

MM5430, MM5431 AM/FM Radio Frequency Display

General Description

The MM5430, MM5431 are monolithic N-channel MOS integrated circuits containing all the necessary logic, timing, control switching and segment drive circuits to display AM or FM radio tuning frequency on a 3 1/2-digit LED display.

The radio station frequency is determined by measuring the radio local oscillator and subtracting the IF frequency. A 10 Hz signal, derived from the 50 or 60 Hz input or from the 4.194304 crystal oscillator and divider circuit, is used to gate the internal digit counter, whose outputs are latched, then decoded into 7-segment format. Three FM IF frequencies of 10.6 MHz to 10.8 MHz (0.1 MHz steps) may be selected by appropriate connection of package pin to supply lines. Three AM IF frequencies of 262.5 kHz, 455 kHz, or 460 kHz may also be selected by connection of package pin*. Two outputs display mode of operation—AM or FM. The display LSD is configured to only show odd integers in the USA FM mode (106.9, 107.1, 107.3, etc.) and held at zero in the USA AM mode (850, 860, 870, etc.). USA/Europe pin select allows even and odd integers in FM (106.8, 106.9, 107.0) and 1 kHz resolution in AM (850, 851, 852). The MM5430, MM5431 interfaces directly with 7-segment LED displays and can drive up to 15 mA/segment for use with low-efficiency green displays. Brightness control is easily obtained by using a photo-resistor or potentiometer for manual operation.

The 4.194304 MHz crystal oscillator and countdown to 60 Hz run from a separate power pin for car clock operation.

*See Table II for selection details.

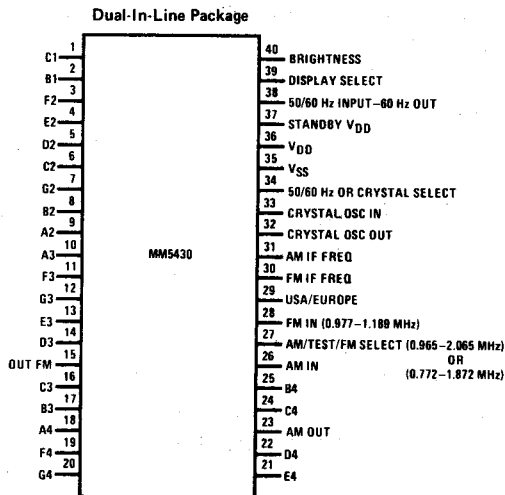
A 60 Hz output signal is available when the 4 MHz crystal oscillator operation is selected.

The MM5431 is electrically identical to the MM5430, but with mirror-image pin out. Both devices are supplied in a 40-lead dual-in-line package.

Features

- AM and FM frequency display
- Programmable IF offset—FM and AM
- Single power supply, 7–11V
- 50/60 Hz line operation or 4.194304 MHz crystal operation
- 60 Hz output from crystal oscillator
- Separate power pin for crystal oscillator and countdown for automobile clock use
- AM and FM indicator outputs
- USA/Europe display resolution selection
- Non-multiplexed direct interface to LED displays
- Single pin brightness control capability
- RFI elimination slow up circuitry at the outputs
- Display enable input (frequency display for 4 seconds after switch release)
- Self select to display enable mode when input frequency changes
- Tuning hysteresis to eliminate display instability

Connection Diagram



TOP VIEW
Order Number MM5430N
See Package 24

FIGURE 1

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Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	VSS to VSS +12V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Segment Drive Current (Figure 4)	≤ 15 mA
Lead Temperature (Soldering, 10 seconds)	300°C

Electrical Characteristics

PIN NO.	PIN DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNITS
37	Standby Voltage	Crystal Oscillator In Use	5		11	V
	Standby Current	Crystal Oscillator In Use			10.0	mA
36	VDD		7		11	V
	I _{DD}			13	20	mA

INPUTS

26	AM Osc. In	Sinewave	1		2	V _{p-p}
		Frequency for Display	0.5		2.2	MHz
28	FM Osc. In	Squarewave	VSS		VSS+0.5	V
		Logic "0"	4.0		VDD	V
		Logic "1"	0.5		1.5	MHz
		Frequency for Display	0.5			
33	Osc. In	Sinewave	0.5			V _{p-p}
		Frequency			4.2	MHz
38	50/60 Hz Input	Pin 34 is Not	VSS		VSS+0.5	V
		Selecting Crystal	VDD-1		VDD	V
		Logic "0"	DC	50/60	100k	Hz
		Logic "1"				
29	USA/Europe	Logic "0"	VSS		VSS+0.5	V
		Logic "1"	VDD-1		VDD	V
27	AM/Test/FM					
31	AM IF	VIN = VSS Sink	Logic "0"		200	μA
30	FM IF	VIN = VDD Source	Logic "1"		2	mA
34	50/60/Crystal					
40	Brightness	VIN = VDD @ Max. Brightness			5	mA
39	Display Select	@ 1 μA	Logic "0"		VSS	V
			Logic "1"	VSS+1.0	VDD	V

OUTPUTS

1-25	Segment Drives	@ Max. Brightness, V _{OUT} = 2V Outputs Off Leakage, V _{OUT} = VDD	15		10	mA
						μA
32	Osc. Out	I _{SINK} @ 4 mA Logic "0"			1.0	V
		I _{SOURCE} @ 0.8 mA Logic "1"	1.0			V
38	60 Hz Output	@ V _{OUT} = VSS+0.5V	0.05			mA
		@ V _{OUT} = VDD-3.0V	20			μA
39	Display Select	Output Device ON @ 1V	1.7			mA

Note 1: Exceeding the Absolute Maximum Ratings may permanently damage the device.

MM5430 Block Diagram

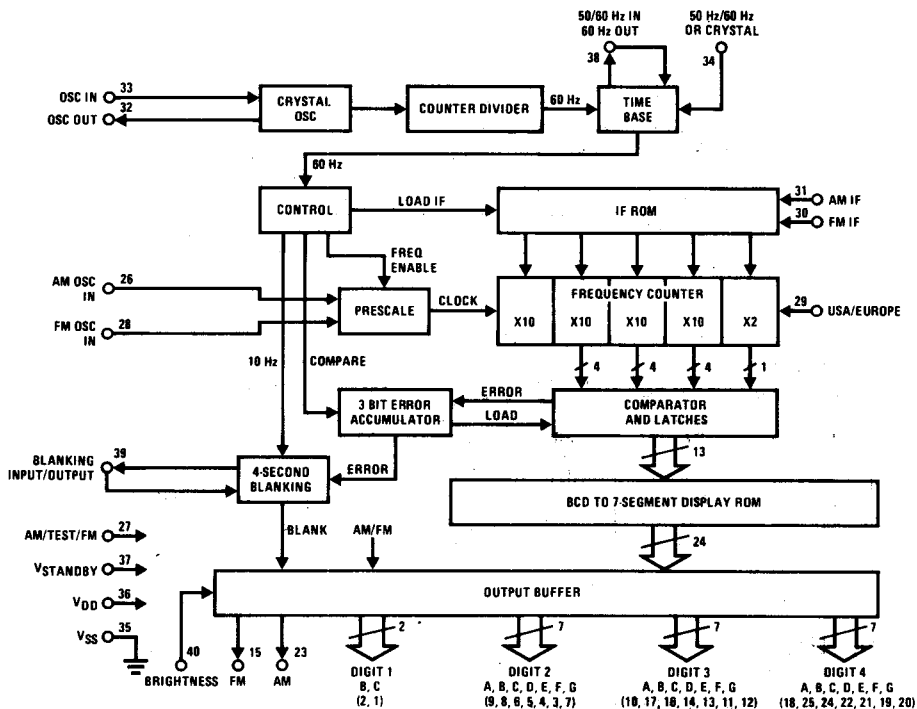


FIGURE 2

Pin Functional Description

1-25. Segment outputs. 25 open-drain outputs are provided with direct drive capability—15 mA max. per segment—to the AM and FM indicators and to all the segments of a 3-1/2-digit display.

26. AM oscillator input. The AM band oscillator can be connected to the AM oscillator input with a capacitor in series. A pre-amplifier circuit is provided internally to facilitate interfacing with the AM local oscillator. This input accepts 1 to 2 V_{p-p} signals up to 2.2 MHz.

27. AM/FM band select. When this input is pulled low (V_{SS}), the AM band is selected and when it is pulled high (V_{DD}), the FM band is selected. If left floating, the device will go into a special test mode, Table 2.

28. FM oscillator input. The FM oscillator input accepts a ÷ 100 prescaled frequency from the local oscillator.

29. USA/Europe. This input selects the USA/Europe modes of operation. Table 1 shows the channel spacing selections. V_{SS} selects Europe.

30. FM IF. Three FM IF frequencies are selectable through this input. Table 2 shows the selections.

31. AM IF. Three AM IF frequencies are selectable through this input. Table 2 shows the selections.

32-33. Oscillator output, oscillator input. These 2 pins form direct connections to a 4.194 MHz crystal. Pin 32 forms the low impedance output and pin 33 forms the high impedance input.

34. 50/60 Hz or crystal select. Time base can be selected from external 50 Hz or 60 Hz sources or the divided down 60 Hz from the crystal oscillator. Table 2 shows the selections.

37. Standby V_{DD}. The crystal oscillator and the circuit that divides down and outputs 60 Hz operates off the standby V_{DD} supply. When only the 60 Hz output is required, the rest of the circuit therefore does not draw power.

38. 50/60 Hz input—60 Hz output. Depending on the state of pin 34, external 50/60 Hz or internal 60 Hz can be selected for input or output on this pin.

39. Display select. This pin exhibits internal low impedance to V_{SS} as long as the display segment drives are active. If it is externally connected to V_{SS}, display segment drives are constantly active. Figure 3 shows the display scheme.

40. Brightness. Variable voltages applied will generate different current drives on the segment outputs. Maximum drive occurs when this pin is connected to V_{DD} directly.

Pin Functional Description (Continued)

TABLE I

MODE	PIN 29	CHANNEL SPACING	
		AM BAND	FM BAND
Europe	"0"	1 kHz	100 kHz
USA	"1"	10 kHz	200 kHz

TABLE II

	BAND SELECT	EUROPE FM IF	USA FM IF	AM IF	TIME BASE
PIN	27	30	30	31	34
"0"	AM	10.8	10.75	262.5	External 60 Hz
Floating	Test	10.7	10.65	455	Crystal 60 Hz
"1"	FM	10.6	10.55	460	External 50 Hz

Display Selection

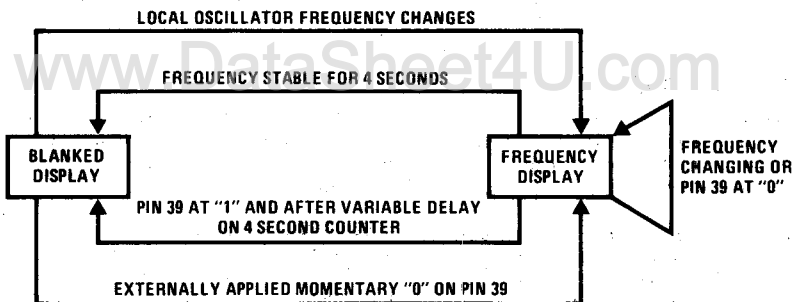


FIGURE 3

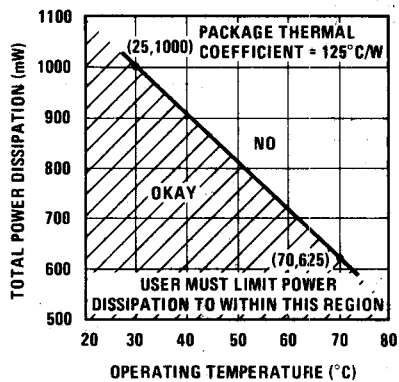


FIGURE 4

Typical Applications

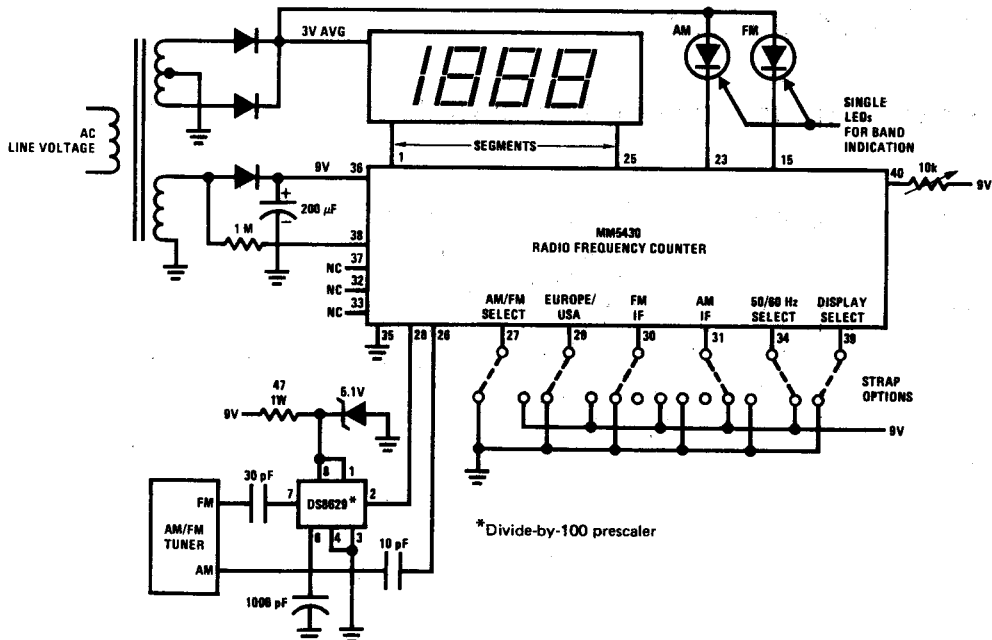


FIGURE 5a. AM/FM Frequency Counter with 50/60 Hz Input from Line Source

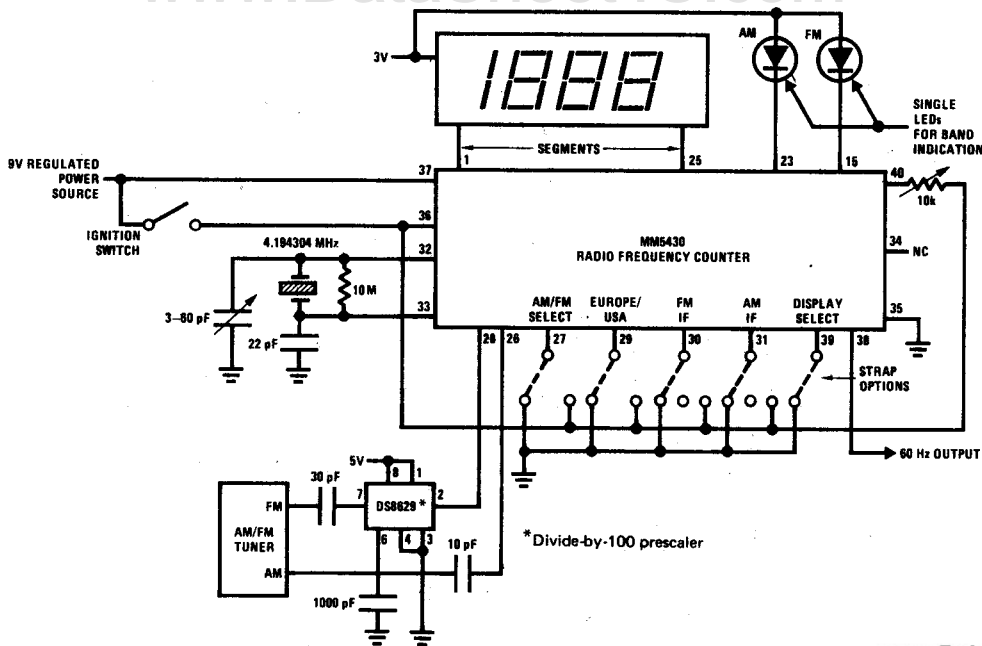


FIGURE 5b. AM/FM Frequency Counter in Automotive Environment with Crystal Oscillator Frequency Source