

ICM7207/A



T-51-19

# ICM7207/A CMOS Timebase Generator

## GENERAL DESCRIPTION

The ICM7207/A consist of a high stability oscillator and frequency divider providing 4 control outputs suitable for frequency counter timebases. Specifically, when used as a frequency counter timebase in conjunction with the ICM7208, ICM7224 or ICM7225 display counters, the four outputs provide the gating signals for the count window, store function, reset function and multiplex frequency reference. Additionally, the duration of the count window may be changed by a factor of 10 to provide a 2 decade range counting system.

The normal operating voltage of the ICM7207/A is 5 volts. The typical power dissipation is less than 2mW when using an oscillator frequency of 6.5536MHz with the 7207 and 5.24288MHz with the 7207A.

## ORDERING INFORMATION

Order Number	Temperature Range	Package
ICM7207IPD	-25°C to +85°C	14-Pin PLASTIC DIP
ICM7207AIPD	-25°C to +85°C	14-Pin PLASTIC DIP

## FEATURES

- Stable HF Oscillator
- Low Power Dissipation  $\leq 2\text{mW}$  With 5 Volt Supply
- Counter Chain Has Outputs at  $\pm 2^{12}$  and  $\pm 2^n$  or  $\pm (2^n \times 10)$ ;  $n = 17$  for 7207, and 20 for 7207A
- Low Impedance Output Drivers  $\leq 100$  Ohms
- Count Windows of 10/100ms (7207 With 6.5536MHz Crystal) or 0.1/1 Sec. (7207A With 5.24288MHz Crystal)

## APPLICATIONS

- System Timebases
- Oscilloscope Calibration Generators
- Marker Generator Strobes
- Frequency Counter Controllers

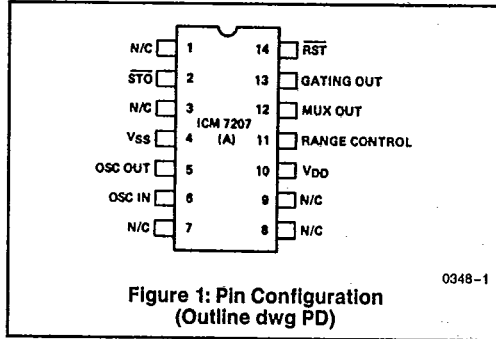


Figure 1: Pin Configuration  
(Outline dwg PD)

HARRIS SEMICONDUCTOR'S SOLE AND EXCLUSIVE WARRANTY OBLIGATION WITH RESPECT TO THIS PRODUCT SHALL BE THAT STATED IN THE WARRANTY ARTICLE OF THE CONDITION OF SALE. THE WARRANTY SHALL BE EXCLUSIVE AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE.

NOTE: All typical values have been characterized but are not tested.

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**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage ( $V_{DD} - V_{SS}$ ) ..... 6.0V  
 Input Voltages .....  $V_{SS} - 0.3V$  to  $V_{DD} + 0.3V$   
 Output Voltages:  
     7207 .....  $V_{SS}$  to  $+6V$   
     7207A .....  $V_{DD}$  to  $V_{SS}$

Output Currents ..... 25mA  
 Power Dissipation @ 25°C Note 1 ..... 200mW  
 Operating Temperature Range ..... -25°C to +85°C  
 Storage Temperature Range ..... -65°C to +125°C  
 Lead Temperature (Soldering, 10sec) ..... 300°C

NOTE 1: Derate by 2mW/°C above 25°C.

Absolute maximum ratings refer to values which if exceeded may permanently change or destroy the device.

NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**ELECTRICAL CHARACTERISTICS**

$f_{osc} = 6.5536MHz(7207), 5.24288MHz(7207A), V_{DD} = 5V, T_A = 25°C, V_{SS} = 0V$ , test circuit unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{DD}$	Operating Voltage Range	-20°C to +85°C	4		5.5	V
$I_{DD}$	Supply Current	All outputs open circuit		260	1000	$\mu A$
$R_{ds(on)}$	Output Low Resistances	Output current = 5mA sink All outputs		50	120	$\Omega$
$I_{OLK}$	Output Leakage Currents	All outputs (STORE only)			50	$\mu A$
$R_{OUT}$	Output High Resistance Terminals 12,13,14	Output current = 50 $\mu A$ source, 7207A only			33K	$\Omega$
$I_{pd}$	Input Pulldown Current	Terminal 11 connected to $V_{DD}$		50	200	$\mu A$
	Input Noise Immunity		25			% supply voltage
$f_{osc}$	Oscillator Frequency Range	Note 2	2		10	MHz
$f_{STAB}$	Oscillator Stability	$C_{IN} = C_{OUT} = 22pF$		0.2	1.0	ppm/V
$r_{OSC}$	Oscillator Feedback Resistance	Quartz crystal open circuit Note 3	3			M $\Omega$

NOTES: 2. Dynamic dividers are used in the initial stages of the divider chain. These dividers have a lower frequency of operation determined by transistor sizes, threshold voltages and leakage currents.

3. The feedback resistor has a non-linear value determined by the oscillator instantaneous input and output voltage voltages and the supply voltage.

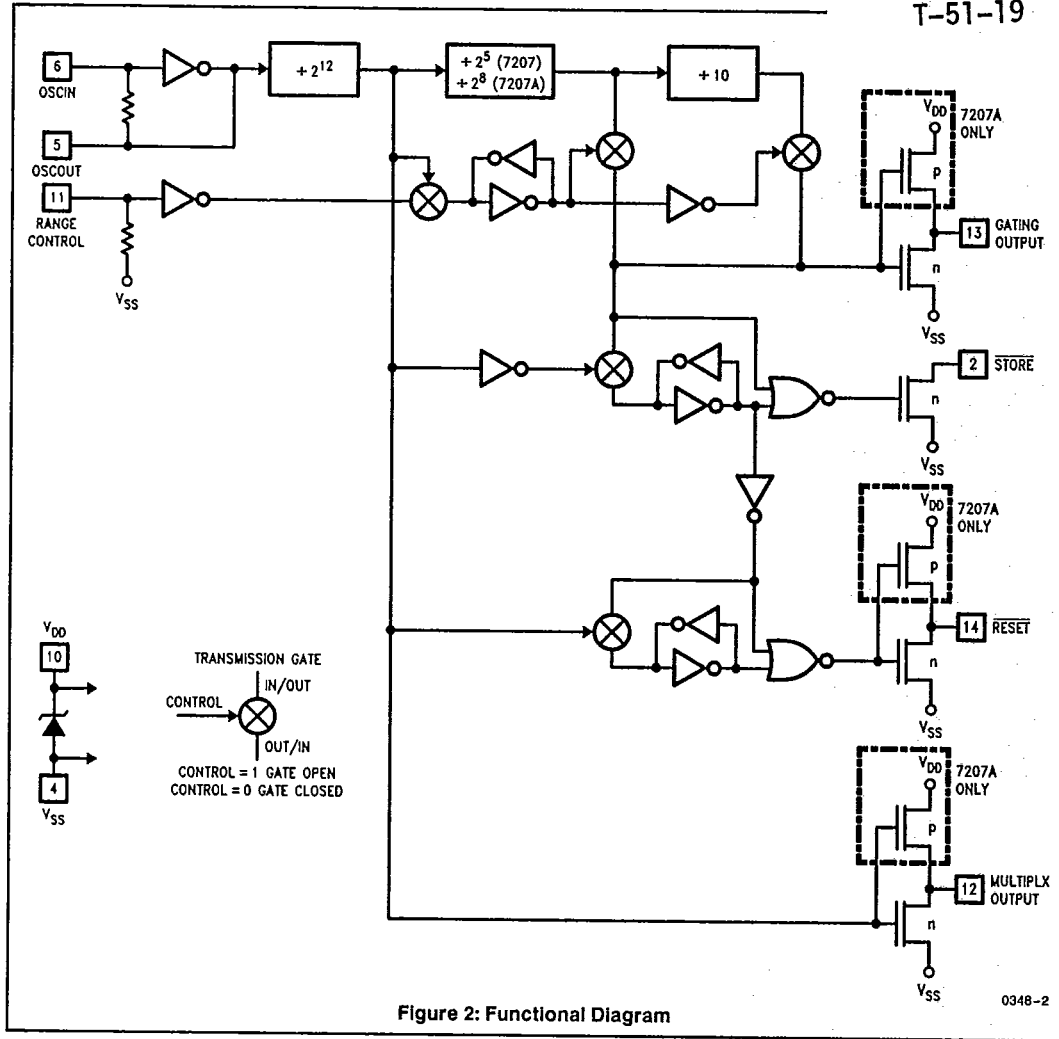
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NOTE: All typical values have been characterized but are not tested.

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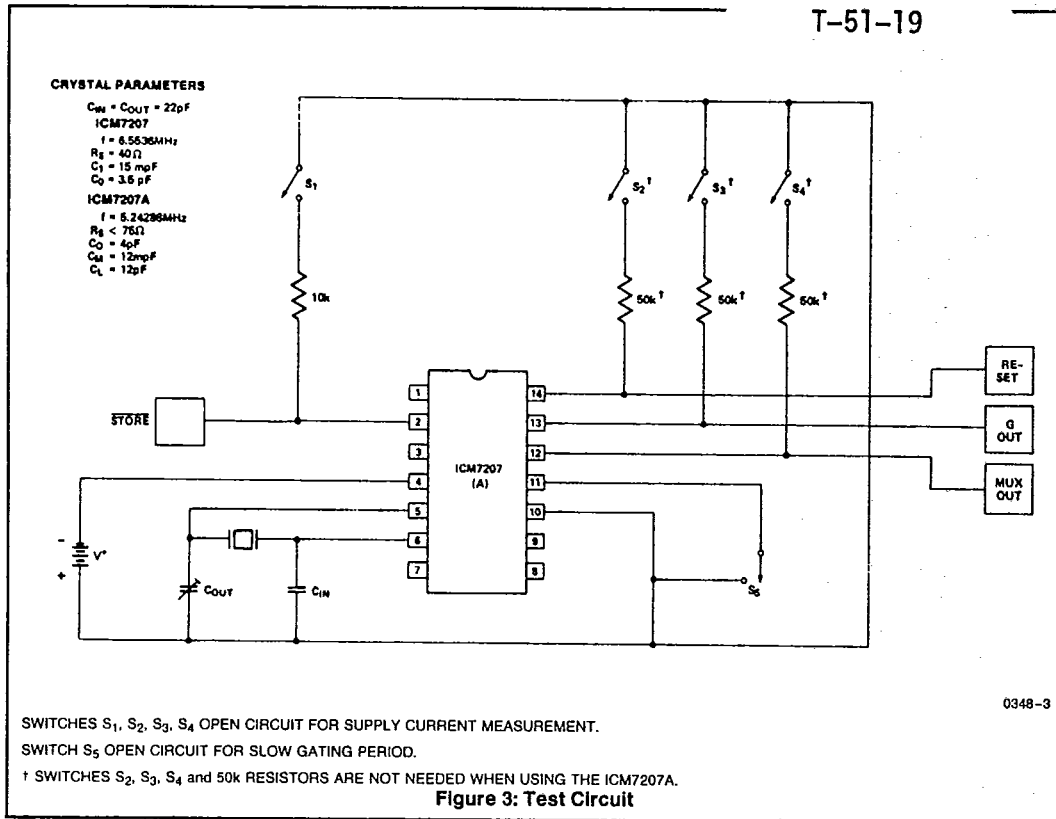


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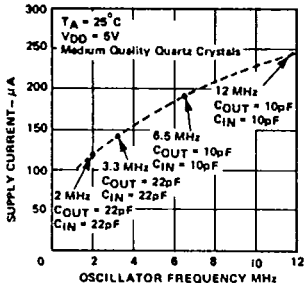
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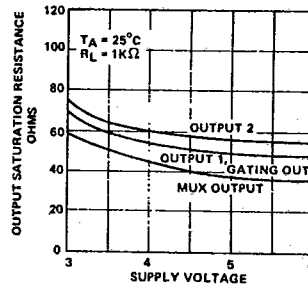
TYPICAL PERFORMANCE CHARACTERISTICS

SUPPLY CURRENT AS A FUNCTION OF OSCILLATOR FREQUENCY



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OUTPUT SATURATION RESISTANCES AS A FUNCTION OF SUPPLY VOLTAGE



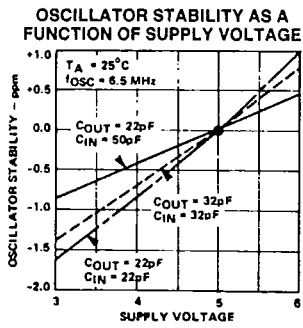
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NOTE All typical values have been characterized but are not tested.

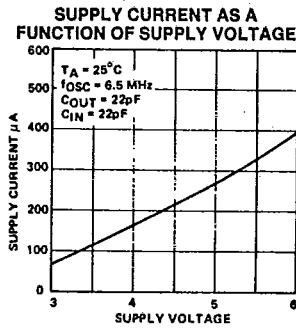
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**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**



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**OUTPUT TIMING WAVEFORMS 7207 (7207A)**

Crystal Frequency = 6.5536(5.24288)MHz

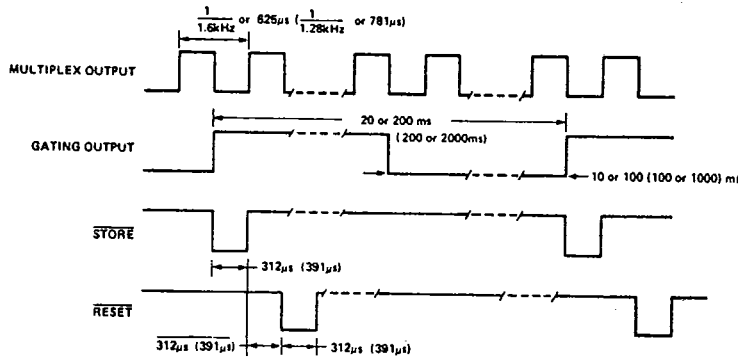


Figure 4: Output Waveform

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**DETAILED DESCRIPTION**

Referring to the Test Circuit, Figure 3, and waveforms, Figure 4, the crystal oscillator frequency is divided by 212 to provide both the multiplex frequency and generate the output pulse widths. The GATING OUTPUT provides a 50% duty cycle signal whose period depends upon whether the RANGE CONTROL terminal is connected to  $V_{DD}$  or  $V_{SS}$  (open circuit).

**OUTPUTS CONSIDERATIONS**

In the ICM7207 version all the outputs (MULTIPLEX, GATING OUT, STORE and RESET) are open drain and need pull up resistors as shown in Figure 3.

In the ICM7207A version the MULTIPLEX, GATING OUT and RESET outputs provide both active pull up and pull down, eliminating the need for 3 external resistors, al-

though, buffering is required if interfacing with TTL logic family. See the electrical characteristics for outputs source and sink resistances. The STORE output is still open drain in 7207A version.

**OSCILLATOR CONSIDERATIONS**

The oscillator consists of a CMOS inverter with a non-linear resistor connected between the input and output terminals to provide biasing. Oscillator stabilities of approximately 0.1 ppm per 0.1 volt change are achievable at a supply voltage of 5 volts, using low cost crystals. The crystal specifications are shown in the TEST CIRCUIT.

It is recommended that the crystal load capacitance ( $C_L$ ) be no greater than 15pF for a crystal having a series resistance equal to or less than 75Ω, otherwise the output amplitude of the oscillator may be too low to drive the divider reliably.

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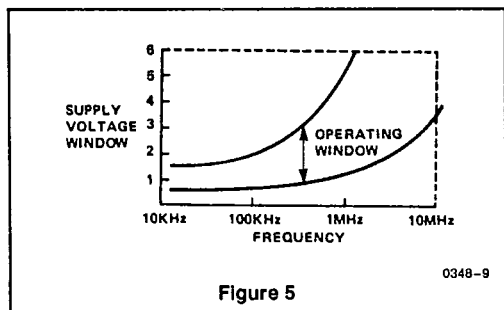
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If a very high quality oscillator is desired, it is recommended that a quartz crystal be used having a tight tuning tolerance  $\pm 10$ ppm, a low series resistance (less than  $25\Omega$ ), a low motional capacitance of 5fF and a load capacitance of 15pF. The fixed capacitor  $C_{IN}$  should be 39pF and the oscillator tuning capacitor should range between approximately 8 and 60pF.

Use of a high quality crystal will result in typical oscillator stabilities of 0.05ppm per 0.1 volt change of supply voltage.

### FREQUENCY LIMITATIONS

The ICM7207/A uses dynamic frequency counters in the initial divider sections. Dynamic frequency counters are faster and consume less power than static dividers but suffer from the disadvantage that there is a minimum operating frequency at a given supply voltage.



For example, if instead of 6.5MHz, a 1MHz oscillator is required, it is recommended that the supply voltage be reduced to between 2 and 2.5 volts. This may be realized by

using a series resistor in series with the 5V positive supply line plus a decoupling capacitor. The quartz crystal parameters, etc., will determine the value of this resistor. NOTE: Except for the output open drain n-channel transistors no other terminal is permitted to exceed the supply voltage limits.

### APPLICATION

#### A PRACTICAL FREQUENCY COUNTER

A complete frequency counter using the ICM7207/A together with the ICM7208 Frequency Counter is described in the ICM7208 data sheet. Other frequency counters using the ICM7207/A can be constructed using the ICM7224 and ICM7225, for LCD and LED displays. The latter are available as EV/Kits also.

#### QUARTZ CRYSTAL MANUFACTURERS

The following list of possible suppliers is intended to be of assistance in putting a design into production. It should not be interpreted as a comprehensive list of suppliers, nor does it constitute an endorsement by Harris.

- CTS Knights, Sandwich, Illinois (815) 786-8411
- Motorola Inc., Franklin Park, Illinois (708) 451-1000
- Sentry Manufacturing Co., Chickasaw, Oklahoma (405) 224-6780
- Tyco Filters Division, Phoenix, Arizona (602) 272-7945
- M-Tron Inds., Yankton, South Dakota (605) 665-9321
- Saronix, Palo Alto, California (415) 856-6900

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