# HA16631P,
HA16631MP

**Read Amplifier**

Description

The HA16631P and HA16631MP monolithic read amplifiers for flexible disk drives provide wave-shaped output signals. The differentiator, zero-volt comparator generate data pulses from the amplified signals from the magnetic head and waveform shaper section.

Features

- Combines all the flexible disk read amplifier function active circuits in one chip
- Direct connection with TTLs

HA16631P

(DP-18A)

HA16631MP

(MP-18)
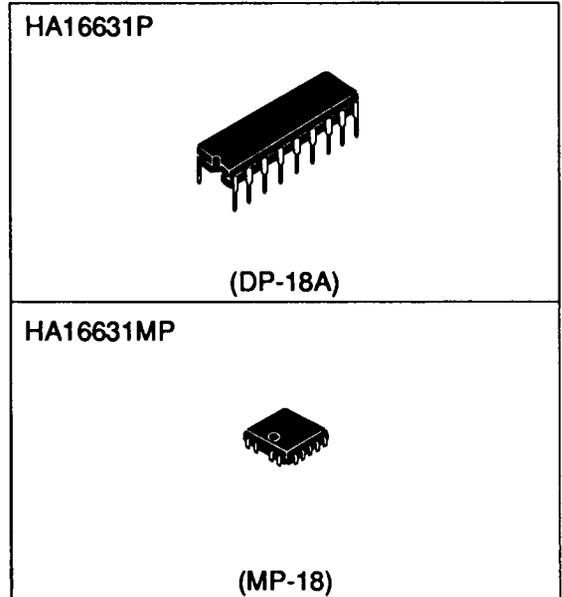
Block Diagram
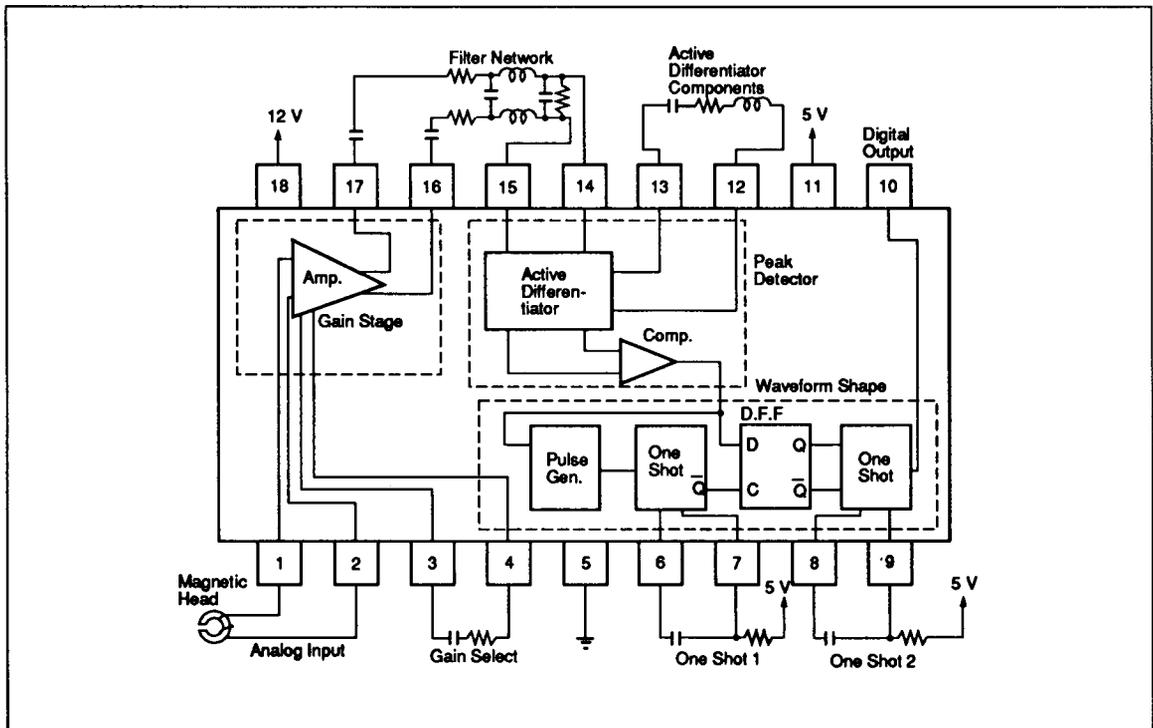
Pin Arrangement

HA16631P

Amp. Input	1	18	Vcc2
	2	17	Amp. Output
Offset Decoupling	3	16	
	4	15	Diff. Input
GND	5	14	
One-Shot 1	6	13	Diff. Comp.
	7	12	
One-Shot 2	8	11	Vcc1
	9	10	Data Output

(Top view)

HA16631MP

Amp Input 2, Amp Input 1, Vcc2 18, Amp Output 17

Offset Decoupling 3		16 Amp Output
Offset Decoupling 4		15 Diff. Input
GND 5		14 Diff. Input
One-Shot 1 6		13 Diff. Comp.
One-Shot 1 7		12 Diff. Comp.

8 One-Shot 2, 9 One-Shot 2, 10 Data Output, 11 Vcc1
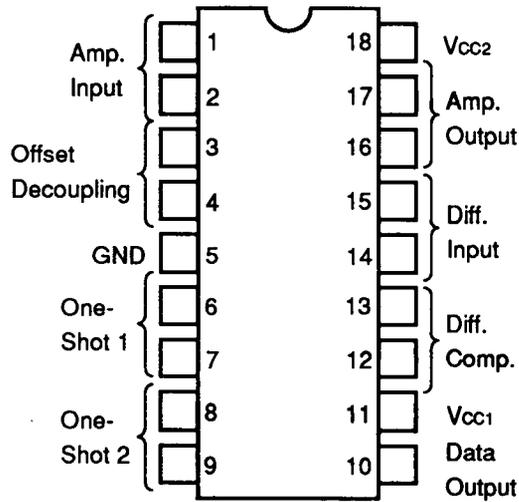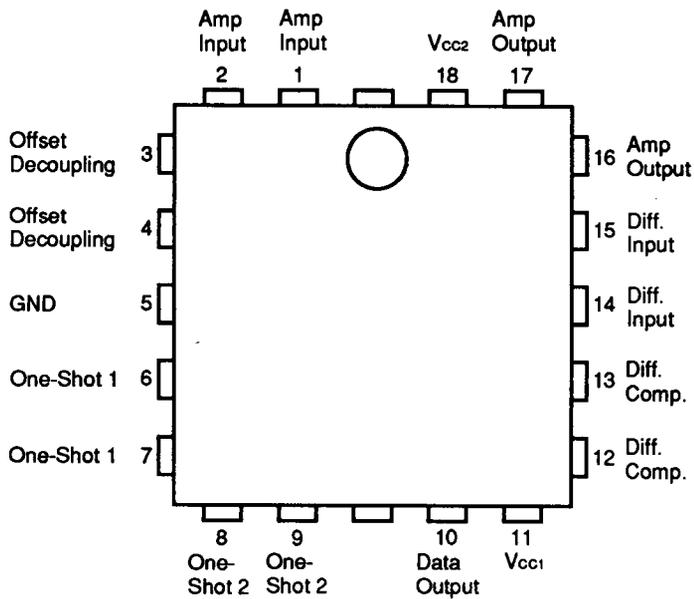
(Top view)

HA16631P, HA16631MP

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Power supply voltage (Pin 11)	VCC1	7.0	V
Power supply voltage (Pin 18)	VCC2	16	V
Input voltage (Pins 1 and 2)	VIN	−0.2 to +7.0	V
Output voltage (Pin 10)	VO	−0.2 to +7.0	V
Differential input voltage (Pins 1 and 2)	VIN (diff)	0 to +5.0	V
Operating temperature	Topr	0 to +70	°C
Storage temperature	Tstg	−55 to +125	°C

Electrical Characteristics

Operating Power Supply Voltage Range (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Power supply voltage range	VCC1R	4.75	5.00	5.25	V		
Power supply voltage range	VCC2R	10.0	12.0	14.0	V		

Amplifier Section (Ta = 25°C, VCC1 = 5.0 V, VCC2 = 12.0 V, unless otherwise specified)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Differential voltage gain	AVD	80	110	140	V/V	f = 250 kHz, VIN = 5 m Vrms VCC1R, VCC2R	Fig. 2
Input bias current	IIB	—	1	9	μA	VCC2 = 12 V, VCM = 4 V	Fig. 4
Common mode voltage range	VCM	1.85	—	6.2	V		Fig. 2
Output distortion ratio	THD	—	1.5	5	%	f = 1 kHz, VIN = 25 mVp-p VCC1R, VCC2R	Fig. 2
Differential output voltage swing	VOD	3.0	4.2	—	Vp-p	VCC1R, VCC2R	Fig 2
Output source current	IO	—	8.0	—	mA		Fig. 8
Output sink current (Pins 16 and 17)	IOS	2.8	4	—	mA	VCC1R, VCC2R	Fig. 9
Input resistance	rIN	30	120	—	kΩ		Fig. 5
Output resistance	ro	—	15	—	Ω		Fig. 6
Common mode rejection ratio	CMRR	50	—	—	dB	f = 100 kHz, VIN = 200 mVp-p	Fig. 11

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Power supply rejection ratio Vcc1	PSRR1	50	—	—	dB	Vcc = 12.0 V 4.75 V ≤ Vcc1 ≤ 5.25 V	Fig. 10
Power supply rejection ratio Vcc2	PSRR2	60	—	—	dB	Vcc1 = 5.0 V 10.0 V ≤ Vcc2 ≤ 14.0 V	Fig. 10
Differential output offset voltage	VDO	—	—	0.4	V		Fig. 7
Common mode output voltage	Vco	—	3.1	—	V		Fig. 7
Effective differential emitter resistance (Pins 3 and 4)	REFF	370	570	770	Ω		Fig. 3

Peak Detector Section (Ta = 25°C, VCC1 = 5.0 V, VCC2 = 12.0 V, unless otherwise specified)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Sink current (Pins 12 and 13)	ISD	1.0	1.5	—	mA		Fig. 12
Peak shift	Ps	—	—	5	%	f = 250 kHz, VIN = 1.0 Vp-p	Fig. 13
Input resistance	rID	—	30	—	kΩ		Fig. 17
Outupt resistance	rOP	—	40	—	Ω		

HA16631P, HA16631MP

Waveform Shaper Section (Ta = 25°C, V_{CC1R}, V_{CC2R}, unless otherwise specified)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Output voltage H (Pin 10)	V_{OH}	2.7	—	—	V	V_{CC1} = 4.75 V V_{CC2} = 12.0 V, I_{OH} = −0.4 mA	Fig. 15
Output voltage L (Pin 10)	V_{OL}	—	—	0.5	V	V_{CC1} = 4.75 V V_{CC2} = 12.0 V, I_{OL} = 8 mA	Fig. 16
Rising time (Pin 10)	t_{TLH}	—	—	25	ns	V_{CC1} = 5.0 V, V_{CC2} = 12.0 V V_{out} = 0.5 V $\rightarrow$ 2.7 V	Fig. 14
Falling time (Pin 10)	t_{THL}	—	—	25	ns	V_{CC1} = 5.0 V, V_{CC2} = 12.0 V V_{out} = 2.7 V $\rightarrow$ 0.5 V	Fig. 14
Timing range #1	$t_{1A, B}$	600	—	2000	ns	f = 125 kHz	
		600	—	1000	ns	f = 250 kHz	
Timing accuracy #1	t_1	850	1000	1150	ns	t_1 = 0.625 C_1R_1 +150 C_1 = 200 pF, R_1 = 6.8 kΩ	Fig. 14
Timing capacitance #1	C_1	150	—	680	pF		Fig. 14
Timing resistance #1	R_1	1.5	—	10	kΩ		Fig. 14
Timing range #2	$t_{2A, B}$	150	—	1000	ns	f = 125 kHz	
		150	—	750	ns	f = 250 kHz	
Timing accuracy #2	t_2	170	200	230	ns	t_1 = 0.625 C_1R_1 C_1 = 200 pF, R_1 = 1.6 kΩ	Fig. 14
Timing capacitance #2	C_2	100	—	800	pF		Fig. 14
Timing resistance #2	R_2	1.5	—	10	kΩ		Fig. 14

Test Circuits
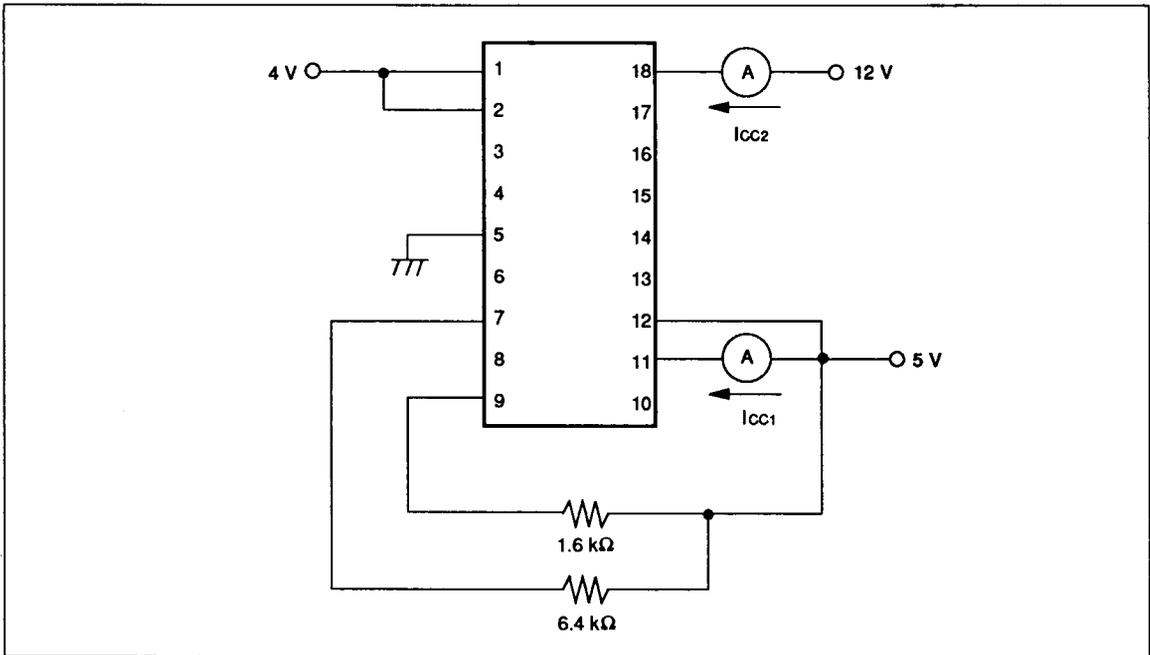
Figure 1   Power Supply Current

$$Av = \frac{Vo16 - Vo17}{Vin}$$
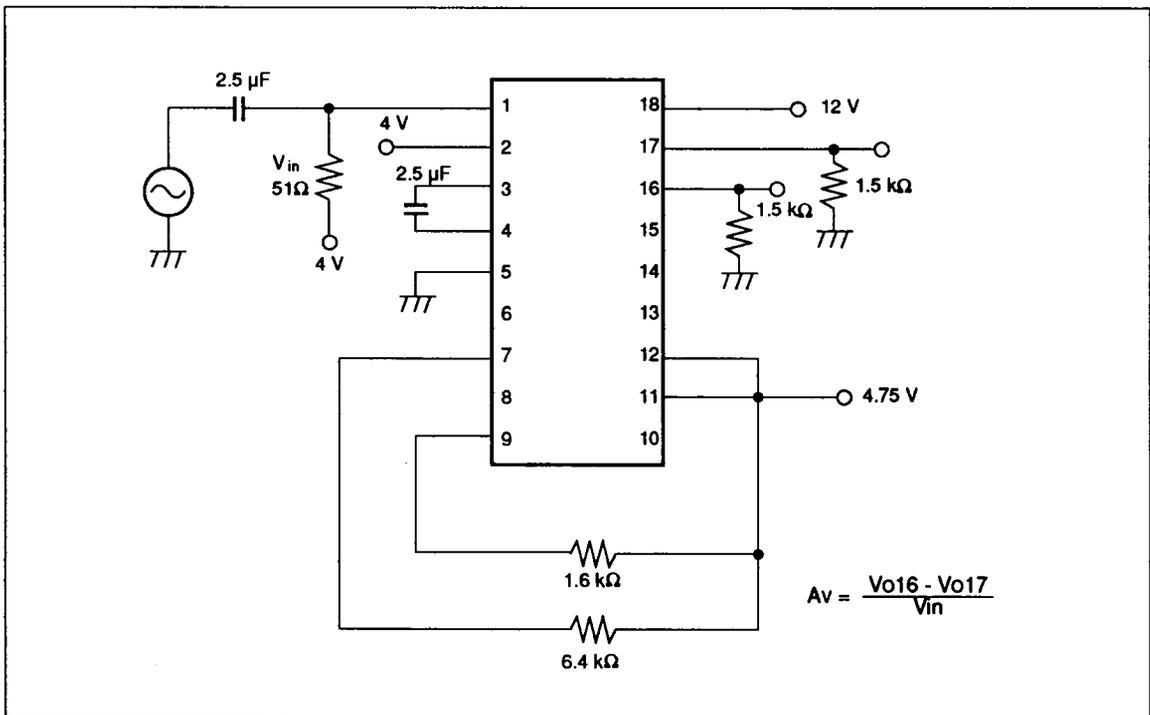
Figure 2   Voltage Gain, Band-width, Output Voltage Swing, Output Distortion Ratio
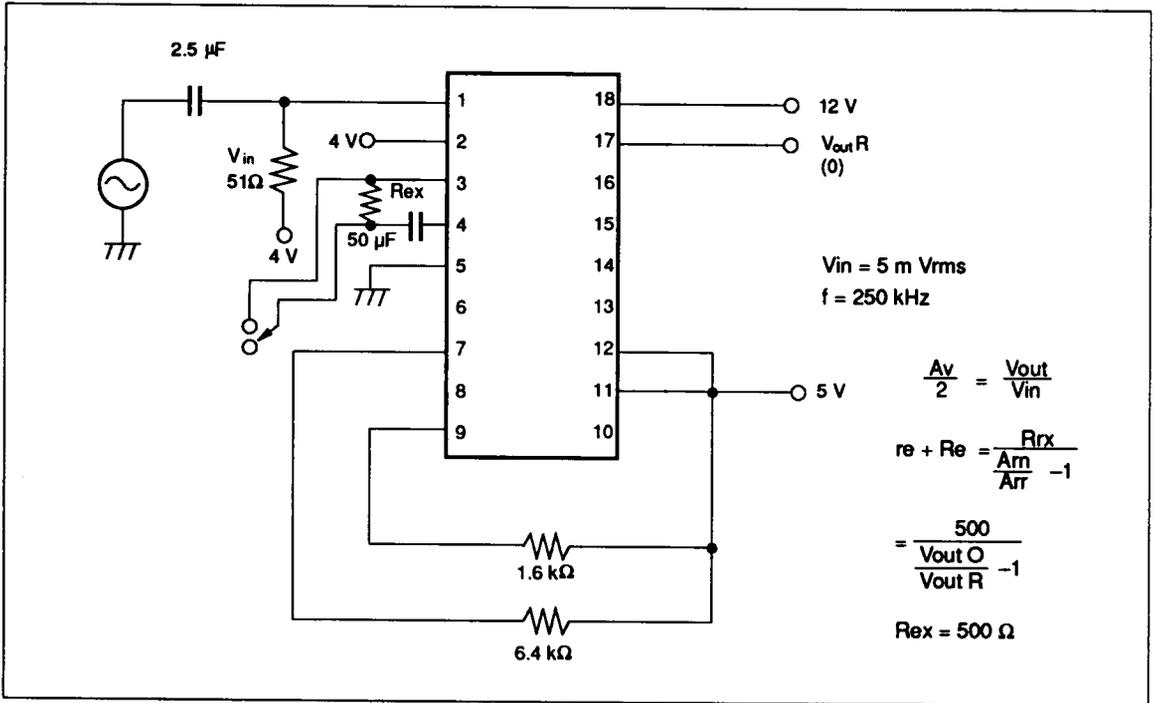
**Figure 3   Pre-Amplifier Section Effective Emitter Resistance (Pins 3 and 4)**

The following are shown in the figure:

Vin = 5 m Vrms
f = 250 kHz

$$\frac{Av}{2} = \frac{Vout}{Vin}$$

$$re + Re = \frac{Rrx}{\frac{Am}{Arr} - 1}$$

$$= \frac{500}{\frac{Vout\ O}{Vout\ R} - 1}$$

Rex = 500 Ω
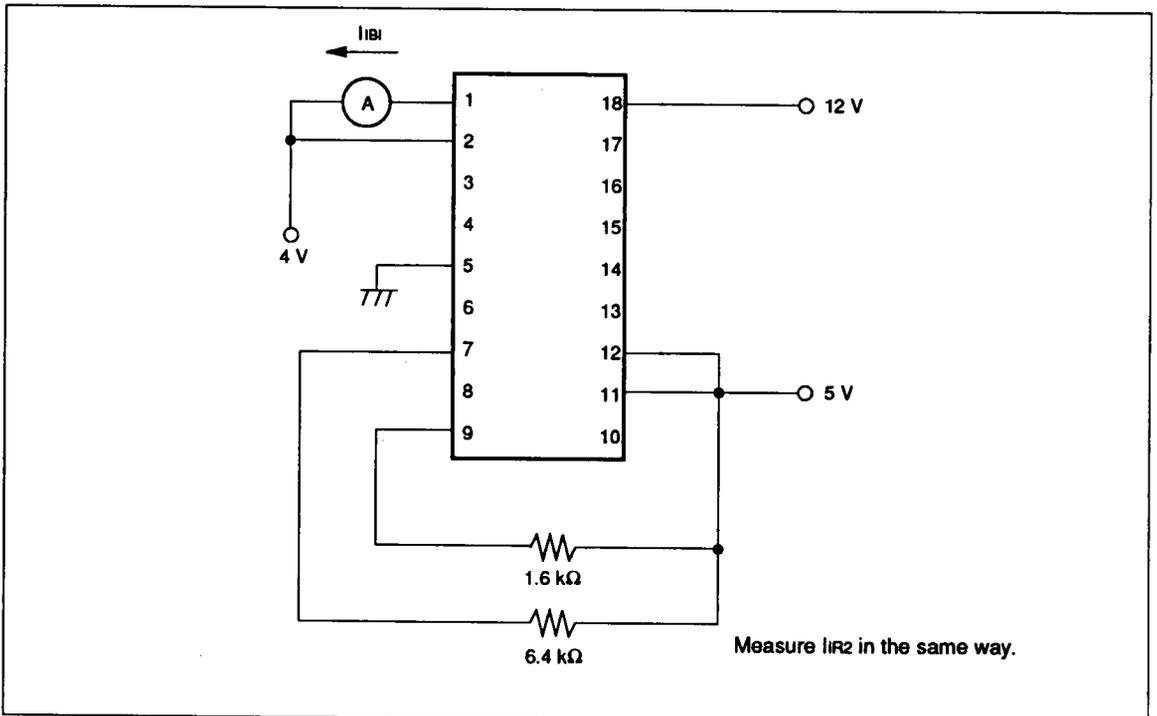
Figure 4   Input Bias Current

Measure I$_{IR2}$ in the same way.
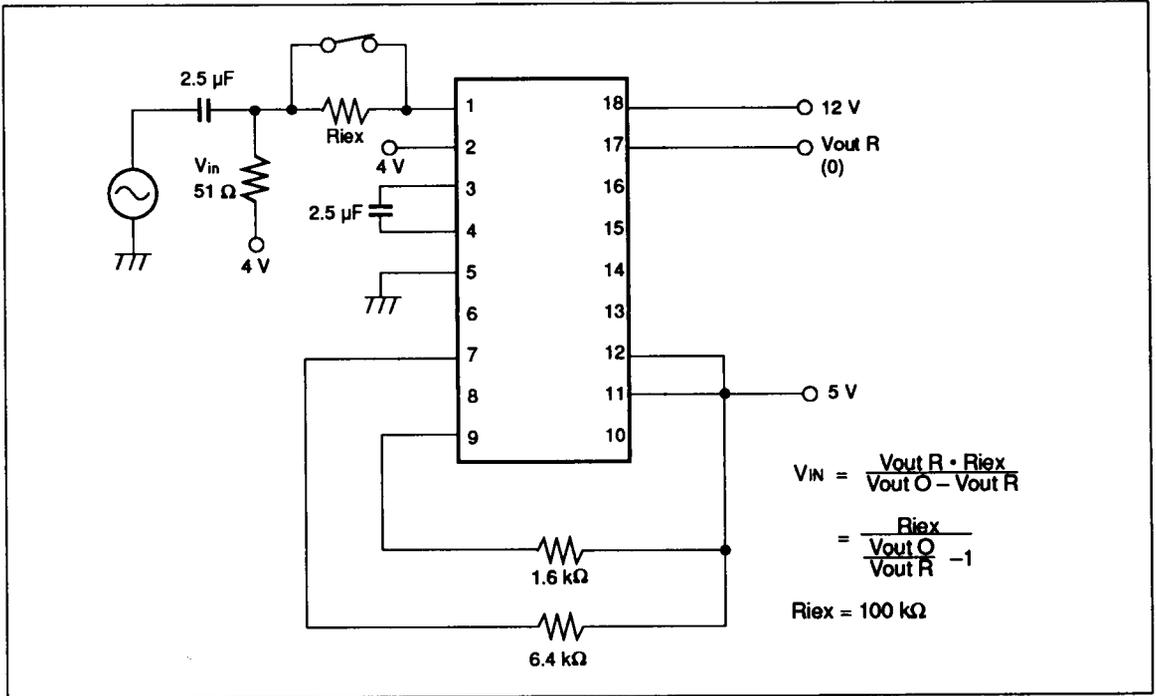
Figure 5   Input Resistance

$$V_{IN} = \frac{Vout\ R \cdot Riex}{Vout\ O - Vout\ R}$$

$$= \frac{Riex}{\frac{Vout\ O}{Vout\ R} - 1}$$

$$Riex = 100\ k\Omega$$
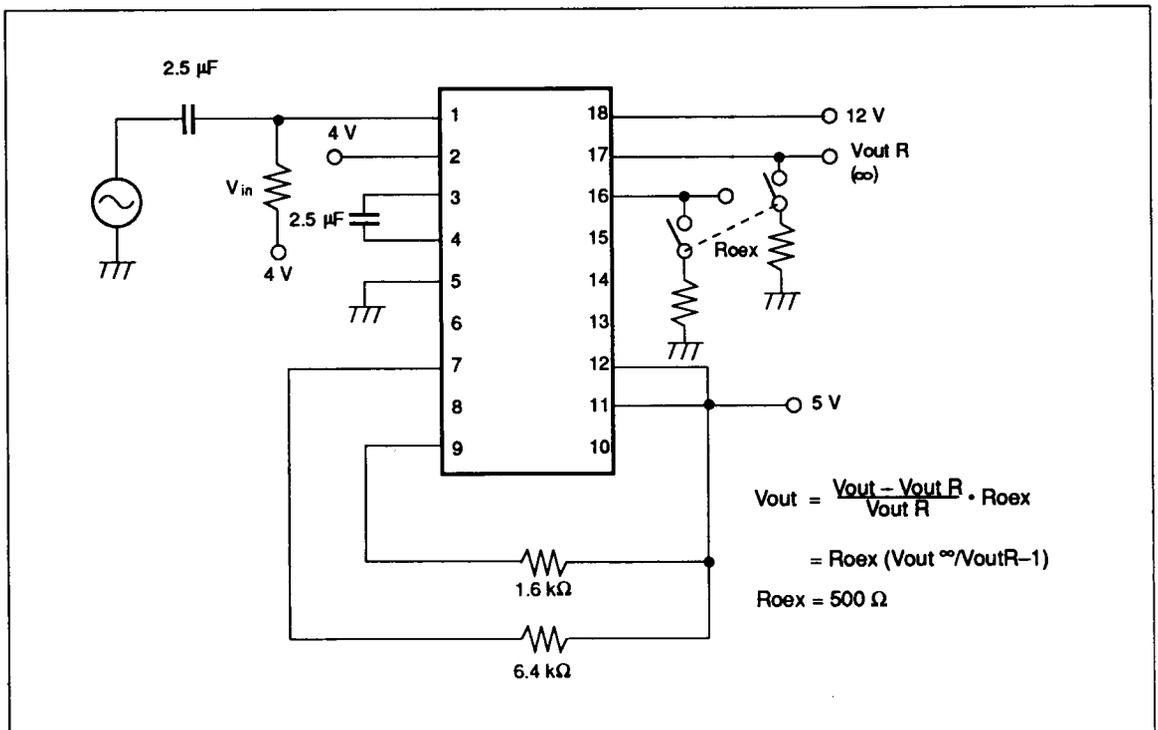
Figure 6   Output Resistance

$$Vout = \frac{Vout - Vout\ R}{Vout\ R} \cdot Roex$$

$$= Roex\ (Vout\ \infty / VoutR - 1)$$

$$Roex = 500\ \Omega$$
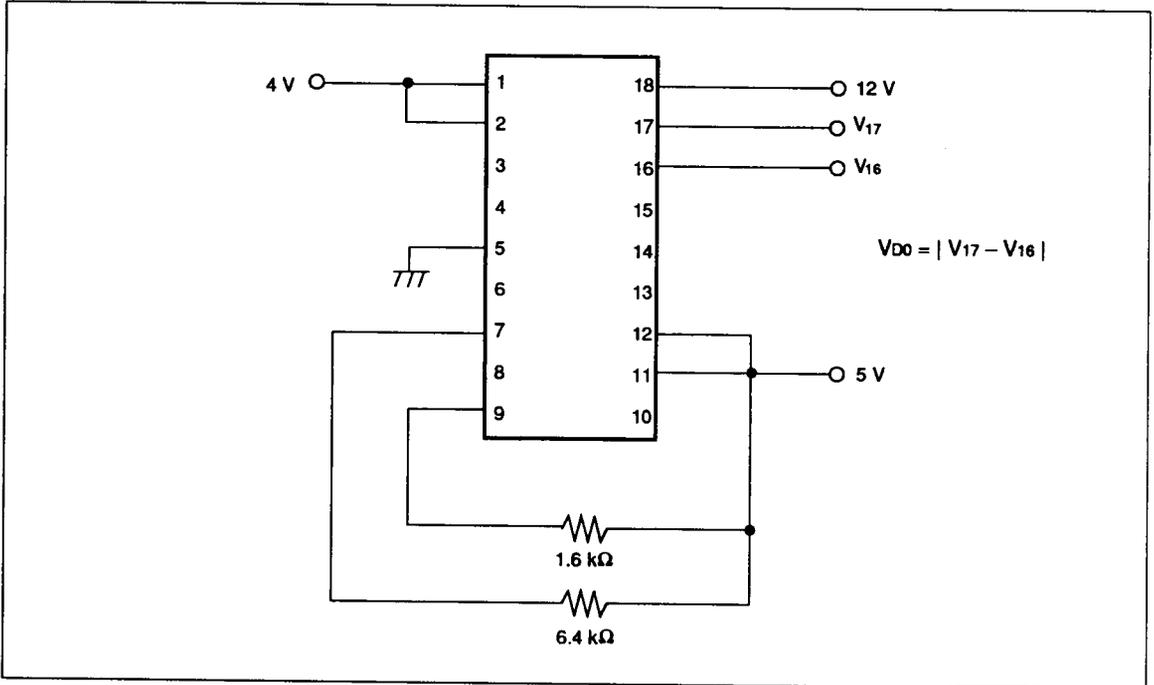
Figure 7 Differential Output Offset Voltage, Common Mode Output Voltage

$V_{DO} = |V_{17} - V_{16}|$

Measure pin 16 in the same way.

Rco: $V_{17}(\infty)$

$\{V_{17}(\infty) - V_{17}(R)\} \leq 0.1$ V
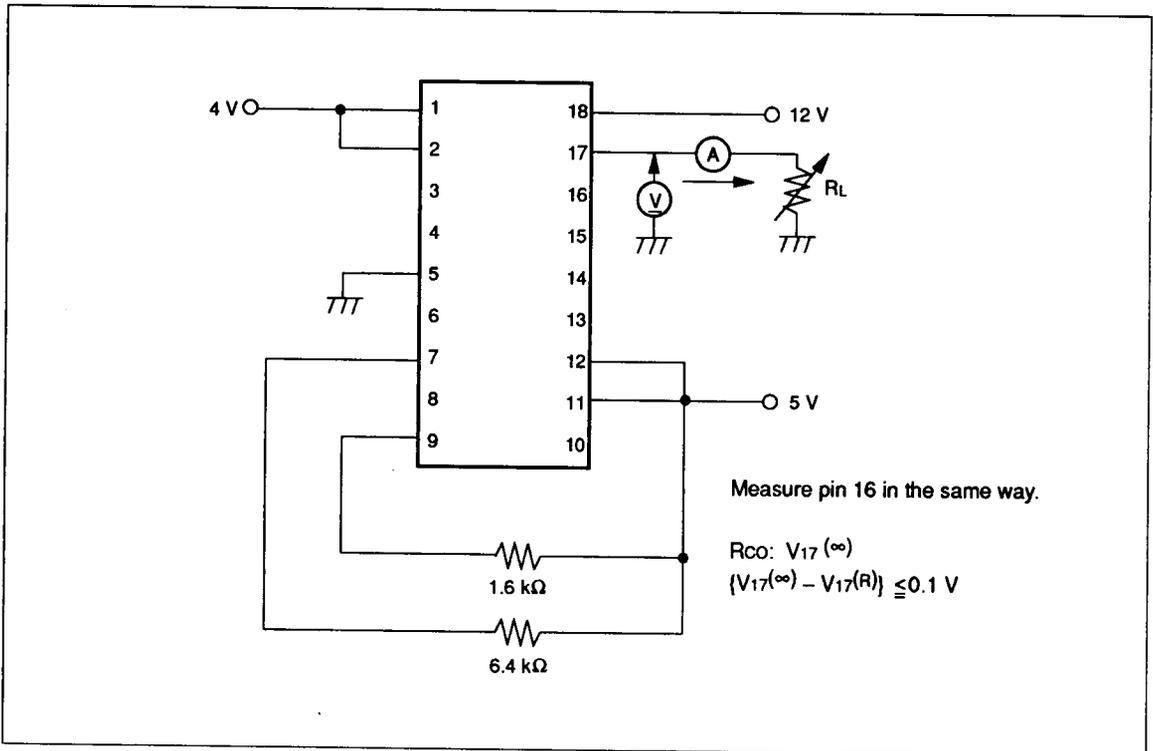
Figure 8 Output Source Current
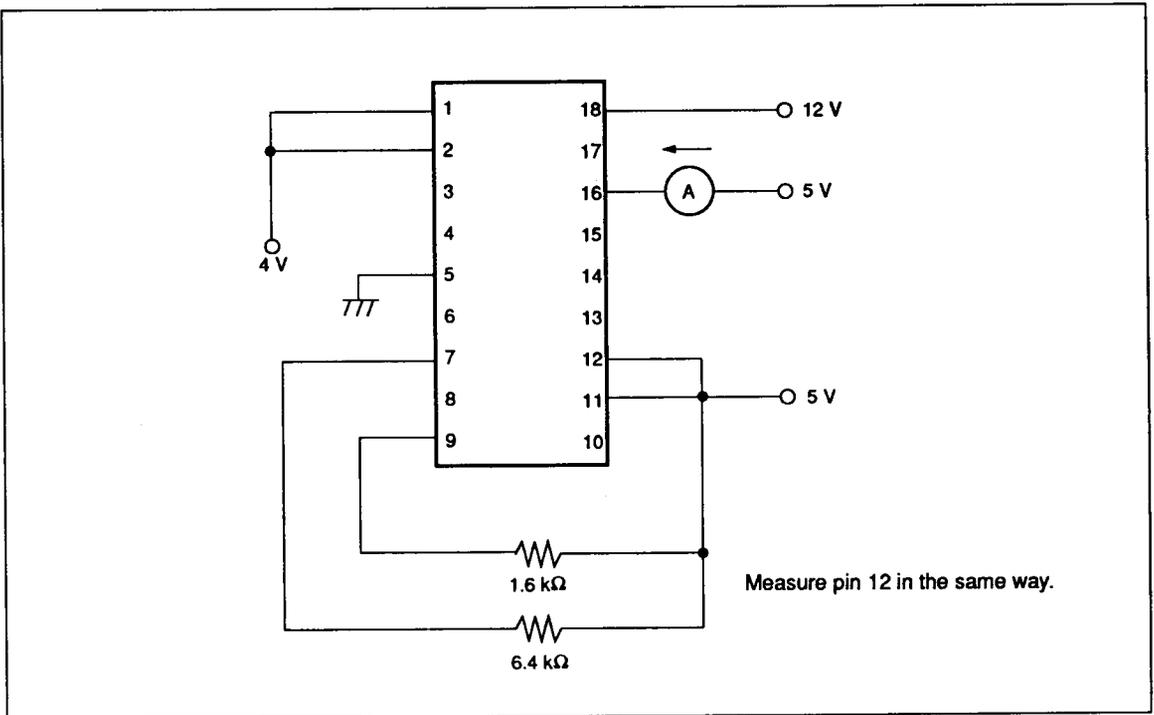
Figure 9   Output Sink Current

Measure pin 12 in the same way.
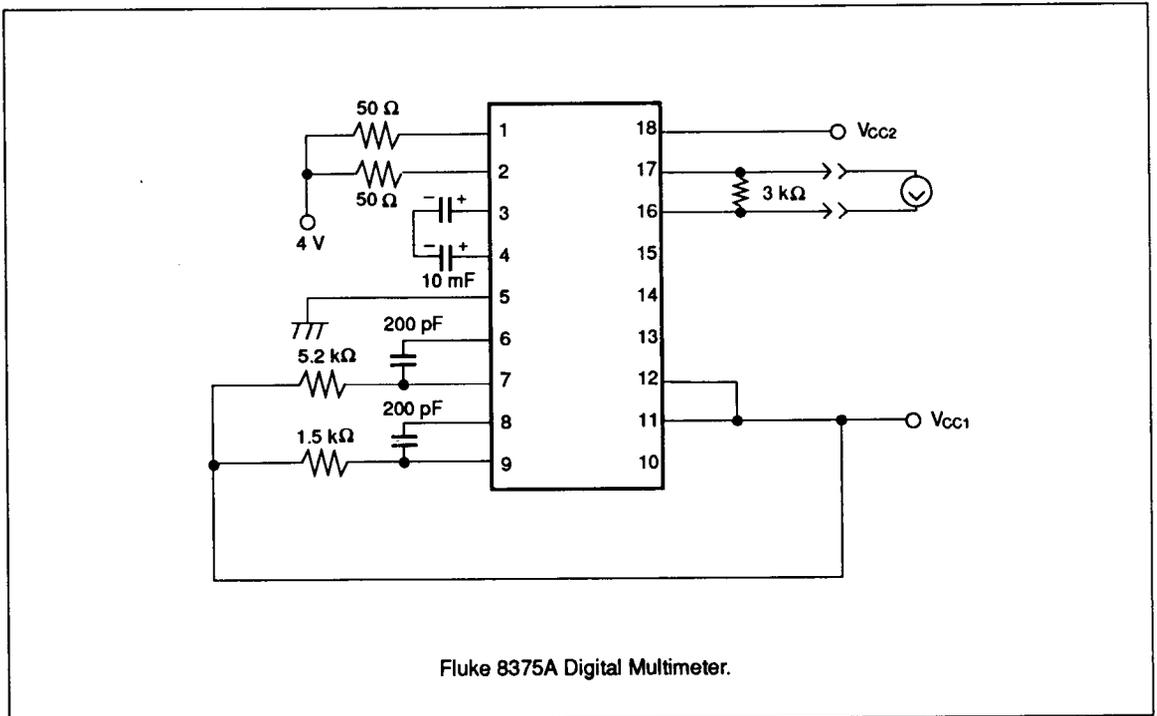
Figure 10   Power Supply Rejection Ratio

Fluke 8375A Digital Multimeter.

253
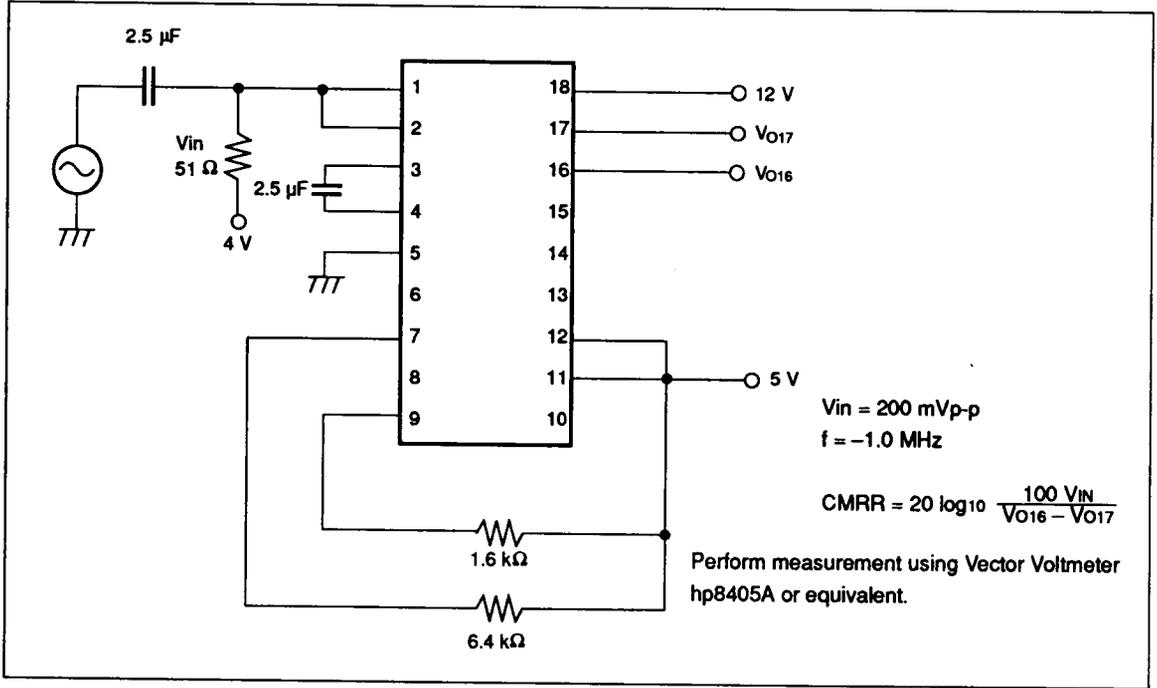
Figure 11 Common Mode Rejection Ratio

Vin = 200 mVp-p

f = −1.0 MHz

$$CMRR = 20 \log_{10} \frac{100\ V_{IN}}{V_{O16} - V_{O17}}$$

Perform measurement using Vector Voltmeter hp8405A or equivalent.

Measure pin 2 in the same way.
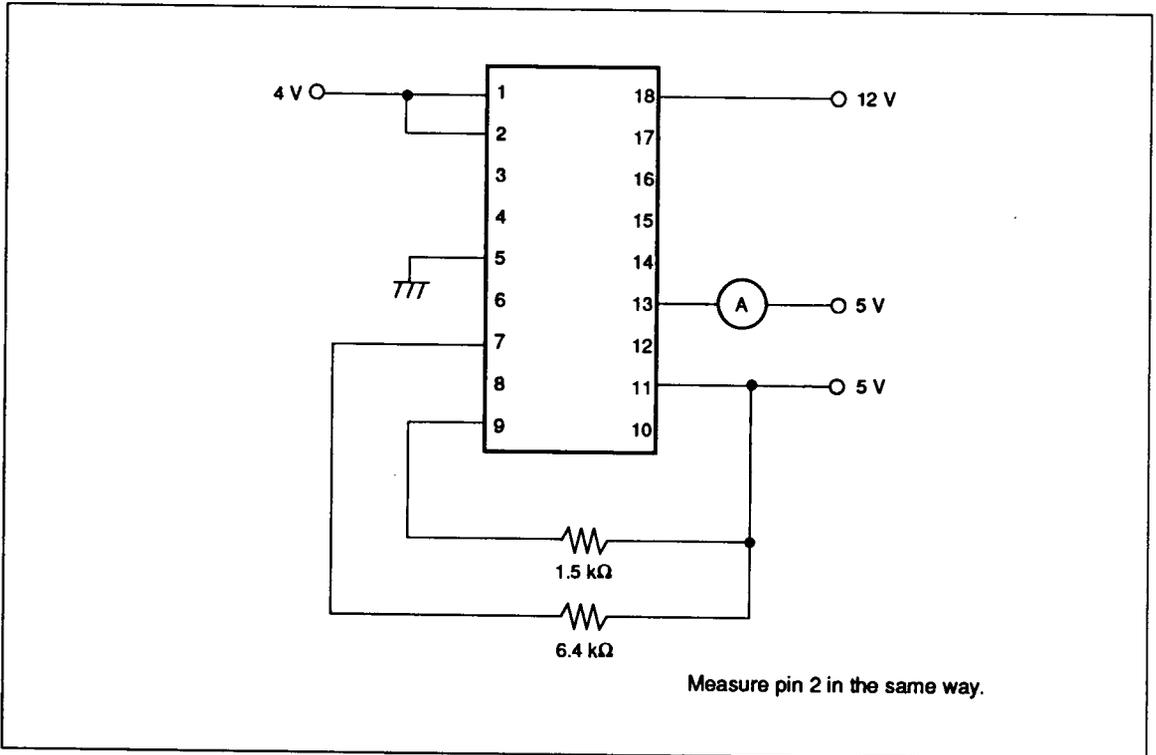
Figure 12 Differentiator Output Sink Current

Figure 13   Peak Shift
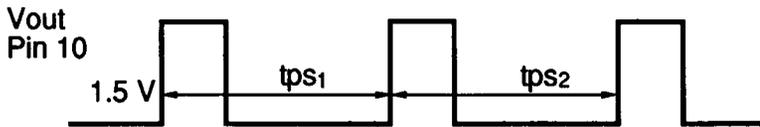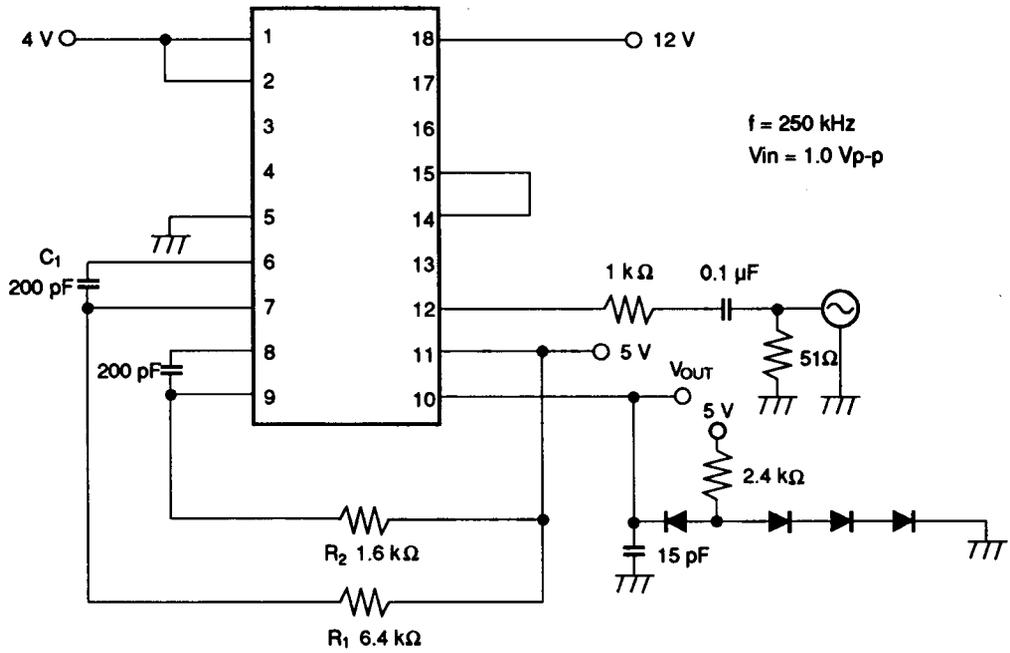
$$PS = 1/2 \cdot \frac{tps1 - tps2}{tps1 + tps2} \times 100\%$$

$$t_{TLH} = t_{THL} = 10 \text{ ns}$$
$$f = 250 \text{ kHz}$$
50% Duty Cycle

$$E_{t1A} = \frac{t_{1A}}{1{,}000 \text{ ns}} \times 100\%$$

$$E_{t1B} = \frac{t_{1B}}{1{,}000 \text{ ns}} \times 100\%$$

$$E_{t2} = \frac{t_2}{200 \text{ ns}} \times 100\%$$
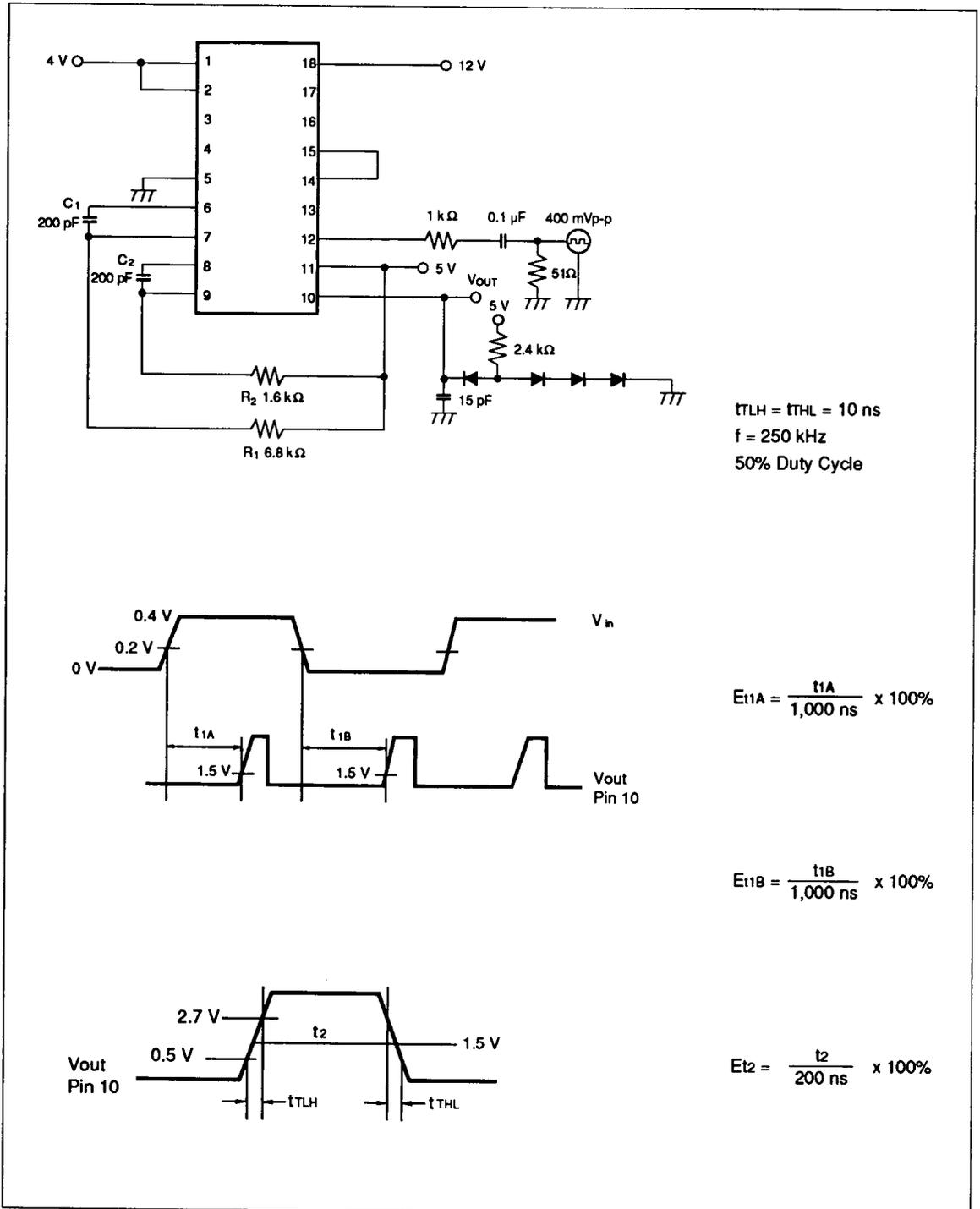
Figure 14   Timing Accuracy, Rising Time, Falling Time
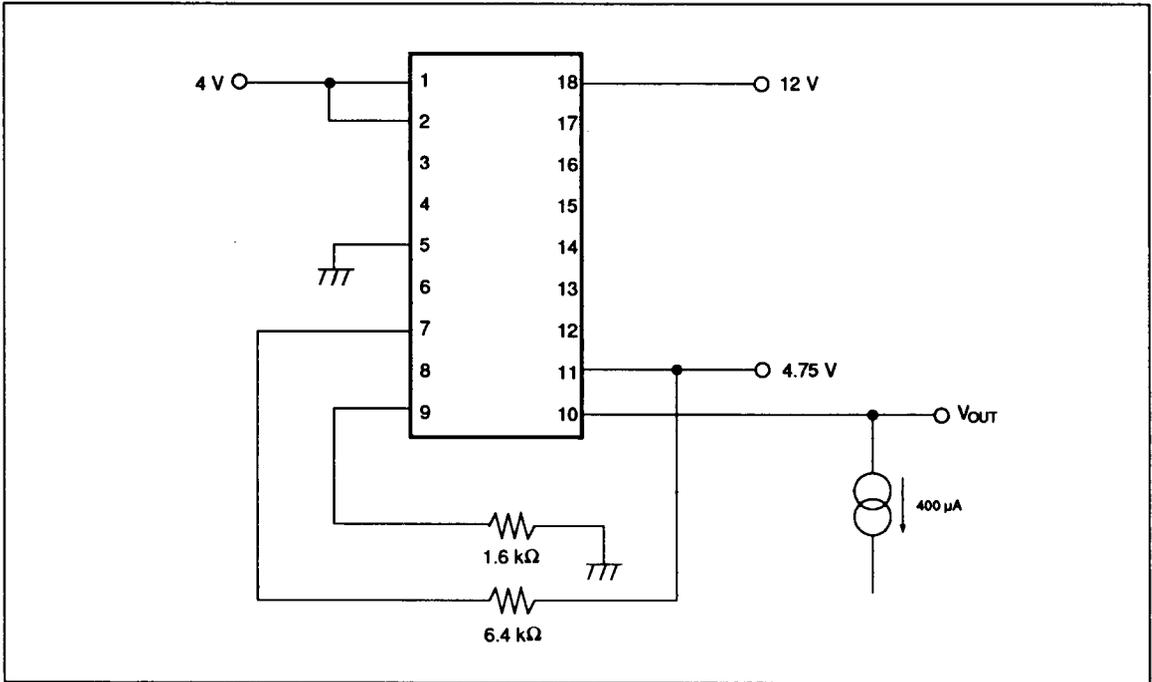
Figure 15 Output Voltage High (Pin 10)
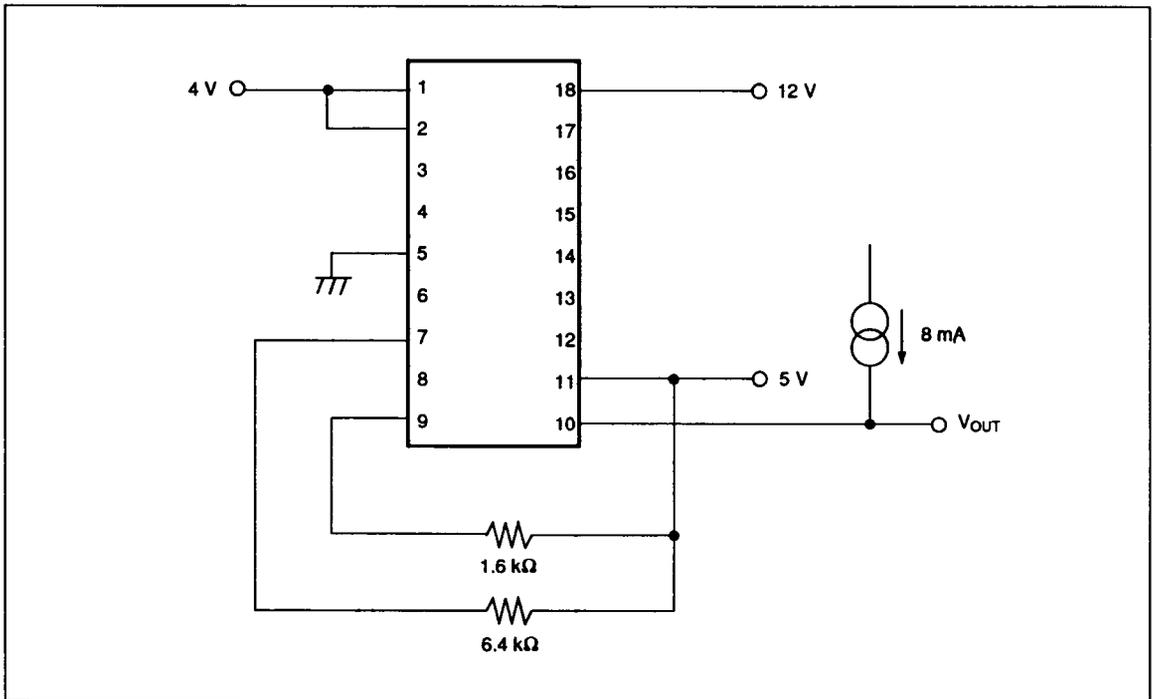
Figure 16 Output Voltage Low (Pin 10)

$$R = \frac{0.5}{I(mA)} (k\Omega)$$
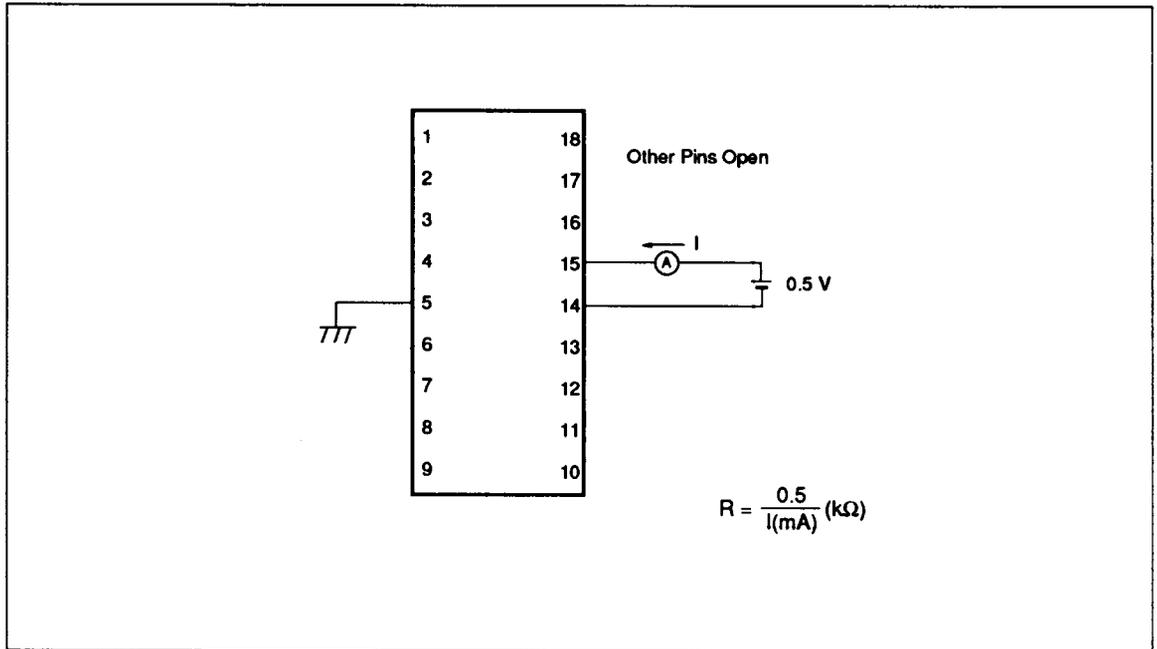
Figure 17   Input Resistance
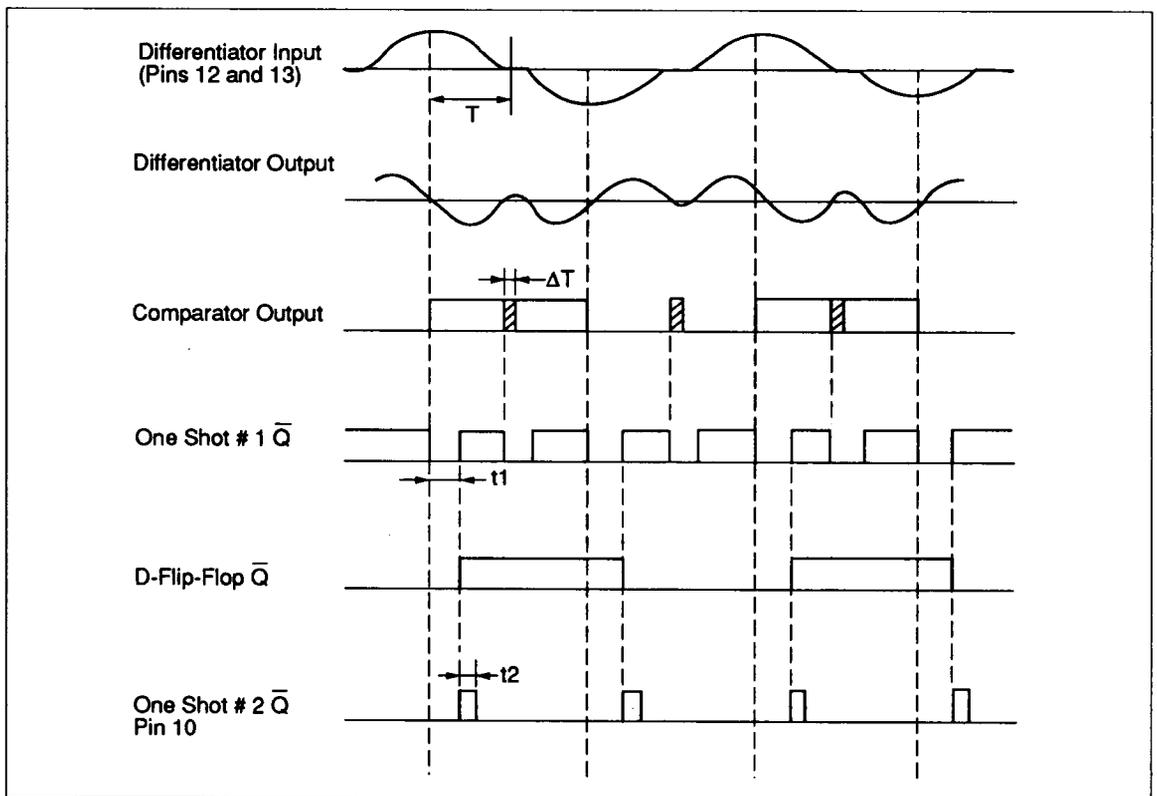
Figure 18   Timing Waveforms
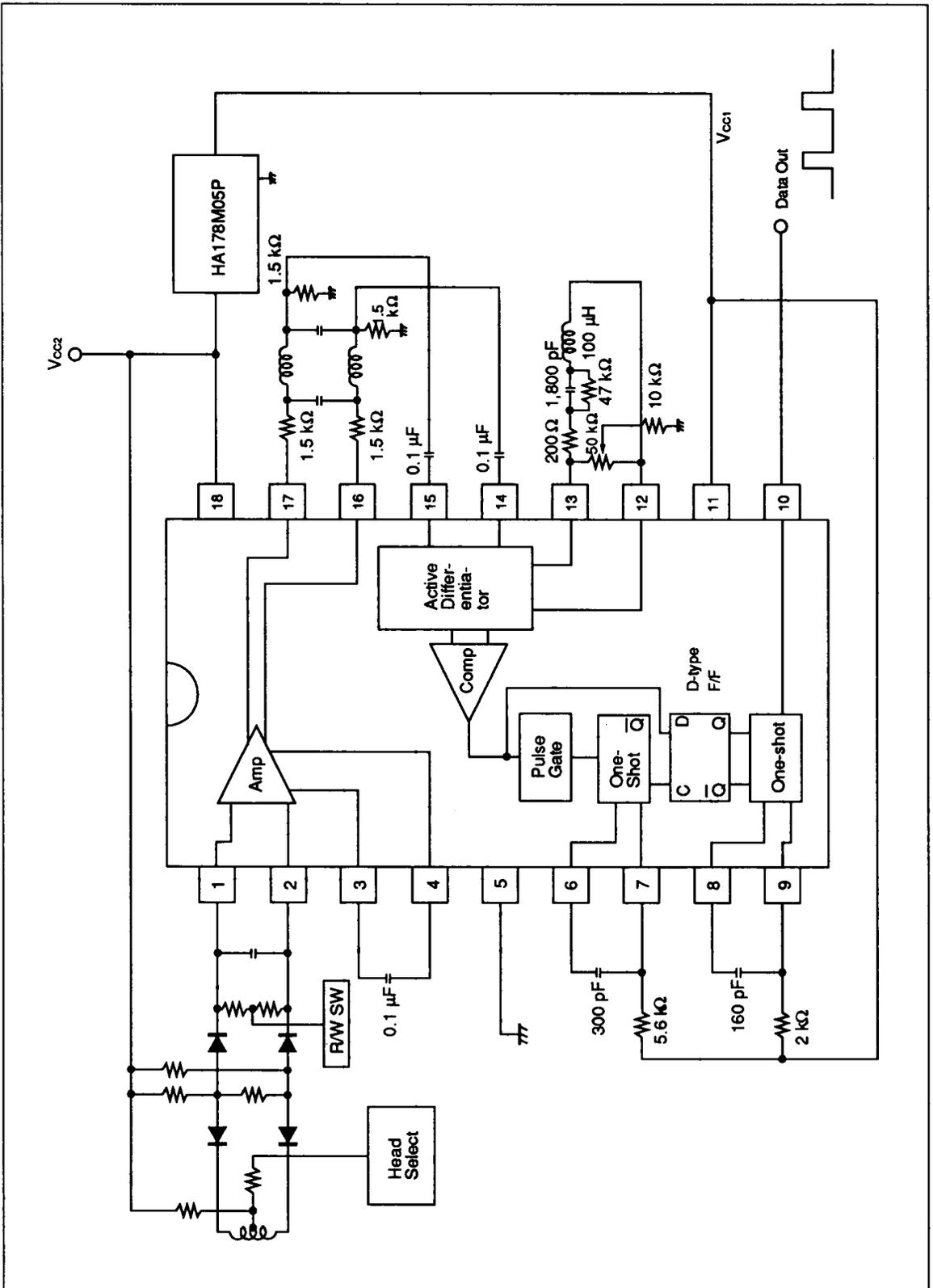
Figure 19   Circuit Example

259
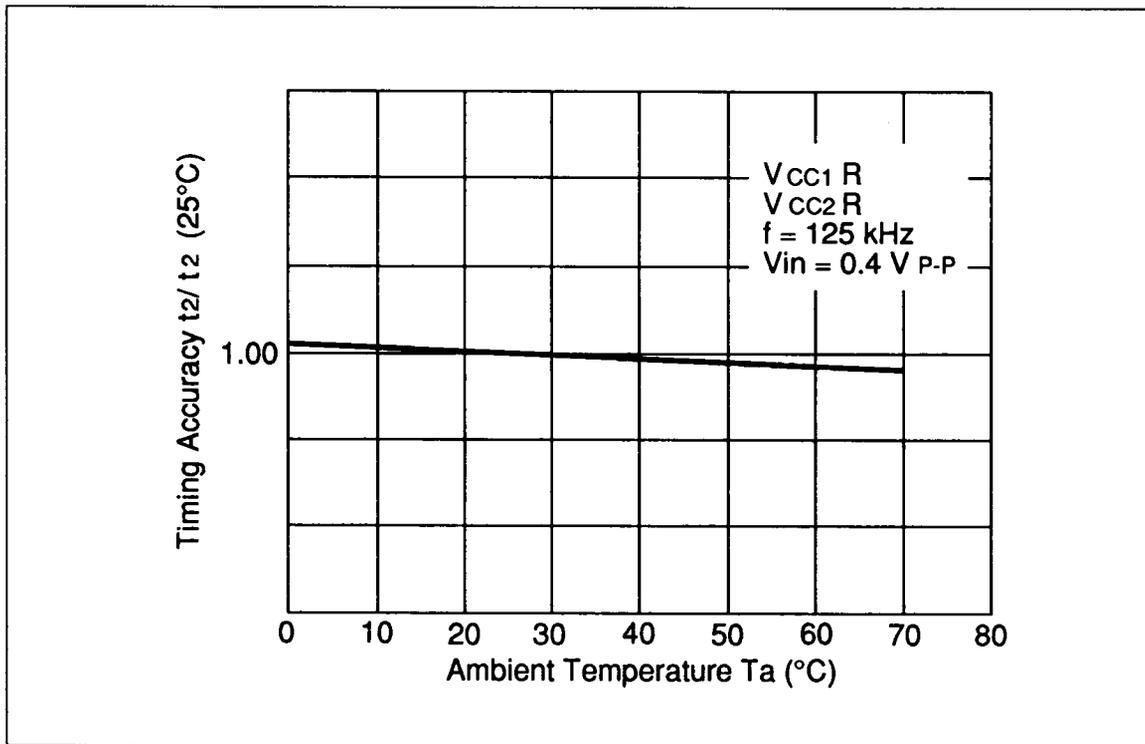
Figure 20　Timing Accuracy vs Ambient Temperature
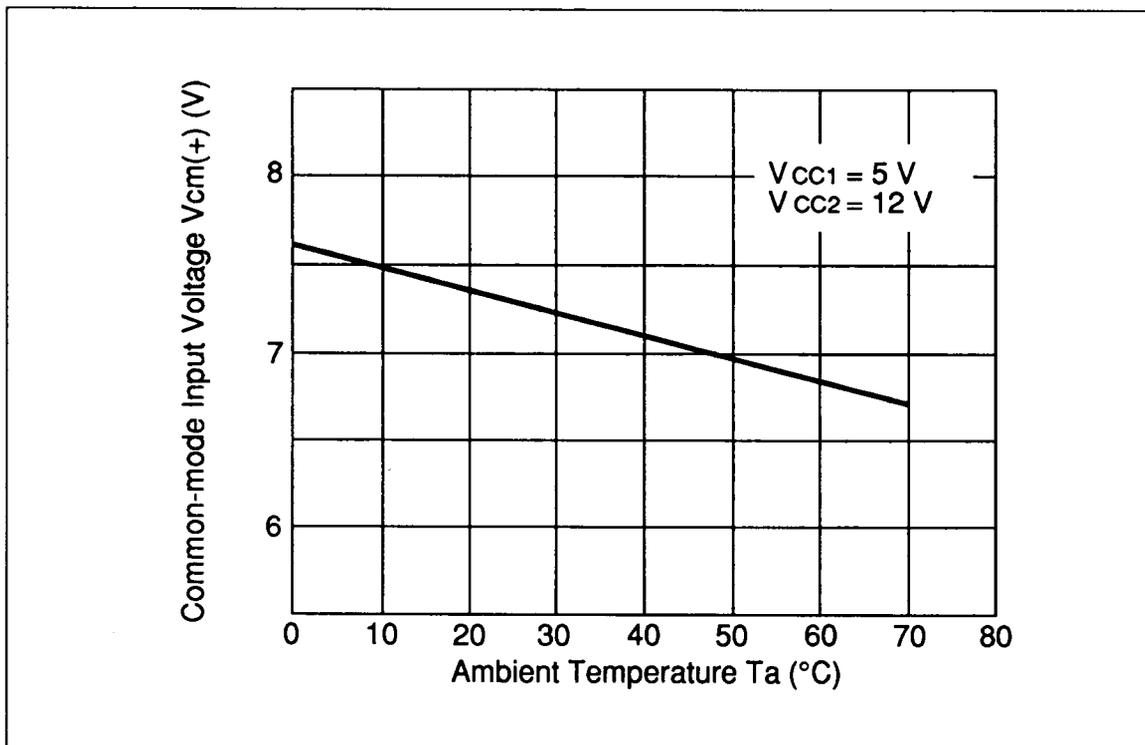
Figure 21　Common-Mode Input Voltage vs Ambient Temperature
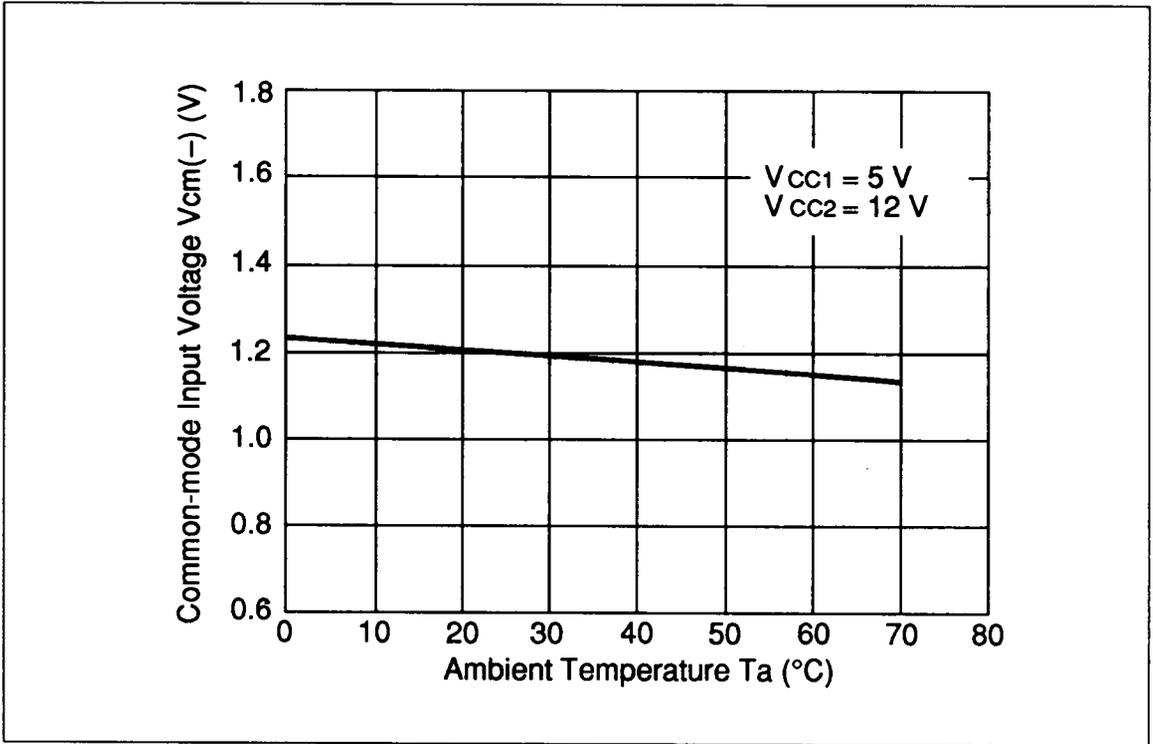
Figure 22   Common-Mode Input Voltage vs Ambient Temperature
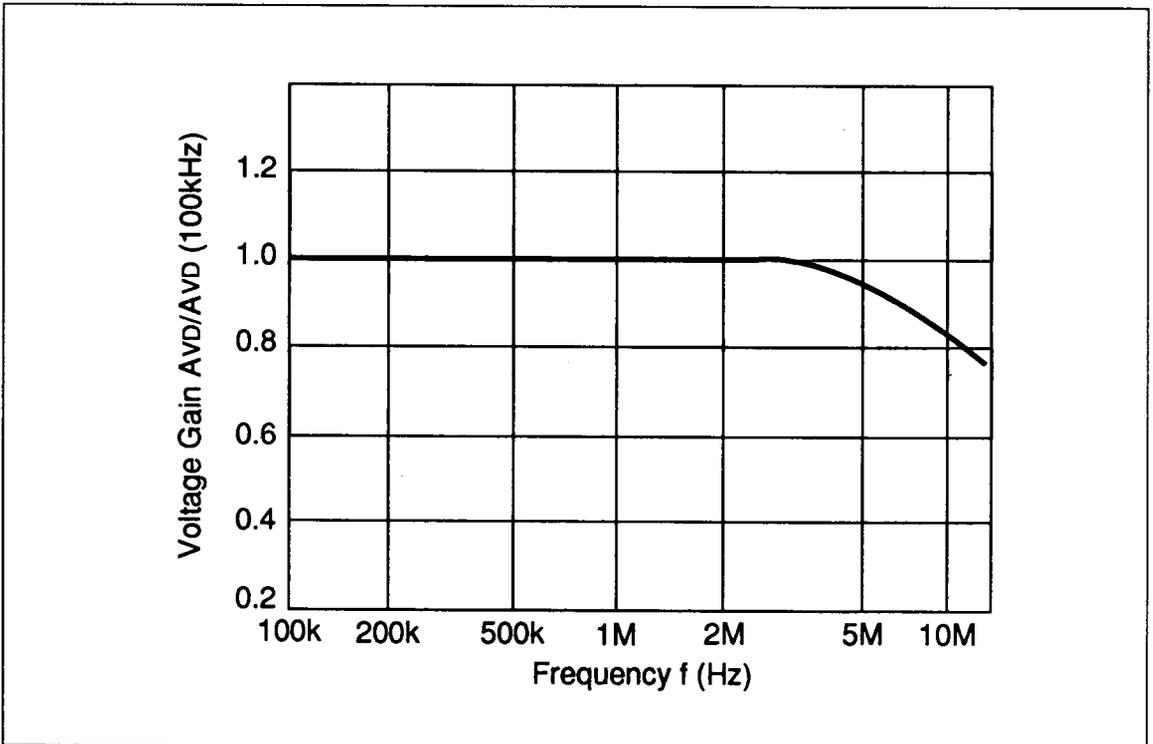

Figure 23   Voltage Gain vs Frequency
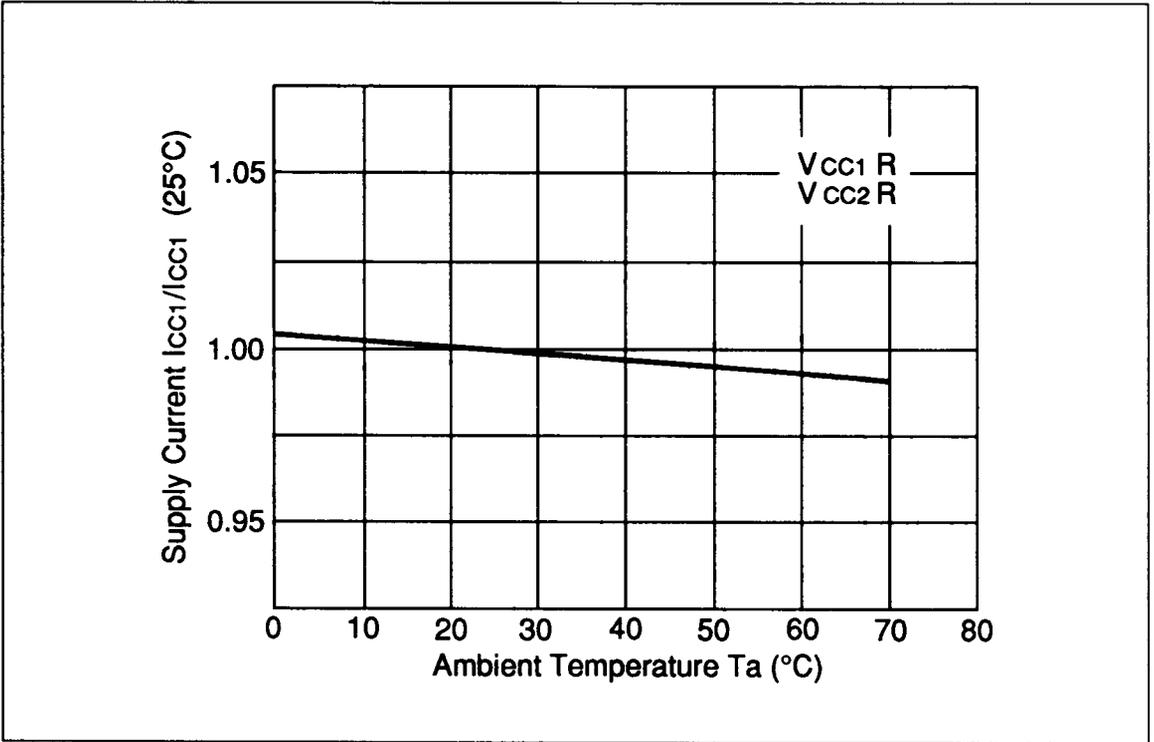
Figure 24 Supply Current vs Ambient Temperature (1)
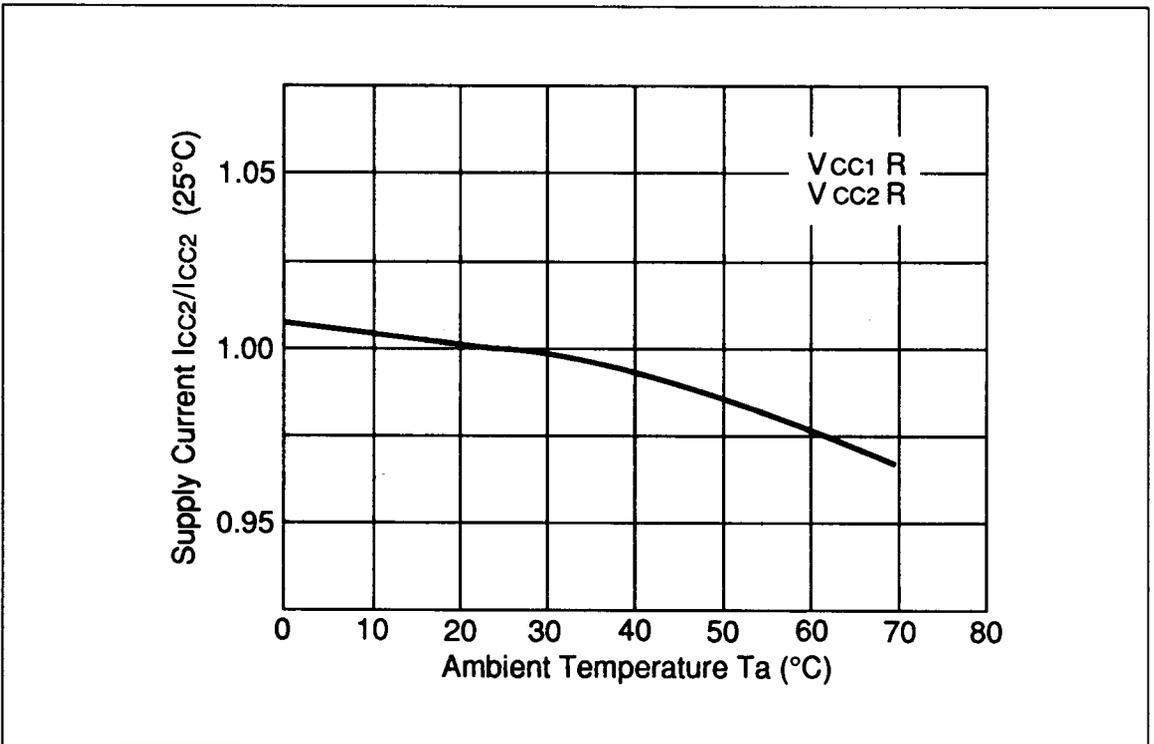
Figure 25 Supply Current vs Ambient Temperature (2)
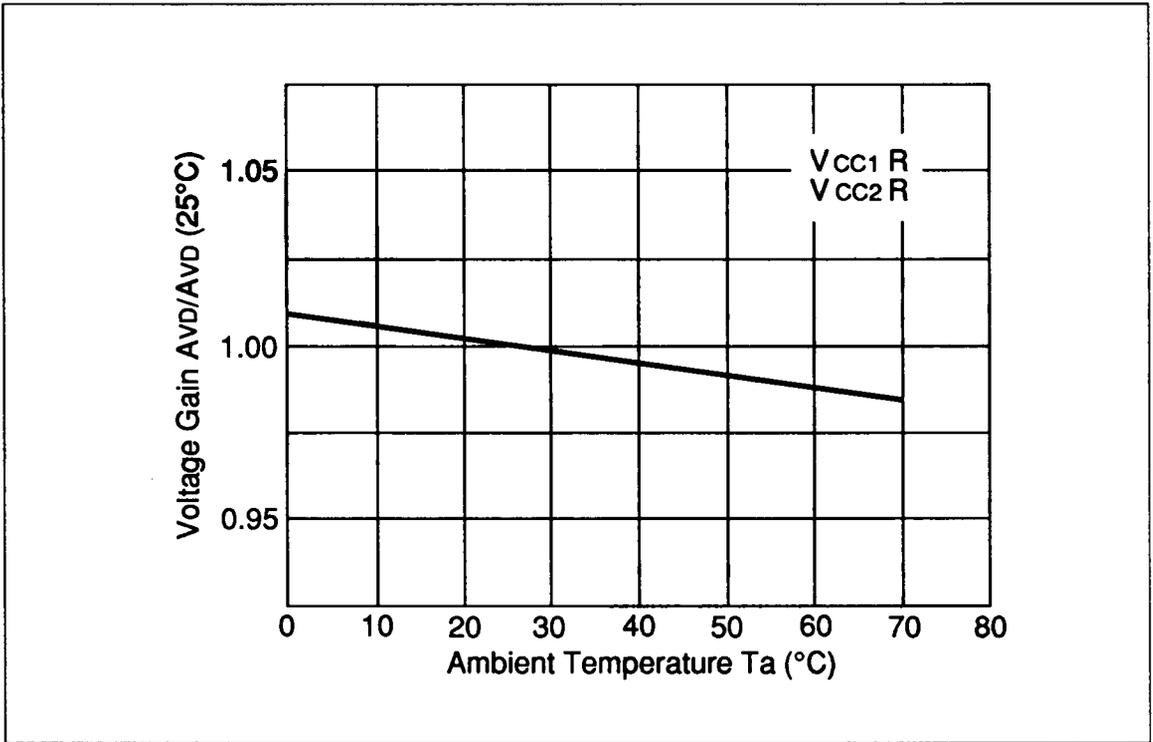
**Figure 26   Voltage Gain vs Ambient Temperature**
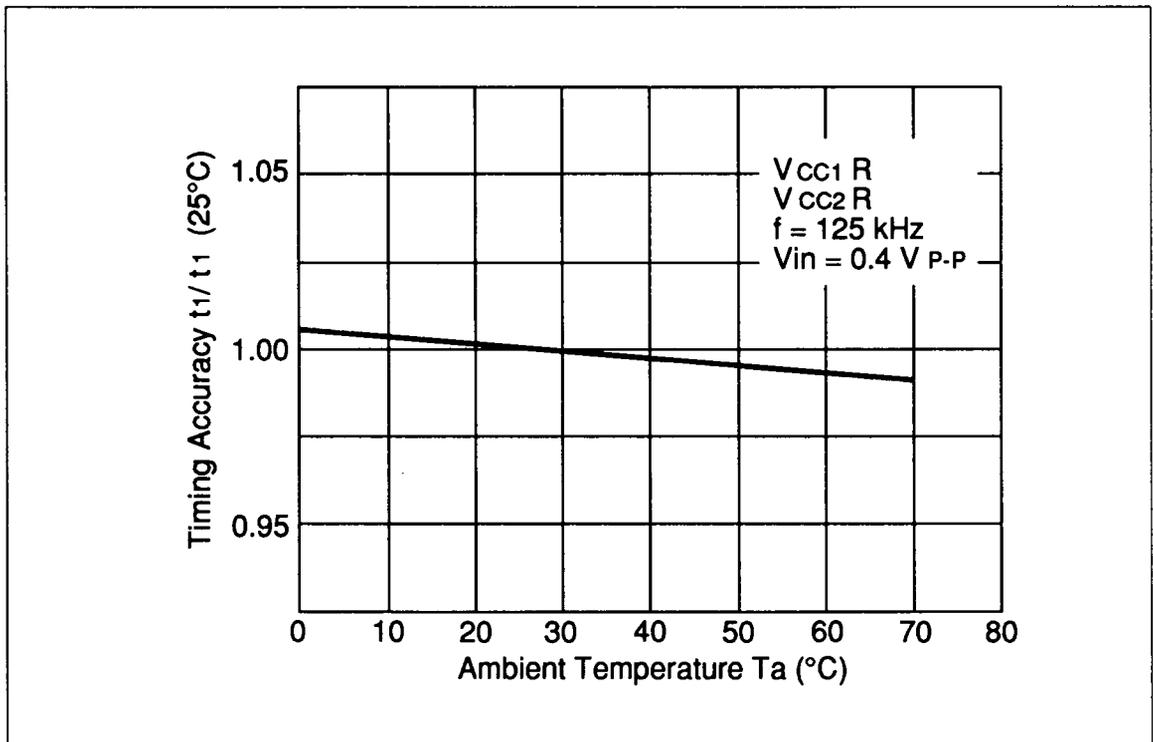
Figure 27   Timing Accuracy vs Ambient Temperature