantime, the power source board supplies DC220V - 400V directly to the ballast in order to light the lamp.
The ballast is like a stabilizer for lighting the lamp.

The ultimate purpose of the TV set is to project an image onto the screen and output the voice signals synchronized with the image. And based on the DMD panel used, a 1-panel TV requires a color wheel while a 3-panel TV does not. The HD3,HD4,HD5 panel needs an actuator while the HD2 does not. However, the drive mechanism and the overall block structure of the two panels are the same.

13-2 Partial Block Description

13-2-1 Power Board Block Description
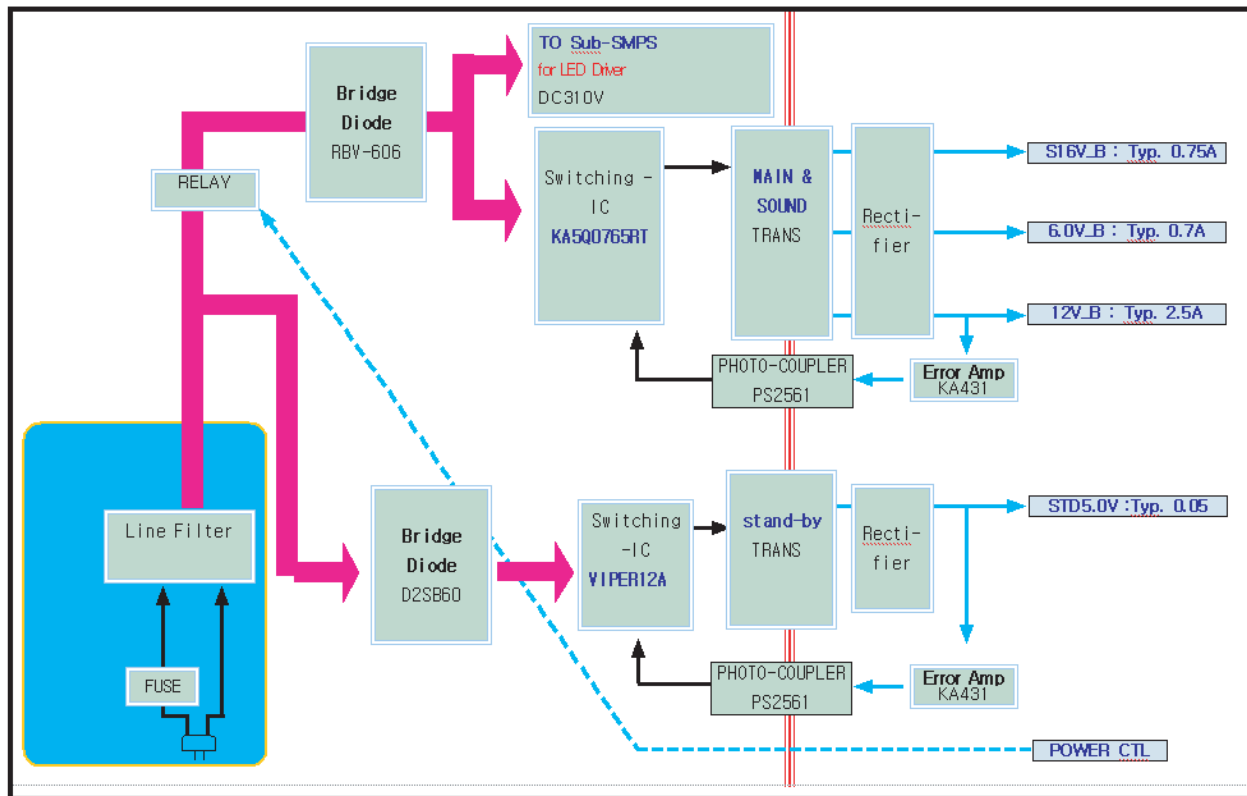
1. What is SMPS?

   This is an acronym for Switching Mode Power Supply and this is responsible for receiving AC input voltage
   (Line frequency: 50HZ~60HZ) and supplying insulated DC output.

2. SMPS Components

   1) Standby Power: A combination of ICS801 (SWITCHING IC) and TS801S (TRANS) that supplies STAND-BY 5V for operating
   the Micom.
   2) Multi Power: The voltage supplied when the power is turned on.It is a combination of IC2 and T801S that supplies various
   voltages including D12V, A6.0V, S16V

3. SMPS Operation

   1) SMPS System: Uses Fly-Back technology for both standby and multi power.
   2) Operation: Fly-Back is one of the most popular power-supply systems and uses less power than 200W as well as being the
   cheapest of all multi output SMPS systems.

   Let's have a look at how it operates…
   a. Converts AC input into DC (HOT) (rectifies to DS801 before smoothing to CS801)
   b. The converted DC voltage is high, especially compared to ground, so touching it will cause electric shock.
   Use T801S (Trans) to insulate the secondary voltage and take advantage of the PWM operations of T801S
   and IC801S to induce it.
   c. The secondary induced voltage is a dozen-KHZ square wave power, which goes through the smoothing
   cap (CS822) to be generated in the standby 5V.
   d. Multi power also operates the same way.

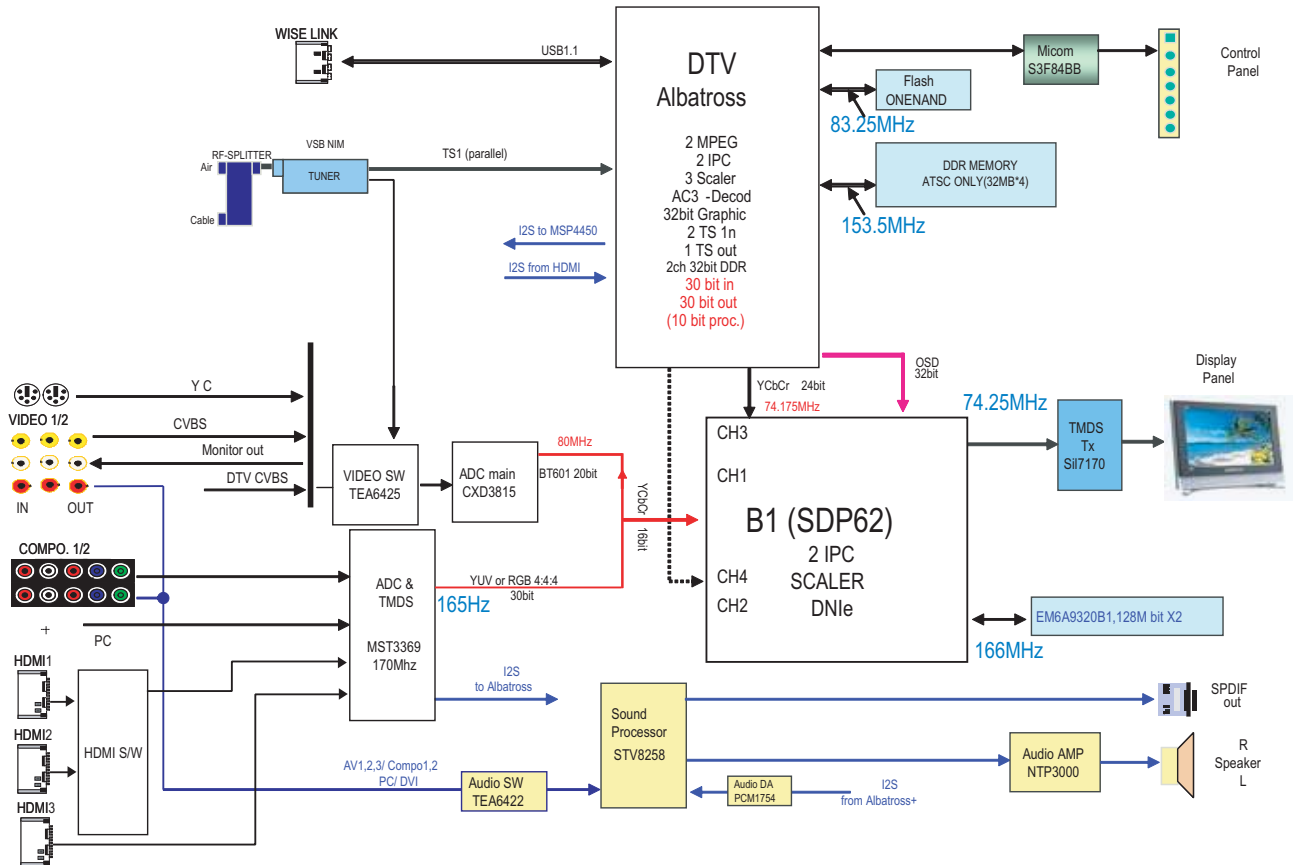   ※ Options are deleted on the ATSC only Model

4. Input&Output voltage

  1) Input voltage ＊ America(AC120V) - OPTION

  2) Output voltage ＊ D12V / 2.5A - 12V , 3.3V , 1.8V : For signal processing
                           ＊ A6.0V / 0.7A - For driving the tuner
                           ＊ S16V / 4A -For driving sound processor
                           ＊ 150W - For driving the Sub SMPS

13-2-2 Digital Board Block Description

※ Options are deleted on the ATSC only Model

■ Select Sound/Video

One is selected from multiple inputs by the switching ID. MICOM decides which port is used for output.

For broadcasting signals, sub-outputs are transferred in CVBS and, the main outputs in Y/C through the 3D Comb, to the digital board.

Sound signals are selected by the switching IC, of which only one input is transferred to the speaker.

■ Detection Signal Flow

When each port is connected to a signal cable, the detection signal is "low" and can be checked by Micom scanning.

■ CXD3815: Analog YPBPR, CVBS, Y/C(SUPER), Input MUXING and Video Decoding

■ S5H2201: CPU, + MPEG Decoder, Audio signals transferred to MSP of the analog board by I2S

■ Tuner: Main-HD Tuner,Sub-Analog Tuner

■ HDMI: Receives Two input signal and transfers it to S5H2201.

■ Others: Anynet implementation, Optical Power Port, USB Update Port (not available for MP3)

13-2-3 DMD Board Block Description

Single DDP3021 Solid State Illumination Formatter
Block Diagram
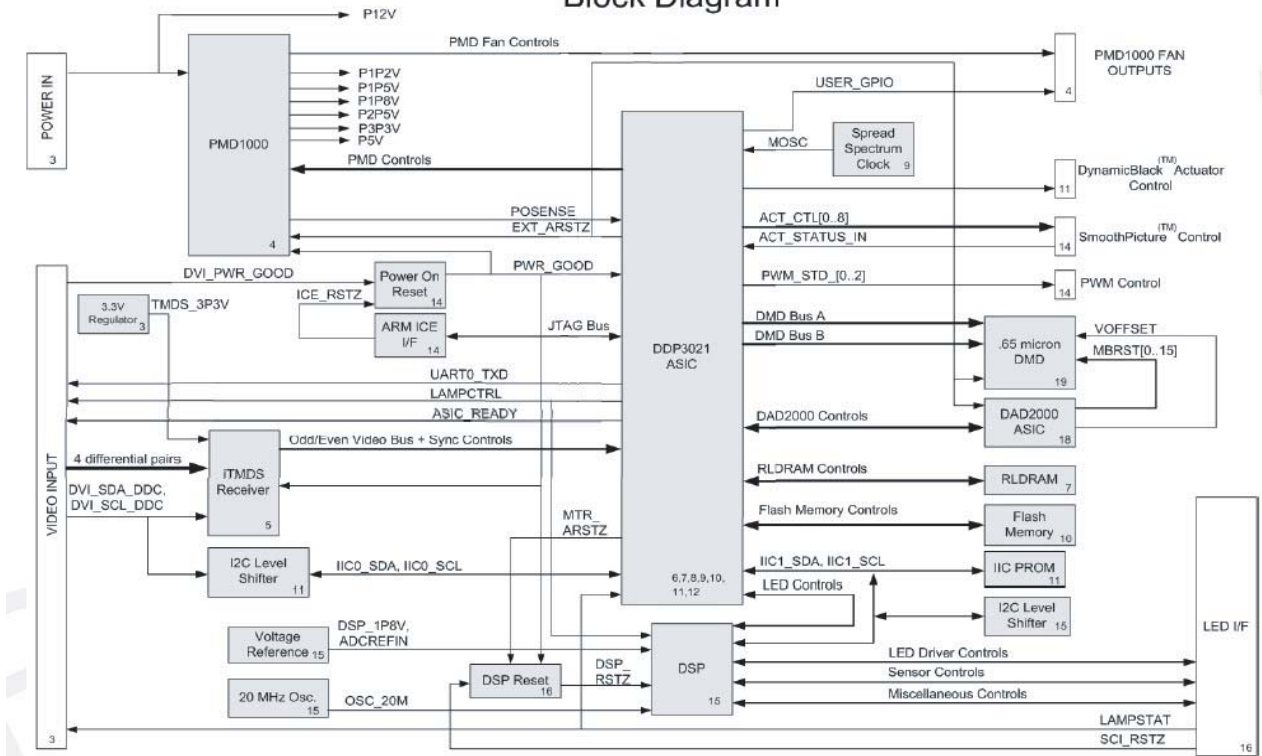
■ Controls the lamp (ON/OFF)
■ Drives the color wheel motor
■ Drives the panel
■ Controls the sensors

13-3 New Circuit Description

13-3-1 Output Voltage States of the DMD Board Parts

Output Terminal waveform

```
      ┌── 26V
      │
      │  8V
      │
      └── -26V
```
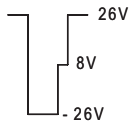
LOC	Characteristics	
CN805, 4pin	LED_LAMPLITZ	High(3.3V) Beffore the LED Turns on, Low(0V)when the LED Turns on.

13-3-2 DMD Panel Pin Terminal Characteristics Diagram

※ Remove the heat sink attached to the DMD Board and tighten the screws in four places and then inspect the characteristics of each pin terminal.

The vertical lines, which may occur due to improper connections between the panel and the PCB, occur with intervals of 50 inches(26mm). If vertical lines occur with intervals of more than 26mms, it indicates a failure of the DDP1011 IC itself. If they occur with intervals of less than 26mm, it means that more than two pins have bad connections.

DA,DB output wave [Screen:WHITE]

	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
A				V		V				DA	N6	DA	N4	V		DA	N2	DA	P0	V		G		G			V	V			G			G			V		N		A
B			V								DA	P6	DA	P4		DA	P2	DA	N0											G					C				V		B
C							G					DA	P7	DA	P5			DA	N3	DA	N1						G			G								V	C	C
D	DA	N8	DA	P8	C		C				DA	N7	DA	N5			DA	P3	DA	P1					G												V				D
E		DA	N10	DA	P10	DA	P9	DA	N9																												V			E
F	V																																			V	V2			F
G		DA	N12	DA	P12	DA	P11	DA	N11																													V2		G
H	V2		V2			DA	P13	DA	N13																												V2			H
J		V																																			V	V2		J
K	DA	P14	DA	N14	DA	P15	DA	N15																													V			K
L		DB	P14	DB	N14	DB	P15	DB	N15																											ME		V		L
M	V																										14		11								V2			M
N		V2		V2		DB	P13	DB	N13																		10		5		1						V2			N
P	DB	N10	DB	P10	DB	P11	DB	N11																			4		V								V2			P
R		V																																			V	V2		R
T	DB	N10	DB	P10	DB	P9	DB	N9																													V			T
U		DB	N8	DB	P8						DB	N7	DB	N5			DB	P3	DB	P1		6		3		T0		G								0			V	V	U
V				EV							DB	P7	DB	P5			DB	N3	DB	N1	13		9					G									V		V
W		V		C		C					DB	P6	DB	N4			DB	P2	DB	N0		12		8				7		T2		G			C			V		W
Y			V		V					DB	N6	DB	P4	V		DB	N2	DB	P0	V			V					2		T1		G						V		Y
	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

Pin Name	Description	Pin Name	Description
V	Voltage : 3.3V	T	Test Point
V2	VCC2 : 8V	ME	Mirror Bias Extra
DA	A Channel Data Bus [When measured, there should be a waveform]	C	Clock
DB	B Channel Data Bus [When measured, there should be a waveform]	P#	A,B Channel Positive
NO.	MBRST# (Mirror Bias Rest) 26V	N#	A,B Channel Negative
G	The part from the present position to the GND (The black part is also a GND.)		

13-3-3 Description of Terminal Characteristics

Pin Name	Description
SCTRL_BN/P	B channel LVDS serial control
DCLK_BN/P	B channel LVDS CLOCK
SCPDI	SERIAL CONTROL DATA INPUT
SCPDO	SERIAL CONTROL DATA OUTPUT
SCPENB	SERIAL CONTROL ENABLE
SCPCK	SERIAL CONTROL CLOCK
DMD RESETB	DMD LOGIC RESET
MBRST(14:0)	MIRROR BIAS RESET
MBRST_EXTRA	UNUSED MIRROR BIAS RESET
SCR_CLR	TEST CLEAR PINS(NORMAL GND)
READOUTA(1:0)	A-CHANNEL SERIAL DATA OUT DURING SPAM READ TEST OPERATION
READOUTB(1:0)	B-CHANNEL SERIAL DATA OUT DURING SPAM READ TEST OPERATION
TP(2:0)	MANUFACTORING TEST POINT(NO CONNECTED DURING NORMAL OPERATION)
RSV_A(4:0)/RSV_B(4:0)	RESERVED PINS(NORMAL:GND)
EVCC	REFERENCE VOLTAGE DURING SPAM READ TEST OPERATION(NORMAL GND)
VCC2	MIRROR ELECTRODE VOLTAGE(7.3V)
VCC	LOGIC SUPPLY
VSS	LOGIC GROUND

13-3-4 Engine Failure Inspection Flow Chart for the DMD Board

No.	Description	Key Point	Remark
1	1) When the power cord is plugged in, 2) DC220V~410V(typical 300V) is automatically supplied to the ballast.	Check whether the DC220V~410V(typical 300V) power is supplied to the ballast.	
2	1) When the power key is pressed via the remote control, the micom of the analog board outputs high (5V) PWR signals. 2) The power board operates normally. 5V and 12V are supplied to the DMD CN105 terminal.	Check whether 5V and 12V are supplied to the CN105 terminal.	* 12V must be supplied to operate the motor.
3	1) The MTR Reset signal is supplied to the R161 terminal of the motor IC101 from the micom on the digital board and then the motor starts to drive. 2) If the color wheel rotates for a certain time and then stops, check whether the color wheel sensor is normal. (Check the waveform on the No.2 terminal below CN102.) ⎍⎍	After the set is powered on, check whether 5V is detected on pin No.49 of IC101. → After a while, the sound generated by the rotating color wheel is heard.	* If 5V is not detected, the motor will not operate.
4	1) Check whether the signal (SCI: START CONTROL INPUT) that turns on lamp #2 of CN109 on the DMD board is high (5V).	Check whether CN109 #2 signal is 5V.	* When SCI is high (5V), the lamp litz of CN109 is low (0V). * CN109 #2 terminal voltage changes to pulse wave form 14 seconds after (for 50 inch TV) the time that the voltage is 5V.
5	1) Method for checking whether the DDP1010 IC RESET is normal.	If the voltage between R254 and R255 is 3V, it is normal.	* When about 4 seconds have passed after changing to pulse waveform, the screens are displayed on the set.

13-3-5 IC Line Up

1. Main Board

Items	Descriptions	Remarks
CPU & MPEG	Albatross (S5H2201)	2MPEG, 2IPC, 3Scaler, AC3-Decod, 32bit Graphic, 2TS 1n, 1TS out,2ch 32bit DDR, 30bit in, 30bit out (10bit proc.)
	Albatross DDR Memory (32MB x 4)	ATSC Only Model Memory 128MB
	Albatross DDR Memory (32MB x 2)	POD Model (Full Model) 192MB
	Albatross Flash Shrink (256MB)	
IPC & Scaler	SDP62	IPC & Scaler & Picture Enhance
	SDP62 Memory FBGA Shrink (128MB x 2)	
TMDS	Sil7170	iTMDS Transmitter, 10bit
DCDC	SC4521 : 1V MP1583 (3V/5V/3.3V/1.3V) x 5	DCDC Converter
Decoder & 3D Comb	CXD3815Q	
Micom	S3F84BBXZZ, Samsung	Micro Controller
Audio Processor	MSP4450K, Micronas	Digital Audio Decoder
Sound AMP	NTP3000	Digital AMP
VSB Nim Tuner	DNVS227IV262B	
Video Switch	TEA6425, SGS-Thomson	Video Switch IC for TV * 2
Audio Switch	MM74HC4052M, PHILIPS	Audio Switch IC for TV
HDMI Receiver & ADC	MST3369M , Mstar	MST3369M , Mstar
HDMI Switch	TDMS341, TI	HDMI Switch , TI

2. Main SMPS

| Items	Descriptions	Remarks
Multi SMPS	KA5Q0765RT,Fairchild	IC-PWM Controller ; Main Power
Stand-by SMPS	Viper12A, STMicroelectronics.	IC-PWM Controller ; Stand-by Power

3. Sub SMPS

Items	Descriptions	Remarks
16VB SMPS	MC33067,Onsemiconductor	IC-PWM Controller ; Main Power
12VA SMPS	Viper22A, STMicroelectronics.	IC-PWM Controller ; 12VA

4. DMD Board

Items	Descriptions	Remarks
DMD Driver	DDP3021, TI	DLP Data Processor
Reset, Power	DAD2000, TI	DMD Power and Reset Driver
Motor Controller	PMD1000, TI	12V VCM/Spindle Pre-Driver, Power Supply(2.5V,3.3V,1.5V)
Frame Buffer	MT49H8M36BM-TI, Micron	128M(246K x 16 x 32B), Rambus DRAM
Spread Spectrum Clock Generator	ICS650-41, ICS	50Mhz Spread Spectrum Clock Generator
Program ROM	M29W800BT x 2, ST	8M(1M x 8 or 512K x 16), Flash Memory
Actuator Driver	DDP3021, TI	DLP Data Processor
AD Converter	AD7801BRU	Actuator Drive , 60Hz
TMDS Receiver	SiI7171,Silicon Image	TMDS Digital Receiver, 75MHz
Color Calibration	TMS320F2801PZA, TI	DSP ASIC IC, 1.8V, Data Calibration

13-3-6 K780 Engine Ass'y
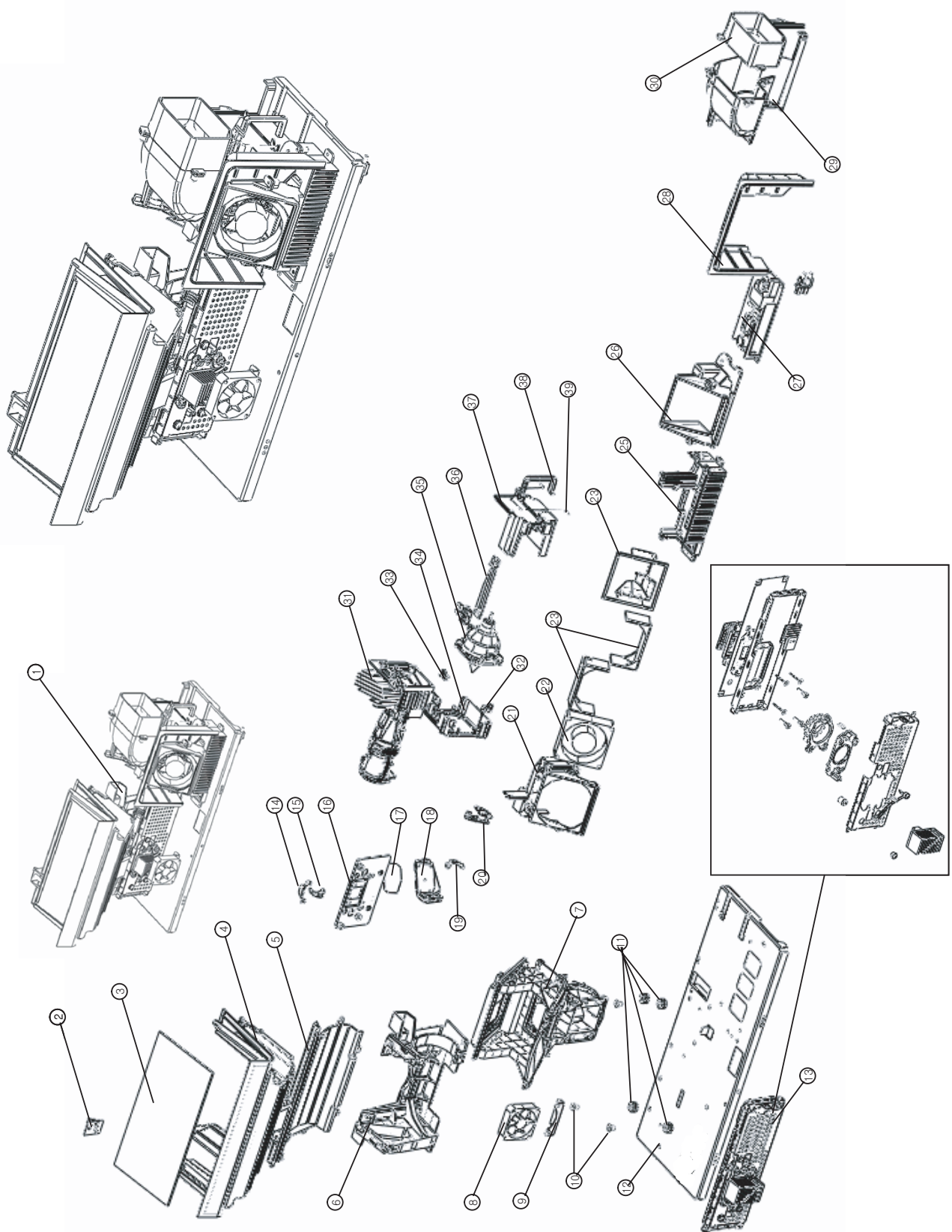
No.	Description	Specification	Q'ty
K780 Engine Exploded View List		
1	ASSY ENGINE P-DLP	K780	1
2	ASSY PCB S-RMC	PCB	1
3	COVER-DUST	GLASS T3.0	1
4	COVER-DUST RIGHT	PC G/F 20% T2.5	1
5	COVER-DUST LEFT	PC G/F 20% T2.5	1
6	BASE-PROJECTION	MG D/C T1.8	1
7	ASSY LENS P-PROJECTION MODULE	LENS ASSY	1
8	FAN-DMD	60*60	1
9	BRACKET-FAN	SECC T1.0	1
10	FAN-LOCK	PH ¥õ7	4
11	RUBBER-FAN	SILICON	4
12	BRACKET-ENGINE BASE	SECC T1.6	1
13	ASSY DMD BOARD	PCB	1
14	BRACKET-MIRROR	AL D/C T1.0	1
15	BRACKET-F/MIRROR (L)	SUS T0.3	1
16	BRACKET-FOCUS	MG D/C T3.0	1
17	GLASS-FRONT FOLDING MIRROR	GLASS T1.1	1
18	HOLDER-FOLDING MIRROR	MG D/C T2.0	1
19	BRACKET-F/MIRROR (R)	SUS T0.3	1
20	ASSY MISC-THERMOSTAT	PCB	1
21	COVER-DUCT TOP	PC G/F 20% T2.5	1
22	FAN-DC	80*80	1
23	RUBBER-FAN	SILICON	2
24	COVER-MIDDLE	PC G/F 20% T2.5	1
25	HOLDER-BALLAST	PC G/F 20% T2.5	1
26	COVER-DUCT BOTTOM	PC G/F 20% T2.5	1
27	LAMP-BALLAST	EUC 132D P/42 132W	1
28	COVER-FAN	PS T2.5	1
29	COVER-DUCT RIGHT	PC G/F 20% T2.5	1
30	COVER-DUCT LEFT	PC G/F 20% T2.5	1
31	ASSY LENS P-ILLUMIANTION	LENS ASSY	1
32	HOLDER-LAMP	PPS G/F 30% T2.5	1
33	BRACKET-LAMP	SUS T0.5	1
34	BRACKET-LAMP	SUS T0.5	1
35	LAMP	UHP 120W/132W 1.0 E22	1
36	BRACKET-HINGE TOP	SECC T1.0	1
37	COVER-LAMP	PPS G/F 30% T2.5	1
38	HANDLE-LAMP	PPS G/F 30% T2.5	1
39	BRACKET-HINGE BOTTOM	SUS T2.0	1

MEMO