INTERSIL 405-050

ICM7207/A CMOS Oscillator Controller

FEATURES

- **Stable HF oscillator**
- **Low power dissipation ≤ 5mW with 5 volt supply**
- **Counter chain has outputs at ÷ 2^{12} and ÷ 2^n or ÷ (2^n x 10); n = 17 for 7207, and 20 for 7207A**
- **Low impedance output drivers ≤100 ohms**
- **Count windows of 20/200ms (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**

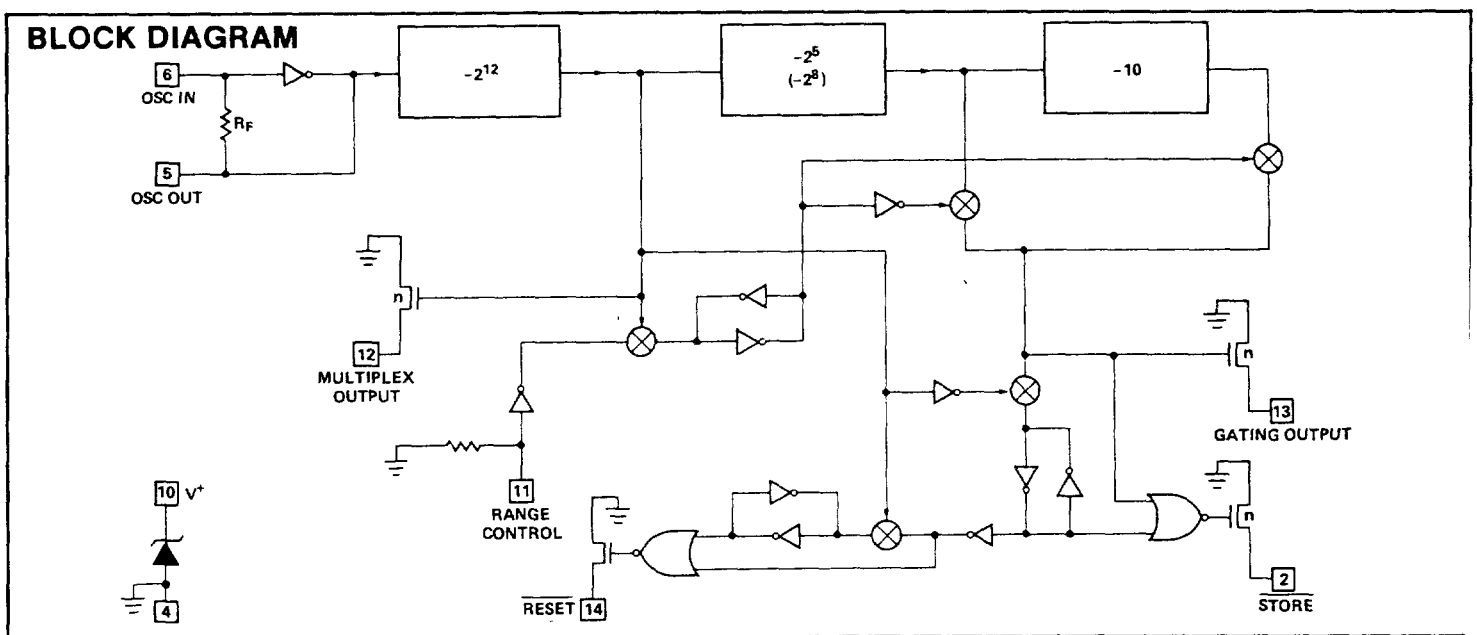
DESCRIPTION

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

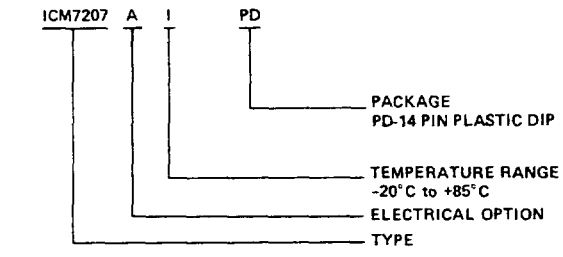
The normal operating voltage of the ICM7207/A is 5 volts at which the typical dissipation is less than 2mW using an oscillator frequency of 6.5536MHz (5.24288MHz).

In the 7207/A the GATING output, $\overline{\text{RESET}}$, 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 T^2L is required. $\overline{\text{RESET}}$ occurs 391μs after $\overline{\text{STORE}}$, eliminating any potential problems of overlap between $\overline{\text{STORE}}$ and $\overline{\text{RESET}}$ when using the ICM7208.

BLOCK DIAGRAM

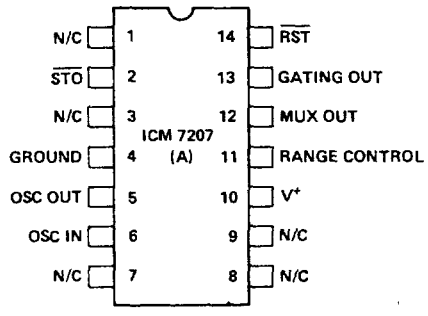


ORDERING INFORMATION



ORDER DEVICES BY FOLLOWING PART NUMBER ICM7207 I PD, ICM7207AIPD
ORDER DICE BY FOLLOWING PART NUMBER ICM7207/D, ICM7207A/D

PIN CONFIGURATION (OUTLINE DRAWING PD)



ABSOLUTE MAXIMUM RATINGS

Supply Voltage 6.0V
Input Voltages ..... Equal to or less than supply voltage
Output Voltages ..... Not more positive than +6V with respect to GROUND
Output Currents 25mA
Power Dissipation @ 25°C Note 1 ..... 200mW
Operating Temperature Range ..... -20°C to +85°C
Storage Temperature Range ..... -55°C to +125°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 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.

TYPICAL OPERATING CHARACTERISTICS

TEST CONDITIONS: fosc = 6.5536MHz(7207), 5.24288MHz(7207A), V+ = 5V, T_A = 25°C, test circuit unless otherwise specified.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage Range	V+	-20°C to +85°C	4		5.5	V
Supply Current	I+	All outputs open circuit		260	1000	μA
Output on Resistances	$r_{ds(on)}$	Output current = 5mA All outputs		50	120	Ω
Output Leakage Currents	I_{OLK}	All outputs (STORE only)			50	μA
(Output Resistance Terminals 12,13,14)	(R_{OUT})	Output current = 50μA, 7207A only			33K	Ω
Input Pulldown Current	$I_{p'd}$	Terminal 11 connected to V+		50	200	μA
Input Noise Immunity			25			% supply voltage
Oscillator Frequency Range	fosc	Note 2	2		10	MHz
Oscillator Stability	f_{STAB}	C_{IN} = C_{OUT} = 22pF		0.2	1.0	ppm/V
Oscillator Feedback Resistance	r_{OSC}	Quartz crystal open circuit Note 3	3			MΩ

NOTE 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.

NOTE 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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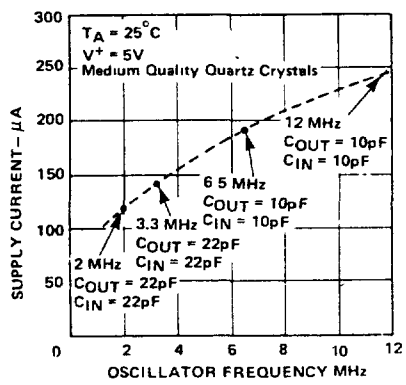
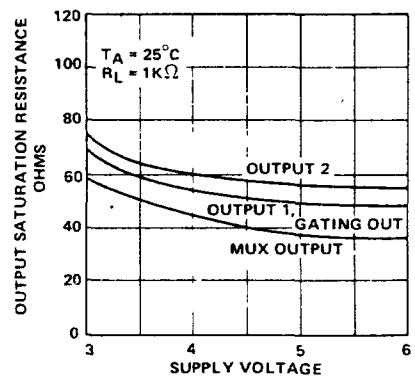
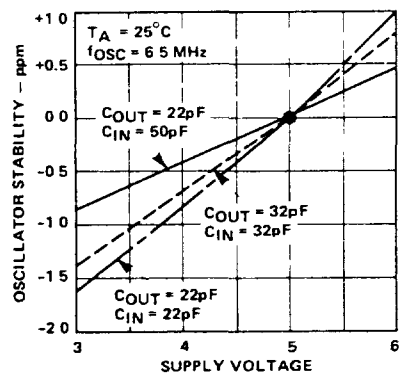
SUPPLY CURRENT AS A FUNCTION OF OSCILLATOR FREQUENCY



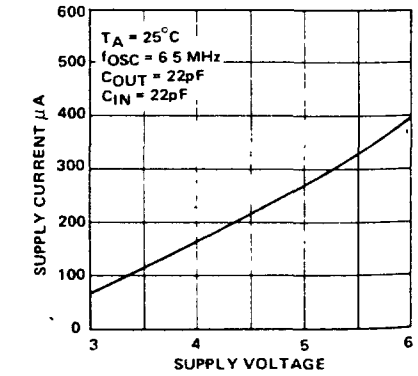
OUTPUT SATURATION RESISTANCES AS A FUNCTION OF SUPPLY VOLTAGE



OSCILLATOR STABILITY AS A FUNCTION OF SUPPLY VOLTAGE

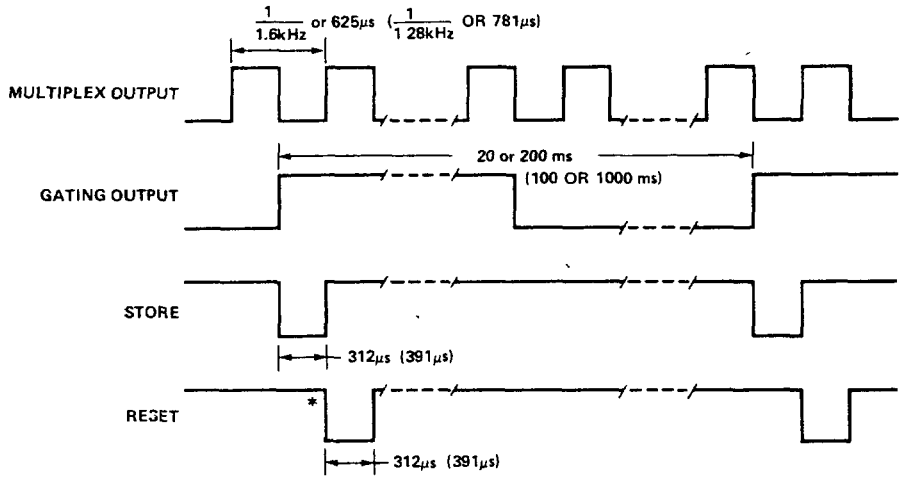


SUPPLY CURRENT AS A FUNCTION OF SUPPLY VOLTAGE



OUTPUT TIMING WAVEFORMS 7207/A

Crystal Frequency = 6.5535/5.24288MHz



Referring to the test circuit, the crystal oscillator frequency is divided by 2^{12} to provide both the multiplex frequency and generate the output pulse widths. The GATING OUTPUT provides a 50% duty cycle signal whose period depends upo whether the RANGE CONTROL terminal is connected to V^+ GROUND (open circuit).

*For ICM7207A this pulse is delayed 391μs

TEST CIRCUIT

CRYSTAL PARAMETERS

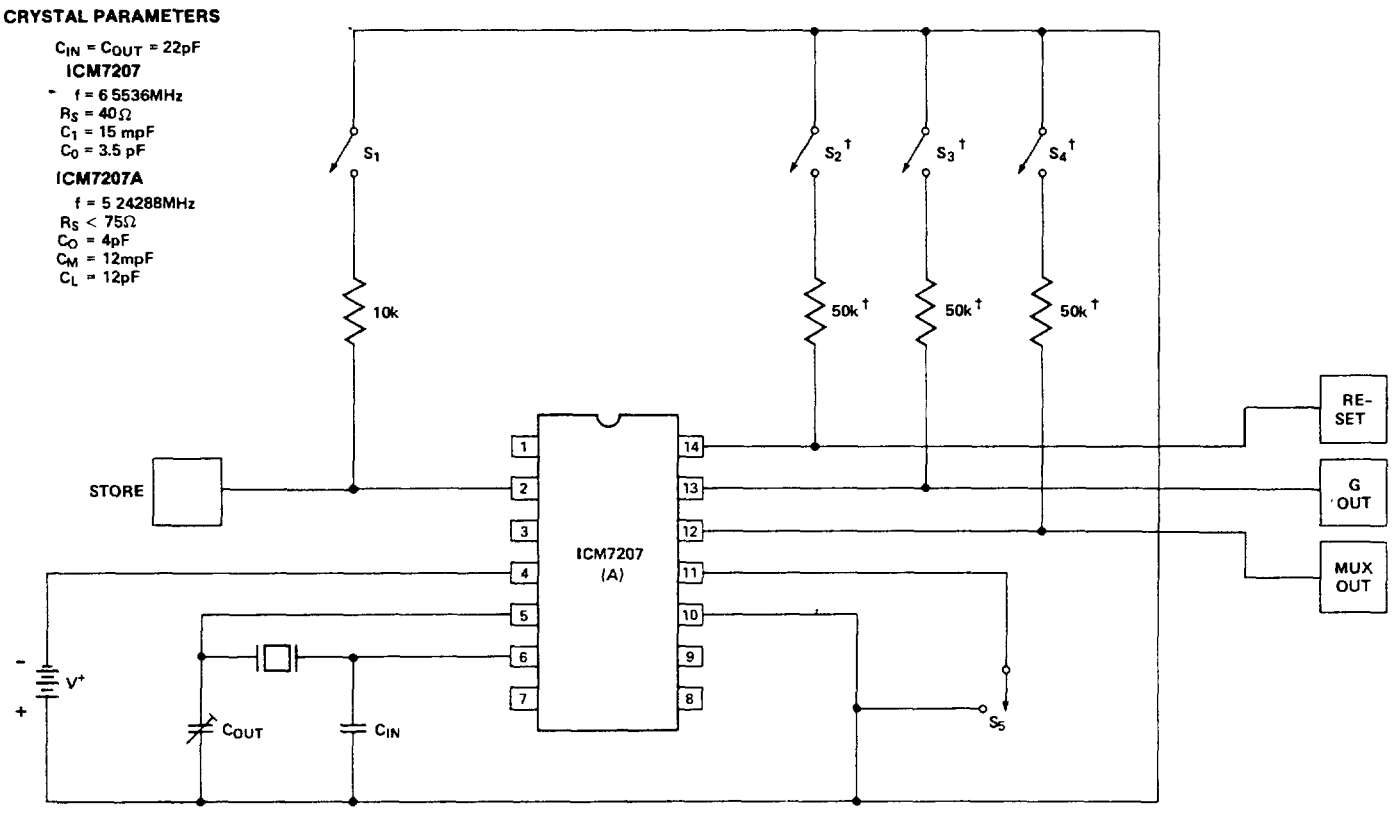
$C_{IN} = C_{OUT} = 22pF$

ICM7207

f = 6 5536MHz
$R_S = 40\Omega$
$C_1 = 15$ mpF
$C_0 = 3.5$ pF

ICM7207A

f = 5 24288MHz
$R_S < 75\Omega$
$C_O = 4pF$
$C_M = 12mpF$
$C_L = 12pF$



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

APPLICATION NOTES

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.

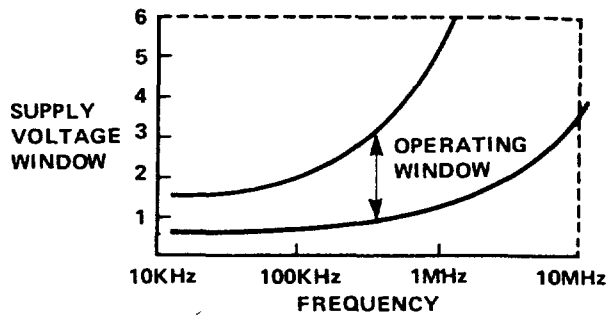
It is recommended that the crystal load capacitance (C_L) be no greater than 15pF for a crystal having a series resistance equal to or less than 75Ω, otherwise the output amplitude of the oscillator may be too low to drive the divider reliably.

If a very high quality oscillator is desired, it is recommended that a quartz crystal be used having a tight tuning tolerance. ±10 ppm, a low series resistance (less than 25Ω), a low motional capacitance of 5mpF and a load capacitance of 20pF. 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 0.05 ppm 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

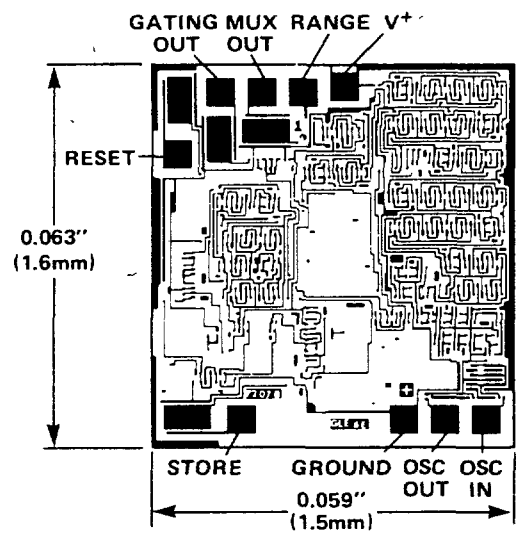


For example, if instead of 6.5MHz, a 1MHz oscillator is required, it is recommended that the supply voltage be reduced to between 2 and 2.5 volts. This may be realized by using a series resistor in series with the 5V positive supply line plus a decoupling capacitor. The quartz crystal parameters, etc., 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.

PRACTICAL FREQUENCY COUNTER

A complete frequency counter using the ICM7207/A together with the ICM7208 Frequency Counter is described in the ICM7208 data sheet.

CHIP TOPOGRAPHY



Chip may be die attached using conventional eutectic or epoxy procedures. Wire bonding may be either aluminum ultrasonic or gold compression.