

# Power unit IC for pagers

## BH6111FV

The BH6111FV is a power unit IC with a driver for VFM switching regulator controllers and vibrators, LEDs, speakers, and LCD backlights. It has internal sensors to detect the reset voltage and battery ejection.

### ● Applications

Pagers

### ● Features

- 1) Internal VFM-type CMOS switching regulator and drivers for 6 channels.
- 2) Equipped with a reset voltage sensor and battery ejection sensor.

### ● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>cc</sub>	-0.3~+6.0	V
Driver output applied voltage	V <sub>Max.</sub>	-0.3~+7.0	V
Power dissipation	P <sub>d</sub>	*400	mW
Maximum driver output current (1)	I <sub>OM1</sub>	500	mA
Maximum driver output current (2)	I <sub>OM2</sub>	400	mA
Maximum driver output current (3)	I <sub>OM3</sub>	300	mA
Operating temperature	T <sub>opr</sub>	-15~+60	°C
Storage temperature	T <sub>stg</sub>	-55~+125	°C

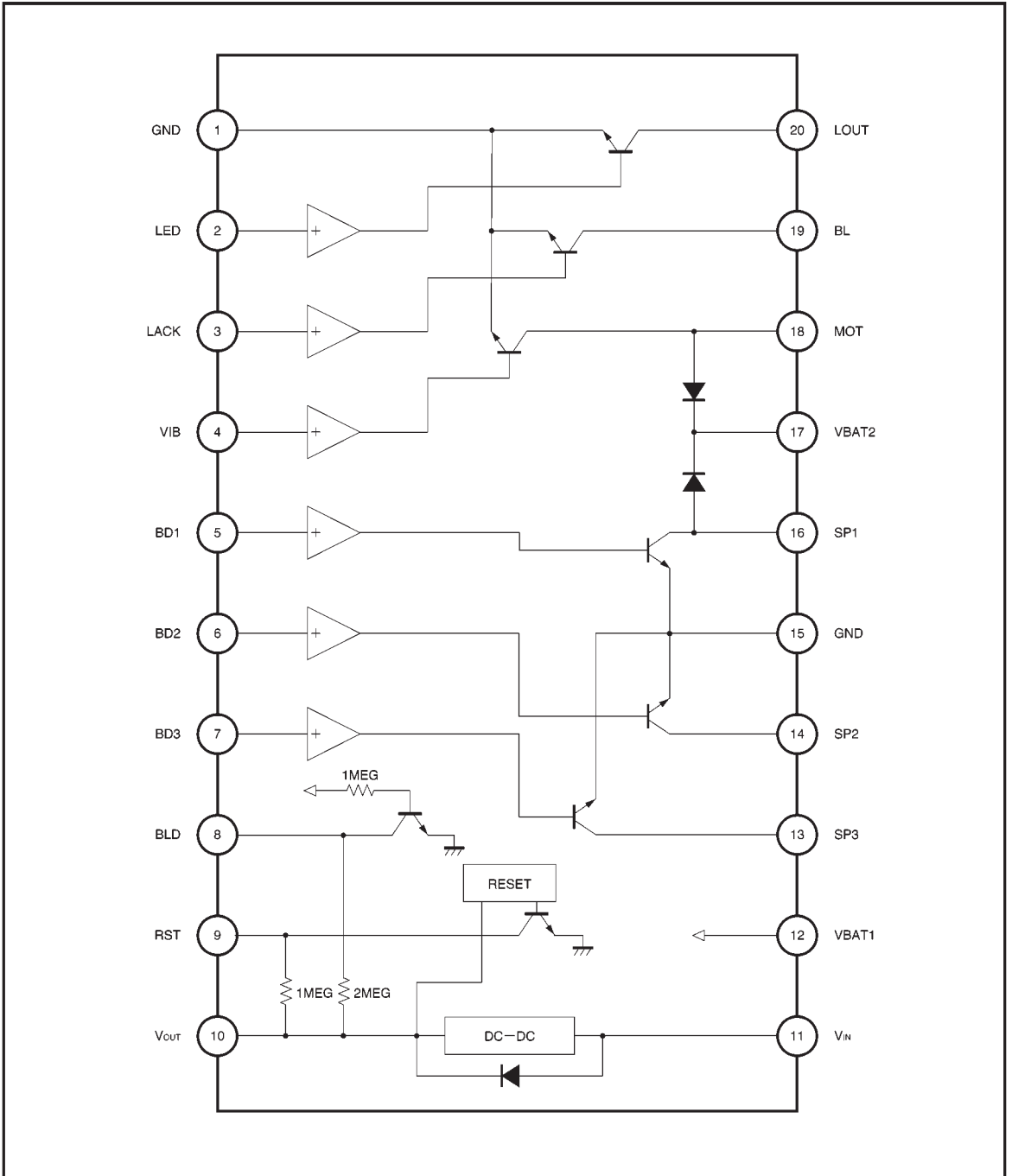
\* Reduced by 4 mW for each increase in Ta of 1°C over 25°C.

### ● Recommended operating conditions

Parameter	Symbol	Limits	Unit
Power supply voltage	V <sub>cc</sub>	0.9~2.5	V
Driver unit operating frequency	f <sub>drv</sub>	DC~100	kHz



● Block diagram



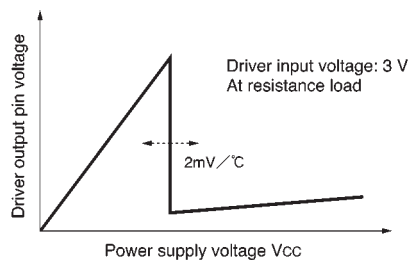
● Pin descriptions

Pin No.	Pin name	I/O	Pin voltage	Internal equivalent circuit	Function
1	GND 2	I	GND		Grounding pin
15	GND 1	I			
12	VBAT 1	I	VBAT		Battery pin
17	VBAT 2	I			
2	LED	I	0V		Driver input pin *1 *2 *3
3	LACK	I			
4	VIB	I			
5	BD 1	I			
6	BD 2	I			
7	BD 3	I			
13	SP 3	O	—		Driver output pin
14	SP 2	O			
19	BL	O			
20	LOUT	O			
16	SP 1	O	—		Driver output pin (internal Di for surge absorption)
18	MOT	O			

\*1 Driver unit input current (3 V system)  
LED, LACK, VIB, BD1, BD2, BD3: 27  $\mu$ A

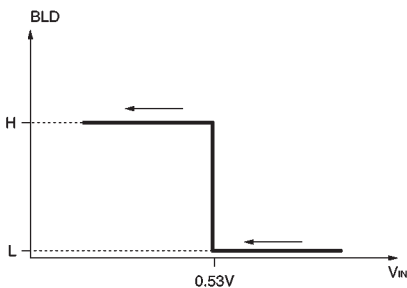
\*2 Driver unit current consumption (1.5 V system)  
LED, LACK, SP2, SP3: 4.1 mA  
SP1 : 4.7 mA  
VIB : 5.6 mA

\*3 Driver unit temperature characteristic  
(Low level hold boundary voltage)

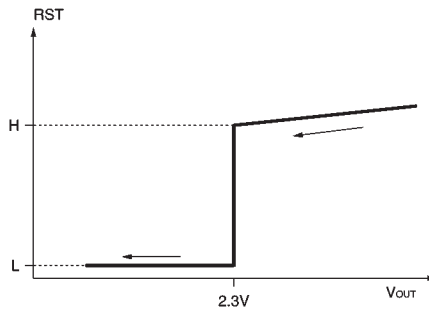


Pin No.	Pin name	I/O	Pin voltage	Internal equivalent circuit	Function
8	BLD	O	—		Battery ejection voltage detection pin *4 (When battery is removed: HIGH) Current consumption 1.5 V system: 0.9 $\mu$ A 3 V system : 1.5 $\mu$ A
9	RST	O	—		CPU reset voltage detection pin *5 (When output power is reduced: LOW) Current consumption 3 V system: 1.8 $\mu$ A
10	V <sub>OUT</sub>	O	3V		DC/DC converter output pin
11	V <sub>IN</sub>	I	—		DC/DC converter switching pin (internal Di for rectification)

\*4 Operation theory for battery ejection circuit



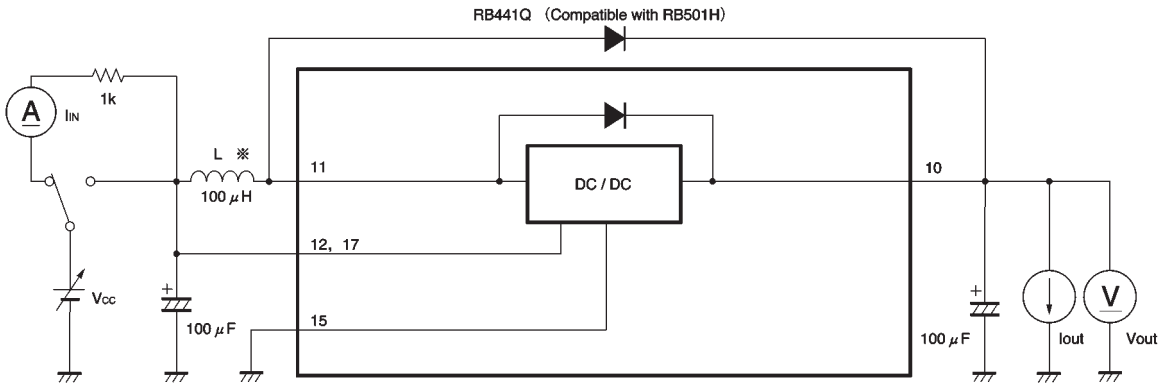
\*5 Operation theory for CPU reset circuit



●Electrical characteristics (unless otherwise noted, Ta = 25°C, V<sub>DD</sub> = 1.5V)

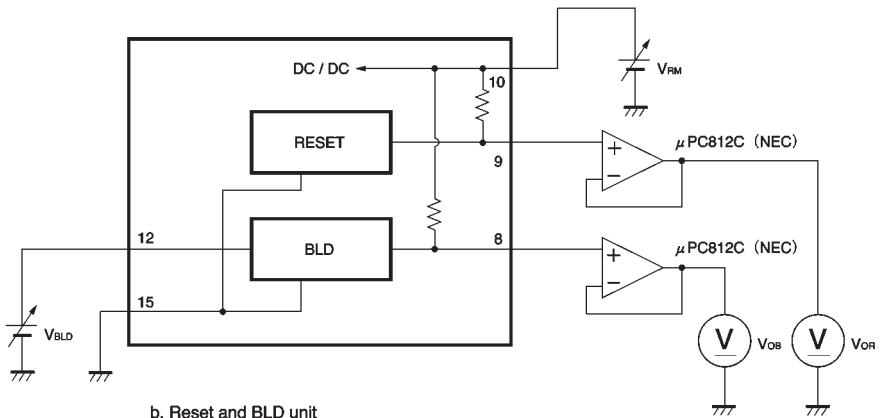
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
〈Overall circuit〉							
Current dissipation	I <sub>IN</sub>	—	34	60	μA	With no load on DC-DC converter	Fig.1
〈DC-DC converter unit〉							
Output voltage	V <sub>OUT</sub>	2.85	3.00	3.08	V	I <sub>OUT</sub> =1.0mA	Fig.1
Operation initiation power supply voltage	V <sub>ST</sub>	—	0.85	0.9	V	I <sub>OUT</sub> =1.0mA, V <sub>CC</sub> ; 0V→2V	Fig.1
Operation sustain power supply voltage	V <sub>hid</sub>	—	0.50	0.7	V	I <sub>OUT</sub> =1.0mA, V <sub>CC</sub> ; 2V→0V	Fig.1
Input voltage stability	ΔV <sub>o1</sub>	—	20	100	mV	I <sub>OUT</sub> =1.0mA, V <sub>CC</sub> =0.9~2.5V	Fig.1
Load regulation	ΔV <sub>o2</sub>	—	20	100	mV	I <sub>OUT</sub> =0.1~5.0mA	Fig.1
Oscillation duty ratio	Df <sub>Max.</sub>	—	70	—	%		Fig.1
Oscillation frequency	f <sub>osc</sub>	80	100	120	kHz		Fig.1
Efficiency	η	70	80	—	%	I <sub>OUT</sub> =3.0mA	Fig.1
〈CPU reset circuit / battery ejection circuit unit〉							
Reset detection voltage	VRM	2.1	2.3	2.5	V		Fig.1
BLD detection voltage	VBLD	0.48	0.53	0.58	V	V <sub>CC</sub> value when V8 pin is 1.5 V	Fig.1
Output high level voltage	VOH	2.7	3.0	—	V		Fig.1
Output low level voltage	VOL	—	0.1	0.4	V		Fig.1
〈Vibrator control unit〉							
Maximum output drive current	I <sub>om1</sub>	300	—	—	mA	V <sub>sat</sub> ≤0.5V	Fig.1
Saturation voltage	V <sub>sat1</sub>	—	0.2	0.3	V	I <sub>OUT</sub> =195mA	Fig.1
Leakage current when off	I <sub>L1</sub>	—	0.0	5.0	μA	V <sub>OUT</sub> =5V	Fig.1
Input threshold level	V <sub>th1</sub>	1.0	1.4	1.8	V		Fig.1
Input current	I <sub>in1</sub>	15	27	35	μA	V <sub>IN</sub> =3.0V	Fig.1
〈Speaker control unit 1〉							
Maximum output drive current	I <sub>om2</sub>	200	—	—	mA	V <sub>sat</sub> ≤0.5V	Fig.1
Saturation voltage	V <sub>sat2</sub>	—	0.1	0.2	V	I <sub>OUT</sub> =90mA	Fig.1
Leakage current when off	I <sub>L2</sub>	—	0.0	5.0	μA	V <sub>OUT</sub> =5V	Fig.1
Input threshold level	V <sub>th2</sub>	1.0	1.4	1.8	V		Fig.1
Input current	I <sub>in2</sub>	15	27	35	μA	V <sub>IN</sub> =3.0V	Fig.1
〈Speaker control units 2 and 3, LED control unit, LCD backlight control unit〉							
Maximum output drive current	I <sub>om3</sub>	100	—	—	mA	V <sub>sat</sub> ≤0.5V	Fig.1
Saturation voltage	V <sub>sat3</sub>	—	0.1	0.2	V	I <sub>OUT</sub> =45mA	Fig.1
Leakage current when off	I <sub>L3</sub>	—	0.0	5.0	μA	V <sub>OUT</sub> =5V	Fig.1
Input threshold level	V <sub>th3</sub>	1.0	1.4	1.8	V		Fig.1
Input current	I <sub>in3</sub>	15	27	35	μA	V <sub>IN</sub> =3.0V	Fig.1

● Measurement circuits

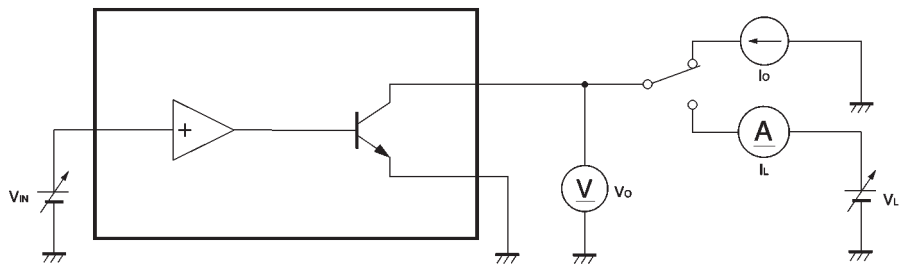


\* LQH4N (MURATA)

a. DC / DC converter unit



b. Reset and BLD unit



c. Driver unit

Fig. 1

● Application example

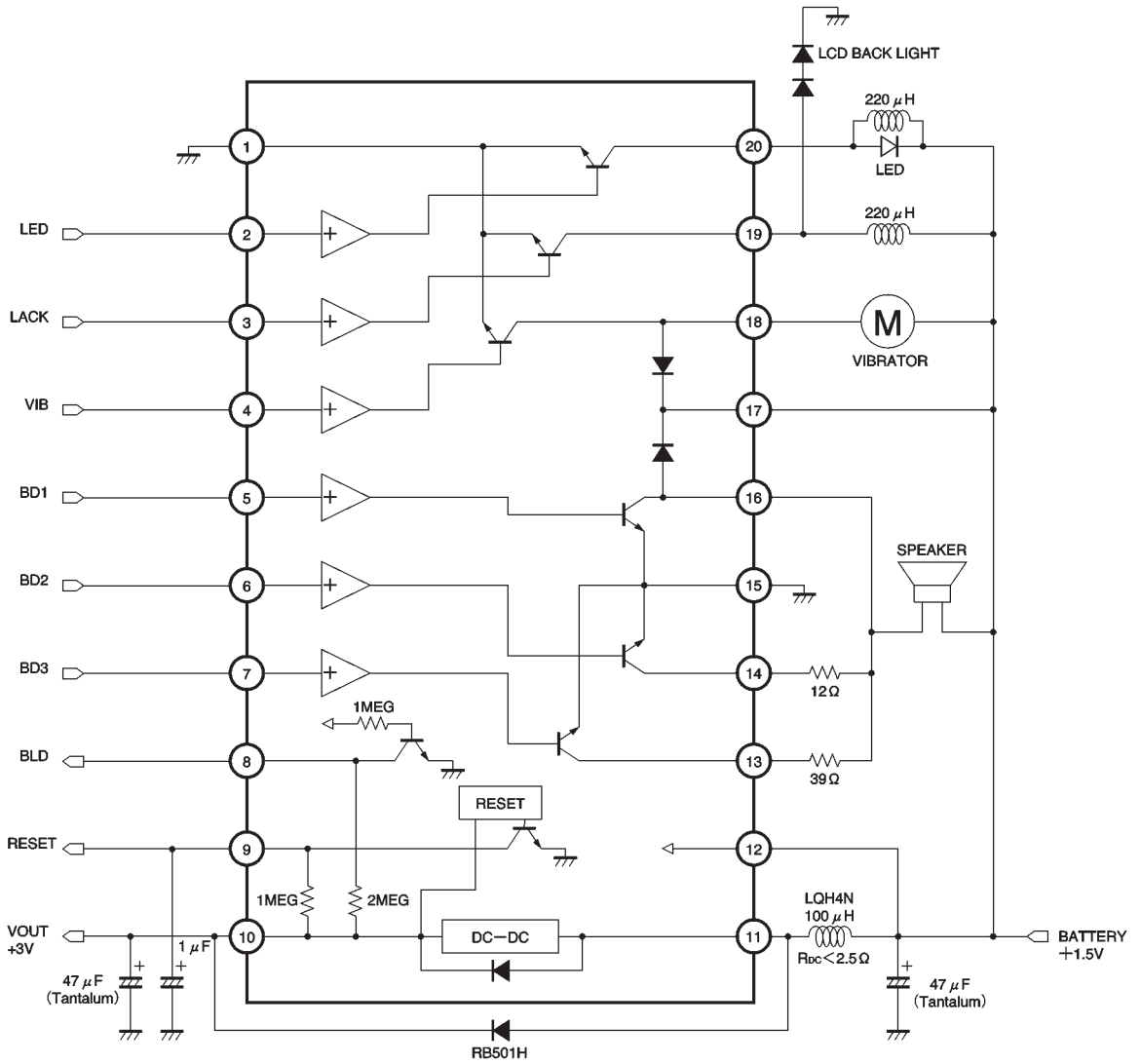


Fig. 2

● Electrical characteristic curves

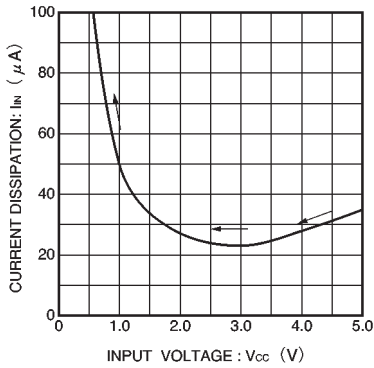


Fig. 3 Current dissipation vs. input voltage

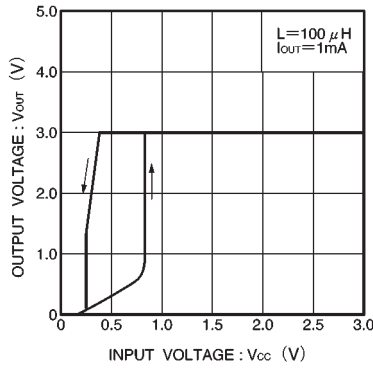


Fig. 4 DC/DC converter Output voltage vs. input voltage

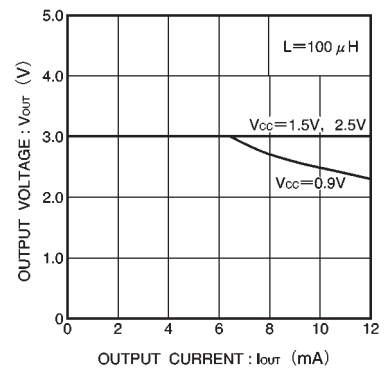


Fig. 5 DC/DC converter Output voltage vs. output current

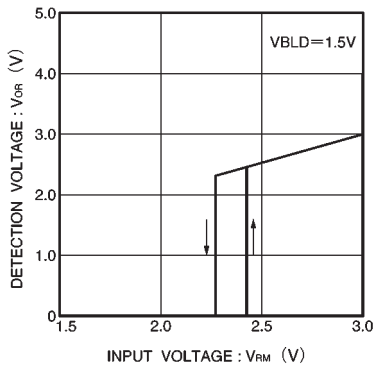


Fig. 6 Reset detection voltage

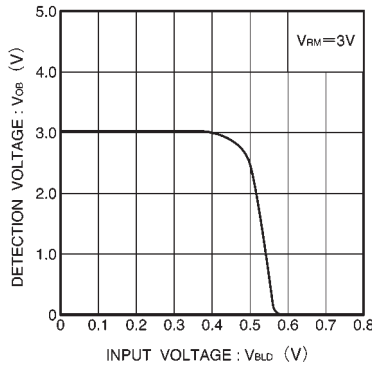


Fig. 7 BLD detection voltage

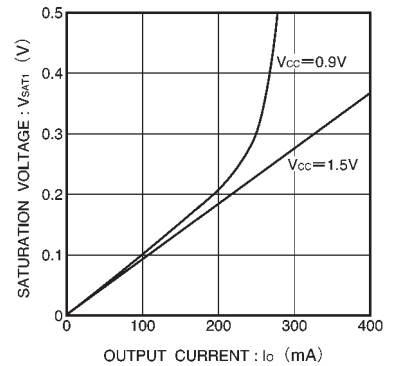


Fig. 8 Vibrator control unit Saturation voltage vs. output current

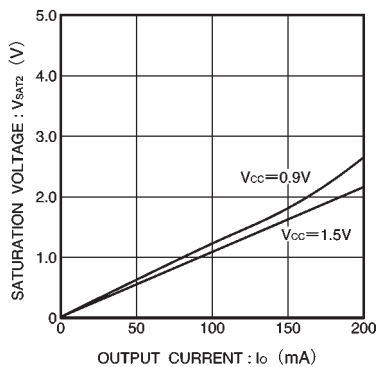


Fig. 9 Speaker control unit 1 Saturation voltage vs. output current

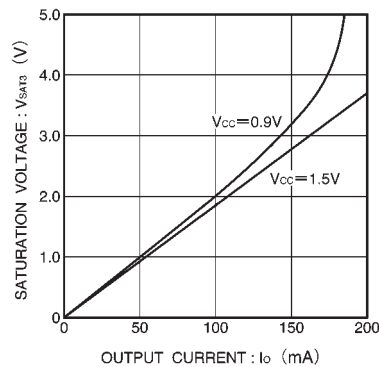


Fig. 10 Speaker control units 2 and 3, LED control unit, LCD backlight control unit Saturation voltage vs. output current

● External dimensions (Units: mm)

