AX88178 RTL8211CL/RTL8251CL RGMII GigaPHY Reference Schematic Index

Note:

1. Please refer to AX88178 USB-to-Gigabit Ethernet Application Design Note for more AX88178 PCB layout design notes.
2. Please contact ASIX Support (support@asix.com.tw) to get AX88178 EEPROM User Guide for more details about AX88178 EEPROM setting.
3. Please deliver us your AX88178 schematic and your AX88178 EEPROM data file for further review.
4. Please contact Realtek's support guys to get the latest RTL8211CL/RTL8251CL reference schematic and Layout Guide and further suggestions before making your PCB board.

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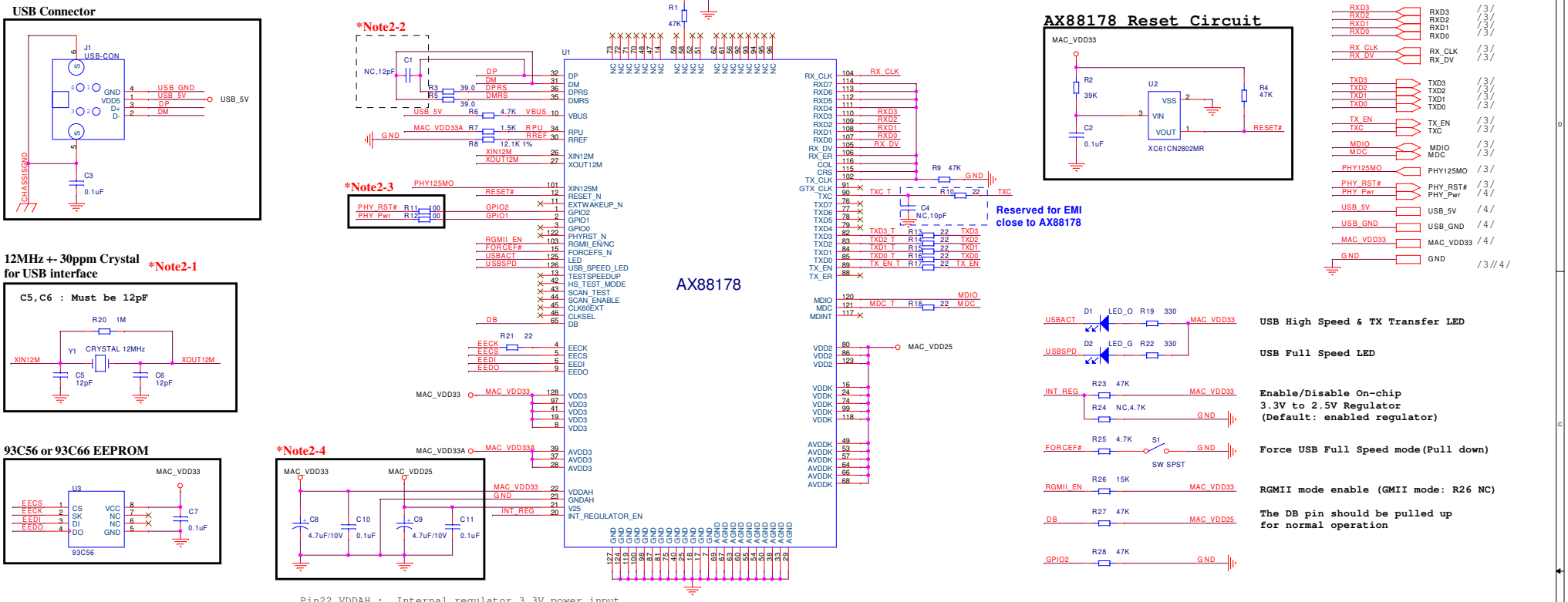
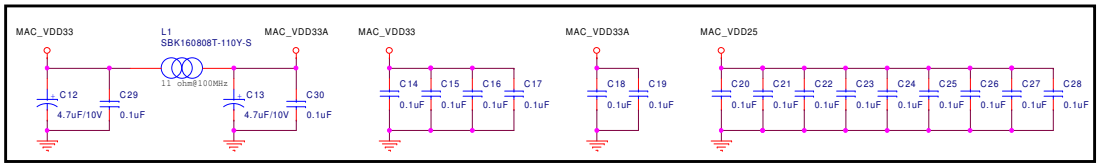


Pin22 VDDAH : Internal regulator 3.3V power input.
Pin21 V25 : Internal regulator 2.5V power output.

Power and by-pass capacitors *Note2-5



***Note2-1:**
The capacitor of 12MHz crystal clock MUST be 12pF. The following is the reason:
The AX88178 expects the ideal frequency range for the 12Mhz clock; this will give most margins for the internal PLL to generate a good 480Mhz clock, which is required by USB High Speed mode. That range is still within the USB 2.0 spec, which requires 480Mhz +/-500ppm accuracy.

Our extensive testing in the past showed higher capacitor value could put the 12Mhz out of above range, which sometimes can cause some problem during USB High Speed mode enumeration.
For example, during the 100 times of repeatedly plug-and-unplug test, there may be 1 time that AX88178 may not be initialized properly.
This is related to the bit error rate on USB bus in High Speed mode, which is higher if 12Mhz is out of above range. Therefore, we strongly suggest customers to use 12pF capacitor on 12MHz clock circuit for most stable operation of the chip.

***Note2-2:**
The C1 12pF capacitor between the DP and DM signals is optional to filter the common-mode noise and should be placed as close as pin #31 and #32.

***Note2-3:**
The GPIO1 and GPIO2 signals are used to control GigaPHY power and reset signals for passing the USB-IF compliant test.

***Note2-4:**
AX88178 on-chip 3.3V to 2.5V regulator is a low dropout regulator (LDO), which requires some large external compensating capacitors on its input (pin #22) and output (pin #21) pins.
The C8, C9, C10 and C11 capacitors are the compensating capacitors for the on-chip regulator.

***Note2-5:**
All power pins should be implemented with a by-pass capacitor, and the by-pass capacitor should be as close as the power pin.

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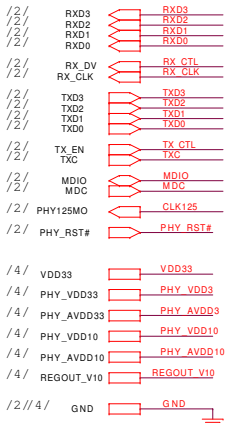
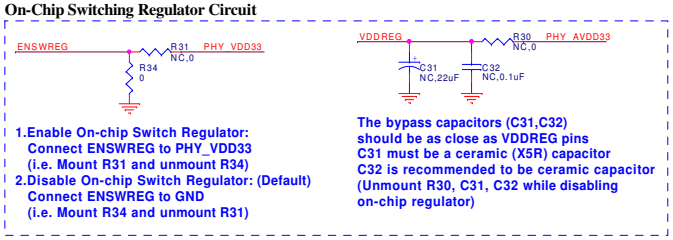
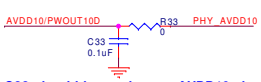


On-Chip Switching Regulator Circuit



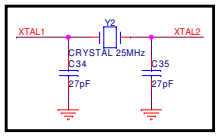
1.Enable On-chip Switch Regulator:
Connect ENSWREG to PHY_VDD33
(i.e. Mount R31 and unmount R34)
2.Disable On-chip Switch Regulator: (Default)
Connect ENSWREG to GND
(i.e. Mount R34 and unmount R31)

The bypass capacitors (C31,C32) should be as close as VDDREG pins
C31 must be a ceramic (X5R) capacitor
C32 is recommended to be ceramic capacitor (Unmount R30, C31, C32 while disabling on-chip regulator)

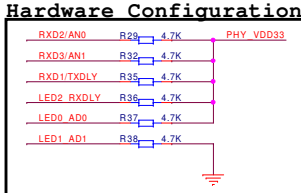


C33 should be as close as AVDD10 pin

25MHz +- 50ppm Crystal for Ethernet interface

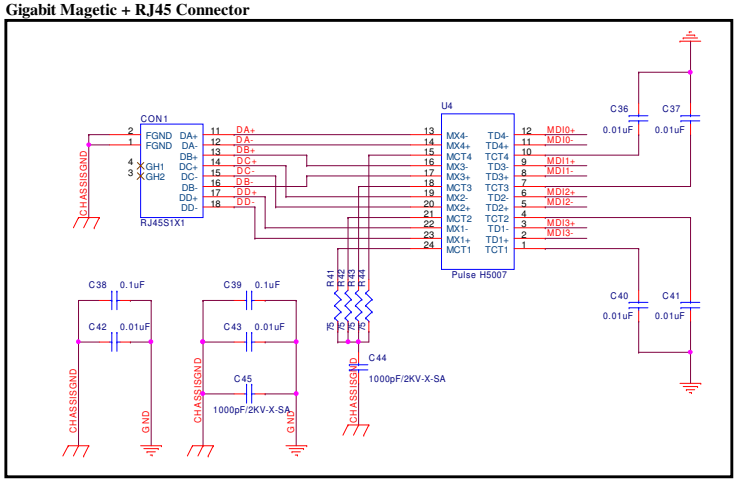


Hardware Configuration



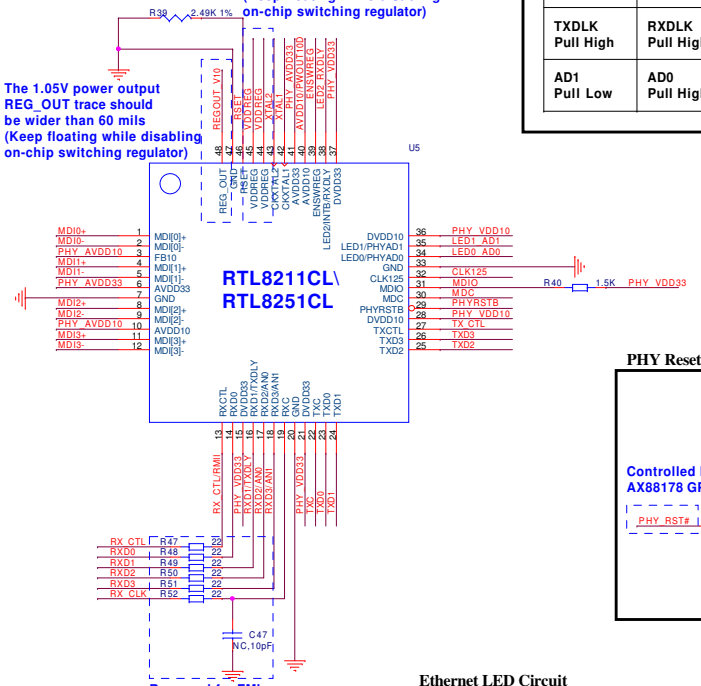
AN0 Pull High	AN1 Pull High	Enable all Nway capabilities
TXDLK Pull High	RXDLK Pull High	Delay TXCLK/RXCLK 2ns
AD1 Pull Low	AD0 Pull High	PHY Address=01

Gigabit Magetic + RJ45 Connector



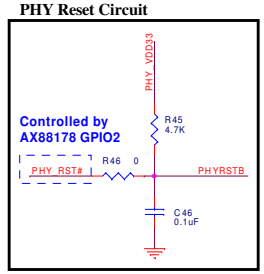
The 3.3V power input VDDREG trace should be wider than 40 mils (Keep floating while disabling on-chip switching regulator)

The 1.05V power output REG_OUT trace should be wider than 60 mils (Keep floating while disabling on-chip switching regulator)

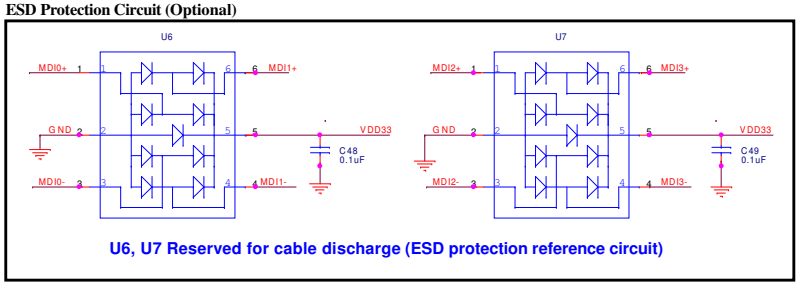


Reserved for EMI close to PHY

PHY Reset Circuit

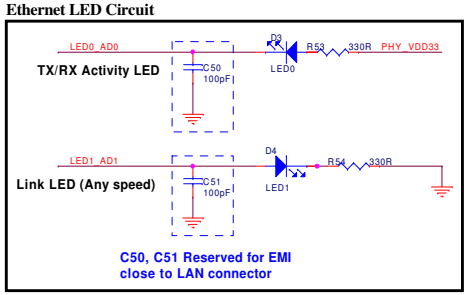


ESD Protection Circuit (Optional)



U6, U7 Reserved for cable discharge (ESD protection reference circuit)

Ethernet LED Circuit



C50, C51 Reserved for EMI close to LAN connector

The Ethernet LED circuit is a reference circuit while the PHY Address was set to 01h.
(i.e. LED0_AD0 was pulled high and LED1_AD1 was pulled low)
Please check Realtek's GigaPHY reference circuit for more details if necessary.

Note:

1.The RTL8211CL/RTL8251CL GigaPHY reference circuits are for customers' reference purpose.
Please contact Realtek's support guys to get the latest RTL8211CL/RTL8251CL reference schematic and Layout Guide before making your PCB board.

2.Please exactly follow up Realtek's RTL8211CL/RTL8251CL Layout Guide to layout RTL8211CL/RTL8251CL 3.3V to 1.05V On-chip Switching Regulator and Ethernet magnetic circuits; otherwise,the RTL8211CL/RTL8251CL might not work normally. Please refer to Realtek's layout guide for more details.

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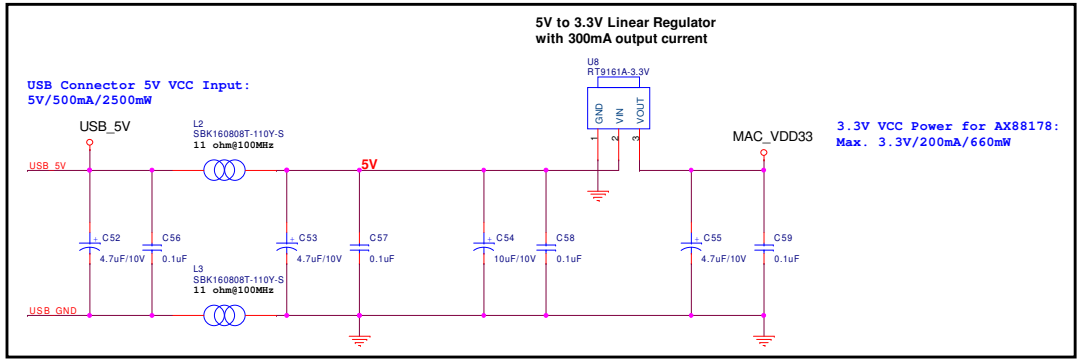
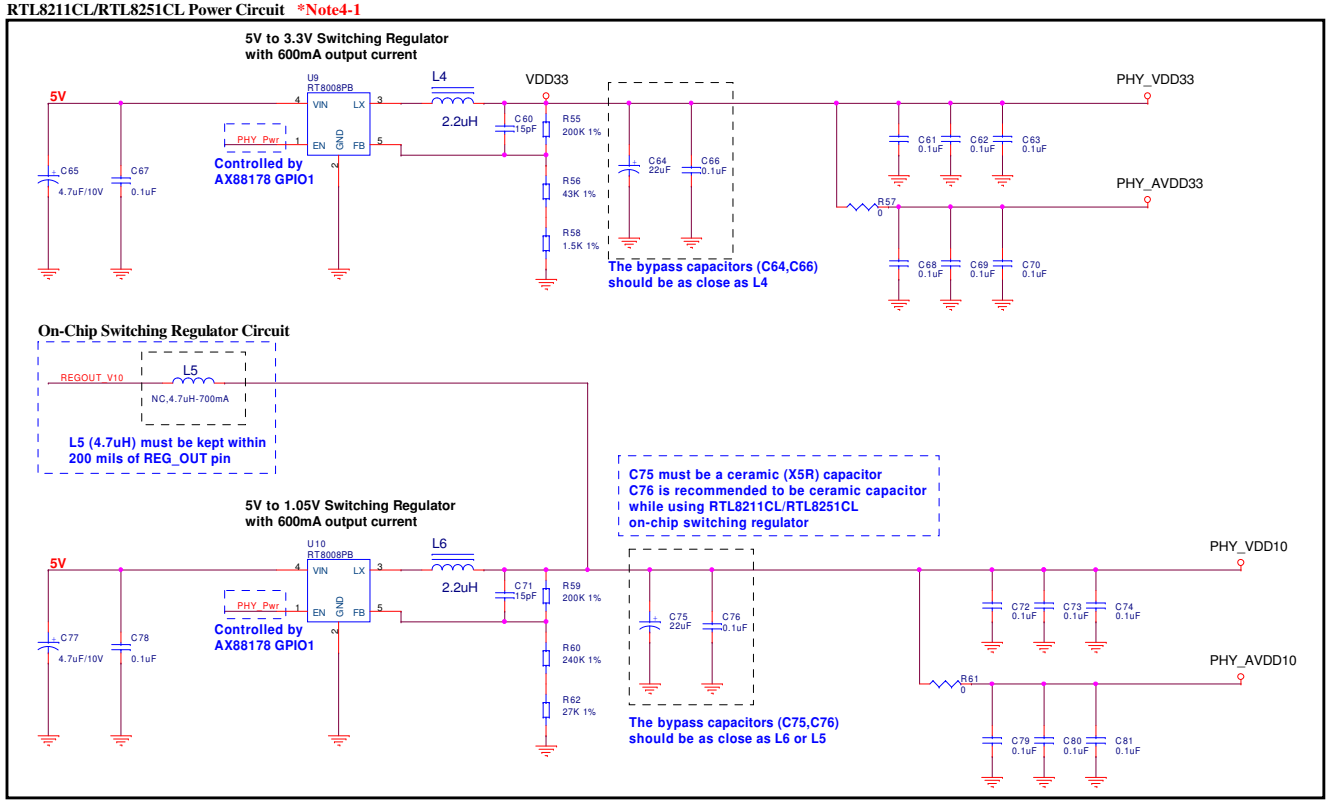
/2/ USB_5V — USB_5V
/2/ USB_GND — USB_GND
/2/ MAC_VDD33 — MAC_VDD33
/2/ PHY_Pwr — PHY_Pwr
/3/ VDD33 — VDD33
/3/ PHY_VDD33 — PHY_VDD33
/3/ PHY_AVDD33 — PHY_AVDD33
/3/ PHY_VDD10 — PHY_VDD10
/3/ PHY_AVDD10 — PHY_AVDD10
/3/ REGOUT_V10 — REGOUT_V10
/2//3/ GND — GND

AX88178 Power Circuit



RTL8211CL/RTL8251CL Power Circuit ***Note4-1**



***Note4-1:**
The RTL8211CL/RTL8251CL GigaPHY power circuits and power consumption information are for customers' reference purpose.
Please contact Realtek's support guys to get more detailed information of RTL8211CL/RTL8251CL GigaPHY related power circuits and power consumption information.

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Revision History

Revision	Date	Comment
V1.00	2009/08/11	Initial release.

ASIX ELECTRONIC CORPORATION

Title: **Revision Histroy**

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