

# HA16631P, HA16631MP

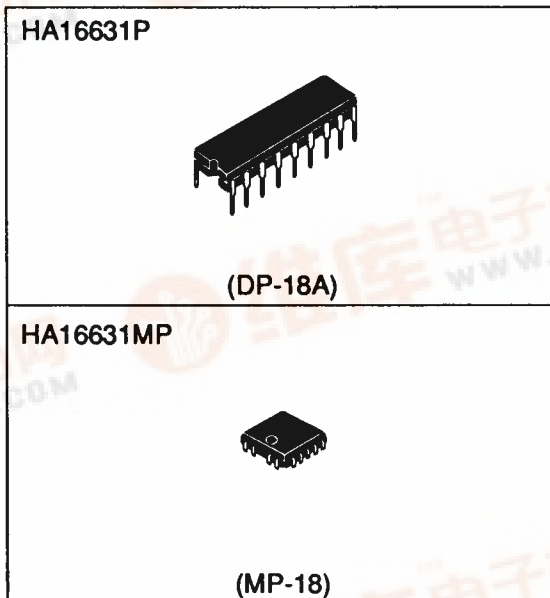
## Read Amplifier

### Description

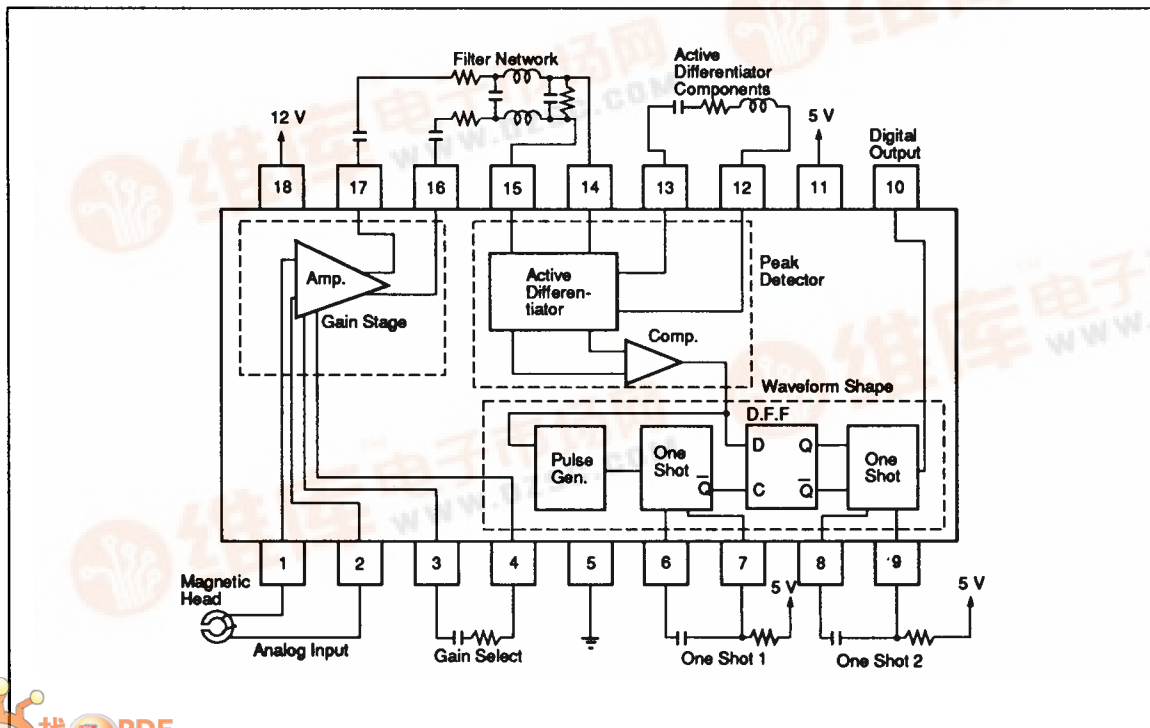
The HA16631P and HA16631MP monolithic read amplifiers for flexible disk drives provide wave-shaped output signals. The differentiator, zero-volt comparator generate data pulses from the amplified signals from the magnetic head and waveform shaper section.

### Features

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

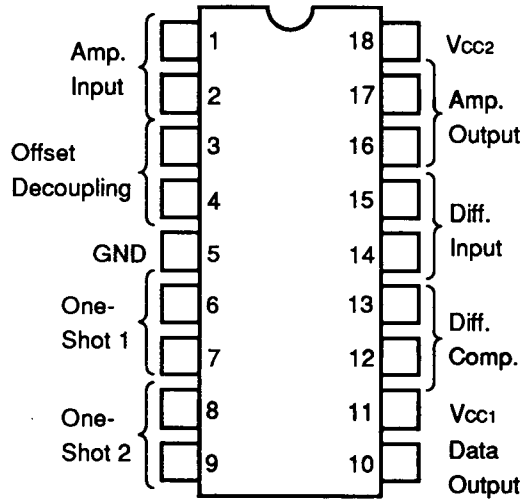


### Block Diagram



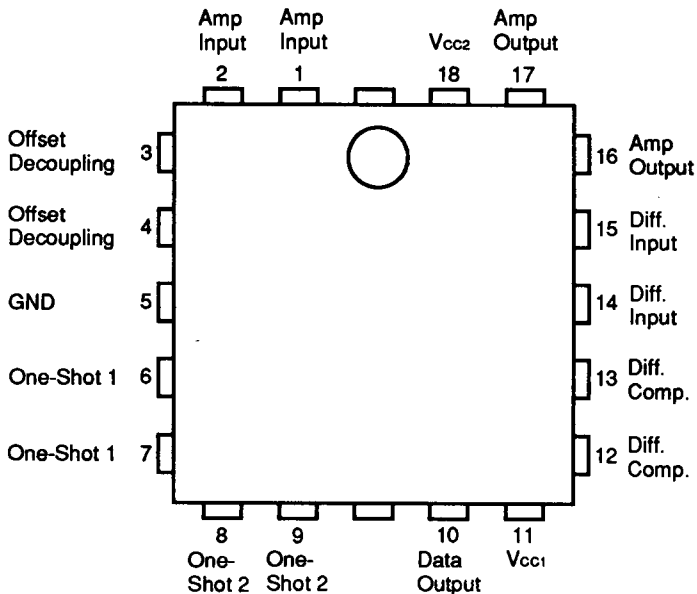
Pin Arrangement

HA16631P



(Top view)

HA16631MP



(Top view)

# HA16631P, HA16631MP

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

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	$^\circ\text{C}$
Storage temperature	Tstg	-55 to +125	$^\circ\text{C}$

## Electrical Characteristics

### Operating Power Supply Voltage Range ( $T_a = 25^\circ\text{C}$ )

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 ( $T_a = 25^\circ\text{C}$ , 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 mVrms VCC1R, VCC2R	Fig. 2
Input bias current	IIB	—	1	9	$\mu\text{A}$	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	—	k $\Omega$		Fig. 5
Output resistance	ro	—	15	—	$\Omega$		Fig. 6
Common mode rejection ratio	CMRR	50	—	—	dB	f = 100 kHz, VIN = 200 mVp-p	Fig. 11

## HA16631P, HA16631MP

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
Output resistance	rop	—	40	—	Ω		

# HA16631P, HA16631MP

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)	$t_{LH}$	—	—	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)	$t_{HL}$	—	—	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	$t_2 = 0.625 C_1 R_1$ $C_1 = 200\text{ pF}$ , $R_1 = 1.6\text{ k}\Omega$	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

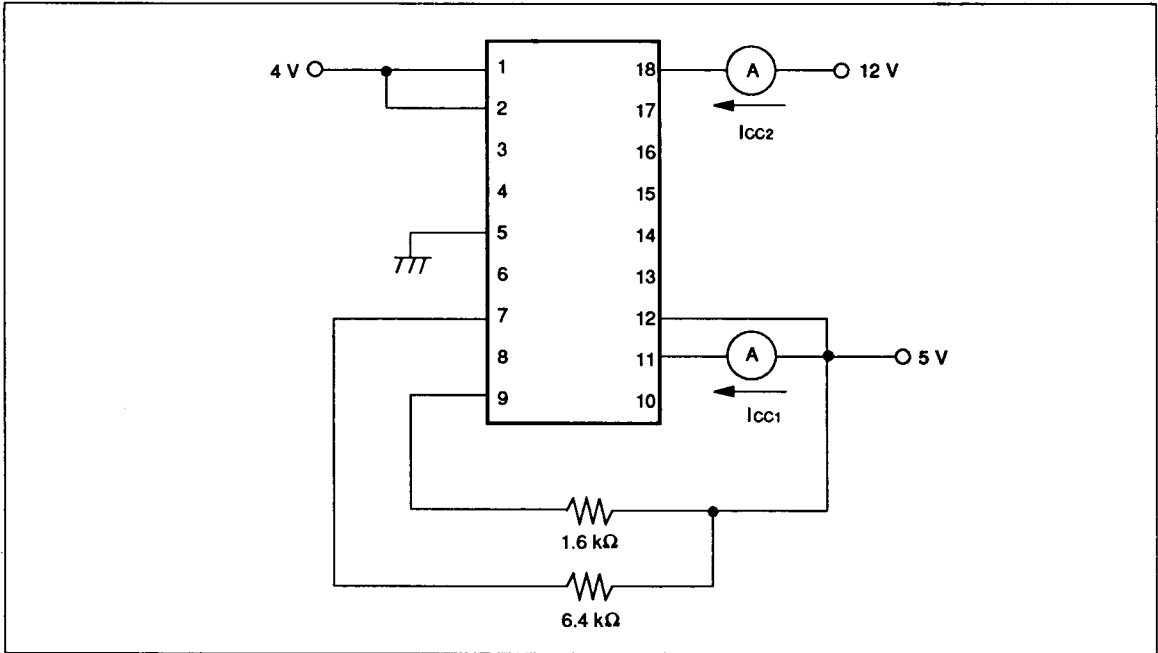


Figure 1 Power Supply Current

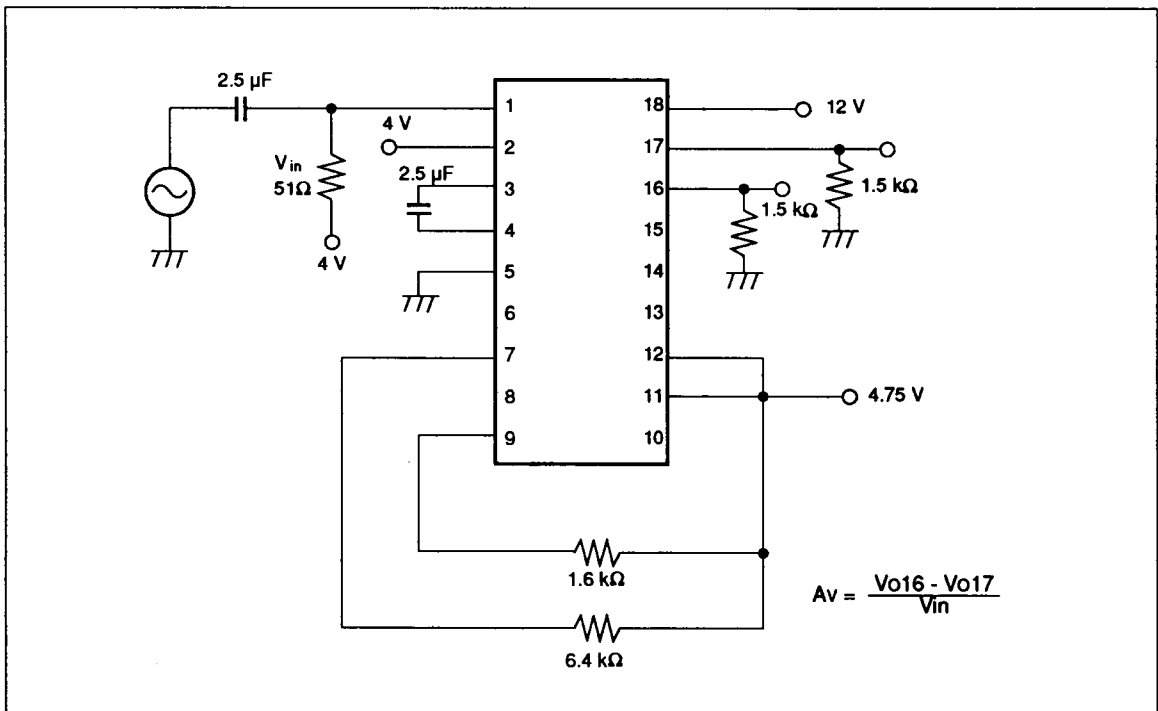
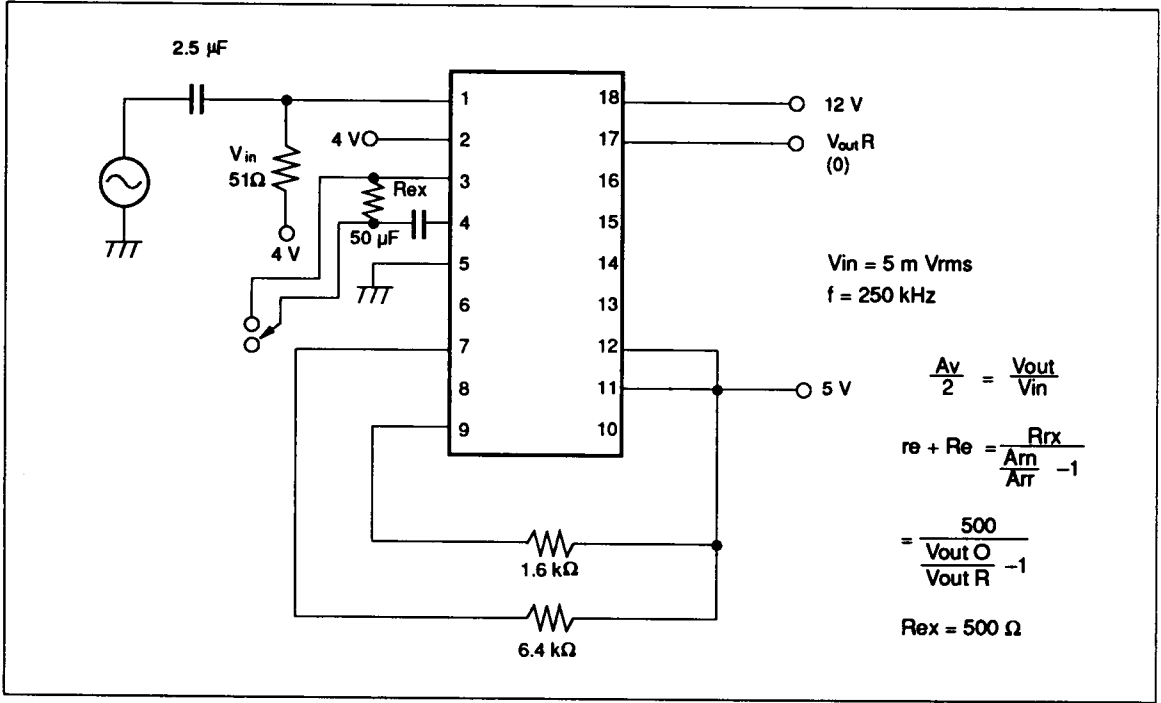
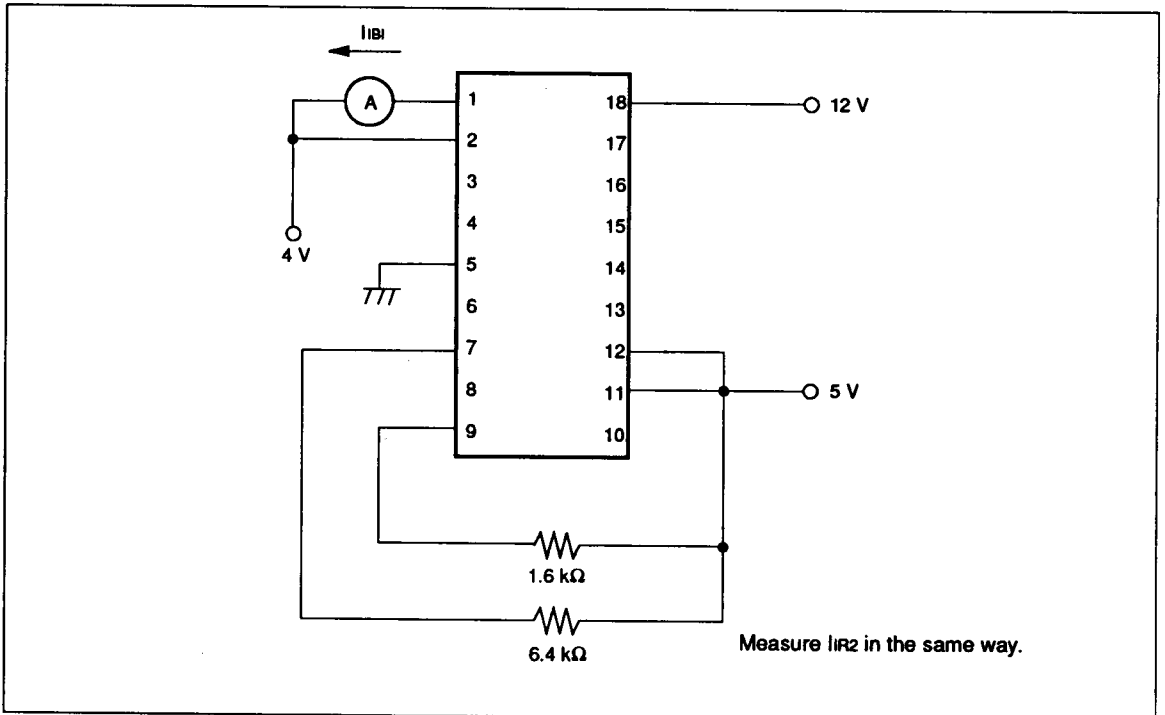


Figure 2 Voltage Gain, Band-width, Output Voltage Swing, Output Distortion Ratio

# HA16631P, HA16631MP



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



**Figure 4 Input Bias Current**

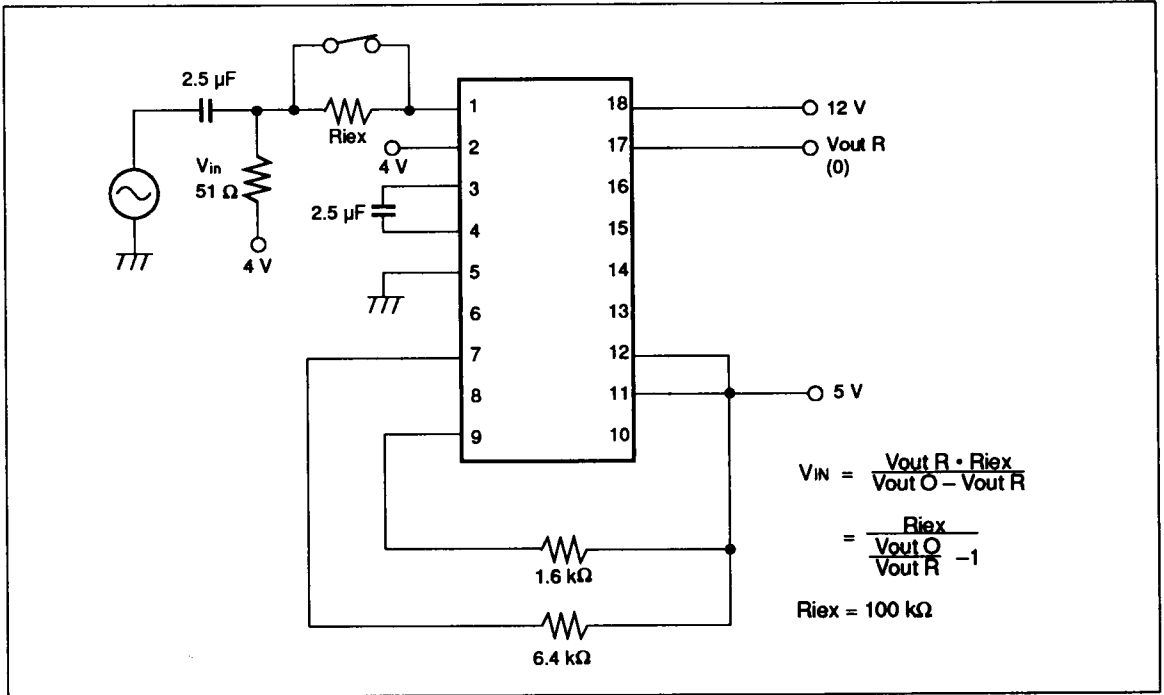


Figure 5 Input Resistance

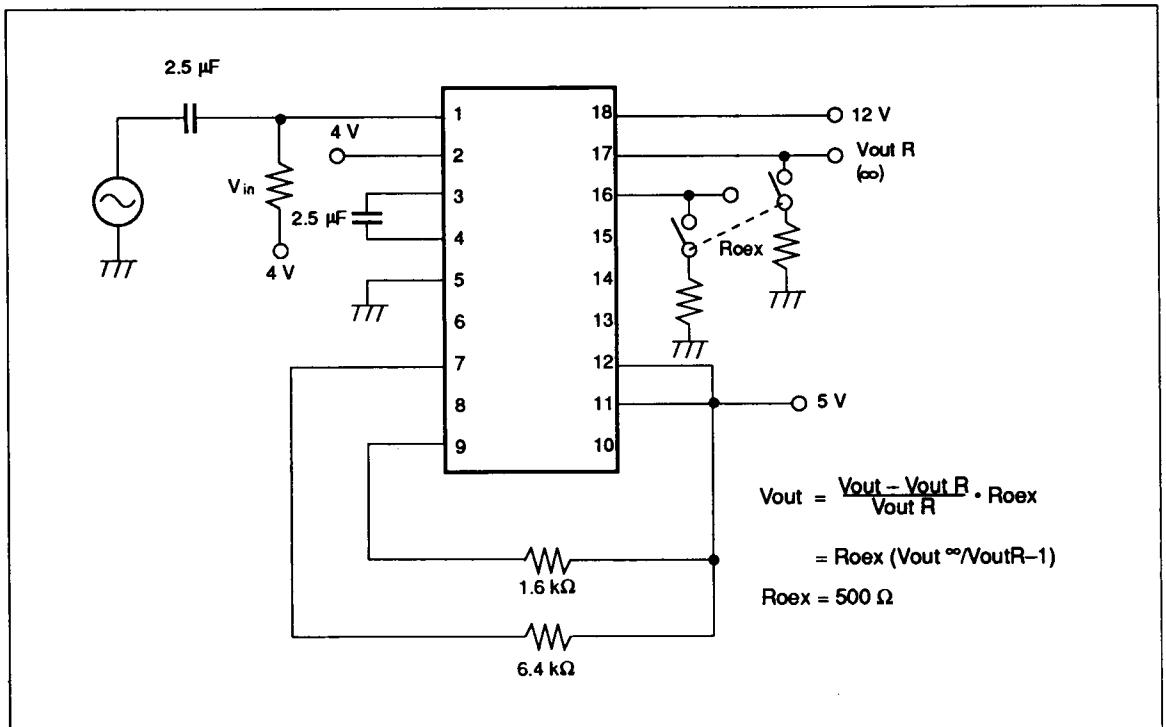


Figure 6 Output Resistance



HA16631P, HA16631MP

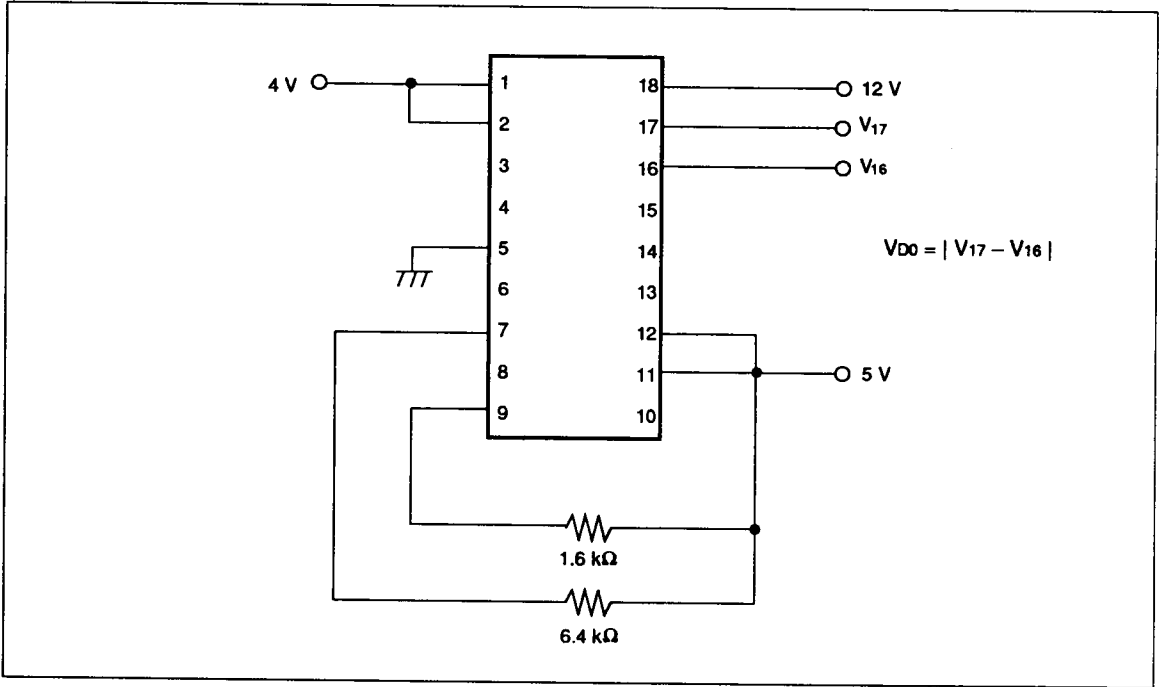


Figure 7 Differential Output Offset Voltage, Common Mode Output Voltage

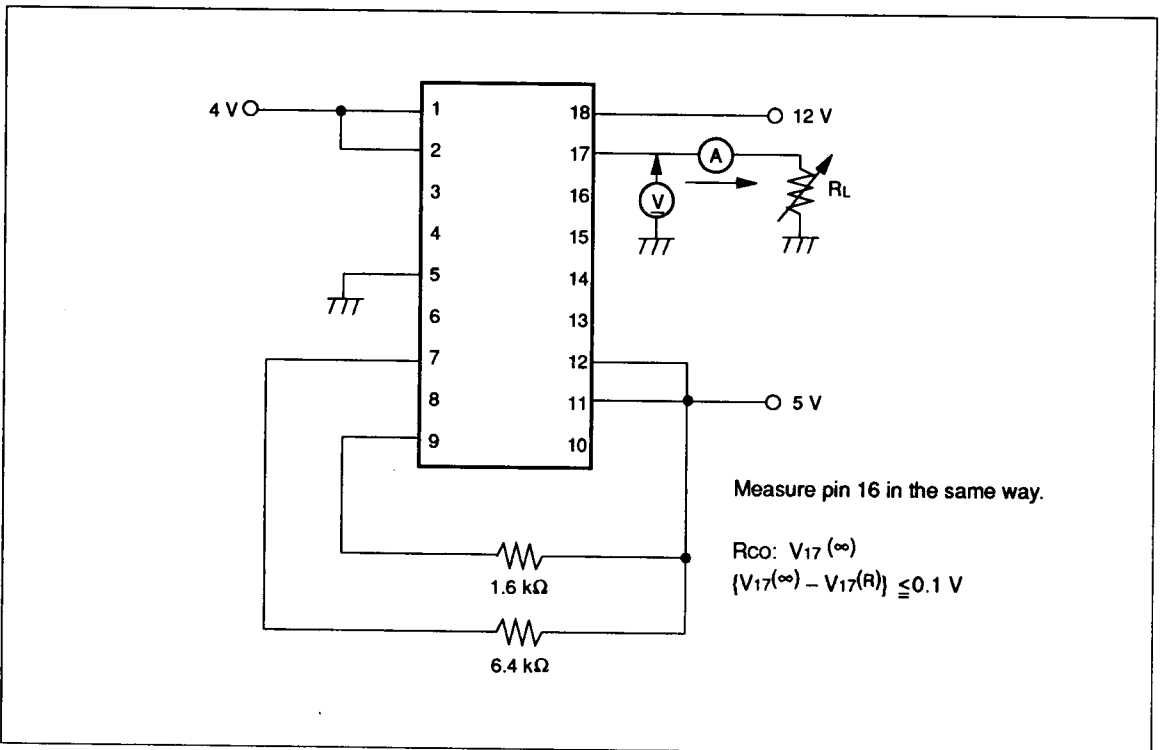


Figure 8 Output Source Current

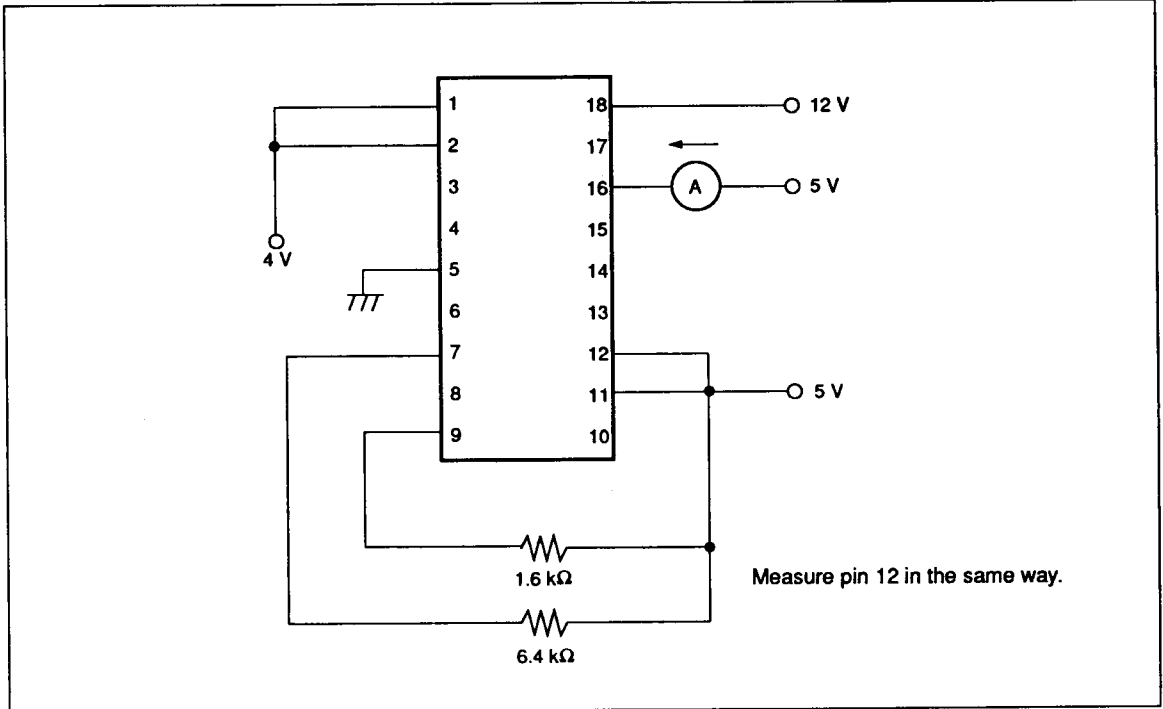


Figure 9 Output Sink Current

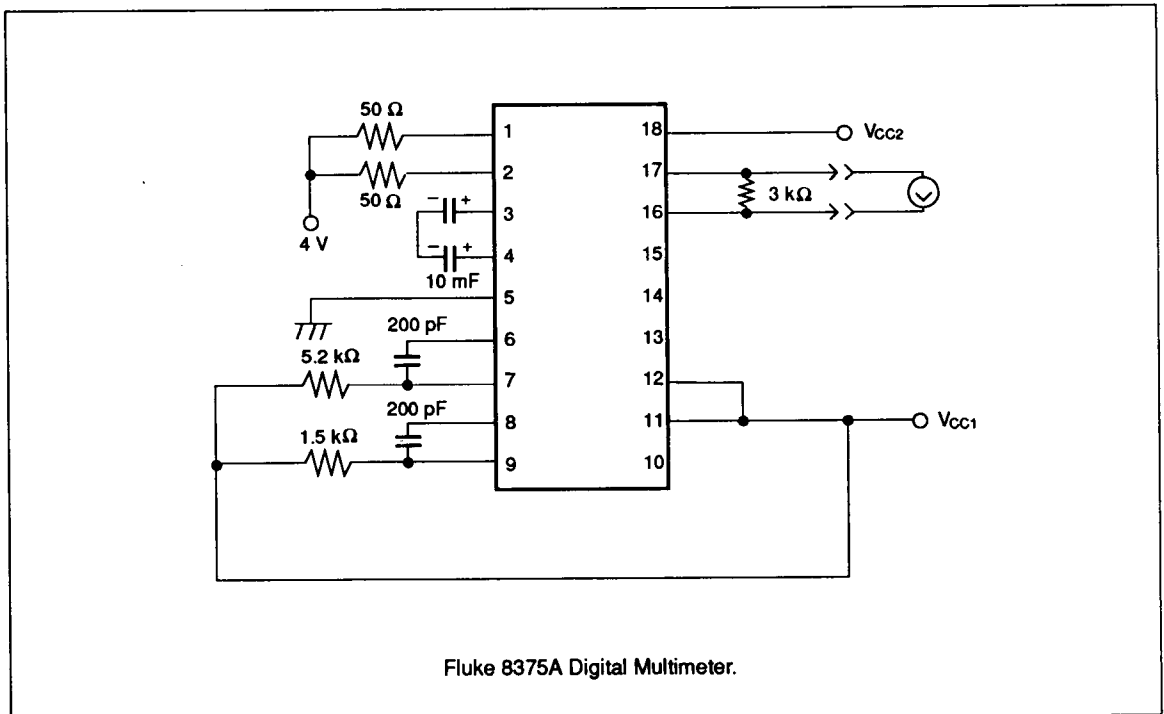
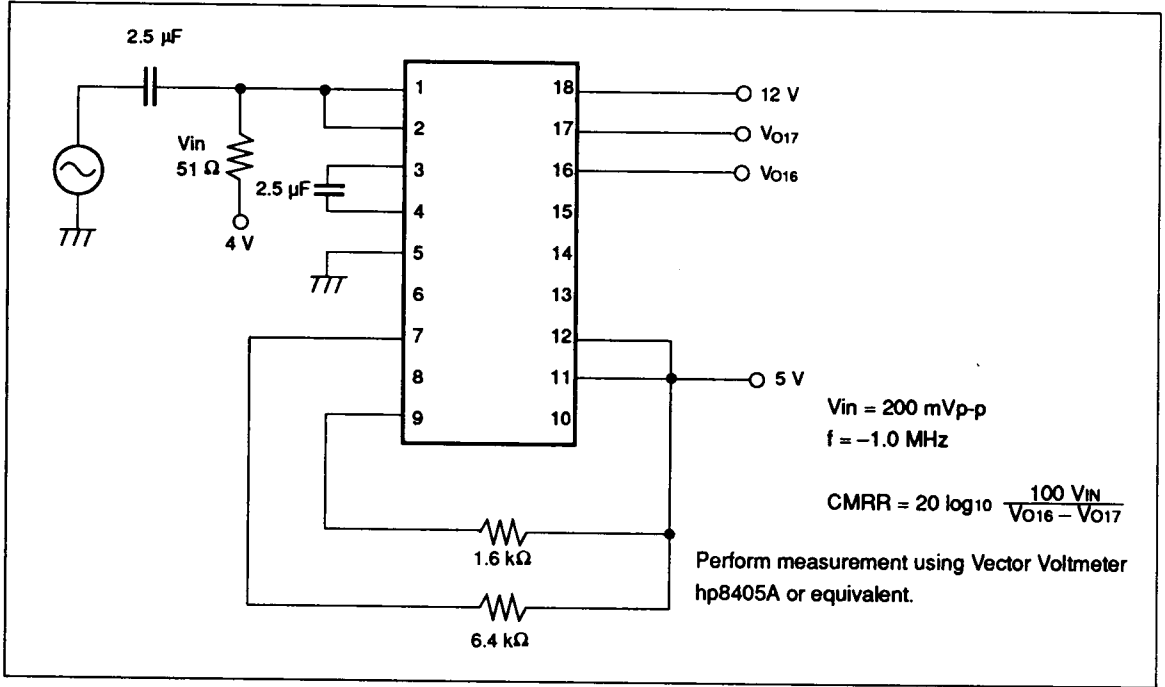
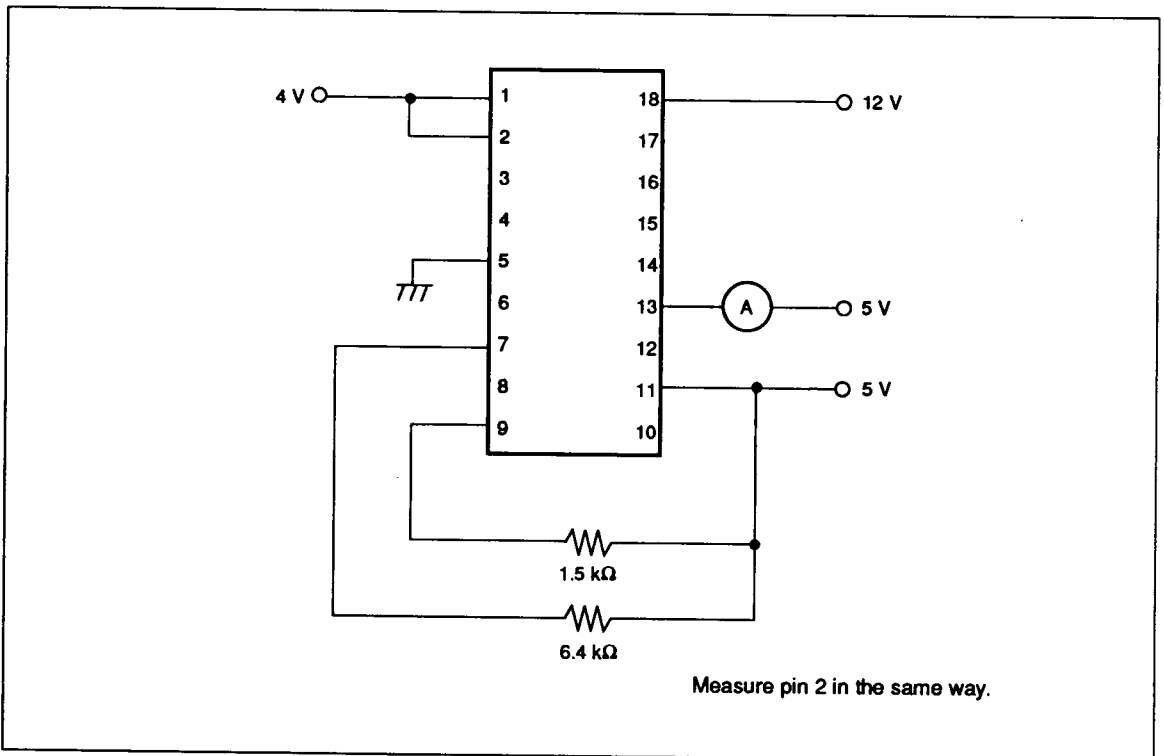


Figure 10 Power Supply Rejection Ratio

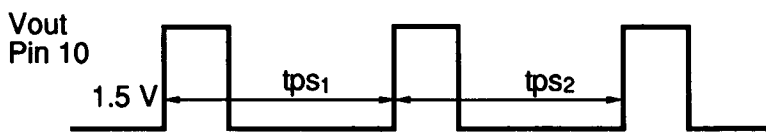
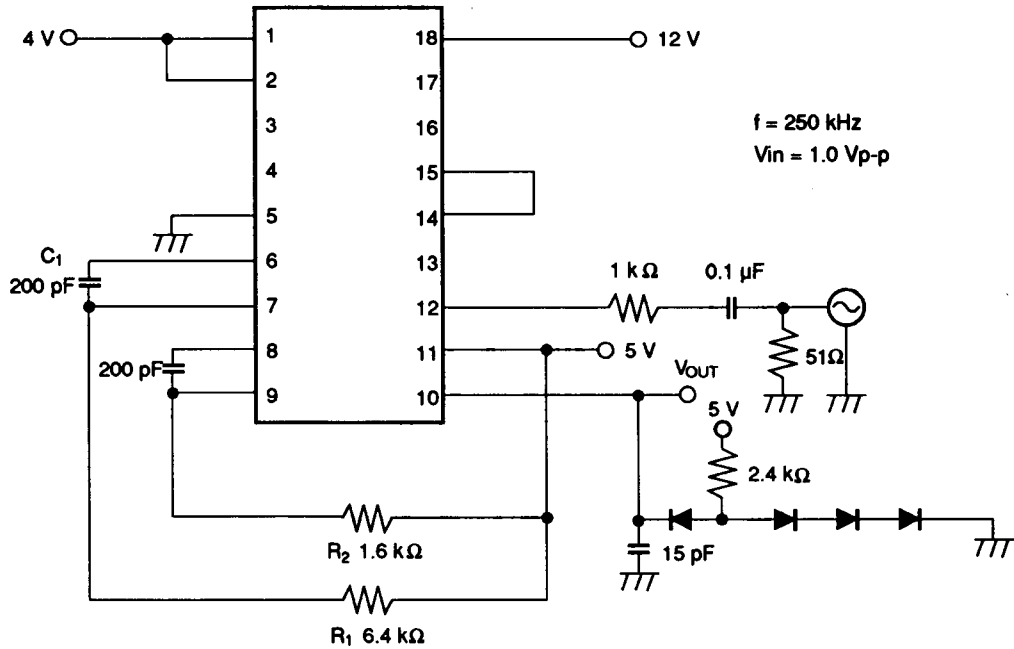
# HA16631P, HA16631MP



**Figure 11 Common Mode Rejection Ratio**



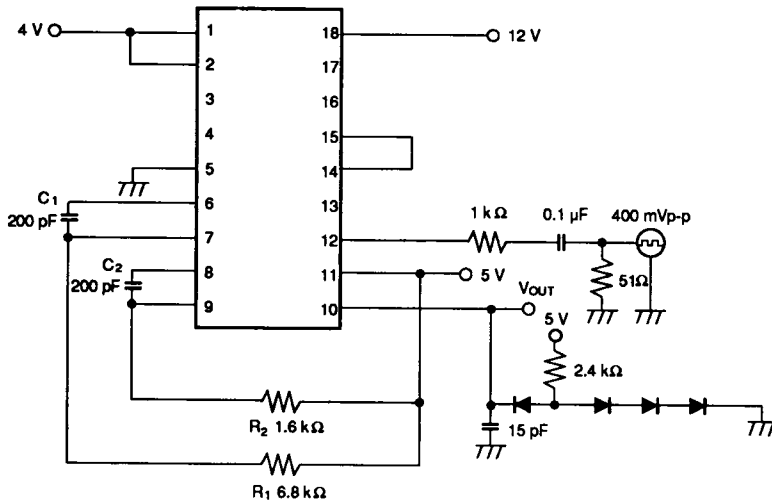
**Figure 12 Differentiator Output Sink Current**



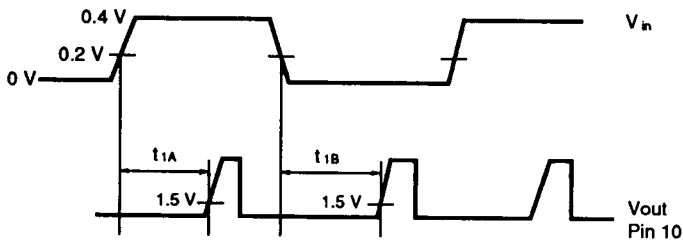
$$PS = 1/2 \cdot \frac{tps1 - tps2}{tps1 + tps2} \times 100\%$$

Figure 13 Peak Shift

# HA16631P, HA16631MP

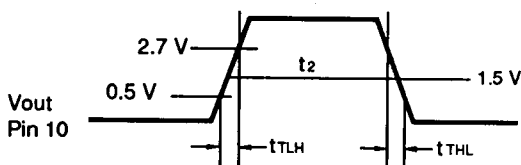


$t_{TLH} = t_{THL} = 10 \text{ ns}$   
 $f = 250 \text{ kHz}$   
 $50\% \text{ Duty Cycle}$



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

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



$$Et_2 = \frac{t_2}{200 \text{ ns}} \times 100\%$$

**Figure 14 Timing Accuracy, Rising Time, Falling Time**

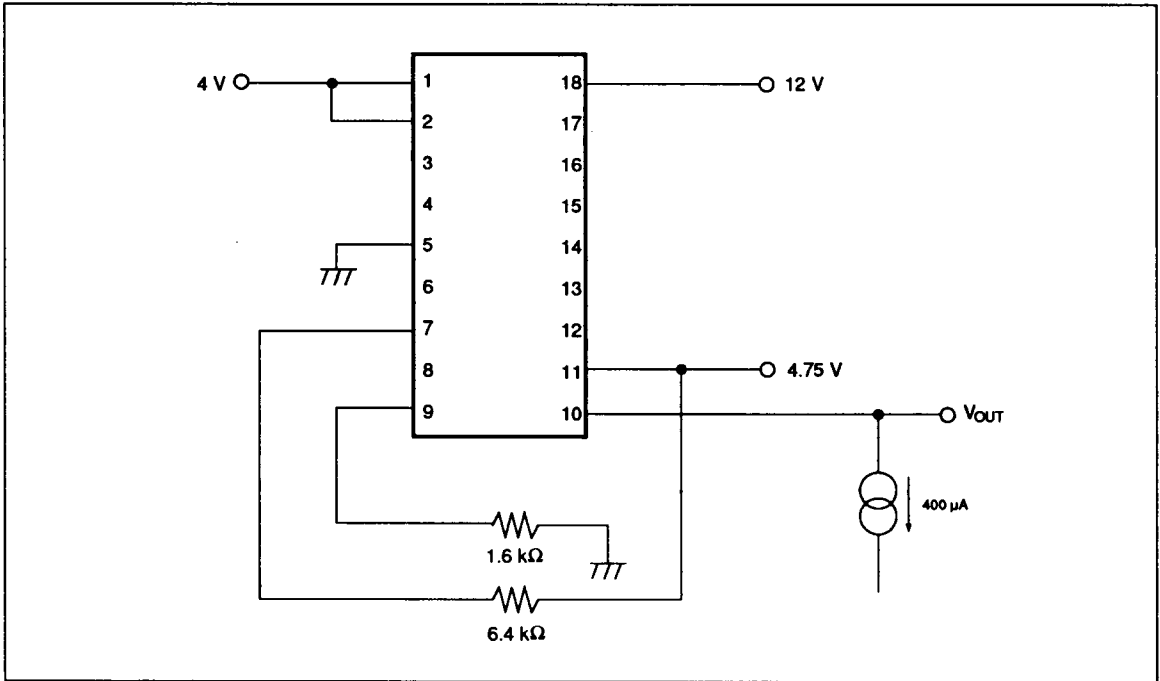


Figure 15 Output Voltage High (Pin 10)

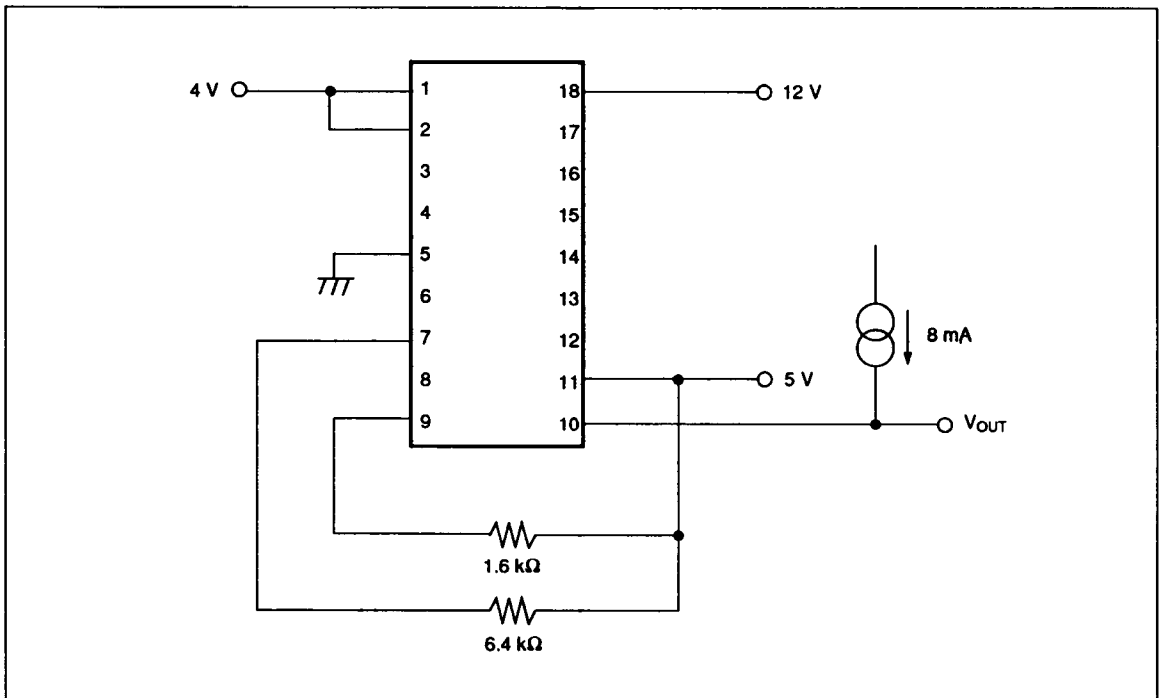


Figure 16 Output Voltage Low (Pin 10)

HA16631P, HA16631MP

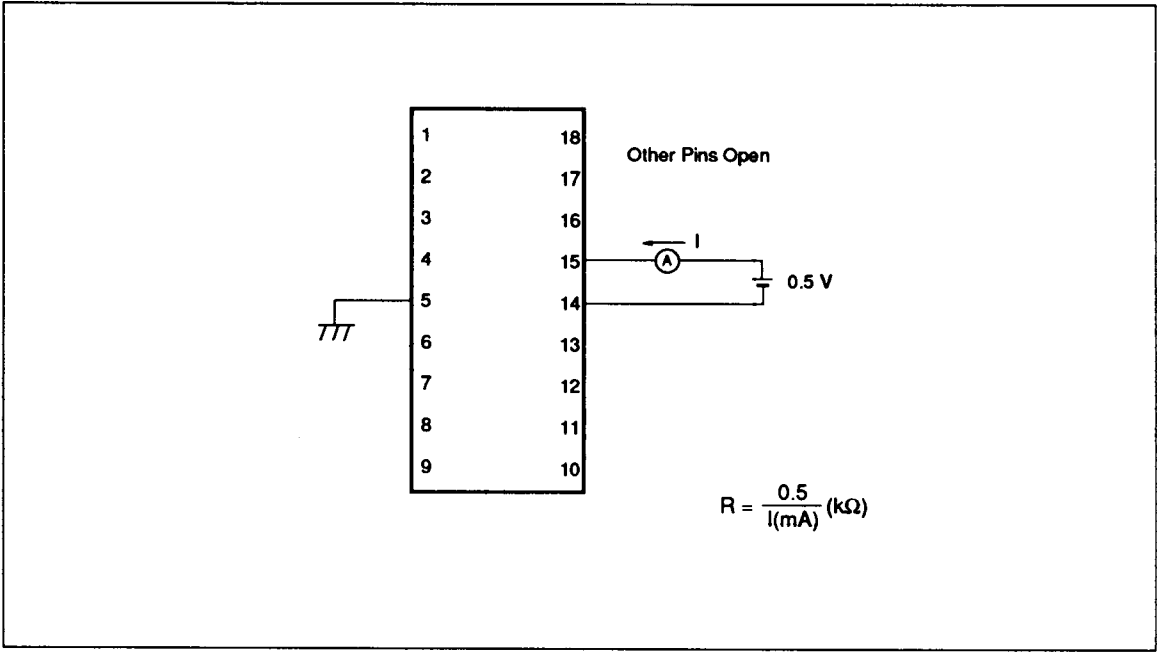


Figure 17 Input Resistance

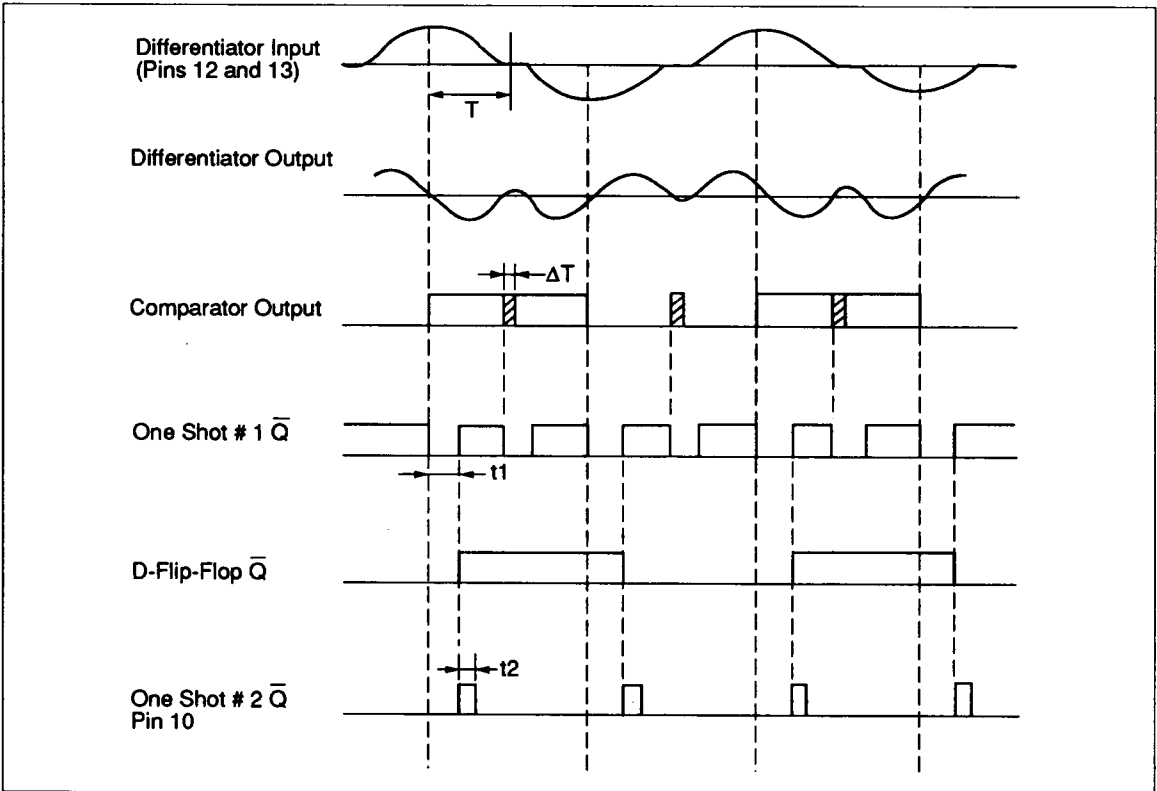


Figure 18 Timing Waveforms

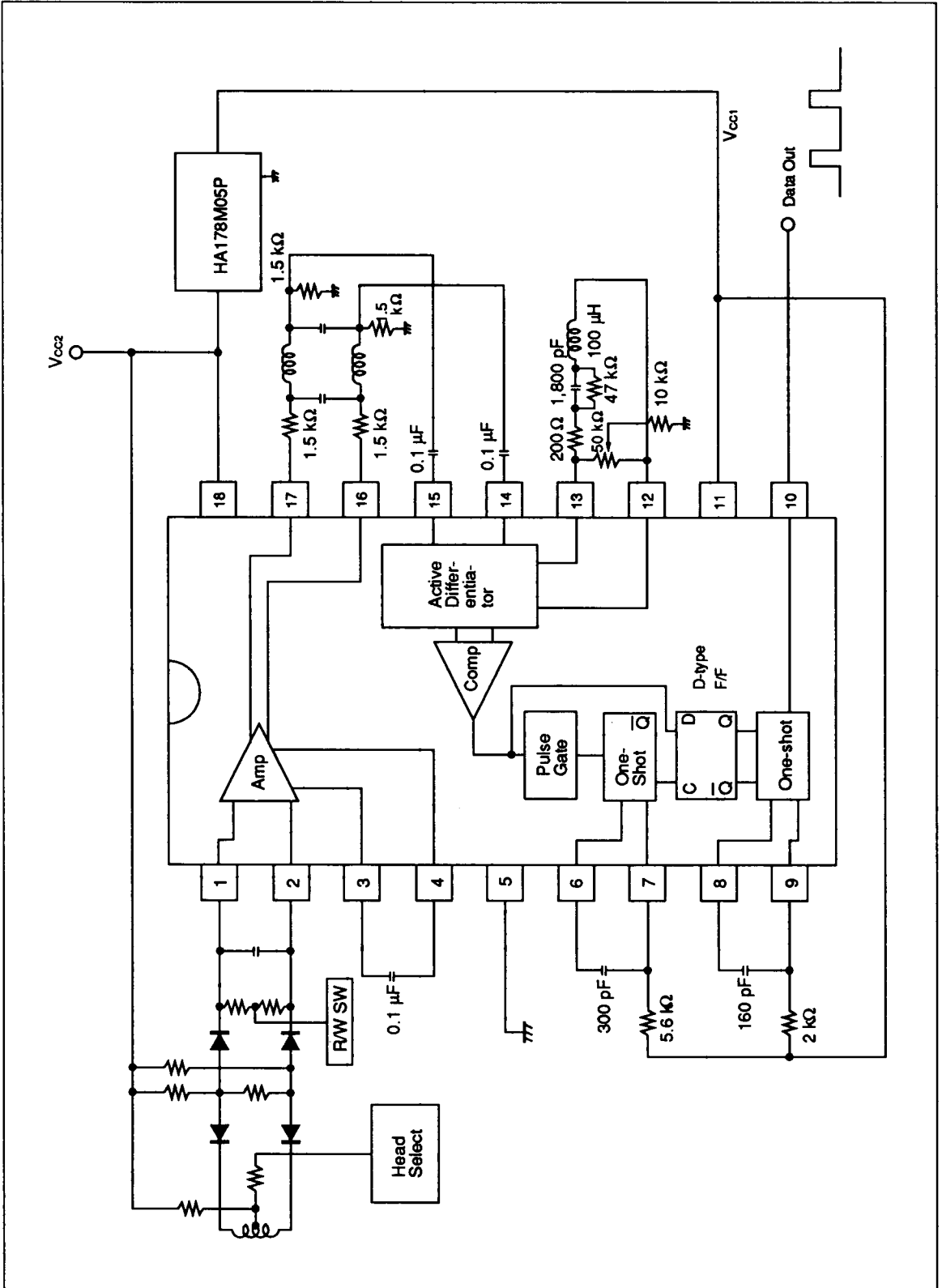


Figure 19 Circuit Example



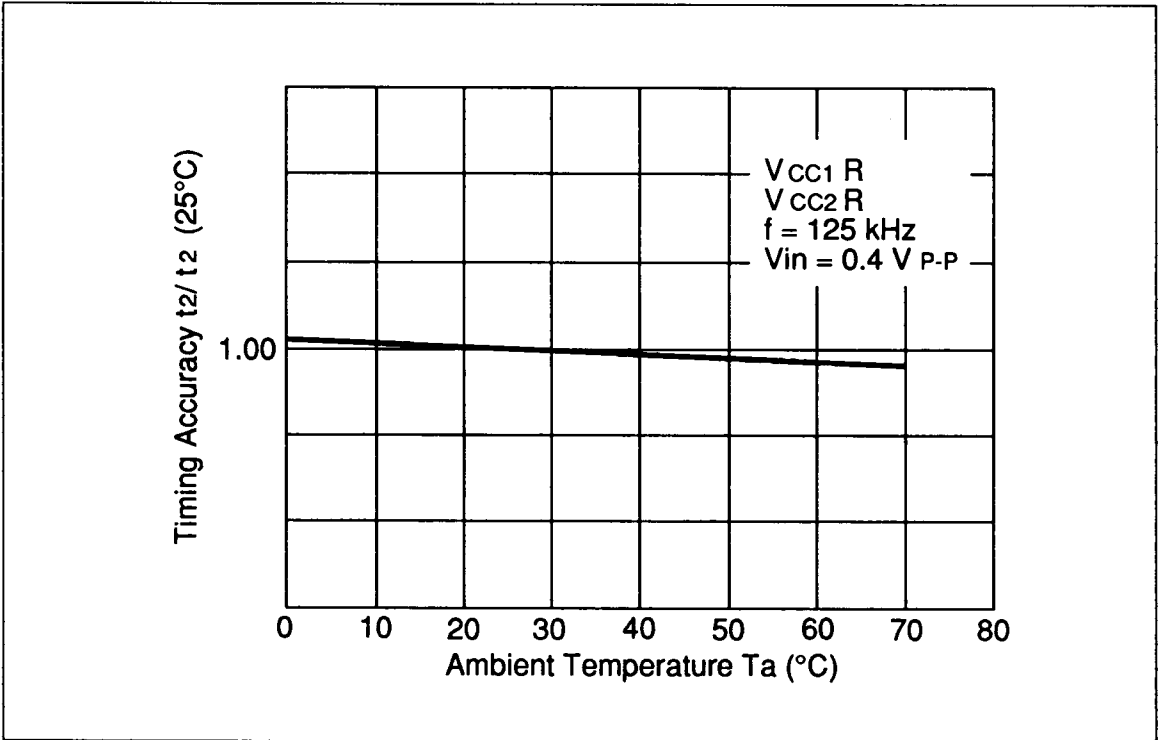


Figure 20 Timing Accuracy vs Ambient Temperature

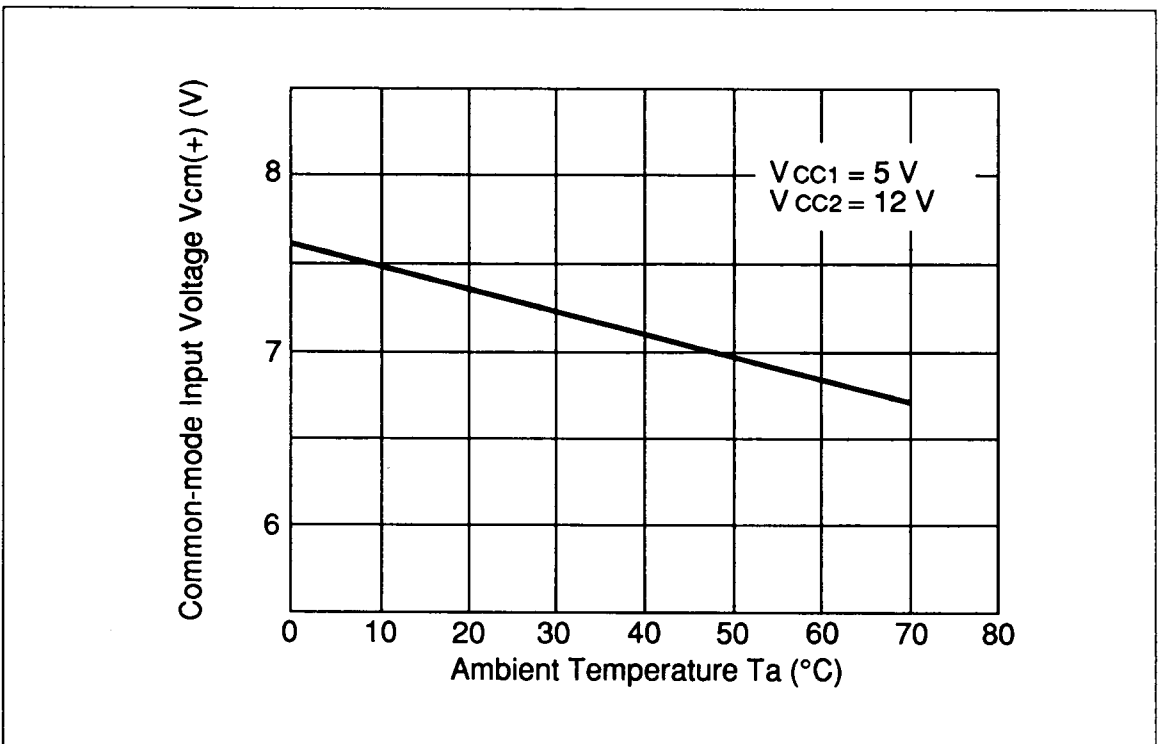


Figure 21 Common-Mode Input Voltage vs Ambient Temperature

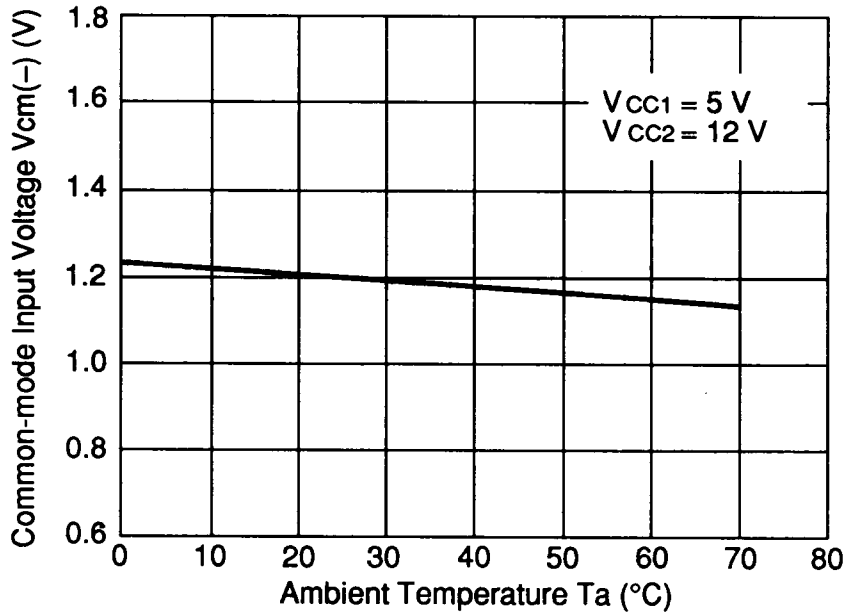


Figure 22 Common-Mode Input Voltage vs Ambient Temperature

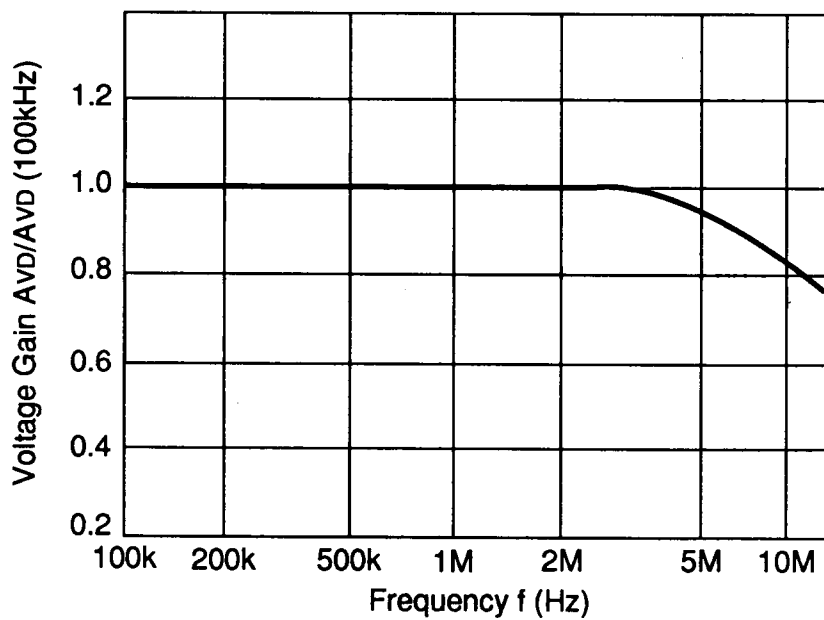


Figure 23 Voltage Gain vs Frequency

HA16631P, HA16631MP

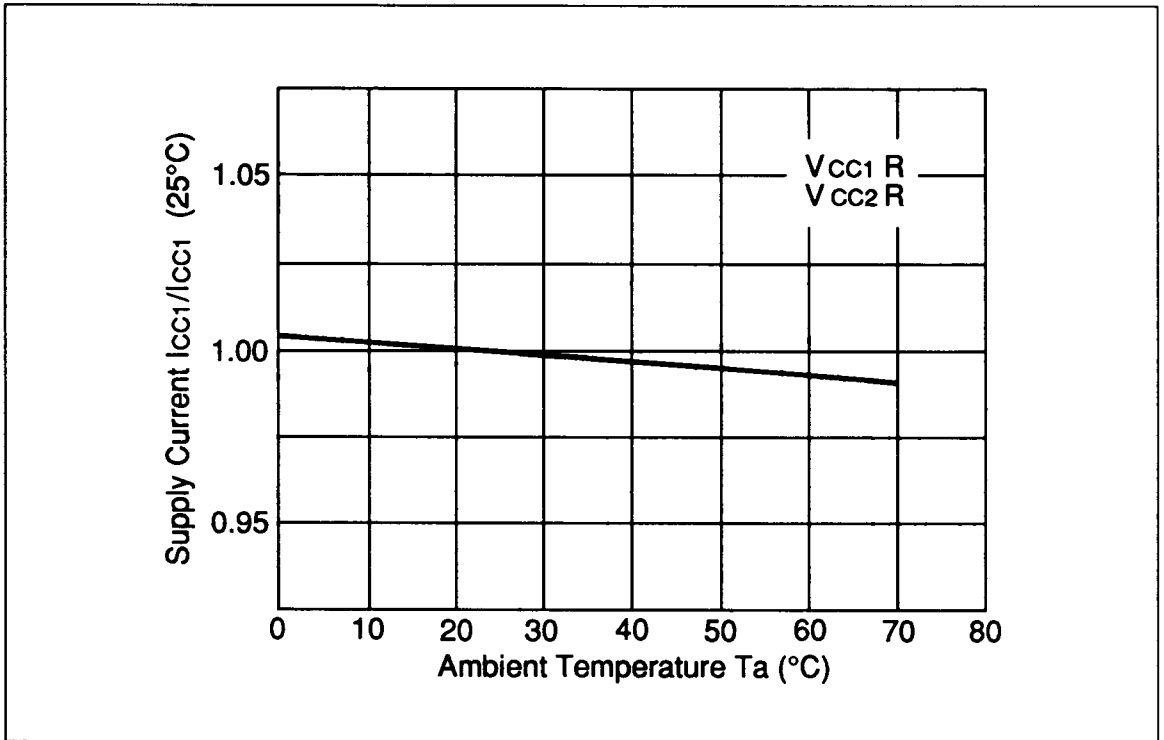


Figure 24 Supply Current vs Ambient Temperature (1)

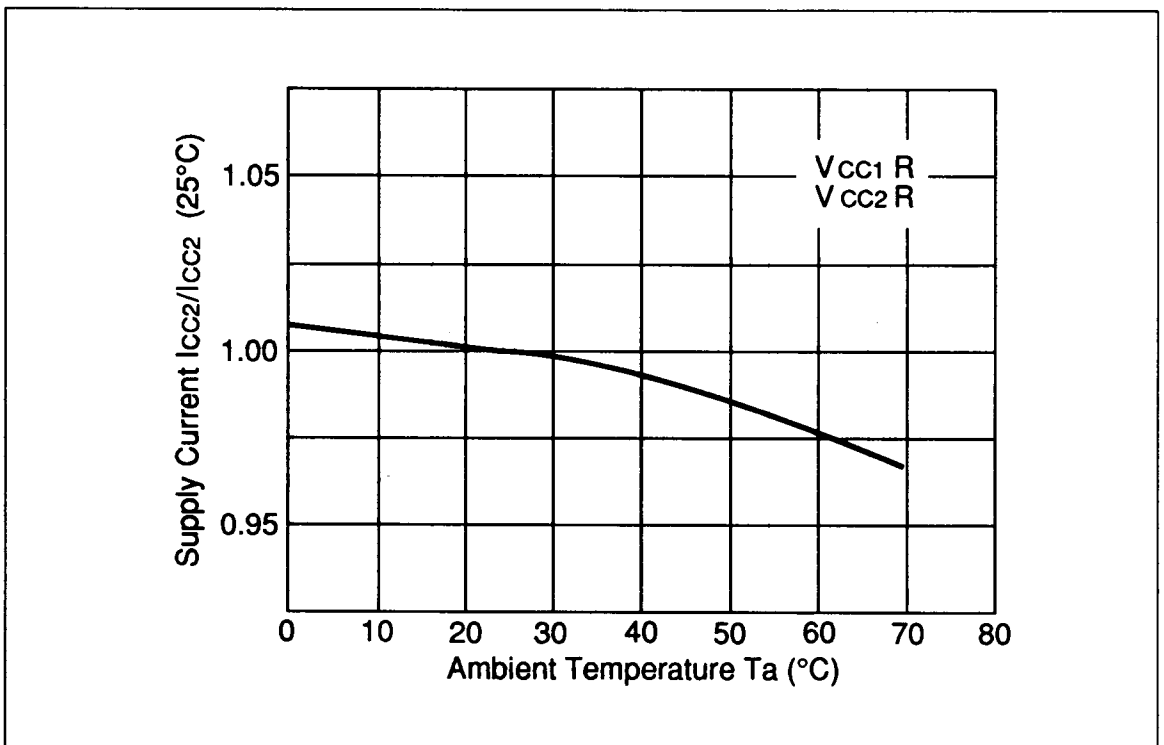


Figure 25 Supply Current vs Ambient Temperature (2)

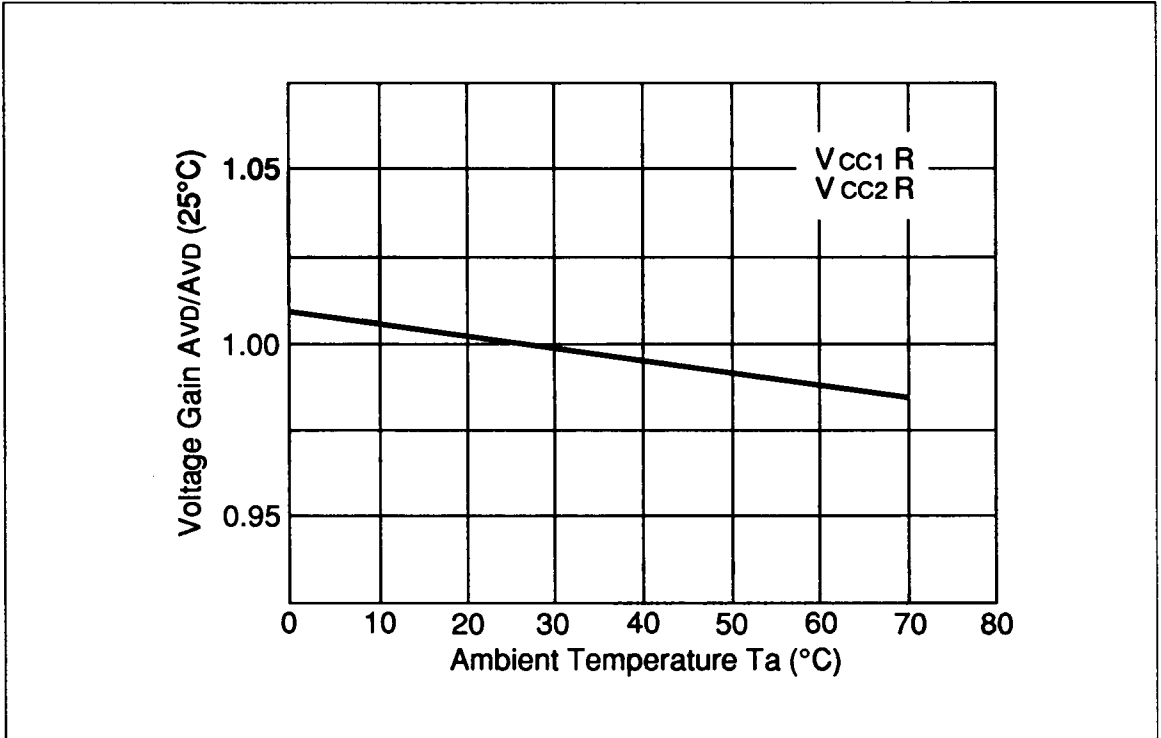


Figure 26 Voltage Gain vs Ambient Temperature

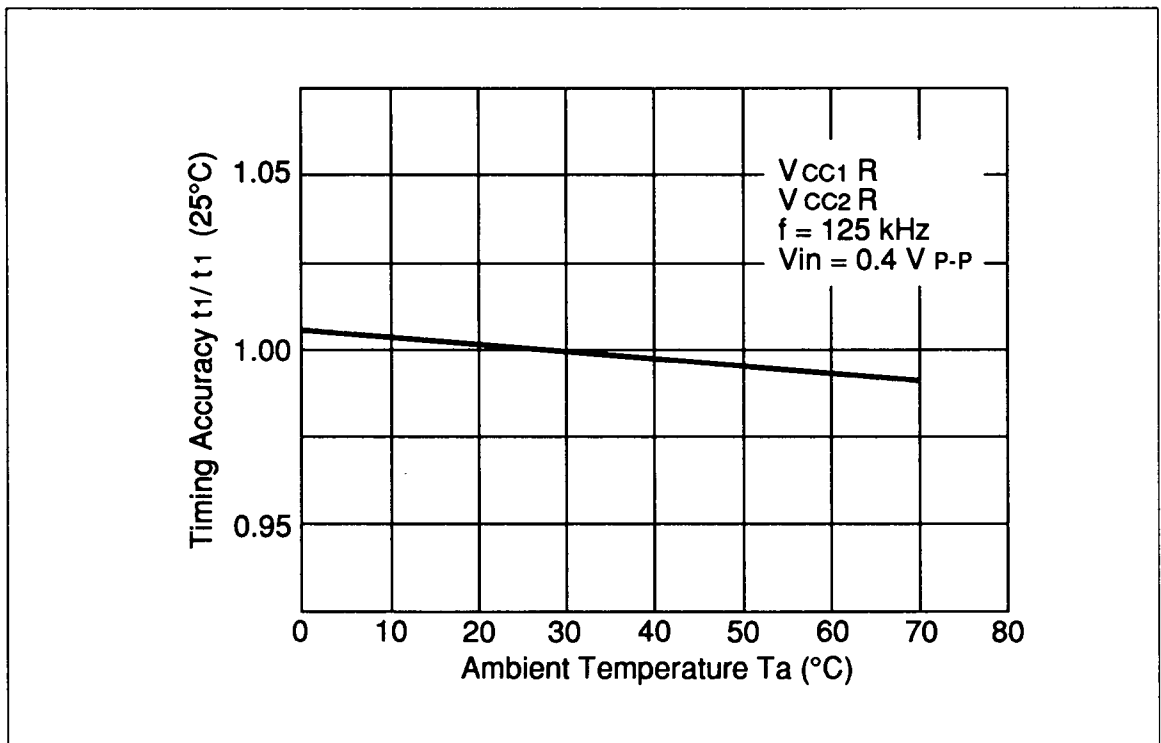


Figure 27 Timing Accuracy vs Ambient Temperature