2-channel driver for CD changers
BA6780

The BA6780 is a 2-channel driver IC for CD changers that includes a reversible, variable speed electronic governor and a reversible driver. On sets that have dual-rail power supplies, the BA6780 can be operated from just the negative supply to reduce influence on the positive power supply.
The input uses PWM control, and it is possible to directly input from a microprocessor running off the positive power supply.

●Applications
Changers for CD players and MD players.

●Features
1) Output voltage can be freely set using the output voltage setting pin.
2) Internal mute function if the power supply voltage drops.
3) Thermal shutdown function.
4) PWM input.
5) Settable reference voltage output pin.
6) Wide operating supply voltage range.

●Absolute maximum ratings (Ta = 25°C)

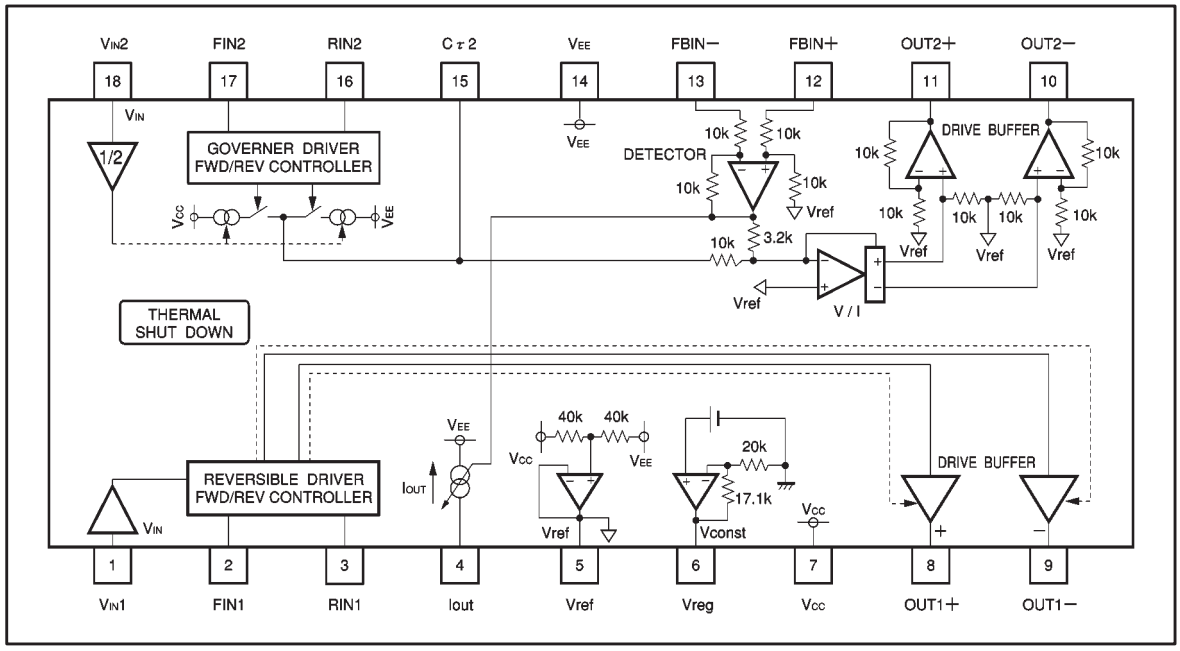
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	18	V
Logic input voltage	V_{FIN}, V_{RIN}	22	V
Power dissipation	Pd	1.31*1	W
Maximum current consumption	Imax	1.4*2	A
Operating temperature	Topr	−25～+75	℃
Storage temperature	Tstg	−55～+150	℃

*1 When a DIP18 package is used.Reduced by 10.48mW for each increase inTa of 1℃ over 25℃.
*2 Should not exceed Pd or ASO values.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	7～16	V
Input voltage for pins 1 and 18	V_{IN}	0～V_{CC} / 2−1.0	V

●Block diagram

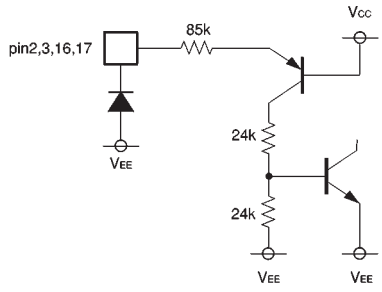
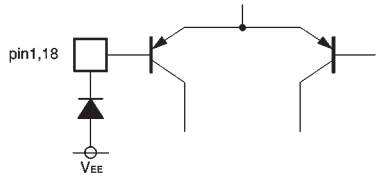
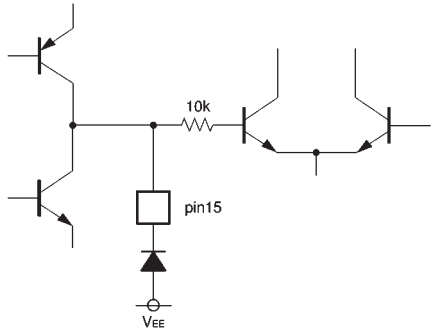
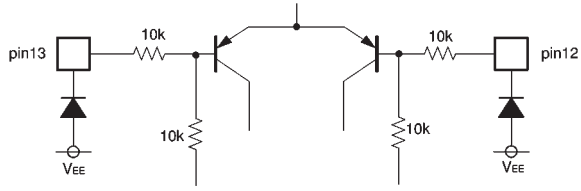


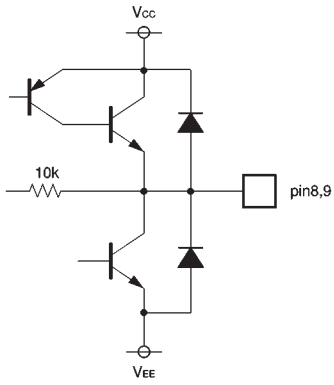
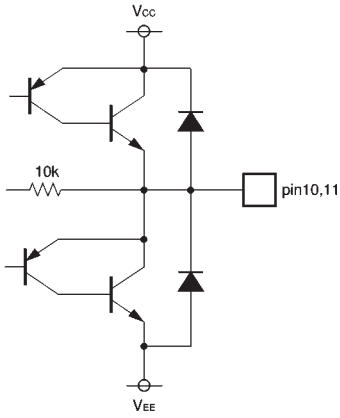
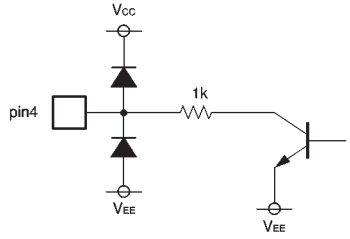
●Pin descriptions

Pin No.	Pin name	I/O	Function
1	$V_{IN}1$	I	Input pin for setting high output voltage for the reversible driver
2	FIN1	I	Input pin for forward control signal for the reversible driver
3	RIN1	I	Input pin for reverse control signal for the reversible driver
4	Iout	O	Governor load current detector output (open collector*1)
5	Vref	O	Internal reference voltage pin
6	Vreg	O	4.6V constant voltage output
7	V_{CC}	I	Power supply (+)
8	OUT1+	O	Reversible driver output (+)
9	OUT1−	O	Reversible driver output (−)
10	OUT2−	O	Governor output (−)
11	OUT2+	O	Governor output (+)
12	FBIN+	I	Governor load current detector amplifier input (+)
13	FBIN−	I	Governor load current detector amplifier input (−)
14	V_{EE}	I	Power supply (−) (connection within substrate)
15	Cτ2	I	For connection of capacitor for the governor PWM filter
16	RIN2	I	Governor reverse control signal input
17	FIN2	I	Governor forward control signal input
18	$V_{IN}2$	I	Input pin for setting high output voltage for the governor

*1 Refer to operating notes.

●Input / output circuits

Pin function	Equivalent circuit
Logic input	
Voltage setting input	
For connection of capacitor for PWM filter	
Load current detector	

Pin function	Equivalent circuit
Output (reversible driver)	
Output (governor)	
Load current detector signal output (governor)	

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 10V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Quiescent current	I_Q	—	8.0	16.0	mA	Open mode with no load
Mute on voltage	V_{CC1}	—	—	3.5	V	Mute on voltage when V_{CC} falls
Mute off voltage	V_{CC2}	5.5	—	—	V	Mute off voltage when V_{CC} rises
Vref input voltage range	V_{IN}	0	—	4	V	—
Vref pin current	I_{IN}	—	0.02	1.0	μA	—
PWM input high level voltage	V_{IH}	4.0	—	—	V	With V_{CC} as the reference potential
PWM input low level voltage	V_{IL}	—	—	1.0	V	With V_{CC} as the reference potential
PWM input high level current	I_{IH}	—	—	100	μA	—
PWM input low level current	I_{IL}	−1.0	—	1.0	μA	—
〈Electronic governor〉						
Output offset voltage	V_{OF}	−100	0	100	mV	RL (load)=9Ω, RO (current detector)=0.6Ω
Max. pin-to-pin output voltage	V_{OM}	6.0	6.5	—	V	RL (load)=9Ω, RO (current detector)=0.6Ω
Pin-to-pin output voltage 1-1	V_{OUT11}	4.2	4.7	5.2	V	Forward mode / 12 and 13 open
Pin-to-pin output voltage 1-2	V_{OUR12}	−5.2	−4.7	−4.2	V	Reverse mode / RL (load)=9Ω
Pin-to-pin output voltage 1-3	V_{OUT13}	−100	0	100	mV	Brake mode / RO (current detector)=0.6Ω
Pin-to-pin output voltage 1-4	V_{OUT14}	−50	0	50	mV	Stop mode / Vref=2.5V
Voltage gain of positive feedback amplifier	G_{VNF}	20.5	22.0	23.5	dB	V_{ref}=0V, V_{IN}=−20dBV, f=1kHz
〈Reversible driver〉						
Output saturation voltage	V_{CEsat}	—	1.0	2.1	V	I_O=100mA, V_{ref}=5V, Total of upper side and lower side ineffective voltage of output Tr
Pin-to-pin output voltage 2-1	V_{OUT21}	4.5	5.0	5.5	V	Forward mode / I_C=100mA / V_{ref}=2.5V
Pin-to-pin output voltage 2-2	V_{OUT22}	−5.5	−5.0	−4.5	V	Reverse mode / I_C=100mA / V_{ref}=2.5V
Pin-to-pin output voltage 2-3	V_{OUT23}	−50	0	50	mV	Brake mode / V_{ref}=2.5V
Pin-to-pin output voltage 2-4	V_{OUT24}	−50	0	50	mV	Stop mode / V_{ref}=2.5V
Output load fluctuation	V_{OUT}	—	200	400	mV	Difference in output voltage for I=400mA and I=100mA / V_{ref}=2.5V
〈4.6V constant-voltage output〉						
Output voltage	V_{reg}	4.35	4.60	4.85	V	—
Output load fluctuation (source)	V_{OSO}	−20	−5	—	mV	1mA source
Output load fluctuation (sink)	V_{OSI}	—	5	20	mV	1mA sink

◎ Not designed for radiation resistance.

●Measurement circuit

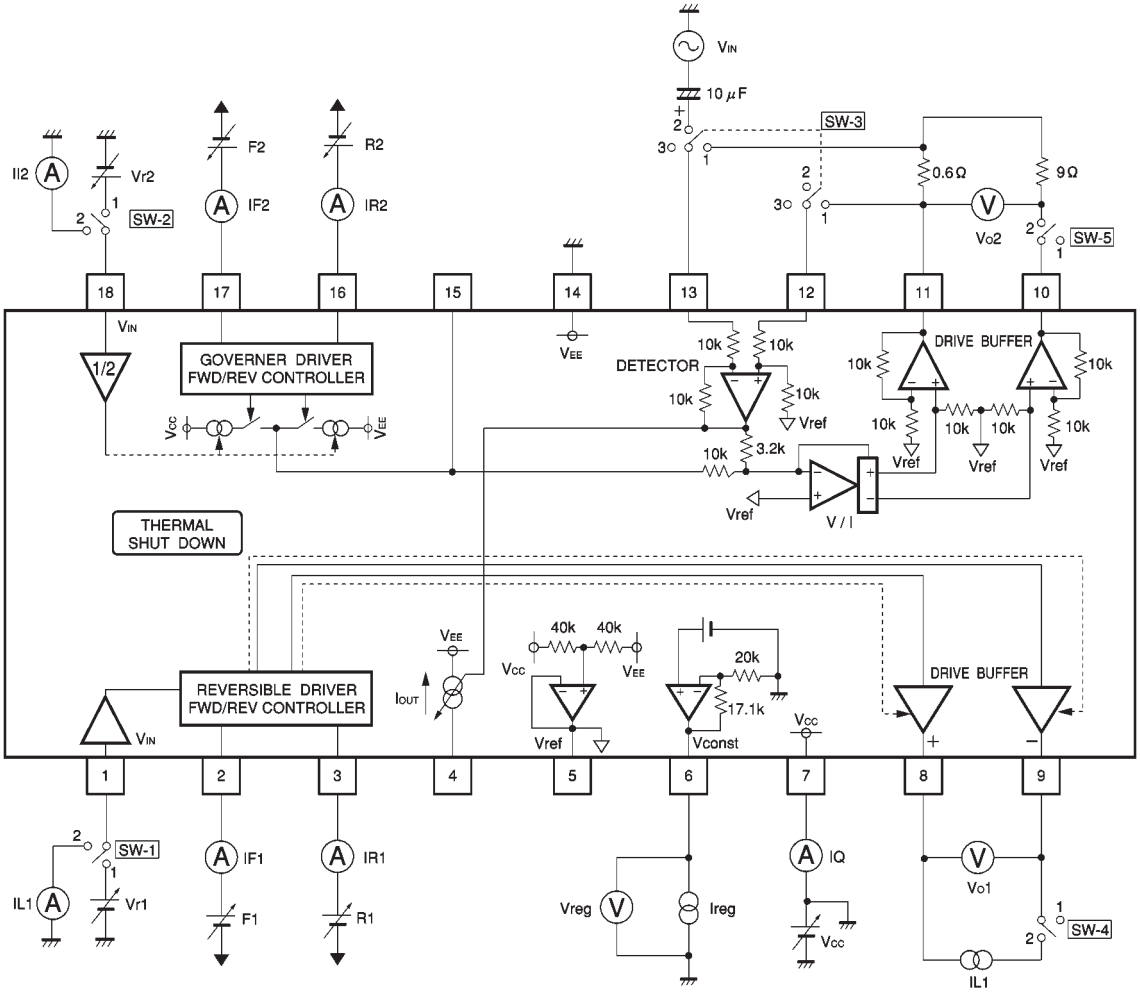


Fig.1

●Measurement circuit switch table

Parameter	SW					Input								Conditions	Measurement
	SW1	SW2	SW3	SW4	SW5	Vr1	Vr2	F1	R1	F2	R2	V_{IN}	IL1		
Quiescent current	1	1	3	1	1	0	0	0	0	0	0	—	—	—	IQ
Mute on voltage	1	1	3	1	1	2	0	0	5	0	0	—	—	V_{CC} swept down from 10V	Vo1
Mute off voltage	1	1	3	1	1	2	0	0	5	0	0	—	—	V_{CC} swept up from 0V	Vo1
Vref input voltage range	1	1	3	1	2	*1	*1	0	5	0	5	—	—	*1 Check for abnormality in output in Vr1 and Vr2 input range	Vo1 Vo2
Vref pin current	2	2	3	1	1	0	0	0	0	0	0	—	—	—	II1 II2
PWM input high level voltage	1	1	3	1	2	2	2	*2	*2	*2	*2	—	—	*2 Sweep the F/R input, and check that the mode switching is occurring in a range that satisfies the rated values	Vo1
PWM input low level voltage	1	1	3	1	2	2	2	*2	*2	*2	*2	—	—		Vo2
PWM input high level current	1	1	3	1	1	0	0	5	5	5	5	—	—	—	IF1 IF2
PWM input low level current	1	1	3	1	1	0	0	5	5	5	5	—	—	—	IR1 IR2
〈Electronic governor〉															
Output offset voltage	1	1	1	1	2	0	0	0	0	5	5	—	—	—	Vo2
Max. pin-to-pin output voltage	1	1	3	1	2	0	4	0	0	0 5	5 0	—	—	—	Vo2
Pin-to-pin output voltage 1-1	1	1	1	1	2	0	2.5	0	0	0	5	—	—	—	Vo2
Pin-to-pin output voltage 1-2	1	1	1	1	2	0	2.5	0	0	5	0	—	—	—	Vo2
Pin-to-pin output voltage 1-3	1	1	1	1	2	0	2.5	0	0	5	5	—	—	—	Vo2
Pin-to-pin output voltage 1-4	1	1	1	1	2	0	2.5	0	0	0	0	—	—	—	Vo2
Voltage gain of positive feedback amplifier	1	1	2	1	1	0	0	0	0	5	5	*3	—	*3 −20dBV、1kHz	Vo2
〈Reversible driver〉															
Output saturation voltage	1	1	1	2	1	5	0	0 5	5 0	0	0	—	*4	*4 100mA (take care with polarity)	V_{CC} −Vo1
Pin-to-pin output voltage 2-1	1	1	3	2	1	2.5	0	0	5	0	0	—	*5	*5 100mA (take care with polarity)	Vo1
Pin-to-pin output voltage 2-2	1	1	3	2	1	2.5	0	5	0	0	0	—			
Pin-to-pin output voltage 2-3	1	1	3	1	1	2.5	0	5	5	0	0	—			
Pin-to-pin output voltage 2-4	1	1	3	1	1	2.5	0	0	0	0	0	—			
Output load fluctuation	1	1	3	2	1	2.5	0	0 5	5 0	0	0	—	*6	*6 Difference in output voltage for I=400mA and I=100mA	Vo1

Parameter	SW					Input								Conditions	Measurement
	SW1	SW2	SW3	SW4	SW5	Vr1	Vr2	F1	R1	F2	R2	VIN	IL1		
〈4.6V constant-voltage output〉															
Output voltage	1	1	3	1	1	0	0	0	0	0	0	—	—	—	Vreg
Output load fluctuation (source)	1	1	3	1	1	0	0	0	0	0	0	—	—	Source Ireg=1mA	Vreg
Output load fluctuation (sink)	1	1	3	1	1	0	0	0	0	0	0	—	—	Sink Ireg=1mA	Vreg

●Application example

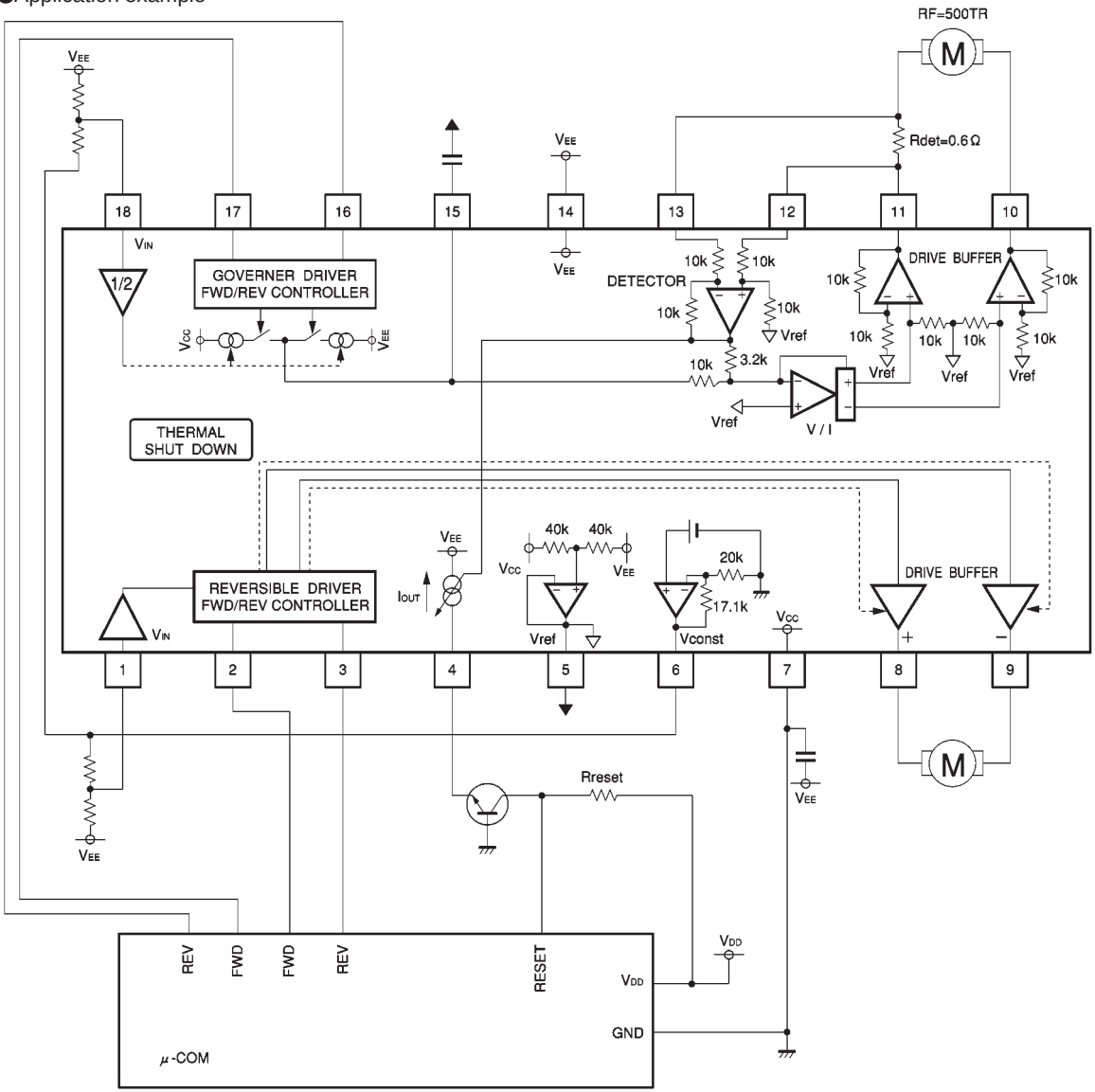


Fig.2

●Input / output truth table

〈Reversible drive〉

FIN	RIN	OUT (+)	OUT (−)	Mode
L	H	H	L	Forward mode
H	L	L	H	Reverse mode
H	H	L	L	Brake mode
L	L	OPEN	OPEN	Open mode

〈Governor drive〉

FIN	RIN	OUT (+)	OUT (−)	Mode
L	H	H	L	Forward mode
H	L	L	H	Reverse mode
H	H	V_{CC} / 2	V_{CC} / 2	Brake mode
L	L	OPEN	OPEN	Open mode

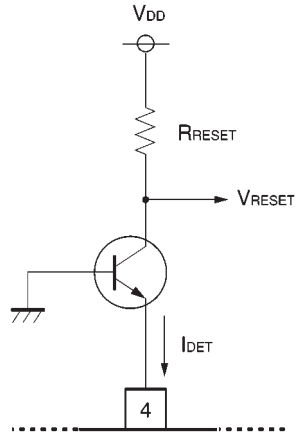
●Using the load current detector output pin (pin 4)

Refer to the example circuit on the right for the connection method. The V_{RESET} value is determined as follows:

$$I_{DET} = \frac{I_O \times R_{DET}}{3.2k\Omega} \quad V_{RESET} = V_{DD} - I_{DET} \times R_{RESET}$$

$$\therefore V_{RESET} = V_{DD} - \frac{I_O \times R_{DET} \times R_{RESET}}{3.2k\Omega}$$

(R_{DET} is the load current detector resistance, refer to the application circuit)



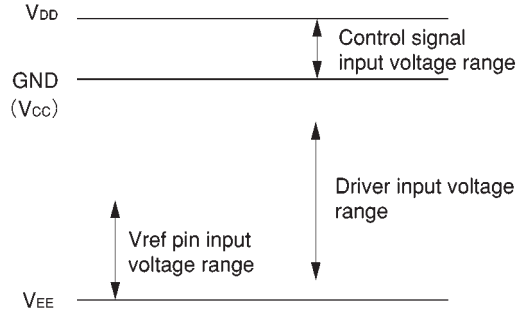
●Operation notes

(1) The BA6780 has a built in thermal shutdown circuit that mutes the output current when the chip temperature reaches 175°C (typ.). The hysteresis is set to 25°C (typ.), so the mute will be released when the chip temperature falls to 150°C (typ.).

(2) The output current is muted when the supply (V_{CC}) falls to 3V or less. When the mute is applied, the reverse driver is set to the V_{EE} level, and the governor driver is set to the $V_{EE}/2$ level.

(3) The V_{CC} voltage level is the reference for the logic input pin input voltage, so when it is converted from the V_{EE} potential, the high level becomes (V_{CC} + 5.0)V, and the low level becomes (V_{CC})V. The voltage potential levels for the pins are shown in the diagram below.

(4) Connect a bypass capacitor at the base of this IC for the power supply.



●Electrical characteristics curves

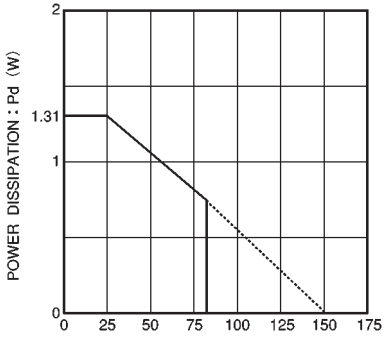


Fig.3 Thermal dissipation curve

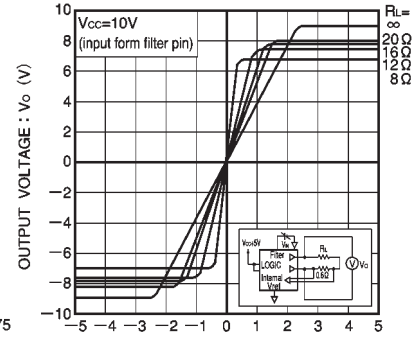


Fig.4 I / O characteristics with governor connected

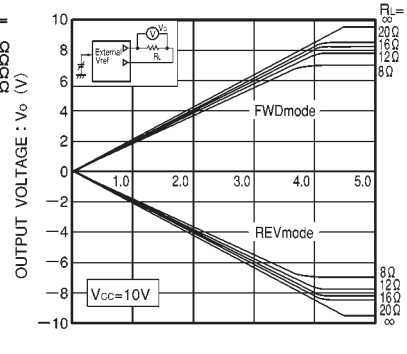


Fig.5 Reversible driver I / O characteristics

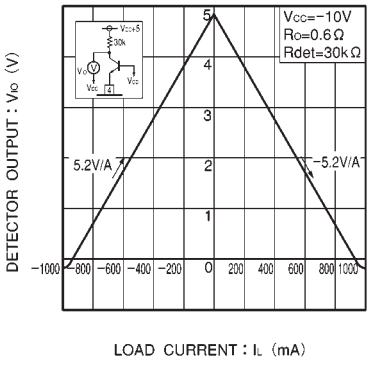


Fig.6 Load current detector output characteristics

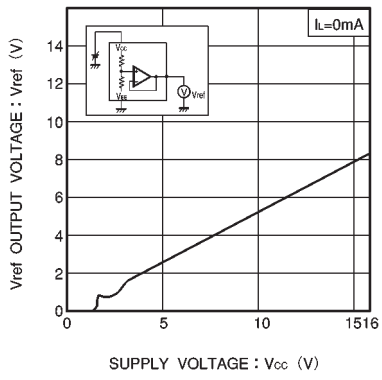


Fig.7 Internal Vref output characteristics

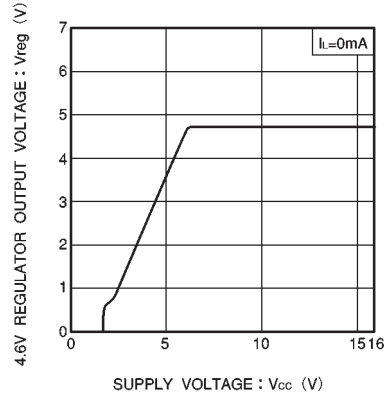


Fig.8 4.6Vconstant-voltage source output voltage characteristics

●External dimensions (Units: mm)