RCL Semiconductors Ltd.

32 KHz Analog Clock with Alarm Driver CMOS IC   C1939

GENERAL DESCRIPTION

The C1939 is an CMOS integrated circuit for application in a 32768 Hz quartz clock driven by bipolar stepping motor. It's alarm output can drive speaker directly. It consists of an oscillator, frequency divider , alarm frequency generator, alarm output and push-pull motor driver. The Cout and Cin capacitors are built-in, so that only an external crystal is required by the oscillator of C1939. In addition, the motor pulse width of C1939 is determined by mask OPTION.

FEATURES

- Single 1.5V battery operation.
- Low power consumption.
- Built-in 32768 Hz oscillator.
- Output 1Hz for stepper motor with two pulse duration options by mask option:
  (1) 31.25 ms
  (2) 46.875 ms
- Alarm output: 2048 x 8 x 1Hz
- Built-in: Cin=Cout=18pf

FUNCTIONAL DESCRIPTION

Oscillator

An integrated oscillator with built-in capacitors (Cout & Cin) at OSCOUT & OSCIN are provided, so that only a 32768 Hz quartz crystal is required to complete the oscillator circuit.

Push-Pull Motor Drivers

The C1939 has two push-pull output drivers. During a motor pulse the n-channel transistor of one driver and the p-channel transistor of the another driver are on. Between two consecutive motor pulses, the p-channel transistors of both drivers are on (Figure 3). The motor pulse width can be chosen by mask.

The motor pulse of C1939 is negative. It also can be positive by mask option.
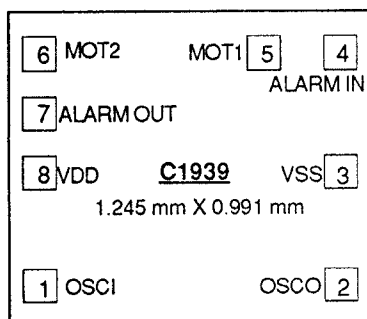
Normal Operation Mode

When ALARM IN is opened, C1939 is in the normal operation mode. The oscillator frequency divided down to 256 Hz can be measured at ALARM IN with a high resistance probe.

When ALARM IN is connected to Vss, an alarm signal of 2048 x 8 x 1Hz outputs to ALARM OUT.

Test mode

When ALARM IN is connected to VDD, C1939 enters to the test mode. The motor cycle time will change to 31.25 ms from 2 sec.

PAD CONFIGURATION

| 6 MOT2   MOT1 5   4 |
| ALARM IN |
| 7 ALARM OUT |
| 8 VDD   C1939   VSS 3 |
| 1.245 mm X 0.991 mm |
| 1 OSCI   OSCO 2 |

Signal	
Vss	Negative supply
Vdd	Positive supply
OSC IN / OSC OUT	Oscillator input / output
MOT I / MOT2	Motor drive output
ALARM IN / ALARM OUT	Alarm signal in / out

Note: Substrata should be either left open or connected to VDD

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ABSOLUTE MAXIMUM RATINGS

Parameter	Value	Unit
Power supply voltage VDD	- 1.7 ~ + 3.0	V
Oscillator Input / output Voltage	0 ~ VDD	V
Operating ambient temperature range	- 10 ~ + 60	°C
Storage temperature range	- 30 ~ + 125	°C

Note: Absolute maximum ratings state parameter limits exceeding which the device may be permanently changed or damaged.

All inputs and outputs are adequately protected against electrostatic discharge. However, cares must be taken to avoid building up of electrostatic charges during device handling.

ELECTRICAL CHARACTERISTICS

(VDD = 1.5V; Vss = 0V; Ta = +25°C; Fosc = 32768 unless otherwise specified)
All voltage levels are measured with reference to Vss.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Supply Voltage	VDD	1.1	---	1.8	V	
Supply Current	IDD	---	1.2	2.0	UA	No Load
Motor Output:						VDD - VSS = 1.4v
Cycle Time	TM	---	2	---	sec	RLoad = 200KΩ
Pulse Duration	TD	---	*	---	ms	Iout = 4.5mA
Impedance	Rout	---	60	100	Ω	
Alarm Output:						VDD = 1.4V
Sink Current	IS	40	60	---	mA	VAO = 0.6V
Alarm Input Debounce	TA	0	70	---	ms	---
Alarm Input Current	IA	---	5	10	uA	---
Oscillator Polarization Resistance	Rp	15	20	50	MΩ	
Oscillator Stability	Fsta	---	0.2	---	ppm	Δ VDD = 100mv
Oscillator Start-up Time	TS	---	---	2.0	sec	VDD = 1.2v

Note : * 46.875ms , 31.25ms by mask OPTION

TEST CIRCUIT
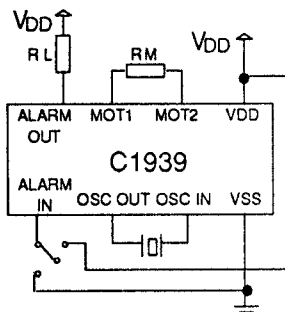
VDD - VSS = 1.4v
When ALARM IN is connected to Vss, C1939 is in Alarm Mode,
When ALARM IN is connected to VDD, C1939 is in Test Mode,
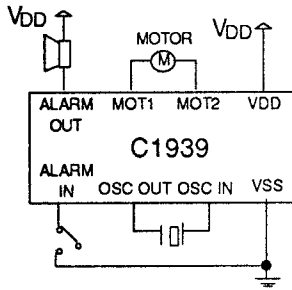RM = 200Ω
RL = 1kΩ
f = 32768 Hz
Crystal Parameter: C1 = 2.5pF
                 C0 = 1.5pF
                 Rs = 30kΩ
Built-in Cin = Cout = 18pF

Figure 1 : Functional test

APPLICATION CIRCUITS

Note: External Cin or Cout is not necessary for oscillator.
The Cout = 18pF binds Pad 2,
the Cin = 18pF binds Pad 1.
Pad 1 - OSCIN   Pad 2 - OSCOUT

Figure 2 : Application circuit

MOTOR PULSE DURATION

The motor pulse duration is by mask option.

Option	Pulse Duration
1939	31.25ms
1939-2	46.875ms

MOTOR OUTPUT WAVEFORMS

C1939 is used to generate a pulse per second to drive bipolar stepper motors.
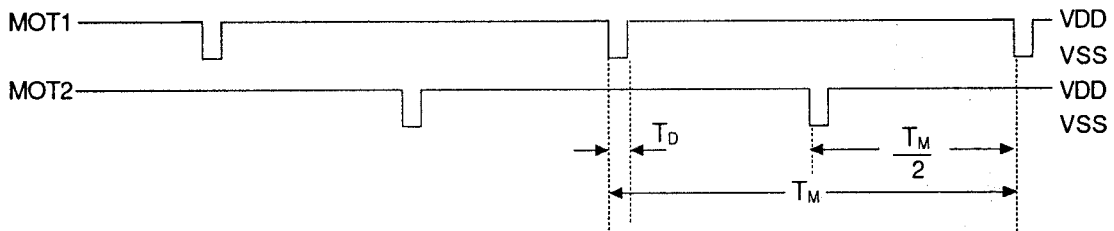
Figure 3 : Motor drive output in normal mode

ALARM OUTPUT WAVEFORMS

C1939 provides the alarm output signal which is activated when the ALARM IN pin is pulled to Vss.
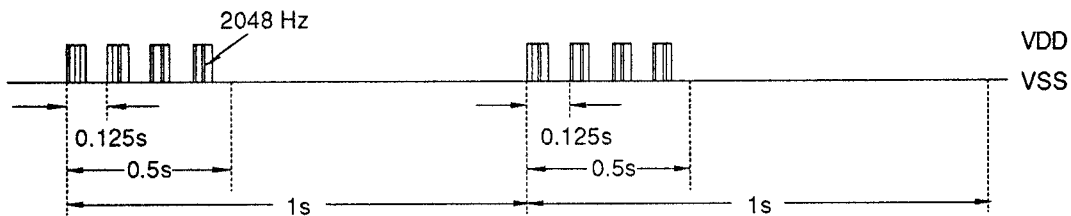The alarm signal is 2048 X 8 X 1 HZ
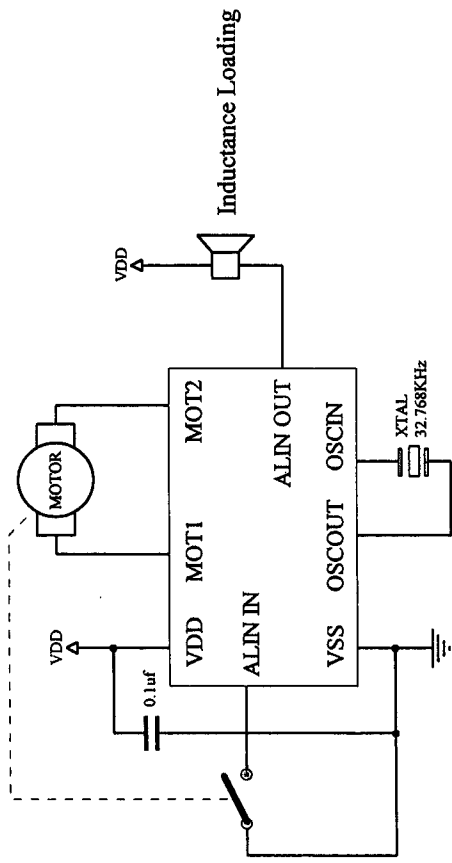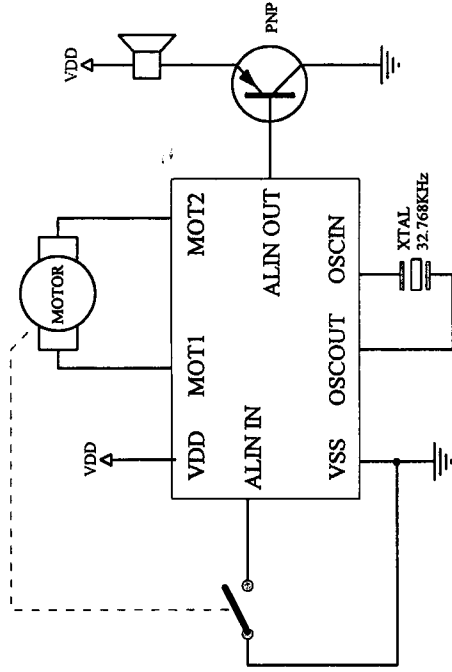

Figure 4 : Alarm output

Figure 2 : C1939 External Transistor Configuration

Figure 1 : C1939 Build-In Transistor Configuration