



REALTEK

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RTL8363NB-VB-CG

LAYER 2 MANAGED 2+1-PORT 10/100/1000M SWITCH CONTROLLER

DATASHEET

(CONFIDENTIAL: Development Partners Only)

Rev. 1.2

19 March 2018

Track ID: JATR-8275-15



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USING THIS DOCUMENT

This document is intended for the hardware and software engineer’s general information on the Realtek RTL8363NB-VB IC.

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- If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe
- Always disconnect the microcontroller from the prototyping board when it is being worked on

REVISION HISTORY

Revision	Release Date	Summary
1.0	2017/06/30	First Release.
1.1	2017/11/20	Revised section 7.2.3 RMII Pins, page 15. Revised section 10.6.3 Extension Ports RMII Clock Input/Output Mode Interface (10/100Mbps), page 44. Revised Table 40 Power and Reset Characteristics, page 59 (LV Power Rising Time).
1.2	2018/03/19	Revised section 7.9 Power and GND Pins, page 19. Corrected minor typing errors.

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1. General Description

The RTL8363NB-VB-CG is a QFN76, high-performance 2+1-port 10/100/1000M Ethernet switch featuring low-power integrated dual-port 10/100/1000M PHYs that support 1000Base-T, 100Base-TX, and 10Base-T.

For specific applications, the RTL8363NB-VB supports an extra interface that can be configured as an RGMII/MII/TMII/RMII interface. The RTL8363NB-VB integrates all the functions of a high-speed switch system; including SRAM for packet buffering, non-blocking switch fabric, and internal register management into a single CMOS device. Only a 25MHz crystal is required; an optional EEPROM is offered for internal register configuration.

The embedded packet storage SRAM in the RTL8363NB-VB features superior memory management technology to efficiently utilize memory space. The RTL8363NB-VB integrates a 2048-entry look-up table with a 4-way XOR Hashing algorithm for address searching and learning. The table provides read/write access from the Slave I2C-like serial Interface, or Slave Media Independent Interface Management (MIIM) Interface. Each of the entries can be configured as a static entry. Normal entry aging time is between 200 and 400 seconds. Sixteen Filtering Databases are used to provide Independent VLAN Learning and Shared VLAN Learning (IVL/SVL) functions.

The Extension GMAC1 of the RTL8363NB-VB implements an RGMII/MII/TMII/RMII interface. This interface could be connected to an external PHY, MAC, CPU, or RISC for specific applications.

Note: The RTL8363NB-VB Extra Interface (Extension GMAC1) supports:

Reduced Gigabit Media Independent Interface (RGMII)

Media Independent Interface (MII)

Turbo Media Independent Interface (TMII)

Reduced Media Independent Interface (RMII)

The RTL8363NB-VB supports standard 802.3x flow control frames for full duplex, and optional backpressure for half duplex. It determines when to invoke the flow control mechanism by checking the availability of system resources, including the packet buffers and transmitting queues. The RTL8363NB-VB supports broadcast/multicast output dropping, and will forward broadcast/multicast packets to non-blocked ports only. For IP multicast applications, the RTL8363NB-VB can forward IPv4 IGMPv1/v2/v3 and IPv6 MLDv1/v2 snooping protocol packets.

In order to support flexible traffic classification, the RTL8363NB-VB supports 48-entry ACL rule check and multiple actions options. Each port can optionally enable or disable the ACL rule check function. The ACL rule key can be based on packet physical port, Layer2, Layer3, and Layer4 information. When an ACL rule matches, the action taken is configurable to Drop/Permit/Redirect/Mirror, change priority value in 802.1q/Q tag, force output tag format, and rate policing. The rate policing mechanism supports from 8Kbps to 1Gbps (in 8Kbps steps).

In Bridge operation the RTL8363NB-VB supports 16 sets of port configurations: disable, block, learning, and forwarding for Spanning Tree Protocol and Multiple Spanning Tree Protocol. To meet security and management application requirements, the RTL8363NB-VB supports IEEE 802.1x Port-based/MAC-based Access Control. A 1-set Port Mirroring function is configured to mirror traffic (RX, TX, or both) appearing on one of the switch's ports. Support is provided on each port for multiple RFC MIB Counters, for easy debug and diagnostics.

To improve real-time and multimedia networking applications, the RTL8363NB-VB supports eight priority assignments for each received packet. These are based on (1) Port-based priority; (2) 802.1p/Q VLAN tag priority; (3) DSCP field in IPv4/IPv6 header; and (4) ACL-assigned priority. Each output port supports a weighted ratio of eight priority queues to fit bandwidth requirements in different applications. The input bandwidth control function helps limit per-port traffic utilization. There is one leaky bucket for average packet rate control for each queue of all ports. Queue scheduling algorithm can use Strict Priority (SP) or Weighted Fair Queue (WFQ) or Weighted Round Robin (WRR) or mixed.

The RTL8363NB-VB provides a 4096-entry VLAN table for 802.1Q port-based, tag-based, and protocol-based VLAN operation to separate logical connectivity from physical connectivity. The RTL8363NB-VB supports four Protocol-based VLAN configurations that can optionally select EtherType, LLC, and RFC1042 as the search key. Each port may be set to any topology via EEPROM upon reset, or Slave I2C-like serial Interface, or Slave Media Independent Interface Management (MIIM) Interface after reset.

2. Features

- Single-chip 2+1-port 10/100/1000M non-blocking switch architecture
- Embedded dual-port 10/100/1000Base-T PHY
- Each port supports full duplex 10/100/1000M connectivity (half duplex only supported in 10/100M mode)
- Extra Interface (Extension GMAC1) supports
 - ◆ Media Independent Interface (MII)
 - ◆ Reduced 10/100/1000M Media Independent Interface (RGMII)
 - ◆ Turbo Media Independent Interface (TMII)
 - ◆ Turbo Media Independent Interface (TMII)
 - ◆ Reduced Media Independent Interface (RMII)
- Full-duplex and half-duplex operation with IEEE 802.3x flow control and backpressure
- Supports 9216-byte jumbo packet length forwarding at wire speed
- Realtek Cable Test (RTCT) function
- Supports 48-entry ACL Rules
 - ◆ Search keys support physical port, Layer2, Layer3, and Layer4 information
 - ◆ Actions include mirror, redirect, dropping, priority adjustment, traffic policing, CVLAN decision, and SVLAN assignment
 - ◆ Supports five types of user defined ACL rule format for 48 ACL rules
 - ◆ Optional per-port enable/disable of ACL function
 - ◆ Optional setting of per-port action to take when ACL mismatch
- Supports IEEE 802.1Q VLAN
 - ◆ Supports 4096 VLANs and 32 Extra Enhanced VLANs
 - ◆ Supports Un-tag definition in each VLAN
 - ◆ Supports VLAN policing and VLAN forwarding decision
 - ◆ Port-based, Tag-based, and Protocol-based VLAN
 - ◆ Up to 4 Protocol-based VLAN entries
 - ◆ Per-port and per-VLAN egress VLAN tagging and un-tagging
- Supports IVL, SVL, and IVL/SVL
 - ◆ 2048-entry MAC address table with 4-way hash algorithm
 - ◆ Up to 2048-entry L2/L3 Filtering Database
 - ◆ Per-port MAC learning limitation
 - ◆ System base MAC learning limitation
- Supports Spanning Tree Port Behavior configuration
 - ◆ IEEE 802.1w Rapid Spanning Tree
 - ◆ IEEE 802.1s Multiple Spanning Tree with up to 16 Spanning Tree instances
- Supports IEEE 802.1x Access Control Protocol
 - ◆ Port-Based Access Control
 - ◆ MAC-Based Access Control

- Supports Auto protection from Denial-of-Service attacks
- Supports trap IGMP/MLD packets to external CPU
- Supports Quality of Service (QoS)
 - ◆ Supports per port Input Bandwidth Control
 - ◆ Traffic classification based on IEEE 802.1p/Q priority definition, physical Port, IP DSCP field, ACL definition, VLAN based priority, MAC based priority and SVLAN based priority
 - ◆ Eight Priority Queues per port
 - ◆ Per queue flow control
 - ◆ Min-Max Scheduling
 - ◆ Strict Priority and Weighted Fair Queue (WFQ), Weighted Round Robin (WRR) packet scheduling
 - ◆ One leaky bucket to constrain the average packet rate of each queue
- Supports rate limiting (12 shared meters, with 8kbps granulation)
- Supports RFC MIB Counter
 - ◆ MIB-II (RFC 1213)
 - ◆ Ethernet-Like MIB (RFC 3635)
 - ◆ Interface Group MIB (RFC 2863)
 - ◆ RMON (RFC 2819)
 - ◆ Bridge MIB (RFC 1493)
 - ◆ Bridge MIB Extension (RFC 2674)
- Supports Stacking VLAN and Port Isolation with eight Enhanced Filtering Databases
- Supports IEEE 802.1ad Stacking VLAN
 - ◆ Supports 64 SVLANs
 - ◆ Supports MAC-based 1:N VLAN
- Supports Port Mirror function for one monitor port for multiple mirroring ports
- Security Filtering
 - ◆ Disable learning for each port
 - ◆ Disable learning-table aging for each port
 - ◆ Drop unknown DA for each port
- Broadcast/Multicast/Unknown DA storm control protects system from attack by hackers
- Supports IEEE 802.3az Energy Efficient Ethernet (EEE)
- Supports Realtek Green Ethernet features
 - ◆ Link-On Cable Length Power Saving
 - ◆ Link-Down Power Saving
- Supports one interrupt output to external CPU for notification
- Each port supports 3 parallel LED outputs
- Supports Slave I2C-like interface or Slave MII Management interface to access configuration register
- Supports 32K-byte EEPROM space for configuration
- Build in 3.3V to 1.1V switch regulator with power MOS
- 25MHz crystal or 3.3V OSC input
- 9x9 QFN 76-pin package

3. System Applications

- 2-Port 1000Base-T Router with RGMII/TMII/RMII/MII Interfaces

4. Application Examples

4.1. 2-Port 1000Base-T Router with RGMII/TMII/RMII/MII

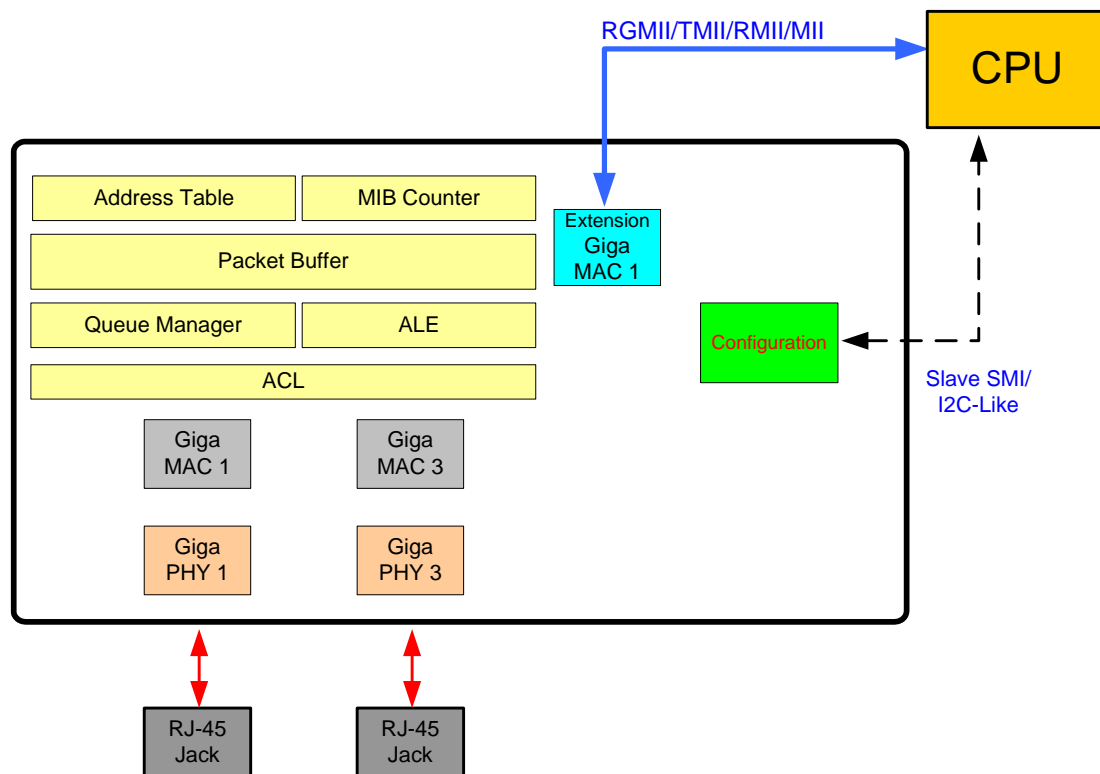


Figure 1. 2-Port 1000Base-T Router with RGMII/TMII/RMII/MII

Note: Extra Interface (Extension GMAC1) in RGMII/TMII/RMII/MII Mode.

5. Block Diagram

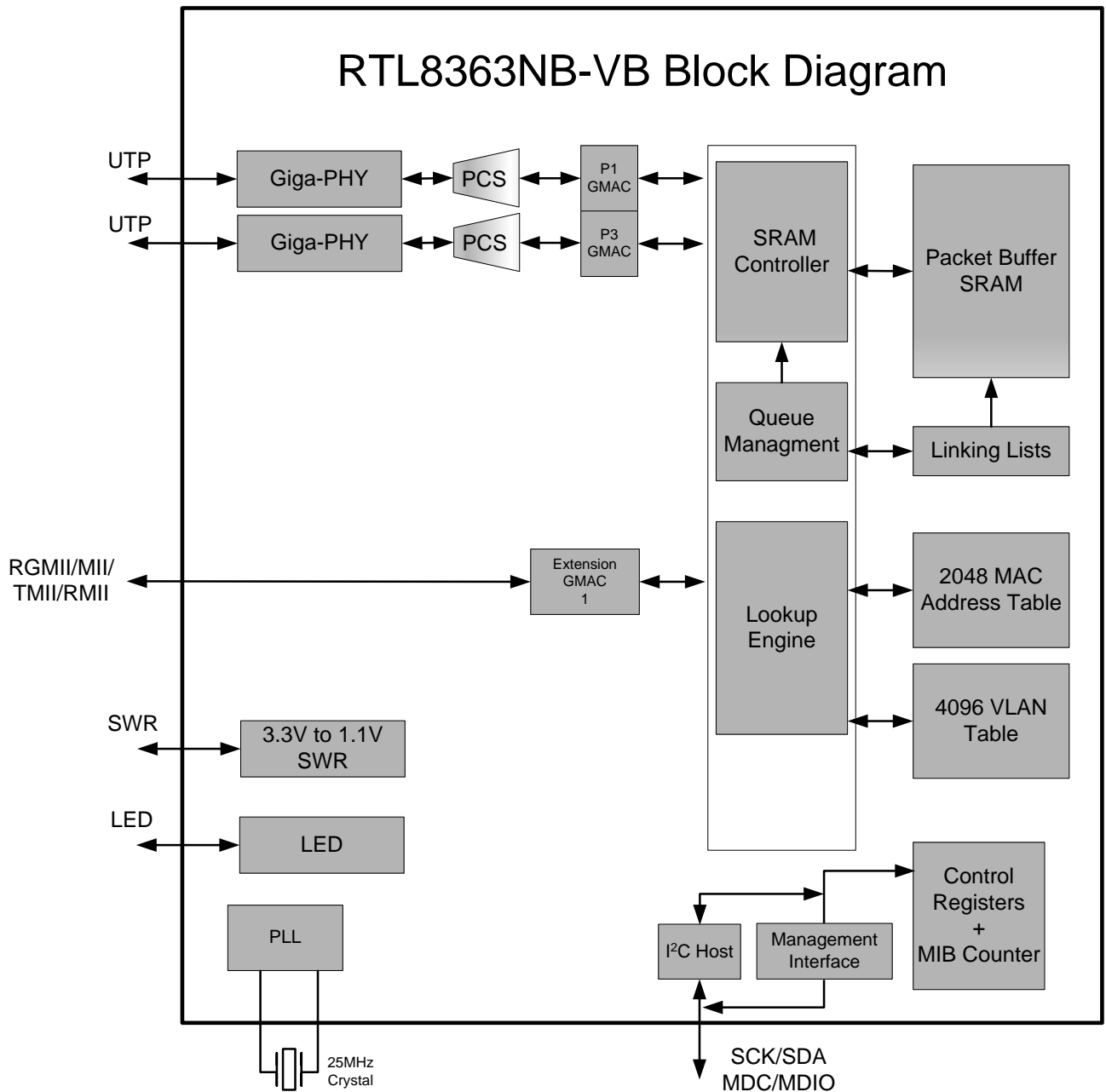


Figure 2. Block Diagram

6. Pin Assignments

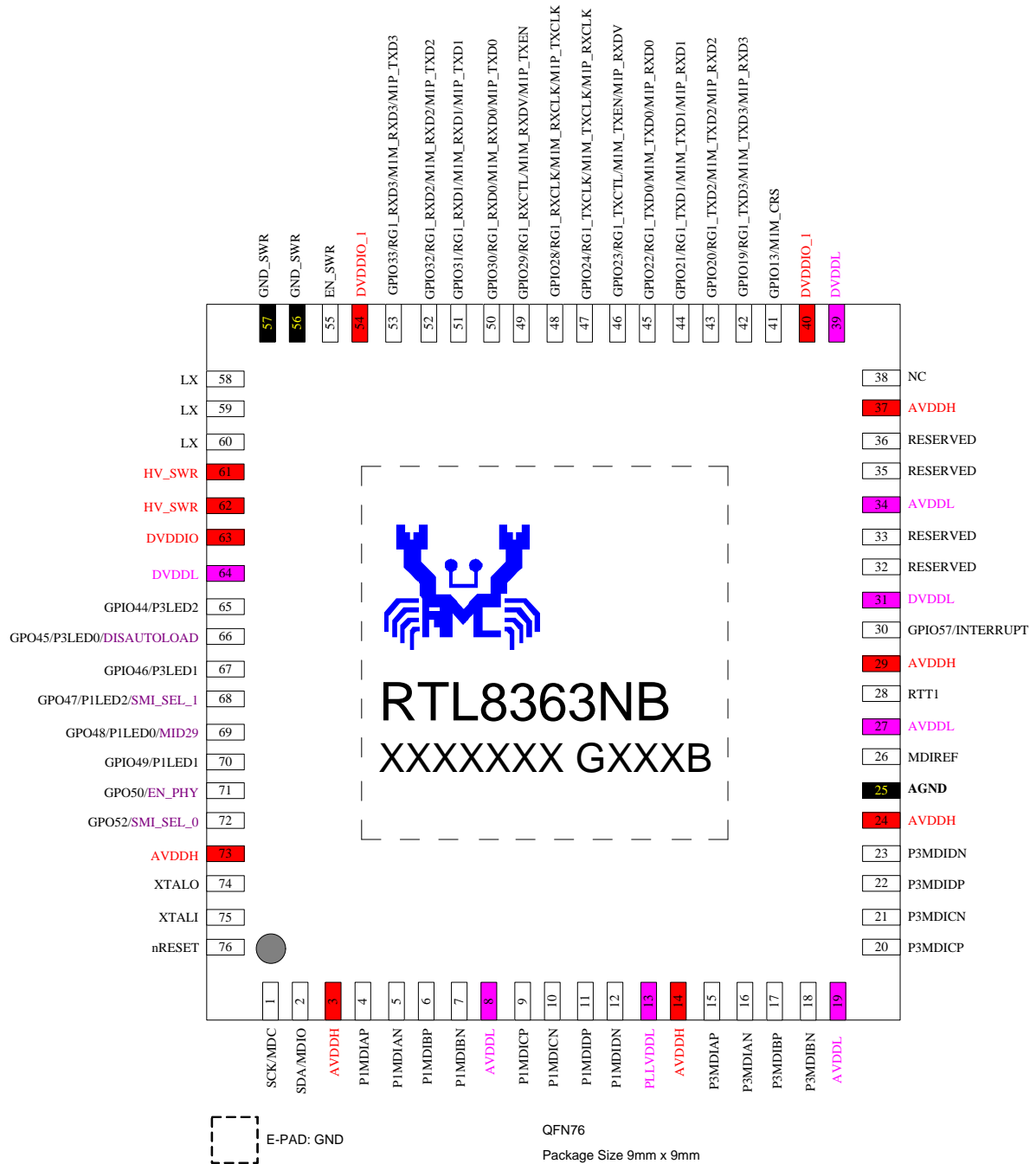


Figure 3. Pin Assignments (QFN-76)

6.1. Package Identification

Green package is indicated by the ‘G’ in GXXXB (Figure 3). The version number is shown by the ‘B’.

6.2. Pin Assignments Table

Upon Reset: Defined as a short time after the end of a hardware reset.

After Reset: Defined as the time after the specified 'Upon Reset' time.

I: Input Pin	AI: Analog Input Pin
O: Output Pin	AO: Analog Output Pin
I/O: Bi-Directional Input/Output Pin	AI/O: Analog Bi-Directional Input/Output Pin
P: Digital Power Pin	AP: Analog Power Pin
G: Digital Ground Pin	AG: Analog Ground Pin
I _{PU} : Input Pin With Pull-Up Resistor; (Typical Value = 75K Ohm)	O _{PU} : Output Pin With Pull-Up Resistor; (Typical Value = 75K Ohm)

Table 1. Pin Assignments Table

Name	Pin No.	Type
SCK/MDC	1	I/O
SDA/MDIO	2	I/O
AVDDH	3	AP
P1MDIAP	4	AI/O
P1MDIAN	5	AI/O
P1MDIBP	6	AI/O
P1MDIBN	7	AI/O
AVDDL	8	AP
P1MDICP	9	AI/O
P1MDICN	10	AI/O
P1MDIDP	11	AI/O
P1MDIDN	12	AI/O
PLLVDDL	13	AP
AVDDH	14	AP
P3MDIAP	15	AI/O
P3MDIAN	16	AI/O
P3MDIBP	17	AI/O
P3MDIBN	18	AI/O
AVDDL	19	AP
P3MDICP	20	AI/O
P3MDICN	21	AI/O
P3MDIDP	22	AI/O
P3MDIDN	23	AI/O
AVDDH	24	AP

Name	Pin No.	Type
AGND	25	AG
MDIREF	26	AO
AVDDL	27	AP
RTT1	28	AO
AVDDH	29	AP
GPIO57/INTERRUPT	30	I/O _{PD}
DVDDL	31	P
RESERVED	32	-
RESERVED	33	-
AVDDL	34	AP
RESERVED	35	-
RESERVED	36	-
AVDDH	37	AP
NC	38	-
DVDDL	39	P
DVDDIO_1	40	P
GPIO13/M1M_CRS	41	I/O _{PD}
GPIO19/RG1_TXD3/ M1M_TXD3/M1P_RXD3	42	I/O
GPIO20/RG1_TXD2/ M1M_TXD2/M1P_RXD2	43	I/O
GPIO21/RG1_TXD1/ M1M_TXD1/M1P_RXD1	44	I/O
GPIO22/RG1_TXD0/ M1M_TXD0/M1P_RXD0	45	I/O

Name	Pin No.	Type
GPIO23/RG1_TXCTL/ M1M_TXEN/M1P_RXDV	46	I/O
GPIO24/RG1_TXCLK/ M1M_TXCLK/M1P_RXCLK	47	I/O
GPIO28/RG1_RXCLK/ M1M_RXCLK/M1P_TXCLK	48	I/O
GPIO29/RG1_RXCTL/ M1M_RXDV/M1P_TXEN	49	I/O
GPIO30/RG1_RXD0/ M1M_RXD0/M1P_TXD0	50	I/O
GPIO31/RG1_RXD1/ M1M_RXD1/M1P_TXD1	51	I/O
GPIO32/RG1_RXD2/ M1M_RXD2/M1P_TXD2	52	I/O
GPIO33/RG1_RXD3/ M1M_RXD3/M1P_TXD3	53	I/O
DVDDIO_1	54	P
EN_SWR	55	AI
GND_SWR	56	AG
GND_SWR	57	AG

Name	Pin No.	Type
LX	58	AO
LX	59	AO
LX	60	AO
HV_SWR	61	AI
HV_SWR	62	AI
DVDDIO	63	P
DVDDL	64	P
GPIO44/P3LED2	65	I/O _{PU}
GPO45/P3LED0/DISAUTOLOAD	66	I/O _{PU}
GPIO46/P3LED1	67	I/O _{PU}
GPO47/P1LED2/SMI_SEL_1	68	I/O _{PU}
GPO48/P1LED0/MID29	69	I/O _{PU}
GPIO49/P1LED1	70	I/O _{PU}
GPO50/EN_PHY	71	I/O _{PU}
GPO52/SMI_SEL_0	72	I/O _{PU}
AVDDH	73	AP
XTALO	74	AI/O
XTALI	75	AI
nRESET	76	I _{PU}

7. Pin Descriptions

7.1. Media Dependent Interface Pins

Table 2. Media Dependent Interface Pins

Pin Name	Pin No.	Type	Drive (mA)	Description
P1MDIAP/N	4	AI/O	10	Port 1 Media Dependent Interface A~D. For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor.
	5			
P1MDIBP/N	6			
	7			
P1MDICP/N	9			
	10			
P1MDIDP/N	11			
	12			
P3MDIAP/N	15	AI/O	10	Port 3 Media Dependent Interface A~D. For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor.
	16			
P3MDIBP/N	17			
	18			
P3MDICP/N	20			
	21			
P3MDIDP/N	22			
	23			

7.2. General Purpose Interfaces

The RTL8363NB-VB supports a multi-function General Purpose Interface that can be configured as RGMII/TMII/RMII/MII mode for extension GMAC interface. The RTL8363NB-VB supports an extension interface (Extension GMAC1) for connecting with an external PHY, MAC, or CPU in specific applications. The extension interface supports RGMII, (T)MII MAC mode, or (T)MII PHY mode or RMII via register configuration.

Table 3. General Purpose Interfaces Pins

Pin No.	GPIO	RGMII	(T)MII MAC Mode	(T)MII PHY Mode	RMII and Other Function	Configuration Strapping
30	GPIO57	-	-	-	INTERRUPT	-
41	GPIO13	-	M1M_CRS	-	-	-
42	GPIO19	RG1_TXD3	M1M_TXD3	M1P_RXD3	-	-
43	GPIO20	RG1_TXD2	M1M_TXD2	M1P_RXD2	-	-
44	GPIO21	RG1_TXD1	M1M_TXD1	M1P_RXD1	RM1M_TXD1	-
45	GPIO22	RG1_TXD0	M1M_TXD0	M1P_RXD0	RM1M_TXD0	-
46	GPIO23	RG1_TXCTL	M1M_TXEN	M1P_RXDV	RM1M_TXEN	-
47	GPIO24	RG1_TXCLK	M1M_TXCLK	M1P_RXCLK	RM1M_CLK	-
48	GPIO28	RG1_RXCLK	M1M_RXCLK	M1P_TXCLK	-	-
49	GPIO29	RG1_RXCTL	M1M_RXDV	M1P_TXEN	RM1M_CRS_DV	-
50	GPIO30	RG1_RXD0	M1M_RXD0	M1P_TXD0	RM1M_RXD0	-
51	GPIO31	RG1_RXD1	M1M_RXD1	M1P_TXD1	RM1M_RXD1	-
52	GPIO32	RG1_RXD2	M1M_RXD2	M1P_TXD2	-	-
53	GPIO33	RG1_RXD3	M1M_RXD3	M1P_TXD3	-	-
65	GPIO44	-	-	-	P3LED2	-
66	GPO45	-	-	-	P3LED0	DISAUTOLOAD
67	GPIO46	-	-	-	P3LED1	-
68	GPO47	-	-	-	P1LED2	SMI_SEL_1
69	GPO48	-	-	-	P1LED0	MID29
70	GPIO49	-	-	-	P1LED1	-
71	GPO50	-	-	-	-	EN_PHY
72	GPO52	-	-	-	-	SMI_SEL_0

7.2.1.RGMII Pins

The Extension GMAC1 of the RTL8363NB-VB supports RGMII interface connection to an external MAC or PHY device when register configuration is set to RGMII mode interface.

Table 4. Extension GMAC1 RGMII Pins

Pin Name	Pin No.	Type	Drive (mA)	Description
RG1_TXD3 RG1_TXD2 RG1_TXD1 RG1_TXD0	42 43 44 45	O	-	RG1_TXD[3:0] Extension GMAC1 RGMII Transmit Data Output. Transmitted data is sent synchronously to RG1_TXCLK.
RG1_TXCTL	46	O	-	RG1_TXCTL Extension GMAC1 RGMII Transmit Control signal Output. The RG1_TXCTL indicates TX_EN at the rising edge of RG1_TXCLK, and TX_ER at the falling edge of RG1_TXCLK. At the RG1_TXCLK falling edge, RG1_TXCTL= TX_EN (XOR) TX_ER.
RG1_TXCLK	47	O	-	RG1_TXCLK Extension GMAC1 RGMII Transmit Clock Output. RG1_TXCLK is 125MHz @ 1Gbps, 25MHz @ 100Mbps, and 2.5MHz @ 10Mbps. Used for RG1_TXD[3:0] and RG1_TXCTL synchronization at RG1_TXCLK on both rising and falling edges.
RG1_RXCLK	48	I	-	RG1_RXCLK Extension GMAC1 RGMII Receive Clock Input. RG1_RXCLK is 125MHz @ 1Gbps, 25MHz @ 100Mbps, and 2.5MHz @ 10Mbps. Used for RG1_RXD[3:0] and RG1_RXCTL synchronization at both RG1_RXCLK rising and falling edges. This pin must be pulled low with a 1K ohm resistor when not used.
RG1_RXCTL	49	I	-	RG1_RXCTL Extension GMAC1 RGMII Receive Control signal input. The RG1_RXCTL indicates RX_DV at the rising of RG1_RXCLK and RX_ER at the falling edge of RG1_RXCLK. At RG1_RXCLK falling edge, RG1_RXCTL= RX_DV (XOR) RX_ER. This pin must be pulled low with a 1K ohm resistor when not used.
RG1_RXD0 RG1_RXD1 RG1_RXD2 RG1_RXD3	50 51 52 53	I	-	RG1_RXD[3:0] Extension GMAC1 RGMII Receive Data Input. Received data is received synchronously by RG1_RXCLK

7.2.2.(T)MII Pins

The Extension GMAC1 of the RTL8363NB-VB supports (T)MII interface connection to an external MAC or PHY device when register configuration is set to (T)MII mode interface. The (T)MII interface can also be configured as (T)MII MAC mode or (T)MII PHY mode by register.

Table 5. Extension GMAC1 (T)MII Pins ((T)MII MAC Mode or (T)MII PHY Mode)

Pin Name	Pin No.	Type	Drive (mA)	Description
M1M_CRS	41	I	-	M1M_CRS Extension GMAC1 (T)MII MAC Mode Carrier Sense Input when operating in 10/100Mbps MII half duplex mode or in 20/200Mbps TMII half duplex mode.
M1M_TXD3/ M1P_RXD3	42	O	-	M1M_TXD[3:0] Extension GMAC1 (T)MII MAC Mode Transmit Data Output.
M1M_TXD2/ M1P_RXD2	43			Transmitted data is sent synchronously at the rising edge of M1M_TXCLK.
M1M_TXD1/ M1P_RXD1	44			M1P_RXD[3:0] Extension GMAC1 (T)MII PHY Mode Receive Data Output.
M1M_TXD0/ M1P_RXD0	45			Received data is received synchronously at the rising edge of M1P_RXCLK.
M1M_TXEN/ M1P_RXDV	46	O	-	M1M_TXEN Extension GMAC1 (T)MII MAC Mode Transmit Data Enable Output. Transmit enable that is sent synchronously at the rising edge of M1M_TXCLK. M1P_RXDV Extension GMAC1 (T)MII PHY Mode Receive Data Valid Output. Receive Data Valid signal that is sent synchronously at the rising edge of M1P_RXCLK.
M1M_TXCLK/ M1P_RXCLK	47	I/O	-	M1M_TXCLK Extension GMAC1 (T)MII MAC Mode Transmit Clock Input. In MII 100Mbps, M1M_TXCLK is 25MHz Clock Input. In MII 10Mbps, M1M_TXCLK is 2.5MHz Clock Input. In TMII 200Mbps, M1M_TXCLK is 50MHz Clock Input. In TMII 20Mbps, M1M_TXCLK is 5MHz Clock Input. Used to synchronize M1M_TXD[3:0] and M1M_TXEN. M1P_RXCLK Extension GMAC1 (T)MII PHY Mode Receive Clock Output. In MII 100Mbps, M1P_RXCLK is 25MHz Clock Output. In MII 10Mbps, M1P_RXCLK is 2.5MHz Clock Output. In TMII 200Mbps, M1P_RXCLK is 50MHz Clock Output. In TMII 20Mbps, M1P_RXCLK is 5MHz Clock Output. Used to synchronize M1P_RXD[3:0] and M1P_RXDV. This pin must be pulled low with a 1K ohm resistor when not used.

Pin Name	Pin No.	Type	Drive (mA)	Description
M1M_RXCLK/ M1P_TXCLK	48	I/O	-	<p>M1M_RXCLK Extension GMAC1 (T)MII MAC Mode Receive Clock Input. In MII 100Mbps, M1M_RXCLK is 25MHz Clock Input. In MII 10Mbps, M1M_RXCLK is 2.5MHz Clock Input. In TMII 200Mbps, M1M_RXCLK is 50MHz Clock Input. In TMII 20Mbps, M1M_RXCLK is 5MHz Clock Input. Used to synchronize M1M_RXD[3:0], M1M_RXDV, and M1M_CRS.</p> <p>M1P_TXCLK Extension GMAC1 (T)MII PHY Mode Transmit Clock Output. In MII 100Mbps, M1P_TXCLK is 25MHz Clock Output. In MII 10Mbps, M1P_TXCLK is 2.5MHz Clock Output. In TMII 200Mbps, M1P_TXCLK is 50MHz Clock Output. In TMII 20Mbps, M1P_TXCLK is 5MHz Clock Output. Used to synchronize M1P_TXD[3:0] and M1P_TXEN. This pin must be pulled low with a 1K ohm resistor when not used.</p>
M1M_RXDV/ M1P_TXEN	49	I	-	<p>M1M_RXDV Extension GMAC1 (T)MII MAC Mode Receive Data Valid Input. Receive Data Valid sent synchronously at the rising edge of M1M_RXCLK.</p> <p>M1P_TXEN Extension GMAC1 (T)MII PHY Mode Transmit Data Enable Input. Transmit Data Enable is received synchronously at the rising edge of M1P_TXCLK. This pin must be pulled low with a 1K ohm resistor when not used.</p>
M1M_RXD0/ M1P_TXD0 M1M_RXD1/ M1P_TXD1 M1M_RXD2/ M1P_TXD2 M1M_RXD3/ M1P_TXD3	50 51 52 53	I	-	<p>M1M_RXD[3:0] Extension GMAC1 (T)MII MAC Mode Receive Data Input. Received data that is received synchronously at the rising edge of M1M_RXCLK.</p> <p>M1P_TXD[3:0] Extension GMAC1 (T)MII PHY Mode Transmit Data Input. Transmitted data is received synchronously at the rising edge of M1P_TXCLK.</p>

7.2.3. RMI Pins

The Extension GMAC1 of the RTL8363NB-VB supports RMI interface connection with an external MAC or PHY device when register configuration is set to RMI mode interface. The RMI interface can be configured as RMI Clock Input mode or RMI Clock Output mode via register.

Table 6. Extension GMAC1 RMI Pins (RMI Clock Input Mode or RMI Clock Output Mode)

Pin No.	Type	RMI	Description
44	O	RM1M_TXD1	RMI 1 TXD1
45	O	RM1M_TXD0	RMI 1 TXD0
46	O	RM1M_TXEN	RMI 1 TXEN
47	I/O	RM1M_CLK	RMI 1 Reference 50MHz Clock In RMI Clock Input Mode, this pin is Input. In RMI Clock Output Mode, this pin is Output.
49	I	RM1M_CRS_DV	RMI 1 CRS_DV
50	I	RM1M_RXD0	RMI 1 RXD0
51	I	RM1M_RXD1	RMI 1 RXD1

7.3. LED Pins

The RTL8363NB-VB LED Pins can be configured to parallel mode LED or serial mode LED interface via Register configuration. LED0, LED1, and LED2 of Port n indicate information that can be defined via register or EEPROM.

In parallel LED mode, when the LED pin is pulled low, the LED output polarity will be high active. When the LED pin is pulled high, the LED output polarity will change from high active to low active. See section 9.17 LED Indicators, page 32 for more details.

Table 7. LED Pins

Pin Name	Pin No.	Type	Drive (mA)	Description
P1LED0/ MID29	69	I/O _{PU}	-	Port 1 LED0 Output Signal. P1LED0 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.
P1LED1	70	I/O _{PU}	-	Port 1 LED1 Output Signal. P1LED1 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.
P1LED2/ SMI_SEL_1	68	I/O _{PU}	-	Port 1 LED2 Output Signal. P1LED2 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.
P3LED0/ DISAUTOLOAD	66	I/O _{PU}	-	Port 3 LED0 Output Signal. P3LED0 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.
P3LED1	67	I/O _{PU}	-	Port 3 LED1 Output Signal. P3LED1 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.

Pin Name	Pin No.	Type	Drive (mA)	Description
P3LED2	65	I/O _{PU}	-	Port 3 LED2 Output Signal. P3LED2 indicates information is defined by register or EEPROM. See section 9.17, page 32 for more details.

7.4. Configuration Strapping Pins

Table 8. Configuration Strapping Pins

Pin Name	Pin No.	Type	Description
DISAUTOLOAD / P3LED0	66	I/O _{PU}	Disable EEPROM Auto-load. Pull Up: Disable EEPROM auto download upon power on or reset. Pull Down: Enable EEPROM auto download upon power on or reset. <i>Note: This pin must be kept floating, or pulled high or low via an external 4.7k ohm resistor upon power on or reset.</i> <i>When this pin is pulled low, the LED output polarity will be high active. When this pin is pulled high, the LED output polarity will change from high active to low active. See section 9.17 LED Indicators, page 32 for more details.</i>
SMI_SEL_1 / P1LED2	68	I/O _{PU}	External CPU Access Interface Selection. SMI_SEL[1:0]: 00: Slave LSB I2C mode 01: Slave MSB I2C mode 10: Slave MII Management MDC/MDIO 11: Realtek Slave I2C-like mode <i>Note: These pins must be kept floating, or pulled high or low via an external 4.7k ohm resistor upon power on or reset.</i> <i>When these pins are pulled high, the LED output polarity will change from high active to low active. See section 9.17 LED Indicators, page 32 for more details.</i>
SMI_SEL_0	72	I/O _{PU}	
MID29 / P1LED0	69	I/O _{PU}	Select MID29. Pull Up: Slave MII Management Interface PHY ID is 29 Pull Down: Slave MII Management Interface PHY ID is 0 <i>Note: This pin must be kept floating, or pulled high or low via an external 4.7k ohm resistor upon power on or reset.</i> <i>When this pin is pulled low, the LED output polarity will be high active. When this pin is pulled high, the LED output polarity will change from high active to low active. See section 9.17 LED Indicators, page 32 for more details.</i>
EN_PHY	71	I/O _{PU}	Enable Embedded PHY. Pull Up: Enable embedded PHY upon power on or reset. Pull Down: Disable embedded PHY upon power on or reset. <i>Note: This pin must be kept floating, or pulled high or low via an external 4.7k ohm resistor upon power on or reset.</i>

7.5. Management Interface Pins

Table 9. Management Interface Pins

Pin Name	Pin No.	Type	Description
SCK/ MDC	1	I/O	Master I2C Interface Clock for EEPROM auto-download. Slave I2C-like Interface Clock for external CPU to access the RTL8363NB-VB. Slave MII Management Interface Clock (selected via the hardware strapping SMI_SEL_1 & SMI_SEL_0).
SDA/ MDIO	2	I/O	Master I2C Interface Data for EEPROM auto-download. Slave I2C-like Interface Data for external CPU to access the RTL8363NB-VB. Slave MII Management Interface Data (selected via the hardware strapping SMI_SEL_1 & SMI_SEL_0).
INTERRUPT	30	O _{PD}	Interrupt output when Interrupt even occurs. Output can be high or low active by register configuration.

7.6. Miscellaneous Pins

Table 10. Miscellaneous Pins

Pin Name	Pin No.	Type	Description
XTALO	74	AO	25MHz Crystal Clock Output Pin. 25MHz +/-50ppm tolerance crystal output. When using a crystal, connect a loading capacitor from each pad to ground.
XTALI	75	AI	25MHz Crystal Clock Input Pin. 25MHz +/-50ppm tolerance crystal reference input. When using a crystal, connect a loading capacitor from each pad to ground. When either using an oscillator or driving an external 25MHz clock from another device, XTALO should be kept floating.
nRESET	76	I _{PU}	System Reset Input Pin. When low active will reset the RTL8363NB-VB.
MDIREF	26	AO	Reference Resistor. A 2.49k ohm (1%) resistor must be connected between MDIREF and GND.
NC	38	-	Not Connected
GPIO13	41	I/O _{PD}	General Purpose Input/Output Interface IO13.
GPIO19	42	I/O	General Purpose Input/Output Interface IO19.
GPIO20	43	I/O	General Purpose Input/Output Interface IO20.
GPIO21	44	I/O	General Purpose Input/Output Interface IO21.
GPIO22	45	I/O	General Purpose Input/Output Interface IO22.
GPIO23	46	I/O	General Purpose Input/Output Interface IO23.
GPIO24	47	I/O	General Purpose Input/Output Interface IO24.
GPIO28	48	I/O	General Purpose Input/Output Interface IO28.
GPIO29	49	I/O	General Purpose Input/Output Interface IO29.
GPIO30	50	I/O	General Purpose Input/Output Interface IO30.
GPIO31	51	I/O	General Purpose Input/Output Interface IO31.
GPIO32	52	I/O	General Purpose Input/Output Interface IO32.
GPIO33	53	I/O	General Purpose Input/Output Interface IO33.

Pin Name	Pin No.	Type	Description
GPIO44/ P3LED2	65	I/O _{PU}	General Purpose Input/Output Interface IO44.
GPO45/ P3LED0/ DISAUTOLOAD	66	I/O _{PU}	General Purpose Output Interface IO45.
GPIO46/ P3LED1	67	I/O _{PU}	General Purpose Input/Output Interface IO46.
GPO47/ P1LED2/ SMI_SEL_1	68	I/O _{PU}	General Purpose Output Interface O47.
GPO48/ P1LED0/ MID29	69	I/O _{PU}	General Purpose Output Interface O48.
GPIO49/ P1LED1	70	I/O _{PU}	General Purpose Input/Output Interface IO49.
GPO50/ EN_PHY	71	I/O _{PU}	General Purpose Output Interface IO50.
GPO52/ SMI_SEL_0	72	I/O _{PU}	General Purpose Output Interface IO52.
GPIO57/ INTERRUPT	30	I/O _{PD}	General Purpose Input/Output Interface IO57.

7.7. Test Pins

Table 11. Test Pins

Pin Name	Pin No.	Type	Description
RTT1	28	AO	Reserved for Internal Use. Must be left floating.

7.8. Embedded Switch Regulator Pins

Table 12. Embedded Switch Regulator Pins

Pin Name	Pin No.	Type	Description
EN_SWR	55	AI	Enable embedded switch regulator. Pull Up: Enable embedded switch regulator. Pull Down: Disable embedded switch regulator. Note: pulled high or low via an external 4.7k ohm resistor to enable or disable embedded switch regulator.
GND_SWR	56, 57	AG	Regulator Ground.
LX	58, 59, 60	AO	Regulator output. It should connect to the external inductor.
HV_SWR	61, 62	AP	Regulator Power Supply Input.

7.9. Power and GND Pins

Table 13. Power and GND Pins

Pin Name	Pin No.	Type	Description
DVDDIO_1	40, 54	P	Digital I/O High Voltage Power for Extension Port 1 General Purpose Interface.
DVDDIO	63	P	Digital I/O High Voltage Power for LED, Management Interface, and nRESET.
DVDDL	31, 39, 64	P	Digital Low Voltage Power.
AVDDH	3, 14, 24, 29, 37, 73	AP	Analog High Voltage Power. Including supply I/O power for INTERRUPT pin.
AVDDL	8, 19, 27, 34	AP	Analog Low Voltage Power.
PLLVDDL	13	AP	PLL Low Voltage Power.
AGND	25	AG	Analog GND.
GND	EPAD	G	Ground.

8. Physical Layer Functional Overview

8.1. MDI Interface

The RTL8363NB-VB embeds Dual 10/100/1000M Ethernet PHYs in one chip. Each port uses a single common MDI interface to support 1000Base-T, 100Base-TX, and 10Base-T. This interface consists of four signal pairs-A, B, C, and D. Each signal pair consists of two bi-directional pins that can transmit and receive at the same time. The MDI interface has internal termination resistors, and therefore reduces BOM cost and PCB complexity. For 1000Base-T, all four pairs are used in both directions at the same time. For 10/100 links and during auto-negotiation, only pairs A and B are used.

8.2. 1000Base-T Transmit Function

The 1000Base-TX transmit function performs 8B/10B coding, scrambling, and 4D-PAM5 encoding. These code groups are passed through a waveform-shaping filter to minimize EMI effects, and are transmitted onto 4-pair CAT5 cable at 125MBaud/s through a D/A converter.

8.3. 1000Base-T Receive Function

Input signals from the media pass through the sophisticated on-chip hybrid circuit to subtract the transmitted signal from the input signal for effective reduction of near-end echo. The received signal is then processed with state-of-the-art technology, e.g., adaptive equalization, BLW (Baseline Wander) correction, cross-talk cancellation, echo cancellation, timing recovery, error correction, and 4D-PAM5 decoding. The 8-bit-wide data is recovered and is sent to the GMII interface at a clock speed of 125MHz. The RX MAC retrieves the packet data from the internal receive MII/GMII interface and sends it to the packet buffer manager.

8.4. 100Base-TX Transmit Function

The 100Base-TX transmit function performs parallel to serial conversion, 4B/5B coding, scrambling, NRZ/NRZI conversion, and MLT-3 encoding. The 5-bit serial data stream after 4B/5B coding is then scrambled as defined by the TP-PMD Stream Cipher function to flatten the power spectrum energy such that EMI effects can be reduced significantly.

The scrambled seed is based on PHY addresses and is unique for each port. After scrambling, the bit stream is driven onto the network media in the form of MLT-3 signaling. The MLT-3 multi-level signaling technology moves the power spectrum energy from high frequency to low frequency, which also reduces EMI emissions.

8.5. 100Base-TX Receive Function

The receive path includes a receiver composed of an adaptive equalizer and DC restoration circuits (to compensate for an incoming distorted MLT-3 signal), an MLT-3 to NRZI and NRZI to NRZ converter to convert analog signals to digital bit-stream, and a PLL circuit to clock data bits with minimum bit error rate. A de-scrambler, 5B/4B decoder, and serial-to-parallel conversion circuits are followed by the PLL circuit. Finally, the converted parallel data is fed into the MAC.

8.6. 10Base-T Transmit Function

The output 10Base-T waveform is Manchester-encoded before it is driven onto the network media. The internal filter shapes the driven signals to reduce EMI emissions, eliminating the need for an external filter.

8.7. 10Base-T Receive Function

The Manchester decoder converts the incoming serial stream to NRZ data when the squelch circuit detects the signal level is above squelch level.

8.8. Auto-Negotiation for UTP

The RTL8363NB-VB obtains the states of duplex, speed, and flow control ability for each port in UTP mode through the auto-negotiation mechanism defined in the IEEE 802.3 specifications. During auto-negotiation, each port advertises its ability to its link partner and compares its ability with advertisements received from its link partner. By default, the RTL8363NB-VB advertises full capabilities (1000Full, 100Full, 100Half, 10Full, 10Half) together with flow control ability.

8.9. Crossover Detection and Auto Correction

The RTL8363NB-VB automatically determines whether or not it needs to crossover between pairs (see Table 14) so that an external crossover cable is not required. When connecting to another device that does not perform MDI crossover, when necessary, the RTL8363NB-VB automatically switches its pin pairs to communicate with the remote device. When connecting to another device that does have MDI crossover capability, an algorithm determines which end performs the crossover function.

The crossover detection and auto correction function can be disabled via register configuration. The pin mapping in MDI and MDI Crossover mode is given below.

Table 14. Media Dependent Interface Pin Mapping

Pairs	MDI			MDI Crossover		
	1000Base-T	100Base-TX	10Base-T	1000Base-T	100Base-TX	10Base-T
A	A	TX	TX	B	RX	RX
B	B	RX	RX	A	TX	TX
C	C	Unused	Unused	D	Unused	Unused
D	D	Unused	Unused	C	Unused	Unused

8.10. Polarity Correction

The RTL8363NB-VB automatically corrects polarity errors on the receiver pairs in 1000Base-T and 10Base-T modes. In 100Base-TX mode, the polarity is irrelevant.

In 1000Base-T mode, receive polarity errors are automatically corrected based on the sequence of idle symbols. Once the de-scrambler is locked, the polarity is also locked on all pairs. The polarity becomes unlocked only when the receiver loses lock.

In 10Base-T mode, polarity errors are corrected based on the detection of valid spaced link pulses. The detection begins during the MDI crossover detection phase and locks when the 10Base-T link is up. The polarity becomes unlocked when the link is down.

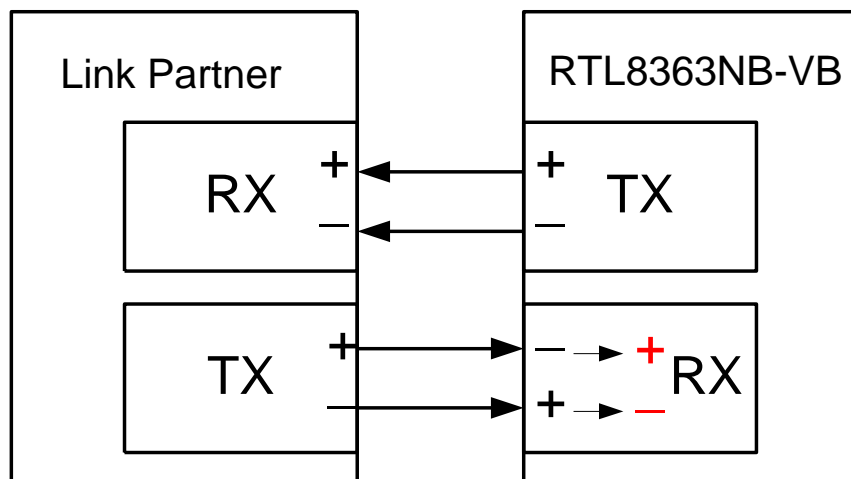


Figure 4. Conceptual Example of Polarity Correction

9. General Function Descriptions

9.1. Reset

9.1.1. Hardware Reset

In a power-on reset, an internal power-on reset pulse is generated and the RTL8363NB-VB will start the reset initialization procedures. These are:

- Determine various default settings via the hardware strap pins at the end of the nRESET signal
- Auto-load the configuration from EEPROM if EEPROM is detected
- Complete the embedded SRAM BIST process
- Initialize the packet buffer descriptor allocation
- Initialize the internal registers and prepare them to be accessed by the external CPU

9.1.2. Software Reset

The RTL8363NB-VB supports two software resets; a chip reset and a soft reset.

9.1.2.1 CHIP_RESET

When CHIP_RESET is set to 0b1 (write and self-clear), the chip will take the following steps:

1. Download configuration from strap pin and EEPROM
2. Start embedded SRAM BIST (Built-In Self-Test)
3. Clear all the Lookup and VLAN tables
4. Reset all registers to default values
5. Restart the auto-negotiation process

9.1.2.2 SOFT_RESET

When SOFT_RESET is set to 0b1 (write and self-clear), the chip will take the following steps:

1. Clear the FIFO and re-start the packet buffer link list
2. Restart the auto-negotiation process

9.2. IEEE 802.3x Full Duplex Flow Control

The RTL8363NB-VB supports IEEE 802.3x flow control in 10/100/1000M modes. Flow control can be decided in two ways:

- When Auto-Negotiation is enabled, flow control depends on the result of NWay
- When Auto-Negotiation is disabled, flow control depends on register definition

9.3. Half Duplex Flow Control

In half duplex mode, the CSMA/CD media access method is the means by which two or more stations share a common transmission medium. To transmit, a station waits (defers) for a quiet period on the medium (that is, no other station is transmitting) and then sends the intended message in bit-serial form. If the message collides with that of another station, then each transmitting station intentionally transmits for an additional predefined period to ensure propagation of the collision throughout the system. The station remains silent for a random amount of time (backoff) before attempting to transmit again.

When a transmission attempt has terminated due to a collision, it is retried until it is successful. The scheduling of the retransmissions is determined by a controlled randomization process called ‘Truncated Binary Exponential Backoff’. At the end of enforcing a collision (jamming), the switch delays before attempting to retransmit the frame. The delay is an integer multiple of slot time (512 bit times). The number of slot times to delay before the *n*th retransmission attempt is chosen as a uniformly distributed random integer ‘*r*’ in the range:

$$0 \leq r < 2^k$$

where:

$k = \min(n, \text{backoffLimit})$. The backoffLimit for the RTL8363NB-VB is 9.

The half duplex back-off algorithm in the RTL8363NB-VB does not have the maximum retry count limitation of 16 (as defined in IEEE 802.3). This means packets in the switch will not be dropped if the back-off retry count is over 16.

9.3.1. Back-Pressure Mode

In Back-Pressure mode, the RTL8363NB-VB sends a 4-byte jam pattern (data=0xAA) to collide with incoming packets when congestion control is activated. The Jam pattern collides at the fourth byte counted from the preamble. The RTL8363NB-VB supports 48PASS1, which receives one packet after 48 consecutive jam collisions (data collisions are not included in the 48). Enable this function to prevent port partition after 63 consecutive collisions (data collisions + consecutive jam collisions).

9.4. Search and Learning

Search

When a packet is received, the RTL8363NB-VB uses the destination MAC address, Filtering Identifier (FID) and Enhanced Filtering Identifier (EFID) to search the 2048-entry look-up table. The 48-bit MAC address, 4-bit FID and 3-bit EFID use a hash algorithm, to calculate an 11-bit index value. The RTL8363NB-VB uses the index to compare the packet MAC address with the entries (MAC addresses) in the look-up table. This is the ‘Address Search’. If the destination MAC address is not found, the switch will broadcast the packet according to VLAN configuration.

Learning

The RTL8363NB-VB uses the source MAC address, FID, and EFID of the incoming packet to hash into a 9-bit index (4-entry). It then compares the source MAC address with the data (MAC addresses) in this index. If there is a match with one of the entries, the RTL8363NB-VB will update the entry with new information. If there is no match and the 4 entries are not all occupied by other MAC addresses, the RTL8363NB-VB will record the source MAC address and ingress port number into an empty entry. This process is called ‘Learning’.

Address aging is used to keep the contents of the address table correct in a dynamic network topology. The look-up engine will update the time stamp information of an entry whenever the corresponding source MAC address appears. An entry will be invalid (aged out) if its time stamp information is not refreshed by the address learning process during the aging time period. The aging time of the RTL8363NB-VB is between 200 and 400 seconds (typical is 300 seconds).

9.5. SVL and IVL/SVL

The RTL8363NB-VB supports a 16-group Filtering Identifier (FID) for L2 search and learning. In default operation, all VLAN entries belong to the same FID. This is called Shared VLAN Learning (SVL). If VLAN entries are configured to different FIDs, then the same source MAC address with multiple FIDs can be learned into different look-up table entries. This is called Independent VLAN Learning and Shared VLAN Learning (IVL/SVL).

9.6. Illegal Frame Filtering

Illegal frames such as CRC error packets, runt packets (length <64 bytes), and oversize packets (length >maximum length) will be discarded by the RTL8363NB-VB. The maximum packet length may be set from 1518 bytes to 16K bytes.

9.7. IEEE 802.3 Reserved Group Addresses Filtering Control

The RTL8363NB-VB supports the ability to drop/forward IEEE 802.3 specified reserved group MAC addresses: 01-80-C2-00-00-00 to 01-80-C2-00-00-2F. The default setting enables forwarding of these reserved group MAC address control frames. Frames with group MAC address 01-80-C2-00-00-01 (802.3x Pause) and 01-80-C2-00-00-02 (802.3ad LACP) will always be filtered. Table 15 shows the Reserved Multicast Address (RMA) configuration mode from 01-80-C2-00-00-00 to 01-80-C2-00-00-2F.

Table 15. Reserved Multicast Address Configuration Table

Assignment	Value
Bridge Group Address	01-80-C2-00-00-00
IEEE Std 802.3, 1988 Edition, Full Duplex PAUSE Operation	01-80-C2-00-00-01
IEEE Std 802.3ad Slow Protocols-Multicast Address	01-80-C2-00-00-02
IEEE Std 802.1X PAE Address	01-80-C2-00-00-03
Provider Bridge Group Address	01-80-C2-00-00-08
Undefined 802.1 Address	01-80-C2-00-00-04 ~ 01-80-C2-00-00-07 & 01-80-C2-00-00-09 ~ 01-80-C2-00-00-0C & 01-80-C2-00-00-0F
Provider Bridge MVRP Address	01-80-C2-00-00-0D
IEEE Std 802.1AB Link Layer Discovery Protocol Address	01-80-C2-00-00-0E
All LANs Bridge Management Group Address	01-80-C2-00-00-10
Load Server Generic Address	01-80-C2-00-00-11
Loadable Device Generic Address	01-80-C2-00-00-12
Undefined 802.1 Address	01-80-C2-00-00-13 ~ 01-80-C2-00-00-17 & 01-80-C2-00-00-19 & 01-80-C2-00-00-1B ~ 01-80-C2-00-00-1F
Generic Address for All Manager Stations	01-80-C2-00-00-18
Generic Address for All Agent Stations	01-80-C2-00-00-1a
GMRP Address	01-80-C2-00-00-20
GVRP Address	01-80-C2-00-00-21
Undefined GARP Address	01-80-C2-00-00-22 01-80-C2-00-00-2F
CDP (Cisco Discovery Protocol)	01-00-0C-CC-CC-CC
CSSTP (Cisco Shared Spanning Tree Protocol)	01-00-0C-CC-CC-CD
LLDP	(01:80:c2:00:00:0e or 01:80:c2:00:00:03 or 01:80:c2:00:00:00) && ethertype = 0x88CC

9.8. Broadcast/Multicast/Unknown DA Storm Control

The RTL8363NB-VB enables or disables per-port broadcast/multicast/unknown DA storm control by setting registers (default is disabled). After the receiving rate of broadcast/multicast/unknown DA packets exceeds a reference rate (number of Kbps per second or number of packets per second), all other broadcast/multicast/unknown DA packets will be dropped. The reference rate is set via register configuration.

9.9. Port Security Function

The RTL8363NB-VB supports three types of security function to prevent malicious attacks:

- Per-port enable/disable SA auto-learning for an ingress packet
- Per-port enable/disable look-up table aging update function for an ingress packet
- Per-port enable/disable drop all unknown DA packets

9.10. MIB Counters

The RTL8363NB-VB supports a set of counters to support management functions.

- MIB-II (RFC 1213)
- Ethernet-Like MIB (RFC 3635)
- Interface Group MIB (RFC 2863)
- RMON (RFC 2819)
- Bridge MIB (RFC 1493)
- Bridge MIB Extension (RFC 2674)

9.11. Port Mirroring

The RTL8363NB-VB supports one set of port mirroring functions for all ports. The TX, or RX, or both TX/RX packets from multiple mirrored port can be mirrored to one monitor port.

9.12. VLAN Function

The RTL8363NB-VB supports 4096 VLAN groups. These can be configured as port-based VLANs, IEEE 802.1Q tag-based VLANs, and Protocol-based VLANs. Two ingress-filtering and egress-filtering options provide flexible VLAN configuration:

Ingress Filtering

- The acceptable frame type of the ingress process can be set to ‘Admit All’, ‘Admit only Untagged’ or ‘Admit only Tagged’
- ‘Admit’ or ‘Discard’ frames associated with a VLAN for which that port is not in the member set

Egress Filtering

- ‘Forward’ or ‘Discard’ Leaky VLAN frames between different VLAN domains
- ‘Forward’ or ‘Discard’ Multicast VLAN frames between different VLAN domains

The VLAN tag can be inserted or removed at the output port. The RTL8363NB-VB will insert a Port VID (PVID) for untagged frames, or remove the tag from tagged frames. The RTL8363NB-VB also supports a special insert VLAN tag function to separate traffic from the WAN and LAN sides in Router and Gateway applications.

9.12.1. Port-Based VLAN

This default configuration of the VLAN function can be modified via an attached Slave I2C-like serial Interface, or Slave Media Independent Interface Management (MIIM) Interface. The 4096-entry VLAN Table designed into the RTL8363NB-VB provides full flexibility for users to configure the input ports to associate with different VLAN groups. Each input port can join with more than one VLAN group.

Port-based VLAN mapping is the simplest implicit mapping rule. Each ingress packet is assigned to a VLAN group based on the input port. It is not necessary to parse and inspect frames in real-time to determine their VLAN association. All the packets received on a given input port will be forwarded to this port’s VLAN members.

9.12.2. IEEE 802.1Q Tag-Based VLAN

The RTL8363NB-VB supports 4096 VLAN entries to perform 802.1Q tag-based VLAN mapping. In 802.1Q VLAN mapping, the RTL8363NB-VB uses a 12-bit explicit identifier in the VLAN tag to associate received packets with a VLAN. The RTL8363NB-VB compares the explicit identifier in the VLAN tag with the 4096 VLAN Table to determine the VLAN association of this packet, and then forwards this packet to the member set of that VLAN. Two VIDs are reserved for special purposes. One of them is all 1’s, which is reserved and currently unused. The other is all 0’s, which indicates a priority tag. A priority-tagged frame should be treated as an untagged frame.

Two VLAN ingress filtering functions are supported in registers by the RTL8363NB-VB. One is the ‘VLAN tag admit control, which provides the ability to receive VLAN-tagged frames only. Untagged or priority tagged (VID=0) frames will be dropped. The other is ‘VLAN member set ingress filtering’, which will drop frames if the ingress port is not in the member set.

9.12.3. Protocol-Based VLAN

The RTL8363NB-VB supports a 4-group Protocol-based VLAN configuration. The packet format can be RFC 1042, LLC, or Ethernet, as shown in Figure 5. There are 4 configuration tables to assign the frame type and corresponding field value. Taking IP packet configuration as an example, the user can configure the frame type to be 'Ethernet', and value to be '0x0800'. Each table will index to one of the entries in the 4096-entry VLAN table. The packet stream will match the protocol type and the value will follow the VLAN member configuration of the indexed entry to forward the packets.

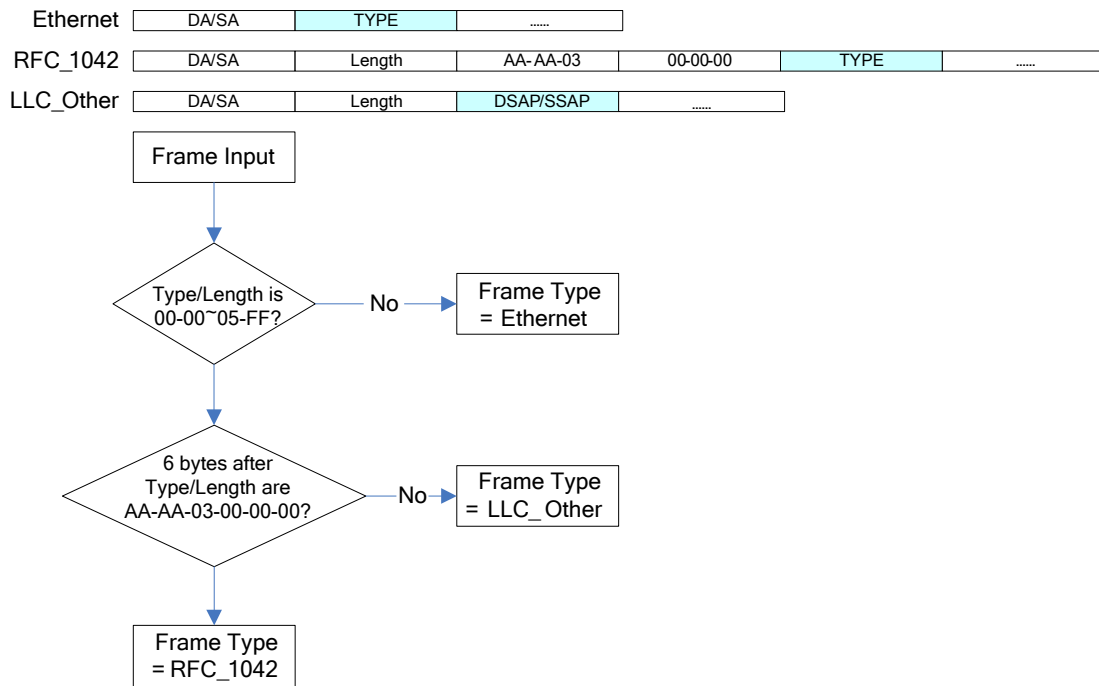


Figure 5. Protocol-Based VLAN Frame Format and Flow Chart

9.13. QoS Function

The RTL8363NB-VB supports 8 priority queues and input bandwidth control. Packet priority selection can depend on Port-based priority, 802.1p/Q Tag-based priority, IPv4/IPv6 DSCP-based priority, and ACL-based priority. When multiple priorities are enabled in the RTL8363NB-VB, the packet's priority will be assigned based on the priority selection table.

Each queue has one leaky bucket for Average Packet Rate. Per-queue in each output port can be set as Strict Priority (SP) or Weighted Round Robin (WRR), or Weighted Fair Queue (WFQ) for packet scheduling algorithm.

9.13.1. Input Bandwidth Control

Input bandwidth control limits the input bandwidth. When input traffic is more than the RX Bandwidth parameter, this port will either send out a 'pause ON' frame, or drop the input packet depending on register setup. Per-port input bandwidth control rates can be set from 8Kbps to 1Gbps (in 8Kbps steps).

9.13.2. Priority Assignment

Priority assignment specifies the priority of a received packet according to various rules. The RTL8363NB-VB can recognize the QoS priority information of incoming packets to give a different egress service priority.

The RTL8363NB-VB identifies the priority of packets based on several types of QoS priority information:

- Port-based priority
- 802.1p/Q-based priority
- IPv4/IPv6 DSCP-based priority
- ACL-based priority
- VLAN-based priority
- MAC-based priority
- SVLAN-based priority

9.13.3. Priority Queue Scheduling

The RTL8363NB-VB supports MAX-MIN packet scheduling.

Packet scheduling offers two modes:

- Average Packet Rate (APR) leaky bucket, which specifies the average rate of one queue
- Weighted Fair Queue (WFQ), which decides which queue is selected in one slot time to guarantee the minimal packet rate of one queue
- Weighted Round Robin (WRR)

In addition, each queue of each port can select Strict Priority or WFQ or WRR packet scheduling according to packet scheduling mode.

9.13.4. IEEE 802.1p/Q and DSCP Remarking

The RTL8363NB-VB supports the IEEE 802.1p/Q and IP DSCP (Differentiated Services Code Point) remarking function. When packets egress from one of the 8 queues, the packet's 802.1p/Q priority and IP DSCP can optionally be remarked to a configured value. 802.1p/Q priority & IP DSCP value can be remarked based on internal priority or original 802.1p/Q priority & IP DSCP value in packets.

9.13.5. ACL-Based Priority

The RTL8363NB-VB supports 48-entry ACL (Access Control List) rules. When a packet is received, its physical port, Layer2, Layer3, and Layer4 information are recorded and compared to ACL entries. If a received packet matches multiple entries, the entry with the lowest address is valid. If the entry is valid, the action bit will be applied to which related action bit is enable.

If a packet hits an ACL rule and the priority action bit is 'enable', then this packet gets a 3-bit ACL-priority from the ACL module.

9.14. IEEE 802.1x Function

The RTL8363NB-VB supports IEEE 802.1x Port-based/MAC-based Access Control.

- Port-Based Access Control for each port
- Authorized Port-Based Access Control for each port
- Port-Based Access Control Direction for each port
- MAC-Based Access Control for each port
- MAC-Based Access Control Direction
- Optional Unauthorized Behavior

9.14.1. Port-Based Access Control

Each port of the RTL8363NB-VB can be set to 802.1x port-based authenticated checking function usage and authorized status. Ports with 802.1X unauthorized status will drop received/transmitted frames.

9.14.2. Authorized Port-Based Access Control

If a dedicated port is set to 802.1x port-based access control, and passes the 802.1x authorization, then its port authorization status can be set to authorized.

9.14.3. Port-Based Access Control Direction

Ports with 802.1X unauthorized status will drop received/transmitted frames only when port authorization direction is 'BOTH'. If the authorization direction of an 802.1X unauthorized port is IN, incoming frames to that port will be dropped, but outgoing frames will be transmitted.

9.14.4. MAC-Based Access Control

MAC-Based Access Control provides authentication for multiple logical ports. Each logical port represents a source MAC address. There are multiple logical ports for a physical port. When a logical port or a MAC address is authenticated, the relevant source MAC address has the authorization to access the network. A frame with a source MAC address that is not authenticated by the 802.1x function will be dropped or trapped to the CPU.

9.14.5. MAC-Based Access Control Direction

Unidirectional and Bi-directional control are two methods used to process frames in 802.1x. As the system cannot predict which port the DA is on, a system-wide MAC-based access control direction setup is provided for determining whether receiving or bi-direction should be authorized.

If MAC-based access control direction is BOTH, then received frames with unauthenticated SA or unauthenticated DA will be dropped. When MAC-based access control direction is IN, only received frames with unauthenticated SA will be dropped.

9.14.6. Optional Unauthorized Behavior

Port-Based Network Access Control and MAC-Based Access Control offer a whole system control to determine unauthorized frame dropping, or trapping to CPU.

9.15. IEEE 802.1D Function

When using IEEE 802.1D, the RTL8363NB-VB supports 16 sets and four status' for each port for CPU implementation 802.1D (STP) and 802.1s (MSTP) function:

- Disabled: The port will not transmit/receive packets, and will not perform learning
- Blocking: The port will only receive BPDU spanning tree protocol packets, but will not transmit any packets, and will not perform learning
- Learning: The port will receive any packet, including BPDU spanning tree protocol packets, and will perform learning, but will only transmit BPDU spanning tree protocol packets
- Forwarding: The port will transmit/receive all packets, and will perform learning

The RTL8363NB-VB also supports a per-port transmission/reception enable/disable function. Users can control the port state via register.

9.16. Realtek Cable Test (RTCT)

The RTL8363NB-VB physical layer transceivers use DSP technology to implement the Realtek Cable Test (RTCT) feature. The RTCT function can be used to detect short, open or impedance mismatch in each differential pair. The RTL8363NB-VB also provides LED support to indicate test status and results.

9.17. LED Indicators

The RTL8363NB-VB supports parallel LEDs for each port. Each port has three LED indicator pins, LED0, LED1, and LED2. Each pin may have different indicator information (defined in Table 16). Refer to section 7.3 LED Pins, page 15 for pin details.

Table 16. LED Definitions

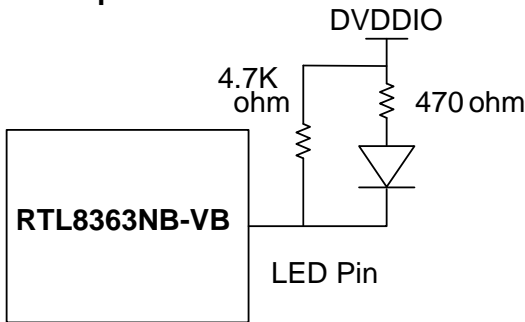
LED Status	Description
LED_Off	LED Output off.
Dup/Col	Duplex/Collision Indicator. Blinking when collision occurs. Low for full duplex, and high for half duplex mode.
Link/Act	Link, Activity Indicator. Low for link established. Link/Act Blinking when the corresponding port is transmitting or receiving.
Spd1000	1000Mbps Speed Indicator. Low for 1000Mbps.
Spd100	100Mbps Speed Indicator. Low for 100Mbps.
Spd10	10Mbps Speed Indicator. Low for 10Mbps.
Spd1000/Act	1000Mbps Speed/Activity Indicator. Low for 1000Mbps. Blinking when the corresponding port is transmitting or receiving.
Spd100/Act	100Mbps Speed/Activity Indicator. Low for 100Mbps. Blinking when the corresponding port is transmitting or receiving.
Spd10/Act	10Mbps Speed/Activity Indicator. Low for 10Mbps. Blinking when the corresponding port is transmitting or receiving.
Spd100 (10)/Act	10/100Mbps Speed/Activity Indicator. Low for 10/100Mbps. Blinking when the corresponding port is transmitting or receiving.
Act	Activity Indicator. Act blinking when the corresponding port is transmitting or receiving.

The LED pin also supports pin strapping configuration functions. The PnLED0, PnLED1, and PnLED2 pins are dual-function pins: input operation for configuration upon reset, and output operation for LED after reset. When the pin input is pulled high upon reset, the pin output is active low after reset. When the pin input is pulled down upon reset, the pin output is active high after reset (see Figure 6 and Figure 7). Typical values for pull-up/pull-down resistors are 4.7KΩ.

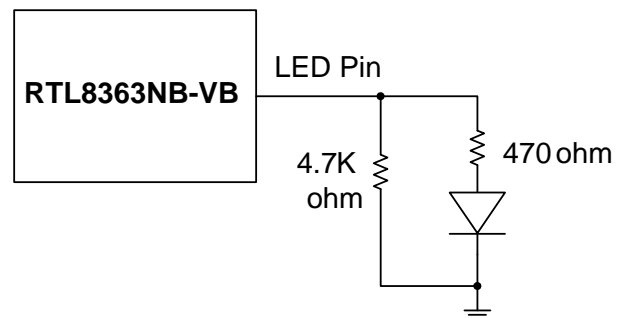
The PnLED1 can be combined with PnLED0 or PnLED2 as a Bi-color LED.

The PnLED1 should operate with the same polarity as other Bi-color LED pins. For example:

- P1LED1 should pull up upon reset if P1LED1 is combined with P1LED2 as a Bi-color LED, and P1LED2 input is pulled high upon reset. In this configuration, the output of these pins is active low after reset
- P1LED1 should be pulled down upon reset if P1LED1 is combined with P1LED2 as a Bi-color LED, and P1LED2 input is pulled down upon reset. In this configuration, the output of these pins is active high after reset

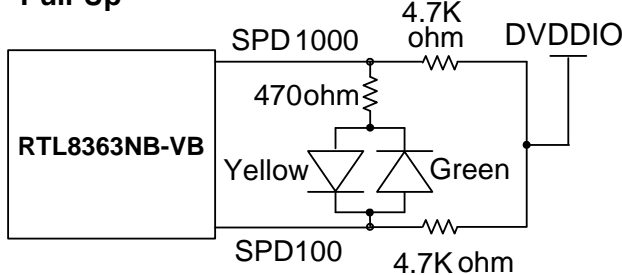
Pull-Up


LED Pins Output Active Low

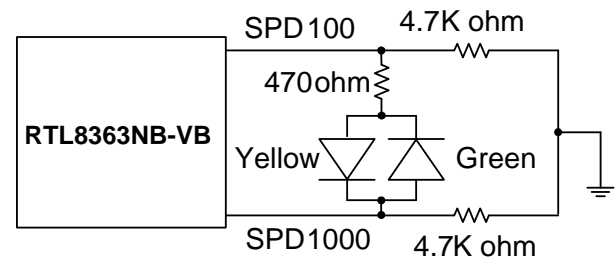
Pull-Down


LED Pins Output Active High

Figure 6. Pull-Up and Pull-Down of LED Pins for Single-Color LED

Pull-Up


LED Pins Output Active Low

Pull-Down


LED Pins Output Active High

Figure 7. Pull-Up and Pull-Down of LED Pins for Bi-Color LED

9.18. Green Ethernet

9.18.1. Link-On and Cable Length Power Saving

The RTL8363NB-VB provides link-on and dynamic detection of cable length and dynamic adjustment of power required for the detected cable length. This feature provides high performance with minimum power consumption.

9.18.2. Link-Down Power Saving

The RTL8363NB-VB implements link-down power saving on a per-port basis, greatly cutting power consumption when the network cable is disconnected. After it detects an incoming signal, it wakes up from link-down power saving and operates in normal mode.

9.19. IEEE 802.3az Energy Efficient Ethernet (EEE) Function

The RTL8363NB-VB supports IEEE 802.3az Energy Efficient Ethernet ability for 1000Base-T and 100Base-TX in full duplex operation.

The Energy Efficient Ethernet (EEE) optional operational mode combines the IEEE 802.3 Media Access Control (MAC) sub-layer with 100Base-TX and 1000Base-T Physical Layers defined to support operation in Low Power Idle mode. When Low Power Idle mode is enabled, systems on both sides of the link can disable portions of the functionality and save power during periods of low link utilization.

- For 1000Base-T PHY: Supports Energy Efficient Ethernet with the optional function of Low Power Idle
- For 100Base-TX PHY: Supports Energy Efficient Ethernet with the optional function of Low Power Idle

The RTL8363NB-VB MAC uses Low Power Idle signaling to indicate to the PHY, and to the link partner, that a break in the data stream is expected, and components may use this information to enter power saving modes that require additional time to resume normal operation. Similarly, it informs the LPI Client that the link partner has sent such an indication.

9.20. Interrupt Pin for External CPU

The RTL8363NB-VB provides one Interrupt output pin to interrupt an external CPU. The polarity of the Interrupt output pin can be configured via register access. In configuration registers, each port has link-up and link-down interrupt flags with mask.

When port link-up or link-down interrupt mask is enabled, the RTL8363NB-VB will raise the interrupt signal to alarm the external CPU. The CPU can read the interrupt flag to determine which port has changed to which status.

9.21. Regulator

The RTL8363NB-VB embeds a 3.3V-1.1V switch regulator to simplify the power solution. The 1.1V output power is used for the digital core and analog circuits. Do not use the regulator for other chips, even if the rating is enough.

10. Interface Descriptions

10.1. Master I2C for EEPROM Auto-load

The EEPROM interface of the RTL8363NB-VB uses the serial I2C bus to read the serial EEPROM. When the RTL8363NB-VB is powered up, it drives SCK and SDA to read the configuration data from the EEPROM by strapping configuration.

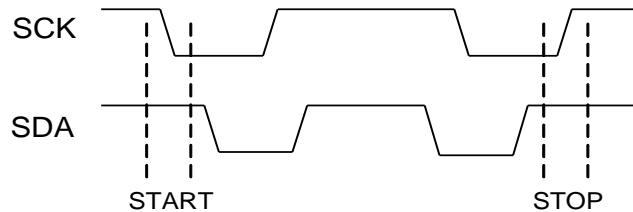


Figure 8. SMI Start and Stop Command

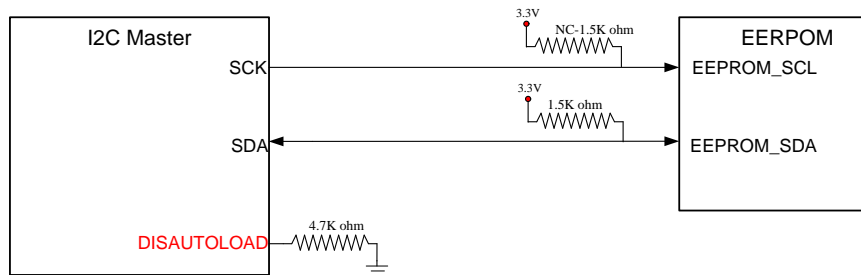


Figure 9. Master I2C for EEPROM Auto-load Interface Connection Example

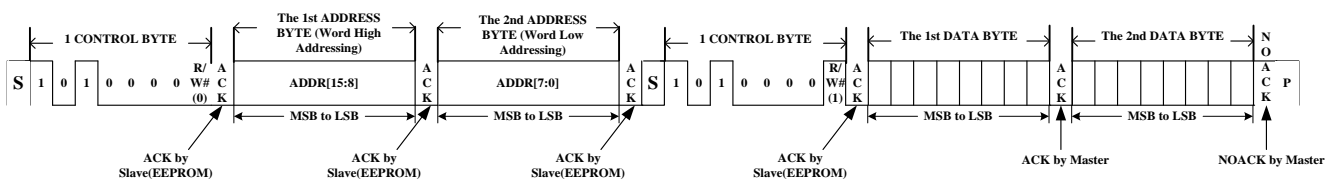


Figure 10. 16-Bit EEPROM Sequential Read

10.2. Realtek Slave I2C-Like Interface for External CPU to Access the RTL8363NB-VB

When EEPROM auto-load is complete, the RTL8363NB-VB registers can be accessed through SCK and SDA via an external CPU. The device address of the RTL8363NB-VB is 0x4. For the start and end of a write/read command, SCK needs one extra clock before/after the start/stop signals.

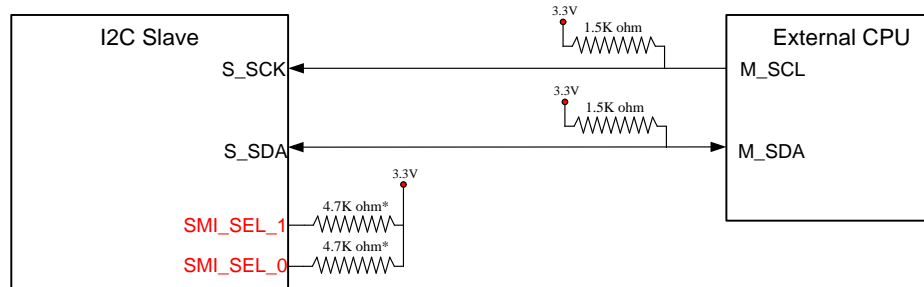


Figure 11. Realtek Slave I2C-Like for External CPU Access Interface Connection Example

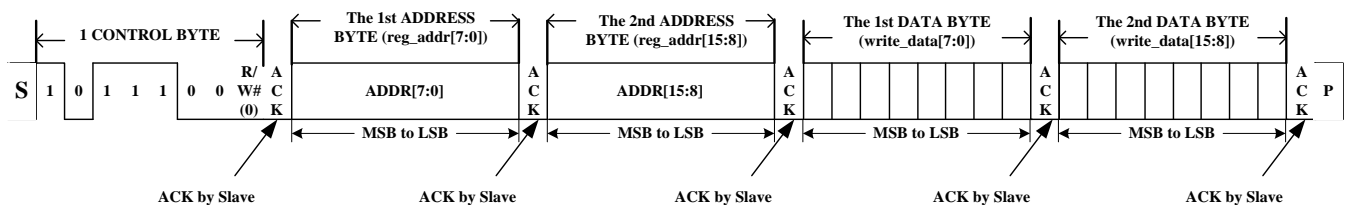


Figure 12. Realtek Slave I2C-Like Interface Write Command

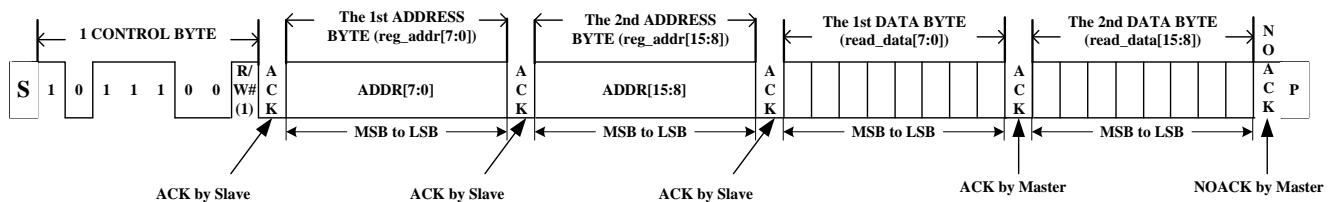


Figure 13. Realtek Slave I2C-Like Interface Read Command

10.3. Slave LSB I2C Interface for External CPU to Access the RTL8363NB-VB

When EEPROM auto-load is complete, the RTL8363NB-VB registers can be accessed through SCK and SDA via an external CPU. The device address of the RTL8363NB-VB is 0x4. For the start and end of a write/read command, SCK needs one extra clock before/after the start/stop signals.

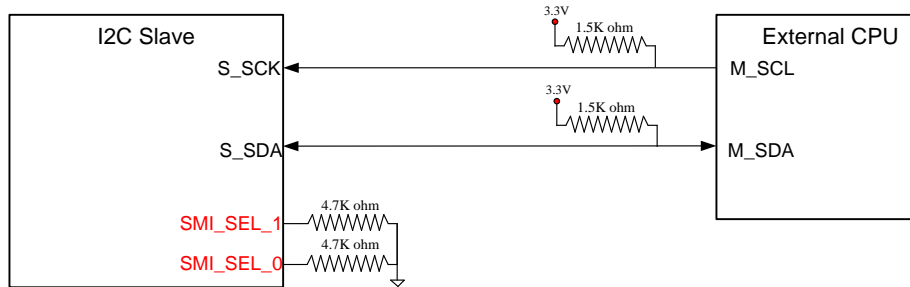


Figure 14. Slave LSB I2C for External CPU Access Interface Connection Example

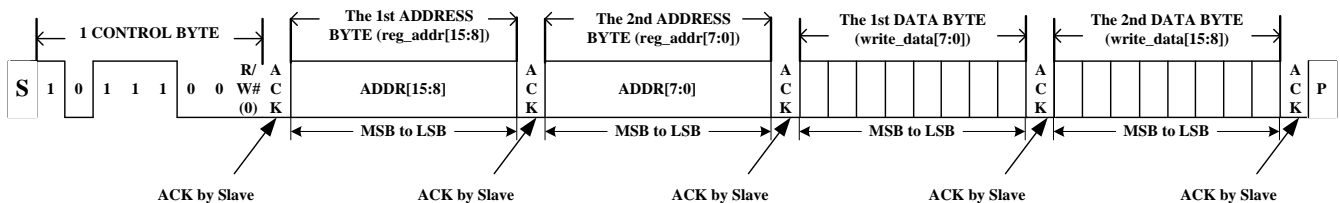


Figure 15. Slave LSB I2C Interface Write Command

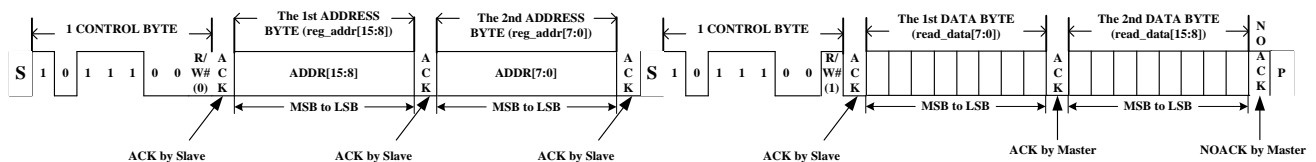


Figure 16. Slave LSB I2C Interface Read Command

10.4. Slave MSB I2C Interface for External CPU to Access the RTL8363NB-VB

When EEPROM auto-load is complete, the RTL8363NB-VB registers can be accessed through SCK and SDA via an external CPU. The device address of the RTL8363NB-VB is 0x4. For the start and end of a write/read command, SCK needs one extra clock before/after the start/stop signals.

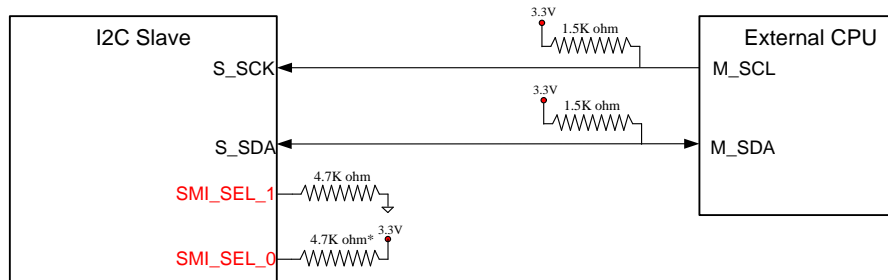


Figure 17. Slave MSB I2C for External CPU Access Interface Connection Example

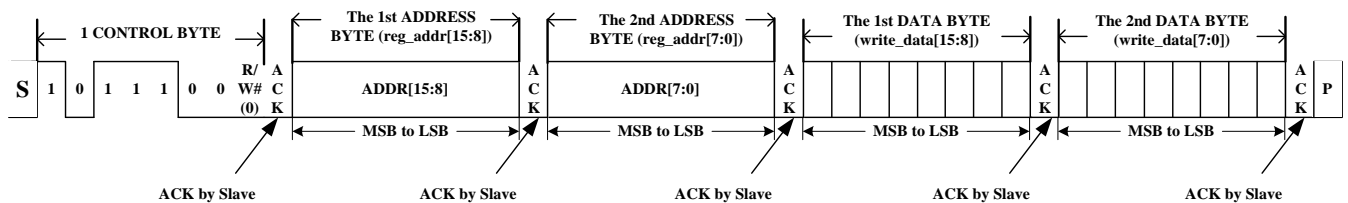


Figure 18. Slave MSB I2C Interface Write Command

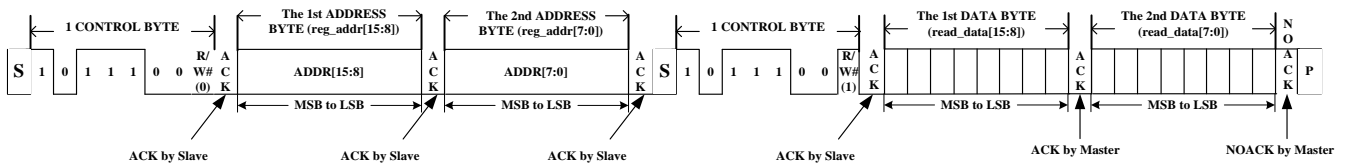


Figure 19. Slave MSB I2C Interface Read Command

10.5. Slave MII Management SMI Interface for External CPU to Access RTL8363NB-VB

The RTL8363NB-VB registers can be accessed via Slave MDC and MDIO via an external CPU (Decided by Strapping Configuration).

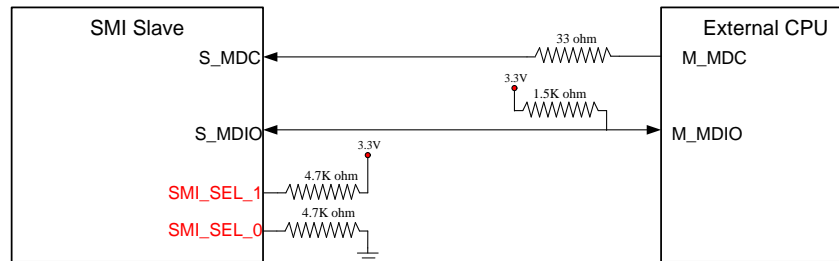


Figure 20. Slave MII Management SMI Interface Connection Example

Table 17. Slave MII Management SMI Access Format

	Management Frame Fields							IDLE
	PRE	ST	OP	DEVAD	REGAD	TA	DATA	
Read	1...1	01	10	AAAAA	RRRRR	Z0	DDDDDDDDDDDDDDDDDD	Z
Write	1...1	01	01	AAAAA	RRRRR	10	DDDDDDDDDDDDDDDDDD	Z

Note: By default the Slave needs no less than 32bit Preamble (PRE) before accessing the slave via the Slave SMI interface. An external CPU can configure the Slave to enable the preamble suppression function. When preamble suppression is enabled the Slave does not need preamble before accessing the slave.

10.6. General Purpose Interface

The RTL8363NB-VB supports an extension interface. The interface function mux is summarized in Table 18. The Extension GMAC1 of the RTL8363NB-VB supports RGMII, (T)MII MAC mode, or (T)MII PHY mode, or RMII mode via register configuration.

Table 18. RTL8363NB-VB Extension Port 1 Pin Definitions

Pin No.	Type	RGMII	(T)MII MAC Mode	(T)MII PHY Mode	RMII Mode
41	I _{PD}	-	M1M_CRS	-	-
42	O	RG1_TXD3	M1M_TXD3	M1P_RXD3	-
43	O	RG1_TXD2	M1M_TXD2	M1P_RXD2	-
44	O	RG1_TXD1	M1M_TXD1	M1P_RXD1	RM1M_TXD1
45	O	RG1_TXD0	M1M_TXD0	M1P_RXD0	RM1M_TXD0
46	O	RG1_TXCTL	M1M_TXEN	M1P_RXDV	RM1M_TXEN
47	I/O	RG1_TXCLK	M1M_TXCLK	M1P_RXCLK	RM1M_CLK
48	I/O	RG1_RXCLK	M1M_RXCLK	M1P_TXCLK	-
49	I	RG1_RXCTL	M1M_RXDV	M1P_TXEN	RM1M_CRS_DV
50	I	RG1_RXD0	M1M_RXD0	M1P_TXD0	RM1M_RXD0
51	I	RG1_RXD1	M1M_RXD1	M1P_TXD1	RM1M_RXD1
52	I	RG1_RXD2	M1M_RXD2	M1P_TXD2	-
53	I	RG1_RXD3	M1M_RXD3	M1P_TXD3	-

10.6.1. Extension Ports RGMII Mode (1Gbps)

The Extension GMAC1 of the RTL8363NB-VB supports RGMII interface connection to an external CPU. The pin numbers and names are shown in Table 19. Figure 21 shows the signal diagram for Extension Port 1 in RGMII interface.

Table 19. Extension GMAC1 RGMII Pins

RTL8363NB-VB Pin No.	Type	Extension Port 1 RGMII
42, 43, 44, 45	O	RG1_TXD[3:0]
46	O	RG1_TXCTL
47	O	RG1_TXCLK
48	I	RG1_RXCLK
49	I	RG1_RXCTL
50, 51, 52, 53	I	RG1_RXD[0:3]

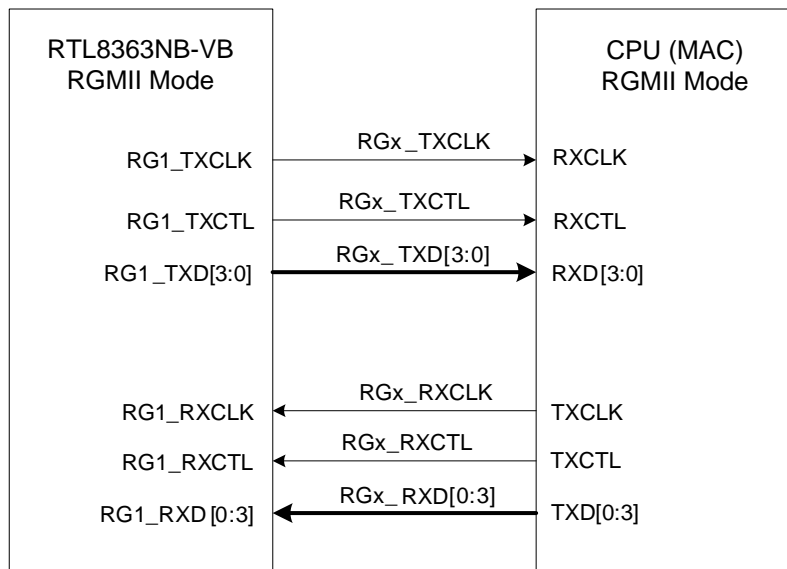


Figure 21. RGMII Mode Interface Signal Diagram

Note: The termination network on the transmitter (for example, a serial termination resistor) may be used for better signal integrity.

10.6.2. Extension Ports (T)MII MAC/PHY Mode Interface

The Extension GMAC1 of the RTL8363NB-VB supports (T)MII MAC/PHY mode interface connection to an external CPU. The pin numbers and names are shown in Table 20.

Figure 22, page 43, shows the signal diagram for the (T)MII PHY mode interface. Figure 23, page 44, shows the signal diagram for the MAC mode interface.

Table 20. Extension GMAC1 (T)MII Pins

RTL8363NB-VB Pin No.	Type	Extension Port 1 (T)MII MAC Mode	Type	Extension Port 1 (T)MII PHY Mode
41	I _{PD}	M1M_CRS	-	-
42, 43, 44, 45	O	M1M_TXD[3:0]	O	M1P_RXD[3:0]
46	O	M1M_TXEN	O	M1P_RXDV
47	I	M1M_TXCLK	O	M1P_RXCLK
48	I	M1M_RXCLK	O	M1P_TXCLK
49	I	M1M_RXDV	I	M1P_TXEN
50, 51, 52, 53	I	M1M_RXD[0:3]	I	M1P_TXD[0:3]

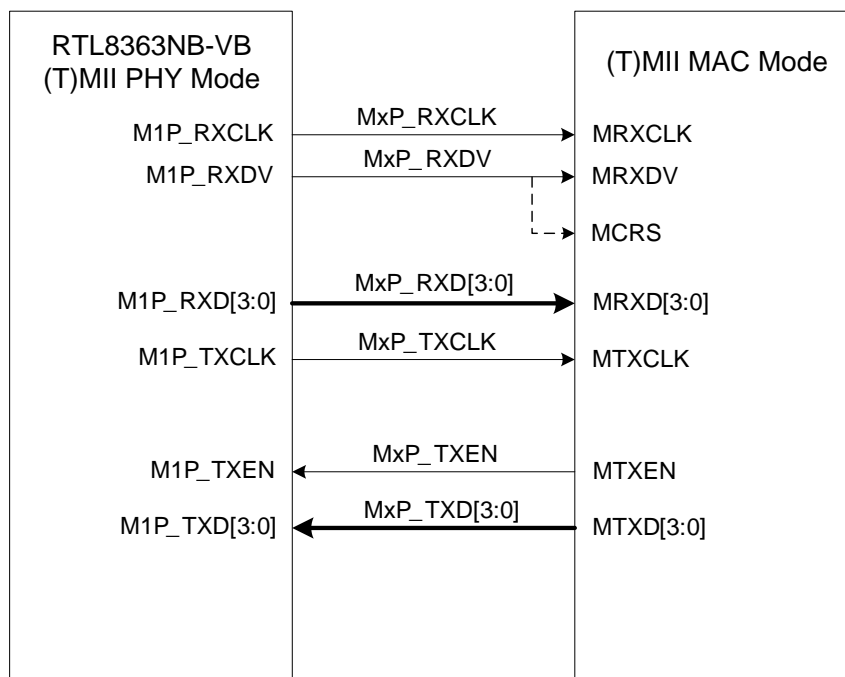


Figure 22. (T)MII PHY Mode Interface Signal Diagram

Note: The termination network on the transmitter (for example, a serial termination resistor) may be used for better signal integrity.

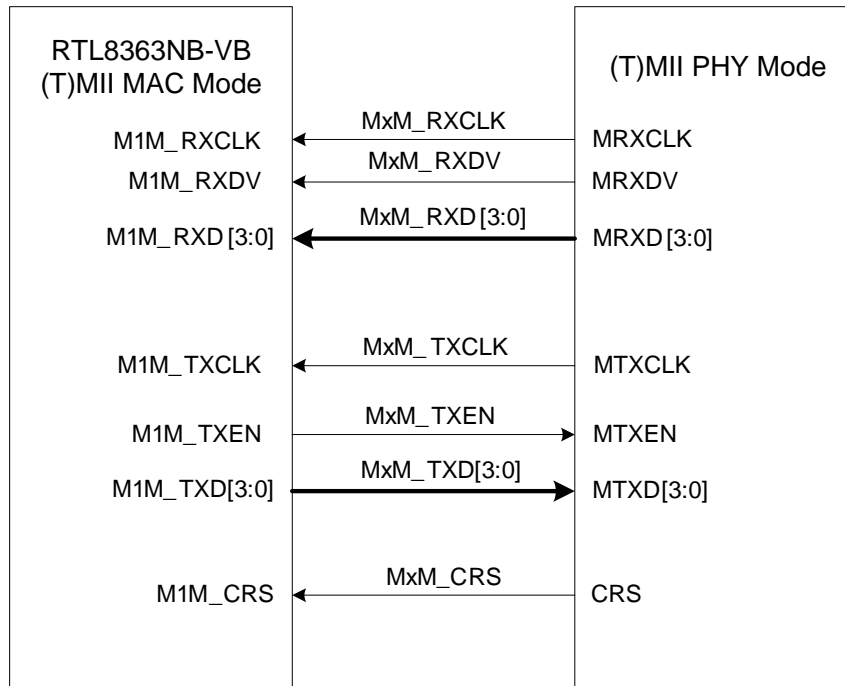


Figure 23. (T)MII MAC Mode Interface Signal Diagram

Note: The termination network on the transmitter (for example, a serial termination resistor) may be used for better signal integrity.

10.6.3. Extension Ports RMII Clock Input/Output Mode Interface (10/100Mbps)

The Extension GMAC1 of the RTL8363NB-VB supports RMII interfaces to connect with an external MAC or PHY device when register configuration is set to RMII mode interface. This RMII interface can be configured as RMII Clock Input or RMII Clock Output mode by register.

Table 21. Extension GMAC1 RMII Pins

Pin No.	Type	RMII
44	O	RM1M_TXD1
45	O	RM1M_TXD0
46	O	RM1M_TXEN
47	I/O	RM1M_CLK
49	I	RM1M_CRS_DV
50	I	RM1M_RXD0
51	I	RM1M_RXD1

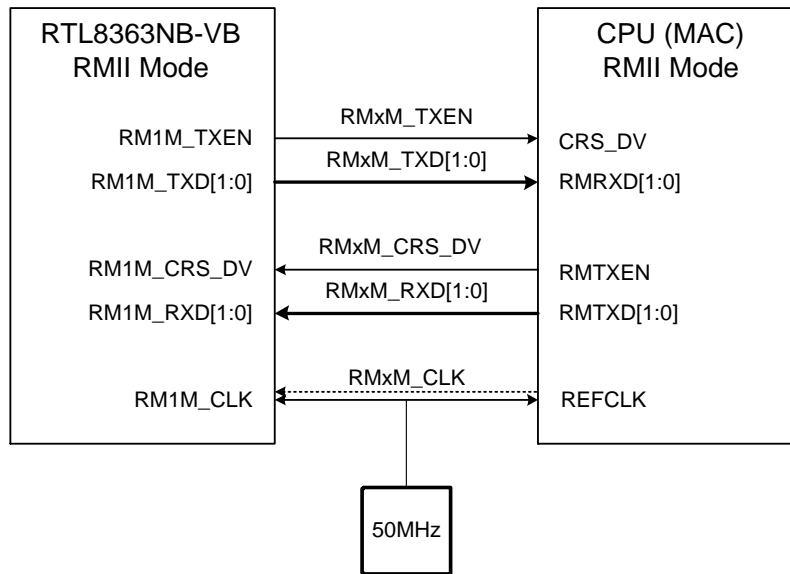


Figure 24. Signal Diagram of RMI Mode (Clock Input Mode)

Note: The termination network on the transmitter (for example, a serial termination resistor) may be used for better signal integrity.

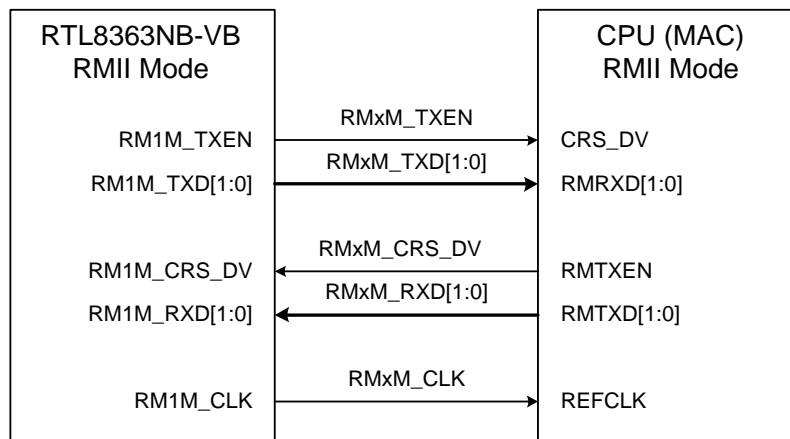


Figure 25. Signal Diagram of RMI Mode (Clock Output Mode)

Note: The termination network on the transmitter (for example, a serial termination resistor) may be used for better signal integrity.

11. Electrical Characteristics

11.1. Absolute Maximum Ratings

WARNING: Absolute maximum ratings are limits beyond which permanent damage may be caused to the device, or device reliability will be affected. All voltages are specified reference to GND unless otherwise specified.

Table 22. Absolute Maximum Ratings

Parameter	Min	Max	Units
Junction Temperature (Tj)	-	+125	°C
Storage Temperature	-45	+125	°C
DVDDIO, DVDDIO_1, AVDDH, HV_SWR Supply Referenced to GND, AGND, and GND_SWR	GND-0.3	+3.63	V
DVDDL, AVDDL, PLLVDDL Supply Referenced to GND, AGND, and GND_SWR	GND-0.3	+1.21	V
Digital Input Voltage	GND-0.3	VDDIO+0.3	V

11.2. Recommended Operating Range

Table 23. Recommended Operating Range

Parameter	Min	Typical	Max	Units
Ambient Operating Temperature (Ta)	0	-	70	°C
AVDDH, HV_SWR Supply Voltage Range	3.135	3.3	3.465	V
DVDDIO Supply Voltage Range	3.3V	3.3	3.465	V
	2.5V	2.375	2.626	V
	1.8V	1.710	1.890	V
DVDDIO_1 Supply Voltage Range (DVDDIO_1: Extension Port 1 Supports 1.8V, 2.5V, or 3.3V)	3.3V	3.3	3.465	V
	2.5V	2.375	2.626	V
	1.8V	1.710	1.890	V
DVDDL, AVDDL, PLLVDDL Supply Voltage Range	1.045	1.1	1.155	V

Note: In some cases, when DVDDIO is in 1.8V mode, the parallel LED pin of the RTL8363NB-VB may not be able to drive the parallel LED directly.

11.3. Thermal Characteristics

11.3.1. Assembly Description

Table 24. Assembly Description

Package	Type	QFN-76
	Dimension (L×W)	9×9 mm ²
	Thickness	0.65 mm
PCB	PCB Dimension (L×W)	80×70 mm ²
	PCB Thickness	1.6 mm
	Number of Cu Layer-PCB	80×82 mm

11.3.2. Material Properties

Table 25. Material Properties

Item		Material	Thermal Conductivity K (W/m-k)
Package	Die	Si	147
	Silver Paste	1033BF	2.5
	Lead Frame	CDA7025	168
	Mold Compound	7372	0.9
PCB		Cu	400
		FR4	0.2

11.3.3. Simulation Conditions

Table 26. Simulation Conditions

Input Power	1.0W
Test Board (PCB)	4L (2S2P) / 2L (1S1P)
Control Condition	Air Flow = 0m/s

11.3.4. Thermal Performance of QFN-76 on PCB Under Still Air Convection

Table 27. Thermal Performance of QFN-76 on PCB Under Still Air Convection

	θ_{JA}	θ_{JB}	θ_{JC}	Ψ_{JT}
4L PCB	22.9	5.95	9.5	0.25
2L PCB	27.2	7.27	10.2	0.29

Note:

θ_{JA} : Junction to ambient thermal resistance

θ_{JB} : Junction to board thermal resistance

θ_{JC} : Junction to case thermal resistance

Ψ_{JT} : Junction-to-top-center thermal characterization parameter

11.4. DC Characteristics

Table 28. DC Characteristics

Parameter	SYM	Min	Typical	Max	Units
System Idle (All UTP Ports Link Down, and 1 Extension Port is Configured as, without LEDs)					
Power Supply Current for VDDH	I_{DVDDIO}, I_{AVDDH}	-	15	-	mA
Power Supply Current for VDDL	$I_{DVDDL}, I_{AVDDL}, I_{PLLVDDL}$	-	59	-	mA
1000M Active (All UTP Ports Link/Active, and 1 Extension Port is Configured as RGMII, without LEDs)					
Power Supply Current for VDDH	I_{DVDDIO}, I_{AVDDH}	-	128	-	mA
Power Supply Current for VDDL	$I_{DVDDL}, I_{AVDDL}, I_{PLLVDDL}$	-	234	-	mA
Power Supply Current for RGMII1 DVDDIO_1 (3.3V)	I_{DVDDIO_1}	-	42	-	mA
Power Supply Current for RGMII1 DVDDIO_1 (2.5V)	I_{DVDDIO_1}	-	34	-	mA
Power Supply Current for RGMII1 DVDDIO_1 (1.8V)	I_{DVDDIO_1}	-	17	-	mA
VDDIO=3.3V					
TTL Input High Voltage	V_{ih}	2.0	-	-	V
TTL Input Low Voltage	V_{il}	-	-	0.7	V
Output High Voltage	V_{oh}	2.7	-	-	V
Output Low Voltage	V_{ol}	-	-	0.6	V
VDDIO=2.5V					
TTL Input High Voltage	V_{ih}	1.7	-	-	V
TTL Input Low Voltage	V_{il}	-	-	0.6	V
Output High Voltage	V_{oh}	2.25	-	-	V
Output Low Voltage	V_{ol}	-	-	0.4	V
VDDIO=1.8V					
TTL Input High Voltage	V_{ih}	1.2	-	-	V
TTL Input Low Voltage	V_{il}	-	-	0.6	V
Output High Voltage	V_{oh}	1.45	-	-	V
Output Low Voltage	V_{ol}	-	-	0.4	V

Note 1: Power Consumption test condition, $DVDDIO=3.3V$, $AVDDH=3.3V$, $DVDDIO_1=3.3V$, $DVDDL=1.1V$, $AVDDL=1.1V$, and $PLLVDDL=1.1V$. Embedded Switch Regulator disabled.

Note 2: I_{DVDDIO_1} should be added to the total current consumption when the extension port of the RTL8363NB-VB is used.

11.5. Switch Regulator

Table 29. Switch Regulator

Symbol	Parameter	Min	Typ	Max	Units
F_{sw}	Oscillator Frequency	-	2	-	MHz
T_{ss}	Soft-Start Time	-	1.5	-	ms

11.6. AC Characteristics

11.6.1. Master I2C for EEPROM Auto-load Interface Timing Characteristics

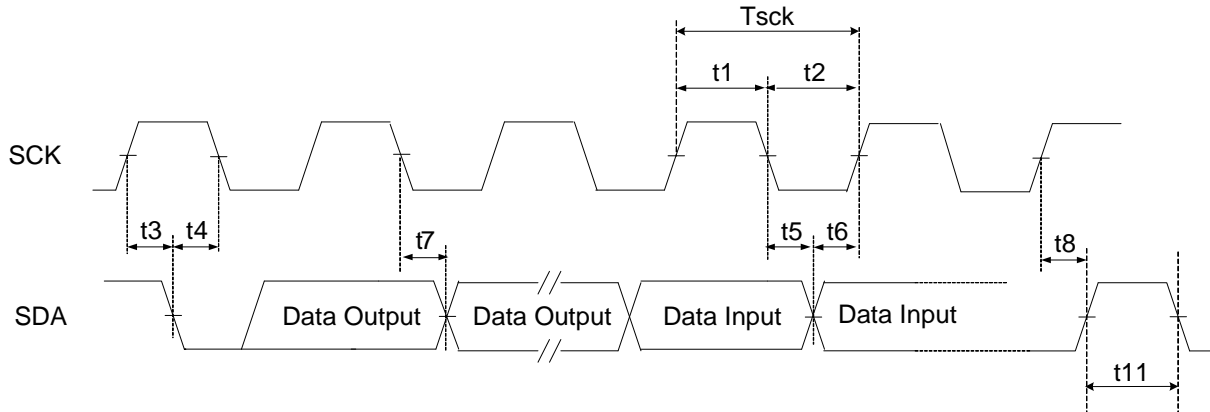


Figure 26. Master I2C for EEPROM Auto-load Timing Characteristics

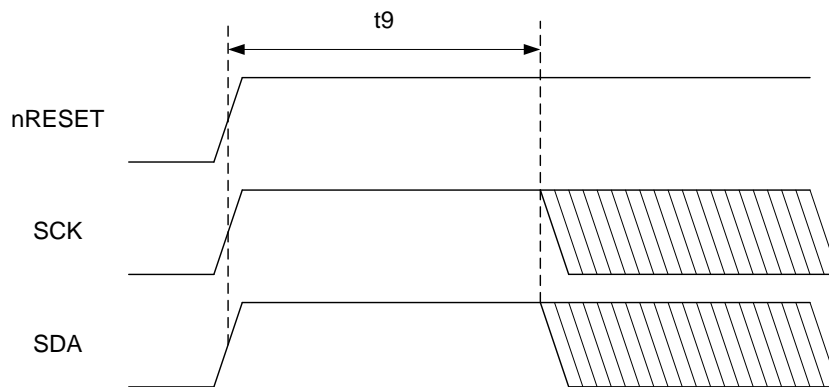


Figure 27. SCK/SDA Power on Timing

Table 30. Master I2C for EEPROM Auto-load Timing Characteristics

Symbol	Description	Type	Min	Typical	Max	Units
T _{sck}	SCK Clock Period	O	-	9	-	μs
t ₁	SCK High Time	O	4.05	4.5	-	μs
t ₂	SCK Low Time	O	4.05	4.5	-	μs
t ₃	START Condition Setup Time	O	2	-	-	μs
t ₄	START Condition Hold Time	O	2	-	-	μs
t ₅	Data Input Hold Time	O	0	-	-	μs
t ₆	Data Input Setup Time	O	10	-	-	μs
t ₇	Data output delay	O	2.15	-	2.35	μs
t ₈	STOP Condition Setup Time	O	2	-	-	μs
t ₉	SCK/SDA Active from Reset Ready	O	-	76.8	-	ms

Symbol	Description	Type	Min	Typical	Max	Units
t11	Time the bus free before new START	O	10	-	-	μs
-	SCK Rise Time (10% to 90%)	O	-	-	100	ns
-	SCK Fall Time (90% to 10%)	O	-	-	100	ns
-	Duty Cycle	O	40	50	60	%

11.6.2. Slave I2C-like Mode Timing Characteristics

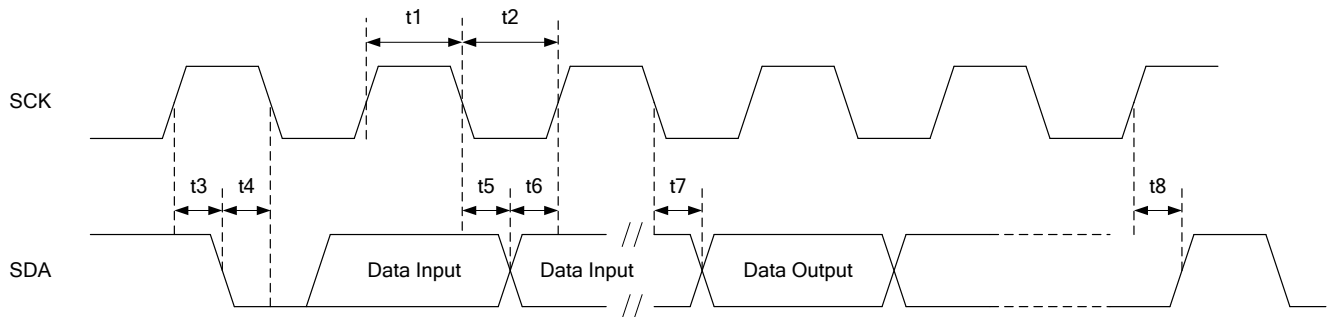


Figure 28. Slave I2C-like Mode Timing Characteristics

Table 31. Slave I2C-like Mode Timing Characteristics

Symbol	Description	Type	Min	Typical	Max	Units
t1	SCK High Time	I	250	-	-	ns
t2	SCK Low Time	I	250	-	-	ns
t3	START Condition Setup Time	I	150	-	-	ns
t4	START Condition Hold Time	I	150	-	-	ns
t5	Data Hold Time	I	150	-	-	ns
t6	Data Setup Time	I	150	-	-	ns
t7	Clock to Data Output Delay	O	10	-	100	ns
t8	STOP Condition Setup Time	I	150	-	-	ns

11.6.3. Slave MII Management SMI for External CPU Access Interface Timing Characteristics

The RTL8363NB-VB supports MDIO slave mode. The Master (CPU) can access the Slave (RTL8363NB-VB) registers via the MDIO interface. The MDIO is a bi-directional signal that can be sourced by the Master or the Slave. In a write command, the master sources the MDIO signal. In a read command, the slave sources the MDIO signal.

- The timing characteristics t_1 , t_2 , and t_3 (Table 32) of the Master (the RTL8363NB-VB link partner CPU) are provided by the Master when the Master sources the MDIO signal (Write command)
- The timing characteristic t_4 (Table 32) of the Slave (RTL8363NB-VB) are provided by the RTL8363NB-VB when the RTL8363NB-VB sources the MDIO signal (Read command)

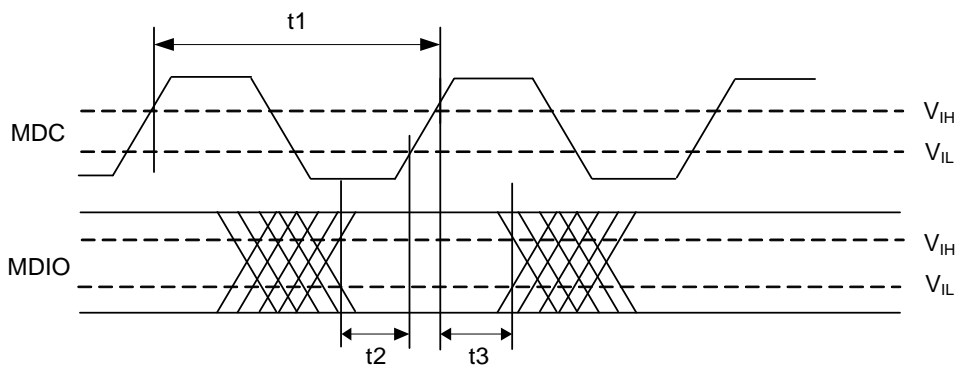


Figure 29. MDIO Sourced by the Master

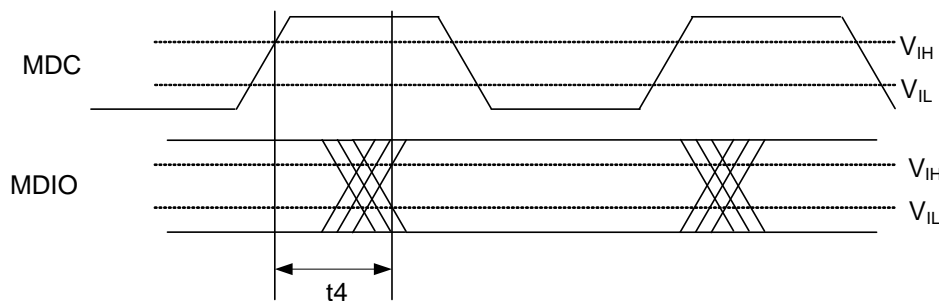


Figure 30. MDIO Sourced by the RTL8363NB-VB (Slave)

Table 32. MDIO Timing Characteristics and Requirement

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
MDC Clock Period	t_1	Clock Period	I	125	-	-	ns
MDIO to MDC Rising Setup Time (Write Data)	t_2	Input Setup Time	I	8	-	-	ns
MDIO to MDC Rising Hold Time (Write Data)	t_3	Input Hold Time	I	8	-	-	ns
MDC to MDIO Delay Time (Read Data)	t_4	Clock (Rising Edge) to Data Delay Time	O	0	-	80	ns

11.6.4. (T)MII MAC Mode Timing

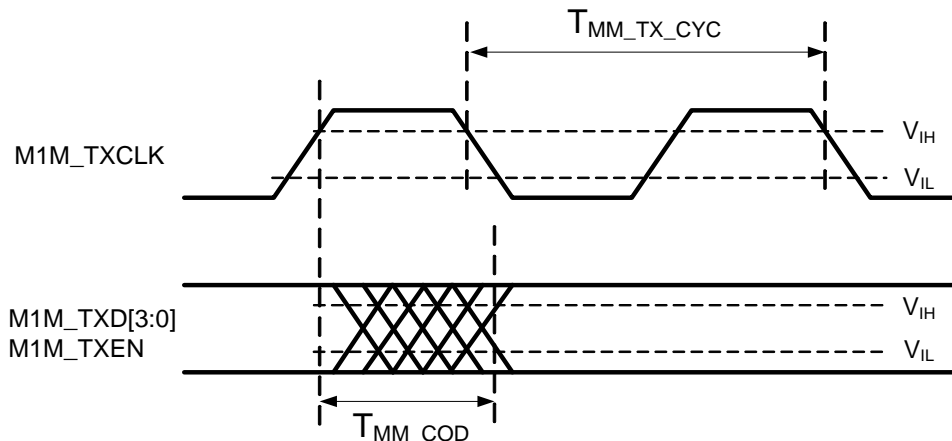


Figure 31. (T)MII MAC Mode Clock to Data Output Delay Timing

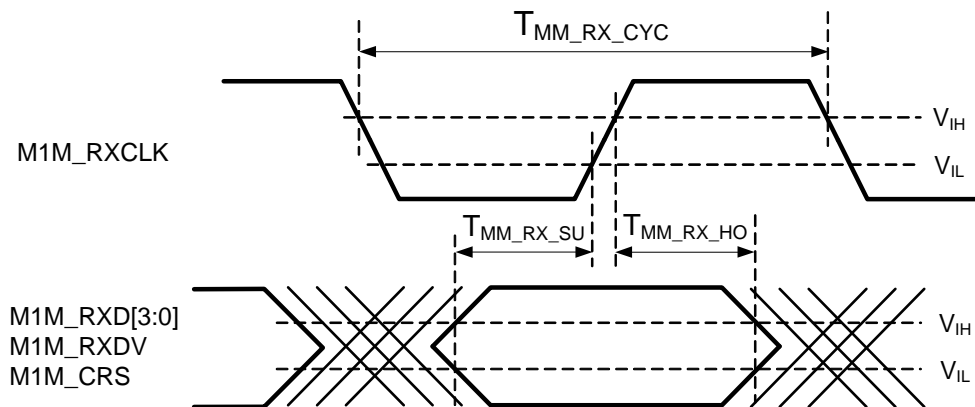


Figure 32. (T)MII MAC Mode Input Timing

Table 33. MII MAC Mode Timing

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
100Base-TX M1M_TXCLK and M1M_RXCLK Input Cycle Time	$T_{MM_TX_CYC}$ $T_{MM_RX_CYC}$	25MHz Clock Input.	I	-	40	-	ns
10Base-T M1M_TXCLK and M1M_RXCLK Input Cycle Time	$T_{MM_TX_CYC}$ $T_{MM_RX_CYC}$	2.5MHz Clock Input.	I	-	400	-	ns
M1M_TXCLK to M1M_TXD[3:0] and M1M_TXEN Output Delay Time	T_{MM_COD}	-	O	2	-	8	ns
M1M_RXD[3:0], M1M_RXDV, and M1M_CRD Input Setup Time	$T_{MM_RX_SU}$	-	I	10	-	-	ns
M1M_RXD[3:0], M1M_RXDV, and M1M_CRD Input Hold Time	$T_{MM_RX_HO}$	-	I	10	-	-	ns

Table 34. TMII MAC Mode Timing

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
100Base-TX M1M_TXCLK and M1M_RXCLK Input Cycle Time	$T_{MM_TX_CYC}$ $T_{MM_RX_CYC}$	25MHz Clock Input.	I	-	20	-	ns
10Base-T M1M_TXCLK and M1M_RXCLK Input Cycle Time	$T_{MM_TX_CYC}$ $T_{MM_RX_CYC}$	2.5MHz Clock Input.	I	-	200	-	ns
M1M_TXCLK to M1M_TXD[3:0] and M1M_TXEN Output Delay Time	T_{MM_COD}	-	O	2	-	8	ns
M1M_RXD[3:0], M1M_RXDV, and M1M_CRD Input Setup Time	$T_{MM_RX_SU}$	-	I	5	-	-	ns
M1M_RXD[3:0], M1M_RXDV, and M1M_CRD Input Hold Time	$T_{MM_RX_HO}$	-	I	5	-	-	ns

11.6.5. (T)MII PHY Mode Timing

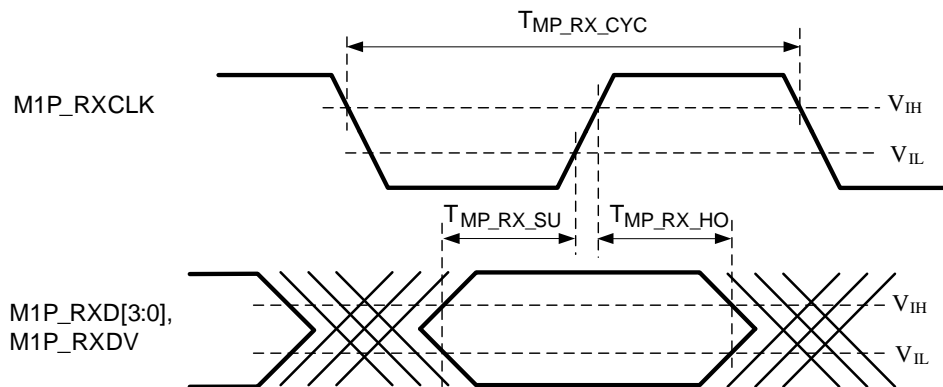
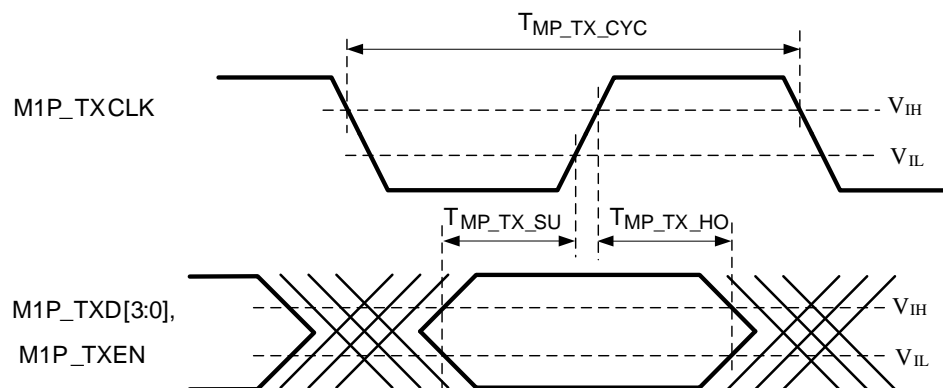

Figure 33. (T)MII PHY Mode Output Timing

Figure 34. (T)MII PHY Mode Input Timing

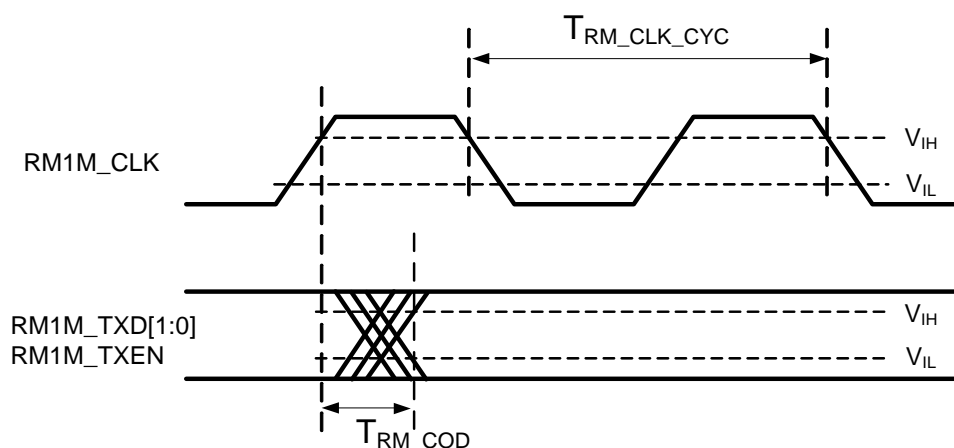
Table 35. MII PHY Mode Timing Characteristics

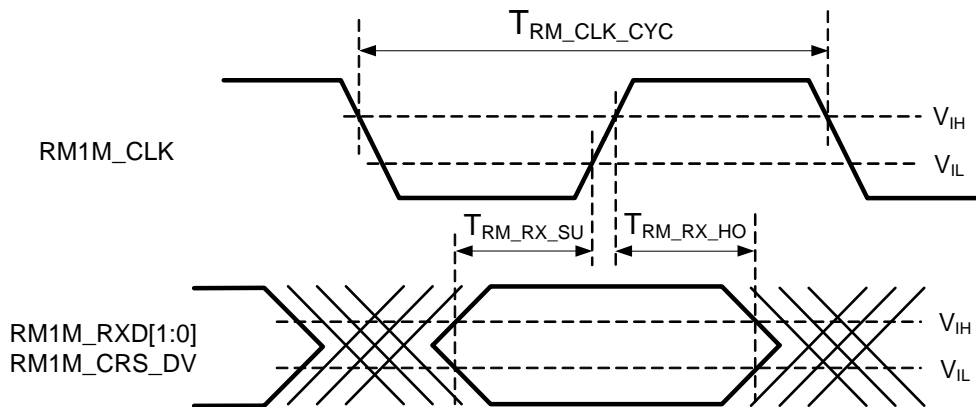
Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
M1P_RXCLK and M1P_TXCLK Output Cycle Time	$T_{MP_RX_CYC}$ $T_{MP_TX_CYC}$	25MHz Clock Output.	O	-	40	-	ns
M1P_RXCLK and M1P_TXCLK Output Cycle Time	$T_{MP_RX_CYC}$ $T_{MP_TX_CYC}$	2.5MHz Clock Output.	O	-	400	-	ns
M1P_RXD[3:0] and M1P_RXDV to M1P_RXCLK Output Setup Time	$T_{MP_RX_SU}$	-	O	14	-	-	ns
M1P_RXD[3:0] and M1P_RXDV to M1P_RXCLK Output Hold Time	$T_{MP_RX_HO}$	-	O	16	-	-	ns
M1P_TXD[3:0], M1P_TXEN to M1P_TXC Input Setup Time	$T_{MP_TX_SU}$	-	I	6	-	-	ns
M1P_TXD[3:0], M1P_TXEN to M1P_TXC Input Hold Time	$T_{MP_TX_HO}$	-	I	0	-	-	ns

Table 36. TMII PHY Mode Timing Characteristics

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
M1P_RXCLK and M1P_TXCLK Output Cycle Time	$T_{MP_RX_CYC}$ $T_{MP_TX_CYC}$	25MHz Clock Output.	O	-	20	-	ns
M1P_RXCLK and M1P_TXCLK Output Cycle Time	$T_{MP_RX_CYC}$ $T_{MP_TX_CYC}$	2.5MHz Clock Output.	O	-	200	-	ns
M1P_RXD[3:0] and M1P_RXDV to M1P_RXCLK Output Setup Time	$T_{MP_RX_SU}$	-	O	7	-	-	ns
M1P_RXD[3:0] and M1P_RXDV to M1P_RXCLK Output Hold Time	$T_{MP_RX_HO}$	-	O	8	-	-	ns
M1P_TXD[3:0], M1P_TXEN to M1P_TXC Input Setup Time	$T_{MP_TX_SU}$	-	I	6	-	-	ns
M1P_TXD[3:0], M1P_TXEN to M1P_TXC Input Hold Time	$T_{MP_TX_HO}$	-	I	0	-	-	ns

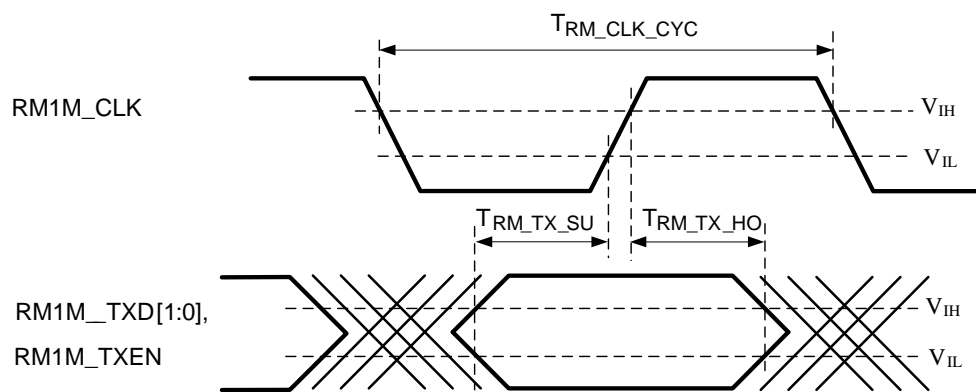
11.6.6. RMII Clock Input Mode Timing

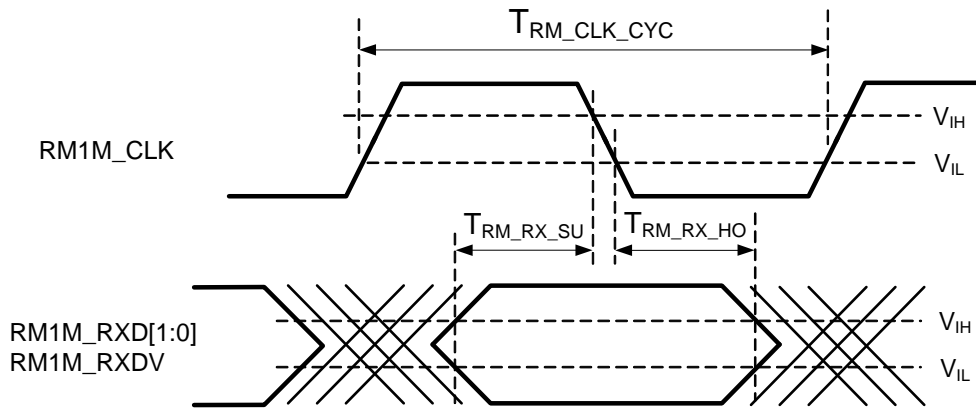

Figure 35. RMII Clock Input Mode Clock to Data Output Delay Timing


Figure 36. RMIIClock Input Mode Input Timing
Table 37. RMIIClock Input Mode Timing Characteristics

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
RM1M_CLK Input Cycle Time	$T_{RM_CLK_CYC}$	50MHz Clock Input.	I	-	20	-	ns
RM1M_CLK Input to RM1M_TXD[1:0], M1M_TXEN Output Delay Time	T_{RM_COD}	-	O	2	-	10.5	ns
RM1M_RXD[1:0], RM1M_CRSDV Input Setup Time	$T_{RM_RX_SU}$	-	I	4	-	-	ns
RM1M_RXD[1:0], RM1M_CRSDV Input Hold Time	$T_{RM_RX_HO}$	-	I	3	-	-	ns

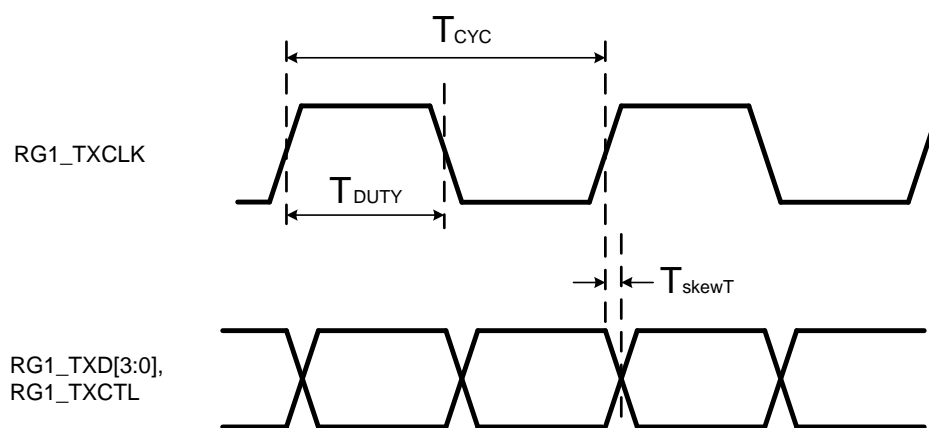
11.6.7. RMIIClock Output Mode Timing


Figure 37. RMIIClock Output Mode Output Timing


Figure 38. RMII Clock Output Mode Input Timing
Table 38. RMII Clock Output Mode Timing Characteristics

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
RM1M_CLK Output Cycle Time	$T_{RM_CLK_CYC}$	50MHz Clock Output.	O	-	20	-	ns
RM1M_CLK Duty cycle	-	-	O	45	50	55	%
RM1M_RXD[3:0], and RM1M_CRS_DV to RM1M_CLK Output Setup Time	$T_{RM_TX_SU}$	-	O	5	-	-	ns
RM1M_TXD[1:0], and RM1M_TXEN to RM1M_CLK Output Hold Time	$T_{RM_TX_HO}$	-	O	8	-	-	ns
RM1M_RXD[1:0], RM1M_CRS_DV Input Setup Time	$T_{RM_RX_SU}$	-	I	4	-	-	ns
RM1M_RXD[1:0], RM1M_CRS_DV Input Hold Time	$T_{RM_RX_HO}$	-	I	0	-	-	ns

11.6.8. RGMII Timing Characteristics


Figure 39. RGMII Output Timing Characteristics (RGx_TXCLK_DELAY=0)

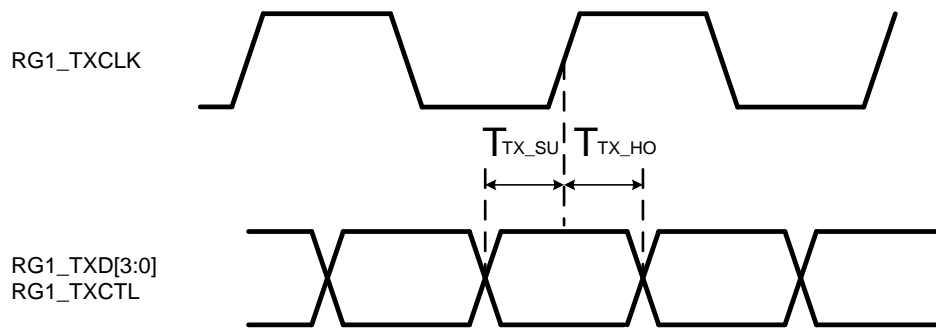


Figure 40. RGMII Output Timing Characteristics (RGx_TXCLK_DELAY=2ns)

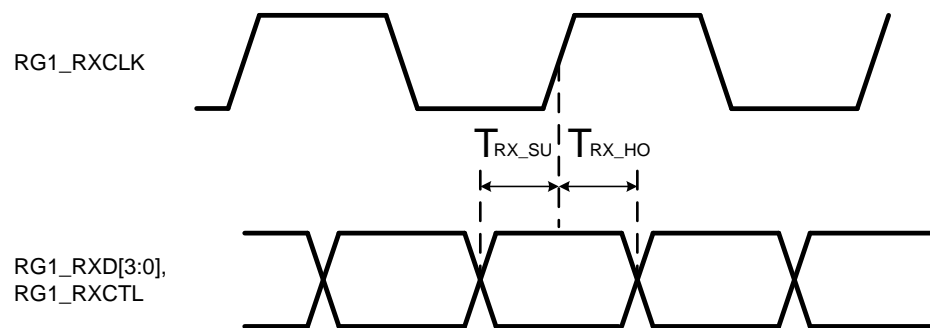


Figure 41. RGMII Input Timing Characteristics (RGx_RXCLK_DELAY=0)

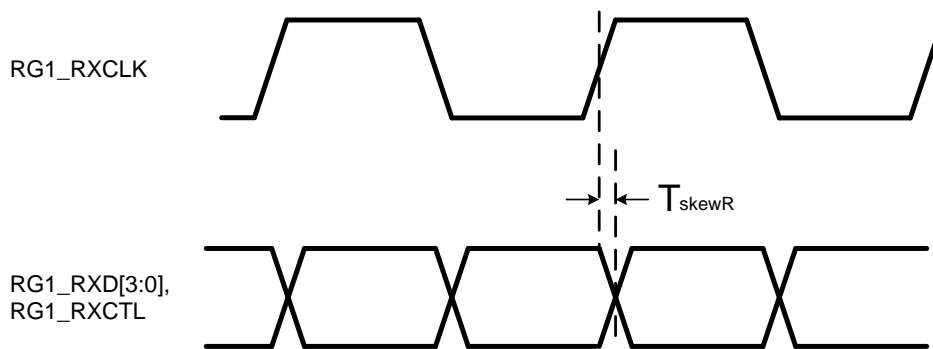


Figure 42. RGMII Input Timing Characteristics (RGx_RXCLK_DELAY=2ns)

Table 39. RGMII Timing Characteristics

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
1000M RG1_TXCLK Output Cycle Time	T _{TX_CYC}	125MHz Clock Output. Refer to Figure 39, page 56.	O	7.6	8	8.6	ns
100M RG1_TXCLK Output Cycle Time	T _{TX_CYC}	25MHz Clock Output. Refer to Figure 39, page 56.	O	38	40	42	ns
10M RG1_TXCLK Output Cycle Time	T _{TX_CYC}	2.5MHz Clock Output. Refer to Figure 39, page 56.	O	380	400	420	ns
RG1_TXD[3:0] and RG1_TXCTL to RG1_TXCLK Output Skew	T _{skewT}	Disable Output Clock Delay. (RGx_TXCLK_DELAY=0). Refer to Figure 39, page 56.	O	-500	-	500	ps
RG1_TXD[3:0] and RG1_TXCTL to RG1_TXCLK Output Setup Time	T _{TX_SU}	Enable Output Clock Delay. (RGx_TXCLK_DELAY=1). Refer to Figure 40, page 57.	O	1.2	-	-	ns
RG1_TXD[3:0] and RG1_TXCTL to RG1_TXCLK Output Hold Time	T _{TX_HO}	Enable Output Clock Delay. (RGx_TXCLK_DELAY=1). Refer to Figure 40, page 57.	O	1.2	-	-	ns
RG1_RXD[3:0] and RG1_RXCTL to RG1_RXCLK Input Setup Time	T _{RX_SU}	Disable Input Clock Delay. (RGx_RXCLK_DELAY=0). Refer to Figure 41, page 57.	I	1.0	-	-	ns
RG1_RXD[3:0] and RG1_RXCTL to RG1_RXCLK Input Hold Time	T _{RX_HO}	Disable Input Clock Delay. (RGx_RXCLK_DELAY=0). Refer to Figure 41, page 57.	I	1.0	-	-	ns
RG1_RXD[3:0] and RG1_RXCTL to RG1_RXCLK Input Skew	T _{skewR}	Enable Input Clock Delay. (RGx_RXCLK_DELAY=1). Refer to Figure 42, page 57.	I	-600	-	600	ps

11.6.9. Power and Reset Characteristics

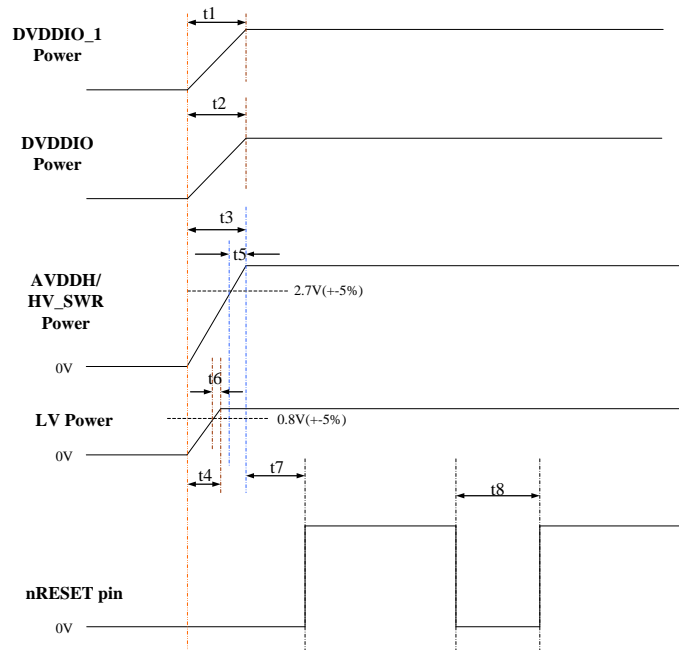


Figure 43. Power and Reset Characteristics

Table 40. Power and Reset Characteristics

Parameter	SYM	Description/Condition	Type	Min	Typical	Max	Units
DVDDIO_1 Rising Time	t1	DVDDIO_1 power rise settling time	I	0.5	-	-	ms
DVDDIO Rising Time	t2	DVDDIO power rise settling time	I	0.5	-	-	ms
HV Power Rising Time	t3	AVDDH, HV_SWR(If embedded SWR be used) power rise settling time	I	0.5	-	-	ms
LV Power Rising Time	t4	DVDDL and AVDDL power rise settling time	I	0.1	-	-	ms
HV Power Ready Time after more than HV POR threshold	t5	The duration from HV power more than HV POR threshold to HV power ready	I	-	-	10	ms
LV Power Ready Time after more than LV POR threshold	t6	The duration from LV power more than LV POR threshold to LV power ready	I	-	-	10	ms
Reset Delay Time	t7	The duration from 'all power steady' to the reset signal released to high	I	10	-	-	ms
Reset Low Time	t8	The duration of reset signal remaining low time before issuing a reset to RTL8363NB-VB	I	10	-	-	ms

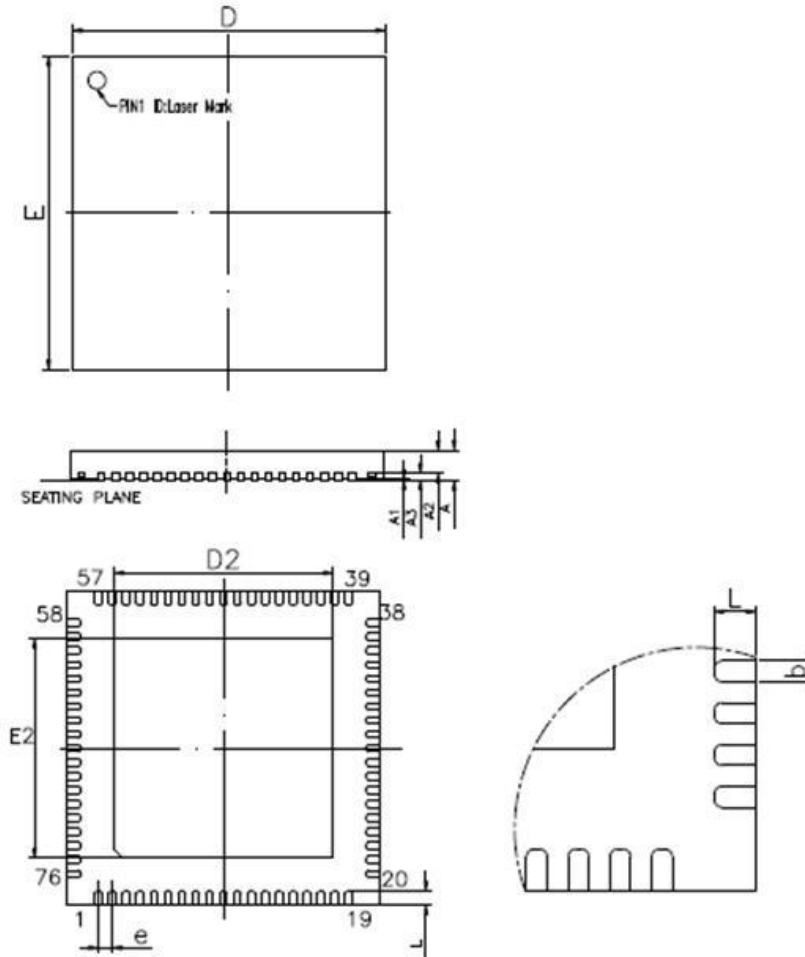
Note 1: If the powers supply voltage of the RTL8363NB-VB lower than normal operation condition happened, the Power On Reset (POR) or Pin Reset is needed for normal operation of the RTL8363NB-VB.

Note 2: AVDDH power must be ready no later than HV_SWR power if embedded SWR be used.

Note 3: AVDDH and LV power must be ready no later than DVDDIO_1 and DVDDIO power.

12. Mechanical Dimensions

Low Profile Plastic Quad Flat Package 76 Leads 9×9mm Outline



Symbol	Dimension in mm			Dimension in inch		
	Min	Nom	Max	Min	Nom	Max
A	0.80	0.85	0.90	0.031	0.033	0.035
A ₁	0.00	0.02	0.05	0.000	0.001	0.002
A ₂	-	0.65	0.70	-	0.026	0.028
A ₃	0.2 REF			0.008 REF		
b	0.15	0.20	0.25	0.006	0.008	0.010
D/E	9.00 BSC			0.354 BSC		
D ₂ /E ₂	6.05	6.30	6.55	0.238	0.248	0.258
e	0.40 BSC			0.016 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020

Note 1: CONTROLLING DIMENSION: MILLIMETER (mm).

Note 2: REFERENCE DOCUMENT: JEDEC MO-220.

13. Ordering Information

Table 41. Ordering Information

Part Number	Package	Status
RTL8363NB-VB-CG	QFN 76-Pin 'Green' Package	Mass Production

Note: See page 7 for package identification.

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