

T-51-19

ICM7207/A

# 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 frequency counter, 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.

In the 7207/A the GATING OUTPUT, ReSeT, and the MULTIPLEX output provide both pull up and pull down, eliminating the need for 3 external resistors; although, buffering must be provided if interfacing with TTL is required.

## ORDERING INFORMATION

Order Number	Temperature Range	Package
ICM72071JD	-25°C to +85°C	14-Pin CERDIP
ICM72071PD	-25°C to +85°C	14-Pin PLASTIC DIP
ICM7207EV/Kit	—	EV/Kit*
ICM7207A1JD	-25°C to +85°C	14-Pin CERDIP
ICM7207A1PD	-25°C to +85°C	14-Pin PLASTIC DIP
ICM7207AEV/Kit	—	EV/Kit*

\*These EV/Kits contain just the IC and the corresponding crystal. The ICM7207A is also used in the 4½-Digit Counter/Driver kits, the ICM7224 EV/Kit, ICM7225 EV/Kit, and ICM7236 EV/Kit, which include several ICs, a crystal, PC board, and some passive components.

## FEATURES

- Stable HF Oscillator
- Low Power Dissipation ≤ 2mW 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 ≤ 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 Strokes
- Frequency Counter Controllers

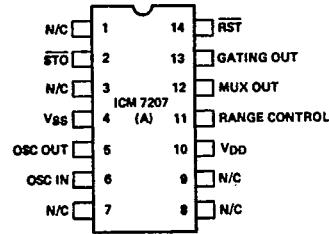


Figure 1: Pin Configuration (Outline dwg PD)

0348-1

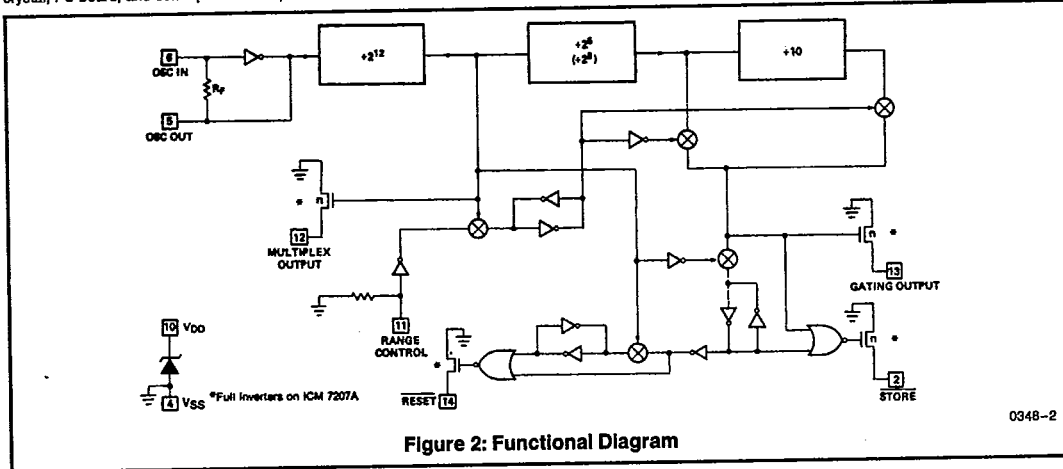


Figure 2: Functional Diagram

0348-2

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

**ICM7207/A**



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T-51-19

**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 on Resistances	Output current = 5mA All outputs		50	120	$\Omega$
$I_{OLK}$	Output Leakage Currents	All outputs (STORE only)			50	$\mu A$
(ROUT)	(Output Resistance Terminals 12,13,14)	Output current = 50 $\mu A$ , 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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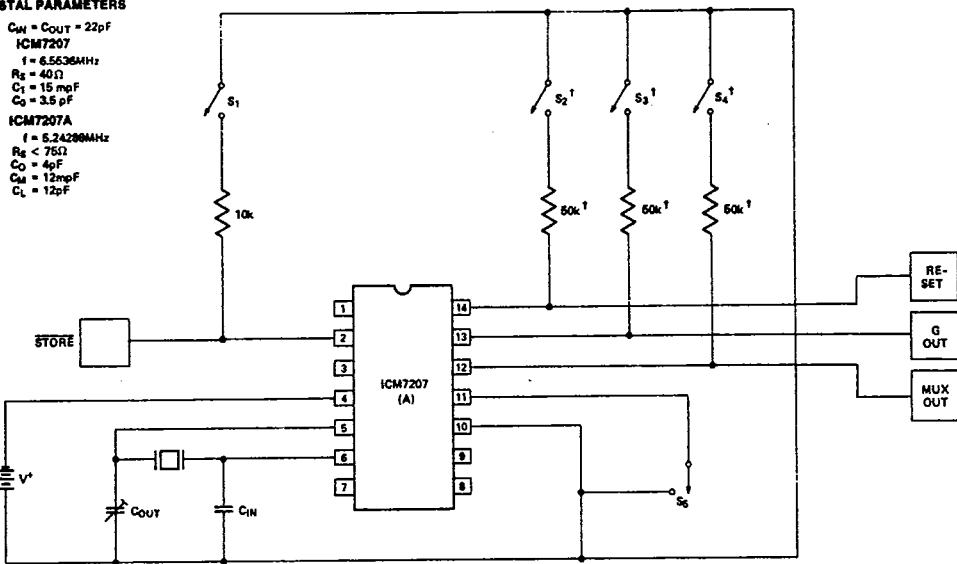
ICM7207/A



T-51-19

CRYSTAL PARAMETERS

$C_{M1} = C_{OUT} = 22pF$   
**ICM7207**  
 $f = 6.5638MHz$   
 $R_s = 40\Omega$   
 $C_1 = 15mpF$   
 $C_0 = 3.5pF$   
**ICM7207A**  
 $f = 6.24288MHz$   
 $R_s < 75\Omega$   
 $C_0 = 4pF$   
 $C_{M1} = 12mpF$   
 $C_L = 12pF$

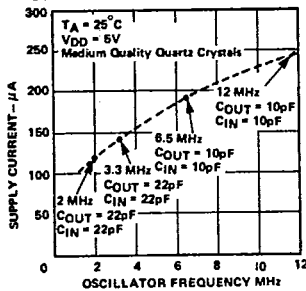


0348-3

SWITCHES  $S_1, S_2, S_3, S_4$  OPEN CIRCUIT FOR SUPPLY CURRENT MEASUREMENT.  
 SWITCH  $S_5$  OPEN CIRCUIT FOR SLOW GATING PERIOD.  
 † SWITCHES  $S_2, S_3, S_4$  AND 50k RESISTORS ARE NOT NEEDED WHEN USING THE ICM7207A.  
**Figure 3: Test Circuit**

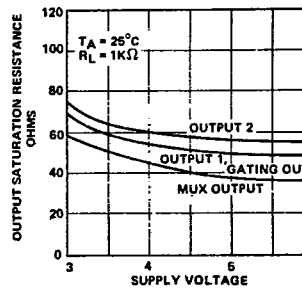
TYPICAL PERFORMANCE CHARACTERISTICS

SUPPLY CURRENT AS A FUNCTION OF OSCILLATOR FREQUENCY



0348-4

OUTPUT SATURATION RESISTANCES AS A FUNCTION OF SUPPLY VOLTAGE



0348-5

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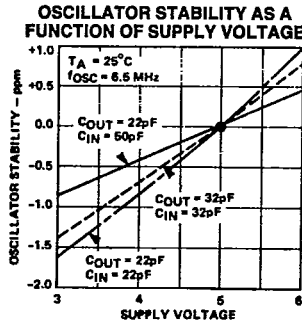
**ICM7207/A**



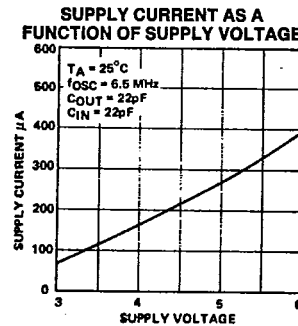
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T-51-19

**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**



0348-6



0348-7

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

Crystal Frequency = 6.5536(5.24288)MHz

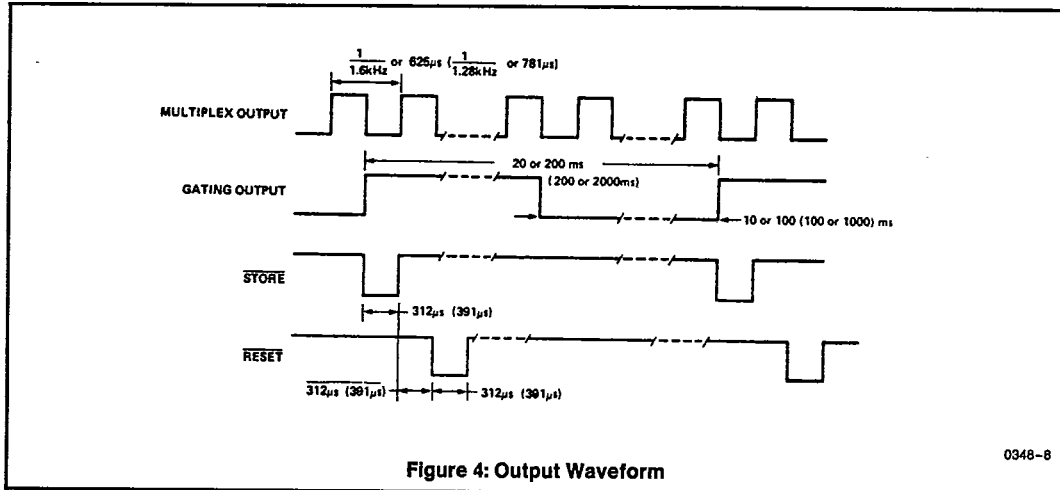


Figure 4: Output Waveform

0348-8

**DETAILED DESCRIPTION**

Referring to the Test Circuit, Figure 3, 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<sub>DD</sub> or V<sub>SS</sub> (open circuit).

**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<sub>L</sub>) 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.

If a very high quality oscillator is desired, it is recommended that a quartz crystal be used having a tight tuning tolerance of ±10ppm, a low series resistance (less than 25Ω), a low motional capacitance of 5mpF and a load capacitance of 15pF. The fixed capacitor C<sub>IN</sub> should be 39pF and the oscillator tuning capacitor should range between approximately 8 and 60pF.

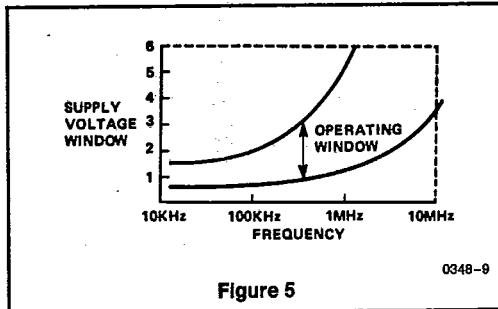
Use of a high quality crystal will result in typical oscillator stabilities of 0.05ppm per 0.1 volt change of supply voltage.

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**ICM7207/A****INTERSIL****ICM7207/A****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.

**Figure 5**

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, ICM7225, and ICM7236, for LCD, LED and VF 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 Intersil.

- a) CTS Knights, Sandwich, Illinois, (815) 786-8411
- b) Motorola Inc., Franklin Park, Illinois (312) 451-1000
- c) Sentry Manufacturing Co., Chickasaw, Oklahoma (405) 224-6780
- d) Tyco Filters Division, Phoenix, Arizona (602) 272-7945
- e) M-Tron Inds., Yankton, South Dakota (605) 665-9321
- f) Saronix, Palo Alto, California (415) 856-6900

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