IS31CS8967A EVB user guide

Rev.C

2019-07-09

DESCRIPTION

IS31CS8967A is a general-purpose microcontroller with extensive peripherals suitable for a wide range of applications. The CPU is based on an enhanced 1-cycle 8051 core equivalent to ten times the speed of a conventional 12-T 8051. The total on-chip memory include 6KB SRAM and a total of 128KB embedded flash memory that can be used as program memory and portion of this can be used as data flash. The 8051 core has built-in T0/T1/T2 timers, 24-bit T3 timer, and a 30-bit watchdog timer. Embedded in the CPU core are also two full-duplex UART ports, one I2C master/slave and one I2C pure slave controllers, up to 42 GPIO pins.

The flexibility in clock setting includes an on-chip precision oscillator with the accuracy deviation of +/-2%, or a slow power internal 100KHz oscillator, and a external 4MHz to 24MHz crystal oscillator, or an ultra-low power precision real time clock (RTC). Unused clock sources can be disabled or used as GPIO pins for system optimization. The clock selections are combined with flexible power management schemes, including PMM, IDLE, and STOP, SLEEP modes to balance CPU speed and power consumption.

Other on-chip peripherals include one SPI control interface, one I2C master/slave and one I2C pure slave controllers, as well as a Programmable Counter Array (PCA) with 6 channels of Capture/Compare/PWM modules.

Analog peripherals include a high performance 12-Bit Analog to Digital Converter (ADC) with 6.4us conversion time, 4 analog comparators with programmable threshold levels, and a 10-bit Voltage Output Digital to Analog Converter (VDAC).

A built-in programmable CEC (Consumer Electronics Control) Controller allows users to control all of the various audiovisual products in a user's environment easily.

IS31CS8967A also provides a flexible means of flash programming that supports ISP and IAP. The protections of loss of Flash contents are implemented in hardware. There is also access restriction on critical registers and low supply voltage detection that allows IS31CS8967A reliable operations under harsh environment. The code security is extremely secure based on sophisticated writer commands and ISP commands. The on-chip break point processor also allows easy debug environments that can be integrated with ISP.

Intended application fields of IS31CS8967A include LCD/PDP TV, LCD Monitor, automotive AV system, home appliance, and other embedded applications.

FEATURES

CPU and Memory

- 1-Cycle 8051 CPU core up to 24MHz operation frequency (One Wait State); 16MHz (Zero Wait State)
- 16-bit Timers T0/T1/T2 and 24-bit Timer T3
- Programmable 30-bit Watch Dog Timer
- Integrated break point controller for software debugger
- Software debugging port through I2C slave
- One full-duplex UART0 port
- Up to 10 external interrupts shared with GPIO pins
- Power saving mode – PMM, IDLE, STOP, and SLEEP modes
- 256B Internal SRAM and 5888B XSRAM
- 128KB Flash Memory and 256B Information Block
  - Configured to be shared by ISP code, program code, and data flash
  - Code security and content loss protection
  - Endurance: 100K cycles

Clock Sources

- Internal oscillator at 16MHz of +/- 2% accuracy
- Internal low power OSC of 100KHz
- Crystal oscillator 4MHz – 24MHz
- RTC - 32KHz of low power consumption

Digital Peripherals

- 16-bit PCA and 6 channel CCP modules
  - Capture/Compare/Timer Mode
  - 8-Bit and 16-bit PWM Mode
  - 8-Bit Windowed PWM Mode
- One 16-bit PWM output with programmable base frequency and duty cycles
- Two I2C Slave Controllers
- One Master/Slave SPI Controller
- One full-duplex LIN-capable EUART
- CEC Controller

Analog Peripherals

- 12-bit monotonic SAR ADC
  - 6.4us conversion time
  - 4 intrinsic time-multiplexed channels and dedicated result registers. 2 of which have sample and hold.

  - 10 inputs multiplexed with GPIO
  - On-chip temperature sensor
- 4 analog comparators
  - Two 8-bit programmable threshold or external threshold
- 10-bit Voltage Output DAC
  - 2mA full scale
  - Configurable Sink/Source
- Power on reset
- Low voltage detection on supply voltage

Miscellaneous

- Up to 42 GPIO pins
- 2.5V to 5.5V single supply with on-chip regulator or 1.8V direct single supply
- Low power standby (< 20uA) in SLEEP mode
- Operating temperature -40°C – 85°C
- LQFP-48 package and RoHS compliant

QUICK START

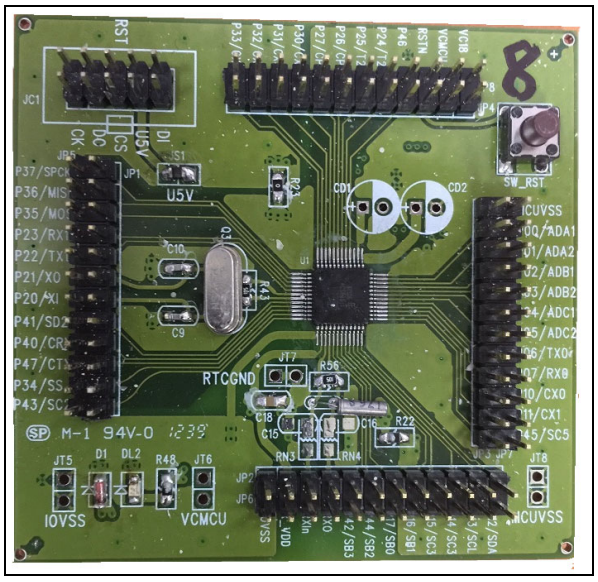

Figure 1: Photo of IS31CS8967A Evaluation Board

RECOMMENDED EQUIPMENT

- 5V power supply
- ≤ 5.5V power supply

PROCEDURE

The IS31CS8967A evaluation board is fully assembled and tested. Follow the steps listed below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

1) Connect the power supply. Pay attention to the supply current.

eZISP BURNING BOARD OPERATION

The IS31CS8967A offers flexible flash programming that can be programmed via the Write Mode or Fast Write Mode of the eZISP Burning Board. The Write Mode and Fast Writer Mode of the eZISP Burning Board requires 7 pins of hardware (RST, CK, CS, MO, MI, GND, VDD, etc.).

Figure 2: Photo of eZISP Burning Board

ABSOLUTE MAXIMUM RATINGS

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31CS8967AG-LQLS2-EB	-40°C ~ +85°C (Industrial)	LQFP-48, Lead-free

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contacts ISSI's analog marketing team at analog@issi.com or (408) 969-6600.

SOFTWARE CONTROL

Before using the eZISP Burning Board, you need to install the USB driver and related files (for example: Microsoft Framework and C++ Library) on your PC. The eZISP software supports the XP / Win7 / Win8 / Win10 operating system.

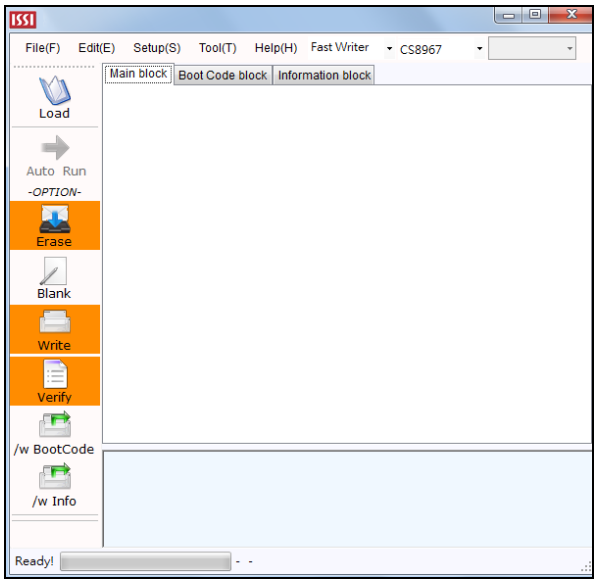

Figure 3: Photo of eZISP software operation interface

eZISP programming operation process is as follows:

1) Connect USB cable between the write connector of the eZISP Burning Board and the USB port of your PC.
2) Use a 10-pin 2x5 Socket-Socket 2.54mm IDC cable from the writer connector on the eZISP Burning Board to the writer connector on the IS31CS8967A Evaluation Board.
3) Execute eZISP software (file name: eZISP-Plus V3.X.X.exe).
4) Select the MCU chip type and programming mode (for example: Writer Mode or Fast Writer Mode).
5) Click the "Load" button and select the programming code (*.hex) to load.
6) Click the “Auto Run” button, the eZISP software will immediately perform “Erase”, “Write” and “Verify”, and the indication information will be displayed at the bottom of the window. The indication message includes the programming result and the running time.
7) After successful programming, the IS31CS8967A chip will start running the program.

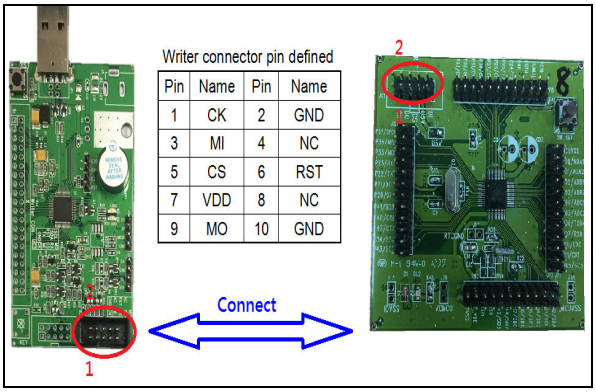

Figure 4: Photo of eZISP Burning Board and IS31CS8967A Evaluation Board connection

The IS31CS8967A Evaluation Board requires a 5V supply voltage.

The steps listed below are examples of GPIO control using the IS31CS8967A.

1) Use the test code in Appendix I and compile the test code in the Keil C51 development environment (IDE, Keil µVision).
2) Create a Hex file of the test code in Keil C51 and load the hex file of the test code in the eZISP software to update the firmware to the IS31CS8967A flash.
3) After the firmware update is complete, the IS31CS8967A chip will automatically reset and execute the program.
4) In this example, you can measure if the P02 pin on the IS31CS8967A Evaluation Board has been toggled.

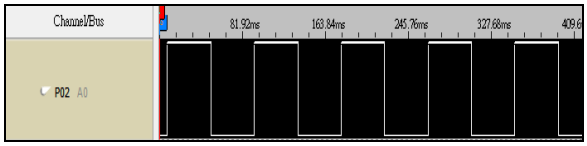

Figure 5: Photo of P02 pin toggling on the IS31CS8967A Evaluation Board

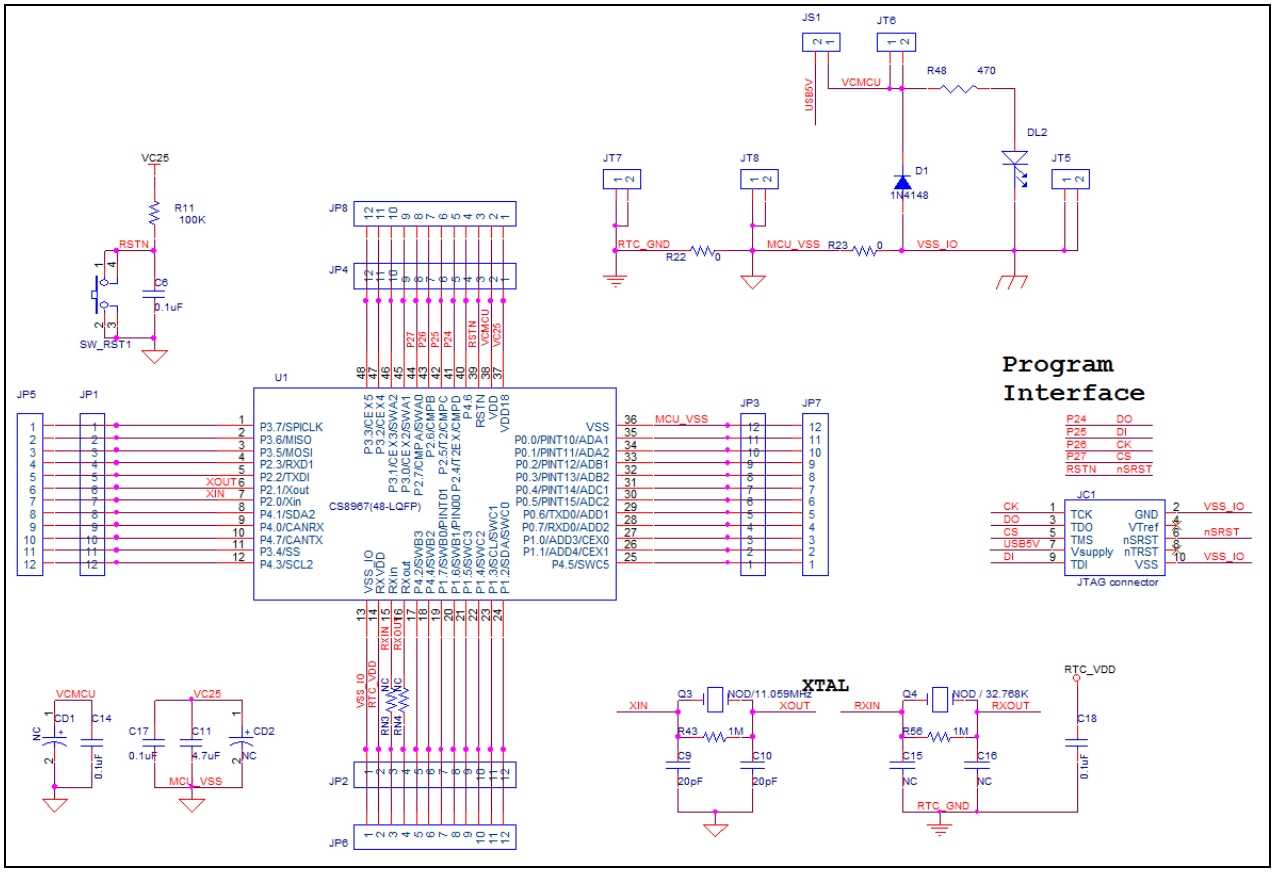

Figure 6: IS31CS8967A Evaluation Board Application Schematic

BILL OF MATERIALS

Name	Symbol	Description	Qty	Supplier	Part No.
MCU	U1	Microcontroller	1	ISSI	IS31CS8967AG-LQLS2
Button	SW_RST1	Push Button	1		
Crystal	Q3	11.059MHz Crystal	1		
Crystal	Q4	32.768KHz Crystal	1		
Diode	D1	1N4148,SMD	1		
LED	DL2	LED, SMD	1		
Capacitor	C11	CAP,4.7uF,16V,±20%,SMD	1		
Capacitor	C9,C10	CAP,20pF,16V,±20%,SMD	2		
Capacitor	C6,C14,C17, C18	CAP,0.1μF,16V,±20%,SMD	4		
Resistor	R22,R23	RES,0R,1/10W,±5%,SMD	2		
Resistor	R48	RES,470R,1/10W,±5%,SMD	1		
Resistor	R11	RES,100K,1/10W,±5%,SMD	1		
Resistor	R43,R56	RES,1M,1/10W,±5%,SMD	2		

Bill of Materials, refer to Figure 6 above.

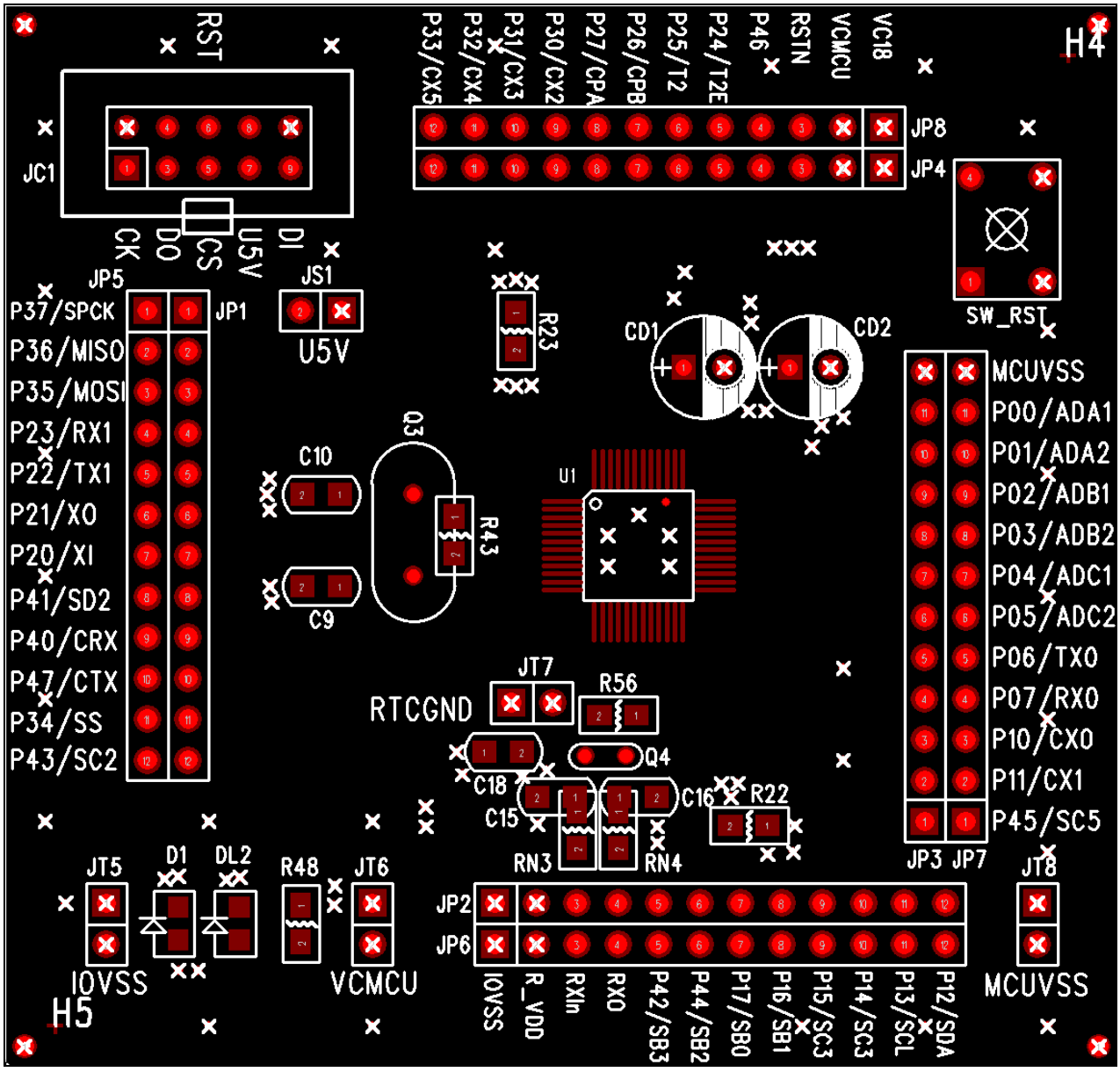

Figure 7: IS31CS8967A Evaluation Board Component Placement Guide - Top Layer

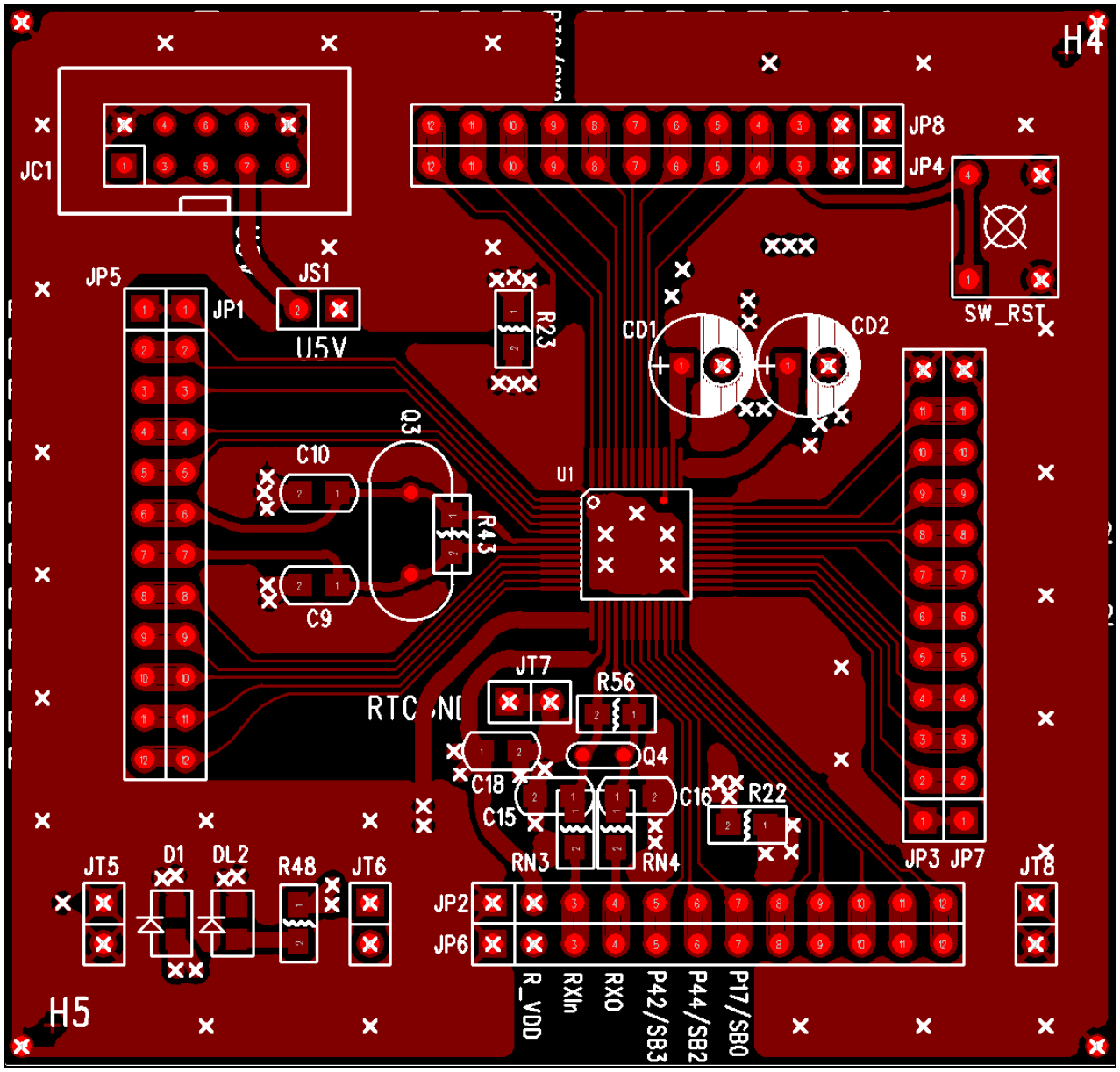

Figure 8: IS31CS8967A Evaluation Board PCB Layout - Top Layer

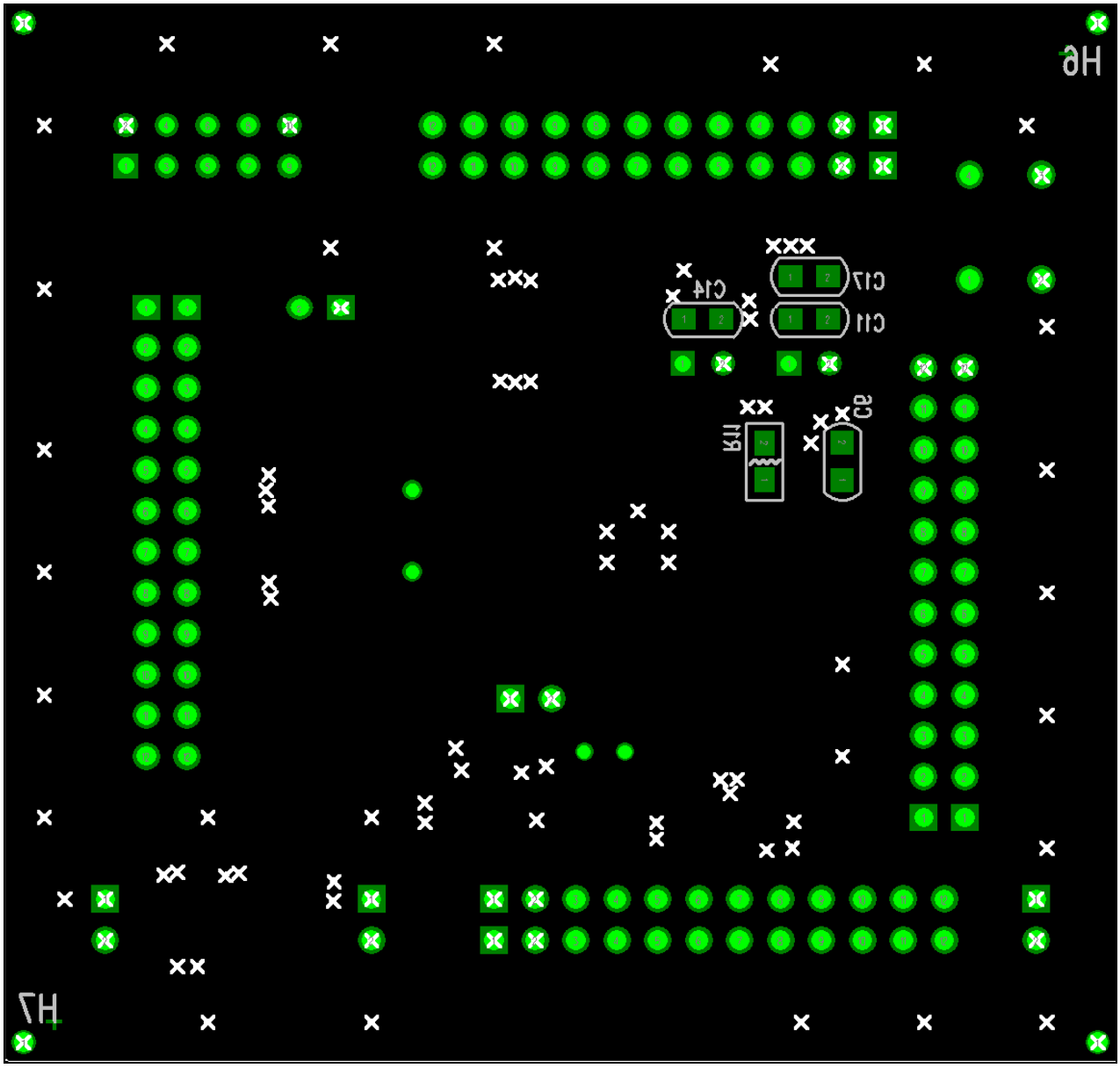

Figure 9: IS31CS8967A Evaluation Board Component Placement Guide - Bottom Layer

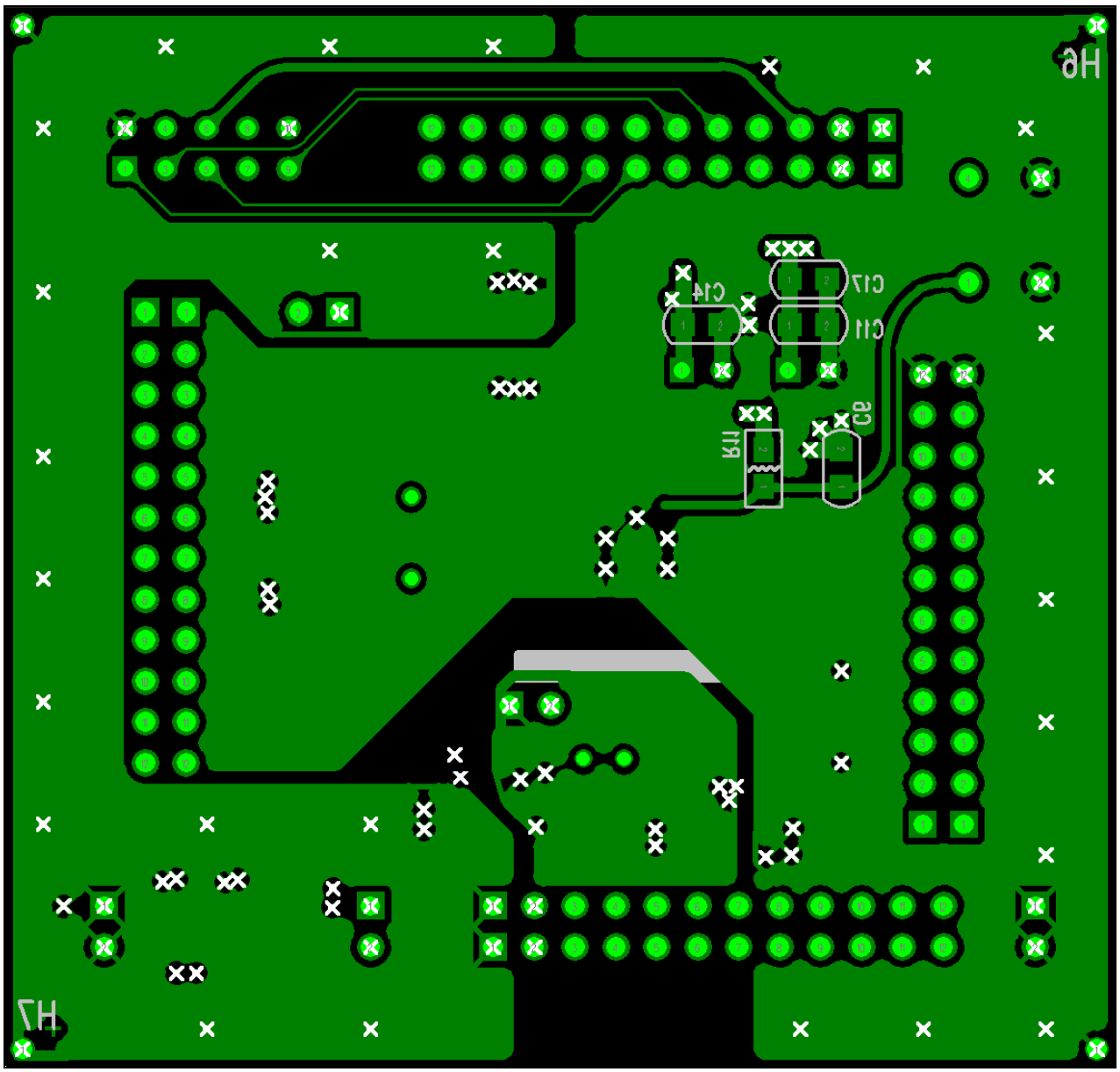

Figure 10: IS31CS8967A Evaluation Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Data
A	Initial release	2018.08.29
B	Modify the ordering information.	2019.07.09

APPENDIX Ⅰ: IS31CS8967A Test Code - IOSC test

```
/*
IOSC function for IS31CS8967a
Version 1.0
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*/

#include "CS8967Asfr.h"
#include "CS8967Axram.h"
#include "HexToBIn.h"
#include "Global.h"

void main (void)

{
        Initial_REGTRM(IFB_Read_1Byte(0x20));                          //Initial IOSC:
        Initial_IOSC(IFB_Read_1Byte(0x21), IFB_Read_1Byte(0x22));      //Default IOSC: 16MHz
        TA=0xAA;
        TA=0x55;
        WDCON = 0x01;                                                  // reset watchdog timer
        TA=0x00;
//      Initial_UART0(19200,iSYSCLK);                                  //Initial UART0
        Test_IO_initial();                                             //Initial test IO

        EA = 1;

        while(1)
        {
//              printS(0x56);
                P0_2 = ~P0_2;
                Delay10ms(1);
        }
}

void Delay10ms(unsigned char delay)
{
        unsigned char i, j, k;

        for(i=0; i<delay; i++)
                for(j=0; j<100; j++)
                        for(k=0; k<120; k++);
}

void printS(unsigned char p)
{
        ES0 = 0;
        SBUF0 = p;
        while (!TI0);
        TI0 = 0;
        ES0 = 1;
}

void Initial_REGTRM(unsigned char regtrm)                              //Initial REGTRM
{
        TB = 0xAA;
        TB = 0x55;
        REGTRM = regtrm;
   TB = 0x00;
}

void Initial_IOSC(unsigned char ITRM, unsigned char VTRM)              //Initial IOSC
{
   TB = 0xAA;
   TB = 0x55;
   IOSCITRM = IOSCITRM;          //ITRM;
   TB = 0x00;

   Delay10ms(1);
```

```
    TB = 0xAA;
    TB = 0x55;
    IOSCVTRM = IOSCVTRM;          //VTRM;
    TB = 0x00;
}

unsigned char IFB_Read_1Byte(unsigned char ADD)                    //IFB Read byte
{
    unsigned char IFB_DAT;

    TB = 0xAA;
    TB = 0x55;
    FLSHADH = 0x00;
    FLSHADL = ADD;
    FLSHCMD = IFB_ByteRead;                                        //IFB read enable
    TB = 0x00;

    TB = 0xAA;
    TB = 0x55;
    IFB_DAT = FLSHDAT;
    TB = 0x00;

    return IFB_DAT;
}

void Initial_UART0(unsigned long BR, unsigned long XTAL)           //Initial UART0 : XOSC,19200BAUD
{
        IOCFGP0_6 = b00000110;                                     //CMOS output(TXD0)
        IOCFGP0_7 = b10100000;                                     //input with pull-up(RXD0)
        MFCFGP0_6 = b00000010;                                     //UART0 TXD0    ENABLE
        MFCFGP0_7 = b00000010;                                     //UART0 RXD0    ENABLE

        CKCON |= 0x10;                                             //timer1 divided by 4
        SCON0 = 0x50;                                              //uart0 mode1
        TMOD = 0x20;                                               //time1 mode2(8bit auto reload mode)
        PCON = PCON|0x80;                                          //smod0 = 1

        TL1 = TH1 = 256-(XTAL/64/BR);                              //CKCON |= 0x10
        TR1 = 1;
}

void Test_IO_initial()
{
        IOCFGP0_2 = AllSeting;
        MFCFGP0_2 = _GPIOEN_;

        P0_2 = 0x00;
}
```