

36-Channels Constant Current LED Driver

General Description

ET6038 is a with 36 independent constant current low resistance LED drive output channels, each channel has 256 steps PWM regulation function, the chip also has 16 steps global current regulation function, the maximum driving current of 42.6mA.

ET6038 using I²C bus structure, with a separate address and continuous address writing function, through the code to configure a variety of register Settings, to achieve the setting of various parameters.

Features

- Supply voltage 2.7V to 5.5V
- 36 constant current output channels
- The constant current output value is not affected by the load voltage
- Accurate current output value
- General difference between channels: < $\pm 5\%$ (typical value)
- With an external resistor, the current output can be adjusted
- Each circuit has 256 order PWM current adjustment function
- Maximum driving current up to 42.6mA
- I²C interface, four chip-address can be set
- Open and short circuit detection function
- Soft shutdown function/external hardware off function
- Package: QFN44(ET6038Y) or LQFP48(ET6038Q)

Device Information

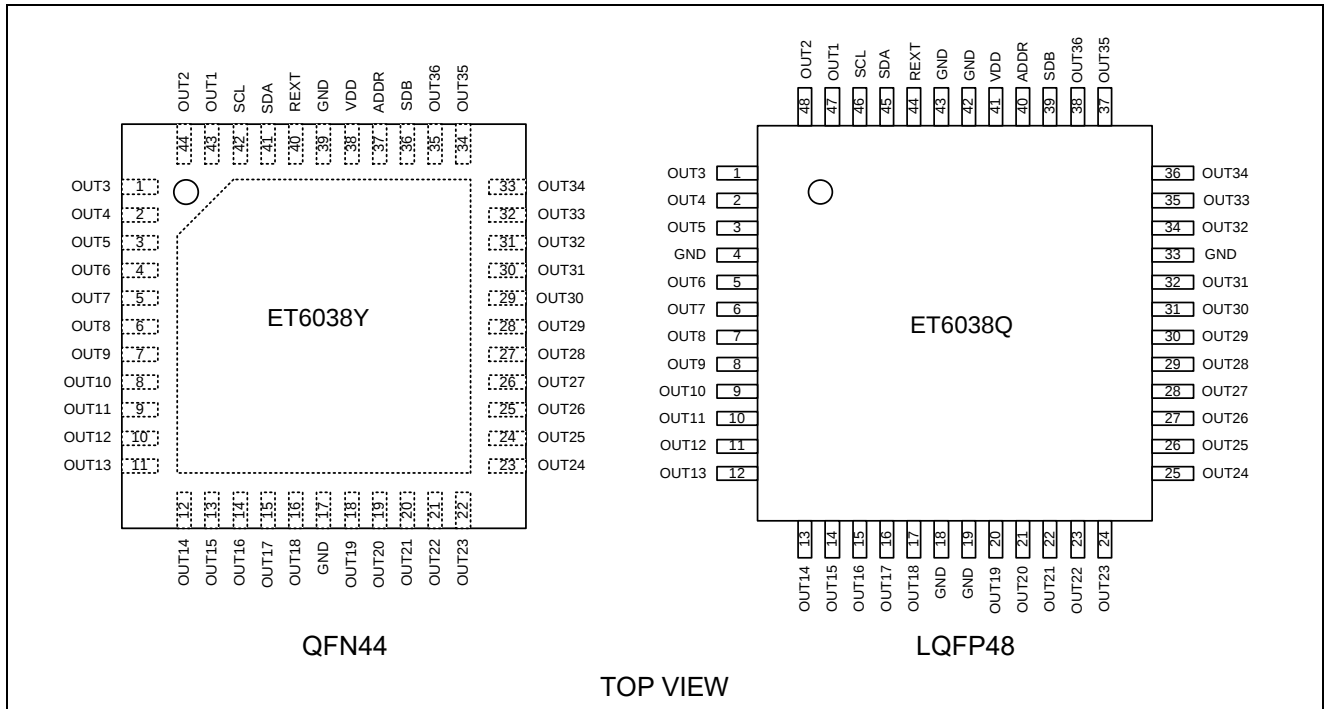
Part No.	Package	Size
ET6038Y	QFN44	5mm × 5mm
ET6038Q	LQFP48	7mm × 7mm

Application

- Household applications, Toy display
- Smart portable devices, Smart audio applications

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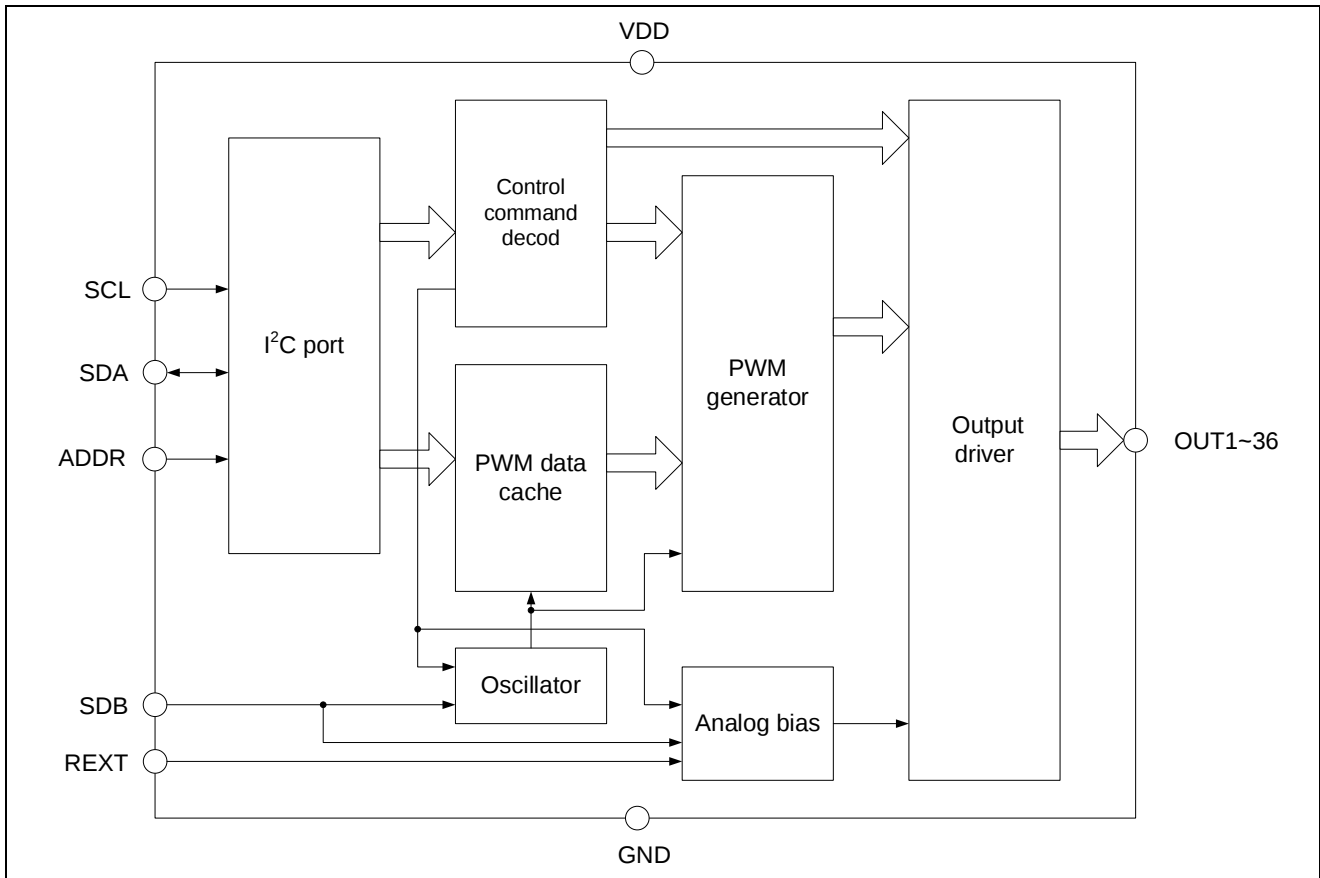
Pin Configuration



Pin Function

Pin No.		Pin Name	Pin Function
(Y) QFN44	(Q) LQFP48		
43,44,1~16,18~35	47,48,1~3,5~17,20~32,34~38	OUT1~OUT36	Constant current output port.
17,39	4,18,19,33,42,43	GND	Ground
36	39	SDB	Shutdown the chip when pulled low
37	40	ADDR	Chip-address select.
38	41	VDD	Positive Supply
40	44	REXT	Input terminal used to connect an external resistor for setting up output current for all output channels.
41	45	SDA	I ² C data input.
42	46	SCL	I ² C clock input.

Function Diagram



Functions Description

1. Serial Port Interface (I²C)

Bus Interface

Base band Processor can transmit data with ET6038 each other through SDA and SCL port. SDA and SCL composite bus interface, and a pull-up resistor to the power supply should be connected.

Data Validity

When the SCL signal is HIGH, the data of SDA port is valid and stable. Only when the SCL signal is low, the level on the SDA port can be changed.

Start (Re-start) and Stop Working Conditions

When the SCL signal is high, SDA signal from high to low represents start or re-start working conditions, while the SCL signal is high, SDA signal from low to high represents stop working conditions.

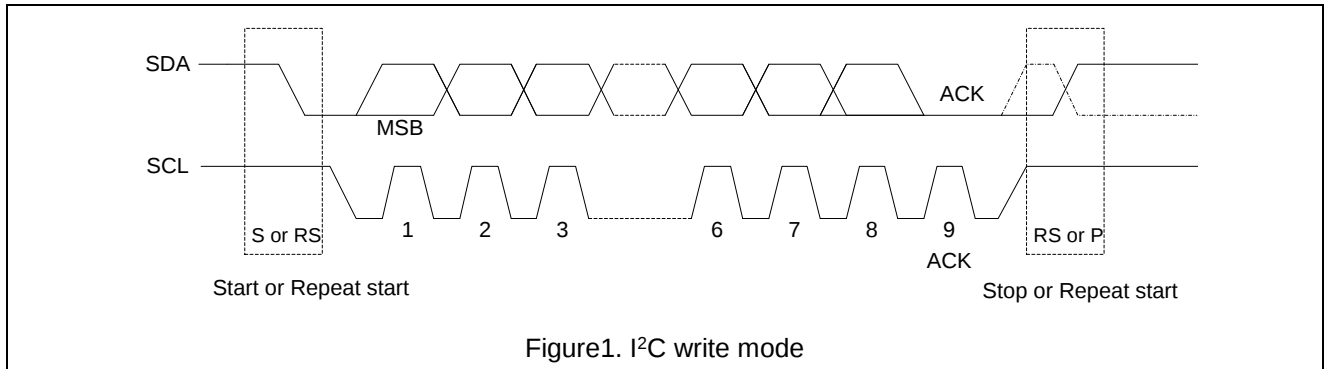
Byte format

Each byte of data line contains 8 bits, which contains an acknowledge bit. The first data is transmitted MSB.

Acknowledge

During the writing mode, ET6038 will send a low level response signal with one period width to the SDA port. During the reading mode, ET6038 will not send response signal and the host will send a high response signal one period width to the SDA.

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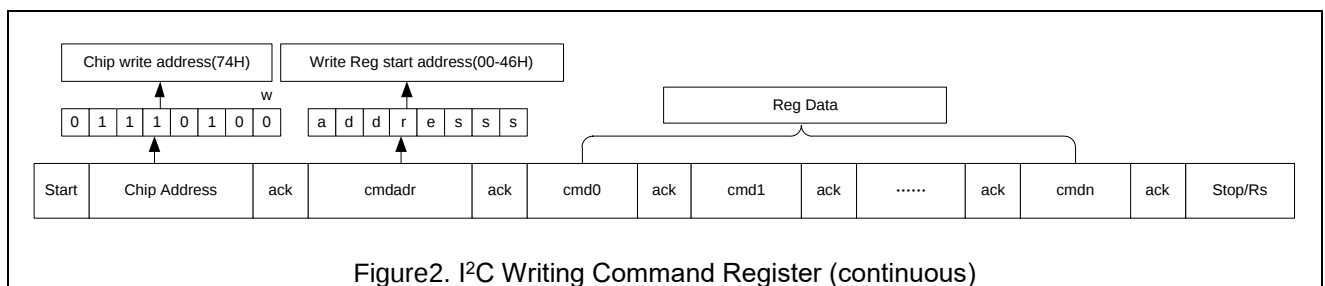
- ACK=Acknowledge
- MSB=Most Significant Bit
- S=Start Conditions RS=Restart Conditions P=Stop Conditions
- Fastest Transmission Speed =400KBITS/S
- Restart: SDA-level turnover as expressed by the dashed line waveform

Chip-Address

ET6038 has 4 chip-address:

ADDR pin connect signal	7bit Chip-Address	8bit Chip-Address
VDD	0111011b(3BH)	76H/77H(W/R)
GND	0111010b(3AH)	74H/75H(W/R)
SCL	0111000b(38H)	70H/71H(W/R)
SDA	0111001b(39H)	72H/73H(W/R)

I²C Writing Command Register Interface Protocol (continuous):



- Start=Start Conditions
- Chip address=Write register address =0111010+0(w)b
- ack=Acknowledge
- Write Reg start address byte = cmdadr(REG's 8bit addresss)
- ack=Acknowledge
- Reg data 0 = cmd0(Command data0)
- ack=Acknowledge
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- Reg data n =cmdn(Command datan)
- ack=Acknowledge
- Stop/Rs=Stop Condition/Restart Condition

I²C Reading Command Register Interface Protocol (continuous):

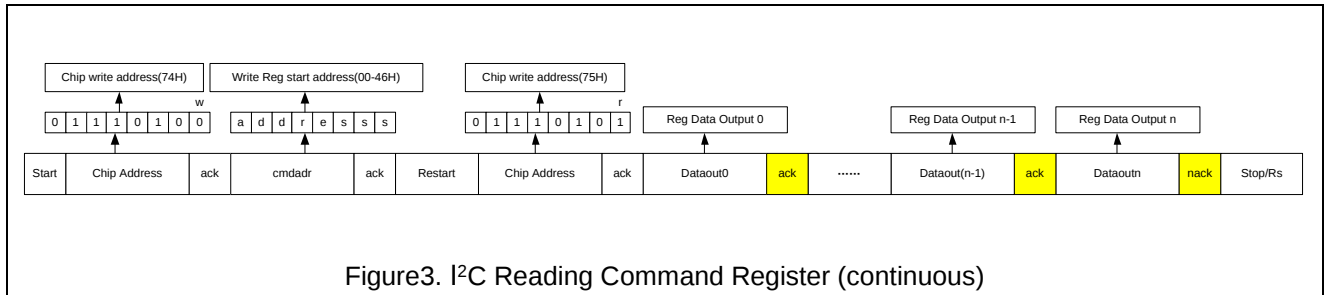


Figure3. I²C Reading Command Register (continuous)

- Start=Start Conditions
- Chip address =Write register address=0111010+0(w)b
- ack=Acknowledge from ET6038
- Write Reg start address byte = cmdadr(REG's 8bit addresss)
- ack=Acknowledge from ET6038
- Restart=Restart condition
- Chip address Read register address=0111010+1(r)b
- ack=Acknowledge from ET6038
- Dataout0=Register data output 0
- ack=Acknowledge from Host
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- Dataoutn=Register data output n
- nack=No Acknowledge from Host
- Stop/Rs=Stop Condition/Restart Condition

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2. Register Definition

Address	Name	Description							
00h	CONTROL1	sw_reset=11011b effective					osc_clk_sel[1:0]		chip_en
01h	CONTROL2	chipid=100			max_cur_sel[3:0]				dis_en
02h	LED_EN1	led8_en	led7_en	led6_en	led5_en	led4_en	led3_en	led2_en	led1_en
03h	LED_EN2	led16_en	led15_en	led14_en	led13_en	led12_en	led11_en	led10_en	led9_en
04h	LED_EN3	led24_en	led23_en	led22_en	led21_en	led20_en	led19_en	led18_en	led17_en
05h	LED_EN4	led32_en	led31_en	led30_en	led29_en	led28_en	led27_en	led26_en	led25_en
06h	LED_EN5	0	0	0	0	led36_en	led35_en	led34_en	led33_en
07h	CUR_SEL1	led4_cur[1:0]		led3_cur[1:0]		led2_cur[1:0]		led1_cur[1:0]	
08h	CUR_SEL2	led8_cur[1:0]		led7_cur[1:0]		led6_cur[1:0]		led5_cur[1:0]	
09h	CUR_SEL3	led12_cur[1:0]		led11_cur[1:0]		led10_cur[1:0]		led9_cur[1:0]	
0Ah	CUR_SEL4	led16_cur[1:0]		led15_cur[1:0]		led14_cur[1:0]		led13_cur[1:0]	
0Bh	CUR_SEL5	led20_cur[1:0]		led19_cur[1:0]		led18_cur[1:0]		led17_cur[1:0]	
0Ch	CUR_SEL6	led24_cur[1:0]		led23_cur[1:0]		led22_cur[1:0]		led21_cur[1:0]	
0Dh	CUR_SEL7	led28_cur[1:0]		led27_cur[1:0]		led26_cur[1:0]		led25_cur[1:0]	
0Eh	CUR_SEL8	led32_cur[1:0]		led31_cur[1:0]		led30_cur[1:0]		led29_cur[1:0]	
0Fh	CUR_SEL9	led36_cur[1:0]		led35_cur[1:0]		led34_cur[1:0]		led33_cur[1:0]	
10h	LED1PWM	led1pwm[7:0]							
11h	LED2PWM	led2pwm[7:0]							
12h	LED3PWM	led3pwm[7:0]							
13h	LED4PWM	led4pwm[7:0]							
14h	LED5PWM	led5pwm[7:0]							
15h	LED6PWM	led6pwm[7:0]							
16h	LED7PWM	led7pwm[7:0]							
17h	LED8PWM	led8pwm[7:0]							
18h	LED9PWM	led9pwm[7:0]							
19h	LED10PWM	led10pwm[7:0]							
1Ah	LED11PWM	led11pwm[7:0]							
1Bh	LED12PWM	led12pwm[7:0]							
1Ch	LED13PWM	led13pwm[7:0]							
1Dh	LED14PWM	led14pwm[7:0]							
1Eh	LED15PWM	led15pwm[7:0]							
1Fh	LED16PWM	led16pwm[7:0]							
20h	LED17PWM	led17pwm[7:0]							
21h	LED18PWM	led18pwm[7:0]							
22h	LED19PWM	led19pwm[7:0]							
23h	LED20PWM	led20pwm[7:0]							
24h	LED21PWM	led21pwm[7:0]							
25h	LED22PWM	led22pwm[7:0]							
26h	LED23PWM	led23pwm[7:0]							
27h	LED24PWM	led24pwm[7:0]							
28h	LED25PWM	led25pwm[7:0]							
29h	LED26PWM	led26pwm[7:0]							
2Ah	LED27PWM	led27pwm[7:0]							
2Bh	LED28PWM	led28pwm[7:0]							
2Ch	LED29PWM	led29pwm[7:0]							
2Dh	LED30PWM	led30pwm[7:0]							
2Eh	LED31PWM	led31pwm[7:0]							
2Fh	LED32PWM	led32pwm[7:0]							
30h	LED33PWM	led33pwm[7:0]							
31h	LED34PWM	led34pwm[7:0]							
32h	LED35PWM	led35pwm[7:0]							
33h	LED36PWM	led36pwm[7:0]							
40h	STA_DET_CTR	00		open_vset[1:0]		short_vset[1:0]		sta_det_en	open_short_sel
41h	LED_STA1	led8_sta	led7_sta	led6_sta	led5_sta	led4_sta	led3_sta	led2_sta	led1_sta
42h	LED_STA2	led16_sta	led15_sta	led14_sta	led13_sta	led12_sta	led11_sta	led10_sta	led9_sta
43h	LED_STA3	led24_sta	led23_sta	led22_sta	led21_sta	led20_sta	led19_sta	led18_sta	led17_sta
44h	LED_STA4	led32_sta	led31_sta	led30_sta	led29_sta	led28_sta	led27_sta	led26_sta	led25_sta
45h	LED_STA5	0	0	0	0	led36_sta	led35_sta	led34_sta	led33_sta
46h	SSP_CTR	otp_en	vds_sel	rext_sel	0	0	0	sspt_sel	ssp_en

Table 1. Registers Definition

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Table 2. CONTROL1 Register

Addr: 00h			CONTROL1 Register		
Addr	Bit	Bit Name	Default	Access	Description
00H	7:3	sw_reset	00000b	R/W	Software Reset Command
					11011b Reset reg00~46h
					Other -
	2:1	osc_clk_sel	00b	R/W	Oscillator frequency Selection
					00 1M
					01 2M
					10 4M
					11 8M
	0	chip_en	0b	R/W	Chip Enable Signal
					0 Disable the IC
					1 Enable the IC

Note: chip_en=0, all the analog circuit will be shutdown, the current consumption will be lowest.

Table 3. CONTROL2 Register

Addr: 01H			Global Current Select Register		
Addr	Bit	Bit Name	Default	Access	Description
01h	7:5	chipid	100b	R	CHIP Identification
	4:1	max_cur_sel	0111b	R/W	Max Current Select for Each Channel
					1111b 42.6mA
					1110b 40mA
					
					0111b 21.3mA
					
					0001b 5.32mA
					0000b 2.66mA
	0	dis_en	0b	R/W	Global Display Enable
					0b Display Disable
					1b Display Enable

Note: The current data in the table3, the condition is that the external resistance between REXT port and GND is 6Kohm.

Table 4. LED_EN1 Registers

Addr: 02H			OUT1~8 Channel Enable Registers		
Addr	Bit	Bit Name	Default	Access	Description
02H	7	led8_en	0b	R/W	OUT8 Channel Enable
					0b Turn off
					1b Turn on

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	6	led7_en	0b	R/W	OUT7 Channel Enable	
					0b	Turn off
					1b	Turn on
	5	led6_en	0b	R/W	OUT6 Channel Enable	
					0b	Turn off
					1b	Turn on
	4	led5_en	0b	R/W	OUT5 Channel Enable	
					0b	Turn off
					1b	Turn on
	3	led4_en	0b	R/W	OUT4 Channel Enable	
					0b	Turn off
					1b	Turn on
	2	led3_en	0b	R/W	OUT3 Channel Enable	
					0b	Turn off
					1b	Turn on
	1	led2_en	0b	R/W	OUT2 Channel Enable	
					0b	Turn off
					1b	Turn on
	0	led1_en	0b	R/W	OUT1 Channel Enable	
					0b	Turn off
					1b	Turn on

Table 5. LED_EN2 Registers

Addr: 03H			OUT9~16 Channel Enable Registers			
Addr	Bit	Bit Name	Default	Access	Description	
03H	7	led16_en	0b	R/W	OUT16 Channel Enable	
					0b	Turn off
					1b	Turn on
	6	led15_en	0b	R/W	OUT15 Channel Enable	
					0b	Turn off
					1b	Turn on
	5	led14_en	0b	R/W	OUT14 Channel Enable	
					0b	Turn off
					1b	Turn on
	4	led13_en	0b	R/W	OUT13 Channel Enable	
					0b	Turn off
					1b	Turn on
	3	led12_en	0b	R/W	OUT12 Channel Enable	
					0b	Turn off
					1b	Turn on
	2	led11_en	0b	R/W	OUT11 Channel Enable	

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					0b	Turn off
					1b	Turn on
	1	led10_en	0b	R/W	OUT10 Channel Enable	
					0b	Turn off
					1b	Turn on
	0	led9_en	0b	R/W	OUT9 Channel Enable	
					0b	Turn off
					1b	Turn on

Table 6. LED_EN3 Registers

Addr: 04H			OUT17~24 Channel Enable Registers			
Addr	Bit	Bit Name	Default	Access	Description	
04H	7	led24_en	0b	R/W	OUT24 Channel Enable	
					0b	Turn off
					1b	Turn on
	6	led23_en	0b	R/W	OUT23 Channel Enable	
					0b	Turn off
					1b	Turn on
	5	led22_en	0b	R/W	OUT22 Channel Enable	
					0b	Turn off
					1b	Turn on
	4	led21_en	0b	R/W	OUT21 Channel Enable	
					0b	Turn off
					1b	Turn on
	3	led20_en	0b	R/W	OUT20 Channel Enable	
					0b	Turn off
					1b	Turn on
	2	led19_en	0b	R/W	OUT19 Channel Enable	
					0b	Turn off
					1b	Turn on
	1	led18_en	0b	R/W	OUT18 Channel Enable	
					0b	Turn off
					1b	Turn on
	0	led17_en	0b	R/W	OUT17 Channel Enable	
					0b	Turn off
					1b	Turn on

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Table 7. LED_EN4 Registers

Addr: 05H			OUT25~32 Channel Enable Registers			
Addr	Bit	Bit Name	Default	Access	Description	
05H	7	led32_en	0b	R/W	OUT32 Channel Enable	
					0b	Turn off
					1b	Turn on
	6	led31_en	0b	R/W	OUT31 Channel Enable	
					0b	Turn off
					1b	Turn on
	5	led30_en	0b	R/W	OUT30 Channel Enable	
					0b	Turn off
					1b	Turn on
	4	led29_en	0b	R/W	OUT29 Channel Enable	
					0b	Turn off
					1b	Turn on
	3	led28_en	0b	R/W	OUT28 Channel Enable	
					0b	Turn off
					1b	Turn on
	2	led27_en	0b	R/W	OUT27 Channel Enable	
					0b	Turn off
					1b	Turn on
	1	led26_en	0b	R/W	OUT26 Channel Enable	
					0b	Turn off
					1b	Turn on
	0	led25_en	0b	R/W	OUT25 Channel Enable	
					0b	Turn off
					1b	Turn on

Table 8. LED_EN5 Registers

Addr: 06H			OUT33~36 Channel Enable Registers			
Addr	Bit	Bit Name	Default	Access	Description	
06H	7:4	-	-	-	Reserved	
	3	led36_en	0b	R/W	OUT36 Channel Enable	
					0b	Turn off
					1b	Turn on
	2	led35_en	0b	R/W	OUT35 Channel Enable	
					0b	Turn off
					1b	Turn on
	1	led34_en	0b	R/W	OUT34 Channel Enable	
					0b	Turn off
					1b	Turn on

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	0	led33_en	0b	R/W	OUT33 Channel Enable	
					0b	Turn off
					1b	Turn on

Table9. LED_CUR1 Register

Addr: 07H			OUT1~OUT4 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
07H	7:6	led4_cur[1:0]	11b	R/W	OUT4 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led3_cur[1:0]	11b	R/W	OUT3 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led2_cur[1:0]	11b	R/W	OUT2 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led1_cur[1:0]	11b	R/W	OUT1 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table10. LED_CUR2 Register

Addr: 08H			OUT5~OUT8 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
08H	7:6	led8_cur[1:0]	11b	R/W	OUT8 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led7_cur[1:0]	11b	R/W	OUT7 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

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	3:2	led6_cur[1:0]	11b	R/W	OUT6 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led5_cur[1:0]	11b	R/W	OUT5 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table11. LED_CUR3 Register

Addr: 09H			OUT9~OUT12 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
09H	7:6	led12_cur[1:0]	11b	R/W	OUT12 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led11_cur[1:0]	11b	R/W	OUT11 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led10_cur[1:0]	11b	R/W	OUT10 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led9_cur[1:0]	11b	R/W	OUT9 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

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Table12. LED_CUR4 Register

Addr: 0AH			OUT13~OUT16 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
0AH	7:6	led16_cur[1:0]	11b	R/W	OUT16 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led15_cur[1:0]	11b	R/W	OUT15 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led14_cur[1:0]	11b	R/W	OUT14 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led13_cur[1:0]	11b	R/W	OUT13 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table13. LED_CUR5 Register

Addr: 0BH			OUT17~OUT20 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
0BH	7:6	led20_cur[1:0]	11b	R/W	OUT20 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led19_cur[1:0]	11b	R/W	OUT19 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led18_cur[1:0]	11b	R/W	OUT18 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current

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					00b	1/4 of Max Channel Current
					OUT17 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table14. LED_CUR6 Register

Addr: 0CH			OUT21~OUT24 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
0CH	7:6	led24_cur[1:0]	11b	R/W	OUT24 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led23_cur[1:0]	11b	R/W	OUT23 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led22_cur[1:0]	11b	R/W	OUT22 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	Led21_cur[1:0]	11b	R/W	OUT21 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table15. LED_CUR7 Register

Addr: 0DH			OUT25~OUT28 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
0DH	7:6	led28_cur[1:0]	11b	R/W	OUT28 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led27_cur[1:0]	11b	R/W	OUT27 Channel Current Selection	
					11b	4/4 of Max Channel Current

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					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led26_cur[1:0]	11b	R/W	OUT26 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led25_cur[1:0]	11b	R/W	OUT25 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

Table16. LED_CUR8 Register

Addr: 0EH			OUT29~OUT32 Channel Current Selection Registers			
Addr	Bit	Bit Name	Default	Access	Description	
0EH	7:6	led32_cur[1:0]	11b	R/W	OUT32 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	5:4	led31_cur[1:0]	11b	R/W	OUT31 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	3:2	led30_cur[1:0]	11b	R/W	OUT30 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current
	1:0	led29_cur[1:0]	11b	R/W	OUT29 Channel Current Selection	
					11b	4/4 of Max Channel Current
					10b	3/4 of Max Channel Current
					01b	2/4 of Max Channel Current
					00b	1/4 of Max Channel Current

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Table17. LED_CUR9 Register

Addr: 0FH			OUT33~OUT36 Channel Current Selection Registers		
Addr	Bit	Bit Name	Default	Access	Description
0FH	7:6	led36_cur[1:0]	11b	R/W	OUT36 Channel Current Selection
					11b 4/4 of Max Channel Current
					10b 3/4 of Max Channel Current
					01b 2/4 of Max Channel Current
					00b 1/4 of Max Channel Current
	5:4	led35_cur[1:0]	11b	R/W	OUT35 Channel Current Selection
					11b 4/4 of Max Channel Current
					10b 3/4 of Max Channel Current
					01b 2/4 of Max Channel Current
					00b 1/4 of Max Channel Current
	3:2	led34_cur[1:0]	11b	R/W	OUT34 Channel Current Selection
					11b 4/4 of Max Channel Current
					10b 3/4 of Max Channel Current
					01b 2/4 of Max Channel Current
					00b 1/4 of Max Channel Current
	1:0	led33_cur[1:0]	11b	R/W	OUT33 Channel Current Selection
					11b 4/4 of Max Channel Current
					10b 3/4 of Max Channel Current
					01b 2/4 of Max Channel Current
					00b 1/4 of Max Channel Current

Table 18. LEDn PWM Register

Addr: 10H→33H			OUT1~36 Channel PWM DATA Registers		
Addr	Bit	Bit Name	Default	Access	Description
10H → 33H	7:0	ledn_pwm(1)	00000000b	R/W	OUTn Channel PWM Data
					00000000b 0/255 duty cycle
					00000001b 1/255 duty cycle
					
					11111110b 254/255 duty cycle
					11111111b 255/255 duty cycle

Note : n is 1→36.

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Table 19. STA_DET_CTR Register

Addr: 40h			Output Status Detection Control Register		
Addr	Bit	Bit Name	Default	Access	Description
40h	7:6	-	-	-	Reserved
	5:4	open_vset[1:0]	00b	R/W	Open Detection Voltage Setting
					00b 0.1V
					01b 0.2V
					10b 0.3V
					11b 0.4V
	3:2	short_vset[1:0]	00b	R/W	Short Detection Voltage Setting
					00b 0.8V
					01b 0.6V
					10b 0.4V
					11b 0.2V
	1	sta_det_en	0b	R/W	Channel OPEN or SHORT Detection Enable
					0b Detection Disable
					1b Detection Enable
	0	open_short_sel	0b	R/W	Channel OPEN or SHORT Detection Selection
					0b OPEN Detection
					1b SHORT Detection

Table 20. LED_STA1 Registers

Addr: 41H			OUT1~8 Channel Status Registers		
Addr	Bit	Bit Name	Default	Access	Description
41H	7	led8_sta	0b	R	OUT8 Channel Open/Short Status Error
					0h Normal
					1b Error
	6	led7_sta	0b	R	OUT7 Channel Open/Short Status Error
					0h Normal
					1b Error
	5	led6_sta	0b	R	OUT6 Channel Open/Short Status Error
					0h Normal
					1b Error
	4	led5_sta	0b	R	OUT5 Channel Open/Short Status Error
					0h Normal
					1b Error
	3	led4_sta	0b	R	OUT4 Channel Open/Short Status Error
					0h Normal
					1b Error

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	2	led3_sta	0b	R	OUT3 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	1	led2_sta	0b	R	OUT2 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	0	led1_sta	0b	R	OUT1 Channel Open/Short Status Error	
					0h	Normal
					1b	Error

Note: Output Error status need to cooperate with Reg40[1:0] sta_det_en and open_short_sel status, while the data is “0”, the output port is the normal status, while the data is “1”, the output port is OPEN or SHORT status.

Table 21. LED_STA2 Registers

Addr: 42H			OUT9~16 Channel Status Registers			
Addr	Bit	Bit Name	Default	Access	Description	
42H	7	led16_sta	0b	R	OUT16 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	6	led15_sta	0b	R	OUT15 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	5	led14_sta	0b	R	OUT14 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	4	led13_sta	0b	R	OUT13 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	3	led12_sta	0b	R	OUT12 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	2	led11_sta	0b	R	OUT11 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	1	led10_sta	0b	R	OUT10 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	0	led9_sta	0b	R	OUT9 Channel Open/Short Status Error	
					0h	Normal
					1b	Error

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Table 22. LED_STA3 Registers

Addr: 43H			OUT17~24 Channel Status Registers		
Addr	Bit	Bit Name	Default	Access	Description
43H	7	led24_sta	0b	R	OUT24 Channel Open/Short Status Error
					0h Normal
					1b Error
	6	led23_sta	0b	R	OUT23 Channel Open/Short Status Error
					0h Normal
					1b Error
	5	led22_sta	0b	R	OUT22 Channel Open/Short Status Error
					0h Normal
					1b Error
	4	led21_sta	0b	R	OUT21 Channel Open/Short Status Error
					0h Normal
					1b Error
	3	led20_sta	0b	R	OUT20 Channel Open/Short Status Error
					0h Normal
					1b Error
	2	led19_sta	0b	R	OUT19 Channel Open/Short Status Error
					0h Normal
					1b Error
	1	led18_sta	0b	R	OUT18 Channel Open/Short Status Error
					0h Normal
					1b Error
	0	led17_sta	0b	R	OUT17 Channel Open/Short Status Error
					0h Normal
					1b Error

Table 23. LED_STA4 Registers

Addr: 44H			OUT25~32 Channel Status Registers		
Addr	Bit	Bit Name	Default	Access	Description
44H	7	led32_sta	0b	R	OUT32 Channel Open/Short Status Error
					0h Normal
					1b Error
	6	led31_sta	0b	R	OUT31 Channel Open/Short Status Error
					0h Normal
					1b Error
	5	led30_sta	0b	R	OUT30 Channel Open/Short Status Error
					0h Normal
					1b Error
	4	led29_sta	0b	R	OUT29 Channel Open/Short Status Error

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					0h	Normal
					1b	Error
	3	led28_sta	0b	R	OUT28 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	2	led27_sta	0b	R	OUT27 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	1	led26_sta	0b	R	OUT26 Channel Open/Short Status Error	
					0h	Normal
					1b	Error
	0	led25_sta	0b	R	OUT25 Channel Open/Short Status Error	
					0h	Normal
					1b	Error

Table 24. LED_STA5 Registers

Addr: 45H			OUT33~26Channel Status Registers		
Addr	Bit	Bit Name	Default	Access	Description
45H	7:4	-	-	-	Reserved
	3	led36_sta	0b	R	OUT36 Channel Open/Short Status Error
					0h Normal
					1b Error
	2	led35_sta	0b	R	OUT35 Channel Open/Short Status Error
					0h Normal
					1b Error
	1	led34_sta	0b	R	OUT34 Channel Open/Short Status Error
					0h Normal
					1b Error
	0	led33_sta	0b	R	OUT33 Channel Open/Short Status Error
					0h Normal
					1b Error

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Table 25. Spread Spectrum Control Register

Addr: 46h			Spread Spectrum Register			
Addr	Bit	Bit Name	Default	Access	Description	
46h	7	otp_en	0	R/W	Chip over-temperature protection(OTP)	
					0	Disable Chip OTP function
					1	Enable Chip OTP function
	6	vds_sel	0	R/W	OUTn VDS selection	
					0	Normal
					1	100mv upper
	5	rext_sel	0	R/W	Reference Resistor Selection	
					0	Select External Resistor
					1	Select Internal Resistor(fixed 12K)
	4:3	-	-	-	Reserved	
	1	sspt_sel	0b	R/W	Spread Spectrum Cycle Time Selection	
					0b	2000us
					1b	1000us
	0	ssp_en	0b	R/W	Spread Spectrum Function Enable	
					0b	Disable
					1b	Enable

Note: Spread Spectrum Function will modulate the OSC frequency in a range of Fosc+/-10% with setting spread spectrum cycle time.

3. Constant current

The difference current of ET6038 is very small between channels or even between chips, this stems from the excellent characteristics of ET6038:

- The current difference between channels is generally less than $\pm 5\%$ (typical value)
- The current difference between channels is generally less than $\pm 5\%$ (typical value), and the current output characteristics are not affected by the voltage of the load terminal. The stability of the output current will not be affected by the change of LED forward voltage (V_f).
- Channel current parameter calculation formula:
 $(\text{max_cur_sel}[3:0]=1111\text{b}; \text{ledn_cur}=11\text{b}(n=1\sim 36), \text{LEDnPWM}=\text{FFH}(n=1\sim 36))$:
 $I_{\text{OUT}}=1.2/R_{\text{EXT}}*213$ (Just consider the resistance relation).
- For example, if the external resistance mode $\text{reg46}[5]=0$, $R_{\text{EXT}}=6\text{K}$, then $I=42.6\text{mA}$; $R_{\text{EXT}}=12\text{K}$, $I=21.3\text{mA}$; $R_{\text{EXT}}=30\text{K}$, $I=8.5\text{mA}$. Built-in resistance mode $\text{reg46}[5]=1$, REXT port suspended, built-in resistance fixed at 12K, not adjustable, so $I=21.3\text{mA}$
- Formula for calculating the current parameters of each channel (considering all adjustment items) :
 $I_{\text{OUT}}=1.2/R_{\text{EXT}}*210*(n/16)*(m/4)*(k/256)$, $n=1\sim 16$ (4-bit modulation current selection), $m=1\sim 4$ (each channel 4 constant current selection), $k=0\sim 255$ (each channel PWM pulse width selection).

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Absolute Maximum Ratings

Symbol	Characteristic	Rating	Unit
V _{DD}	Supply Voltage	0~6.0	V
V _{IN}	Input Voltage	-0.4~V _{DD} +0.4	V
I _{OUT}	Output Current	+42.6	mA
I _{GND}	GND Terminal Current	+1000	mA
T _J	Operating Junction Temperature	-40~+150	°C
T _{STG}	Storage Temperature	-65~+150	°C
V _{ESD}	HBM	±1.0	KV
	CDM	±1.0	KV

Recommended Operating Conditions

Symbol	Characteristic	Min	Typ	Max	Unit
V _{DD}	Supply Voltage	2.7	5.0	5.5	V
F _{CLK}	Clock Frequency			400	kHz
V _{IH}	Logic High Level	1.0	—	V _{DD}	V
V _{IL}	Logic Low Level	0	—	0.3	V
T _A	Operating Temperature	-40		+85	°C

Electrical Characteristics

(V_{DD}=5V , T_A=25°C)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Supply Voltage	V _{DD}	-		2.7	5.0	5.5	V
The Output Adjusts Maximum Current	I _{OUT_MAX}	V _{DS} =1.0V, R _{EXT} =6KΩ LEDnPWM=FFH(n=1~36) CUR_SELm=FFH(m=1~9) max_cur_sel[3:0]=1111b		-	42.6	-	mA
The Output Adjusts Minimum Current	I _{OUT_MIN}	V _{DS} =1.0V, R _{EXT} =6KΩ LEDnPWM=FFH(n=1~36) CUR_SELm=FFH(m=1~9) max_cur_sel[3:0]=0000b		-	2.67	-	mA
Output Leakage Current	I _{OH}	V _{OH} =V _{DD}		-	-	0.5	μA
The Output Adjusts the Default Current	I _{OUT_DEF}	V _{DS} =1.0V, R _{EXT} =6KΩ LEDnPWM=FFH(n=1~36) CUR_SELm=FFH(m=1~9) max_cur_sel[3:0]=0111b		-	21.3	-	mA
Current Skew (between ICs)	dI _{OUT1}	I _{OUT1} =21.3mA V _{DS} =1.0V	R _{EXT} =6KΩ	-	±5	±10	%
Input High Voltage	V _{IH}	SCL/SDA/ADDR Pins		1			V
Input Low Voltage	V _{IL}	SCL/SDA/ADDR Pins				0.3	V

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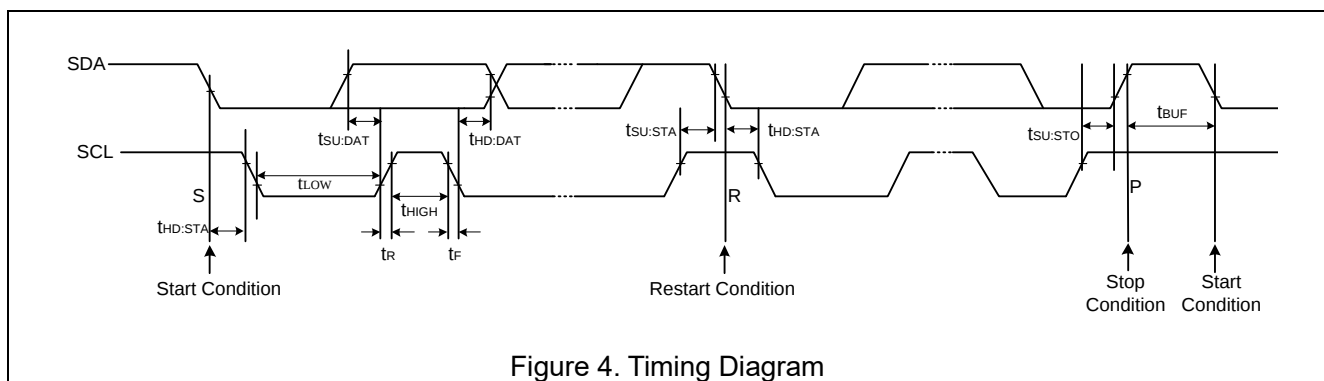
SDA Output Low Level		V_{OL_SDA}	$I_{OUT}=3mA$			0.4	V
Shutdown Current		I_{SD}	chip_en=0	-	-	6	μA
Supply Current	"OFF"	$I_{DD} (off)1$	$R_{EXT} = Floating$ max_cur_sel[3:0]=0000b OUT0~OUT35=Off	-	2	4	mA
		$I_{DD} (off)2$	$R_{EXT} = 6K\Omega$ max_cur_sel[3:0]=0000b OUT0~OUT35=Off	-	2.2	5	
	"ON"	$I_{DD} (on)1$	$R_{EXT} = 6K\Omega$ max_cur_sel[3:0]=1111b OUT0~OUT35=On Ledn_pwm=0xff	-	11	15	

I²C Mode Timing

Symbol	Parameter	Min	Typ	Max	Unit
F_{SCL}	SCL Clock Frequency	0	-	400	KHz
t_{BUF}	Bus Free Time Between a STOP and START Condition	1.3	-	-	μs
$t_{HD:STA}$	Hold Time(Repeated) START Condition	0.6	-	-	μs
t_{LOW}	Low Period of SCL Clock	1.3	-	-	μs
t_{HIGH}	HIGH Period of SCL Clock	0.6	-	-	μs
$t_{SU:STA}$	Setup Time for a Repeated START Condition	0.6	-	-	μs
$t_{HD:DAT}$	Data Hold Time	0.1	-	-	μs
$t_{SU:DAT}$	Data Setup Time	100	-	-	ns
t_R	Data Hold Time	-	$20+0.1C_b^{(1)}$	-	ns
t_F	Data Hold Time	-	$20+0.1C_b^{(1)}$	-	ns
$t_{SU:STO}$	Setup Time for STOP Condition	0.6	-	-	μs

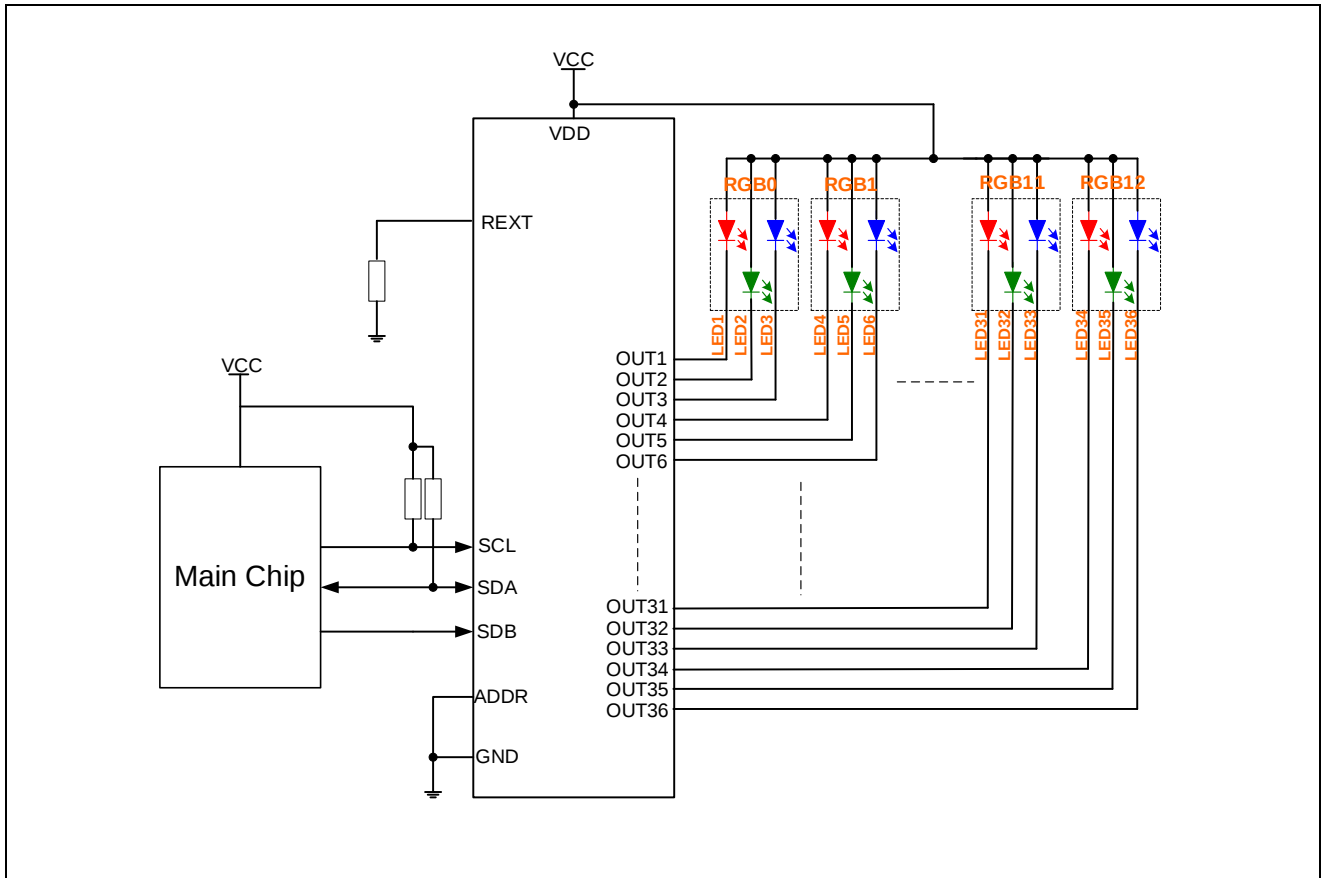
Note1: Cb=total capacitance of one bus line in PF.

I²C Mode Timing Diagram



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Application circuit



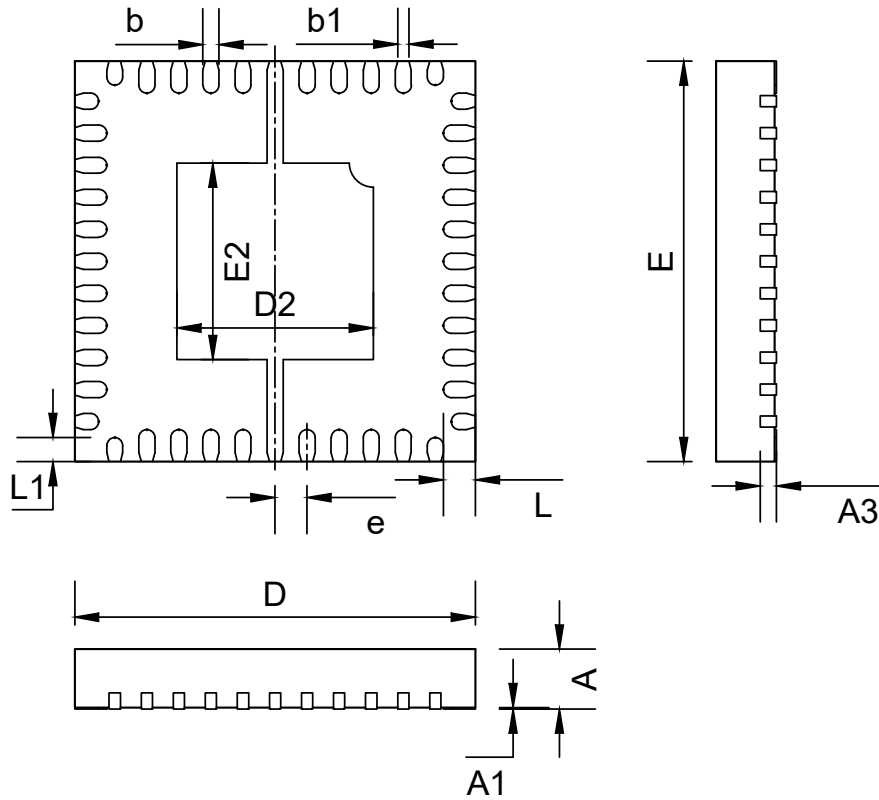
Note*:

1. This application circuit is only for reference.
2. VDD recommends using 1uF filter capacitors.
3. ET6038 enters hardware shutdown mode when the SDB pin is pulled low.

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Package Dimension

QFN44

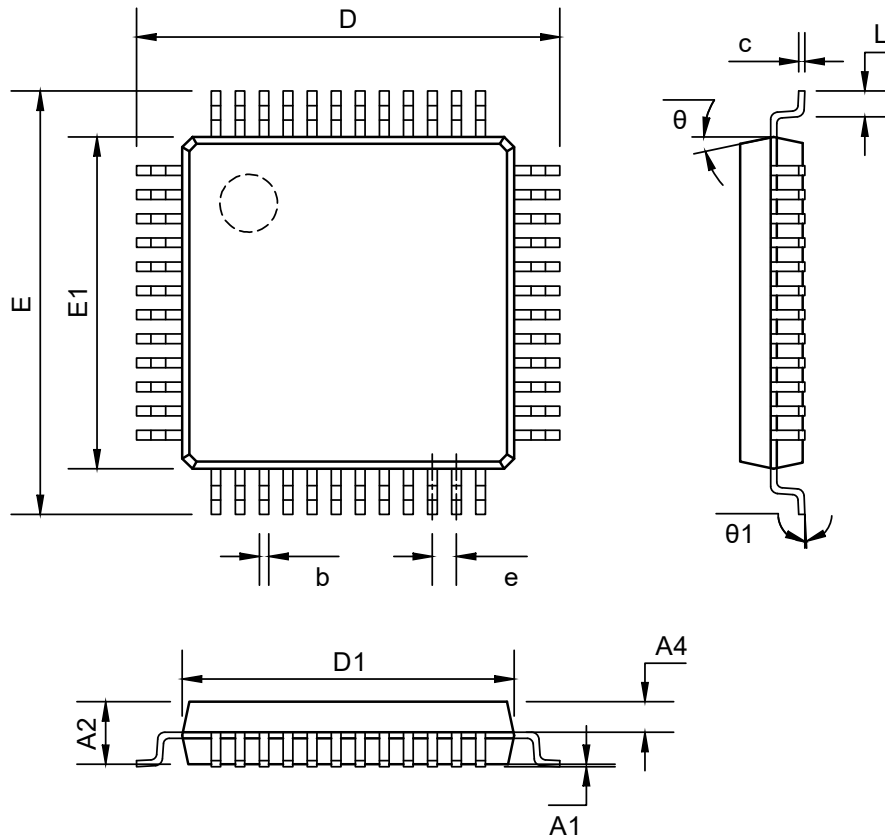


COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3	0.18	0.20	0.25
b	0.15	0.20	0.25
b1	0.14REF		
D	4.90	5.00	5.10
E	4.90	5.00	5.10
D2	2.35	2.45	2.55
E2	2.35	2.45	2.55
e	0.40BSC		
L	0.35	0.40	0.45
L1	0.25	0.30	0.35

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LQFP48



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	MAX
A1	0.05	0.15
A2	1.30	1.50
A4	0.636REF	
b	0.20BSC	
c	0.127	0.16
D	8.80	9.20
E	8.80	9.20
D1	6.90	7.10
E1	6.90	7.10
e	0.50BSC	
L	0.50	0.80
θ	12°REF	
$\theta1$	0°	5°

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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2023-05-24	Preliminary Version	Tianqh	Sunsb	Liujiy
1.0	2023-08-14	Original Version	Tianqh	Sunsb	Liujiy
1.1	2024-10-22	Add ESD	Shibo	Sunsb	Liujiy
1.2	2025-9-19	t _{HD:DAT} Remove MAX value	Shibo	Sunsb	Liujiy