

APPLICATION NOTE

RTL8100C(L) / RTL8110S-32 / RTL8110SB(L) RTL8110SC(L)

128-pin (L)QFP and 64-pin QFN COMPATIBLE BOARD DESIGN GUIDELINES

(Rev. 1.10; 2005/9/07)



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INTRODUCTION

This application is written to help board layer designer to create a PCB layout which will be able to accept both Realtek's 10/100 Fast Ethernet Chip (RTL8100C(L)) and Realtek's Gigabit Single Chip solution (RTL8110S-32, RTL8110SB(L) & RTL8110SC(L)). All four chips packages share similar pin assignment in order to achieve Pin-Compatibility feature that means all four chips will be able to use a common footprint so that any one of these 4 ICs can be placed on the same PCB layout. RTL8100C, RTL8110S-32, RTL8110SB and RTL8110SC all use 128 pins (L)QFP package.

Due to the functional differences, the particular surrounding components are also required to populate with corresponding IC. Through this application note, the information between these three designs consideration will be highlighted and discussed to help the board layer designer to achieve the pin-compatible layout in the shortest period.

DESIGN CONSIDERATIONS

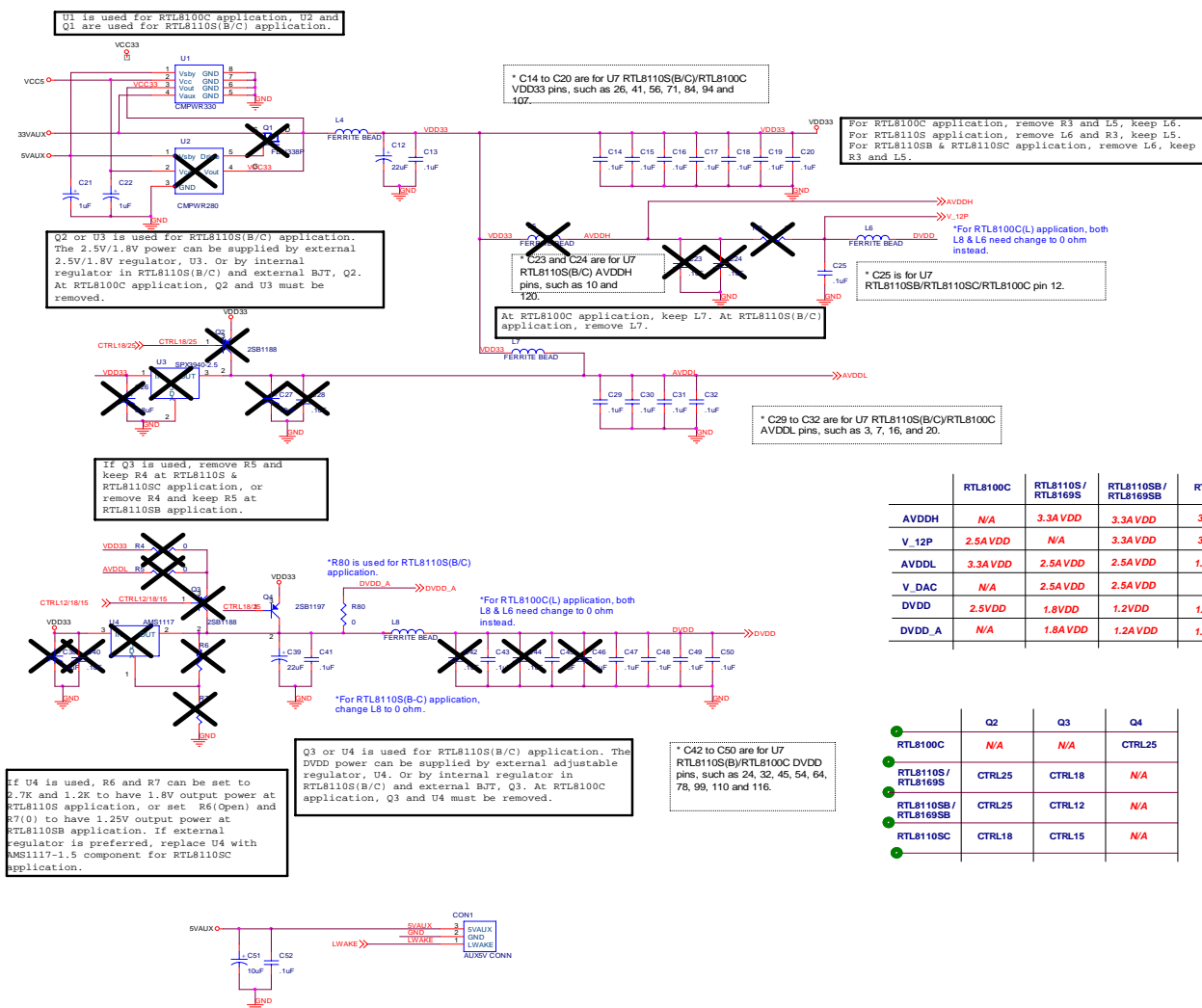
Several Major points must be considered while designing a PCB that will accept all five RTL8100C(L), RTL8110S-32, RTL8110SB(L) & RTL8110SC(L) ICs. Those points have been categorized as below and been detailed in the following chapters.

- Power Distribution Circuitry
- RJ45 Jack & Magnetics Interfaces
- LED



Power Distribution Circuitries:

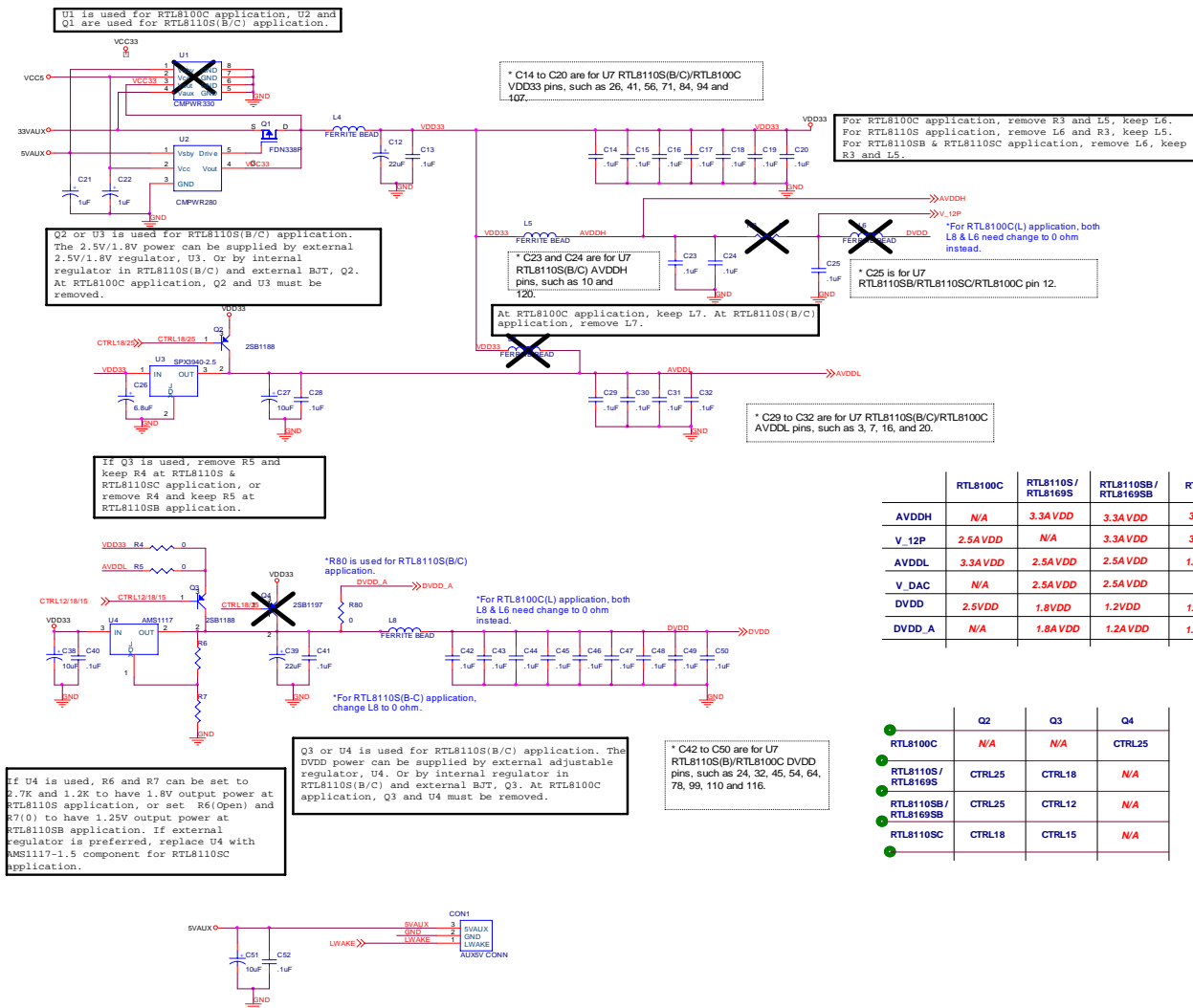
Due to the different Fabrication processes (0.25 micron for RTL8100C(L); 0.18 micron for RTL8110S-32; 0.13 micron for RTL8110SB(L); 0.15 micron for RTL8110SC), the power requirement for all five chips are slightly different from each due to smaller fabrication process requires smaller core voltage (i.e. 3.3V & 2.5V for RTL8100C(L); 3.3V, 2.5V & 1.8V for RTL8110S-32; 3.3V, 2.5V & 1.2V for RTL8110SB(L); 3.3V, 1.8V & 1.5V for RTL 8110SC). Moreover, the power is distributed as needed to various parts of chip and differential pair terminations (ex. V_DAC). Details of placing correct decoupling capacitors & beads on each application have been shown in the following Figures.



	RTL8100C	RTL8110S / RTL8169S	RTL8110SB / RTL8169SB	RTL8110SC
AVDDH	N/A	3.3A VDD	3.3A VDD	3.3A VDD
V _{12P}	2.5A VDD	N/A	3.3A VDD	3.3A VDD
AVDDL	3.3A VDD	2.5A VDD	2.5A VDD	1.8A VDD
V _{DAC}	N/A	2.5A VDD	2.5A VDD	N/A
DVDD	2.5VDD	1.8VDD	1.2VDD	1.5VDD
DVDD _A	N/A	1.8A VDD	1.2A VDD	1.5A VDD

	Q2	Q3	Q4
RTL8100C	N/A	N/A	CTRL25
RTL8110S / RTL8169S	CTRL25	CTRL18	N/A
RTL8110SB / RTL8169SB	CTRL25	CTRL12	N/A
RTL8110SC	CTRL18	CTRL15	N/A

Fig.1 10/100 BASE-T Fast Ethernet Application Circuit – Power : RTL8100C(L)



	RTL8100C	RTL8110S / RTL8169S	RTL8110SB / RTL8169SB	RTL8110SC
AVDDH	N/A	3.3A VDD	3.3A VDD	3.3A VDD
V _{12P}	2.5A VDD	N/A	3.3A VDD	3.3A VDD
AVDDL	3.3A VDD	2.5A VDD	2.5A VDD	1.8A VDD
V _{DAC}	N/A	2.5A VDD	2.5A VDD	N/A
DVDD	2.5VDD	1.8VDD	1.2VDD	1.5VDD
DVDD_A	N/A	1.8A VDD	1.2A VDD	1.5A VDD

	Q2	Q3	Q4
RTL8100C	N/A	N/A	CTRL25
RTL8110S / RTL8169S	CTRL25	CTRL18	N/A
RTL8110SB / RTL8169SB	CTRL25	CTRL12	N/A
RTL8110SC	CTRL18	CTRL15	N/A

Fig.2 10/100/1000 Gigabit Ethernet Application Circuit – Power : RTL8110S-32

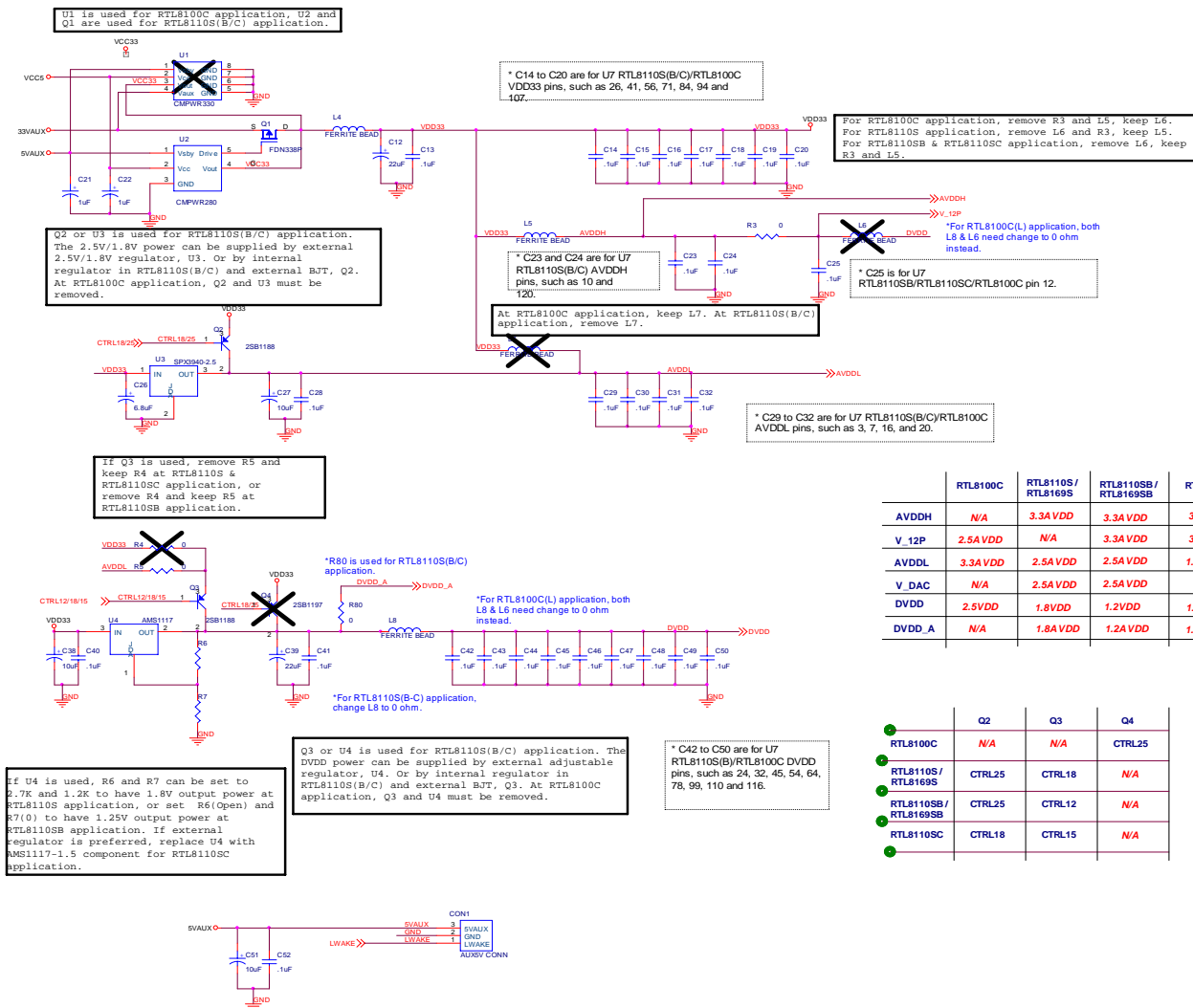


Fig.3 10/100/1000 Gigabit Ethernet Application Circuit – Power : RTL8110SB(L)

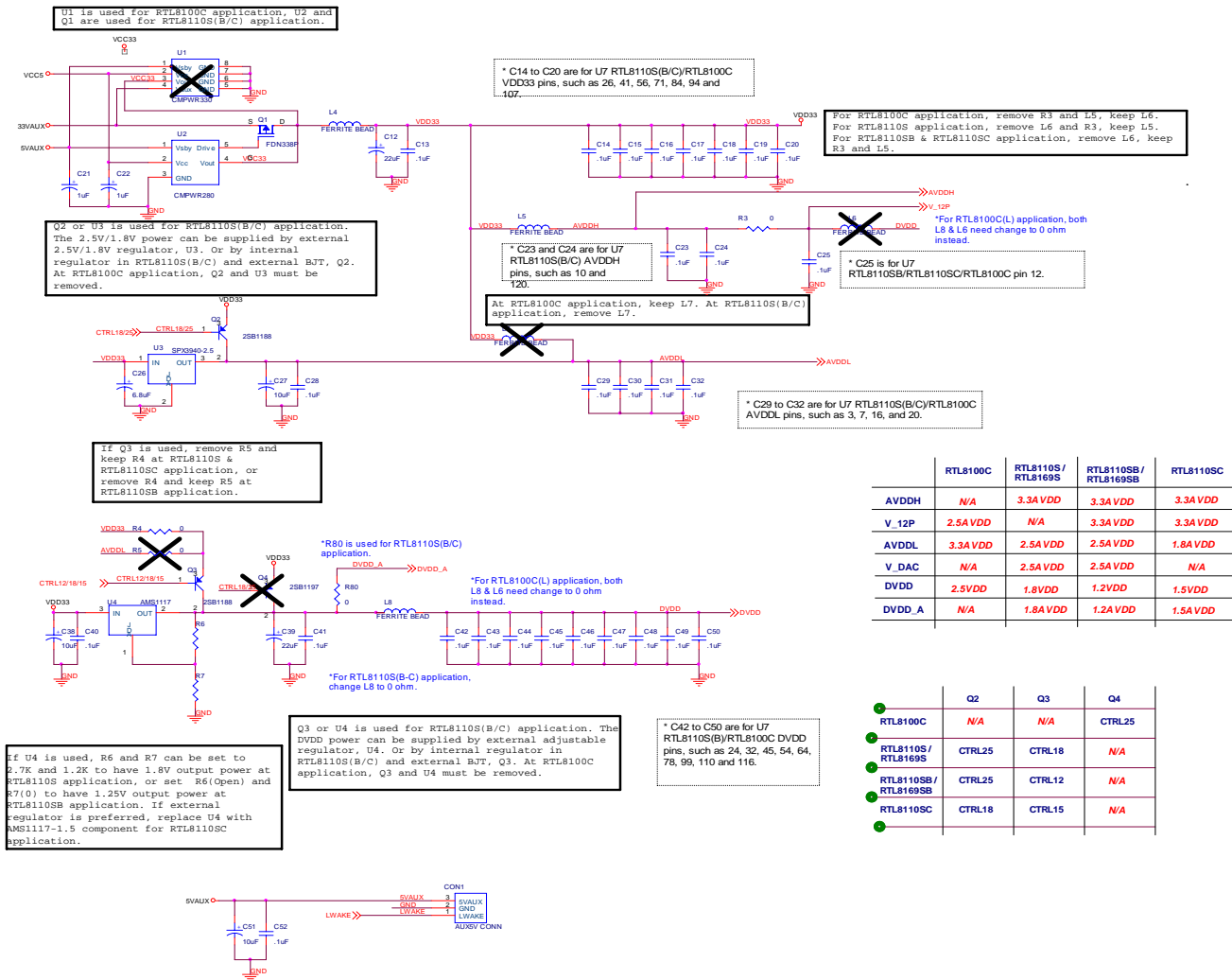
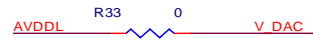


Fig.3 10/100/1000 Gigabit Ethernet Application Circuit – Power : RTL8110SC(L)



RJ45 Jack & Magnetics Interface

The Realtek RTL8110S-32/ RTL8110SB(L)/RTL81110SC(L) are 10/100/1000 BASE-T Gigabit Ethernet Single Chip, but the RTL8100C(L) only supports 10/100 BASE-T Fast Ethernet. Therefore, 2 extra differential pairs will be required for interfacing the Magnetics Transformer (i.e. 2 pairs only for RTL8100C(L)) while using RTL8110S-32, RTL8110SB(L) or RTL8111B. These 2 extra differential pairs should be neglected while populating RTL8100C(L). Since the PCB interface should be designed for both RTL8100C(L) & RTL8110S-32 devices, it is important that the design guidelines as shown below must be followed to ensure the proper operation for both Applications (Fast Ethernet & Gigabit Ethernet). A proper magnetic transformer must be selected carefully, which must have the same footprint for both Fast Ethernet & Gigabit Ethernet applications. One Ideal Example would be Pulse Engineer's H5007 (Gigabit Transformer) and H1285 (Fast Ethernet Transformer). Further more, the guideline for PCB routing should be followed as shown in Fig 4.



R33 is used for RTL8110S & RTL8110SB. For RTL8100C & RTL8110SC application R33 must be removed.

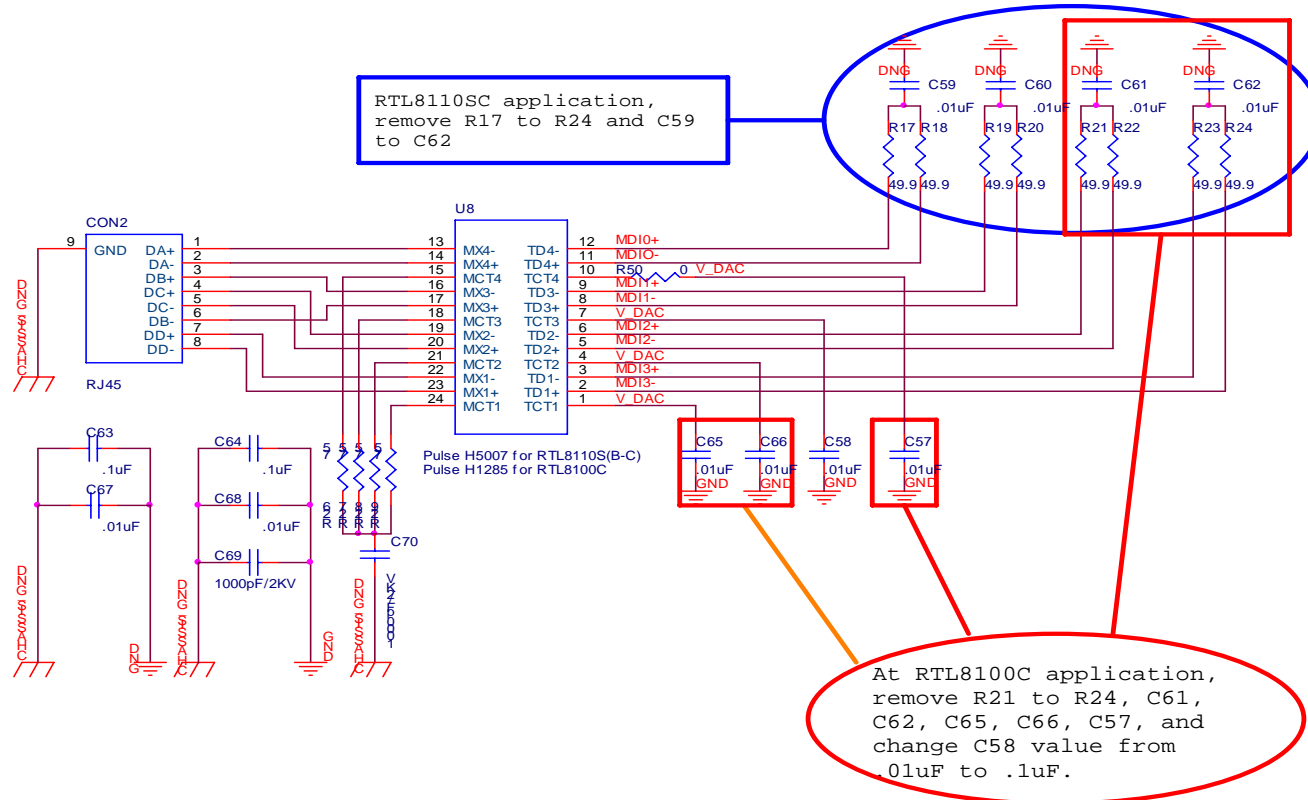
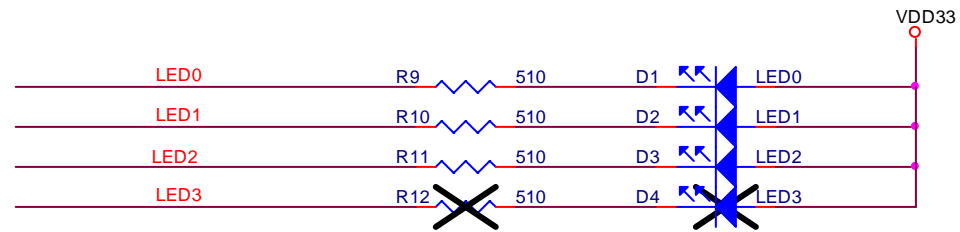


Fig 4: RJ45 Jack & Magnetics Interface

LEDS

LED3 & R12 are removed in RTL8100C application



For RTL8110S-32/RTL8110SB/RTL8110SC applications, all resistors and LEDs must be kept for correct output LED information.

Fig 5. LED circuit for 10/100 Fast Ethernet : RTL8100C(L)

HISTORIES OF REVISION

- (0123) Rev. 1.01: Initial Release: 2003/1/23
- (0224) Rev. 1.02:
 1. Change PIN assignment from PIN 121 to 126.
 2. Fix the not correct assignment between RJ45 and Transformer.
- (0226) Rev. 1.02:
 1. Add Transformer Part No. for RTL8100C(L) application circuit (page 8, fig 3)
 2. Remove C9 instead of C10 (keeping C10) for RTL8100C(L) application circuit (pag28, fig 3)
- (0630) Rev. 1.03
 1. Add Transformer Part No. for RTL8110S-32 application circuit (page 8, fig3)
- (0324) Rev. 1.04
 1. Add Extra Information regarding RTL8110SB(L) to ensure all three ICs can be Co-Layout
- (0416) Rev. 1.05
 1. Add Extra Information regarding RTL8100C(L) power source 2.5V (page 6, fig3)
- (050318) Rev. 1.07
 1. Add RTL8111B circuit.
- (050318) Rev. 1.08
 1. Add R50 between U8 and C57.
 2. Add description table for CTRL12/18/15 and CTRL18/25.
- (050318) Rev. 1.10
 1. Add RTL8110SC circuit.