

HA16631P, HA16631MP

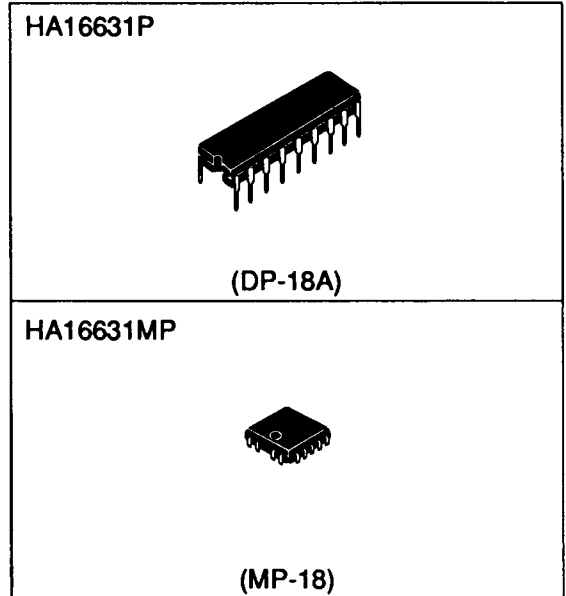
Read Amplifier

Description

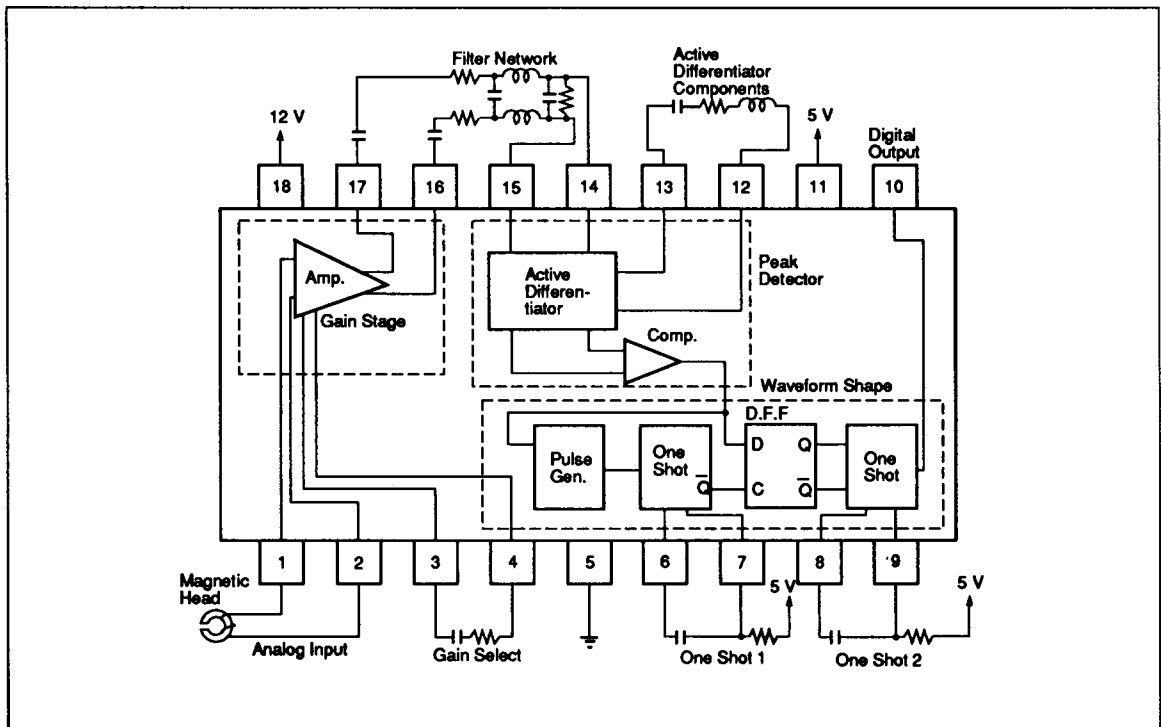
The HA16631P and HA16631MP monolithic read amplifiers for flexible disk drives provide wave-shaped output signals. The differentiator, zero-volt comparator generate data pulses from the amplified signals from the magnetic head and waveform shaper section.

Features

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

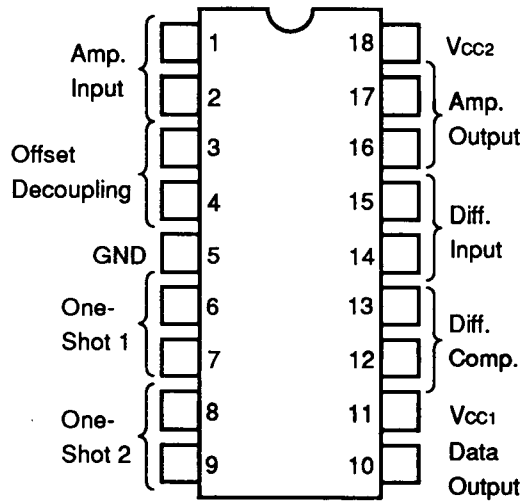


Block Diagram



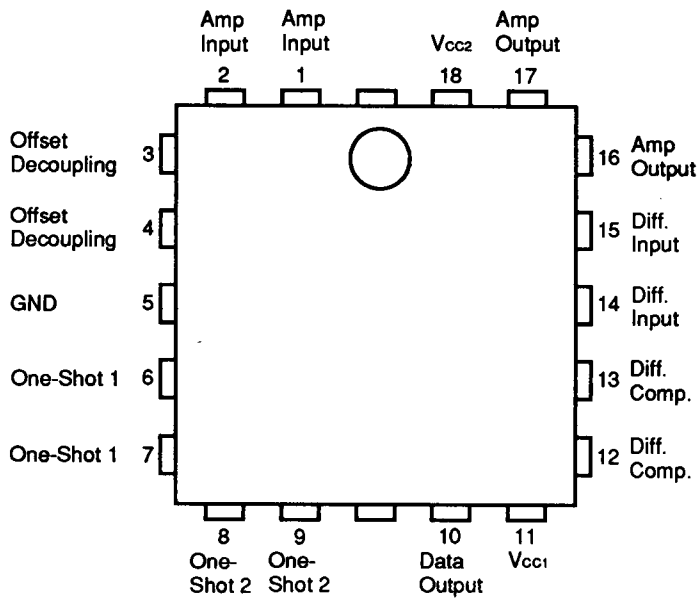
Pin Arrangement

HA16631P



(Top view)

HA16631MP



(Top view)

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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 |

HA16631P, HA16631MP

| Item | Symbol | Min | Typ | Max | Unit | Test Condition | Test Circuit |
|---|-------------------|-----|-----|-----|----------|--|--------------|
| Power supply rejection ratio V_{CC1} | PSRR ₁ | 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 ₂ | 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 _{DO} | — | — | 0.4 | V | | Fig. 7 |
| Common mode output voltage | V _{CO} | — | 3.1 | — | V | | Fig. 7 |
| Effective differential emitter resistance (Pins 3 and 4) | REFF | 370 | 570 | 770 | Ω | | 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) | ISD | 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 _{ID} | — | 30 | — | k Ω | | Fig. 17 |
| Output resistance | r _{OP} | — | 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 | k Ω | | 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 | $t_2 = 0.625 C_2 R_2$ $C_2 = 200\text{ pF}$, $R_2 = 1.6\text{ k}\Omega$ | Fig. 14 |
| Timing capacitance #2 | C_2 | 100 | — | 800 | pF | | Fig. 14 |
| Timing resistance #2 | R_2 | 1.5 | — | 10 | k Ω | | Fig. 14 |

Test Circuits

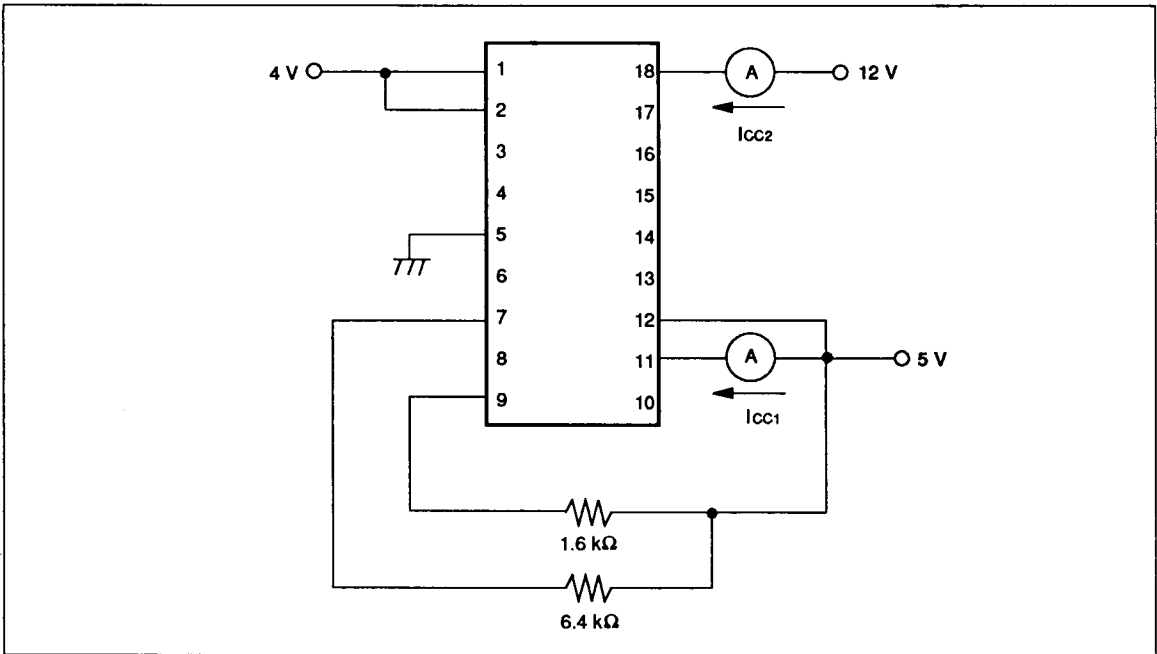


Figure 1 Power Supply Current

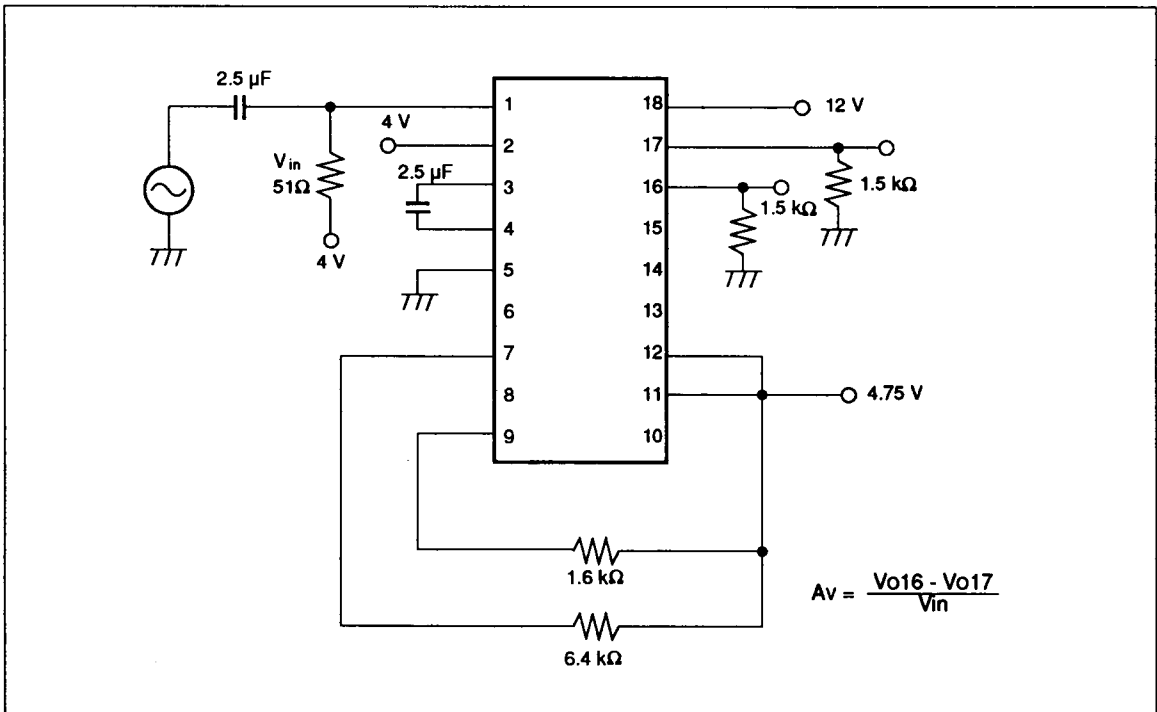


Figure 2 Voltage Gain, Band-width, Output Voltage Swing, Output Distortion Ratio

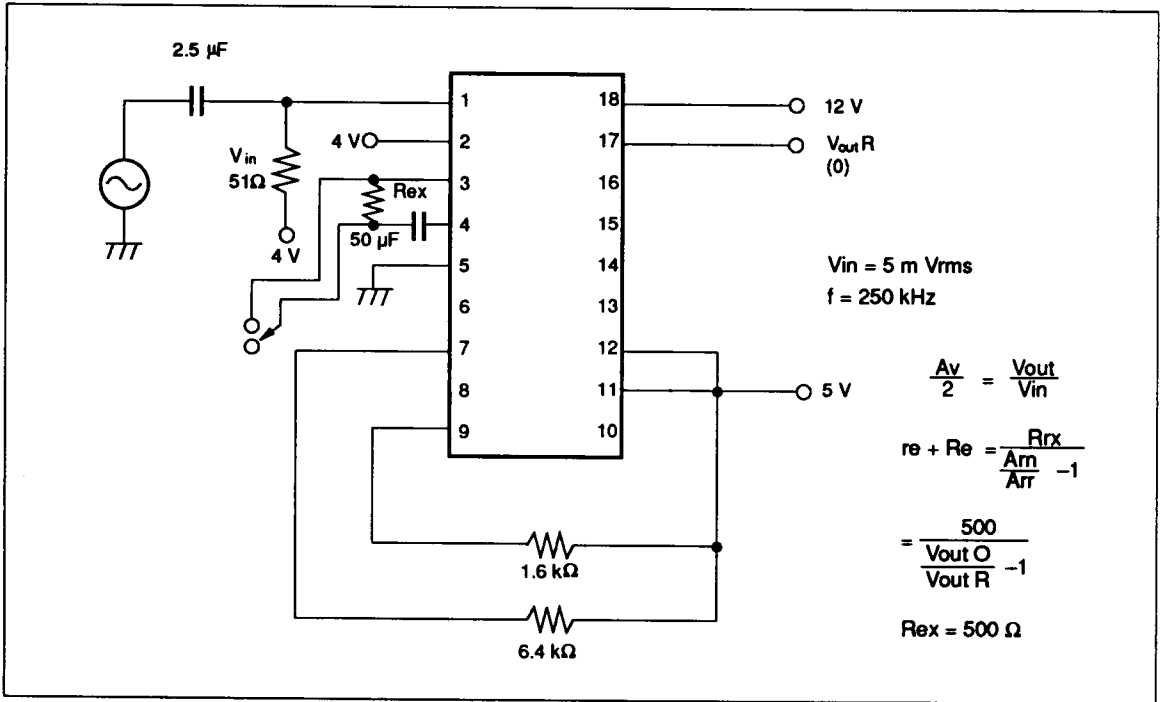


Figure 3 Pre-Amplifier Section Effective Emitter Resistance (Pins 3 and 4)

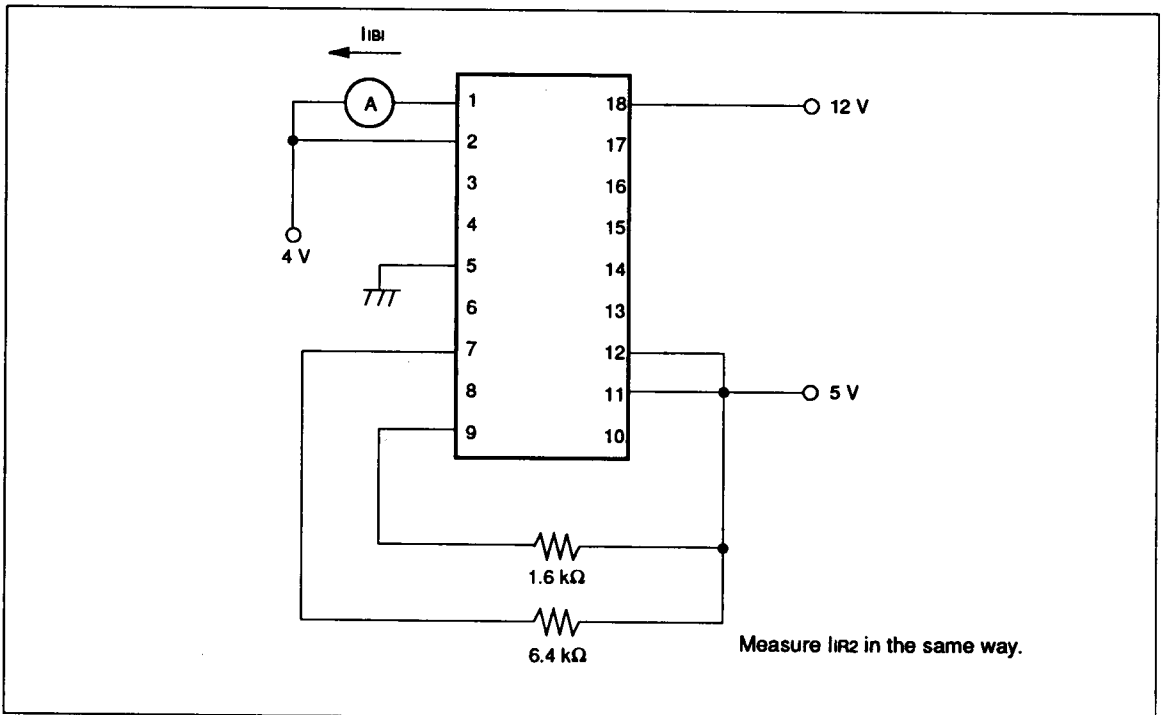


Figure 4 Input Bias Current

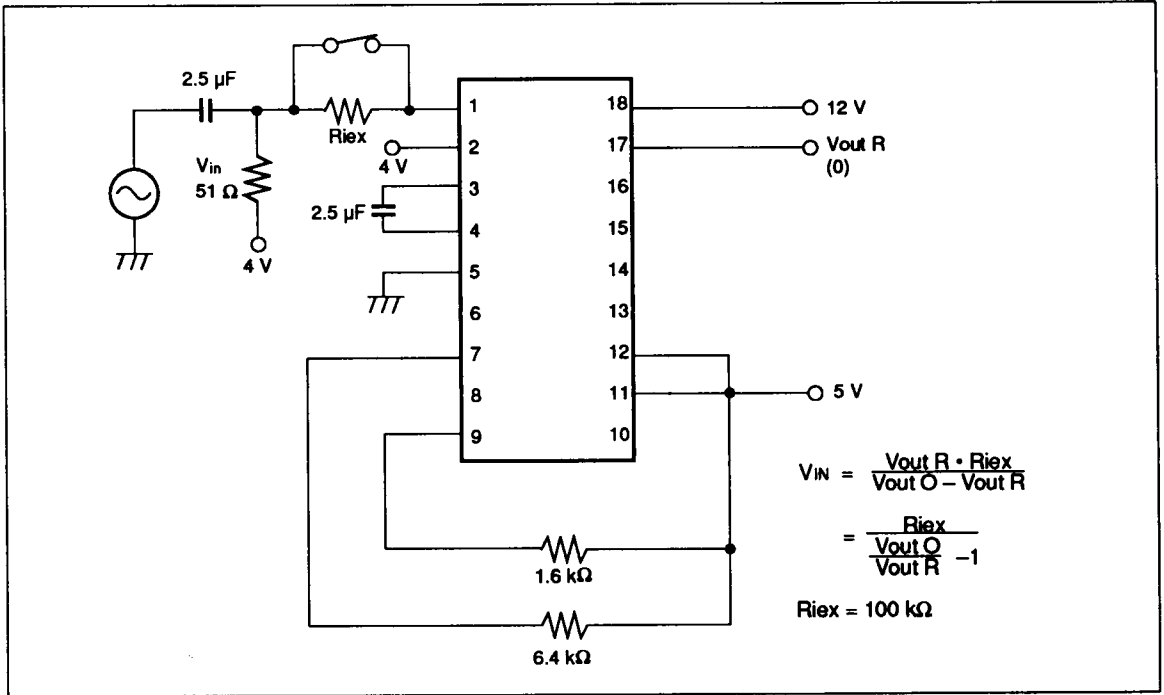


Figure 5 Input Resistance

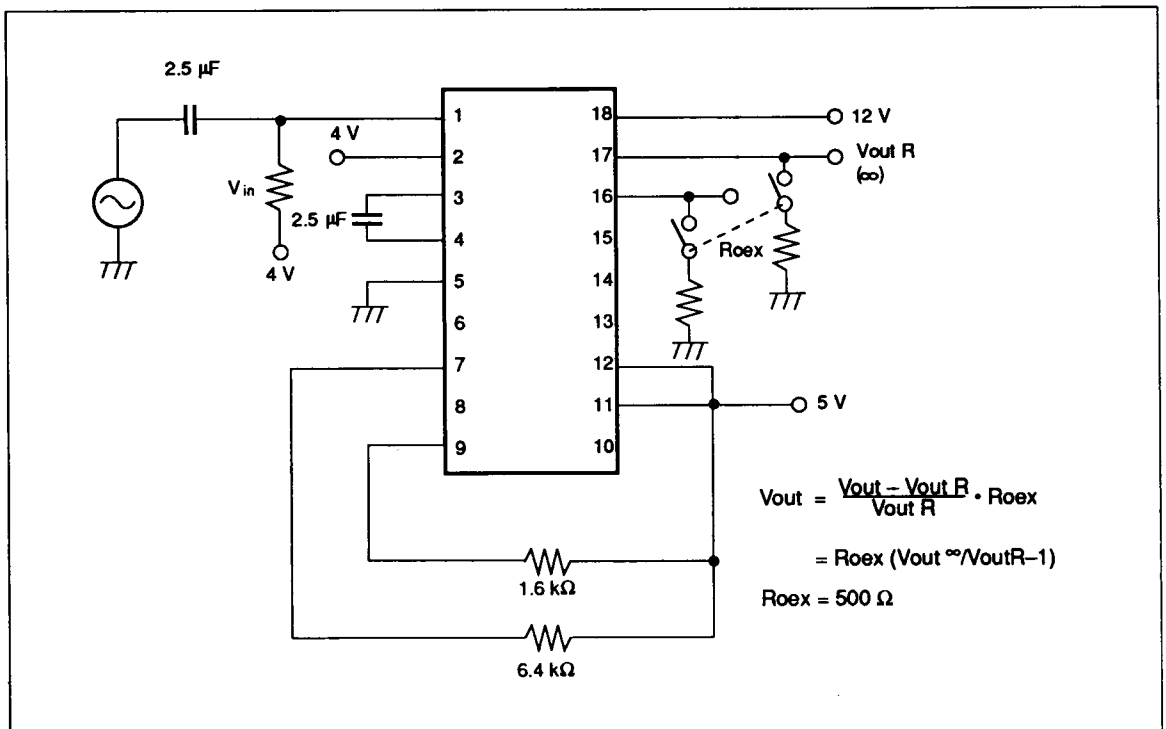


Figure 6 Output Resistance

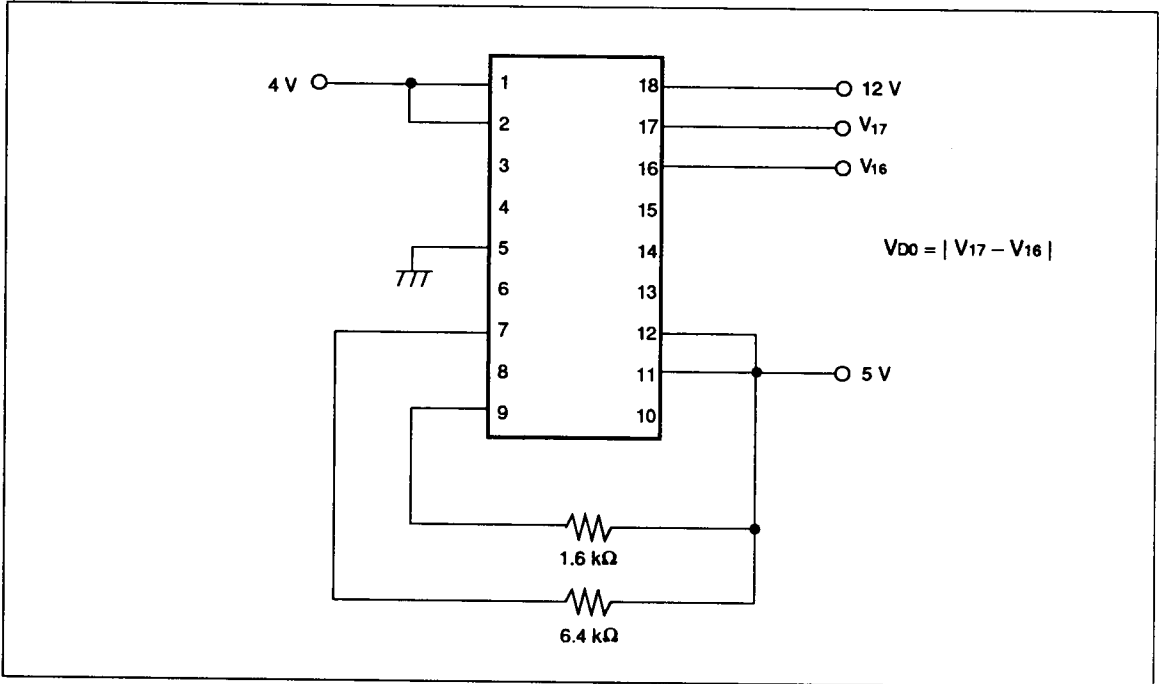


Figure 7 Differential Output Offset Voltage, Common Mode Output Voltage

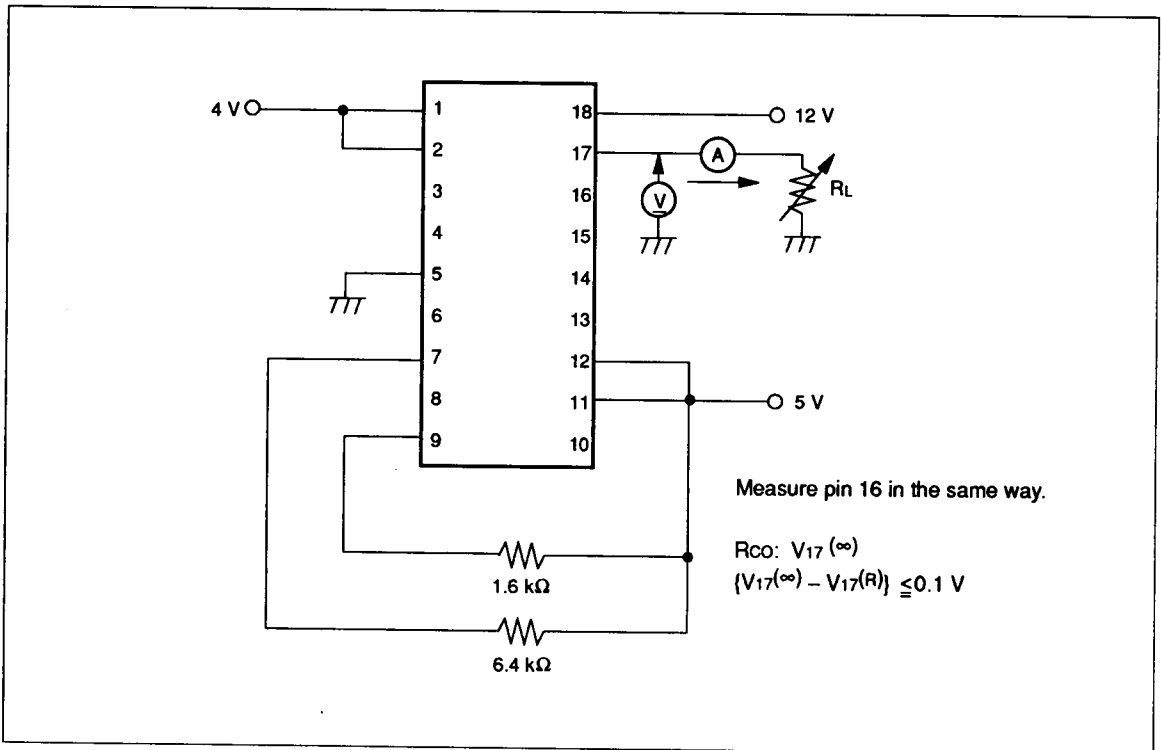


Figure 8 Output Source Current

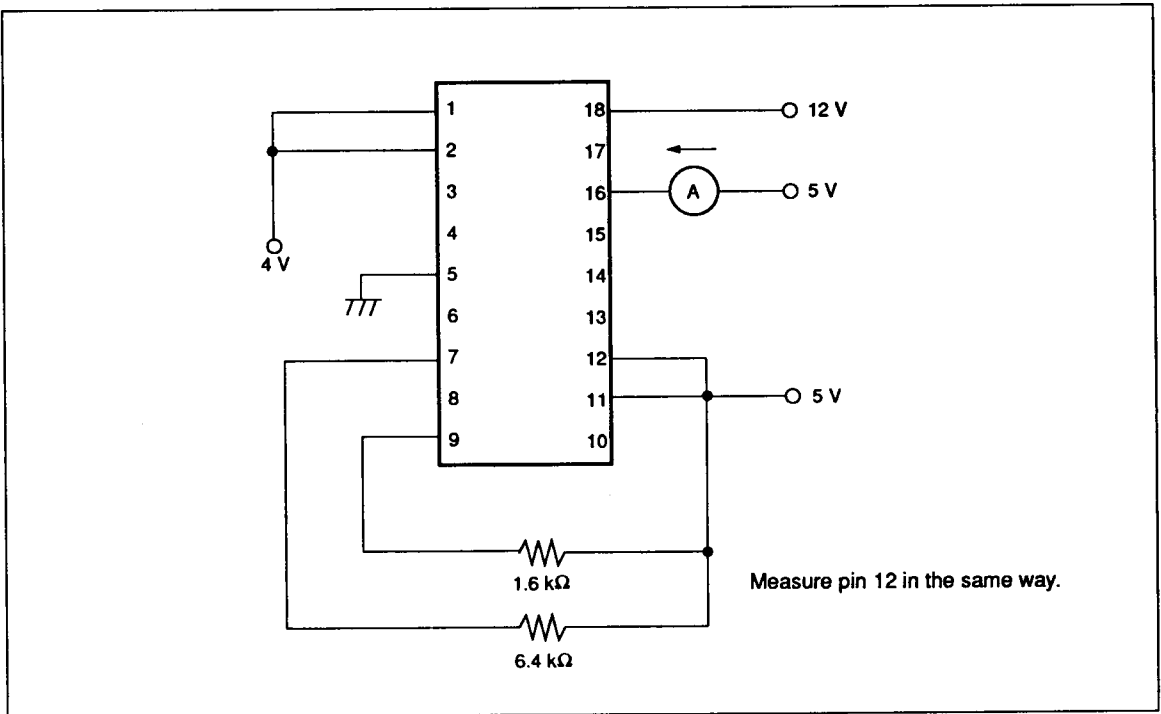


Figure 9 Output Sink Current

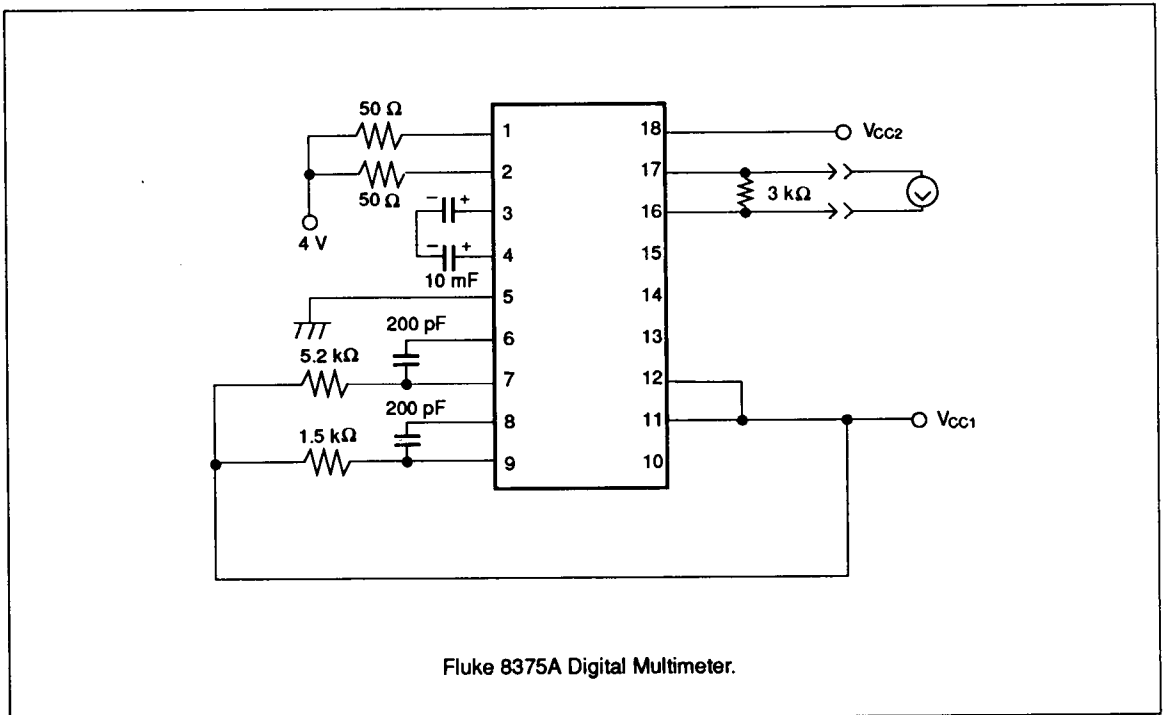


Figure 10 Power Supply Rejection Ratio

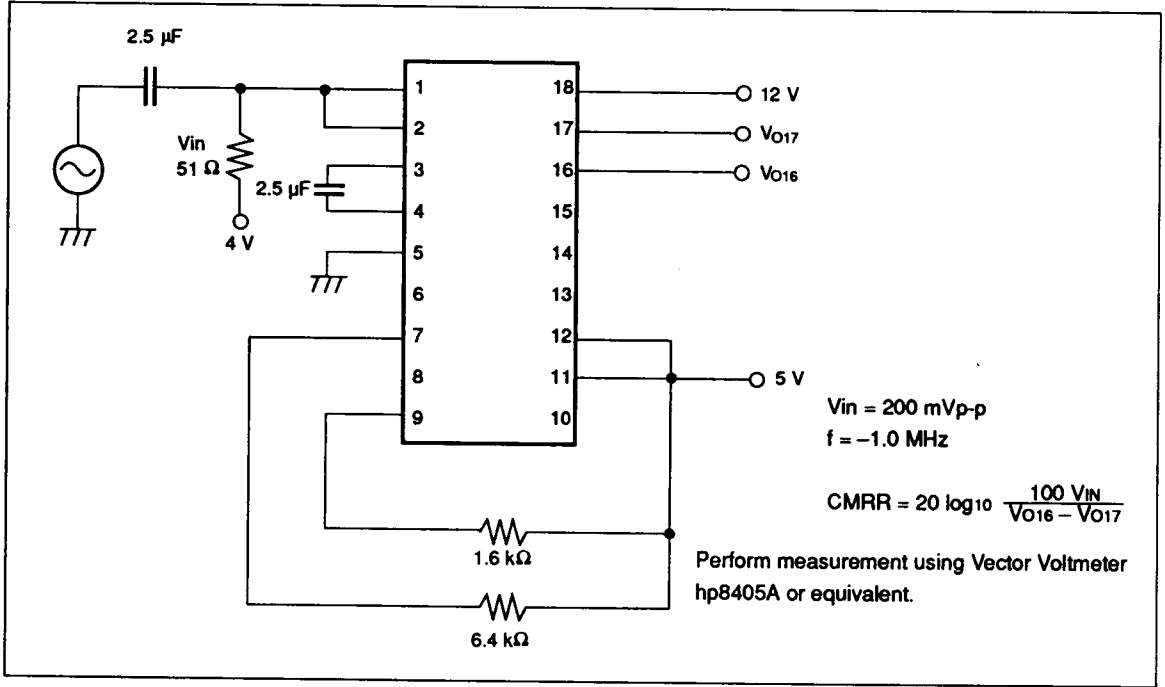


Figure 11 Common Mode Rejection Ratio

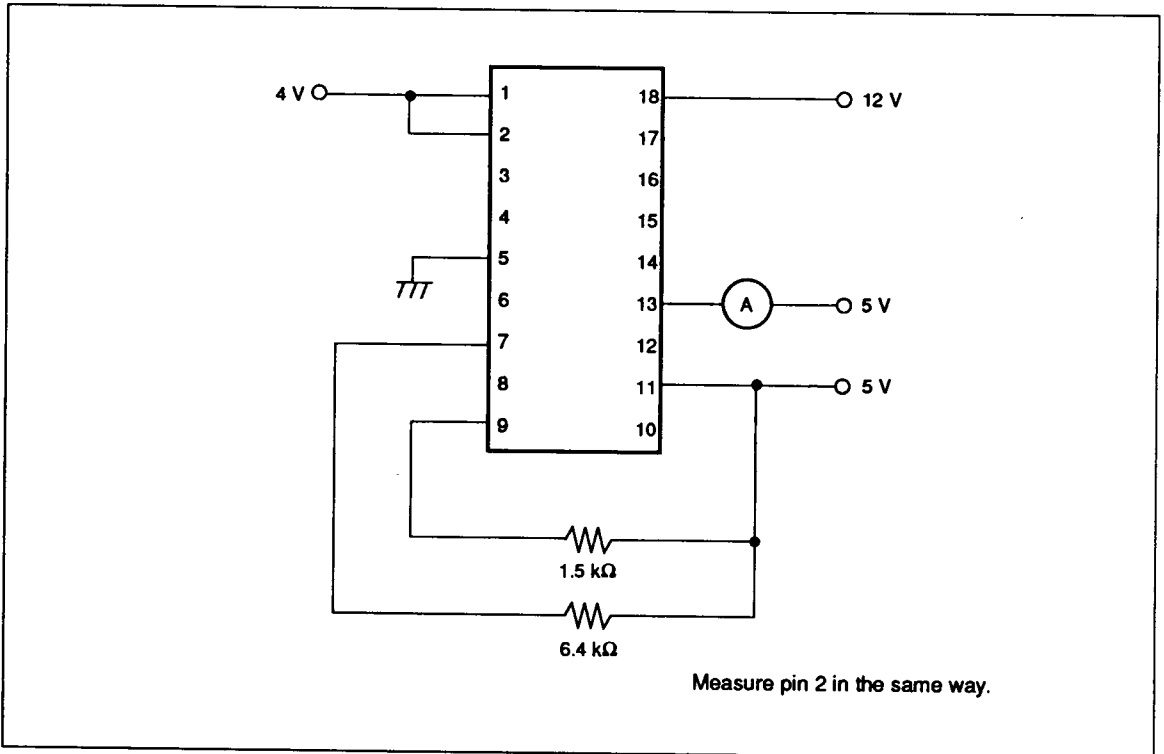
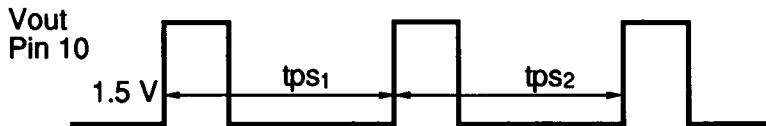
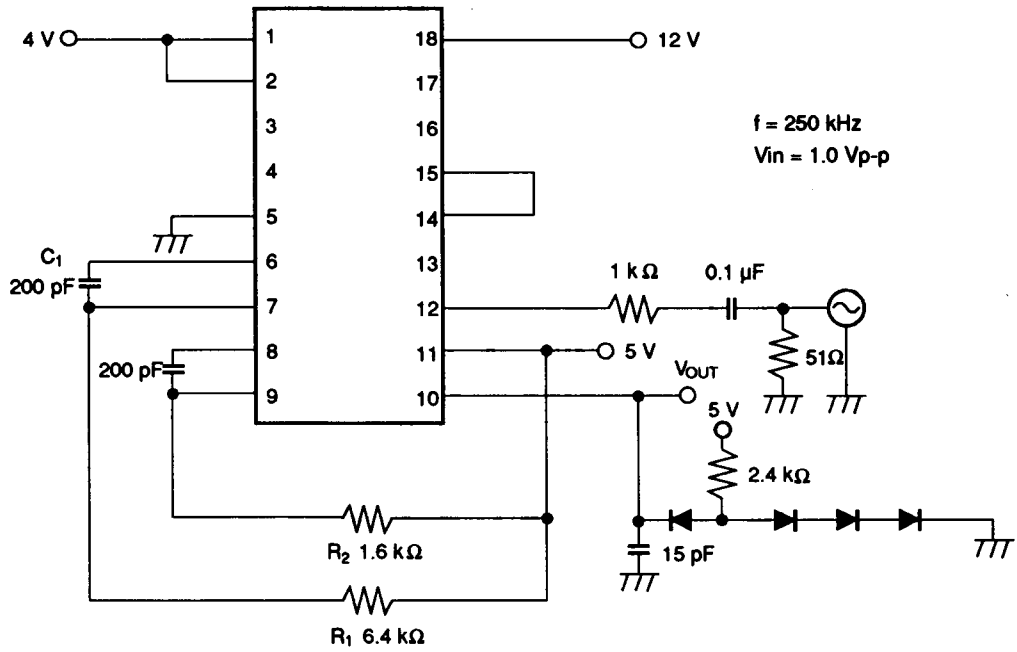


Figure 12 Differentiator Output Sink Current



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

Figure 13 Peak Shift

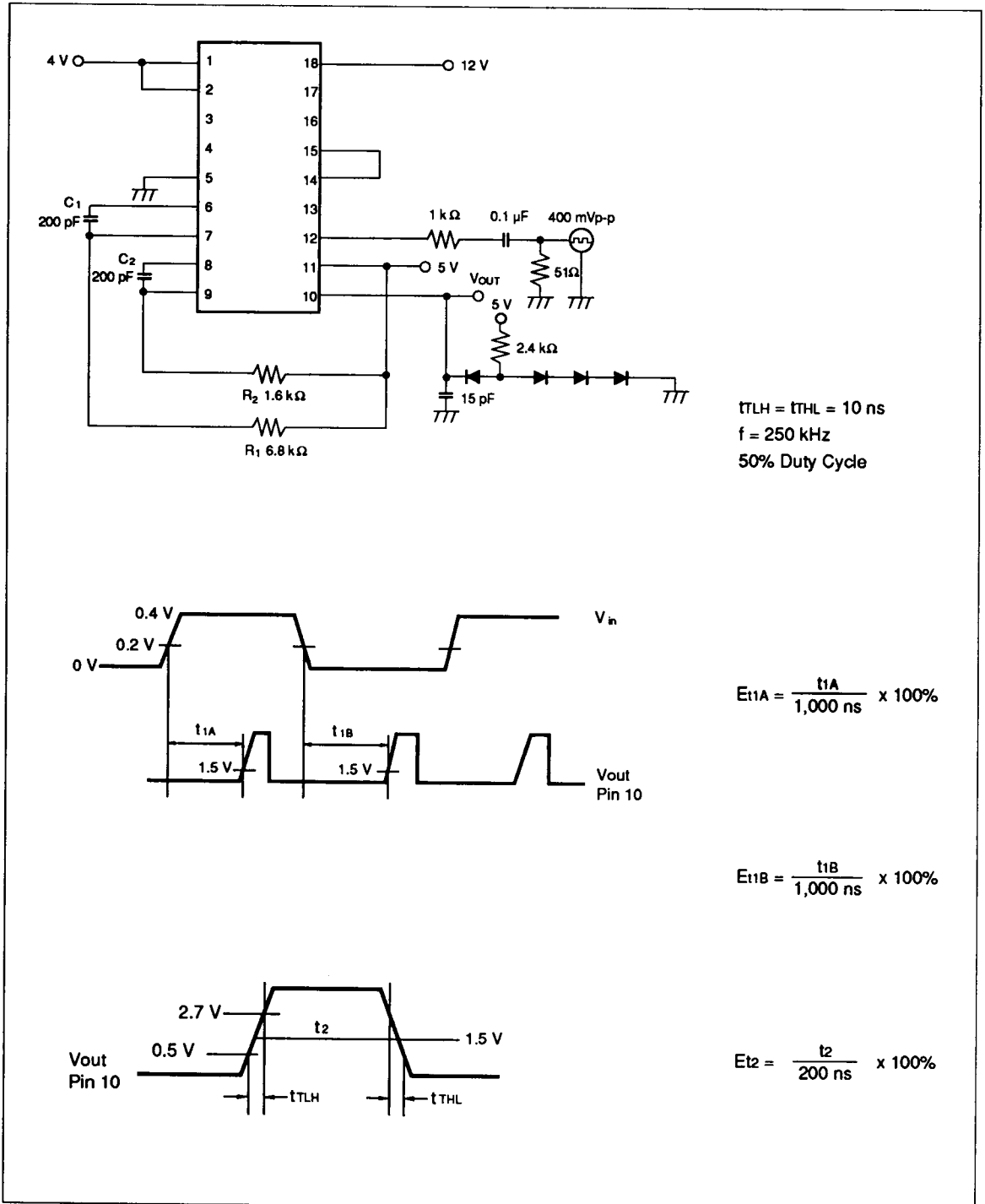


Figure 14 Timing Accuracy, Rising Time, Falling Time

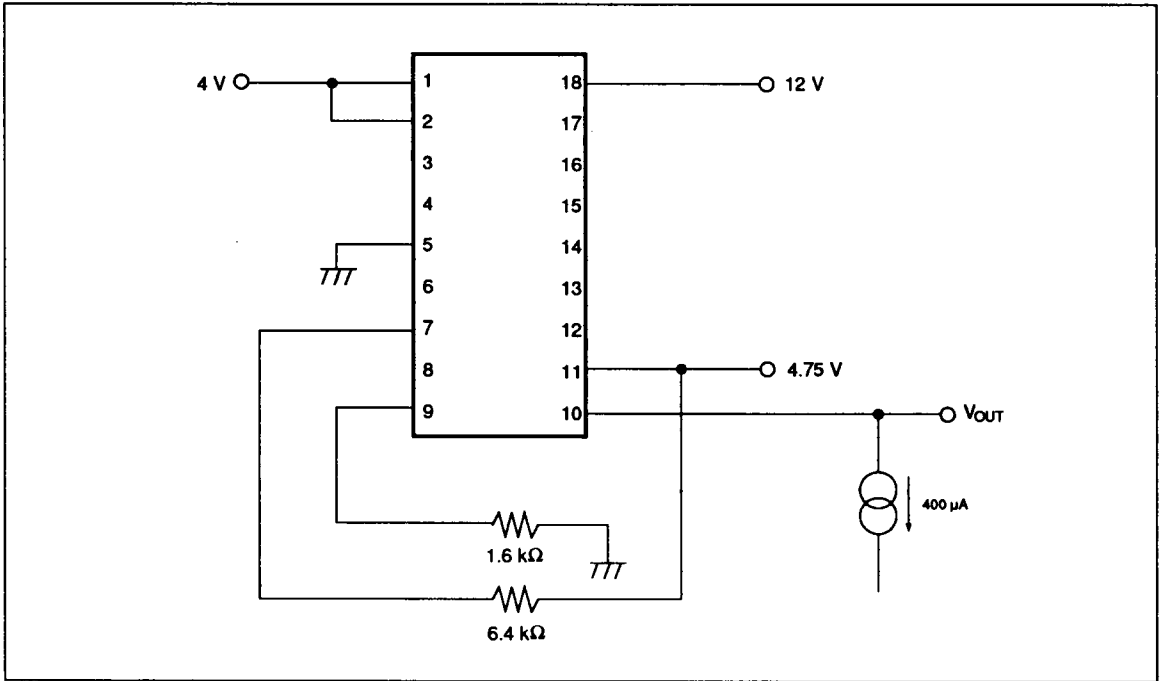


Figure 15 Output Voltage High (Pin 10)

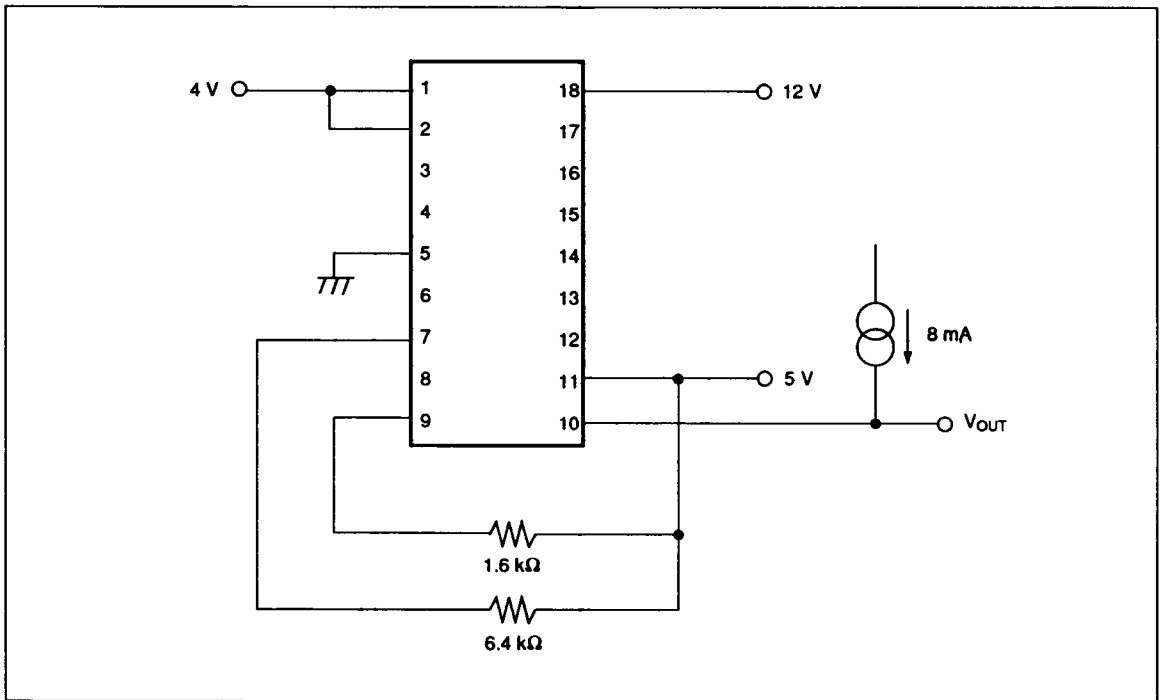


Figure 16 Output Voltage Low (Pin 10)

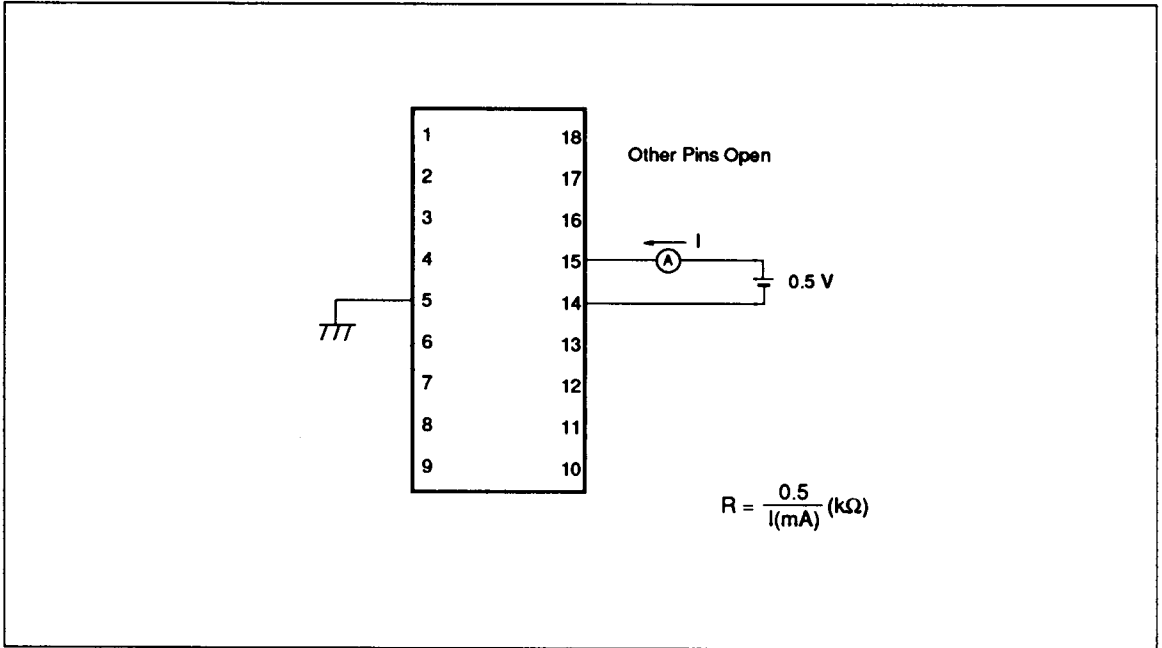


Figure 17 Input Resistance

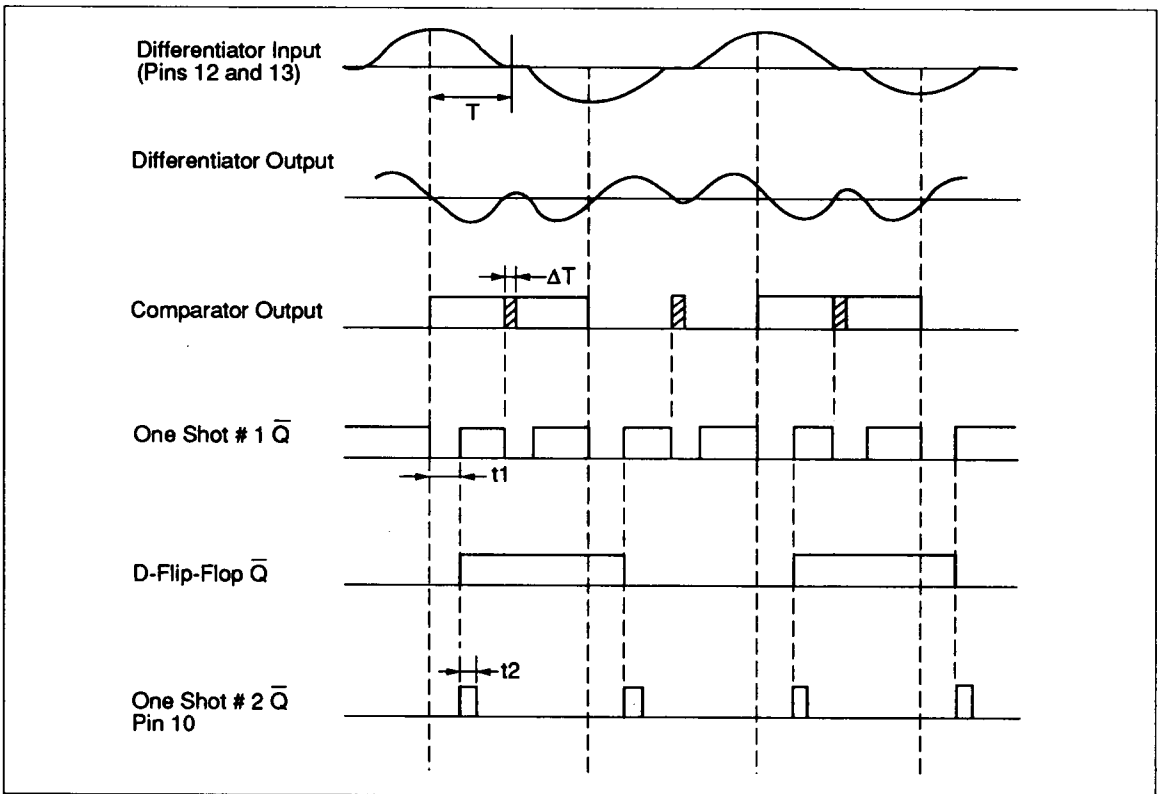


Figure 18 Timing Waveforms

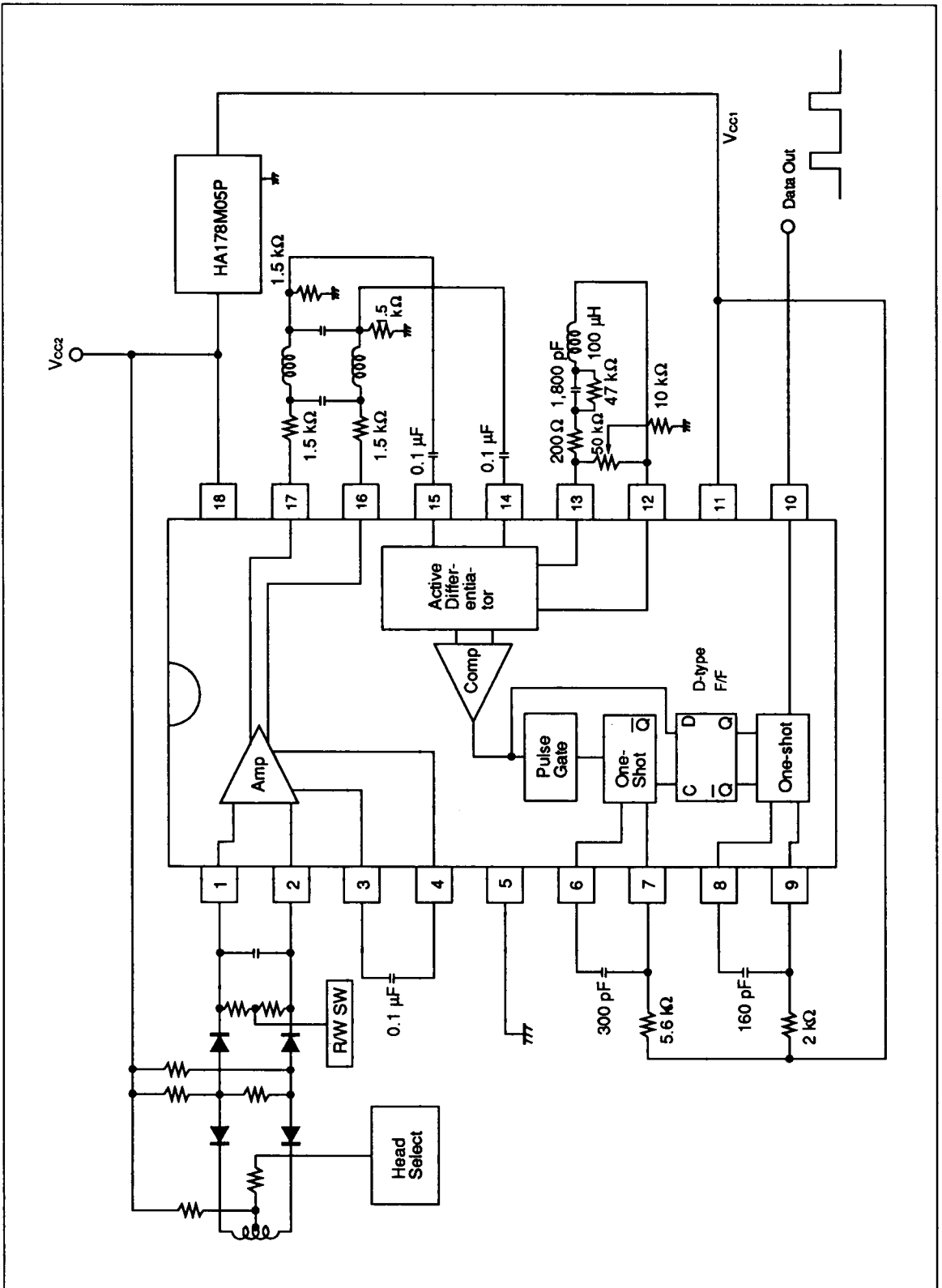


Figure 19 Circuit Example

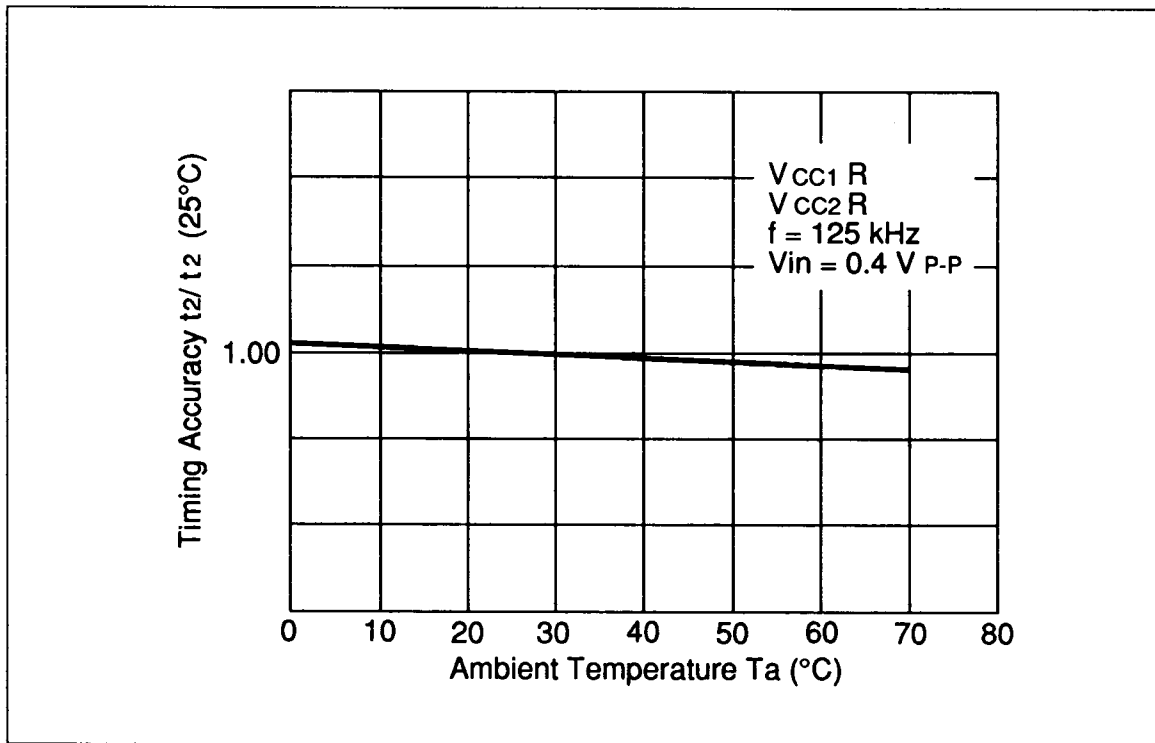


Figure 20 Timing Accuracy vs Ambient Temperature

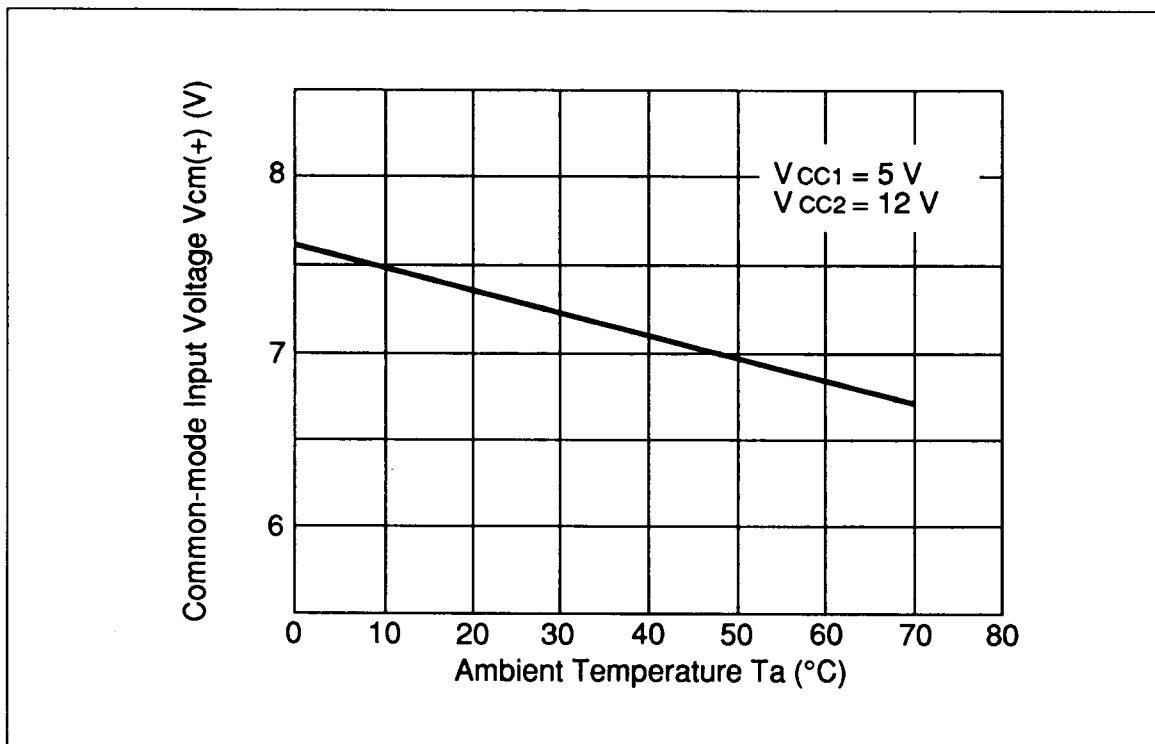


Figure 21 Common-Mode Input Voltage vs Ambient Temperature

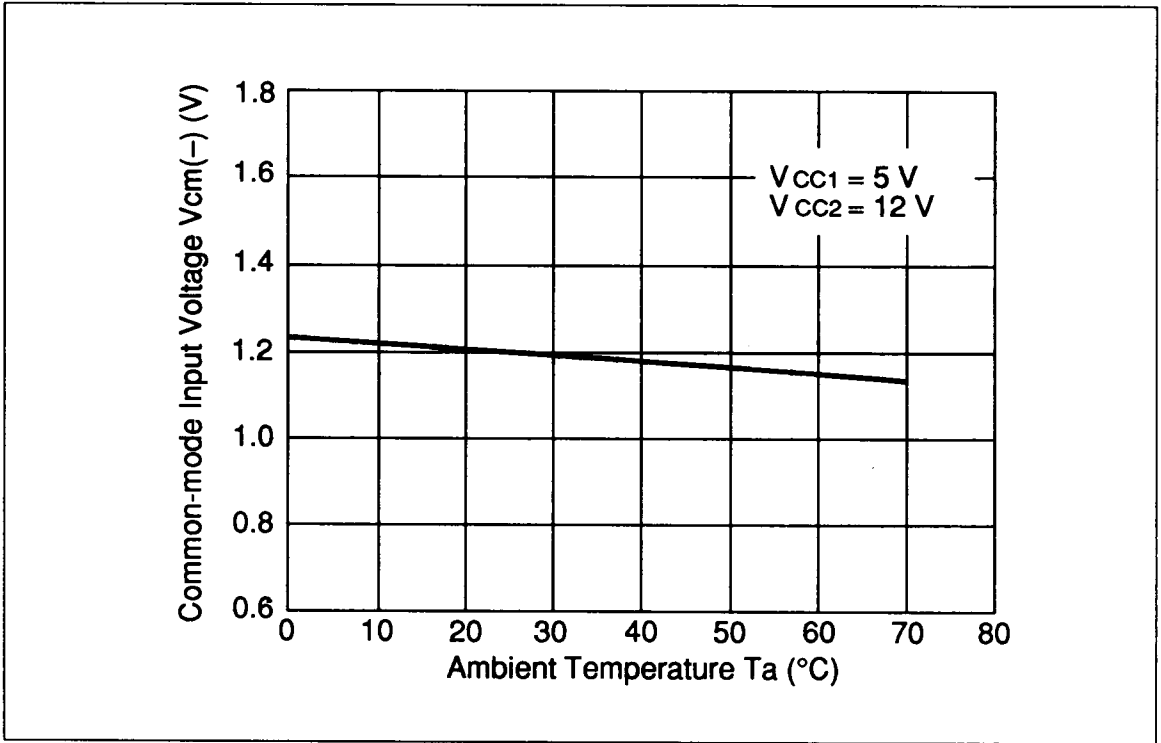


Figure 22 Common-Mode Input Voltage vs Ambient Temperature

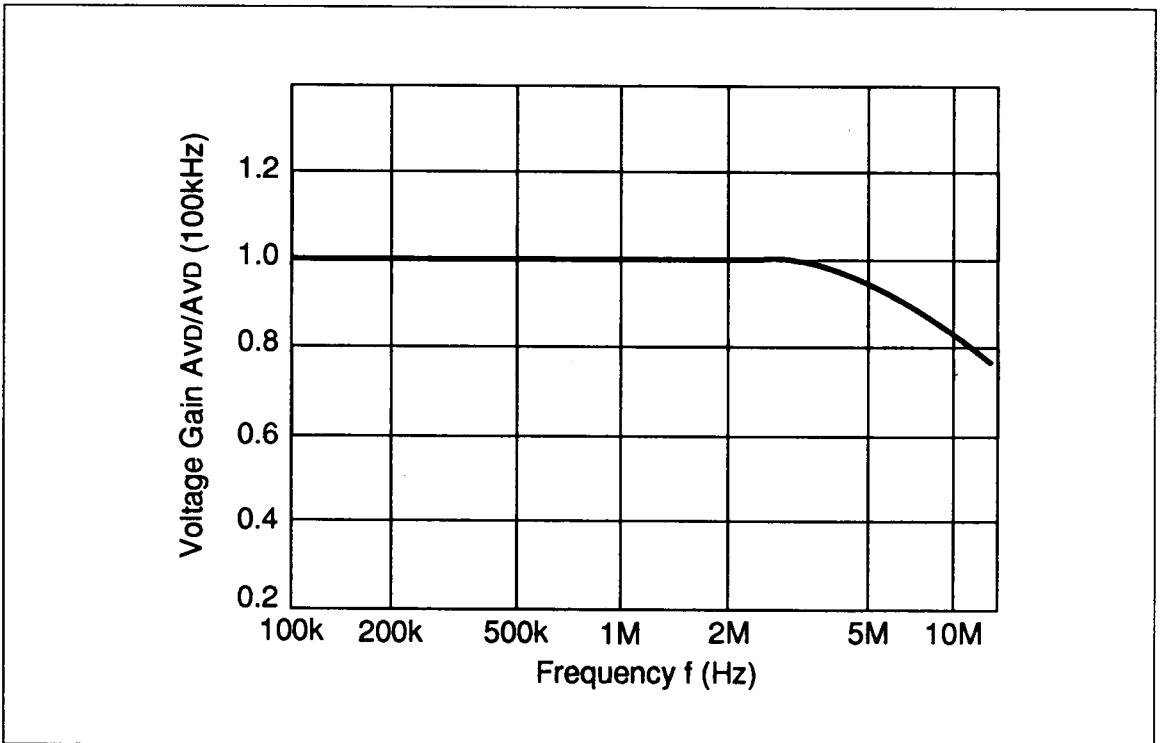


Figure 23 Voltage Gain vs Frequency

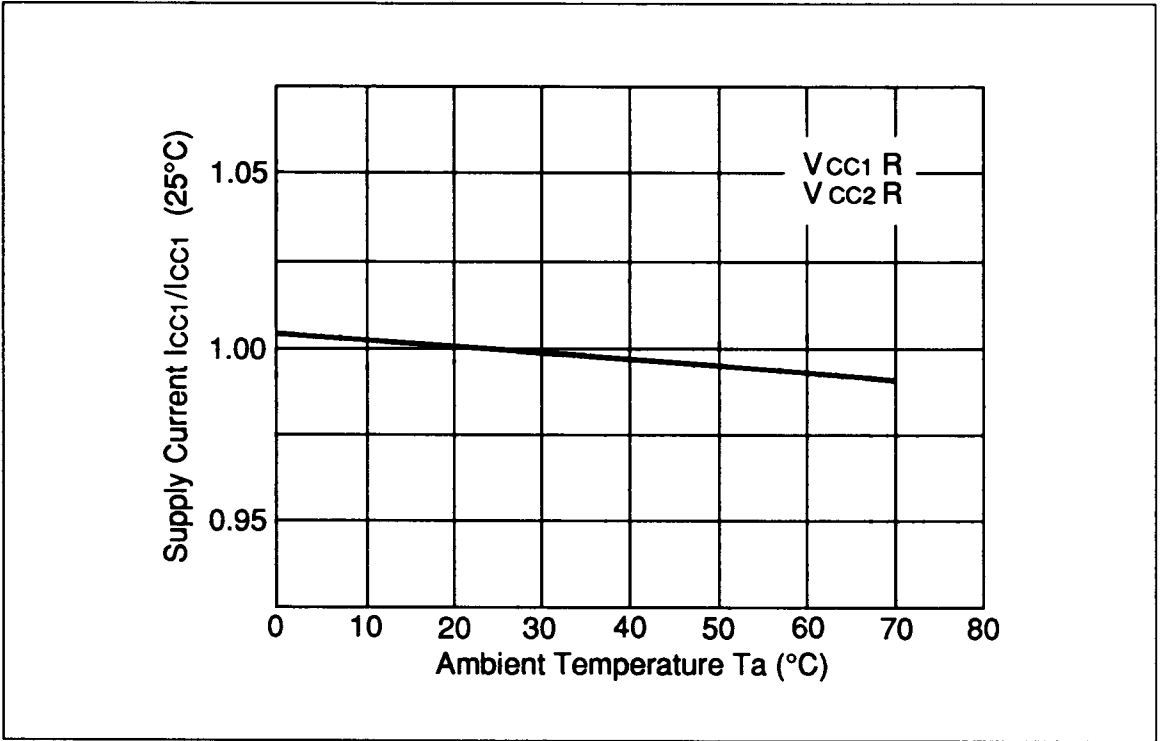


Figure 24 Supply Current vs Ambient Temperature (1)

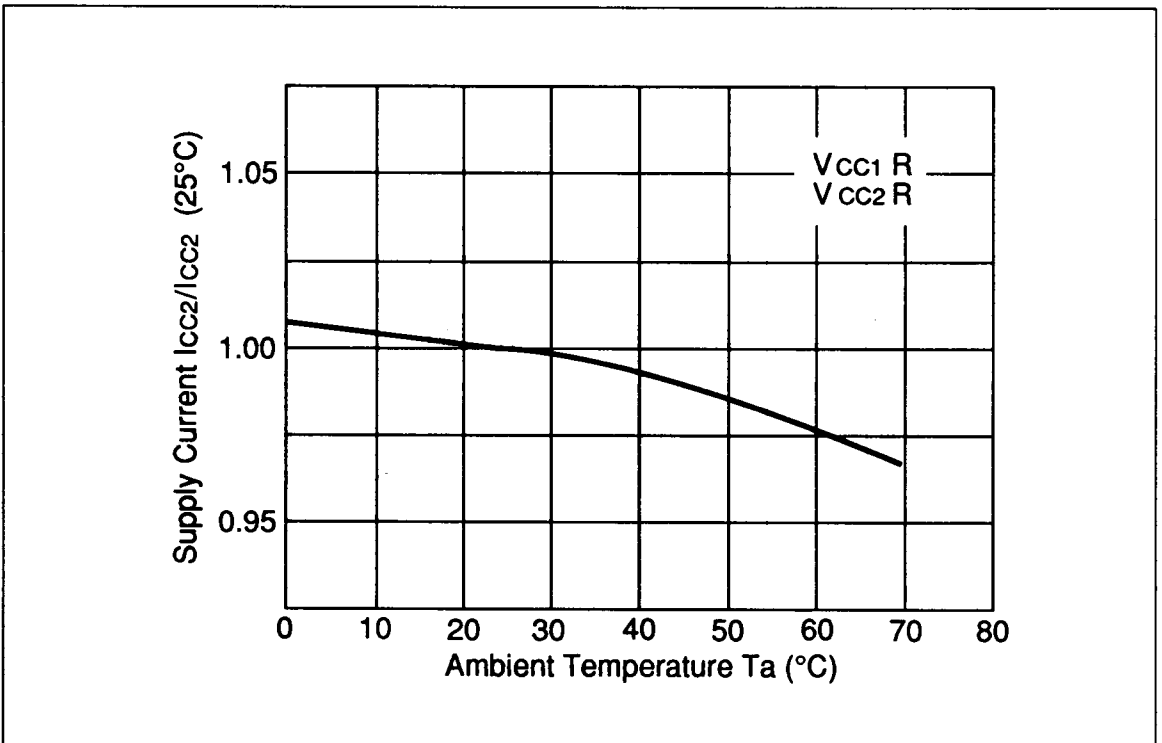


Figure 25 Supply Current vs Ambient Temperature (2)

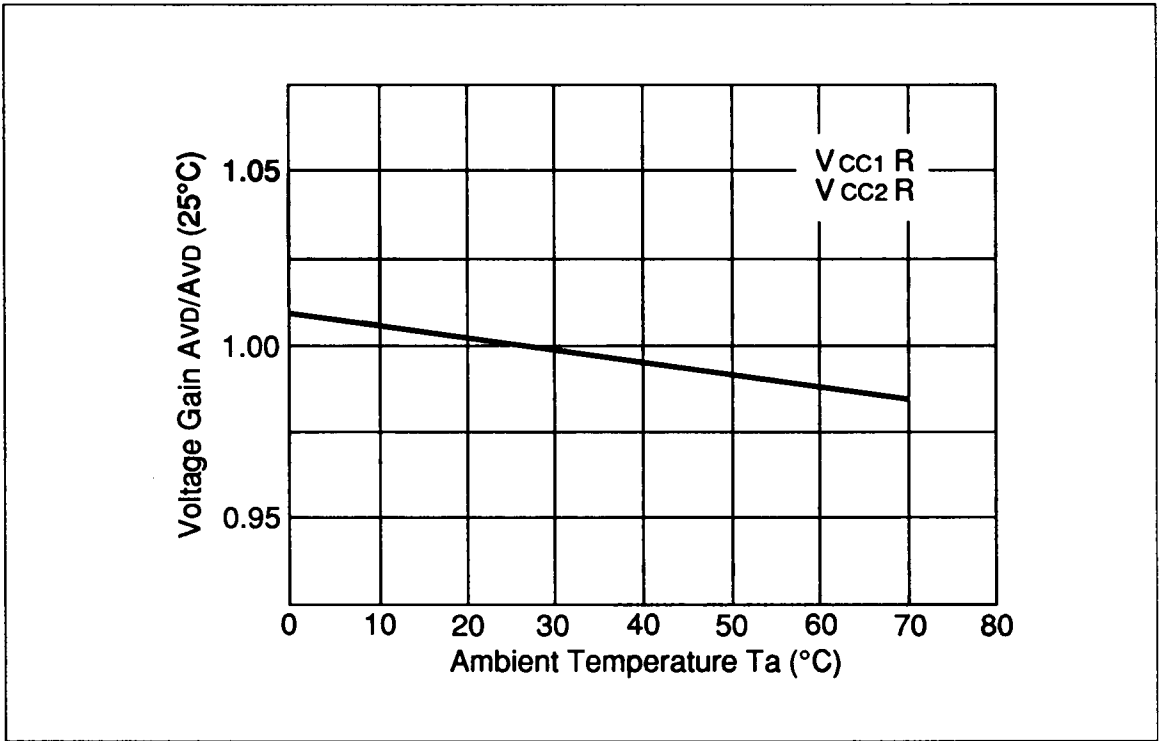


Figure 26 Voltage Gain vs Ambient Temperature

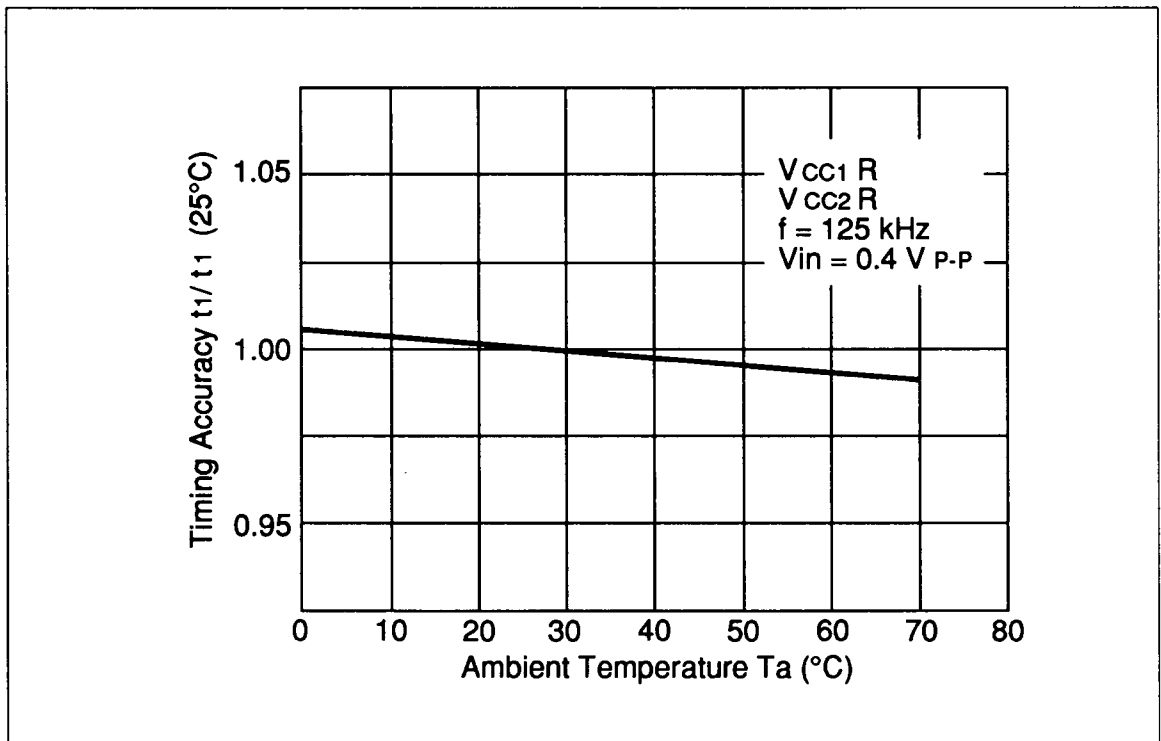


Figure 27 Timing Accuracy vs Ambient Temperature

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