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Panasonic

AN32051A

http://www.semicon.panasonic.co.jp/en/

7 x 7 Dots Matrix LED Driver LSI

FEATURES

- 7 x 7 LED Matrix Driver
  (Total LED that can be driven = 49)
- Built-in memory (ROM, RAM)
- LDO : 2-ch
- SPI interface : 1-ch
- LED driver for RGB : 1-ch
- 35 pin Wafer Level Chip Size Package (WLCSP)

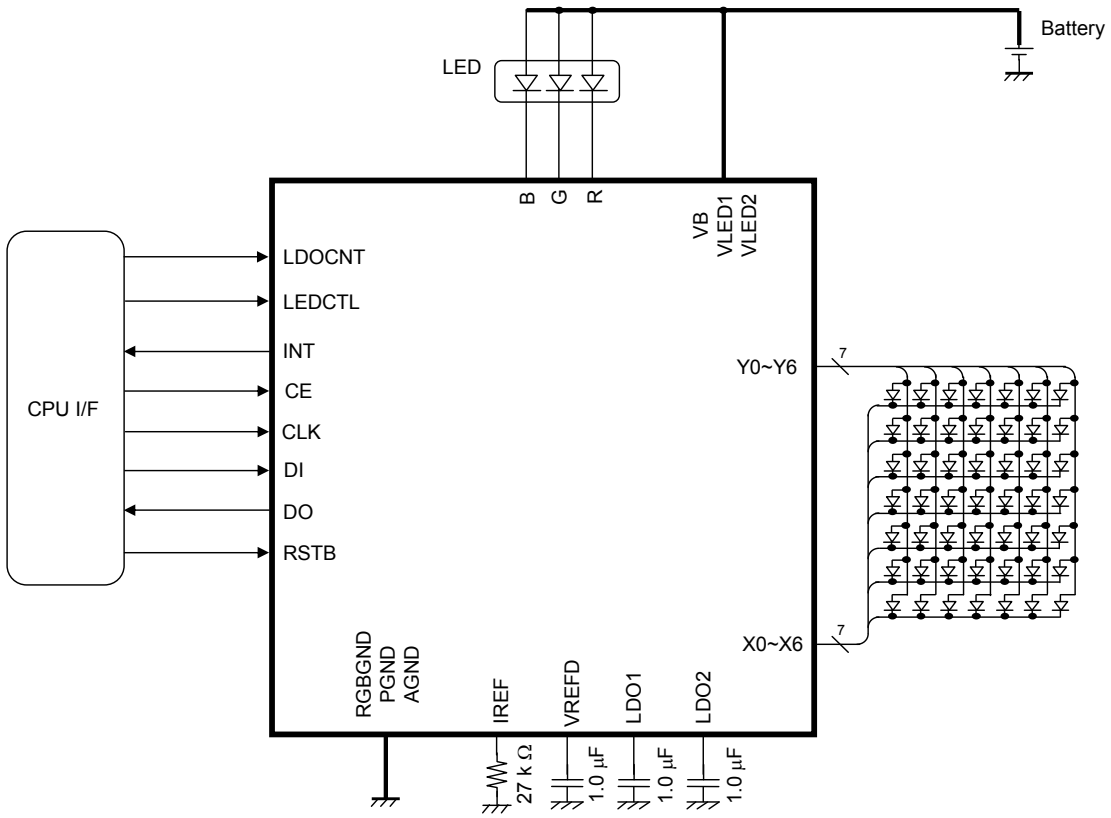
DESCRIPTION

AN32051A is a 49 Dots Matrix LED Driver. It can drive up to 16 RGB LEDs.

APPLICATIONS

- Mobile Phone
- Smart Phone
- PCs
- Game Consoles
- Home Appliances etc.

TYPICAL APPLICATION



Note)
The application circuit is an example. The operation of the mass production set is not guaranteed. Sufficient evaluation and verification is required in the design of the mass production set. The Customer is fully responsible for the incorporation of the above illustrated application circuit in the design of the equipment.

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CONTENTS

Established : 2009-11-18
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ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Note
Supply voltage	VB_{MAX}	6.0	V	*1
	$VLED_{MAX}$	6.5	V	*1
Operating ambience temperature	T_{opr}	– 30 to + 85	°C	*2
Operating junction temperature	T_j	– 30 to + 125	°C	*2
Storage temperature	T_{stg}	– 55 to + 125	°C	*2
Input Voltage Range	LEDCTL, RSTB, CE, CLK, DI	– 0.3 to 3.4	V	—
	LDOCNT	– 0.3 to 6.0	V	—
Output Voltage Range	INT, DO	– 0.3 to 3.4	V	—
	R, G, B, LDO1, LDO2, X0, X1, X2, X3, X4, X5, X6, Y0, Y1, Y2, Y3, Y4, Y5, Y6	– 0.3 to 6.5	V	—
ESD	HBM	2.0	kV	—

Note) This product may sustain permanent damage if subjected to conditions higher than the above stated absolute maximum rating. This rating is the maximum rating and device operating at this range is not guaranteeable as it is higher than our stated recommended operating range.
When subjected under the absolute maximum rating for a long time, the reliability of the product may be affected.
*1: VB_{MAX} = VB, $VLED_{MAX}$ = VLED.
The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.
*2: Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for T_a = 25°C.

POWER DISSIPATION RATING

PACKAGE	θ_{JA}	P_D (Ta=25 °C)	P_D (Ta=85 °C)
35 pin Wafer Level Chip Size Package (WLCSP)	141.5 °C /W	0.706 W	0.304 W

Note) For the actual usage, please refer to the P_D-Ta characteristics diagram in the package specification, follow the power supply voltage, load and ambient temperature conditions to ensure that there is enough margin and the thermal design does not exceed the allowable value.

CAUTION

Although this IC has built-in ESD protection circuit, it may still sustain permanent damage if not handled properly. Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gates.

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RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage range	VB	3.1	3.7	4.6	V	*1
	VLED	3.1	5.0	5.6	V	*1
Input Voltage Range	LEDCTL, RSTB, CE, CLK, DI	– 0.3	—	3.0	V	—
	LDOCNT	– 0.3	—	VB + 0.3	V	*2
Output Voltage Range	INT, DO	– 0.3	—	3.0	V	—
	R, G, B, LDO1, LDO2, X0, X1, X2, X3, X4, X5, X6, Y0, Y1, Y2, Y3, Y4, Y5, Y6	– 0.3	—	VLED + 0.3	V	*2

Note) *1: The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.
Do not apply external currents and voltages to any pin not specifically mentioned.
Voltage values, unless otherwise specified, are with respect to GND. GND is voltage for AGND, RGBGND and PGND.
VB is voltage for VB. VLED is voltage for VLED1 and VLED2.
*2: (VB + 0.3) V must not exceed 6 V. (VLED + 0.3) V must not exceed 6.5 V.

ELECTRICAL CHARACTERISTICS

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Current consumption							
Current consumption (1)	ICC1	At OFF mode LDOCNT = Low	—	0	1	μA	—
Current consumption (2)	ICC2	At Standby mode LDOCNT = Low LDO2 is active.	—	8	12	μA	—
Current consumption (3)	ICC3	LDOCNT = High LDO1 and LDO2 are active.	—	18	24	μA	—
Reference voltage							
Output voltage	VREF	I_{VREF} = 0 μA	1.22	1.25	1.28	V	—
Reference current							
Output voltage	VIREF	I_{IREF} = 0 μA	0.44	0.54	0.64	V	—
Voltage regulator (LDO1)							
Output voltage	VL1	I_{LDO1} = – 30 mA	1.79	1.85	1.91	V	—
Short circuit protection current	IPT1	LDOCNT = High REG18 = High V_{LDO1} = 0 V, IPT1 = I_{LDO1}	50	100	200	mA	—
Ripple rejection (1)	PSL11	VB = 3.6 V + 0.2 V[p-p] f = 1 kHz I_{LDO1} = – 15 mA PSL11 = 20log (acV_{LDO1} / 0.2)	—	– 45	– 40	dB	—
Ripple rejection (2)	PSL12	VB = 3.6 V + 0.2 V[p-p] f = 10 kHz I_{LDO1} = – 15 mA PSL12 = 20log (acV_{LDO1} / 0.2)	—	– 35	– 25	dB	—

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Voltage regulator (LDO2)							
Output voltage	VL2	I_{LDO2} = – 30 mA	2.76	2.85	2.94	V	—
Short circuit protection current	IPT2	LDOCNT = High V_{LDO2} = 0V IPT2 = I_{LDO2}	50	100	300	mA	—
Ripple rejection (1)	PSL21	VB = 3.6 V + 0.2 V[p-p] f = 1 kHz I_{LDO2} = – 15 mA PSL21 = 20log (acV_{LDO2} / 0.2)	—	– 40	– 30	dB	—
Ripple rejection (2)	PSL22	VB = 3.6 V + 0.2 V[p-p] f = 10 kHz I_{LDO2} = – 15 mA PSL22 = 20log (acV_{LDO2} / 0.2)	—	– 25	– 15	dB	—
Oscillator							
Oscillation frequency	FDC	—	0.96	1.20	1.44	MHz	—
SCAN Switch							
Resistance at the Switch ON	RSCAN	$I_{Y0, Y1, Y2, Y3, Y4, Y5, Y6}$ = 5 mA RSCAN = $V_{Y0, Y1, Y2, Y3, Y4, Y5, Y6}$ / 5 mA	—	2	4.8	Ω	—

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Current generator (For 7 × 7 dots matrix LED)							
Output current (1)	IMX1	At 1mA setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 1 V IMX1 = $I_{X0, X1, X2, X3, X4, X5, X6}$	0.952	1.035	1.118	mA	*1
Output current (2)	IMX2	At 2 mA setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 1 V IMX2 = $I_{X0, X1, X2, X3, X4, X5, X6}$	1.923	2.090	2.258	mA	*1
Output current (3)	IMX4	At 4 mA setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 1 V IMX4 = $I_{X0, X1, X2, X3, X4, X5, X6}$	3.843	4.177	4.512	mA	*1
Output current (4)	IMX8	At 8 mA setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 1 V IMX8 = $I_{X0, X1, X2, X3, X4, X5, X6}$	7.692	8.361	9.030	mA	*1
Output current (5)	IMX15	At 15 mA setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 1 V IMX15 = $I_{X0, X1, X2, X3, X4, X5, X6}$	14.399	15.651	16.903	mA	*1
Leakage Current when matrix LED turns off	IMXOFF	Current OFF setup $V_{X0, X1, X2, X3, X4, X5, X6}$ = 4.75 V IMXOFF = $I_{X0, X1, X2, X3, X4, X5, X6}$	—	—	1	μA	—
The error between channels	IMXCH	The average value of all channels, and the current error of each channel	– 5	—	5	%	—

*1 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Current generator (For RGB color unit)							
Output current (1)	IRGB1	At 1mA setup $V_{R, G, B}$ = 1 V	0.949	1.031	1.114	mA	*1
Output current (2)	IRGB2	At 2 mA setup $V_{R, G, B}$ = 1 V	1.901	2.066	2.231	mA	*1
Output current (3)	IRGB4	At 4 mA setup $V_{R, G, B}$ = 1 V	3.781	4.110	4.438	mA	*1
Output current (4)	IRGB8	At 8 mA setup $V_{R, G, B}$ = 1 V	7.554	8.210	8.867	mA	*1
Leakage Current when RGB turn off	IRGBOFF	Current OFF setup $V_{R, G, B}$ = 4.75 V IRGBOFF = $I_{R, G, B}$	—	—	1	μA	—
The error between channels	IRGBCH	The average value of all channels, and the current error of each channel	– 5	—	5	%	—

*1 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
SPI I/F, LEDCTL, RSTB							
Input voltage range of High-level	VIH	High-level recognition voltage	1.38	—	LDO2 + 0.3	V	—
Input voltage range of Low-level	VIL	Low-level recognition voltage	–0.3	—	0.4	V	—
Input current of High-level	IIH	$V_{LEDCTL, RSTB, CE, CLK, DI}$ = 1.85 V IIH = $I_{LEDCTL, RSTB, CE, CLK, DI}$	—	0	1	µA	—
Input current of Low-level	IIL	$V_{LEDCTL, RSTB, CSB, CLK, DI}$ = 0 V IIL = $I_{LEDCTL, RSTB, CE, CLK, DI}$	—	0	1	µA	—
INT							
Output voltage of High-level (1)	VOH1	I_{INT} = – 2 mA VDDSEL = LDO2	LDO2 × 0.8	—	—	V	—
Output voltage of Low-level (1)	VOL1	I_{INT} = 2 mA VDDSEL = LDO2 (I_{INT} = 0.5 mA)	—	—	LDO2 × 0.2	V	—
Output voltage of High-level (2)	VOH2	I_{INT} = – 2 mA VDDSEL = LDO1	LDO1 × 0.8	—	—	V	—
Output voltage of Low-level (2)	VOL2	I_{INT} = 2 mA VDDSEL = LDO1 (I_{INT} = 0.5 mA)	—	—	LDO1 × 0.3	V	—

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
LDOCNT							
Input voltage range of High-level	VIH	High-level recognition voltage	VB × 0.7	—	VB + 0.3	V	—
Input voltage range of Low-level	VIL	Low-level recognition voltage	– 0.3	—	0.4	V	—
Input current of High-level	IIH	V_{LDOCNT} = 3.6 V IIH = I_{LDOCNT}	—	0	1	µA	—
Input current of Low-level	IIL	V_{LDOCNT} = 0 V IIL = I_{LDOCNT}	—	0	1	µA	—
DO							
Output voltage of High-level	VOH	I_{DO} = – 2 mA	LDO1 × 0.8	—	—	V	—
Output voltage of Low-level	VOL	I_{DO} = 2 mA	—	—	LDO1 × 0.2	V	—

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ELECTRICAL CHARACTERISTICS (continued)

VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Voltage regulator (LDO1) Output capacitor 1 µF, Output capacitor's ESR less than 0.1 Ω							
Rise time	Tsu1	Time until output voltage reaches to 0 V to 90%	—	0.25	—	ms	*2 *3
Fall time	Tsd1	Time until output voltage reaches to 10%	—	5	—	ms	*2 *3
Maximum load current	IOMAX1	—	—	15	—	mA	*3
Load transient response (1)	Vtr11	I_{LDO1} = – 50 µA → – 15 mA (1 µs)	—	70	—	mV	*3
Load transient response (2)	Vtr12	I_{LDO1} = – 15 mA → – 50 µA (1 µs)	—	70	—	mV	*3
Voltage regulator (LDO2) Output capacitor 1 µF, Output capacitor's ESR less than 0.1 Ω							
Rise time	Tsu2	Time until output voltage reaches to 0 V to 90%	—	0.25	—	ms	*2 *3
Fall time	Tsd2	Time until output voltage reaches to 10%	—	5	—	ms	*2 *3
Maximum load current	IOMAX2	—	—	15	—	mA	*3
Load transient response (1)	Vtr21	I_{LDO2} = – 50 µA → – 15 mA (1 µs)	—	70	—	mV	*3
Load transient response (2)	Vtr22	I_{LDO2} = – 15 mA → – 50 µA (1 µs)	—	70	—	mV	*3
TSD (Thermal shutdown circuit)							
Detection temperature	Tdet	Temperature which LDO1, LDO2, Constant current circuit, Matrix SW and RGB turns off.	—	160	—	°C	*3 *4
Return temperature	Tsd11	Returning temperature	—	110	—	°C	*3 *5

Note) *2 : Rise time and Fall time are defined as below.

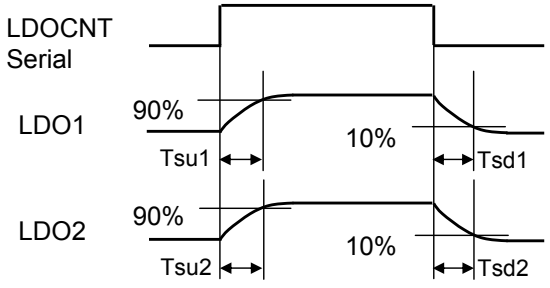
Actual evaluation result of rise time : LDO1 : 290 to 400 µs, LDO2 : 220 to 310 µs

Actual evaluation result of fall time : LDO1 : 6.2 to 8.5 ms, LDO2 : 5.8 to 7.9 ms

*3 : Typical Design Value

*4 : LDO1, LDO2, Constant current circuit, and Matrix SW and RGB are turned off when TSD is High. When TSD is High, the register is set as 14hD1 = 1. However, data can be read only when the register is read immediately after INT occurs since internal regulator is turned off.

*5 : Only LDO1 and LDO2 return after ON state of TSD. A logic part will be in Reset state.



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ELECTRICAL CHARACTERISTICS (continued)

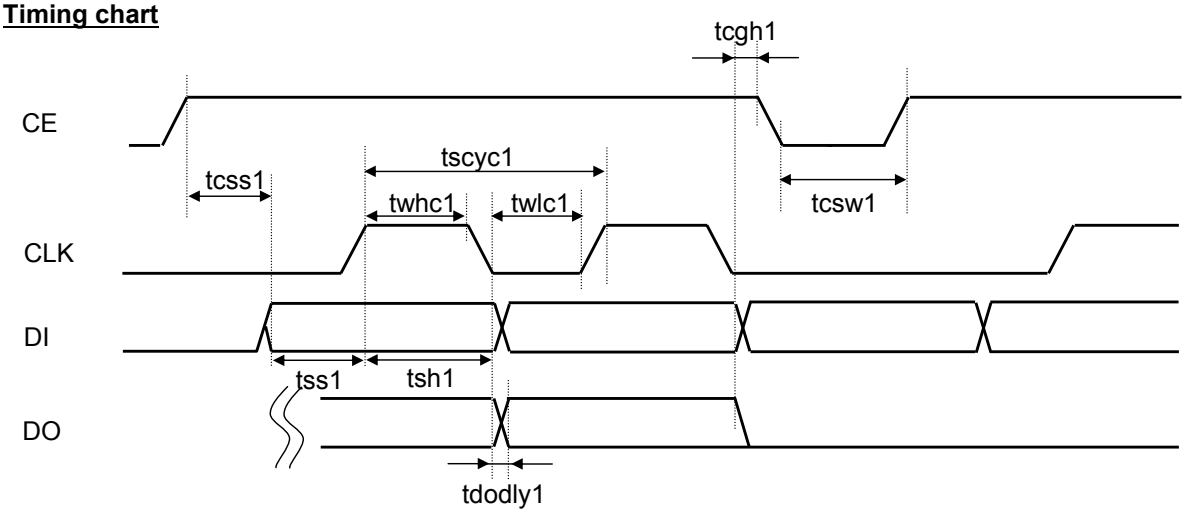
VB = 3.6 V, VLED1 = VLED2 = 4.9 V

Note) T_a = 25 °C ± 2 °C unless otherwise specified.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Microcomputer interface characteristic (Vdd = 1.85 V ± 3 %) Write access Timing							
CLK cycle time	tscyc1	—	—	125	—	ns	*3
CLK cycle time High period	twhc1	—	—	60	—	ns	*3
CLK cycle time Low period	twlc1	—	—	60	—	ns	*3
Serial-data setup time	tss1	—	—	62	—	ns	*3
Serial-data hold time	tsh1	—	—	62	—	ns	*3
Transceiver interval	tcsw1	—	—	62	—	ns	*3
Chip enable setup time	tcss1	—	—	5	—	ns	*3
Chip enable hold time	tcgh1	—	—	5	—	ns	*3
Microcomputer interface characteristic (Vdd = 1.85 V ± 3 %) Read access Timing							
CLK cycle time	tscyc1	—	—	125	—	ns	*3
CLK cycle time High period	twhc1	—	—	60	—	ns	*3
CLK cycle time Low period	twlc1	—	—	60	—	ns	*3
Serial-data setup time	tss1	—	—	62	—	ns	*3
Serial-data hold time	tsh1	—	—	62	—	ns	*3
Transceiver interval	tcsw1	—	—	62	—	ns	*3
Chip enable setup time	tcss1	—	—	5	—	ns	*3
Chip enable hold time	tcgh1	—	—	5	—	ns	*3
DC delay time	tdodly1	Only read mode	—	25	—	ns	*3

Note) *3 : Typical Design Value

Timing chart



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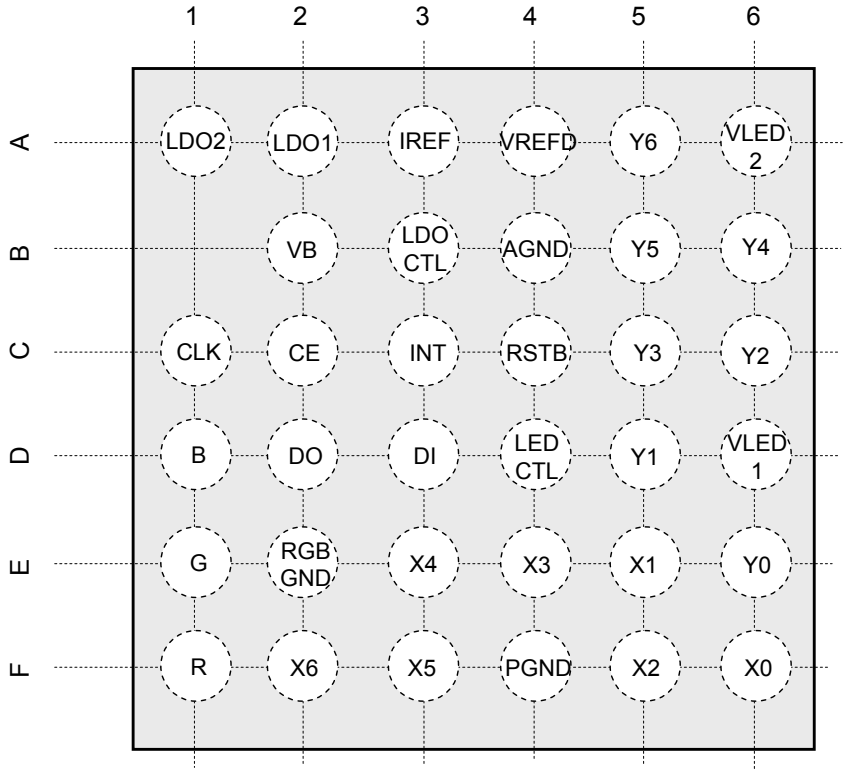
PIN CONFIGURATION

Top View



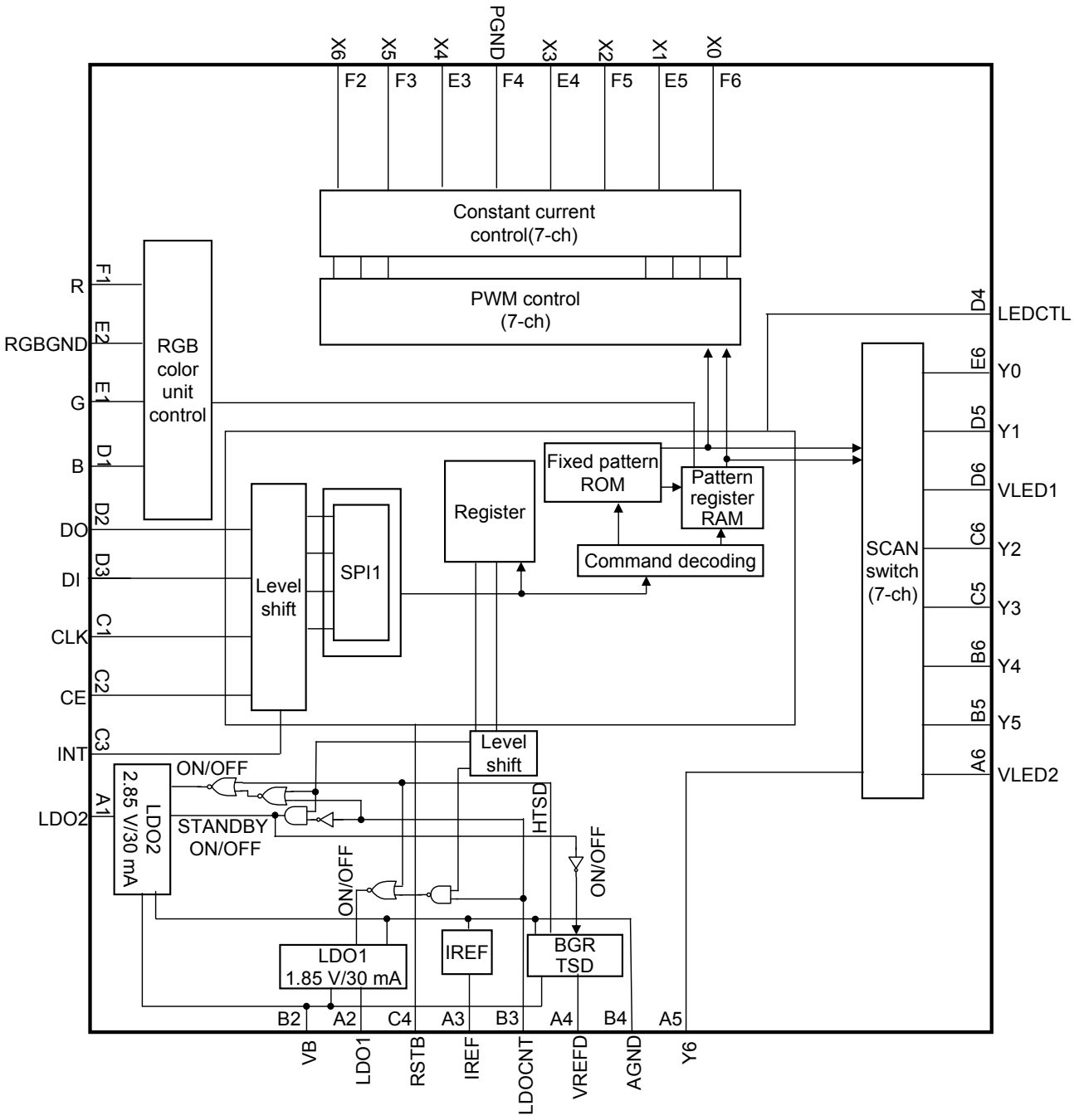
PIN FUNCTIONS

Pin No.	Pin name	Type	Description
B2	VB	Power supply	Power supply for Bandgap circuit and LDO circuit
A2	LDO1	Output	LDO1 (1.85 V) output pin
C4	RSTB	Input	Reset input (Active : High)
A3	IREF	Output	Resistor connection pin for constant current setup
B3	LDOCNT	Input	ON/OFF control pin for LDO1 and LDO2
A4	VREFD	Output	Bandgap circuit output
B4	AGND	Ground	GND for analog block
A5	Y6	Output	Constant current circuit, output pin of PWM control It connects with the G column of matrix LED.
B5	Y5	Output	Constant current circuit, output pin of PWM control It connects with the F column of matrix LED.
B6	Y4	Output	Constant current circuit, output pin of PWM control It connects with the E column of matrix LED.
C5	Y3	Output	Constant current circuit, output pin of PWM control It connects with the D column of matrix LED.
C6	Y2	Output	Constant current circuit, output pin of PWM control It connects with the C column of matrix LED.

PIN FUNCTIONS (Continued)

Pin No.	Pin name	Type	Description
D6 A6	VLED1 VLED2	Power supply	Power supply connection pin for matrix LED
D5	Y1	Output	Constant current circuit, output pin of PWM control It connects with the B column of matrix LED.
E6	Y0	Output	Constant current circuit, output pin of PWM control It connects with the A column of matrix LED.
D4	LEDCTL	Input	ON/OFF operation control of LED lighting (by serial address 0Ah)
F6	X0	Output	Constant current circuit, output pin of PWM control It connects with the 1st row of matrix LED.
E5	X1	Output	Constant current circuit, output pin of PWM control It connects with the 2nd row of matrix LED.
F5	X2	Output	Constant current circuit, output pin of PWM control It connects with the 3rd row of matrix LED.
E4	X3	Output	Constant current circuit, output pin of PWM control It connects with the 4th row of matrix LED.
F4	PGND	Ground	GND for matrix LED
E3	X4	Output	Constant current circuit, output pin of PWM control It connects with the 5th row of matrix LED.
F3	X5	Output	Constant current circuit, output pin of PWM control It connects with the 6th row of matrix LED.
F2	X6	Output	Constant current circuit, output pin of PWM control It connects with the 7th row of matrix LED.
F1	R	Output	LED connection pin
E2	RGBGND	Ground	GND for RGB pin
E1	G	Output	LED connection pin
D1	B	Output	LED connection pin
D2	DO	Output	SPI interface data output
D3	DI	Input	SPI interface data input
C1	CLK	Input	SPI interface clock input
C2	CE	Input	SPI interface chip enable (Active : High)
C3	INT	Output	Interrupt output
A1	LDO2	Output	LDO2 (2.85 V) output

FUNCTIONAL BLOCK DIAGRAM



Notes: This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

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OPERATION

1. Explanation of each mode (Power supply startup sequence)

Mode	LDOCNT	REG18	REG28	Note
OFF mode	Low	0	0	- LDOCNT should be set to High in order to recover from OFF mode.
OFF mode → Normal mode	Low → High	0/1	0/1	- Serial signal is not received at LDOCNT = Low and REG28 = [0] or REG18 = [0]. - This LSI shifts to Standby mode at LDOCNT = Low, REG28 = [1] and REG18 = [0]. - Serial signal is not received at Standby mode. (Power supplies for logic are LDO1 and LDO2.) Therefore, Standby mode cannot be released by serial signal. - When LDOCNT is changed from Low to High, it is impossible to shift Standby mode to Normal mode. - It is impossible to shift Standby mode to OFF mode. Once returning to Normal mode, shift to OFF mode.
	High	0/1	0/1	
Normal mode → OFF mode	High → Low	0	0	- At LDOCNT = High, LDO1 turns on regardless of REG18. - At LDOCNT = High, LDO2 turns on regardless of REG28. - At RSTB = Low, serial signal is not received. - It is possible to receive the serial signal at 5 ms or more after LDOCNT is set to High. - The Low interval of RSTB should be one internal clock or more. - Don't input a signal except rectangle wave to RSTB pin. - All register's settings become default values if RSTB is set to Low. (The default value of REG18 and REG28 bit is [1]. Note that LDO1 and LDO2 don't turn off when RSTB is set to Low before LDOCNT is set to Low.) - All register's settings are reset when LDO2 turns off. (Register setting initialization) - The setup step to OFF mode is as follows. REG18, 28 = [0] → LDOCNT = Low → RSTB = Low
Normal mode → Standby mode		0	1	

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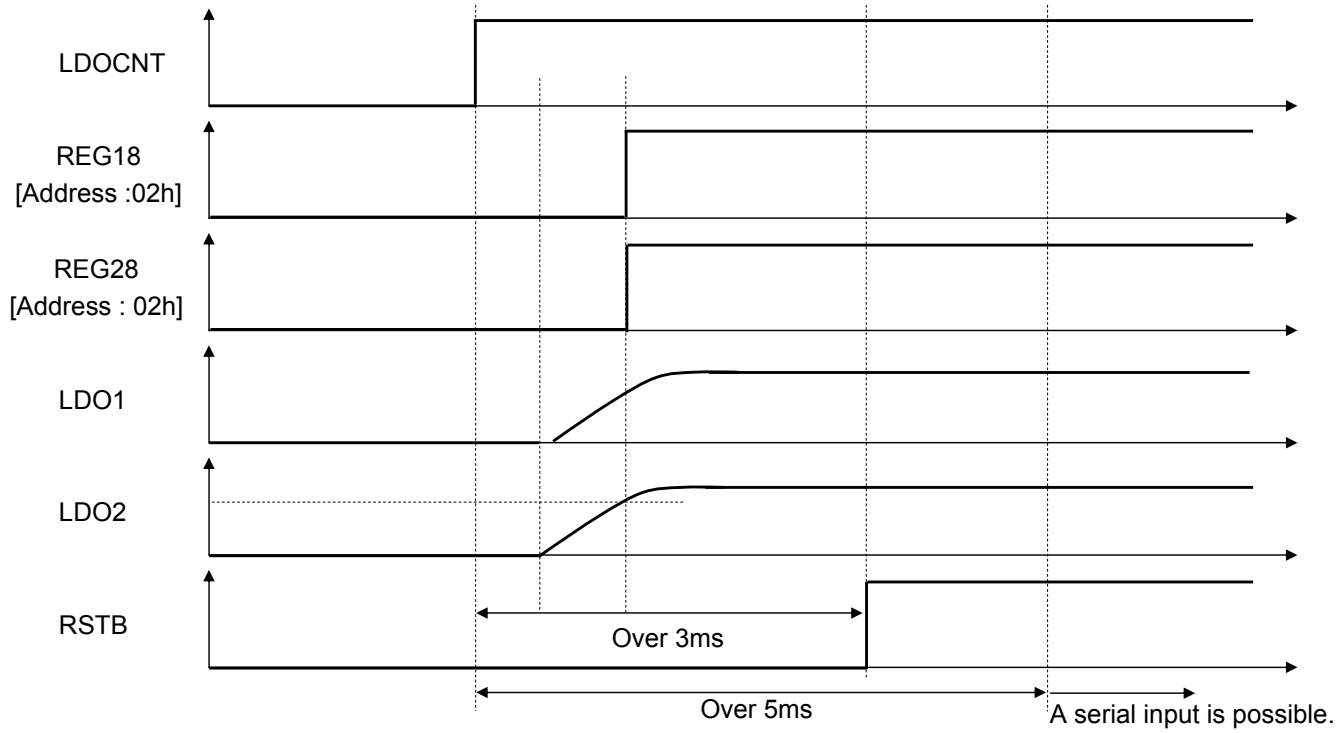
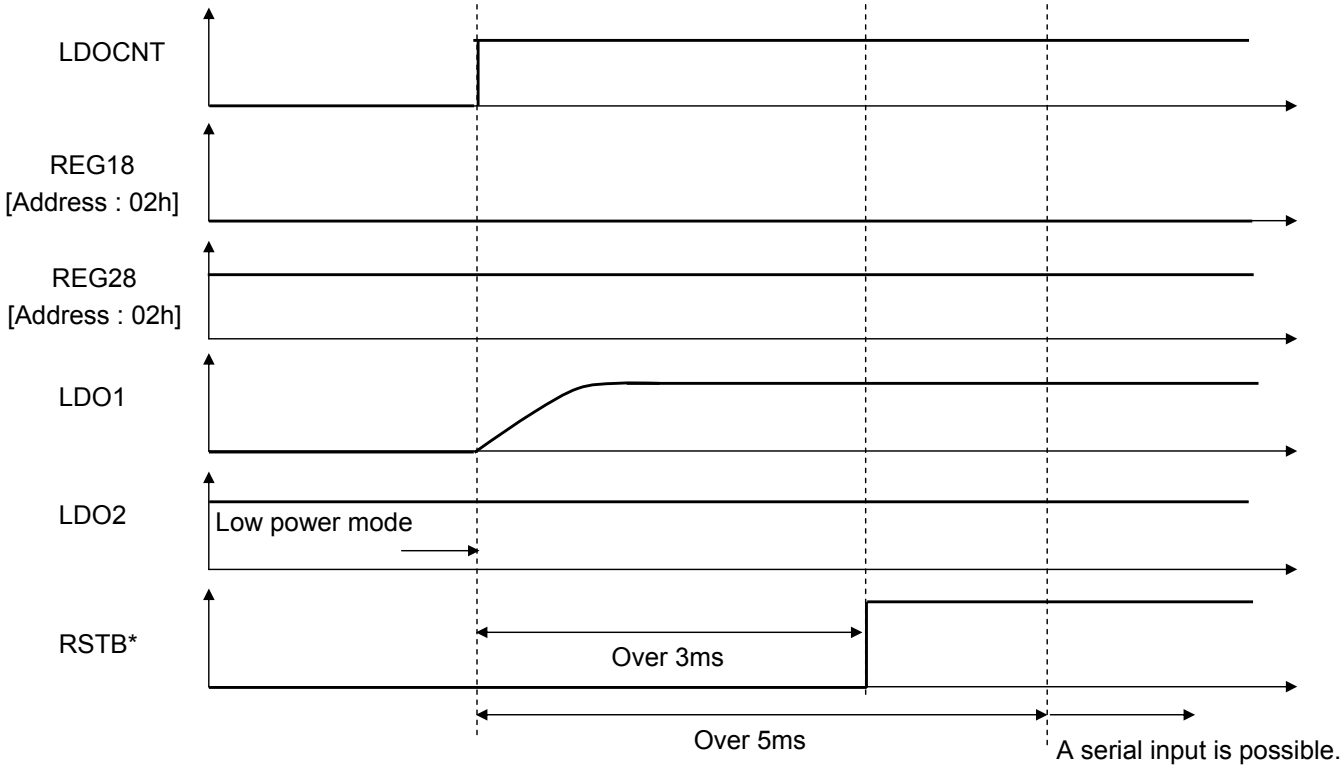
OPERATION (continued)

1. Explanation of each mode (Power supply startup sequence) (continued)

- Shift to Normal mode from OFF mode



- Shift to Normal mode from Standby mode



Note) The above waveform is under the condition that the register setup is reset in standby mode.
Maintain the state of RSTB = High to hold the register setup.

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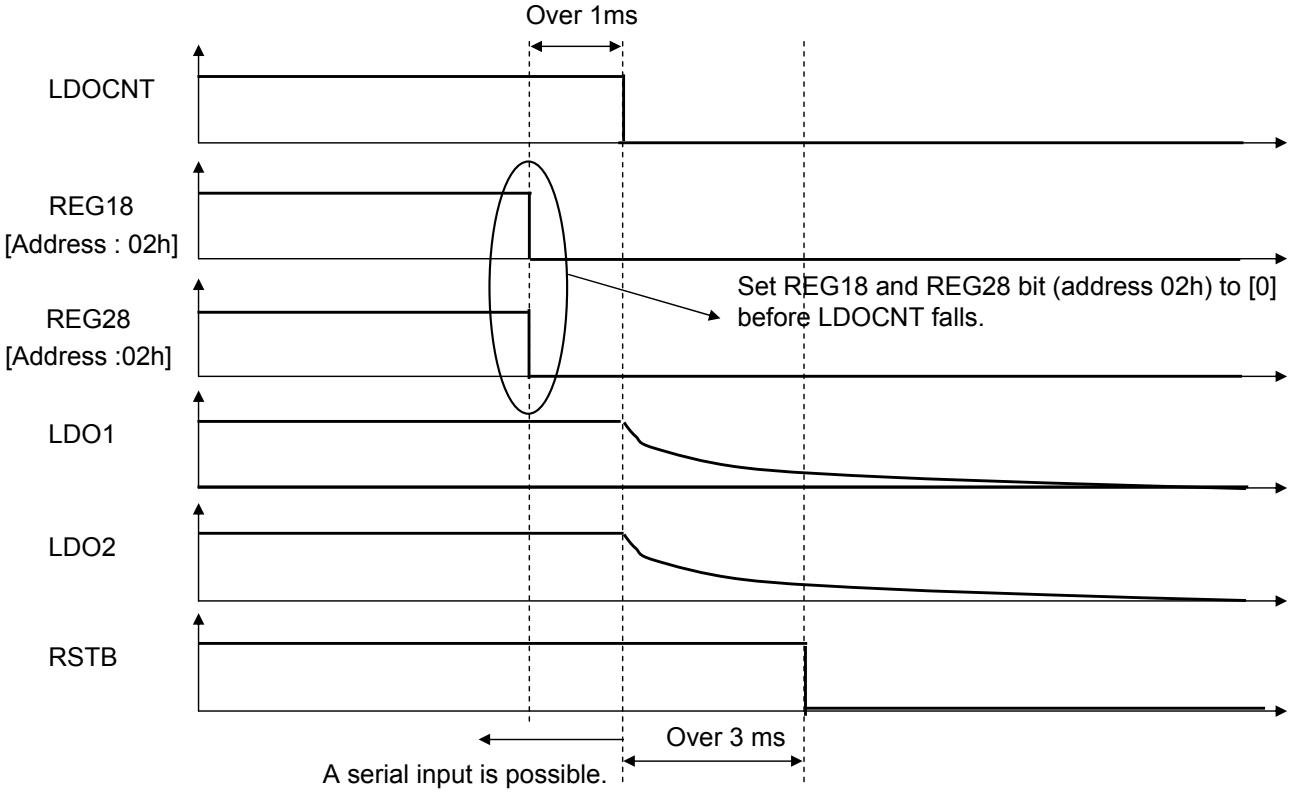
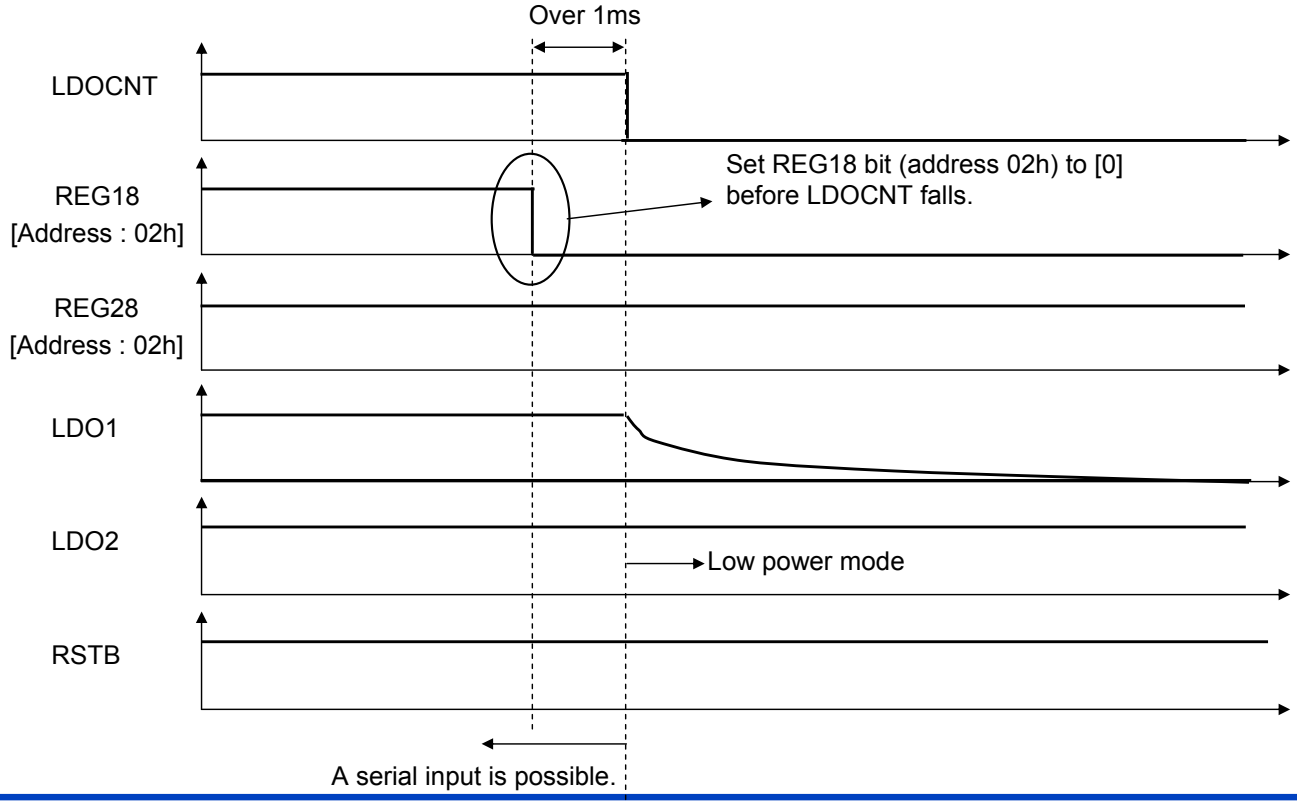
OPERATION (continued)

1. Explanation of each mode (Power supply startup sequence) (continued)

- Shift to OFF mode from Normal mode



- Shift to Standby mode from Normal mode



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OPERATION (continued)

1. Explanation of each mode (Power supply startup sequence) (continued)

Mode which is specified by VBAT / LDOCNT

VBAT	LDOCNT	MODE
Low	Low	OFF
Low	High	Prohibition
High	Low	OFF
High	High	ON

Note) "Low" in column of VBAT and LDOCNT means 0 V.
"High" in column of VBAT and LDOCNT means 3.1 V to 4.6 V (operation supply voltage range).

Logic pin conditions

The following setting is common for OFF, Standby and Normal mode.
The pin setting when RSTB = Low, under Normal mode is as follows.

Pin name	Pin state	Logic state*
INT	Output	Low
CE	Input	Low
CLK	Input	Low
DI	Input	Low
DO	Output	Low
LEDCTL	Input	Low
LDOCNT	Input	Depends on each mode setup

Note)*: Logic state for pins indicated as “Output” under Pin state shows the output level.
Logic state for pins indicated as “Input” under Pin state shows the input level to be set to the pins.

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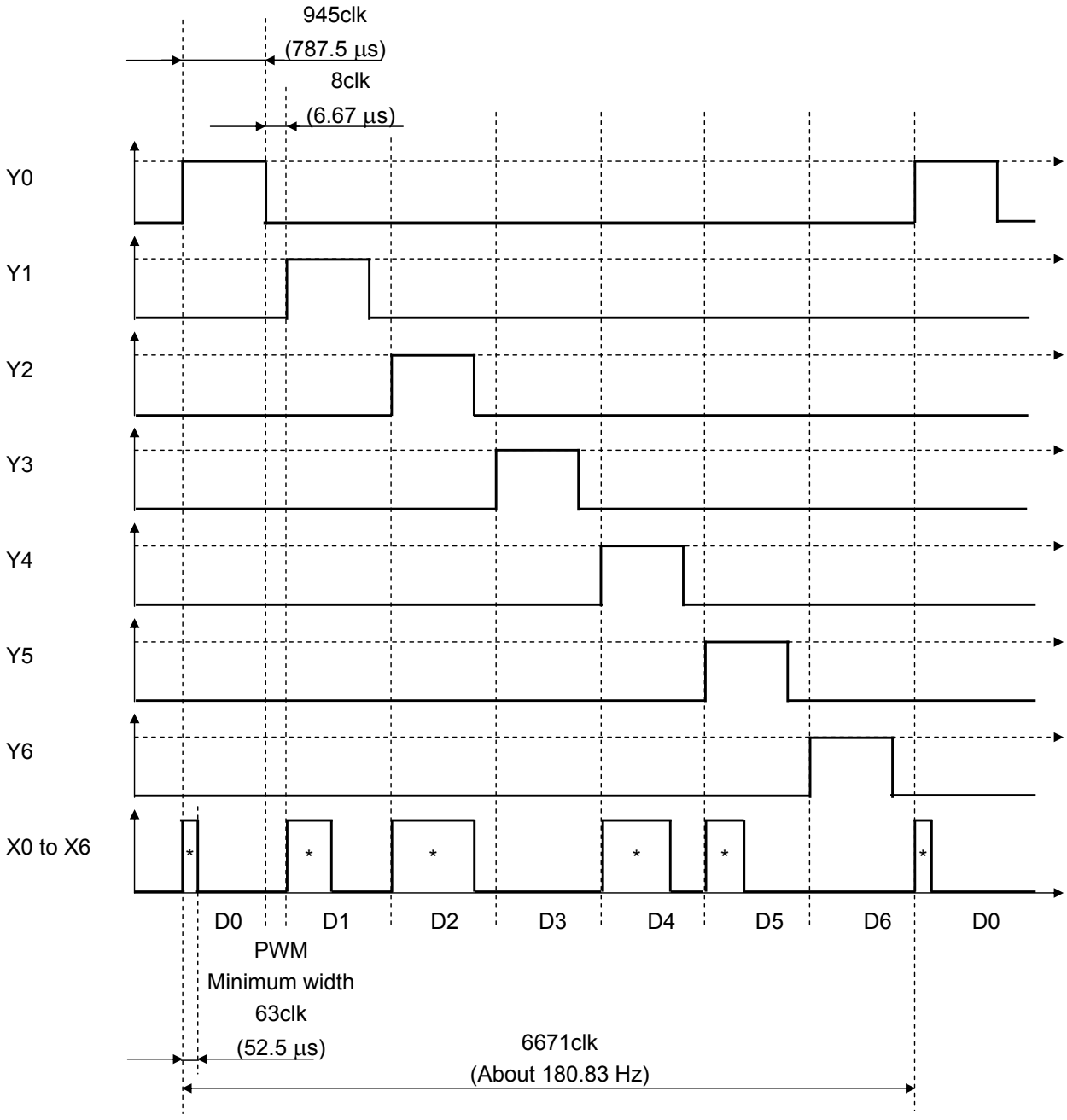
OPERATION (continued)

2. Explanation of operation

Matrix part operation waveform

The following waveform is a timing chart example at operation.
It is controlled by internal 1.2 MHz clock under the default condition.
Y side switches from Y0 to Y6 in that order. The ON period of each pin is constant 945clk (787.5 μs).
The ON period includes an 8clk(6.67 μs) interval.
In the case of the following figure, "*" mark shows ON period. Therefore, D3 and D4 are OFF period.
7 × 7 matrix display is controlled by the lines of X1 to X6.
The following waveforms are internal signals. The actual waveform of Yx pin becomes Hi-Z at Yx = Xx = Low.



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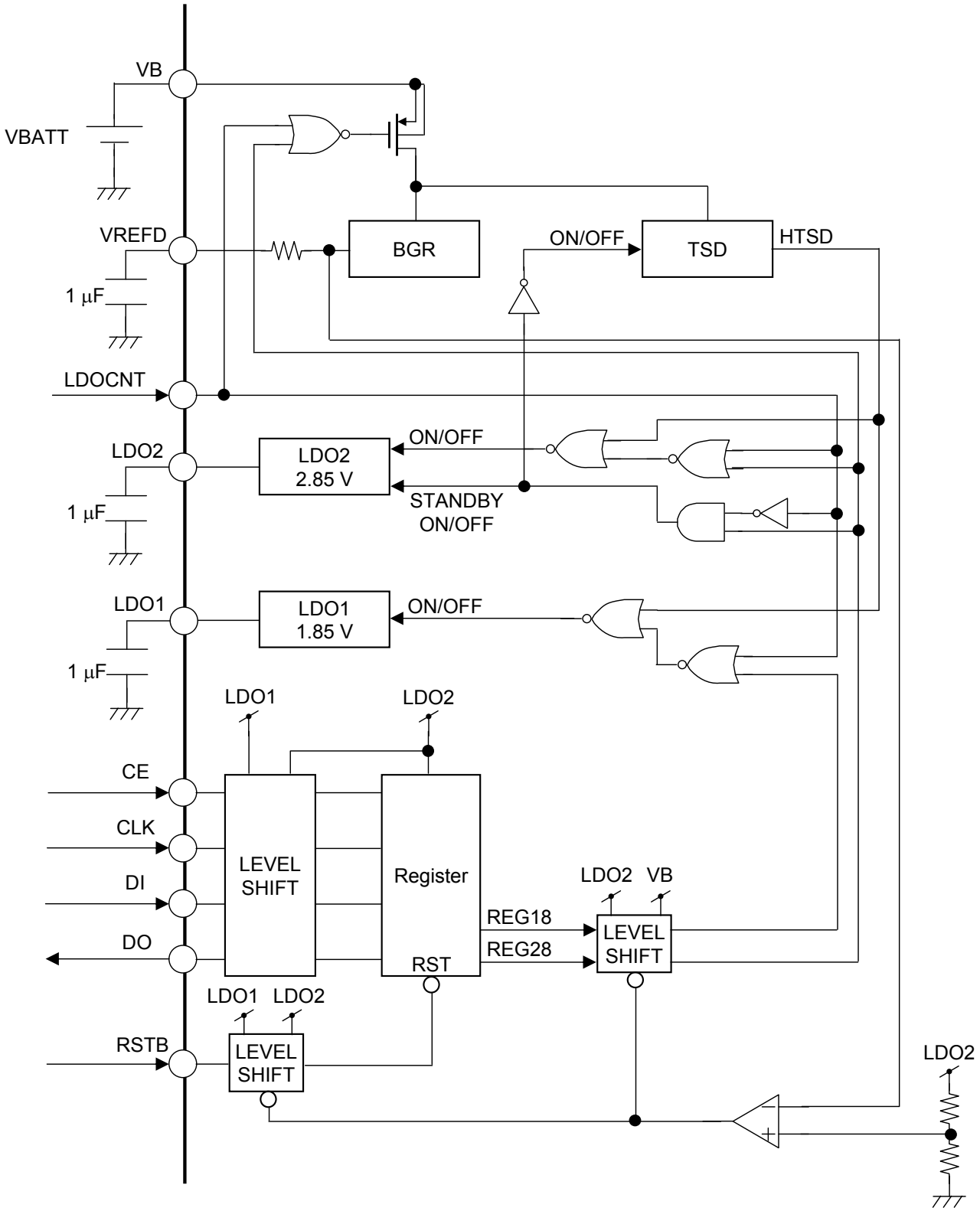
OPERATION (continued)

3. Block configuration

RESET part block configuration



Note) All the logic portions and blocks to which the power supply is not connected are supplied from VB.

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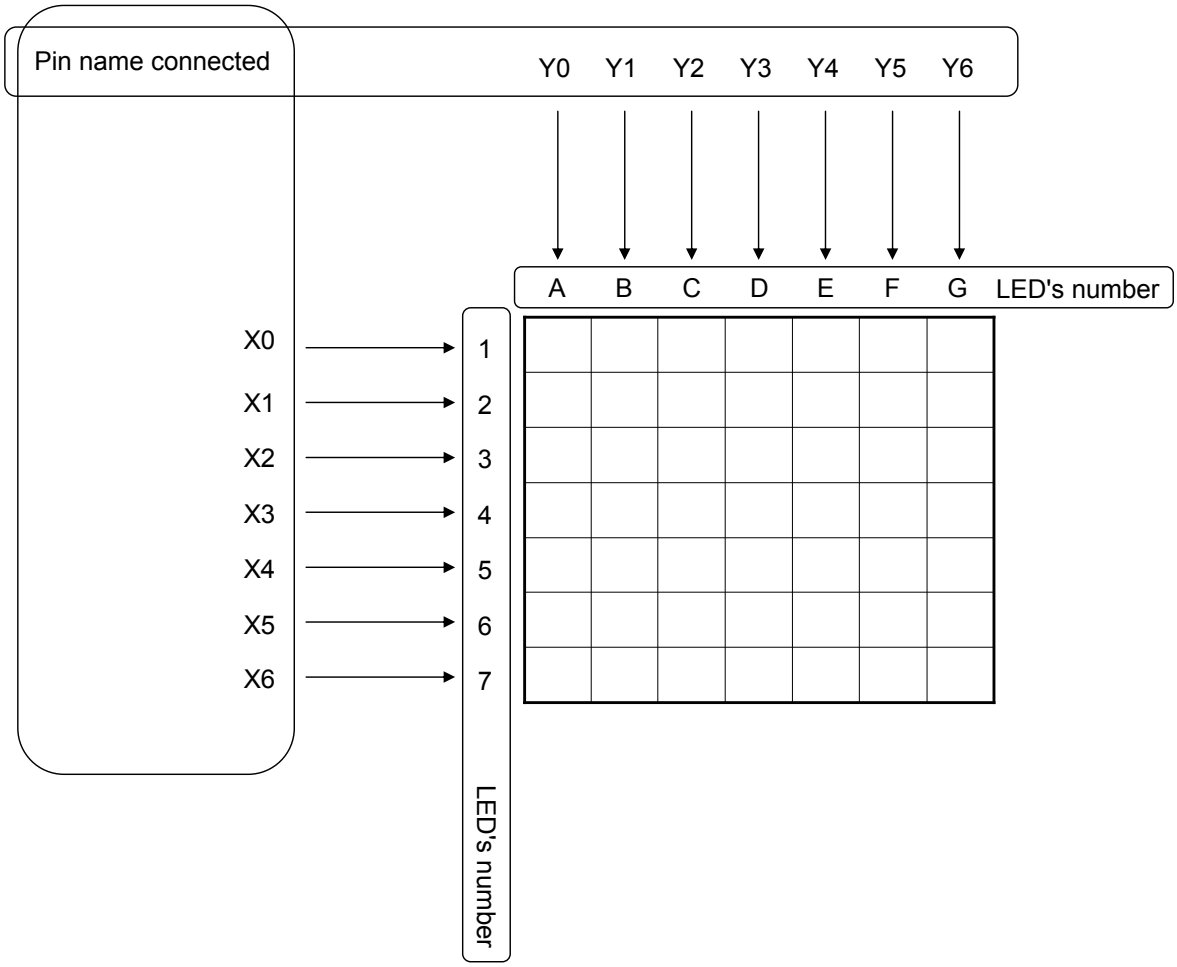
OPERATION (continued)

3. Block configuration (continued)

Explanation of matrix LED part, matrix LED's number

LED matrix driver can display characters and patterns by controlling 7 × 7 matrix LED individually.
In this product standards, LED's number controlled by each pin is as the following figure.
An internal logic circuit is controlled by internal clock.
In scroll mode, the display of character specified in the following arrangement is moved from right to left.



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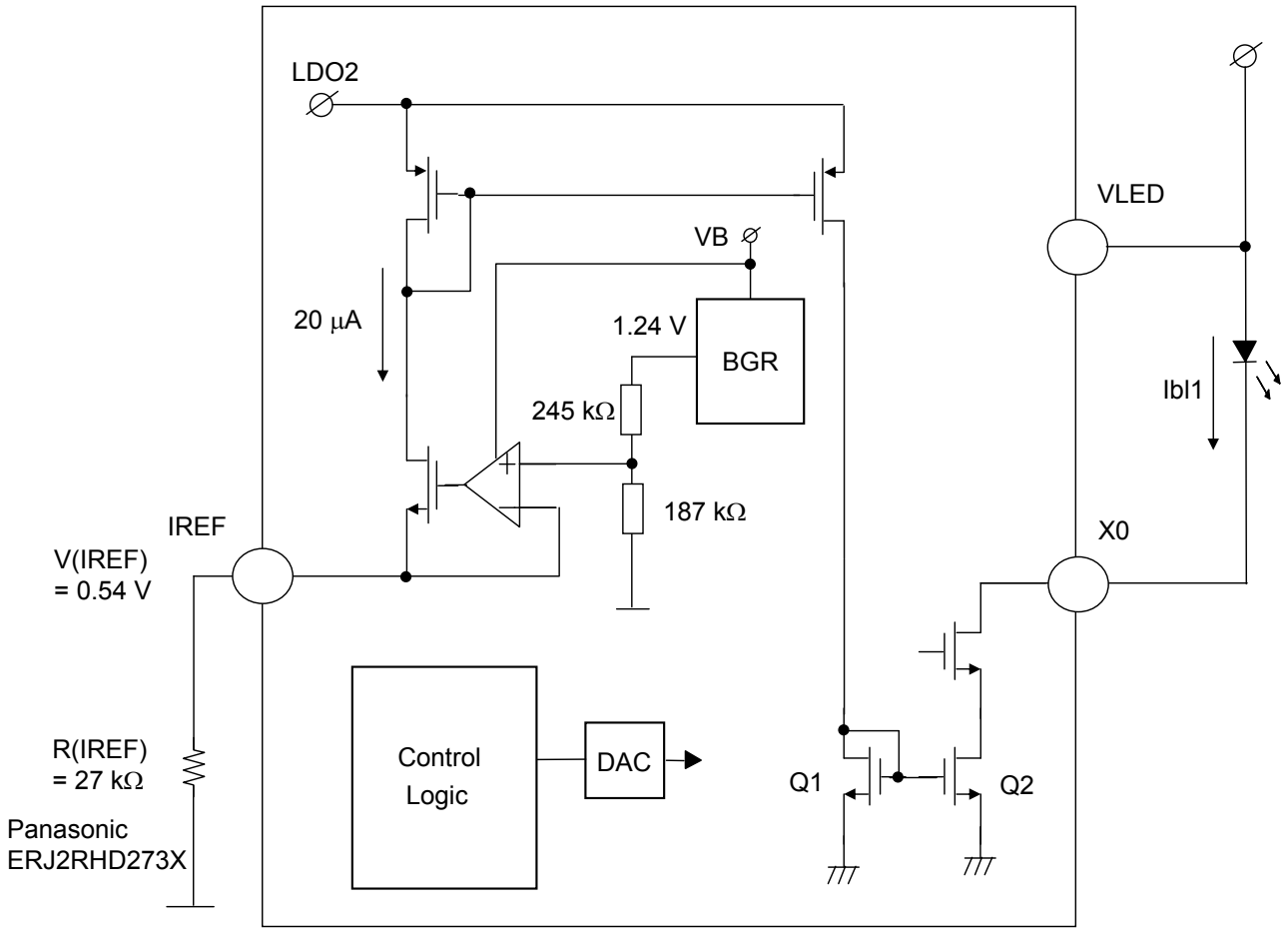
OPERATION (continued)

3. Block configuration (continued)

Equivalent circuit example of constant current driver

In case of X0 pin



The constant current equivalent circuit example (X0 pin) for LED driver is shown in the above figure.
The reference current for constant current driver is calculated by the following formula.

V(IREF) / R(IREF) = 0.54 V / 27 kΩ = 20 μA

The LED driver current can be set to the range of 0 mA to 30 mA by setting the mirror ratio between Q1 and Q2 by DAC via serial interface.
The constant current can be changed by the resistor connected to IREF pin, but the accuracy in case of this setting is not guaranteed.
It is recommended that ERJ2RHD273X is used as R(IREF) to keep the accuracy of constant current of LED driver.

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OPERATION (continued)

4. Register and Address

Register map

Sub address	R/W	Data name	Data							
			D7	D6	D5	D4	D3	D2	D1	D0
01h	W	POWERCNT	—	—	—	—	—	OSCEN	—	—
02h	W	LDOCNT	—	—	—	—	—	—	REG18	REG28
03h	For test									
04h	For test									
05h	For test									
06h	For test									
07h	For test									
08h	For test									
09h	For test									
0Ah	W	LEDCTL	LEDACT	—	—	—	—	DISMTX	DISRGB	—
⋮										
10h	For test									
11h	For test									
12h	For test									
13h	For test									
14h	R	IOFACTOR	FACGD1	—	—	—	RAM ACT	FRMINT	CPUWRER	TSD
15h	For test									
16h	For test									
17h	For test									
18h	For test									
19h	For test									
1Ah	W/R	VDDSEL	INTVSEL	—	—	—	—	—	—	—

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OPERATION (continued)

4. Register and Address (continued)

Register map (continued)

Sub address	R/W	Data name	Data							
			D7	D6	D5	D4	D3	D2	D1	D0
20h	R/W	MTXON	—	—	—	—	—	—	—	MTXON
21h	R/W	MTXDATA	MTXDATA[7 : 0]							
22h	R/W	FFROM	—	—	—	—	—	—	ROM77[1 : 0]	
23h	R/W	ROMSEL	SELROM[7 : 0]							
24h	R/W	RAMCOPY	—	—	—	—	—	—	SELRAM	COPY START
25h	R/W	SETFROM	SETFROM[7 : 0]							
26h	R/W	SETTO	SETTO[7 : 0]							
27h	R/W	REPON	—	—	—	—	—	—	—	REPON
28h	R/W	SETTIME	—	—	—	—	—	—	SETTIME[1 : 0]	
29h	R/W	RAMRST	—	—	—	—	—	—	RAM1	RAM2
2Ah	R/W	SCROLL	—	—	—	—	—	—	—	SCLON
2Bh	For test									
2Ch	R/W	RGBON	—	—	—	—	—	—	—	RGBON
2Dh	R/W	RGBDATA	—	—	RGBDATA[5 : 0]					
2Eh	For test									
30h	R/W	RAMNUM	—	—	—	—	—	—	—	RAMNUM
⋮										
6Bh	For test									
6Dh	For test									
6Fh	For test									
70h	For test									
71h	For test									
72h	For test									
73h	For test									
74h	For test									
75h	For test									
76h	For test									
77h	For test									

Note) Don't access to the address 6Bh to 77h.

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