ePH1200

Handwriting Recognition Microcontroller

Product Specification

DOC. VERSION 2.0

ELAN MICROELECTRONICS CORP.

June 2005

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Contents

Specification Revision History		
Doc. Version	Revision Description	Date
2.0	ePH1200 initial specification (derived from ePH1100 V2.2)	2005/06/08

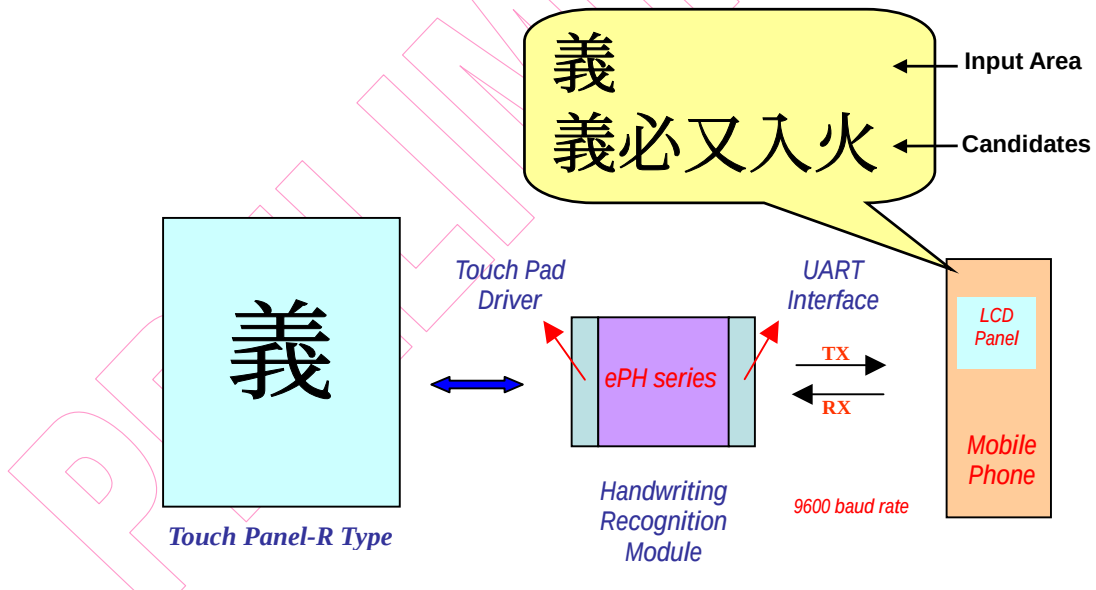
1 Introduction

The ePH1200 chip is an 8 bit RISC microcontroller embedded with recognition core. When connected to an external resistance type touch panel, the chip becomes suitable for handwriting recognition application products, such as SMS, Stylus Remote Controller, mobile phones, handwriting input device, etc. The ePH1200 has low power dissipation, low cost, and yet is capable of providing high performance rate of recognition. These quality features are vital for shorter lead-time in developing new handwriting recognition related products or pressure-sensitive screen input devices.

2 Features

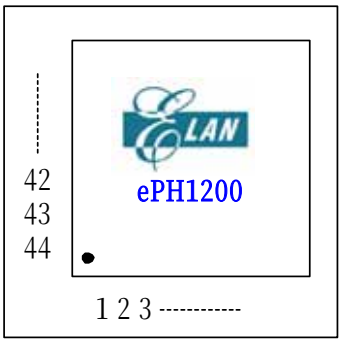
Product No.	Package	Input	Output	Interface	Remarks
ePH1200	CSP/ LQFP44	1. Simplified Chinese 2. ASCII 3. Gesture	Unicode /GB2312	UART	Can recognize Simplified Chinese of 6,763 (GB2312) characters

3 Block Diagram



4 Pin Assignment

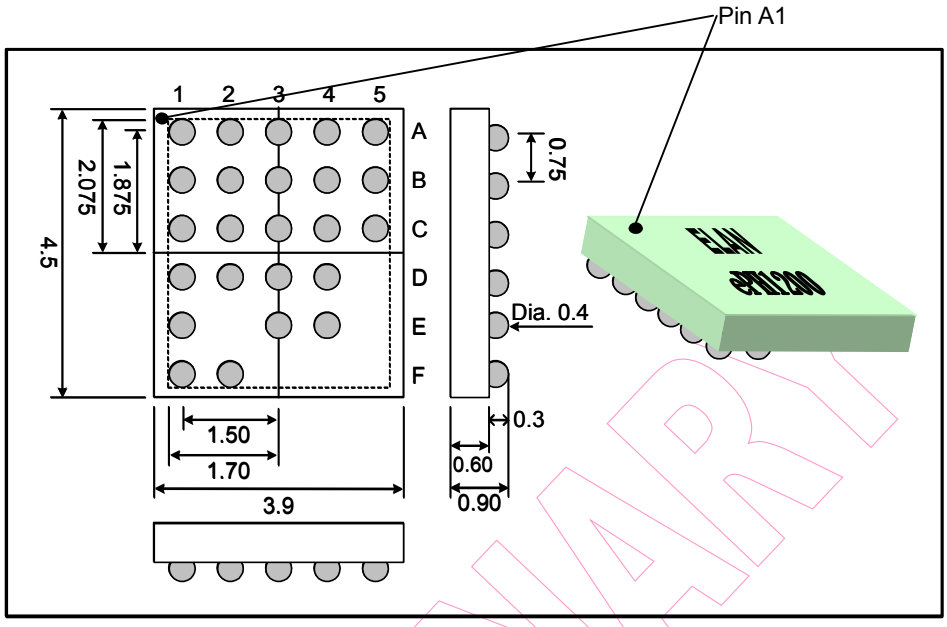
4.1 LQFP 44 Pin



No.	Pin Name	No.	Pin Name	No.	Pin Name	No.	Pin Name
1	NC	12	YP	23	CE	34	NC
2	NC	13	XP	24	NC	35	NC
3	HTEST	14	YN (WKO)	25	NC	36	NC
4	PLLC	15	XN	26	NC	37	NC
5	OSCI	16	VREX	27	NC	38	NC
6	OSCO	17	VDD	28	NC	39	NC
7	RESETB	18	STEST	29	NC	40	NC
8	VDDA	19	Key2	30	ECR	41	NC
9	VSS	20	Key1	31	NC	42	NC
10	TX	21	WKI(Key0)	32	NC	43	NC
11	RX	22	NC	33	NC	44	NC

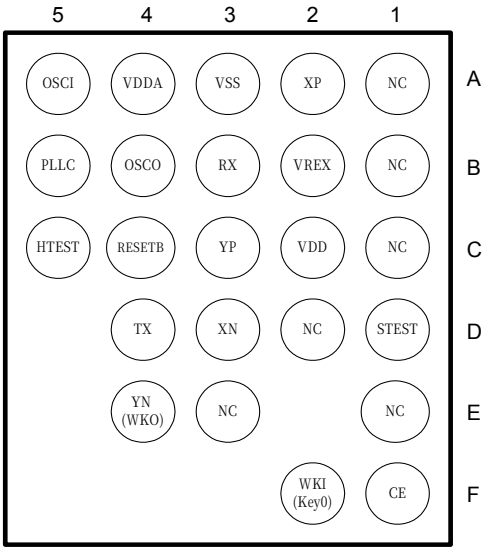
4.2 CSP (Chip Size Package) 24 Pin

Perspective view of the pin locations viewed from top surface of the chip.



Perspective View from TOP Side						
Y Coordinate \ X Coordinate		–1.500	–0.750	0.000	0.750	1.500
		1	2	3	4	5
1.875	A	NC	XP	VSS	VDDA	OSCI
1.125	B	NC	VREX	RX	OSCO	PLLC
0.375	C	NC	VDD	YP	RESETB	HTEST
–0.375	D	STEST	NC	XN	TX	–
–1.125	E	NC	–	NC	YN (WKO)	–
–1.875	F	CE	WKI(Key0)	–	–	–

Pin location and assignment viewed from actual pin (bottom) side of the chip.



4.3 Ordering Information

Orderable Part Number	Package Type	
ePH1200SH	CSP	Tray of 72
ePH1200KSH		Tape reel of 2040
ePH1200AQ	LQFP44 10x10mm	

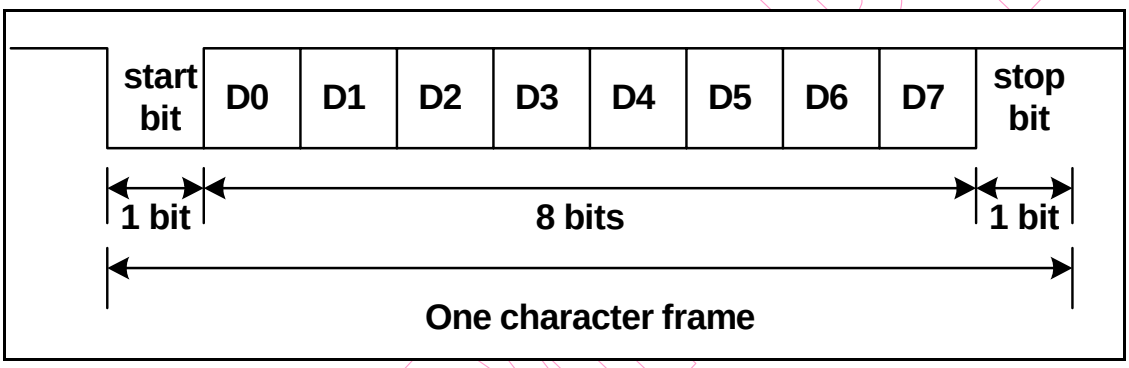
5 Pin Description

CSP	LQFP44	Name	I/O/P Type	Description
C2	17	VDD	P	Digital power supply, the range is from 2.8V to 3.6V. Should be connected to VSS through a 0.1μF capacitor.
A3	9	VSS	P	Negative power supply
A4	8	VDDA	P	Analog power supply. The range is from 2.8V to 3.6V. Should be connected to VSS through a 0.1μF capacitor.
C4	7	RESETB	I	System reset input pin with built-in pull up resistor (typical value = 100KΩ): • "L" : RESET asserted. • "H" : RESET released.
C5	3	HTEST	I	Hardware testing. Normally connected to VSS
A5	5	OSCI	I	Crystal or External Clock Source connector pin: • Crystal: Connect a 32.768 KHz crystal and connect to VSS through a 20pF capacitor • External Clock Source: Connect a 32.768 KHz (±20ppm) clock signal through a 0.1μF capacitor (Clock V_{PP}>0.3V_{DD})
B4	6	OSCO	O	Crystal or External Clock Source connector pin: • Crystal: Connect a 32.768 KHz crystal and connect to VSS through a 20pF capacitor. • External Clock Source: Keep the pin floating.
B5	4	PLLC	I	PLL capacitor connector pin. Should be connected to VSS through a 0.047μF capacitor.
B2	16	VREX	I/O	Internal reference voltage for A/D converter. Should be connected to VSS through a 0.1μF capacitor.
F1	23	CE	I	"Floating": Chip Enable. "L": Chip power down. UART interface pin will change to High-Z status.
D1	18	STEST	I	Software testing. Normally floating or connected to VDD.
D4	10	TX	O	UART Interface Tx pin
B3	11	RX	I	UART Interface Rx pin
C3	12	YP	I	Touch screen Y direction positive pin
A2	13	XP	I	Touch screen X direction positive pin
E4	14	YN (WKO)	O	Touch screen Y direction negative pin. This pin should be connected to input pin of the host. Such host input pin must be set as "non-pull-up" resistor type and provides wakeup function.
D3	15	XN	O	Touch screen X direction negative pin

CSP	LQFP44	Name	I/O/P Type	Description
F2	21	WKI (Key0)	I	(ePH1200 mode only) Wakeup input pin. Host wakes up ePH1200 from power saving mode through this pin. LQFP44 and ECR mode only. This pin can use as Key Button 0.
–	19	Key2	I	LQFP44 and ECR mode only. This pin can use as Key Button 2.
–	20	Key1	I	LQFP44 and ECR mode only. This pin can use as Key Button 1.
–	30	ECR	I	"L": ECR mode "Floating": ePH1200 mode

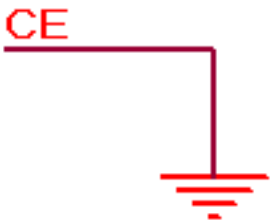
6 Interface Control Timing Description

6.1 UART Interface Control (9600, N, 8, 1)



7 Pin Option Description

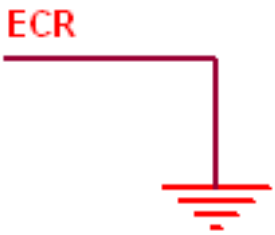
7.1 CE Pin Option



Chip Disabled

Chip Enabled

7.2 ECR Pin Option



ECR mode

ePH1200 mode

The differences between ePH1200 and ECR mode are**:**

1. Coordinates**:** Hand writing orientation under ECR mode is rotated 90°.
2. WKI (Key0) does not provide WKI function under ECR mode. It is merely used as a button key (Kye0) under ECR mode (see below).
3. ECR mode has three button keys (0~2)**:**
   Pressing these keys will cause ePH1200 to output the following key information to the host.
   - Key0 down: 50 20 04 01 FF FF FF 3B
   - Key0 release: 50 20 04 00 FF FF FF 2D
   - Key1 down: 50 22 04 01 FF FF FF 69
   - Key1 release: 50 22 04 00 FF FF FF 7F
   - Key2 down: 50 24 04 01 FF FF FF 9F
   - Key2 release: 50 24 04 00 FF FF FF 89

8 Electrical Characteristic

8.1 Absolute Maximum Ratings

Items	Symbol	Condition	Limits	Unit
Supply Voltage	VDD		–0.3 to +3.6	V
Input Voltage (General Input Port)	VIN		–0.5 to VDD +0.5	V
Operating Temperature Range	TOPR		–20 to +80	°C
Storage Temperature Range	TSTR		–55 to +125	°C

8.2 Recommended Operating Conditions

Items	Symbol	Condition	Limits	Unit
Supply Voltage	VDD		2.8 to 3.6	V
	VDDA		2.8 to 3.6	
Input Voltage	VIH		VDD x 0.9 to VDD	V
	VIL		0 to VDD x 0.1	V
A/D Full-Scale Input Span	ADRG	Positive input–negative input	0 to VREX	V
Operating Temperature	TOPR		–20 to +80	°C

8.3 DC Electrical Characteristics (Condition: Ta=25° C, VDD= 3.0 +/– 0.3V)

Parameter	Symbol	Condition		Min	Type	Max	Unit
CLOCK	Fmain	Main-clock frequency		–	9.83	–	MHz
	Fsub	Sub-clock frequenc	X'tal OSC	–	32.768	–	KHz
Supply Current	Idd2	IDLE mode	VDD=3V, X'tal OSC.	–	5	8	μA
	Idd3	FAST mode	VDD=3V, Fmain=9.83MHz, without touch panel load	–	2000	3000	
Input Voltage	VIH1	Input pin		VDD×0.7	–	VDD	V
	VIL1			0	–	VDD×0.3	
Input Threshold Voltage (Schmitt)	VT+	RESETB pin		0.5×VDD	–	0.75×VDD	V
	VT–			0.2×VDD	–	0.4×VDD	
Output Current	IOH1	Output pin	VDD=3V, VOH=2.4V	–1.1	–2.2	–3.3	mA
	IOL1		VDD=3V, VOL=0.2V	+1.1	+2.2	+3.3	
Input Leakage Current	IIL	ALL Input port (without pull up/down resistor) Vin=VDD or GND		–	–	+/–1	μA
Touch Panel Pull Down Resistance	RPD3	DET=1,Xn pin	Vin=VDD, VDD=3V	25	50	100	KΩ
Data Retention Voltage	Vret			1.6	–	–	V
Power on Reset Voltage	Vpor			1.4	1.5	1.6	V

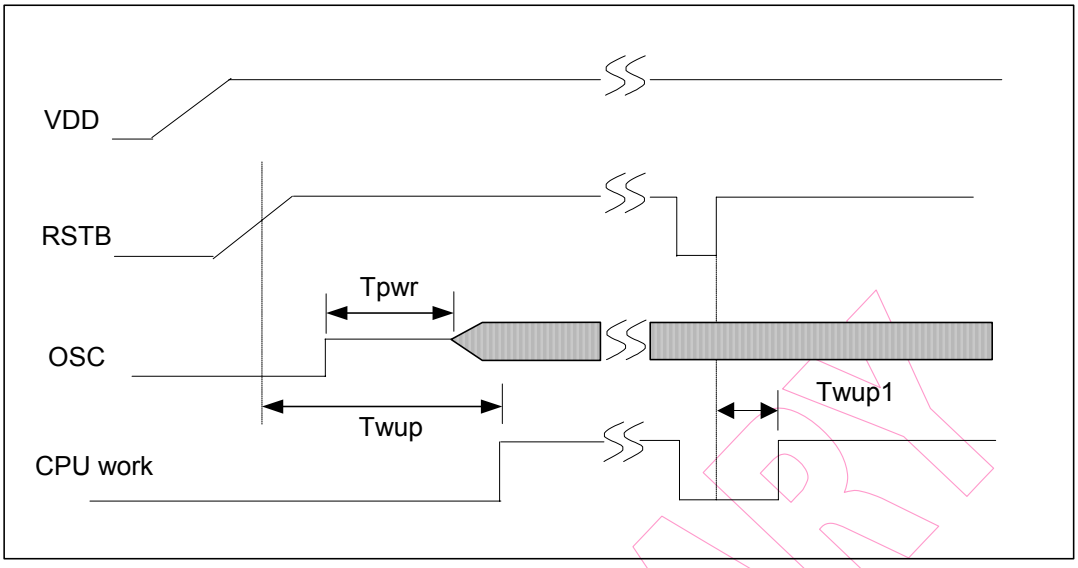
8.4 A/D Conversion (VDD=3.0V, VDDA=3.0V, Ta=25° C, Fclk=12*Fsample)

Parameter	Symbol	Condition	Min	Type	Max	Unit
Analog Input						
Mux Leakage Current	Imux	On/off leakage current, Vin=0 or VDD	–	0.1	1	μA
System Perfomance						
Resolution			–	10	-	Bits
Integral Non-Linearity	INL		–2	–	+2	LSB
Differential Non-linearity	DNL		–2	–	+2	LSB
Offset Error	OErr		–4	–	+4	LSB
Gain Error	GErr		–4	–	+4	LSB
Missing Code	MC					Bit
VDDA Supply Current	Ivdd3	VDD=3.0V, VDDA=3.0V, Fsample=20kHz, ADEN=1,VRS=1	–	0.5	0.7	mA
	Ivdd4	ADEN=0,VRS=1	–	–	1	uA
Driver Current	IOH	Xp,Yp(VDD= 2.9 +/- 0.3V) (Voh=VDD-0.2V)	–20	–30	–45	mA
Sink Current	IOL	Xn,Yn(VDD= 2.9 +/- 0.3V)(Vol=0.2V)	+20	+30	+45	mA

8.5 AC Electrical Characteristics (Condition: Ta=25° C, VDD=3.0 +/– 0.3V)

Parameter	Symbol	Condition	Min	Type	Max	Unit
A/D conversion (VDD=3.0V,VDDA=3.0V, Ta=-10~+60 °C)						
Throughput Rate		VDD=3.0V, VDDA=3.0V	–	–	80	ksps
		VDD=2.4V, VDDA=2.4V	–	–	60	
Power Supply Rejection Ratio	PSRR1+	Power noise: 1kHz, 100mV	37	40	–	dB
	PSRR1–	Power noise: 1kHz, 100mV	43	46	–	
Signal to Noise Ratio	SNR		51	54	–	dB

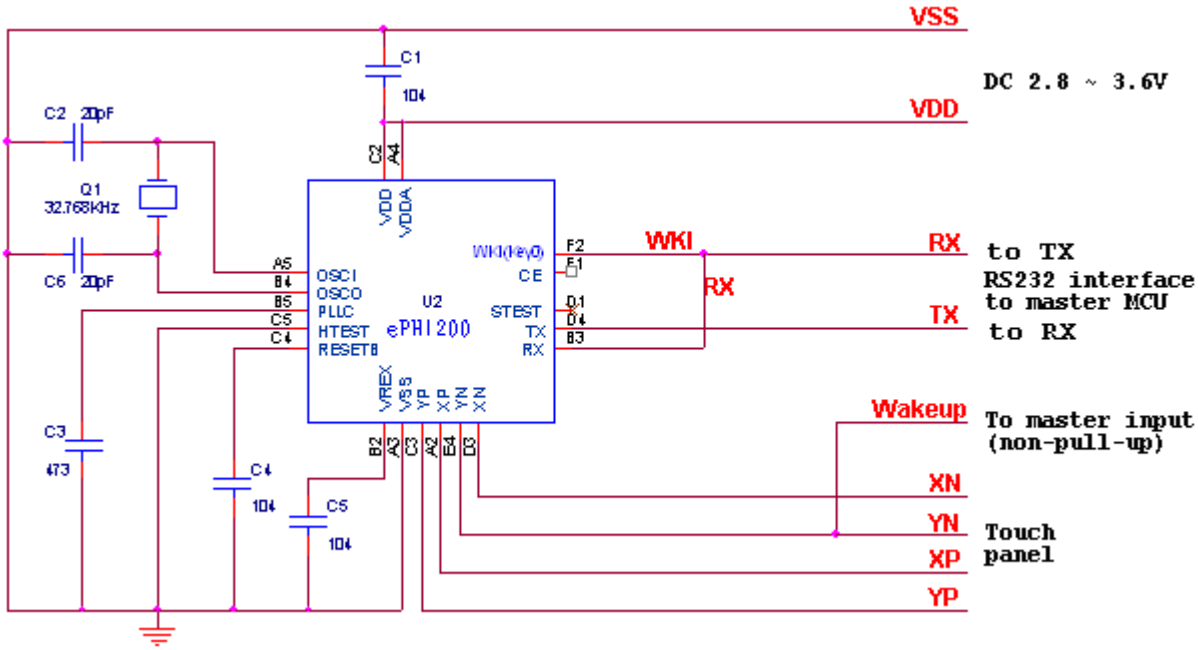
9 Power–up and Reset Timing



Symbol	Characteristics	Min.	Type	Max.	Unit
Tpwr	Oscillator start up time	100	226	300	ms
Twup	CPU warm up time	260	340	550	ms
Twup1	CPU reset time	18	22	44	ms

10 Application Circuit

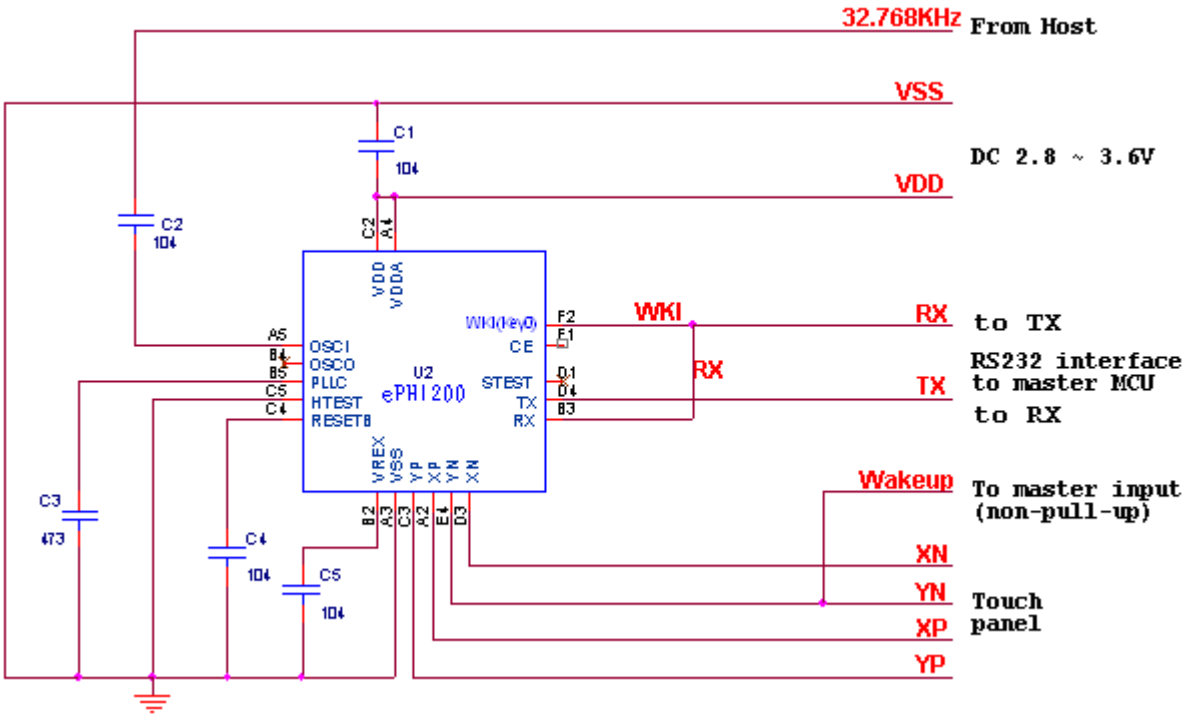
10.1 UART Interface Application Circuit (with 32.768KHz Crystal)



10.1.1 BOM Table

Component	Component P/N	Pin Location	Packaging	Qty
MCU	ePH1200	U2	CSP	1
Oscillator	32768HZ Crystal	Q1	D	1
Capacitor	20pF	C2, C6	S	2
Capacitor	0.1μF (104)	C1, C4, C5	S	3
Capacitor	0.047μF (473)	C3	S	1

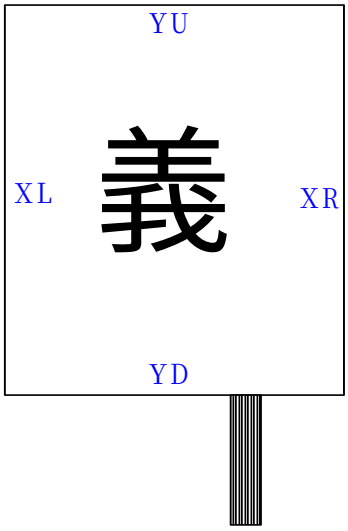
10.2 UART Interface Application Circuit (with 32.768KHz External Clock)



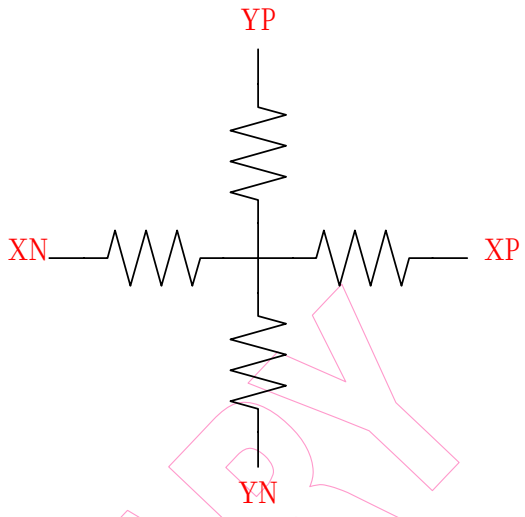
10.2.1 BOM Table

Component	Component P/N	Pin Location	Packaging	Qty
MCU	ePH1200	U2	CSP	1
Capacitor	0.1μF (104)	C1, C2, C4, C5	S	4
Capacitor	0.047μF (473)	C3	S	1

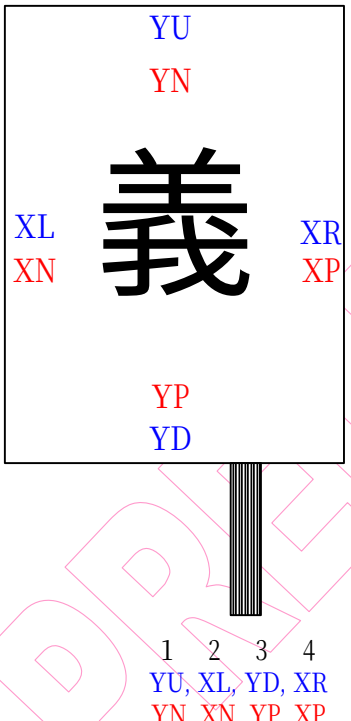
10.3 Touch Panel and YP, XP, YN, & XN Layout Format

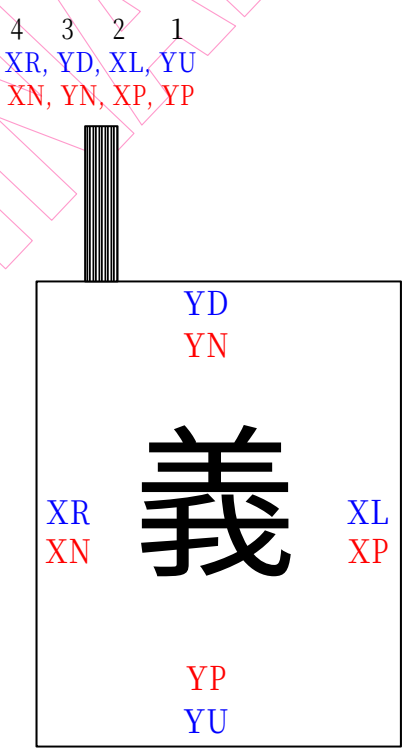


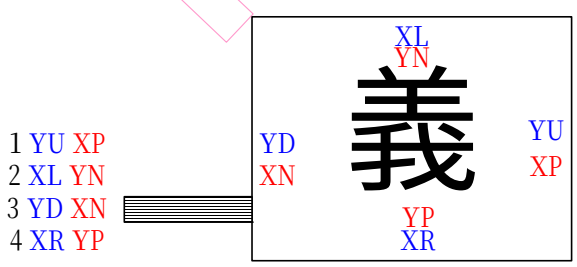
Touch Panel

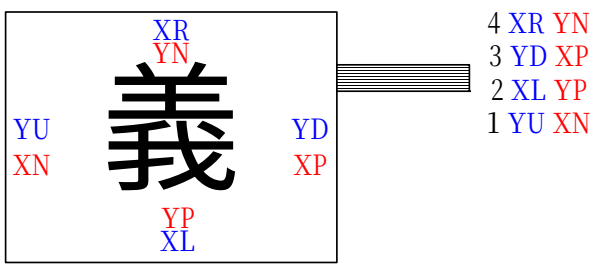


ePH1200 Pin Setting









11 HWRE Software Specification

11.1 HWRE Software Description

- ePH1200 provides seven free-hand input recognition proficiencies; including Chinese character Set I, Chinese character Set II, etc.
- You can choose to access the input as you write (inking) with recognized characters feedback, or to access the recognized characters only without accessing the inking (input).
- ePH1200 transmits both hand-written characters and hand-drawn graphics. Graphics inking are transmitted without recognition.
- ePH1200 can only transmit data to host through a defined touch panel button area coordinates (located at a designated area of the touch panel). When you tap and drag on the panel, only the tapping is transmitted. Dragging is ignored.

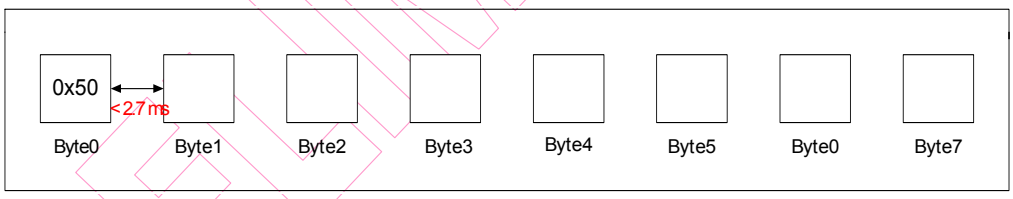
11.2 Communication Protocol and Command List

11.2.1 Communication Interface: UART

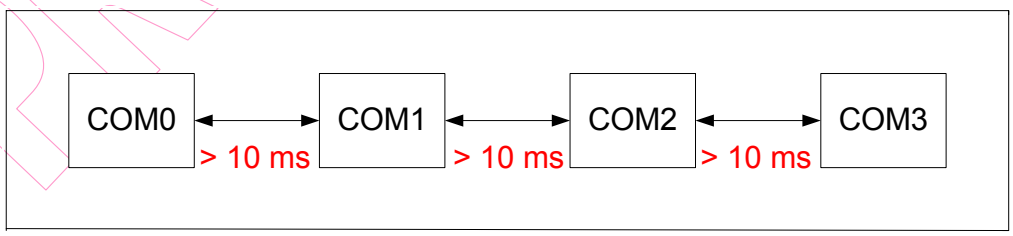
UART parameter**:** baud rate 9600; no parity check; 8 bits data length.

11.2.2 Command Timing Request

When host sends command to ePH1200, the time between two bytes must be less than 2.7ms. Otherwise, ePH1200 will not accept the command and access the “ACK error” message.



When host transmits command to ePH1200, the time between two consecutive commands must be longer than 10 ms.



11.2.3 *Commands from Host* (see Section 11.3 for details)

Command	Brief Description	Command Response	Response at Tapping*
0x33	Wake-up ePH1200	Not applicable	Not applicable
0x10	Execute the set character recognition mode	Instantaneous	Instantaneous
0x14	Execute the set inking transmit switch	Instantaneous	Instantaneous
0x1A	Execute the set pen up (next tapping) waiting time	Instantaneous	As soon as pen is up
0x1B	Recognition before timeout	Instantaneous	As soon as pen is up
0x1C	Host Ready	Instantaneous	Instantaneous
0x1D	Convert recognition & “tap to wake-up” data into even numbered package	Instantaneous	Instantaneous
0x1E	Pen up timeout offset (shorten timeout)	Instantaneous	As soon as pen is up
0x40	Get handwriting firmware version	Instantaneous	Instantaneous
0x41	Output with different code table	Instantaneous	Instantaneous
0x42	Software reset	Instantaneous	Instantaneous
0x43	Abort the current inking	Instantaneous	Instantaneous
0x44	Calibration	Instantaneous	Instantaneous
0x46	Set writing area location	Instantaneous	Instantaneous
0x49	Set Recognition / Graphic mode	Instantaneous	Instantaneous
0x4A	Set power saving mode	Instantaneous	Instantaneous
0x4B	Set A/D resolution	Instantaneous	Instantaneous
0x4C	Rotate touch panel	Instantaneous	Instantaneous
0xF0	Output PROM/DROM checksum	Instantaneous	Instantaneous

* 1. Shows which command takes effect immediately when host sends command to ePH1200 with the pen tapped and held on touch panel.

2. If there is inadequate time to receive the host command, ePH1200 will initially access the “ACK error” message and wait for the host to send the correct command within 1.5 sec. After receiving valid command or 1.5 sec timeout, ePH1200 continues to execute the original program.

11.2.4 *Responses from ePH1200* (see Section 11.4 for details)

Command	Description
0x00	Ack error
0x16	Inking (written input) coordinates
0x17	Touch panel button area coordinates
0x18	Recognized characters array
0x33	Exit from power saving mode
0x42	Initial power ON
Host command dependent	Ack OK

11.3 Commands from Host Specifications

11.3.1 Wake up ePH1200 (0x33; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x33
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0x00; 0x00; 0x00; 0x00
7	Checksum	1	HEX	0xC7

Description: Host can use this command to wake up ePH1200.
Note that this command is applicable only when ePH1200 is in idle mode and it cannot ACK any response when in FAST mode.

Example:

Command / Response	Host	ePH1200
Command wakeup	50 33 04 00 00 00 00 C7	
Command wakeup response		50 33 04 FF FF FF FF 19

11.3.2 Set Character Recognition Mode (0x10; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x10
2	Parameter length	1	HEX	0x04
3-4	Parameter	2	HEX	User define
5-6	Stuff	2	HEX	0xFF; 0xFF
7	Checksum	1	HEX	–

Description: Set recognition type.

Recognition Type Definition: Total 10 bits **(Default value: 0x3F01)**

- **Byte 3**

Bit No.	Recognition Type Description	Recognition Type Setting
0	Set Chinese character Set I	0x0100
1	Set Chinese character Set II	0x0200
2	Set capital letter	0x0400
3	Set numeral	0x0800
4	Set symbol	0x1000
5	Set default gesture	0x2000
6~7	Not define	

■ **Byte 4**

Bit No.	Recognition Type Description	Recognition Type Setting
0	Set small letter	0x0001
1	Not define	–

Stroke (Gesture) Definition:

Default Stroke Description	Default Stroke Setting
BackSpace	0x0008
Return/Enter	0x000D
Delete	0x0010
SPACE	0x0020

The following graphs show the default writing stroke. Dot on each stroke shows where to begin. Then lift the pen (stylus) at the end of the stroke. You only need to lightly tap and drag on the touch panel.

BackSpace (0x0008)

Return/Enter (0x000D)

Delete (0x0010)

Space (0x0020)

Example:

Command / Response	Host	ePH1200
COM (set recognition type)	50 10 04 FF 01 FF FF 19	
ACK (set recognition type)		50 10 04 FF FF FF FF 59

11.3.3 Set Inking Transmit Switch (0x14; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x14
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	On :0x01/Off: 0x00
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: Select whether to transmit or not the inking (written input). Default is to transmit (ON). During Graphic mode, inking transmit switch OFF command is ignored, but is carried out once you enter Recognition mode.

Examples:

1. Transmit inking coordinates (0x14)

Command / Response	Host	ePH1200
COM (Set inking transmit)	50 14 04 01 FF FF FF 3A	
ACK (Set inking transmit)		50 14 04 FF FF FF FF FD

2. Do not transmit inking coordinates (0x14)

Command / Response	Host	ePH1200
COM (Do not transmit inking)	50 14 04 00 FF FF FF 2C	
ACK (Do not transmit inking)		50 14 04 FF FF FF FF FD

11.3.4 Set Pen Up (Lifting of Stylus) Waiting Time (0x1A; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x1A
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: Set pen up (lifting of stylus) waiting time.

Pen Up Waiting Time Setting:

1. ePH1200 divides the pen up time into 10 steps. 1~10 are valid values, other values represent infinite waiting. Default is 600 ms.
2. Every step increases by an increment of about 200ms. 1 represents 1x200 ms, and 10 represent 10x200 ms. If infinite pen up time is used, ePH1200 must initially receive the “Recognizing immediately (0x1B)” command before executing character recognition.

Example:

Command / Response	Host	ePH1200
COM (set pen up waiting time)	50 1A 04 03 FF FF FF AF	
ACK (set pen up waiting time)		50 1A 04 FF FF FF FF 44

11.3.5 Perform Recognition Immediately, i.e., Before Timeout (0x1B; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x1B
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0x6D

Description: Proceed to character recognition immediately.

Example:

Command / Response	Host	ePH1200
COM (recognize emmediately)	50 1B 04 FF FF FF FF 6D	
ACK (can not recognize immediately)		50 1B 04 00 00 00 00 B3
ACK (can Recognize immediately)		50 1B 04 FF FF FF FF 6D

11.3.6 Host Ready (0x1C; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x1C
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0xB2

Description: With this command, the host notifies ePH1200, “I am ready.” You can then start transmitting data after wake-up occurs (by tapping touch pad).

Example: Same as Section 11.4.5, *Exit from Power Saving Mode*.

11.3.7 Set Even Numbered Package for Recognizing Characters and to Trigger Wake-Up by Tapping Touch Pad (0x1D; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x1D
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	OFF:0x00/ON:0x01
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: This command defines the data format (even numbered) for recognizing characters and for responding to touch pad tapping to wake-up ePH1200 (Add 0x00).

Example:

Command / Response	Host	ePH1200
COM (even package)	50 1D 04 01 FF FF FF 5C	
ACK (even package)		50 1D 04 FF FF FF FF 9B

11.3.8 Pen Up (Lifting of Stylus) Timeout Offset (0x1E; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x1E
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	ON:0x01/OFF:0x00
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: This command subtracts 100ms from original setup pen up time.

Examples:

- **Original pen up time = 200ms**

Command / Response	Host	ePH1200
COM(Pen up time 200ms)	50 1A 04 01 FF FF FF 83	
ACK(Pen up time 200ms)	50 1A 04 FF FF FF FF 44	
COM (Pen up timeout offset)	50 1E 04 01 FF FF FF 27	
ACK (Pen up timeout offset) 200-100 = 100ms		50 1E 04 FF FF FF FF E0

■ **Original pen up time =400ms**

Command / Response	Host	ePH1200
COM (Pen up time 400ms)	50 1A 04 02 FF FF FF B9	
ACK (Pen up time 400ms)	50 1A 04 FF FF FF FF 44	
COM (Pen up timeout offset)	50 1E 04 01 FF FF FF 27	
ACK (Pen up timeout offset) 400-100=300ms		50 1E 04 FF FF FF FF E0

11.3.9 Access the HWRE Firmware Version (0x40; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x40
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0xB1

Description: Access the Handwriting Recognition firmware version.

Example:

Command / Response	Host	ePH1200
COM (access firmware version)	50 40 04 FF FF FF FF B1	
ACK (access firmware version)		50 40 04 02 23 51 11 D3 (V2.21 : 2005/1/11)

11.3.10 Output with Different Code Table (0x41; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x41
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	default :GB2312 output 0x01:Unicode output others:GB2312 output
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: ePH1200 offers two code tables for your selection. Any values except "0x01" are regarded as default value. Default value is GB2312 output, and code table 0x01 is Unicode output.

- write "华" ➔ Unicode output (0x534E)
- write "华" ➔ GB2312 output (0xBBAA)

Example:

Command / Response	Host	ePH1200
COM (output with different code table)	50 41 04 02 FF FF FF 65	
ACK (output with different code table)		50 41 04 FF FF FF FF 98

11.3.11 Software Reset (0x42; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x42
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0xE3

Description: Host can use this command to reset ePH1200. ePH1200 will reset to initial power on when this command is executed and all settings will return to its default values.

Example:

Command / Response	Host	ePH1200
COM (software reset)	50 42 04 FF FF FF FF E3	
ACK (software reset)		50 42 04 FF FF FF FF E3
COM (initial power on)		50 42 04 00 00 00 00 3D

11.3.12 Abort the Current Inking (0x43; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x43
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0xCA

Description: Clear the current inking.

Example:

Command / Response	Host	ePH1200
COM (clear current inking)	50 43 04 FF FF FF FF CA	
ACK (clear current inking)		50 43 04 FF FF FF FF CA

11.3.13 Calibration (0x44; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x44
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF;
7	Checksum	1	HEX	0x15

Description: Use this command to demand for ePH1200 calibration. ePH1200 cannot determine whether the executed calibration command is successful or not. The host should accommodate this function.

Example:

Command / Response	Host	ePH1200
COM (calibration)	50 44 04 FF FF FF FF 15	
ACK (calibration)		50 44 04 FF FF FF FF 15
COM (calibrate: top- left)		50 44 04 25 36 FF FF F3
COM (calibrate: bottom- right)		50 44 04 FF FF D7 CE 84

11.3.14 Set Writing Area Location (0x46; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x46
2	Parameter length	1	HEX	0x04
3	Top-left X coordinate	1	HEX	0x00—0xFE
4	Top-left Y coordinate	1	HEX	0x00—0xFE
5	Bottom-right X coordinate	1	HEX	0x00—0xFE
6	Bottom-right Y coordinate	1	HEX	0x00—0xFE
7	Checksum	1	HEX	

Description: Set the desired location of the writing area.

Example:

Command / Response	Host	ePH1200
COM (set writing area location)	50 46 04 10 10 F0 F0 96	
ACK (set writing area location)		50 46 04 FF FF FF FF 47

11.3.15 Set Recognition Mode / Graphic Mode (0x49; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x49
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	Recognition:0x00 / Graphic:0x01
4-6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: Default is Recognition mode. Graphic mode transmission coordinates are similar to Recognition mode except recognition is not processed under Graphic mode.

Example:

1. Recognition Mode:

Command / Response	Host	ePH1200
COM (set recognition mode)	50 49 04 00 FF FF FF 06	
ACK (set recognition mode)		50 49 04 FF FF FF FF D7

2. Graphic Mode (0x49):

Command / Response	Host	ePH1200
COM (set Graphic Mode)	50 49 04 01 FF FF FF 10	
ACK (set Graphic Mode)		50 49 04 FF FF FF FF D7

11.3.16 Set Power Saving Mode (0x4A; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x4A
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	Enable "Tap to wake-up": 0x01 Disable "Tap to wake-up": 0x00
4	User defined	1	HEX	Idle time for idle mode to take effect: 1~20
5-6	Stuff	2	HEX	0xFF; 0xFF
7	Checksum	1	HEX	

Description:

1. Byte 3 represents the tap to wake-up switch
   0x01→ Enable "Tap to wake-up" function
   0x00→ Disable "Tap to wake-up" function (does not work under ECR mode)
2. Byte 4 represents the idle (no input) time before power saving mode takes effect. ePH1200 divides the time into 20 steps; i.e., 1~20 (valid values) Any other value above 20 is considered as "20." Every step increases by about 15 seconds. "1" represents 1x15 seconds and 20 represent 20x15 seconds. "0" value (default) is used to prevent ePH1200 from entering into power saving mode.
3. To instantly enter into power saving mode, add "0x80" to the defined idle time. Note that the instant power saving mode works only once and the defined idle time takes over.

Example:

Command / Response	Host	ePH1200
COM (set power saving mode)	50 4A 04 01 02 FF FF 96	
ACK (set power saving mode)		50 4A 04 FF FF FF FF AC

11.3.17 Set A/D Resolution (0x4B; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x4B
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	A/D 8 bit resolution : 0x01 A/D 10 bit resolution : 0x00
4~6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: ePH1200 supports two A/D resolutions: 8-bit or 10-bit (default is 8-bit).

Example:

Command / Response	Host	ePH1200
COM (set A/D resolution:8 bit)	50 4B 04 01 FF FF FF 42	
COM (set A/D resolution:10 bit)	50 4B 04 00 FF FF FF 54	
ACK (set A/D resolution)		50 4B 04 FF FF FF FF 85

11.3.18 Rotate Touch Panel (0x4C; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x4C
2	Parameter length	1	HEX	0x04
3	User defined	1	HEX	
4~6	Stuff	3	HEX	0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	

Description: Exchange touch panel X/Y axis.

- **Byte 3**

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0				0	0	0	0

Bit 6=1 represents XN/YN exchange, XP/YP exchange

Bit 5=1 represents XN/XP exchange, Y direction fixed

Bit 4=1 represents YN/YP exchange, X direction fixed

Bit 7, Bit0~3 must be fixed to 0.

Example:

Command / Response	Host	ePH1200
COM (rotate touch panel)	50 4C 04 70 FF FF FF B9	
ACK (rotate touch panel)		50 4C 04 FF FF FF FF 5A

11.3.19 Output PROM/DROM checksum (0xF0; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0XF0
2	Parameter length	1	HEX	0x04
3~6	Stuff	4	HEX	0xFF; 0xFF; 0xFF ; 0xFF
7	Checksum	1	HEX	0xF8

Description: ePH1200 can output PROM/DROM checksum through this command.

Example:

Command / Response	Host	ePH1200
COM (output PROM/DROM checksum)	50 F0 04 FF FF FF FF F8	
ACK (output PROM/DROM checksum)		50 F0 04 FF FF FF FF F8
PROM checksum		50 F0 04 07 3A 05 1A 25
DROM checksum		50 F0 04 E5 3E 5E 40 DC

11.4 Responses from ePH1200 Specifications

11.4.1 ACK_ERROR (0x00; 8 Bytes)

Bytes	Function	Length	Data format	Remark
0	Header	1	HEX	0x50
1	Command	1	HEX	0x00
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0x00; 0x00; 0x00; 0x00;
7	Checksum	1	HEX	0x19

Description: If host sends an invalid command, ePH1200 will respond “ACK ERROR” to host.

Example:

Command / Response	Host	ePH1200
Response (ACK error)		50 00 04 00 00 00 00 19

11.4.2 Inking (Access to Written Input) Coordinates (0x16; 6 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x16
2	Parameter length	1	HEX	0x02
3	X coordinate	1	HEX	0x00—0xFE
4	Y coordinate	1	HEX	0x00—0xFE
5	Checksum	1	HEX	

Description:

- Normal inking: when the stylus taps the touch panel, the coordinate is transmitted.
- Stroke over: when the stylus leaves the touch panel, “0xFF,0xFF” is transmitted.
- Word over: when a word is completed, “0xFF,0x00” is transmitted.

Example:

ePH1200 Inking Response	Desciption
50 16 02 60 60 ED	=>Normal inking
50 16 02 65 61 AB 50 16 02 6A 61 68 50 16 02 6F 60 2E 50 16 02 74 5F 53	
50 16 02 FF FF 1B	=>Stroke over
50 16 02 40 8D CE 50 16 02 45 8F 81 50 16 02 4A 8F 42 50 16 02 4F 8F 03 50 16 02 55 8E D1 50 16 02 5C 8E 6C 50 16 02 62 8D 4A 50 16 02 67 8D 0B 50 16 02 6F 8C A4 50 16 02 74 8B 71 50 16 02 79 8A 9F 50 16 02 7E 8A F4 50 16 02 83 89 00 50 16 02 89 89 82 50 16 02 8E 88 EE 50 16 02 93 87 7D 50 16 02 98 86 ED	
50 16 02 FF FF 1B	=>Stroke over
50 16 02 FF 00 E8	=>Word over
50 18 15 0A 8C 4E A0 4E AB 51 35 6C 09 4E 3D 00 3A 00 3B 00 69 00 21 00 F9	

11.4.3 Touch Panel Button Coordinates (0x17; 6 Bytes; 0XFF is Pen Up Signal)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x17
2	Parameter length	1	HEX	0x02
3	X coordinate	1	HEX	0x00—0xFE; 0xFF
4	Y coordinate	1	HEX	0x00—0xFE; 0xFF
5	Checksum	1	HEX	

Description: The default values of the touch panel writing area are (0x10, 0x10) and (0xF0, 0xF0). ePH1200 will transmit coordinates through the touch panel button area (0x17) if the tapping occurs outside the writing area.

Example:

Command / Response	Host	ePH1200
Response (touch panel button)		50 17 02 01 01 3B

11.4.4 Recognized Characters Array (0x18; Maximum 25 Bytes; Minimum 6 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x18
2	Parameter length	1	HEX	
3	Max. qty. of characters	1	HEX	
4	Characters (low byte)	1	HEX	
5	Characters (high byte)	1	HEX	
….				
N	Checksum	1	HEX	

Description: Recognized characters array package. No character will utilize 6 bytes.

Example:

Command / Response	Host	ePH1200
Response (characters)		50 18 03 01 08 00 3A

11.4.5 Exit from Power Saving Mode (0x33; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x33
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF; 0xFF; 0xFF; 0xFF
7	Checksum	1	HEX	0x19

Description:

A. Wake-up Conditions

When ePH1200 enters power saving mode, ePH1200 will wake-up when one of the following conditions occurs**:**

1. Touch panel wake-up (“tap to wakeup”)**:**

   Tap the touch panel and ePH1200 wakes-up and sends 1 byte (0x00) to host. Host must respond “Host ready” within 7.5 sec, else ePH1200 will enter power saving mode again. Note that ePH1200 must have the tap-to-wakeup function enabled in order to perform this function.

Example:

Command / Response	Host	ePH1200
Touch panel wakeup response		00
Com (Host ready)	50 1C 04 FF FF FF FF B2	
ACK (Host ready)		50 1C 04 FF FF FF FF B2
Response		50 33 04 FF FF FF FF 19

2. Command wake-up: Host executes command “50 33 04 00 00 00 00 C7” to wakeup ePH1200.

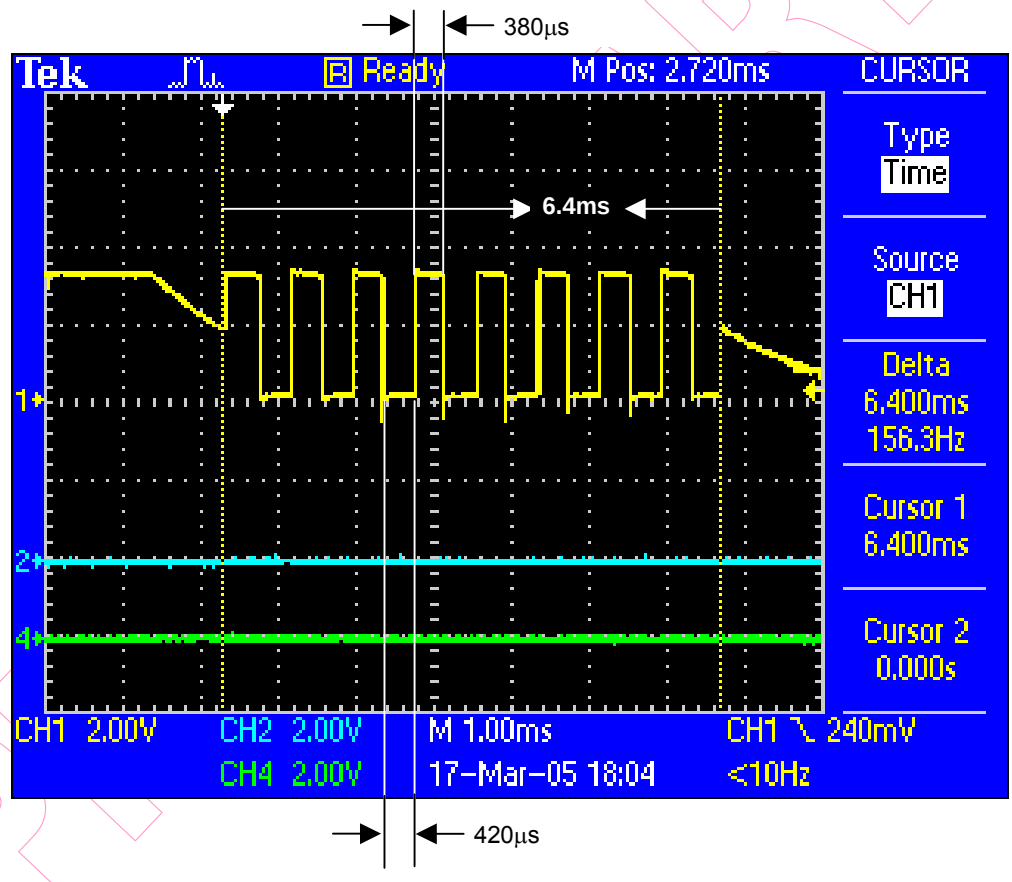
NOTE

Under ECR mode, Touch panel wake-up (Item 1) is always enabled while Command wake-up (Item 2) does not work under ECR mode.

Example:

Command / Response	Host	ePH1200
Command wakeup	50 33 04 00 00 00 00 C7	
Command wakeup response		50 33 04 FF FF FF FF 19

B. ePH1200 Wake-up Response Signal Details



The above waveform illustrates the characteristics of the signal which ePH1200 sends to host after it wakes up from Idle mode. This signal is compose of 8 clock with total width of 6.4ms and is applicable only under “Tap to wakeup” condition.

11.4.6 Initial Power On (0x42; 8 Bytes)

Bytes	Function	Length	Data Format	Remarks
0	Header	1	HEX	0x50
1	Command	1	HEX	0x42
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0x00; 0x00; 0x00; 0x00;
7	Checksum	1	HEX	0x3D

Description: When ePH1200 is powered on, it will send “Initial power on” response to host.

Example:

Command / Response	Host	ePH1200
Response (initial power on)		50 42 04 00 00 00 00 3D

11.4.7 ACK_OK (Carry Out Host Command; 8 Bytes)

Bytes	Function	Length	Data format	Remark
0	Header	1	HEX	0x50
1	Follow host command	1	HEX	
2	Parameter length	1	HEX	0x04
3-6	Stuff	4	HEX	0xFF,0xFF,0xFF,0xFF
7	Checksum	1	HEX	

Description: After executing the host command, ePH1200 response with an ACK OK format which corresponds to the given command.

Example: Refer to each command sample provided in this specification.

11.5 Checksum Program

Reference : www.6502.org:

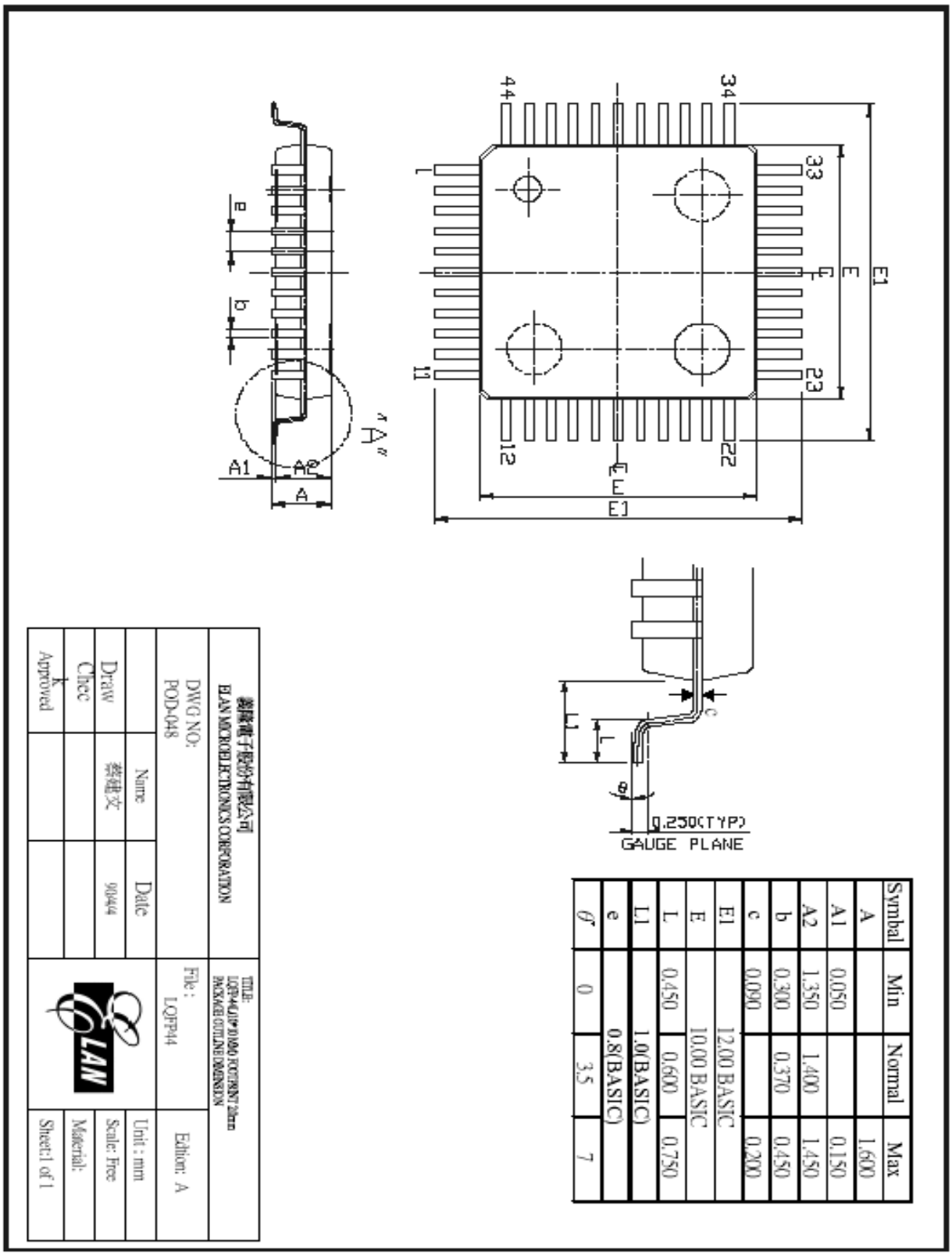
Source: CRC Calculations

```
CRC-8 8bits checksum table
const BYTE CRCTable[256]={
0x00,0x07,0x0E,0x09,0x1C,0x1B,0x12,0x15,0x38,0x3F,0x36,0x31,
0x24,0x23,0x2A,0x2D,0x70,0x77,0x7E,0x79,0x6C,0x6B,0x62,0x65,
0x48,0x4F,0x46,0x41,0x54,0x53,0x5A,0x5D,0xE0,0xE7,0xEE,0xE9,
0xFC,0xFB,0xF2,0xF5,0xD8,0xDF,0xD6,0xD1,0xC4,0xC3,0xCA,0xCD,
0x90,0x97,0x9E,0x99,0x8C,0x8B,0x82,0x85,0xA8,0xAF,0xA6,0xA1,
0xB4,0xB3,0xBA,0xBD,0xC7,0xC0,0xC9,0xCE,0xDB,0xDC,0xD5,0xD2,
0xFF,0xF8,0xF1,0xF6,0xE3,0xE4,0xED,0xEA,0xB7,0xB0,0xB9,0xBE,
0xAB,0xAC,0xA5,0xA2,0x8F,0x88,0x81,0x86,0x93,0x94,0x9D,0x9A,
0x27,0x20,0x29,0x2E,0x3B,0x3C,0x35,0x32,0x1F,0x18,0x11,0x16,
0x03,0x04,0x0D,0x0A,0x57,0x50,0x59,0x5E,0x4B,0x4C,0x45,0x42,
0x6F,0x68,0x61,0x66,0x73,0x74,0x7D,0x7A,0x89,0x8E,0x87,0x80,
0x95,0x92,0x9B,0x9C,0xB1,0xB6,0xBF,0xB8,0xAD,0xAA,0xA3,0xA4,
0xF9,0xFE,0xF7,0xF0,0xE5,0xE2,0xEB,0xEC,0xC1,0xC6,0xCF,0xC8,
0xDD,0xDA,0xD3,0xD4,0x69,0x6E,0x67,0x60,0x75,0x72,0x7B,0x7C,
0x51,0x56,0x5F,0x58,0x4D,0x4A,0x43,0x44,0x19,0x1E,0x17,0x10,
0x05,0x02,0x0B,0x0C,0x21,0x26,0x2F,0x28,0x3D,0x3A,0x33,0x34,
0x4E,0x49,0x40,0x47,0x52,0x55,0x5C,0x5B,0x76,0x71,0x78,0x7F,
0x6A,0x6D,0x64,0x63,0x3E,0x39,0x30,0x37,0x22,0x25,0x2C,0x2B,
0x06,0x01,0x08,0x0F,0x1A,0x1D,0x14,0x13,0xAE,0xA9,0xA0,0xA7,
0xB2,0xB5,0xBC,0xBB,0x96,0x91,0x98,0x9F,0x8A,0x8D,0x84,0x83,
0xDE,0xD9,0xD0,0xD7,0xC2,0xC5,0xCC,0xCB,0xE6,0xE1,0xE8,0xEF,
0xFA,0xFD,0xF4,0xF3};

Code of produce and verify checksum :
unsigned char GenerateCRC(unsigned char *Packet,
 int size)
{
int i;
unsigned char value;
value=0;
for(i=0;i<size-1;i++){
  value ^= Packet[i];
  value=CRCTable[value];
}
return value;
}


void main(void)
{
  unsigned char Packet[8]; //produce checksum of 8bytes package
  int I;
  for(I=0;I<8;I++)Packet[I]=0;
  Packet[7]=GenerateCRC(Packet,sizeof(Packet)) //checksum place the eighth
                                                byte }
```

12 Package LQFP44



Symbal	Min	Normal	Max
A			1.600
A1	0.050		0.150
A2	1.350	1.400	1.450
b	0.300	0.370	0.450
c	0.090		0.200
E1		12.00 BASIC	
E		10.00 BASIC	
L	0.450	0.600	0.750
L1		1.0(BASIC)	
e		0.8(BASIC)	
θ	0	3.5	7

凌陽電子股份有限公司 ELAN MICROELECTRONICS CORPORATION			TITLE: LQFP44L(10*10)0.8/1.0 2.0mm PACKAGE OUTLINE DIMENSION
DWG NO: POD-048	Name	Date	File: LQFP44
			Edition: A
Draw	蔡健文	98/4/4	Unit: mm
Chec			Scale: Free
k			Material:
Approved			Sheet:1 of 1

13 Tape Reel Specification