ICM7213

One Second/One Minute Timebase Generator

August 1997

Features

- **Guaranteed 2V Operation**
- **Very Low Current Consumption (Typ) . . . . 100μA at 3V**
- **All Outputs TTL Compatible**
- **On Chip Oscillator Feedback Resistor**
- **Oscillator Requires Only 3 External components: Fixed Capacitor, Trim Capacitor, and A Quartz Crystal**
- **Output Inhibit Function**
- **4 Simultaneous Outputs: One Pulse/s, One Pulse/Min, 16Hz and Composite 1024 + 16 + 2Hz Outputs**
- **Test Speed-Up Provides Other Frequency Outputs**

Ordering Information

PART NUMBER	TEMP. RANGE (^{o}C)	PACKAGE	PKG. NO.
ICM7213IPD	-25 to 85	14 Ld PDIP	E14.3

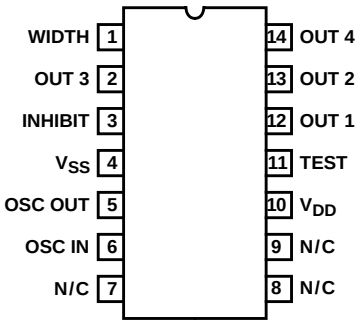
Description

The ICM7213 is a fully integrated micropower oscillator and frequency divider with four buffered outputs suitable for interfacing with most logic families. The power supply may be either a two battery stack (Ni-cad, alkaline, etc.) or a regular power supply greater than 2V. Depending upon the state of the WIDTH, INHIBIT, and TEST inputs, using a 4.194304MHz crystal will produce a variety of output frequencies including 2048Hz, 1024Hz, 34.133Hz, 16Hz, 1Hz, and $^{1}/_{60}$Hz (plus composites).

The ICM7213 utilizes a very high speed low power metal gate CMOS technology which uses 6.4V zeners between the drains and sources of each transistor and also across the supply terminals. Consequently, the ICM7213 is limited to a 6V maximum V_{SUPPLY}, although a simple dropping network can be used to extend the V_{SUPPLY} range well above 6V (See Figure 9).

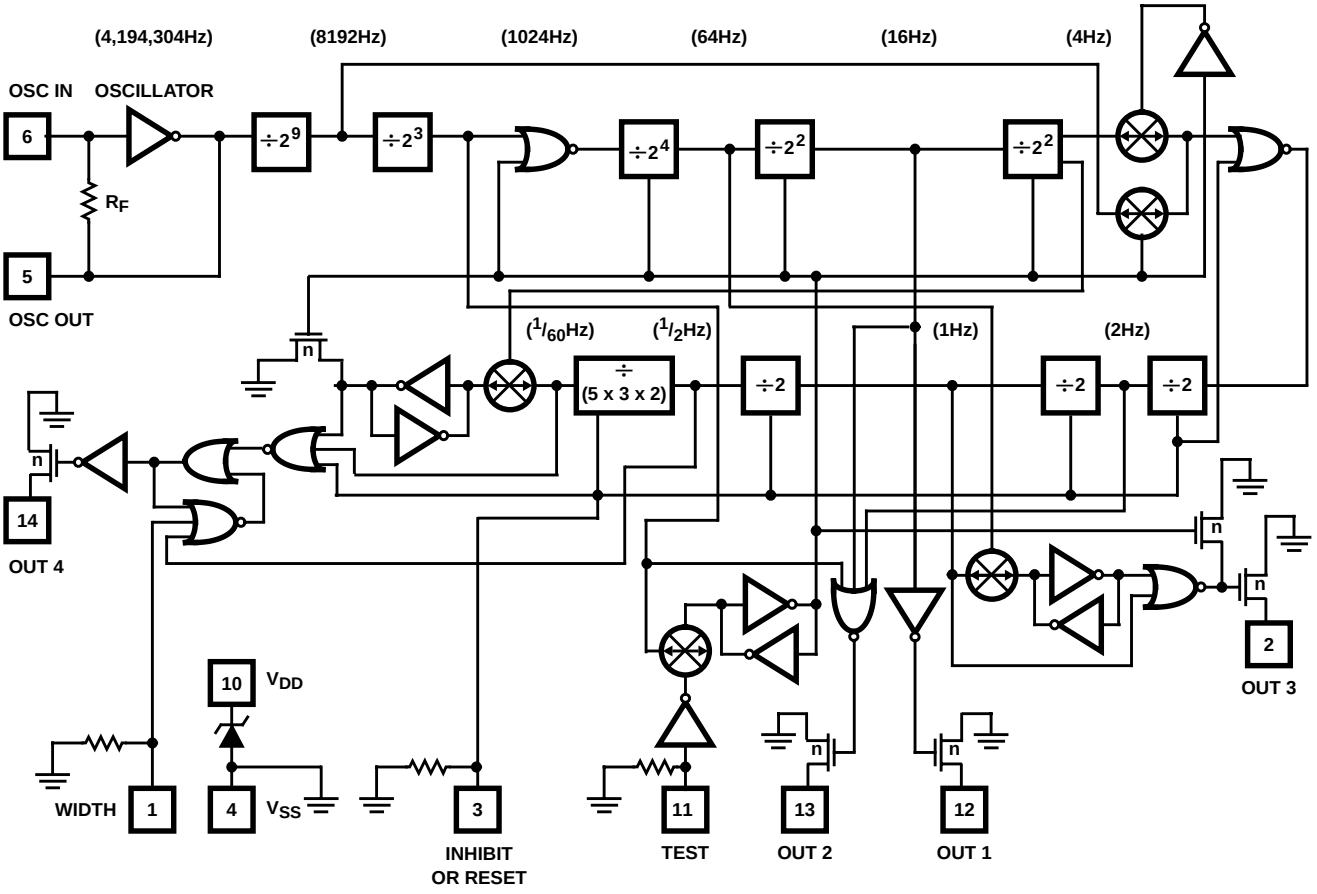
Pinout

ICM7213
(PDIP)
TOP VIEW



File Number **3165.1**

Functional Block Diagram



Absolute Maximum Ratings

Supply Voltage (V_{DD} - V_{SS}) 6V
Output Current (Any Output) 20mA
All Input and Oscillator Voltages . . . . . V_{SS} - 0.3V to V_{DD} + 0.3V
All Output Voltages . . . . . V_{SS} to 6V

Operating Conditions

Temperature Range . . . . . -25°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} (°C/W)
PDIP Package	100

Maximum Junction Temperature . . . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering, 10s) . . . . . 300°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

V_{DD} - V_{SS} = 3.0V, f_{OSC} = 4.194304MHz, Test Circuit, T_A = 25°C, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Current, I_{DD}		-	100	140	µA
Guaranteed Operating Supply Voltage Range (V_{DD} - V_{SS}), V_{SUPPLY}	-20°C to 85°C	2	-	4	V
Output Leakage Current, I_{OLK}	Any output, V_{OUT} = 6V	-	-	10	µA
Output Sat. Resistance, R_{OUT}	Any output, I_{OLK} = 2.5mA	-	120	200	Ω
Inhibit Input Current, I_I	Inhibit terminal connected to V_{DD}	-	10	40	µA
Test Point Input Current, I_{TP}	Test point terminal connected to V_{DD}	-	10	40	µA
Width Input Current, I_W	Width terminal connected to V_{DD}	-	10	40	µA
Oscillator Transconductance, g_M	V_{DD} = 2V	100	-	-	µS
Oscillator Frequency Range (Note 1), f_{OSC}		1	-	10	MHz
Oscillator Stability, f_{STAB}	2V < V_{DD} < 4V	-	1.0	-	ppm
Oscillator Start Time, t_S		-	0.1	-	s
	V_{DD} = 2V	-	0.2	-	s

NOTE:

1. The ICM7213 uses dynamic dividers for high frequency division. As with any dynamic system, information is stored on very small nodal capacitances instead of latches (static system), therefore there is a lower frequency of operation. Dynamic dividers are used to improve the high frequency performance while at the same time significantly decreasing power consumption. At low V_{SUPPLY}, operation at less than 1MHz is possible.

Output Definitions

(NOTE 1) INPUT STATES			PIN 12 OUT 1	PIN 13 OUT 2	PIN 2 OUT 3	PIN 14 OUT 4
TEST	INHIBIT	WIDTH				
L	L	L	16Hz ÷ 2^{18}	$\overline{1024 + 16 + 2}$Hz (÷ 2^{12} ÷ 2^{18} ÷ 2^{21}) Composite	1Hz, 7.8ms ÷ 2^{22}	1/60Hz, 1s ÷ (2^{24} x 3 x 5)
L	L	H	16Hz ÷ 2^{18}	$\overline{1024 + 16 + 2}$Hz (÷ 2^{12} ÷ 2^{18} ÷ 2^{21}) Composite	1Hz, 7.8ms ÷ 2^{22}	$^1/_{60}$Hz, 125ms
L	H	L	16Hz ÷ 2^{18}	$\overline{1024 + 16}$Hz (÷ 2^{12} ÷ 2^{18}) Composite	OFF	OFF
L	H	H	16Hz ÷ 2^{18}	$\overline{1024 + 16}$Hz (÷ 2^{12} ÷ 2^{18}) Composite	OFF	See Waveforms
H	L	L	ON	$\overline{4096 + 1024}$Hz (÷ 2^{10} ÷ 2^{12}) Composite	2048Hz ÷ 2^{11}	34.133Hz, 50% DC ÷ (2^{13} x 5 x 3)
H	L	H	ON	$\overline{4096 + 1024}$Hz (÷ 2^{10} ÷ 2^{12}) Composite	2048Hz ÷ 2^{11}	34.133Hz, 50% DC ÷ (2^{13} x 5 x 3)
H	H	L	ON	1024Hz ÷ 2^{12}	ON	OFF
H	H	H	ON	1024Hz ÷ 2^{12}	ON	OFF

NOTE:

1. When TEST and RESET are connected to ground, or left open, all outputs except for OUT 3 and OUT 4 have a 50% duty cycle.

Timing Waveforms

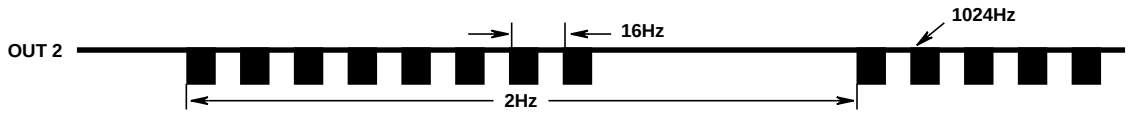


FIGURE 1. OUTPUT WAVEFORM

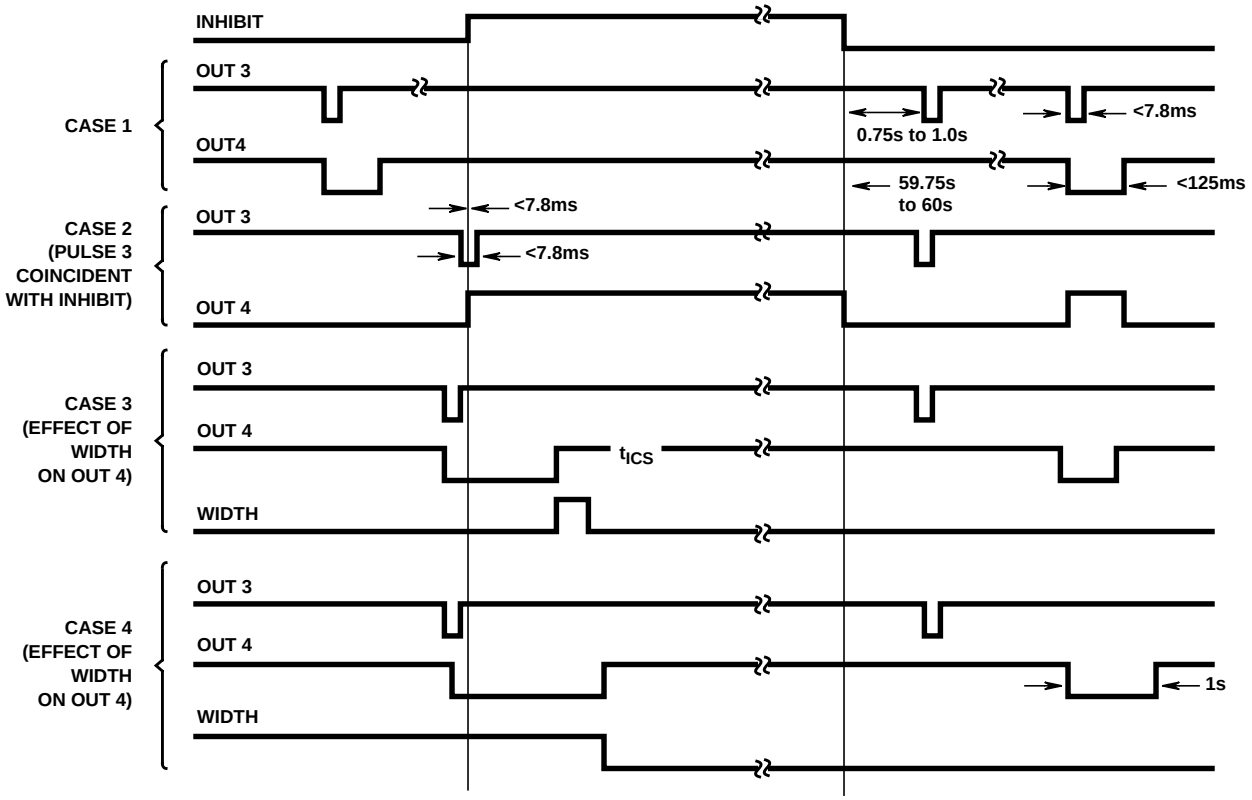


FIGURE 2. EFFECT OF THE INHIBIT (TEST CONNECTED TO V_{SS} OR LEFT OPEN)

Typical Performance Curves

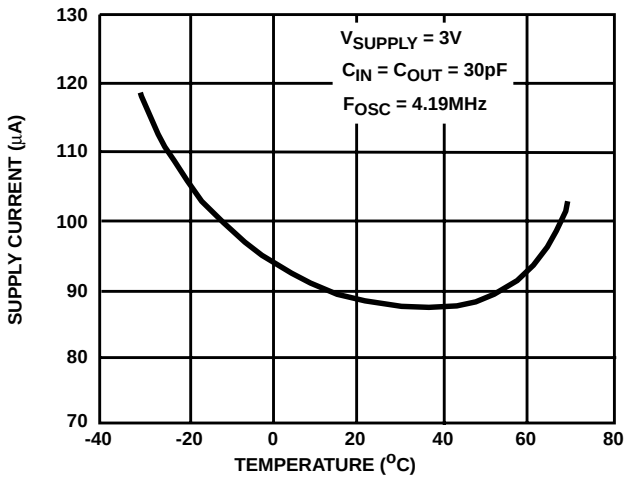


FIGURE 3. SUPPLY CURRENT AS A FUNCTION OF TEMPERATURE

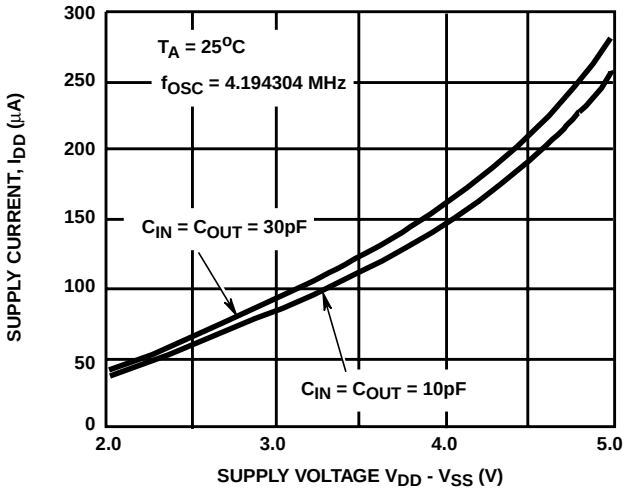


FIGURE 4. SUPPLY CURRENT AS A FUNCTION OF SUPPLY VOLTAGE

Typical Performance Curves (Continued)

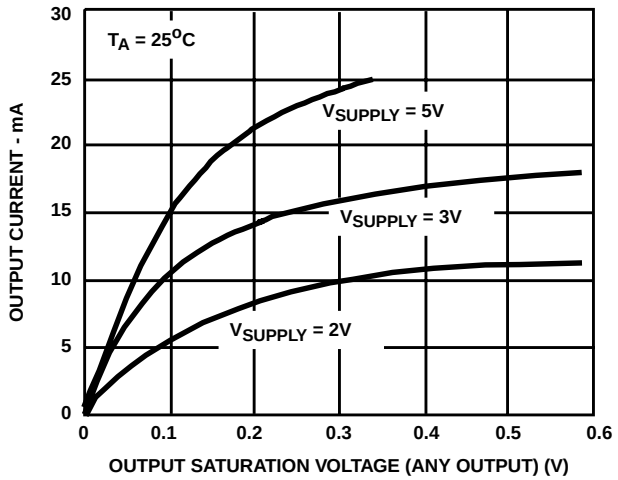


FIGURE 5. OUTPUT CURRENT AS A FUNCTION OF OUTPUT SATURATION VOLTAGE

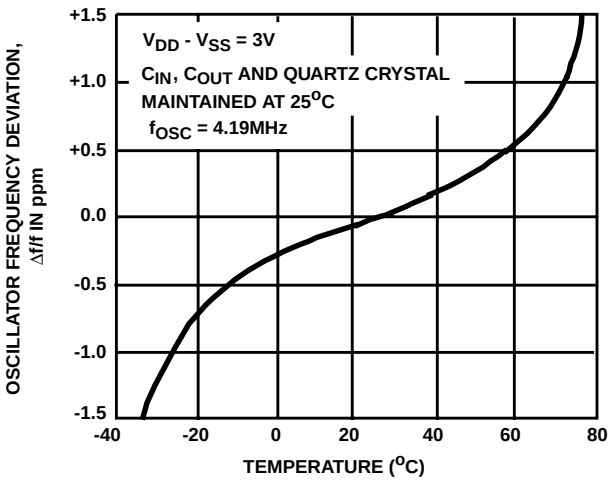


FIGURE 6. OSCILLATOR STABILITY AS A FUNCTION OF DEVICE TEMPERATURE

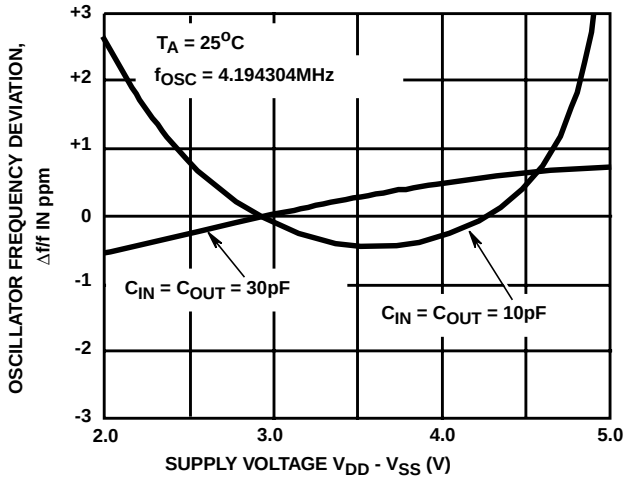


FIGURE 7. OSCILLATOR STABILITY AS A FUNCTION OF SUPPLY VOLTAGE

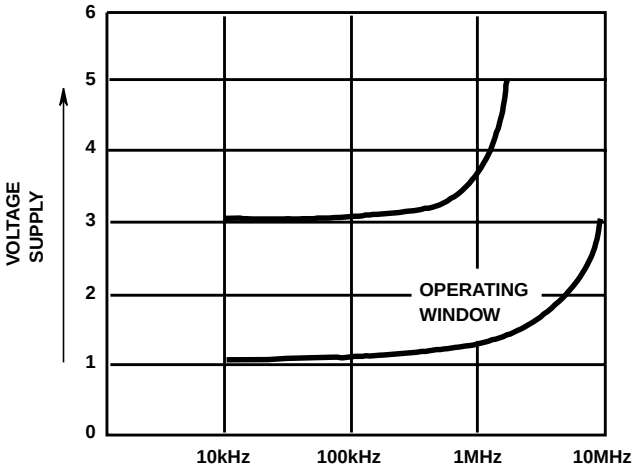
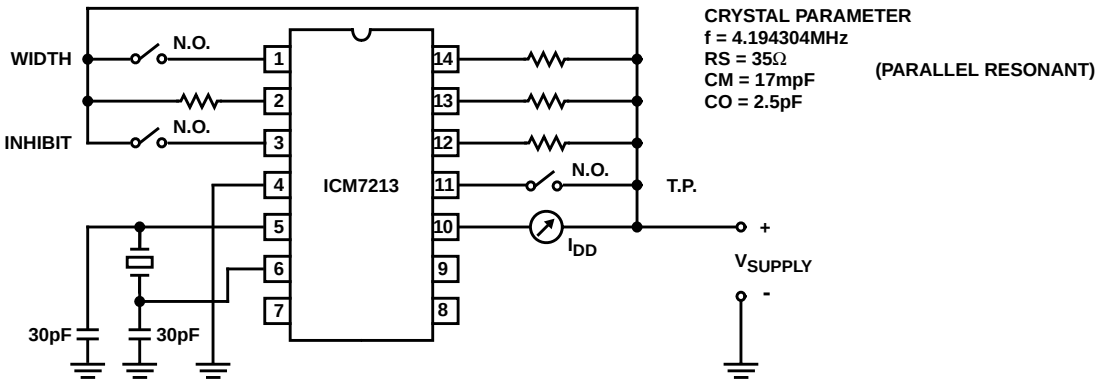


FIGURE 8. WINDOW OF CORRECT OPERATION

Test Circuit



Detailed Description

Supply Voltage Considerations

The ICM7213 may be used to provide various precision outputs with frequencies from 2048Hz to $^1/_{60}$Hz using a 4.194304MHz quartz oscillator, and other output frequencies may be obtained using other quartz crystal frequencies. Since the ICM7213 uses dynamic high frequency dividers for the initial frequency division there are limitations on the V_{SUPPLY} range depending on the oscillator frequency. If, for example, a low frequency quartz crystal is selected, the V_{SUPPLY} should be selected in the center of the operating window, or approximately 1.7V.

The V_{SUPPLY} to the ICM7213 may be derived from a high voltage supply by using a simple resistor divider (if power is of no concern), by using a series resistor for minimum current consumption, or by means of a regulator.

Outputs

Pull up resistors will generally be required to interface with other logic families. These resistors must be connected between the various outputs and the positive power supply.

Oscillator Considerations

The oscillator consists of a CMOS inverter and a feedback resistor whose value is dependent on the voltage at the oscillator input and output terminals and the V_{SUPPLY}. Oscillator stabilities of approximately 0.1ppm per 0.1V variation are achievable with a nominal V_{SUPPLY} of 5V and a single voltage dropping resistor. The crystal specifications are shown in the Test Circuit.

It is recommended that the crystal load capacitance (CL) be no greater than 22pF 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.

It a very high quality oscillator is desired, it is recommended that a quartz crystal be used having a tight tuning tolerance ±10ppm, 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 30pF and the oscillator tuning capacitor should range between approximately 16pF and 60pF.

Use of a high quality crystal will result in typical stabilities of 0.05ppm per 0.1V change of V_{SUPPLY}.

Control Inputs

The TEST input inhibits the 2^{18} output and applies the 2^9 output to the 2^{21} divider, thereby permitting a speedup of the testing of the ÷ 60 section by a factor of 2048 times. This also results in alternative output frequencies (see table).

The WIDTH input may be used to change the pulse width of OUT 4 from 125ms to 1s, or to change the state of OUT 4 from ON to OFF during INHIBIT.

See Figures 1 and 2 for output waveforms and effect of control inputs.

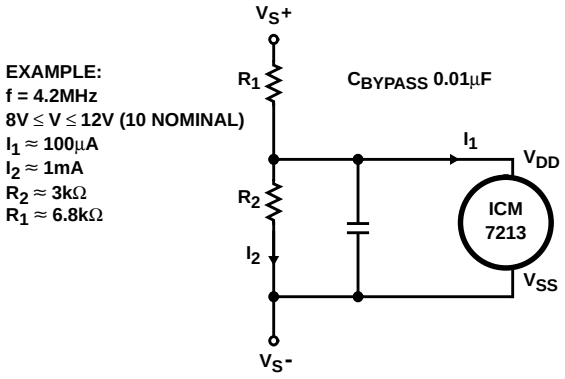


FIGURE 9A.

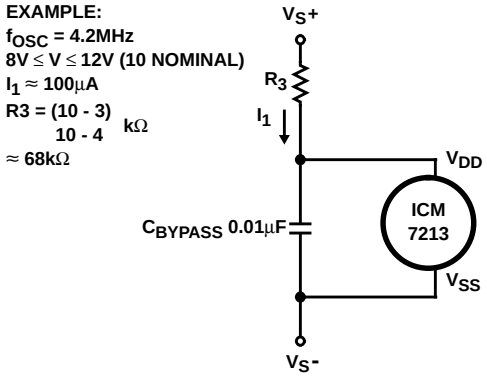


FIGURE 9B.

FIGURE 9. BIASING SCHEMES WITH HIGH VOLTAGE SUPPLIES