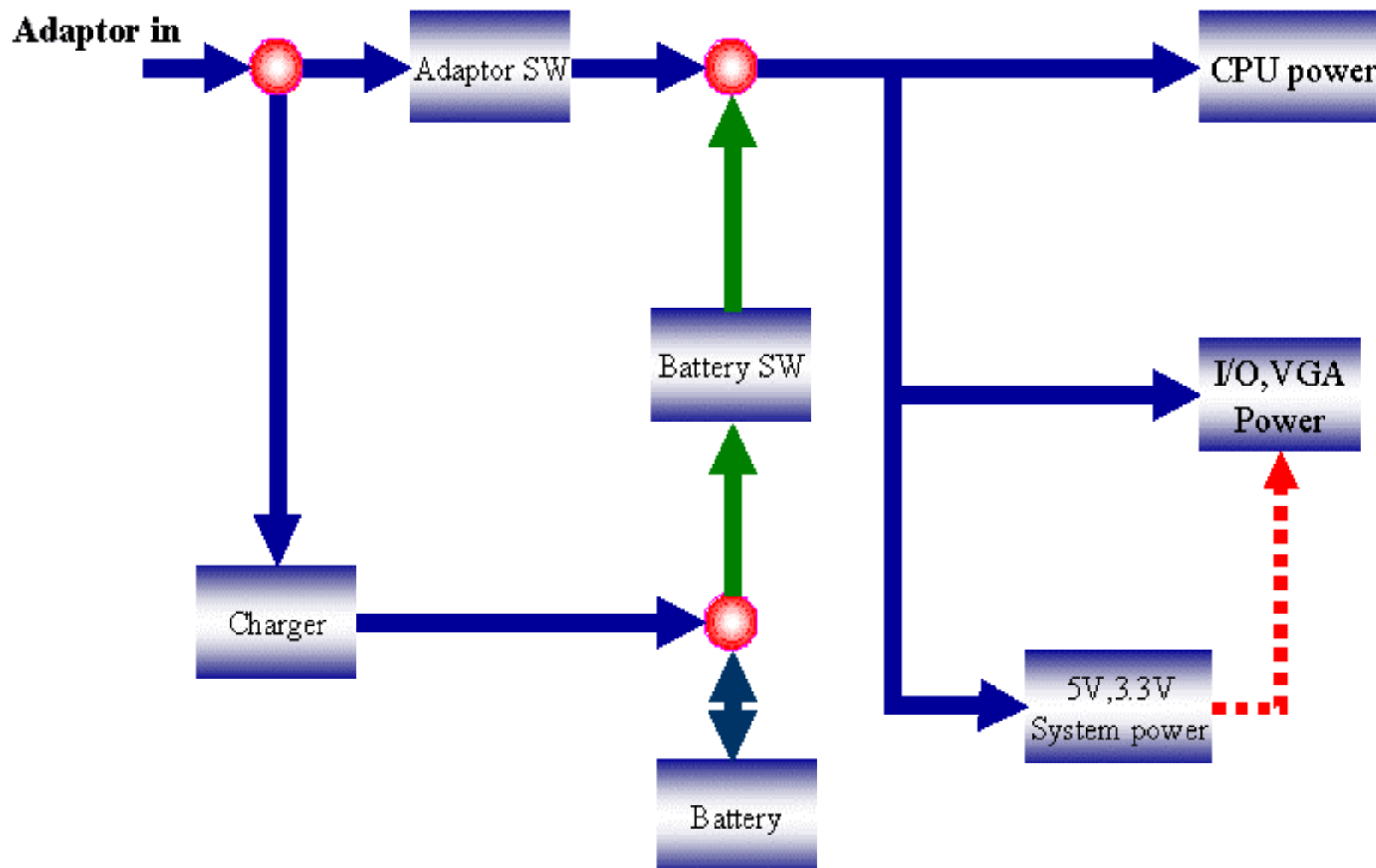
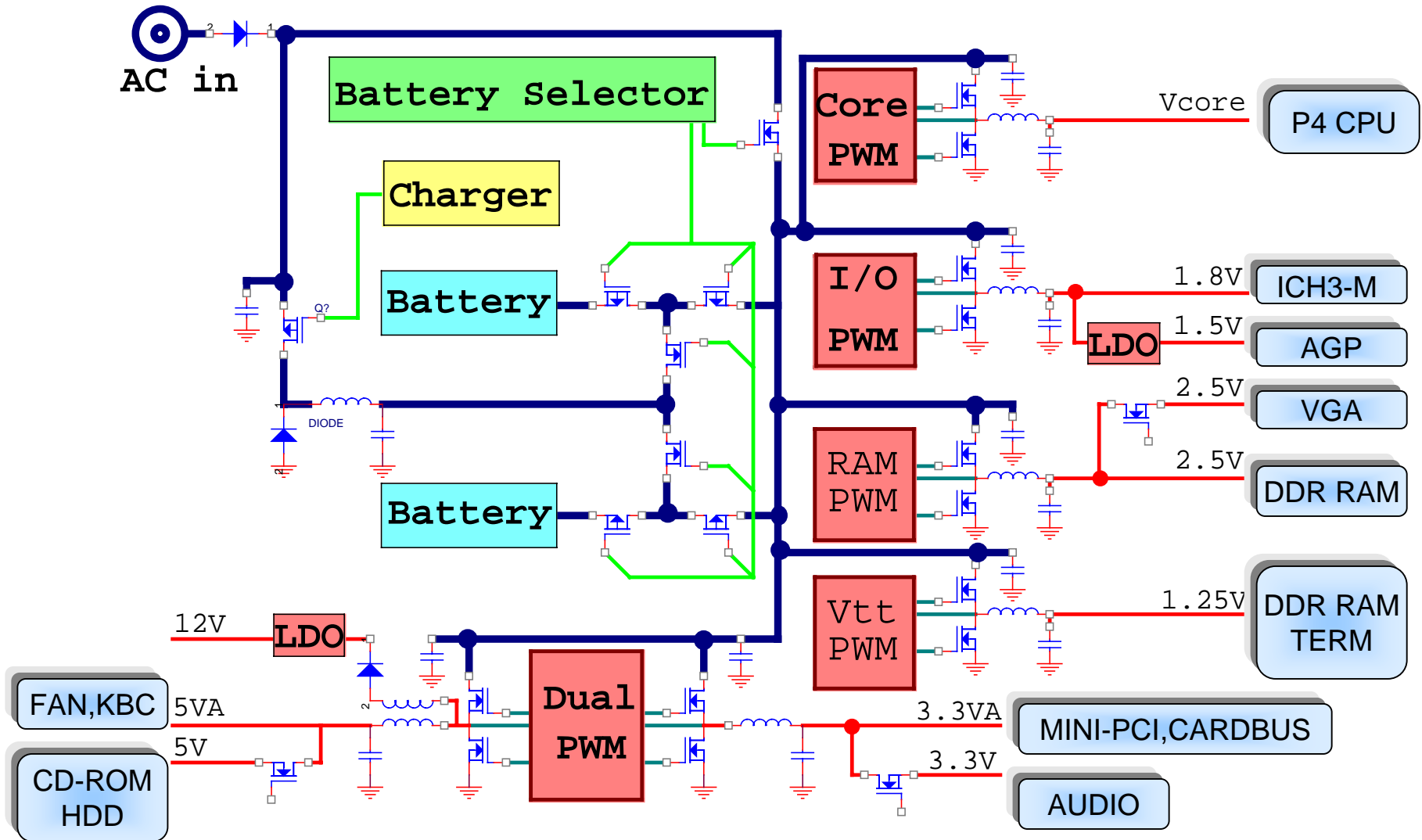


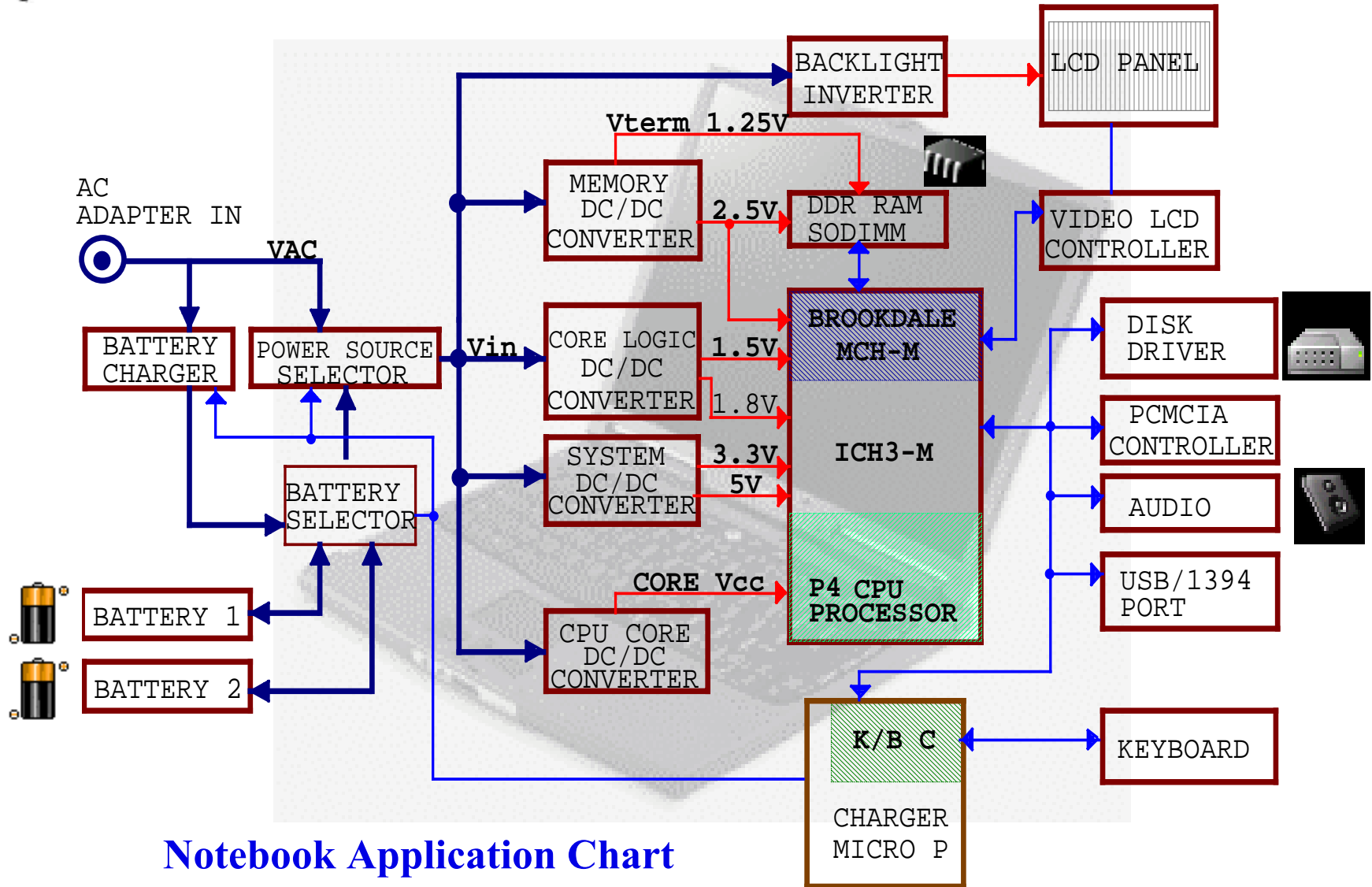
# Application of AOS MOSFET for Notebook



## Note book structure







**Notebook Application Chart**

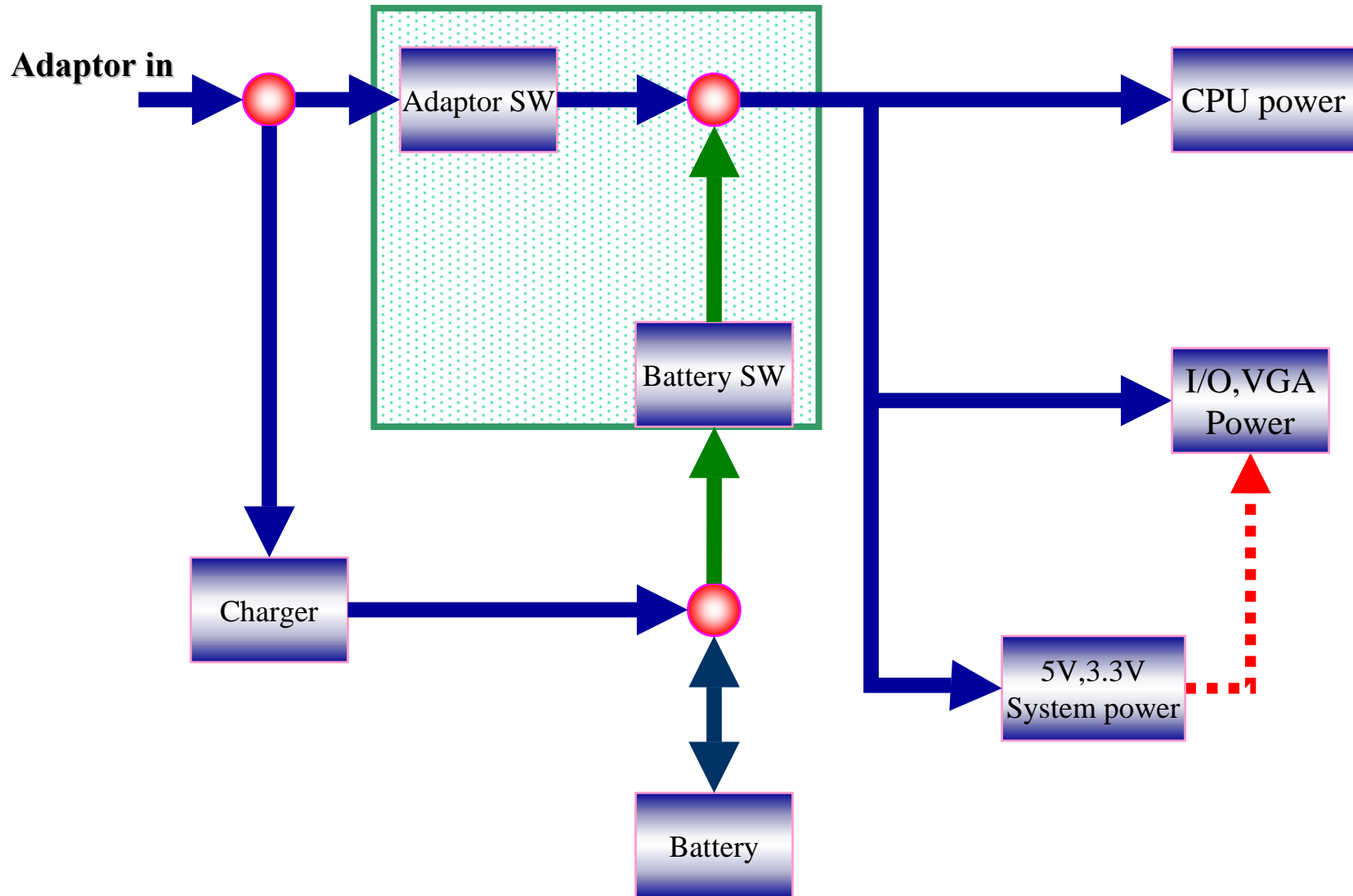
# **The application of MOSFET**

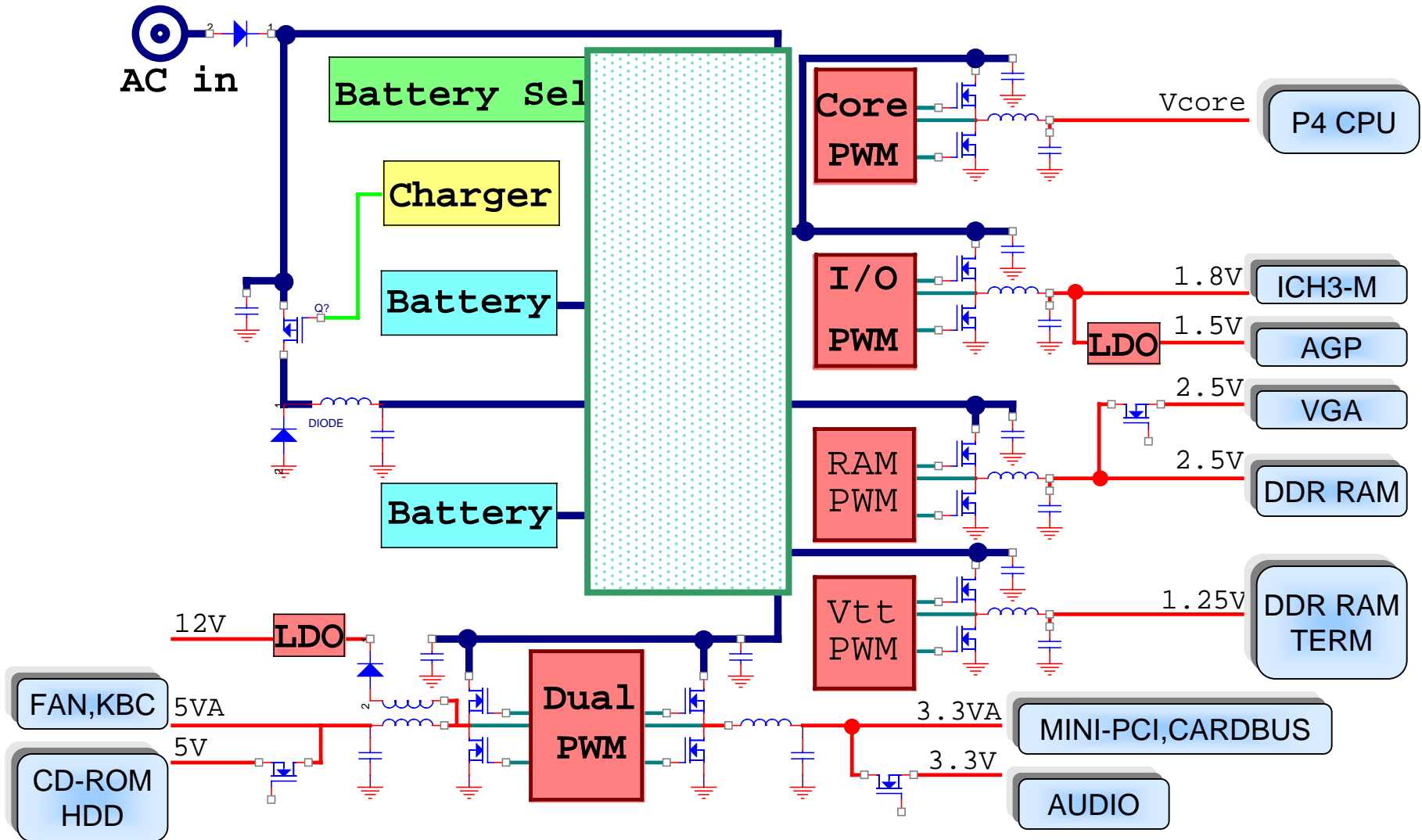
## **1. Load SW**

- a. Adaptor SW**
- b. Battery SW**
- c. Small power SW**
- d. Small single SW**

## **2. Buck converter DC-DC power**

- a. CPU core power**
  - b. System power 5V, 3.3V**
  - c. I/O, VGA, RAM power**
-



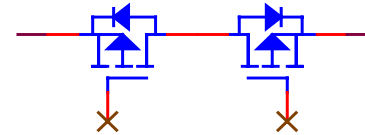


## Adapter SW

**P-ch is used normally.**

**The type of Adapter SW:**

**back to back P-ch, or single P depend on Input current**



**$V_{DS}$  : depend on voltage of adaptor + 5V↑**

**$V_{GS}$  > depend on voltage of adaptor ↑**

**$I_D$  :  $W_{adaptor} / V_{adaptor} = I_{adaptor}$  ↑**

**$R_{ds(on)}$  : as small as possible , reducing Voltage drop out**

**Be a SW, switching losses is not a major issue.**



## **Adaptor SW (con.)**

**For example.**

**Adaptor 19V / 3.68A or 70W /19V**

**We can make a choice easily.....**

**P-ch.  $V_{ds}=30V$ ,  $V_{gs}=20V$ ,  $I_d=4A$**

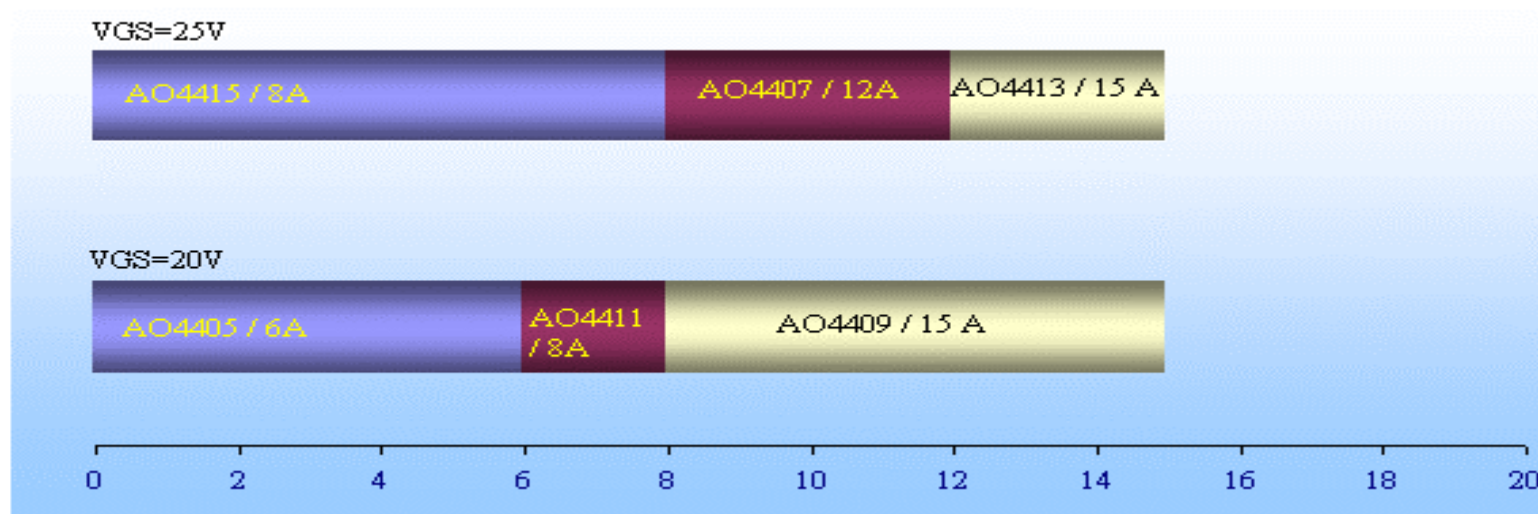
---

## Adaptor SW (con.)

**AOS PRODUCT ...**

**VGS=25V AO4413 → AO4407 → AO4415**

**VGS=20V AO4405 → AO4410 → AO4409**



## Battery SW

**Back to Back P-ch is used normally.**

**$V_{DS} >$  depend on battery voltage  $+5V \uparrow$**

**$V_{GS} >$  Battery voltage  $\uparrow$**

**$I_D$ : Capacity of battery  $\rightarrow 6000mA$**

**$R_{DS(on)}$  : as small as possible , reducing Voltage drop out**

**Be a SW, switching losses is not a major issue.**

---

## Battery SW(con.)

**For example.**

**14.4V / 4000mAH or 14.8V /4000mAH**

**The maximum voltage is 16.8V**

**$V_{ds}=30V$ ,  $V_{gs}=20V$ ,  $i_d=4.5A$**

---

# AOS MOSFET for Battery /Adaptor SW

## AOS PRODUCT ...

**VGS=25V**

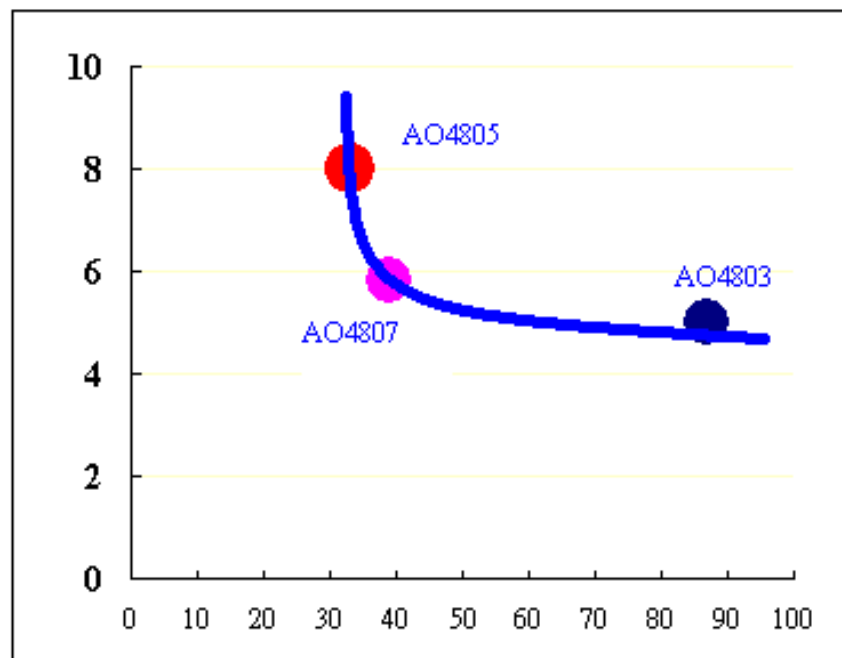
**AO4413 → AO4407 → AO4415**

**VGS=20V**

**AO4405 → AO4410 → AO4409**

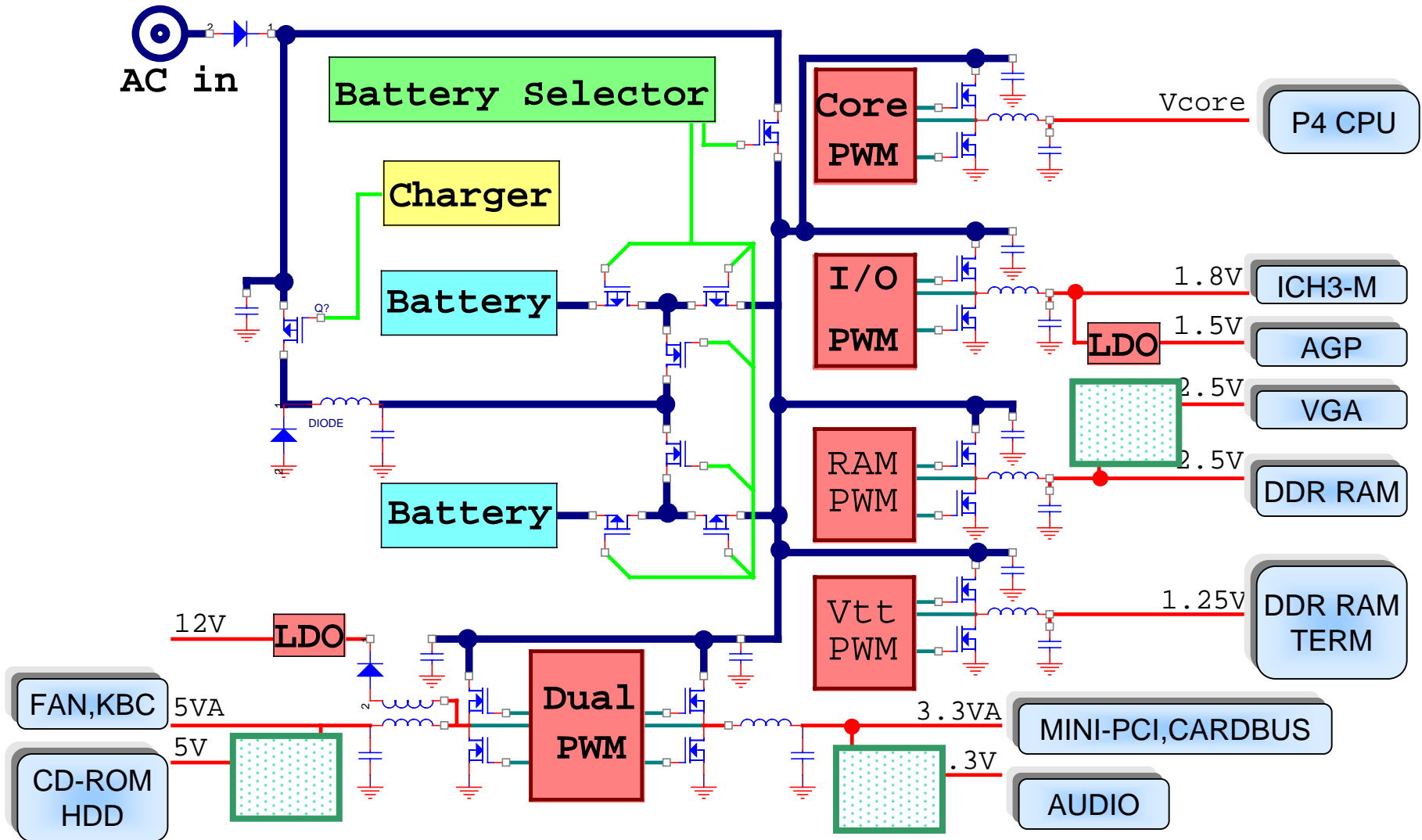
**DUAL P-ch**

**AO4805 → AO4807 → AO4803**



# Power consumption

	Voltage	Current	Power Plane	Active State	Controller	Chip
1	1.5V	60A	VCORE	S0-S1	RUN_ON	CPU (Northwood), ICH3
2	1.2V	500mA	VCCID	S0-S1	RUN_ON	CPU VID
3	1.25V	2.1A	VTERM	S0-S3	SUSON	DDR Termination
4	1.8V	0.7A	+1.8V	S0-S1	MAINON	CPU, ICH3
		2.5A	+1.8V	S0-S1	MAINON	ATI M6 core
		0.3A	1.8V_S5	S0-S5	S5_ON	ICH3
		0.2A	1.8V_S5	S0-S4	S5_ON	ICH3_LAN
5	1.5V	3A	+1.5V	S0-S1	MAINON	NB core
		2A	+1.5V	S0-S1	MAINON	ATI AGP
6	2.5V	3.2A	2.5V_VGA	S0-S1	MAINON	ATI Frame buffer
		3.2A	2.5SUS	S0-S3	SUSON	NB VCCSM, DDR RAM
7	3.3V	4A	+3V	S0-S1	MAINON	MINIPCI, NS391, VGAIO
			3VSUS	S0-S3	SUSON	ATI VCCSUS, 1394 PHY
			3VAUX	S0-S4	3VAUX_ON	TI 1520, LAN_PHY
			3V_S5	S0-S5	S5_ON	ICH3
			3V_591	ALWAYS		NS87591
8	5V	4A	+5V	S0-S1	MAINON	HDD, CD-ROM, FDD, FAN
			5VSUS	S0-S3	SUSON	
9	12V	0.1A	12VOUT	ALWAYS		
			+12V	S0-S1		



## Load SW – Small power SW

P-ch small power SW

Normally 4 to 2 A

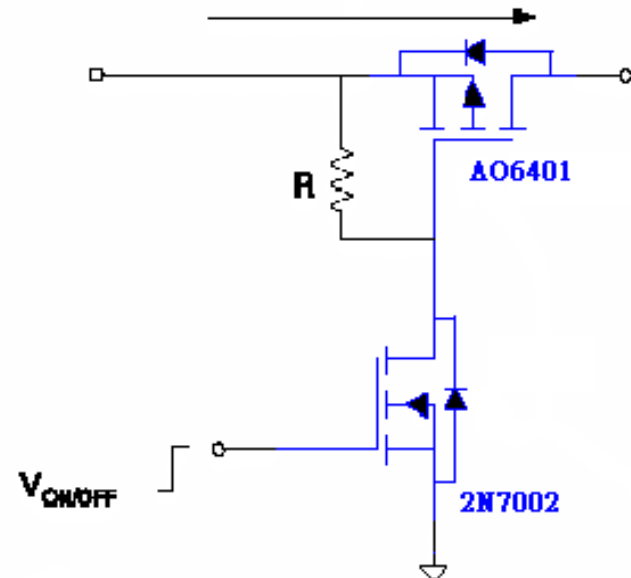
$V_{DS}=20V$ ,  $V_{GS}=8V \uparrow$

$R_{ds(on)}$ : as small as possible

Package: as small as possible

Switching parameter is not major concerns.

Minimum turn on Voltage of G-S is a key point. (minimum Voltage rating)





# Load SW—By package

## AOS small power SW

$V_{\text{turn-on}} = 1.8\text{V}$

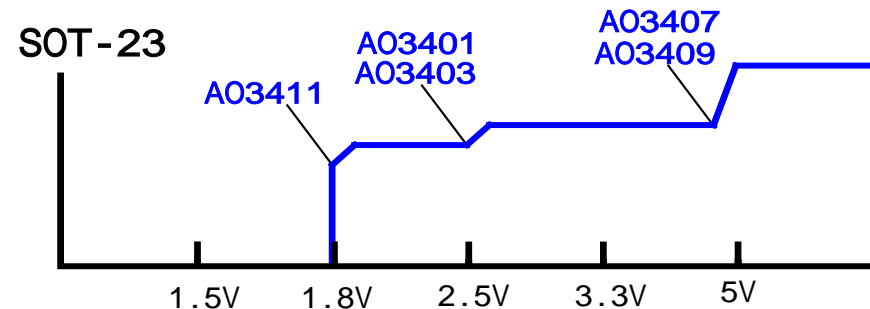
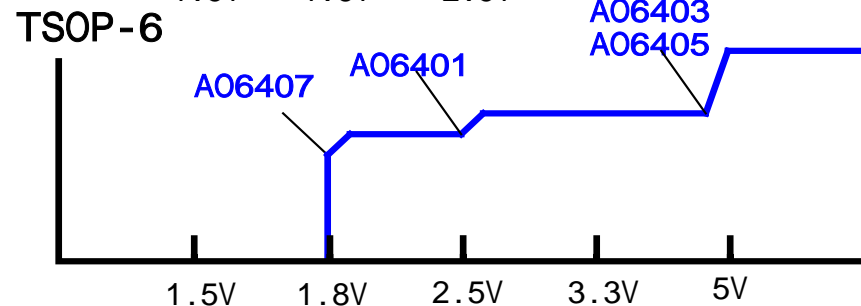
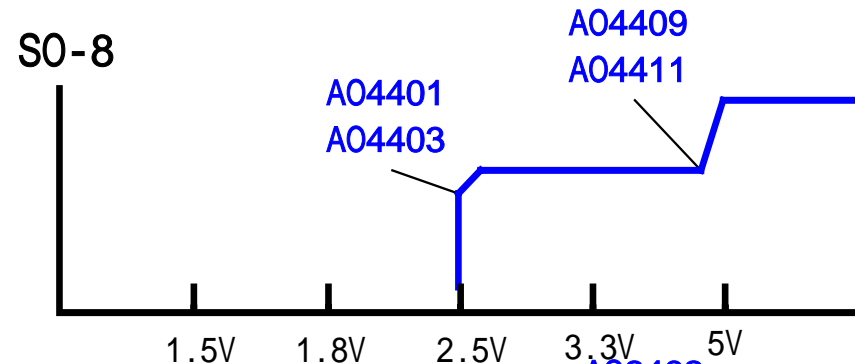
AO3411, AO6407

$V_{\text{turn-on}} = 2.5\text{V}$

AO3401, AO3403, AO6401,  
AO4401, AO4403

$V_{\text{turn-on}} = 4.5\text{V}$

AO3407, AO3409, AO6403,  
AO6405, AO4409, AO4411



# Load SW – Small power SW

**N-ch small power SW**

**Normally 4 to 2A**

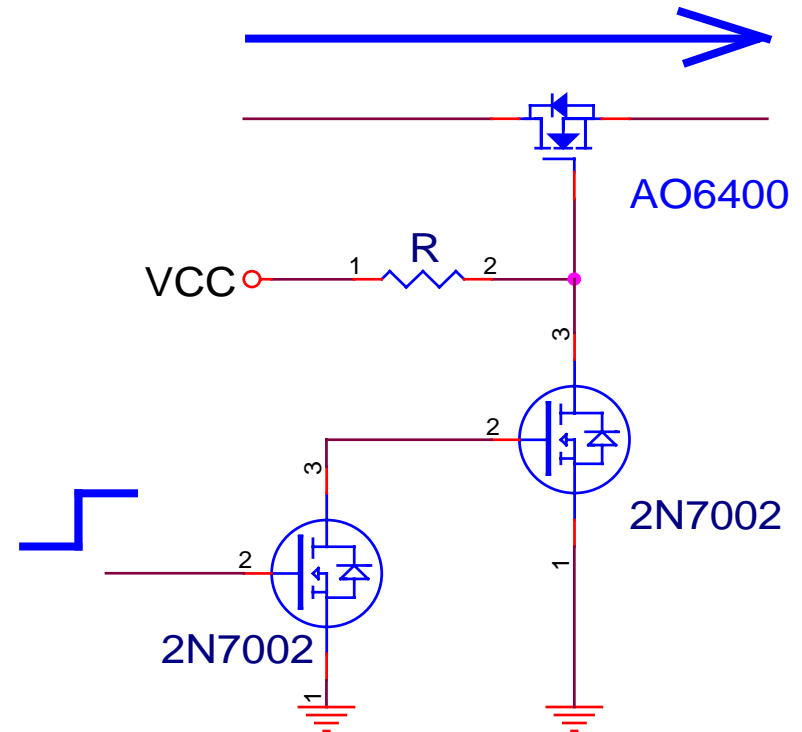
**$V_{DS}=20V$ ,  $V_{GS}=20V \uparrow$**

**$R_{ds(on)}$ : as small as possible**

**Package: as small as possible**

**Switching parameter is not major concerns.**

**Minimum turn on Voltage of G-S is a key point. (minimum pull high Voltage rating)**

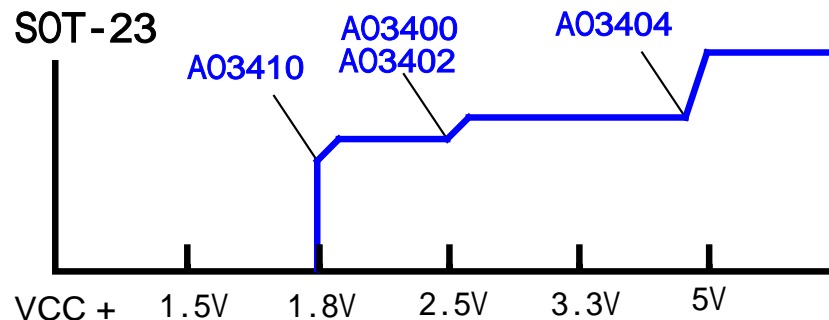


## Low SW by n-ch package

### AOS small power SW

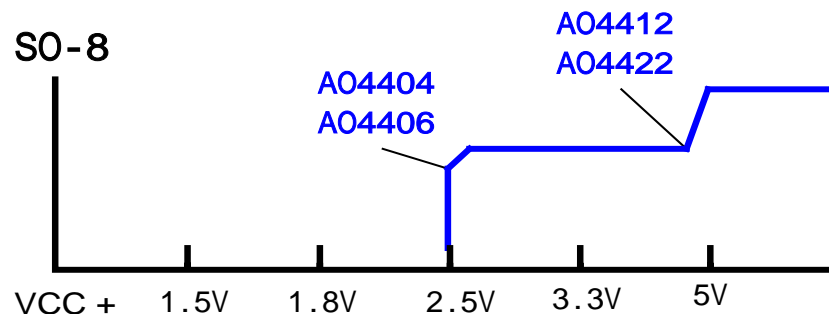
$V_{\text{turn-on}} = 1.8\text{V}$

AO3410, AO6404



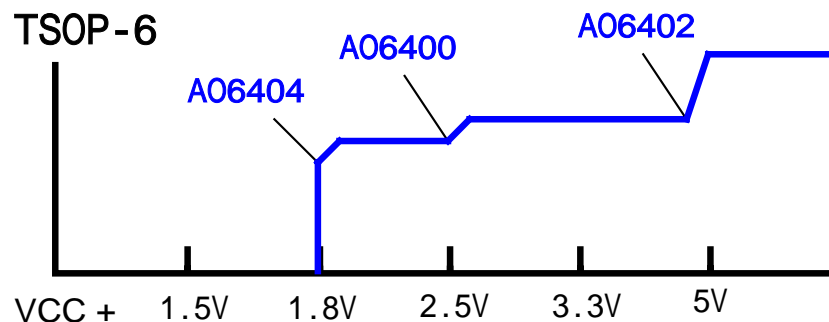
$V_{\text{turn-on}} = 2.5\text{V}$

AO3400, AO3402, AO4404,  
AO4406

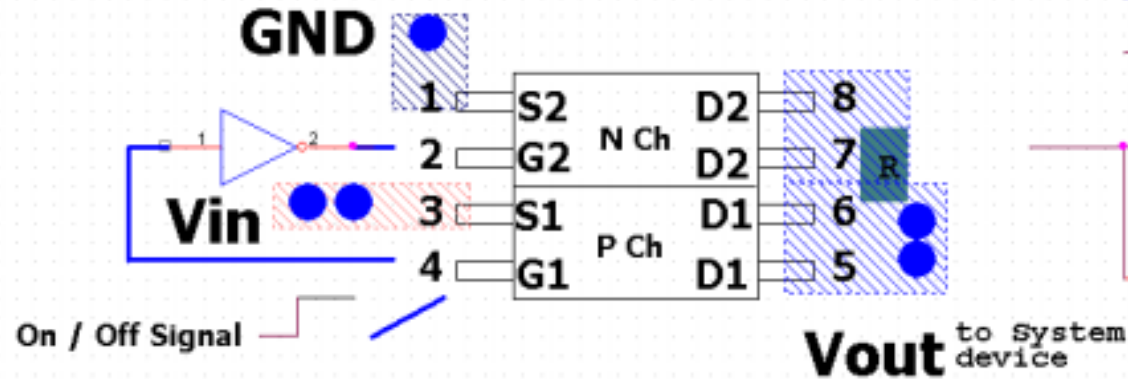


$V_{\text{turn-on}} = 4.5\text{V}$

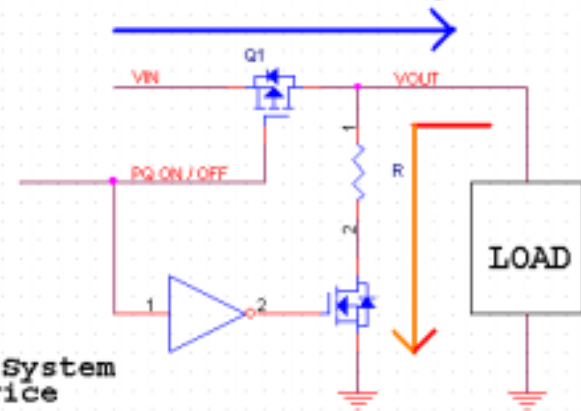
AO3404, AO6402, AO4412,  
AO4422



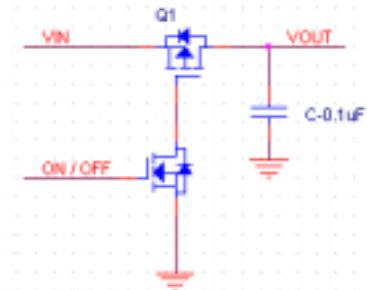
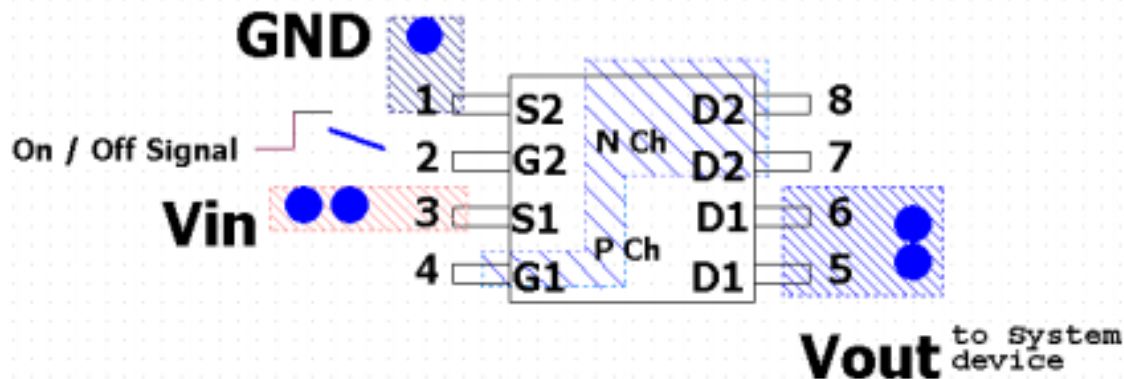
# AO4601 p+n load sw



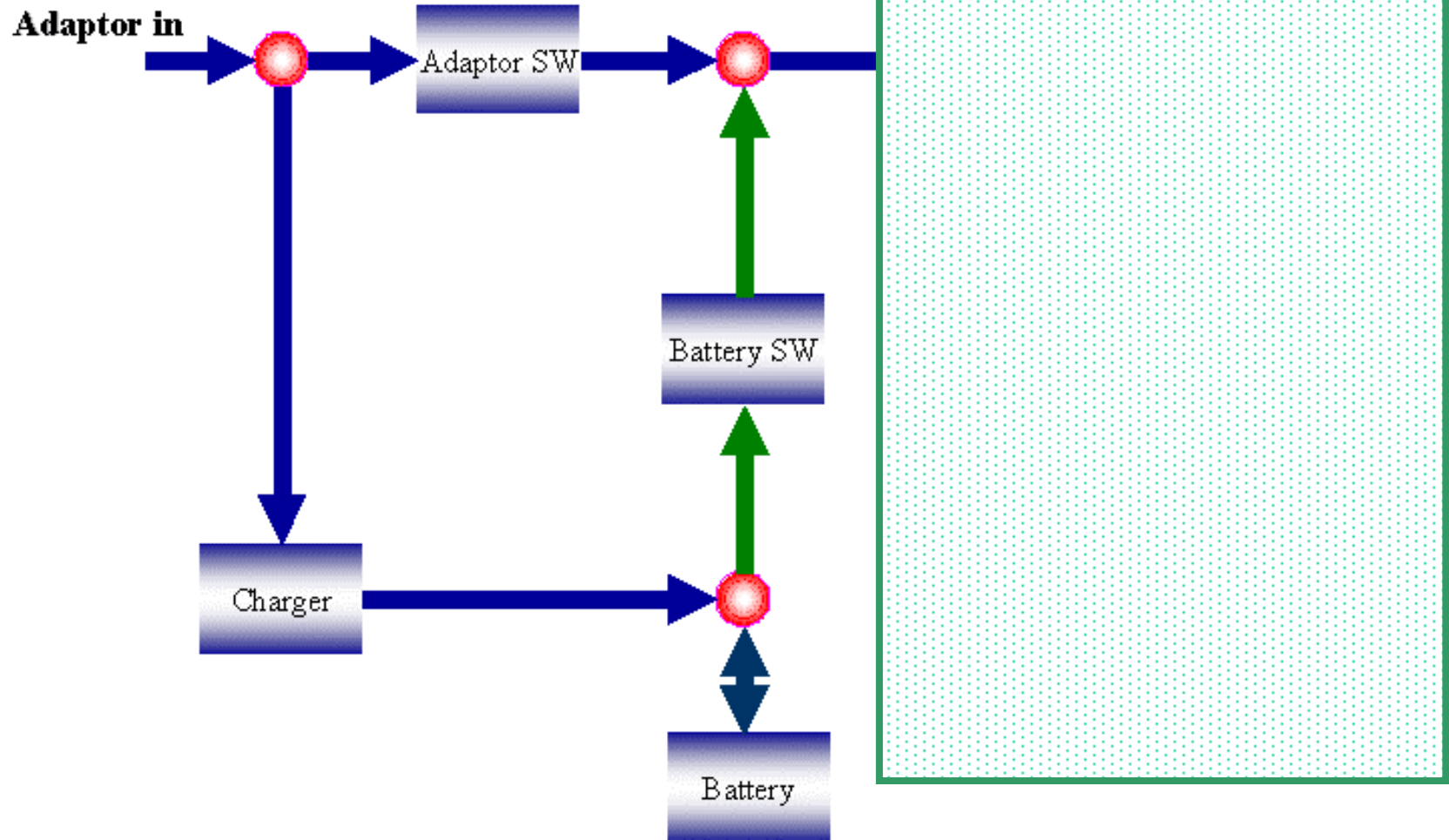
current flow, when PQ on signal



current flow, when PQ Off signal



## Note book structure



# **The type of power consumption**

## **CPU Vcore:**

**0.65 ~ 1.75V / 40A to 60A**

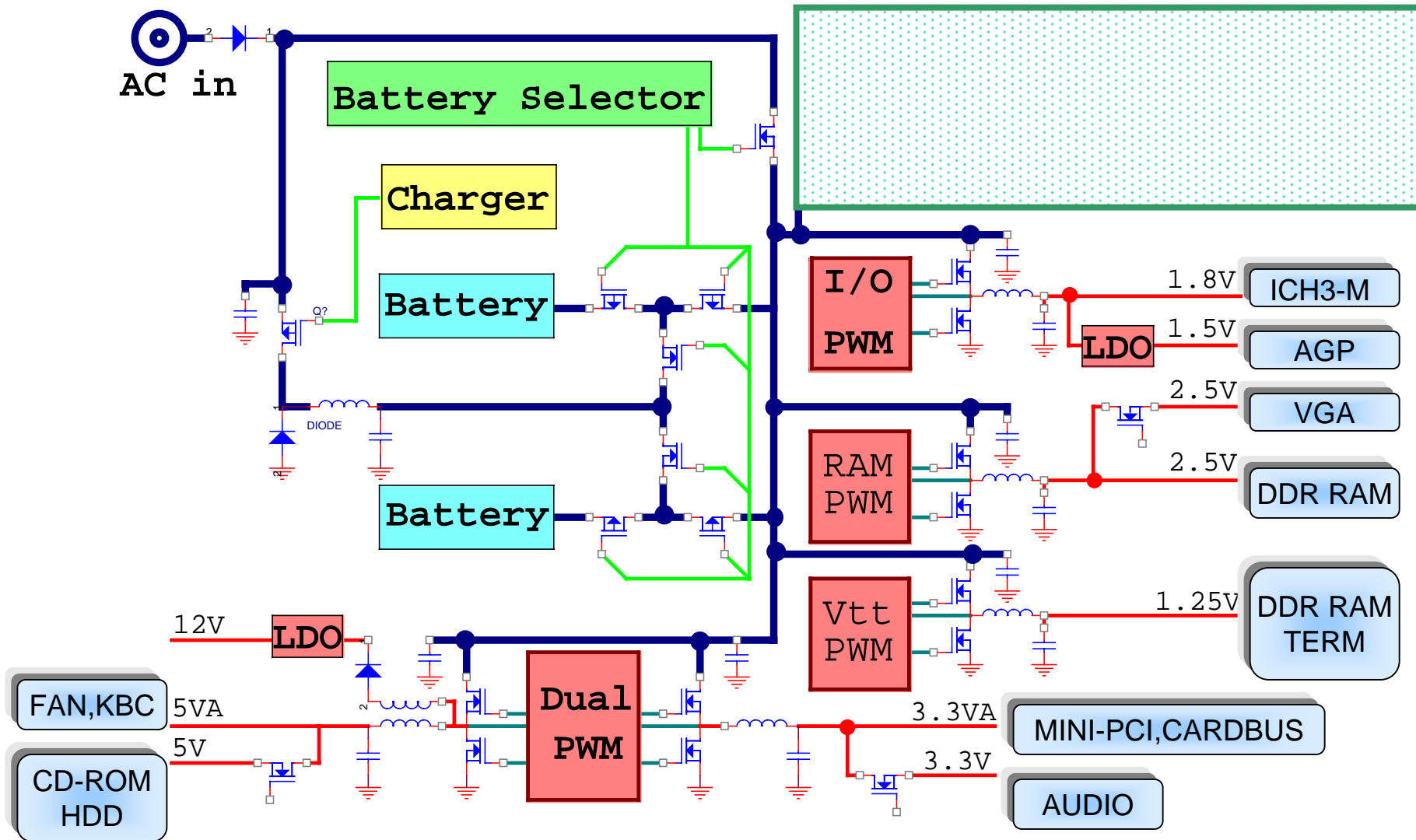
## **I/O ,VGA Power:**

**1.5V /5A, 1.8V/ 3A/, 2.5V/ 7A**

## **SYSTEM POWER:**

**3.3V/4A, 5V/4A, 12V/0.1A**

---



# AOS MOSFET for CPU Core

CPU core solution..

**AO4408 + AO4410**

**AO4408 is similar to IRF7811A**

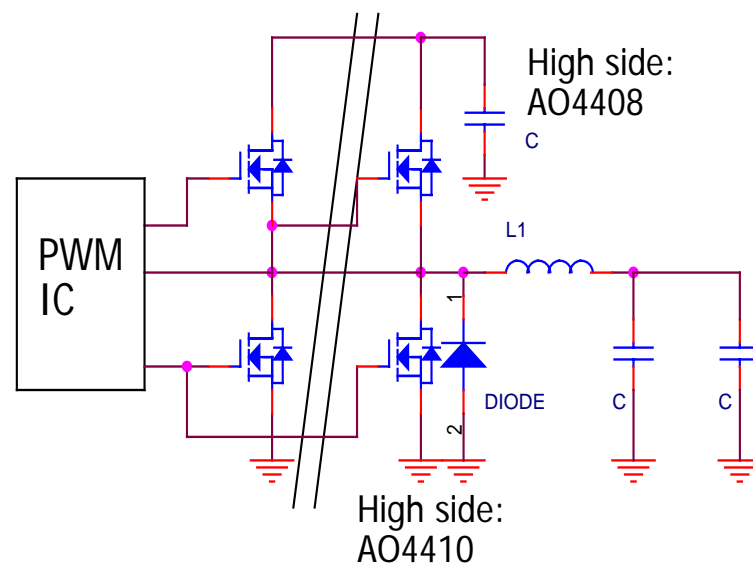
**AO4410 is similar to SI4362**

**So...**

**AO4408 + SI4362**

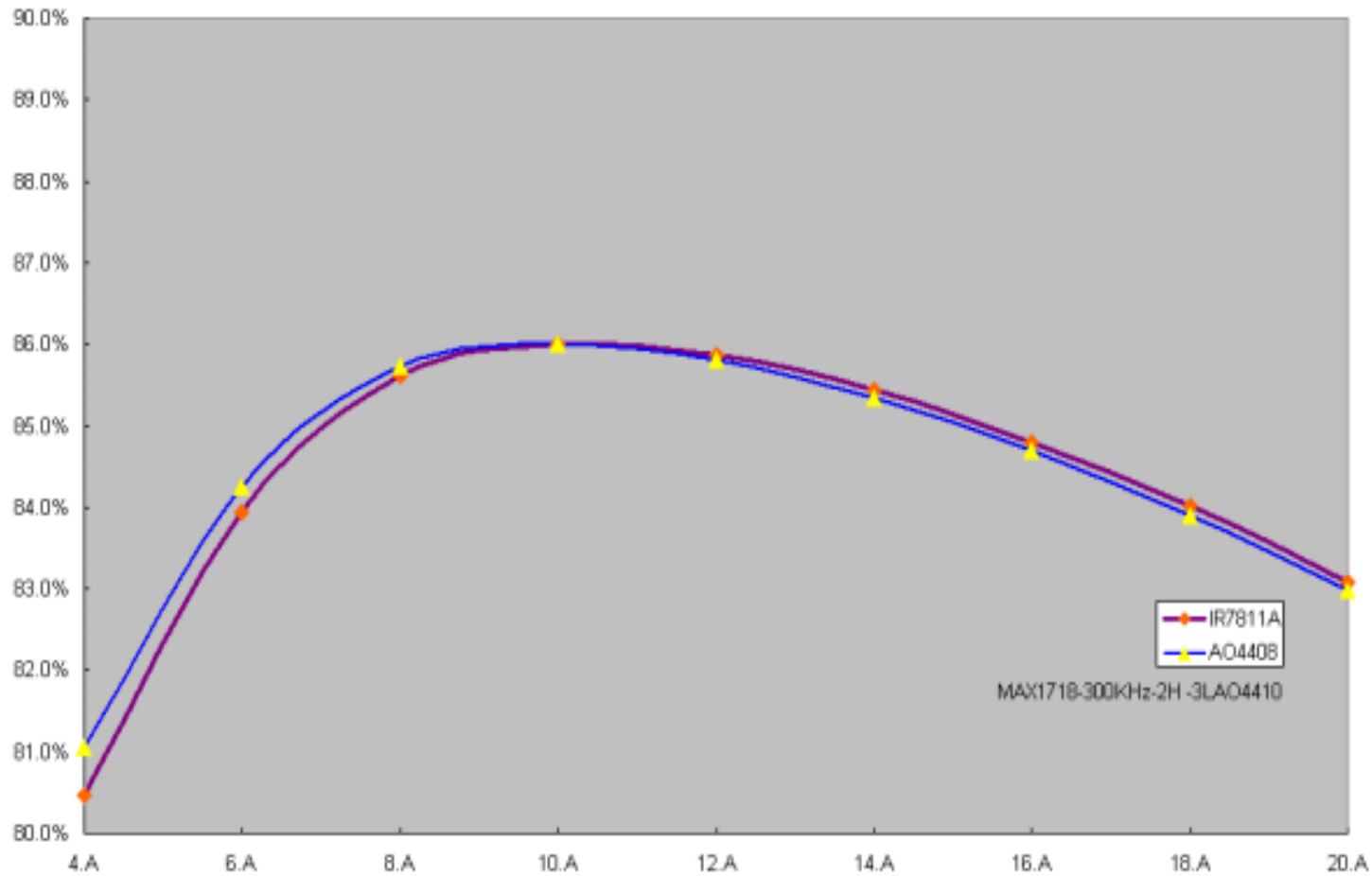
**IRF7811A + AO4410**

**ALSO HAVE A GOOD EFFICIENCE.**

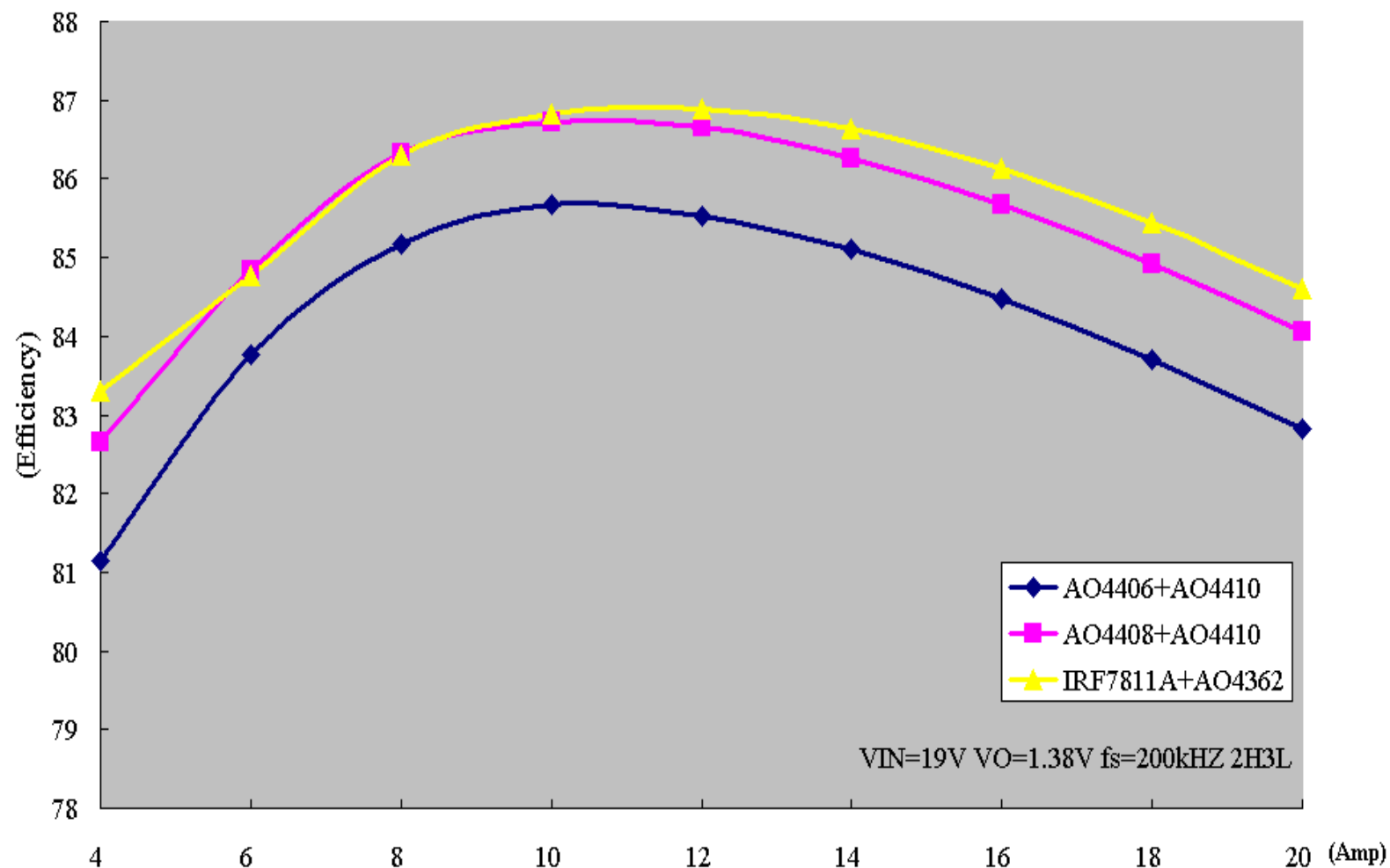




# Efficiency curve of AOS MOSFET

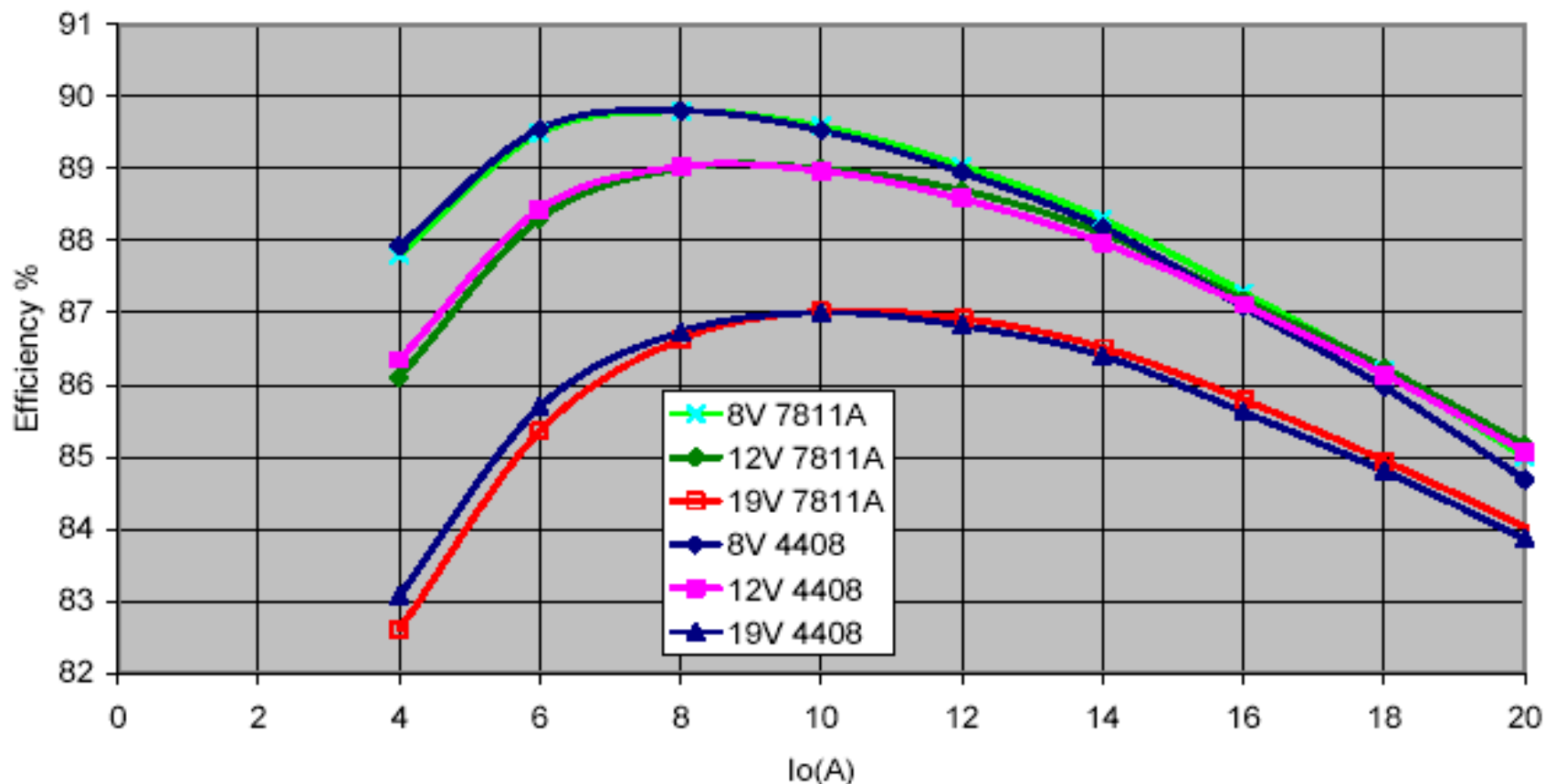


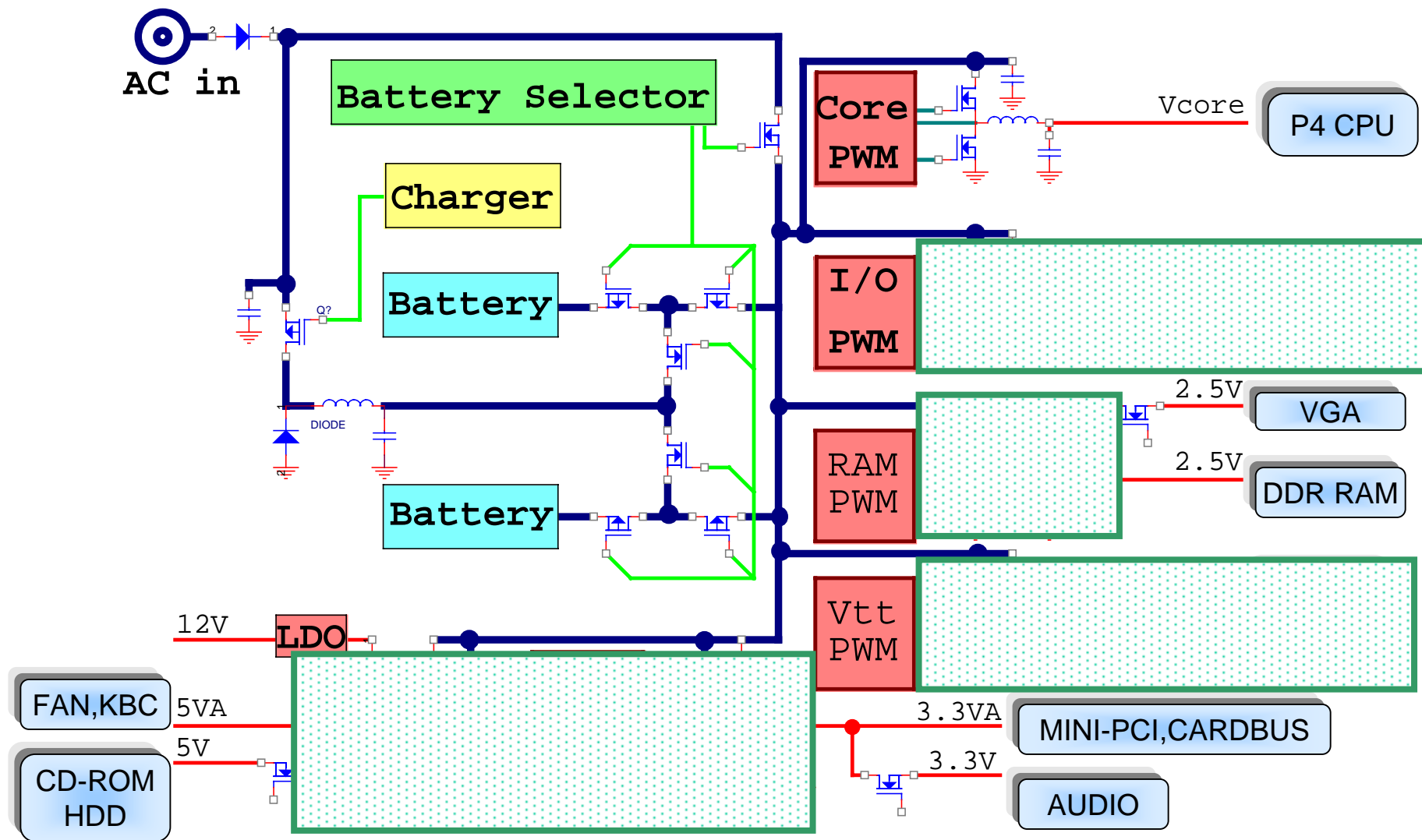
## efficiency



## Efficiency only high side

3XSi4362 LS, 300kHz with Schottkies  
2XHS FETs





# AOS MOSFET for I/O VGA and system power.

Under 5A...

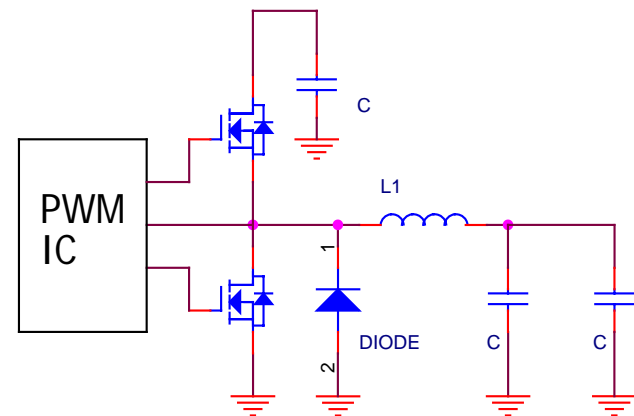
Dual N-Ch MOSFET

AO4900, AO4906

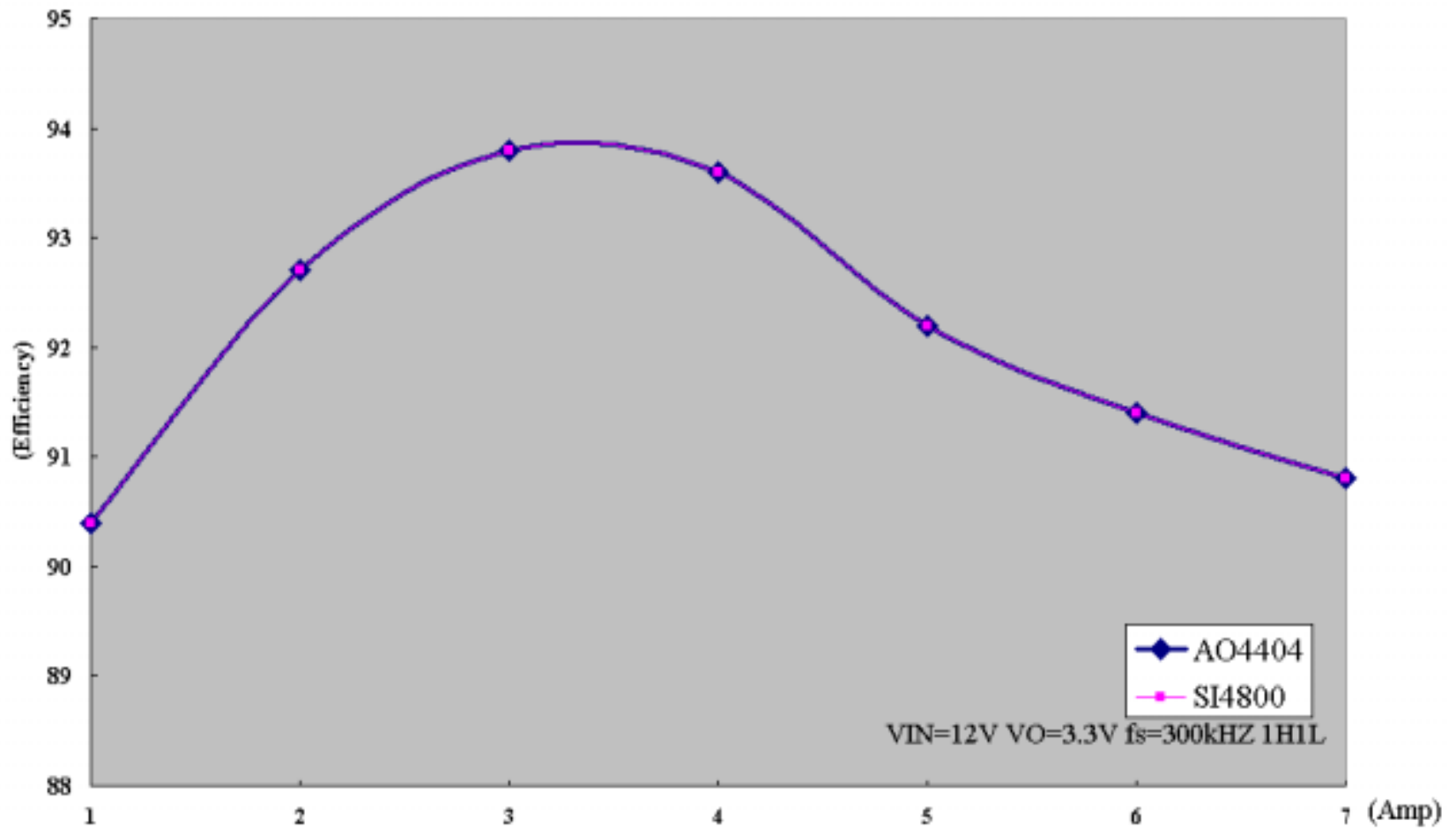
Between 5A and 10A

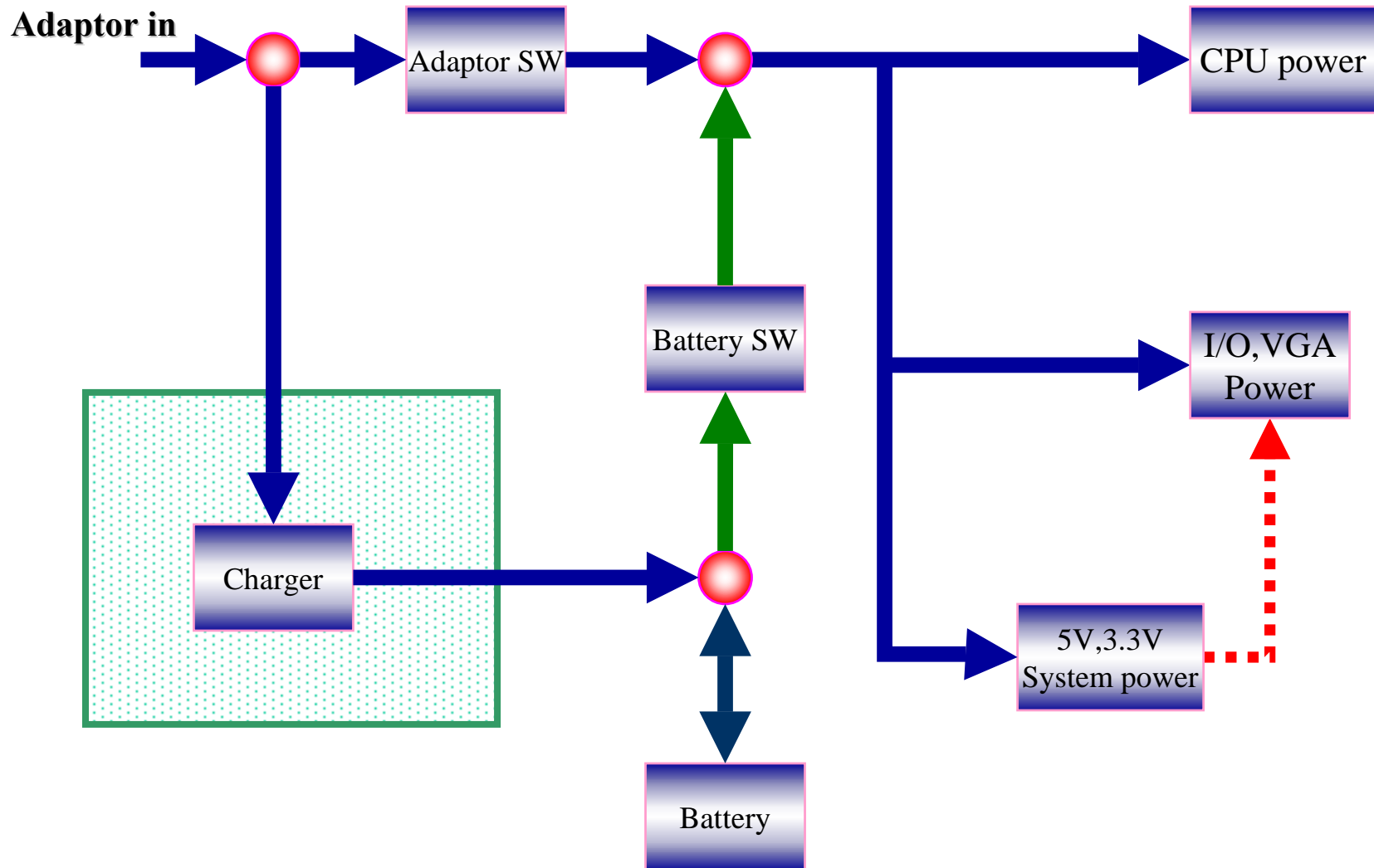
AO4404+AO4404

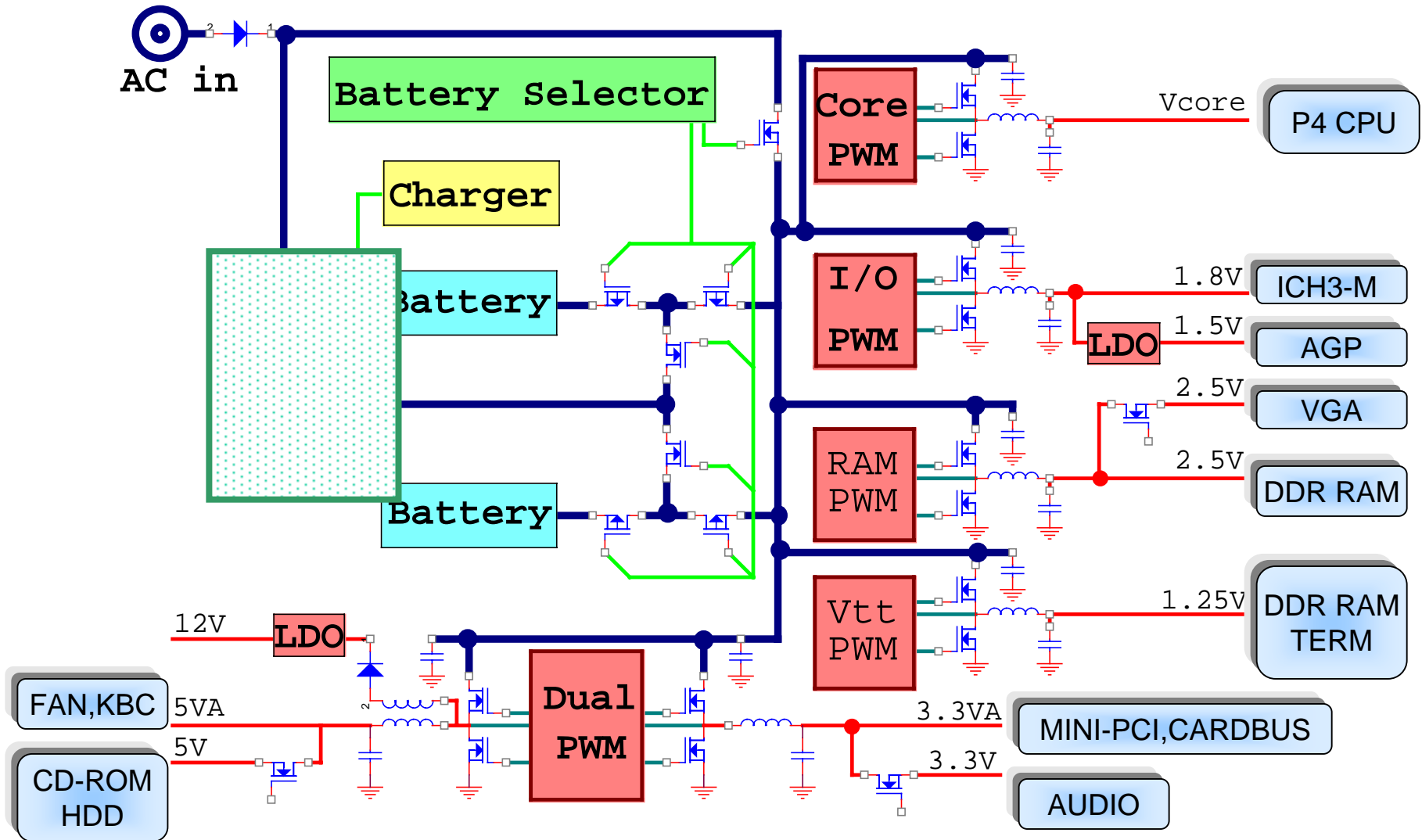
AO4404+AO4406



## Efficiency of AO4404









# Charger

## Concerns:

Non-synchronize - single P-ch

$V_{DS}=30V, V_{GS}=20V,$

$I_D = 4A \nearrow, R_{DS(ON)}=60m\Omega \searrow$

## Charge current under 4A

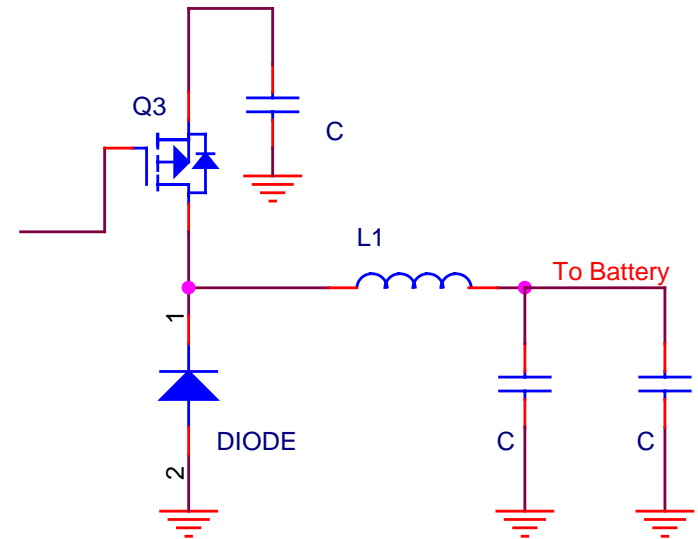
Single P-Ch

AO4405  $\rightarrow$  AO4411  $\rightarrow$  AO4409

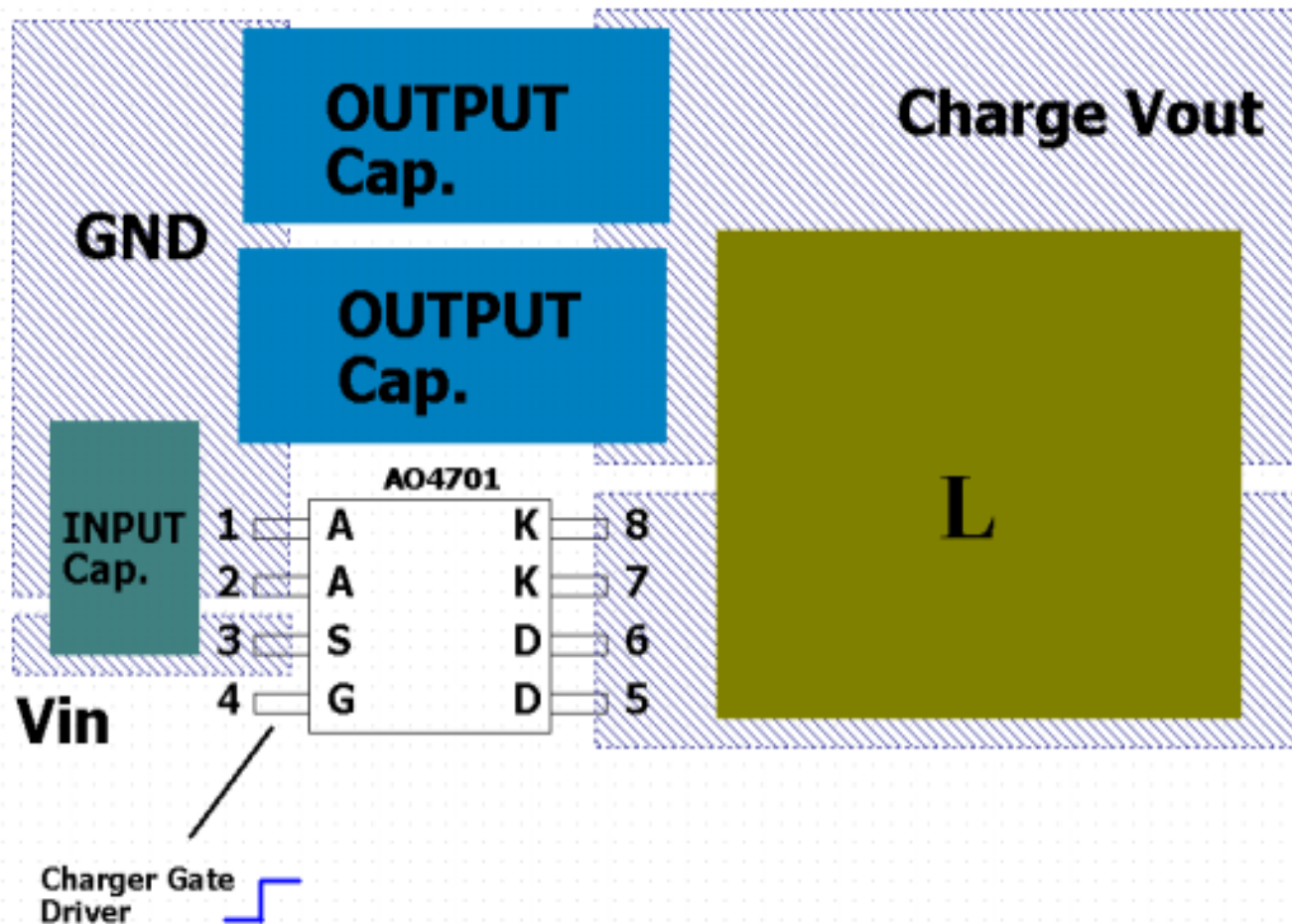
## Charge current under 2.5A

AO4701 ( save a schottky diode)

AO4705 ( save a schottky diode)



# AO4701 Layout for Charger



# AO4705 Layout for Charger

