Power unit IC for pagers

BH6113FV

The BH6113FV is a power unit IC with a driver for VFM switching regulator controllers and vibrators, LEDs, and speakers, and a built-in battery ejection sensor.

●Applications

Pagers

●Features

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

●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Power supply voltage	+B	−0.3～+6.0	V
Driver output applied voltage	$V_{Max.}$	−0.3～+7.0	V
Power dissipation	Pd	350*	mW
Maximum driver output current (1)	$I_{OM}1$	350	mA
Maximum driver output current (2)	$I_{OM}2$	250	mA
Maximum driver output current (3)	$I_{OM}3$	150	mA
Maximum driver output current (4)	$I_{OM}4$	10	mA
Operating temperature	T_{opr}	−15～+60	℃
Storage temperature	T_{stg}	−55～+125	℃

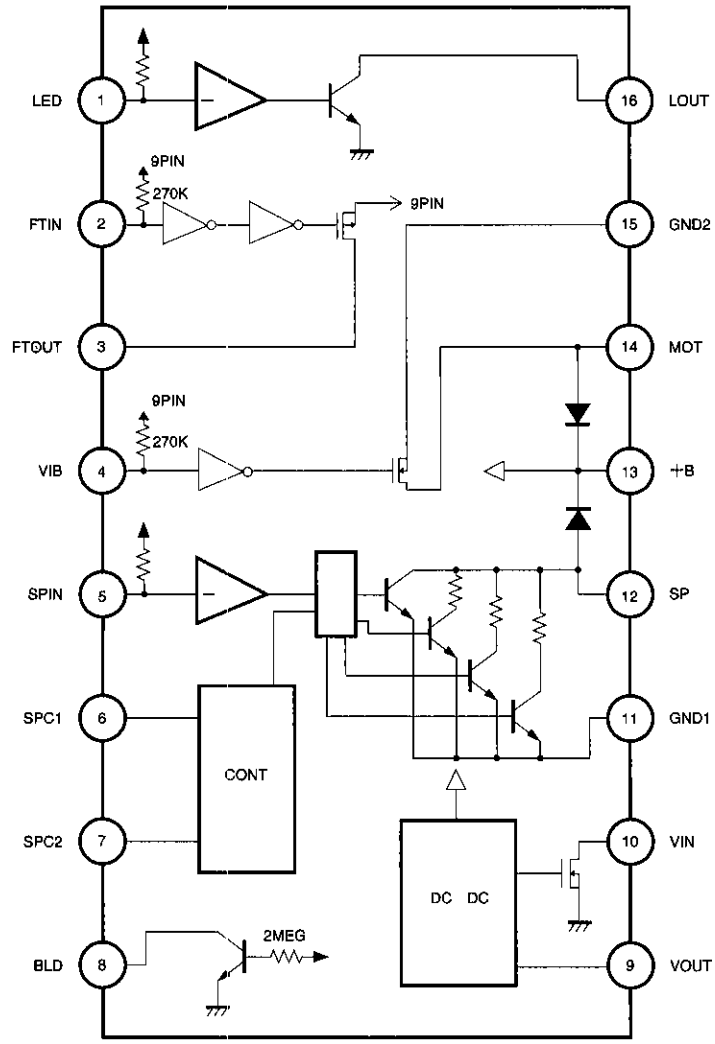
* Reduced by 3.5 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating range

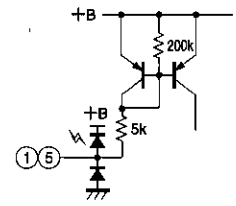
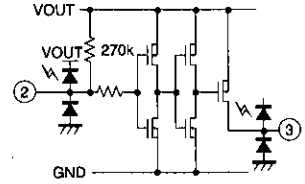
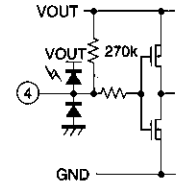
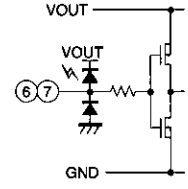
Parameter	Symbol	Limits	Unit
Power supply voltage	+B	0.9～1.7	V
Driver unit operation frequency	f_{drv}	DC～100*	kHz

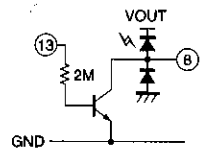
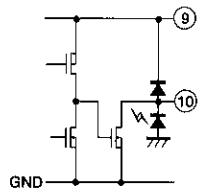
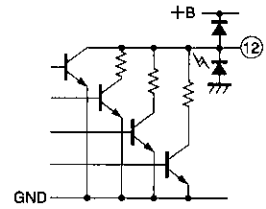
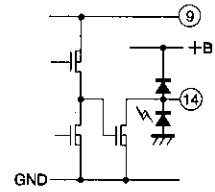
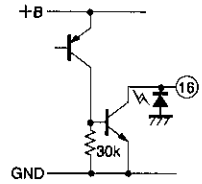
* The driver operation frequency does not include the motor unit.

●Block diagram

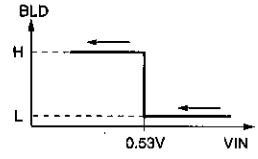


●Pin descriptions

Pin No.	Pin Name	I/O	Pin Voltage	Internal Equivalent Circuit	Function
11 15	GND 1 GND 2	I I	GND	——	Grounding pin
13	+B	I	+B	——	Battery pin
1 5	LED SPIN	I I	+B (OPEN) +B (OPEN)		Driver input pin LO: act HI (OPEN): Output HIGH-z
2	FTIN	I	——		Driver input pin LO: act HI (OPEN): Output HIGH-z
3	FTOUT	O	——		Driver output pin (internal Di for surge absorption)
4	VIB	I	——		Driver input pin LO: act HI (OPEN): Output HIGH-z
6	SPC 1	I	——		Volume control pin 1
7	SPC 2	I	——		Volume control pin 2 LO: act OPEN: undefined HI: Output HIGH-z

Pin No.	Pin Name	I/O	Pin Voltage	Internal Equivalent Circuit	Function
8	BLD	O	——		Battery ejection voltage detection pin ∗1 (When battery is removed: HIGH) Current consumption 1.5 V system: 0.45 μA
9	VOUT	O	3V		DC/DC converter output pin
10	VIN	I	——		DC/DC converter switching pin (internal rectifier Di)
12	SP	O	——		Driver output pin
14	MOT	O	——		Driver output pin
16	LOUT	O	——		Driver output pin

∗1 Operation theory for battery ejection circuit



●Electrical characteristics (Unless otherwise noted : Ta=25℃, +B=1.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Overall circuit							
Quicient Current	Iin	—	12	20	μA	With no load on DC-DCconverter and all drives off BLDOUT=OPEN	Fig.1
DC-DC converter unit							Fig.1
Output voltage	Vout	2.90	3.00	3.10	V	Iout=4.0mA	Fig.1
Operation initiation power supply voltage	V_{ST}	—	0.80	0.90	V	Rout=680Ω, V_{CC} ; 0V→1.7V	Fig.1
Operation sustain power supply voltage	V_{hld}	—	0.70	0.80	V	Rout=680Ω, V_{CC} ; 1.7V→0V	Fig.1
Input voltage stability	ΔVo1	—	10	100	mV	Iout=4.0mA, V_{CC} ; 0.9~1.7V	Fig.1
Load regulation	ΔVo2	—	5	100	mV	Iout=2.0~4.0mA	Fig.1
Oscillation duty ratio	$Df_{Max.}$	—	85	—	%	At maximum oscillation frequency	Fig.1
Maximum oscillation frequency	fosc	—	100	140	kHz		Fig.1
Efficiency 1 (light load)	η1	70	75	—	%	Iout=100μA	Fig.1
Efficiency 2 (medium load)	η2	70	80	—	%	Iout=1mA	Fig.1
Efficiency 3 (heavy load)	η3	70	80	—	%	Iout=4mA	Fig.1
Battery ejection circuit unit							
BLD detection voltage	VBLD	0.48	0.53	0.58	V	+B value at BLDOUT = 1.5 V, R_{BLD}=3MΩ	Fig.1
"H" output voltage	VOH	2.7	3.0	—	V	R_{BLD}=3MΩ	Fig.1
"L" output voltage	VOL	—	0.1	0.4	V	R_{BLD}=3MΩ	Fig.1
Vibrator control unit							
Maximum output drive current	I_{OM1}	300	—	—	mA	V_{SAT}≦0.5V	Fig.1
Saturation voltage	Vsat1	—	0.18	0.36	V	Iout=180mA	Fig.1
Leakage current when off	IL1	—	0.0	5.0	μA	Vout=5V	Fig.1
Pull-up resistance 1	Rin1	190	270	350	kΩ		Fig.1
Speaker control unit							
Line current when on	Io2	4.5	8.0	15.5	mA	For loud volume	Fig.1
Maximum drive current/ loud volume	I_{OM2}	200	—	—	mA	V_{SAT}≦0.5V	Fig.1
Saturation voltage/loud volume	Vsat2A	—	0.10	0.20	V	Iout=100mA (Z=1Ω)	Fig.1
Saturation voltage/ ordinary volume	Vsat2B	0.12	0.22	0.32	V	Iout=10mA (Z=22Ω)	Fig.1
Saturation voltage/ medium volume	Vsat2C	0.10	0.19	0.30	V	Iout=5mA (Z=38Ω)	Fig.1
Saturation voltage/low volume	Vsat2D	0.04	0.12	0.24	V	Iout=1mA (Z=120Ω)	Fig.1
Leakage current when off	IL2	—	0.0	5.0	μA	Vout=5V	Fig.1
Input threshold level	Vth2	+B −0.85V	—	—	V		Fig.1
Input current	Iin2	10	16	25	μA	Vin=+B−0.8V	Fig.1

●Electrical characteristics (Unless otherwise noted, : Ta=25℃, +B=1.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
LED control unit							
Quicient current when on	Iq3	2.5	4.5	8.0	mA		Fig.1
Maximum output drive current	IOM3	100	—	—	mA	VSAT≦0.5V	Fig.1
Saturation voltage	Vsat3	—	0.1	0.2	V	Iout=40mA	Fig.1
Leakage current when off	IL3	—	0.0	5.0	μA	Vout=5V	Fig.1
Input threshold level	Vth3	+B −0.85V	—	—	V		Fig.1
Input current	Iin3	10	16	25	μA	Vin=+B−0.8V	Fig.1
Photocoupler driver unit							
Maximum output drive current	IOM4	5	—	—	mA	VSAT≦0.5V	Fig.1
Saturation voltage	Vsat4	—	0.1	0.2	V	Iout=3mA	Fig.1
Leakage current when off	IL4	—	0.0	5.0	μA	Vout=5V	Fig.1
Pull - up resistance 4	Rin4	190	270	350	kΩ		Fig.1

Speaker unit logic table

Pin	Volume			
	High	Medium(high)	Medium(low)	Low
SPC1	LOW	HIGH	LOW	HIGH
SPC2	LOW	LOW	HIGH	HIGH

●Measurement circuits

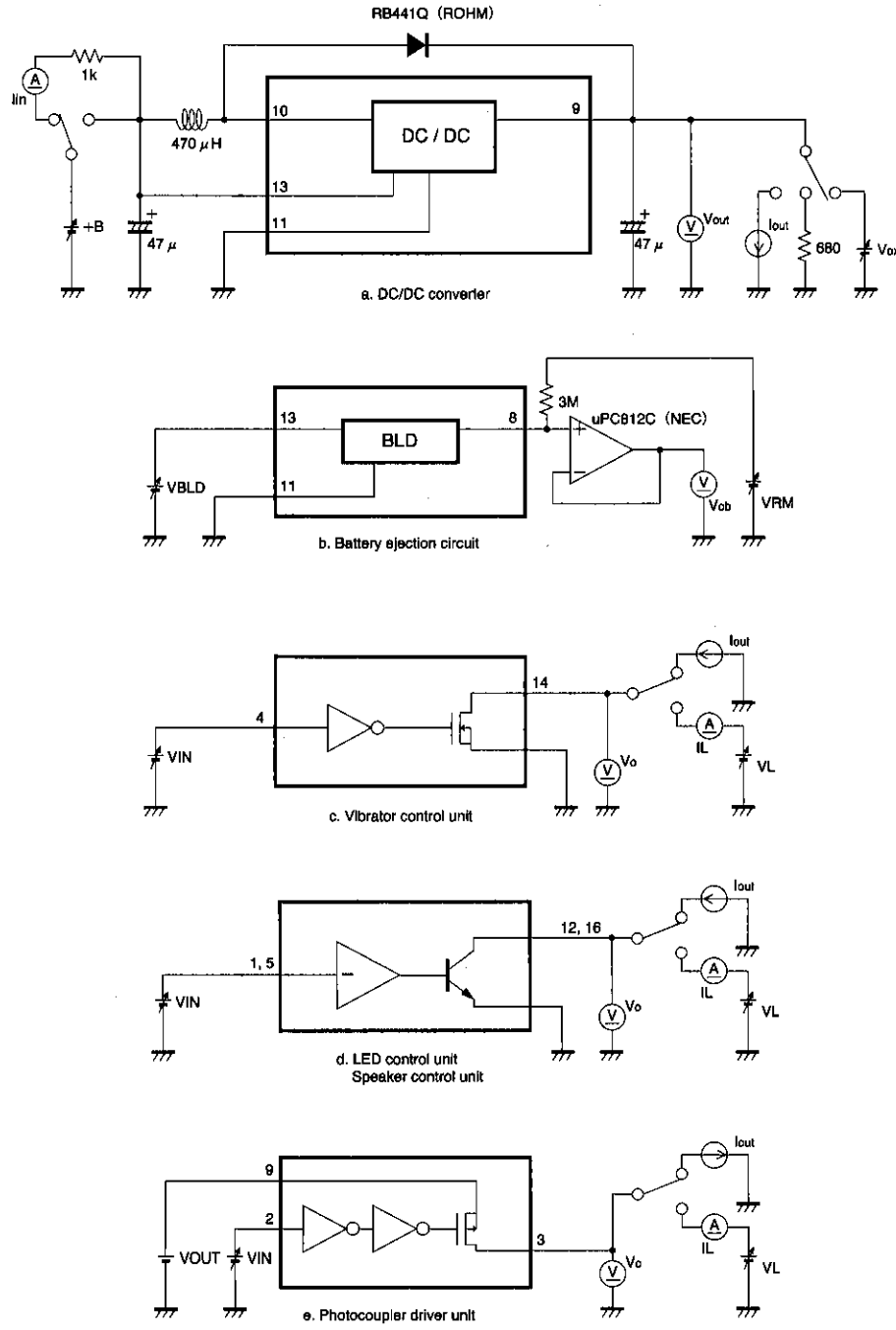


Fig. 1 Measurement circuits

●Application circuit

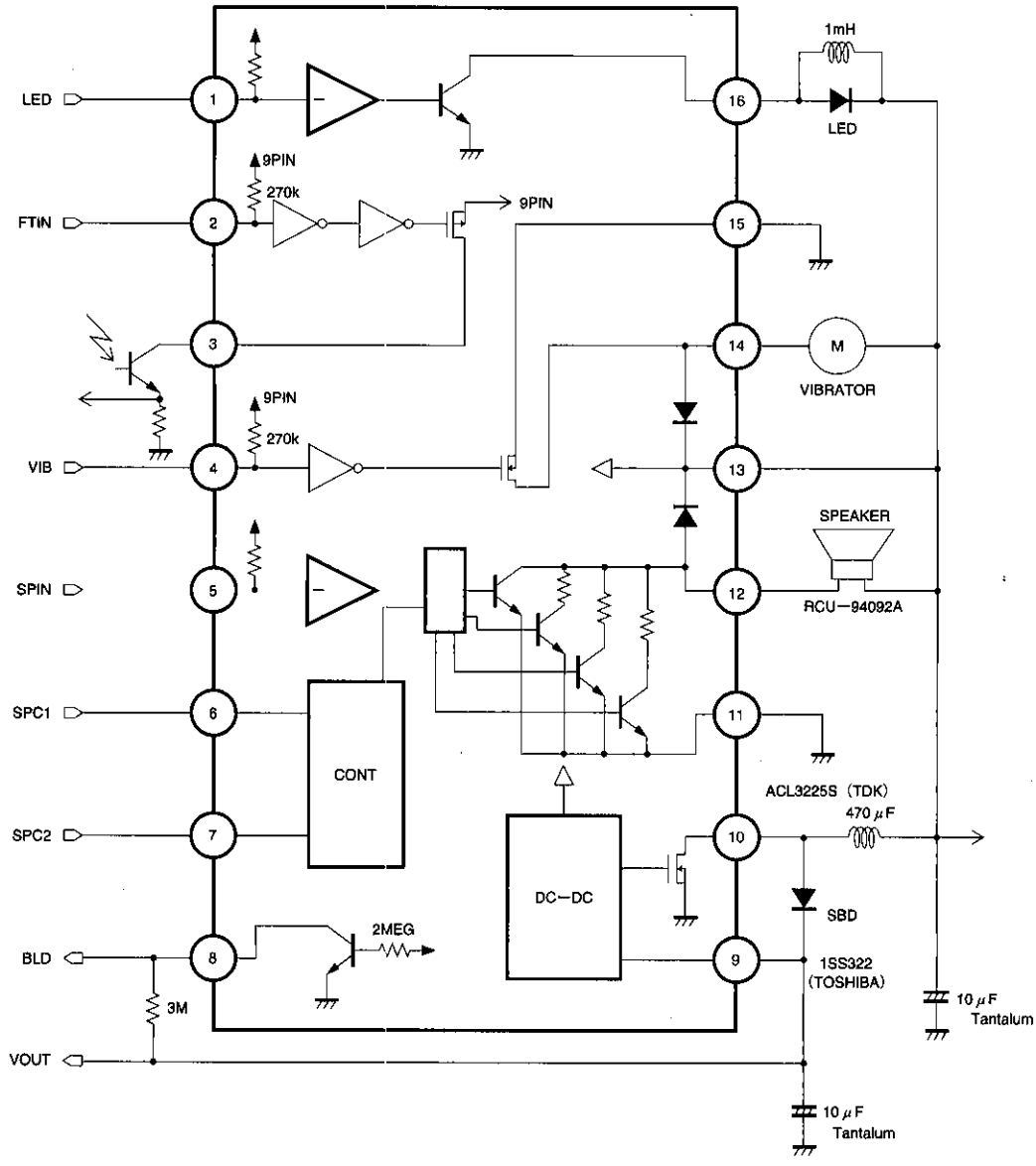


Fig. 2 Application circuit

●Electrical characteristic curves

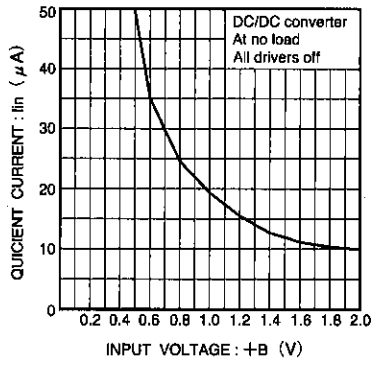


Fig. 3 Quicient Current (at no load) vs. input voltage characteristic

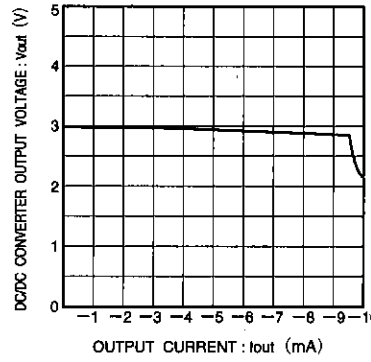


Fig. 4 DC/DC converter unit load regulation

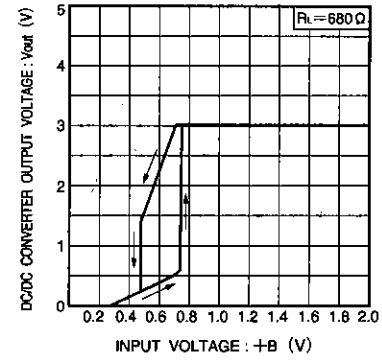


Fig. 5 DC/DC converter unit line regulation

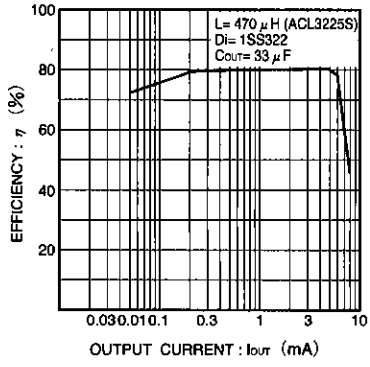


Fig. 6 DC/DC converter unit Efficiency vs. load current characteristic

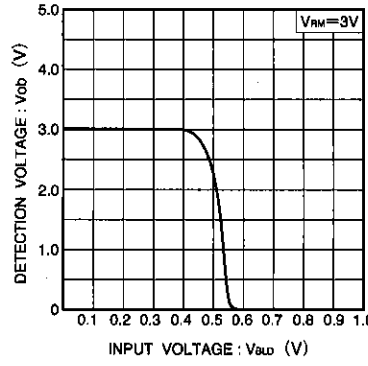


Fig. 7 BLD detection voltage

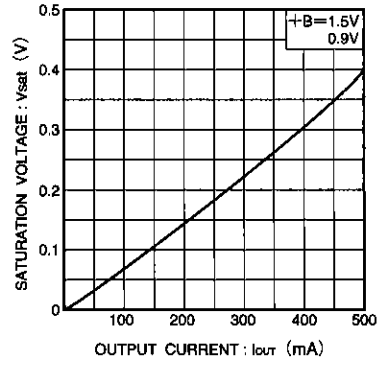


Fig. 8 Vibrator control unit Saturation voltage vs. output current characteristic

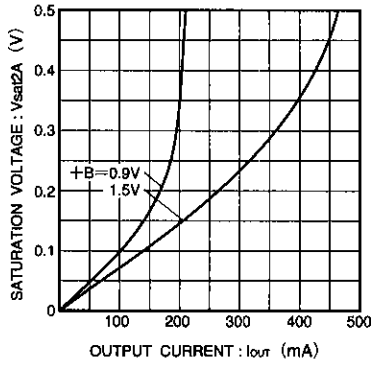


Fig. 9 Speaker control unit (loud volume) Saturation voltage vs. output current characteristic

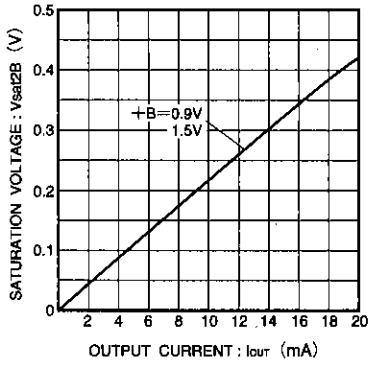


Fig. 10 Speaker control unit (normal volume) Saturation voltage vs. output current characteristic

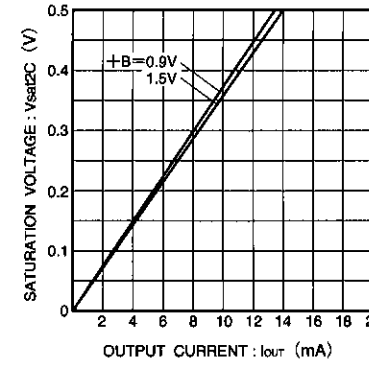


Fig. 11 Speaker control unit (medium volume) Saturation voltage vs. output current characteristic

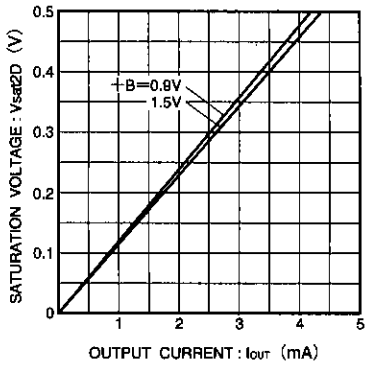


Fig. 12 Speaker control unit (low volume) Saturation voltage vs. output current characteristic

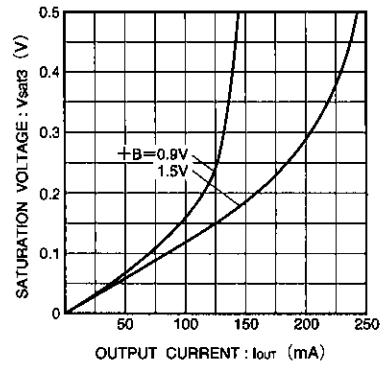


Fig. 13 LED control unit Saturation voltage vs. output current

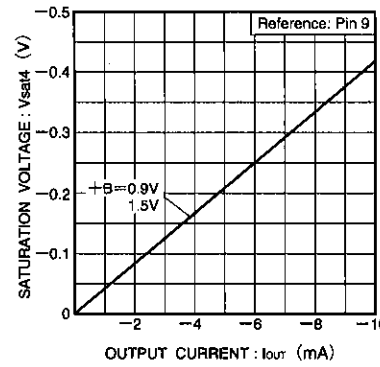


Fig. 14 Photocoupler driver control unit Saturation voltage vs. output current

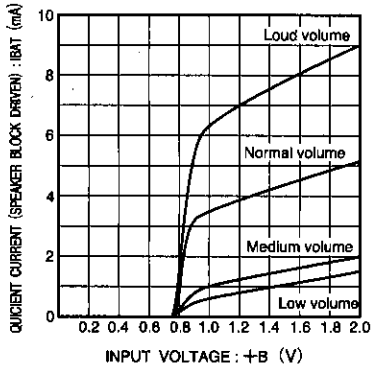


Fig. 15 Speaker control unit Quicient current when on vs. input voltage characteristic

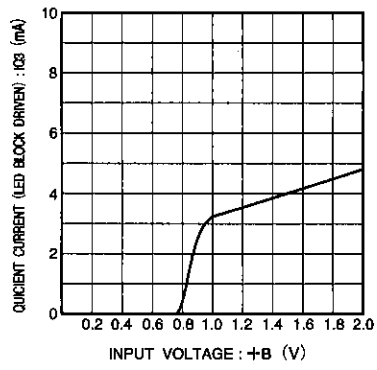
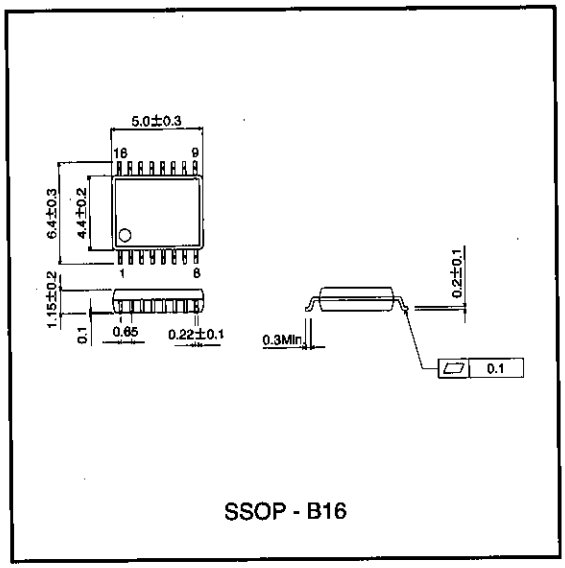


Fig. 16 LED control unit Quicient current when on vs. input voltage characteristic

●External dimensions (Units: mm)



SSOP - B16

Notes

- The contents described in this catalogue are correct as of March 1997.
- No unauthorized transmission or reproduction of this book, either in whole or in part, is permitted.
- The contents of this book are subject to change without notice. Always verify before use that the contents are the latest specifications. If, by any chance, a defect should arise in the equipment as a result of use without verification of the specifications, ROHM CO., LTD., can bear no responsibility whatsoever.
- Application circuit diagrams and circuit constants contained in this data book are shown as examples of standard use and operation. When designing for mass production, please pay careful attention to peripheral conditions.
- Any and all data, including, but not limited to application circuit diagrams, information, and various data, described in this catalogue are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO., LTD., disclaims any warranty that any use of such device shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes absolutely no liability in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices; other than for the buyer's right to use such devices itself, resell or otherwise dispose of the same; no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by ROHM CO., LTD., is granted to any such buyer.
- The products in this manual are manufactured with silicon as the main material.
- The products in this manual are not of radiation resistant design.

The products listed in this catalogue are designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment, office-automation equipment, communications devices, electrical appliances, and electronic toys). Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers, or other safety devices) please be sure to consult with our sales representatives in advance.

- Notes when exporting
  - It is essential to obtain export permission when exporting any of the above products when it falls under the category of strategic material (or labor) as determined by foreign exchange or foreign trade control laws.
  - Please be sure to consult with our sales representatives to ascertain whether any product is classified as a strategic material.