4-channel BTL driver for CD players
BA5931FP

The BA5931FP is a 4-channel BTL driver designed for CD player motors and actuators. The 28-pin HSOP package allows for application miniaturization.

●Applications
CD players, CD-ROM drives

●Features
1) Internal drivers for focus coils, tracking coils, spindle motors, feed motors and loading.
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 thermal shutdown circuit.

●Absolute maximum ratings (Ta = 25°C)

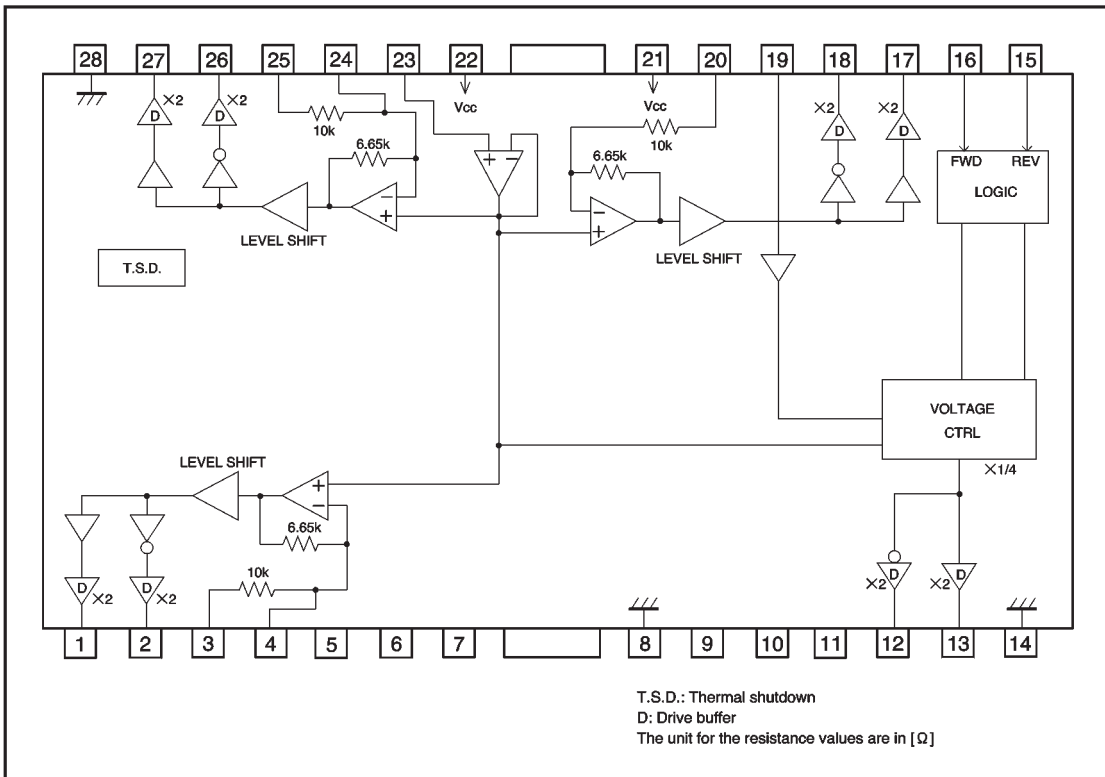| Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	18	V
Power dissipation	Pd	1.7 $*$	W
Operating temperature	Topr	$-35 \sim +85$	℃
Storage temperature	Tstg	$-55 \sim +150$	℃

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

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC}	4.5	—	13.2	V

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●Block diagram

T.S.D.: Thermal shutdown
D: Drive buffer
The unit for the resistance values are in [Ω]

●Pin descriptions

Pin No.	Pin name	Function	Pin No.	Pin name	Function
1	OUT1−1	Channel 1 negative output	15	REV	Loading reverse input
2	OUT1−2	Channel 1 positive output	16	FWD	Loading forward input
3	IN1−1	Channel 1 input	17	OUT3−1	Channel 3 negative output
4	IN1−2	Channel 1 gain adjustment input	18	OUT3−2	Channel 3 positive output
5	N.C.	N.C.	19	LDIN	Loading input
6	N.C.	N.C.	20	IN3	Channel 3 input
7	N.C.	N.C.	21	Vcc	Vcc
8	GND	Ground	22	Vcc	Vcc
9	N.C.	N.C.	23	VrefIN	Bias amplifier input
10	N.C.	N.C.	24	IN4−2	Channel 4 gain adjustment input
11	N.C.	N.C.	25	IN4−1	Channel 4 input
12	OUT2−2	Loading positive output	26	OUT4−2	Channel 4 positive output
13	OUT2−1	Loading negative output	27	OUT4−1	Channel 4 negative output
14	GND	Substrate ground	28	GND	Substrate ground

Note 1: positive and negative output is relative to the polarity of the input pins.

Note 2: "Loading positive output" and "loading negative output" indicate polarity relative to the mode.

●Input／output circuits
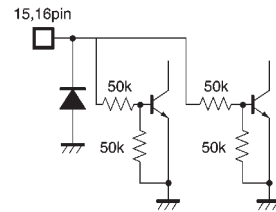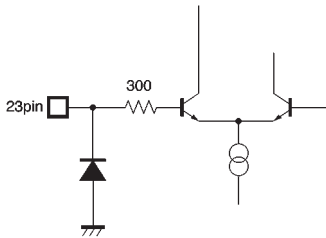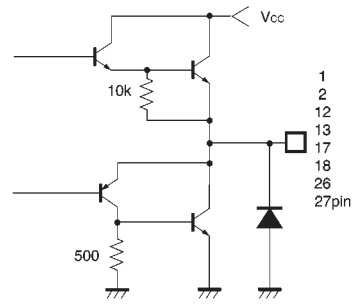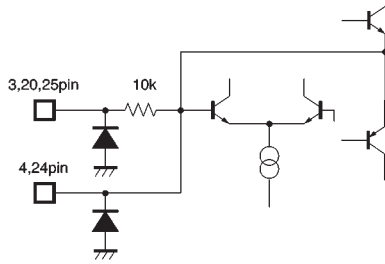
●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 8V, R_L = 8Ω, Vb = 2.5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current dissipation	I_{CC}	—	6.3	9.8	mA	No load
〈All drivers other than loading driver〉						
Output voltage, offset	V_{OO}	−40	—	40	mV	Driver channels 1, 3 and 4
Maximum output pin voltage 1	V_{OH1}	4.7	5.6	—	V	VBIAS=4V, V_{IN}=8V
Maximum output pin voltage 2	V_{OH2}	—	−5.6	−4.7	V	VBIAS=4V, V_{IN}=0.7V
Closed loop voltage gain	G_{VC}	7.4	8.4	9.4	dB	V_{IN}=0.5V
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}	2.0	2.6	3.2	V	V_{CC}=8V, RL=8Ω, LDIN=2.5V
Output voltage R	V_{OR}	−3.1	−2.5	−1.9	V	
Output voltage range F	V_{OMF}	2.3	3.1	—	V	V_{CC}=5V, RL=8Ω, LDIN=4.5V ＊1
Output voltage range R	V_{OMR}	—	−3.1	−2.3	V	
Output load variation F1	ΔVF1	—	250	500	mV	V_{CC}=8V, LDIN=3.0V I=100→400mA ＊2
Output load variation R1	ΔVR1	—	250	500	mV	
Output load variation F2	ΔVF2	—	600	850	mV	V_{CC}=5V, LDIN=OPEN I=100→400mA ＊2
Output load variation R2	ΔVR2	—	600	850	mV	
Supply voltage variation F	ΔVFL	−500	—	500	mV	V_{CC}=4.5V→13.2V, RL=∞
Supply voltage variation R	ΔVRL	−500	—	500	mV	
Output voltage, offset	V_{OOL}	−50	—	50	mV	Output voltage during braking
〈Controller FWD REV pin〉						
Input high level voltage 1	V_{IH1}	2.0	—	—	V	Determined by input pin voltage FWD (pin 16) and REV (pin 15)
Input low level voltage 1	V_{IL1}	—	—	0.5	V	
Input high level current	I_{IH}	—	—	500	μA	V_{IN}=5V
Input low level current	I_{IL}	—	—	500	μA	V_{IN}=0V

◎Not designed for radiation resistance.

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

＊2 ΔVF1 and ΔVR1 indicate load variation at unclipped, 3.0 V output.

ΔVF2 and ΔVR2 indicate load variation when output is clipped to open input at reduced voltage (5 V).

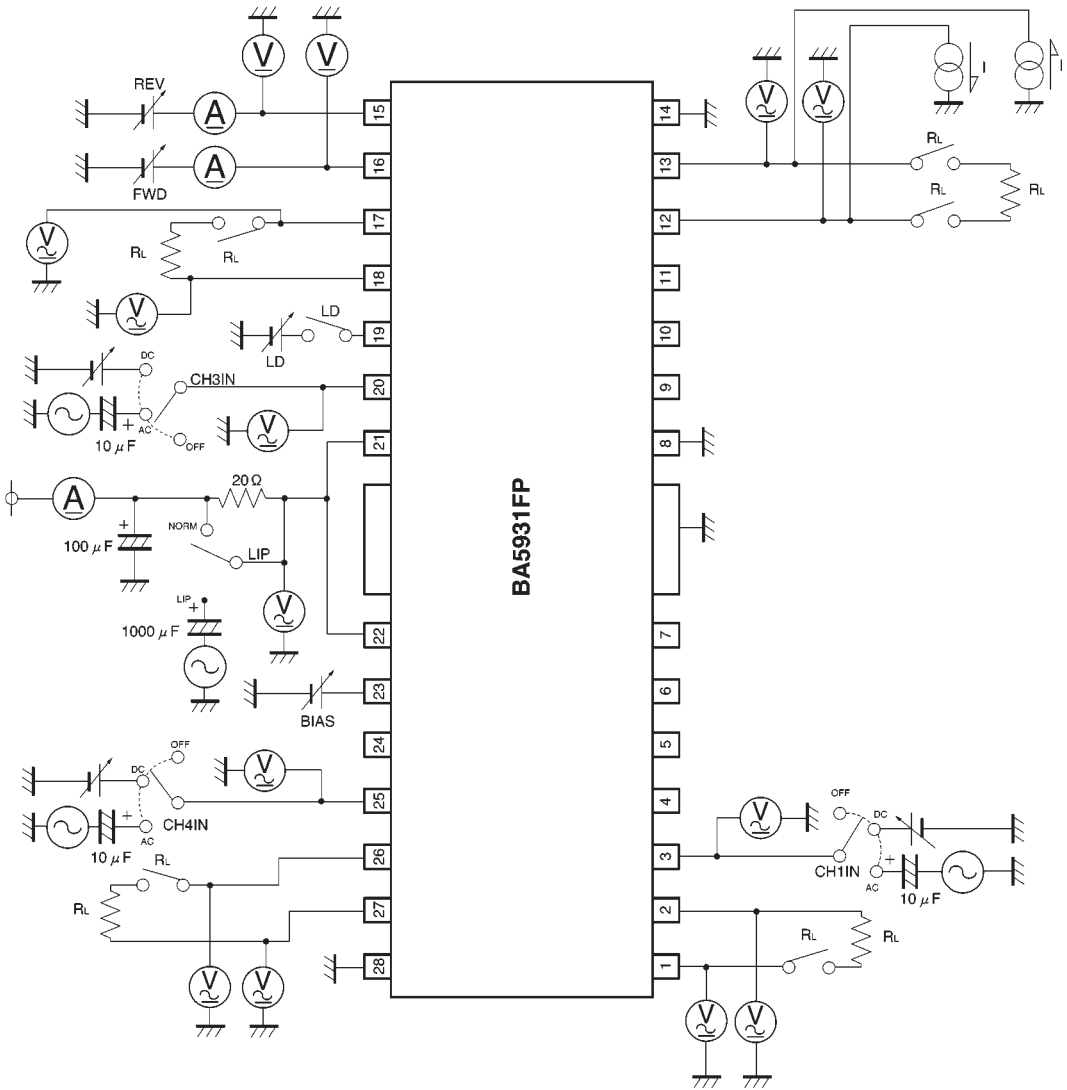This is the load variation in this state.

●Measurement circuit

Fig. 1

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●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.
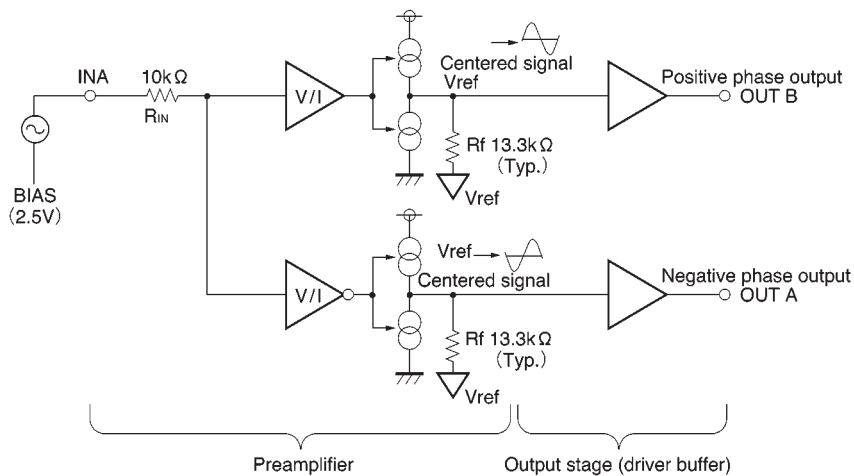
Fig. 2

(2) Switching the loading motor driver output mode (Vcc = 8V)

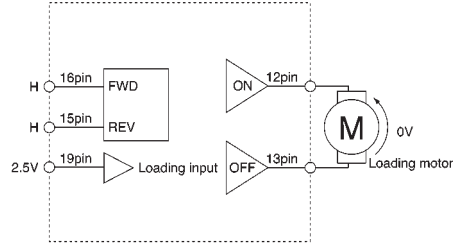| FWD	REV	Loading	Illustration
L	L	High impedance	Fig.3
L	H	Reverse	Fig.4
H	L	Forward	Fig.5
H	H	Brake	Fig.6
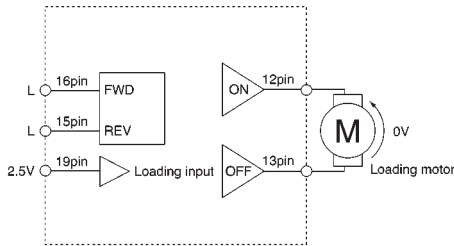
Fig. 3
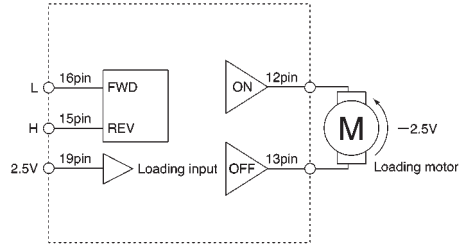
Fig. 4
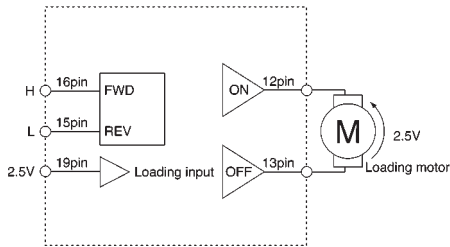
Fig. 5

Fig. 6

Note: Loading driver gain = 0dB

(3) Setting the loading driver voltage (forward mode)
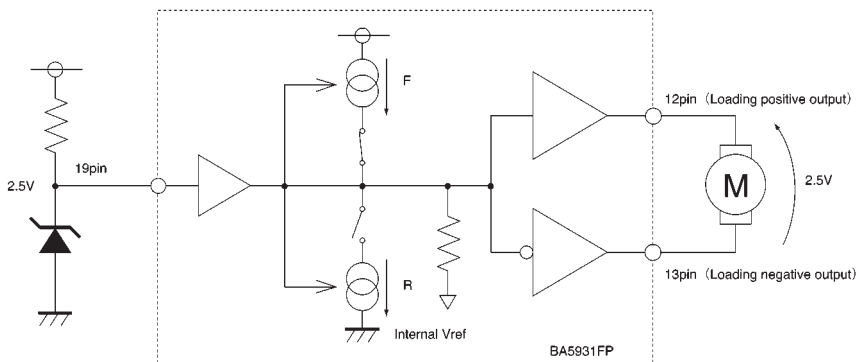
Fig. 7

Input voltage is equal to output voltage(gain is 0 dB)

Note: The loading output voltage will not exceed the power supply's maximum output voltage, even if set above this maximum voltage.

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 input pin (19 pin).
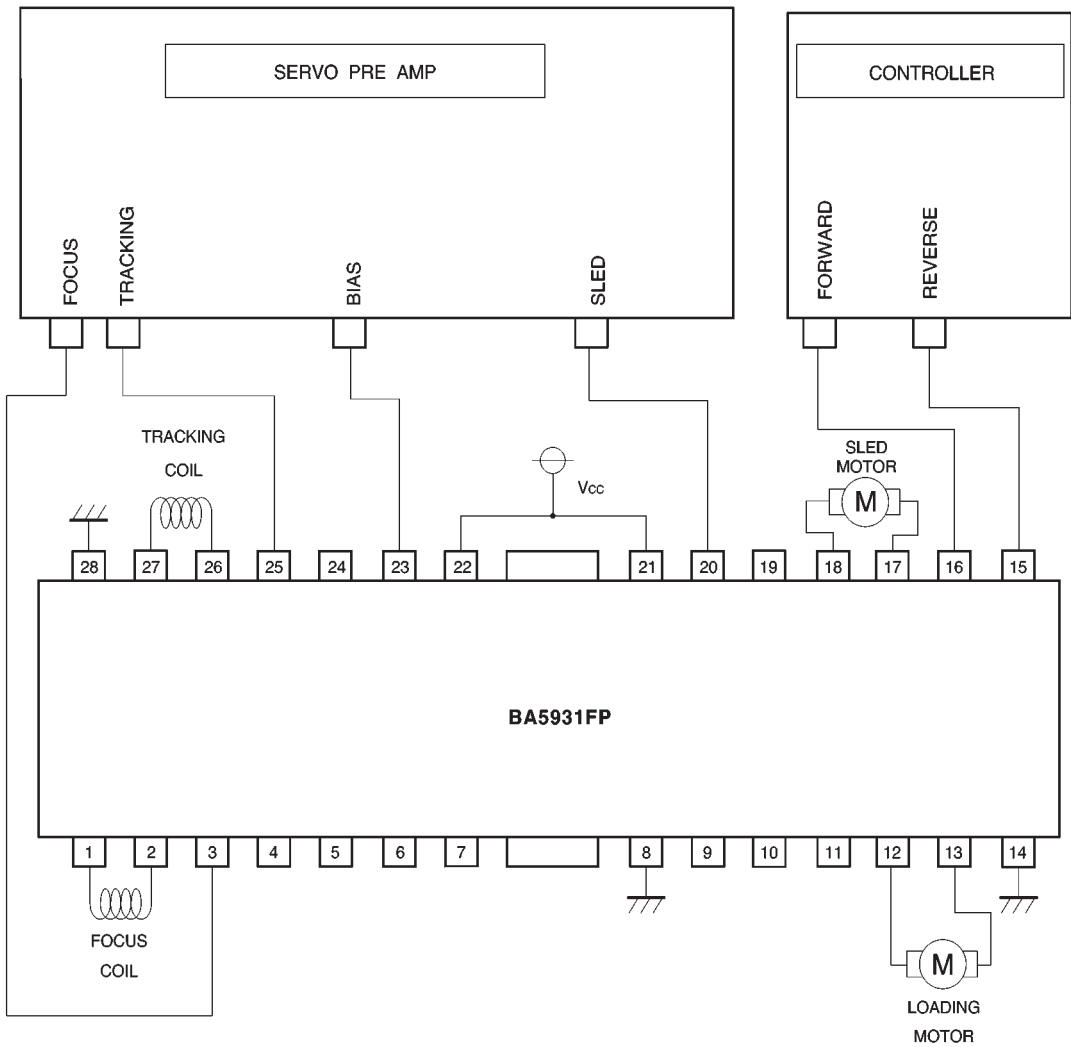
●Application example

Fig. 8

●Operation notes

(1) The BA5931FP has a thermal shutdown circuit. The output current is muted when the chip temperature rises above 175°C (typically).

(2) The IC is muted when the bias pin (pin 23) is lowered below 1.4V (typically). Make sure it stays between 1.6V and 6.5V during normal use.

(3) Muting occurs during thermal shutdown or a drop in the bias pin voltage. In each case, only the drivers are muted. During muting, the output pins remain at the internal bias voltage, (approx $V_{CC}/2$).

(4) Connect the IC to a 0.1μF bypass capacitor between power supplies, at the base of the IC.

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

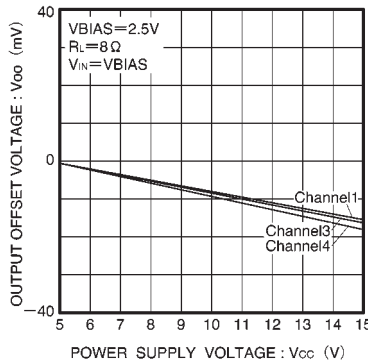●Electrical characteristic curves
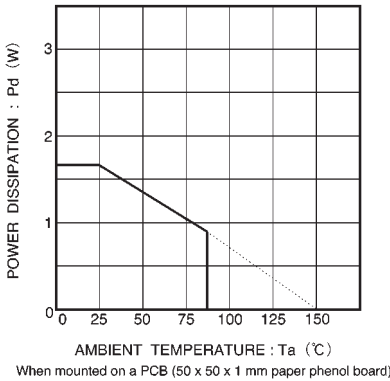
Fig. 9 Thermal derating curve
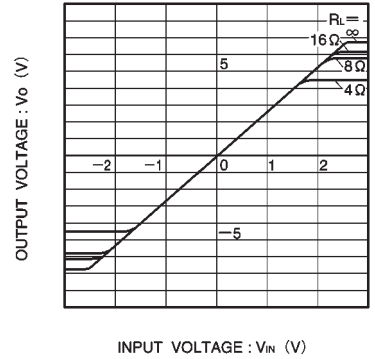
Fig. 10 Power supply voltage vs. output offset voltage

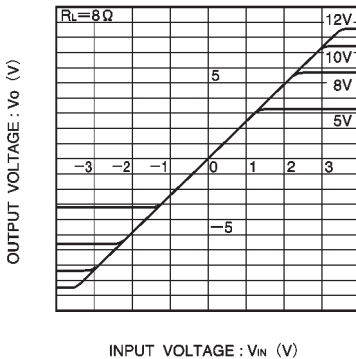Fig. 11 Channel 1, 3 and 4 I / O characteristics (variable load)

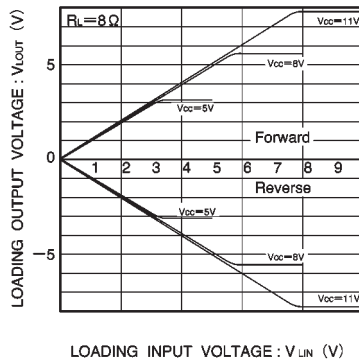Fig. 12 Channel 1, 3 and 4 I / O characteristics (variable Vcc)

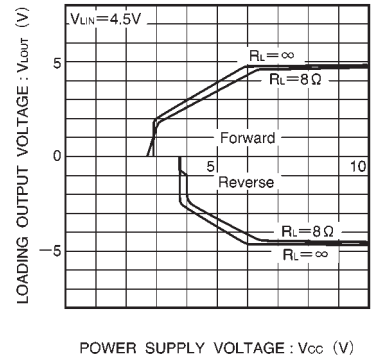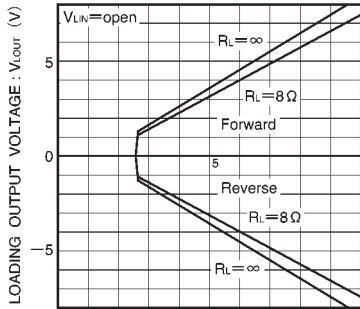Fig. 13 Loading driver I / O characteristics

Fig. 14 Loading output vs. power supply voltage

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Fig. 15 Loading output vs. power supply voltage

●External dimensions (Units: mm)

HSOP28