

LAB HANDBOOK

Module 1:

Flow Summary	
<<Filter>>	
Flow Status	Successful - Wed Feb 21 15:04:39 2018
Quartus Prime Version	16.1.0 Build 196 10/24/2016 SJ Lite Edition
Revision Name	pwm_led_top
Top-level Entity Name	pwm_led_top
Family	MAX 10
Device	10M50DAF484C7G
Timing Models	Final
Total logic elements	33 / 49,760 (< 1 %)
Total registers	31
Total pins	6 / 360 (2 %)
Total virtual pins	0
Total memory bits	0 / 1,677,312 (0 %)
Embedded Multiplier 9-bit elements	0 / 288 (0 %)
Total PLLs	1 / 4 (25 %)
UFM blocks	0 / 1 (0 %)
ADC blocks	0 / 2 (0 %)

Figure 1: Compilation report of Module 1 (PWM)

	Fmax	Restricted Fmax	Clock Name	Note
1	422.83 MHz	416.15 MHz	b2v_inst altp...d pll1 clk[1]	limit due to minimum period restriction (tmin)
2	508.65 MHz	416.15 MHz	b2v_inst altp...d pll1 clk[0]	limit due to minimum period restriction (tmin)

Figure 2: Fmax of Module 1(PWM)

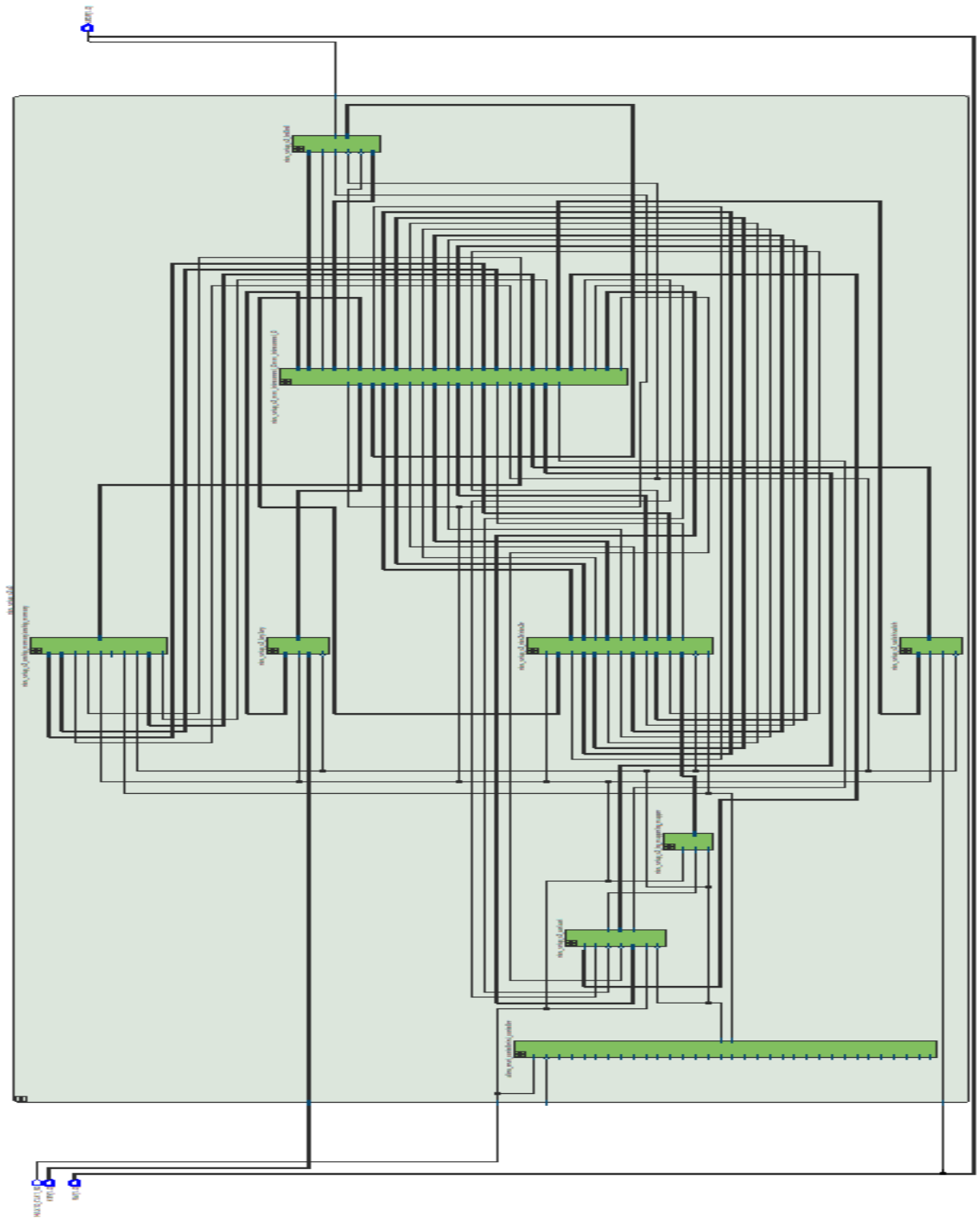
Flow Summary	
<<Filter>>	
Flow Status	Successful - Wed Feb 07 19:38:31 2018
Quartus Prime Version	16.1.0 Build 196 10/24/2016 SJ Lite Edition
Revision Name	pwm_led_top
Top-level Entity Name	pwm_led_top
Family	MAX 10
Device	10M50DAF484C6GES
Timing Models	Preliminary
Total logic elements	4,734 / 49,760 (10 %)
Total registers	3233
Total pins	50 / 360 (14 %)
Total virtual pins	0
Total memory bits	270,176 / 1,677,312 (16 %)
Embedded Multiplier 9-bit elements	0 / 288 (0 %)
Total PLLs	2 / 4 (50 %)
UFM blocks	0 / 1 (0 %)
ADC blocks	1 / 2 (50 %)

Figure 3: Compilation report of Module 1(ADC)

Slow 1200mV 85C Model Fmax Summary				
<<Filter>>				
	Fmax	Restricted Fmax	Clock Name	Note
1	50.38 MHz	50.38 MHz	ADC_CLK_10	
2	64.02 MHz	64.02 MHz	altera_reserved_tck	
3	413.74 MHz	413.74 MHz	inst altpll_c...d pll1 clk[1]	
4	623.05 MHz	450.05 MHz	inst altpll_c...d pll1 clk[0]	limit due to minimum period restriction (tmin)

Figure 4: Fmax of Module 1(ADC)

Module 2:



System: nios_setup_v2 Path: clk_0

Use	Connections	Name	Description	Export	Clock	Base	End	IRQ	Tags
<input checked="" type="checkbox"/>		clk_0	Clock Source						
		clk_in	Clock Input	clk	exported				
		clk_in_reset	Reset Input	reset					
		clk	Clock Output	Double-click to export	clk_0				
		clk_reset	Reset Output	Double-click to export					
<input checked="" type="checkbox"/>		nios2e	Nios II Processor						
		clk	Clock Input	Double-click to export	clk_0				
		reset	Reset Input	Double-click to export	[clk]				
		data_master	Avalon Memory Mapped Master	Double-click to export	[clk]				
		instruction_master	Avalon Memory Mapped Master	Double-click to export	[clk]				
		irq	Interrupt Receiver	Double-click to export	[clk]			IRQ 0	
		debug_reset_request	Reset Output	Double-click to export	[clk]				
		debug_mem_slave	Avalon Memory Mapped Slave	Double-click to export	[clk]				
		custom_instruction_m...	Custom Instruction Master	Double-click to export	[clk]				
<input checked="" type="checkbox"/>		onchip_memory	On-Chip Memory (RAM or ROM)						
		clk1	Clock Input	Double-click to export	clk_0				
		s1	Avalon Memory Mapped Slave	Double-click to export	[clk1]	0x4000	0x7fff		
		reset1	Reset Input	Double-click to export	[clk1]				
<input checked="" type="checkbox"/>		uart	JTAG UART						
		clk	Clock Input	Double-click to export	clk_0				
		reset	Reset Input	Double-click to export	[clk]				
		avalon_jtag_slave	Avalon Memory Mapped Slave	Double-click to export	[clk]	0x9030	0x9037		
		irq	Interrupt Sender	Double-click to export	[clk]				
<input checked="" type="checkbox"/>		switch	PIO (Parallel I/O)						
		clk	Clock Input	Double-click to export	clk_0				
		reset	Reset Input	Double-click to export	[clk]				
		s1	Avalon Memory Mapped Slave	Double-click to export	[clk]	0x9020	0x902f		
		external_connection	Conduit	switch_external_conne...					
<input checked="" type="checkbox"/>		led	PIO (Parallel I/O)						
		clk	Clock Input	Double-click to export	clk_0				
		reset	Reset Input	Double-click to export	[clk]				
		s1	Avalon Memory Mapped Slave	Double-click to export	[clk]	0x9010	0x901f		
		external_connection	Conduit	led_external_connection					
<input checked="" type="checkbox"/>		key	PIO (Parallel I/O)						
		clk	Clock Input	Double-click to export	clk_0				
		reset	Reset Input	Double-click to export	[clk]				
		s1	Avalon Memory Mapped Slave	Double-click to export	[clk]	0x9000	0x900f		
		external_connection	Conduit	key_external_connection					

Figure 6: Qsys connections of Module 2

Slow 1200mV 85C Model Fmax Summary				
<<Filter>>				
	Fmax	Restricted Fmax	Clock Name	Note
1	119.47 MHz	119.47 MHz	altera_...ved_tck	

Figure 7: Fmax of Module 2

Flow Summary	
<<Filter>>	
Flow Status	Successful - Wed Feb 21 17:44:26 2018
Quartus Prime Version	17.1.0 Build 590 10/25/2017 SJ Lite Edition
Revision Name	hello_world_lab
Top-level Entity Name	hello_world
Family	MAX 10
Device	10M50DAF484C6GES
Timing Models	Preliminary
Total logic elements	1,626 / 49,760 (3 %)
Total registers	886
Total pins	7 / 360 (2 %)
Total virtual pins	0
Total memory bits	142,336 / 1,677,312 (8 %)
Embedded Multiplier 9-bit elements	0 / 288 (0 %)
Total PLLs	0 / 4 (0 %)
UFM blocks	0 / 1 (0 %)
ADC blocks	0 / 2 (0 %)

Figure 8: Compilation Report of Module 2

```

hello_world_sw Nios II Hardware configuration - cable: USB-Blaster on l
Hello from Nios II!
Press Push buttons to display names.
Vikrant Waje
Anay Gondhalekar
Anay Gondhalekar
Anay Gondhalekar
Vikrant Waje
Vikrant Waje

```

Figure 9: Output of software part of Module 2

Module 3:

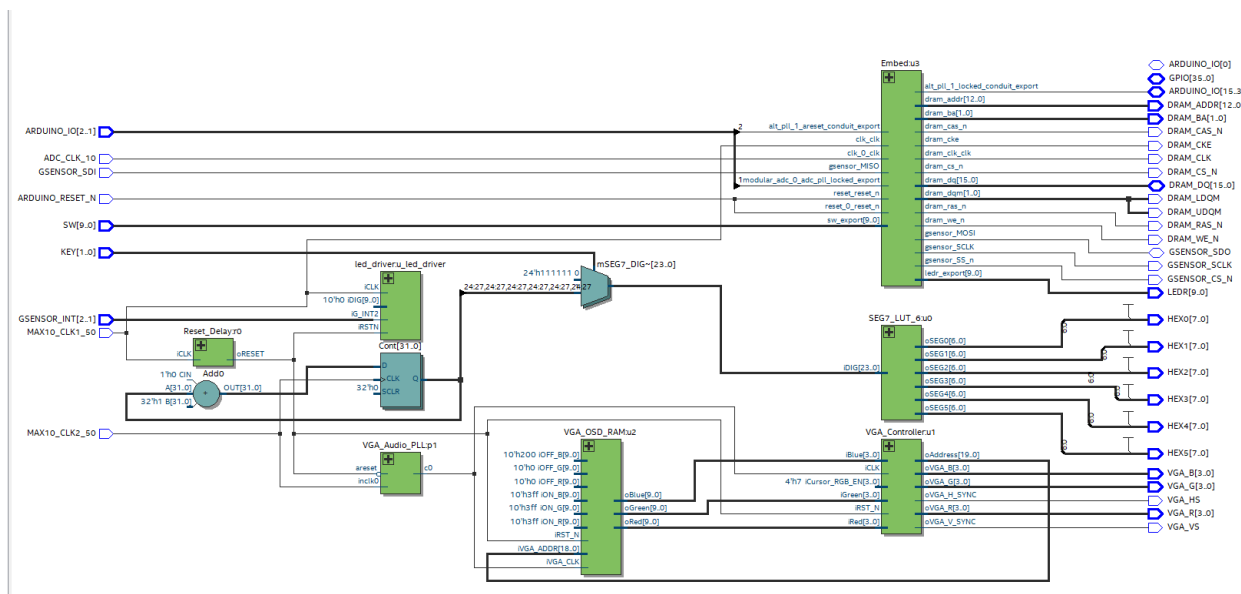


Figure 10: RTL view of Module 3


Slow 1200mV 85C Model Fmax Summary				
 <<Filter>>				
	Fmax	Restricted Fmax	Clock Name	Note
1	86.22 MHz	86.22 MHz	altera_reserved_tck	

Figure 11: Fmax of Module 3

Flow Status	Successful - Fri Feb 16 15:03:52 2018
Quartus Prime Version	16.1.0 Build 196 10/24/2016 SJ Lite Edition
Revision Name	Embed
Top-level Entity Name	DE10_LITE_Default
Family	MAX 10
Device	10M50DAF484C6GES
Timing Models	Preliminary
Total logic elements	7,778 / 49,760 (16 %)
Total registers	4606
Total pins	185 / 360 (51 %)
Total virtual pins	0
Total memory bits	490,296 / 1,677,312 (29 %)
Embedded Multiplier 9-bit elements	6 / 288 (2 %)
Total PLLs	3 / 4 (75 %)
UFM blocks	1 / 1 (100 %)
ADC blocks	1 / 2 (50 %)

Figure 12: Compilation report of Module 3

```

Embed_System Nios II Hardware configuration - cable: USB-Blaster on localhost [USB-0] device ID: 1 instance ID: 0 n...
led_control program starting...

CONGRATULATIONS! You have successfully compiled a Nios II project!

Press 'u' to count up
Press 'd' to count down
Press '3' to count by threes
Press 't' to count down by ten
Press '5' to count up by 5

t
You selected: 't'
- counting down by 10
0xfa 0xf0 0xe6 0xdc 0xd2 0xc8 0xbe 0xb4 0xaa 0xa0 0x96 0x8c 0x82 0x78 0x6e 0x64
0x5a 0x50 0x46 0x3c 0x32 0x28 0x1e 0x14 0xa 0x0
|
LED control program completed its loop ...

```

Figure 13: Output when down counting of 10 is done by pressing 't'

Embed_System Nios II Hardware configuration - cable: USB-Blaster on localhost [USB-0] device ID: 1 instance ID: 0 n...

```
You selected: 'u'
- counting up by 1
0x0 0x1 0x2 0x3 0x4 0x5 0x6 0x7 0x8 0x9 0xa 0xb 0xc 0xd 0xe 0xf
0x10 0x11 0x12 0x13 0x14 0x15 0x16 0x17 0x18 0x19 0x1a 0x1b 0x1c 0x1d 0x1e 0x1f
0x20 0x21 0x22 0x23 0x24 0x25 0x26 0x27 0x28 0x29 0x2a 0x2b 0x2c 0x2d 0x2e 0x2f
0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x3a 0x3b 0x3c 0x3d 0x3e 0x3f
0x40 0x41 0x42 0x43 0x44 0x45 0x46 0x47 0x48 0x49 0x4a 0x4b 0x4c 0x4d 0x4e 0x4f
0x50 0x51 0x52 0x53 0x54 0x55 0x56 0x57 0x58 0x59 0x5a 0x5b 0x5c 0x5d 0x5e 0x5f
0x60 0x61 0x62 0x63 0x64 0x65 0x66 0x67 0x68 0x69 0x6a 0x6b 0x6c 0x6d 0x6e 0x6f
0x70 0x71 0x72 0x73 0x74 0x75 0x76 0x77 0x78 0x79 0x7a 0x7b 0x7c 0x7d 0x7e 0x7f
0x80 0x81 0x82 0x83 0x84 0x85 0x86 0x87 0x88 0x89 0x8a 0x8b 0x8c 0x8d 0x8e 0x8f
0x90 0x91 0x92 0x93 0x94 0x95 0x96 0x97 0x98 0x99 0x9a 0x9b 0x9c 0x9d 0x9e 0x9f
0xa0 0xa1 0xa2 0xa3 0xa4 0xa5 0xa6 0xa7 0xa8 0xa9 0xaa 0xab 0xac 0xad 0xae 0xaf
0xb0 0xb1 0xb2 0xb3 0xb4 0xb5 0xb6 0xb7 0xb8 0xb9 0xba 0xbb 0xbc 0xbd 0xbe 0xbf
0xc0 0xc1 0xc2 0xc3 0xc4 0xc5 0xc6 0xc7 0xc8 0xc9 0xca 0xcb 0xcc 0xcd 0xce 0xcf
0xd0 0xd1 0xd2 0xd3 0xd4 0xd5 0xd6 0xd7 0xd8 0xd9 0xda 0xdb 0xdc 0xdd 0xde 0xdf
0xe0 0xe1 0xe2 0xe3 0xe4 0xe5 0xe6 0xe7 0xe8 0xe9 0xea 0xeb 0xec 0xed 0xee 0xef
0xf0 0xf1 0xf2 0xf3 0xf4 0xf5 0xf6 0xf7 0xf8 0xf9 0xfa 0xfb 0xfc 0xfd 0xfe 0xff
```

Figure 14: Upcounting by 1

Embed_System Nios II Hardware configuration - cable: USB-Blaster on localhost [USB-0] device ID: 1 instance ID: 0 n...

```
d
You selected: 'd'
- counting down by 1
0xff 0xfe 0xfd 0xfc 0xfb 0xfa 0xf9 0xf8 0xf7 0xf6 0xf5 0xf4 0xf3 0xf2 0xf1 0xf0
0xef 0xee 0xed 0xec 0xeb 0xea 0xe9 0xe8 0xe7 0xe6 0xe5 0xe4 0xe3 0xe2 0xe1 0xe0
0xdf 0xde 0xdd 0xdc 0xdb 0xda 0xd9 0xd8 0xd7 0xd6 0xd5 0xd4 0xd3 0xd2 0xd1 0xd0
0xcf 0xce 0xcd 0xcc 0xcb 0xca 0xc9 0xc8 0xc7 0xc6 0xc5 0xc4 0xc3 0xc2 0xc1 0xc0
0xbf 0xbe 0xbd 0xbc 0xbb 0xba 0xb9 0xb8 0xb7 0xb6 0xb5 0xb4 0xb3 0xb2 0xb1 0xb0
0xaf 0xae 0xad 0xac 0xab 0xaa 0xa9 0xa8 0xa7 0xa6 0xa5 0xa4 0xa3 0xa2 0xa1 0xa0
0x9f 0x9e 0x9d 0x9c 0x9b 0x9a 0x99 0x98 0x97 0x96 0x95 0x94 0x93 0x92 0x91 0x90
0x8f 0x8e 0x8d 0x8c 0x8b 0x8a 0x89 0x88 0x87 0x86 0x85 0x84 0x83 0x82 0x81 0x80
0x7f 0x7e 0x7d 0x7c 0x7b 0x7a 0x79 0x78 0x77 0x76 0x75 0x74 0x73 0x72 0x71 0x70
0x6f 0x6e 0x6d 0x6c 0x6b 0x6a 0x69 0x68 0x67 0x66 0x65 0x64 0x63 0x62 0x61 0x60
0x5f 0x5e 0x5d 0x5c 0x5b 0x5a 0x59 0x58 0x57 0x56 0x55 0x54 0x53 0x52 0x51 0x50
0x4f 0x4e 0x4d 0x4c 0x4b 0x4a 0x49 0x48 0x47 0x46 0x45 0x44 0x43 0x42 0x41 0x40
0x3f 0x3e 0x3d 0x3c 0x3b 0x3a 0x39 0x38 0x37 0x36 0x35 0x34 0x33 0x32 0x31 0x30
0x2f 0x2e 0x2d 0x2c 0x2b 0x2a 0x29 0x28 0x27 0x26 0x25 0x24 0x23 0x22 0x21 0x20
0x1f 0x1e 0x1d 0x1c 0x1b 0x1a 0x19 0x18 0x17 0x16 0x15 0x14 0x13 0x12 0x11 0x10
0xf 0xe 0xd 0xc 0xb 0xa 0x9 0x8 0x7 0x6 0x5 0x4 0x3 0x2 0x1 0x0
```

Figure 15: Down counting by 1


```

3
You selected: '3'
- counting up by 3
0x0 0x3 0x6 0x9 0xc 0xf 0x12 0x15 0x18 0x1b 0x1e 0x21 0x24 0x27 0x2a 0x2d
0x30 0x33 0x36 0x39 0x3c 0x3f 0x42 0x45 0x48 0x4b 0x4e 0x51 0x54 0x57 0x5a 0x5d
0x60 0x63 0x66 0x69 0x6c 0x6f 0x72 0x75 0x78 0x7b 0x7e 0x81 0x84 0x87 0x8a 0x8d
0x90 0x93 0x96 0x99 0x9c 0x9f 0xa2 0xa5 0xa8 0xab 0xae 0xb1 0xb4 0xb7 0xba 0xbd
0xc0 0xc3 0xc6 0xc9 0xcc 0xcf 0xd2 0xd5 0xd8 0xdb 0xde 0xe1 0xe4 0xe7 0xea 0xed
0xf0 0xf3 0xf6 0xf9 0xfc 0xff

```

Figure 16: Upcounting by 3

```

Embed_System Nios II Hardware configuration - cable: USB-Blaster on localhost [USB-0] device ID: 1 instance ID: 0 n...
^

Press 'u' to count up
Press 'd' to count down
Press '3' to count by threes
Press 't' to count down by ten
Press '5' to count up by 5

5
You selected: '5'
- counting up by 5
0x0 0x5 0xa 0xf 0x14 0x19 0x1e 0x23 0x28 0x2d 0x32 0x37 0x3c 0x41 0x46 0x4b
0x50 0x55 0x5a 0x5f 0x64 0x69 0x6e 0x73 0x78 0x7d 0x82 0x87 0x8c 0x91 0x96 0x9b
0xa0 0xa5 0xaa 0xaf 0xb4 0xb9 0xbe 0xc3 0xc8 0xcd 0xd2 0xd7 0xdc 0xe1 0xe6 0xeb
0xf0 0xf5 0xfa 0xff

LED control program completed its loop ...

```

Figure 17: Up counting by 5