

AX88178 RTL8211CL/RTL8251CL RGMII GigAPHY Reference Schematic Index

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(12MHz Crystal, EEPROM,  
USB Connector, Reset Circuit)

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Realtek RTL8211CL/RTL8251CL GigAPHY  
(25MHz Crystal, RJ-45 Transformer)

**Note:**

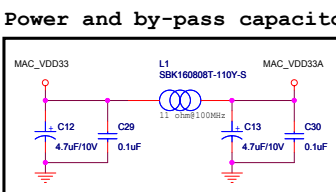
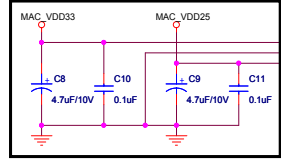
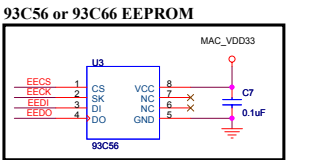
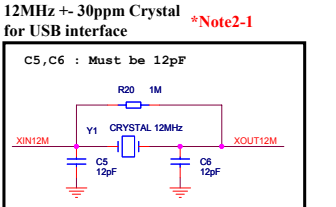
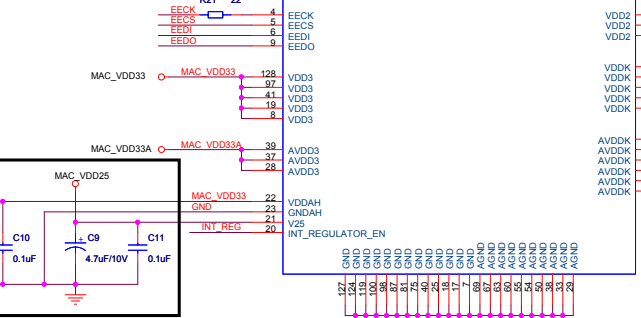
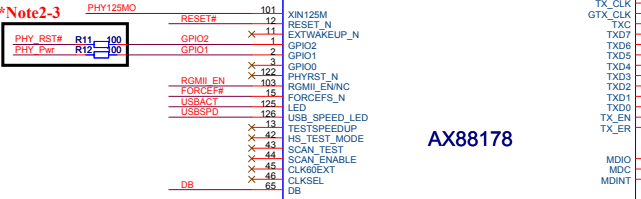
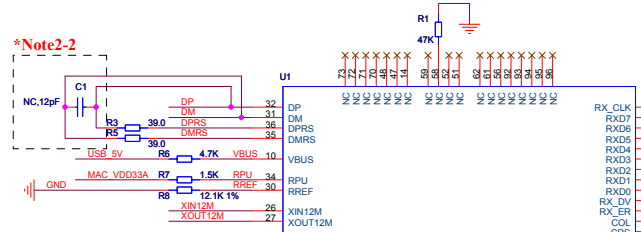
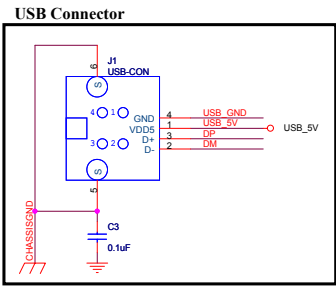
1. Please refer to AX88178 USB-to-Gigabit Ethernet Application Design Note for more AX88178 PCB layout design notes.

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.

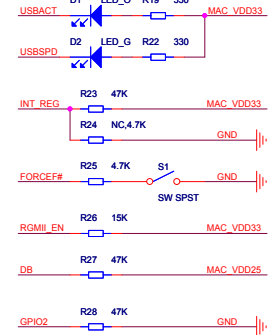
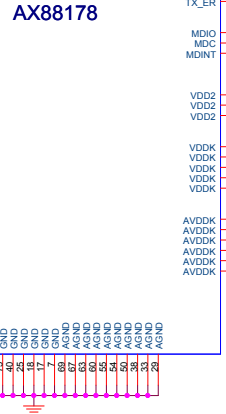
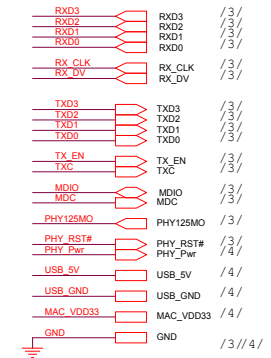
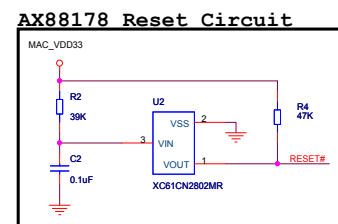
4. Please contact Realtek's support guys to get the latest RTL8211CL/RTL8251CL reference schematic and Layout Guide and further suggestions before making your PCB board.

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**\*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.



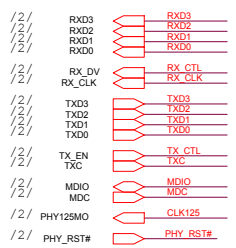
**USB High Speed & TX Transfer LED**  
**USB Full Speed LED**  
**Enable/Disable On-chip 3.3V to 2.5V Regulator (Default: enabled regulator)**  
**Force USB Full Speed mode (Pull down)**  
**RGMII mode enable (GMII mode: R26 NC)**  
**The DB pin should be pulled up for normal operation**

**\*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.

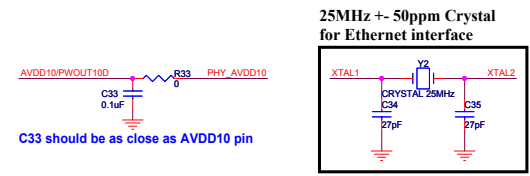
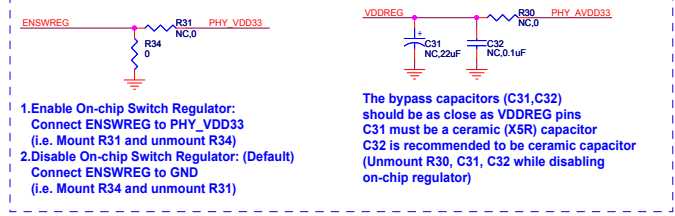
**\*Note2-3:**  
The GPIO1 and GPIO2 signals are used to control GigAPHY power and reset signals for passing the USB-IF compliant test.

**\*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.

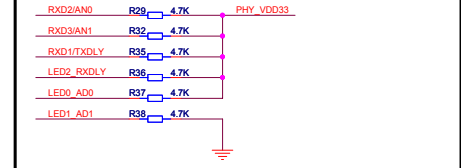
**\*Note2-5:**  
All power pins should be implemented with a by-pass capacitor, and the by-pass capacitor should be as close as the power pin.



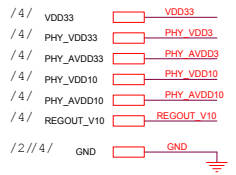
### On-Chip Switching Regulator Circuit



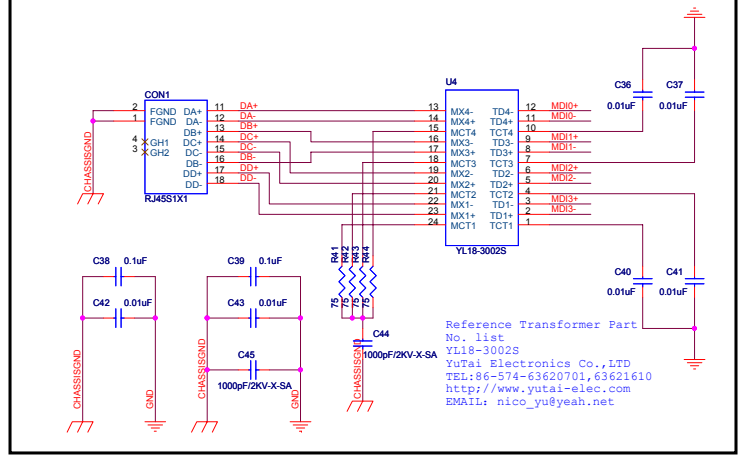
### Hardware Configuration



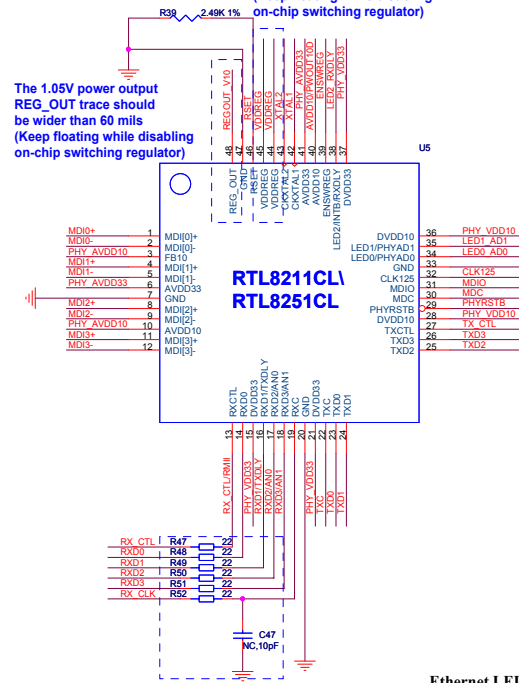
AN0 Pull High	AN1 Pull High	Enable all Nway capabilities
TXCLK Pull High	RXDCLK Pull High	Delay TXCLK/RXCLK 2ns
AD1 Pull Low	ADD Pull High	PHY Address=01



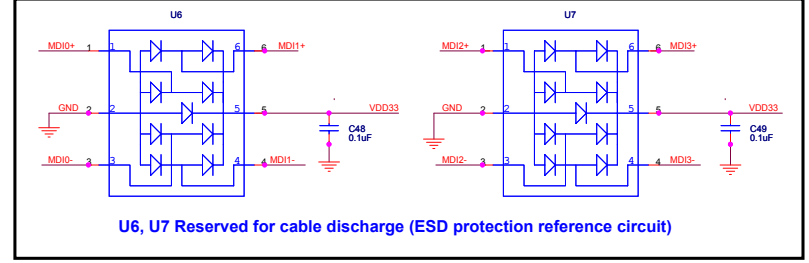
### Gigabit Magnetic + RJ45 Connector



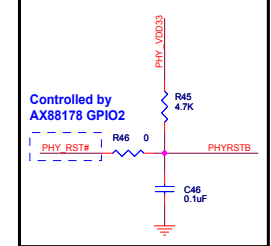
The 1.05V power output REG\_OUT trace should be wider than 60 mils (Keep floating while disabling on-chip switching regulator)



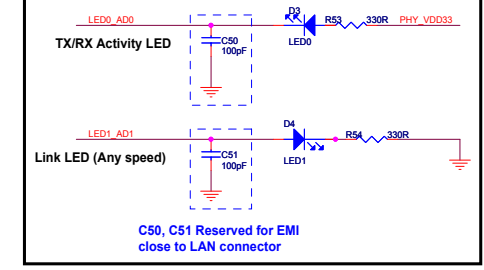
### ESD Protection Circuit (Optional)



### PHY Reset Circuit



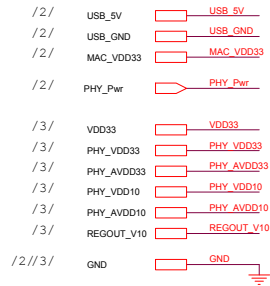
### Ethernet LED Circuit



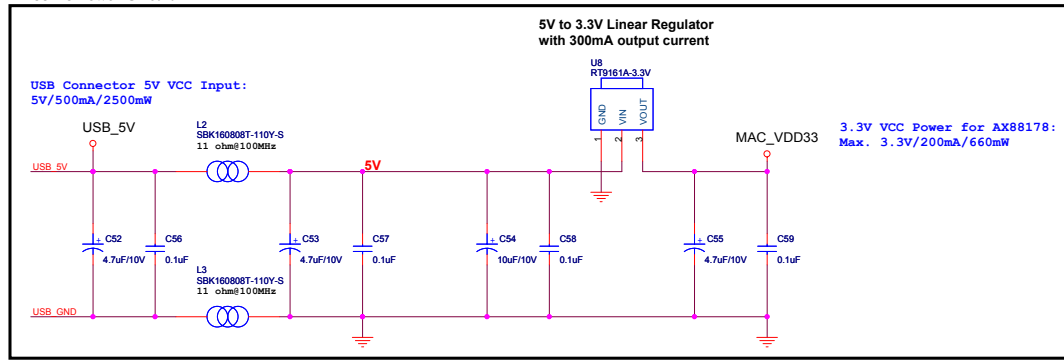
The Ethernet LED circuit is a reference circuit while the PHY Address was set to 01h. (i.e. LED0\_ADD was pulled high and LED1\_AD1 was pulled low) Please check Realtek's GigaPHY reference circuit for more details if necessary.

**Note:**

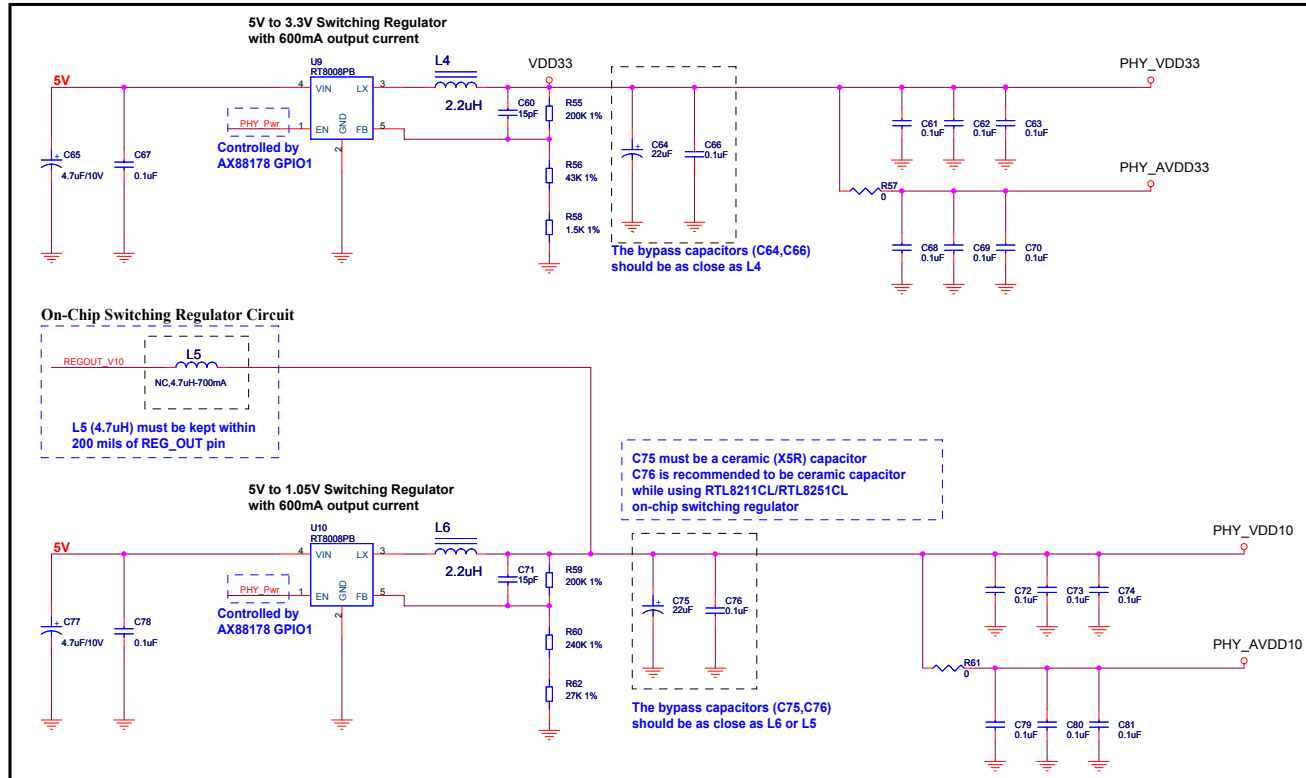
- The RTL8211CL/RTL8251CL GigaPHY reference circuits are for customers' reference purpose. Please contact Realtek's support guys to get the latest RTL8211CL/RTL8251CL reference schematic and Layout Guide before making your PCB board.
- Please exactly follow up Realtek's RTL8211CL/RTL8251CL Layout Guide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



**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.

**Revision History**

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

**ASIX ELECTRONIC CORPORATION**

Title		
Revision Histroy		
Size	Document Number	Rev
B	AX88178_RTL8211CL_RTL8251CL	V1.00
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