OBSOLETE

Application Report

SNVA069A – May 2004 – Revised April 2013

AN-1291 Driving RGB LEDs Using LP3933 Lighting Management System

ABSTRACT

This application note discusses driving LEDs using the LP3933 Back/Funlight Management IC system.

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1 Introduction

The LP3933 Back/Funlight Management IC contains two versatile RGB LED Drivers. It needs only a few register writes through the serial interface to start and maintain complex blinking patterns thus reducing microcontroller loading.

Each RGB driver has three low-impedance open-drain outputs, R1 and R2 (red), G1 and G2 (green) and B1 and B2 (blue), for driving two three-color LEDs or six LEDs of any kind.

Timing and brightness of each output can be controlled separately, making color blending and different blinking sequences possible. A high current FLASH mode is also available.

A functional block diagram of RGB1 driver is shown in Figure 1. RGB2 driver is identical and the blinking cycle control is common for both blocks. The blue output control channel structure is shown in detail. The green and red channels have identical structure.

2 Functional Block Diagram

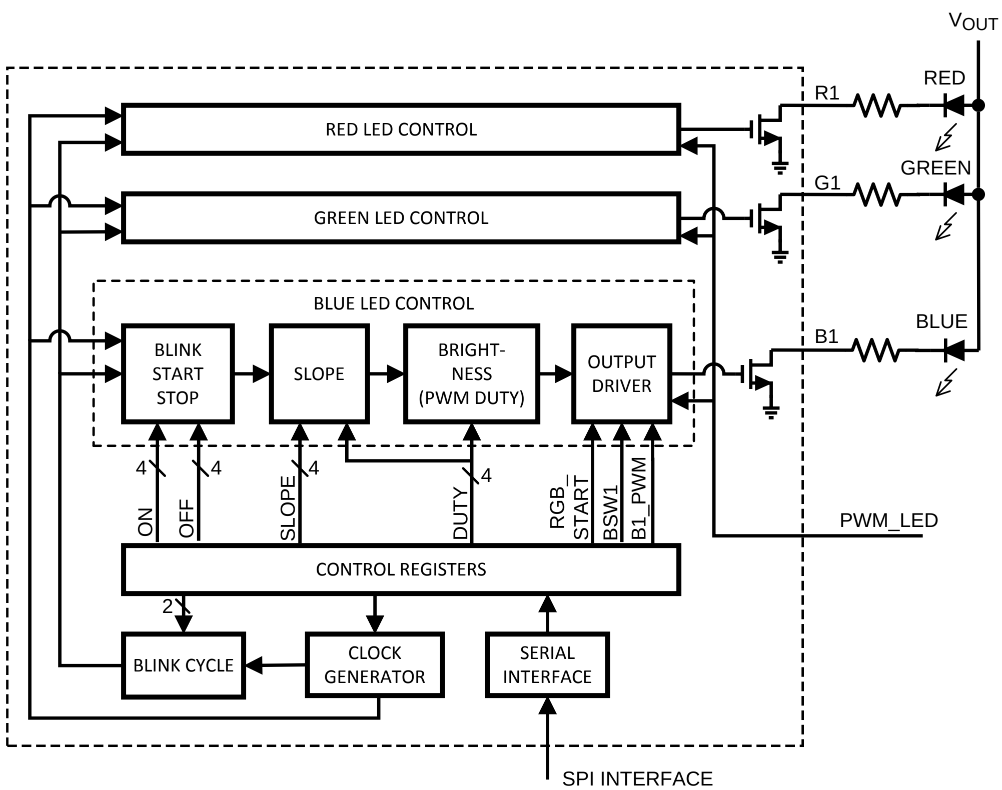

Figure 1. Functional Block Diagram of One RGB Driver in LP3933

3 Controls

LP3933 has 19 user controllable registers. The complete register map is shown in Section 6.

3.1 On/Off Controls

RGB Drivers are enabled by writing the RGB_START control bit high. This is the master control for both RGB drivers. Each output has an enable bit to turn it on and off (RSW1, GSW1, BSW1, RSW2, GSW2 and BSW2).

The PWM_LED pin can be used as a hardware on/off control or for external PWM brightness control. This control can be enabled for each output (control bits R1_PWM, G1_PWM, B1_PWM, R2_PWM, G2_PWM and B2_PWM). The default value after reset for these controls is disabled.

3.2 Brightness Control

LED brightness is proportional to its current. With the LP3933, an external resistor, the output voltage, and the LED voltage drop determine the maximum current for each LED. The maximum brightness is achieved when the LEDs are continuously switched on. This continuous mode can be entered by setting control bit RGB_PWM low, RGB_START high and desired LED outputs high. In this mode only on/off control is possible. Figure 2 shows waveforms of two outputs in continuous mode.

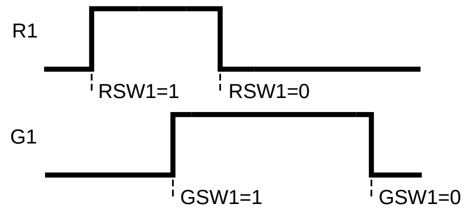

Figure 2. Continuous Mode Operation

The PWM_LED input pin can be used as an additional brightness control of selected LEDs by applying a PWM waveform to it. Control bits R1_PWM, G1_PWM, B1_PWM, R2_PWM, G2_PWM and B2_PWM enable this control to the RGB outputs. Bits WLED_PWM and CLED_PWM enable control to the two groups of white LEDs. Figure 3 shows the R1 output in the following conditions (RGB_PWM = 0, RGB_START = 1):

1. output off
2. output continuously on
3. output PWM controlled by PWM_LED, 30% duty cycle
4. output off
5. output PWM controlled by PWM_LED, 70% duty cycle

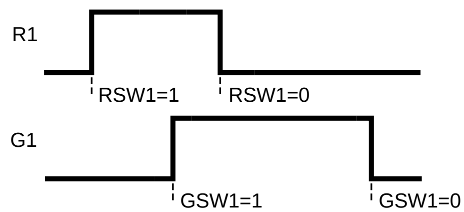

Figure 3. Continuous Mode PWM Control

In the normal mode, the RGB Drivers control the LED brightness by turning the LEDs on and off in a PWM fashion (Pulse Width Modulated). This mode is entered by setting control bit RGB_PWM high. The PWM waveform is produced from an internal clock signal. The PWM period is 50 µs. In the normal PWM mode, the three color outputs are enabled in successive PWM periods, and the combined PWM period is 150 µs (6.67 kHz). Each output has a maximum pulse width of 50 µs in a 150 µs PWM cycle, giving a maximum duty cycle of 33%. Example waveforms with different duty cycles are shown in Figure 4.

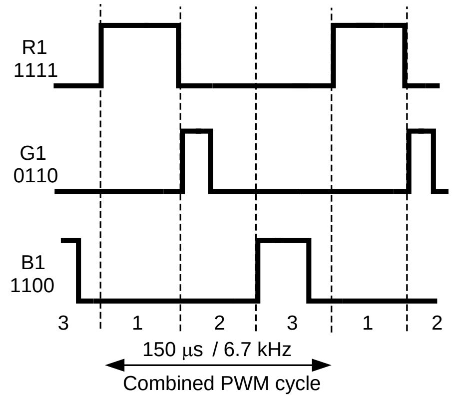

Figure 4. Normal Mode PWM Control

In FLASH mode, all outputs are simultaneously on, and the PWM frequency is 20 kHz (50 µs). The maximum duty cycle is 100% (50 µs). FLASH_EN1 enables the FLASH mode for the RGB1 driver and FLASH_EN2 enables the FLASH mode for the RGB2 driver.

FLASH mode PWM current waveforms for the RGB2 driver at different DUTY settings are shown in Figure 5.

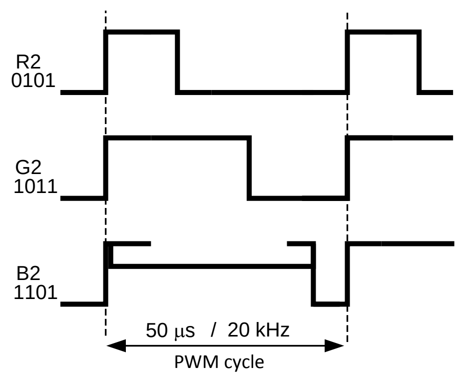

Figure 5. FLASH Mode PWM Control

The brightness is controlled in both FLASH and normal mode with 4 bits (DUTY[3:0]) between 0% and the maximum duty cycle.

The time averaged LED current in FLASH and normal modes can be calculated from the following equations.

$$I = I_{max} * (N_{DUTY} * 17 / 256) * D_{PWM\_LED} \text{ (FLASH)} \quad (1)$$

$$I = I_{max} * (N_{DUTY} * 17 / (3 * 256)) * D_{PWM\_LED} \text{ (norm.)} \quad (2)$$

where	I_{max} = Maximum LED current (peak)
	N_{DUTY} = Duty cycle control setting (0–15)
	D_{PWM_LED} = PWM_LED signal duty cycle (0–100%)
	D_{PWM_LED} has effect only if external PWM control is enabled for the LED.

3.3 Blinking Control

Figure 6 shows the different blinking controls of the RGB driver. Blinking cycle defines the blinking frequency. ON and OFF times define the turn-on and turn-off times within the blinking cycle. SLOPE defines the interval during which the brightness increases from 0 to the defined brightness and similarly the dimming time.

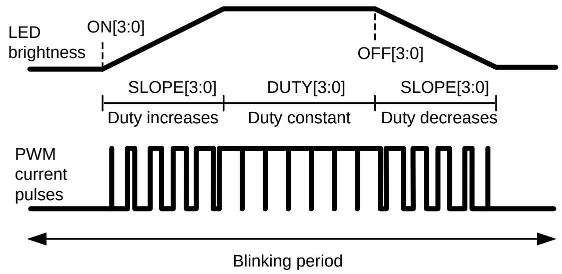

Figure 6. RGB LED Blinking Control Principle

DUTY defines the maximum brightness during the cycle.

Blinking period is selected from 4 predefined values using control bits CYCLE[1:0] as shown in Table 1.

Table 1. Blinking Period Control

CYCLE 1	CYCLE 0	Period (s)
0	0	0.25
0	1	0.5
1	0	1.0
1	1	2.0

Each output has own ON and OFF controls. These determine the turn-on and turn-off times within the blinking period with 4-bit resolution, according to the following equation.

$$t_{on/off} = t_{cycle} * N_{on/off} / 16 \quad (3)$$

where	$t_{on/off}$ = ON or OFF time from cycle start
	t_{cycle} = selected cycle period (0.25/0.5/1/2 s)
	$N_{on/off}$ = ON or OFF setting (0–15)

If t_{on} − occurs before t_{off}, the light pulse is within one blink period. The decreasing slope may extend to the next period, if t_{off} is close to the cycle end. This situation is shown in the R1 waveform in Figure 7.

If t_{off} occurs before t_{on}, the pulse will start in one blinking period and end in the next period. This situation is shown in the G1 waveform in Figure 7.

An example of the blinking waveforms is shown in Figure 7. R1 is set blinking with ON time before OFF time within the cycle. G1 has OFF time before ON time. G1 has a smaller (faster) SLOPE setting than R1. B1 has been set to be on without blinking by setting ON and OFF times to 0. **If ON and OFF times are set the same, but not 0, the output is turned off.** DUTY settings determine the brightness of each LED during blinking.

The register write sequence for blinking according to Figure 7 is described in Section 8 #1.

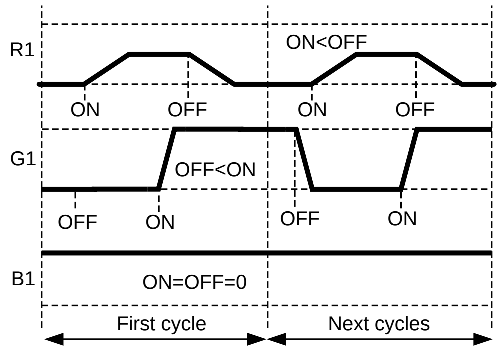

Figure 7. Blinking Waveform Example (LED Average Currents)

3.4 Slope Control

LED turn-on and dimming speed during blinking can be adjusted with the 4 bit SLOPE[3:0] setting, as shown in Figure 6. During turn-on, the slope control increases the PWM duty cycle (LED current) from 0 to the set DUTY value. During turn-off, the slope control decreases the PWM duty cycle from the DUTY value to 0.

If the programmed blinking pulse ON time is shorter than the programmed slope period, the turn-off slope will begin before the LED reaches the programmed brightness. If the OFF time in the blinking cycle is programmed shorter than the slope period, the LED will turn off at the blinking on-time, and the turn-on slope will begin from 0. These situations are shown in Figure 8.

The slope duration is defined at maximum DUTY setting (15) as shown in the Table 2. If the DUTY setting is smaller, the slope period will be respectively smaller due to constant slope speed. The slope period t_{SLOPE} for any SLOPE and DUTY setting can be calculated with the following formula.

$$t_{SLOPE} = t_{Smax} * N_{duty} / 15 \text{ (ms)} \tag{4}$$

where	t_{Smax} = slope period of selected SLOPE setting at max. DUTY (15)

$$N_{duty} = \text{DUTY setting (0–15)} \tag{5}$$

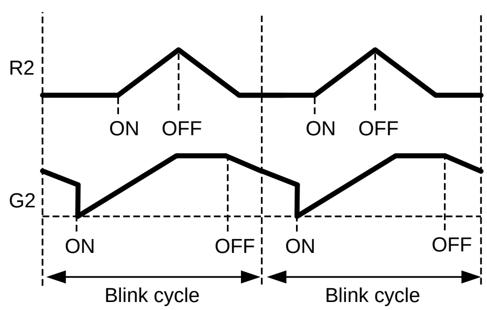

Figure 8. Blinking Slope Variations

The SLOPE values at maximum DUTY are shown in the Table 2. All slope values are shown in the Table 6 at the end of the document.

NOTE: The cycle length programming has no effect on slope period.

Table 2. Maximum Slope Values

SLOPE Setting	t_{SLOPE} (ms) (at DUTY = 15)
0	31
1	62

Table 2. Maximum Slope Values (continued)

SLOPE Setting	t_{SLOPE} (ms) (at DUTY = 15)
2	124
3	186
4	248
5	310
6	372
7	434
8	496
9	558
10	620
11	682
12	744
13	806
14	868
15	930

4 Flash

FLASH function is intended to drive a cell phone camera's flashlight, but it can be used for driving other high current loads, too. Both RGB drivers support the FLASH function. The flash LED can be a RGB LED (combination of RED + GREEN + BLUE → WHITE), a single high-power white LED, or several lower-power white LEDs in parallel. If a RGB LED is used, it is possible to adjust the color balance by adjusting the brightness of the colors separately.

The FLASH LED current must be limited with external resistors to 120 mA per RGB input. Lower current values can be used if maximum intensity is not needed. The Boost converter can drive up to 300 mA of current at low battery condition. Therefore maximum FLASH LED currents may have to be limited and other LEDs during FLASH may need to be turned off.

There are several options for controlling the flash. The simplest is the continuous mode, but the color balance and brightness cannot be adjusted in this mode. In FLASH mode, the brightness can be controlled for each output separately and the other RGB driver can be used normally at the same time.

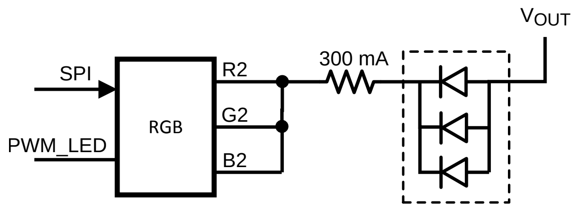

Figure 9. Flash with White LED Flash Module

Figure 9 shows how the flash can be done using a white-LED flash module. Outputs of one RGB driver can be connected in parallel to drive up to 360 mA maximum current. The current is set using one resistor. The flash can be triggered from the SPI bus, or if the flash has to be synchronized to a hardware signal, the PWM_LED input can be used.

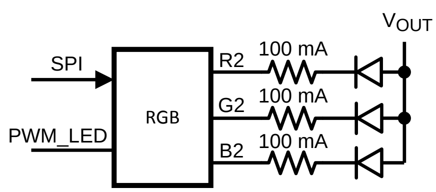

Figure 10. Flash with RGB LED

Figure 10 shows the flash done with a RGB LED. Each color requires its own ballast resistor due to different forward voltages and different dynamic resistances of the LEDs. If a viewfinder light (pre-light before the flash) is needed, it can be done using a lower brightness duty setting first and then full brightness. One way is to use normal mode setting for viewfinder and flash mode for the flash.

It is also possible to use RGB1 port for pre-light and RGB2 port for the flash. In this case the viewfinder must be started using SPI port and the flash can be controlled from SPI bus or from PWM_LED input.

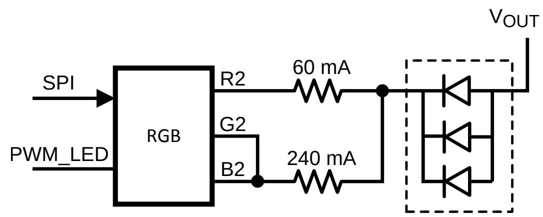

Figure 11. Flash Using White LED Module with Viewfinder

Figure 11 shows how a viewfinder light can be driven from one color output and the flash driven from two other outputs connected in parallel. The viewfinder output can be on during the flash for increasing the flash current. In this way the viewfinder light is continuous whereas the light is PWM modulated when internal duty control is used.

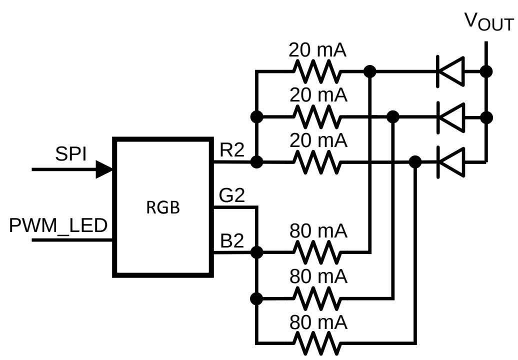

Figure 12. Flash Using RGB LED or several White LEDs with Viewfinder

Figure 12 shows the flash connection using RGB LED with viewfinder. It is easy to use just one color in viewfinder mode if desired by connecting just one of the LEDs to R2 output. The color balance adjustment can be done with internal duty setting or with external ballast resistors. In both cases the viewfinder mode needs to be started using SPI interface and the flash can be controlled either via SPI or using PWM_LED pin. It is possible to connect RGB1 and RGB2 outputs in parallel to get even higher currents, up to 720 mA. Programming examples 2 and 3 show the control sequences for different flash types.

5 Current Limiting Resistors

LED forward voltages vary widely depending on LED color, current, manufacturer, manufacturing lot, temperature etc. White, blue and some green LEDs exhibit the largest forward voltages and variations. The high dynamic resistance of these LEDs at high currents further adds to the voltage drop in FLASH operation. The drop may exceed 5V.

The maximum peak current for each individual RGB output is 120 mA. This current is available in continuous mode and in FLASH mode. In normal mode the maximum average current is 33% of the continuous and FLASH mode current, but the peak current will be the same in all cases.

The current limiting resistor size can be calculated from the following formula.

$$R_{LED} = (V_{OUT} - V_{LED})/I_{MAX} - R_{SW} \quad (6)$$

where	V_{OUT} = DC/DC converter output voltage
	V_{LED} = LED voltage drop at I_{MAX}
	I_{MAX} = Selected maximum peak current
	R_{SW} = Output switch resistance

Table 3 and Table 4 show the voltages and current limiting resistors at 75 mA and 25 mA PWM peak currents. As the input power calculation shows, if high FLASH currents are not needed, it is better to use the circuit in FLASH mode and limit the current to the normal value with external resistors. Lower LED peak current makes possible to use lower boost voltage to improve efficiency.

Boost output voltage is selected sufficiently higher than the highest LED forward voltage. Sharp RGB LED GM5WA06250 forward voltages are used in these examples. A nominal switch resistance of 3Ω is used in the calculations. Other values are calculated as:

	$V_{SW} = R_{SW} * I_{LED}$
	$V_R = V_{OUT} – V_{LED} – V_{SW}$
	$R_{LED} = V_R / I_{LED}$

Table 3. Resistor Size Calculation, FLASH and Normal Modes in Use

	Red	Green	Blue	Unit
I_{LED}	75	75	75	mA
V_{OUT}	5,30	5,30	5,30	V
V_{LED}	2,60	4,80	5,00	V
V_{SW}	0,23	0,23	0,23	V
V_R	2,48	0,28	0,07	V
R_{LED}	33,00	3,67	1,00	Ω
Power in FLASH mode			1,19	W
Power in normal mode			0,40	W

Table 4. Resistor Size Calculation, FLASH Mode Used as Normal Mode

	Red	Green	Blue	Unit
I_{LED}	25	25	25	mA
V_{OUT}	4,50	4,50	4,50	V
V_{LED}	2,30	3,80	4,00	V
V_{SW}	0,08	0,08	0,08	V
V_R	2,13	0,63	0,43	V
R_{LED}	85,00	25,00	17,00	Ω
Power in FLASH mode			0,34	W

6 Control Registers

Control registers and register bits are shown in Table 5.

Table 5. LP3933 Control Registers

ADDR	REGISTER	D7	D6	D5	D4	D3	D2	D1	D0
00H	**RGB Control register1**	rgb pwm	rgb start	rsw1	gsw1	bsw1	rsw2	gsw2	bsw2
01H	**red1_on_off**	r1_on[3]	r1_on[2]	r1_on[1]	r1_on[0]	r1_off[3]	r1_off[2]	r1_off[1]	r1_off[0]
02H	**green1_on_off**	g1_on[3]	g1_on[2]	g1_on[1]	g1_on[0]	g1_off[3]	g1_off[2]	g1_off[1]	g1_off[0]
03H	**blue1_on_off**	b1_on[3]	b1_on[2]	b1_on[1]	b1_on[0]	b1_off[3]	b1_off[2]	b1_off[1]	b1_off[0]

Table 5. LP3933 Control Registers (continued)

ADDR	REGISTER	D7	D6	D5	D4	D3	D2	D1	D0
04H	**r1slope, r1duty**	r1slope[3]	r1slope[2]	r1slope[1]	r1slope[0]	r1duty[3]	r1duty[2]	r1duty[1]	r1duty[0]
05H	**g1slope, g1duty**	g1slope[3]	g1slope[2]	g1slope[1]	g1slope[0]	g1duty[3]	g1duty[2]	g1duty[1]	g1duty[0]
06H	**b1slope, b1duty**	b1slope[3]	b1slope[2]	b1slope[1]	b1slope[0]	b1duty[3]	b1duty[2]	b1duty[1]	b1duty[0]
07H	**RGB Control register2**	cycle[1]	cycle[0]	r1_pwm	g1_pwm	b1_pwm	r2_pwm	g2_pwm	b2_pwm
08H	**wled control reg**					wled_pwm	cled_pwm	en_wled	en_cled
09H	**WLED1–4**	wled[7]	wled[6]	wled[5]	wled[4]	wled[3]	wled[2]	wled[1]	wled[0]
0AH	**CLED1–2**	cled[7]	cled[6]	cled[5]	cled[4]	cled[3]	cled[2]	cled[1]	cled[0]
0BH	**enables**		nsby	en_boost	en_flash1	en_flash2			
0DH	**boost output**	boost[7]	boost[6]	boost[5]	boost[4]	boost[3]	boost[2]	boost[1]	boost[0]
2AH	**red2_on_off**	r2_on[3]	r2_on[2]	r2_on[1]	r2_on[0]	r2_off[3]	r2_off[2]	r2_off[1]	r2_off[0]
2BH	**green2_on_off**	g2_on[3]	g2_on[2]	g2_on[1]	g2_on[0]	g2_off[3]	g2_off[2]	g2_off[1]	g2_off[0]
2CH	**blue2_on_off**	b2_on[3]	b2_on[2]	b2_on[1]	b2_on[0]	b2_off[3]	b2_off[2]	b2_off[1]	b2_off[0]
2DH	**r2slope, r2duty**	r2slope[3]	r2slope[2]	r2slope[1]	r2slope[0]	r2duty[3]	r2duty[2]	r2duty[1]	r2duty[0]
2EH	**g2slope, g2duty**	g2slope[3]	g2slope[2]	g2slope[1]	g2slope[0]	g2duty[3]	g2duty[2]	g2duty[1]	g2duty[0]
2FH	**b2slope, b2duty**	b2slope[3]	b2slope[2]	b2slope[1]	br2slope[0]	br2duty[3]	br2duty[2]	br2duty[1]	br2duty[0]

7 Slope Values

All slope times in milliseconds at different SLOPE and DUTY settings are shown in Table 6. The CYCLE setting does not affect slope time.

Table 6. LP3933 Slope Times

slope	duty															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
0	0	2	4	6	8	10	12	14	17	19	21	23	25	27	29	31
1	0	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62
2	0	8	17	25	33	41	50	58	66	74	83	91	99	107	116	124
3	0	12	25	37	50	62	74	87	99	112	124	136	149	161	174	186
4	0	17	33	50	66	83	99	116	132	149	165	182	198	215	231	248
5	0	21	41	62	83	103	124	145	165	186	207	227	248	269	289	310
6	0	25	50	74	99	124	149	174	198	223	248	273	298	322	347	372
7	0	29	58	87	116	145	174	203	231	260	289	318	347	376	405	434
8	0	33	66	99	132	165	198	231	265	298	331	364	397	430	463	496
9	0	37	74	112	149	186	223	260	298	335	372	409	446	484	521	558
10	0	41	83	124	165	207	248	289	331	372	413	455	496	537	579	620
11	0	45	91	136	182	227	273	318	364	409	455	500	546	591	637	682
12	0	50	99	149	198	248	298	347	397	446	496	546	595	645	694	744
13	0	54	107	161	215	269	322	376	430	484	537	591	645	699	752	806
14	0	58	116	174	231	289	347	405	463	521	579	637	694	752	810	868
15	0	62	124	186	248	310	372	434	496	558	620	682	744	806	868	930

8 Programming Examples

8.1 Programming Example #1

RGB1 blinking according to Figure 7	
50% duty cycle for red	
Maximum duty cycles for green and blue	
Cycle time is 2 sec	
R1 output slope is maximum (15, slowest)	
G1 output slope is 6	
B1 is on without blinking	
Step 0:	Reset the chip after power on and turn the chip on
Step 1:	Set R1_ON to switch R1 output on at 19% of the cycle Set R1_OFF to switch R1 output off at 63% of the cycle
Step 2:	Set G1_ON to switch G1 output off at 50% of the cycle Set G1_OFF to switch G1 output off at 13% of the cycle
Step 3:	Set B1_ON to 0% (on without blinking when B1_ON=B1_OFF=0%) Set B1_OFF to 0%
Step 4:	Set R1DUTY, R1SLOPE to achieve 50% duty and maximum slope
Step 5:	Set G1DUTY, G1SLOPE to achieve maximum duty and medium slope
Step 6:	Set B1DUTY to achieve maximum intensity of the B1 output
Step 7:	Set RGB CONTROL REGISTER2 pwm-bits to 0 to disable external control of LEDs Set CYCLE to achieve a period of 2 sec
Step 8:	Turn RGB1 LEDs on

Step	Description	Register Name Register # (Hex)	Set to (Hex)
0	Set NSTBY to 1 Set EN_BOOST to 1	ENABLES 0B	60
1	Set R1_ON to 19% (R1_ON = 3) Set R1_OFF to 63% (R1_OFF = 10)	RED1_ON_OFF 01	3A
2	Set G1_ON to 50% (G1_ON = 8) Set G1_OFF to 13% (G1_OFF = 2)	GREEN1_ON_OFF 02	82
3	Set B1_ON to 0 (B1_ON = 0) Set B1_OFF to 0 (B1_OFF = 0)	BLUE1_ON_OFF 03	00
4	Set R1DUTY to 50% (R1DUTY = 8) Set R1SLOPE to MAX (R1SLOPE = 15)	R1SLOPE, R1DUTY 04	F8
5	Set G1DUTY to MAX (G1DUTY = 15) Set G1SLOPE to 6 (G1SLOPE = 6)	G1SLOPE, G1DUTY 05	6F
6	Set B1DUTY to MAX (B1DUTY = 15) Set B1SLOPE to 0 (B1SLOPE = 0)	B1SLOPE, B1DUTY 06	0F
7	Set R1_PWM, G1_PWM, B1_PWM to 0 Set CYCLE to 2 sec (CYCLE = 3)	RGB_CONTROL_ REG2 07	C0
8	Set RSW1, GSW1, BSW1 to 1 Set RGB_PWM, RGB_START to 1	RGB_CONTROL_ REG1 00	F8

8.2 Programming Example #2

FLASH with viewfinder triggered via SPI according to Figure 10.	
RGB2 driver used in normal mode for viewfinder and in FLASH mode for flashlight.	
Flash length 100 ms.	
Flash light is adjusted white by adjusting individual color brightnesses to red=40%, green=66% and blue=100%.	
Step 0:	Reset the chip after power on, turn the chip on and set normal mode for RGB2
Step 1:	Set R2_ON to 0% (on without blinking when R2_ON=R2_OFF=0%) Set R2_OFF to 0%
Step 2:	Set G2_ON to 0% Set G2_OFF to 0%
Step 3:	Set B2_ON to 0% Set B2_OFF to 0%
Step 4:	Set R2DUTY to 40%
Step 5:	Set G2DUTY to 66%
Step 6:	Set B2DUTY to 100%
Step 7:	Set RGB CONTROL REGISTER2 pwm-bits to 0 to disable external control of LEDs
Step 8:	Turn RGB2 LEDs on for viewfinder mode
Step 9:	Start flash by setting FLASH mode for RGB2
Step 10:	Turn RGB2 LEDs off **after 100 ms**

Step	Description	Register Name Register # (Hex)	Set to (Hex)
0	Set NSTBY to 1 Set EN_BOOST to 1 Set EN_FLASH1 and EN_FLASH2 to 0	ENABLES 0B	60
1	Set R2_ON to 0% (R2_ON = 0) Set R2_OFF to 0% (R2_OFF = 0)	RED2_ON_OFF 2A	00
2	Set G2_ON to 0% (G2_ON = 0) Set G2_OFF to 0% (G2_OFF = 0)	GREEN2_ON_OFF 2B	00
3	Set B2_ON to 0 (B2_ON = 0) Set B2_OFF to 0 (B2_OFF = 0)	BLUE2_ON_OFF 2C	00
4	Set R2DUTY to 40% (R2DUTY = 6) Set R2SLOPE to 0 (R2SLOPE = 0)	R2SLOPE, R2DUTY 2D	06
5	Set G2DUTY to 66% (G2DUTY = 10) Set G2SLOPE to 0 (G2SLOPE = 0)	G2SLOPE, G2DUTY 2E	0A
6	Set B2DUTY to 100% (B2DUTY = 15) Set B2SLOPE to 0 (B2SLOPE = 0)	B2SLOPE, B2DUTY 2F	0F
7	Set R2_PWM, G2_PWM, B2_PWM to 0 (Other bits may maintain previous values, here all bits are set to 0)	RGB_CONTROL_REG2 07	00
8	Set RSW2, GSW2, BSW2 to 1 Set RGB_PWM, RGB_START to 1	RGB_CONTROL_REG1 00	C7
9	Set EN_FLASH2 to 1	ENABLES 0B	68

Step	Description	Register Name Register # (Hex)	Set to (Hex)
10	Set RSW2, GSW2, BSW2 to 0 Set RGB_PWM, RGB_START to 0	RGB_CONTROL_REG1 00	00

8.3 Programming Example #3

FLASH with viewfinder controlled from PWM_LED input according to Figure 11 and Figure 12.	
R2 output used for viewfinder and G2 and B2 used for flash.	
RGB2 driver used in continuous mode.	
Viewfinder length 1 second and flash length 100 ms.	
Step 0:	Reset the chip after power on, turn the chip on (PWM_LED input is low)
Step 1:	Enable PWM_LED control for G2 and B2 outputs
Step 2:	Start viewfinder by setting RGB_START and RSW2 to 1. GSW2 and BSW2 can be set to 1, G1 and B1 will turn on only after PWM_LED input goes high.
Step 3:	After 1s start flash by taking PWM_LED high for 100ms
Step 4:	Disable RGB outputs

Step	Description	Register Name Register # (Hex)	Set to (Hex)
0	Set NSTBY to 1 Set EN_BOOST to 1	ENABLES 0B	60
1	Set R2_PWM to 0 Set G2_PWM and B2_PWM to 1	RGB_CONTROL_REG2 07	03
2	Set RSW2, GSW2 and BSW2 to 1 Set RGB_START to 1	RGB_CONTROL_REG1 00	47
3	Wait 1s. Take PWM_LED input high for 100ms		
4	Set RSW2, GSW2, BSW2 to 0 Set RGB_PWM, RGB_START to 0	RGB_CONTROL_REG1 00	00

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