

REALTEK

RTL9600
SINGLE-CHIP PON

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LED
Application Note
(CONFIDENTIAL: Development Partners Only)

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REVISION HISTORY

Revision	Release Date	Summary
1.0.1	2013/06/20	1. add PON alarm / warning register 2. Fix some typo
1.0.0	2013/05/13	First Release

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1. Overview

This application note introduces how to control RTL9600 LED controller.

2. LED Mode

The ASIC provide parallel and serial LED mode. For parallel led provide 17 LEDs. For serial led provide 32 LEDs.

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 LED index please reference ASIC H/W PIN definition. For serial LED the LED index is show as following figure.

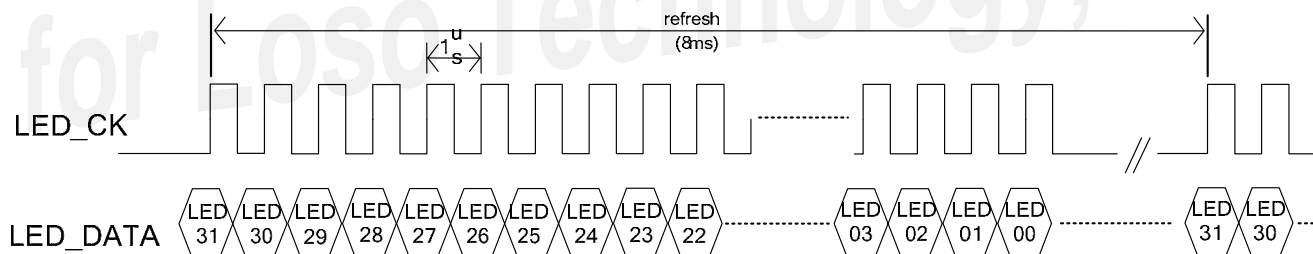


Figure 1. Serial LED output signal

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 : 0xBB01E0A8

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 : 0xBB01E0A4

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 can select its own led source. User can select LED source by setting bis[20:16]. The LED source including UTP port, PON port, USB ...

For UTP port this register also can select this LED is for indicate speed, duplex or Tx/Rx activity by setting bits[11~0].

LED can also set as CPU force mode. When set bits[12] to 1. The force value can be control by register.

Table 4. LED Source Register

REGISTER ADDRESS : 0xBB01E004 ~ 0xBB01E080 (LED0 ~ LED31)

Field	Description	Bit position
LED_CFG	Select led port 0b00000: Disable 0b 00001: UTP0 0b 00010: UTP1 0b 00011: UTP2 0b 00100: UTP3 0b 00101: UTP4 (if not PON) 0b 00110: RGMII 0b 00111 11001:Reserved 0b 11010: Fiber 0b 11011: PON 0b 11100: USB P0 0b 11101: USB P1 0b 11110: Reserved 0b 11111: Reserved	20:16
CPU_FORCE_MOD	CPU force LED	12
UTP_SPD1000	LED light when UTP link at Speed 1000 RW 0x0	11
UTP_SPD500	LED light when UTP link at Speed 500 RW 0x0	10
UTP_SPD100	LED light when UTP link at Speed 100 RW 0x0	9
UTP_SPD10	LED light when UTP link at Speed 10 RW 0x0	8
UTP_DUP	LED light when UTP link at full duplex mode RW 0x0	7
UTP_SPD1000_ACT	LED blink when packet access at Speed 1000 RW 0x0	6
UTP_SPD500_ACT	LED blink when packet access at Speed 500 RW 0x0	5
UTP_SPD100_ACT	LED blink when packet access at Speed 100 RW 0x0	4
UTP_SPD10_ACT	LED blink when packet access at Speed 10 RW 0x0	3
UTP_RX_ACT	LED blink when RX packet access RW 0x0	2

UTP_TX_ACT	LED blink when TX packet access RW 0x0	1
UTP_COL	LED blink when collision occur RW 0x0	0

For UTP port LED source, LED output is combining following signal.

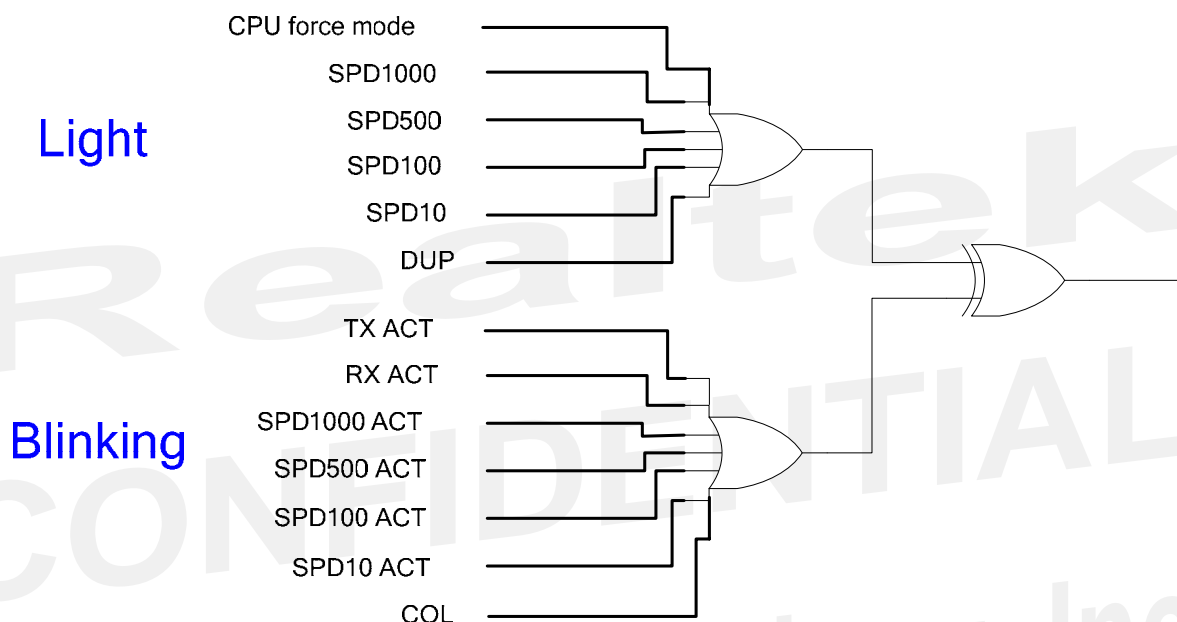


Figure 2. LED combination mode (UTP)

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

Bit position	UTP	Fiber	PON	USB
11	UTP Spd1000	Fiber Spd1000	PON Link	USB Link / Act
10	UTP SPD500	N/A	N/A	N/A
9	UTP Spd100	Fiber Spd100	N/A	N/A
8	UTP Spd10	N/A	N/A	N/A
7	UTP Dup	N/A	N/A	N/A
6	UTP Spd1000 Act	Fiber Spd1000 Act	N/A	N/A
5	UTP SPD500 ACT	N/A	N/A	N/A
4	UTP Spd100 Act	Fiber Spd100 Act	PON ALARM	N/A
3	UTP Spd10 Act	N/A	PON WARNING	N/A
2	UTP Rx Act	Fiber Rx Act	PON Rx Act	N/A
1	UTP Tx Act	Fiber Tx Act	PON Tx Act	N/A
0	UTP Col	N/A	N/A	N/A

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 : 0xBB01E08C ~ 0xBB01E090

Register	Description	Bit number
LED_FORCE_VALUE_CFG	0b00: force 0 0b 01: force 1 0b 10: force blinking 0b 11: reserved	2

0xBB01E08C[1:0] for LED0

0xBB01E08C[3:2] for LED1 ...

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.

REGISTER ADDRESS : 0xBB01E08C ~ 0xBB01E0B0

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

6. LED Active Mode

LED can configure as High active or LOW active mode.

6.1. Parallel LED Active Mode

For parallel LED mode the active mode is control by follow register. For parallel mode the polarity can be apply by each LED.

Table 7. Parallel LED Active Register

REGISTER ADDRESS : 0x BB01E084

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

Bit 0~16 : LED0 ~ LED16

6.2. Serial LED Active Mode

For serial LED mode the active mode is control by follow register. For serial mode the polarity setting is global.

Table 8. Serial LED Active Register

REGISTER ADDRESS : 0x BB01E088

Register	Description	Bit position
SERI_LED_POLARITY_IN V	Invert LED polarity 0: Normal 1: Invert	0

7. Enable LED

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

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

Table 9. LED IO Enable Register

REGISTER ADDRESS : 0xBB023014

Register	Description	Bit position
SERI_LED_EN	enable serial LED 0b0: disable serial LED IO 0b1: enable serial LED IO	1
LEDn_EN (n=0~16)	enable LEDn 0b0: disable LEDn IO 0b1: enable LEDn IO	0~16

Table 10. LED enable Register

REGISTER ADDRESS : 0xBB01E0A0

Register	Description	Bit position
LED_SERI_DATA_EN	enable serial LED Data PIN 0b0: disable 0b1: enable	19
LED_SERI_CLK_EN	enable serial LED clock PIN 0b0: disable 0b1: enable	18
LEDn_PARA_EN (n=0~16)	Enable parallel LEDn 0b0: disable LEDn 0b1: enable LEDn	1~17

8. LED Blinking Rate

The blinking of LED would be configured. Here list the register to set the blinking rate.

Table 11. LED Blinking Rate

REGISTER ADDRESS : 0xBB01E094

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	14:12
SEL_MAC_LED_RATE	select UTP 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	11:9
SEL_USB_LED_RATE	select USB 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	8:6

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 0~4 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;

if((ret= rtk_led_parallelEnable_set (4,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
set LED1 to UTP1 and check link and Rx/RX activity
set LED5 to CPU force -force blinking, blinking rate set to 256MHz
*/

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;

/*set LED1 for UTP1 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_UTP1 , &ledCfg)) != RT_ERR_OK)
    return ret;

/*set LED5 to force mode*/
memset(&ledCfg,0x0,sizeof(rtk_led_config_t));
ledCfg. ledEnable[LED_CONFIG_FORCE_MODE]=ENABLED;
if((ret= rtk_led_config_set (5, 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 LED5 to force mode
    And set to force BLINK
    The blinkg rate set to LED_BLINKRATE_512MS
*/

rtk_led_config_t ledCfg;
int32 ret;
uint32 port ;

/*set LED5 to force mode*/
memset(&ledCfg,0x0,sizeof(rtk_led_config_t));
ledCfg. ledEnable[LED_CONFIG_FORCE_MODE]=ENABLED;
if((ret= rtk_led_config_set(5, LED_TYPE_UTP0 , &ledCfg)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_modeForce_set (5, LED_FORCE_BLINK)) != RT_ERR_OK)
    return ret;

if((ret= rtk_led_blinkRate_set(5,
                                LED_BLINK_GROUP_FORCE_MODE,
                                LED_BLINKRATE_512MS)) != RT_ERR_OK)

    return ret;
```

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