

REALTEK

ETHERNET CONTROLLER DEEP SLUMBER MODE (DSM)

APPLICATION NOTES (CONFIDENTIAL: Development Partners Only)

Rev. 1.7

23 March 2009

Track ID: JATR-1076-21



Realtek Semiconductor Corp.

No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan

Tel.: +886-3-578-0211. Fax: +886-3-577-6047

www.realtek.com

COPYRIGHT

©2009 Realtek Semiconductor Corp. All rights reserved. No part of this document may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language in any form or by any means without the written permission of Realtek Semiconductor Corp.

DISCLAIMER

Realtek provides this document “as is”, without warranty of any kind, neither expressed nor implied, including, but not limited to, the particular purpose. Realtek may make improvements and/or changes in this document or in the product described in this document at any time. This document could include technical inaccuracies or typographical errors.

TRADEMARKS

Realtek is a trademark of Realtek Semiconductor Corporation. Other names mentioned in this document are trademarks/registered trademarks of their respective owners.

USING THIS DOCUMENT

This document is intended for the engineer’s reference and provides detailed application information.

Though every effort has been made to ensure that this document is current and accurate, more information may have become available subsequent to the production of this guide.

REVISION HISTORY

Revision	Release Date	Summary
1.0	2007/05/19	First release.
1.1	2007/08/18	Revised section 2 Deep Slumber Mode Version 1 Implementation, page 1. Revised Figure 1, page 2, and Figure 5, page 6. Revised section 7 Power Consumption, page 9.
1.2	2008/02/01	Revised section 2 Deep Slumber Mode Version 1 Implementation, page 1.
1.3	2008/06/06	Added section 6 ACPI RMV, page 8.
1.4	2008/10/03	Added Figure 3, page 4. Revised section 7 Power Consumption, page 9.
1.5	2008/10/29	Added RTL8103E figure (Figure 2, page 3). Added Table 4 RTL8103E & RTL8103T Power Consumption, page 9.
1.6	2008/12/22	Added RTL8103T data.
1.7	2009/03/23	Added Deep Slumber Mode version 2 (DSMv2) information. Revised section 6 ACPI RMV, page 8. Revised section 7.2 RTL8111D(L) Power Consumption, page 9. Added section 7.3 RTL8111D(L)-VB Power Consumption, page 9. Added section 7.5 RTL8103E(L)-VB & RTL8103T-VB Power Consumption (Estimated Value), page 10.

Table of Contents

1. INTRODUCTION	1
2. DEEP SLUMBER MODE VERSION 1 IMPLEMENTATION.....	1
2.1. RTL8111C(P) & RTL8111D OGPIO AND ISOLATEB CIRCUIT (64-PIN).....	2
2.2. RTL8103E OGPIO AND ISOLATEB CIRCUIT (64-PIN).....	3
2.3. OGPIO AND ISOLATEB CIRCUIT (48-PIN).....	4
2.4. RTL8103T OGPO AND ISOLATEB CIRCUIT (32-PIN).....	5
3. DEEP SLUMBER MODE V1 OPERATION.....	6
4. DSMV2 INTRODUCTION.....	7
5. DEEP SLUMBER MODE V2 IMPLEMENTATION.....	7
6. ACPI RMV.....	8
7. POWER CONSUMPTION.....	9
7.1. RTL8111C(P) POWER CONSUMPTION.....	9
7.2. RTL8111D(L) POWER CONSUMPTION.....	9
7.3. RTL8111D(L)-VB POWER CONSUMPTION.....	9
7.4. RTL8103E & RTL8103T POWER CONSUMPTION.....	9
7.5. RTL8103E(L)-VB & RTL8103T-VB POWER CONSUMPTION (ESTIMATED VALUE).....	10

List of Tables

TABLE 1. RTL8111C(P) POWER CONSUMPTION	9
TABLE 2. RTL8111D(L) POWER CONSUMPTION	9
TABLE 3. RTL8111D(L)-VB POWER CONSUMPTION.....	9
TABLE 4. RTL8103E & RTL8103T POWER CONSUMPTION	9
TABLE 5. RTL8103E(L)-VB & RTL8103T-VB POWER CONSUMPTION (ESTIMATED VALUE).....	10

List of Figures

FIGURE 1. RTL8111C(P) & RTL8111D OGPIO AND ISOLATEB CIRCUIT (64-PIN)	2
FIGURE 2. RTL8103E OGPIO AND ISOLATEB CIRCUIT (64-PIN)	3
FIGURE 3. OGPIO AND ISOLATEB CIRCUIT (48-PIN)	4
FIGURE 4. RTL8103T OGPO AND ISOLATEB CIRCUIT (32-PIN).....	5
FIGURE 5. DEEP SLUMBER MODE OPERATION	6

1. Introduction

This application note will help board layer designers to implement the Deep Slumber Mode (DSM) power saving feature for Realtek's Ethernet Controllers.

For Deep Slumber Mode version 1 (DSMv1), please read the following sections. For Deep Slumber Mode version 2 (DSMv2), go to section 4, page 7.

2. Deep Slumber Mode Version 1 Implementation

When DSMv1 is implemented, the BIOS must enable the DSM_en bit (Set I/O Register Offset 0x6D Bit7 to 1h) **before** the local machine enters the Windows system, and must follow the steps given below **after** the local machine enters the Windows system.

- The board designer must provide a circuit to connect the OGPIO pin. The BIOS then monitors the edge status of OGPIO to determine whether a cable is connected.
- When a cable is unplugged, the OGPIO will go from high to low. The BIOS must set configuration space offset 0x44 to 03h first (the Ethernet Controller enters D3 state), cut off VCC33 (see Figure 1 to Figure 4), and ask the local machine's OS to run a Hardware Scan, which will then remove the Ethernet Controller.
- On connection of a cable, the OGPIO will go from low to high. The BIOS must provide VCC33 and (after 100ms) ask the local machine's OS to run a Hardware Scan in order to recover all resources (E.g., IO space and Memory address). The system is then restored to a normal state.
- When DSM is disabled, the BIOS must disable DSM_en bit (Set I/O Register Offset 0x6D Bit7 to 0h).

Note 1: If Deep Slumber Mode v1 is enabled and the network cable is unplugged, and the OS then enters S3, S4, or S5 power states, the Ethernet Controller will not support Wake-on-LAN (WOL).

Note 2: If implementing EEPROM_Less and DSMv1 Modes at the same time, the BIOS must provide the SVID, SDID, and the Serial Number to the Realtek Ethernet IC after ISOLATEB goes from low to high.

Note 3: If the system does not provide auxiliary power to the Realtek Ethernet IC in S3/S4 states, the BIOS must enable DSM_en again when the system resumes from S3/S4 state.

Note 4: When DSMv1 mode is implemented, the BIOS might declare _RMV code in the ACPI. Refer to section 6 ACPI RMV, page 8 for more details.

Note 5: When DSMv1 mode is implemented, please use the recommended driver revision:

Windows Vista: 6.205 or later

Windows XP: 5.688 or later

Note 6: If the board designer wants to use ISOLATEB to disable the Ethernet Controller, follow the steps below:

- Step 1. Set I/O Register Offset 0x6E Bit0 to 0h.
- Step 2. Set I/O register Offset 0x6F Bit7 to 0h.
- Step 3. Set configuration space offset 0x44 to 03h (the Ethernet Controller enters D3 state).
- Step 4. Cut-off VCC33 (see Figure 1 to Figure 4).
- Step 5. If the board designer wants to enable the Ethernet Controller, provide VCC33 and set I/O register Offset 0x6F Bit7 to 1h.

2.1. RTL8111C(P) & RTL8111D OGPIO and ISOLATEB Circuit (64-Pin)

BIOS monitors the edge status of OGPIO

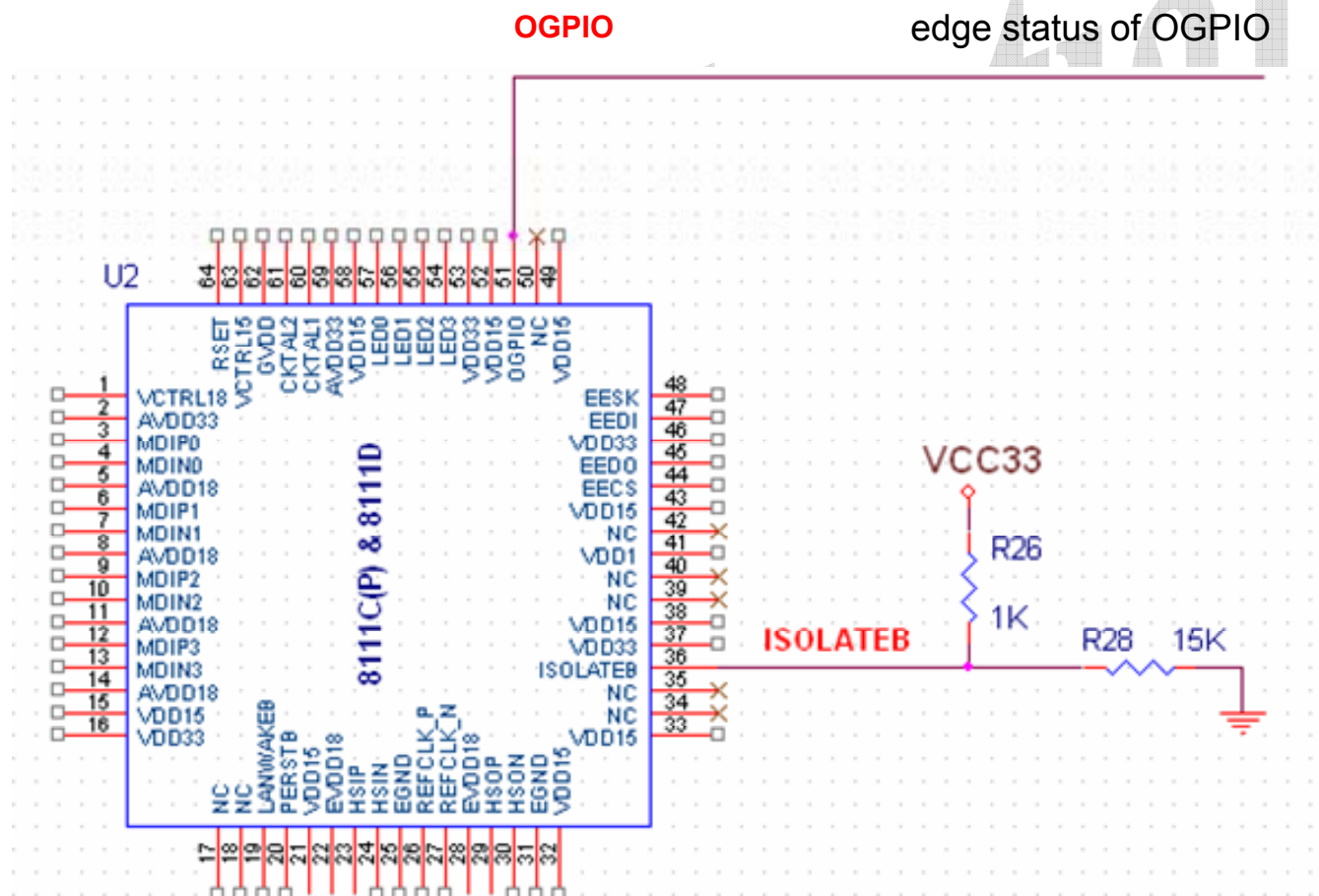


Figure 1. RTL8111C(P) & RTL8111D OGPIO and ISOLATEB Circuit (64-Pin)

2.2. RTL8103E OGPIO and ISOLATEB Circuit (64-Pin)

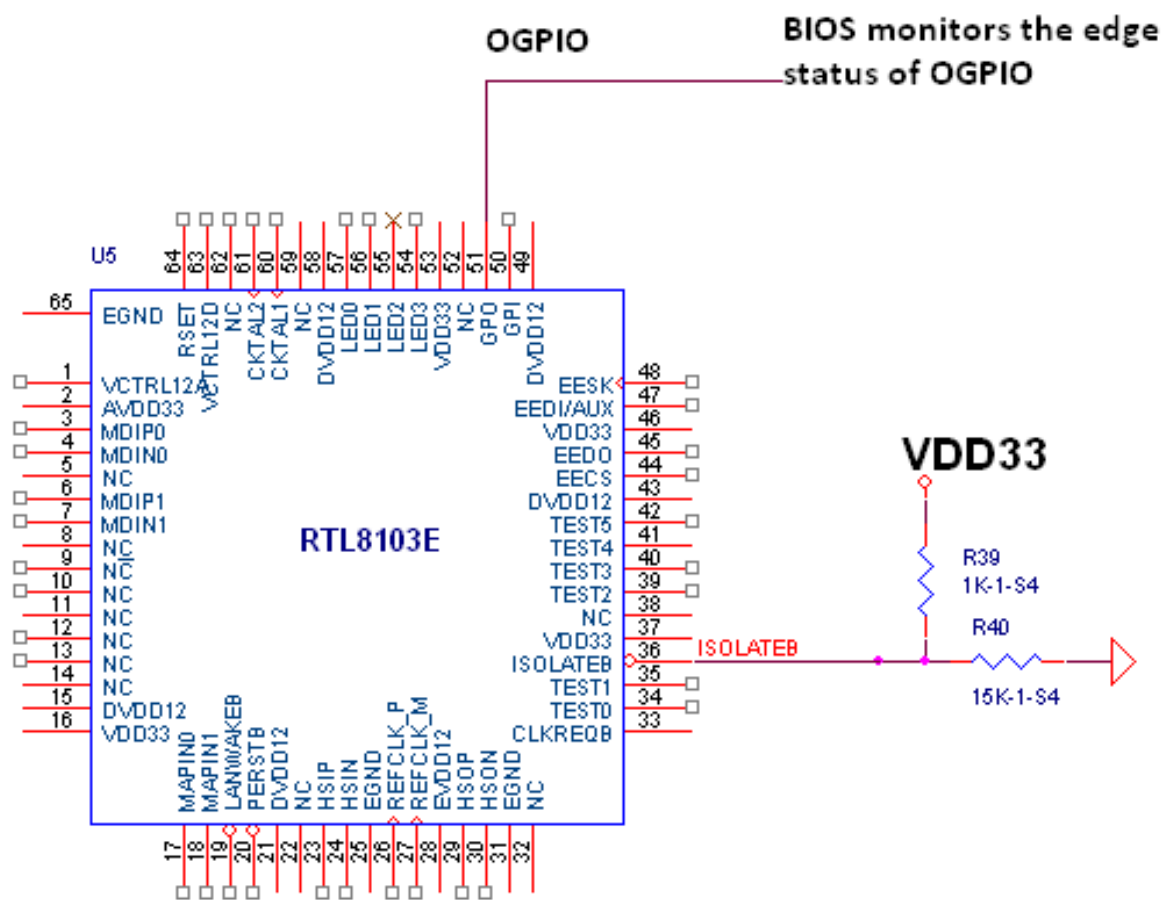


Figure 2. RTL8103E OGPIO and ISOLATEB Circuit (64-Pin)

2.3. OGPIO and ISOLATEB Circuit (48-Pin)

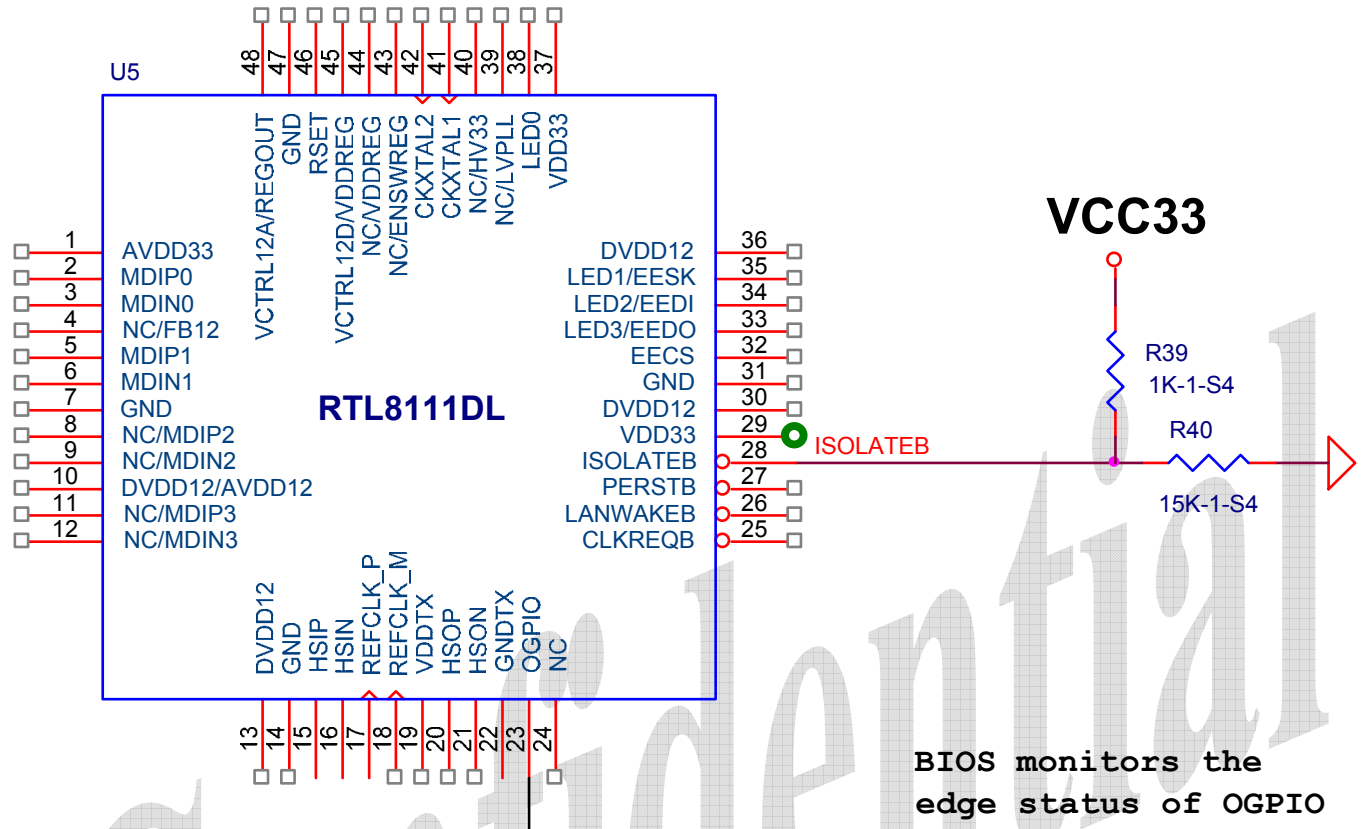


Figure 3. OGPIO and ISOLATEB Circuit (48-Pin)

2.4. RTL8103T OGPO and ISOLATEB Circuit (32-Pin)

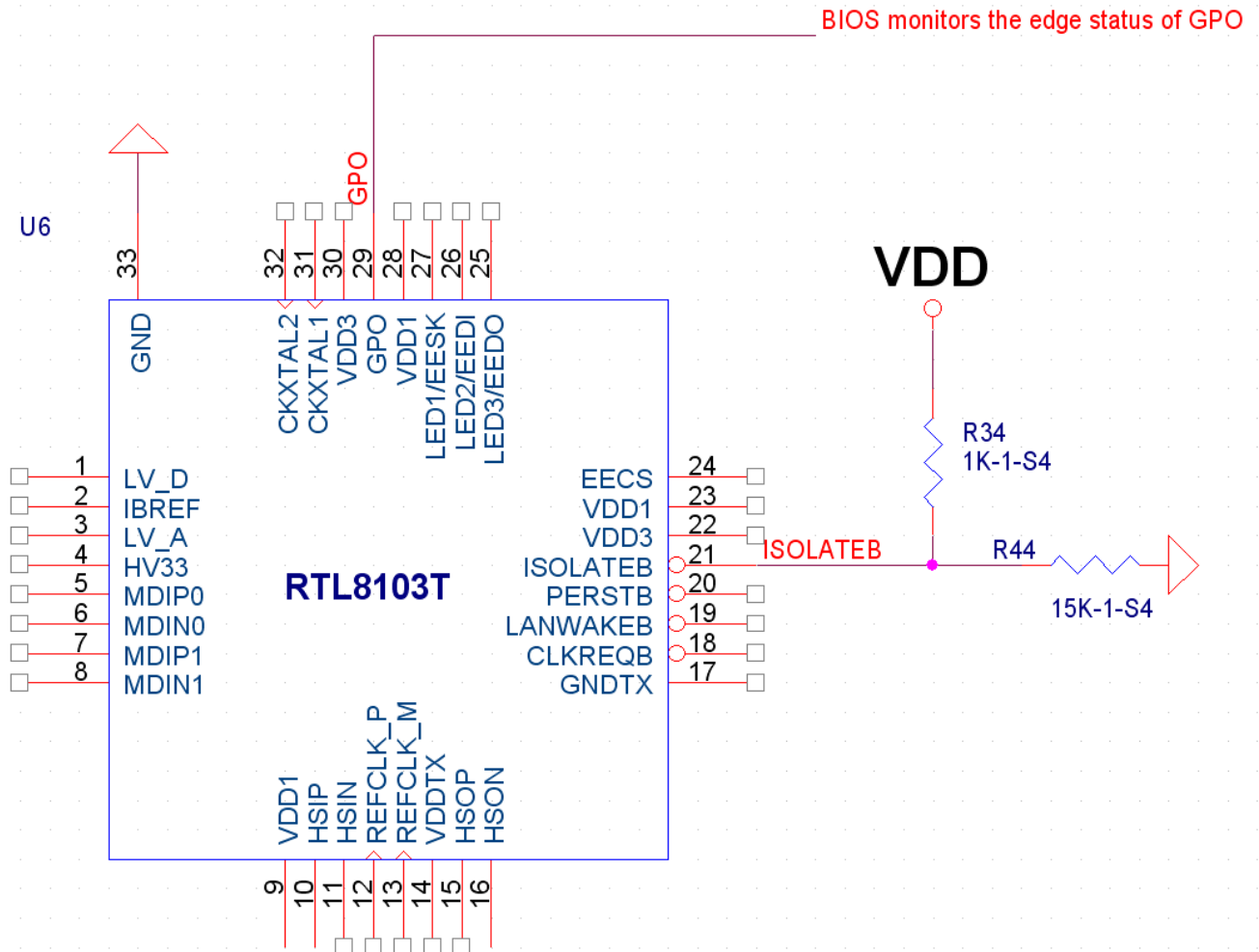


Figure 4. RTL8103T OGPO and ISOLATEB Circuit (32-Pin)

3. Deep Slumber Mode V1 Operation

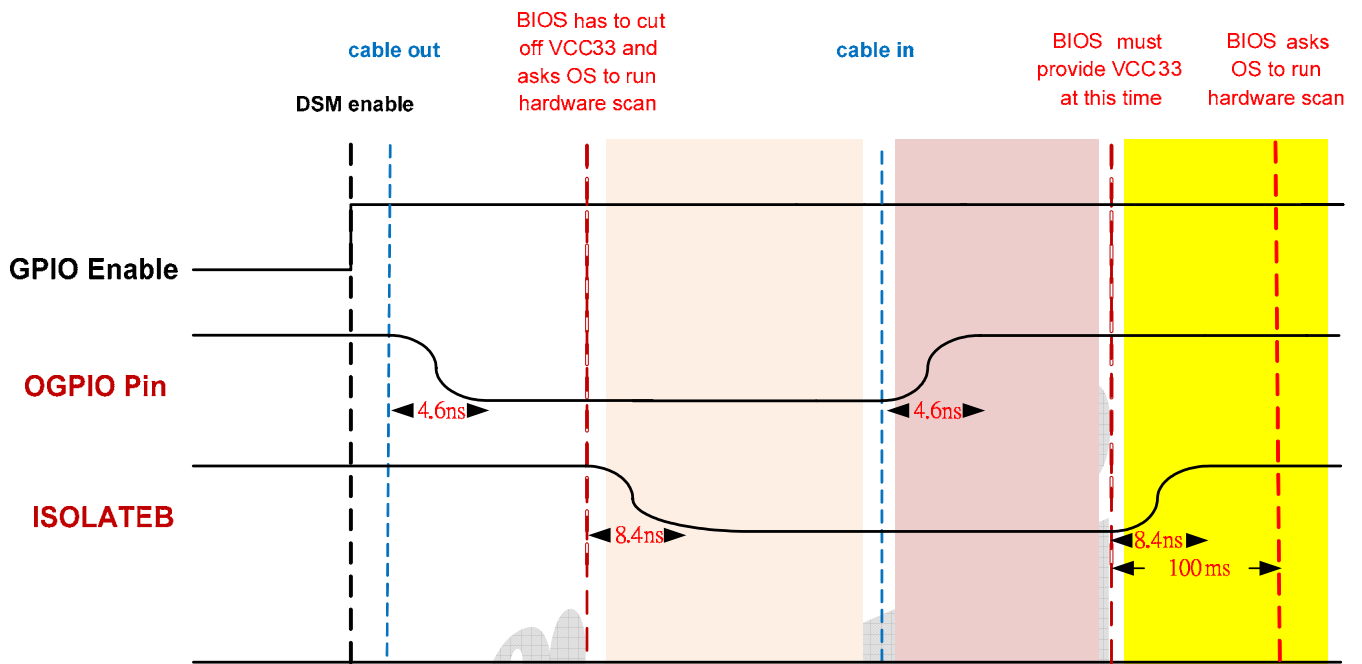


Figure 5. Deep Slumber Mode Operation

4. DSMv2 Introduction

Deep Slumber Mode version 2 (DSMv2) is a simplified implementation of DSMv1 that requires very little BIOS effort to implement. When a cable is un-plugged, the North or South Bridge will detect that the Ethernet Controller has disappeared, and automatically ask the OS to run a hardware scan. If the hardware scan fails to find the un-plugged cable, the OS will remove the Ethernet Controller.

When a cable is connected, the North or South Bridge will detect that the Ethernet Controller has been plugged in, and automatically ask the OS to run a hardware scan and recover all resources (E.g., IO and Memory base addresses).

5. Deep Slumber Mode V2 Implementation

When DSMv2 is implemented, the BIOS must:

- First declare or enable the PnP function for the Ethernet Controller
- Then enable the DSMv2_en bit (Set I/O Register Offset 0x6D Bit5 to 1h) **before** the local machine enters the Windows system
- When DSMv2 is disabled, the BIOS must disable DSMv2_en bit (Set I/O Register Offset 0x6D Bit5 to 0h)

Note 1: The chipset (North or South Bridge) must have the capability to detect the PCIE Ethernet Controller when the PnP function is declared by the BIOS (e.g. in an Intel chipset). Alternatively, the board designer might provide a circuit to connect the OGPI pin and monitor the edge status of OGPI in order to determine whether a cable is connected (e.g. in an AMD chipset).

Note 2: If Deep Slumber Mode v2 is enabled and the network cable is unplugged, and the OS then enters S3, S4, or S5 power states, the Ethernet Controller will not support Wake-on-LAN (WOL).

Note 3: If implementing EEPROM_Less and DSMv2 Modes at the same time, the BIOS must provide the SVID, SDID, and the Serial Number to the Realtek Ethernet IC after resuming from S3/S4 states.

Note 4: If the system does not provide auxiliary power to the Realtek Ethernet IC in S3/S4 states, the BIOS must enable DSMv2_en again when the system resumes from S3/S4 state.

Note 5: When DSMv2 mode is implemented, the BIOS might declare RMV code in the ACPI. Refer to section 6 ACPI RMV, page 8 for more details.

Note 6: When DSMv2 mode is implemented, please use the recommended driver revision:

Windows Vista: 6.218 or later

Windows XP: 5.716 or later

6. ACPI RMV

The Deep Slumber Mode (DSM) function is a special application of Realtek's Ethernet Controllers. When a cable is unplugged, this function will reduce the power consumption of the system. DSM needs to cooperate with the BIOS and OS. If the BIOS declares RMV code in ACPI to implement DSM mode, the OS will show a 'safely remove hardware' icon in the taskbar, however, the LAN device is not hot-pluggable, and cannot be removed safely using this icon.

If the BIOS does not declare RMV code in ACPI, the OS will not show the 'safely remove hardware' icon. When a cable is disconnected, an error message is entered in the system event log.

Windows Vista System

- The Windows Vista system CAN declare `surprise_remove_ok` to avoid multiple error messages in the system event log, but the first error message is unavoidable. The error message has no affect on function. If this error message does not need not to be entered in the event log, declare RMV code in ACPI via the BIOS.

Windows XP System

- The Windows XP system CANNOT declare `surprise_remove_ok`. The BIOS might need to define RMV code in the ACPI (a 'safely remove NIC' icon (hot plug device) will be in the taskbar), otherwise an error message will appear.

7. Power Consumption

Measured values from the Realtek demo board are under ASPM L1, CLK_REQ, no EEPROM, and the driver version of Windows XP is version 5.718.

7.1. RTL8111C(P) Power Consumption

Table 1. RTL8111C(P) Power Consumption

State	Current (mA)	Power (mW)
Normal (Cable Connected, GBE idle)	202.1	667
Link Down Power Saving	77.8	257
Deep Slumber Mode (DSMv1)	26.9	89

7.2. RTL8111D(L) Power Consumption

Table 2. RTL8111D(L) Power Consumption

State	Current (mA)	Power (mW)
Normal (Cable Connected, GBE idle)	144.8	477.8
Link Down Power Saving	30.6	101
Deep Slumber Mode (DSMv1)	10	33

7.3. RTL8111D(L)-VB Power Consumption

Table 3. RTL8111D(L)-VB Power Consumption

State	Current (mA)	Power (mW)
Normal (Cable Connected, GBE idle)	144.8	477.8
Advanced Link Down Power Saving	15.5	51.2
Deep Slumber Mode (DSMv2)	9	29.7

7.4. RTL8103E & RTL8103T Power Consumption

Table 4. RTL8103E & RTL8103T Power Consumption

State	Current (mA)	Power (mW)
Normal (Cable Connected, 100M idle)	88	290.4
Link Down Power Saving	50	165
Deep Slumber Mode (DSMv1)	19	62.7

7.5. *RTL8103E(L)-VB & RTL8103T-VB Power Consumption (Estimated Value)*

Table 5. RTL8103E(L)-VB & RTL8103T-VB Power Consumption (Estimated Value)

State	Current (mA)	Power (mW)
Normal (Cable Connected, 100M idle)	178	587.4
Advanced Link Down Power Saving	50	165
Deep Slumber Mode (DSMv2)	12	39.6

Confidential

Realtek Semiconductor Corp.

Headquarters

No. 2, Innovation Road II

Hsinchu Science Park, Hsinchu 300, Taiwan

Tel.: +886-3-578-0211. Fax: +886-3-577-6047

www.realtek.com