5-channel BTL driver for CD players

BA6795FP

The BA6795FP is a 5-channel BTL power driver for CD players and has an internal 5V regulator (attached PNP transistor required). The loading and spindle motor output pins are dual-use output pins and are switched between drivers using a control input. In addition, the internal level shifting circuit reduces the number of external components.

●Applications

CD players, CD-ROM drives and other optical disc devices

●Features

1) 5-channel BTL driver in a HSOP 28-pin package, ideal for application miniaturization.
2) Internal level shifting circuit reduces the number of external components.
3) Gain is adjustable with an attached resistor.
4) Internal thermal shutdown circuit.
5) Internal 5V regulator. (attached PNP transistor required)

●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～+85	℃
Storage temperature	Tstg	−55～+150	℃

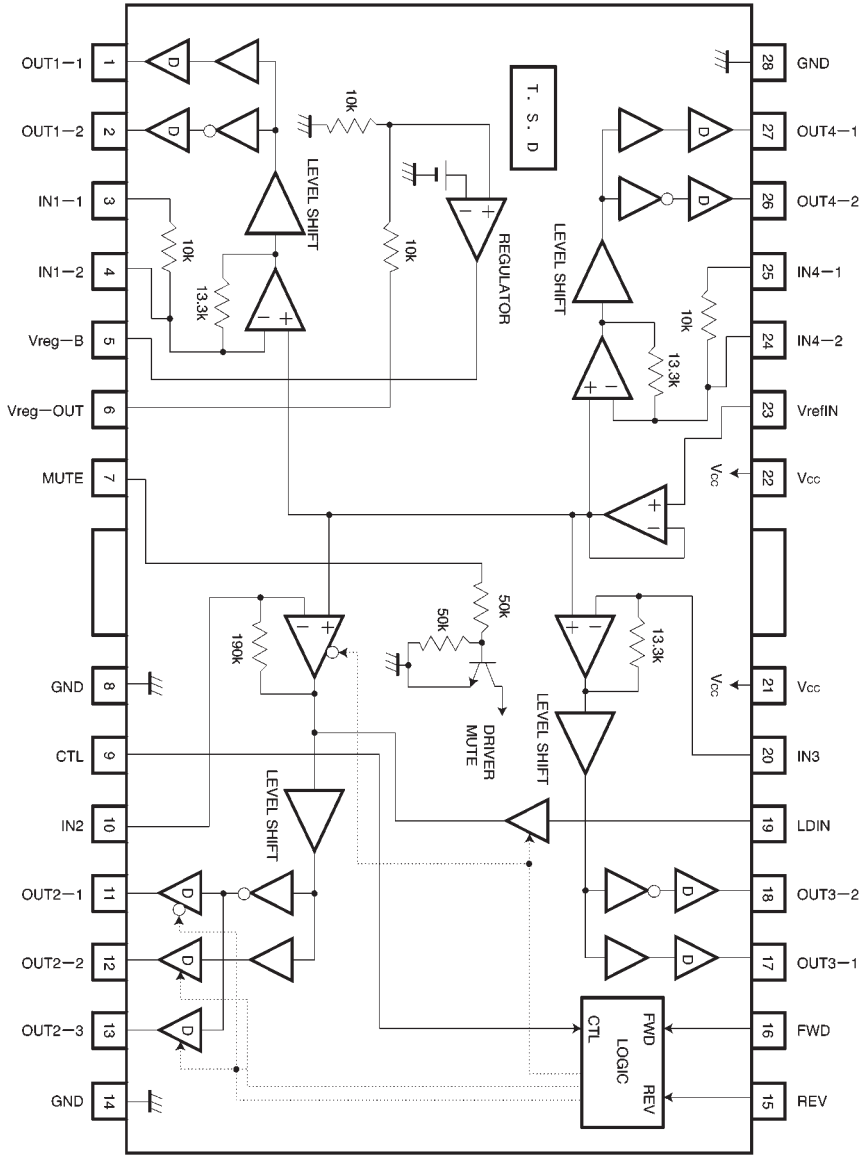
*1 When mounted on a 50 mm×50 mm×1.0 mm paper phenol board
Reduced by 13.6 mW for each increase in Ta of 1℃ over 25℃.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC}	4.8	—	12.0	V
		6.0	—	12.0	V*2

*2 Without regulator

●Block diagram



●Pin descriptions

Pin No.	Pin name	Function
1	OUT−1	Channel 1 negative output
2	OUT−2	Channel 1 positive output
3	IN 1−1	Channel 1 input
4	IN 1−2	Channel 1 gain adjustment input
5	Vreg−B	Attached transistor base connection
6	Vreg−OUT	Constant voltage output (attached transistor collector connection)
7	MUTE	Mute-on control
8	GND	Ground
9	CTL	Loading/spindle switching
10	IN 2	Channel 2 gain adjustment input
11	OUT−1	Channel 2 positive output
12	OUT−2	Channel 2 negative output/Loading positive output
13	OUT−3	Loading negative output
14	GND	Substrate ground
15	REV	Loading reverse input
16	FWD	Loading forward input
17	OUT3−1	Channel 3 negative output
18	OUT3−2	Channel 3 positive output
19	LDIN	Loading input
20	IN 3	Channel 3 gain adjustment input
21	V_{CC}	Vcc
22	V_{CC}	Vcc
23	VrefIN	Bias amplifier input
24	IN 4−2	Channel 4 gain adjustment input
25	IN 4−1	Channel 4 input
26	OUT4−2	Channel 4 positive output
27	OUT4−1	Channel 4 negative output
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 the phase relative to the mode.

●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 drive)〉						
Output offset voltage 1	V_{OO1}	−40	—	40	mV	Channels 1, 3 and 4, Driver
Output offset voltage 2	V_{OO2}	−60	—	60	V	Channel 2 driver (spindle)
Maximum output voltage 1	V_{OH1}	3.8	4.3	—	V	V_{IN}=8V
Maximum output voltage 2	V_{OH2}	—	−4.3	−3.8	V	V_{IN}=0.7V
Closed loop voltage gain 1	G_{VC1}	5.5	8.0	10.5	dB	V_{IN}= μ0.5V *1
Closed loop voltage gain 2	G_{VC2}	7.5	11.0	14.5	dB	V_{IN}= μ0.5V *2
Ripple rejection	RR	—	60	—	dB	V_{IN}=0.1V_{rms}, 100Hz
Slew rate	SR	—	2.0	—	V/μs	100 Hz square wave, 3V_{P-P} output
〈Loading drivers〉						
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}=8V, RL=45Ω, VLD=4.5V*3
Output voltage range R	V_{OMR}	—	−2.2	−1.9	V	
Output load variation F1	ΔV_{F1}	—	250	500	mV	V_{CC}=8V, VLD=3.0V I=100→400mA*4
Output load variation R1	ΔV_{R1}	—	250	500	mV	
Output load variation F2	ΔV_{F2}	—	600	850	mV	V_{CC}=5V, VLD=4.5V I=100→400mA*5
Output load variation R2	ΔV_{R2}	—	600	850	mV	
Supply voltage variation F	ΔV_{FL}	−500	—	500	mV	V_{CC}=4.8V→12V, RL=∞
Supply voltage variation R	ΔV_{RL}	−500	—	500	mV	
Output offset voltage	V_{OOL}	−50	2.0	50	mV	When braking: Output voltage
〈Controllers CTL, FWD and REV〉						
Input high level voltage 1	V_{IH1}	2.0	—	—	V	FWD (pin 16), REV (pin 15) Determined by input pin voltage
Input low level voltage 1	V_{IL1}	—	—	0.5	V	
Input high level voltage 2	V_{IH2}	4.0	—	—	V	CTL (pin 9) Determined by input pin voltage
Input low level voltage 2	V_{IL2}	—	—	0.5	V	
Input high level current	I_{IH}	—	—	500	μA	V_{IN}=5V
Input low levelcurrent	I_{IL}	—	—	500	μA	V_{IN}=0V
〈5 V regulator〉						
Output voltage	Vreg	4.75	5.00	5.25	V	I_L=100mA
Output load variation	ΔV_{RL}	−50	0	50	mV	I_L=0～200mA
Supply voltage variation	ΔV_{VCC}	−50	0	25	mV	(V_{CC}=6～9V) I_L=100mA

◎Not designed for radiation resistance.

*1 Attach a 10 kΩ resistor to the inputs (channel 1, channel 3 and channel 4).

*2 Attach a 100 kΩ resistor to the inputs (channel 2).

*3 V_{omf} and V_{omr} remain roughly the same even when loading input VLD (pin 19) is opened.

*4 ΔV_{f1}, ΔV_{r1} indicate load variation at unclipped, 3.0 V output.

*5 ΔV_{f2}, ΔV_{r2} indicate load variation when output is clipped to generate 4.5 V input at reduced voltage (5 V).

●Measruement circuit

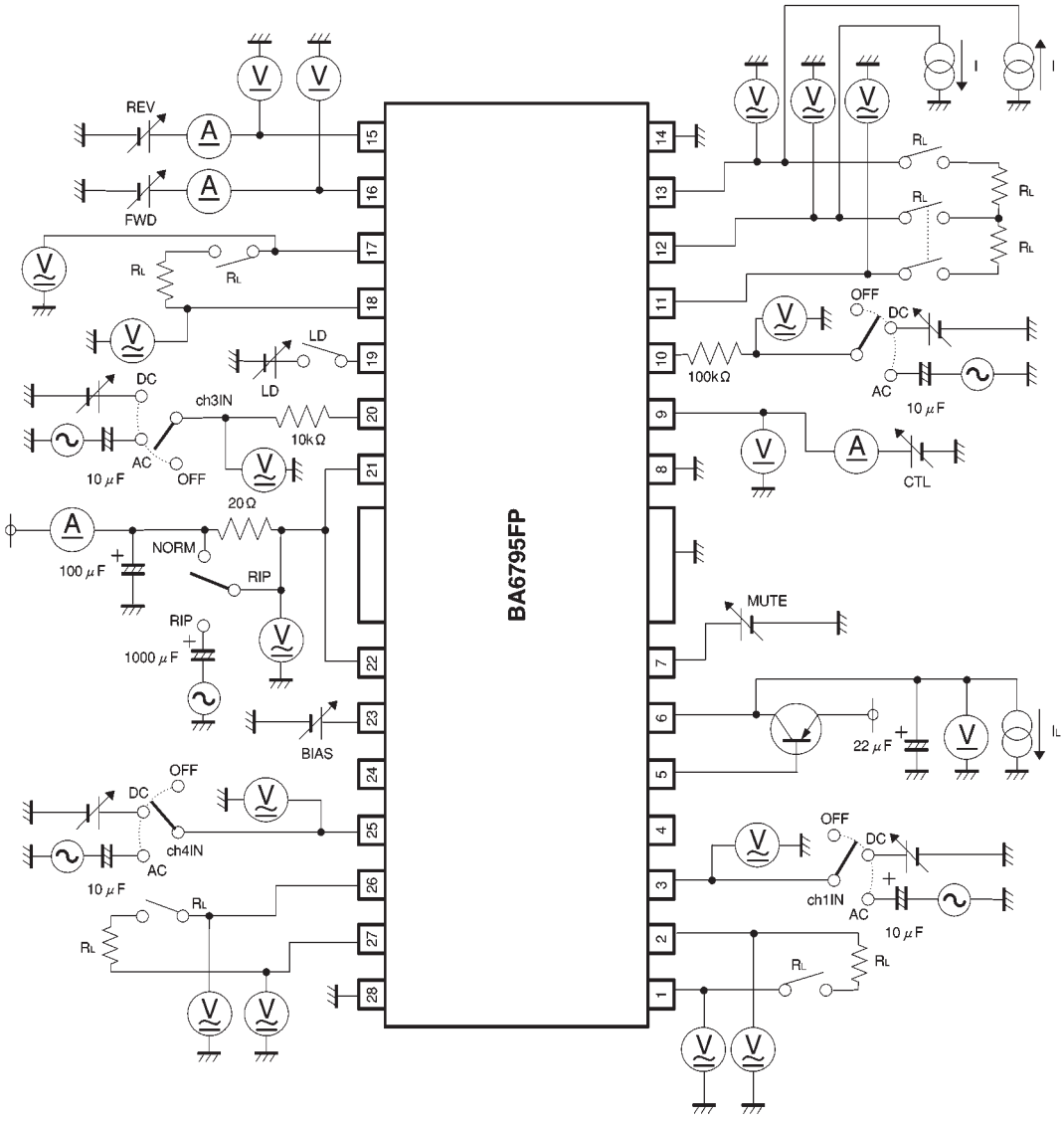


Fig.1

●Measruement circuit switch table

Parameter	Switch								Note
	RL	RL'	LD	RIP	CH1	CH2	CH3	CH4	
Quiescent current dissipation	OFF	OFF	OFF	NORM	OFF	OFF	OFF	OFF	
Mute-off voltage	ON	ON	↓	↓	DC	DC	DC	DC	DC : Vcc or GND
Mute-on voltage	ON	ON	↓	↓	DC	DC	DC	DC	DC : Vcc or GND
〈Drivers (other than loading driver)〉									
Output offset voltage	ON	ON	OFF	NORM	DC	DC	DC	DC	DC: bias voltage
Maximum output voltage	↓	↓	↓	↓	↓	↓	↓	↓	DC : Vcc or 0.7V
Closed loop voltage gain 1	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias ±0.5 V
Closed loop voltage gain 2	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias ±0.5 V
Ripple rejection	↓	↓	↓	RIP	↓	↓	↓	↓	DC: bias voltage
Slew rate	↓	↓	↓	NORM	AC	AC	AC	AC	AC: 100 Hz square wave
〈Loading drivers〉									
Output voltage F	ON	ON	ON	NORM	OFF	DC	OFF	OFF	DC: bias voltage
Output voltage R	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias voltage
Output voltage range F	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias voltage
Output voltage range R	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias voltage
Load regulation F	↓	OFF	↓	↓	↓	↓	↓	↓	DC: bias voltage
Load regulation R	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias voltage
Line regulation	↓	↓	↓	↓	↓	↓	↓	↓	DC: bias voltage
Output offset voltage	↓	ON	OFF	↓	↓	↓	↓	↓	DC: bias voltage (brake mode)
〈Controller pins〉									
Input high level voltage 1	ON	ON	OFF	NORM	OFF	DC	OFF	OFF	
Input low level voltage 1	↓	↓	↓	↓	↓	↓	↓	↓	
Input high level voltage 2	↓	↓	↓	↓	↓	↓	↓	↓	
Input low level voltage 2	↓	↓	↓	↓	↓	↓	↓	↓	
Input low level current	OFF	OFF	OFF	↓	↓	OFF	↓	↓	
〈5 V regulator〉									
Output voltage	OFF	OFF	OFF	NORM	OFF	OFF	OFF	OFF	
Load regulation	↓	↓	↓	↓	↓	↓	↓	↓	
Line regulation	↓	↓	↓	↓	↓	↓	↓	↓	

∗ When measuring drivers (excluding loading driver), CTL voltage should be under 0.5 V.

∗ I and I_L, used in the test circuit diagram, are the same as the symbols used in electrical characteristics table.

●Circuit operation

(1) Switching between spindle and loading motor driver output modes (V_{CC} = 8V)

CTL	FWD	REV	Spindle	Loading		Dimentions
L	L	L	ON	OFF		Fig. 2
		H				
	H	L				
		H				
H	L	L	OFF	OFF	High impedance	Fig. 3
		H		ON	Reverse	Fig. 4
	H	L			Forward	Fig. 5
		H			Brake	Fig. 6

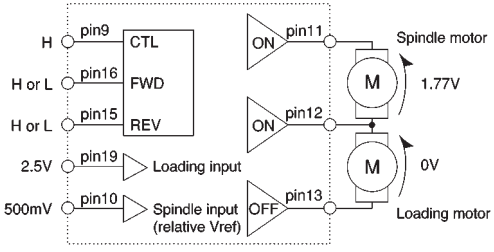


Fig. 2

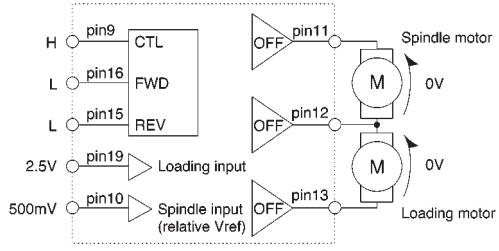


Fig.3

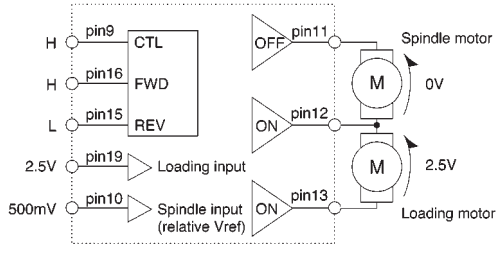


Fig. 4

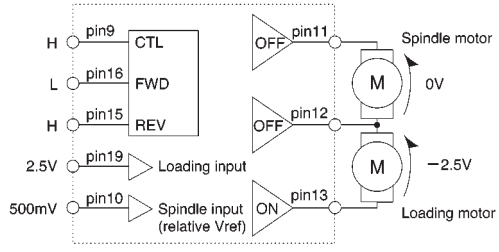


Fig. 5

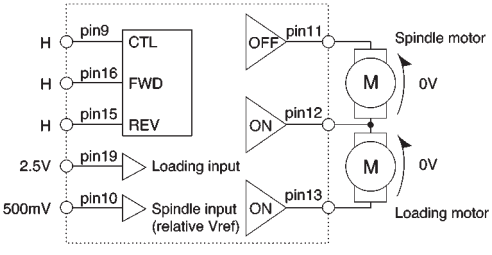
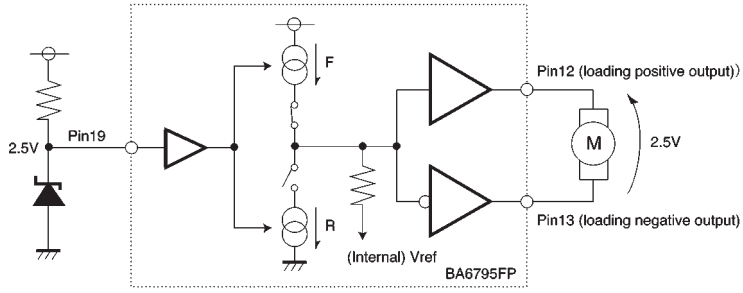


Fig. 6

Note: Gains for spindle driver (channel 2) and loading driver are 11dB and 0dB, respectively.

●Circuit operation

(2) Loading motor driver voltage setting (forward mode)



Input voltage = output voltage (gain: 0 dB)

Note: When the loading input pin (pin 19) is opened, a voltage corresponding to the dynamic range of the power supply being used is output according to the mode.

Fig. 7

●Application example

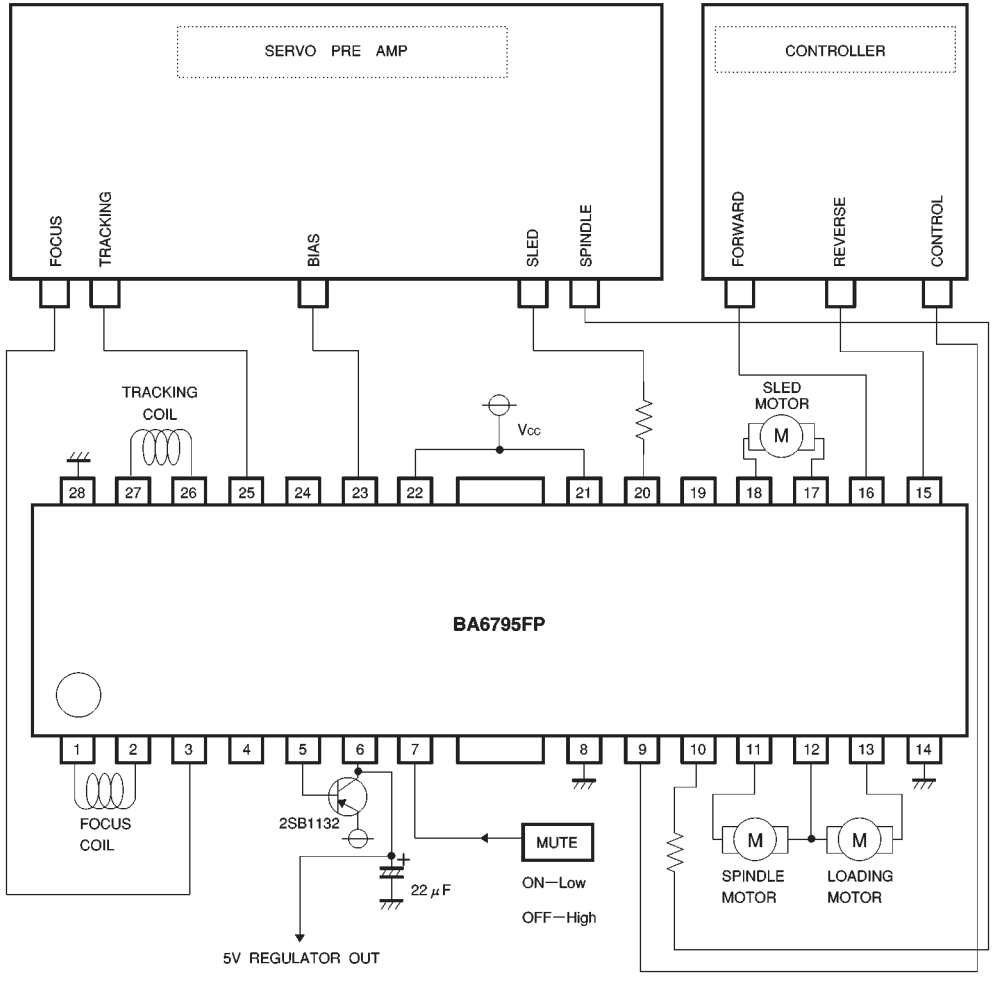


Fig.8

●Operation notes

(1) The BA6795FP 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) 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 $(V_{CC}–V_F)/2$.

(5) 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).

(6) Fluctuation due to temperature occurs in the gain when using an attached resistor as the input resistor for a driver other than the spindle driver (typically 2200ppm per degree) or for the spindle driver (typically 4600ppm per degree. (Only when using the gain adjustment pin.)

(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.

●Electrical characteristic curves

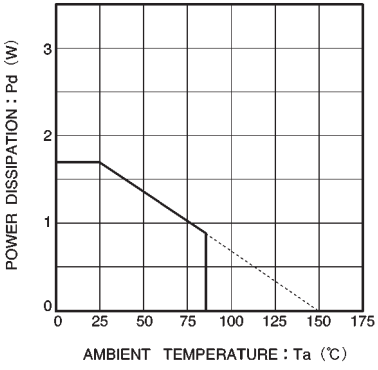


Fig. 9 Thermal derating curve

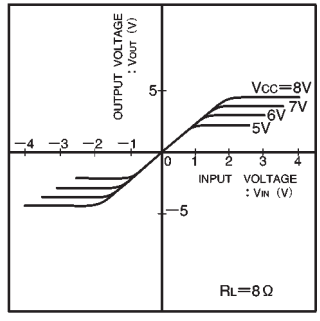


Fig. 10 Driver I / O characteristics (when load changes) (except channel 2)

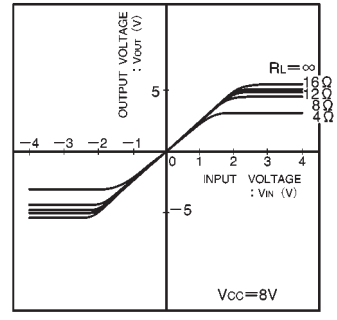


Fig. 11 Driver I / O characteristics (when power supply voltage power changes) (except channel 2)

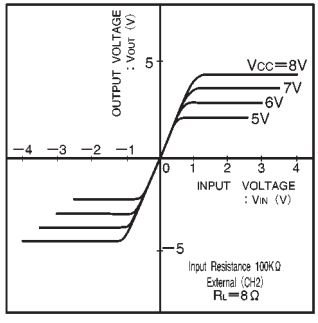


Fig. 12 Driver I / O characteristics (channel 2)

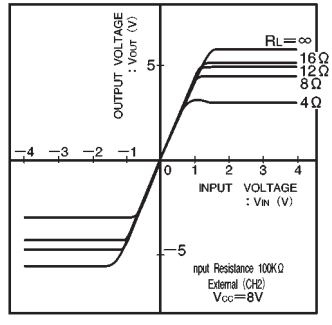
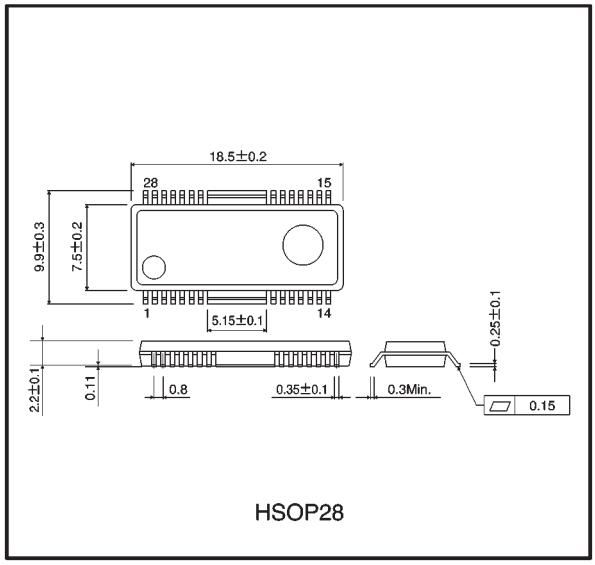


Fig. 13 Driver I / O characteristics (channel 2)

●External dimensions (Units: mm)



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