



# AKD4160-A

## Evaluation board Rev.0 for AK4160

### GENERAL DESCRIPTION

The AKD4160-A is an evaluation board for the AK4160, which is 16-channel capacitive touch sensor with a low operating voltage and a low operating power. Since the AKD4160-A has a I2C serial I/F, it is possible to control the AK4160 by writing and reading registers, and operate kinds of touch pad with a capacitor sensor connector on the AKD4160-A,

### ■ Ordering guide

AKD4160-A --- Evaluation board for AK4160  
(Cable for connecting with an USB port and control software is packed with this.)

### FUNCTION

- I<sup>2</sup>C serial I/F
- Cap Sensor Connector
- Touch Pad Operations

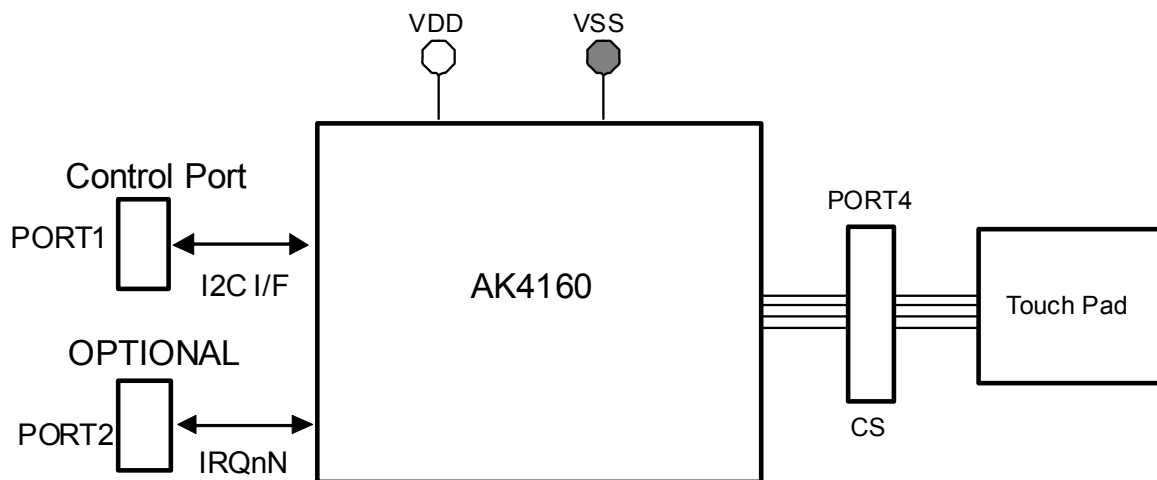


Figure 1. AKD4160 Block Diagram

\* Circuit diagram and PCB layout are attached at the end of this manual.

<b>BOARD OUTLINE CHART</b>
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■ Outline Chart

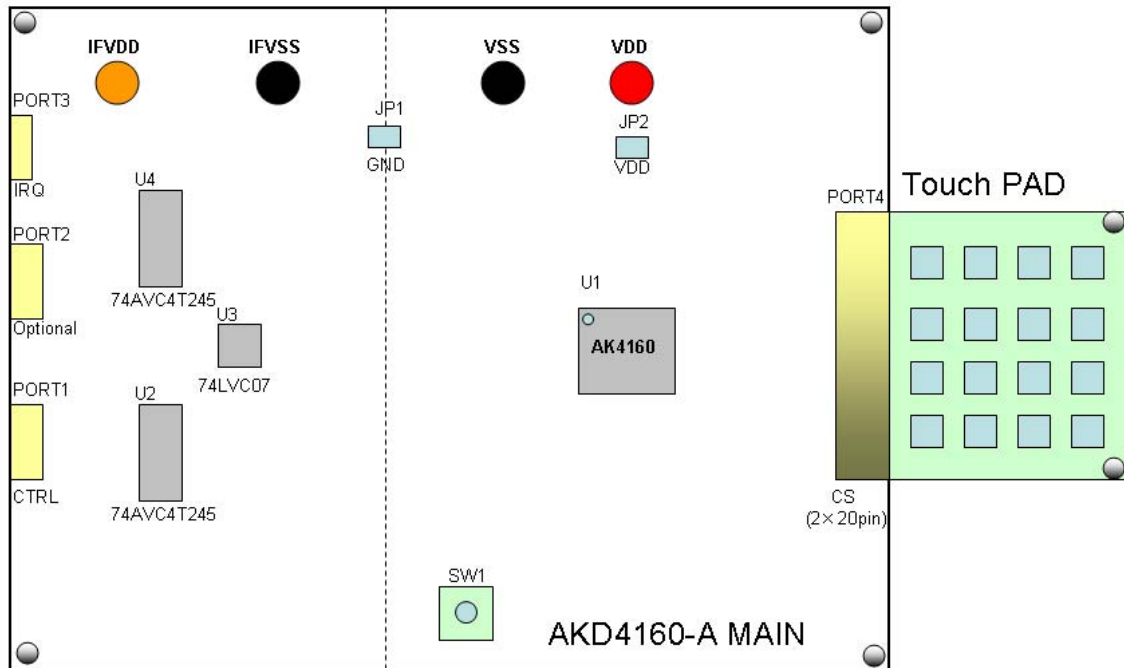


Figure 2. AKD4160-A Outline Chart

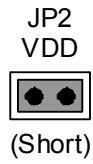
■ Comment

- (1) VDD, VSS, IFVDD, IFVSS  
Connect power supply with these pins.
- (2) SW1  
The tactile switch for AK4160's reset.
- (3) PORT1  
Control port. Connect the bundled cable into this port.
- (4) PORT2  
This Port is for I/O of IRQ interrupt and input of reset pin.
- (5) PORT3  
This Port is for testing GPIO functions of IRQ pins.
- (6) PORT4  
This is a connector for the touch pad connection. Connect the touch pad "16 PAD" or "8PAD+8LED" into this port.

## ■ Operation sequence

(1) Power supply lines. <Default>

Jumper pin setting.



The power supply lines' connection.

Name	Color	Voltage	Comments
VDD	Red	1.71~3.6V(typ=1.8V)	Power supply for VDD of AK4160.
IFVDD	Orange	typ=3.3V	Power supply for digital logic circuits.
VSS	Black	0V	AK4160's GND.
IFVSS	Black	0V	Digital logic circuits' GND.

Table 1. Set up of power supply lines

\* Each supply line should be distributed from the power supply unit.

(2) Set up the evaluation mode and jumper pins. (See the followings.)

## ■ Evaluation mode

**When evaluating the functions of the AK4160, it is necessary to connect a touch pad board with the PORT4. Regarding pin assignment of PORT4, refer to Figure 4 or circuit diagrams in this manual. As for the AK4160's register definitions, refer to the datasheet of the AK4160.**

### (1) 16-channel Touch Switch <Default>

Capacitive touch sensors up to 16 channels are available for touch switch.

Connect the touch pad board "16PAD" with the PORT4.

Set up the registers of AK4160 with the "akd4160-a.exe" by loading the register file "ak4160\_16ch Touch Switch. akr" which is included in the CD. (Refer to Page 8)

### (2) 8-channel Touch Switch and 8-channel LED Display

Maximum 8 channels out of the 16-channel capacitive touch sensors can be configured to LED drives. GPIOn (n=0 ~ 7) outputs the status of terminal CSn. (Table 2)

Connect the touch pad board "8PAD+8LED" with the PORT4.

Set up the registers of AK4160 with the "akd4160-a.exe" by loading the register file "ak4160\_8ch Touch Switch & 8ch LED Display. akr" which is included in the CD. (Refer to Page 8)

No.	CSn Status	GPIOn Output
1	CS0	GPIO0
2	CS1	GPIO1
3	CS2	GPIO2
4	CS3	GPIO3
5	CS4	GPIO4
6	CS5	GPIO5
7	CS6	GPIO6
8	CS7	GPIO7

Table 2. The correspondence of GPIOn outputs and CSn status

## ■ Other Jumper Pins set up

### Main Board

- [JP1] (GND): Analog ground and Digital ground  
 OPEN: Separated.  
 SHORT: Common. <Default>
- [JP4] (I/O): Selection of U4 (74AVC4T245)'s operation  
 A-B: A data to B bus when IRQ / GPIO is used as input. <Default>  
 B-A: B data to A bus when IRQ / GPIO is used as output.
- [JP5] (AD0): Device address bit 0's setting on I2C-bus Mode  
 OPEN: AD0 bit is fixed to "H".  
 SHORT: AD0 bit is fixed to "L". <Default>
- [JP6] (AD1): Device address bit 1's setting on I2C-bus Mode  
 OPEN: AD1 bit is fixed to "H".  
 SHORT: AD1 bit is fixed to "L". <Default>
- [JP7] (IRQ0N): Interrupt I/O pin 0's setting  
 H: IRQ0N pin is pulled up.  
 L: IRQ0N pin is pulled down. <Default>
- [JP8] (IRQ1N): Interrupt I/O pin 1's setting  
 H: IRQ1N pin is pulled up.  
 L: IRQ1N pin is pulled down. <Default>
- [JP9] (IRQ2N): Interrupt I/O pin 2's setting  
 H: IRQ2N pin is pulled up.  
 L: IRQ2N pin is pulled down. <Default>
- [JP10] (3.3V): Power supply short  
 OPEN: When the voltage of IFVDD and VDD is different. <Default>  
 SHORT: When the voltage of IFVDD and VDD is the same.

## ■ The function of the Switch

- [SW1] (RSTN): A push button switch for reset control of the AK4160.  
 Keep pushing SW1 if continuous reset is needed.

■ Serial Control

The AKD4160 can be connected with an USB port.

Connect PORT1 (Control Port) with a PC by the USB box packed with the AKD4160.

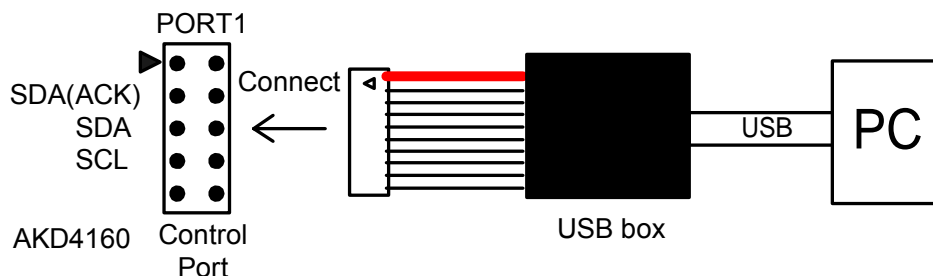


Figure 3. Connect of the USB box

■ Pin Assignment of Cap Sensor Connector

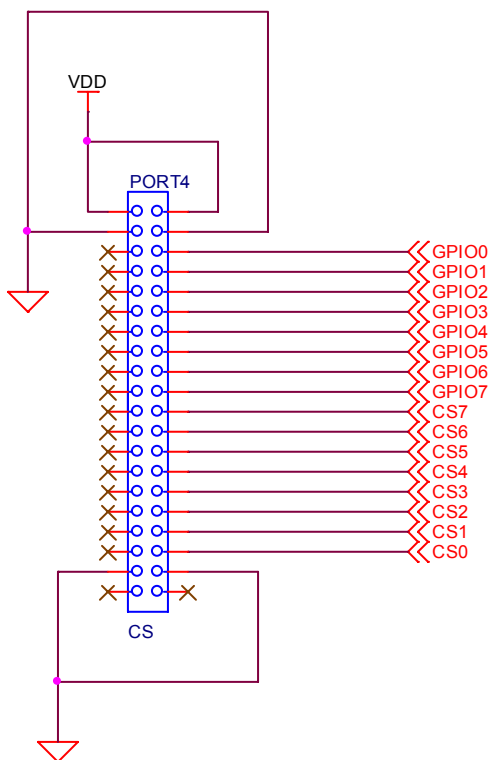


Figure 4. Cap Sensor Connector Pin Assign

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**CONTROL SOFTWARE MANUAL**

**■ Evaluation Board and Control Soft Settings**

1. Set an evaluation board properly.
2. Connect PORT1 (Control Port) with a PC by the USB box packed with the AKD4160. (Please install the driver in the CD-ROM when using this control software is used on Windows 2000/XP/Vista. Please refer “Installation Manual of Control Software Driver by AKM device control software”. In case of running on Windows95/98/ME, the driver install is not needed. In case of Windows Vista/7, open the property of the control soft, and set the compatibility to “Windows XP”. This control software does not operate on Windows NT.)
3. Continue to evaluation by following steps.

**■ Operation Screen**

1. Start up the control program, and the operation screen is shown below.

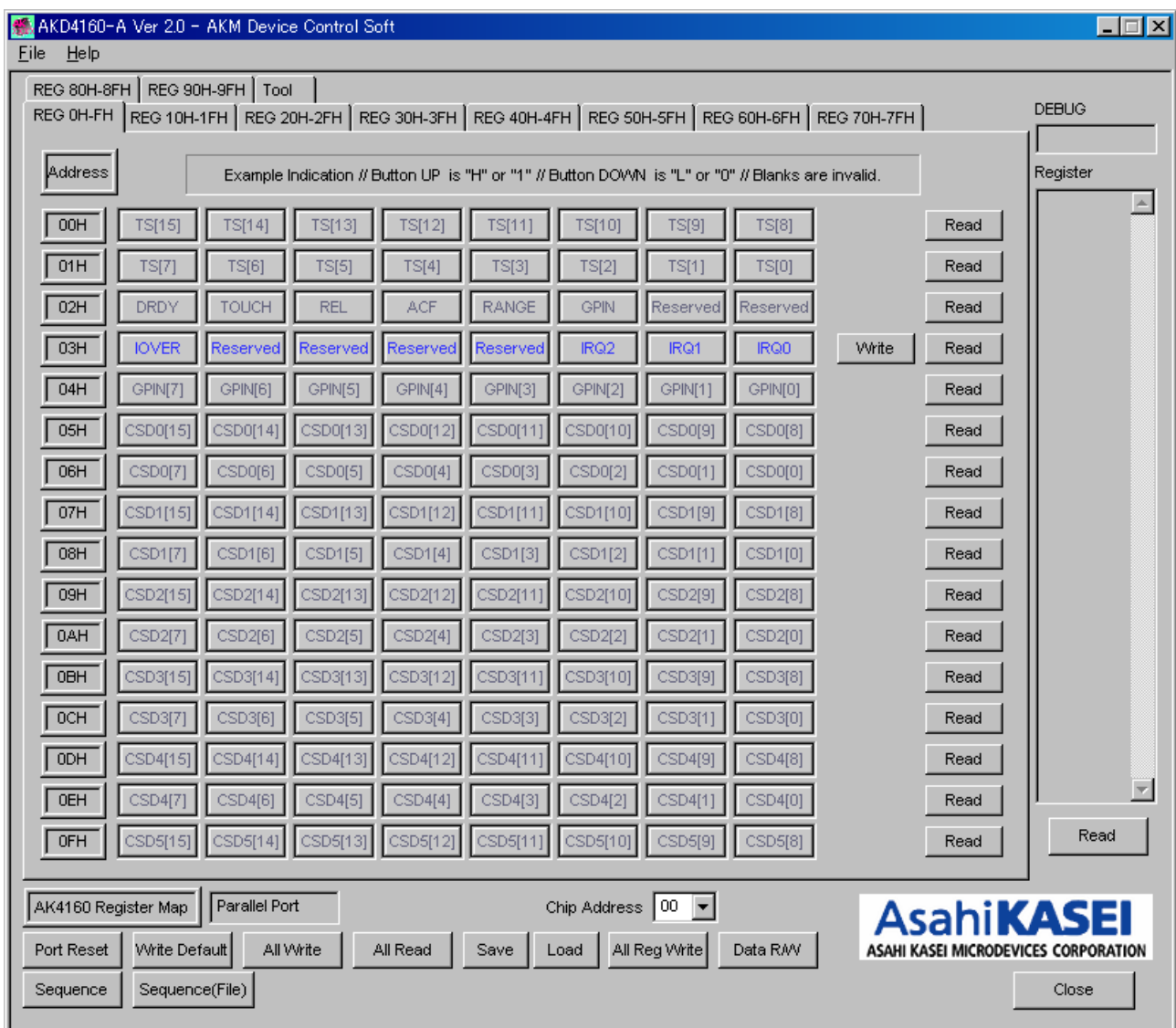


Figure 5. Operation Screen of Control Soft

## ■ Operation Overview

Register map and testing tool can be controlled by this control soft. These controls are selected by upper tabs.

Buttons which are frequently used such as register initializing button “Write Default”, are located outside of the switching tab window. Refer to the “■ Dialog Boxes” for details of each dialog box setting.

1. [Port Reset]: For when connecting to USB I/F board (AKDUSBIF-B)  
Click this button after the control soft starts up when connecting USB I/F board (AKDUSBIF-B).
2. [Write Default]: Register Initializing  
When the device is reset by a hardware reset, use this button to initialize the registers.
3. [All Write]: Executing write commands for all registers displayed.
4. [All Read]: Executing read commands for all registers displayed.
5. [Save]: Saving current register settings to a file.
6. [Load]: Executing data write from a saved file.
7. [All Reg Write]: “All Reg Write” dialog box is popped up.
8. [Data R/W]: “Data R/W” dialog box is popped up.
9. [Sequence]: “Sequence” dialog box is popped up.
10. [Sequence(File)]: “Sequence(File)” dialog box is popped up.
11. [Read]: Reading current register settings and display on to the Register area (on the right of the main window).  
This is different from [All Read] button, it does not reflect to a register map, only displaying hexadecimal.

■ Tab Functions

1. [REG]: Register Map

This tab is for a register writing and reading.

Each bit on the register map is a push-button switch.

Button Down indicates “H” or “1” and the bit name is in red (when read only it is in deep red).

Button Up indicates “L” or “0” and the bit name is in blue (when read only it is in gray)

Grayout registers are Read Only registers. They can not be controlled.

The registers which is not defined in the datasheet are indicated as “---”.

20H	CSD13[7]	CSD13[6]	CSD13[5]	CSD13[4]	CSD13[3]	CSD13[2]	CSD13[1]	CSD13[0]		Read
21H	CSD14[15]	CSD14[14]	CSD14[13]	CSD14[12]	CSD14[11]	CSD14[10]	CSD14[9]	CSD14[8]		Read
22H	CSD14[7]	CSD14[6]	CSD14[5]	CSD14[4]	CSD14[3]	CSD14[2]	CSD14[1]	CSD14[0]		Read
23H	CSD15[15]	CSD15[14]	CSD15[13]	CSD15[12]	CSD15[11]	CSD15[10]	CSD15[9]	CSD15[8]		Read
24H	CSD15[7]	CSD15[6]	CSD15[5]	CSD15[4]	CSD15[3]	CSD15[2]	CSD15[1]	CSD15[0]		Read
25H	T8X0	TT0[6]	TT0[5]	TT0[4]	TT0[3]	TT0[2]	TT0[1]	TT0[0]	Write	Read
26H	R8X0	RT0[6]	RT0[5]	RT0[4]	RT0[3]	RT0[2]	RT0[1]	RT0[0]	Write	Read
27H	T8X1	TT1[6]	TT1[5]	TT1[4]	TT1[3]	TT1[2]	TT1[1]	TT1[0]	Write	Read
28H	R8X1	RT1[6]	RT1[5]	RT1[4]	RT1[3]	RT1[2]	RT1[1]	RT1[0]	Write	Read
29H	T8X2	TT2[6]	TT2[5]	TT2[4]	TT2[3]	TT2[2]	TT2[1]	TT2[0]	Write	Read
2AH	R8X2	RT2[6]	RT2[5]	RT2[4]	RT2[3]	RT2[2]	RT2[1]	RT2[0]	Write	Read
2BH	T8X3	TT3[6]	TT3[5]	TT3[4]	TT3[3]	TT3[2]	TT3[1]	TT3[0]	Write	Read
2CH	R8X3	RT3[6]	RT3[5]	RT3[4]	RT3[3]	RT3[2]	RT3[1]	RT3[0]	Write	Read
2DH	T8X4	TT4[6]	TT4[5]	TT4[4]	TT4[3]	TT4[2]	TT4[1]	TT4[0]	Write	Read
2EH	R8X4	RT4[6]	RT4[5]	RT4[4]	RT4[3]	RT4[2]	RT4[1]	RT4[0]	Write	Read
2FH	T8X5	TT5[6]	TT5[5]	TT5[4]	TT5[3]	TT5[2]	TT5[1]	TT5[0]	Write	Read

Figure 6. Register Map example

**[Write]: Data Writing Dialog**

It is for when changing two or more bits on the same address at the same time.

Click [Write] button located on the right of the each corresponded address for a pop-up dialog box.

When checking the checkbox, the register will be “H” or “1”, when not checking the register will be “L” or “0”.  
Click [OK] to write setting value to the registers, or click [Cancel] to cancel this setting.

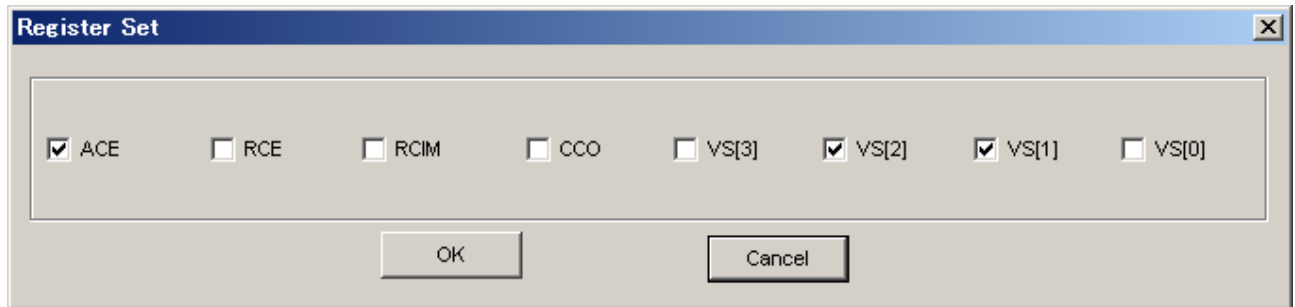


Figure 7. Register writing dialog example

**[Read]: Data Read**

Click [Read] button located on the right of the each corresponded address to execute register reading.

After register reading, the display will be updated regarding to the register status.

Button Down indicates “H” or “1” and the bit name is in red (when read only it is in deep red).

Button Up indicates “L” or “0” and the bit name is in blue (when read only it is in gray)

Please be care that button statuses will be changed by Read command.

## 2. [Tool]: Testing Tools

This tab screen is for evaluation testing tool.  
Click buttons for each testing tool.

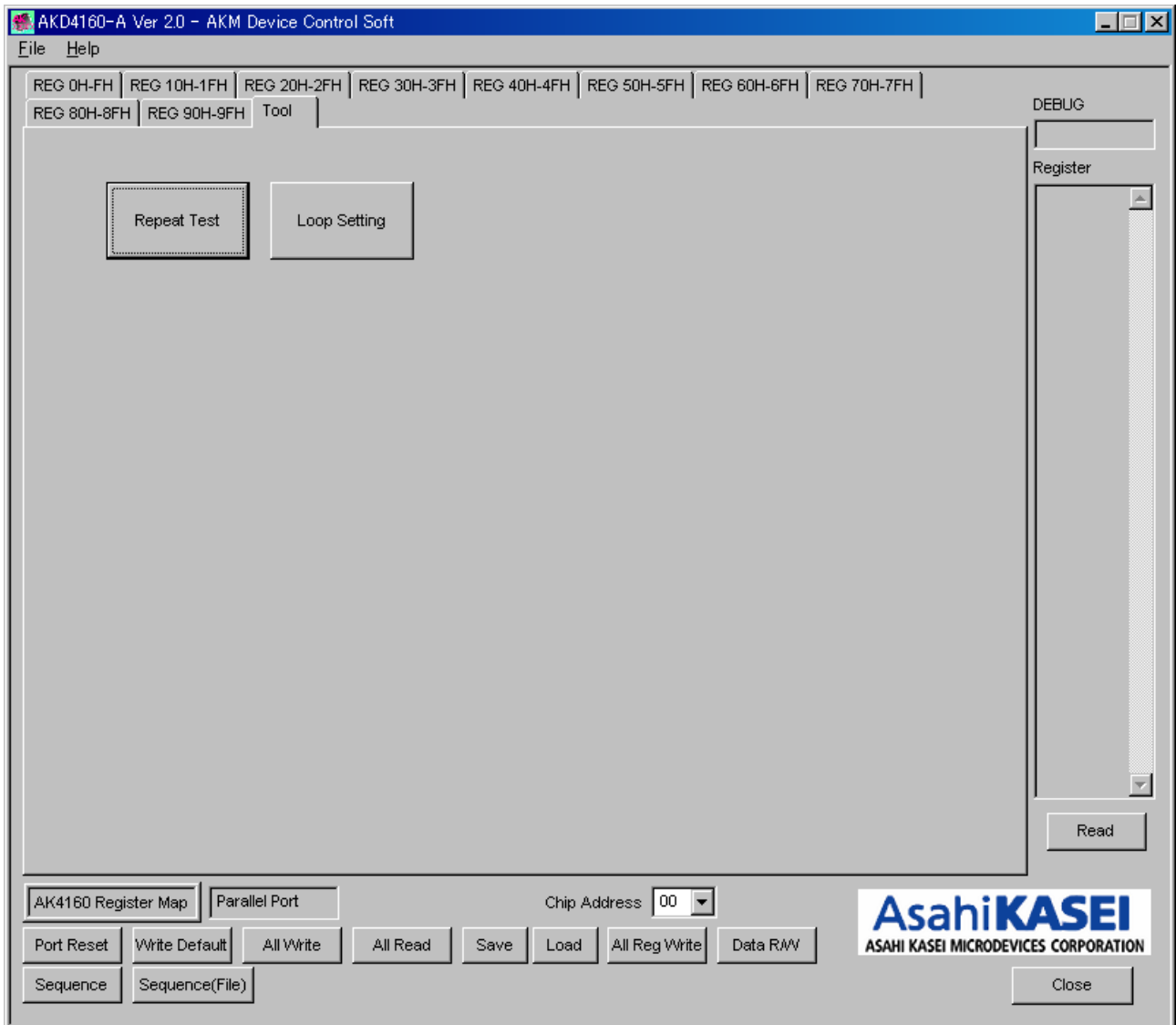


Figure 8. Repeat Test & Loop Setting

## ■ Dialog Boxes

### 1. [All Req Write]: All Req Write dialog box

Click [All Reg Write] button in the main window to open register setting files.  
Register setting files saved by [SAVE] button can be applied.

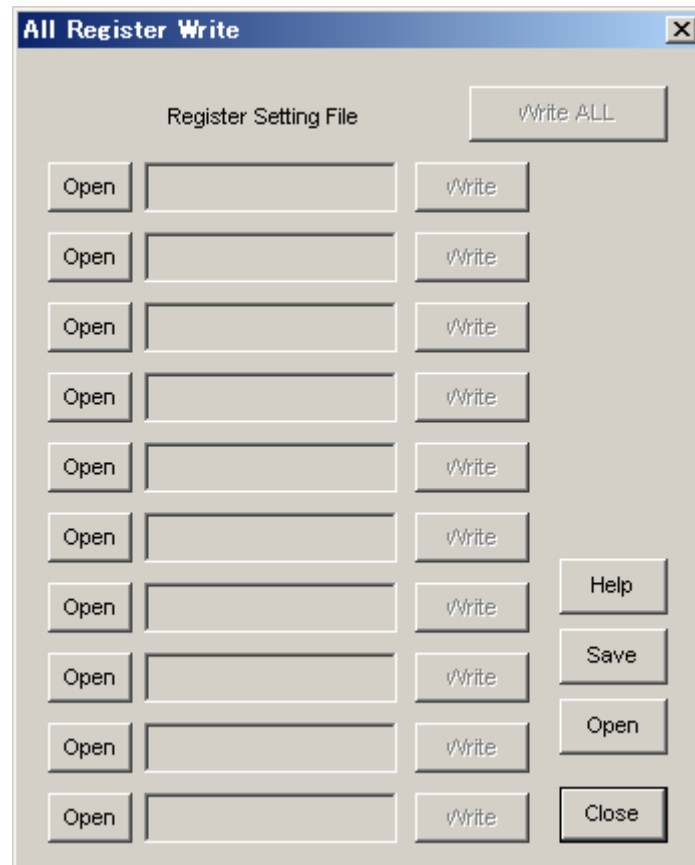


Figure 9. [All Reg Write] Window

[Open (left)]: Selecting a register setting file (\*.akr).

[Write]: Executing register writing.

[Write All]: Executing all register writings.

Writings are executed in descending order.

[Help]: Help window is popped up.

[Save]: Saving the register setting file assignment. The file name is “\*.mar”.

[Open (right)]: Opening a saved register setting file assignment “\*. mar”.

[Close]: Closing the dialog box and finish the process.

#### \*Operating Suggestions

- (1) Those files saved by [Save] button and opened by [Open] button on the right of the dialog “\*.mar” should be stored in the same folder.
- (2) When register settings are changed by [Save] button in the main window, re-read the file to reflect new register settings.

## 2. [Data R/W]: Data R/W Dialog Box

Click the [Data R/W] button in the main window for data read/write dialog box.  
Data write is available to specified address.

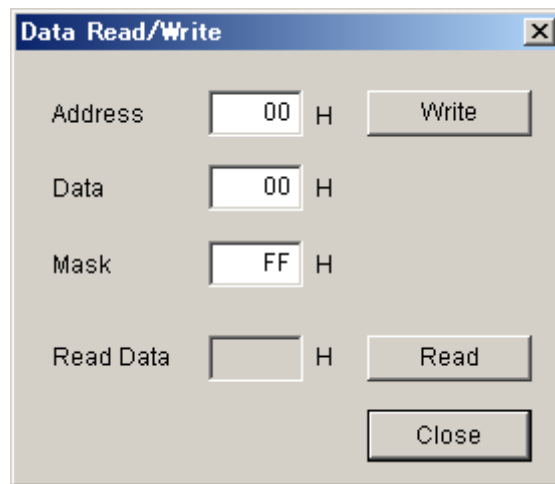


Figure 10. [Data R/W] Window

Address Box: Input data address in hexadecimal numbers for data writing.

Data Box: Input data in hexadecimal numbers.

Mask Box: Input mask data in hexadecimal numbers.

This is "AND" processed input data.

[Write]: Writing to the address specified by "Address" box.

[Read]: Reading from the address specified by "Address" box.

The result will be shown in the Read Data Box in hexadecimal numbers.

[Close]: Closing the dialog box and finish the process.

Data writing can be cancelled by this button instead of [Write] button.

\*The register map will be updated after executing [Write] or [Read] commands.

### 3. [Sequence]: Sequence Dialog Box

Click [Sequence] button to open register sequence setting dialog box.  
Register sequence can be set in this dialog box.

	Address	Data	Mask	Interval	Select		Address	Data	Mask	Interval	Select
1	00 H	00 H	FF H	0 ms	No_use	16	00 H	00 H	FF H	0 ms	No_use
2	00	00	FF	0	No_use	17	00	00	FF	0	No_use
3	00	00	FF	0	No_use	18	00	00	FF	0	No_use
4	00	00	FF	0	No_use	19	00	00	FF	0	No_use
5	00	00	FF	0	No_use	20	00	00	FF	0	No_use
6	00	00	FF	0	No_use	21	00	00	FF	0	No_use
7	00	00	FF	0	No_use	22	00	00	FF	0	No_use
8	00	00	FF	0	No_use	23	00	00	FF	0	No_use
9	00	00	FF	0	No_use	24	00	00	FF	0	No_use
10	00	00	FF	0	No_use	25	00	00	FF	0	No_use
11	00	00	FF	0	No_use						
12	00	00	FF	0	No_use						
13	00	00	FF	0	No_use						
14	00	00	FF	0	No_use						
15	00	00	FF	0	No_use						

Start Step: 1

Buttons: Start, Help, Save, Open, Close

Figure 11. [Sequence] Window

#### Sequence Setting

Set register sequence by following process bellow.

##### (1) Select a command

Use [Select] pull-down box to choose commands.

Corresponding boxes will be valid.

< Select Pull-down menu >

- No\_use: Not using this address
- Register: Register writing
- Reg(Mask): Register writing (Masked)
- Interval: Taking an interval
- Stop: Pausing the sequence
- End: Finishing the sequence

##### (1) Input sequence

[Address]: Data address

[Data]: Writing data

[Mask]: Mask

[Data] box data is ANDed with [Mask] box data. This is the actual writing data.  
When Mask = 0x00, current setting is hold.

When Mask = 0xFF, the 8bit data which is set in the [Data] box is written.

When Mask = 0x0F, lower 4bit data which is set in the [Data] box is written.  
Upper 4bit is hold to current setting.

[ Interval ]: Interval time

Valid boxes for each process command are shown bellow.

- No\_use: None
- Register: [Address], [Data], [Interval]
- Reg(Mask): [Address], [Data], [Mask], [Interval]
- Interval: [Interval]
- Stop: None
- End: None

### Control Buttons

The function of Control Button is shown bellow.

[Start]: Executing the sequence

[Help]: Opening a help window

[Save]: Saving sequence settings as a file. The file name is "\*.aks".

[Open]: Opening a sequence setting file "\*.aks".

[Close]: Closing the dialog box and finish the process.

### Stop of the sequence

When "Stop" is selected in the sequence, processing is paused and it starts again when [Start] button is clicked.

Restarting step number is shown in the "Start Step" box. When finishing the process until the end of sequence, "Start Step" will return to "1".

The sequence can be started from any step by writing the step number to the "Start Step" box.

Write "1" to the "Start Step" box and click [Start] button, when restarting the process from the beginning.

#### 4. [Sequence(File)]: Sequence Setting File Dialog Box

Click [Sequence(File)] button to open sequence setting file dialog box.  
Those files saved in the “Sequence setting dialog” can be applied in this dialog.

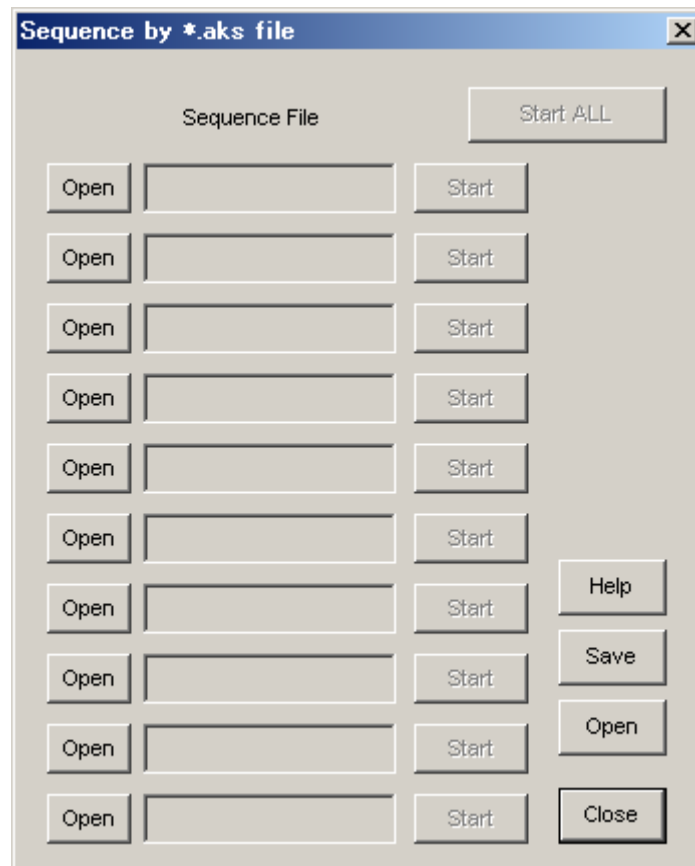


Figure 12. [Sequence(File)] Window

[Open (left)]: Opening a sequence setting file (\*.aks).

[Start]: Executing the sequence setting.

[Start All]: Executing all sequence settings.

Sequences are executed in descending order.

[Help]: Pop up the help window.

[Save]: Saving sequence setting file assignment. The file name is “\*.mas”.

[Open(right)]: Opening a saved sequence setting file assignment “\*. mas”.

[Close]: Closing the dialog box and finish the process.

#### \*Operating Suggestions

(1) Those files saved by [Save] button and opened by [Open] button on the right of the dialog “\*.mas” should be stored in the same folder.

(2) When “Stop” is selected in the sequence the process will be paused and a pop-up message will appear. Click “OK” to continue the process.

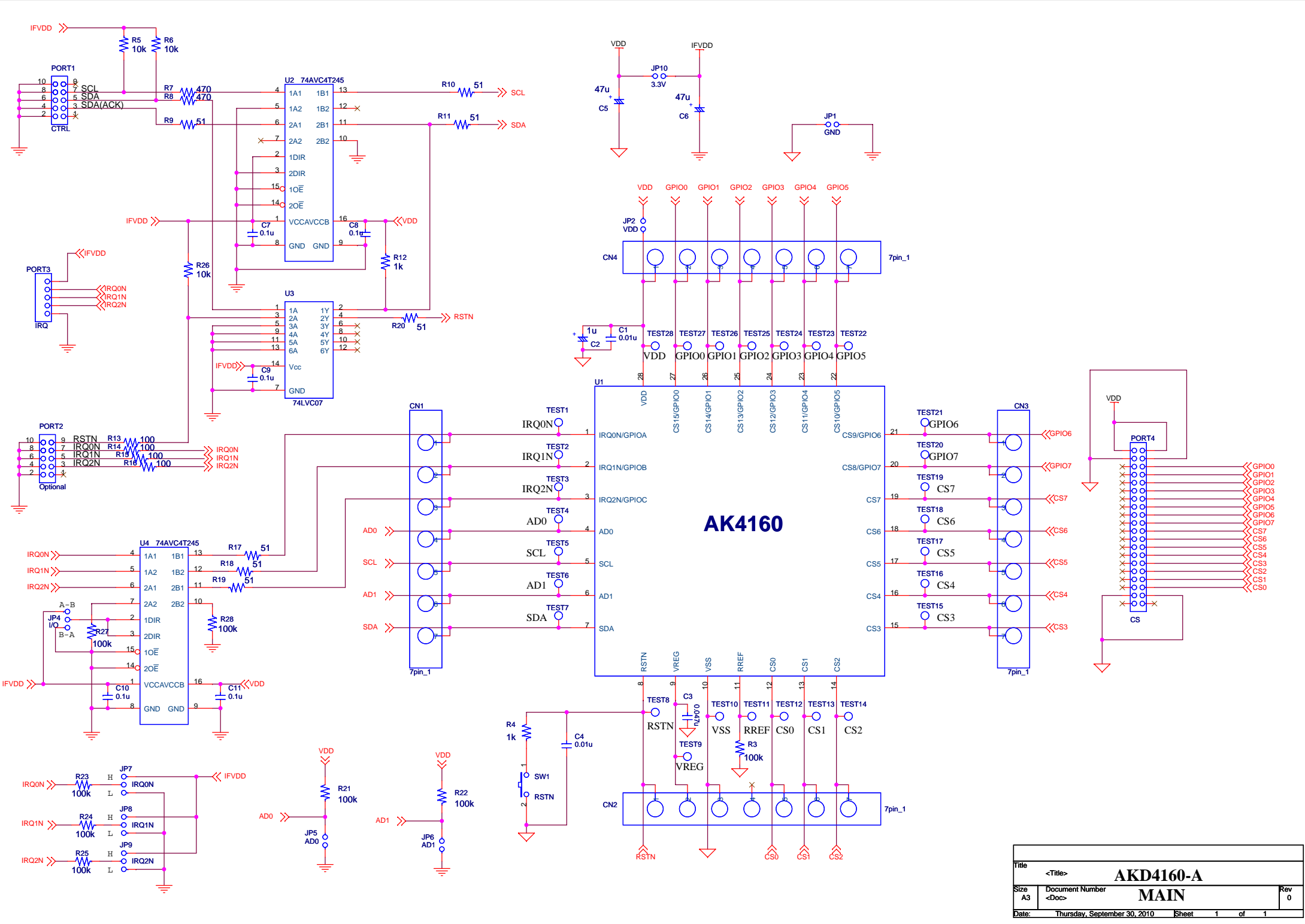


<b>REVISION HISTORY</b>
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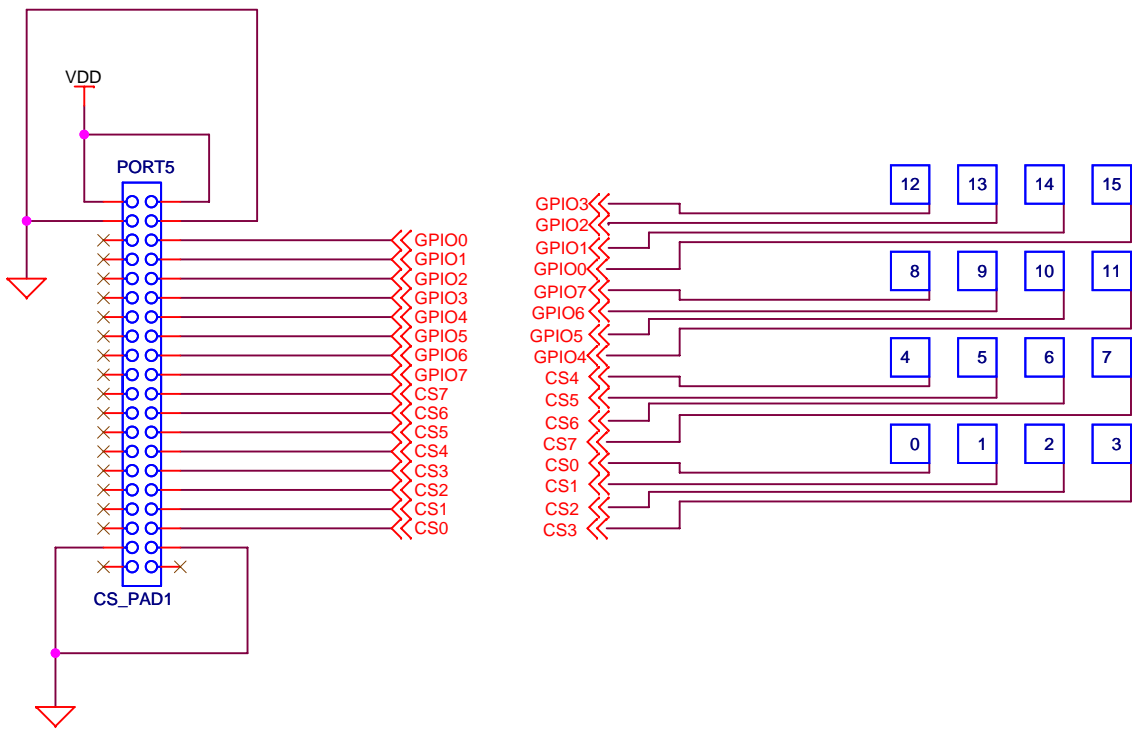
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10/11/05	KM104500	0	First Edition		
10/11/26	KM104501	0		6	Figure.4 add
10/11/26	KM104501	0		8	Figure.6 change
10/11/26	KM104501	0		12	Figure.8 change

### IMPORTANT NOTICE

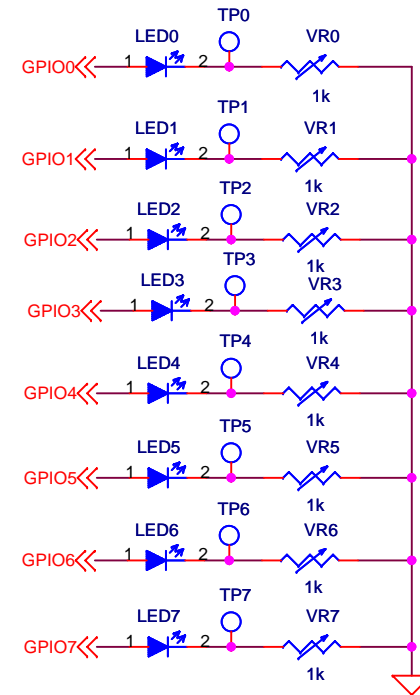
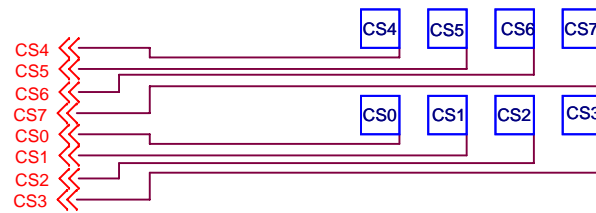
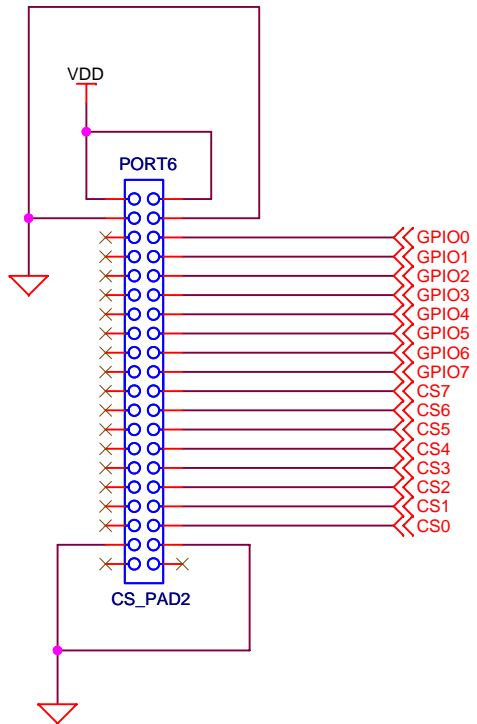
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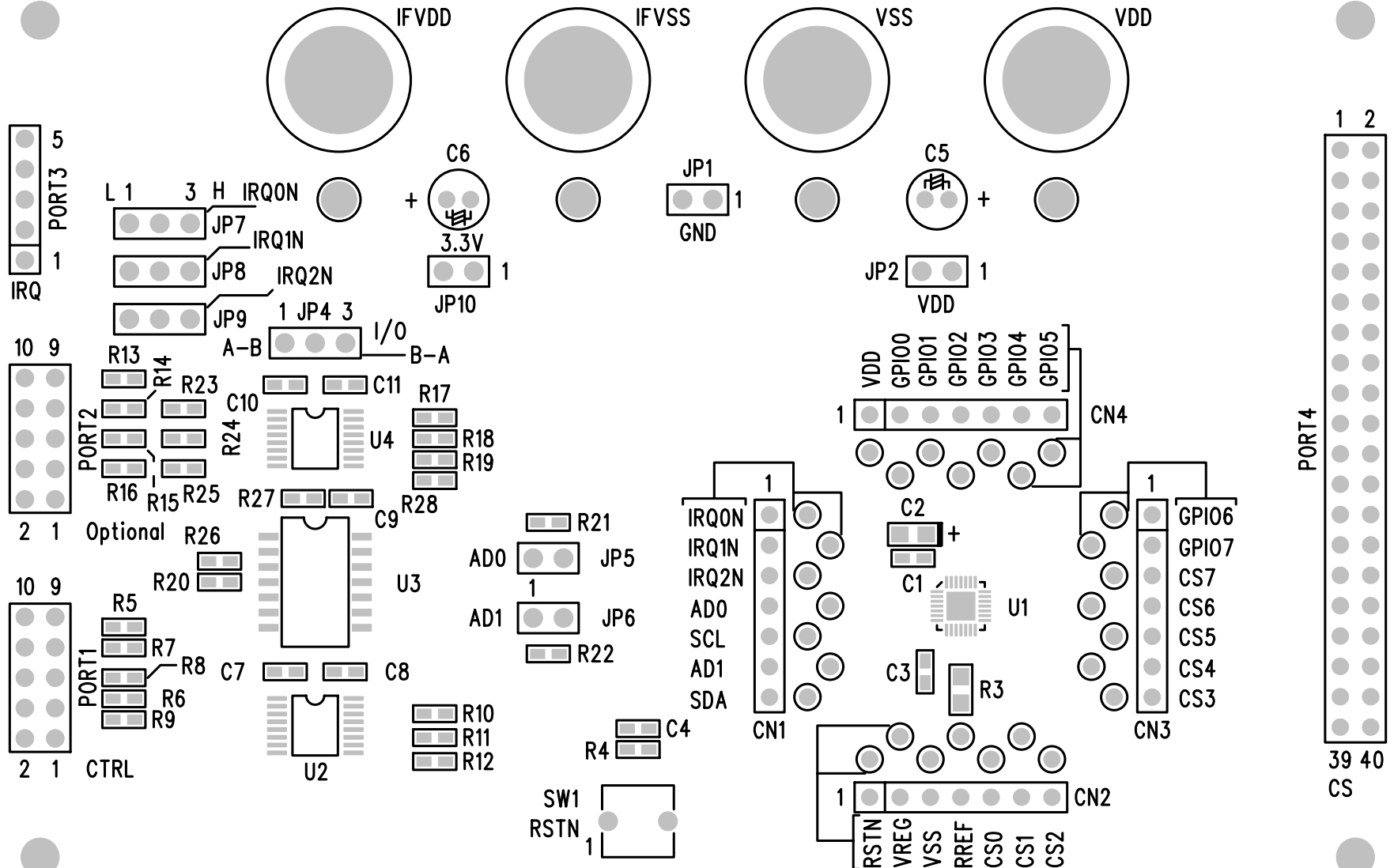


Title		
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Date:	Wednesday, September 08, 2010	Sheet 1 of 1



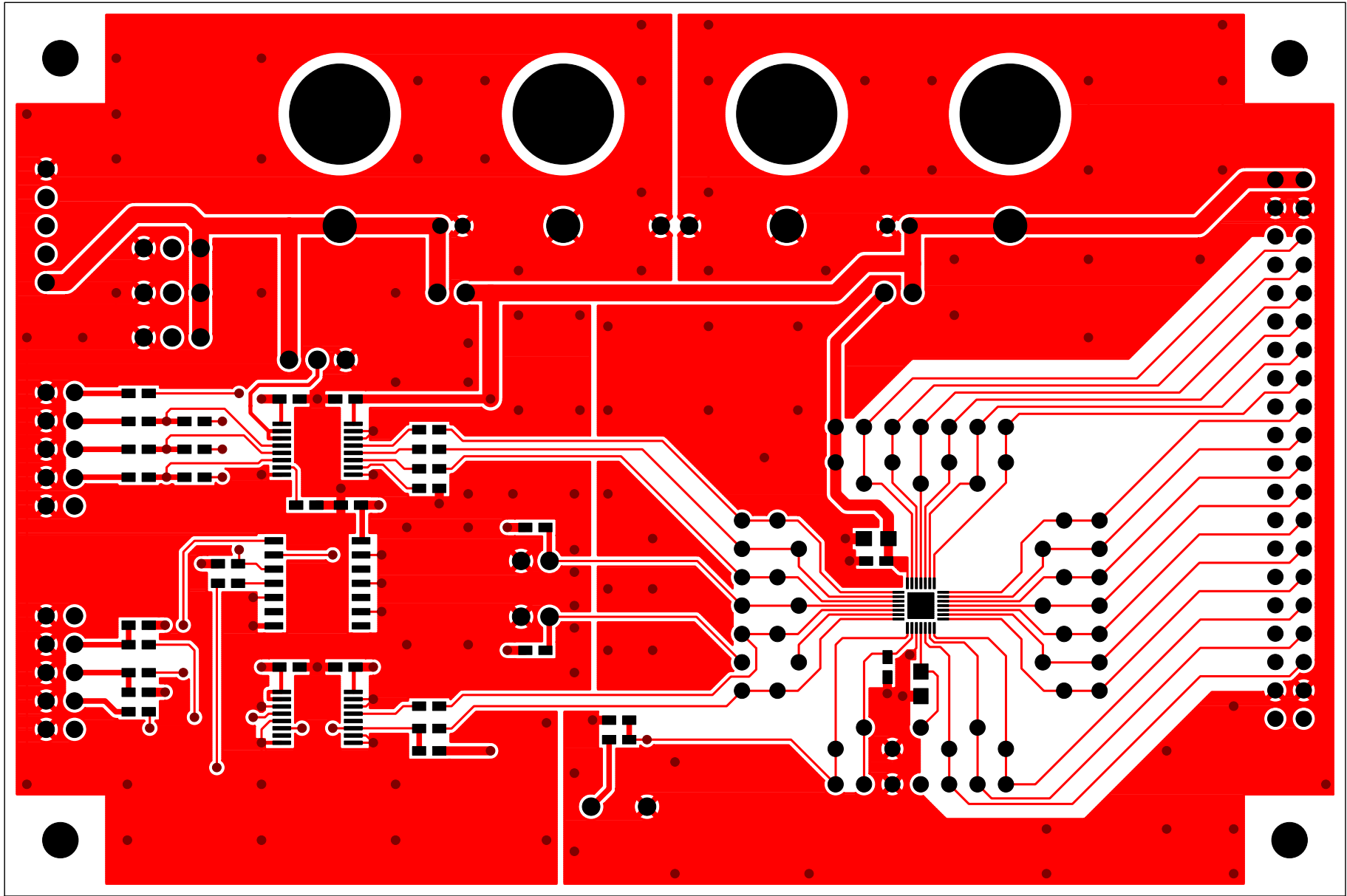
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Date:	Wednesday, September 08, 2010	Sheet 1 of 1

# AKD4160-A Rev.0 Evaluation Board



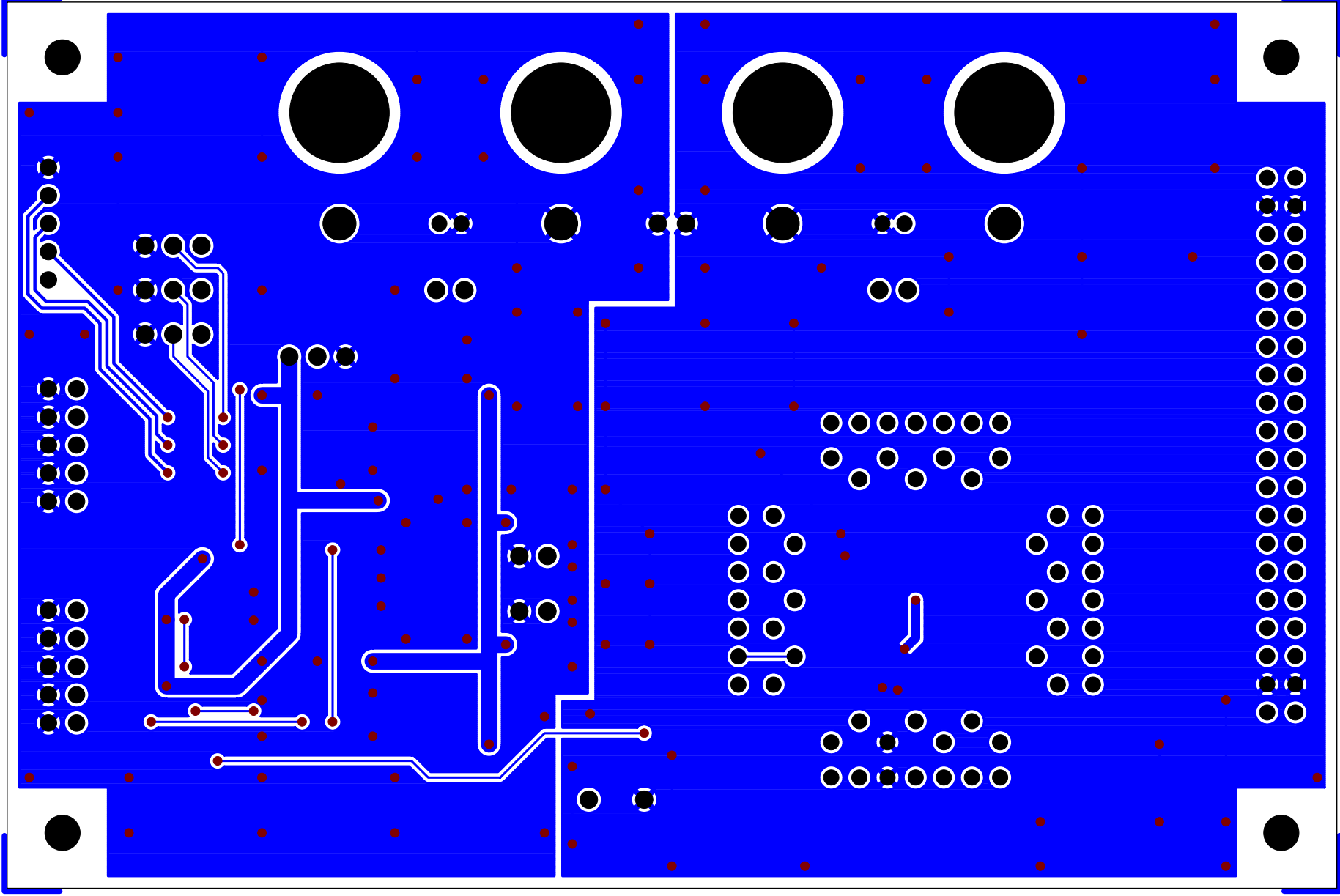
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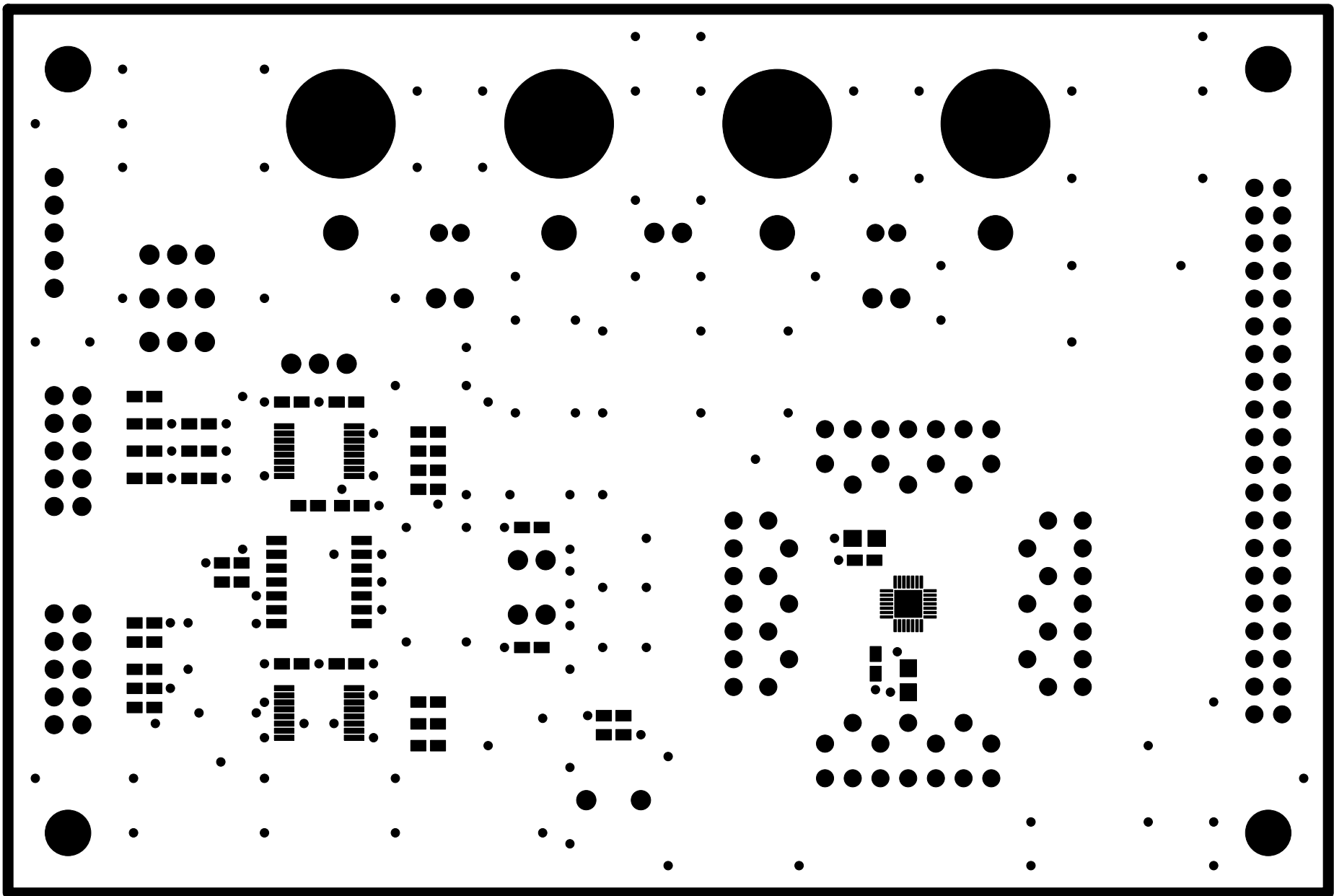
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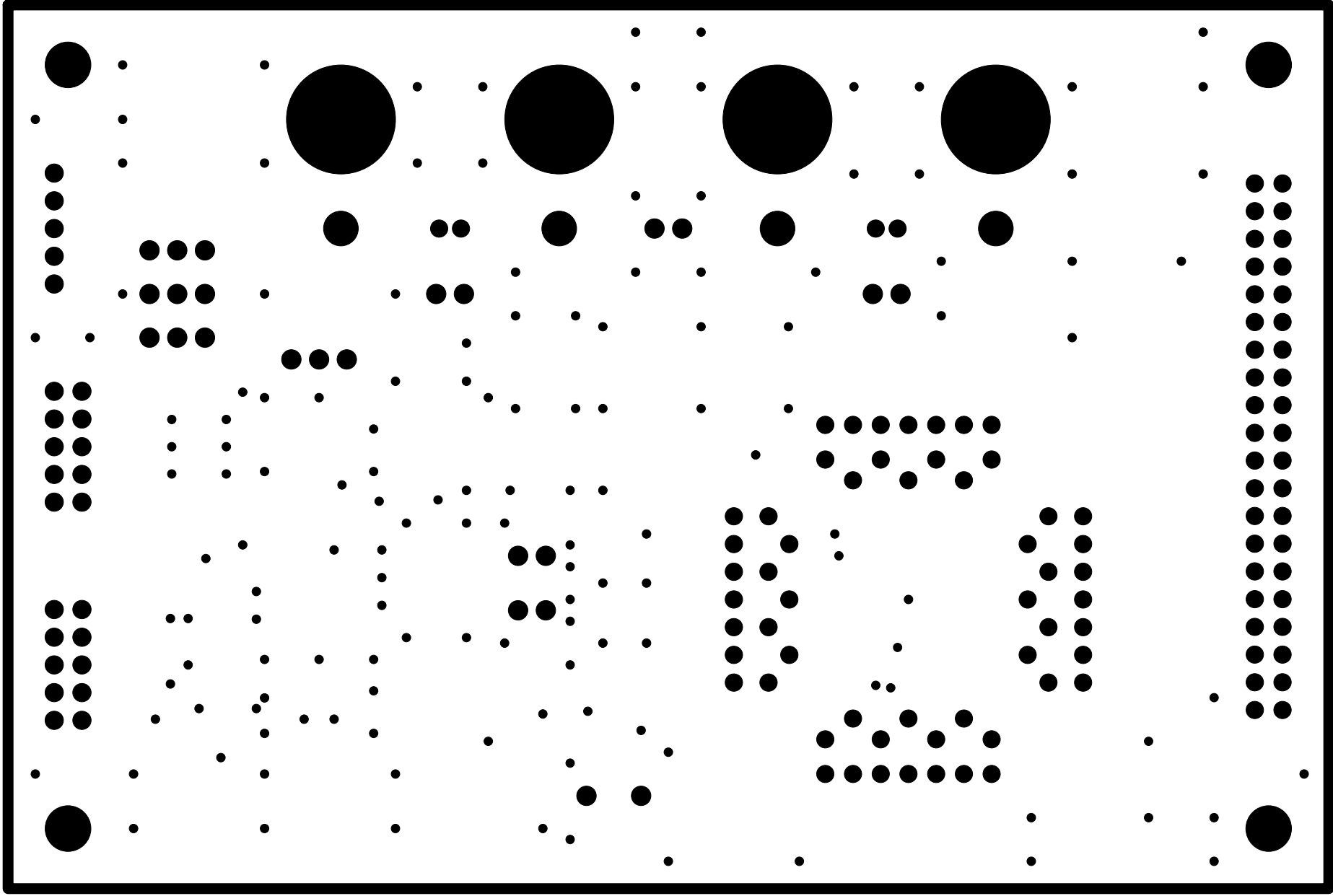
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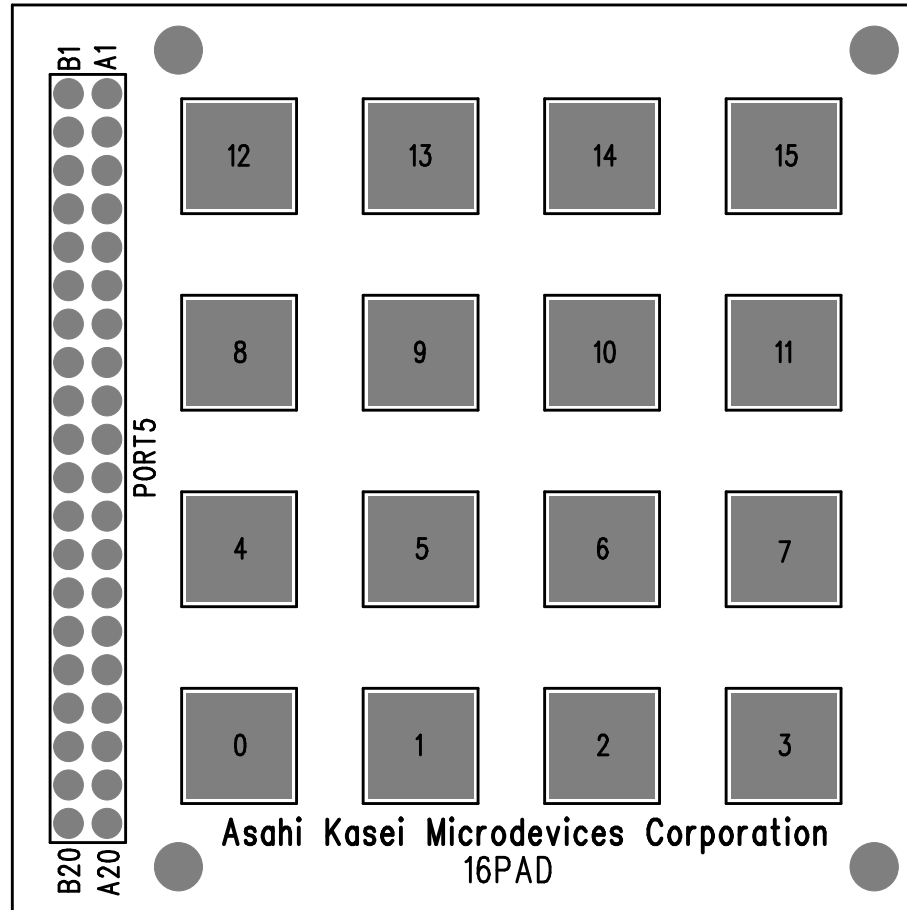
AKD4160-A Rev.0 Evaluation Board LAYS





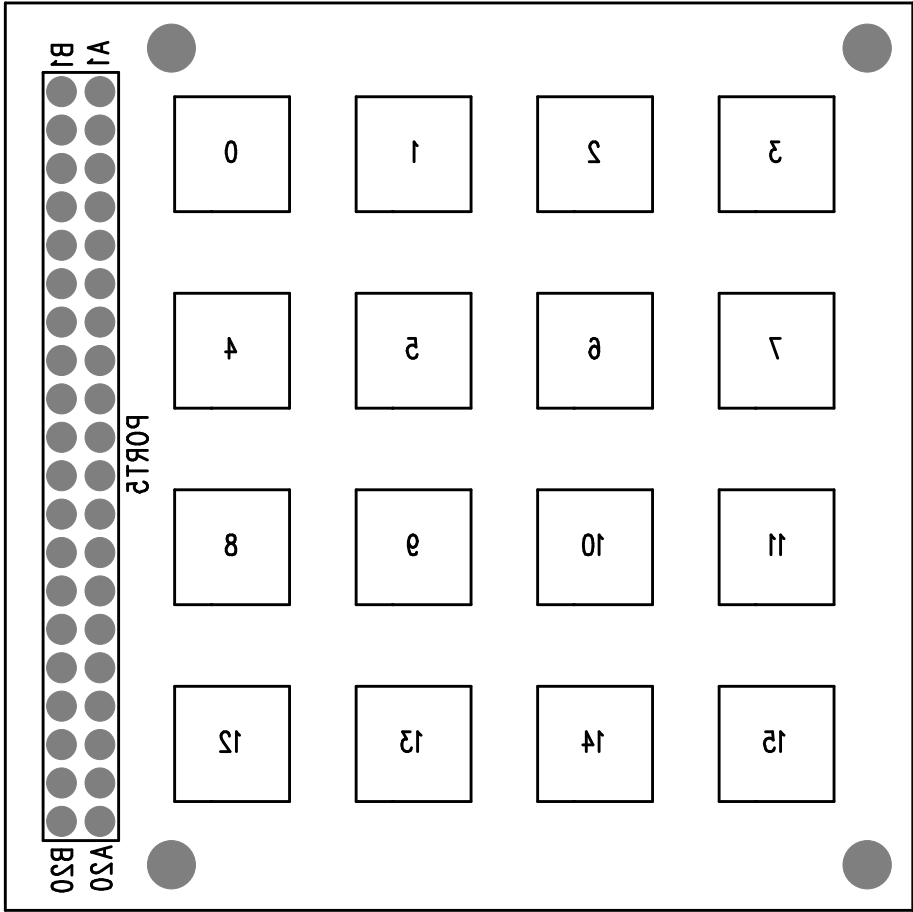
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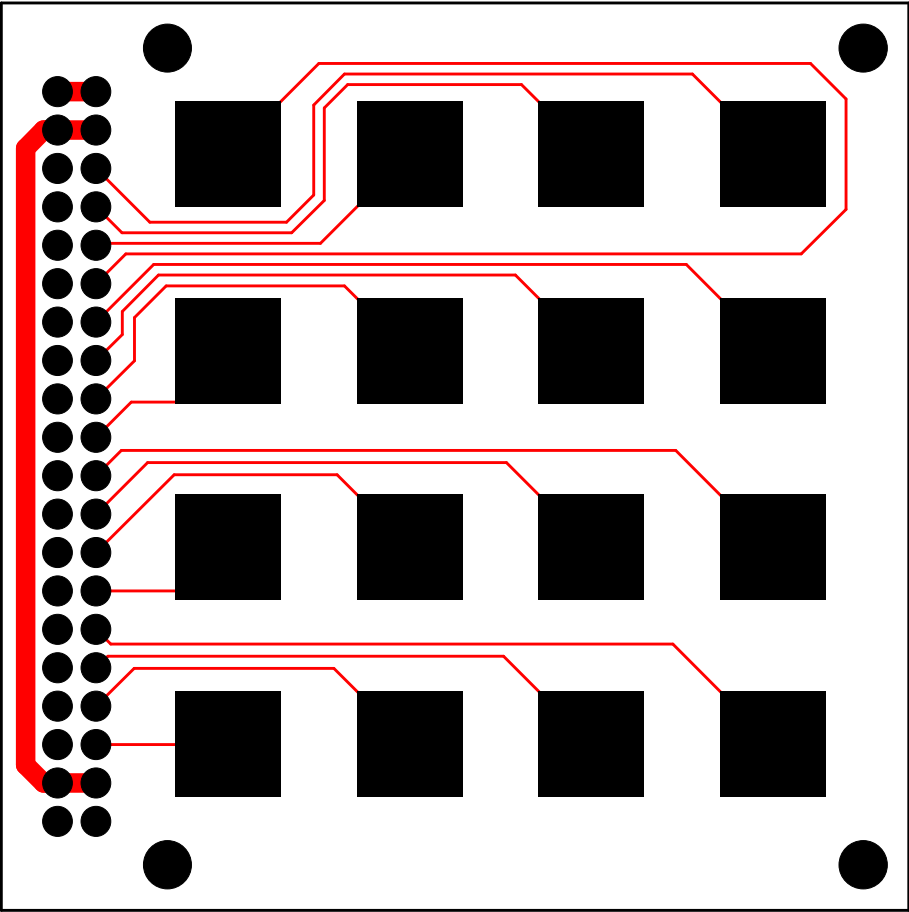




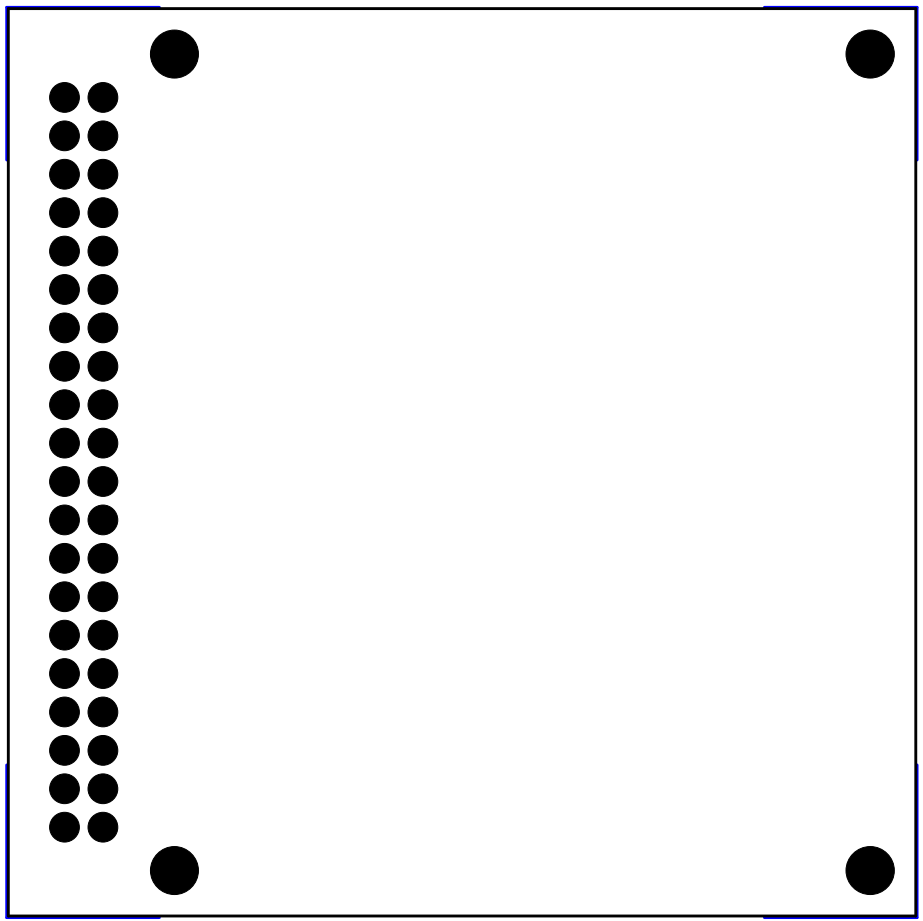
16PAD SLK1 SEP.30.2010

10PAD 2LKS SEP.30.2010

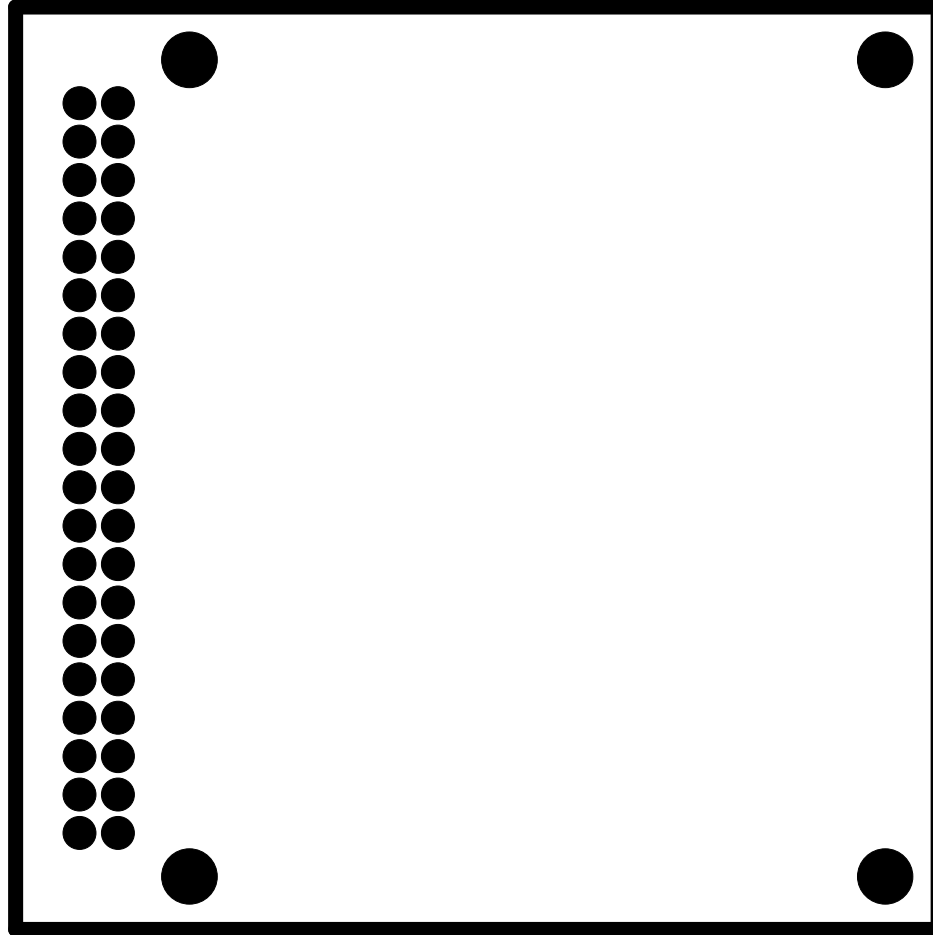




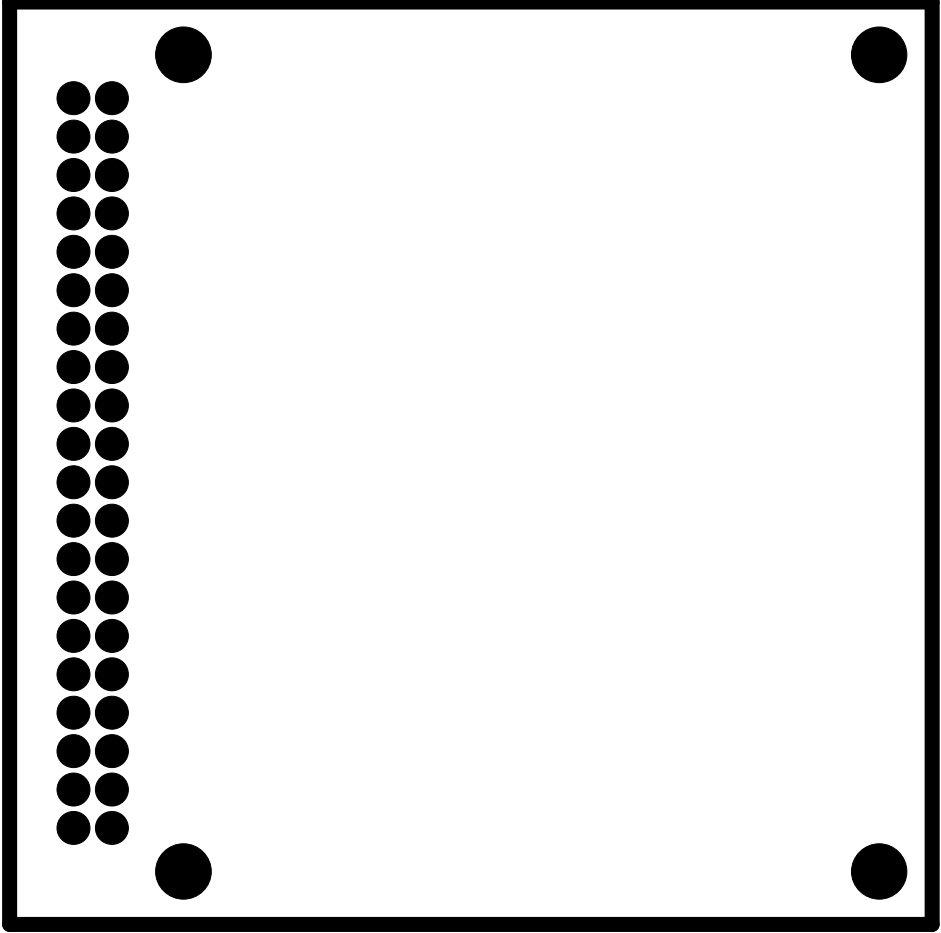
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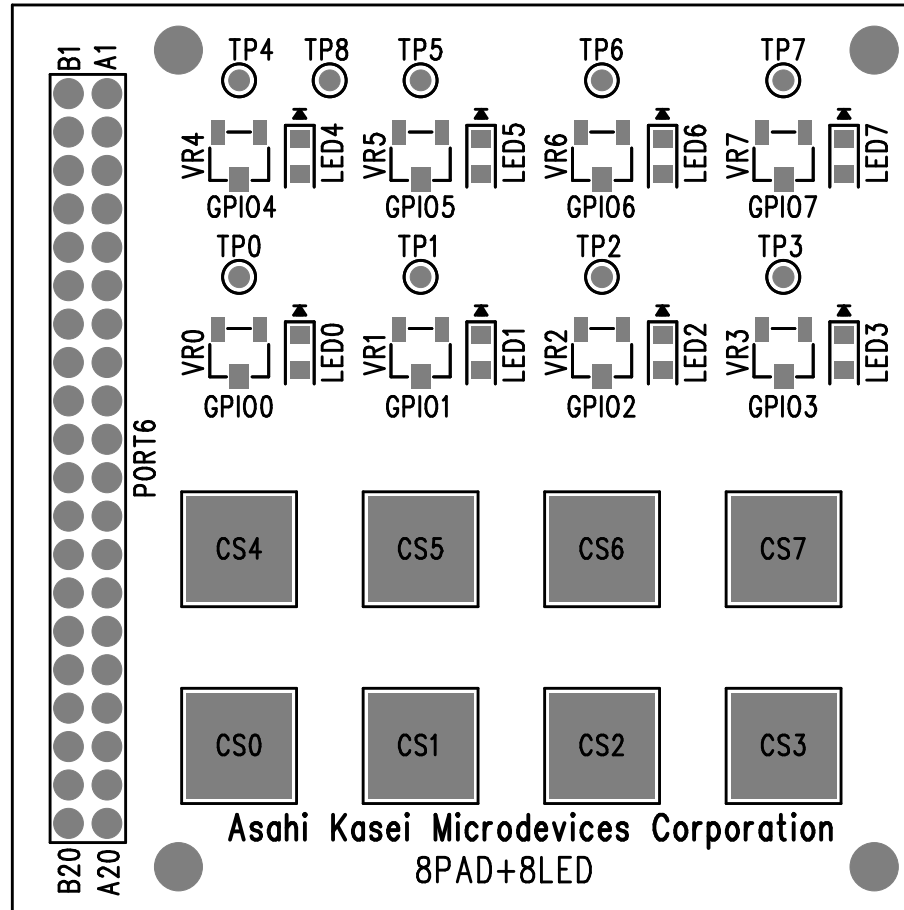
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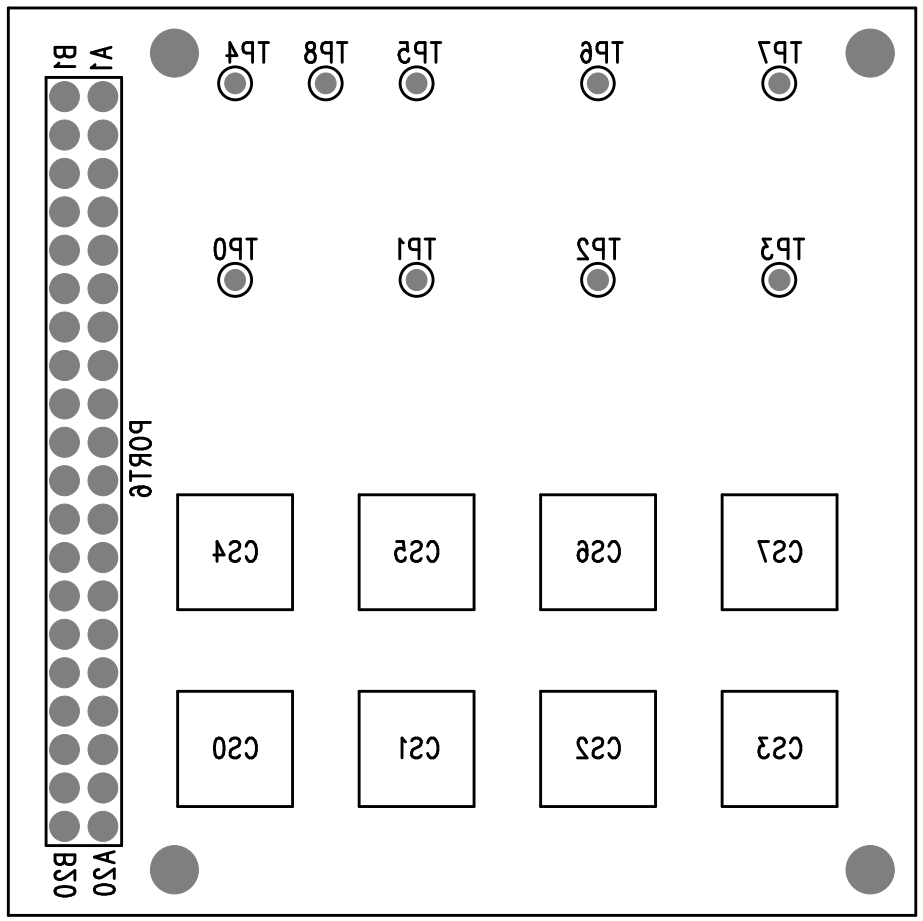


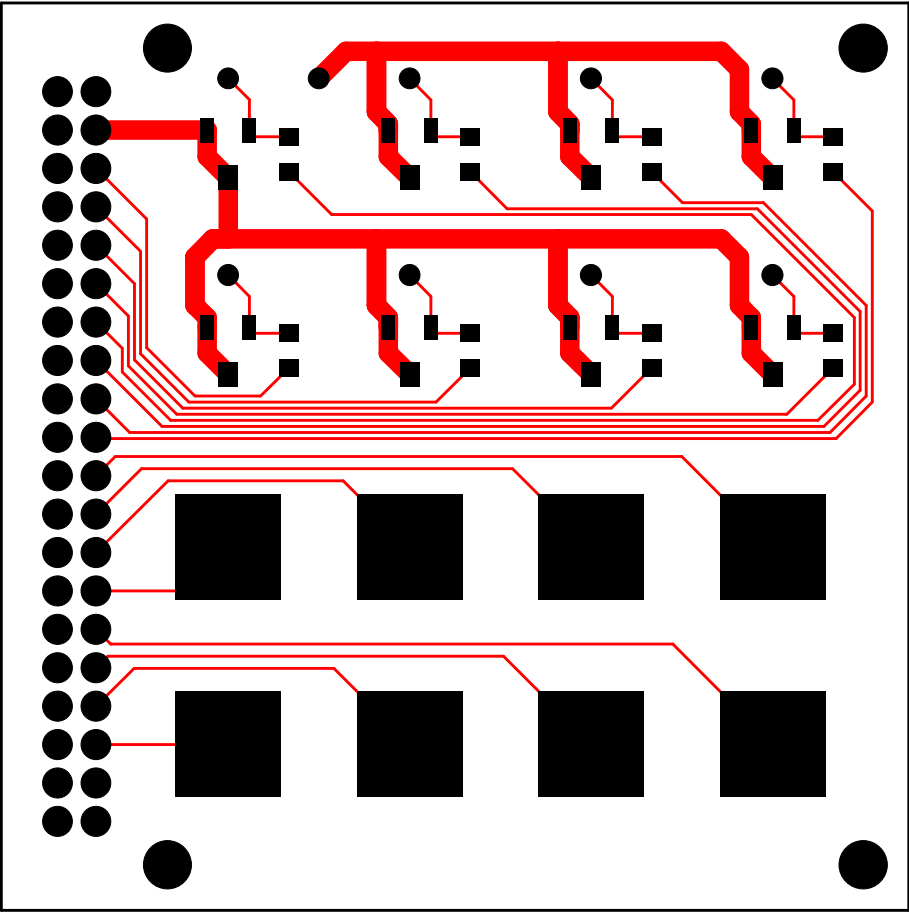
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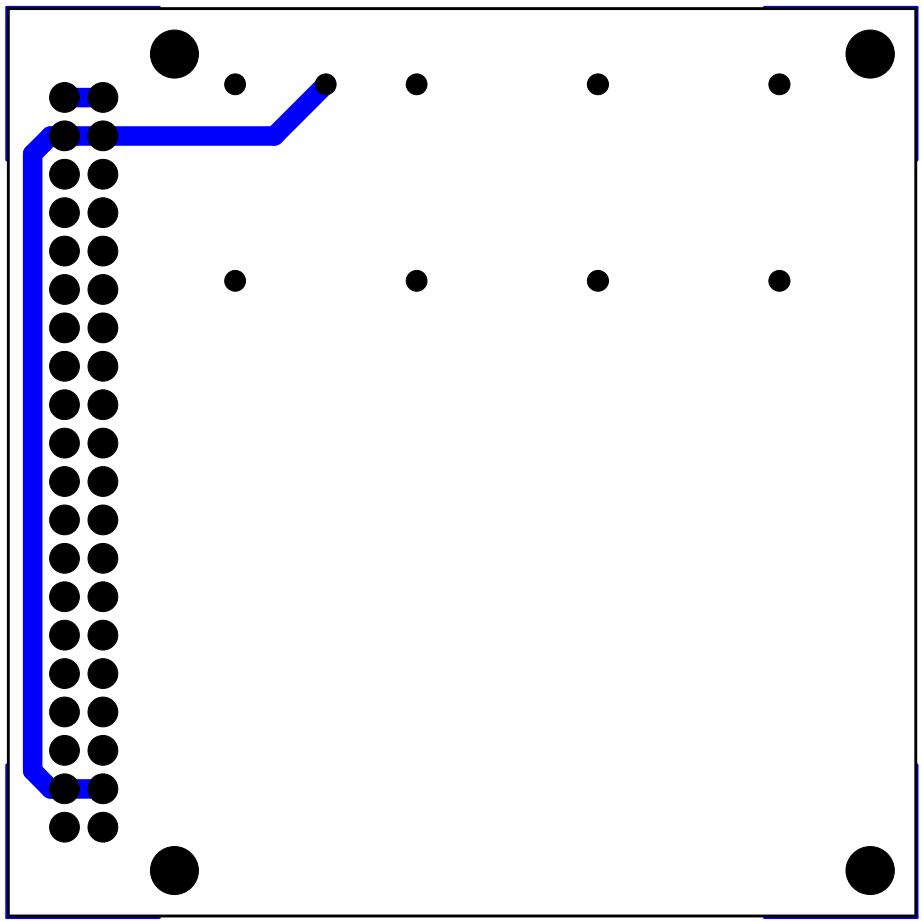
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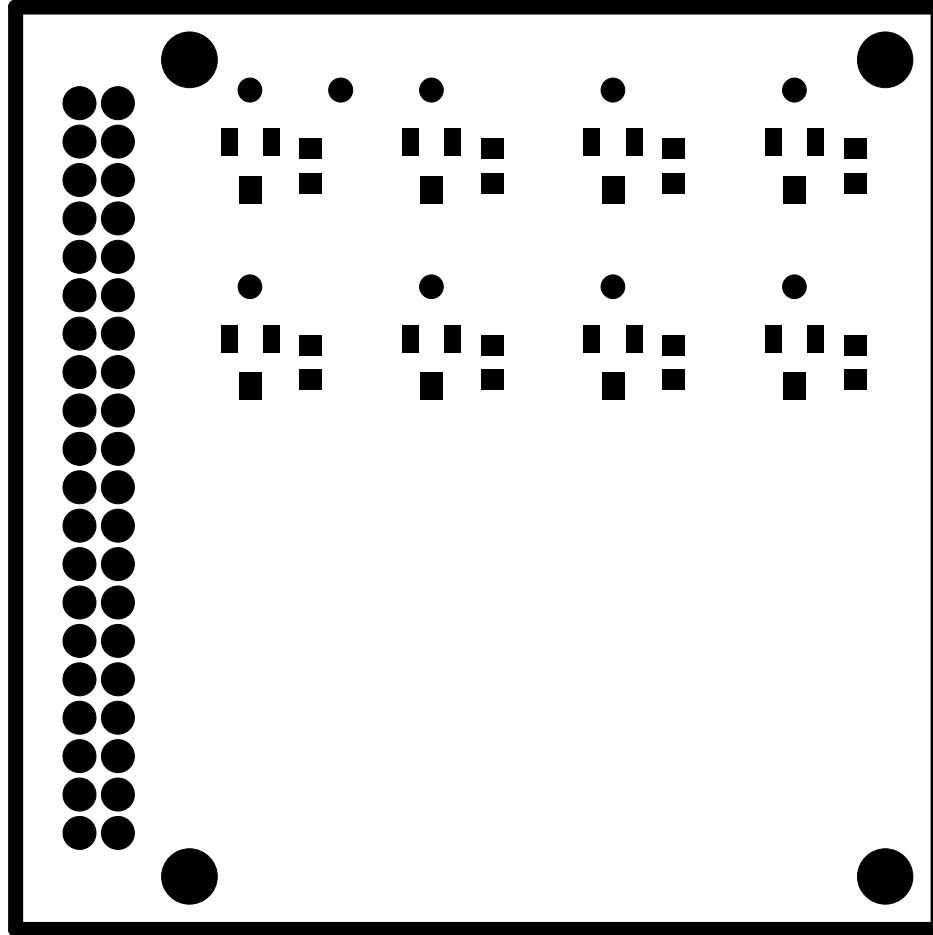




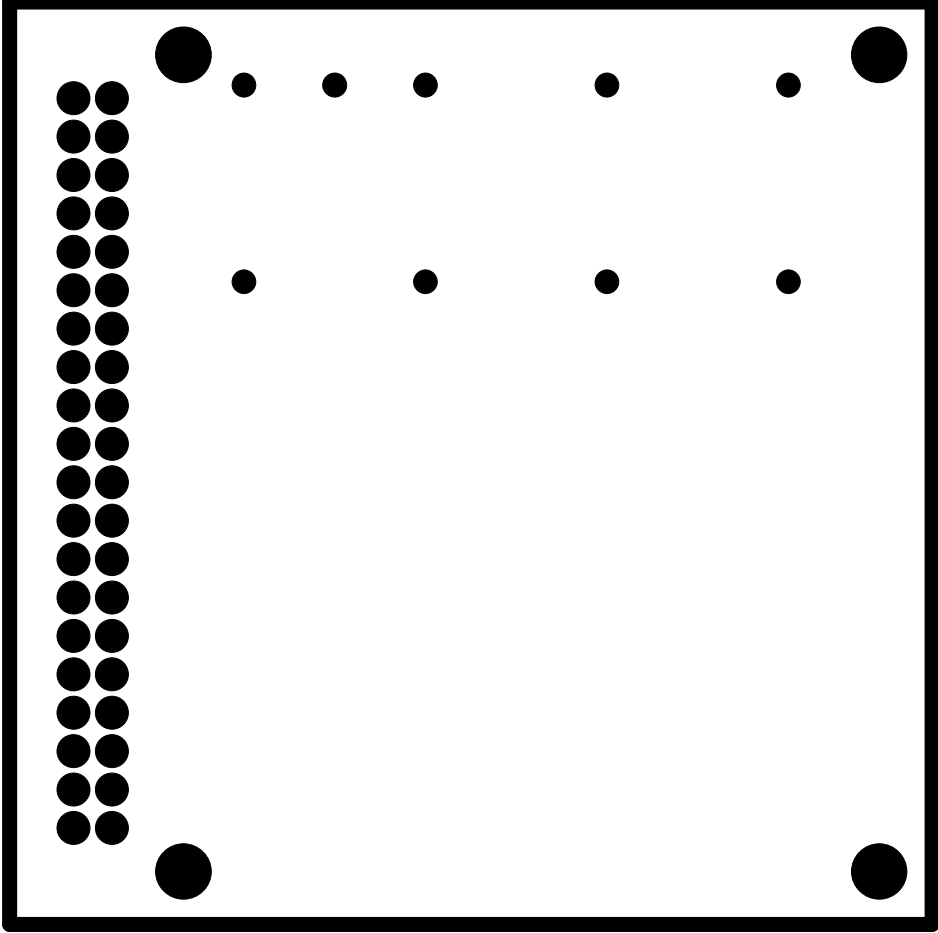
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