DATA SHEET

Part No.	AN32055A
Package Code No.	XBGA080-W-3737

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Contents

AN32055A

Step-up DC-DC Converter IC for White LED

■ Overview

AN32055A is equipped with 6-ch of the LED driver for LCD backlights, and the driver for LED matrix. They supply voltage by step-up DC-DC converter.

■ Features

- Driver for 7 × 7 dots matrix LED
- Built-in memory (ROM and RAM)
- Step-up DC-DC converter
- LDO : 2-ch
- GPIO : 2-ch
- GPI : 3-ch (3pins from GPI1 to GPI3 are in common with SPI2)
- GPO : 2-ch
- SPI Interface : 2-ch (SPI2 is only receiving. It is possible to control only address 05h by SPI2.
- Driver for LED (Main LED : 4-ch, Sub LED : 2-ch, LED for Photo flash : 2-ch, RGB color unit : 1-ch)

■ Applications

- LED Driver LSI for Cellular phones

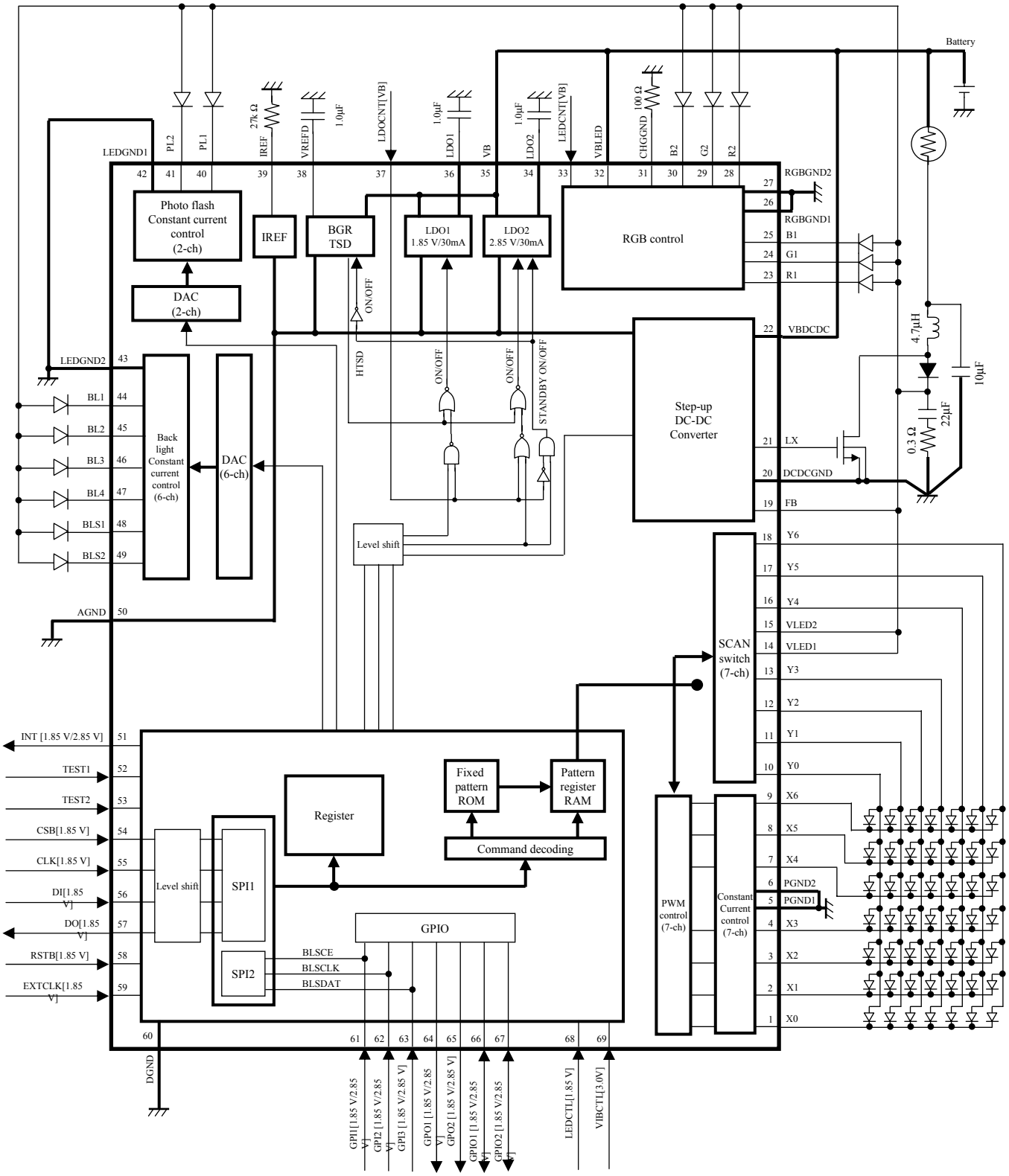
■ Package

- 80 pin Wafer level chip size package (WLCSP) Size:3.7 mm × 3.7 mm (0.4 mm pitch)

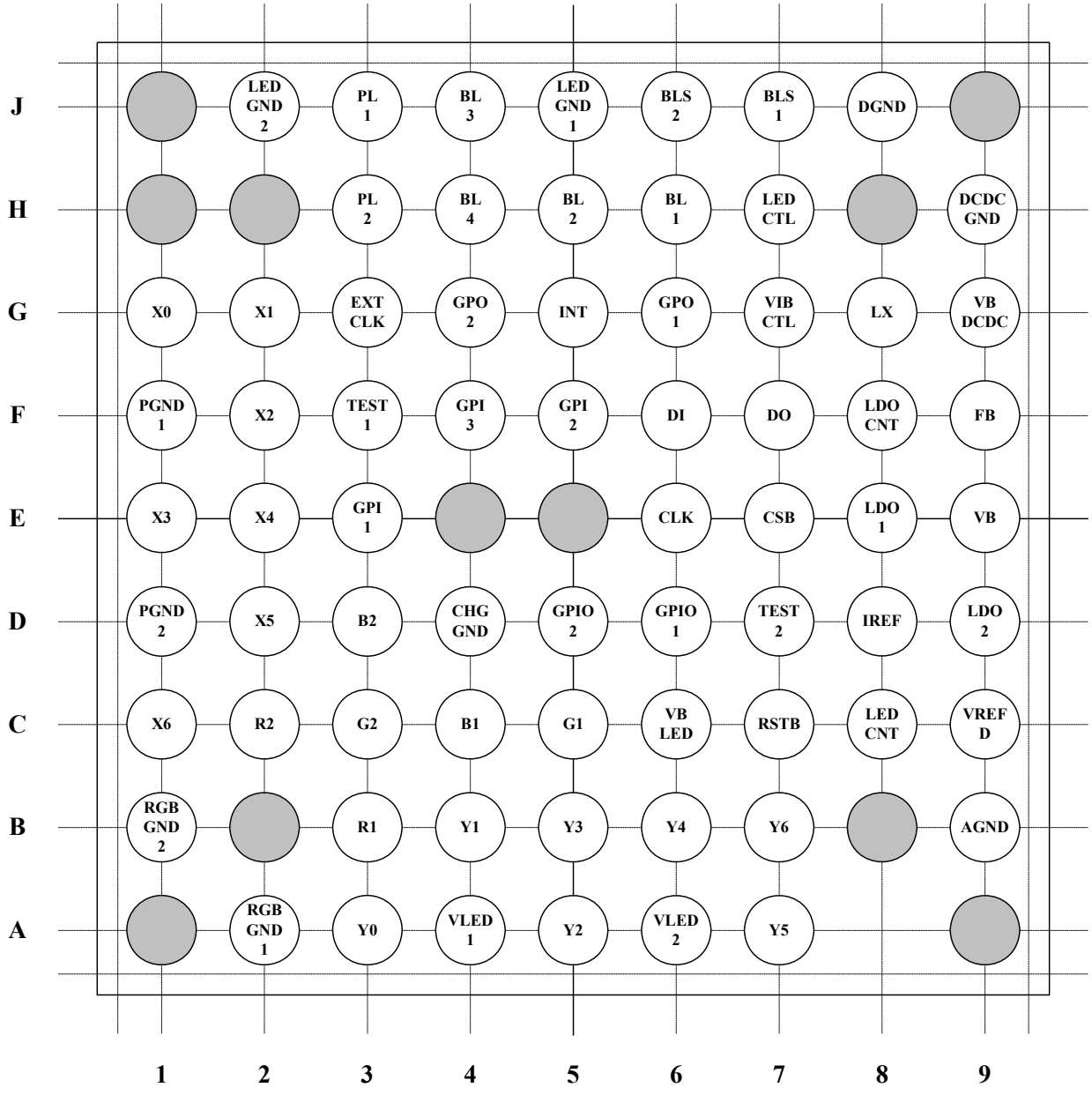
■ Type

- Bi-CMOS IC

■ Application Circuit Example



■ Pin Descriptions



Bottom View

■ Pin Descriptions (continued)

Pin No.	Pin name	Type	Description
1 (G1)	X0	Output	Constant current circuit. The output terminal of PWM control. It connects with the 1st Row of matrix LED.
2 (G2)	X1	Output	Constant current circuit. The output terminal of PWM control. It connects with the 2nd Row of matrix LED.
3 (F2)	X2	Output	Constant current circuit. The output terminal of PWM control. It connects with the 3rd Row of matrix LED.
4 (E1)	X3	Output	Constant current circuit. The output terminal of PWM control. It connects with the 4th Row of matrix LED.
5 (F1)	PGND1	Ground	The GND terminal for matrix LED
6 (D1)	PGND2	Ground	The GND terminal for matrix LED
7 (E2)	X4	Output	Constant current circuit. The output terminal of PWM control. It connects with the 5th Row of matrix LED.
8 (D2)	X5	Output	Constant current circuit. The output terminal of PWM control. It connects with the 6th Row of matrix LED.
9 (C1)	X6	Output	Constant current circuit. The output terminal of PWM control. It connects with the 7th Row of matrix LED.
10 (A3)	Y0	Output	Constant current circuit. The output terminal of PWM control. It connects with the A Column of matrix LED.
11 (B4)	Y1	Output	Constant current circuit. The output terminal of PWM control. It connects with the B Column of matrix LED.
12 (A5)	Y2	Output	Constant current circuit. The output terminal of PWM control. It connects with the C Column of matrix LED.
13 (B5)	Y3	Output	Constant current circuit. The output terminal of PWM control. It connects with the D Column of matrix LED.
14 (A4)	VLED1	Power supply	The power supply's connect terminal for matrix LED. Connect with the output of battery or step-up DC-DC converter.
15 (A6)	VLED2	Power supply	The power supply's connect terminal for matrix LED. Connect with the output of a battery or step-up DC-DC converter.
16 (B6)	Y4	Output	Constant current circuit. The output terminal of PWM control. It connects with the E Column of matrix LED.
17 (A7)	Y5	Output	Constant current circuit. The output terminal of PWM control. It connects with the F Column of matrix LED.
18 (B7)	Y6	Output	Constant current circuit. The output terminal of PWM control. It connects with the G Column of matrix LED.

■ Pin Descriptions (continued)

Pin No.	Pin name	Type	Description
19 (F9)	FB	Input	The feedback terminal for step-up DC-DC converter.
20 (H9)	DCDCGND	Ground	The GND terminal for step-up DC-DC converter.
21 (G8)	LX	Output	The terminal for External Nch-type MOS-Tr Gate driver.
22 (G9)	VBDCDC	Power supply	The power supply's connect terminal for step-up DC-DC converter.
23 (B3)	R1	Output	LED contact terminal. Control by LEDCNT terminal is also possible.
24 (C5)	G1	Output	LED contact terminal.
25 (C4)	B1	Output	LED contact terminal.
26 (A2)	RGBGND1	Ground	The GND terminal for RGB terminal.
27 (B1)	RGBGND2	Ground	The GND terminal for RGB terminal.
28 (C2)	R2	Output	General-purpose output terminal.(Nch-MOS Open Drain)
29 (C3)	G2	Output	General-purpose output terminal.(Nch-MOS Open Drain)
30 (D3)	B2	Output	General-purpose output terminal.(Nch-MOS Open Drain)
31 (D4)	CHGGND	Output	The resistance contact terminal for charge LED.(Connect current restriction resistance between this terminal and GND terminal.)
32 (C6)	VBLED	Power supply	Battery voltage's connect terminal. This terminal supplies Power supply to R1 terminal and R2 terminal.
33 (C8)	LEDCNT	Input	ON/OFF control terminal of LED connected to R1 terminal and R2 terminal.
34 (D9)	LDO2	Output	LDO2 (2.85 V) output terminal.
35 (E9)	VB	Power supply	The power supply's connect terminal for BGR circuit and LDO circuit.
36 (E8)	LDO1	Output	LDO1 (1.85 V) output terminal.
37 (F8)	LDOCNT	Input	ON/OFF control terminal of LDO1 and LDO2.
38 (C9)	VREFD	Output	BGR circuit output terminal.
39 (D8)	IREF	Output	The resistance connect terminal for constant current value setup.

■ Pin Descriptions (continued)

Pin No.	Pin name	Type	Description
40 (J3)	PL1	Output	The constant current output terminal for LED driver. (0 to 61 mA) This terminal is driven with the same current value as PL2 terminal.
41 (H3)	PL2	Output	The constant current output terminal for LED driver. (0 to 61 mA) This terminal is driven with the same current value as PL1 terminal.
42 (J5)	LEDGND1	Ground	The GND terminal for constant current circuits for LED driver.
43 (J2)	LEDGND2	Ground	The GND terminal for constant current circuits for LED driver.
44 (H6)	BL1	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BL2, BL3 and BL4 terminal.
45 (H5)	BL2	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BL1, BL3 and BL4 terminal.
46 (J4)	BL3	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BL1, BL2 and BL4 terminal.
47 (H4)	BL4	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BL1, BL2 and BL3 terminal.
48 (J7)	BLS1	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BLS2 terminal.
49 (J6)	BLS2	Output	The constant current output terminal for LED driver. (0 to 31 mA) This terminal is driven with the same current value as BLS1 terminal.
50 (B9)	AGND	Ground	The GND terminal for Analog circuitry.
51 (G5)	INT	Output	Interrupt output terminal.
52 (F3)	TEST1	Input	Test terminal.
53 (D7)	TEST2	Input	Test terminal.
54 (E7)	CSB	Input	Chip-enable terminal for SPI1 interface.
55 (E6)	CLK	Input	Clock input terminal for SPI1 interface.
56 (F6)	DI	Input	Data input terminal for SPI1 interface.
57 (F7)	DO	Output	Data output terminal for SPI1 interface.
58 (C7)	RSTB	Input	Reset input terminal

■ Pin Descriptions (continued)

Pin No.	Pin name	Type	Description
59 (G3)	EXTCLK	Input	External clock input terminal. (It can operate by the clock frequency of a maximum of 1.44 MHz.)
60 (J8)	DGND	Ground	The GND terminal for Logic circuitry.
61 (E3)	GPI1	Input	GPI input port terminal. (Chip-enable terminal for SPI2 interface.)
62 (F5)	GPI2	Input	GPI input port terminal. (Clock input terminal for SPI2 interface.)
63 (F4)	GPI3	Input	GPI input port terminal. (Data input terminal for SPI2 interface.)
64 (G6)	GPO1	Output	GPO output port terminal.
65 (G4)	GPO2	Output	GPO output port terminal.
66 (D6)	GPIO1	Input / Output	GPIO input/output port terminal.
67 (D5)	GPIO2	Input / Output	GPIO input/output port terminal.
68 (H7)	LEDCTL	Input	LED's lighting ON/OFF control terminal. (It is based on register 0Ah.)
69 (G7)	VIBCTL	Input	LED's lighting ON/OFF control terminal. (It is based on register 09h.)

■ Absolute Maximum Ratings

A No.	Parameter	Symbol	Rating	Unit	Notes
1	Supply voltage	VB_{MAX}	6.0	V	*1
		$VLED_{MAX}$	6.5		
2	Supply current	I_{CC}	—	A	—
3	Power dissipation	P_D	77.2	mW	*2
4	Operating ambient temperature	T_{opr}	–30 to +85	°C	*3
5	Storage temperature	T_{stg}	–55 to +125	°C	*3

Notes) *1 :VBMAX = VBDCDC = VBLED = VB, VLEDMAX = VLED1 = VLED2. The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2 : The power dissipation shown is the value at T_a = 85°C for the independent (unmounted) IC package without a heat sink. When using this IC, refer to the • P_D – T_a diagram in the ■ Technical Data and use under the condition not exceeding the allowable value.

*3 : Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for T_a = 25°C.

■ Operating supply voltage range

Parameter	Symbol	Range	Unit	Notes
Supply voltage range	VBDCDC VBLED VB	3.1 to 4.6	V	*1
	VLED1 VLED2	3.1 to 5.6		*1

Note) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

■ Electrical Characteristics at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current consumption								
1	Current consumption (1)	ICC1	At OFF mode VB = 3.1 V to 4.4 V ICC1 = IPM	—	0	1	µA	—
2	Current consumption (2)	ICC2	At Standby mode VB = 3.1 V to 4.4 V LDOCNT = Low ILOAD = 0 µA ICC2 = IPM	—	8	12	µA	—
3	Current consumption (3)	ICC3	VB = 3.1 V to 4.4 V LDOCNT = High ILOAD = 0 µA ICC3 = IPM	—	18	24	µA	—
Reference voltage								
4	Output voltage	VREF	VB = 3.1 V to 4.4 V IP38 = 0 µA VREF = VP38	1.21	1.24	1.27	V	—
Reference current								
5	Output voltage	VIREF	VB = 3.1 V to 4.4 V IP39 = 0 µA VIREF = VP39	0.44	0.54	0.64	V	—
Voltage regulator (LDO1)								
6	Output voltage	VL1	VB = 3.1 V to 4.4 V IP36 = 10 µA to 30 mA VL1 = VP36	1.79	1.85	1.91	V	—
7	Current at the time of OFF	IOFF1	LDOCNT = High REG18 = Low VP36 = 0 V IOFF1 = IP36	—	—	1	µA	—
8	Short circuit protection current	IPT1	LDOCNT = High REG18 = High VP36 = 0 V IPT1 = IP36	50	100	200	mA	—
9	Ripple rejection (1)	PSL11	VB = 3.6 V + 0.2 V[p-p] f = 1 kHz IP36 = 15 mA PSL11 = 20log(acVP36 / 0.2)	—	–45	–40	dB	—
10	Ripple rejection (2)	PSL12	VB = 3.6 V + 0.2 V[p-p] f = 10 kHz IP36 = 15 mA PSL12 = 20log(acVP36 / 0.2)	—	–35	–25	dB	—

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Voltage regulator (LDO2)								
11	Output voltage	VL2	VB = 3.1 V to 4.4 V IP32 = 10 µA to 30 mA VL2 = VP34	2.76	2.85	2.94	V	—
12	Current at the time of OFF	IOFF2	LDOCNT = Low REG28 = Low VP34 = 0 V IOFF2 = IP34	—	—	1	µA	—
13	Short circuit protection current	IPT2	LDOCNT = High VP34 = 0V IPT2 = IP34	50	100	300	mA	—
14	Ripple rejection (1)	PSL21	VB = 3.6 V + 0.2 V[p-p] f = 1 kHz IP34 = 15 mA PSL21 = 20log(acVP34 / 0.2)	—	–35	–30	dB	—
15	Ripple rejection (2)	PSL22	VB = 3.6 V + 0.2 V[p-p] f = 10 kHz IP34 = 15 mA PSL22 = 20log(acVP34 / 0.2)	—	–25	–15	dB	—
Step-up DC-DC converter								
16	Output voltage (1)	VDC1	Mode 1 VB = 3.1 V to 4.4 V Iout = 0 µA to 400 mA	4.62	4.89	5.16	V	—
17	Output voltage (2)	VDC2	Mode 2 VB = 3.1 V to 4.4 V Iout = 0 µA to 400 mA	5.03	5.3	5.57	V	—
18	Oscillation frequency	FDC	VB = 3.1 V to 4.4 V OSCEN = [1] , DDSW = [1]	0.96	1.20	1.44	MHz	*1
19	Short detection delay time	TSCP	Time when INT is set to High from Low, after short detection.	3	13	30	ms	—
SCAN Switch								
20	Resistance at the Switch ON	RSCAN	VP14 = VP15 = 4.9 V IP10 to 13, 16 to 18 = 5 mA RSCAN = VP10 to 13, 16 to 18 / 5 mA	—	2	4.8	Ω	—

Note) *1: Make sure to set both bits of OSCEN and DDSW to [1].
During OSCEN = [1] , DDSW must be set to [1].

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current generator (For backlights)								
21	Output current (1)	IBL1	At 1mA setup VP44 to 47 = 1 V IBL1 = IP44 to 47	0.945	1.027	1.109	mA	*2
22	Output current (2)	IBL2	At 2 mA setup VP44 to 47 = 1 V IBL2 = IP44 to 47	1.894	2.058	2.223	mA	*2
23	Output current (3)	IBL4	At 4 mA setup VP44 to 47 = 1 V IBL4 = IP44 to 47	3.808	4.139	4.470	mA	*2
24	Output current (4)	IBL8	At 8 mA setup VP44 to 47 = 1 V IBL8 = IP44 to 47	7.630	8.294	8.957	mA	*2
25	Output current (5)	IBL16	At 16 mA setup VP44 to 47 = 1 V IBL16 = IP44 to 47	15.516	16.865	18.214	mA	*2
26	Leak current at the time of OFF	IBLOFF	At current OFF setup VP44 to 47 = 4.75 V IBLOFF = IP44 to 47	—	—	1	µA	—
27	The error between channels	IBLCH	At 15 mA setup The average value of all channels, and the current error of each channel	–5	—	5	%	—

Note) *2 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current generator (For sub backlights)								
28	Output current (1)	IBLS1	At 1mA setup VP48 to 49 = 1 V IBLS1 = IP48 to 49	0.949	1.032	1.114	mA	*2
29	Output current (2)	IBLS2	At 2 mA setup VP48 to 49 = 1 V IBLS2 = IP48 to 49	1.912	2.078	2.244	mA	*2
30	Output current (3)	IBLS4	At 4 mA setup VP48 to 49 = 1 V IBLS4 = IP48 to 49	3.818	4.149	4.480	mA	*2
31	Output current (4)	IBLS8	At 8 mA setup VP48 to 49 = 1 V IBLS8 = IP48 to 49	7.677	8.344	9.011	mA	*2
32	Output current (5)	IBLS16	At 16 mA setup VP48 to 49 = 1 V IBLS16 = IP48 to 49	15.331	16.665	17.998	mA	*2
33	Leak current at the time of OFF	IBLSOFF	At current OFF setup VP48 to 49 = 4.75 V IBLSOFF = IP48 to 49	—	—	1	µA	—
34	The error between channels	IBLSCH	At 15 mA setup The average value of all channels, and the current error of each channel	–5	—	5	%	—

Note) *2 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current generator (For photo flashes)								
35	Output current (1)	IPL1	At 1mA setup VP40 to 41 = 1 V IPL1 = IP40 to 41	0.942	1.024	1.105	mA	*2
36	Output current (2)	IPL2	At 2 mA setup VP40 to 41 = 1 V IPL2 = IP40 to 41	1.887	2.051	2.215	mA	*2
37	Output current (3)	IPL4	At 4 mA setup VP40 to 41 = 1 V IPL4 = IP40 to 41	3.757	4.083	4.410	mA	*2
38	Output current (4)	IPL8	At 8 mA setup VP40 to 41 = 1 V IPL8 = IP40 to 41	7.526	8.180	8.835	mA	*2
39	Output current (5)	IPL16	At 16 mA setup VP40 to 41 = 1 V IPL16 = IP40 to 41	15.215	16.538	17.861	mA	*2
40	Output current (6)	IPL30	At 30mA setup VP40 to 41 = 1 V IPL30 = IP40 to 41	28.244	30.700	33.156	mA	*2
41	Leak current at the time of OFF	IPLOFF	At current OFF setup VP40 to 41 = 4.75 V IPLOFF = IP40 to 41	—	—	1	μA	—
42	The error between channels	IPLCH	At 15 mA setup The average value of all channels, and the current error of each channel	–5	—	5	%	—

Note) *2 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current generator (For 7*7 dots matrix LED)								
43	Output current (1)	IMX1	At 1mA setup VP1 to 4, 7 to 9 = 1 V IMX1 = IP1 to 4, 7 to 9	0.920	1.000	1.080	mA	*2 *3
44	Output current (2)	IMX2	At 2 mA setup VP1 to 4, 7 to 9 = 1 V IMX2 = IP1 to 4, 7 to 9	1.858	2.019	2.181	mA	*2 *3
45	Output current (3)	IMX4	At 4 mA setup VP1 to 4, 7 to 9 = 1 V IMX4 = IP1 to 4, 7 to 9	3.742	4.068	4.393	mA	*2 *3
46	Output current (4)	IMX8	At 8 mA setup VP1 to 4, 7 to 9 = 1 V IMX15 = IP1 to 4, 7 to 9	7.480	8.131	8.781	mA	*2 *3
47	Output current (5)	IMX15	At 15 mA setup VP1 to 4, 7 to 9 = 1 V IMX15 = IP1 to 4, 7 to 9	14.220	15.456	16.693	mA	*2 *3
48	Leak current at the time of OFF	IMXOFF	Current OFF setup VP1 to 4, 7 to 9 = 4.75 V IMXOFF = IP1 to 4, 7 to 9	—	—	1	µA	—
49	The error between channels	IMXCH	The average value of all channels, and the current error of each channel	–5	—	5	%	*3

Notes) *2 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.
*3 : In all the preset values of 7 × 7 dots matrix LED part, absolute precision is ±8%, and the error between channels is ±5%.

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current generator (For RGB color unit)								
50	Output current (1)	IRGB1	At 1mA setup VP23 to 25, 28 to 30 = 1 V	0.950	1.032	1.115	mA	*2
51	Output current (2)	IRGB2	At 2 mA setup VP23 to 25, 28 to 30 = 1 V	1.903	2.068	2.234	mA	*2
52	Output current (3)	IRGB4	At 4 mA setup VP23 to 25, 28 to 30 = 1 V	3.777	4.105	4.434	mA	*2
53	Output current (4)	IRGB8	At 8 mA setup VP23 to 25, 28 to 30 = 1 V	7.566	8.223	8.881	mA	*2
54	Leak current at the time of OFF	IRGBOFF	Current OFF setup VP23 to 25, 28 to 30 = 4.75 V IRGBOFF = IP23 to 25, 28 to 30	—	—	1	µA	—
55	The error between channels	IRGBCH	The average value of all channels, and the current error of each channel	–5	—	5	%	—
Switch of Pch-MOS (VLED1)								
56	VBLED – VLED output impedance	RVLED	VB = 2.2 V, VP31 = 0 V IP15 = –10 mA RVLED = (2.2 V – VP15) / 10 mA	—	5	20	Ω	—
Switch of Nch-MOS (R1, R2, G2, B2)								
57	R1 output impedance	RR1	VB = 2.2 V, VP31 = 0 V IP23 = 5 mA RR1 = VP23 / 5 mA	—	10	50	Ω	—
58	R2 output impedance	RR2	Register : 19hD4 = High IP28 = 5 mA RR2 = VP28 / 5 mA	—	10	30	Ω	—
59	G2 output impedance	RG2	Register : 19hD3 = High IP29 = 5 mA RG2 = VP29 / 5 mA	—	10	30	Ω	—
60	B2 output impedance	RB2	Register : 19hD2 = High IP30 = 5 mA RB2 = VP30 / 5 mA	—	10	30	Ω	—

Note) *2 : Values when recommended parts (ERJ2RHD273X) are used for IREF terminal.
The other current settings are combination of above items.

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
SPI I/F, LEDCTL, RSTB								
61	Input voltage range of High-level	VIH	High-level recognition voltage of Pin No.54 to 56, 59, 68	1.4	—	LDO1 + 0.3	V	—
62	Input voltage range of Low-level	VIL	Low-level recognition voltage of Pin No.54 to 56, 59, 68	– 0.3	—	0.4	V	—
63	Input current of High-level	IIH	VP54 to 56, 59, 68 = 1.85 V IIH = IP54 to 56, 59, 68	—	0	1	µA	—
64	Input current of Low-level	IIL	VP54 to 56, 59, 68 = 0 V IIL = IP54 to 56, 59, 68	—	0	1	µA	—
GPIO I/F, GPI I/F								
65	Input voltage range of High-level 1	VIH1	High-level recognition voltage of Pin No.61 to 63, 66 to 67 (LDO1 mode)	1.4	—	LDO1 + 0.3	V	—
66	Input voltage range of High-level 1	VIH2	High-level recognition voltage of Pin No. 66 to 67 (LDO2 mode)	2.1	—	LDO2 + 0.3	V	—
67	Input voltage range of Low-level	VIL	Low-level recognition voltage of Pin No.61 to 63, 66 to 67	– 0.3	—	0.4	V	—
68	Input current of High-level	IIH	VP66 to 67 = 2.85 V IIH = IP66 to 67	—	0	1	µA	—
69	Input current of Low-level	IIL	VP66 to 67 = 0 V IIL = IP61 to 63, 66 to 67	—	0	1	µA	—
GPIO I/F, GPO I/F, INT								
70	Output voltage of High-level (1)	VOH1	IP51, 64 to 67 = –2 mA VDDSEL = LDO2	LDO2 × 0.8	—	—	V	—
71	Output voltage of Low-level (1)	VOL1	IP51, 64 to 67 = 2 mA VDDSEL = LDO2 (IP51, 64 – 67 = 0.5 mA)	—	—	LDO2 ×0.2 (0.15)	V	—
72	Output voltage of High-level (2)	VOL2	IP51, 64 to 67 = –2 mA VDDSEL = LDO1	LDO1 × 0.8	—	—	V	—
73	Output voltage of Low-level (2)	VOL2	IP51, 64 to 67 = 2 mA VDDSEL = LDO1 (IP51, 64 – 67 = 0.5 mA)	—	—	LDO1 ×0.3 (0.15)	V	—

■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
LDOCNT, LEDCNT								
74	Input voltage range of High-level	VIH	High-level recognition voltage of Pin No.33, 37	VB × 0.7	—	VB + 0.3	V	—
75	Input voltage range of Low-level	VIL	Low-level recognition voltage of Pin No.33, 37	– 0.3	—	0.4	V	—
76	Input current of High-level	IIH	VP33, 37 = 3.6 V IIH = IP33, 37	—	0	1	µA	—
77	Input current of Low-level	IIL	VP33, 37 = 0 V IIL = IP33, 37	—	0	1	µA	—
VIBCTL								
78	Input voltage range of High-level	VIH	High-level recognition voltage of Pin No.69	2.1	—	3.3	V	—
79	Input voltage range of Low-level	VIL	Low-level recognition voltage of Pin No.69	–0.3	—	0.4	V	—
80	Input current of High-level	IIH	VP69 = 3.0 V IIH = IP69	—	0	1	µA	—
81	Input current of Low-level	IIL	VP69 = 0 V IIL = IP69	—	0	1	µA	—
DO								
82	Output voltage of High-level	VOH3	IP57 = –2 mA	LDO1 × 0.8	—	—	V	—
83	Output voltage of Low-level	VOL3	IP57 = 2 mA	—	—	LDO1 × 0.2	V	—
TEST1, TEST2, GPI1, GPI2, GPI3								
84	Pull-down resistance	RPD	IP52, 53, 61, 62, 63 = 5 µA RPD = VP52, 53, 61, 62, 63 / 5 µA	70k	100k	130k	Ω	—
GPIO1, GPIO2								
85	Pull-up resistance	RPU	IP66, 67 = 0 µA RPU1 = VP66, 67 IP66, 67 = –5 µA RPU = (RPU1 – VP66, 67) / 5 mA	70k	100k	130k	Ω	—

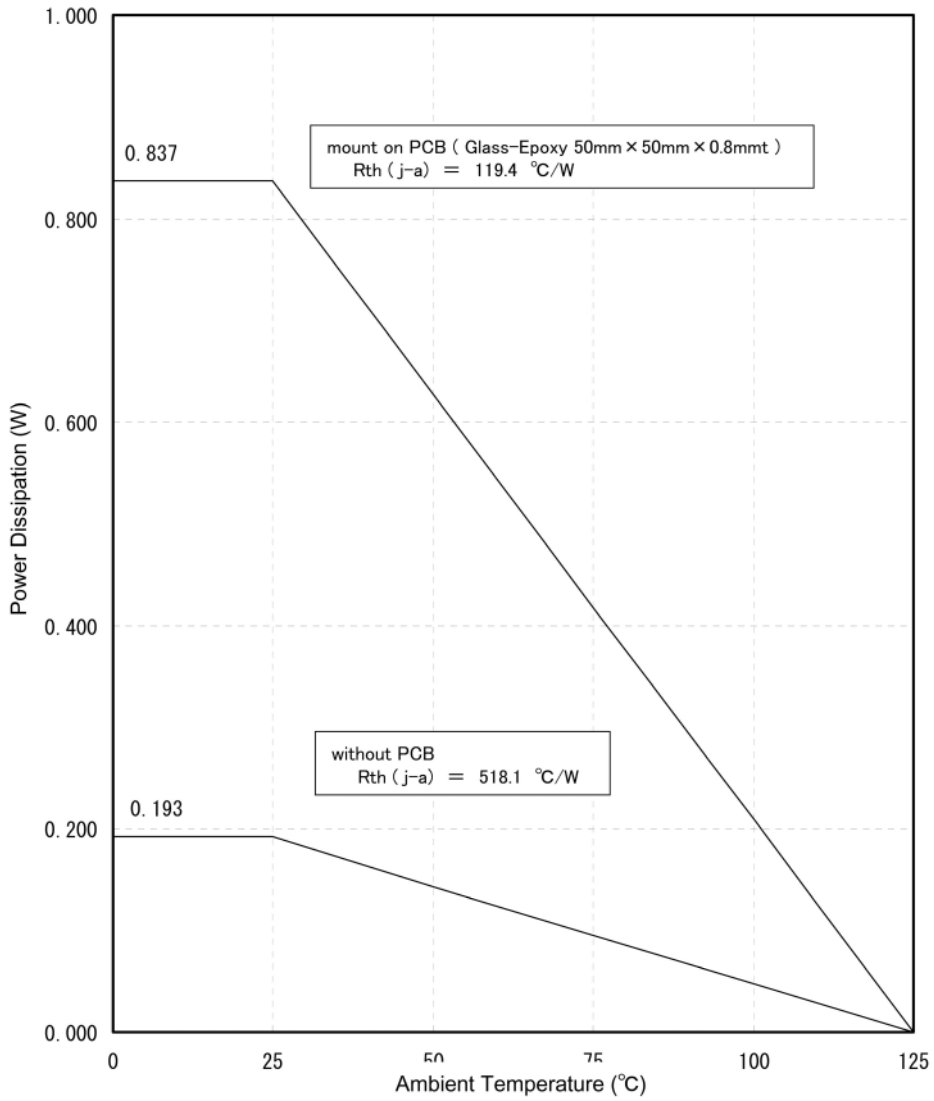
■ Electrical Characteristics (continued) at VB = VBDCDC = VBLED = 3.6 V, VLED1 = VLED2 = 4.9 V

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

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
DC-DC converter automatic control part								
86	Detection voltage	VMON	Voltage which DC-DC converter turns on when the voltage of BL1, BL2, BL3, BL4, BLS1, and BLS2 terminal falls	0.36	0.40	0.44	V	—
Current consumption of DC-DC converter part								
87	DC-DC control current (1)	IDC1	Current when DC-DC converter is active. VB = 3.1 V to 4.4 V ICC1 = IPM	—	1.2	3.0	mA	—
88	DC-DC control current (2)	IDC2	Current when DC-DC converter is inactive and the automatic control circuit is operating VB = 3.1 V to 4.4 V ICC1 = IPM	—	0.7	1.4	mA	—

■ Technical Data

• P_D — T_a diagram



■ Usage Notes

- About mounting orientation

  If this IC is the wrong orientation, it will heat to a smoke-generating temperature and be destroyed.
  Check the mounting orientation carefully and do not operated the IC in the wrong orientation.

- Due to unshielded structure of this IC, under exposure of light, function and characteristic of the product cannot be guaranteed.
  During normal operation or even under testing condition, please ensure that IC is not exposed to light.
- Basically, chip surface is ground potential. Please design to ensure no contact between chip surface and metal shielding.

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Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

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