

永久型数字式电位器 X9313 及其应用

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摘要: 永久型数字式电位器 X9313 系列, 其内部包含有控制电路, 5 位二进制可逆计数器, 32 选 1 译码器, 5 位 E²PROM 以及电阻阵列, 它即可用单片机控制, 也可应用于非单片机控制锁相环中心频率电路中。

关键词: 数字式电位器; 电阻器; 锁相环

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在处理一些要求比较严格的模拟信号电路中, 电阻器的阻值适当显得很重要。人们常用电位器或可调电阻器替代关键部位的电阻器, 以便能够将其调整到最佳状态。由于手动式电位器在调节时不易调准, 并且随着环境条件的变化及使用时间的增长, 其阻值波动较大。一种永久型数字式电位器 X9313 系列, 可以改善以上的不足, 并且可以在运行中通过程序对其进行必要的调整。下面介绍它的功能、特点及应用。

1 功能

X9313 系列包括 X9313Z (最大电阻为 1 kΩ)、X9313W (最大电阻为 10 kΩ)、X9313U (最大电阻为 50 kΩ) 和 X9313T (最大电阻为 100 kΩ) 四种。其内部包含控制电路、5 位二进制可逆计数器、32 选 1 译码器、5 位 E²PROM 及电阻阵列, 功能方框图如图 1 所示。电阻阵列包含有 31 个电阻单元, 在每个单元的两个端点都有可被滑动单元访问的抽头点。对滑动单元抽头点位置的访问由 \overline{CS} 、 U/\overline{D} 和 \overline{NC} 三个输入端所输入的数据经 5 位可逆计数器计数, 32 选 1 译码器译码后控制单接点的电子开关来实现。在滑动端改变抽头位置时以“先接通后断开”的方式进行工作。X9313 的分辨率等于最大电阻值被 31 除。例如 X9313W 的每个抽头间的阻值为 $10\,000\ \Omega/31 = 323\ \Omega$ 。

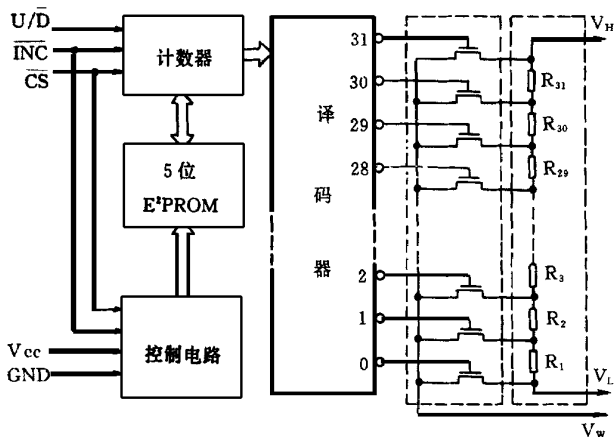


图 1 内部功能框图

5 位二进制可逆计数器当计数达到一个极端时, 不会循环回复, 即当加计数时, 不会由 11111 跳到 00000; 减计数时不会由 00000 跳到 11111。

控制电路负责控制 5 位 E²PROM 对计数器数据 (滑动端的位置) 的贮存和掉电后再次上电时的调用。E²PROM 所存数据可保存 100 年。

1.1 管脚功能

X9313 具有 8 引脚的 DIP、SO IC、TSSOP 三种封装形式, 如图 2 所示。

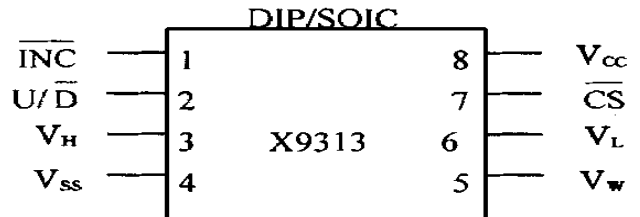


图 2 X9313 的管脚排列图

\overline{NC} ——加/减计数脉冲输入端, 下降沿触发。

U/\overline{D} ——加/减计数控制端, U/\overline{D} 脚输入高电平时为加计数, 输入低电平时为减计数。

V_H 、 V_L ——高电压端及低电压端, 高、低电压端等效于一个机械电位器的两个固定端。

V_W ——滑动端, 相当于机械电位器的可移动端, 滑动端的串联电阻 (电子开关的导通电阻) 典型值为 $40\ \Omega$ 。

\overline{CS} ——片选输入端, 当 \overline{CS} 端输入低电平时器件被选中。当 \overline{NC} 端为高电平时, \overline{CS} 端的上升沿可使当前计数器的值被贮存在非易失性存储器中。当 \overline{NC} 端为低电平时, \overline{CS} 端的上升沿不能贮存数据, 而是返回等待。

V_{CC} 、 V_{SS} ——电源输入端。

1.2 时序图

时序图如图 3 所示, 图中所列参数参见表 1。

1.3 工作参数

(1) 工作温度范围: $-65 \sim +135$;

(2) 温度系数 (在 $-40 \sim +85$)

X9313Z $+ 600 \times 10^{-6} \text{ } ^{-1}$

X9313W、X9313U、X9313T $+ 300 \times 10^{-6} \text{ } ^{-1}$

(3) 电源电压 $V_{CC} = 3 \sim 5.5 \text{ V}$ ，工作电流最大为 3 mA 。输入电阻两端相对于滑动输出端 V_w 的电压 V_H 及 V_L 均可为 $-5 \sim +5 \text{ V}$ ，25 时的额定功率: X9313Z 为 16 mW ; X9313W、X9313U、X9313T 为 10 mW 。流过滑动端的最大电流为 $\pm 1 \text{ mA}$ 。

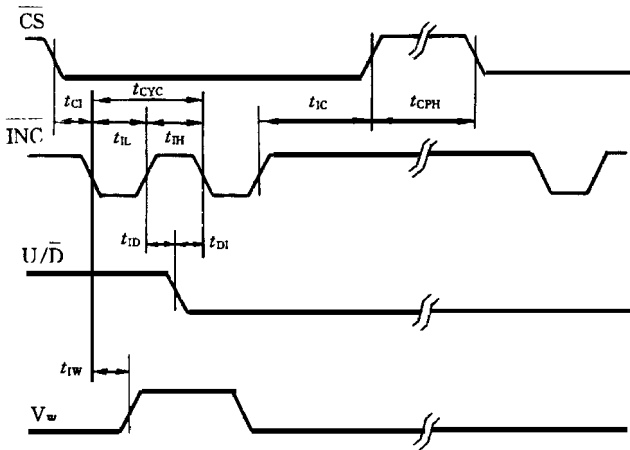


图3 时序图

表1 时序图参数

符号	参数	极限值			单位
		最小值	正常值	最大值	
t_{CT}	CS至 NC两个降沿间隔	100	—	—	ns
t_D	NC上升沿至U/D电平转变	100	—	—	ns
t_{DI}	U/D电平转变至NC下降沿	2.9	—	—	μs
t_L	NC低电平保持时间	1	—	—	μs
t_H	NC高电平保持时间	1	—	—	μs
t_{TC}	贮存时NC上升沿至CS上升沿	1	—	—	μs
t_{CPH}	CS高电平保持时间	20	—	—	ms
t_w	NC下降沿至Vw的输出变化	—	100	500	μs
t_{CYC}	NC电平变化的周期	4	—	—	μs
t_R 、 t_F	NC电平转换时间	—	—	500	μs

2 应用举例

X9313的应用前途十分广泛,既可以应用于具有单片机控制的电路,也可以用于非单片机控制的电路。图4为一控制锁相环中心频率的电路。在环境温度及其他条件变化时,锁相环LM567的中心频率将会发生变化,单片机89C51通过INT0中断检测并计算锁相环LM567的中心频率,与所需要的锁相频率比较,如果其差值超过或接近超过所允许的偏差时,可通过89C51的P1.0~P1.2口线调整X9313的输出电阻,来调整LM567的中心频率。调整过程的程序框图如图5所示。

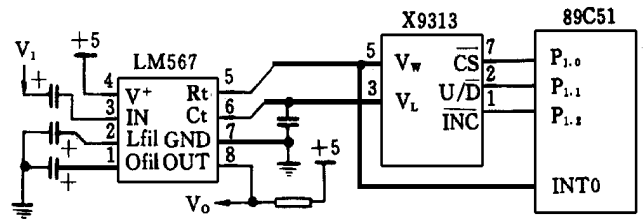


图4 控制锁相环中心频率电路

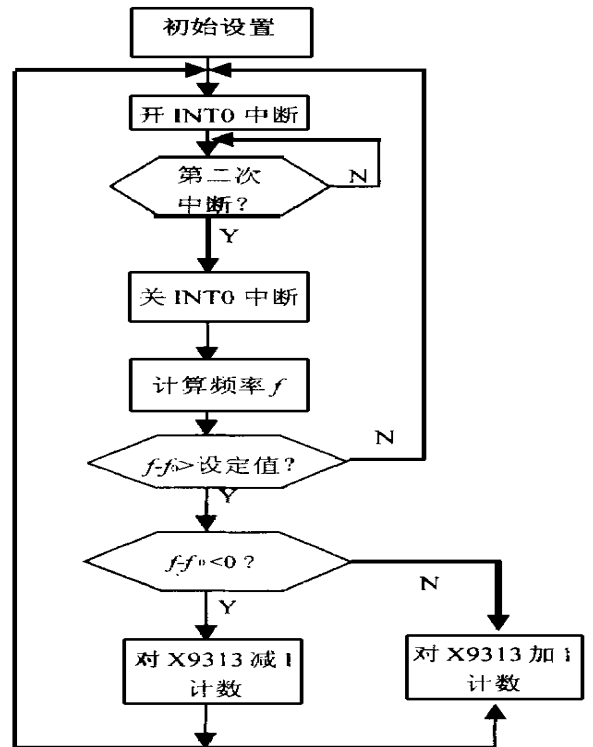


图5 程序流程图

3 结论

X9313能够实现同单片机的接口,可根据需要随时对其阻值进行调整,对可靠性和稳定性要求比较高的电路,可通过X9313来满足要求。

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Key words A N; thin film; matallization

High speed aging technology for electrolytic capacitors ZHANG Feixian, WANG Jin (Shenzhen Wanjie Capacitors Co., Ltd, Shenzhen Guangdong 518004), ZHU Xu-fei, LI L in (Nanjing University of Science and Technology, Nanjing Jiangsu 210094)

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 24-26 (Oct 1999). In Chinese

Some of the disadvantages of the traditional aging technology are analyzed Aging may resume capacitors' inherent electric properties The effect of aging time and temperature on the electric properties is discussed and a new high-speed aging technology is presented, which reduces the aging time to three hours Electrolyte of high quality is the precondition of high-speed aging (5 refs)

Key words electrolytic capacitors; aging technology; electrolyte; leakage current; reliability; load life

China made formed foils for low voltage application CHEN Ming-tao (Xiamen Overseas Chinese Electronics Co., Ltd., Xiamen Fujian 361006)

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 27-28 (Oct 1999). In Chinese

At present, most foils come from abroad, especially those for low voltage application. By adjusting production technology, some low voltage electrolytic capacitors were successfully developed with China made foils. The experiences of trial production and batch production show that China made foils of 13 mm or more, 25 V and 35 V are reliable (no refs)

Key words low voltage; formed foils; riveting quality; aging technology

X9313 nonvolatile digital potentiometer and its application CHENG Yong, WANG Yu-mei (Weifang Institute, Weifang Shandong 261041).

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 29-30 (Oct 1999). In Chinese

X9313 consists of a control circuit, a 5-digital binary reversible counter,

a decoder, a 5-digital EPROM and a resistor array. It can be used in chip microcomputers, or in the center frequency circuit of phase-lock loop in the non-chip microcomputers (2 refs)

Key words digital potentiometers; resistors; phase-lock loop

Technology for directly bonding copper on A N HUANG An-bing, CUI Song ZHANG Hao (The 43rd Institute, China Ministry of Information Industry, Hefei Anhui 230031).

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 31, 33 (Oct 1999). In Chinese

Directly bonding copper (DBC) on A N substrate is a new technology based on the technology for directly bonding copper on Al_2O_3 substrates. When A N substrates surface is pre-oxidized, in the nitrogen atmosphere, at 1063~1070 °C, copper foil may naturally fomed on the A N substrates. The peel strength is up to 853.2 Pa, thickness 0.1~0.5 mm and the maximum substrates area 50 mm × 50 mm. (3 refs)

Key words A N; A N-DBC; transition layer; surface finish

X-band five-bit phase shifter and low power switch HM IC XIE Yu (Nanjing Research Institute of Electronic Technology, Nanjing Jiangsu 210013)

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 32-33 (Oct 1999). In Chinese

The X-band five-digit phase shifter and low power switch HM IC are made through the manufacture technology of hybrid microwave package. The design and technology are presented. The effect of the manufacture technology on the performance of the shifter is analyzed (1 ref)

Key words phase shifters; low power switch; manufacture technology

New batteries in China GAO Zong-ming (Chengdu Huaxi Institute of Electromechanical Appliances, Chengdu Sichuan 610041).

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 35-36 (Oct 1999). In Chinese

Quantitatively, China produces most batteries in the world but among them 90% are of low grade. However, in the recent ten years, China made new batteries come to the market. Among them, there are alkaline zinc-manganese batteries, lithium batteries, small rechargeable cadmium-nickel batteries, hydrogen-nickel batteries and lithium ion batteries. Some new batteries made in Chinese are represented (no refs)

Key words alkaline zinc-manganese batteries; lithium batteries; cadmium-nickel batteries; hydrogen-nickel batteries; lithium ion batteries

The effect of electric contacts in communication system on the signal transmission SUN Bai-sheng, ZHANG Ji-gao, CHEN GLU-bang, LI NG Xue-yan (Electric Contact Research Lab., Beijing University of Post & Telecommunication, Beijing 100876)

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 37-38 (Oct 1999). In Chinese

Poor contacts impair signal transmission. A physical model of electric contacts is established based on the electric contact theory and the transmission characters of the signal at high frequency. When contact resistance is two times higher than the transmission line characteristic impedance, the amplitude of received signal at the terminal may reduce by more than half ($A < 1/4$). Therefore, the error codes occur. It is necessary to reduce contact impedance (3 refs)

Key words electric contact; error code rate; connectors; contact impedance; digital signal

Thick film piezoresistive materials and strain sensors MA Yi-wu, SONG Jian CHANG Hui-m in (State Key Laboratories of transducer Technology, Hefei Institute of Intelligent Machines, Chinese Academy of Sciences, Hefei Anhui 230031)

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 39-41 (Oct 1999). In Chinese

The development, existing state and the trend of thick-film materials and sensors based on piezoresistive effect are introduced. The structure, characteristics and the methods for improving the performances related the sensors are discussed (13 refs)

Key words Thick film technology; piezoresistive effect; strain sensors

Super-capacitors of conductive polymer electrodes ZHANG Guangmin, (Southwestern University of Finance and Economics, Chengdu Sichuan 226361), YAN Kan-ping (Sichuan University, Chengdu Sichuan 610065), YAN Ji-xing (Nantong Haixing Electronics CO., Ltd., Tongzhou Jiangsu 226361).

ELECTRONIC COMPONENTS & MATERIALS (China), Vol 18, No. 5, P. 42-44 (Oct 1999). In Chinese

There are two kinds of super-capacitors of conductive polymer electrodes. One has the electrodes made directly from conductive polymer; the other has the electrodes made from hard carbon acquired by thermal decomposition of conductive polymer. The capacitors are based on the principle of faradic pseudo-capacitance. Anions go through the positive electrodes and basic ions through the negative electrodes. The capacitance of the capacitors is 2~3 times as high as that of doublelayer capacitors (11 refs)

Key words super-capacitors; electrochemical capacitance; conductive polymer