RTL9607C
SINGLE-CHIP PON

LED
Application Note
(CONFIDENTIAL: Development Partners Only)

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REVISION HISTORY

Revision	Release Date	Summary
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1. Overview

This application note introduces how to control RTL9607C LED controller.

2. LED Mode

The ASIC provide both parallel and serial LED mode, user can program either one of them as the system LED mode. ASIC supports 18 parallel and 18 serial LED groups.

Table 1 LED Mode Register

REGISTER ADDRESS : 0xBB01E000

Field	Description	Bit position
LED_SEL	configuration system led mode 0:parallel mode 1:serial mode	0

3. LED Index

The LED is control using LED index. For parallel and serial LED index please reference ASIC H/W PIN definition.

4. Serial LED Timing

The refresh time of serial mode LED would be control by following register.

Table 2 Serial LED Refresh Register

REGISTER ADDRESS : 0xBB01E070

Field	Description	Bit position
CFG_SERI_LED_REGRESH_TIME	select serial LED refresh time 00 = 16 ms 01 = 32 ms 10 = 64 ms (default) 11 = 128 ms	1:0

The serial LED output clock period would be control by following register.

Table 3 Serial LED Clock Register

REGISTER ADDRESS : 0xBB01E06C

Field	Description	Bit position
CFG_SERI_LED_CLK_PER	select clock period 00 = 3.9MHz(256ns) 01 = 7.8MHz(128ns) (default) 10 = 15.62MHz(64ns) 11 = 15.62MHz(64ns)	1:0

5. LED Source

Each LED supports several control sources. User can select one of the control sources by setting bits[20:16]. The LED control sources are listed in table 4 LED_CFG field. For these control sources, additional control bits [11:0] can be set for to choose different behavior of those sources. Such as link speed, duplex and Tx/Rx activities. LED also support CPU force mode. When set bits[14] to 1, the force value can be control by register in section 5.2

Table 4 LED Source Register

REGISTER ADDRESS : 0xBB01E004 ~ 0xBB01E048 (LED0 ~ LED17)

Field	Description	Bit position
LED_CFG	Select led port 00000: Disable 00001: UTP0 00010: UTP1 00011: UTP2 00100: UTP3 00101: UTP4 00110: Fiber 00111: HiSG0 01000: HiSG1 01001: RGMII 01010:CPU0 01011:CPU1 11011:PON 11100_11111:Reserved Note:USB/PCIE control by SW	20:16
CPU_FORCE_MOD	CPU force LED	14
HSG_SPD2500	LED light when HSG link at Speed 2500	13
UTP_SPD1000	LED light when UTP link at Speed 1000	12
UTP_SPD500	LED light when UTP link at Speed 500	11
UTP_SPD100	LED light when UTP link at Speed 100	10
UTP_SPD10	LED light when UTP link at Speed 10	9
UTP_DUP	LED light when UTP link at full duplex mode	8
HSG_SPD2500_ACT	LED blink when HSG link at Speed 2500	7
UTP_SPD1000_ACT	LED blink when packet access at Speed 1000	6
UTP_SPD500_ACT	LED blink when packet access at Speed 500	5
UTP_SPD100_ACT	LED blink when packet access at Speed 100	4
UTP_SPD10_ACT	LED blink when packet access at Speed 10	3
UTP_RX_ACT	LED blink when RX packet access	2
UTP_TX_ACT	LED blink when TX packet access	1
COL	LED blink when collision occur	0

For LED source of above mentioned ports, LED output is combing following signal.

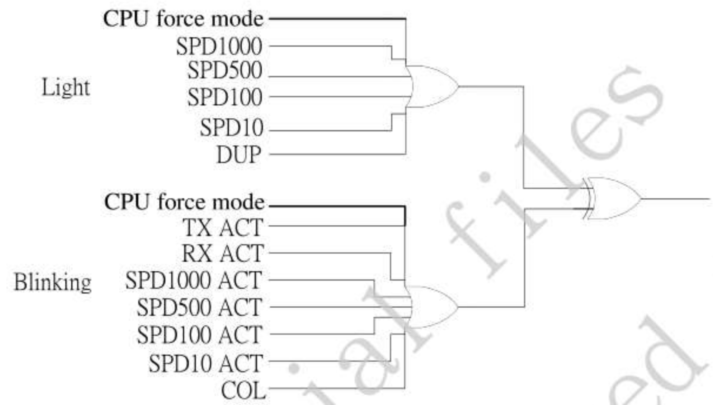

Figure 1. LED combination mode (UTP)

5.1. Speed and Link Activity Indicator

For link, speed, duplex and activity, the LED is light and blinking is control by ASIC if the LED source is selected. User also need to select this LED is indicate for what. Here list available indicator according to each LED source.

Table 5 LED Source Register

Bits	UTP.	FIBER	PON	HiSG0/1	RGMII
13				SPD2500	
12	SPD1000	SPD1000	-	SPD1000	SPD1000
11	SPD500	-	-	SPD500	
10	SPD100	SPD100	-	SPD100	SPD100
9	SPD10	-	-	SPD10	SPD10
8	DUP	-	-	DUP	DUP
7				SPD2500 ACT	
6	SPD1000 ACT	SPD1000 ACT	-	SPD1000 ACT	SPD1000 ACT
5	SPD500 ACT	-	-	SPD500 ACT	
4	SPD100 ACT	SPD100 ACT	ALARM(Option)	SPD100 ACT	SPD100 ACT
3	SPD10 ACT	-	WARNING(Option)	SPD10 ACT	SPD10 ACT
2	RX ACT	RX ACT	RX ACT	RX ACT	RX ACT
1	TX ACT	TX ACT	TX ACT	TX ACT	TX ACT
0	COL			COL	COL

5.2. CPU Force LED

LED also can force by CPU by setting LED source to CPU force mode. The force value can be control by following register.

Table 6 CPU Force LED Register

REGISTER ADDRESS : 0xBB01E054 ~ 0xBB01E058

Register	Description	Bit number
LED_FORCE_VALUE_CFG	00: force 0 01: force 1 10: force blinking 11: reserved	2

0xBB01E054[1:0] for LED0

0xBB01E054[3:2] for LED1

...

0xBB01E054[31:30] for LED15

0xBB01E058[1:0] for LED16

0xBB01E058[3:2] for LED17

5.3. PON Alarm and Warning

When LED set to PON, it would indicator the PON status. This register can set the PON warning and alarm status.

Table 7 LED active high/low Register

REGISTER ADDRESS : 0xBB01E078

Register	Description	Bit position
PON_ALARM	0b0: pon not in alarm state 0b1: pon in alarm state	1
PON_WARN	0b0: pon not in warning state 0b1: pon in warning state	0

6. LED Active Polarity

LED active polarity can be low or high depends on the below configurations.

6.1. Parallel LED Active Polarity

For parallel LED mode the active mode is control by follow register. The polarity of each parallel LED can be configured separately.

Table 8 Parallel LED active high/low Register

REGISTER ADDRESS : 0xBB01E04C

Register	Description	Bit number
LED_ACTIVE_LOW	Invert LED polarity 0: Normal 1: Invert	1

0xBB01E04C [0] for LED0

0xBB01E04C [1] for LED1

…

0xBB01E04C [17] for LED17

6.2. Serial LED Active Polarity

For serial LED mode the active mode is control by follow register. It is a global configuration for all LEDs.

Table 9 Serial LED active high/low Register

REGISTER ADDRESS : 0xBB01E050

Register	Description	Bit position
SERI_LED_ACTIVE_LOW	Invert LED polarity 0: Normal 1: Invert	0

7. Enable LED

The LED IO PIN must be enabled first, and then this PIN can start working as LED mode.

For parallel LED each LED IO PIN must be enabled individually. The both IO and LED must be enabled. Here list the parallel LED enable register.

Table 10 LED IO Enable Register

REGISTER ADDRESS : 0xBB023010

Register	Description	Bit position
SERI_LED_EN	Enable LED 0b0: Disable serial LED 0b1: Enable serial LED	23
LEDn_EN (n = 0~17)	Enable LEDn 0b0: Disable LEDn 0b1: Enable LEDn	0-17

Table 11 LED enable Register

REGISTER ADDRESS : 0xBB01E068

Register	Description	Bit position
LED_SERI_DATA_EN	enable serial LED data 0b0: Disable 0b1: Enable	25
LEDn_PARA_EN (n=0~17)	Enable parallel LEDn 0b0: Disable LEDn 0b1: Enable LEDn	1:18

8. LED Blinking Rate

The blinking rate of difference LED control source can be configured separately.

Table 12 LED Blinking Rate

REGISTER ADDRESS : 0xBB01E05C

Register	Description	Bit position
SEL_LED_FORCE_RATE	select CPU force mode LED blink rate 000 = 32 ms 001 = 64 ms 010 = 128 ms 011 = 256 ms 100 = 512 ms 101 = 1024 ms 110 = 48 ms 111 = 96 ms	5:3
SEL_MAC_LED_RATE	select MAC LED blink rate 000 = 32 ms 001 = 64 ms 010 = 128 ms 011 = 256 ms 100 = 512 ms 101 = 1024 ms 110 = 48 ms 111 = 96 ms	2:0

9. API

Realtek API provides a series of interface to let users setup the LED without writing register and table directly. This section will discuss these APIs

9.1. LED Mode

The ***rtk_led_operation_set*** API will set LED mode.

Example:

```
/*
   Set led mode to parallel mode
*/
int32 ret ;
if((ret= rtk_led_operation_set (LED_OP_PARALLEL)) != RT_ERR_OK)
{
    return ret;
}
```

9.2. Parallel Enable

The ***rtk_led_parallelEnable_get*** API would enable LED pin for given LED PIN number.

Example:

```
/*set parallel led 0~3 to enable*/
int32 ret;

if((ret= rtk_led_parallelEnable_set (0,ENABLED)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_parallelEnable_set (1,ENABLED)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_parallelEnable_set (2,ENABLED)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_parallelEnable_set (3,ENABLED)) != RT_ERR_OK)
    return ret;
```

9.3. Select LED source

The ***rtk_led_config_set*** API would select LED source by given LED index. For force mode setting the LED type parameter is don't care.

Example:

```
/*
  set LED0 to UTP0  and check link and Rx/RX activity
*/

rtk_led_config_t  ledCfg;
int32 ret;
/*set LED0 for UTP0 link and Tx/Rx activity */
memset(&ledCfg,0x0,sizeof(rtk_led_config_t));
ledCfg.ledEnable[LED_CONFIG_TX_ACT]=ENABLED;
ledCfg.ledEnable[LED_CONFIG_RX_ACT]=ENABLED;
ledCfg.ledEnable[LED_CONFIG_SPD10]=ENABLED;
ledCfg.ledEnable[LED_CONFIG_SPD100]=ENABLED;
```

```
ledCfg.ledEnable[LED_CONFIG_SPD100]=ENABLED;

if((ret= rtk_led_config_set (0, LED_TYPE_UTP0 , &ledCfg)) != RT_ERR_OK)
    return ret;
```

9.4. LED Force Mode API

The ***rtk_led_modeForce_set*** API would set force LED status for LED_FORCE_ON/ LED_FORCE_OFF/ LED_FORCE_BLINK. If user want to force LED status must call rtk_led_config_set first to set LED mode to force mode.

The ***rtk_led_blinkRate_set*** API would set the LED blinking rate when LED set to force blink mode.

Example:

```
/*
   set LED1 to force mode and force BLINK
   The blinkg rate set to LED_BLINKRATE_512MS
*/

rtk_led_config_t  ledCfg;
int32 ret;

/*set LED1 to force mode*/
memset(&ledCfg,0x0,sizeof(rtk_led_config_t));
ledCfg.ledEnable[LED_CONFIG_FORCE_MODE]=ENABLED;
if((ret= rtk_led_config_set(1, LED_TYPE_UTP0 , &ledCfg)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_modeForce_set (1, LED_FORCE_BLINK)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_blinkRate_set(1,
                               LED_BLINK_GROUP_FORCE_MODE,
                               LED_BLINKRATE_512MS)) != RT_ERR_OK)
    return ret;
```

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