

# HA16631P, HA16631MP

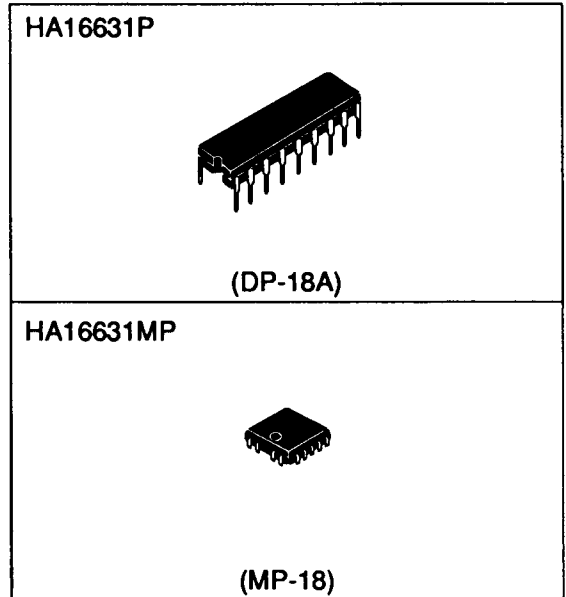
## Read Amplifier

### Description

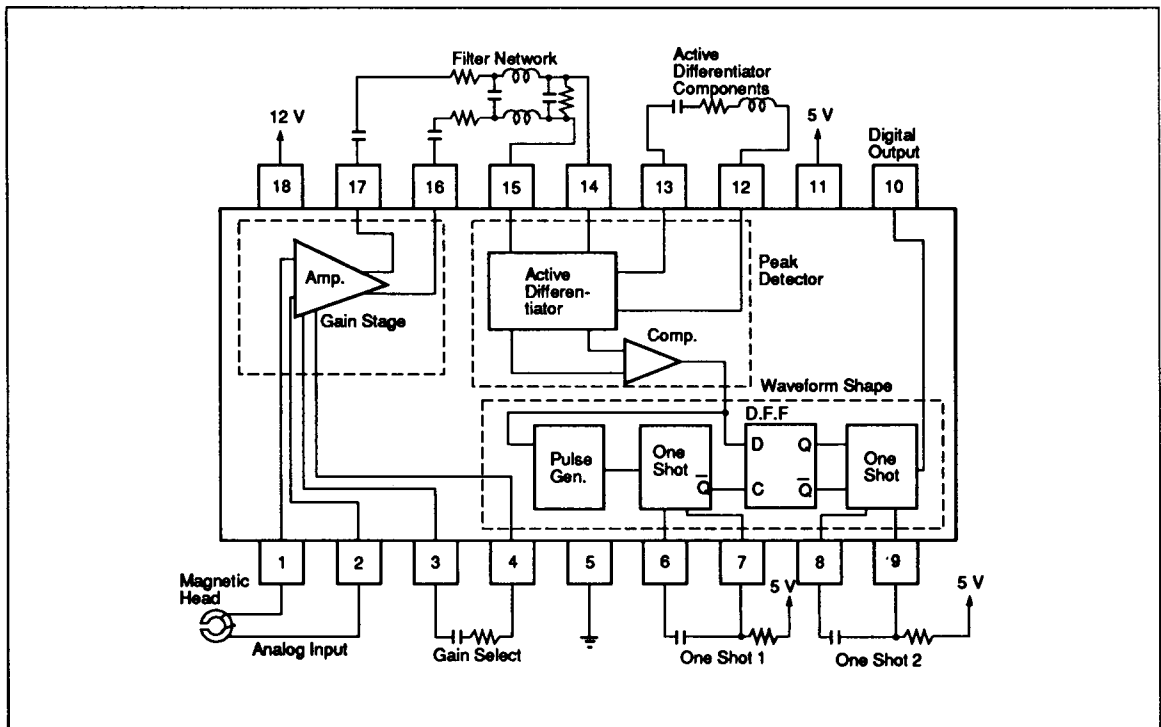
The HA16631P and HA16631MP monolithic read amplifiers for flexible disk drives provide wave-shaped output signals. The differentiator, zero-volt comparator generate data pulses from the amplified signals from the magnetic head and waveform shaper section.

### Features

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

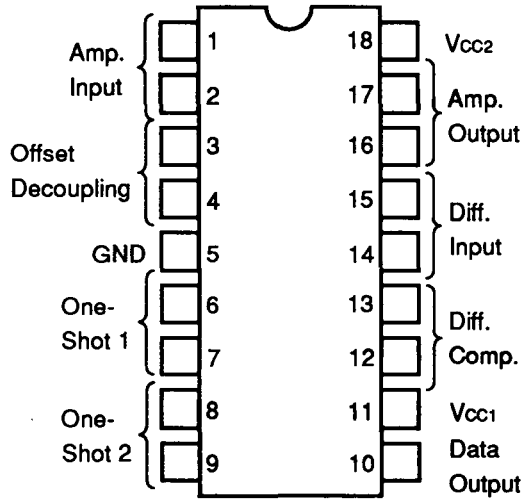


### Block Diagram



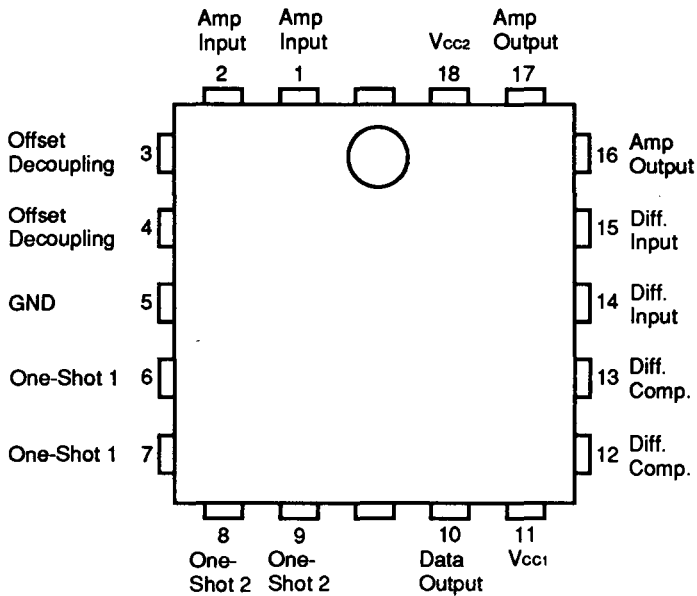
Pin Arrangement

HA16631P



(Top view)

HA16631MP



(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

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Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Power supply rejection ratio $V_{CC1}$	PSRR <sub>1</sub>	50	—	—	dB	$V_{CC} = 12.0\text{ V}$ $4.75\text{ V} \leq V_{CC1}$ $\leq 5.25\text{ V}$	Fig. 10
Power supply rejection ratio $V_{CC2}$	PSRR <sub>2</sub>	60	—	—	dB	$V_{CC1} = 5.0\text{ V}$ $10.0\text{ V} \leq V_{CC2}$ $\leq 14.0\text{ V}$	Fig. 10
Differential output offset voltage	V <sub>DO</sub>	—	—	0.4	V		Fig. 7
Common mode output voltage	V <sub>CO</sub>	—	3.1	—	V		Fig. 7
Effective differential emitter resistance (Pins 3 and 4)	REFF	370	570	770	$\Omega$		Fig. 3

**Peak Detector Section ( $T_a = 25^\circ\text{C}$ ,  $V_{CC1} = 5.0\text{ V}$ ,  $V_{CC2} = 12.0\text{ V}$ , unless otherwise specified)**

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Test Circuit
Sink current (Pins 12 and 13)	I <sub>SD</sub>	1.0	1.5	—	mA		Fig. 12
Peak shift	Ps	—	—	5	%	$f = 250\text{ kHz}$ , $V_{IN} = 1.0\text{ V}_{p-p}$	Fig. 13
Input resistance	r <sub>ID</sub>	—	30	—	k $\Omega$		Fig. 17
Output resistance	r <sub>OP</sub>	—	40	—	$\Omega$		

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Waveform Shaper Section ( $T_a = 25^\circ\text{C}$ ,  $V_{CC1R}$ ,  $V_{CC2R}$ , unless otherwise specified)

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

Test Circuits

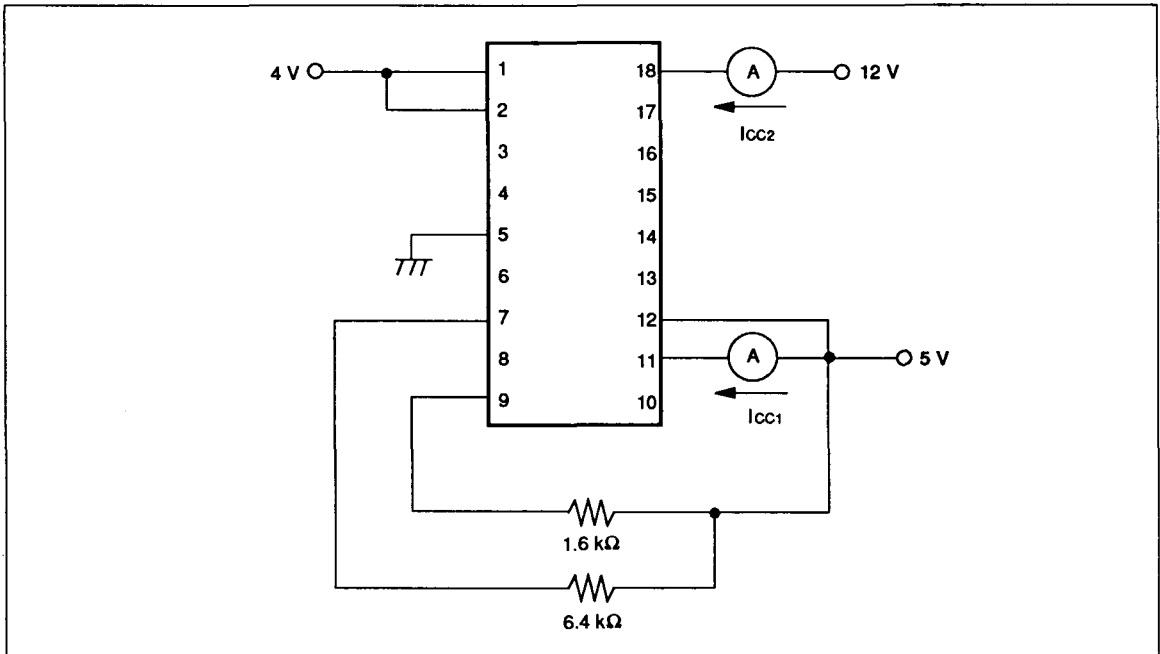


Figure 1 Power Supply Current

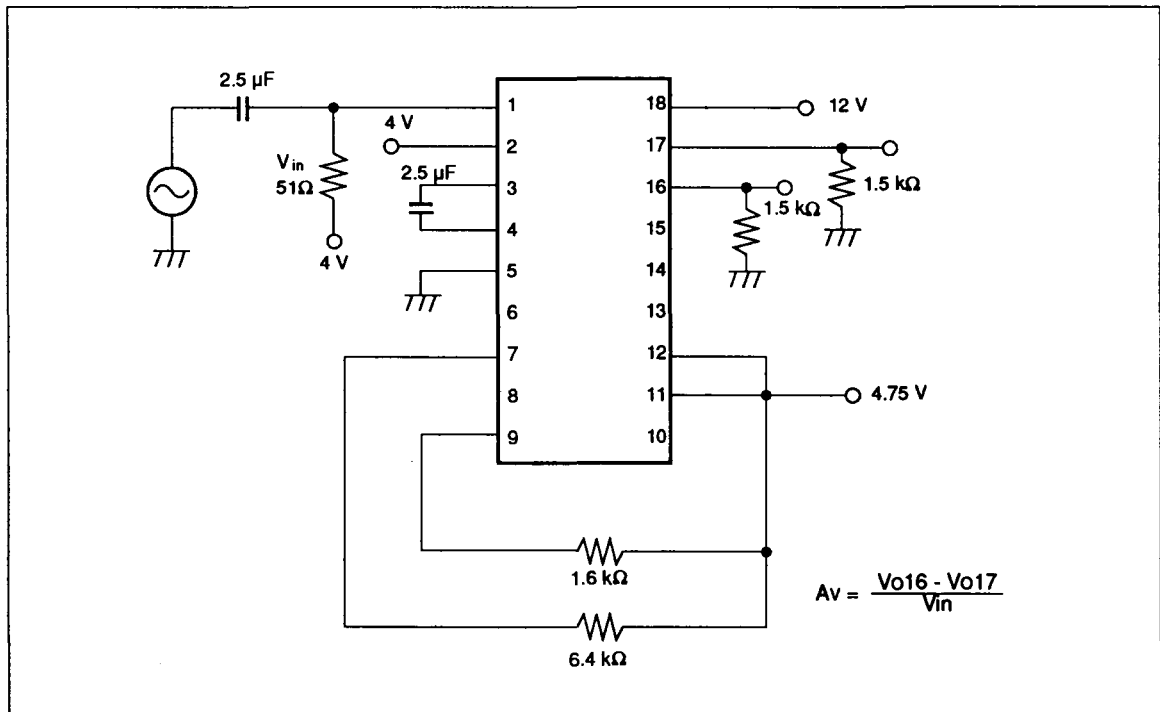


Figure 2 Voltage Gain, Band-width, Output Voltage Swing, Output Distortion Ratio

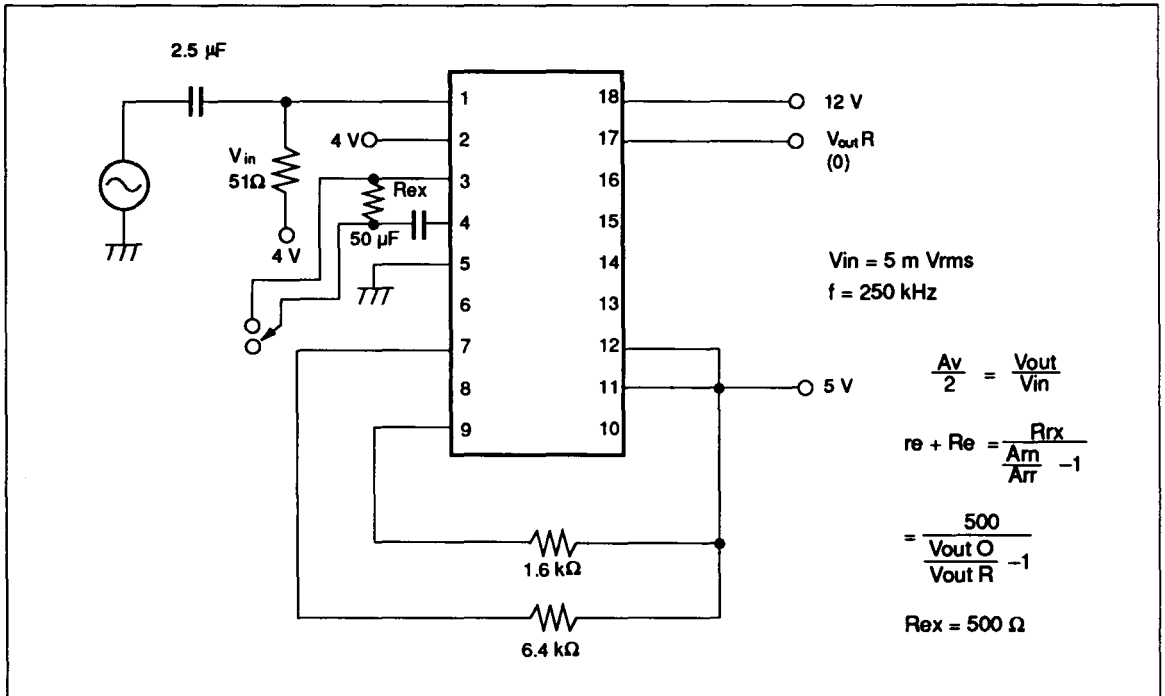


Figure 3 Pre-Amplifier Section Effective Emitter Resistance (Pins 3 and 4)

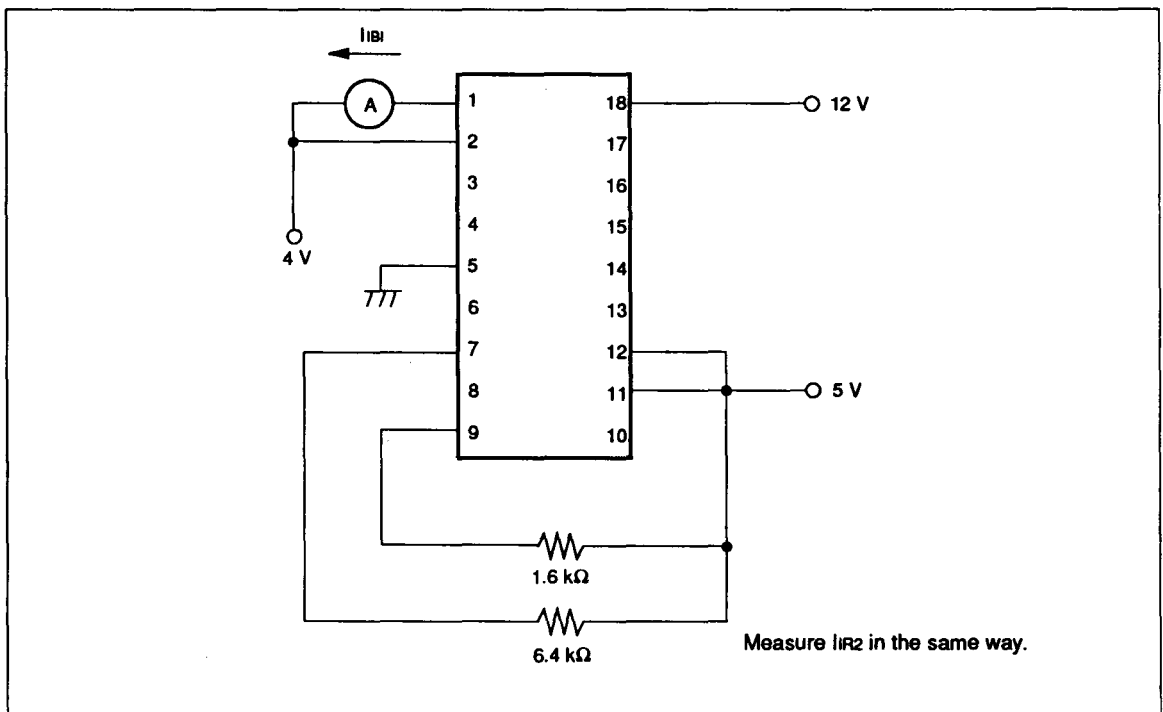


Figure 4 Input Bias Current

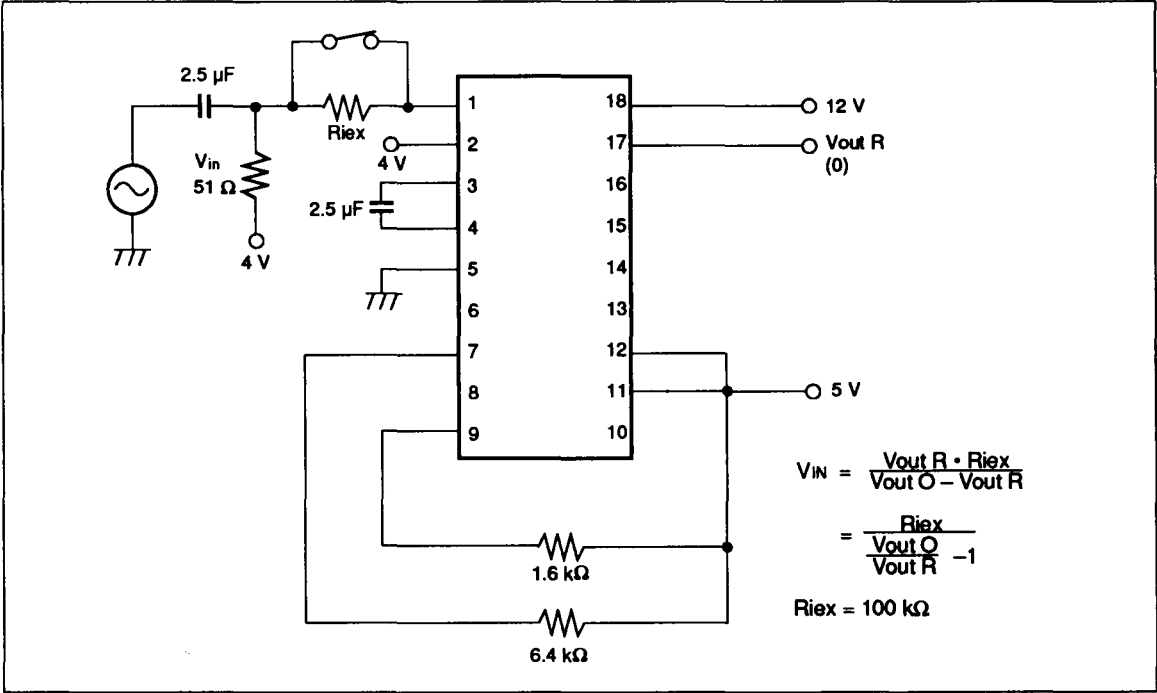


Figure 5 Input Resistance

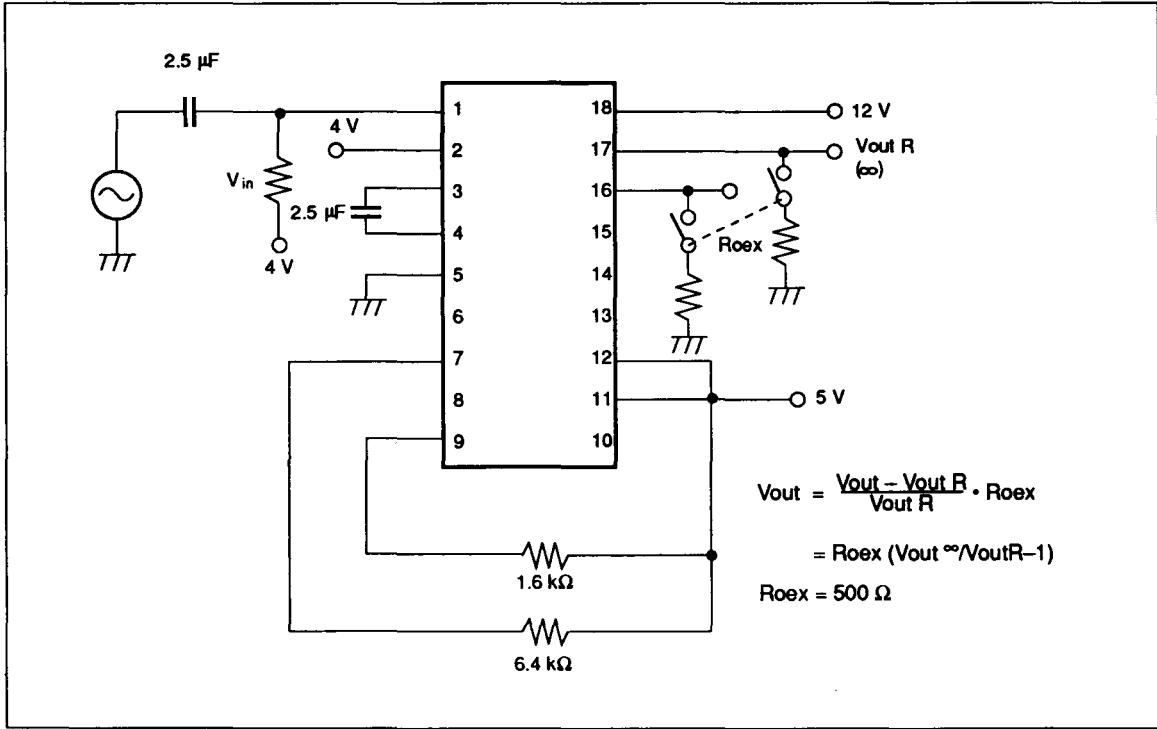


Figure 6 Output Resistance



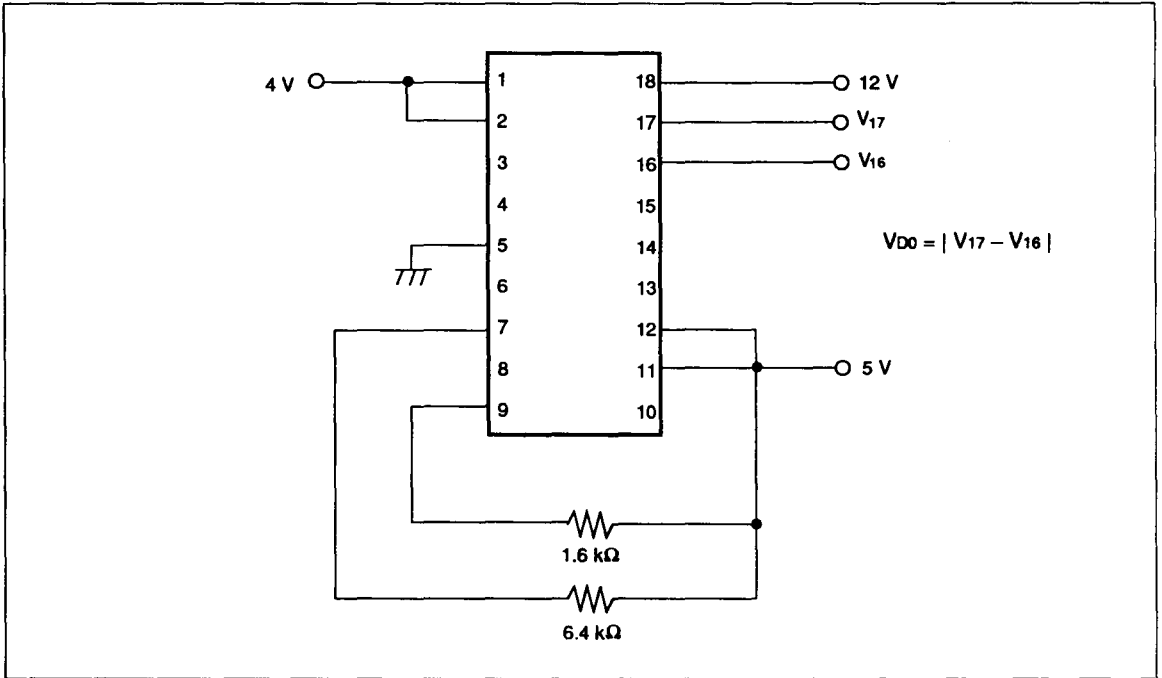


Figure 7 Differential Output Offset Voltage, Common Mode Output Voltage

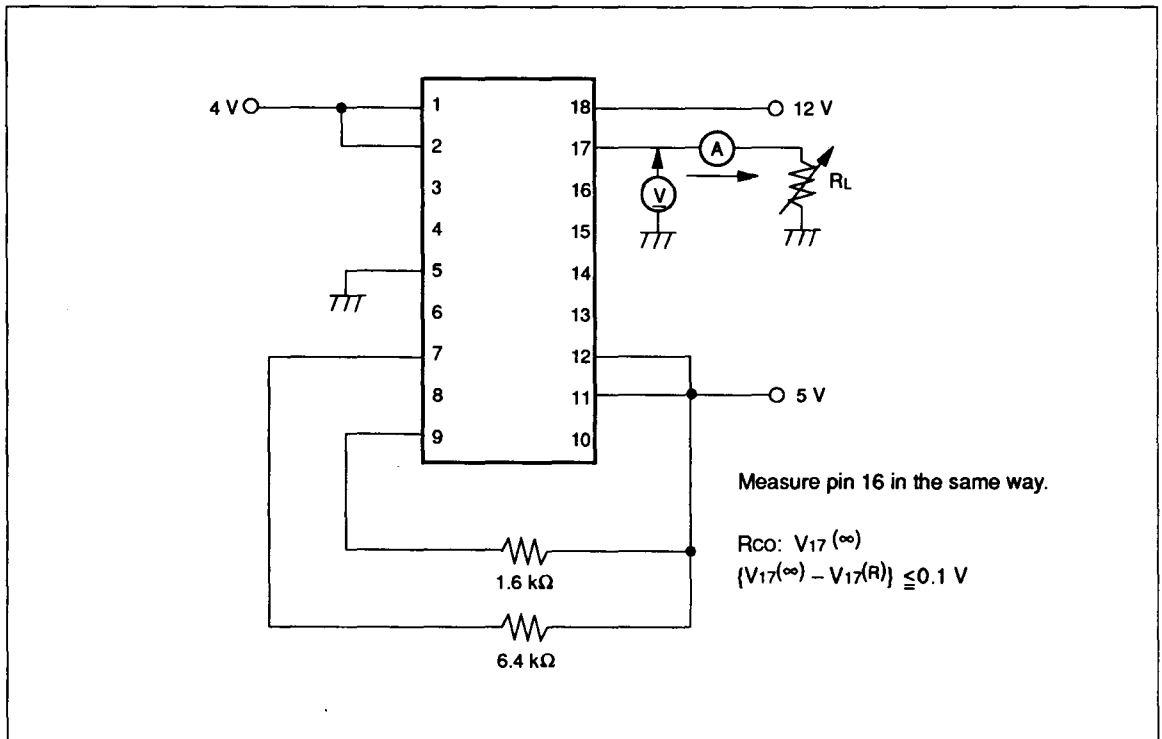


Figure 8 Output Source Current

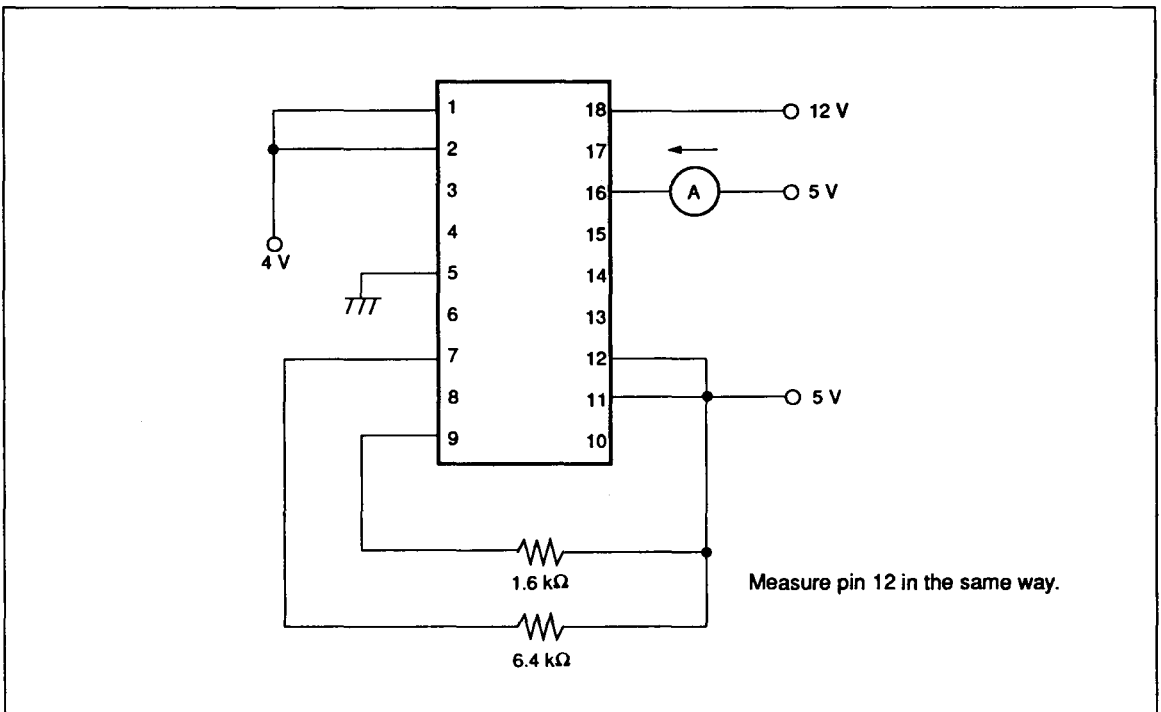


Figure 9 Output Sink Current

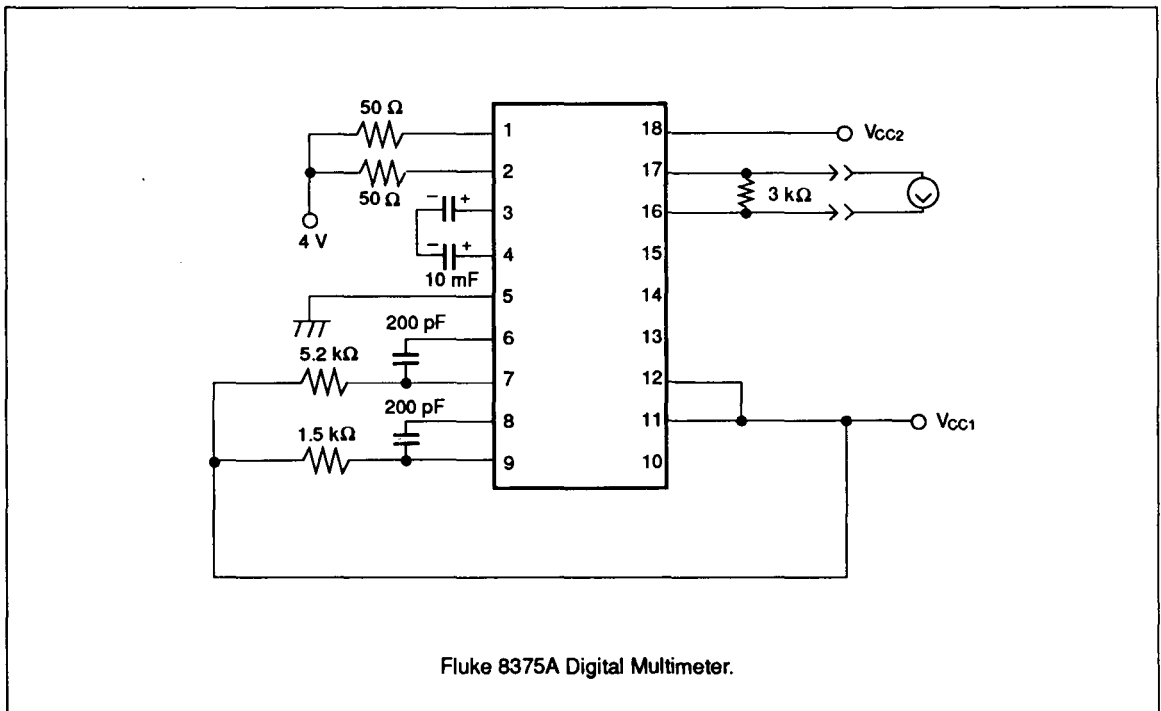


Figure 10 Power Supply Rejection Ratio

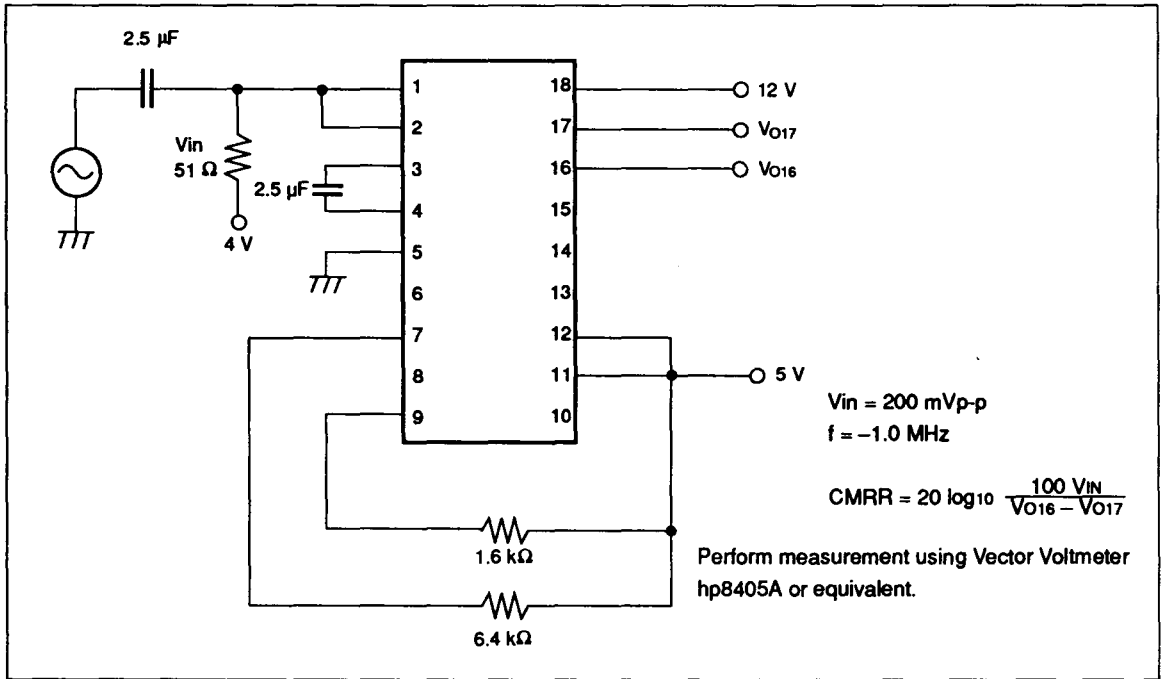


Figure 11 Common Mode Rejection Ratio

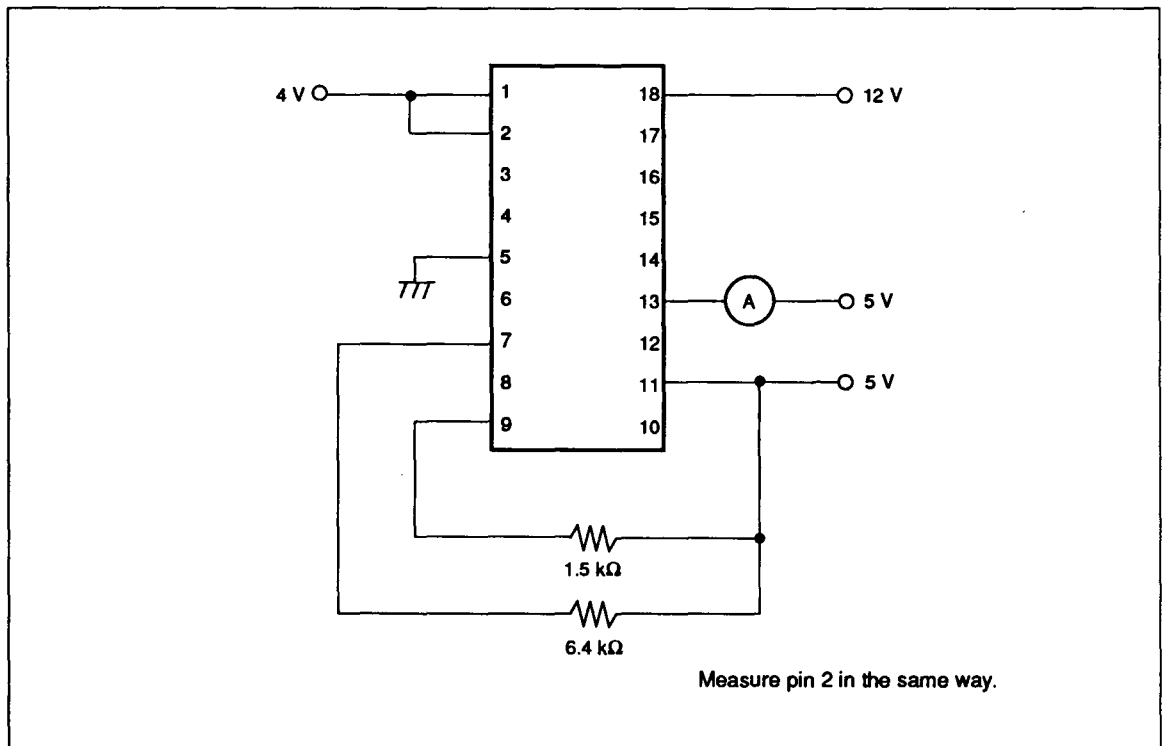
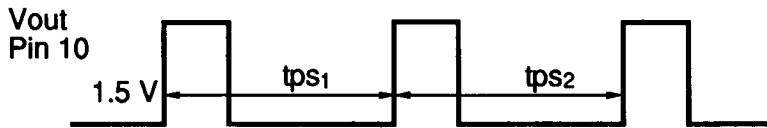
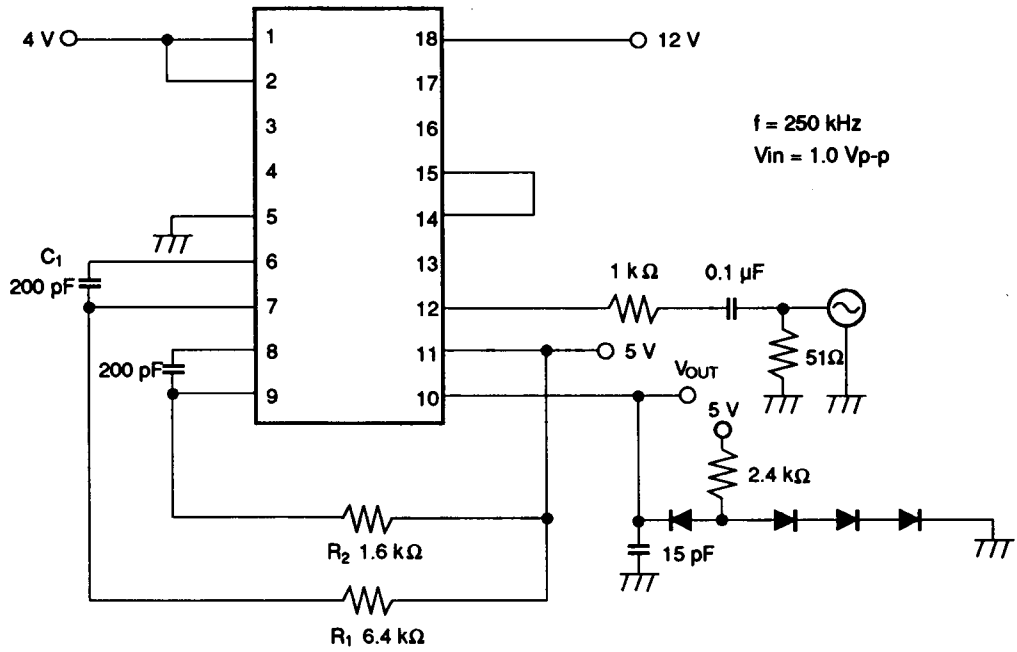


Figure 12 Differentiator Output Sink Current



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

Figure 13 Peak Shift

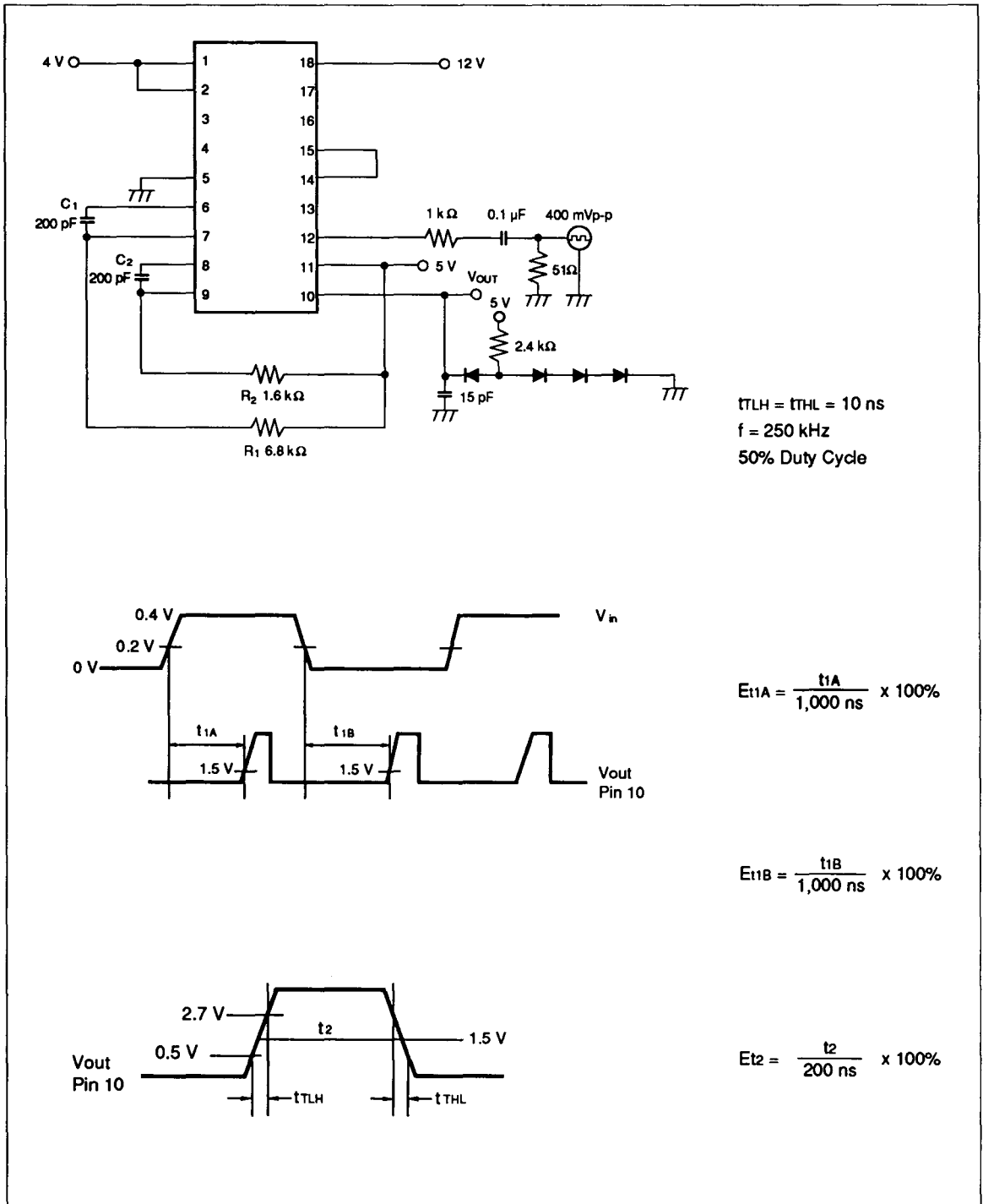


Figure 14 Timing Accuracy, Rising Time, Falling Time

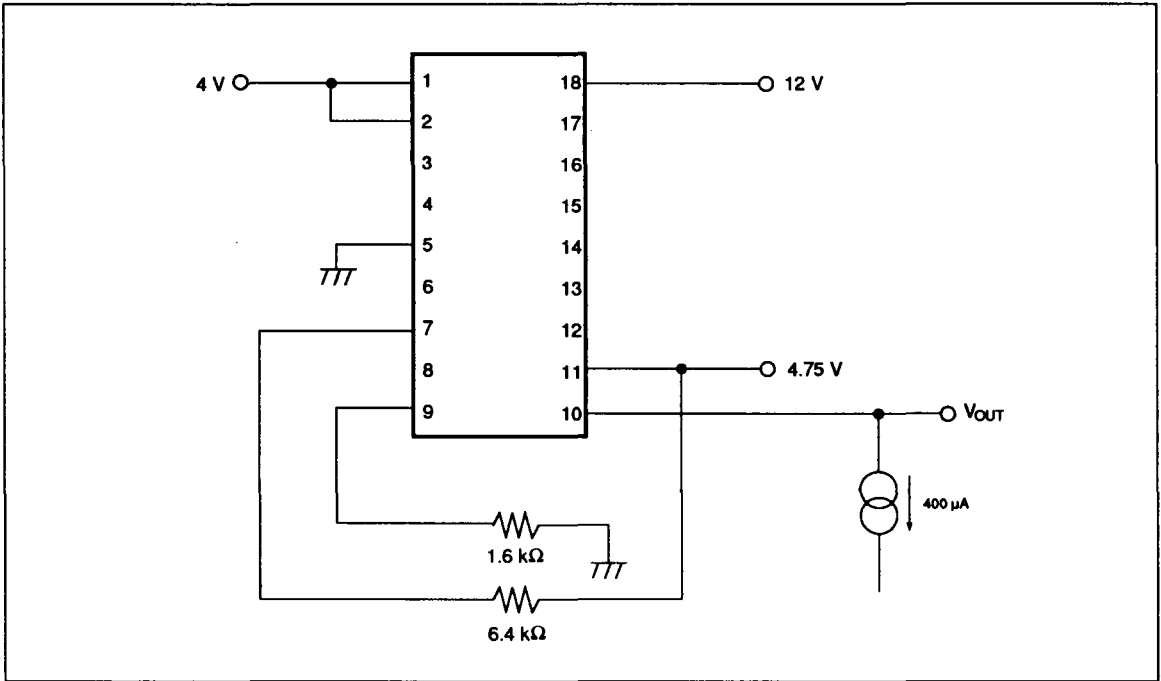


Figure 15 Output Voltage High (Pin 10)

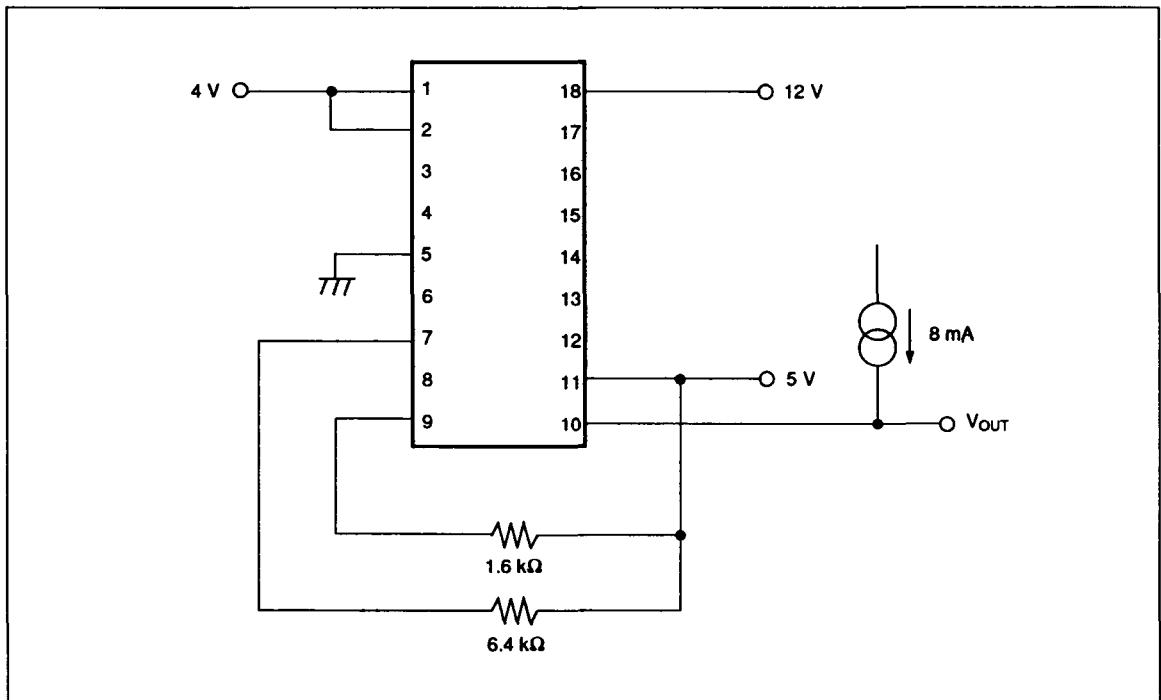


Figure 16 Output Voltage Low (Pin 10)

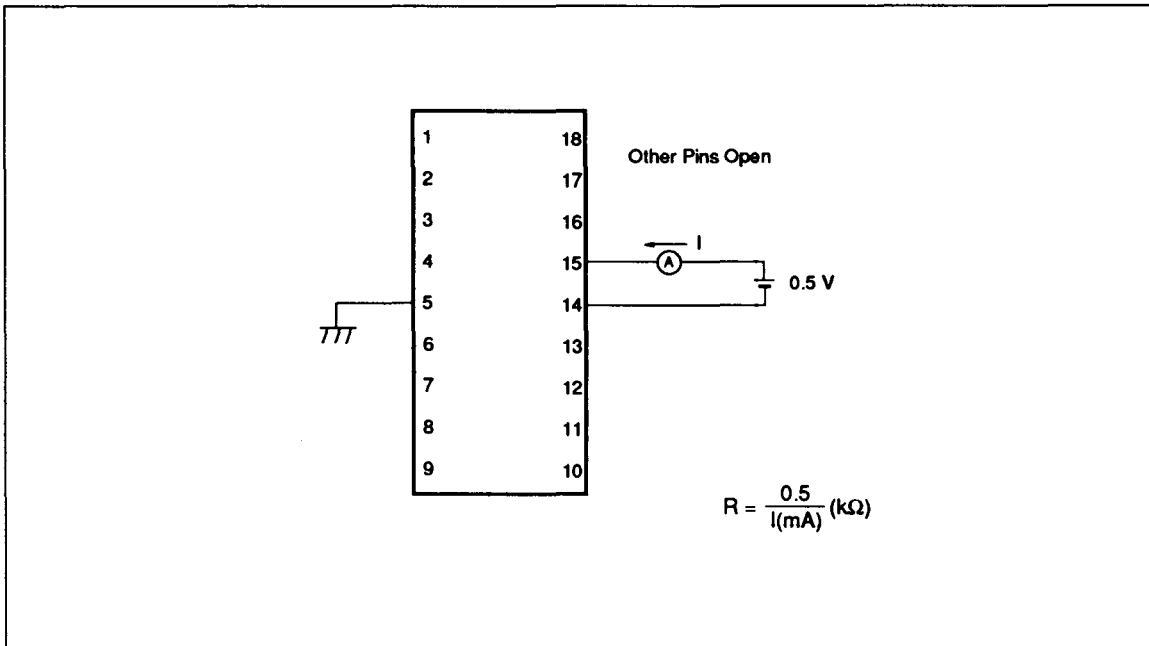


Figure 17 Input Resistance

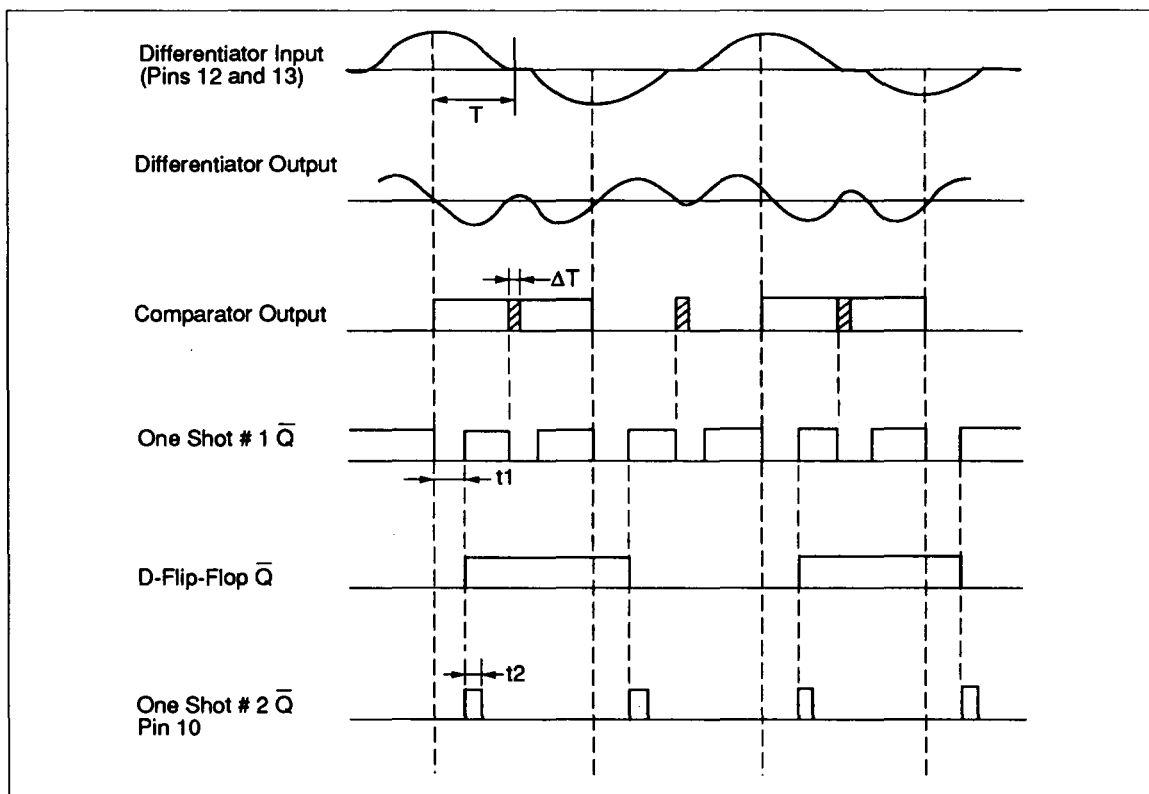


Figure 18 Timing Waveforms

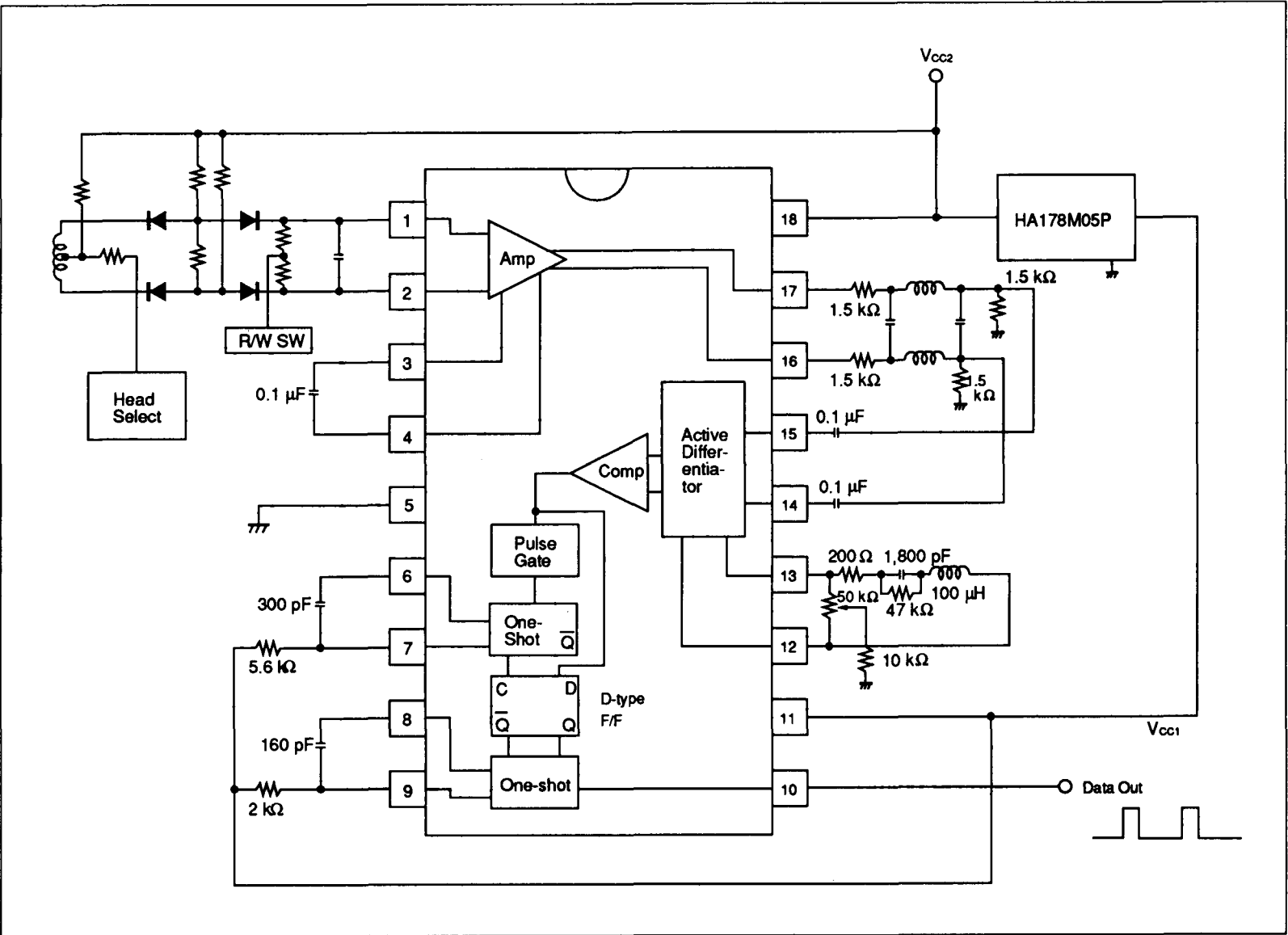


Figure 19 Circuit Example



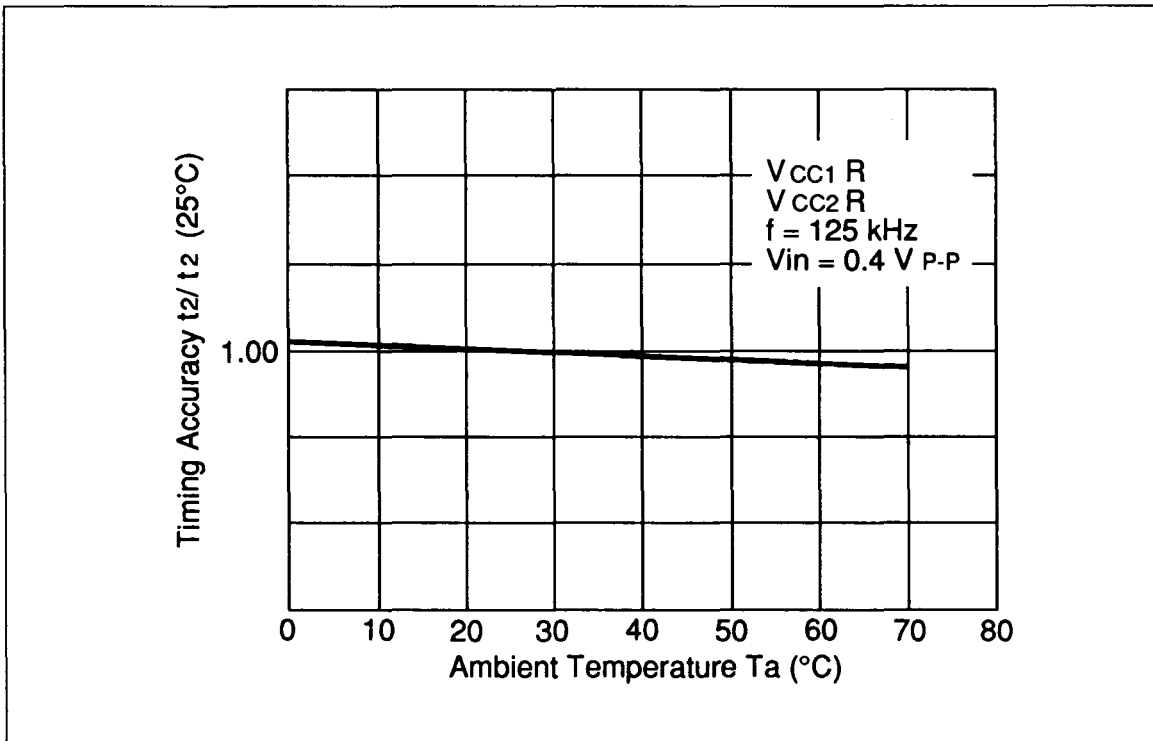


Figure 20 Timing Accuracy vs Ambient Temperature

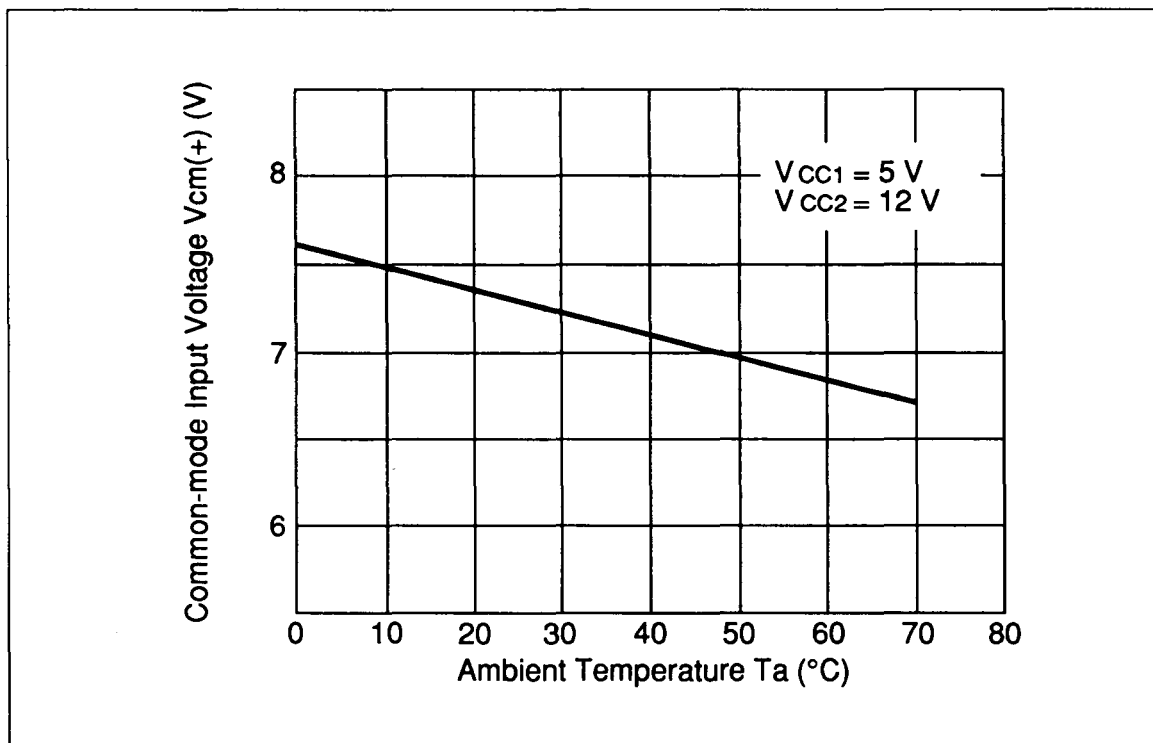


Figure 21 Common-Mode Input Voltage vs Ambient Temperature

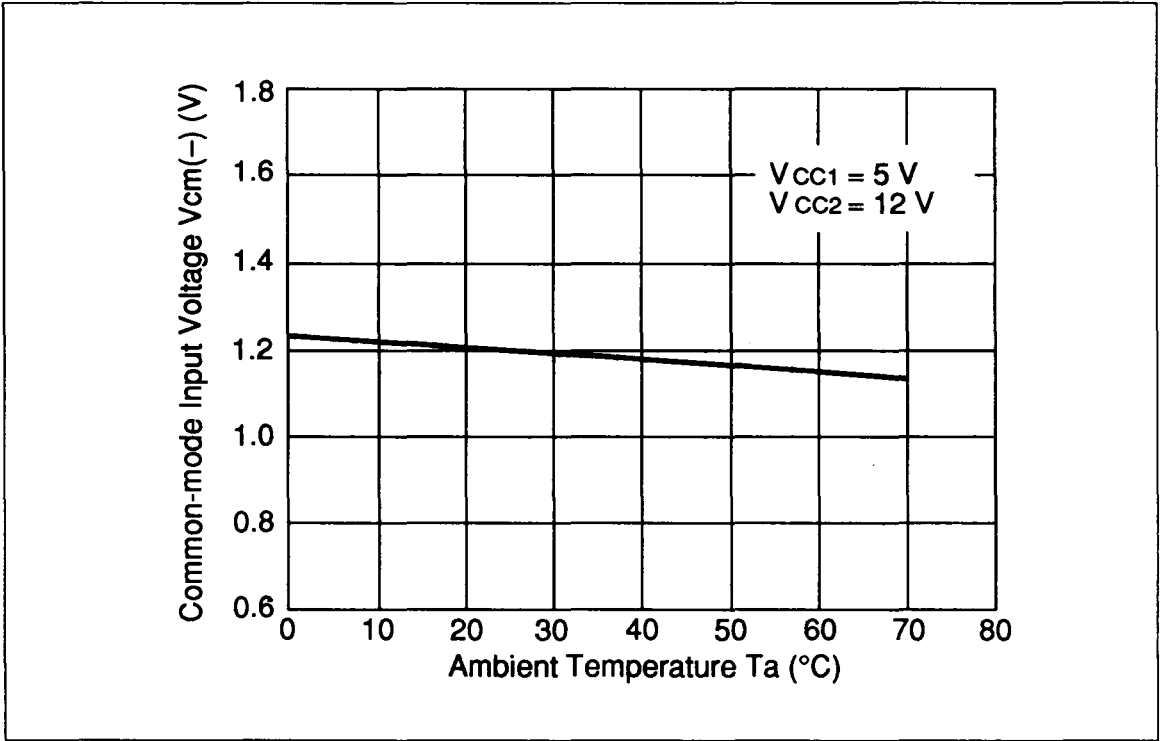


Figure 22 Common-Mode Input Voltage vs Ambient Temperature

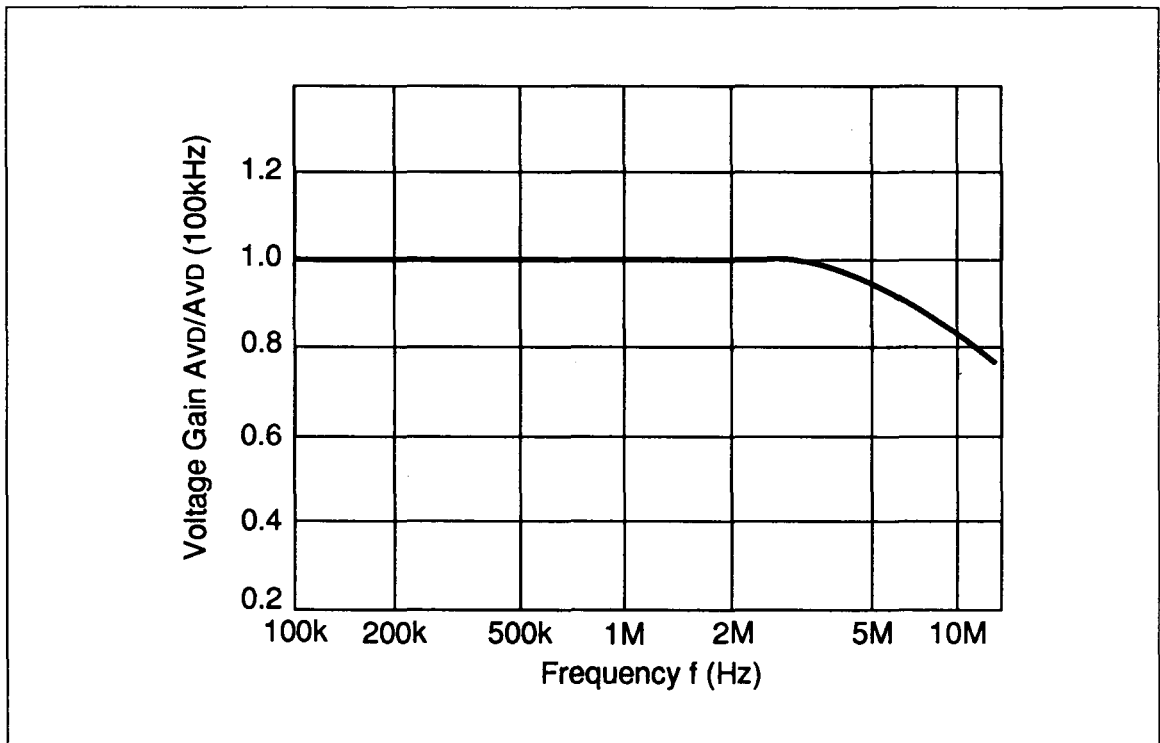


Figure 23 Voltage Gain vs Frequency

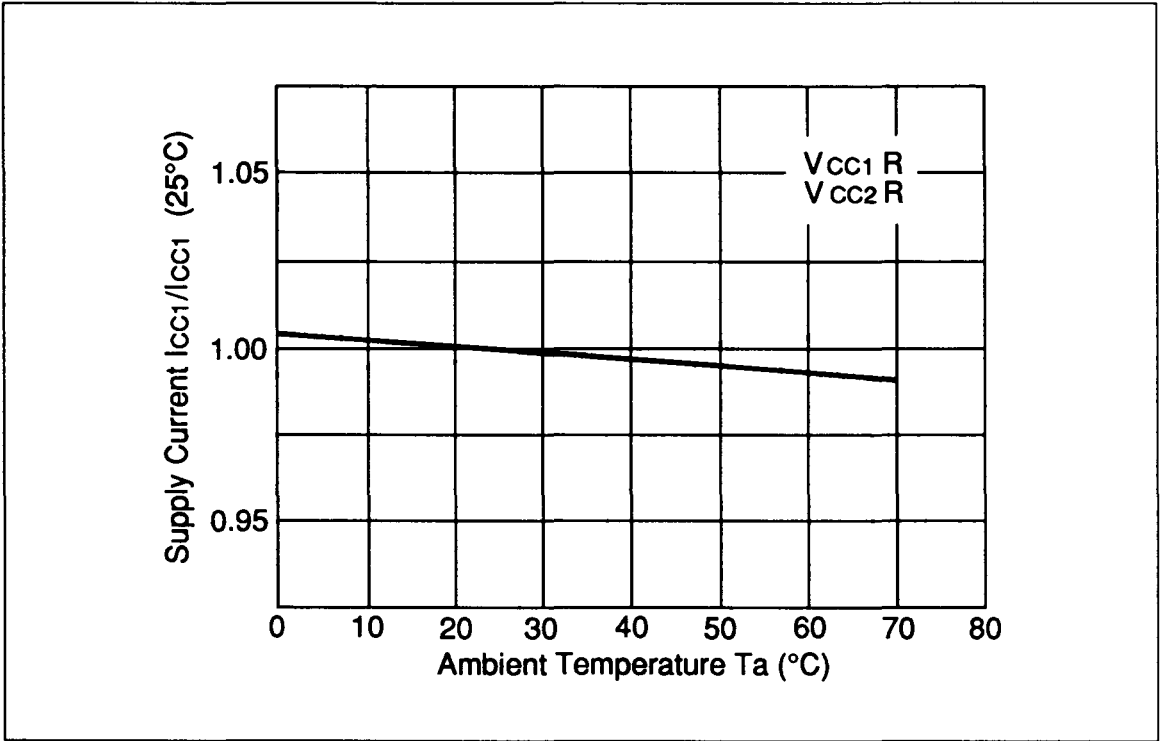


Figure 24 Supply Current vs Ambient Temperature (1)

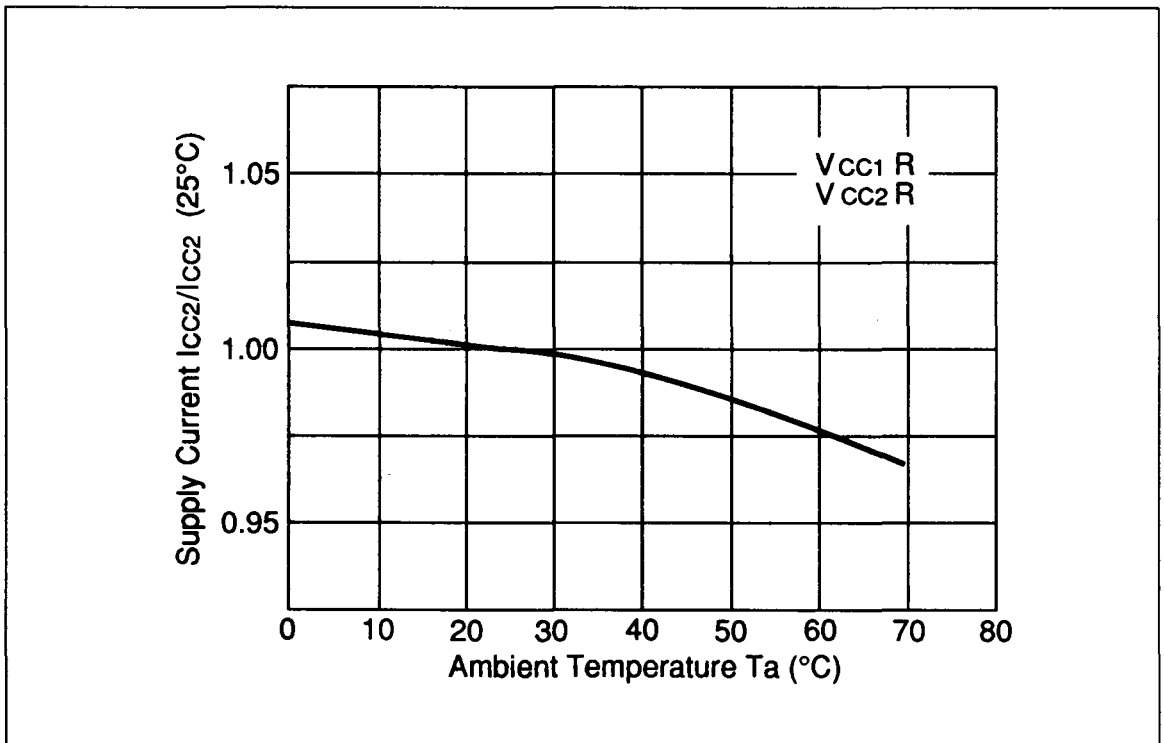


Figure 25 Supply Current vs Ambient Temperature (2)

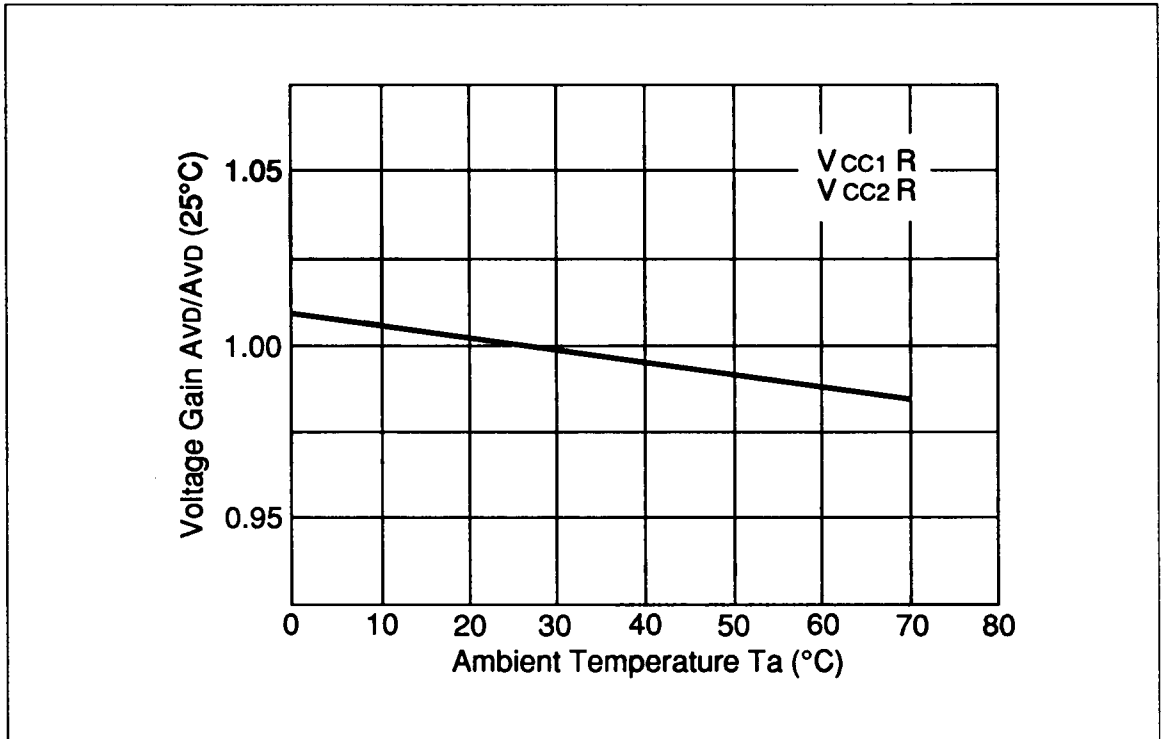


Figure 26 Voltage Gain vs Ambient Temperature

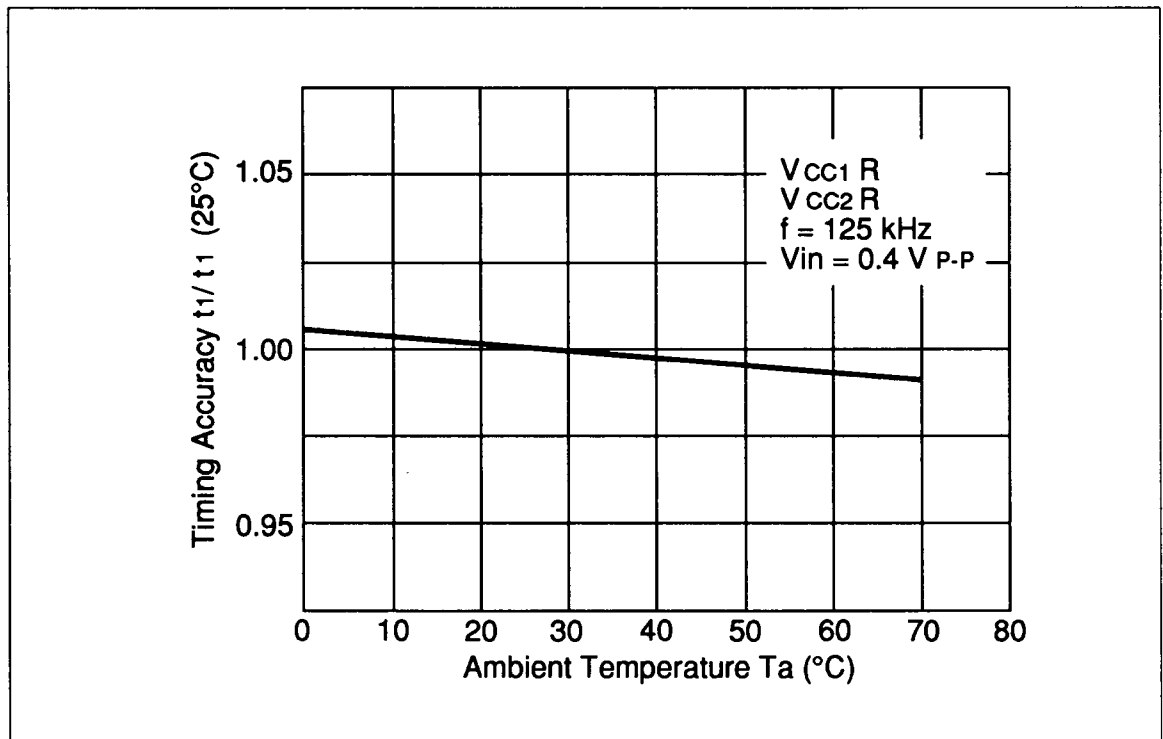


Figure 27 Timing Accuracy vs Ambient Temperature