VID69 DRIVER VK12/VK11

DESCRIPTION

The VK12/VK11 is a CMOS Microcontroller designed to be used as a driver for the VID69 analogue car clock.

The VK12 is a clock driver circuit designed for Wellgain VID69xxP clock motors.
The VK11 is a clock driver circuit designed for Wellgain VID69xx clock motors.

In the normal operating mode a pulse train is sent to the motor every 60 seconds to obtain a 6° rotation of minute shaft. Two push-buttons allow to correct the time in both directions of rotation.

An E²PROM based calibration design permits tuning of the quartz oscillation in the range of ±60PPM in a resolution of 1PPM per step, this guarantees an accuracy of less than ±1 s/Day at 25°C .

FEATURES

- Power supply 5V
- Digital E²PROM Tuning
- Oscillator 4.194304 MHz
- Low power consumption

E-mial: vid.info@wellgain.com Website: http://www.vid.wellgain.com/

PIN CONFIGRATION

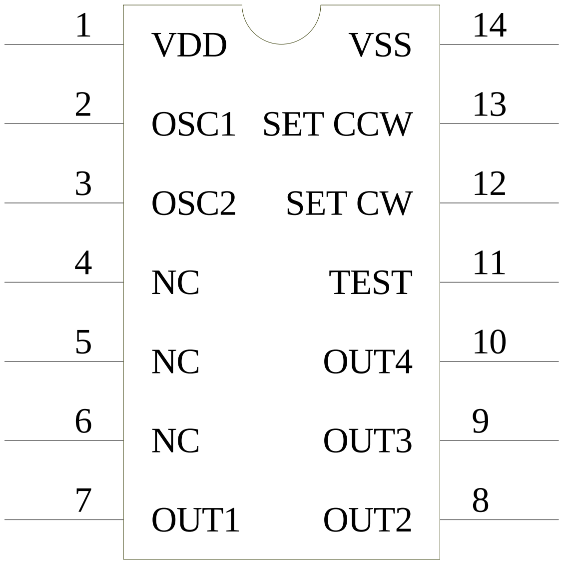


Fig. 1

PIN DESCRIPTION

Pin Number	symbol	I/O	level	Function
1	VDD	V	--	Positive supply voltage
2	OSC1	I	--	Oscillator input1
3	OSC2	I	--	Oscillator input2
4	NC	X	--	No description
5	NC	X	--	No description
6	NC	X	--	No description
7	OUT1	O	H/L	Coil output1
8	OUT2	O	H/L	Coil output2
9	OUT3	O	H/L	Coil output3
10	OUT4	O	H/L	Coil output4
11	TEST	O	L to H	Calibration Frequency test
12	SET CW	I	H to L	Clock time positive adjustment and calibration negative adjustment
13	SETCCW	I	H to L	Clock time negative adjustment and calibration positive adjustment
14	VSS	V	--	Negative supply voltage

ABSOLUTE MAXIMUM RATINGS

Ambient temperature under bias... -40 to +125°C
Storage temperature .... -65°C to +150°C
Voltage on VDD with respect to VSS .... -0.3 to +6.5V
Voltage on all other pins with respect to VSS .. .. -0.3V to (VDD + 0.3V)
Maximum current out of VSS pin ....300 mA
Maximum current into VDD pin .... 250 mA
Input clamp current, IIK (VI < 0 or VI > VDD)............................± 20 mA
Output clamp current, IOK (Vo < 0 or Vo >VDD) ....± 20 mA
Maximum output current sunk by any I/O pin...... .... 25 mA
Maximum output current sourced by any I/O pin .... 25 mA

DC CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	VDD	4.5	5.0	5.5	V
Input high voltage	VIH	2.0	--	VDD	V
Input low voltage	VIL	Vss	--	0.8	V
output high voltage	VOH	VDD-0.7	--	VDD	V
output low voltage	VOL	--	--	0.6	V

Note :
for further information , please refer to **www.microchip.com** **PIC16F630** datasheet

TYPICAL CONNECTION DIAGRAM

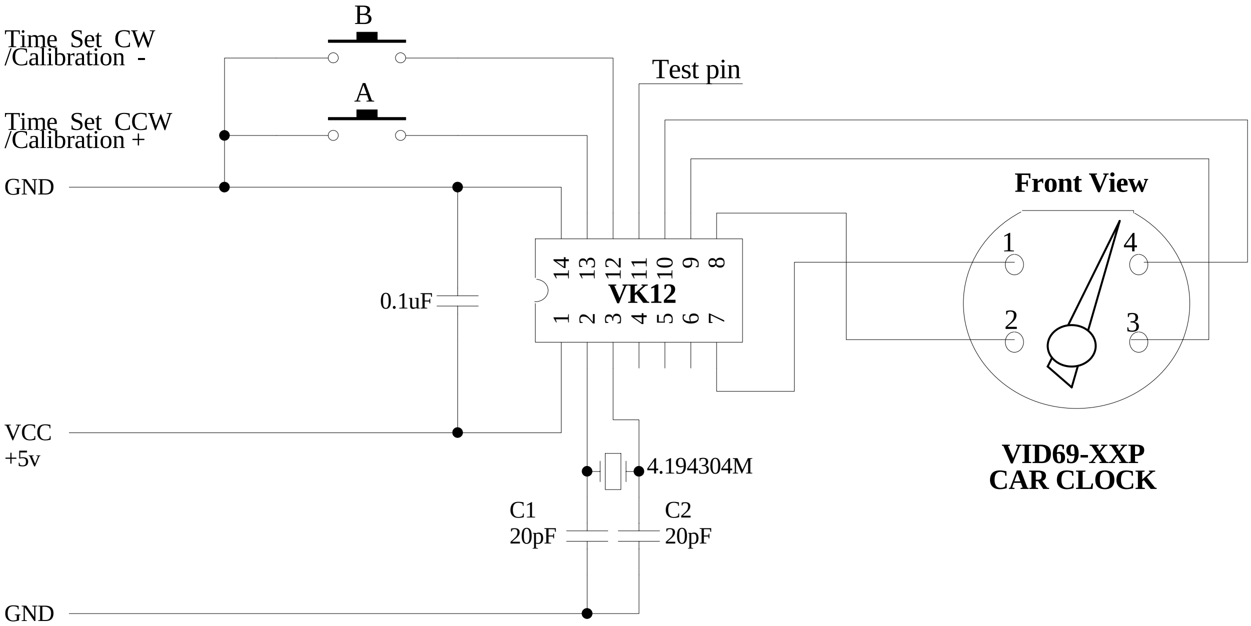


Fig 2. VK12 Connection diagram

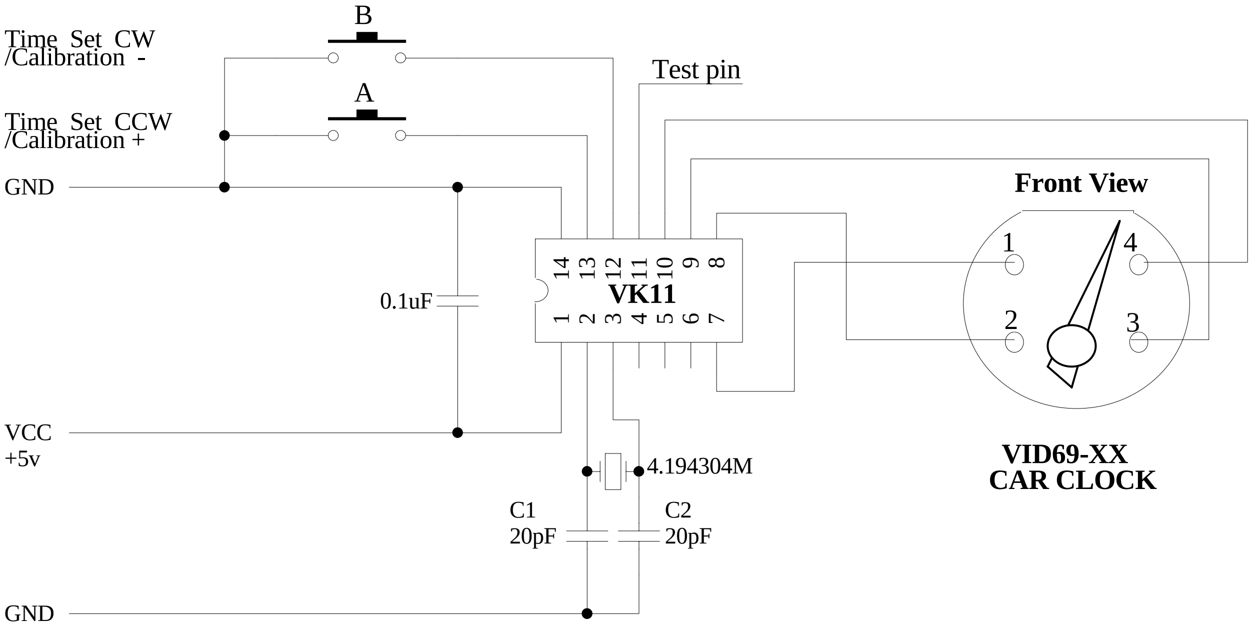
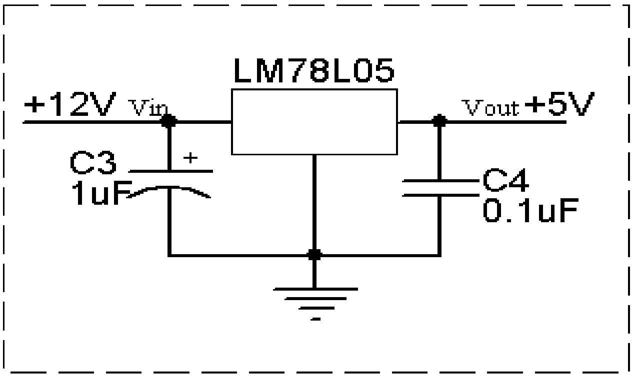


Fig 3. VK11 Connection diagram

Voltage Regulator



POWER CONSUMPTION

With quartz 4.194304MHz and motor connected. T=25° C.

Parameter	Test Conditions	Type	Max.	Units
Peak Current	@5V	18.0	20.0	mA
Average Current		0.8	1.0	
Peak Current	@4.5V	16.0	18.0	mA
Average Current		0.7	0.9	
Peak Current	@4V	13.0	15.0	mA
Average Current		0.6	0.9	

TIME SETTING

Two push-buttons inputs are provided for setting the time. The button A is for retarding and the button B is for advancing. Each pressing of the button retards or advances the clock by one minute. If the button is kept pressed, the following acceleration of the minute hand takes place.

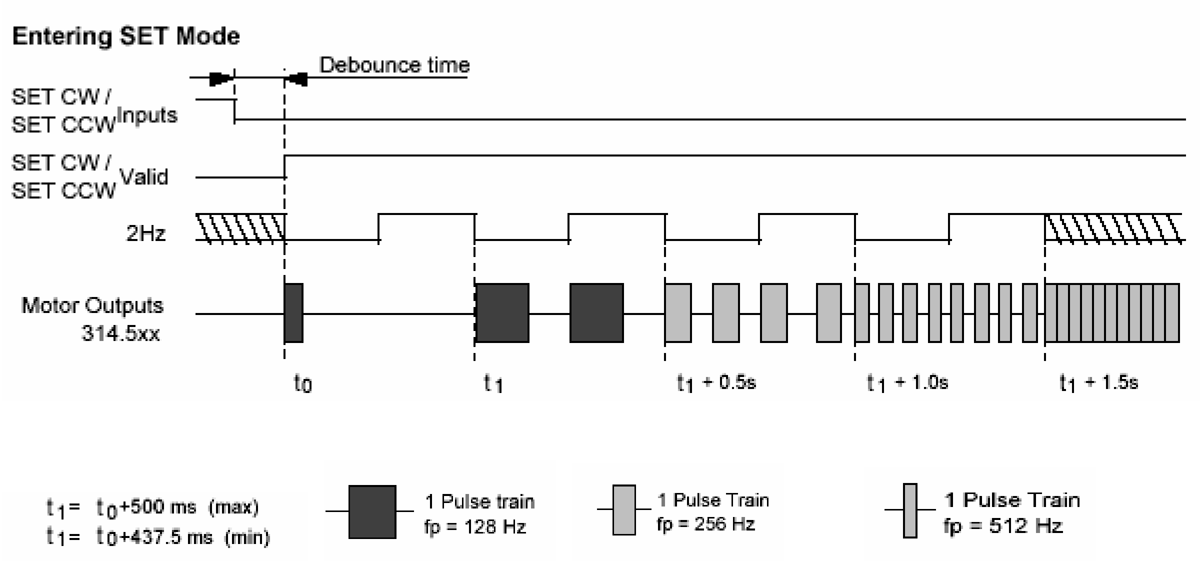


Fig 4.

CALIBRATION

The clock frequency precision can be calibrated up to 1.000000 Hz with a pulse width about 1.0 us. It can be checked by the Calibration Frequency test pin (pin 11).

The chip is delivered with standard program. The timing of the clock is tested either with precision clock in 24hrs or some other test equipments (eg. Witschi Q Test 6000 or Frequency Meter). If the accuracy is more than±1s/day, the chip must be calibrated to adapt to the external quartz.

At power-up, if no button is pressed, clock will turn 6º clockwise, the program starts in normal clock mode, with possibility to adjust the time. If the precision must be adjusted, the value in data EEPROM is modified with a special reset as follows:

Keep press one of the two buttons (A or B) during power-up. The software will respond and the minute hand will turn +60º and back.When the button is released, the minute hand will turn 30º clockwise and back. The program has a timeout feature: if no button is pressed in 3 seconds, the program will resume normal operating mode. The minute hand moves by one minute clockwise or counterclockwise at every action. When the 3 seconds timeout occurs, the correction value is written to the data EEPROM and the minute hand returns to its original position and the program continues in normal clock mode.

When the accuracy of clock (secs/month or frequency) is known, the appropriate number N of keystrokes can be read in the Correction Table For VK12/VK11 (see table 1 & table2).

Doing successive corrections will increase/decrease the PPM correction up to +/- 127 PPM.

If a greater correction is the result of a set of actions, the value is saturated at + 127 or -127, and the error is shown by the minute hand doing a full 360º alternate movement.

CIRCUIT IN CALIBRATION MODE

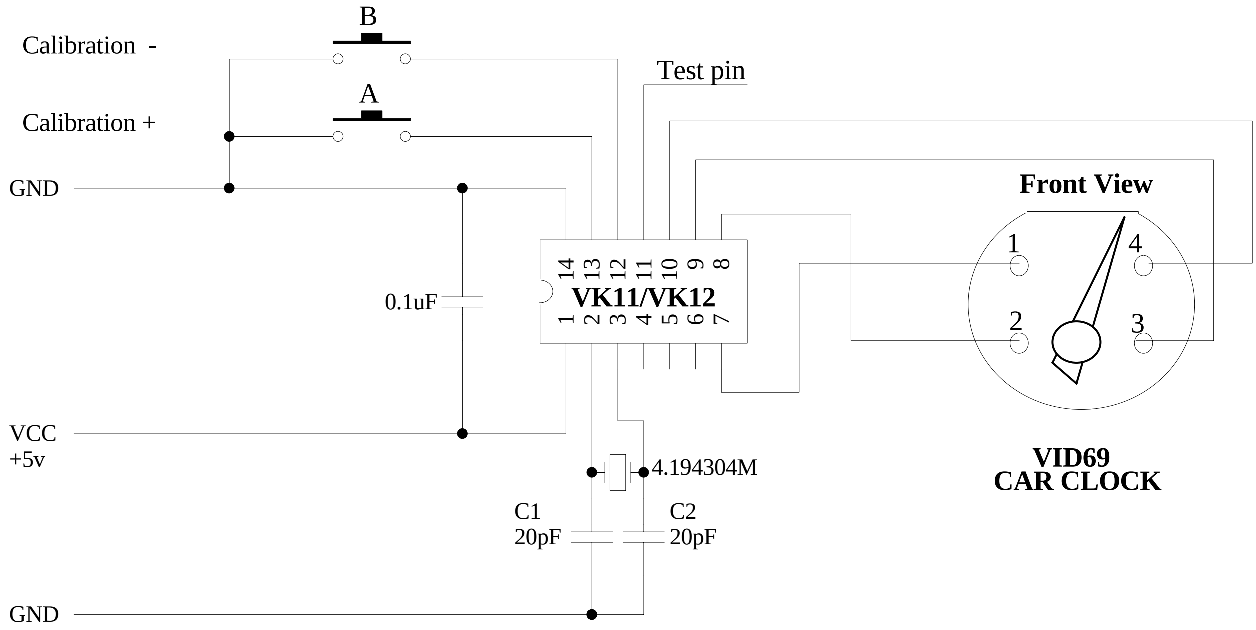


Fig 5.

Examples

➤ **Q Test 6000 reveals: -83 secs/month**

The Correction Table indicates that -83 secs/month = A-10

1. Switch off VK12/VK11
2. Press one of the 2 buttons and keep pressed
3. Power up the VK12/VK11
4. The minute hand will now turn +60º and back
5. When the button is released, the minute hand will turn +30º and back
6. Press the button A 10 times, the minute hand will advance with each press by one minute. If no button is pressed after more than 3 seconds, timeout occurs .
7. More than 16 actions are equivalent to 16
8. After the Timeout the minute hand will return to its original position and the data is written to the EEPROM

We still have an error of -2 PPM = 5.2 secs/month, = 0.17 seconds a day. If we want to be very precise at this point, we can re-measure with Q Test 6000, result =-8secs/month.

Follows steps 1 through 6, the correction Table indicates that -8 secs/month = A-3, press A button 3 times. After timeout the minute hand will return to its original position and the data is written to the EEPROM.

We now have a 0 PPM Calibration.

➤ Frequency Meter reveals: **1.000029** = **29 PPM** fast

29 PPM fast = B-10 =Press button B 10 times = correction value of 30 PPM

1. Switch off VK12/VK11
2. Press one of the 2 buttons and keep pressed
3. Power up the VK12/VK11
4. The minute hand will now turn +60º and back
5. When the button is released, the minute hand will turn +30º and back
6. Press the button B 10 times, the minute hand will advance with each press by one minute. If no button is pressed after more than 3 seconds, timeout occurs .
7. More than 16 actions are equivalent to 16
8. After the Timeout the minute hand will return to its original position and the data is written to the EEPROM.

Recheck the frequency and correct the clock again, if need more precise correction.

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***Note: As the setup timeout is 3 seconds, please read the frequency on Test Pin (Pin 11) and consult the calibration table before proceeding to avoid hesitation.**

CORRECTION TABLE FOR VK12/VK11 USING Q TEST 6000

N Clicks A or B	∆time(s/month) PPM*2.592	PPM
A-16	-156	-60
A-15	-143	-55
A-14	-130	-50
A-13	-117	-45
A-12	-104	-40
A-11	-91	-35
A-10	-78	-30
A-9	-65	-25
A-8	-52	-20
A-7	-39	-15
A-6	-26	-10
A-5	-13	-5
A-4	-10	-4
A-3	-8	-3
A-2	-5	-2
A-1	-3	-1
0	0	0
B-1	3	1
B-2	5	2
B-3	8	3
B-4	10	4
B-5	13	5
B-6	26	10
B-7	39	15
B-8	52	20
B-9	65	25
B-10	78	30
B-11	91	35
B-12	104	40
B-13	117	45
B-14	130	50
B-15	143	55
B-16	156	60

Table 1

CORRECTION TABLE FOR VK12/VK11 USING FREQUENCY METER ON PIN11

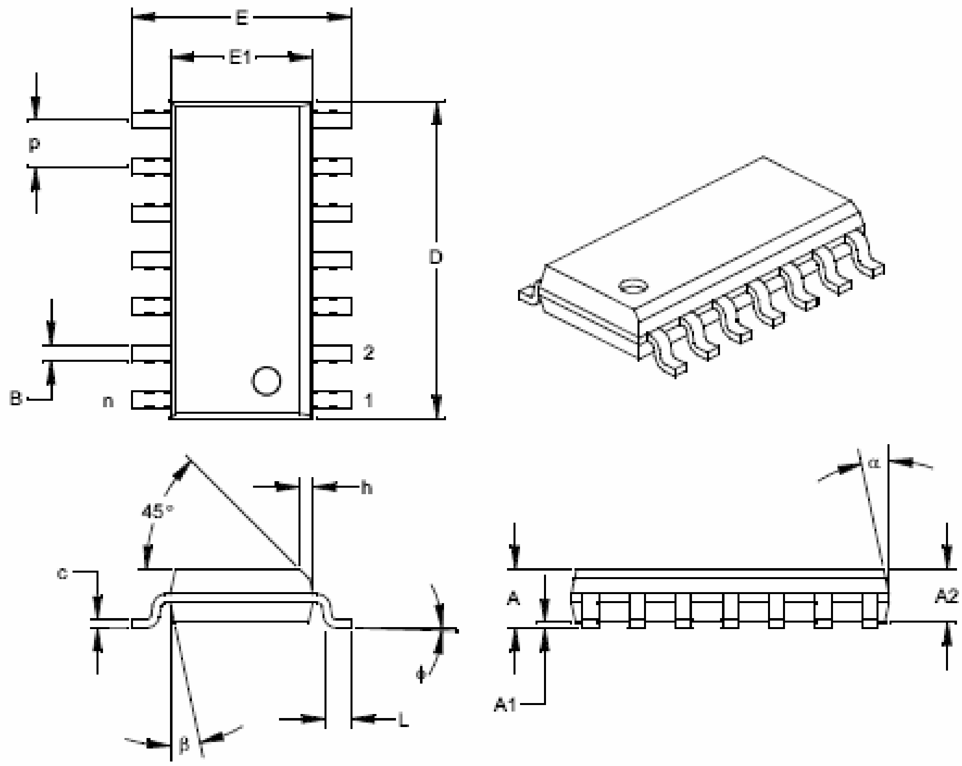
N Clicks	f/4 Internal counter	PIN 11 Hz per second	∆time(s/month) PPM*2.592	PPM
A-16	1,048,516	0.999943	-156	-60.00
A-15	1,048,521	0.999948	-143	-55.00
A-14	1,048,526	0.999952	-130	-50.00
A-13	1,048,531	0.999957	-117	-45.00
A-12	1,048,536	0.999962	-104	-40.00
A-11	1,048,541	0.999967	-91	-35.00
A-10	1,048,546	0.999971	-78	-30.00
A-9	1,048,551	0.999976	-65	-25.00
A-8	1,048,556	0.999981	-52	-20.00
A-7	1,048,561	0.999986	-39	-15.00
A-6	1,048,566	0.999990	-26	-10.00
A-5	1,048,571	0.999995	-13	-5.00
A-4	1,048,572	0.999996	-10	-4.00
A-3	1,048,573	0.999997	-8	-3.00
A-2	1,048,574	0.999998	-5	-2.00
A-1	1,048,575	0.999999	-3	-1.00
0	1,048,576	1.000000	0	0.00
B-1	1,048,577	1.000001	3	1.00
B-2	1,048,578	1.000002	5	2.00
B-3	1,048,579	1.000003	8	3.00
B-4	1,048,580	1.000004	10	4.00
B-5	1,048,581	1.000005	13	5.00
B-6	1,048,586	1.000010	26	10.00
B-7	1,048,591	1.000014	39	15.00
B-8	1,048,596	1.000019	52	20.00
B-9	1,048,601	1.000024	65	25.00
B-10	1,048,606	1.000029	78	30.00
B-11	1,048,611	1.000033	91	35.00
B-12	1,048,616	1.000038	104	40.00
B-13	1,048,621	1.000043	117	45.00
B-14	1,048,626	1.000048	130	50.00
B-15	1,048,631	1.000052	143	55.00
B-16	1,048,636	1.000057	156	60.00

Note: accuracy of frequency is up to 6 decimal places

Table 2

PACKAGE DETAILS

14-Lead Plastic Small Outline (SL) – Narrow, 150 mil (SOIC)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		14			14	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.236	.244	5.79	5.99	6.20
Molded Package Width	E1	.150	.154	.157	3.81	3.90	3.99
Overall Length	D	.337	.342	.347	8.56	8.69	8.81
Chamfer Distance	h	.010	.015	.020	0.25	0.38	0.51
Foot Length	L	.016	.033	.050	0.41	0.84	1.27
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.008	.009	.010	0.20	0.23	0.25
Lead Width	B	.014	.017	.020	0.36	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

Appendix

1. Frequency test method (Pin11)

(1) When using oscillator, can get such a pulse like below(Fig 1). Need to widen pulse width (Fig 2), if wanting to get the frequency of Pin11 on oscilloscope.

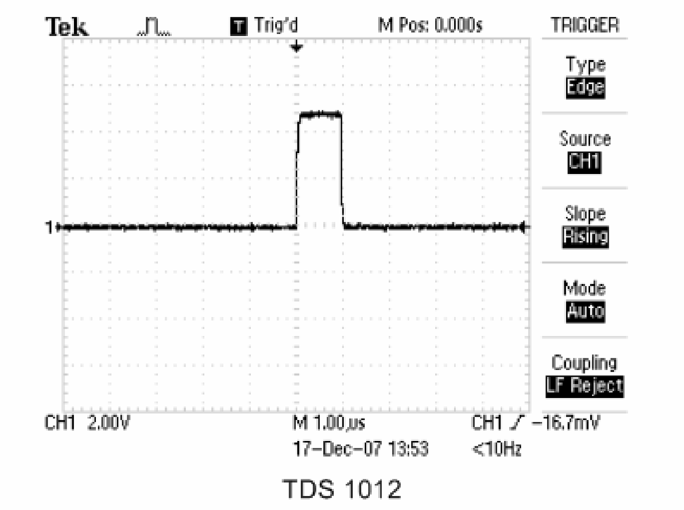


Fig 1.

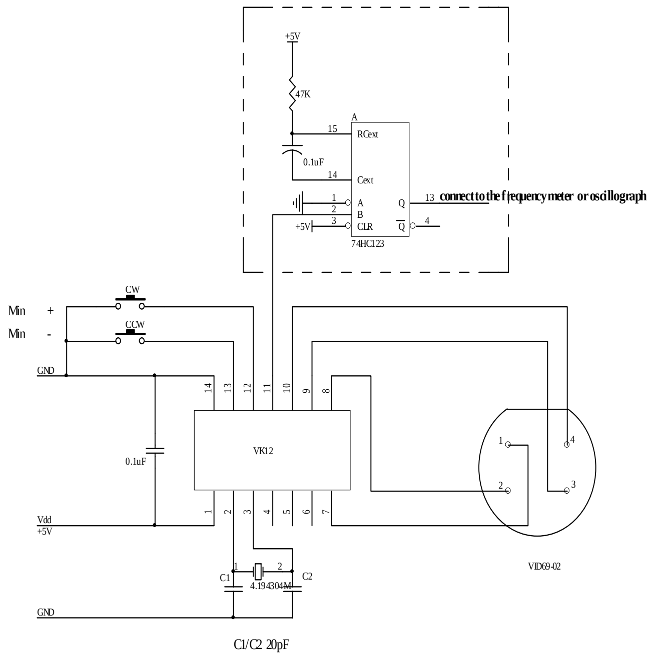


Fig 2.

(2) When using frequency meter, can get frequency of Pin11 directly, and the frequency meter requirement is like below (see Table1).

Frequency ranges	DC ~ 100M Hz, 20mVrms ~ ±5Vac+dc
Display	7 decimal place

Table 1

2. Quartz Crystal guidance

parameters	
Frequency	4.194304M Hz
Frequency tolerance	±20ppm
Load capacitance	15~ 30 pF
Operating temperature	-40°C to +105 °C
Temperature Stability	< 40ppm

Table 2

Since each crystal has its own characteristics, the user should consult the crystal manufacturer for appropriate values of external components.