BA6395AFP

5-channel BTL driver

The BA6395AFP is a 5-channel BTL driver for the motors or actuators on a CD player.

Features

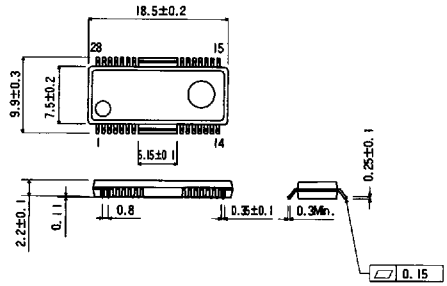
- available in a HSOP28 package
- contains drivers for focus coil, tracking coil, spindle motor, feed motor (sledge), and disc loading motor.
- supply voltage range (6 ~ 12V)
- gain of driver output can be changed by changing a single external resistor
- built-in 5-V regulator
- internal mute circuit provided, mute on when BIAS pin low
- built-in thermal shutdown circuit

Applications

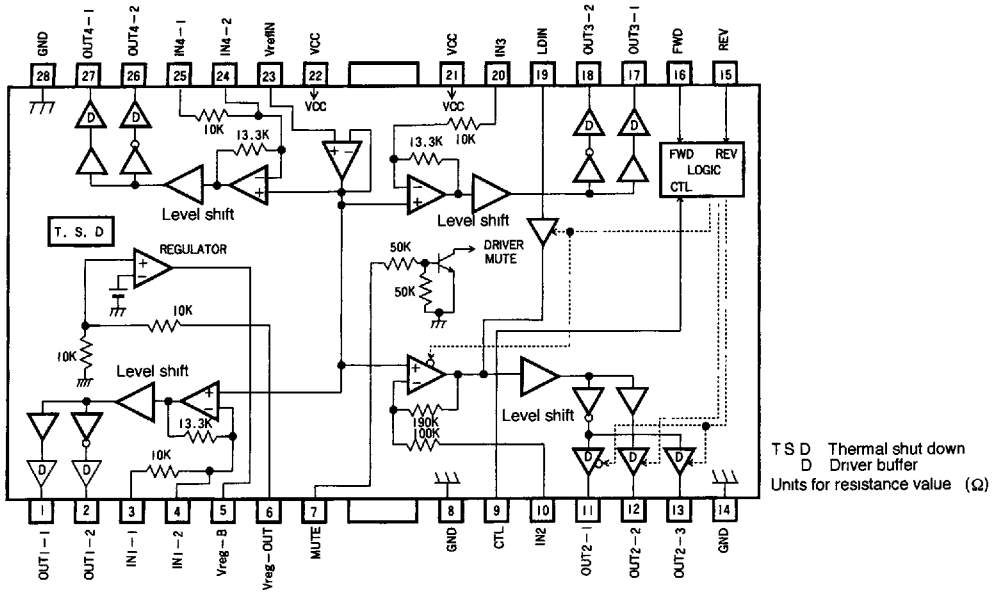
- CD player
- CD-ROM

Dimensions (Units : mm)

BA6395AFP (HSOP28)



Block diagram



T S D Thermal shut down
D Driver buffer
Units for resistance value (Ω)

Table 1 Pin description (Sheet 1 of 2)

Pin no.	Symbol	Description
1	OUT1-1	Driver CH1 negative output
2	OUT1-2	Driver CH1 positive output
3	IN1-1	Driver CH1 input
4	IN1-2	Driver CH1 input, gain adjustment pin
5	V_{REG} B	Connect to external transistor base
6	V_{REG} OUT	Constant voltage output, connects to external transistor collector
7	MUTE	Driver mute control input
8	GND	Ground
9	CTL	Loading and driver CH2 switch
10	IN 2	Driver CH2 input
11	OUT2-1	Driver CH2 positive output
12	OUT2-2	Driver CH2 negative output/loading positive output pin
13	OUT2-3	Loading negative output pin
14	GND	Ground
15	REV	Loading input, reverse

Table 1 Pin description (Sheet 2 of 2)

Pin no.	Symbol	Description
16	FWD	Loading input, forward
17	OUT3-1	Driver CH3 negative output
18	OUT3-2	Driver CH3 positive output
19	LDIN	Loading input
20	IN 3	Driver CH3 input
21	V_{CC}	
22	V_{CC}	
23	V_{REF} IN	Bias amplifier input
24	IN4-2	Driver CH4 gain adjustment pin
25	IN4-1	Driver CH4 input
26	OUT4-2	Driver CH4 positive output
27	OUT4-1	Driver CH4 negative output
28	GND	Ground

Absolute maximum ratings (T_a = 25°C)

Parameter	Symbol	Limits	Unit	Conditions
Power supply voltage	V_{CC}	18	V	
Power dissipation	P_d	1.7	W	Reduce power by 13.6 mW for each degree above 25°C. Mounted on 50 × 50 × 1.0 mm phenol paper PCB
Operating temperature	T_{opr}	−35 ~ +85	°C	
Storage temperature	T_{stg}	−55 ~ +150	°C	

Recommended operating conditions (T_a = 25°C)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Power supply voltage	V_{CC}	6	8	12	V	Driver section can operate as low as 4.8 V

Electrical characteristics (unless otherwise noted, T_a = 25°C, V_{CC} = 8 V, R_L = 8 Ω, f = 1 kHz) (Sheet 1 of 2)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Quiescent current	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	
Driver (other than the loading driver)						
Output voltage, offset 1	V_{OO1}	–40		40	mV	CH1, CH3, CH4 driver
Output voltage, offset 2	V_{OO2}	–60		60	mV	CH2 driver (spindle)
Voltage, max output 1	V_{OH1}	3.8	4.3		V	V_{IN} = 0.7 V
Voltage, max output 2	V_{OH2}		–4.3	–3.8	V	V_{IN} = 8.0 V
Gain (close circuit) 1	G_{VC1}	7.0	8.0	9.0	dB	V_{IN} = 0.5 V (excluding spindle)
Gain (close circuit) 2	G_{VC2}	8.5	11.0	13.5	dB	V_{IN} = 0.5 V (spindle)
Ripple rejection	RR		60		dB	V_{IN} = 0.1 m V_{rms}, f = 100 Hz
Slew rate	SR		2.0		V/μs	V_{OUT} = 3 V_{pk-pk}, square wave, f = 100 kHz
Loading driver						
Output voltage, forward	V_{OF}	2.7	3.2	3.7	V	V_{CC} = 8 V, V_{LD} = 3.0 V, R_L = 45 Ω
Output voltage, reverse	V_{OR}	–2.5	–3.0	–3.5	V	
Output voltage range, forward	V_{OF}	1.9	2.2		V	V_{CC} = 5V, V_{LD} = 4.5 V, R_L = 10 Ω Even if the loading input (pin 19) V_{LD} is open, $V_{OMF} \cong V_{OMR}$
Output voltage range, reverse	V_{OR}		–2.2	–1.9	V	
Output load variance, F1	ΔV_{F1}		250	500	mV	V_{CC} = 8 V, V_{LD} = 3.0 V, I = 100 ~ 400 mA (see note)
Output load variance, R1	ΔV_{R1}		250	500	mV	
Output load variance, F2	ΔV_{F2}		600	850	mV	V_{CC} = 5 V, V_{LD} = 4.5 V, I = 100 ~ 400 mA (see note)
Output load variance, R2	ΔV_{R2}		600	850	mV	
Applied voltage variance F	ΔV_{FL}	–500		500	mV	V_{CC} = 4.8 ~ 12 V, R_L = ∞
Applied voltage variance R	ΔV_{RL}	–500		500	mV	
Output voltage, offset	V_{OOL}	–50		50	mV	Output voltage when braking
Controller CTL, FWD, and REV pins						
Input voltage, HIGH 1	V_{IH1}	2.0			V	FWD (pin 16), REV (pin 15), defined by input pin voltage
Input voltage, LOW1	V_{IL1}			0.5	V	

Electrical characteristics (unless otherwise noted, T_a = 25°C, V_{CC} = 8 V, R_L = 8 Ω, f = 1 kHz) (Sheet 2 of 2)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Input voltage, HIGH 2	V_{IH2}	4.0			V	CTL (pin 9), defined by input pin voltage
Input voltage, LOW 2	V_{IL2}			0.5	V	
Input current, high	I_{IH}			500	μA	V_{IN} = 5 V
Input current, low	I_{IL}			500	μA	V_{IN} = 0 V
5 V regulator						
Output voltage	V_{REG}	4.75	5.00	5.25	V	I_L = 100 mA
Output load variation	ΔV_{RL}	−50		50	mV	I_L = 0 ~ 200 mA
Power supply voltage variation	ΔV_{VCC}	−10		25	mV	I_L = 100 mA (V_{CC} = 6 ~ 9 V)

Note: ΔVF1 and ΔVR1 are the load variance for the state in which 4.5 V is output without clipping. In order to input 4.5 V during a power drop of 5 V, the output of ΔVF2 and ΔVR2 are clipped. They are the load variance for this state.

Figure 1 Application example

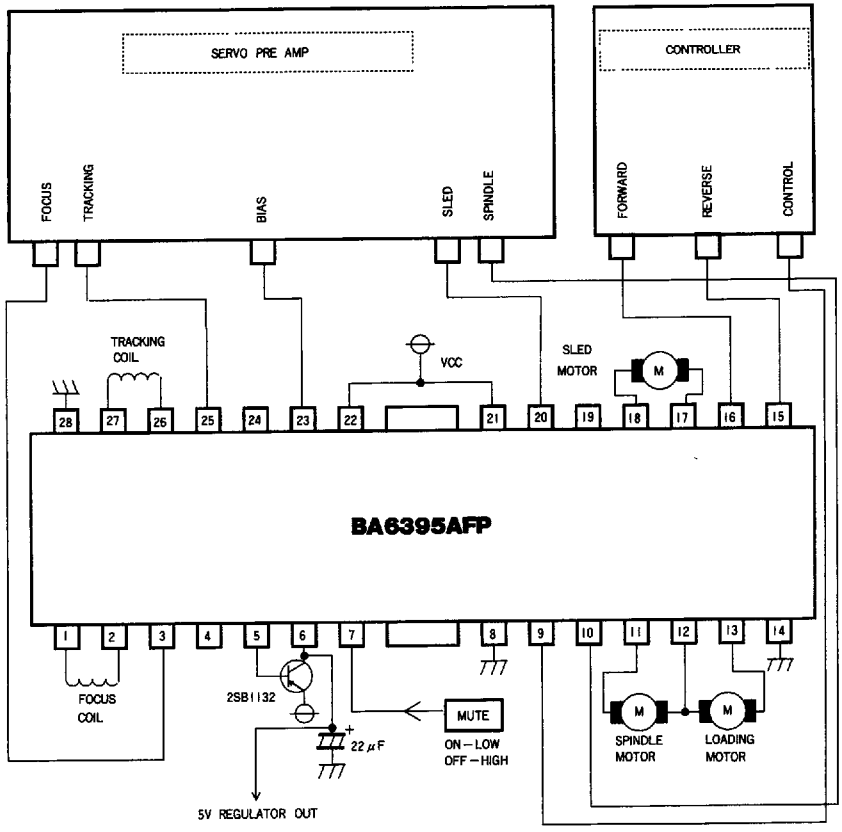
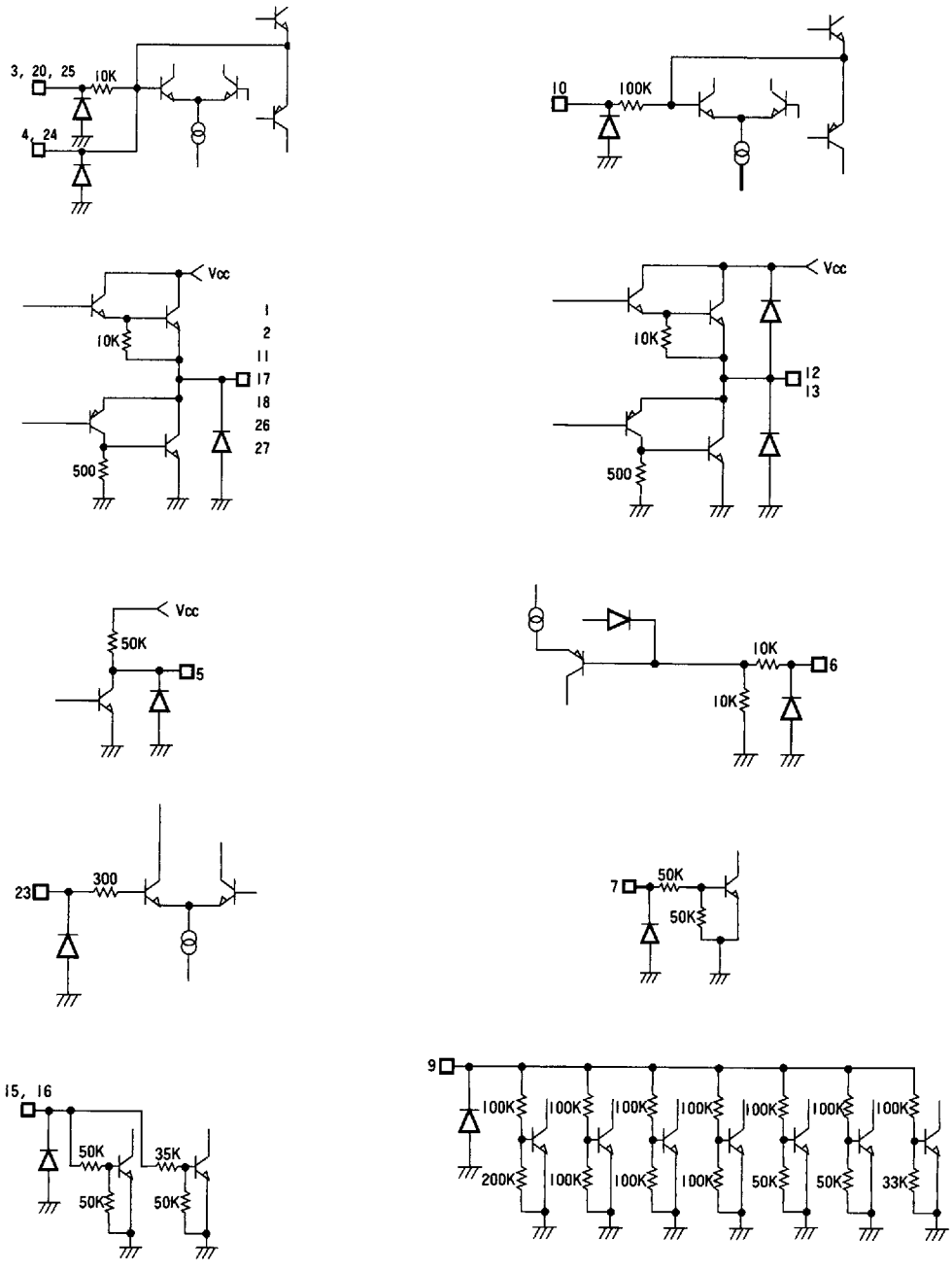


Figure 2 Input and output equivalent circuits



Circuit operation

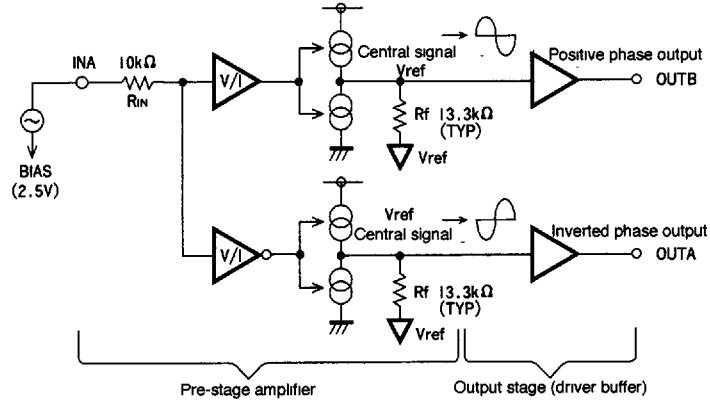
Drivers

The error signal of the focus tracking from the servo preamplifier and the control signal from the motor are the input to the driver.

The input is normally a signal centered around 2.5 V. This voltage is converted to a current by the pre-stage amplifier. (See Figure 3) The current flows through the internal reference voltage section by way of the resistor. As a result, the output of the pre-stage amplifier is a signal centered on the internal reference voltage.

Note that when performing the voltage to current conversion, a positive phase and a negative phase are created. The BTL output is acquired through the drive buffer.

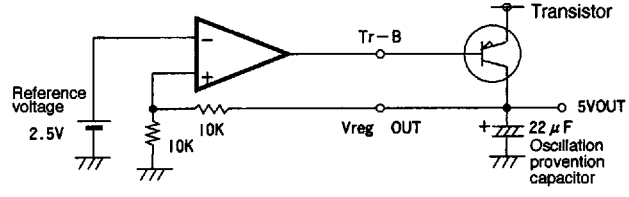
Figure 3 Driver equivalent circuit



Voltage regulator

The voltage regulator is a typical series regulator which creates a reference voltage internally. A PNP low -saturated- type transistor is connected externally.

Figure 4 Voltage regulator equivalent circuit



Operational amplifier

This is a standard 4558 type.

CH2/loading motor driver output mode switch (V_{CC} = 8 V)

CTL	FWD	REV	CH2	Loading		Figure ref
LOW	LOW	LOW	ON	OFF		5
		HIGH				
	HIGH	LOW				
		HIGH				
HIGH	LOW	LOW	OFF	OFF	High impedance	6
		HIGH		ON	Reverse	7
	HIGH	LOW			Forward	8
		HIGH			Braking	9

Figure 5

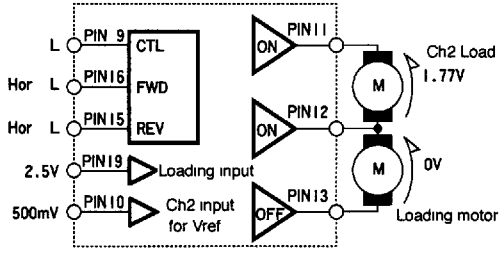


Figure 6

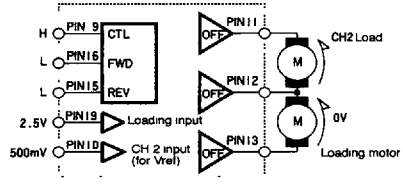


Figure 7

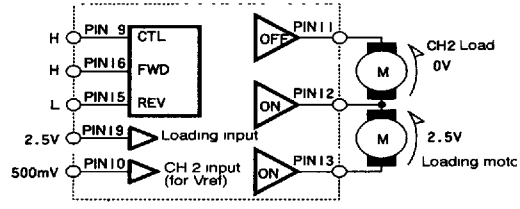


Figure 8

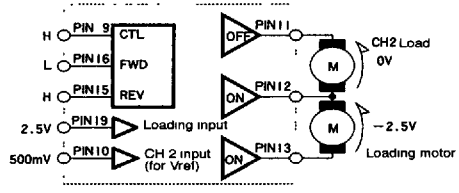
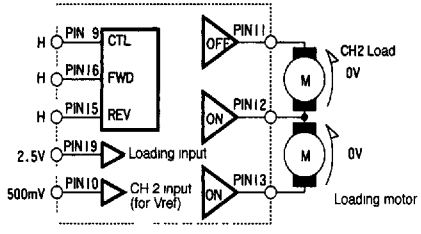
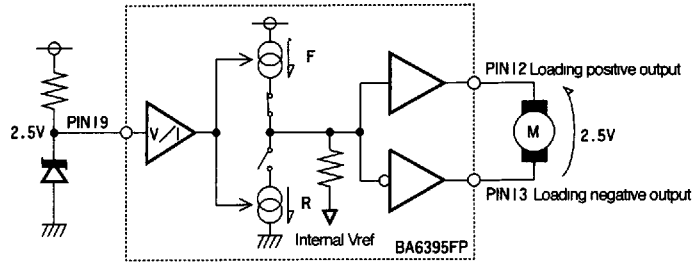


Figure 9



Loading motor driver voltage setting (example: forward mode)

Figure 10 Input voltage = loutput voltagel (gain 0 dB)



Input voltage = 1 output voltage 1 (gain 0 dB)

Precautions for use

- A thermal shut down circuit is built into the IC. When the temperature of the chip reaches 175°C (typically), the output current is muted.
- If the mute pin (pin 7) voltage opens or falls below 0.5 V, the output will be muted. Under normal operating conditions, make sure to pull pin 7 above 2.0 V.
- If the bias pin (pin 23) drops below 1.4 V, the output is muted. Make sure that under normal operating conditions, this pin is at 1.6 V or above.
- If the power supply voltage drops below 4.3 V, the drivers are turned OFF. When the voltage exceeds 4.5 V, the drivers return to their previous state.
- The output is muted in the event of a thermal shut down, a bias pin voltage drop, or a power supply voltage drop. Other sections are not muted.
- When muted, the internal bias voltage of the output pin becomes roughly $(V_{CC} - V_F)/2$.
- The built-in input resistance has a positive temperature coefficient of 2200 ppm/°C. When changing the gain using an external resistance, the gain will change as the temperature of the resistor changes. When using the built-in input resistance, there are virtually no gain variations due to temperature.
- Make sure to connect a 0.1 µF capacitor to the dc supplied power main input to filter out voltage ripples.
- Heat dissipation fins are attached to the GND on the inside of the package. Make sure to connect these to the external GND.
- The capacitor connected between the regulator output (pin 6) and the GND also serves to stop oscillation of the IC circuit. Consequently, make sure to use one with good temperature characteristics.

Electrical characteristic curves

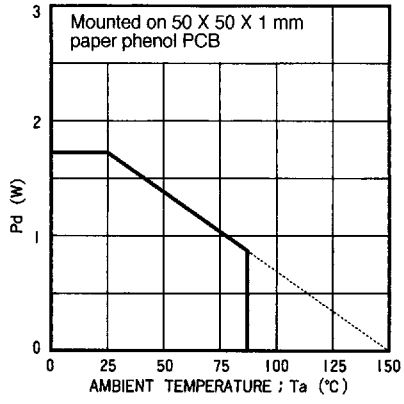


Figure 11

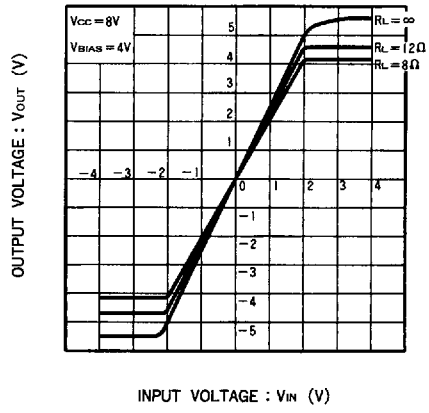


Figure 12

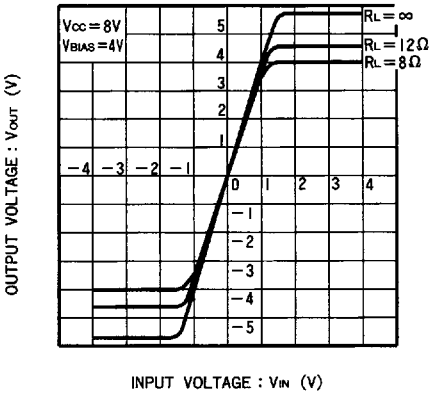


Figure 13

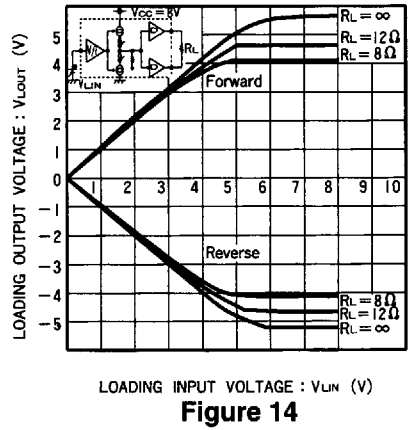


Figure 14

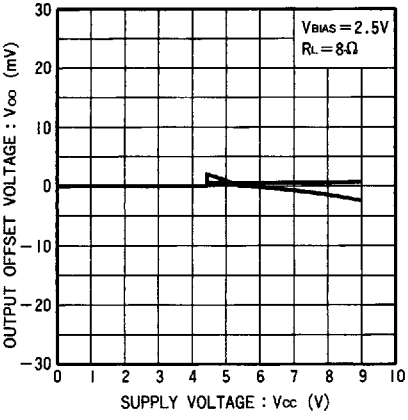


Figure 15

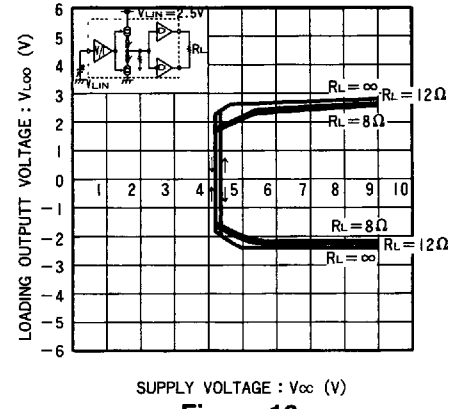


Figure 16

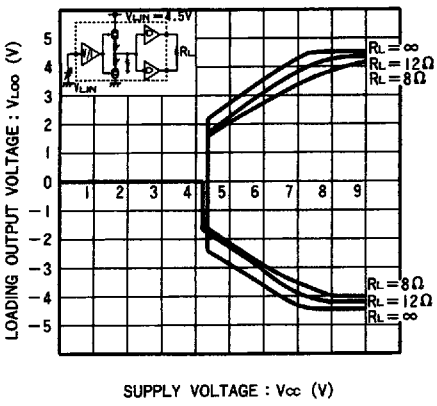


Figure 17

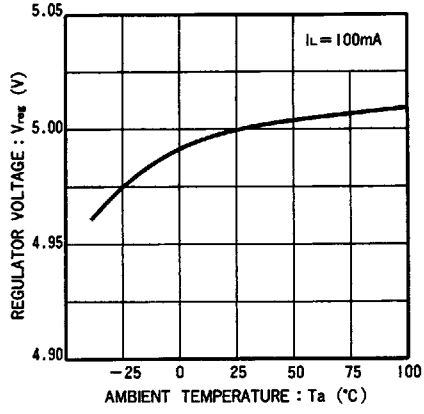


Figure 18