GENERAL DESCRIPTION

The Harris ICM7209 is a versatile CMOS clock generator capable of driving a number of 5 volt systems with a variety of input requirements. When used to drive up to 5 TTL gates, the typical rise and fall times are 10ns.
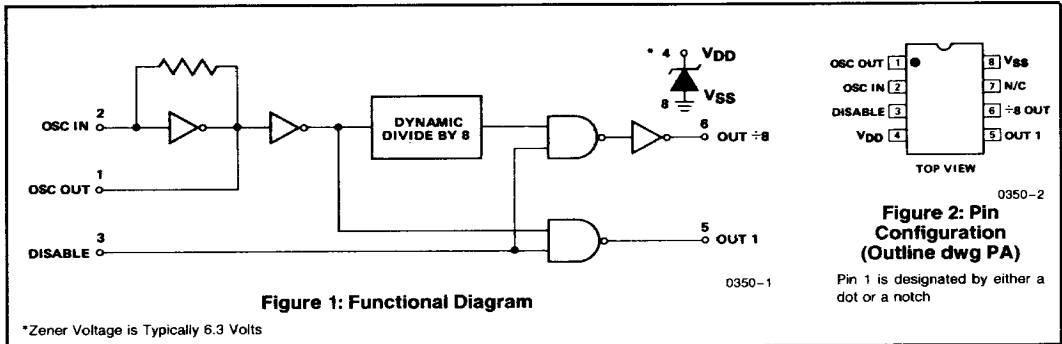
The ICM7209 consists of an oscillator, a buffered output equal to the oscillator frequency and a second buffered output having an output frequency one-eighth that of the oscillator. The guaranteed maximum oscillator frequency is 10MHz. Connecting the DISABLE terminal to the negative supply forces the ÷8 output into the '0' state and the OUT1 into the '1' state.

FEATURES

• **High Frequency Operation — 10MHz Guaranteed**
• **Requires Only A Quartz Crystal and Two Capacitors**
• **Bipolar, CMOS Compatibility**
• **High Output Drive Capability — 5×TTL Fanout With 10ns Rise and Fall Times**
• **Low Power — 50mW at 10MHz**
• **Choice of Two Output Frequencies — Osc., and Osc. ÷ 8 Frequencies**
• **Disable Control for Both Outputs**
• **Wide Industrial Temperature Range — 20°C to +85°C**

ORDERING INFORMATION

Part Number	Temperature Range	Package
ICM7209IPA	−20°C to +85°C	8 pin PLASTIC

Figure 1: Functional Diagram

*Zener Voltage is Typically 6.3 Volts

Figure 2: Pin Configuration (Outline dwg PA)

Pin 1 is designated by either a dot or a notch

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

ICM7209

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 6V
Output Voltages .... $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$
Input Voltages .... $V_{SS} - 0.3V$ to $V_{DD} + 0.3V$

Power Dissipation (25°C) 300mW
Storage Temperature .... −55°C to +125°C
Operating Temperature Range .... −20°C to +85°C
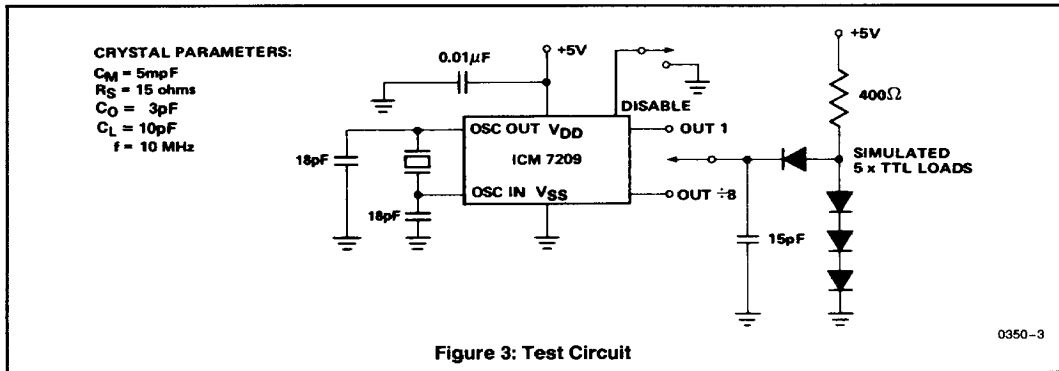Lead Temperature (Soldering, 10sec) .... 300°C

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

($V_{DD} - V_{SS} = 5V$, test circuit, $f_{osc} = 10MHz$, $T_A = 25°C$ unless otherwise specified.)

| Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_{DD}	Supply Current	Note 1 No Load		11	20	mA
C_D	Disable Input Capacitance			5		pF
I_{ILK}	Disable Input Leakage	Either '1' or '0' state			±10	μA
V_{OL}	Output Low State	Either OUT 1 or OUT ÷8 simulated 5×TTL loads			0.4	V
V_{OH}	Output High State	Either OUT 1 or OUT ÷8 simulated 5×TTL loads	4.0	4.9		
t_R	Output Rise Time (Note 3)	Either OUT 1 or OUT ÷8 simulated 5×TTL loads		10		ns
t_F	Output Fall Time (Note 3)	Either OUT 1 or OUT ÷8 simulated 5×TTL loads		10		
f_{OSC}	Minimum OSC Frequency for ÷8 Output	Note 2	2			MHz
	Output ÷8 duty cycle	Any operating frequency Low state : High state		7:9		
GM	Oscillator Transconductance		80	200		μS

NOTES: 1. The power dissipation is a function of the oscillator frequency (1st ORDER EFFECT see curve) but is also effected to a small extent by the oscillator tank components.
2. The ÷8 circuitry uses a dynamic scheme. As with any dynamic system, information or data is stored on very small nodal capacitances instead of latches (static systems) and there is a lower cutoff frequency of operation. Dynamic dividers are used in the ICM7209 to significantly improve high frequency performance and to decrease power consumption.
3 Rise and fall times are defined between the output levels of 0.5 and 2.4 volts.

CRYSTAL PARAMETERS:
$C_M = 5mpF$
$R_S = 15$ ohms
$C_O = 3pF$
$C_L = 10pF$
$f = 10$ MHz

Figure 3: Test Circuit

0350−3

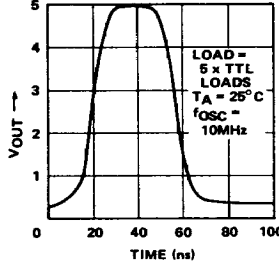*NOTE: All typical values have been characterized but are not tested.*

TYPICAL PERFORMANCE CHARACTERISTICS ($V_{DD} - V_{SS} = 5V$)
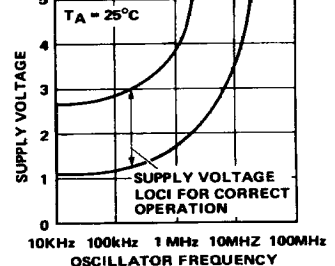
SUPPLY CURRENT AS A FUNCTION OF OSCILLATOR FREQUENCY
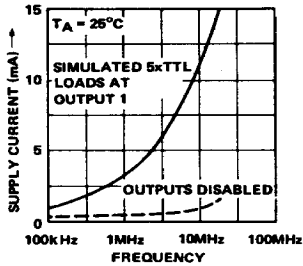
TYPICAL OUT 1 RISE AND FALL TIMES

SUPPLY VOLTAGE RANGE FOR CORRECT OPERATION OF ÷ 8 COUNTER AS A FUNCTION OF OSCILLATOR FREQUENCY.

0350-4

0350-5

0350-6

Rise and fall times of OUT ÷ 8 are similar to those of OUT 1.

DETAILED DESCRIPTION

OSCILLATOR CONSIDERATIONS

The oscillator consists of a CMOS inverter with a non-linear resistor connected between the oscillator input and output to provide D.C. biasing. Using commercially obtainable quartz crystals the oscillator will operate from low frequencies (10kHz) to 10MHz.

The oscillator circuit consumes about $500\mu A$ of current using a 10MHz crystal with a 5 volt supply, and is designed to operate with a high impedance tank circuit. It is therefore necessary that the quartz crystal be specified with a load capacitance (C_L) of 10pF instead of the standard 30pF. To maximize the stability of the oscillator as a function of supply voltage and temperature, the motional capacitance of the crystal should be low (5mpF or less). Using a fixed input capacitor of 18pF and a variable capacitor of nominal value of 18pF on the output will result in oscillator stabilities of typically 1ppm per volt change in supply voltage.

THE ÷ 8 OUTPUT

A dynamic divider is used to divide the oscillator frequency by 8. Dynamic dividers use small nodal capacitances to store voltage levels instead of latches (which are used in static dividers). The dynamic divider has advantages in high speed operation and low power but suffers from limited low frequency operation. This results in a window of operation for any oscillator frequency (see TYPICAL PERFORMANCE CHARACTERISTICS).

OUTPUT DRIVERS

The output drivers consist of CMOS inverters having active pullups and pulldowns. Thus the outputs can be used to directly drive TTL gates, other CMOS gates operating with a 5 volt supply, or TTL compatible MOS gates. The guaranteed fanout is 5 TTL loads although typical fanout capability is at least 10 TTL loads with slightly increased output rise and fall times.

DEVICE POWER CONSUMPTION

At low frequencies the principal component of the power consumption is the oscillator. At high oscillator frequencies the major portion of the power is consumed by the output drivers, thus by disabling the outputs (activating the DISABLE INPUT) the device power consumption can be dramatically reduced.

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