P3016-020 /P3016-0G0 /P3016-010
P3020-A20 /P3020-AG0 /P3020-A10
Projected Capacitive Touch Solution
Datasheet

Rev. : 1.3
Released date: 2014/02/12

Preface

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Revision Table

Date	Revision	Changes
2012/11/02	0.0	Initial Release
2012/12/14	1.0	Modify PM1500 Mechanical Drawing
2013/04/19	1.1	Modify Power Consumption, Sample Rate and Maximum Touch Line
2013/08/22	1.2	Modify PM1500 Information & control board system block diagram
2014/02/12	1.3	Added P3020 18.5” PCI touch panel

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Chapter 1: Scope

1.1 Products

The 15.6” and 18.5” projected capacitive touch panels (AMT named it as ‘PCI’) with PenMount control boards, their part no. are:

- P3016-020: 15.6” PCI with 1.8mm plain glass on top
- P3016-0G0: 15.6” PCI with 1.8mm décor glass on top
- P3016-010: 15.6” PCI without top glass, this item is only offered to specific partners
- P3020-A20: 18.5” PCI with 1.8mm plain glass on top
- P3020-AG0: 18.5” PCI with 1.8mm décor glass on top
- P3020-A10: 18.5” PCI without top glass, this item is only offered to specific partners

The above touch panels are used the same PenMount control board, the part no. of this control board is PenMount 1500 (AMT named it as PM1500).

1.2 Part no. Definition

The entire part number of this PCI products is presented as 92-P30nn-xyz, code “nn” is the sequence number of AMT standard stock PCI items and the last 3 codes of the part number represent which types of controller/ glass/version are used and they are shown as follows:

92 - P 3 0 n n - x y z

x Code	Description
0	Glass-Film-Film-Film structure
A	Glass-Film-Film structure

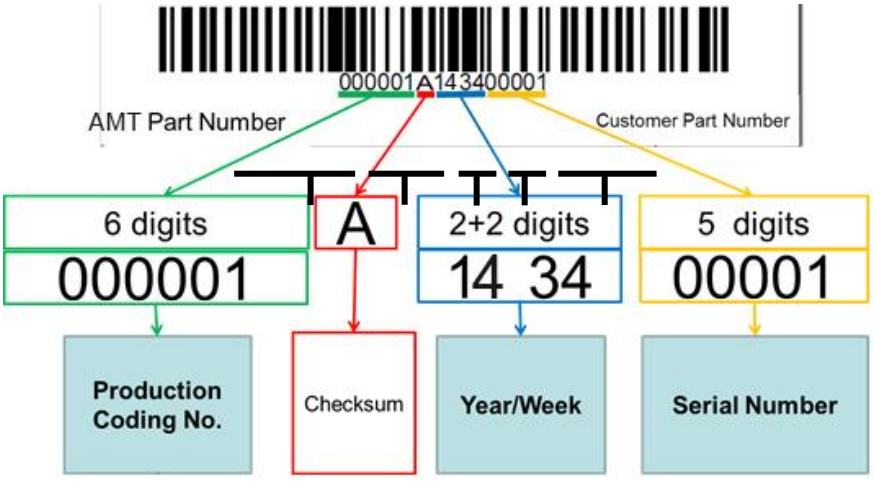
y Code	Description
1	No top glass on the PCI touch
2	Use AMT defined plain glass
G	Use décor glass

z Code	Description
0	Version

For example, if the product part no. is P3016-020, the last three codes represent that PenMount control board, AMT defined plain glass and version A are used in this product.

1.3 Serial no. Identification

The sticker is on the PCI tail side, it shows the serial no. of this PCI touch panel as the picture below. The example below explains the serial no.representations of AMT’s products:



1. As of February 10th, 2014, the new bar code has 16 digits in total.

2. The first six digits represent the production coding number of the product. In order to facilitate the ease of tracking for products, all existing valid AMT models will be assigned a unique production coding number when the new bar code system takes effect. In the future, when a new model number is created, a corresponding production coding number will also be assigned to the new model at the same time. The same model will always have the same production coding number. For example, if the touch panel with the part number 92-P3016-020 is assigned the production coding number 000001, the same model (92-P3016-020) will still have the same production coding number 000001 in all future batches.

3. The 7th digit “Checksum” is an internal check number represented by letters A, S, or T. This number is for AMT's internal check purposes only.

4. The 8th and 9th digits indicate the year (e.g. 14=2014).
   The 10th and 11th digits indicate the week (e.g. 34=34th week of the year).

5. The last five digits constitute the serial number assigned to each piece of product. Thus, each piece of product will have its own unique identification code, allowing for easy and efficient tracking of all products manufactured by AMT.

6. In the bottom left area indicated by “**AMT Part Number”**, the complete 12-digit AMT part number of the product (e.g. 92-P3016-020) will be printed for quick reference.

7. The bottom right area indicated by “**Customer Part Number**” is an optional function. It is reserved for customers who have needs and request to print their designated part number on the bar code label (maximum 20 digits).

Chapter 2: Product Specifications

2.1 Mechanical Specification

Touch Panel Mechanical Specification:

Part No.	P3016-020	P3016-0G0	P3016-010	P3020-A20	P3020-AG0	P3020-A10
Touch Panel Size	15.6”			18.5”		
Total Thickness (mm)	2.4± 0.2	2.4± 0.2	0.6± 0.15	2.2± 0.2	2.2± 0.2	0.4± 0.1
Thickness of Top glass (mm)	1.8	1.8	n/a	1.8	1.8	n/a
Outside Dimension L x W (mm)	367.23 x 223.54	395.23 x 258.54	366.23 x 222.54	437.80 x 265.40	466.80 x 301.40	436.80 x 264.40
View Area L x W (mm)	351.23 x 200.54	345.23 x 194.54	351.23 x 200.54	416.80 x 237.40	410.80 x 231.40	416.80 x 237.40
Active Area L x W (mm)	350.23 x 199.54	344.23 x 193.54	350.23 x 199.54	415.80 x 236.40	415.80 x 236.40	415.80 x 236.40
Surface Finish	Clear Type		n/a	Clear Type		n/a
Haze	<3%					
Light Transmission rate	87 ± 3%			90 ± 3%		
Construction	GFFF		AFFF	GFF		AFF

Note: n/a: Not Available AFFF: OCA-Film-Film-Film GFFF: Glass-Film-Film-Film
AFF: OCA-Film-Film GFF: Glass-Film-Film

PM1500 Control Board Mechanical Specification:

Control Board Part No.	PM1500 Control Board
Support Touch Screen Size	For 15" to 18.5” PCI
Touch Controller	PenMount P2-02 * 2 pcs PenMount P2-04 * 1 pcs
Connector pins	Three 40 pins + 40 pins + 40 pins ZIF connector for PCI touch screen FPC tail, one USB connector for 4-pin USB cable (optional) , and one RS-232 connector for 5-pin RS-232 cable (optional) , and one I²C connector for 7-pin I²C cable (optional).
Mechanical Size L*W (mm)	30 x 125
Max. support Sensing Lines	66
Max. support Driving Lines	46

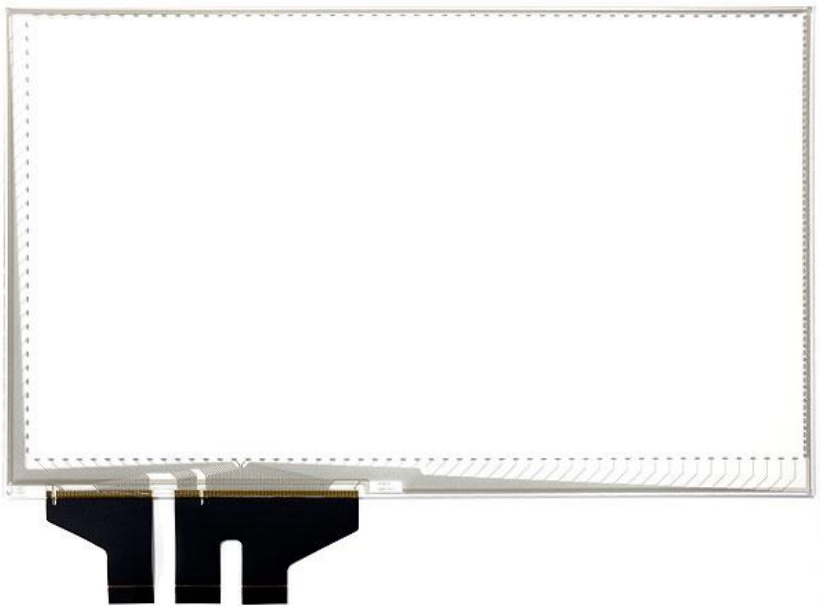
2.2 Mechanical Dimension

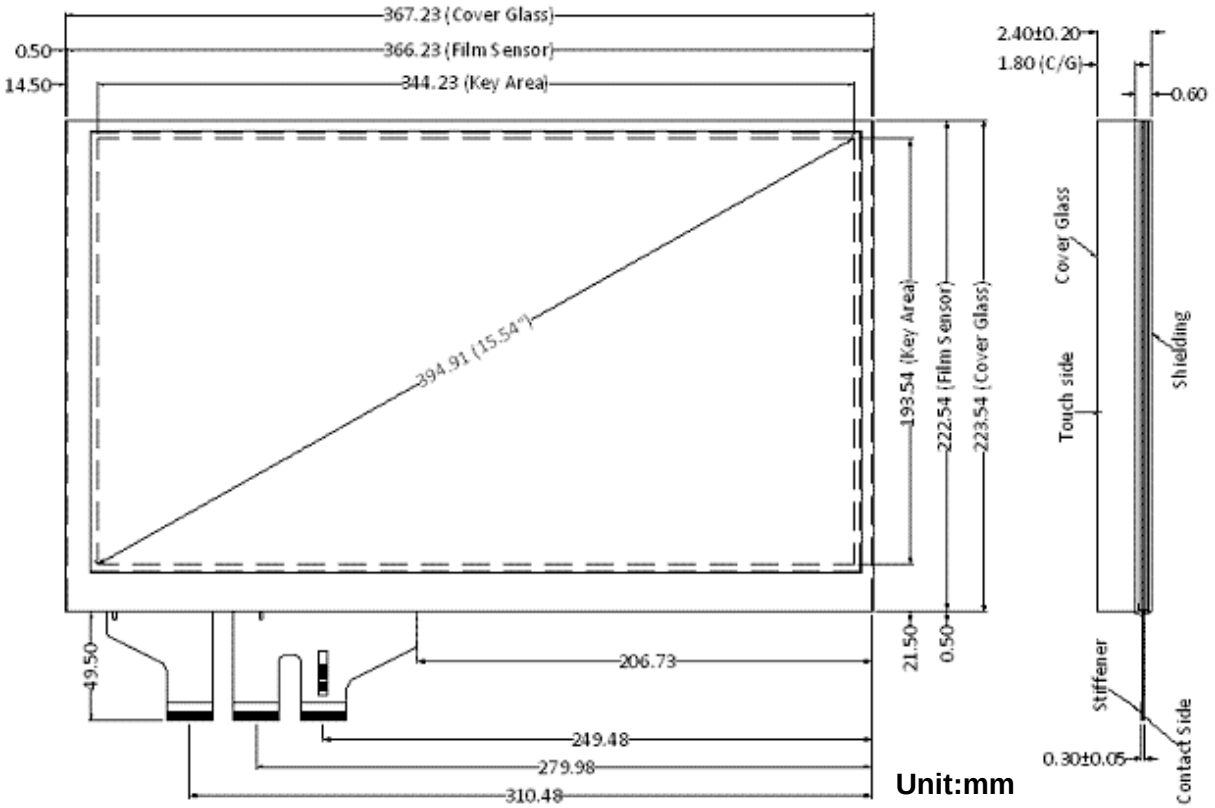
The followings are the drawings of P3016-020, P3016-0G0, P3016-010, P3020-A20, P3020-AG0, P3020-A10 and PM1500 control board. If you need more detailed drawings or information, please visit our website and choose “support & download”, click on the item you need and then download.

2.2.1 Touch Panel Mechanical Drawing and Real Product View

P3016-020 : 15.6” PCI with 1.8mm top glass

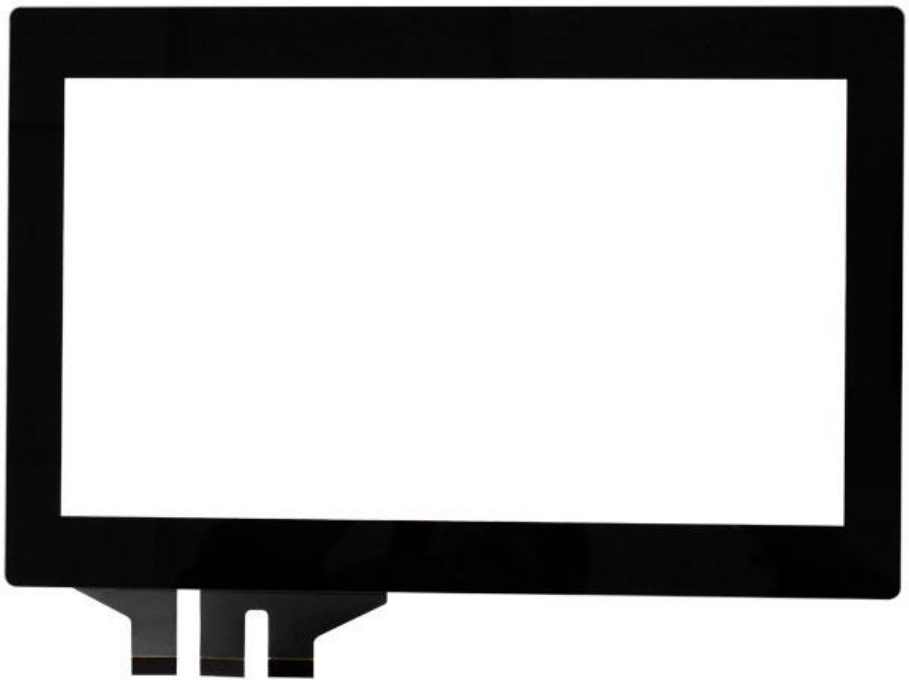
Front View

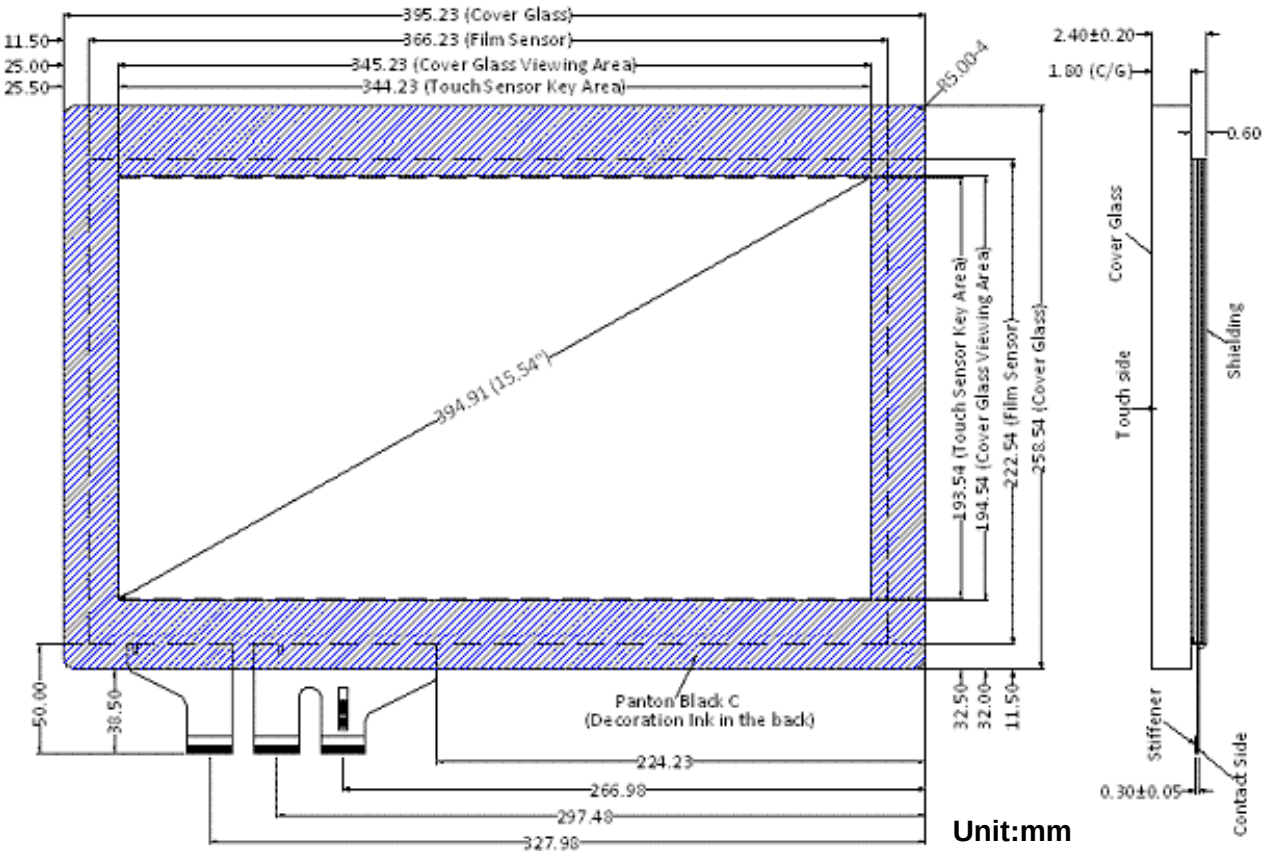




P3016-0G0: 15.6” PCI with 1.8mm black printed glass

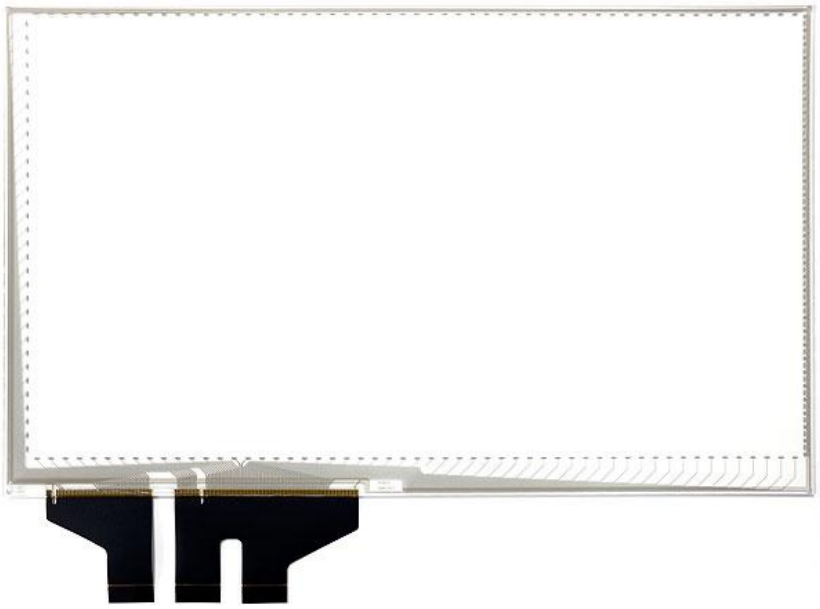
Front View

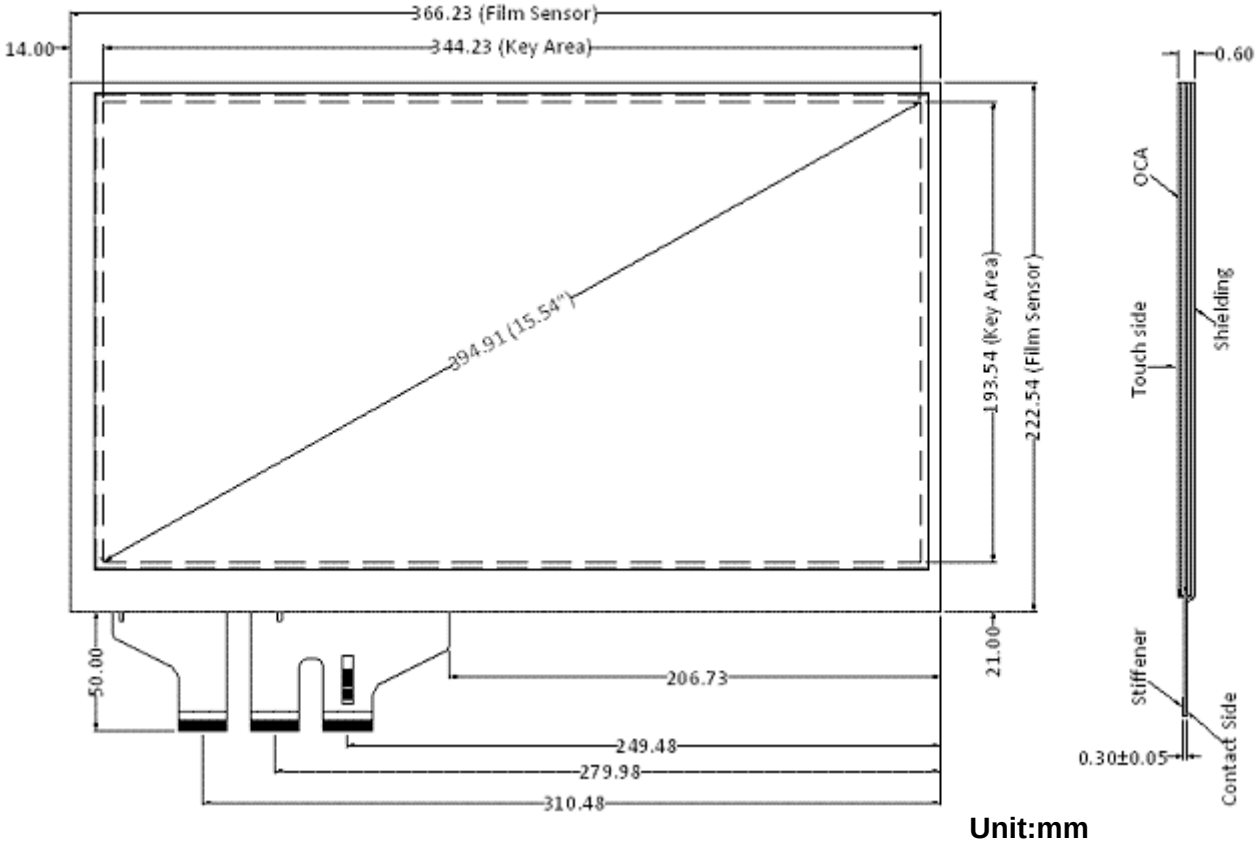




P3016-010 : 15.6” PCI without top glass

Front View



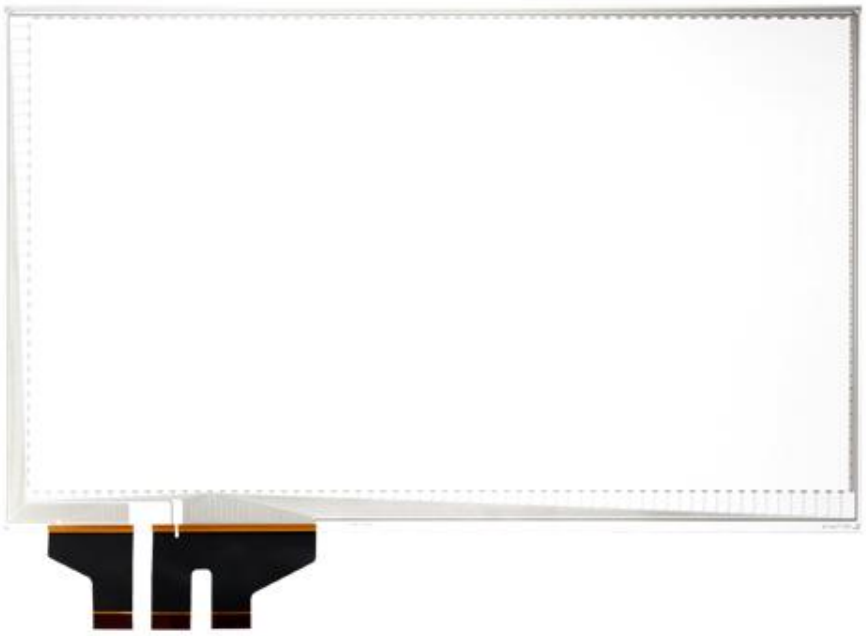


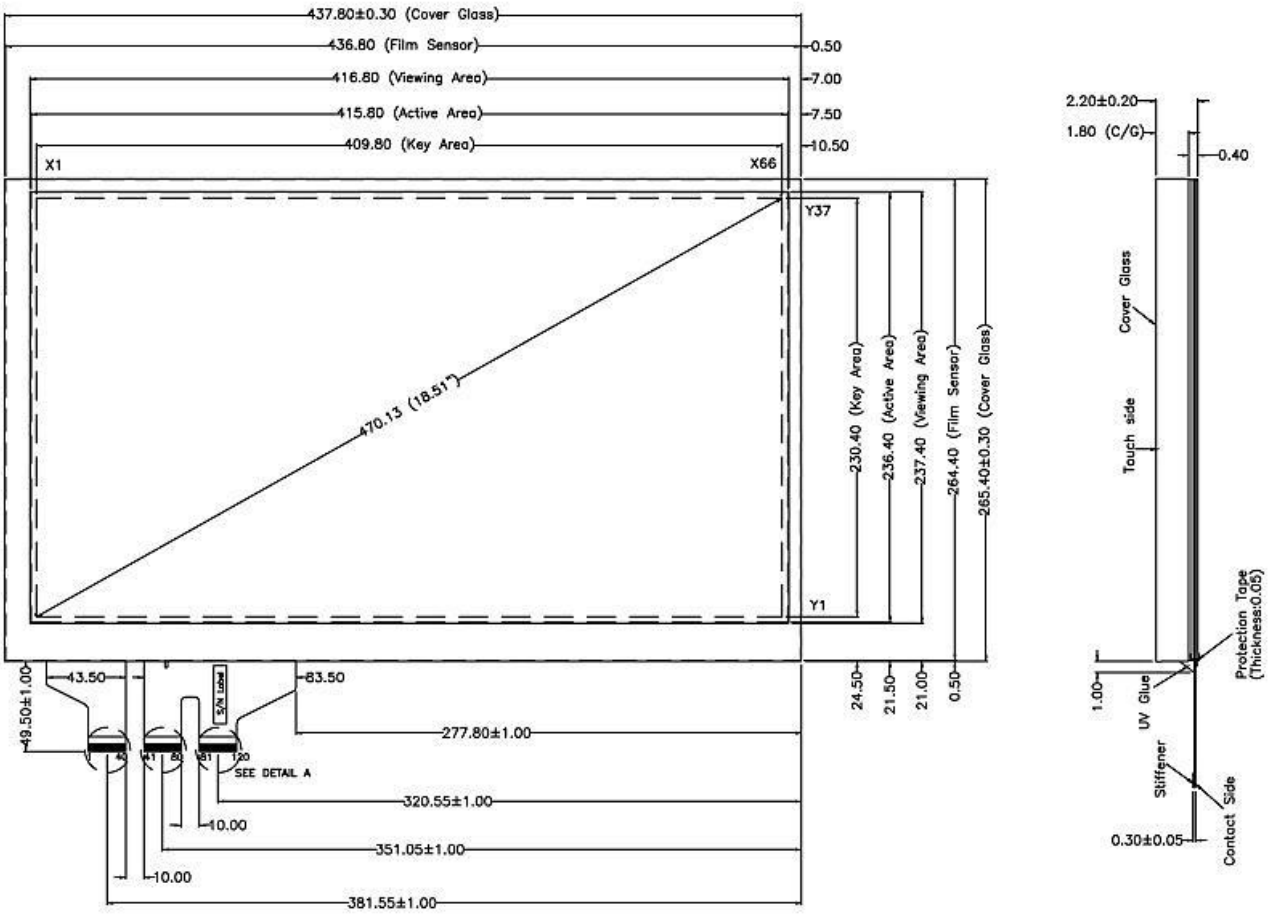
Unit:mm

Remark: Item P3016-010 is only available for AMT’s selected partners.

P3020-A20 : 18.5” PCI with 1.8mm top glass

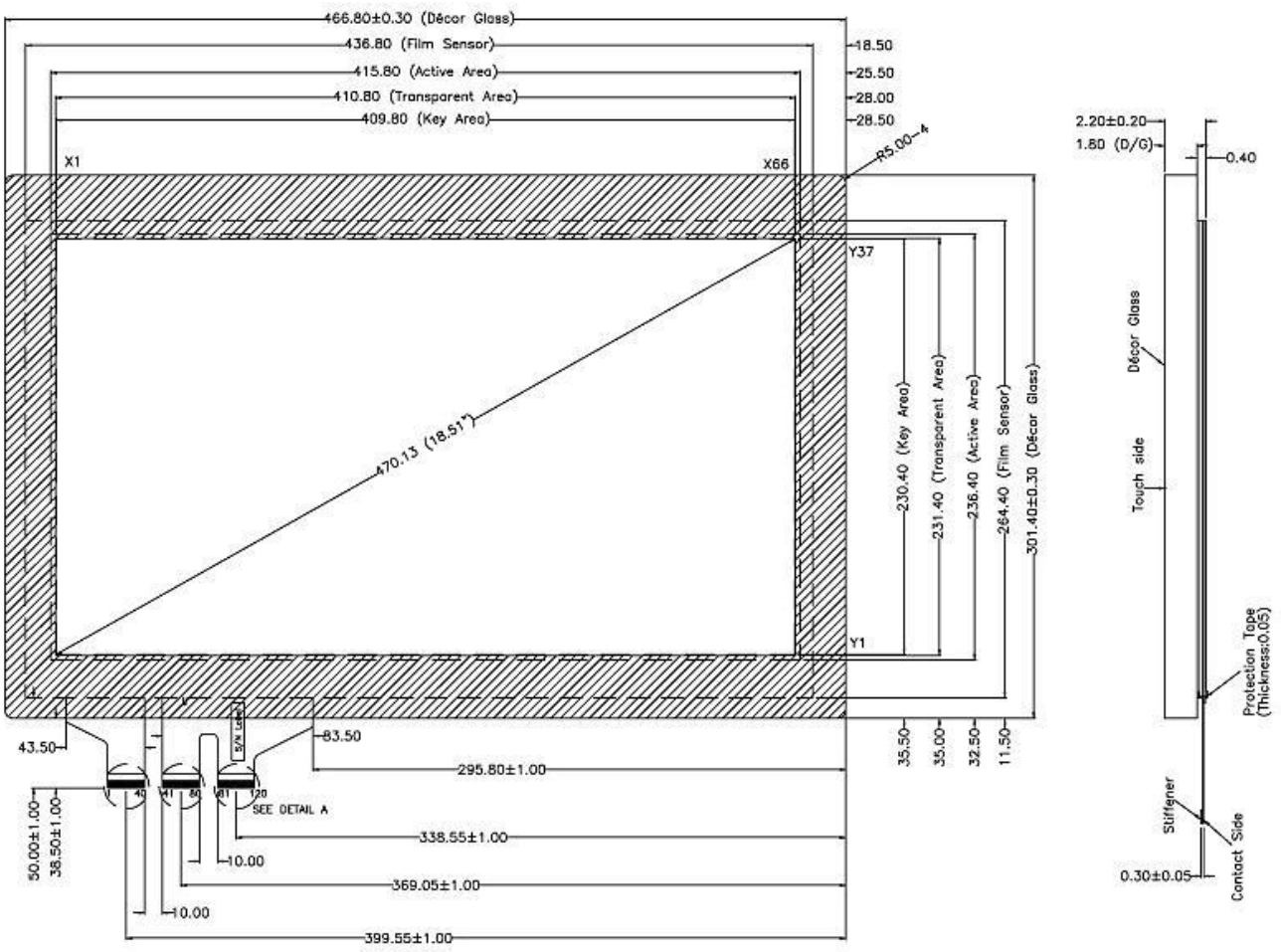
Front View





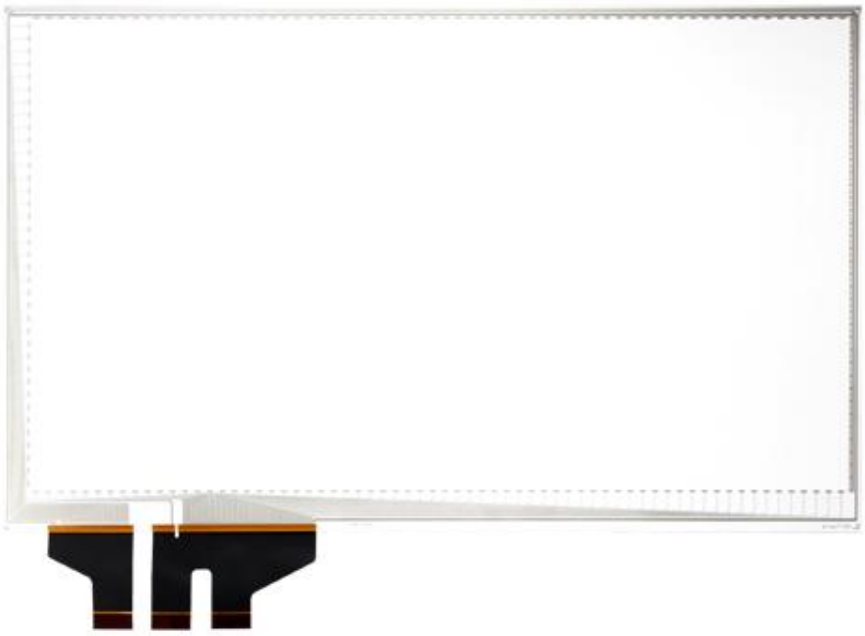
P3020-AG0: 18.5” PCI with 1.8mm black printed glass

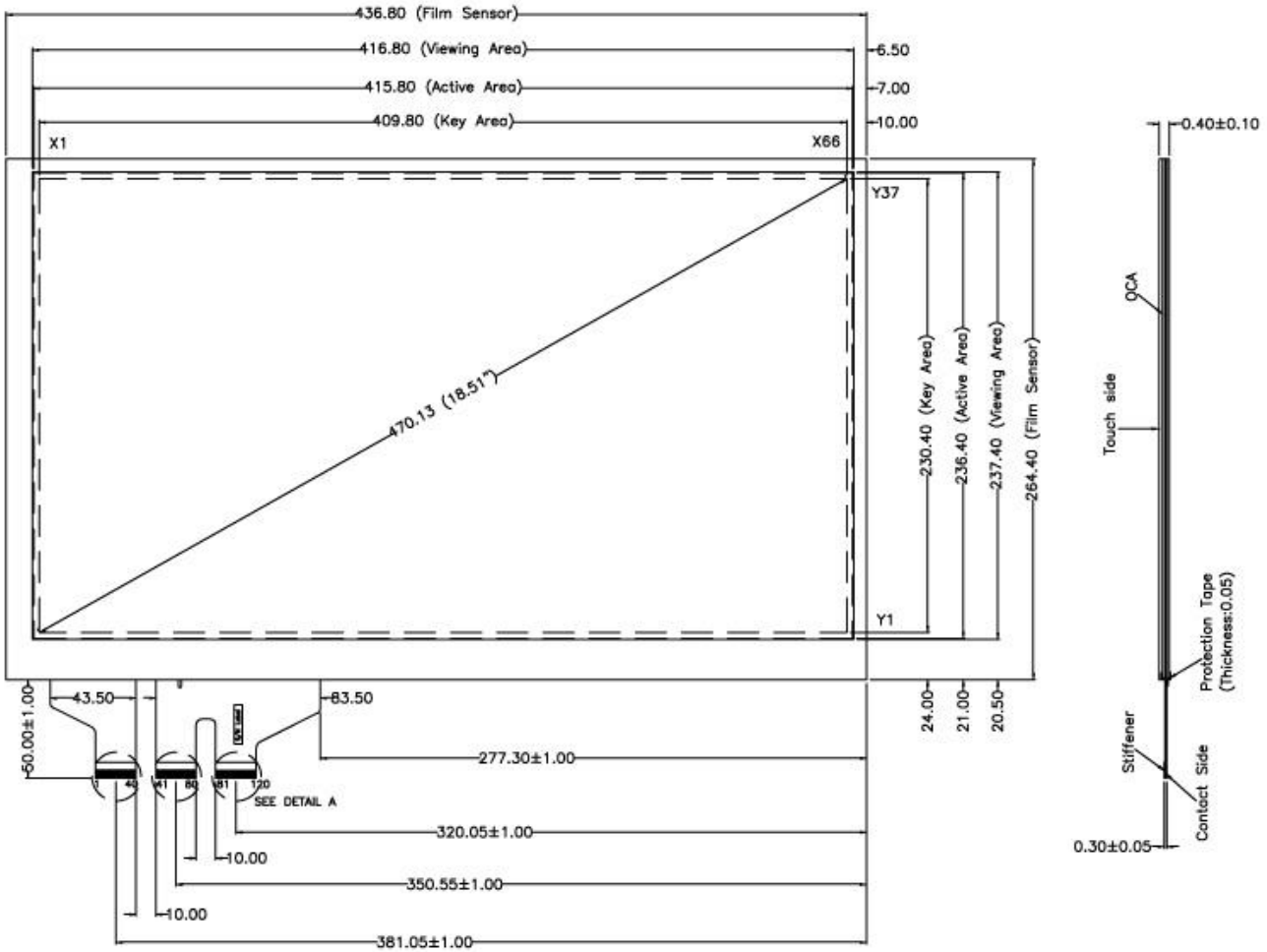
Front View



P3020-A10 : 18.5” PCI without top glass

Front View

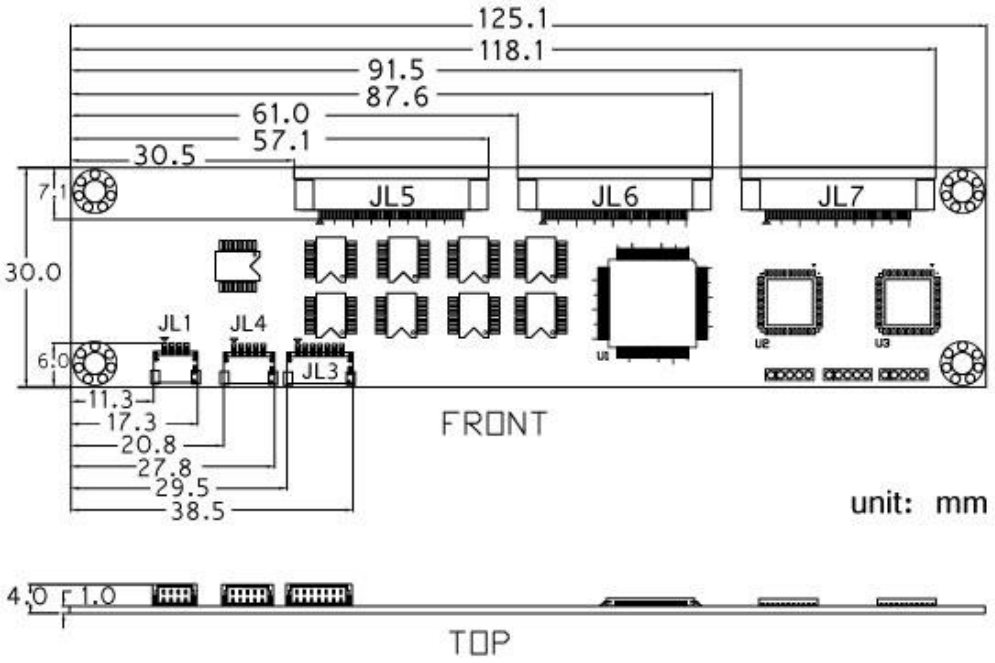




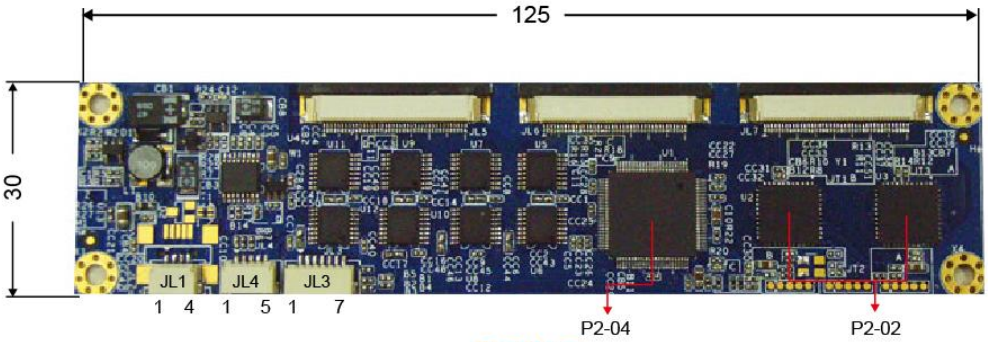
Remark: Item P3020-A10 is only available for AMT’s selected partners.

2.2.2 PM1500 Control Board Mechanical Size and Rear/ Front View

Mechanical Size:



Front View



Rear View

Unit: mm

Chapter 3: PM1500 Control Board Hardware Specifications

3.1 Interface Specifications

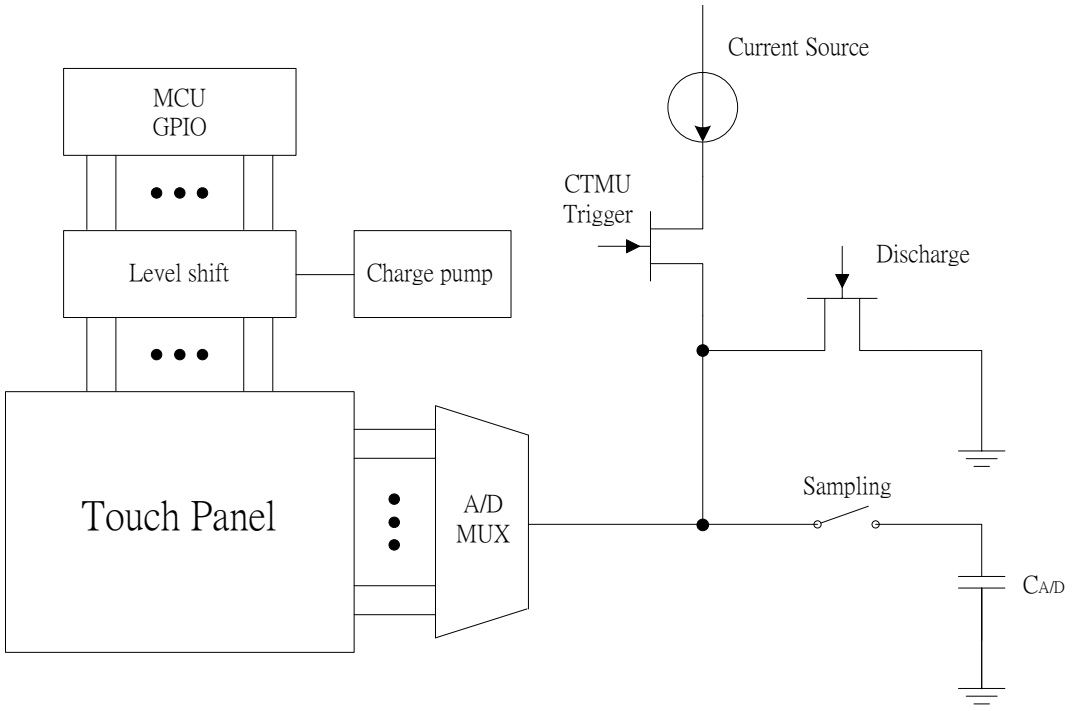
There are six connectors on this board: three 40 Pins ZIF connectors for PCI touch screen FPC cable, one USB connector for 4-pin USB cable (optional) , one RS-232 connector for 5-pin RS-232 cable (optional) , and one I²C connector for 7-pin I²C cable (optional), the pin definition is set as below:

JL1 / 4PIN / USB	
PIN NO.	DESIGNATION
1	5V IN
2	D-
3	D+
4	Ground

JL4 / 5PIN / RS-232	
PIN NO.	DESIGNATION
1	5V IN
2	RXD
3	TXD
4	Ground
5	Ground

JL3 / 7PIN / UART / I²C	
PIN NO.	DESIGNATION
1	5V IN
2	Ground
3	SCL / RXD
4	SDA/ TXD
5	N/A
6	N/A
7	INTHM

3.2 Control Board System Block Diagram



3.3 Interface

USB, UART, RS-232, I^2C connectors are provided for connecting this control board to your system. The followings are the functions for different interfaces.

3.3.1 USB Interface and Data Communication

USB (Universal Serial Bus) is an industry standard, which is a connection between the computer/ notebook/ laptop and the external devices. It is commonly used in connecting to PC or handheld device. There are 4 pins on PM1500 control board to define USB connection.

3.3.2 RS-232

RS-232 (Recommended Standard 232) is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit-terminating Equipment). It is a specification for serial communications between a DCE and DTE (eg, computer and modem); it defines electrical characteristics, the 25-way 'D' connector and the various functions of the various signal lines. There are 5 pins on PM1500 control board to define RS-232 connection.

3.3.3 UART

A UART (Universal Asynchronous Receiver/ Transmitter) is a serial port, it is commonly used in conjunction with communication standards such as RS-232 or others. There are 7 pins on PM1500 control board to define UART connection.

3.3.4 I²C

The I²C (Inter-IC) bus is a bi-directional two-wire serial bus that provides a communication link between integrated circuits (ICs). Typical voltages used are +5 V or +3.3 V.

The I²C bus has two roles for nodes: master and slave:

- Master node — node that issues the clock and addresses slaves
- Slave node — node that receives the clock line and address.

The bus is a multi-master bus which means any number of master nodes can be present. Additionally, master and slave roles may be changed between messages (after a STOP is sent).

There are four potential modes of operation for a given bus device, although most devices only use a single role and its two modes:

- master transmit — master node is sending data to a slave
- master receive — master node is receiving data from a slave
- slave transmit — slave node is sending data to the master
- slave receive — slave node is receiving data from the master

PenMount I²C interface provide ‘ INTHM’ pin as an optional. Generally, I²C (without INTHM pin) uses polling communication method, master communicates with slave in a period of time. If there is an INTHM pin, slave can “ask” master whether it gets ready or not, so that master no need to keep “asking” slave, thus it becomes more efficient. There are 7 pins on PM1500 control board to define I^2C connection.

Chapter 4: PenMount PCI Controller IC Specifications

4.1 General Descriptions

Touch Controller IC	PenMount P2-02 *2 PenMount P2-04 *1
Interface	USB: Full-speed, 12Mbps UART,RS-232 Interface 38400 baud rate / 8bit data / non parity / one stop bit / non-PnP I²C, Slave, support 400 kHz specifications.
ADC resolution	10 bits
Operating Voltage	+5V
Storage Temperature	-40°C ~ +85°C
Operating Temperature	-20°C ~ +70°C
Power Consumption	Typical – Working Mode: 61 mA / 5V; Idle Mode: 47 mA / 5V; Sleep Mode: 4.2 mA / 5V;
Sample rate/second	>100sps
Touch media	Finger, gloved hand (please contact us for details)
Firmware	Develop by PenMount team
Operation force	Light
Top glass thickness supported	Up to 2.8mm
Driver supports	All popular O.S., like Microsoft Windows and Win CE and various Linux distribution

Note: Sample rate/second are varied based on different versions of firmware and touch panel.
PenMount P2-04 is using Microchip PIC24FJ256GB210 IC.
PenMount P2-02 is using Microchip PIC18F45K22 IC.

4.2 Control IC Features

PM1500 control board contains three IC, 2 pcs of PenMount P2-02 and one pcs of PenMount P2-04 are used respectively. Their features are shown as below.

4.2.1 Features of PenMount P2-02

- Charge Time Measurement Unit(CTMU)
- 16 MIPS operation at 64MHz CPU
- 32KB program memory
- 10-bit, up to 28 channel Analog-to-Digital converter
- Run mode: 1mA/MIPS, 2.0 Typical
- Sleep mode: Current down to 100nA Typical
- Standby Current with 32 KHz Oscillator: 2.5uA, 2.0V typical
- RS-232, I²C serial bus
- Other details controller specification, please refer to Microchip PIC18F45K22 datasheet

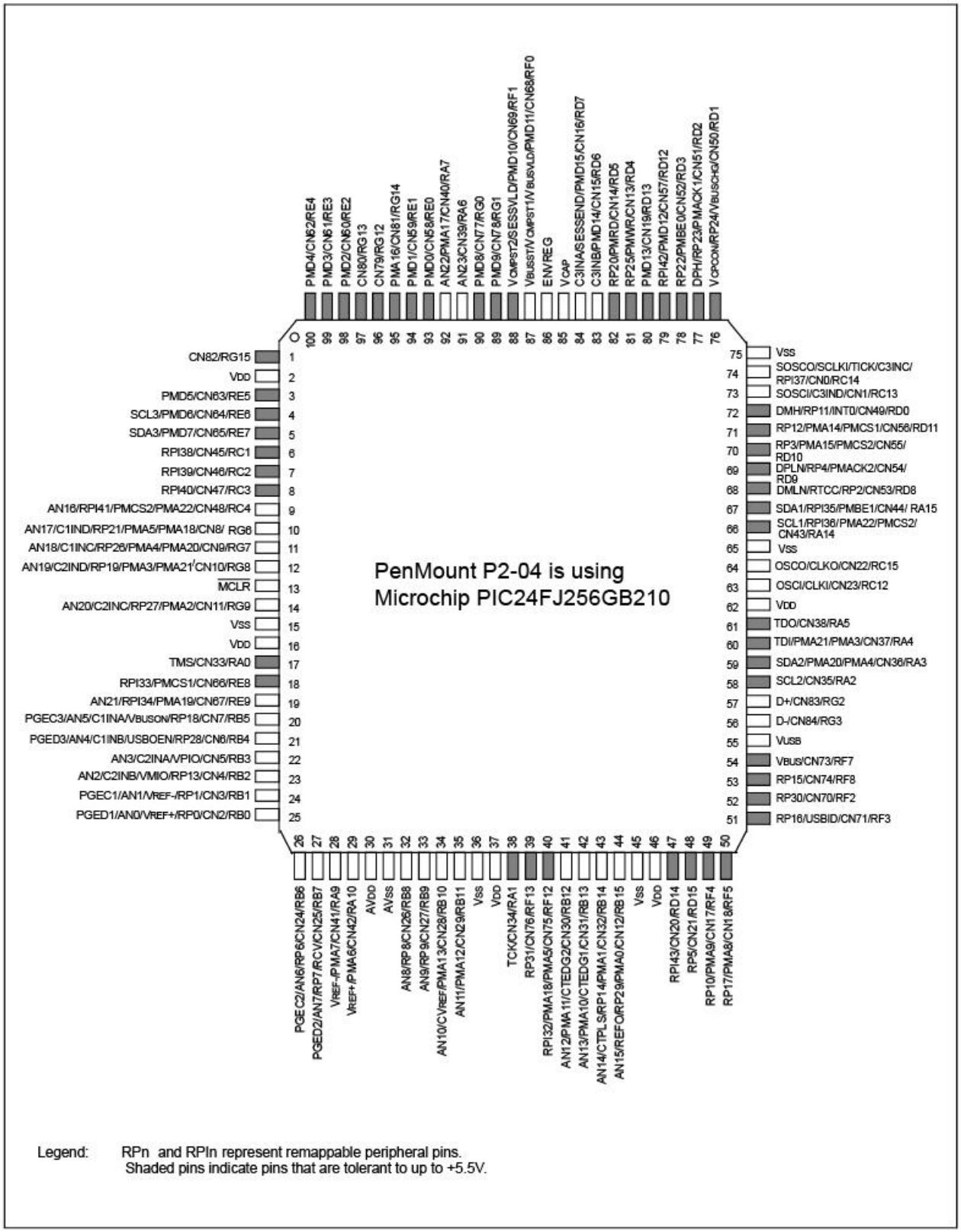
4.2.2 Features of PenMount P2-04

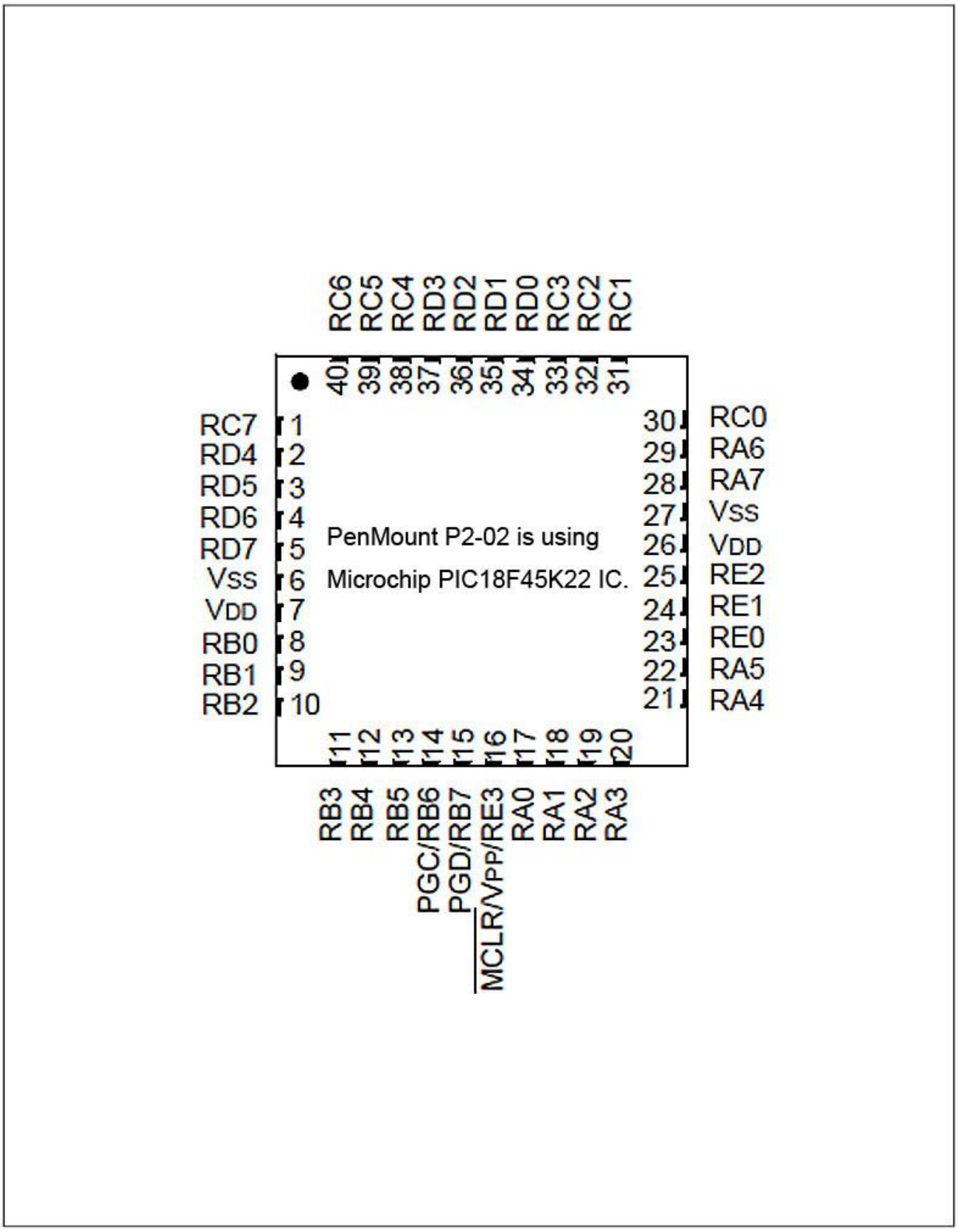
- Charge Time Measurement Unit(CTMU)
- Single 16 MIPS operation at 32MHz CPU
- 256KB program memory
- 10-bit, up to 24 channel Analog-to-Digital converter
- On-Chip 1.8V Voltage Regulator
- Run mode: 800μA/MIPS, 3.3 Typical
- Sleep mode: Current down to 20μA , 3.3 Typical
- Standby Current with 32 KHz Oscillator: 22μA, 3.3V typical
- Other details controller specification, please refer to Microchip PIC24FJ256GB210

4.3 Firmware Features

- On Field-update firmware
- Support controller power-saving : working, idle (No touch slow-scanning), and sleep (USB suspend)
- Signal sensitivity tuning capability
- With noise filter feature on firmware
- Perform smoothing & jitter filter for drawing
- Touch panel rotation with X-Y coordinate reverse and/or swap
- Touch linearity compensation in border area
- High sampling rate
- Multi-sensing to increase scan speed

4.4 Controller IC Pin out




RC6 RC5 RC4 RD3 RD2 RD1 RD0 RC3 RC2 RC1
40 39 38 37 36 35 34 33 32 31
RC7 1
RD4 2
RD5 3
RD6 4
RD7 5
VSS 6
VDD 7
RB0 8
RB1 9
RB2 10
30 RC0
29 RA6
28 RA7
27 VSS
26 VDD
25 RE2
24 RE1
23 RE0
22 RA5
21 RA4
PenMount P2-02 is using
Microchip PIC18F45K22 IC.
11 12 13 14 15 16 17 18 19 20
RB3 RB4 RB5 PGC/RB6 PGD/RB7 MCLR/VPP/RE3 RA0 RA1 RA2 RA3

Chapter 5: Software Drivers & PenMount Utility

5.1 Available Drivers & Where to Download

Drivers for USB and RS-232 are available in AMT’s website, please go to the link below for downloading the drivers you need. However, drivers for I²C are not released in our website, if you are using I²C, please contact our sale representatives or distributors for further information.

http://www.amtouch.com.tw/support-downloads/penmount-drivers-and-utilities/pci-touch-controller/pci-linux-and-other-drivers/

Please note that if you use USB interface and Windows Vista/7/8, the default driver is available inside the OS, so you no need to download and install an additional driver. The drivers will be modified and updated from time to time, the most updated drivers are available in AMT and PenMount website. Drivers’ versions are subject to change without notice.

PM1500 drivers :
For I²C:
Windows CE : Provide binary driver for freescale iMX platform. Other platform by request.
Linux / Android : Provide source code for integration.
For USB / RS-232 / UART:
Windows 2000, XP, 2003: single touch, mouse driver.
Windows Vista: single touch, inbox driver.
Windows 7,8: dual touch, Inbox driver.
Linux: Ubuntu, Android, other Linux distributions under development.

5.2 PCIMSet Introduction

PCIMSet is a utility software developed by PenMount for users to adjust the touch screen’s accuracy, sensitivity… and others features. When you have AMT PCI touch kits, we provide you this utility program, so you can choose the appropriate interface through PCIMSet setting. If you need more detailed information, please see “PCIMSet User Guide”.

5.3 Firmware Update

5.3.1 Firmware Interface

We provide USB, RS-232, UART, and I^2C interface in firmware, the shipping default is set at USB interface, and you can change the interface by PCIMset utility if the USB interface is not required by your system. Details are all described in our “PMUpdate User Guide”, please read it carefully before making the firmware update.

5.3.2 New Firmware Request

The latest PenMount controller firmware version is programmed inside the chip. PenMount controller firmware is able to be renewed in customer side, PenMount will release the new firmware with new features or modification, the new updated firmware is available in AMT or PenMount customer services team. As the new updated firmware is sent by request, if you need to update the new firmware, please follow the updated firmware request procedures as below:

a. First, please fill in the ‘PenMount PCI Firmware Update Request’ (FUR) form. The FUR form is sent by request, so please contact our sale representatives, customer services team or distributors in your region for requesting the FUR form.
b. Sent back the FUR form to AMT or PenMount sale representatives, customer services team or distributors in your region.
c. After checking and confirmed by AMT or PenMount team, we will send the updated firmware for customers to do on field update.

5.3.3 Firmware download and update

The PMUpdate utility is developed for users to update the latest firmware version. Please note that only our standard firmware offers a free update service, if it is a special developed firmware in accordance with the requests of the client, or any adjustment has been made for the firmware due to the requests of the client, these are regarded as a special firmware, and they won’t have a free firmware update. The firmware update will be provided once we have a new firmware ready. If you need any further information about this, please contact our sale representatives or distributors in your region. And if you want to get more information about the operation steps of PMUpdate, you can read “PMUpdate User Guide” to get more details.

Chapter 6: Product Test

The following test has been done by AMT Projected Capacitive Touch and PenMount controller or Control board.

6.1 Operating Test

PCI Touch panels were tested under the temperatures range at -20˚C and +70˚C, the PCI touch panels can operate normally under the above temperature.

6.2 Environmental Test

PCI touch panels were tested under the temperature:

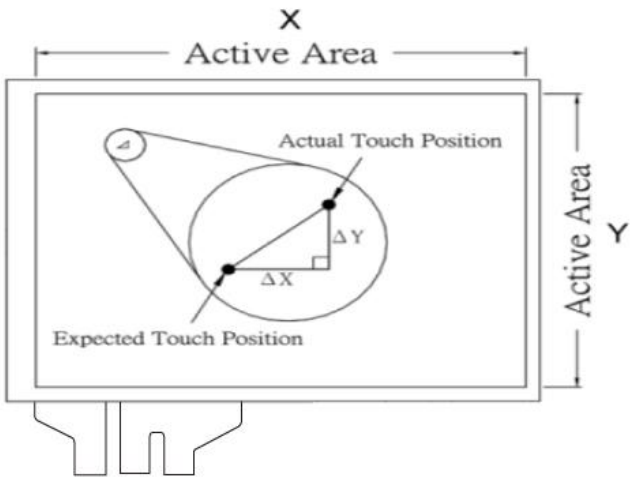
- -40˚C for 288H,
- 60 ˚C with 90RH for 288H,
- 80˚C for 288H,
- -40˚C ~ +80˚C for 20 cycles.

Touch panels can operate normally after the test, please see PCI approval sheet for details.

6.3 ESD

PCI touch solution can withstand 15KV air discharge and 8KV contact discharge. However, the PCI touch has to be integrated properly with good grounding.

6.4 Linearity Test



This test is to calculate the difference between the actual touch position and the expected touch position, which

$\frac{\Delta X}{X}\% < 1.5\%$ and $\frac{\Delta Y}{Y}\% < 1.5\%$

6.5 Optical Inspection

AMT PCI has its optical specification, please refer to AMT PCI optical specification A003.

6.6 Others

For other test, please contact to our sale representatives or distributors for detailed information.

Chapter 7: Warranty

We provide one year limited liability warranty. We shall not be held responsible for any damage, destroy or defect caused by accident, misinstallation, misunderstanding of the instructions, customer modification, misuse of software or their use in a defective or deficient environment or any misuse during their operation of the touch panels.

Chapter 8: Other Documents

The following documents can be provided to our clients for guiding our customers how to install and operate our products:

- AMT PCI Integration Guide—AMT PCI Integration guide is the guide that to instruct you how to install the touch panel into your products, and what you should aware of.
- AMT PCI Design Guide—AMT PCI Design Guide describes the general design rules and requirements for AMT projective capacitive input (PCI) touch panels, such as their structure, size, pattern and lines.
- PCI PenMount 1000 Device Driver Development Guide—it provides necessary information about the protocols for PenMount and guide you to operate the USB, RS-232 and I^2C protocols of PenMount 1000.
- PenMount Projected Capacitive Input (PCI) User Guide—it contains detailed information of our touch Screen kits, such as what software you need, how to install drivers, what is PenMount PCIMSet and firmware update instructions and etc. You can go to the link below to download the manual/ PenMount Projected Capacitive Input (PCI) User Guide.
  http://www.amtouch.com.tw/support-downloads/manuals-downloads/

Note: AMT PCI Integration Guide, AMT PCI Design Guide and PCI PenMount 1000 Device Driver Development Guide are sent by request, so please contact our sale representatives or distributors in your region for request if you need these guides. Document versions are subject to change without notice.

Chapter 9: Contact Information

Headquarter
Apex Material Technology Corp.
No. 84, WuXun Street, Anle District,
Keelung City 20446, Taiwan R.O.C.
Tel : + 886-2-2430 2666
Fox: + 886-2-2430 3255
Email: amt1@amtouch.com.tw
Web : www.amtouch.com.tw

The North American Sales Office
AMTouch USA, Inc.
5050 W. State Street
Milwaukee, WI 53201, USA
Tel : + 1-414-847-1814/15
Fax : + 1-414-445-1968
Website: www.amtouchusa.com
Email: sales@amtouchusa.com