

Agenda

I . Introduction

II . Main PBA

III. OPE PBA

IV. SMPS PBA

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Objectives

- I. To make you aware of the key specification points
- II. To show you how SCX-4200 series are different

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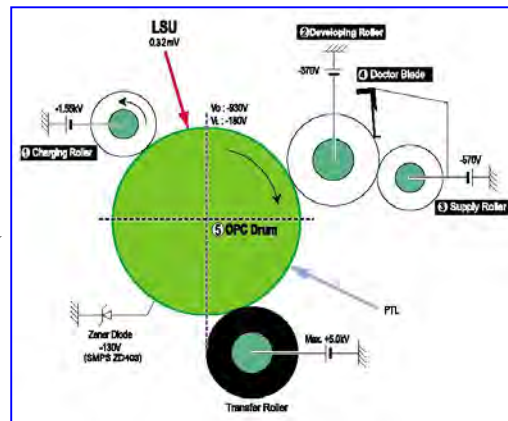
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1-1. Overview

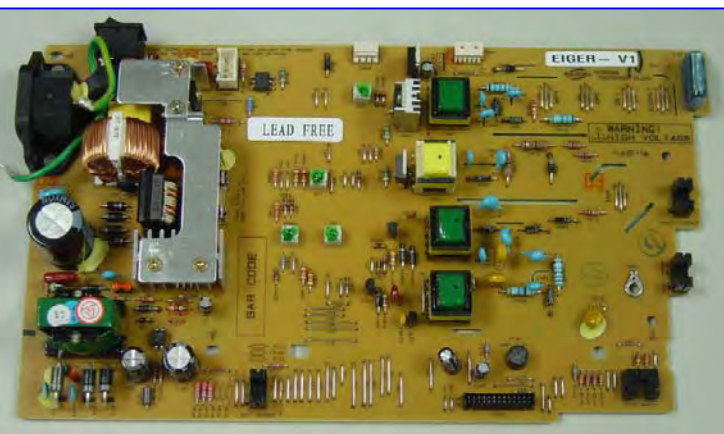
Panel Board



OPC



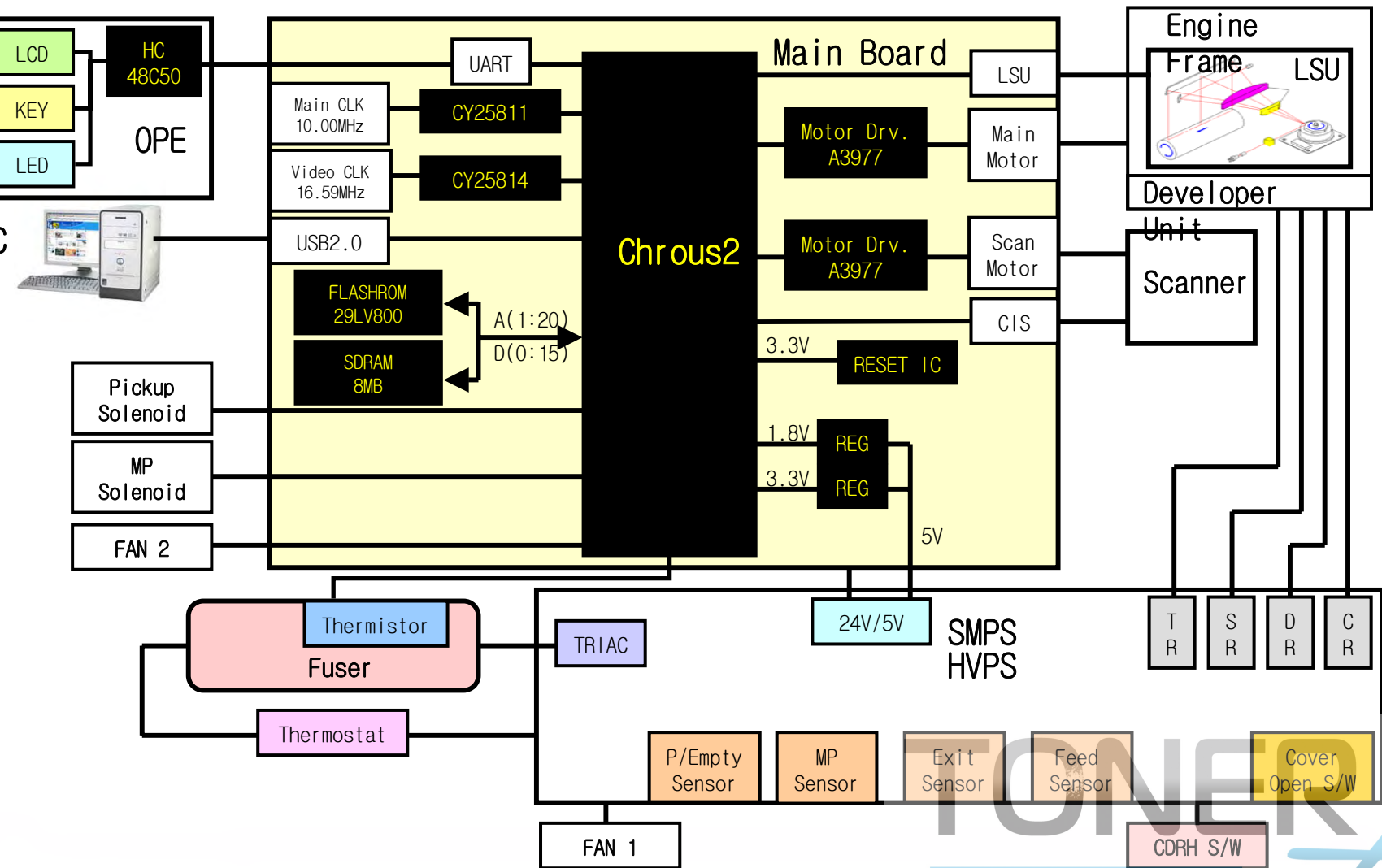
SMPS + HVPS



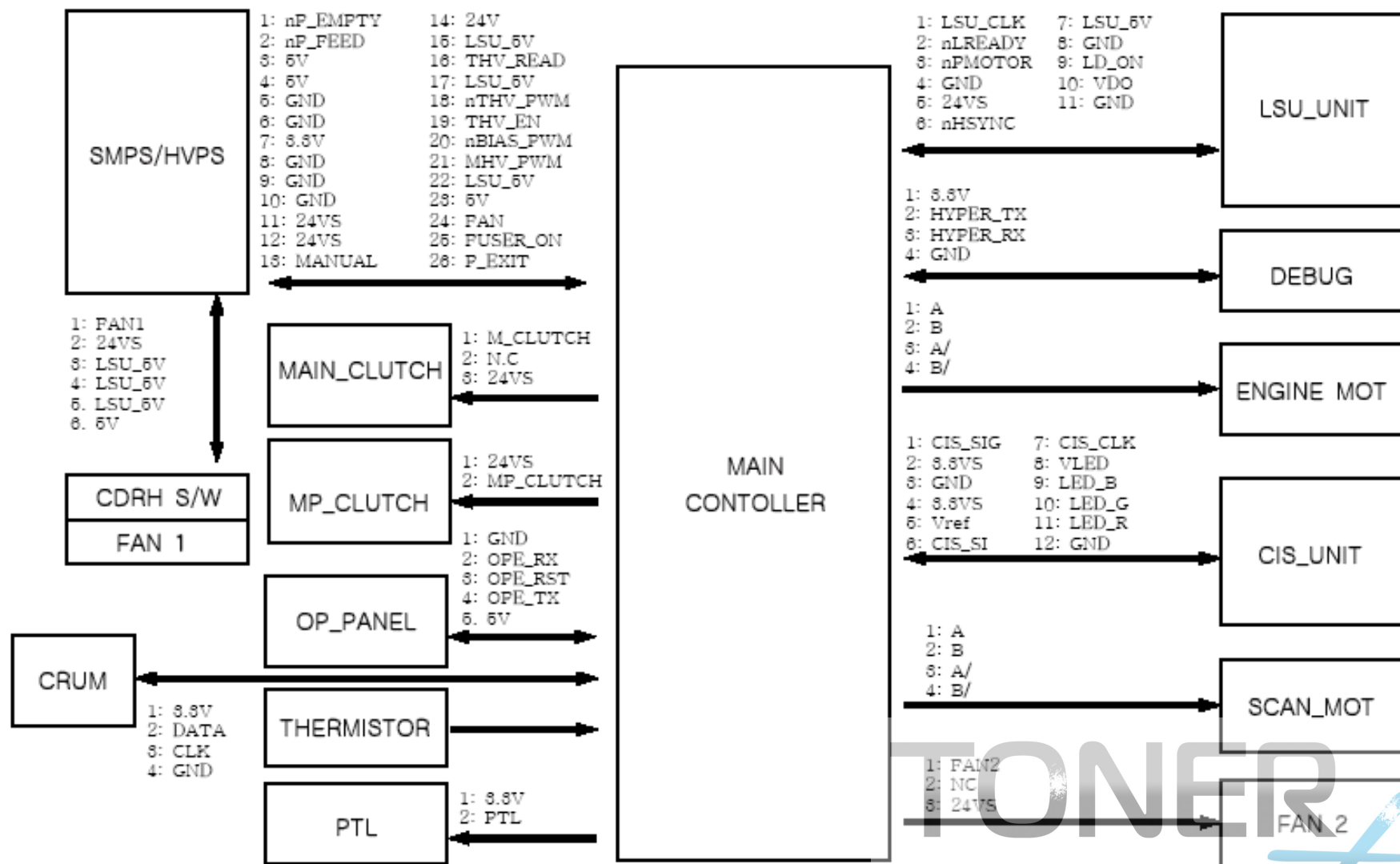
Main Board



1-2. Block Diagram



1-3. Connection Diagram



1-4. General Spec.

General specifications

Item	Description
Model name	SCX-4200 (EG42MFC)
Paper input capacity	Tray with multi-pages: 250 multi-pages for plain paper (20 lb, 75 g/m ² bond) Tray with single page and manual tray: 1 single page for plain paper, transparencies, labels, Post Card and envelopes (16 ~43 lb, 60 ~ 165 g/m ² bond)
Paper output capacity	Face down: 50 sheets Face up: 1 sheet
Consumables	1-piece toner cartridge system
Power rating	110 - 127 VAC, 50/60 Hz, 4.5 A (USA, Canada) 220 - 240 VAC, 50/60 Hz, 2.5 A (Others)
Power consumption	Average: 350 W Power save mode: Less than 10 W
Noise level ^a	Standby mode: Less than 38 dBA Scanning / Printing mode: Less than 53 dBA Warn-up: Less than 50 dBA
Warm-up time	Less than 42 seconds
First print out time	Standby mode: less than 11 seconds Cold status: less than 53 seconds
Operating environment	Temperature: 50° F to 89° F (10° C to 32° C) Humidity: 20% to 80% RH
Display	16 characters x 2 lines
Toner cartridge life ^b	3,000 pages at ISO 19752 5% coverage (Ships with 1,000 pages toner cartridge)
Memory	8 MB (Non-extendable)
External dimension (W x D x H)	409 x 362 x 232 mm (16.1 x 14.3 x 9.1 inches)
Weight	9.3 Kg (including consumables)
Package weight	Paper: 1.8 Kg, Plastic: 0.4 Kg

Scanner and copier specifications

Item	Description
Compatibility	TWAIN standard/ WIA standard
Scanning method	Color CIS
Resolution	Optical: Max. 600 x 2400 dpi (Mono and color) Enhanced: 4,800 x 4,800 dpi
Effective scanning length	Max. 297 mm (11.7 inches)
Effective scanning width	Max. 216 mm (8.5 inches) Effective: 208 mm (8.2 inches)
Color bit depth	24 bit
Mono bit depth	1 bit for Black & White mode 8 bit for Gray mode
Copy speed ^a	Up to 18 ppm in A4 (19 ppm in Letter)
Copy resolution	Scan: up to 600 x 300 dpi (Text, Text/Photo) up to 600 x 600 dpi (Photo) Print: up to 600 x 600 dpi (Text, Text/Photo, Photo)
Zoom rate	50 ~ 200%
Multiple copies	1-99 pages
Gray scale	256 levels



1-4. General Spec.

Printer specifications

Item	Description
Printing method	Laser Beam Printing
Printing speed ^a	Up to 18 ppm in A4 (19 ppm in Letter)
First print out time	11 seconds (From Ready)
Print resolution	Up to 600 x 600 dpi
Printer language	SPL (Samsung Printer Language)
OS Compatibility ^b	Windows 98/Me/2000/XP, Various Linux OS (USB only), Macintosh 10.3/10.4
Interface	USB 2.0

1-5. Comparison Between SCX-4100 and SCX-4200

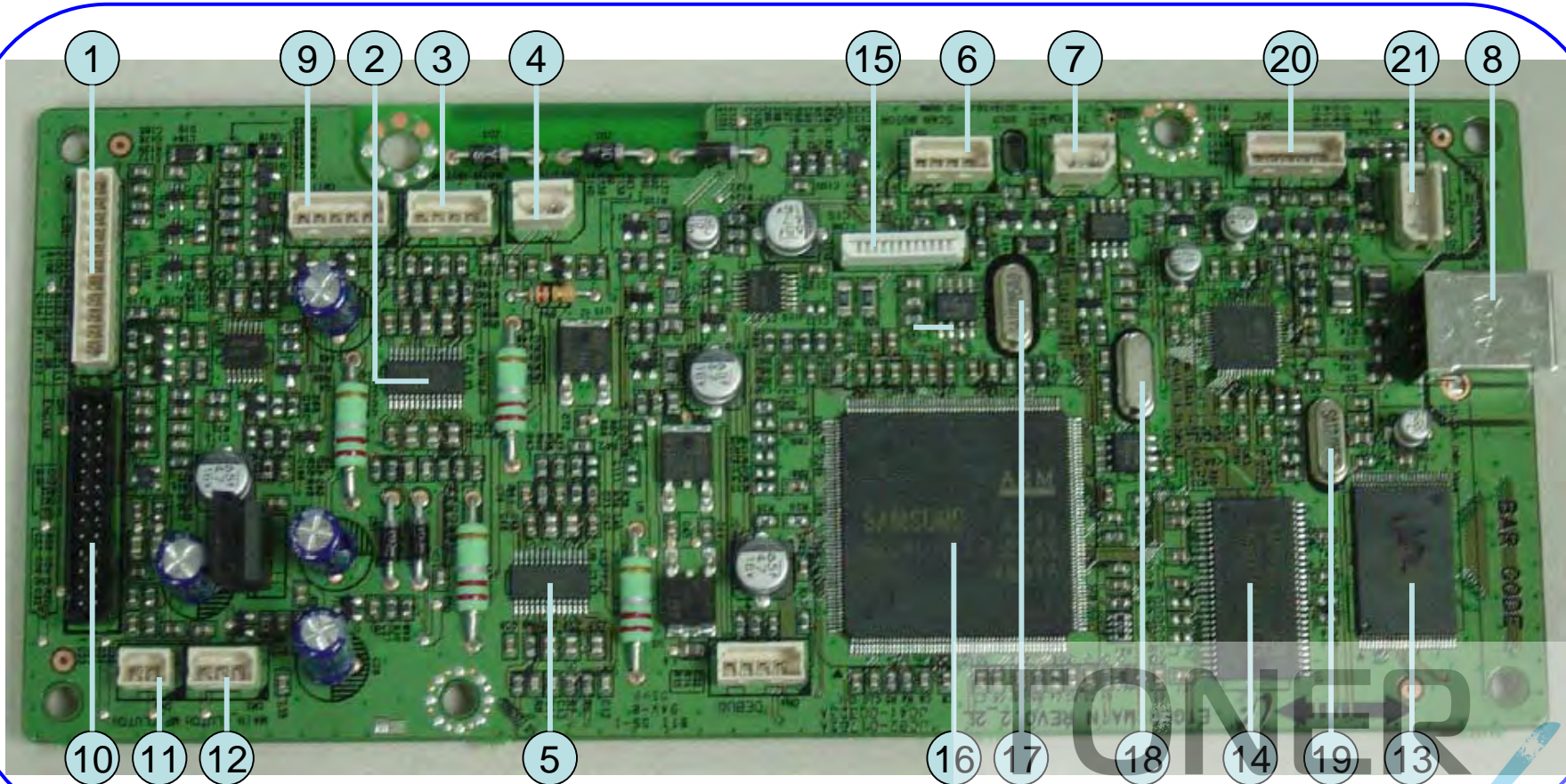
Item		SCX-4100	SCX-4200	ETC
Main	CPU	Same (Chorus 2)		
	ROM	Same (1MB)		
	RAM	Same (8MB)		
	Video Clock	12.99MHz	16.59MHz	
	USB	USB 1.1	USB 2.0	
	Main-Motor	2K (Bi-Polar)	2NK (Bi-polar)	
	Motor-IC	AN44060	A3977	
	Heat-Lamp	Same (600W)		
	LSU	Same		
	Fan	Main(1)	Main(1) + Sub(1)	
Scan	CIS	Canon 600dpi	LITEON 600dpi	
	Scan-Motor	Uni-Polar(35Φ)	Bi-Polar(35Φ)	
	Motor-IC	STA403A(Uni-Polar)	A3977 (Bi-polar)	
Panel	LCD	2*16 , 7Keys	2*16 , 8Keys , 1LED	
	ASIC	9228(SEC)	48C05(Holtec)	
SMPS /HVPS	SMPS	Same		SMPS/HVPS on 1 Board ->Heat Sink Added
	HVPS	Same		

Objectives

- I. To show you the structure and key elements of Main PBA in SCX-4200

2-1. General description

- Main PBA employs Chorus2 as an ASIC, which is developed for LBP Printer



2-1. General description

1	LSU CONNECTOR (CN5)	12	MAIN CLUTCH CONNECTOR3 (CN2)
2	MAIN MOTOR DRIVER IC –A3977(U12)	13	FLASH ROM–29LV800 (U4)
3	MAIN MOTOR CONNECOR (CN10)	14	SDRAM –K4S641623H–TL75 (U2)
4	PTL CONNECTOR (CN9)	15	CIS CONNECTOR (CN8)
5	SCAN MOTOR DRIVER IC –A3977 (U6)	16	GRAPHIC PROCESSOR ASIC–CHORUS2 (U5)
6	SCAN MOTOR CONNECTOR (CN13)	17	MAIN CLOCK CRYSTAL–10.00 MHz (OSC3)
7	THERMISTOR CONNECTOR (CN12)	18	VIDEO CLOCK CRYSTAL –16.59MHz (OSC2)
8	USB 2.0 (CN6)	19	USB CLOCK CRYSTAL – 12MHz (OSC1)
9	CRUM CONNECTOR (CN11)	20	OPE CONNECTOR (CN14)
10	ENGINE CONNECTOER (CN4)	21	FAN2 (CN7)
11	MP CLUTCH CONNECTOR (CN3)		

2-2. LBP CPU Serises

CPU	Core	Clock	Bus	Package	features
Jupiter 4e	ARM 9	150MHz	16 bit	QFP	Internal Flash 0.5MB
SPGPm	ARM 9	166MHz	16 bit	BGA	RAM 32bit Control
SPGPv3	ARM 10	400MHz	32 bit	BGA	DDR Memory supporting
Chorus 2	ARM 7	66MHz	16 bit	QFP	Internal CIP
Chorus m	ARM 9	300MHz	32 bit	BGA	Internal CIP
PPC 266	PPC	266MHz	32 bit	QFP	CPU
RM7000Se	MIPS	460MHz~	64 bit	BGA	CPU

2-3. Chorus2

Samsung's S3C46Q0X 16/32-bit RISC micro controller is designed to provide a cost-effective, low power, small die size and high performance micro-controller solution for inkjet, laser beam printer and MFP.

The S3C46Q0X is developed using ARM7TDMI core, 0.18m CMOS standard cell, and memory cell.

The integrated on-chip functions are as follows:

- 1.8V internal, 3.3V external (I/O boundary) microprocessor with 4KByte Cache
- Image Processor
- On-chip clock generator with PLL
- Memory & External Bank Control
- DMA Control (5-channel)
- Interrupt Control
- 2-port USB Host /1- port USB Device (ver 2.0) Interface Control
- UART (2 Channel)
- Synchronous Serial Interface Control
- Timer (4 Channel)
- Watch Dog Timer
- Power control: Normal, Slow, Idle, Stop and SL_IDLE mode
- A/D Converter (10-bit, 2 Channel)
- General I/O Port Control
- Print Head Control
- Carrier Motor Control
- Paper Motor Control
- Tone Generator
- RTC with calendar function
- S/W Assistant function(Rotator)

Block diagram

The block diagram illustrates the ARM7TDMI CPU system architecture. The central CPU Unit, containing the ARM7TDMI CPU Core, Write Buffer, and 4K Byte Cache, is connected to a Bus Arbiter and a System Bus Bridge & Arbitration / BDMA (2-Ch.) block. The Bus Arbiter manages communication between the CPU Unit and various peripheral blocks: Memory I/F ROM/ SRAM DRAM/SDRAM, PRT_TOP, Interrupt Controller, General DMA (2-CH), and IP_TOP. The System Bus Bridge & Arbitration / BDMA (2-Ch.) block facilitates communication between the CPU Unit and a wide range of peripherals, including the 10bit ADC, Watchdog Timer, Rotator, RTC (Real Time Clock), USB v1.1, GPIO Controller, System Timer (4-ch), UART (2-ch), HP SIO, Tone Generator, CRCON, LFCON, CRFIRE, LSU I/F, and Parallel Port (P1284). The CPU Unit is also connected to a Boundary Scan ARM7TDMI TAP Controller (JTAG) and three Clock Generators (MPLL, UPLL, PPLL). AIN[3:0] is connected to the 10bit ADC. A General Purpose I/O bus is shown on the right.

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2-4 Flash Memory (as ROM) : AM29LV800

- Storing the systems program and downloading the system program through the PC interface.

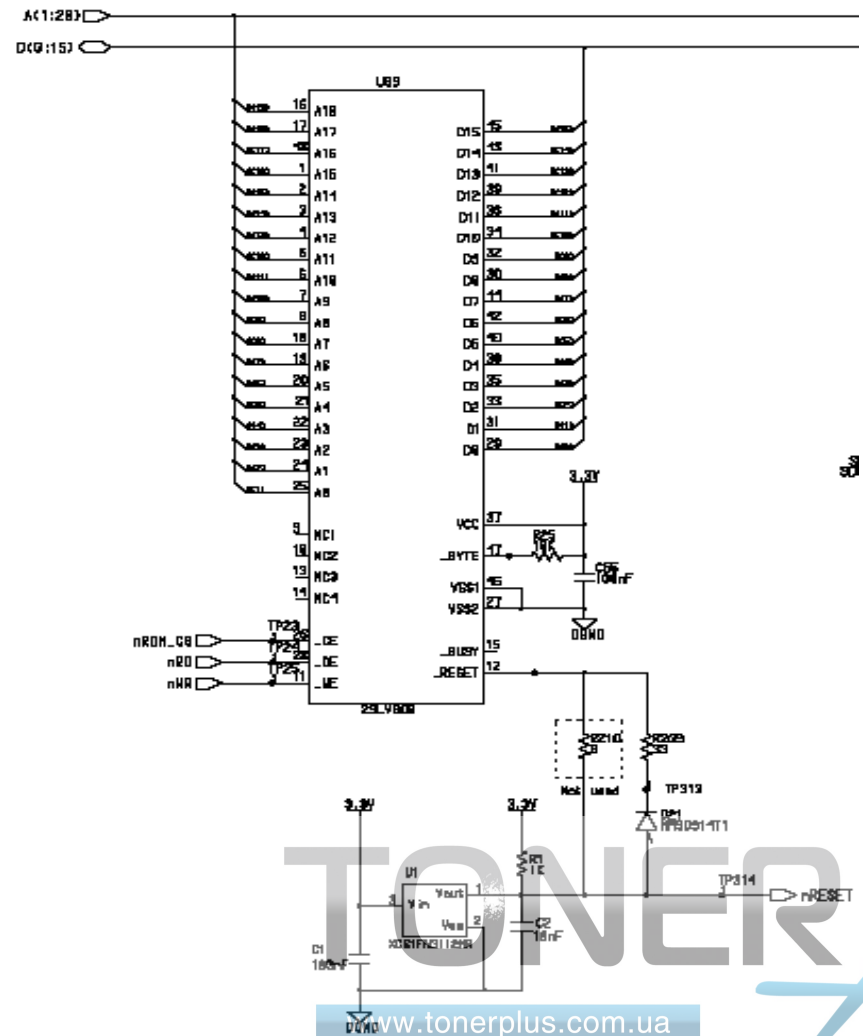
Capacity : 1 Mega Byte.

- AM29LV800
- Access Time : 70 nsec

PIN CONFIGURATION

A0–A18	=	19 addresses
DQ0–DQ14	=	15 data inputs/outputs
DQ15/A-1	=	DQ15 (data input/output, word mode), A-1 (LSB address input, byte mode)
BYTE#	=	Selects 8-bit or 16-bit mode
CE#	=	Chip enable
OE#	=	Output enable
WE#	=	Write enable
RESET#	=	Hardware reset pin, active low
RY/BY#	=	Ready/Busy# output
V _{CC}	=	3.0 volt-only single power supply (see Product Selector Guide for speed options and voltage supply tolerances)
V _{SS}	=	Device ground
NC	=	Pin not connected internally

Circuit Diagram of Flash Memory



2-5. SDRAM

Used as a buffer, system working memory area, etc, while printing

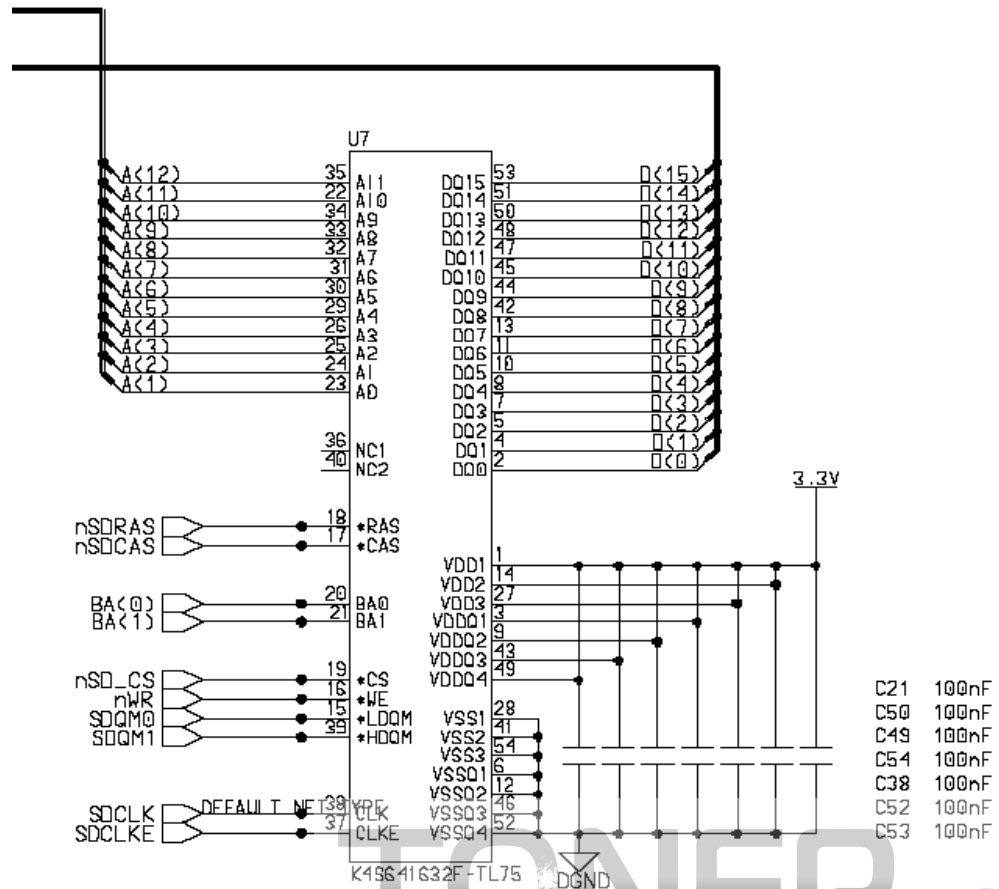
Capacity : 8 Mbyte
K4S641632H-TL75)

Access Time : 133 MHz

PIN FUNCTION DESCRIPTION

Pin	Name
CLK	System clock
CS	Chip select
CKE	Clock enable
A0 ~ A11	Address
BA0 ~ BA1	Bank select address
RAS	Row address strobe
CAS	Column address strobe
WE	Write enable
DQM	Data input/output mask
DQ0 ~ N	Data input/output
VDD/VSS	Power supply/ground
VDDQ/VSSQ	Data output power/ground

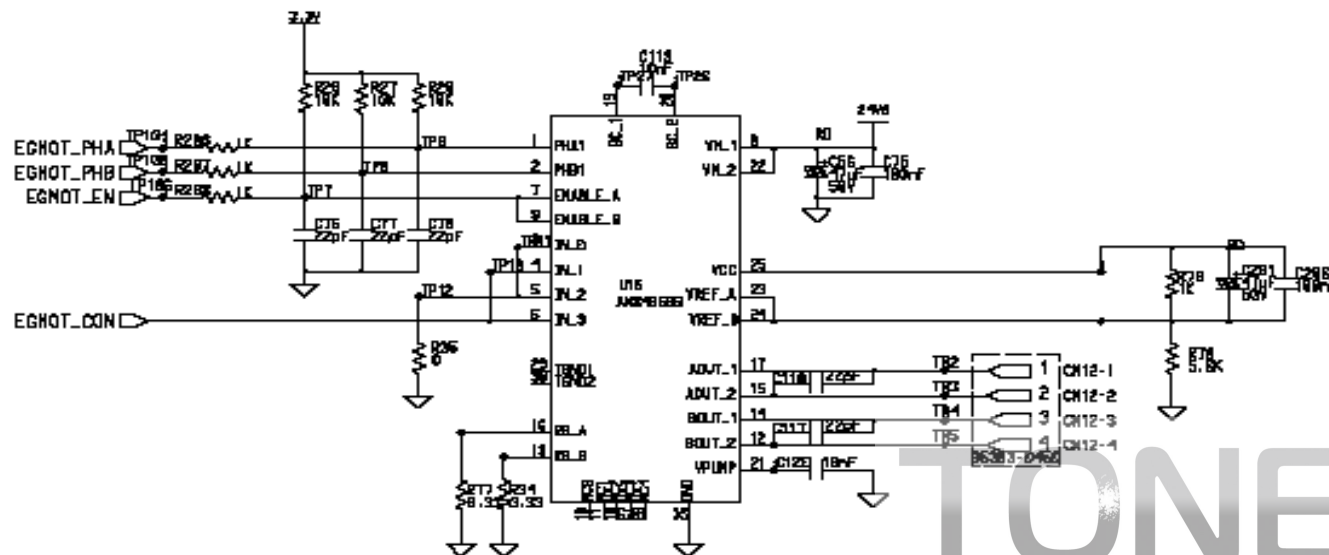
Circuit Diagram of SDRAM



2-6. Main motor Driver

Using A3977 as Motor Drive

By gearing the main motor drives the rollers such as feeding roller, developing roller, fuser roller, and distributing roller. The step motor is controlled for the sections, acceleration section and fixed speed section. In the initial stage of the motor run, appoint the acceleration section to prevent the isolation of the motor. It is controlled by the AN44060 motor drive IC. The step signal and the enable signal are sent to make the phase for driving the motor in CPU.



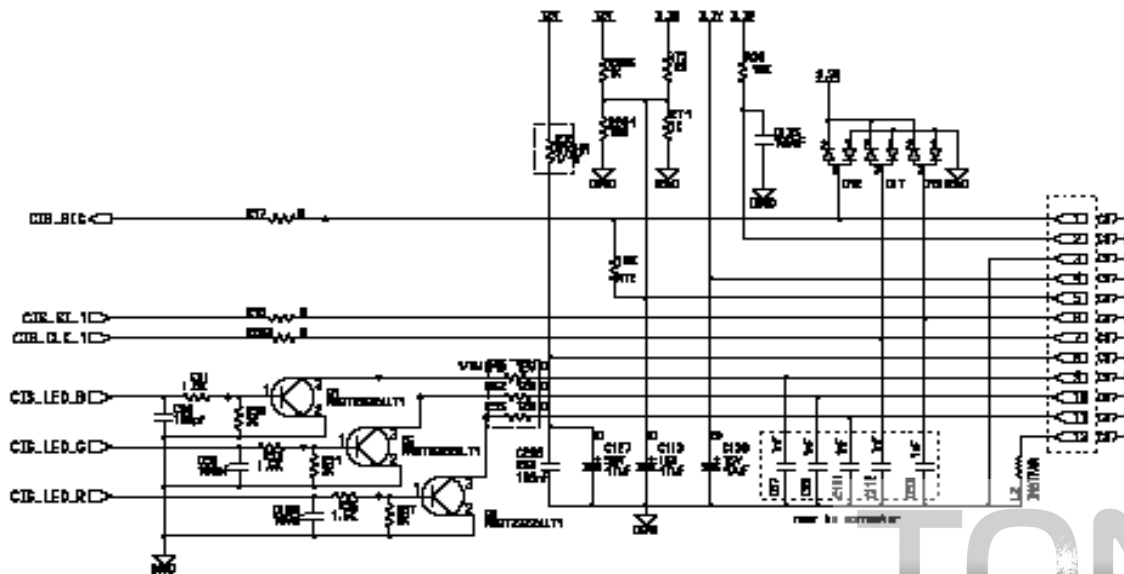
2-7. USB INTERFACE

Uses PHILIPS ISP1582BS IC

- Complies fully with:
 - Universal Serial Bus Specification Rev. 2.0
 - Most Device Class specifications
 - ACP, OnNow and USB power management requirements.
- Supports data transfer at high-speed (480 Mbit/s) and full-speed (12 Mbit/s)
- High performance USB peripheral controller with integrated Serial Interface Engine (SIE), Parallel Interface Engine (PIE), FIFO memory and data transceiver
- Automatic Hi-Speed USB mode detection and Original USB fall-back mode
- Supports sharing mode
- Supports I/O voltage range of 1.65 V to 3.6 V
- Supports VBUS sensing
- High-speed DMA interface
- Fully autonomous and multi-configuration DMA operation
- 7 IN endpoints, 7 OUT endpoints and a fixed control IN/OUT endpoint
- Integrated physical 8 kbytes of multiconfiguration FIFO memory
- Endpoints with double buffering to increase throughput and ease real-time data transfer
- Bus-independent interface with most microcontrollers and microprocessors
- 12 MHz crystal oscillator with integrated PLL for low EMI
- Software-controlled connection to the USB bus (SoftConnect)
- Low-power consumption in operation and power-down modes; suitable for use in bus-powered USB devices

2-8. CIS

CIS Module radiates the light by LED to the document, then according to LED, the reflection signals are divided with R,G,B data. The RGB data (analog signal) convert into digital signal through ADC, then the digital signal is transmitted to Chorus2 Image Processor Block.

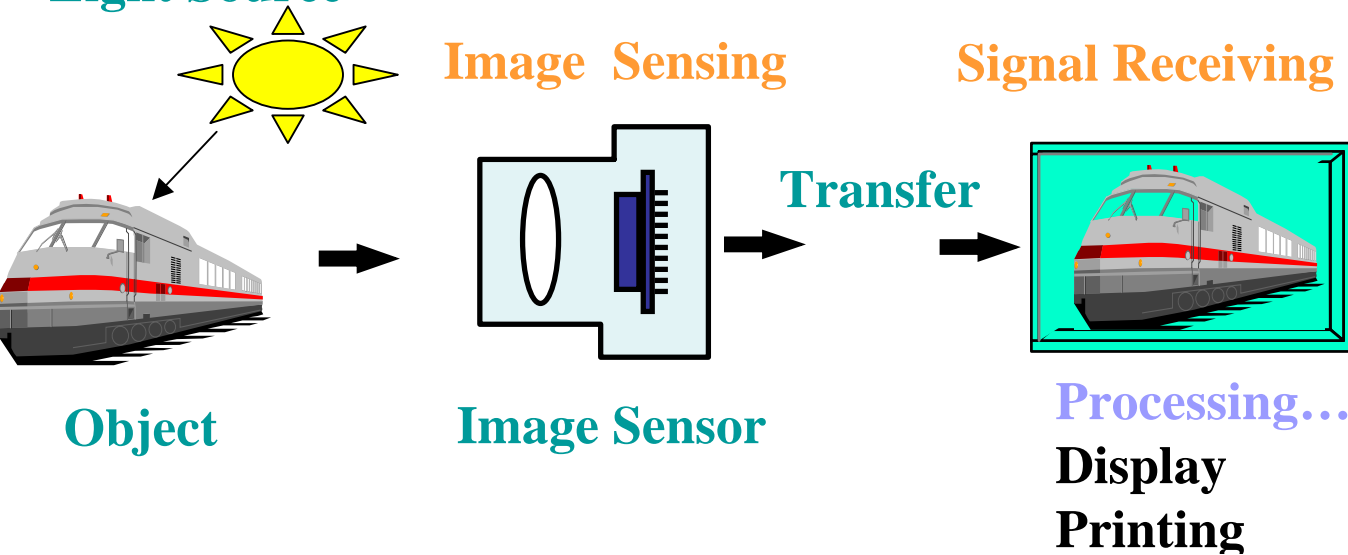


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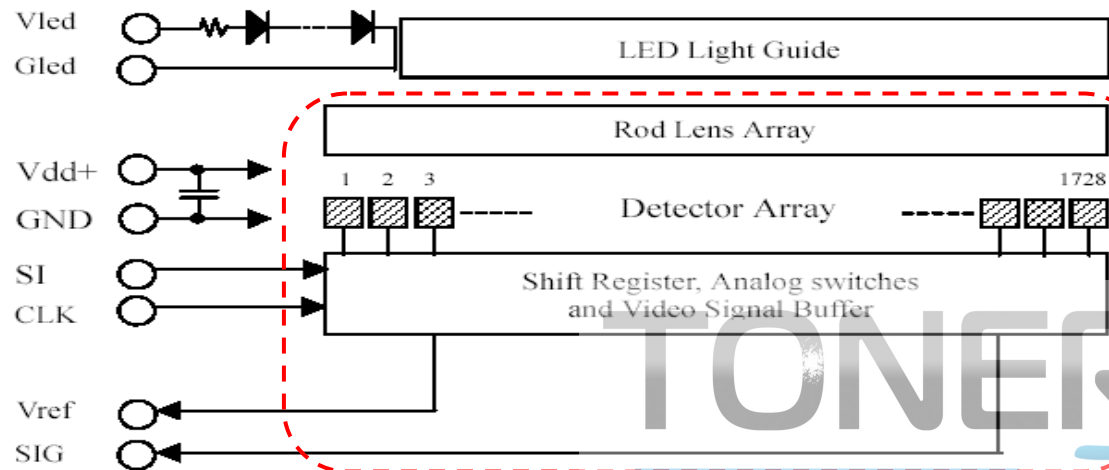
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Image Scanning Process

Light Source

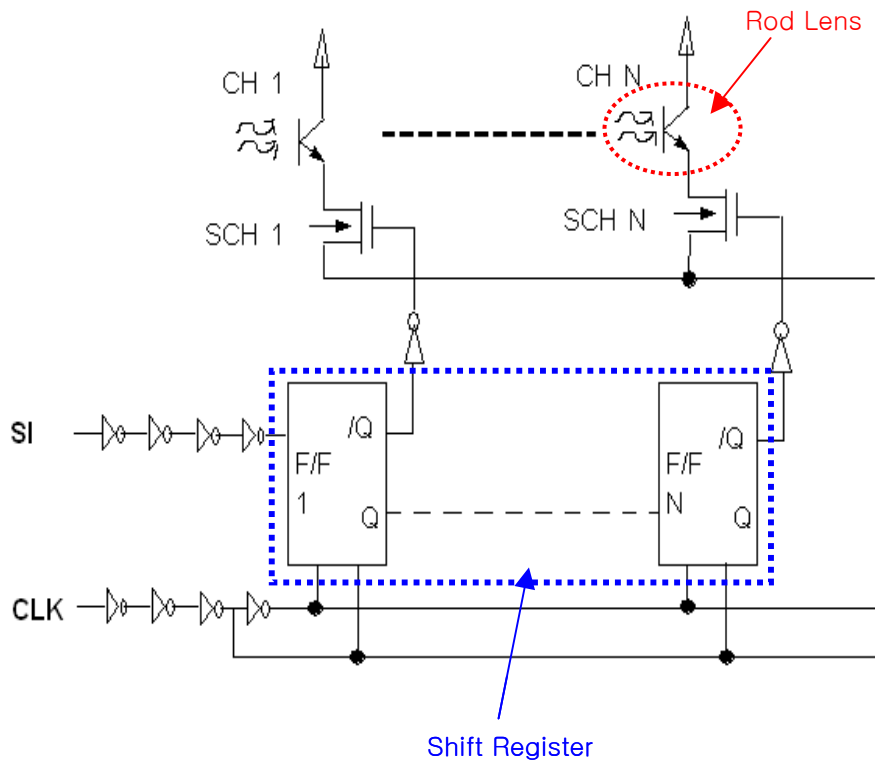


Structure of CIS

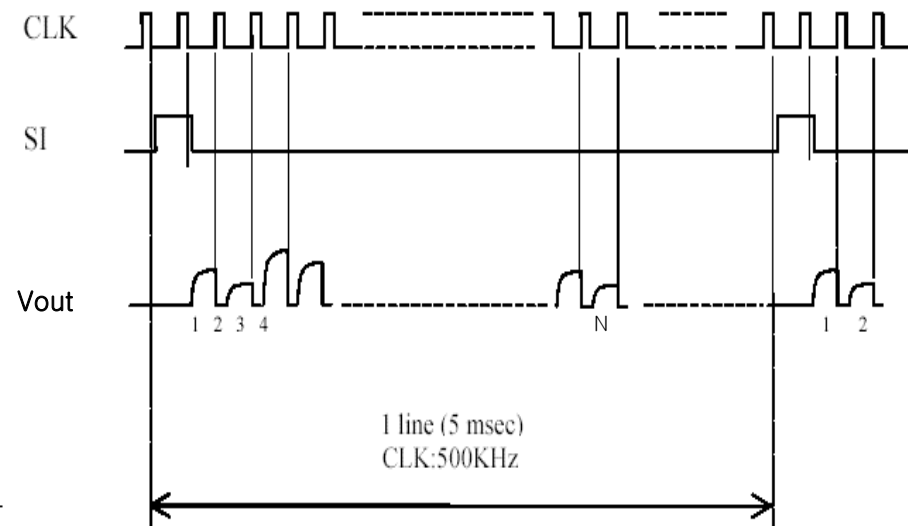


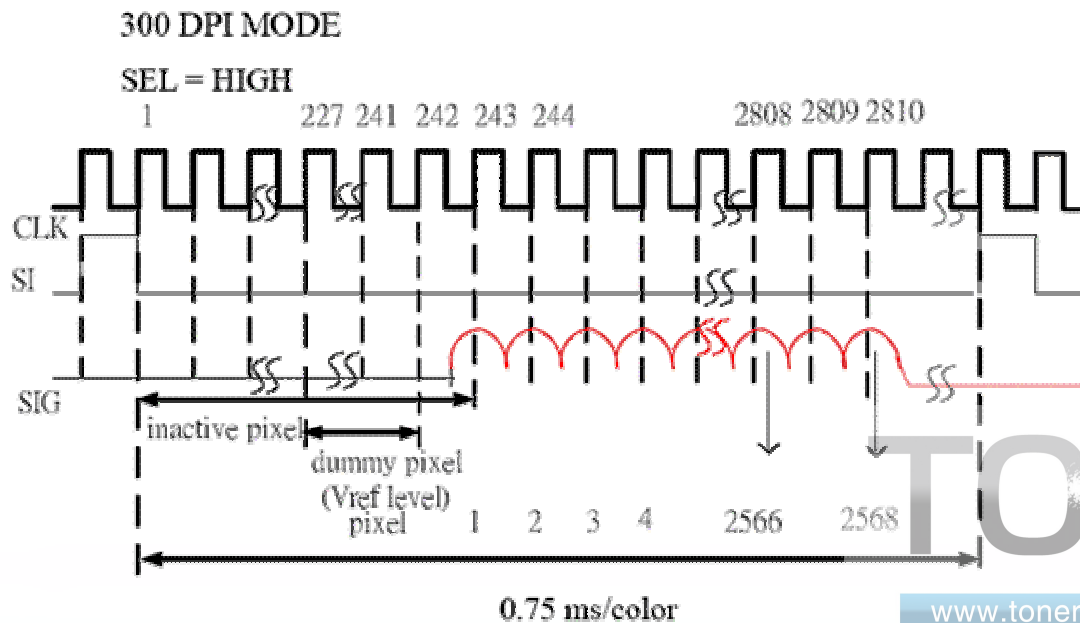
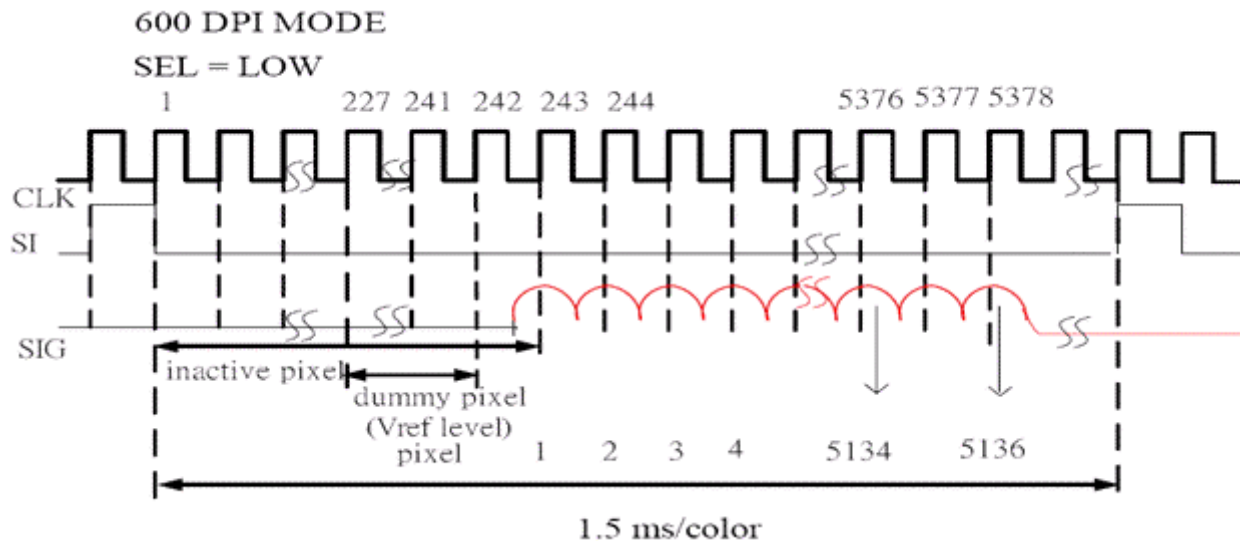
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Circuits



Timing Diagram

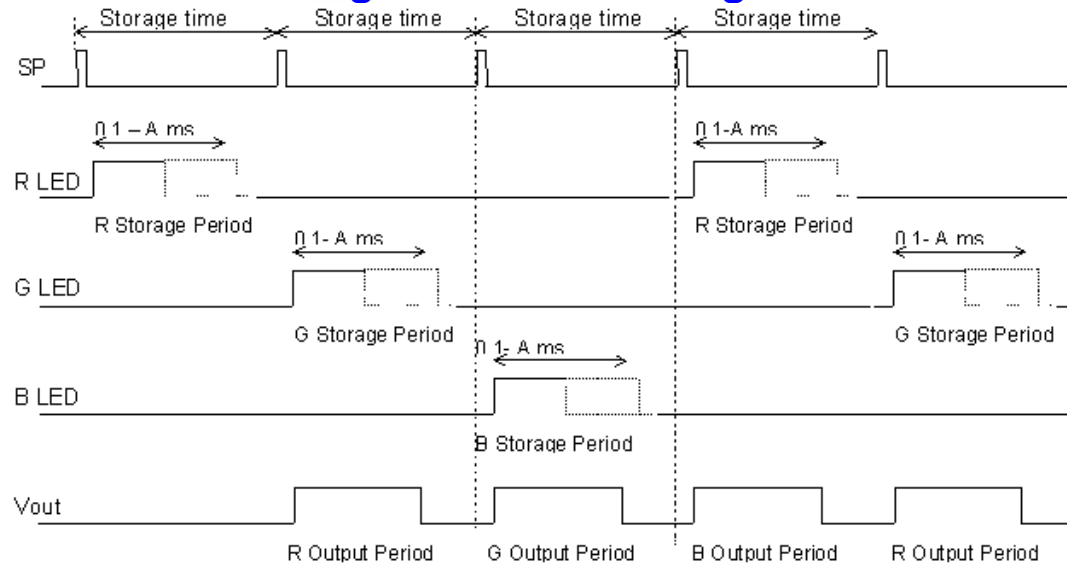




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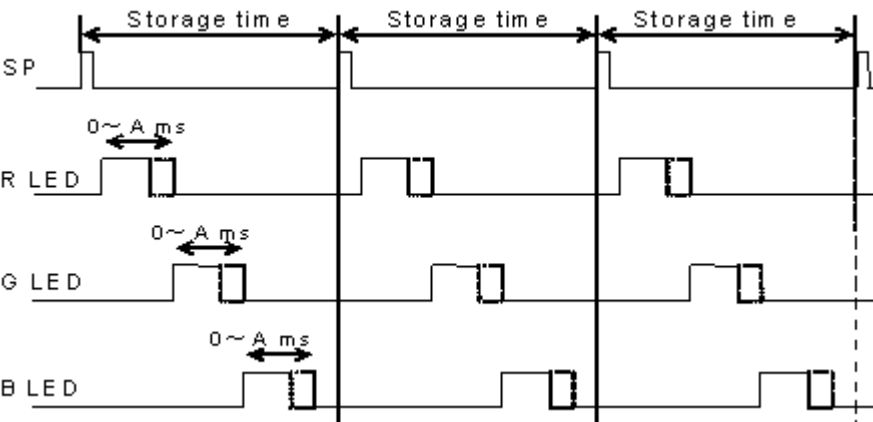
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LED Timing for Color Reading

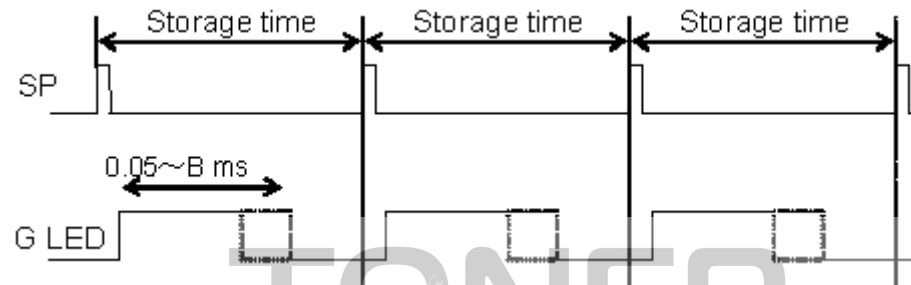


LED Timing for Mono Chrome Reading

1. Per 3 Color per Storage Time

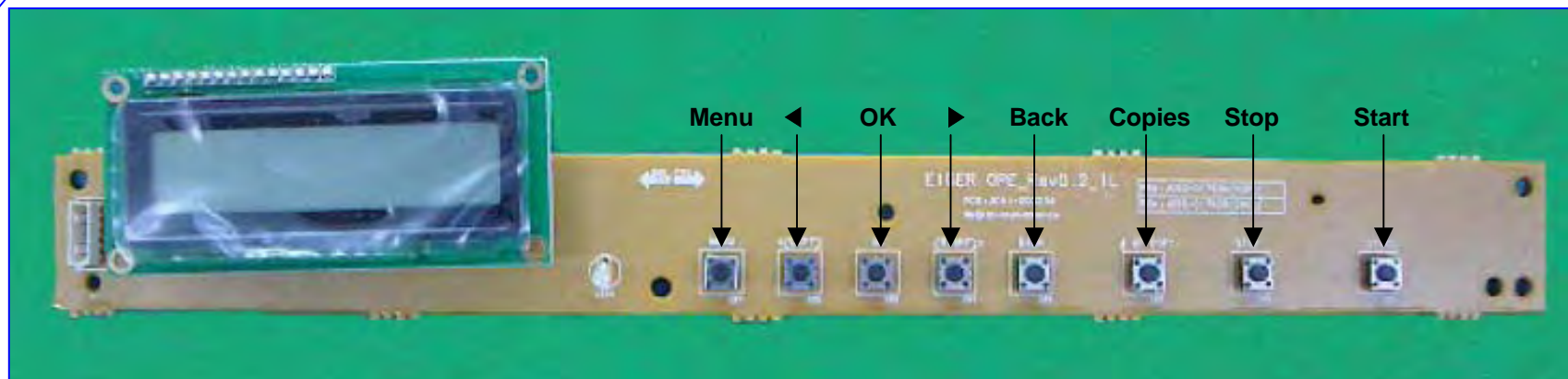


2. Only Green LED ON



3-1. General description

OPE board is consisted of various function keys and LCD to display an operation of key.
OP micom(48C05) is 8-bit micro controller device designed for multiple I/O control. It creates a panel circuit with LCD and other devices. A communication method with a CPU of a main board is UART(TXD-transmit, RXD-receive).



Menu	This is to be used to enter the Menu
Copies	1-99
OK	This key is used to select the right item what customer wants from several items.
Start	This key is used to activate the job
Stop	This key is used to stop the job being done or to exit from the Menu.
Back	This key is used to move previous menu – upper level
◀/▶	Left/Right Arrow Key

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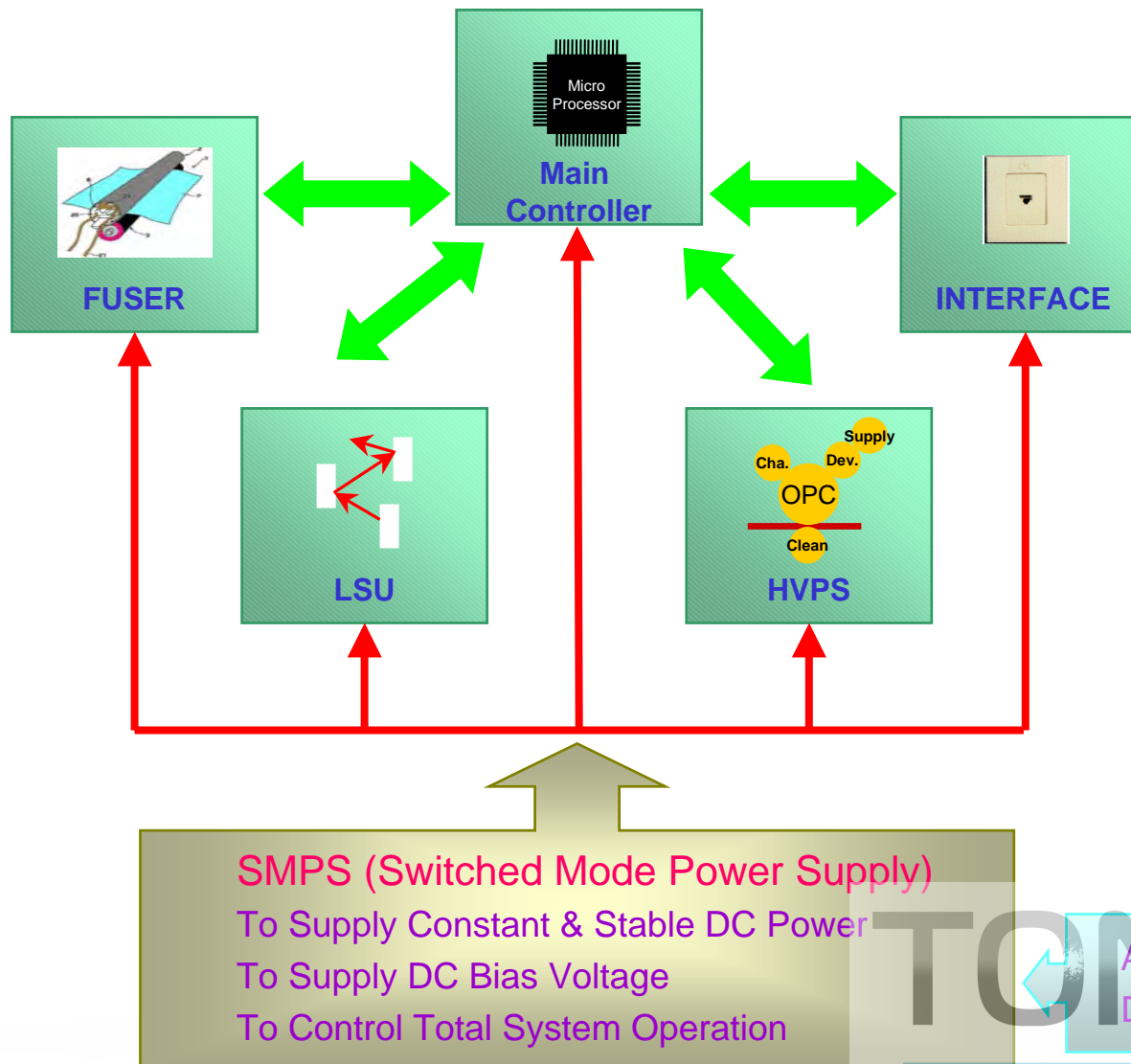
3-2. UART

- OPE and main board exchange information by UART.
The band rate is 9600bps, and uses 7.37 MHz resonator as oscillating element. It engages in communication with 8 bit data without parity bit. UART has two lines for Tx and Rx. The default level is in the 'high' state. For communication, the start bit (low level) is transmitted before the data. When the data transmission is completed, the high state is maintained as the stop bit is transmitted.
- UART TX format : Codes for change of keys are transmitted in single code, and OK or error message to check if communication is performed properly are also transmitted in single code.



- UART RX format : Data being received will be arranged to be received as according to the following specified format to know what data they are.

1. The Role of SMPS & HVPS



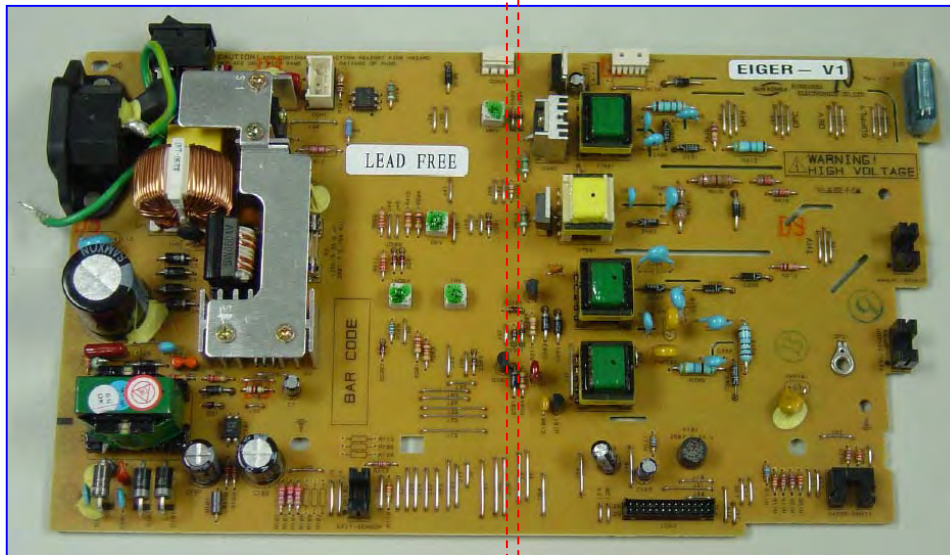
4-2. SMPS & HVPS Spec.

SMPS is the power source of entire system. It is assembled by an independent module and completely common use with SCX-4200 and it is same characteristic with SCX-4100. It is mounted at the bottom of the set. The SMPS supplies the DC power for driving the system, and the AC heater control part, which supplies the power to fuser. it has two output channels. Which are +5V and +24V.

HVPS creates the high voltage of THV/MHV/Supply/Dev and supplies it to the developer part for making best condition to display the image. The HVPS part takes the 24V and outputs the high voltage for THV/MHV/BIAS, and the outputted high voltage is supplied to the toner, OPC cartridge, and transfer roller.

SMPS(Switching Mode Power Supply)

HVPS (High Voltage Power Supply)



4-3. SMPS & HVPS Spec.

- 1) Transfer High Voltage(THV+)
 - Input Voltage: 24 V DC $\pm 15\%$
 - Output Voltage: MAX +5.0KV $\pm 5\%$ (Duty Variable, no loading)
 -1.0KV $\pm 15\%$ (when clearing, 200Mohm)
 - Output Voltage Trigger :6.5 μ A
 - Input contrast of the Voltage stability degree under $\pm 5\%$ (fluctuating input 21.6V~26.4V)
 Loading contrast : $\pm 5\%$ or less
 - Output Voltage Rise Time : 100ms Max
 - Output Voltage Fall Time : 100ms Max
 - Transfer voltage range as environment variable :+650V(Duty 90%) ~5KV(Duty 10%)
 - Environment Recognition Control Method :The THV-PWM ACTIVE transfers active signal. It detects the resistance by recognizing the voltage value, F/B, while permits the environmental recognition voltage.
 - Output Voltage Control Method :Transfer Output Voltage is output and controlled by changing the Duty cycle of the THV PWM Signal. 90% Duty:+650V, 10% Duty:+5KV $\pm 5\%$

- 2) Charge Voltage(MHV)
 - Input Voltage: 24 V DC $\pm 15\%$
 - Output Voltage: -1.3KV ~ -1.8KV DC ± 50 V
 - Output Voltage Rise Time : 50ms Max

4-4. SMPS & HVPS Spec.

- Output Voltage Fall Time : 50ms Max
- Output Loading Range : 30M ohm ~1000M ohm
- Output Control Signal(MHV-PWM):CPU is HV output when PWM is LOW

3) Clearing Voltage(THV-)

- The(+) Transfer Voltage is not output because the THV PWM is controlled with high.
- The(-) Transfer Voltage is output because the THV -Enable Signal is controlled with low.
- The output fluctuation range is big because there is no Feedback control.

4) Developing Voltage(DEV)

- Input Voltage: 24 V DC $\pm 15\%$
- Output Voltage: - 200V~600V DC $\pm 20V$
- Output Voltage Fluctuation range: PWM Control
- Input contrast of the output stability degree $\pm 5\%$ or less
Loading contrast : $\pm 5\%$ or less
- Output Voltage Rise Time : 50ms Max
- Output Voltage Fall Time : 50ms Max
- Output Loading range : 10M ohm ~1000M ohm
- Output Control Signal(BIAS-PWM): the CPU output is HV output when PWM is low.

5) Supply

- Output Voltage: -400V ~ 800V DC $\pm 50V$ (ZENER using, DEV)
- Input contrast of the output stability degree under $\pm 5\%$