5-channel BTL driver for CD players
BA6395AFP

The BA6395AFP is a 5-channel BTL driver for CD player motors and actuators. This IC has an internal 5V regulator, and is suited to a wide range of applications.

●Applications
CD players and CD-ROM drives

●Features
1) Internal drivers for focus coils, tracking coils, spindle motors, feed motors and loading. (The loading and spindle motor output pins are dual-use output pins and are switched between drivers using a control input.)
2) HSOP 28-pin package allows for miniaturization of applications.
3) Low number of external components.
4) Driver gain is adjustable with a single attached resistor.
5) Internal 5V regulator. (requires attached PNP transistor)
6) Internal thermal shutdown circuit.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	18	V
Power dissipation	Pd	1.7[*1]	W
Operating temperature	Topr	$-35\sim+85$	℃
Storage temperature	Tstg	$-55\sim+150$	℃

[*1] When mounted on a 50 mm × 50 mm × 1.0 mm paper phenol board.
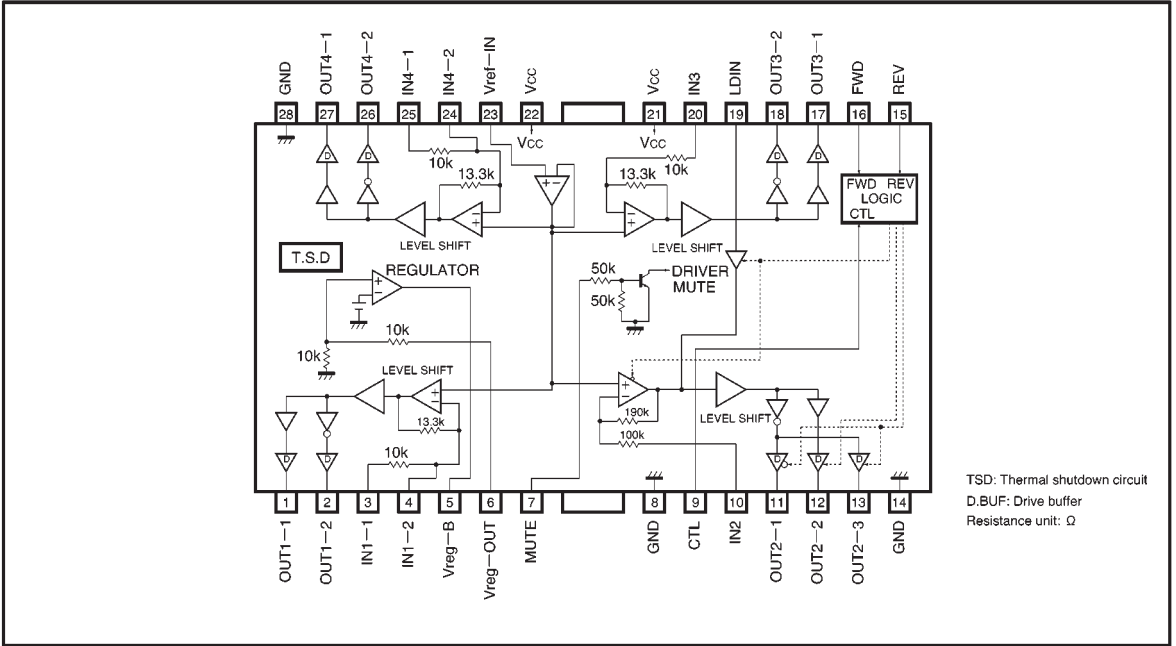Reduced by 13.6 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	$6\sim12$[*2]	V

[*2] The driver can operate as low as 4.8 V.

●Block diagram

TSD: Thermal shutdown circuit
D.BUF: Drive buffer
Resistance unit: Ω

●Pin descriptions

Pin No.	Pin name	Function
1	OUT1−1	Driver channel 1 negative output
2	OUT1−2	Driver channel 1 positive output
3	IN1−1	Driver channel 1 input
4	IN1−2	Driver channel 1 input, gain adjustment pin
5	Vreg−B	Connect to external transistor base
6	Vreg−OUT	Constant voltage output, connects to external transistor collector
7	MUTE	Mute control input
8	GND	Ground
9	CTL	Loading and driver channel 2 switch
10	IN2	Driver channel 2 input
11	OUT2−1	Driver channel 2 positive output
12	OUT2−2	Driver channel 2 negative output/loading output pin
13	OUT2−3	Loading negative output pin
14	GND	Ground
15	REV	Loading input, reverse
16	FWD	Loading input, forward
17	OUT3−1	Driver channel 3 negative output
18	OUT3−2	Driver channel 3 positive output
19	LDIN	Loading input
20	IN3	Driver channel 3 input
21	V_{CC}	Power supply
22	V_{CC}	Power supply
23	Vref−IN	Bias amplifier input
24	IN4−2	Driver channel 4 gain adjustment pin
25	IN4−1	Driver channel 4 input
26	OUT4−2	Driver channel 4 positive output
27	OUT4−1	Driver channel 4 negative output
28	GND	Ground

Note: Postive and negative output is relative to the polarity of the input pins.
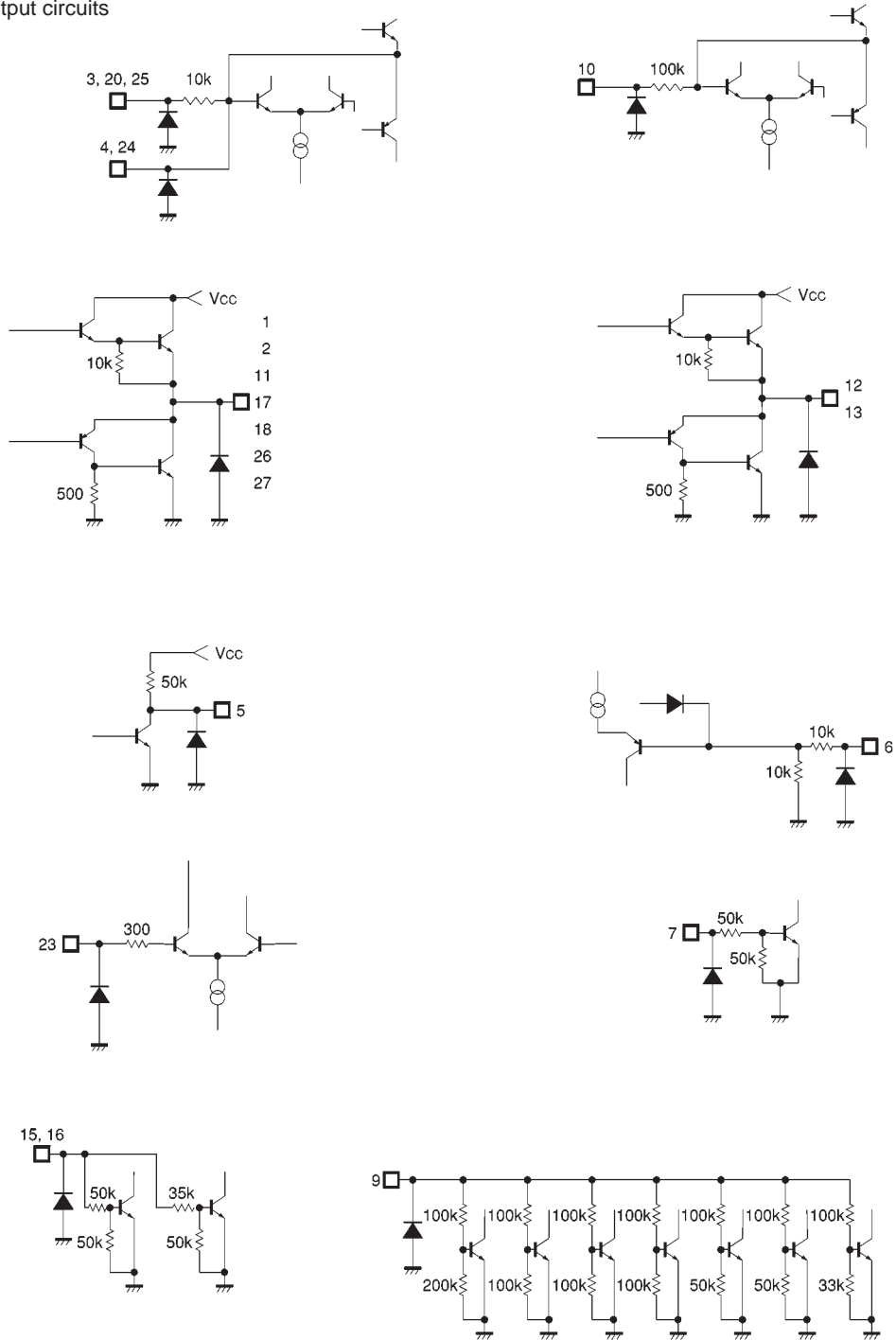
●Input/output circuits

Fig.1

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 8V, f = 1kHz, R_L = 8Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current dissipation	I_{CC}	7.0	10.0	13.0	mA	No load
Mute-off voltage	V_{MOFF}	2.0	—	—	V	
Mute-on voltage	V_{MON}	—	—	0.5	V	
⟨Drivers (other than loading driver)⟩						
Output offset voltage 1	V_{OO1}	−40	—	40	mV	Channel 1,3,4 drivers
Output offset voltage 2	V_{OO2}	−60	—	60	mV	Channel 2 driver (spindle)
Maximum output voltage 1	V_{OH1}	3.8	4.3	—	V	V_{IN}=0.7V
Maximum output voltage 2	V_{OH2}	—	−4.3	−3.8	V	V_{IN}=8V
Closed loop voltage gain 1	G_{VC1}	7.0	8.0	9.0	dB	V_{IN}=0.5V (excluding spindle)
Closed loop voltage gain 2	G_{VC2}	8.5	11.0	13.5	dB	V_{IN}=0.5V (pindle)
Ripple rejection	RR	—	60	—	dB	V_{IN}=0.1V_{rms} ,100Hz
Slew rate	SR	—	2.0	—	V/μs	100 Hz square wave, 3 V_{P-P} output
⟨Loading driver⟩						
Output voltage F	V_{OF}	2.7	3.2	3.7	V	V_{CC}=8V, RL=45Ω, VLD=3.0V
Output voltage R	V_{OR}	−2.5	−3.0	−3.5	V	
Output voltage range F	V_{OMF}	1.9	2.2	—	V	V_{CC}=5V, RL=10Ω, VLD=4.5V*1
Output voltage range R	V_{OMR}	—	−2.2	−1.9	V	
Load regulation F 1	ΔV_{F1}	—	250	500	mV	V_{CC}=8V, VLD=3.0V
Load regulation R 1	ΔV_{R1}	—	250	500	mV	I=100→400mA *2
Load regulation F 2	ΔV_{F2}	—	600	850	mV	V_{CC}=5V, VLD=4.5V
Load regulation R 2	ΔV_{R2}	—	600	850	mV	I=100→400mA *2
Line regulation F	ΔV_{FL}	−500	—	500	mV	V_{CC}=4.8V→12V, R_L=∞
Line regulation R	ΔV_{RL}	−500	—	500	mV	
Output offset voltage	V_{OOL}	−50	—	50	mV	
⟨Controller CTL, FWD, REV pins⟩						
Input high level voltage 1	V_{IH1}	2.0	—	—	V	FWD (16pin), REV (15pin)
Input low level voltage 1	V_{IL1}	—	—	0.5	V	Determined by input pin voltage
Input high level voltage 2	V_{IH2}	4.0	—	—	V	CTL (9pin)
Input low level voltage 2	V_{IL2}	—	—	0.5	V	Determined by input pin voltage
Input high level current	I_{IH}	—	—	500	μA	V_{IN}=5V
Input low level current	I_{IL}	—	—	500	μA	V_{IN}=0V
⟨5 V regulator⟩						
Output voltage	Vreg	4.75	5.00	5.25	V	I_L=100mA
Load regulation	ΔV_{RL}	−50	0	50	mV	I_L=0～200mA
Line regulation	ΔV_{CC}	−10	0	25	mV	(V_{CC}=6～9V) I_L=0～100mA

∗1 V_{OMF} and V_{OMR} remain roughly the same even when loading input VLD (pin 19) is opened.

∗2 ΔVF1, ΔVR1 indicate load variation at unclipped, 4.5 V output.

   ΔVF2, ΔVR2 indicate load variation when output is clipped to generate 4.5 V input at reduced voltage (5 V)

   This is the load variation in this state.

●Circuit operation

(1) Driver

Inputs to the IC are the focus tracking error signal from the servo preamplifier and the control signal from the motor. The input signals, which normally center on 2.5V, are V/I converted by the preamplifier, generating a current corresponding to the input voltage. This current is passed through a resistor and into the internal reference voltage component, the preamplifier output being a signal centering on the internal reference voltage. Two systems (positive phase and negative phase) are created during V/I conversion, generating BTL output via the driver buffer.
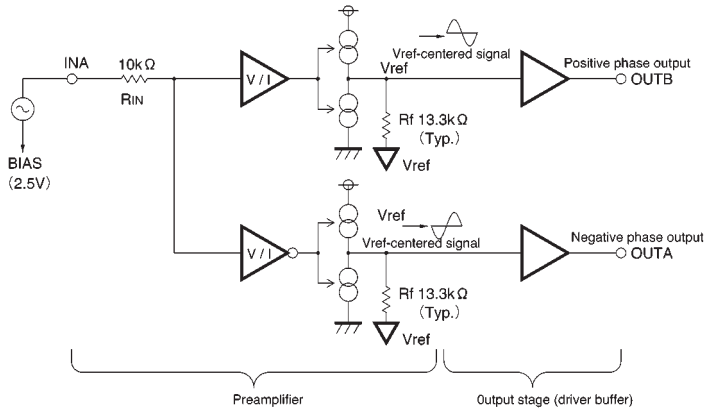
Fig.2

(2) Regulator

This is a typical series regulator that generates a reference voltage internally. A PNP low saturation transistor must be connected.
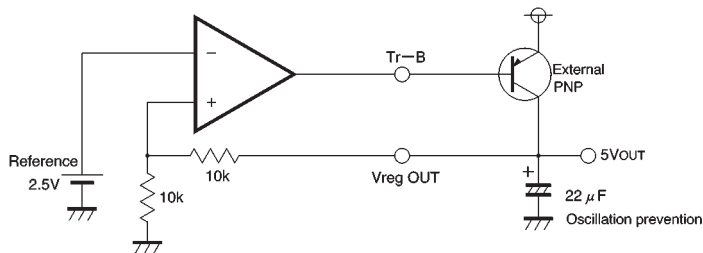
Fig.3

(3) Operational amplifier

A standard 4558 type.

4. Channel 2/loading motor driver output mode switching ($V_{CC} = 8V$)

CTL	FWD	REV	CH2	Loading		Illustration
L	L	L	ON	OFF		Fig. 4
		H				
	H	L				
		H				
H	L	L	OFF	OFF	High impedance	Fig. 5
		H			Reverse	Fig. 6
	H	L		ON	Forward	Fig. 7
		H			Brake	Fig. 8
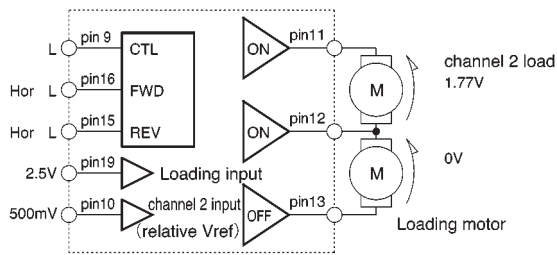
Fig. 4
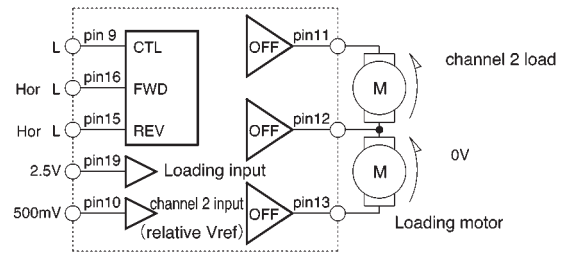
Fig. 5
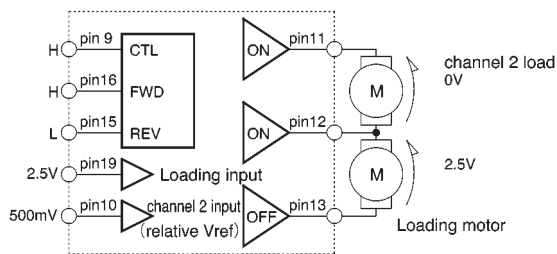
Fig. 6
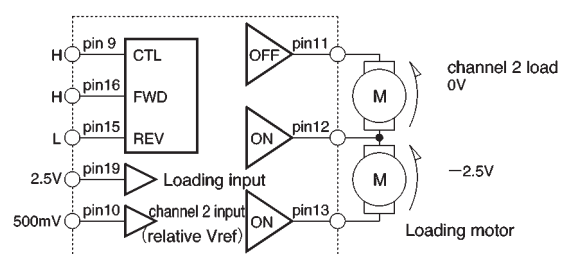
Fig. 7
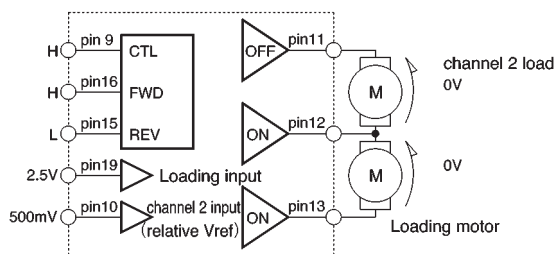
Fig. 8

(5)   Loading motor driver voltage setting
Example : Forward motor
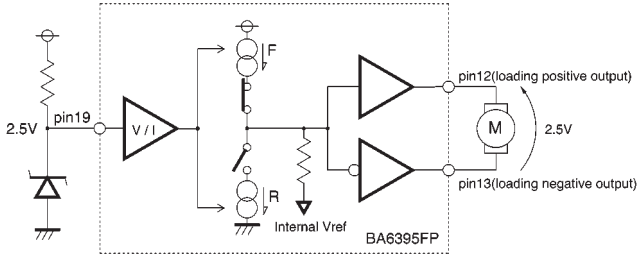
Input voltage = |output voltage| (gain: 0 dB)

Fig. 9

∗ Loading driver output voltage cannot be set higher than the maximum output voltage for the power supply. The example above applies only when setting below the maximum output voltage. Maximum output voltage for the power supply can be output by opening the loading pin (pin 19).

●Application example
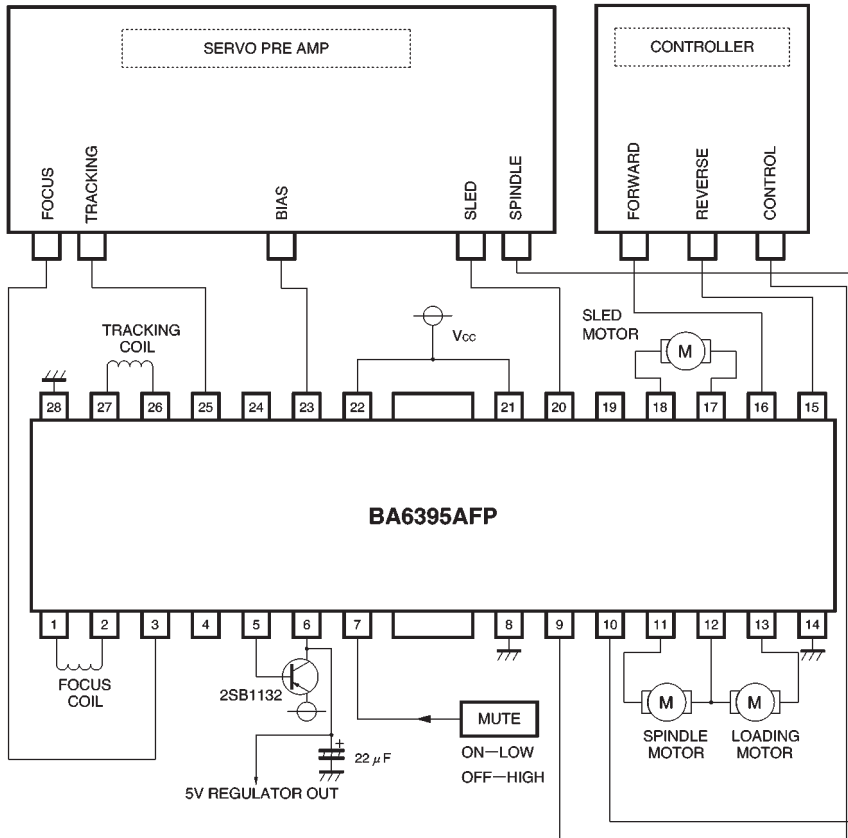
Fig. 10

●Operation notes

(1)   The BA6795AFP has an internal thermal shutdown circuit. Output current is muted when the chip temperature exceeds 175°C (typically).

(2)   If the mute pin (pin 7) voltage is opened or lowered below 0.5V, the output current will be muted. Pin 7 should be pulled up above 2.0V during normal use.

(3)   The bias pin (pin 23) is muted when lowered below 1.4V (typically). make sure it stays above 1.6V during normal use.

(4)   The driver circuit shuts down when the supply voltage drops below 4.3V (typically), and starts up again when the voltage rises above 4.5V (typically).

(5)   Muting occurs during thermal shutdown, mute-on operations or a drop in the bias pin voltage or supply voltage. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, roughly $(V_{CC}-V_F)/2$.

(6)   The internal input resistor has a positive temperature coefficient of roughly 2000ppm/degree, and so when changing the gain using an attached resistor, gain will also change at a rate of roughly 2000ppm/degree. There is virtually no gain variation due to temperature when using the internal input resistor.

(7)   Be sure to connect the IC to a 0.1μF bypass capacitor to the power supply, at the base of the IC.

(8)   The radiating fin is connected to the package's internal GND, but should also be connected to an external ground.

(9)   The capacitor between regulator output (pin 6) and GND also serves to prevent oscillation of the IC, so select one with good temperature characteristics.
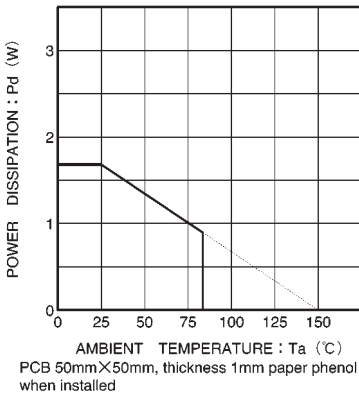
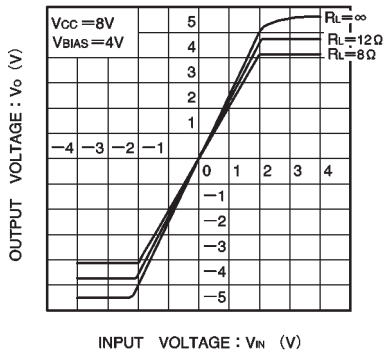●Thermal derating curves

Fig. 11 Thermal derating curve

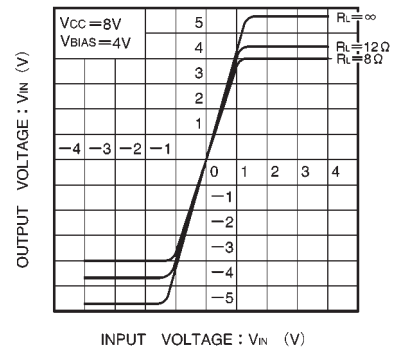Fig. 12 Output voltage vs. input voltage (channels 1, 3 and 4)
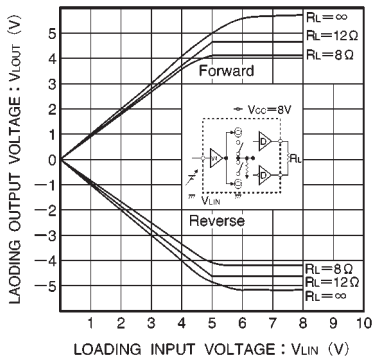

Fig. 13 Output voltage vs. input voltage (channel 2)

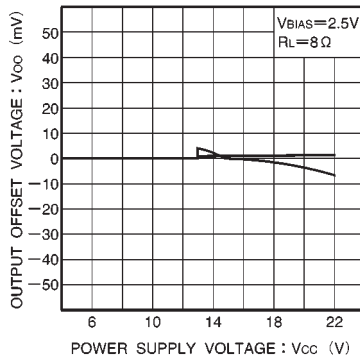Fig. 14 Loading driver I / O
characteristics

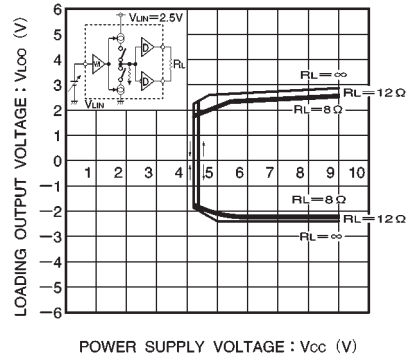Fig. 15 Output offset voltage vs.
power supply voltage
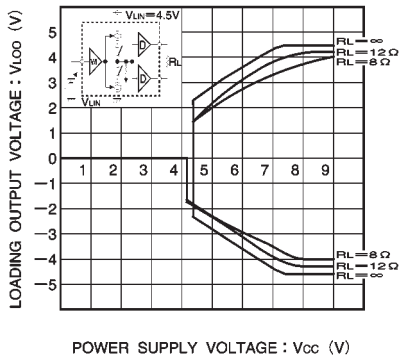

Fig. 16 Loading output vs.
power supply voltage

Fig. 17 Loading output vs.
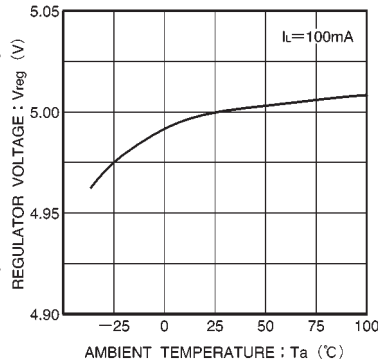power supply voltage

Fig. 18 Regulator voltage vs.
ambient temperature

●External dimensions (Units: mm)

HSOP28