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Technical Note

LED Drivers for LCD BackLights

Multifunction Backlight LED Driver for Small LCD Panels (Charge Pump Type)

BD6083GUL

No.10040EAT16

●Description

BD6083GUL is “Intelligent LED Driver” that is the most suitable for the cellular phone.
It has 3 - 6LED driver and output variable LDO4ch for LCD Backlight.
It has ALC function that is “Low Power Consumption System” realized.
It can be developed widely from the high End model to the Low End model.
As it has charge pump circuit for DCDC, it is no need to use coils, and it contributes to small space.
VCSP50L3 (3.15mm x 3.15mm 0.5mm pitch)
It adopts the very thin CSP package that is the most suitable for the slim phone.

●Features

1) Total 3 - 6LEDs driver for LCD Backlight
   - It has 4LEDs (it can select 4LED or 3LED) for exclusire use of Main and 2LEDs which can chose independent control or a main allotment by resister setting.
   - Main Group” can be controlled by Auto Luminous Control (ALC) system. “Main Group” can be controlled by external PWM signal.
   - ON/ Off and a setup of LED current are possible at the time of the independent control by the independence.
2) Ambient Light sensor interface
   - Incorporates various functions such as a sensor bias adjustment function, an ADC with an average filter, a gainoffset adjustment function and an LOG conversion function so that options can be increased for illumination intensity sensors (Photo Diode, Photo Transistor, Photo IC (Linear/LOG)).
   - Incorporates an auto gain switching function for suppressing an illumination intensity sensor current at high illumination intensity and improving sensitivity at low illumination intensity
   - Capable of customizing an LED current value according to a table setting.
   - Slope control loading and an independent control change are possible.
3) Charge Pump DC/DC for LED driver
   - It has x1/x1.5/ x2 mode that will be selected automatically.
   - The most suitable voltage up magnification is controlled automatically by LED port voltage.
   - Soft start functions、Over voltage protection (Auto-return type),Over current protection (Auto-return type) loading
4) 4ch Series Regulator (LDO)
   - It has selectable output voltage by the register.(16 steps) LDO1, LDO2, LDO3, LDO4: Iomax=150mA
5) Thermal shutdown
6) I^2C BUS FS mode (max 400 kHz) Compatibility

●Absolute Maximum Ratings (Ta=25 ℃)

Parameter	Symbol	Ratings	Unit
Maximum Voltage	VMAX	7	V
Power Dissipation	Pd	1280 (Note)	mW
Operating Temperature Range	Topr	-30 ~ +85	℃
Storage Temperature Range	Tstg	-55 ~ +150	℃

(Note) Power dissipation deleting is 10.24mW/ ℃ , when it’s used in over 25 ℃.
(It’s deleting is on the board that is ROHM’s standard)

●Operating Conditions (VBAT≥VIO, Ta=-30~85 ℃)

Parameter	Symbol	Limits	Unit
VBAT Input Voltage	VBAT	2.7 ~ 5.5	V
VIO Pin Voltage	VIO	1.65 ~ 3.3	V

●Electrical Characteristics (Unless otherwise specified, Ta=25℃, VBAT=3.6V, VIO=1.8V)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
【Circuit Current】						
VBAT Circuit Current 1	IBAT1	-	0.1	3.0	μA	RESETB=0V, VIO= 0V
VBAT Circuit Current 2	IBAT2	-	0.5	3.0	μA	RESETB=0V, VIO=1.8V
VBAT Circuit Current 3	IBAT3	-	61	65	mA	DC/DC x1 mode, Io=60mA VBAT=4.0V
VBAT Circuit Current 4	IBAT4	-	92	102	mA	DC/DC x1.5 mode, Io=60mA VBAT=3.6V
VBAT Circuit Current 5	IBAT5	-	123	140	mA	DC/DC x2 mode, Io=60mA VBAT=2.7V
VBAT Circuit Current 6	IBAT6	-	0.25	1.0	mA	ALC Operating ALCEN=1, AD cycle=0.5s setting Except sensor current
VBAT Circuit Current 7	IBAT7	-	90	150	μA	LDO1,2=ON, I_{LDO}=0mA
VBAT Circuit Current 8	IBAT8	-	90	150	μA	LDO3,4=ON, I_{LDO}=0mA
【LED Driver】						
LED Current Step (Setup)	ILEDSTP1		128		Step	LED1~6
LED Current Step (At slope)	ILEDSTP2		256		Step	LED1~6
LED Maximum Setup Current	IMAXWLED	-	25.6	-	mA	LED1~6
LED Current Accuracy	IWLED	-7%	15	+7%	mA	I_{LED}=15mA setting, VLED=1.0V
LED Current Matching	ILEDMT	-	-	4	%	Between LED1~6 at VLED=1.0V, ILED=15mA
LED OFF Leak Current	ILKLED	-	-	1.0	μA	VLED=4.5V
【DC/DC(Charge Pump)】						
Output Voltage	VoCP	-	Vf+0.2	Vf+0.25	V	Vf is forward direction of LED
Drive Ability	IOUT	-	-	150	mA	VBAT≥3.2V, VOUT=3.9V
Switching Frequency	fosc	0.8	1.0	1.2	MHz	
Over Voltage Protection Detect Voltage	OVP	-	5.6	-	V	
Over Current Protection Detect Current	OCP	-	250	375	mA	VOUT=0V
【Sensor Interface】						
SBIAS Output Voltage	VoS	2.85	3.0	3.15	V	Io=200μA
SBIAS Maximum Output Current	IomaxS	30	-	-	mA	
SBIAS Discharge Resister at OFF	ROFFS	-	1.0	1.5	kΩ	
SSENS Input Range	VISS	0	-	VoS × 255/256	V	
ADC Resolution	ADRES		8		bit	
ADC Integral Calculus Non-linearity	ADINL	-3	-	+3	LSB	
ADC Differential Calculus Non-linearity	ADDNL	-1	-	+1	LSB	

●Electrical Characteristics (Unless otherwise specified, Ta=25℃, VBAT=3.6V, VIO=1.8V)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
【Regulator (LDO1)】						
Output Voltage	Vo1	1.164	1.20	1.236	V	Io=50mA
		1.261	1.30	1.339	V	Io=50mA
		1.455	1.50	1.545	V	Io=50mA
		1.552	1.60	1.648	V	Io=50mA
		1.746	1.80	1.854	V	Io=50mA <Initial Voltage>
		2.134	2.20	2.266	V	Io=50mA
		2.328	2.40	2.472	V	Io=50mA
		2.425	2.50	2.575	V	Io=50mA
		2.522	2.60	2.678	V	Io=50mA
		2.619	2.70	2.781	V	Io=50mA
		2.716	2.80	2.884	V	Io=50mA
		2.813	2.90	2.987	V	Io=50mA
		2.910	3.00	3.090	V	Io=50mA
		3.007	3.10	3.193	V	Io=50mA
		3.104	3.20	3.296	V	Io=50mA
		3.201	3.30	3.399	V	Io=50mA
Output Current	Io1	-	-	150	mA	Vo=1.8V
Dropout Voltage	Vsat1	-	0.2	0.3	V	VBAT=2.5V, Io=150mA, Vo=2.8V
Load Stability	ΔVo11	-	10	60	mV	Io=1~150mA, Vo=1.8V
Input Voltage Stability	ΔVo12	-	10	60	mV	VBAT=3.4~4.5V, Io=50mA, Vo=1.8V
Ripple Rejection Ratio	RR1	-	65	-	dB	f=100Hz, Vin=200mVp-p, Vo=1.2V Io=50mA, BW=20Hz~20kHz
Short Circuit Current Limit	Ilim1	-	200	400	mA	Vo=0V
Discharge Resister at OFF	ROFF1	-	1.0	1.5	kΩ	
【Regulator (LDO2)】						
Output Voltage	Vo2	1.164	1.20	1.236	V	Io=50mA
		1.261	1.30	1.339	V	Io=50mA
		1.455	1.50	1.545	V	Io=50mA
		1.552	1.60	1.648	V	Io=50mA
		1.746	1.80	1.854	V	Io=50mA
		2.134	2.20	2.266	V	Io=50mA
		2.328	2.40	2.472	V	Io=50mA
		2.425	2.50	2.575	V	Io=50mA <Initial Voltage>
		2.522	2.60	2.678	V	Io=50mA
		2.619	2.70	2.781	V	Io=50mA
		2.716	2.80	2.884	V	Io=50mA
		2.813	2.90	2.987	V	Io=50mA
		2.910	3.00	3.090	V	Io=50mA
		3.007	3.10	3.193	V	Io=50mA
		3.104	3.20	3.296	V	Io=50mA
		3.201	3.30	3.399	V	Io=50mA
Output Current	Io2	-	-	150	mA	Vo=2.5V
Dropout Voltage	Vsat2	-	0.2	0.3	V	VBAT=2.5V, Io=150mA, Vo=2.8V
Load Stability	Δvo21	-	10	60	mV	Io=1~150mA, Vo=2.5V
Input Voltage Stability	Δvo22	-	10	60	mV	VBAT=3.4~4.5V, Io=50mA, Vo=2.5V
Ripple Rejection Ratio	RR2	-	65	-	dB	f=100Hz, Vin=200mVp-p, Vo=1.2V Io=50mA, BW=20Hz~20kHz
Short Circuit Current Limit	Ilim2	-	200	400	mA	Vo=0V
Discharge Resister at OFF	ROFF2	-	1.0	1.5	kΩ	

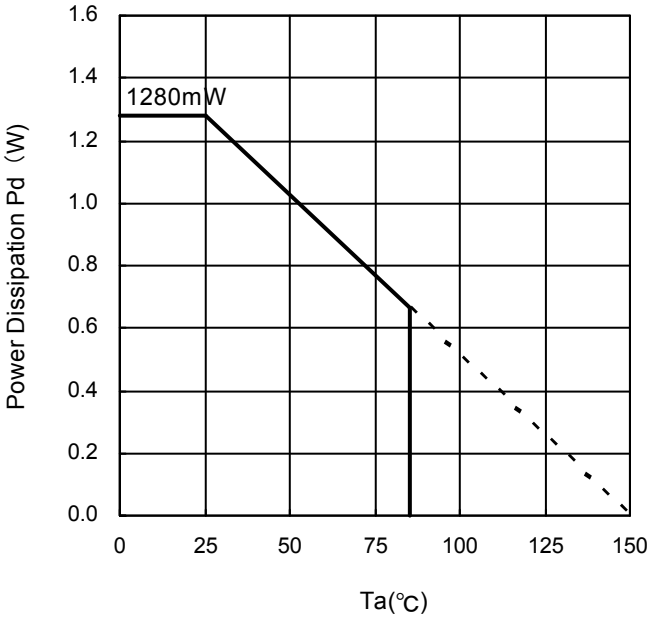
●Electrical Characteristics (Unless otherwise specified, Ta=25℃, VBAT=3.6V, VIO=1.8V)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
【Regulator (LDO3)】						
Output Voltage	Vo3	1.164	1.20	1.236	V	Io=50mA
		1.261	1.30	1.339	V	Io=50mA
		1.455	1.50	1.545	V	Io=50mA
		1.552	1.60	1.648	V	Io=50mA
		1.746	1.80	1.854	V	Io=50mA <Initial Voltage>
		2.134	2.20	2.266	V	Io=50mA
		2.328	2.40	2.472	V	Io=50mA
		2.425	2.50	2.575	V	Io=50mA
		2.522	2.60	2.678	V	Io=50mA
		2.619	2.70	2.781	V	Io=50mA
		2.716	2.80	2.884	V	Io=50mA
		2.813	2.90	2.987	V	Io=50mA
		2.910	3.00	3.090	V	Io=50mA
		3.007	3.10	3.193	V	Io=50mA
		3.104	3.20	3.296	V	Io=50mA
		3.201	3.30	3.399	V	Io=50mA
Output Current	Io3	-	-	150	mA	Vo=1.8V
Dropout Voltage	Vsat3	-	0.2	0.3	V	VBAT=2.5V, Io=150mA, Vo=2.8V
Load Stability	ΔVo31	-	10	60	mV	Io=1~150mA, Vo=1.8V
Input Voltage Stability	ΔVo32	-	10	60	mV	VBAT=3.4~4.5V, Io=50mA, Vo=1.8V
Ripple Rejection Ratio	RR3	-	65	-	dB	f=100Hz, Vin=200mVp-p, Vo=1.2V Io=50mA, BW=20Hz~20kHz
Short Circuit Current Limit	Ilim3	-	200	400	mA	Vo=0V
Discharge Resister at OFF	ROFF3	-	1.0	1.5	kΩ	
【Regulator (LDO4)】						
Output Voltage	Vo4	1.164	1.20	1.236	V	Io=50mA
		1.261	1.30	1.339	V	Io=50mA
		1.455	1.50	1.545	V	Io=50mA
		1.552	1.60	1.648	V	Io=50mA
		1.746	1.80	1.854	V	Io=50mA
		2.134	2.20	2.266	V	Io=50mA
		2.328	2.40	2.472	V	Io=50mA
		2.425	2.50	2.575	V	Io=50mA
		2.522	2.60	2.678	V	Io=50mA
		2.619	2.70	2.781	V	Io=50mA
		2.716	2.80	2.884	V	Io=50mA <Initial Voltage>
		2.813	2.90	2.987	V	Io=50mA
		2.910	3.00	3.090	V	Io=50mA
		3.007	3.10	3.193	V	Io=50mA
		3.104	3.20	3.296	V	Io=50mA
		3.201	3.30	3.399	V	Io=50mA
Output Current	Io4	-	-	150	mA	Vo=2.8V
Dropout Voltage	Vsat4	-	0.2	0.3	V	VBAT=2.5V, Io=150mA, Vo=2.8V
Load Stability	ΔVo41	-	10	60	mV	Io=1~150mA, Vo=2.8V
Input Voltage Stability	ΔVo42	-	10	60	mV	VBAT=3.4~4.5V, Io=50mA, Vo=2.8V
Ripple Rejection Ratio	RR4	-	65	-	dB	f=100Hz, Vin=200mVp-p, Vo=1.2V Io=50mA, BW=20Hz~20kHz
Short Circuit Current Limit	Ilim4	-	200	400	mA	Vo=0V
Discharge Resister at OFF	ROFF4	-	1.0	1.5	kΩ	

●Electrical Characteristics (Unless otherwise specified, Ta=25℃, VBAT=3.6V, VIO=1.8V)

Parameter	Symbol	Limits			Unit	Condition
		Min.	Typ.	Max.		
【SDA, SCL】 (I^2C Interface)						
L Level Input Voltage	VILI	-0.3	-	0.25 ×VIO	V	
H Level Input Voltage	VIHI	0.75 ×VIO	-	VBAT+0.3	V	
Hysteresis of Schmitt trigger Input	VhysI	0.05 ×VIO	-	-	V	
L Level Output Voltage	VOLI	0	-	0.3	V	SDA Pin, IOL=3 mA
Input Current	IinI	-	-	1	μA	Input Voltage= 0.1×VIO ~ 0.9×VIO
【RESETB】 (CMOS Input Pin)						
L Level Input Voltage	VILR	-0.3	-	0.25 ×VIO	V	
H Level Input Voltage	VIHR	0.75 ×VIO	-	VBAT+0.3	V	
Input Current	IinR	-	-	1	μA	Input Voltage = 0.1×VIO ~ 0.9×VIO
【WPWMIN】 (NMOS Input Pin)						
L Level Input Voltage	VILA	-0.3	-	0.3	V	
H Level Input Voltage	VIHA	1.4	-	VBAT+0.3	V	
Input Current	IinA	-	3.6	10	μA	Input Voltage = 1.8V
PWM Input Minimum High Pulse Width	PWmin	250	-	-	μs	WPWMIN Pin
【GC1, GC2】 (Sensor Gain Control CMOS Output Pin)						
L Level Output Voltage	VOLS	-	-	0.2	V	IOL=1mA
H Level Output Voltage	VOHS	VoS-0.2	-	-	V	IOH=1mA

●Power Dissipation (On the ROHM's standard board)



Information of the ROHM's standard board
Material: glass-epoxy
Size : 50mm × 58mm × 1.75mm(8^{th} layer)
Wiring pattern figure Refer to after page.

Fig.1 Power Dissipation

●Block Diagram / Application Circuit Example 1

6LED + ALC +PWM

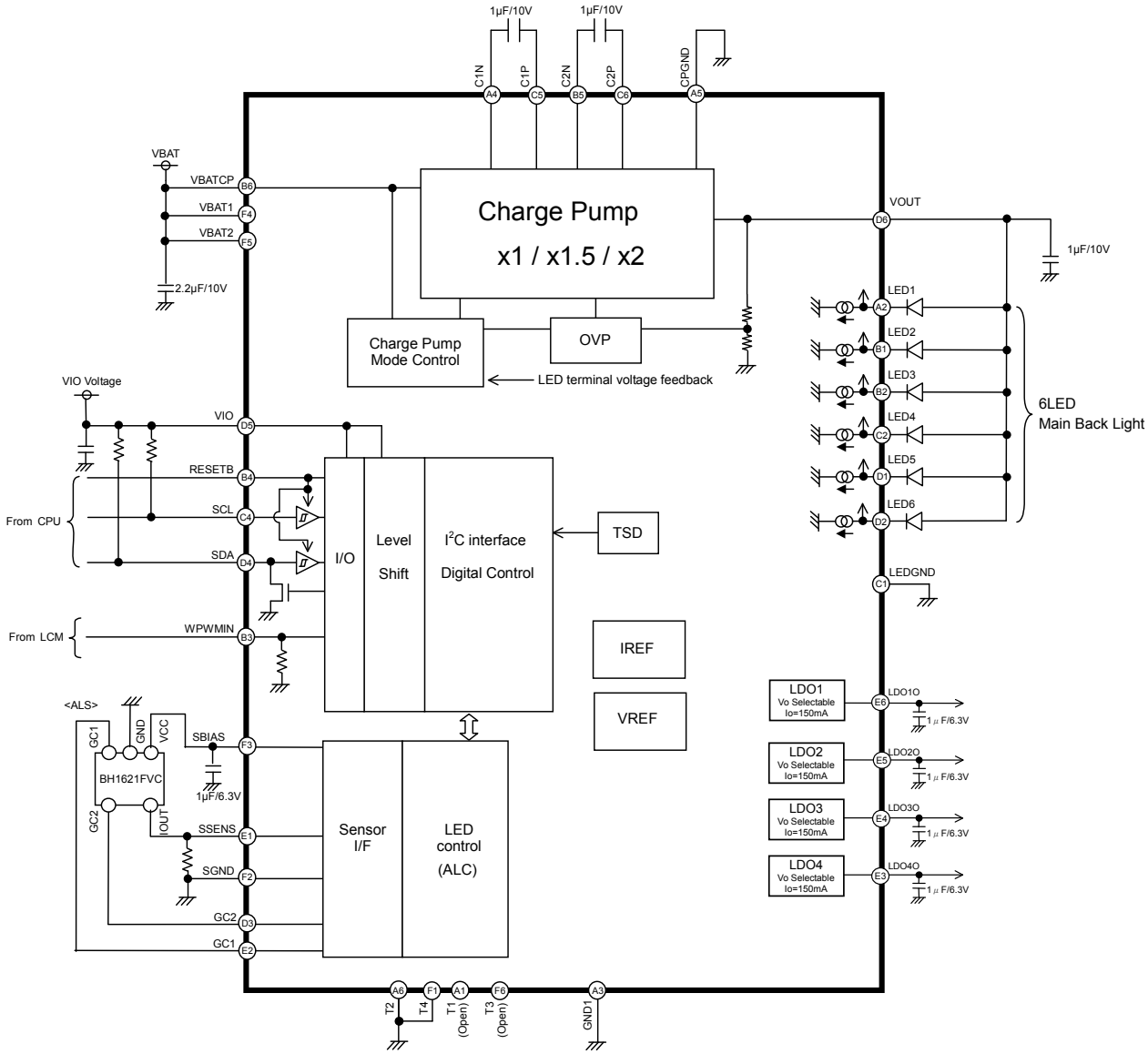


Fig.2 Block Diagram / Application Circuit Example 1

●Block Diagram / Application Circuit Example 2

5LED + ALC +PWM

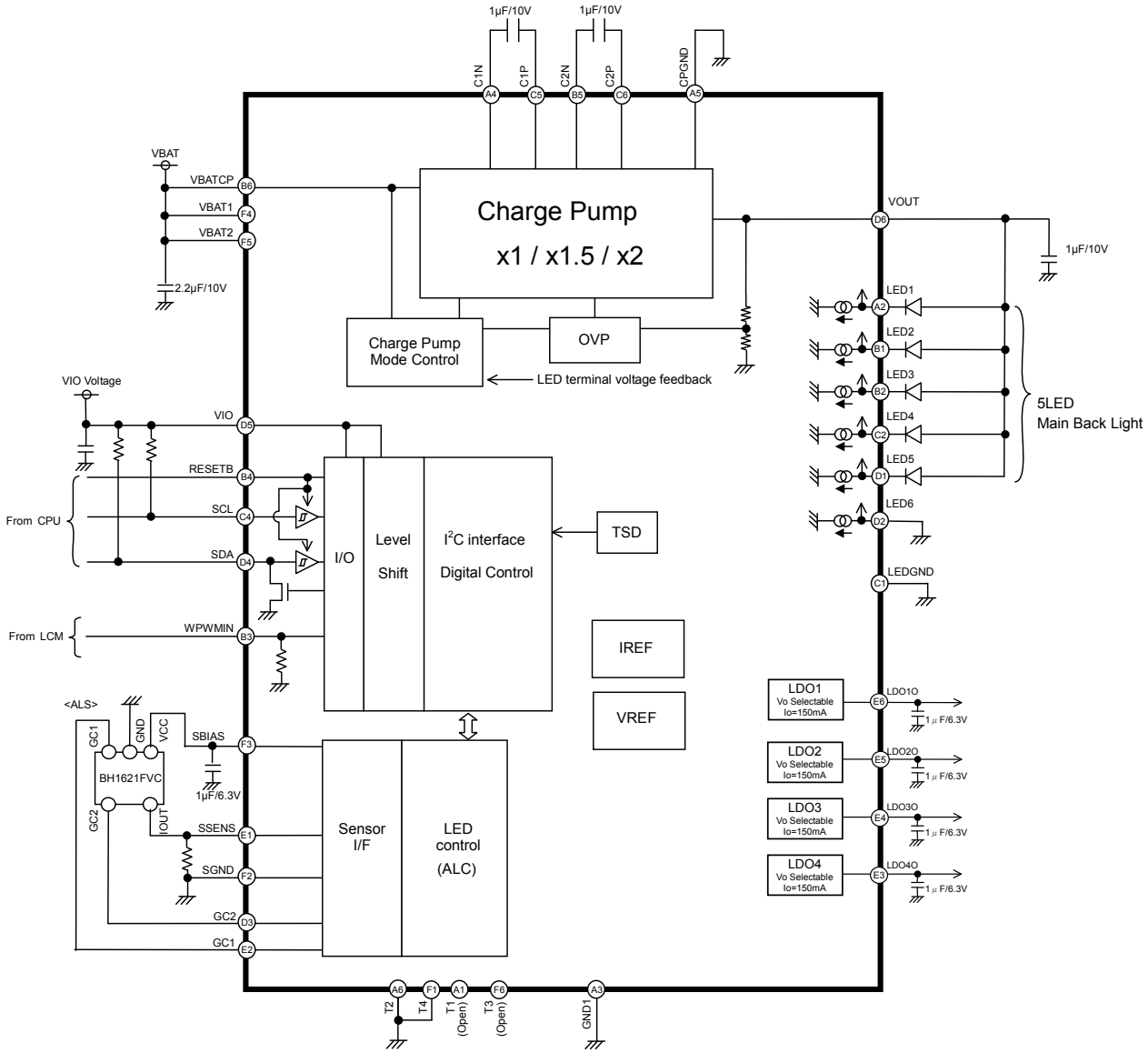


Fig.3 Block Diagram / Application Circuit Example 2

●Block Diagram / Application Circuit Example 3

4LED + 2LED + ALC +PWM

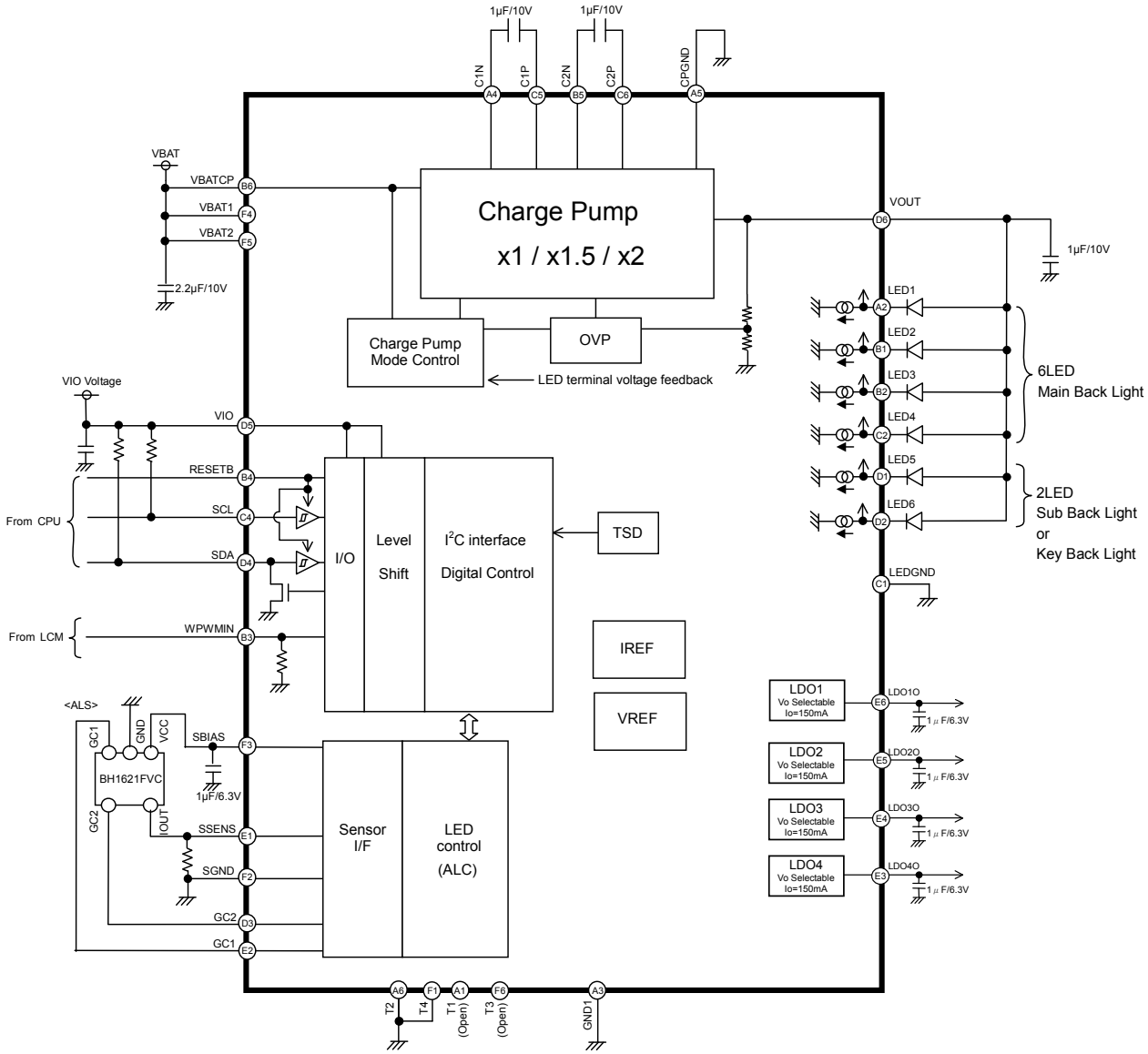


Fig.4 Block Diagram / Application Circuit Example 3

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●Pin Arrangement［Bottom View］

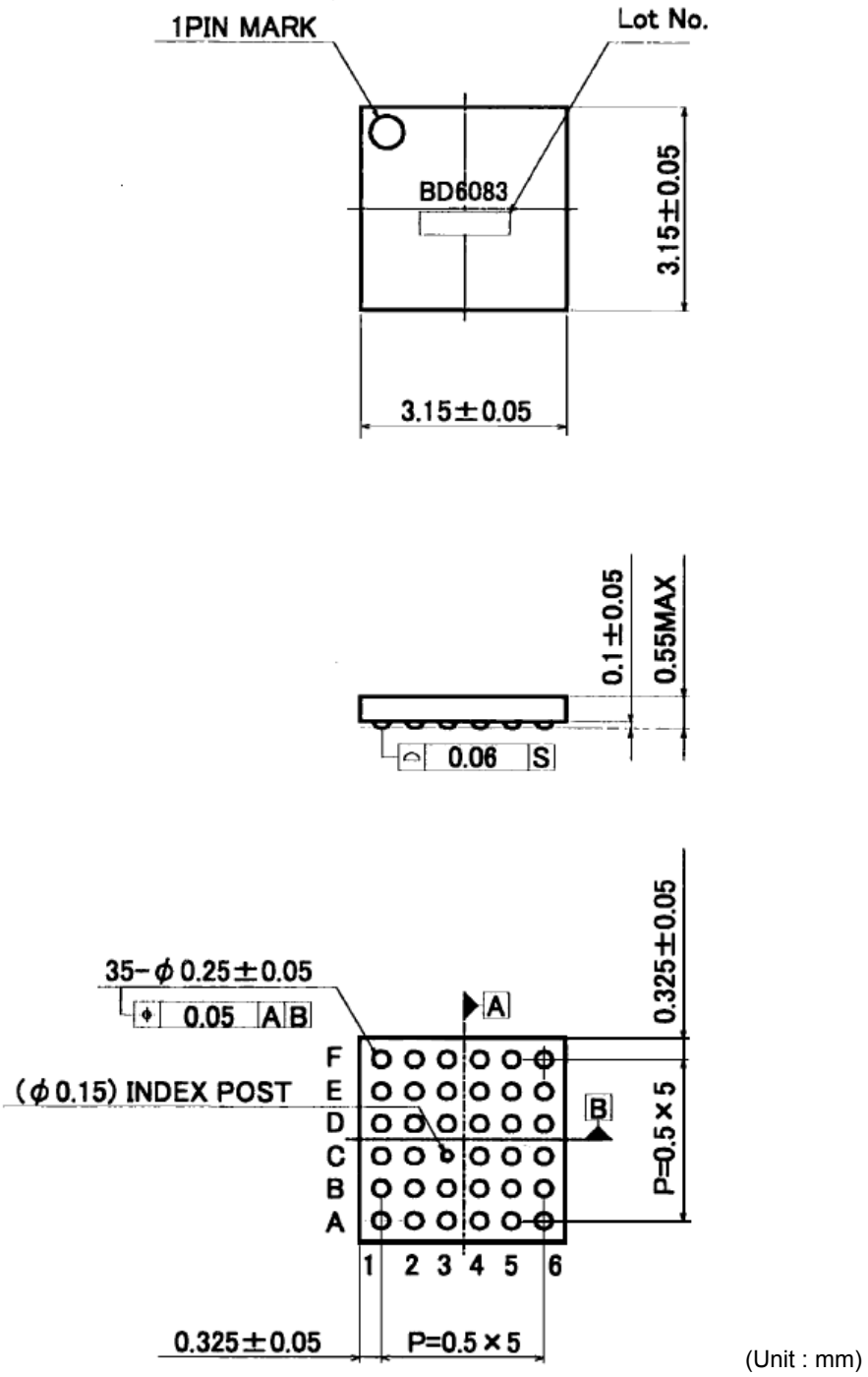
	1	2	3	4	5	6
F	T4	SGND	SBIAS	VBAT1	VBAT2	T3
E	SSENS	GC1	LDO4O	LDO3O	LDO2O	LDO1O
D	LED5	LED6	GC2	SDA	VIO	VOUT
C	LEDGND	LED4	index ○	SCL	C1P	C2P
B	LED2	LED3	WPWMIN	RESETB	C2N	VBATCP
A	T1	LED1	GND1	C1N	CPGND	T2

Total 35 Ball

Fig.5 Pin Arrangement

●Package Outline

VCSP50L3 CSP small package
SIZE : 3.15mm x 3.15mm (A difference in public:X,Y Both ±0.05mm)
Height : 0.55mm max
A ball pitch : 0.5 mm



(Unit : mm)

Fig.6 Package Outline

●Pin Functions

No	Ball No.	Pin Name	I/O	ESD Diode		Functions	Equivalent Circuit
				For Power	For Ground		
1	B6	VBATCP	-	-	GND	Battery is connected	A
2	F4	VBAT1	-	-	GND	Battery is connected	A
3	F5	VBAT2	-	-	GND	Battery is connected	A
4	A1	T1	O	VBAT	GND	Test Output Pin(Open)	N
5	A6	T2	I	VBAT	GND	Test Input Pin (short to Ground)	S
6	F6	T3	O	VBAT	GND	Test Output Pin(Open)	M
7	F1	T4	I	VBAT	GND	Test Input Pin (short to Ground)	S
8	D5	VIO	-	VBAT	GND	I/O Power supply is connected	C
9	B4	RESETB	I	VBAT	GND	Reset input (L: reset, H: reset cancel)	H
10	D4	SDA	I/O	VBAT	GND	I^2C data input / output	I
11	C4	SCL	I	VBAT	GND	I^2C clock input	H
12	A5	CPGND	-	VBAT	-	Ground	B
13	A3	GND1	-	VBAT	-	Ground	B
14	C1	LEDGND	-	VBAT	-	Ground	B
15	A4	C1N	I/O	VBAT	GND	Charge Pump capacitor is connected	F
16	C5	C1P	I/O	-	GND	Charge Pump capacitor is connected	G
17	B5	C2N	I/O	VBAT	GND	Charge Pump capacitor is connected	F
18	C6	C2P	I/O	-	GND	Charge Pump capacitor is connected	G
19	D6	VOUT	O	-	GND	Charge Pump output pin	A
20	A2	LED1	I	-	GND	LED is connected 1 for LCD Back Light	E
21	B1	LED2	I	-	GND	LED is connected 2 for LCD Back Light	E
22	B2	LED3	I	-	GND	LED is connected 3 for LCD Back Light	E
23	C2	LED4	I	-	GND	LED is connected 4 for LCD Back Light	E
24	D1	LED5	I	-	GND	LED is connected 5 for LCD Back Light	E
25	D2	LED6	I	-	GND	LED is connected 6 for LCD Back Light	E
26	F3	SBIAS	O	VBAT	GND	Bias output for the Ambient Light Sensor	Q
27	E1	SSENS	I	VBAT	GND	Ambient Light Sensor input	N
28	E2	GC1	O	VBAT	GND	Ambient Light Sensor gain control output 1	X
29	D3	GC2	O	VBAT	GND	Ambient Light Sensor gain control output 2	X
30	F2	SGND	-	VBAT	-	Ground	B
31	B3	WPWMIN	I	VBAT	GND	External PWM input for Back Light *	L
32	E6	LDO1O	O	VBAT	GND	LDO1 output pin	Q
33	E5	LDO2O	O	VBAT	GND	LDO2 output pin	Q
34	E4	LDO3O	O	VBAT	GND	LDO3 output pin	Q
35	E3	LDO4O	O	VBAT	GND	LDO4 output pin	Q

* A setup of a register is separately necessary to make it effective.

●Equivalent Circuit

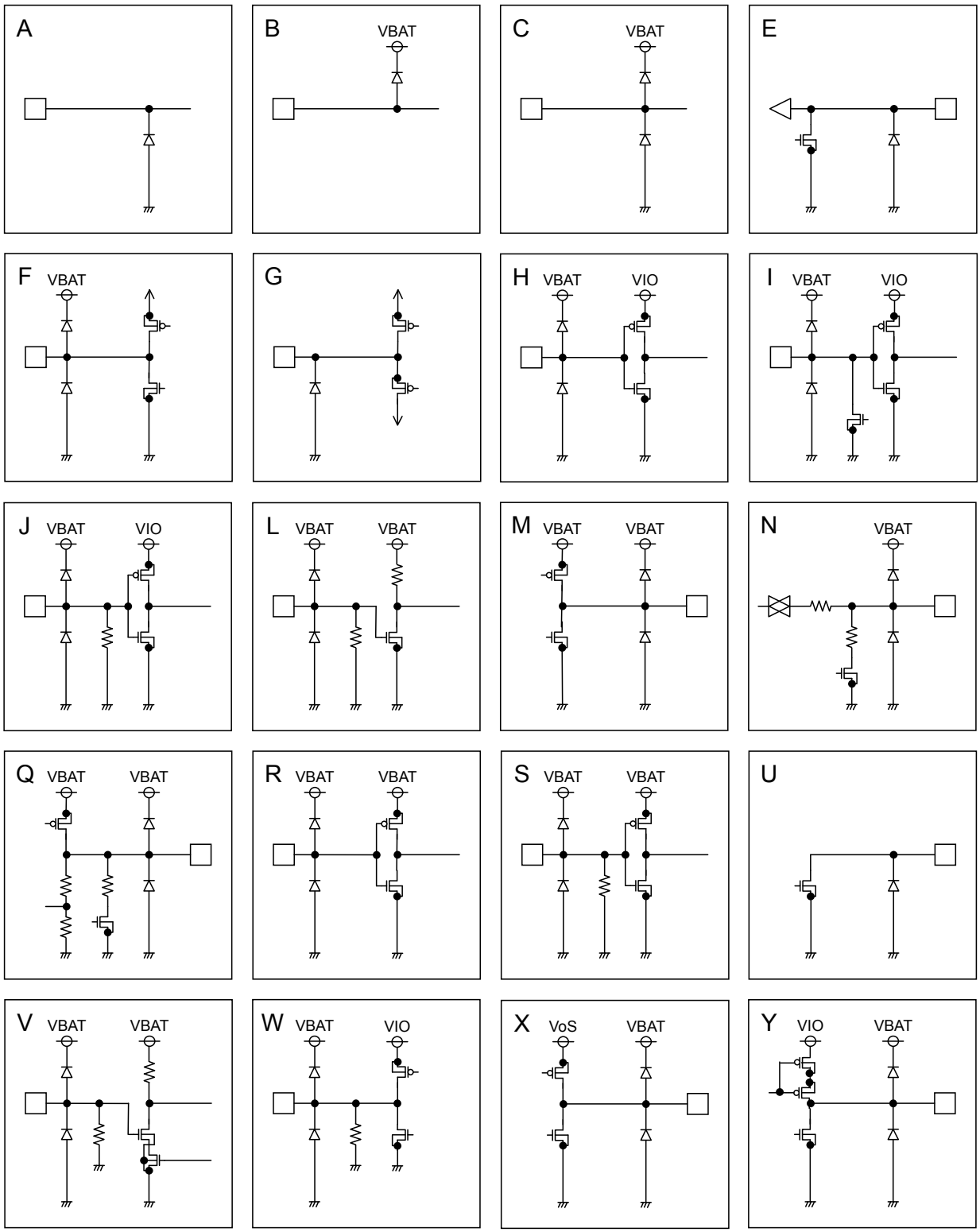


Fig.7 Equivalent Circuit

●I²C BUS Format

The writing/reading operation is based on the I²C slave standard.

・Slave address

A7	A6	A5	A4	A3	A2	A1	R/W
1	1	1	0	1	1	0	1/0

・Bit Transfer

SCL transfers 1-bit data during H. SCL cannot change signal of SDA during H at the time of bit transfer. If SDA changes while SCL is H, START conditions or STOP conditions will occur and it will be interpreted as a control signal.

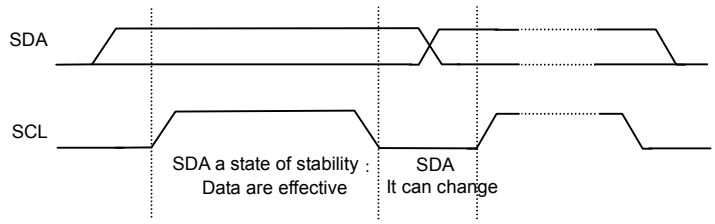


Fig.8

・START and STOP condition

When SDA and SCL are H, data is not transferred on the I²C- bus. This condition indicates, if SDA changes from H to L while SCL has been H, it will become START (S) conditions, and an access start, if SDA changes from L to H while SCL has been H, it will become STOP (P) conditions and an access end.

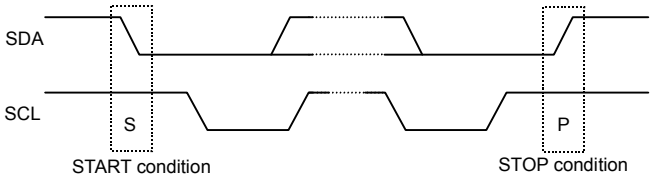


Fig.9

・Acknowledge

It transfers data 8 bits each after the occurrence of START condition. A transmitter opens SDA after transfer 8bits data, and a receiver returns the acknowledge signal by setting SDA to L.

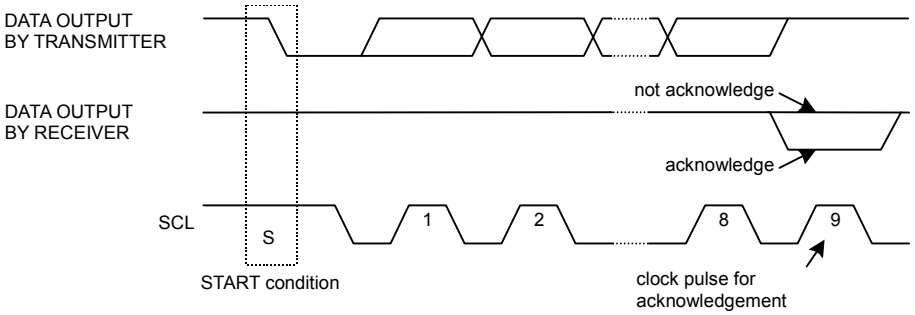


Fig.10

・Writing protocol

A register address is transferred by the next 1 byte that transferred the slave address and the write-in command. The 3rd byte writes data in the internal register written in by the 2nd byte, and after 4th byte or, the increment of register address is carried out automatically. However, when a register address turns into the last address, it is set to 00h by the next transmission. After the transmission end, the increment of the address is carried out.

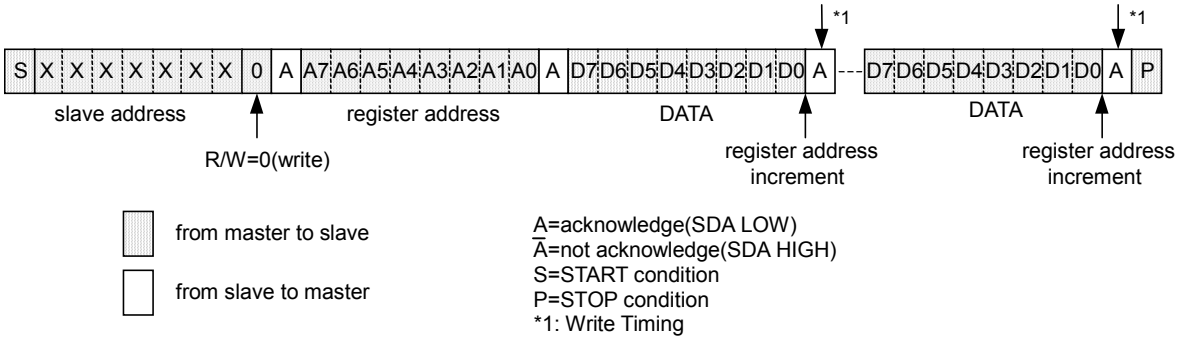


Fig.11

・Reading protocol

It reads from the next byte after writing a slave address and R/W bit. The register to read considers as the following address accessed at the end, and the data of the address that carried out the increment is read after it. If an address turns into the last address, the next byte will read out 00h. After the transmission end, the increment of the address is carried out.

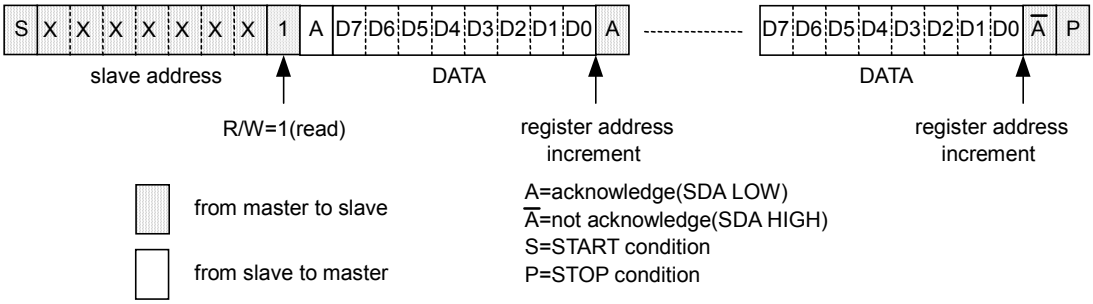


Fig.12

・Multiple reading protocols

After specifying an internal address, it reads by repeated START condition and changing the data transfer direction. The data of the address that carried out the increment is read after it. If an address turns into the last address, the next byte will read out 00h. After the transmission end, the increment of the address is carried out.

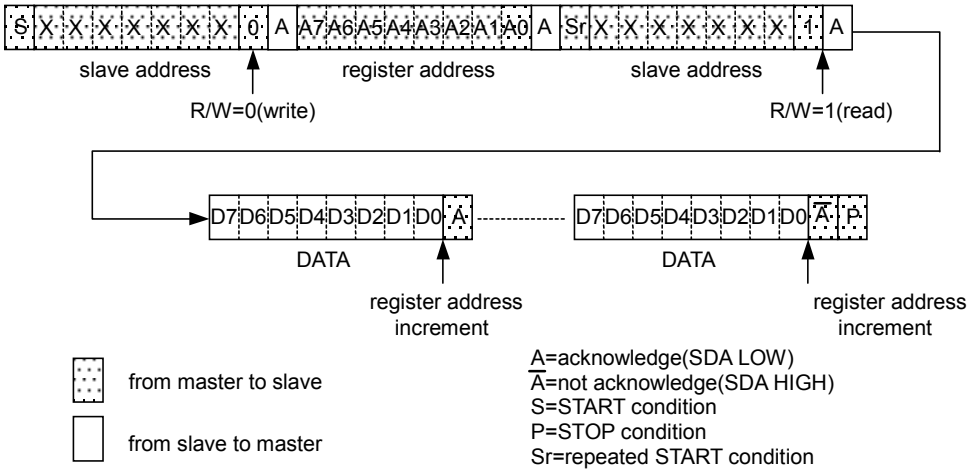


Fig.13

As for reading protocol and multiple reading protocols, please do Ā(not acknowledge) after doing the final reading operation. It stops with read when ending by A(acknowledge), and SDA stops in the state of Low when the reading data of that time is 0. However, this state returns usually when SCL is moved, data is read, and Ā (not acknowledge) is done.

●Timing Diagram

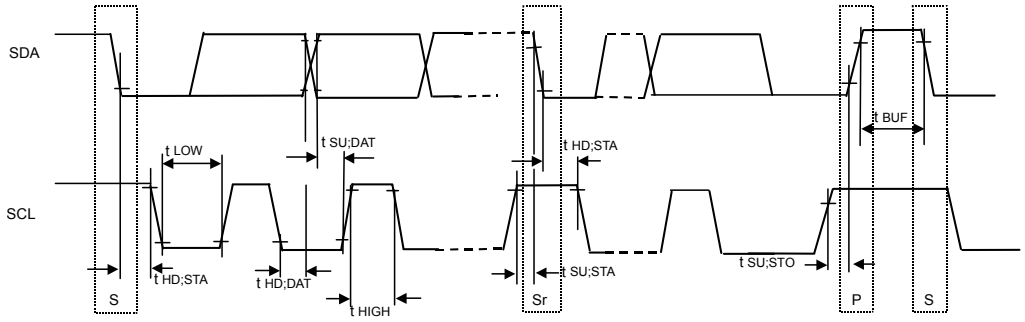


Fig.14

●Electrical Characteristics(Unless otherwise specified, Ta=25 °C, VBAT=3.6V, VIO=1.8V)

Parameter	Symbol	Standard-mode			Fast-mode			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
【I^2C BUS format】								
SCL clock frequency	f_{SCL}	0	-	100	0	-	400	kHz
LOW period of the SCL clock	t_{LOW}	4.7	-	-	1.3	-	-	µs
HIGH period of the SCL clock	t_{HIGH}	4.0	-	-	0.6	-	-	µs
Hold time (repeated) START condition After this period, the first clock is generated	$t_{HD;STA}$	4.0	-	-	0.6	-	-	µs
Set-up time for a repeated START condition	$t_{SU;STA}$	4.7	-	-	0.6	-	-	µs
Data hold time	$t_{HD;DAT}$	0	-	3.45	0	-	0.9	µs
Data set-up time	$t_{SU;DAT}$	250	-	-	100	-	-	ns
Set-up time for STOP condition	$t_{SU;STO}$	4.0	-	-	0.6	-	-	µs
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	-	1.3	-	-	µs

●Register List

Address	W/R	Register data								Function
		D7	D6	D5	D4	D3	D2	D1	D0	
00h	W	-	-	-	-	-	-	-	SFTRST	Software Reset
01h	W	-	-	-	-	W6MD	W5MD	W4MD	MLEDMD	LED Pin function setting
02h	W	WPWMEN	ALCEN	-	-	W6EN	W5EN	-	MLEDEN	LED Power Control
03h	W	-	IMLED(6)	IMLED(5)	IMLED(4)	IMLED(3)	IMLED(2)	IMLED(1)	IMLED(0)	Main group current setting
04h	-	-	-	-	-	-	-	-	-	-
05h	W	-	IW5(6)	IW5(5)	IW5(4)	IW5(3)	IW5(2)	IW5(1)	IW5(0)	LED5 current setting
06h	W	-	IW6(6)	IW6(5)	IW6(4)	IW6(3)	IW6(2)	IW6(1)	IW6(0)	LED6 current setting
07h	-	-	-	-	-	-	-	-	-	-
08h	-	-	-	-	-	-	-	-	-	-
09h	W	THL (3)	THL (2)	THL (1)	THL (0)	TLH (3)	TLH (2)	TLH (1)	TLH (0)	Main Current transition
0Ah	W	-	ADCYC	-	GAIN	-	-	MDCIR	SBIASON	Measurement mode setting
0Bh	W	-	-	-	-	CRV	STEP (2)	STEP (1)	STEP (0)	ALC Slope curve setup
0Ch	R	-	-	-	-	AMB (3)	AMB (2)	AMB (1)	AMB (0)	Ambient level
0Dh	W	-	IU0 (6)	IU0 (5)	IU0 (4)	IU0 (3)	IU0 (2)	IU0 (1)	IU0 (0)	LED Current at Ambient level 0h (ALC)
0Eh	W	-	IU1 (6)	IU1 (5)	IU1 (4)	IU1 (3)	IU1 (2)	IU1 (1)	IU1 (0)	LED Current max (ALC)
0Fh	-	-	-	-	-	-	-	-	-	-
10h	-	-	-	-	-	-	-	-	-	-
11h	-	-	-	-	-	-	-	-	-	-
12h	-	-	-	-	-	-	-	-	-	-
13h	W	-	-	-	-	LDO4EN	LDO3EN	LDO2EN	LDO1EN	LDO Power Control
14h	W	LDO2VSEL3	LDO2VSEL2	LDO2VSEL1	LDO2VSEL0	LDO1VSEL3	LDO1VSEL2	LDO1VSEL1	LDO1VSEL0	LDO1 Vout Control LDO2 Vout Control
15h	W	LDO4VSEL3	LDO4VSEL2	LDO4VSEL1	LDO4VSEL0	LDO3VSEL3	LDO3VSEL2	LDO3VSEL1	LDO3VSEL0	LDO3 Vout Control LDO4 Vout Control

Input "0" for "-".
A free address has the possibility to assign it to the register for the test.
Access to the register for the test and the undefined register is prohibited.

●Register Map

Address 00h < Software Reset >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00h	W	-	-	-	-	-	-	-	SFTRST
Initial Value	00h	-	-	-	-	-	-	-	0

Bit[7:1] : (Not used)

Bit0 : **SFTRST** Software Reset
"0" : Reset cancel
"1" : Reset(All register initializing)
Refer to "Reset" for detail.

Address 01h < LED Pin function setting>

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
01h	W	-	-	-	-	W6MD	W5MD	W4MD	MLEDMD
Initial Value	02h	-	-	-	-	0	0	1	0

Bit[7:4] : (Not used)

Bit3 : **W6MD** LED6 control setting (individual / Main group)
"0" : LED6 individual control (Initial Value)
"1" : LED6 Main group control
Refer to "LED Driver" for detail.

Bit2 : **W5MD** LED5 control setting (individual / Main group)
"0" : LED5 individual control (Initial Value)
"1" : LED5 Main group control
Refer to "LED Driver" for detail.

Bit1 : **W4MD** LED4 Control Board setting (unuse / use)
"0" : LED4 unuse
"1" : LED4 use (Main group Control) (Initial Value)
Refer to "LED Driver" for detail.

Bit0 : **MLEDMD** Main group setting (Normal / ALC)
"0" : Main group Normal Mode(ALCNon-reflection)(Initial Value)
"1" : Main group ALC Mode
Refer to "(1) Auto Luminous Control ON/OFF" of "ALC" for detail.

Set up a fixation in every design because it isn't presumed W*PW that it is changed dynamically.
And, do the setup of W*PW when each LED is Off.

Address 02h < LED Power Control>

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
02h	W	WPWMEN	ALCEN	-	-	W6EN	W5EN	-	MLEDEN
Initial Value	00h	0	0	0	0	0	0	0	0

Bit7 : **WPWMEN** External PWM Input “WPWMIN” terminal Enable Control (Valid/Invalid)
“0” : External PWM input invalid (Initial Value)
“1” : External PWM input valid
Refer to “(10) Current Adjustment” of “ALC” for detail.

Bit6 : **ALCEN** ALC function Control (ON/OFF)
“0” : ALC block OFF (Initial Value)
“1” : ALC block ON (Ambient Measurement)
Refer to “(1) Auto Luminous Control ON/OFF” of “ALC” for detail.

Bit[5:4] : (Not used)

Bit3 : **W6EN** LED6 Control (ON/OFF)
“0” : LED6 OFF (Initial Value)
“1” : LED6 ON(individual control)
Refer to “LED Driver” for detail.

Bit2 : **W5EN** LED5 Control (ON/OFF)
“0” : LED5 OFF (Initial Value)
“1” : LED5 ON(individual control)
Refer to “LED Driver” for detail.

Bit1 : (Not used)

Bit0 : **MLEDEN** Main group LED Control (ON/OFF)
“0” : Main group OFF (Initial Value)
“1” : Main group ON
Refer to “(1) Auto Luminous Control ON/OFF” of “ALC” for detail.

Address 03h < Main group LED Current setting(Normal Mode) >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
03h	W	-	IMLED(6)	IMLED(5)	IMLED(4)	IMLED(3)	IMLED(2)	IMLED(1)	IMLED(0)
Initial Value	00h	-	0	0	0	0	0	0	0

Bit7 : (Not used)

Bit[6:0] : **IMLED (6:0)** Main Group LED Current Setting at non-ALC mode

“0000000” :	0.2 mA (Initial Value)	“1000000” :	13.0 mA
“0000001” :	0.4 mA	“1000001” :	13.2 mA
“0000010” :	0.6 mA	“1000010” :	13.4 mA
“0000011” :	0.8 mA	“1000011” :	13.6 mA
“0000100” :	1.0 mA	“1000100” :	13.8 mA
“0000101” :	1.2 mA	“1000101” :	14.0 mA
“0000110” :	1.4 mA	“1000110” :	14.2 mA
“0000111” :	1.6 mA	“1000111” :	14.4 mA
“0001000” :	1.8 mA	“1001000” :	14.6 mA
“0001001” :	2.0 mA	“1001001” :	14.8 mA
“0001010” :	2.2 mA	“1001010” :	15.0 mA
“0001011” :	2.4 mA	“1001011” :	15.2 mA
“0001100” :	2.6 mA	“1001100” :	15.4 mA
“0001101” :	2.8 mA	“1001101” :	15.6 mA
“0001110” :	3.0 mA	“1001110” :	15.8 mA
“0001111” :	3.2 mA	“1001111” :	16.0 mA
“0010000” :	3.4 mA	“1010000” :	16.2 mA
“0010001” :	3.6 mA	“1010001” :	16.4 mA
“0010010” :	3.8 mA	“1010010” :	16.6 mA
“0010011” :	4.0 mA	“1010011” :	16.8 mA
“0010100” :	4.2 mA	“1010100” :	17.0 mA
“0010101” :	4.4 mA	“1010101” :	17.2 mA
“0010110” :	4.6 mA	“1010110” :	17.4 mA
“0010111” :	4.8 mA	“1010111” :	17.6 mA
“0011000” :	5.0 mA	“1011000” :	17.8 mA
“0011001” :	5.2 mA	“1011001” :	18.0 mA
“0011010” :	5.4 mA	“1011010” :	18.2 mA
“0011011” :	5.6 mA	“1011011” :	18.4 mA
“0011100” :	5.8 mA	“1011100” :	18.6 mA
“0011101” :	6.0 mA	“1011101” :	18.8 mA
“0011110” :	6.2 mA	“1011110” :	19.0 mA
“0011111” :	6.4 mA	“1011111” :	19.2 mA
“0100000” :	6.6 mA	“1100000” :	19.4 mA
“0100001” :	6.8 mA	“1100001” :	19.6 mA
“0100010” :	7.0 mA	“1100010” :	19.8 mA
“0100011” :	7.2 mA	“1100011” :	20.0 mA
“0100100” :	7.4 mA	“1100100” :	20.2 mA
“0100101” :	7.6 mA	“1100101” :	20.4 mA
“0100110” :	7.8 mA	“1100110” :	20.6 mA
“0100111” :	8.0 mA	“1100111” :	20.8 mA
“0101000” :	8.2 mA	“1101000” :	21.0 mA
“0101001” :	8.4 mA	“1101001” :	21.2 mA
“0101010” :	8.6 mA	“1101010” :	21.4 mA
“0101011” :	8.8 mA	“1101011” :	21.6 mA
“0101100” :	9.0 mA	“1101100” :	21.8 mA
“0101101” :	9.2 mA	“1101101” :	22.0 mA
“0101110” :	9.4 mA	“1101110” :	22.2 mA
“0101111” :	9.6 mA	“1101111” :	22.4 mA
“0110000” :	9.8 mA	“1110000” :	22.6 mA
“0110001” :	10.0 mA	“1110001” :	22.8 mA
“0110010” :	10.2 mA	“1110010” :	23.0 mA
“0110011” :	10.4 mA	“1110011” :	23.2 mA
“0110100” :	10.6 mA	“1110100” :	23.4 mA
“0110101” :	10.8 mA	“1110101” :	23.6 mA
“0110110” :	11.0 mA	“1110110” :	23.8 mA
“0110111” :	11.2 mA	“1110111” :	24.0 mA
“0111000” :	11.4 mA	“1111000” :	24.2 mA
“0111001” :	11.6 mA	“1111001” :	24.4 mA
“0111010” :	11.8 mA	“1111010” :	24.6 mA
“0111011” :	12.0 mA	“1111011” :	24.8 mA
“0111100” :	12.2 mA	“1111100” :	25.0 mA
“0111101” :	12.4 mA	“1111101” :	25.2 mA
“0111110” :	12.6 mA	“1111110” :	25.4 mA
“0111111” :	12.8 mA	“1111111” :	25.6 mA

Address 05h < LED5 Current setting(Independence control) >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
05h	W	-	IW5(6)	IW5(5)	IW5(4)	IW5(3)	IW5(2)	IW5(1)	IW5(0)
Initial Value	00h	-	0	0	0	0	0	0	0

Bit7 : (Not used)

Bit[6:0] : **IW5 (6:0)** LED5 Current setting

“0000000” :	0.2 mA (Initial Value)	“1000000” :	13.0 mA
“0000001” :	0.4 mA	“1000001” :	13.2 mA
“0000010” :	0.6 mA	“1000010” :	13.4 mA
“0000011” :	0.8 mA	“1000011” :	13.6 mA
“0000100” :	1.0 mA	“1000100” :	13.8 mA
“0000101” :	1.2 mA	“1000101” :	14.0 mA
“0000110” :	1.4 mA	“1000110” :	14.2 mA
“0000111” :	1.6 mA	“1000111” :	14.4 mA
“0001000” :	1.8 mA	“1001000” :	14.6 mA
“0001001” :	2.0 mA	“1001001” :	14.8 mA
“0001010” :	2.2 mA	“1001010” :	15.0 mA
“0001011” :	2.4 mA	“1001011” :	15.2 mA
“0001100” :	2.6 mA	“1001100” :	15.4 mA
“0001101” :	2.8 mA	“1001101” :	15.6 mA
“0001110” :	3.0 mA	“1001110” :	15.8 mA
“0001111” :	3.2 mA	“1001111” :	16.0 mA
“0010000” :	3.4 mA	“1010000” :	16.2 mA
“0010001” :	3.6 mA	“1010001” :	16.4 mA
“0010010” :	3.8 mA	“1010010” :	16.6 mA
“0010011” :	4.0 mA	“1010011” :	16.8 mA
“0010100” :	4.2 mA	“1010100” :	17.0 mA
“0010101” :	4.4 mA	“1010101” :	17.2 mA
“0010110” :	4.6 mA	“1010110” :	17.4 mA
“0010111” :	4.8 mA	“1010111” :	17.6 mA
“0011000” :	5.0 mA	“1011000” :	17.8 mA
“0011001” :	5.2 mA	“1011001” :	18.0 mA
“0011010” :	5.4 mA	“1011010” :	18.2 mA
“0011011” :	5.6 mA	“1011011” :	18.4 mA
“0011100” :	5.8 mA	“1011100” :	18.6 mA
“0011101” :	6.0 mA	“1011101” :	18.8 mA
“0011110” :	6.2 mA	“1011110” :	19.0 mA
“0011111” :	6.4 mA	“1011111” :	19.2 mA
“0100000” :	6.6 mA	“1100000” :	19.4 mA
“0100001” :	6.8 mA	“1100001” :	19.6 mA
“0100010” :	7.0 mA	“1100010” :	19.8 mA
“0100011” :	7.2 mA	“1100011” :	20.0 mA
“0100100” :	7.4 mA	“1100100” :	20.2 mA
“0100101” :	7.6 mA	“1100101” :	20.4 mA
“0100110” :	7.8 mA	“1100110” :	20.6 mA
“0100111” :	8.0 mA	“1100111” :	20.8 mA
“0101000” :	8.2 mA	“1101000” :	21.0 mA
“0101001” :	8.4 mA	“1101001” :	21.2 mA
“0101010” :	8.6 mA	“1101010” :	21.4 mA
“0101011” :	8.8 mA	“1101011” :	21.6 mA
“0101100” :	9.0 mA	“1101100” :	21.8 mA
“0101101” :	9.2 mA	“1101101” :	22.0 mA
“0101110” :	9.4 mA	“1101110” :	22.2 mA
“0101111” :	9.6 mA	“1101111” :	22.4 mA
“0110000” :	9.8 mA	“1110000” :	22.6 mA
“0110001” :	10.0 mA	“1110001” :	22.8 mA
“0110010” :	10.2 mA	“1110010” :	23.0 mA
“0110011” :	10.4 mA	“1110011” :	23.2 mA
“0110100” :	10.6 mA	“1110100” :	23.4 mA
“0110101” :	10.8 mA	“1110101” :	23.6 mA
“0110110” :	11.0 mA	“1110110” :	23.8 mA
“0110111” :	11.2 mA	“1110111” :	24.0 mA
“0111000” :	11.4 mA	“1111000” :	24.2 mA
“0111001” :	11.6 mA	“1111001” :	24.4 mA
“0111010” :	11.8 mA	“1111010” :	24.6 mA
“0111011” :	12.0 mA	“1111011” :	24.8 mA
“0111100” :	12.2 mA	“1111100” :	25.0 mA
“0111101” :	12.4 mA	“1111101” :	25.2 mA
“0111110” :	12.6 mA	“1111110” :	25.4 mA
“0111111” :	12.8 mA	“1111111” :	25.6 mA

Address 06h < LED6 Current setting(Independence control) >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
06h	W	-	IW6(6)	IW6(5)	IW6(4)	IW6(3)	IW6(2)	IW6(1)	IW6(0)
Initial Value	00h	-	0	0	0	0	0	0	0

Bit7 : (Not used)

Bit[6:0] : **IW6 (6:0)** LED6 Current setting

“0000000” :	0.2 mA (Initial Value)	“1000000” :	13.0 mA
“0000001” :	0.4 mA	“1000001” :	13.2 mA
“0000010” :	0.6 mA	“1000010” :	13.4 mA
“0000011” :	0.8 mA	“1000011” :	13.6 mA
“0000100” :	1.0 mA	“1000100” :	13.8 mA
“0000101” :	1.2 mA	“1000101” :	14.0 mA
“0000110” :	1.4 mA	“1000110” :	14.2 mA
“0000111” :	1.6 mA	“1000111” :	14.4 mA
“0001000” :	1.8 mA	“1001000” :	14.6 mA
“0001001” :	2.0 mA	“1001001” :	14.8 mA
“0001010” :	2.2 mA	“1001010” :	15.0 mA
“0001011” :	2.4 mA	“1001011” :	15.2 mA
“0001100” :	2.6 mA	“1001100” :	15.4 mA
“0001101” :	2.8 mA	“1001101” :	15.6 mA
“0001110” :	3.0 mA	“1001110” :	15.8 mA
“0001111” :	3.2 mA	“1001111” :	16.0 mA
“0010000” :	3.4 mA	“1010000” :	16.2 mA
“0010001” :	3.6 mA	“1010001” :	16.4 mA
“0010010” :	3.8 mA	“1010010” :	16.6 mA
“0010011” :	4.0 mA	“1010011” :	16.8 mA
“0010100” :	4.2 mA	“1010100” :	17.0 mA
“0010101” :	4.4 mA	“1010101” :	17.2 mA
“0010110” :	4.6 mA	“1010110” :	17.4 mA
“0010111” :	4.8 mA	“1010111” :	17.6 mA
“0011000” :	5.0 mA	“1011000” :	17.8 mA
“0011001” :	5.2 mA	“1011001” :	18.0 mA
“0011010” :	5.4 mA	“1011010” :	18.2 mA
“0011011” :	5.6 mA	“1011011” :	18.4 mA
“0011100” :	5.8 mA	“1011100” :	18.6 mA
“0011101” :	6.0 mA	“1011101” :	18.8 mA
“0011110” :	6.2 mA	“1011110” :	19.0 mA
“0011111” :	6.4 mA	“1011111” :	19.2 mA
“0100000” :	6.6 mA	“1100000” :	19.4 mA
“0100001” :	6.8 mA	“1100001” :	19.6 mA
“0100010” :	7.0 mA	“1100010” :	19.8 mA
“0100011” :	7.2 mA	“1100011” :	20.0 mA
“0100100” :	7.4 mA	“1100100” :	20.2 mA
“0100101” :	7.6 mA	“1100101” :	20.4 mA
“0100110” :	7.8 mA	“1100110” :	20.6 mA
“0100111” :	8.0 mA	“1100111” :	20.8 mA
“0101000” :	8.2 mA	“1101000” :	21.0 mA
“0101001” :	8.4 mA	“1101001” :	21.2 mA
“0101010” :	8.6 mA	“1101010” :	21.4 mA
“0101011” :	8.8 mA	“1101011” :	21.6 mA
“0101100” :	9.0 mA	“1101100” :	21.8 mA
“0101101” :	9.2 mA	“1101101” :	22.0 mA
“0101110” :	9.4 mA	“1101110” :	22.2 mA
“0101111” :	9.6 mA	“1101111” :	22.4 mA
“0110000” :	9.8 mA	“1110000” :	22.6 mA
“0110001” :	10.0 mA	“1110001” :	22.8 mA
“0110010” :	10.2 mA	“1110010” :	23.0 mA
“0110011” :	10.4 mA	“1110011” :	23.2 mA
“0110100” :	10.6 mA	“1110100” :	23.4 mA
“0110101” :	10.8 mA	“1110101” :	23.6 mA
“0110110” :	11.0 mA	“1110110” :	23.8 mA
“0110111” :	11.2 mA	“1110111” :	24.0 mA
“0111000” :	11.4 mA	“1111000” :	24.2 mA
“0111001” :	11.6 mA	“1111001” :	24.4 mA
“0111010” :	11.8 mA	“1111010” :	24.6 mA
“0111011” :	12.0 mA	“1111011” :	24.8 mA
“0111100” :	12.2 mA	“1111100” :	25.0 mA
“0111101” :	12.4 mA	“1111101” :	25.2 mA
“0111110” :	12.6 mA	“1111110” :	25.4 mA
“0111111” :	12.8 mA	“1111111” :	25.6 mA

Address 09h < Main Current slope time setting >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
09h	W	THL(3)	THL(2)	THL(1)	THL(0)	TLH(3)	TLH(2)	TLH(1)	TLH(0)
Initial Value	C7h	1	1	0	0	0	1	1	1

Bit[7:4] : **THL (3:0)** Main LED current Down transition per 0.2mA step
"0000" : 0.256 ms
"0001" : 0.512 ms
"0010" : 1.024 ms
"0011" : 2.048 ms
"0100" : 4.096 ms
"0101" : 8.192 ms
"0110" : 16.38 ms
"0111" : 32.77 ms
"1000" : 65.54 ms
"1001" : 131.1 ms
"1010" : 196.6 ms
"1011" : 262.1 ms
"1100" : 327.7 ms (Initial Value)
"1101" : 393.2 ms
"1110" : 458.8 ms
"1111" : 524.3 ms
Setting time is counted based on the switching frequency of Charge Pump.
The above value becomes the value of the Typ (1MHz) time.
Refer to "(8) Slope Process" of "ALC" for detail.

Bit[3:0] : **TLH (3:0)** Main LED current Up transition per 0.2mA step
"0000" : 0.256 ms
"0001" : 0.512 ms
"0010" : 1.024 ms
"0011" : 2.048 ms
"0100" : 4.096 ms
"0101" : 8.192 ms
"0110" : 16.38 ms
"0111" : 32.77 ms (Initial Value)
"1000" : 65.54 ms
"1001" : 131.1 ms
"1010" : 196.6 ms
"1011" : 262.1 ms
"1100" : 327.7 ms
"1101" : 393.2 ms
"1110" : 458.8 ms
"1111" : 524.3 ms
Setting time is counted based on the switching frequency of Charge Pump.
The above value becomes the value of the Typ (1MHz) time.
Refer to "(8) Slope Process" of "ALC" for detail.

Address 0Ah < ALC mode setting >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0Ah	W	-	ADCYC	-	GAIN	-	-	MDCIR	SBIASON
Initial Value	01h	-	0	-	0	-	-	0	1

Bit7 : (Not used)

Bit6 : **ADCYC** ADC Measurement Cycle
"0" : 0.52 s (Initial Value)
"1" : 1.05 s
Refer to "(4) A/D conversion" of "ALC" for detail.

Bit5 : (Not used)

Bit4 : **GAIN** Sensor Gain Switching Function Control
"0" : Auto Change (Initial Value)
"1" : Fixed
Refer to "(3) Gain control" of "ALC" for detail.

Bit[3:2] : (Not used)

Bit1 : **MDCIR** LED Current Reset Select by Mode Change
"0" : LED current non-reset when mode change (Initial Value)
"1" : LED current reset when mode change
Refer to "(9) LED current reset when mode change" of "ALC" for detail.

Bit0 : **SBIASON**
"0" : Measurement cycle synchronous
"1" : Usually ON (at ALCEN=1) (Initial Value)
Refer to "(4) A/D conversion" of "ALC" for detail.

Address 0Bh < ALC slope curve setting >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0Bh	W	-	-	-	-	CRV	STEP (2)	STEP (1)	STEP (0)
Initial Value	00h	-	-	-	-	0	0	0	1

Bit[7:4] : (Not used)

Bit3 : **CRV** Brightness Current Conversion Curve Type
"0" Log curve (Initial Value)
"1" linear

Bit[2:0] : **STEP (2:0)** Step At the time of Brightness Current Conversion
"000" : 1.0mA
"001" : 1.1mA (Initial Value)
"010" : 1.2mA
"011" : 1.3mA
"100" : 1.6mA
"101" : 1.7mA
"110" : 1.8mA
"111" : 1.9mA

Refer to "(7) Convert LED Current" of "ALC" for detail.

Address 0Ch < Ambient level (Read Only) >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0Ch	R	-	-	-	-	AMB(3)	AMB(2)	AMB(1)	AMB(0)
Initial Value	(00h)	-	-	-	-	(0)	(0)	(0)	(0)

Bit[7:4] : (Not used)

Bit[3:0] : **AMB (3:0)** Ambient Level
"0000" : 0h (Initial Value)
"0001" : 1h
"0010" : 2h
"0011" : 3h
"0100" : 4h
"0101" : 5h
"0110" : 6h
"0111" : 7h
"1000" : 8h
"1001" : 9h
"1010" : Ah
"1011" : Bh
"1100" : Ch
"1101" : Dh
"1110" : Eh
"1111" : Fh

It begins to read Ambient data through I^2C, and possible.
To the first AD measurement completion, it is AMB(3:0)=0000.
Refer to "(6) Ambient level detection" of "ALC" for detail.

Address 0Dh < Ambient LED Current setting >

Address	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0Dh	W	-	IU0 (6)	IU0 (5)	IU0 (4)	IU0 (3)	IU0 (2)	IU0 (1)	IU0 (0)
Initial Value	13	-	0	0	1	0	0	1	1

Bit7 : (Not used)

Bit[6:0] : **IU0 (6:0)** Main Current at Ambient Level for 0h

“0000000” :	0.2 mA	“1000000” :	13.0 mA
“0000001” :	0.4 mA	“1000001” :	13.2 mA
“0000010” :	0.6 mA	“1000010” :	13.4 mA
“0000011” :	0.8 mA	“1000011” :	13.6 mA
“0000100” :	1.0 mA	“1000100” :	13.8 mA
“0000101” :	1.2 mA	“1000101” :	14.0 mA
“0000110” :	1.4 mA	“1000110” :	14.2 mA
“0000111” :	1.6 mA	“1000111” :	14.4 mA
“0001000” :	1.8 mA	“1001000” :	14.6 mA
“0001001” :	2.0 mA	“1001001” :	14.8 mA
“0001010” :	2.2 mA	“1001010” :	15.0 mA
“0001011” :	2.4 mA	“1001011” :	15.2 mA
“0001100” :	2.6 mA	“1001100” :	15.4 mA
“0001101” :	2.8 mA	“1001101” :	15.6 mA
“0001110” :	3.0 mA	“1001110” :	15.8 mA
“0001111” :	3.2 mA	“1001111” :	16.0 mA
“0010000” :	3.4 mA	“1010000” :	16.2 mA
“0010001” :	3.6 mA	“1010001” :	16.4 mA
“0010010” :	3.8 mA	“1010010” :	16.6 mA
“0010011” :	4.0 mA (Initial Value)	“1010011” :	16.8 mA
“0010100” :	4.2 mA	“1010100” :	17.0 mA
“0010101” :	4.4 mA	“1010101” :	17.2 mA
“0010110” :	4.6 mA	“1010110” :	17.4 mA
“0010111” :	4.8 mA	“1010111” :	17.6 mA
“0011000” :	5.0 mA	“1011000” :	17.8 mA
“0011001” :	5.2 mA	“1011001” :	18.0 mA
“0011010” :	5.4 mA	“1011010” :	18.2 mA
“0011011” :	5.6 mA	“1011011” :	18.4 mA
“0011100” :	5.8 mA	“1011100” :	18.6 mA
“0011101” :	6.0 mA	“1011101” :	18.8 mA
“0011110” :	6.2 mA	“1011110” :	19.0 mA
“0011111” :	6.4 mA	“1011111” :	19.2 mA
“0100000” :	6.6 mA	“1100000” :	19.4 mA
“0100001” :	6.8 mA	“1100001” :	19.6 mA
“0100010” :	7.0 mA	“1100010” :	19.8 mA
“0100011” :	7.2 mA	“1100011” :	20.0 mA
“0100100” :	7.4 mA	“1100100” :	20.2 mA
“0100101” :	7.6 mA	“1100101” :	20.4 mA
“0100110” :	7.8 mA	“1100110” :	20.6 mA
“0100111” :	8.0 mA	“1100111” :	20.8 mA
“0101000” :	8.2 mA	“1101000” :	21.0 mA
“0101001” :	8.4 mA	“1101001” :	21.2 mA
“0101010” :	8.6 mA	“1101010” :	21.4 mA
“0101011” :	8.8 mA	“1101011” :	21.6 mA
“0101100” :	9.0 mA	“1101100” :	21.8 mA
“0101101” :	9.2 mA	“1101101” :	22.0 mA
“0101110” :	9.4 mA	“1101110” :	22.2 mA
“0101111” :	9.6 mA	“1101111” :	22.4 mA
“0110000” :	9.8 mA	“1110000” :	22.6 mA
“0110001” :	10.0 mA	“1110001” :	22.8 mA
“0110010” :	10.2 mA	“1110010” :	23.0 mA
“0110011” :	10.4 mA	“1110011” :	23.2 mA
“0110100” :	10.6 mA	“1110100” :	23.4 mA
“0110101” :	10.8 mA	“1110101” :	23.6 mA
“0110110” :	11.0 mA	“1110110” :	23.8 mA
“0110111” :	11.2 mA	“1110111” :	24.0 mA
“0111000” :	11.4 mA	“1111000” :	24.2 mA
“0111001” :	11.6 mA	“1111001” :	24.4 mA
“0111010” :	11.8 mA	“1111010” :	24.6 mA
“0111011” :	12.0 mA	“1111011” :	24.8 mA
“0111100” :	12.2 mA	“1111100” :	25.0 mA
“0111101” :	12.4 mA	“1111101” :	25.2 mA
“0111110” :	12.6 mA	“1111110” :	25.4 mA
“0111111” :	12.8 mA	“1111111” :	25.6 mA