M58434P, M58435P
M58436-001P, M58437-001P

CMOS ANALOG CLOCK CIRCUITS

DESCRIPTION

This family of CMOS circuits is particularly suited for crystal-controlled clocks where induction motors or stepping motors are used.

Type	Process	Crystal oscillator	Motor	Alarm sound
M58434P	Silicon-gate CMOS	4.1943MHz	Induction motor	1024Hz
M58435P	Silicon-gate CMOS	4.1943MHz	Stepping motor	1024Hz
M58436 −001P	Aluminum-gate CMOS	4.1943MHz	Stepping motor	4096×8×1Hz
M58437 −001P	Aluminum-gate CMOS	32.768KHz	Stepping motor	4096×8×1Hz

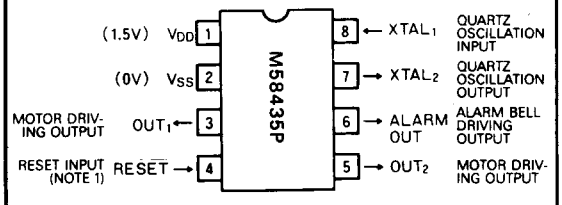
FEATURES

- Low power dissipation:
  - M58434P, M58435P: 30μA (typ)
  - M58436-001P: 35μA (typ)
  - M58437-001P: 2μA (typ)
- Low voltage operation:
  - M58434P, M58435P: 1.2V (min)
  - M58436-001P: 1.1V (min)
- Direct drive of ceramic resonator (M58436-001P and M58437-001P only)

APPLICATIONS

- Crystal-controlled alarm clock
- Precision timepiece for electronic apparatus
- Frequency divider for electronic apparatus

PIN CONFIGURATION (TOP VIEW)



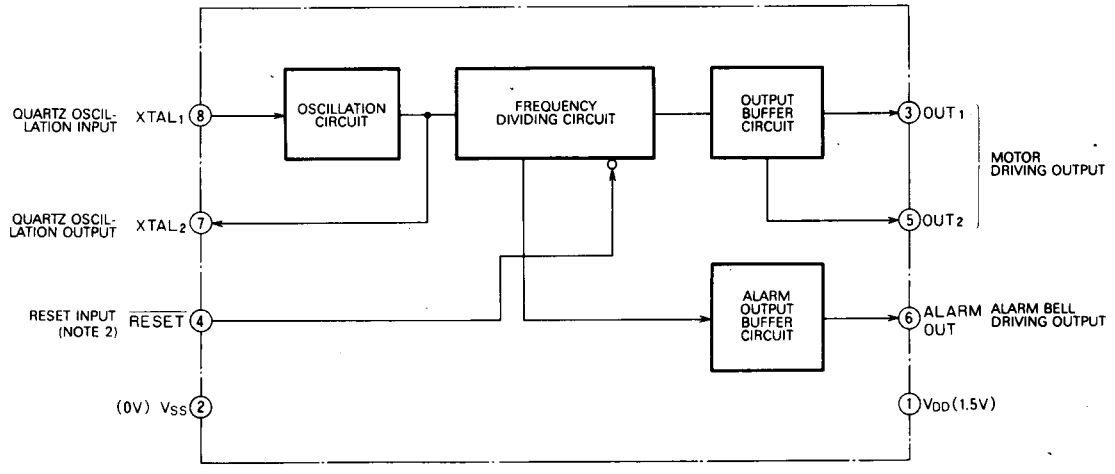
Note 1 : This pin is non-connected for M58434P.

Outline 8P1 (M58434P)
(M58435P)
(M58436-001P)
(M58437-001P)

FUNCTION

Circuitry consists of an oscillator, frequency divider, bridge-type driver circuit for an induction motor (M58434P) or a stepping motor (M58435P, M58436-001P, M58437-001P), and an alarm bell driver circuit. The oscillator frequency is 32.768 kHz for the M58437-001P and 4.1943 MHz for the other types.

BLOCK DIAGRAM



Note 2 : M58434P has no reset input pin.

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M58434P, M58435P
M58436-001P, M58437-001P

CMOS ANALOG CLOCK CIRCUITS

FUNCTIONAL DESCRIPTION

Oscillation Circuit

This circuit is completed by connecting a crystal between $XTAL_1$ (oscillation input) and $XTAL_2$ (oscillation output) and capacitances between both terminals and GND.

Motor Driver Circuit

This circuit amplifies motor driving current at the output frequency of the last divider. In M58434P and M58435P, Outputs OUT_1 and OUT_2 are always in a mutually reversed phase, while in the M58436-001P and M58437-001P, OUT_1 has a wave-form delayed 1sec from OUT_2. It is realized by continuous movement or stepped movement when the M58434P is connected to an induction motor (M58434), to a stepping motor with series-connected capacitance (M58435P) or a stepping motor (M58436-001P and M58437-001P). The size of the capacitance for M58435P is determined by the total current consumption and the required motor torque, and with a 47μF capacitor, SUM-2 manganese dry cells will last for about one year.

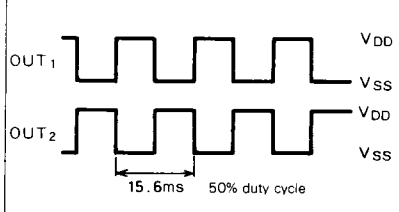
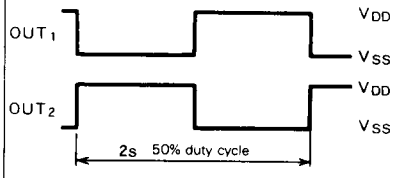
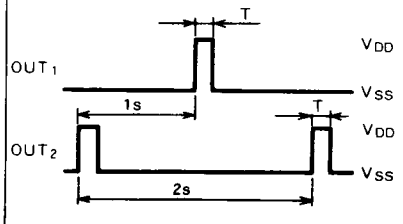
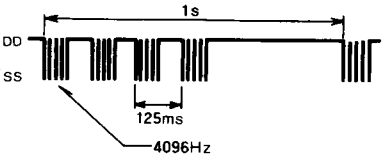
Reset Input ($\overline{RESET}$)

When the $\overline{RESET}$ terminal of the M58435P is held at V_{SS} level, outputs OUT_1 and OUT_2 hold their current states of that time, and invert 0.97~1.0sec after the reset terminal is released from the V_{SS} level. In the M58436-001P and M58437-001P, OUT_1 and OUT_2 go to the V_{SS} level, and 0.97~1.0sec after the reset terminal is released from V_{SS} level, a 31ms pulse is generated from the output opposite to the one that emitted a 31ms pulse immediately before the reset. If the $\overline{RESET}$ terminal is connected with the V_{SS} during the 31ms pulse, the reset will be started completely after the pulse ends. This prevents inadvertent interruption of complete action of the motor owing to the reset function. The M59434P has no reset function.

Alarm Output Buffer Circuit

This circuit consists of an N-channel open-drain MOS transistor and generates a signal to drive a ceramic resonator or magnetic speaker (see p. 10-14). The alarm output is a 1024 Hz signal, with a duty cycle of 50% for M5843P and M58435P, and burst signals of 4096Hz, 8Hz, and 1Hz, each of 50% duty, for M58436-001P and M58437-001P. Direct drive of the ceramic resonator by M58436-001P and M58437-001P is possible because of the high alarm output breakdown voltage.

Table 1 Output Waveforms on the OUT_1, OUT_2, and ALARM OUT terminals

Type	OUT_1 and OUT_2 waveform	Pulse width (ms)	ALARM OUT waveform
M58434P		—	
M58435P		—	
M58436-001P M58437-001P		31	 50% duty cycle for 4096Hz, 8Hz, and 1Hz

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Limits	Unit
V_{DD}	Supply voltage	With respect to V_{SS}	−0.3~5	V
Pd	Maximum power dissipation	Ta=25℃	300	mW
Topr	Operating free-air ambient temperature range		−20~70	℃
Tstg	Storage temperature range		−40~125	℃

RECOMMENDED OPERATING CONDITIONS (Ta=25℃, unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min	Nom	Max	
V_{DD}	Supply voltage			1.5		V
V_{SS}	Supply voltage (GND)			0		V
f_{OSC}	Crystal oscilation frequency	M58434P M58435P M58436-001P		4.1943		MHz
		M58437-001P		32.768		kHz
R_O	Crystal impedance of crystal oscillator	M58434P M58435P M58436-001P		30	60	Ω
		M58437-001P		20	30	kΩ
C_{IN}	External input capacity			20		pF
C_{OUT}	External output capacity			20		pF

ELECTRICAL CHARACTERISTICS (Ta=25℃, V_{SS}=0 V, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
V_{DD}	Supply voltage	M58434P M58435P	$C_{IN}=C_{OUT}=20pF$, $R_O=30\Omega$	1.2	1.5	1.9	V
		M58436-001P	$C_{IN}=C_{OUT}=20pF$, $R_O=30\Omega$	1.1	1.5	1.9	V
		M58437-001P	$C_{IN}=C_{OUT}=20pF$, $R_O=20k\Omega$				
I_{DD}	Supply current	M58434P M58435P	$V_{DD}=1.5V$, $C_{IN}=C_{OUT}=20pF$, $R_O=30\Omega$		30	50	μA
		M58436-001P	$V_{DD}=1.5V$, $C_{IN}=C_{OUT}=20pF$, $R_O=30\Omega$		35	70	μA
		M58437-001P	$V_{DD}=1.5V$, $C_{IN}=C_{OUT}=20pF$, $R_O=20k\Omega$		2	5	μA
$R_{ON(P+N)}$	Motor driving output saturation resistance (P-channel + N-channel)	M58434P M58435P	$V_{DD}=1.5V$, $I_{OUT}=\pm 3$ mA		150	300	Ω
		M58436-001P M58437-001P	$V_{DD}=1.5V$, $I_{OUT}=\pm 3$ mA		100	200	Ω
$R_{ON(AL)}$	Alarm bell driving output saturation resistance (N-channel)	M58434P M58435P	$V_{DD}=1.5V$, $I_{OUT}=3$ mA		0.5	1	kΩ
		M58436-001P M58437-001P	$V_{DD}=1.5V$, $I_{OUT}=3$ mA		100	200	Ω
I_{SW}	Reset input current	M58435P M58436-001P M58437-001P	$V_{DD}=1.5V$,			1	μA

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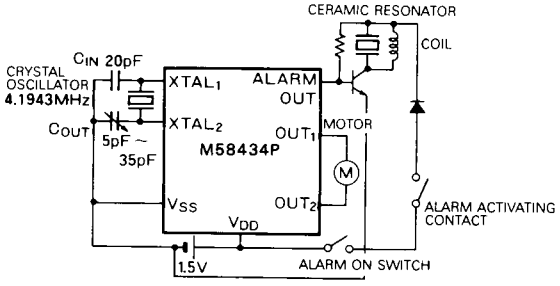
M58434P, M58435P
M58436-001P, M58437-001P

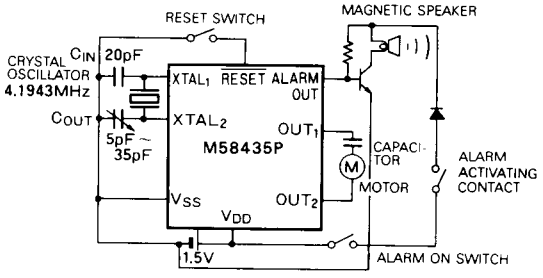
CMOS ANALOG CLOCK CIRCUITS

TYPICAL APPLICATION CIRCUITS

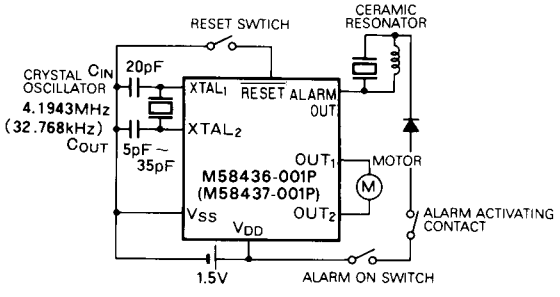
1. Ceramic resonator with M58434P



2. Magnetic speaker with M58435P



3. Ceramic buzzer with M58436-001P or M58437-001P



4. Magnetic speaker with M58436-001P or M58437-001P