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^2C serial I/F**
- **Cap Sensor Connector**
- **Touch Pad Operations**

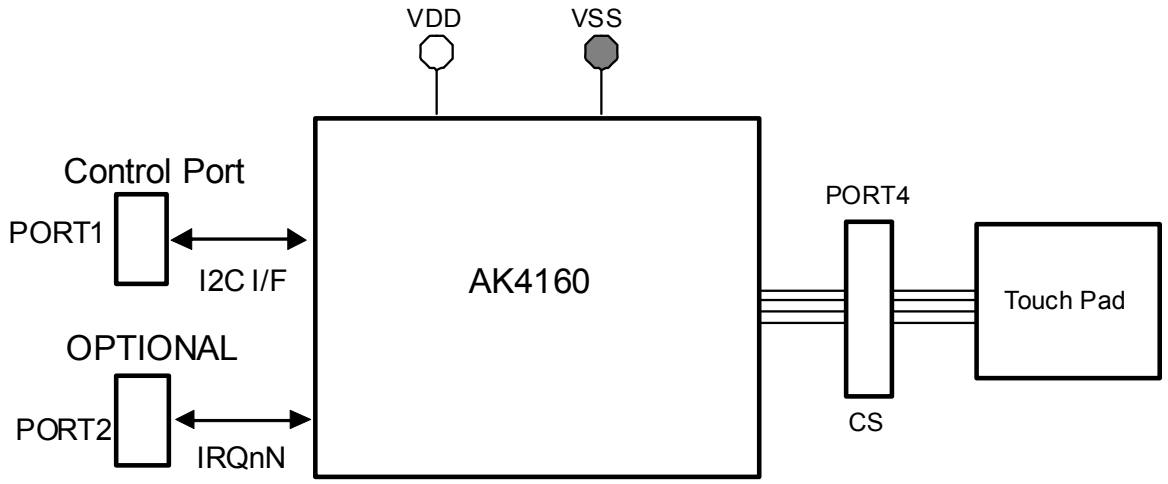

Figure 1. AKD4160 Block Diagram

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

BOARD OUTLINE CHART

■ Outline Chart

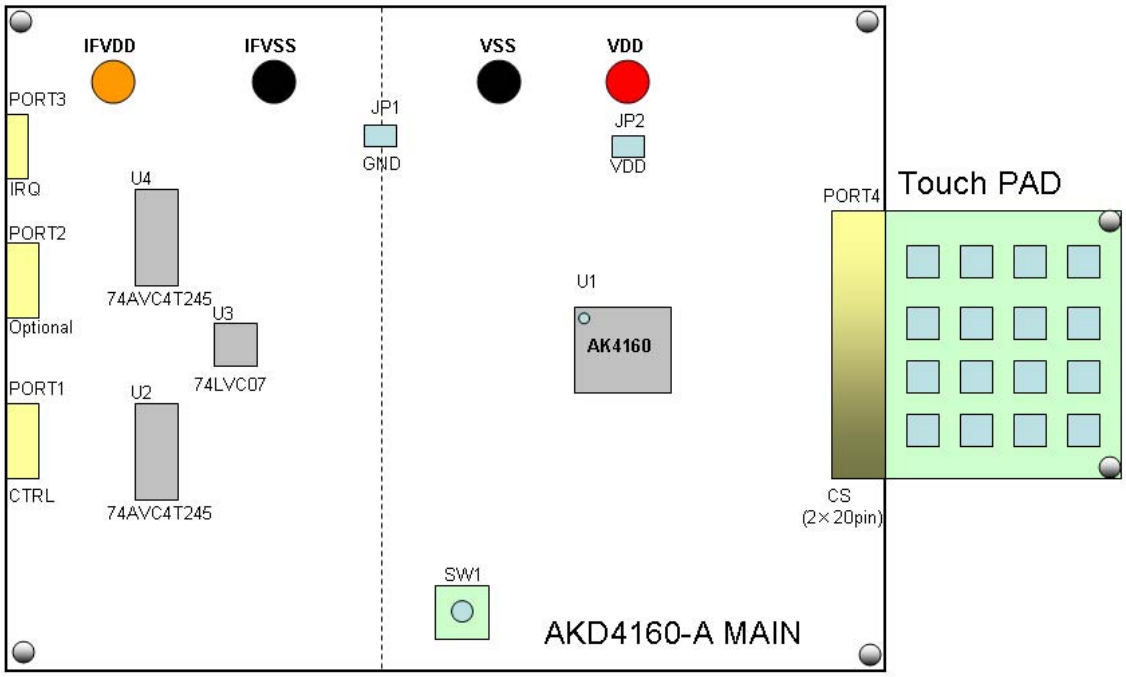

Figure 2. AKD4160-A Outline Chart

■ 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.

JP2
VDD

(Short)

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.

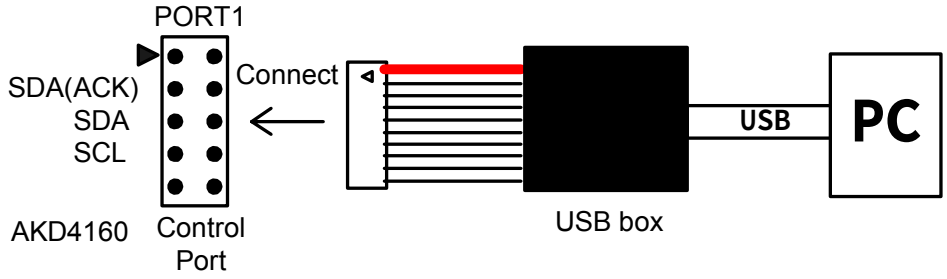

Figure 3. Connect of the USB box

■ Pin Assignment of Cap Sensor Connector

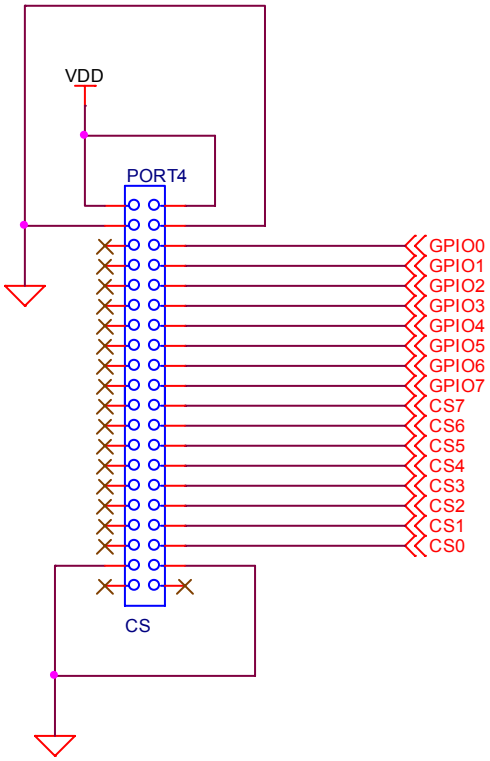

Figure 4. Cap Sensor Connector Pin Assign

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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.

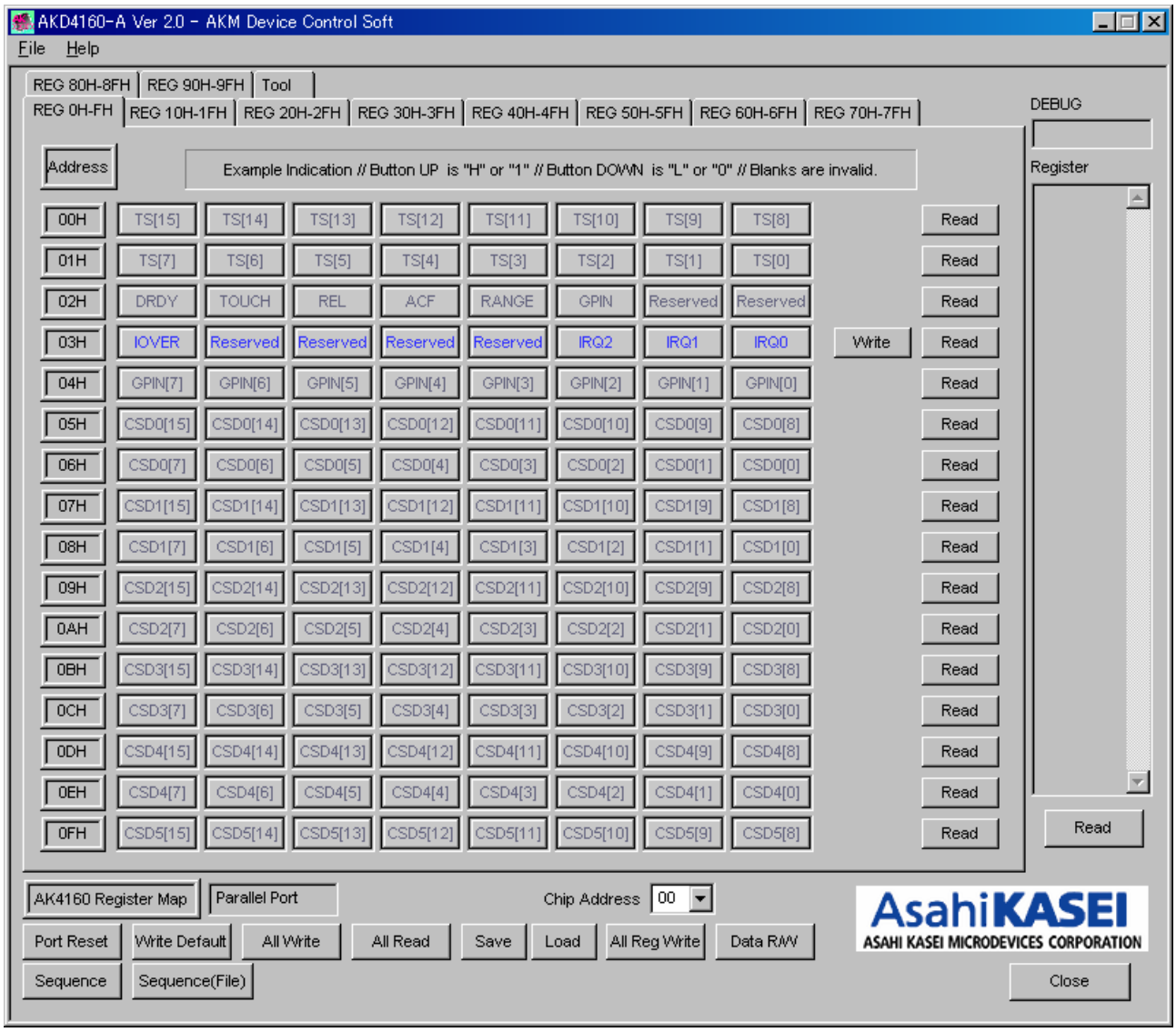

Figure 5. Operation Screen of Control Soft

■ 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 “---”.

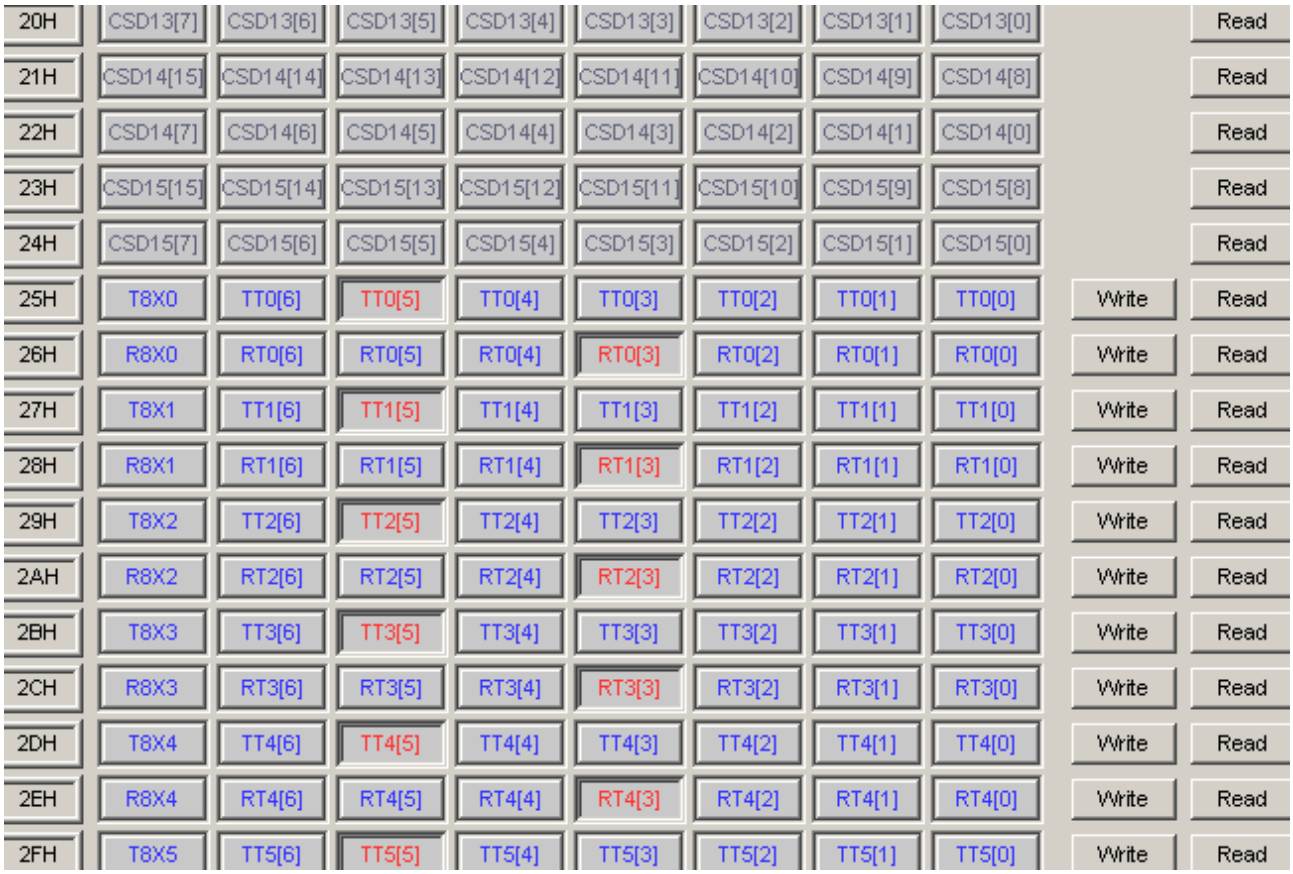

Figure 6. Register Map example

[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.

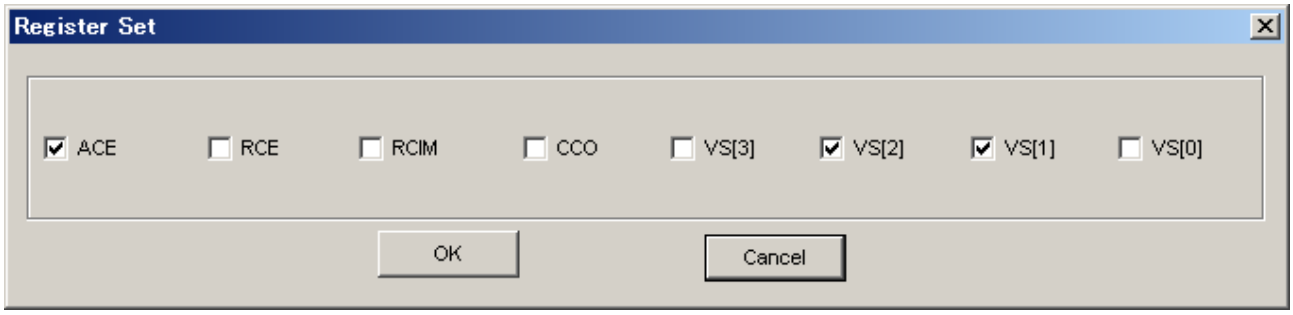

Figure 7. Register wring dialog example

[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.

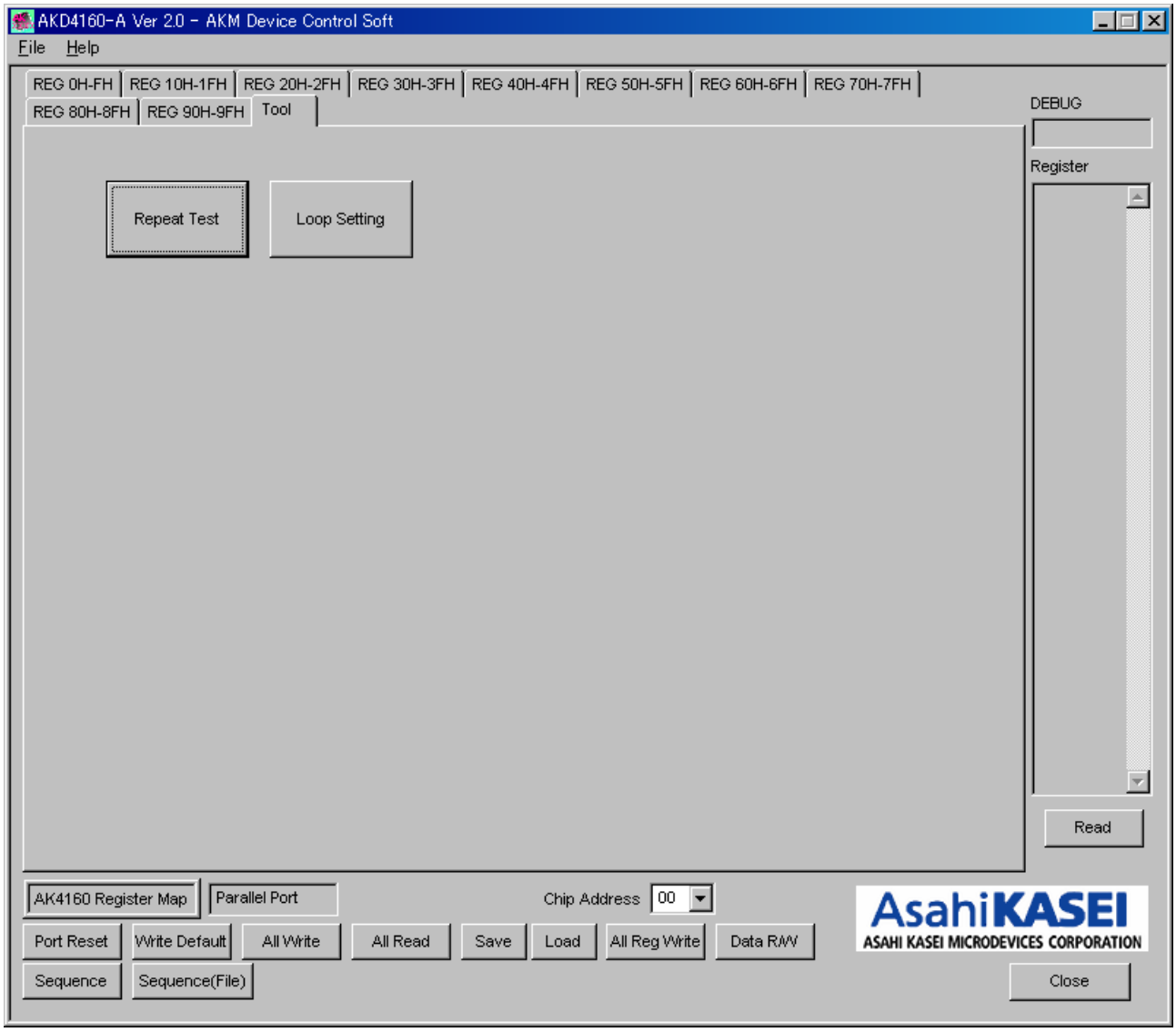

Figure 8. Repeat Test & Loop Setting

■ 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.

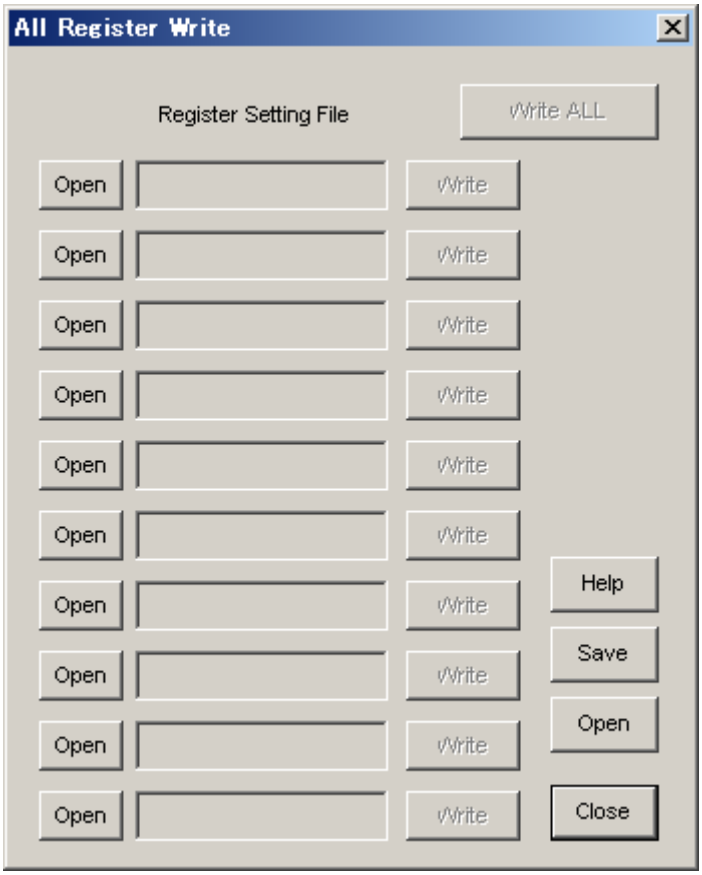

Figure 9. [All Reg Write] Window

[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.

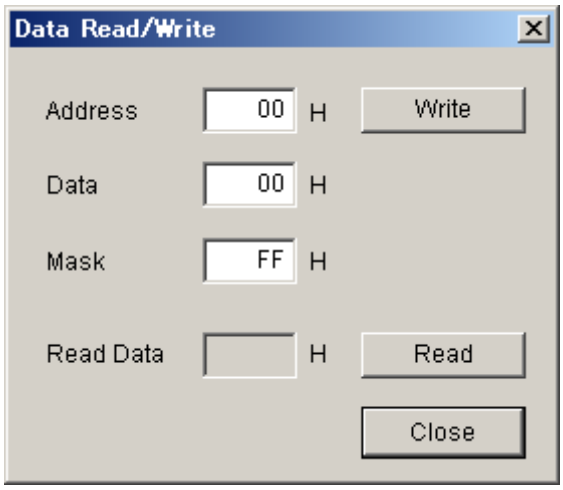

Figure 10. [Data R/W] Window

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.

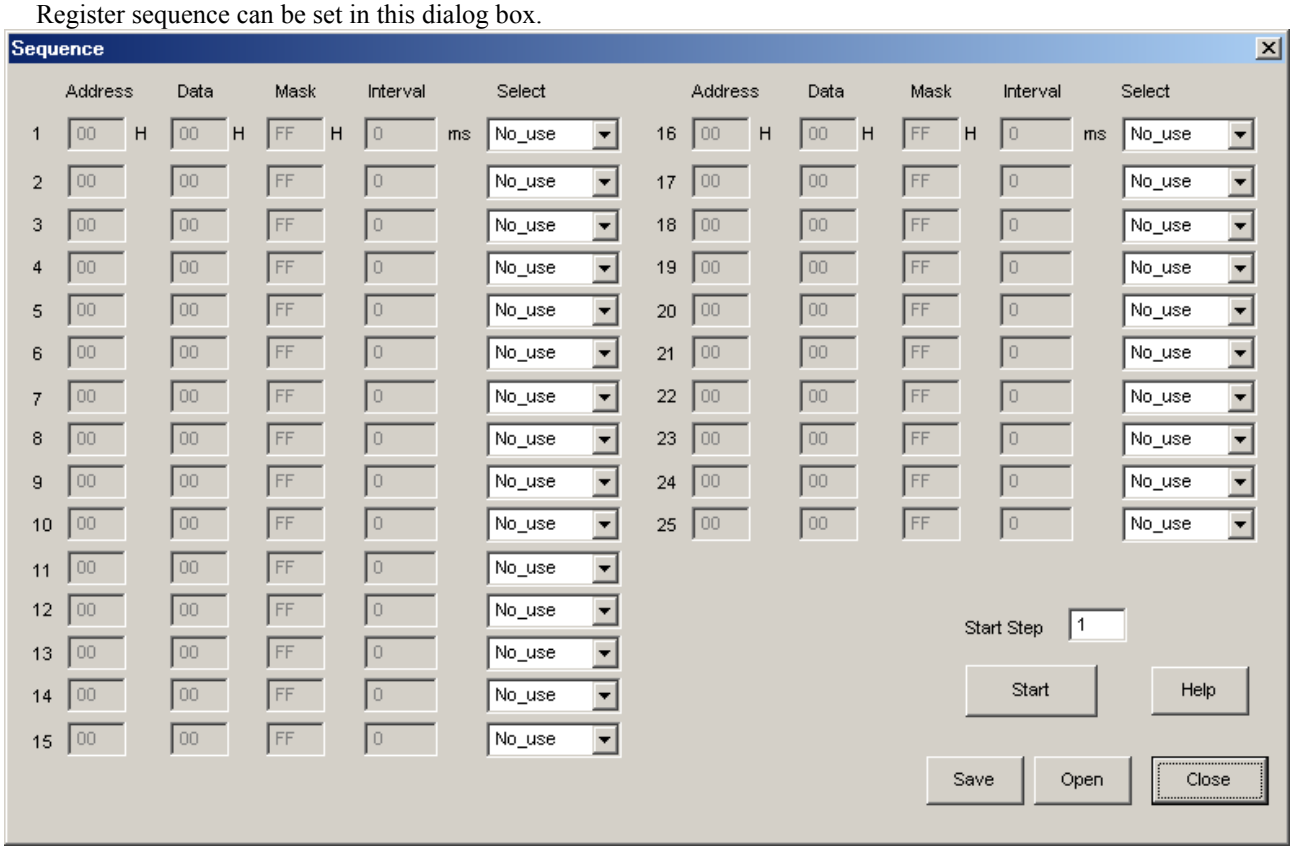

Figure 11. [Sequence] Window

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.

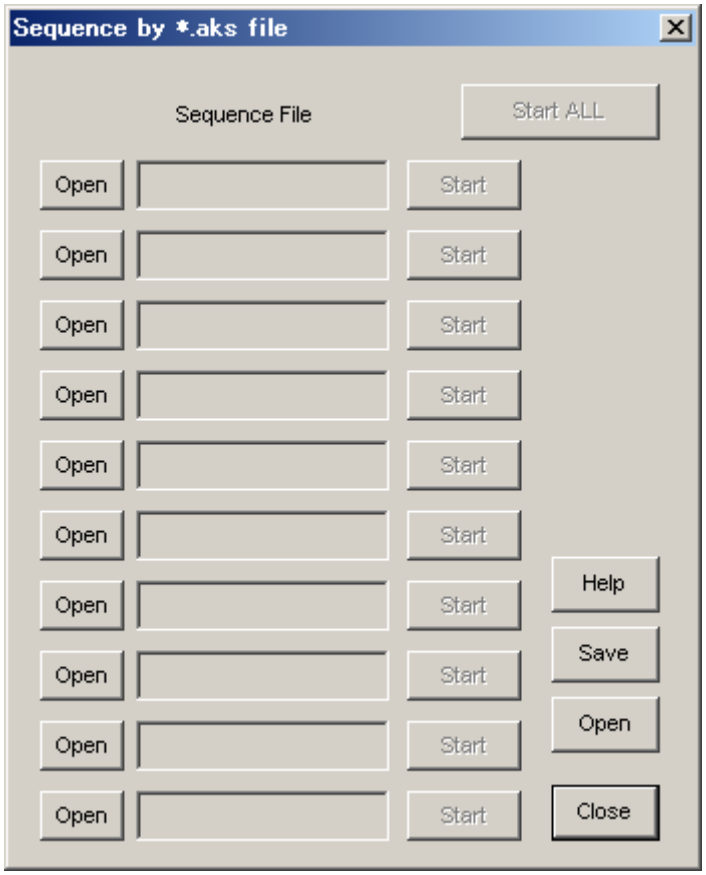

Figure 12. [Sequence(File)] Window

[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.

REVISION HISTORY

Date (yy/mm/dd)	Manual Revision	Board Revision	Reason	Page	Contents
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

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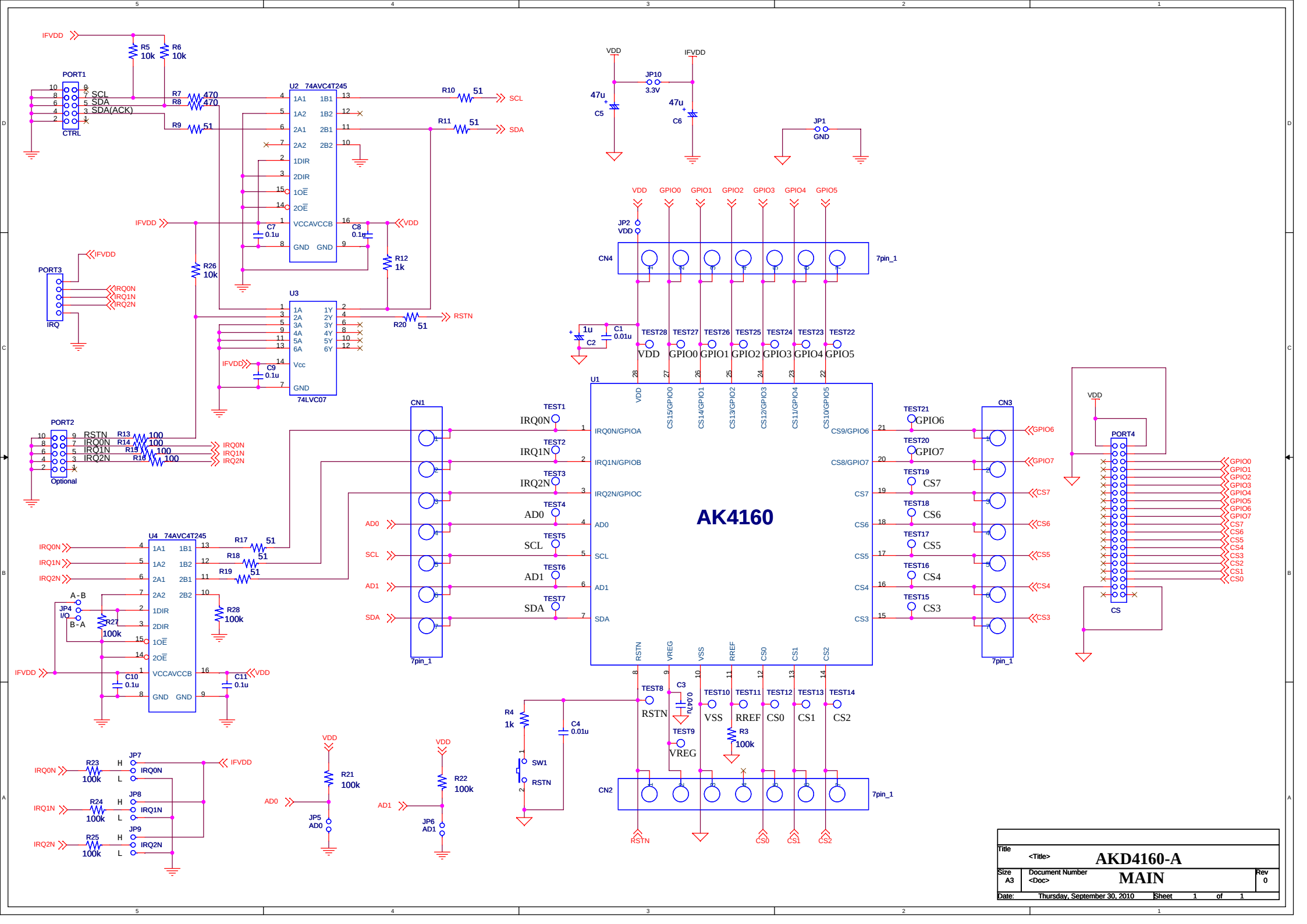
AK4160
U1
U2 74AVC4T245
U3
74LVC07
U4 74AVC4T245
PORT1
CTRL
PORT2
Optional
PORT3
IRQ
PORT4
CS
CN1
CN2
CN3
CN4
7pin_1
JP1
GND
JP2
VDD
JP10
3.3V
JP4
A-B
B-A
JP5
AD0
JP6
AD1
JP7
JP8
JP9
SW1
RSTN
IFVDD
VDD
SCL
SDA
SDA(ACK)
RSTN
IRQ0N
IRQ1N
IRQ2N
GPIO0
GPIO1
GPIO2
GPIO3
GPIO4
GPIO5
GPIO6
GPIO7
CS0
CS1
CS2
CS3
CS4
CS5
CS6
CS7
R5 10k
R6 10k
R7 470
R8 470
R9 51
R10 51
R11 51
R12 1k
R13 100
R14 100
R15 100
R16 100
R17 51
R18 51
R19 51
R20 51
R21 100k
R22 100k
R23 100k
R24 100k
R25 100k
R26 10k
R27 100k
R28 100k
R3 100k
R4 1k
C1 0.01u
C2 1u
C3 0.47u
C4 0.01u
C5 47u
C6 47u
C7 0.1u
C8 0.1u
C9 0.1u
C10 0.1u
C11 0.1u
TEST1 IRQ0N
TEST2 IRQ1N
TEST3 IRQ2N
TEST4 AD0
TEST5 SCL
TEST6 AD1
TEST7 SDA
TEST8 RSTN
TEST9 VREG
TEST10 VSS
TEST11 RREF
TEST12 CS0
TEST13 CS1
TEST14 CS2
TEST15 CS3
TEST16 CS4
TEST17 CS5
TEST18 CS6
TEST19 CS7
TEST20 GPIO7
TEST21 GPIO6
TEST22 GPIO5
TEST23 GPIO4
TEST24 GPIO3
TEST25 GPIO2
TEST26 GPIO1
TEST27 GPIO0
TEST28 VDD
IRQ0N/GPIOA
IRQ1N/GPIOB
IRQ2N/GPIOC
AD0
SCL
AD1
SDA
CS9/GPIO6
CS8/GPIO7
CS7
CS6
CS5
CS4
CS3
VDD
CS15/GPIO0
CS14/GPIO1
CS13/GPIO2
CS12/GPIO3
CS11/GPIO4
CS10/GPIO5
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VSS
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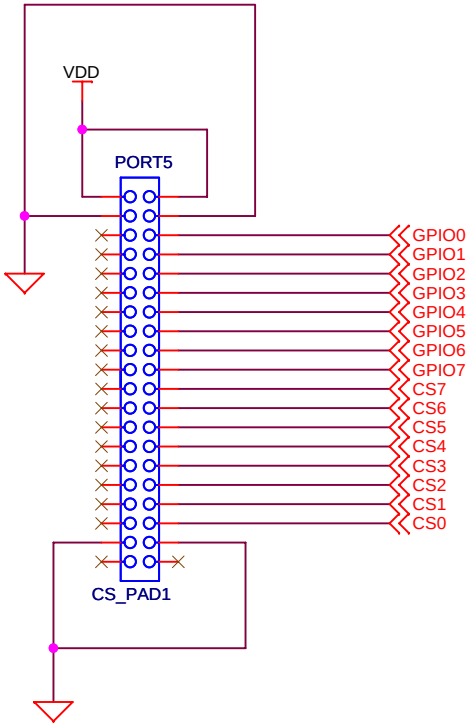

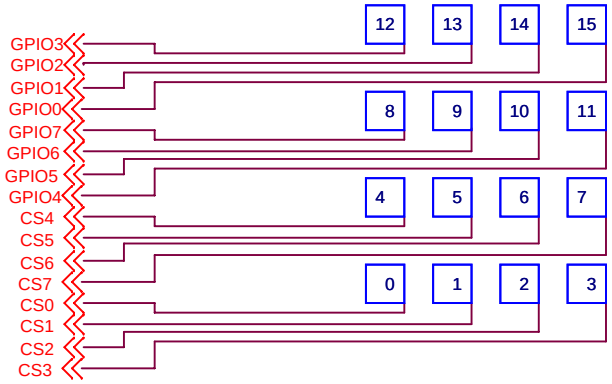

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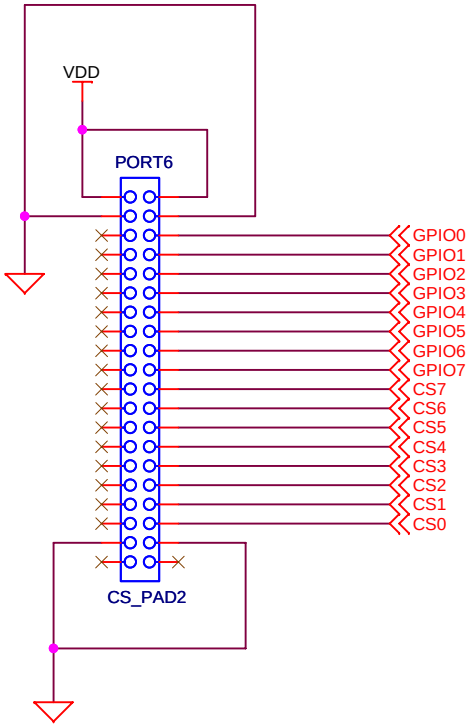
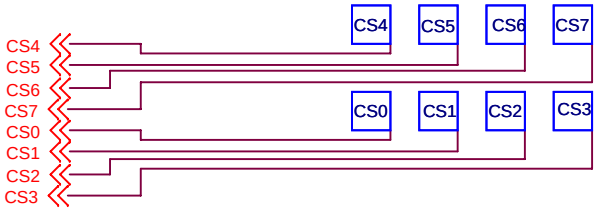
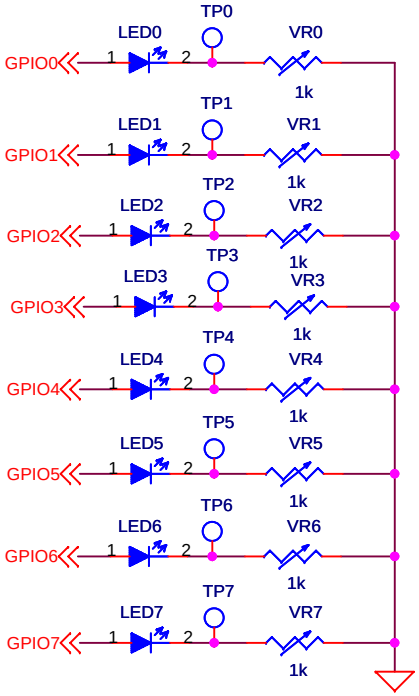
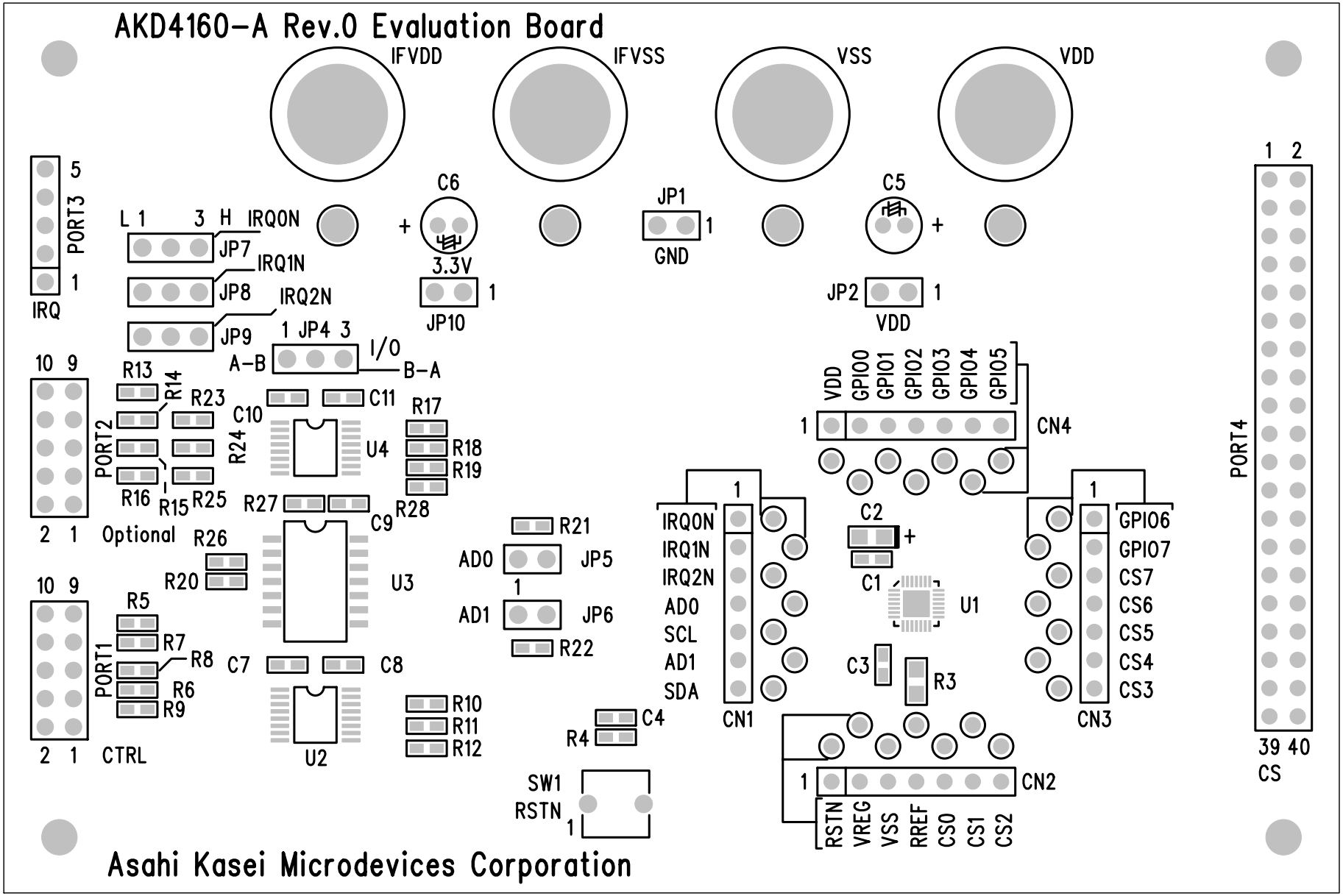
Size A4	Document Number <Doc> **16 PAD**	Rev 0
Date: Wednesday, September 08, 2010	Sheet 1 of 1	



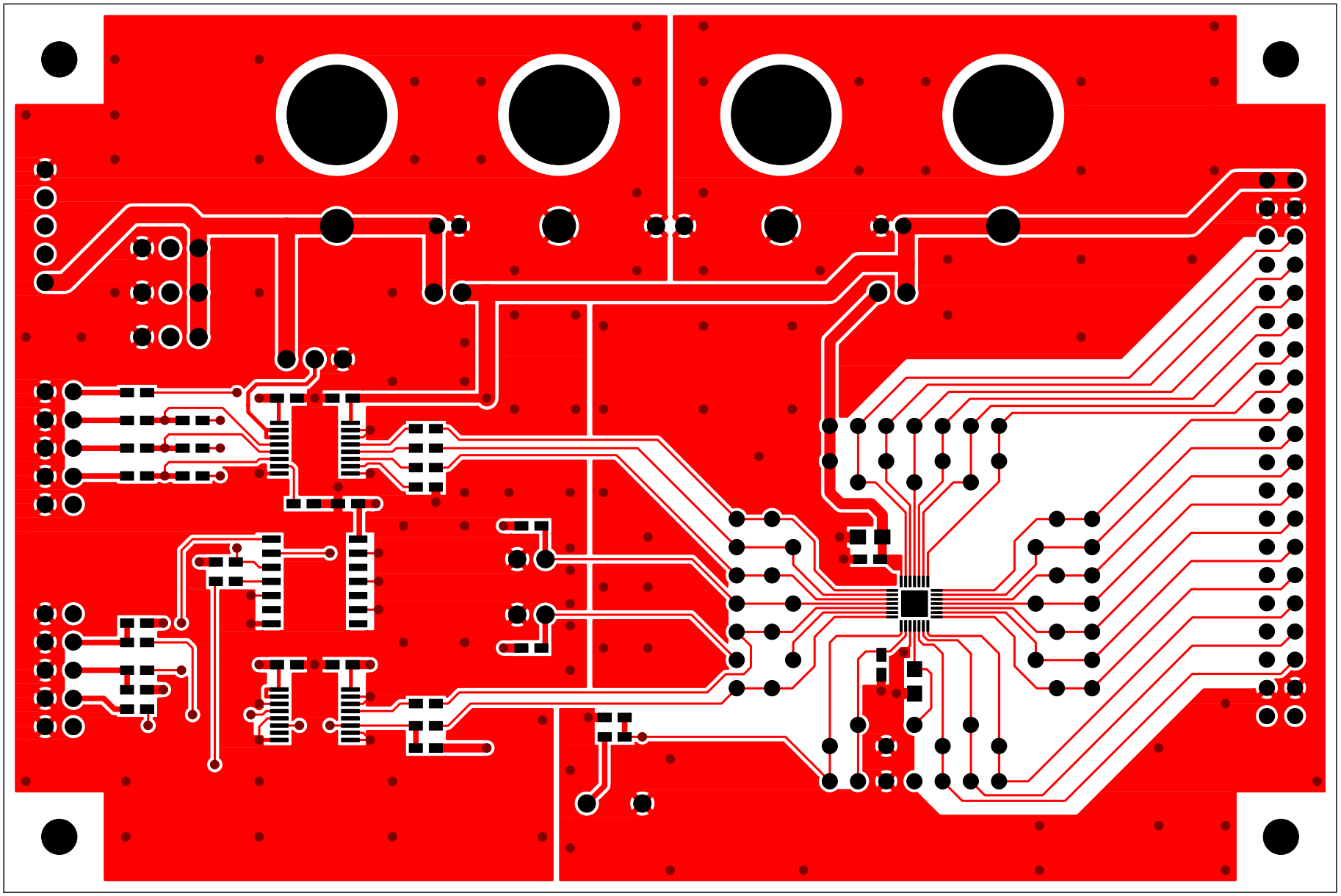




Title	<Title>	**AKD4160-A-Touch Pad**	
Size A4	Document Number <Doc>	**8PAD & 8LED**	Rev 0
Date: Wednesday, September 08, 2010	Sheet 1 of 1		

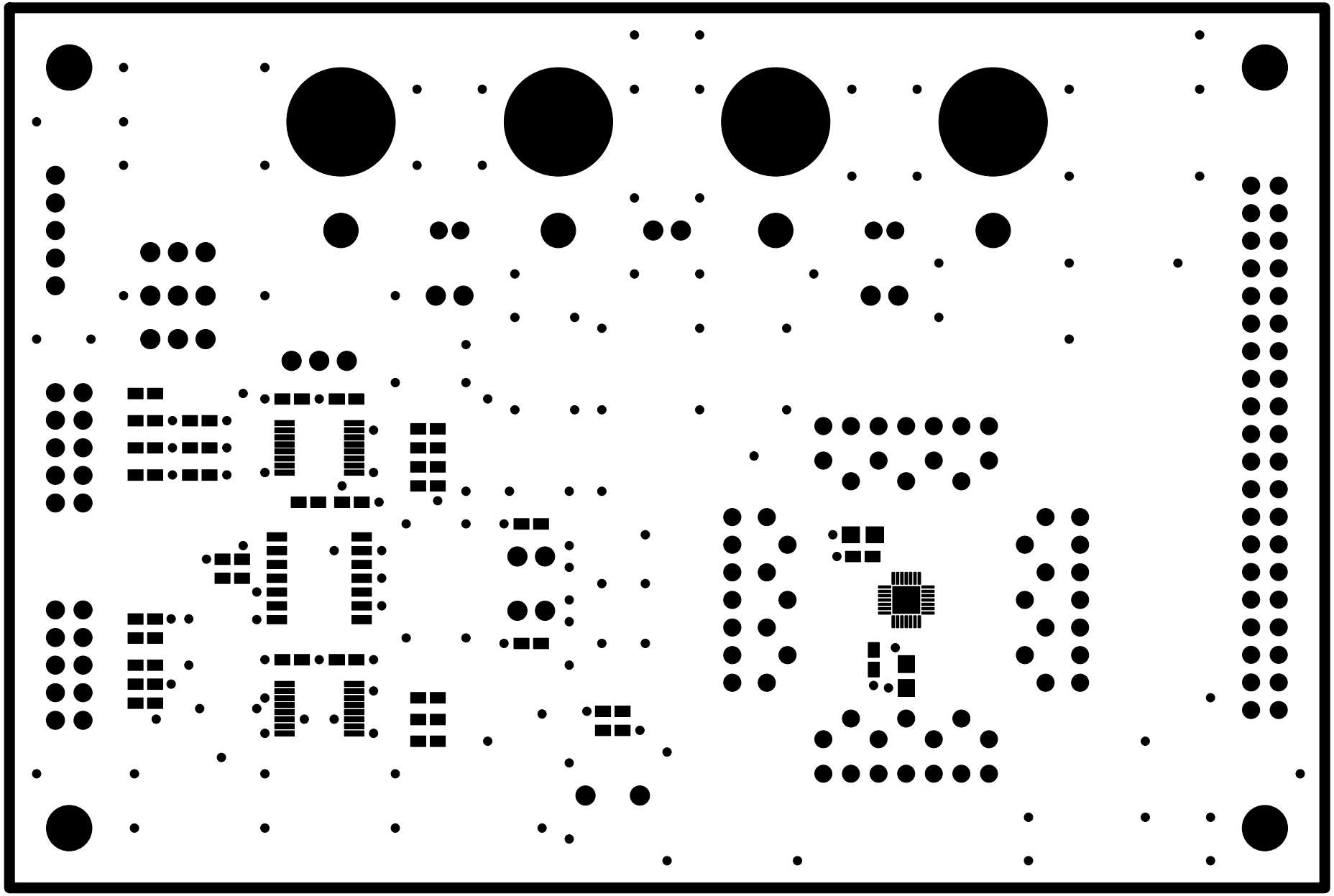


AKD4160-A Rev.0 Evaluation Board LAY1-SK



AKD4160-A Rev.0 Evaluation Board LAY1

AKD4160-A Rev.0 Evaluation Board LAY2



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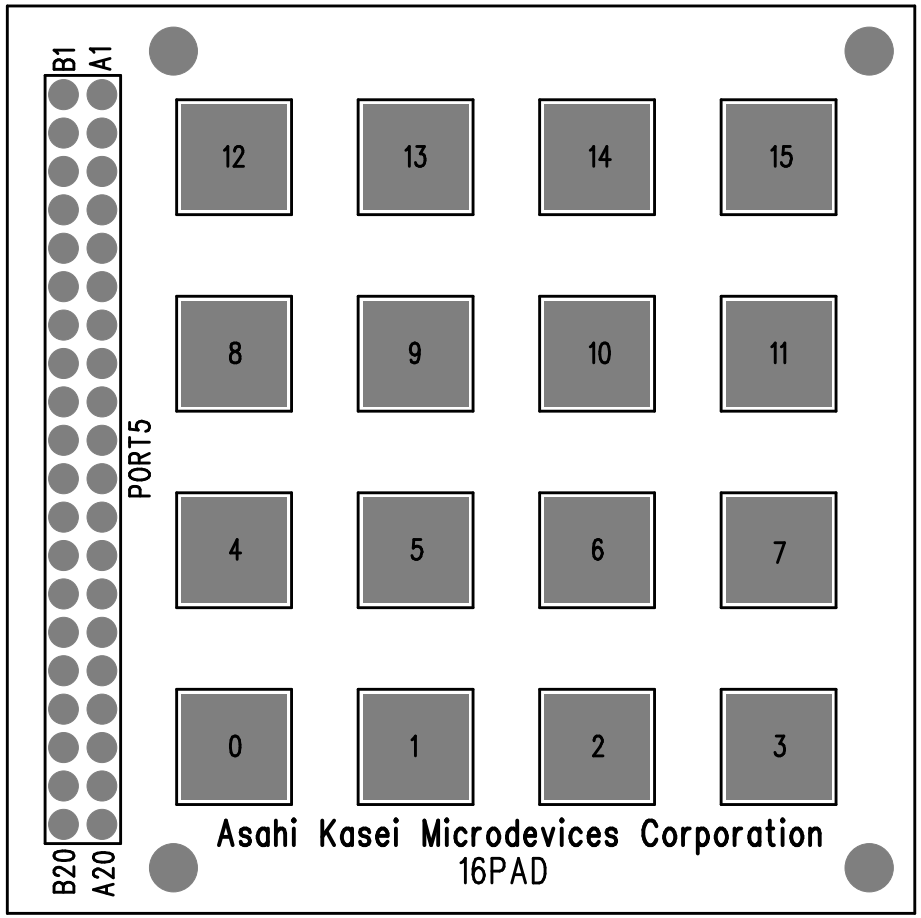

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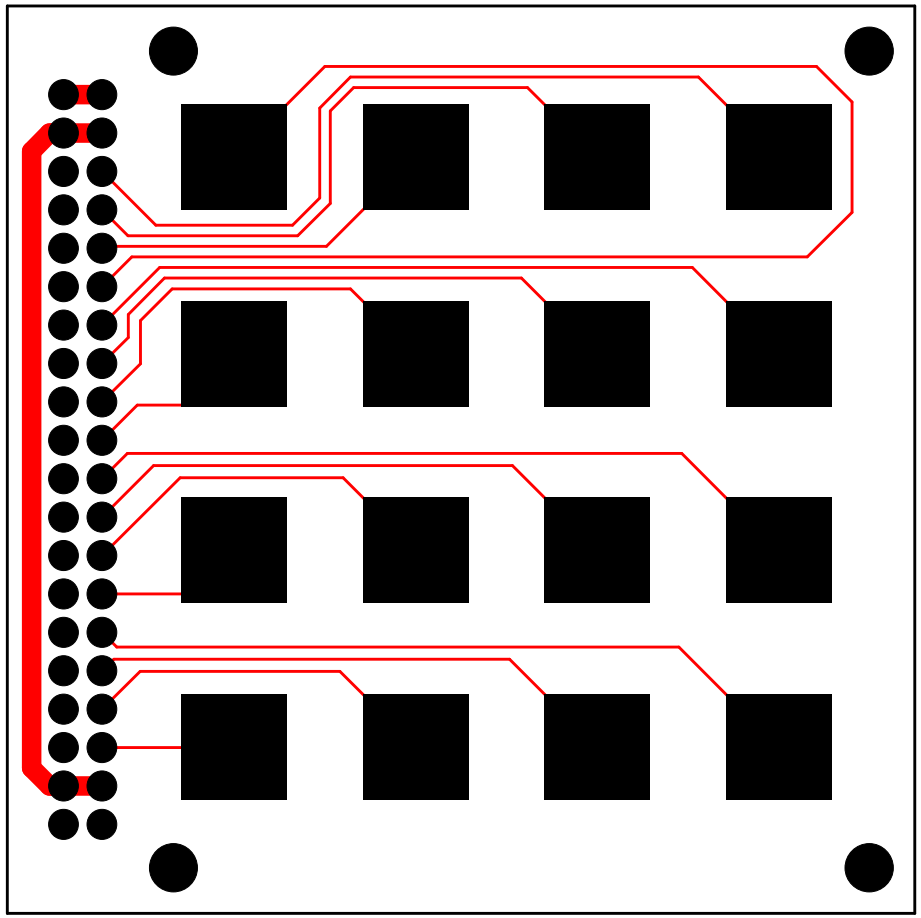

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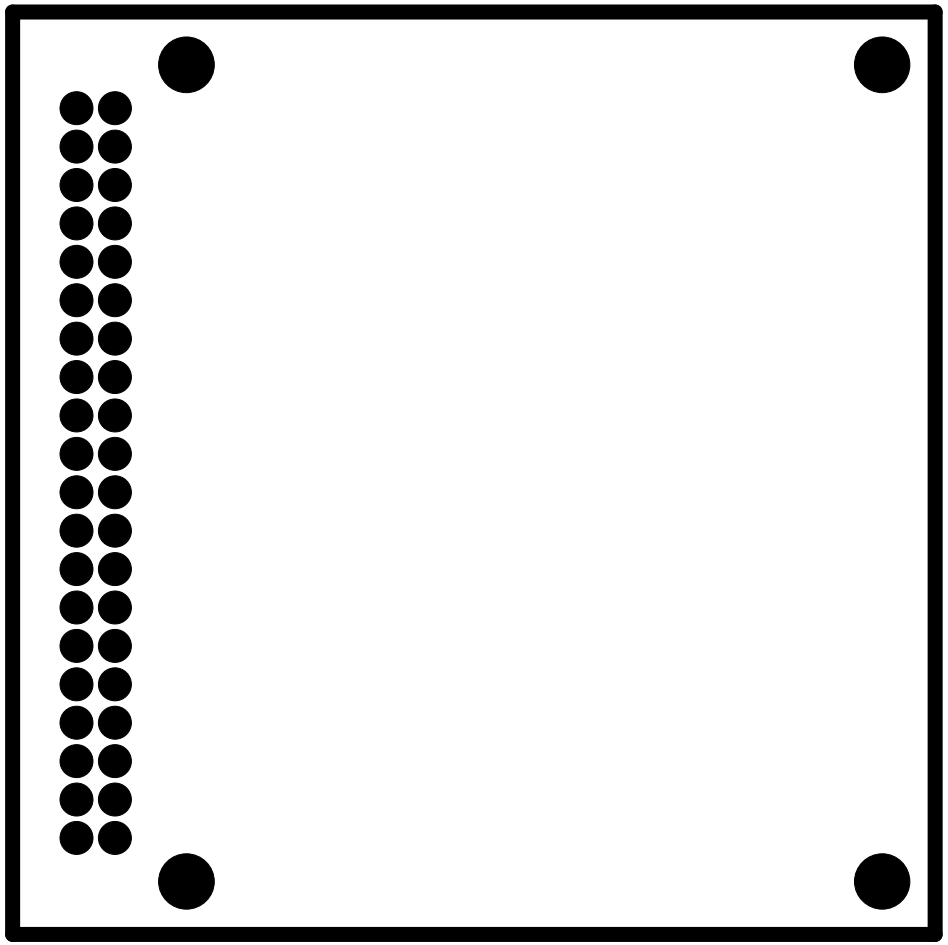

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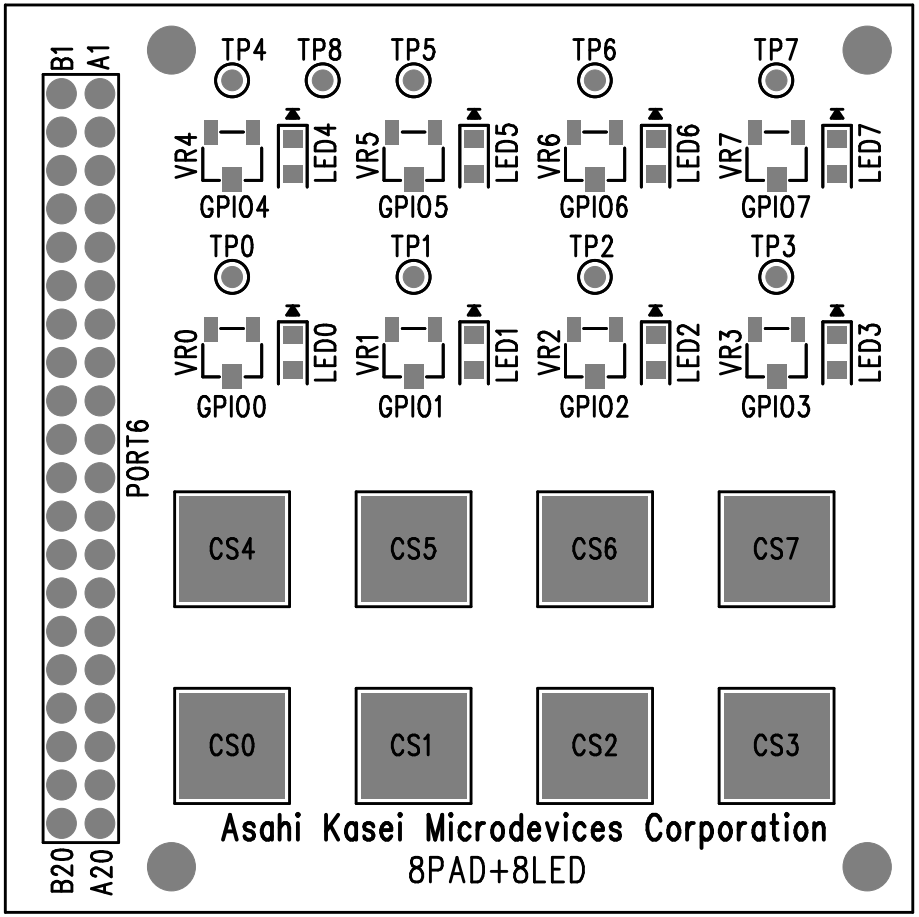

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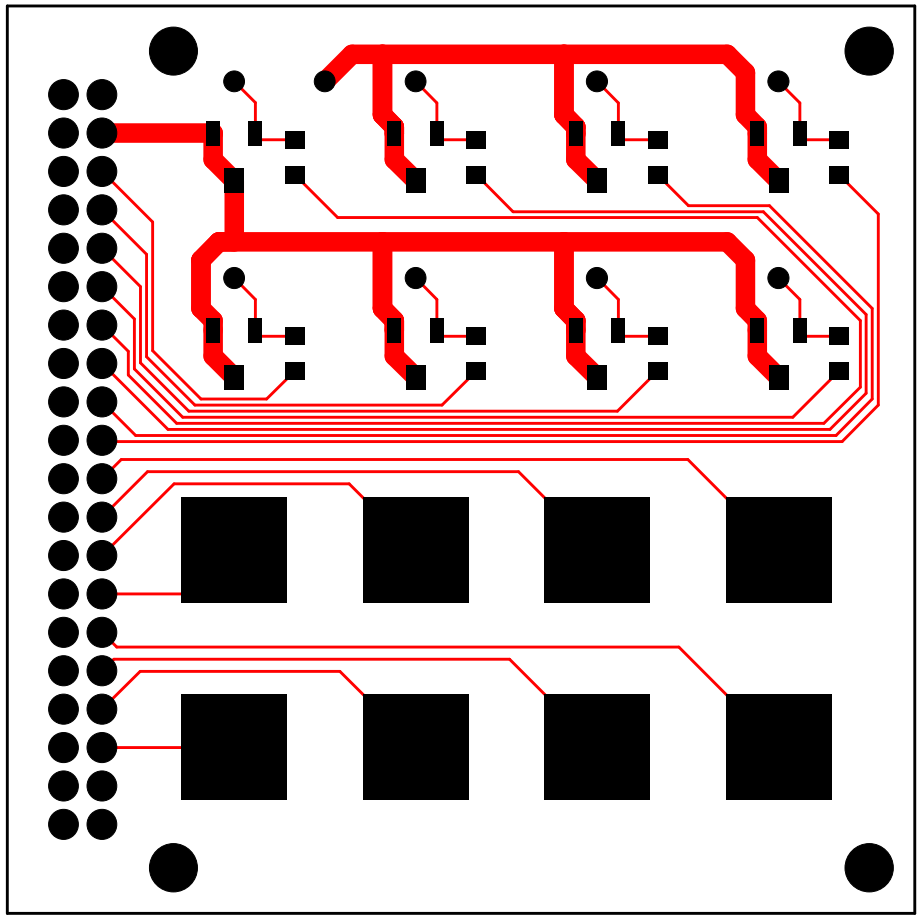

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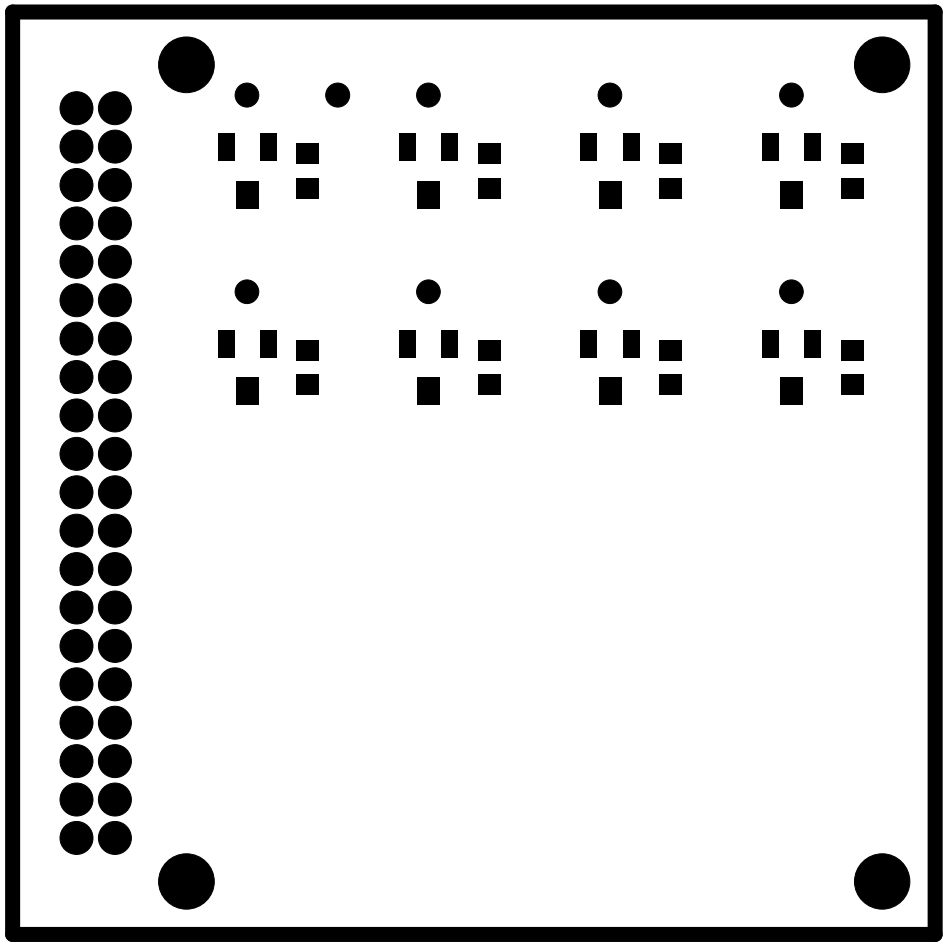

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