上海冠显光电科技有限公司
Shanghai Top Display Optoelectronics Co., LTD

X2B1 Model
Datasheet

Revision 1.2
2026-5-23

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Revision History SS

Revision	Date	Description
1.0	Mar.28.2025	Initial Release Version.
1.1	July.19.2025	Updated overview,modified PIN labeling, and added CAN circuit reference design.
1.2	2026-5-23	Remove CAN function description

Table of Contents

Declaration 1
Revision History 2
Table of Contents 3
1. Overview 4
2. Description 5
2.1 CPU Architecture 5
2.2 Memory Subsystem 5
2.3 Reliability Assurance System 6
2.4 Display System 6
2.5 Audio Subsystem 6
2.6 System Peripherals 7
2.7 Firmware update 9
3. PIN Description 10
3.1 Pin Table 10
3.2 Detailed Pin Description 13
4. Electrical Characteristics 15
4.1 Maximum Ratings 15
4.2 Recommended Operating Conditions 15
4.3 DC Electrical Characteristics 15
4.4 Power Up/ Down Sequence 16
5. Package Dimension 17
5.1 Structure 17
6. Reflow Profile 18

1. Overview

1. High performance and low cost.
2. Shorten the development time of product human-computer interaction: Use the PC software ("GIRAFFE®") to drag and drop to design the user interface and control GPIO, communication, peripherals, etc.
3. Based on the RISC-V CPU architecture. Equipped with powerful 2D graphics acceleration processor, PNG/JPEG decoding engine.
4. 24/18/16 - bit RGB interface, and the LCD resolution supports up to 1024x768.
5. Support WAV and MP3 format audio playback.
6. 3 UARTs with a baud rate of up to 3Mbps, support hardware - controlled 485 direction, and the 485 communication rate is also up to 3Mbps.
7. 2 I2Cs.
8. Support up to 2 independent 16 - bit PWMs or 1 complementary PWM.
9. Support resistive touchscreens and capacitive touchscreens.
10. Built - in 12MB of ROM for users to save the user interface. Larger ROMs can be selected or expanded via an SD card.

Model	Maximum Resolution	ROM
X2B1	1024*768	12MB

2. Description

2.1 CPU Architecture

The X2 Model is based on RISC-V CPU architecture.

2.2 Memory Subsystem

This section consists of internal memory and external memory:

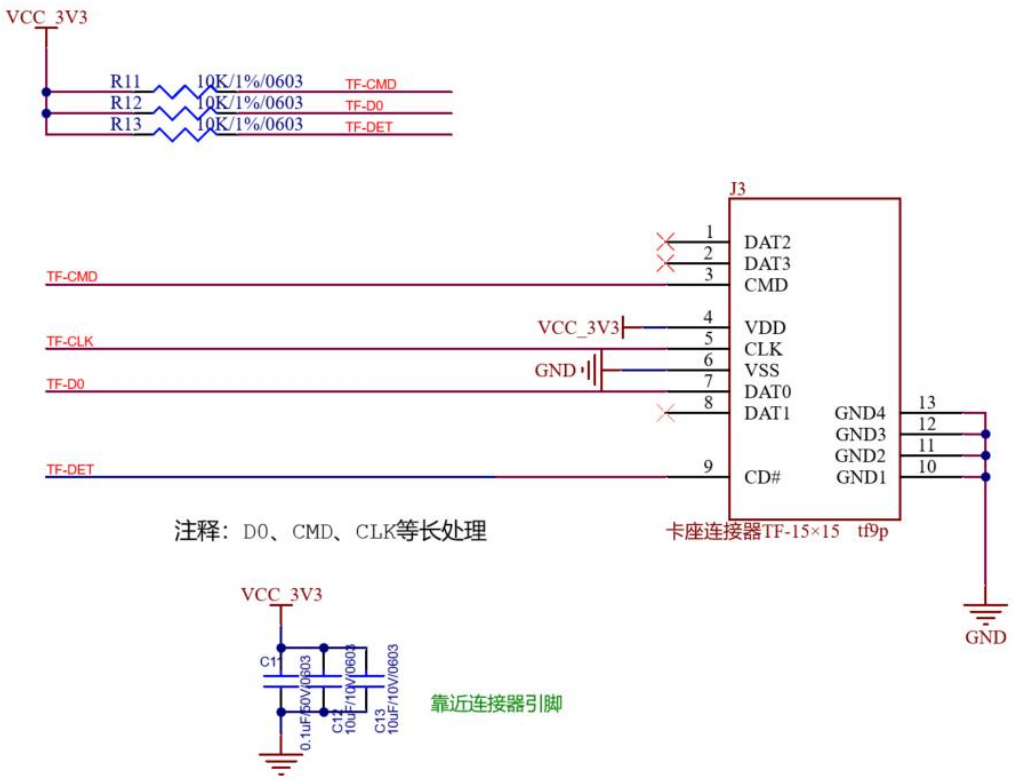
- ROM
- SD Interface

ROM

- Internal 16M Bytes memory, 12M Bytes left for users.
- Support Firmware download via a Micro SD card.

SD Interface

- Support external memory
- SD reference design



2.3 Reliability Assurance System

- Support watchdog reset inside
- Built - in temperature sensor, support high - and - low - temperature interrupt alarms and over - temperature reset.

2.4 Display System

This section includes:

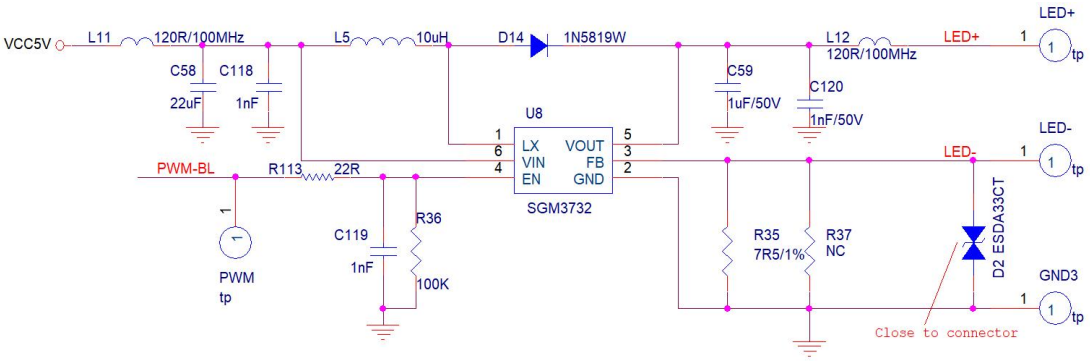
- **Display Output**
- **Backlight Control**

Display Output

- RGB interface, up to 1024×600@60Hz.
- Support RGB565/RGB666/RGB888 interfaces.

Backlight Control

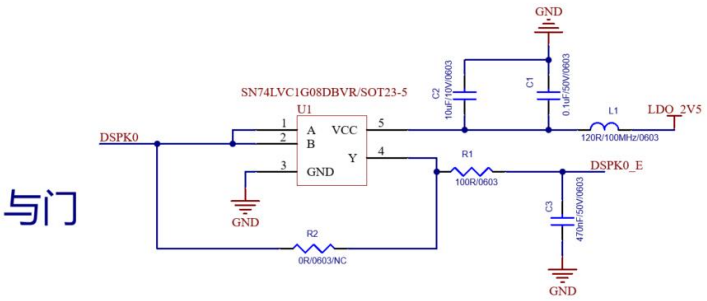
- To adjust backlight brightness & power on/off backlight
- Reference design for backlight control



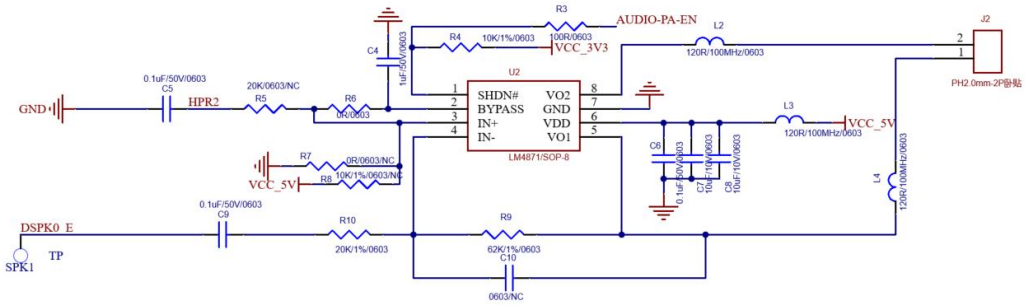
2.5 Audio Subsystem

Audio Decoder

- Digital PWMS output (DSPK).
- Reference Design



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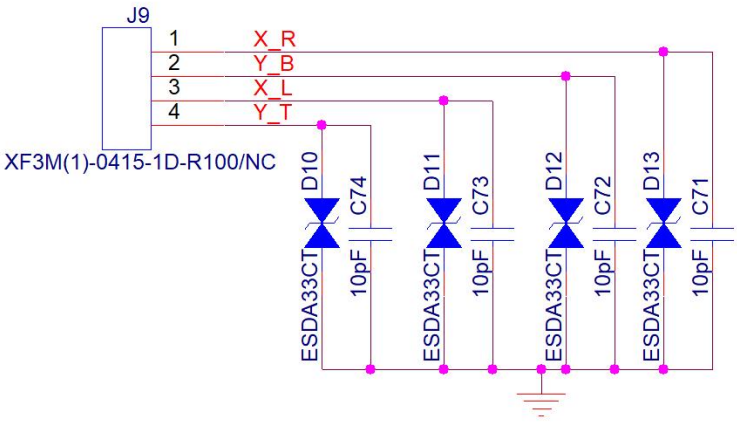
2.6 System Peripherals

This section includes:

- **TP**
- **UART**
- **IIC**

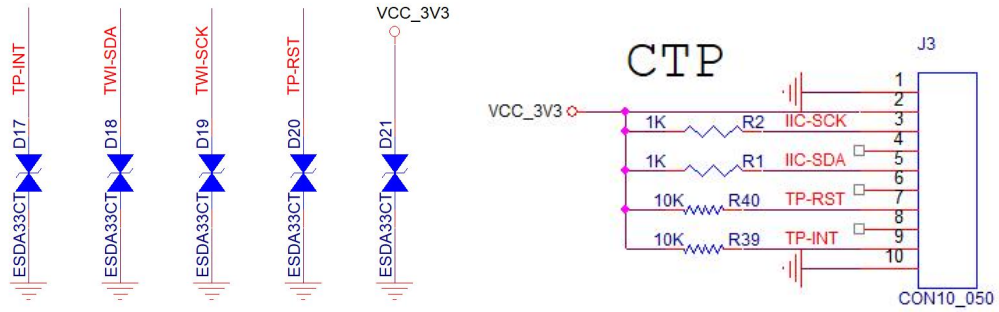
Resistive Touch Screen (RTP)

- 12-bit SAR type analog-to-digitalconverter
- 4-wire I/F
- Sampling frequency: 2MHz
- Median and averaging filter to reduce noise
- Support the functions of X and Y changes.
- Reference Design



Capacitive Touch Screen (CTP)

- Reference Design

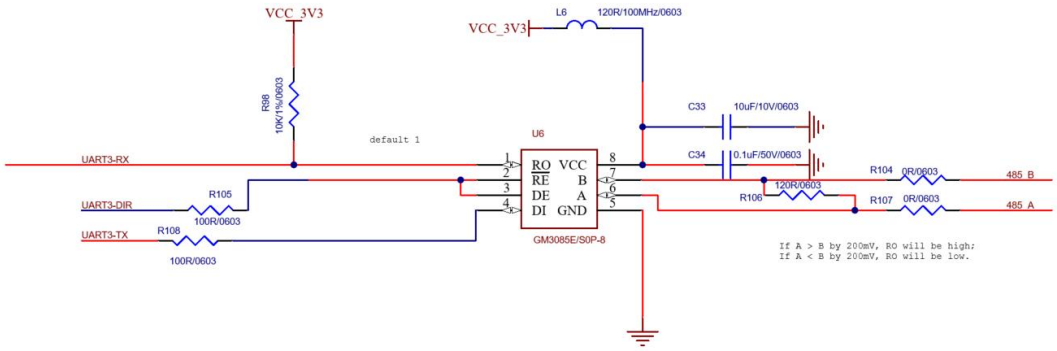


UART

- 2 UART for user
- Compatible with industry-standard 16550 UART
- Baud rate: up to 3Mbps.
- Data bits: 8, parity bit: none, stop bits:1

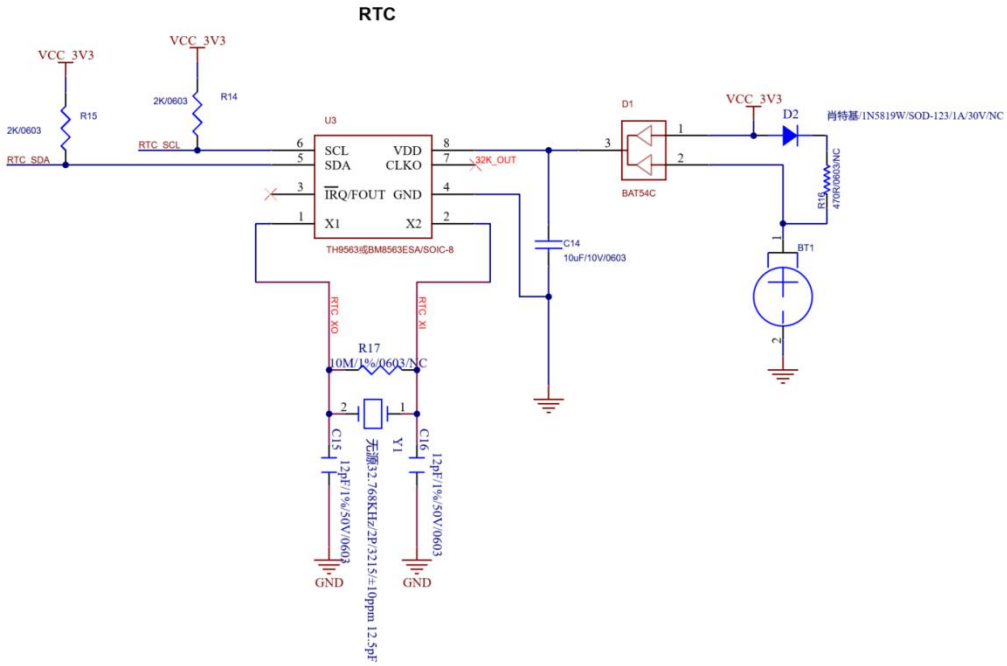
485

- 485 speed can reach 3Mbps.
- Reference Design



I2C

- 2 user I2Cs.
- Can mount multiple devices simultaneously.
- RTC - supported ICs: PCF8563, TH9563, TCS9563, HYM8563.
- Reference Design



2.7 Firmware update

- **Via TF card**

Update firmware via TF card

- Download the firmware to a TF card, and then plug in and restart.

3. PIN Description

3.1 Pin Table

Following table describes the X2B1 pin characteristics from seven aspects: *Pin Num, Pin Name, Default Function, Type, Reset* State, Default Pull Up/Down and so on.

(1) ***Default function:*** defines the default function of each pin, especially for pins with multiplexing functions; pins marked with port numbers in Function 2 can be used as GPIOs when other multiplexing functions are not in use.
(2)***Pin types:*** O for output, I for input, I/O for input/output, A for analog, AI for analog input, AO for analog output, AI/O for analog input/output, OD for Open-Drain, P for power and G for ground;
(3)***Reset state:*** defines the terminal state during reset. Z represents high impedance.
(4)***Default pull - up/pull - down:*** defines whether there is an internal pull - up or pull - down resistor. Unless otherwise specified, the pin is floating by default and can be configured as pull - up or pull - down.

Pin Num(1)	Default Function	Function 2	Function 3	Pin Type(2)	Reset State(3)	Default Pull Up/ Down(4)	Description
SD Card							
4	SDC-DET			I/O	Z	-	Used for TF card.
67	SDC-D0			I/O	Z	-	
68	SDC-CLK			I/O	Z	-	
1	SDC-CMD			I/O	Z	-	
Debug and Reset							
56	Debug_TX				Z		Debug interface, which can check the system operating status. UART 3.3V, baud rate 115200. Keeping Debug_TX grounded during startup can force the device into update mode.
57	Debug_RX				Z		

50	RESET#				-	-	Enabled by low level.
GPIO/Peripherals							
2	PWM0_A	PC4	I2C1_SCL	I/O	Z	-	16 - bit PWM, with a maximum frequency of 24MHz. When PWM0_A and PWM0_B work simultaneously, their frequencies must be the same.
3	PWM0_B	PC5	I2C1_SDA	I/O	Z	-	
36	BUZZER	PE12		I/O	Z	-	Connected to an active buzzer.
37	DSPK0	PE13		I/O	Z	-	Digital PWM audio output port.
44	PA-EN	PB6	UART1_TX	I/O	Z	-	Automatically enables/disables the audio power amplifier. A logic high level is used to turn it off.
45	LCD-CS	PB7	UART1_RX	I/O	Z	-	This pin is used for LCDs that require SPI initialization.
46	LCD-RST	PB8	UART1_RTS	I/O	Z	-	This pin is used for LCDs that require initialization.
47	UART3_DIR	PB9		I/O	Z	-	Connected to the direction pin of the 485 chip during 485 communication.
48	UART3_TX	PB10		I/O	Z	-	Used for UART or RS485, 3.3V TTL.
49	UART3_RX	PB11		I/O	Z	-	

58	I2C1_SCL	PA2	ADC2/UART1_TX /UART2_CTS	I/O	Z	-	A 2 - 5KΩ pull-up resistor is required.
59	I2C1_SDA	PA3	ADC3/UART1_RX /UART2_RTS	I/O	Z	-	A 2 - 5KΩ pull-up resistor is required.
60	UART2_TX	PA4	ADC4	I/O	Z	-	3.3V TTL
61	UART2_RX	PA5	ADC5	I/O	Z	-	3.3V TTL
66	STATUS-LED	PC0		I/O	Z	-	Indicates the working status of the system. For example, when no screen is connected, it can indicate the download completion status, etc.
LCD							
5	LCD-PWM			I/O	Z		Enable/disable or adjust the LCD backlight brightness.
6	LCD-DE			I/O	Z		
7	LCD-VSYNC			I/O	Z		
8	LCD-HSYNC			I/O	Z	-	The RGB order of the LCD is determined by the pull-up/down states of Config-RB/Config16-23/Config8-15/Config0-7 during power-on. The pull-up/down resistors cannot be omitted. Config-RB: Swap RB; Config16-23: Mirror the color order of PD16 -
10	LCD-CLK			I/O	Z	-	
12	LCD-R7	PD23		I/O	Z	-	
13	LCD-R6	PD22		I/O	Z	-	
14	LCD-R5	PD21		I/O	Z	-	
15	LCD-R4	PD20	Config-RB	I/O	Z	-	
16	LCD-R3	PD19	Config16-23	I/O	Z	-	
17	LCD-R2	PD18		I/O	Z	-	
18	LCD-R1	PD17		I/O	Z	-	
19	LCD-R0	PD16		I/O	Z	-	
20	LCD-G7	PD15		I/O	Z	-	
21	LCD-G6	PD14		I/O	Z	-	
22	LCD-G5	PD13		I/O	Z	-	
23	LCD-G4	PD12	Config8-15	I/O	Z	-	
24	LCD-G3	PD11	Config0-7	I/O	Z		
25	LCD-G2	PD10		I/O	Z		
26	LCD-G1	PD9		I/O	Z		

27	LCD-G0	PD8		I/O	Z		PD23; Config8-15: Mirror the color order of PD8 - PD15; Config0-7: Mirror the color order of PD0 - PD7.
28	LCD-B7	PD7		I/O	Z		
29	LCD-B6	PD6		I/O	Z		
30	LCD-B5	PD5		I/O	Z		
31	LCD-B4	PD4	LCDInit-CLK	I/O	Z		
32	LCD-B3	PD3	LCDInit-SDA	I/O	Z		
33	LCD-B2	PD2		I/O	Z		
34	LCD-B1	PD1		I/O	Z		
35	LCD-B0	PD0		I/O	Z		
Touch Screen							
62	CTP_SCL	PA8	RTP-XR	A	-	-	Used for capacitive/resistive touch screens.
63	CTP_SDA	PA9	RTP-YB	A	-	-	
64	CTP-RST	PA10	RTP-XL	A	-	-	
65	CTP-INT	PA11	RTP-YT	A	-	-	
QSPI/GPIO							
38	NC						
39	NC						
40	NC						
41	NC						
42	NC						
43	NC						
Power							
53, 54	VCC			P	-	-	3.3±0.3V input
55	LDO_2V5			P	-	-	2.5V output, used to provide a reference power supply for audio output.
9, 11, 51, 52	GND			P	-	-	-

3.2 Detailed Pin Description

Pin Name	Description	Type
Touch panel		
RTP_YT	Resistive touch screen Y-axis top input	AI
RTP_YB	Resistive touch screen Y-axis bottom input	AI
RTP_XR	Resistive touch screen X-axis right input	AI

RTP_XL	Resistive touch screen X-axis left input	AI
Other Signals		
RESET#	Chip reset signal, active low	I
PWM	Pulse width modulation signal output	O
UART		
UART_TX	UART data transmission	O
UART_RX	UART data reception	I
SDC		
SDC_D0	SD/MMC/SDIO data bit	I/O
SDC_CLK	SD/MMC/SDIO clock	O
SDC_CMD	SD/MMC/SDIO command	I/O
IIC(Open-Drain)		
IIC_SCL	IIC clock	I/O
IIC_SDA	IIC data	I/O

4. Electrical Characteristics

4.1 Maximum Ratings

Symbol	Parameter	Min	Max	Unit
Tstg	Storage Temperature	-20	125	℃
II/O	Input/output Current for Input and Output	-55	60	mA
VCC	Power Supply for VCC and I/O	-0.3	3.6	V

4.2 Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
Tj	Junction Temperature	-20	-	105	℃
Ta	Ambient Operating Temperature [Commercial grade]	-20	-	85	℃
VCC	Power Supply	3.0	3.3	3.6	V
P	Module Power Consumption			0.5	W

4.3 DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-Level Input Voltage	0.7 * 3.3	-	3.3 + 0.3	V
V_{IL}	Low-Level Input Voltage	-0.3	-	0.3 * 3.3	V
R_{PU}	Input pull-up resistance		33		KΩ
R_{PD}	Input pull-down resistance		33		KΩ
I_{IH}	High-Level Input Current	-	-	10	uA
I_{IL}	Low-Level Input Current	-	-	10	uA
V_{OH}	High-Level Output Voltage	3.3-0.3	-	3.3	V
V_{OL}	Low-Level Output Voltage	0	-	0.3	V
IoH	High - level driving capability	8	-	60	mA
IoL	Low - level driving capability	8	-	55	mA
I_{OZ}	Tri-State Output Leakage Current	-10	-	10	uA
C_{IN}	Input Capacitance	-	-	5	pF
C_{OUT}	Output Capacitance	-	-	5	pF

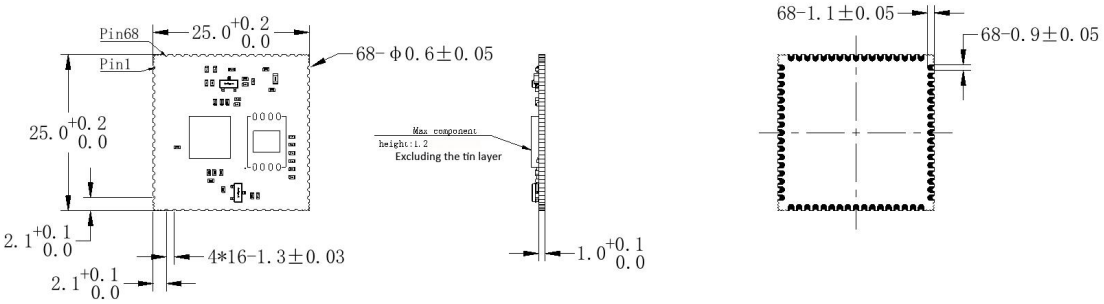
4.4 Power Up/ Down Sequence

No special restrictions for power up/ down sequence.

5. Package Dimension

5.1 Structure

The following figure shows the top, bottom, and side views of the X2B1 package dimensions.

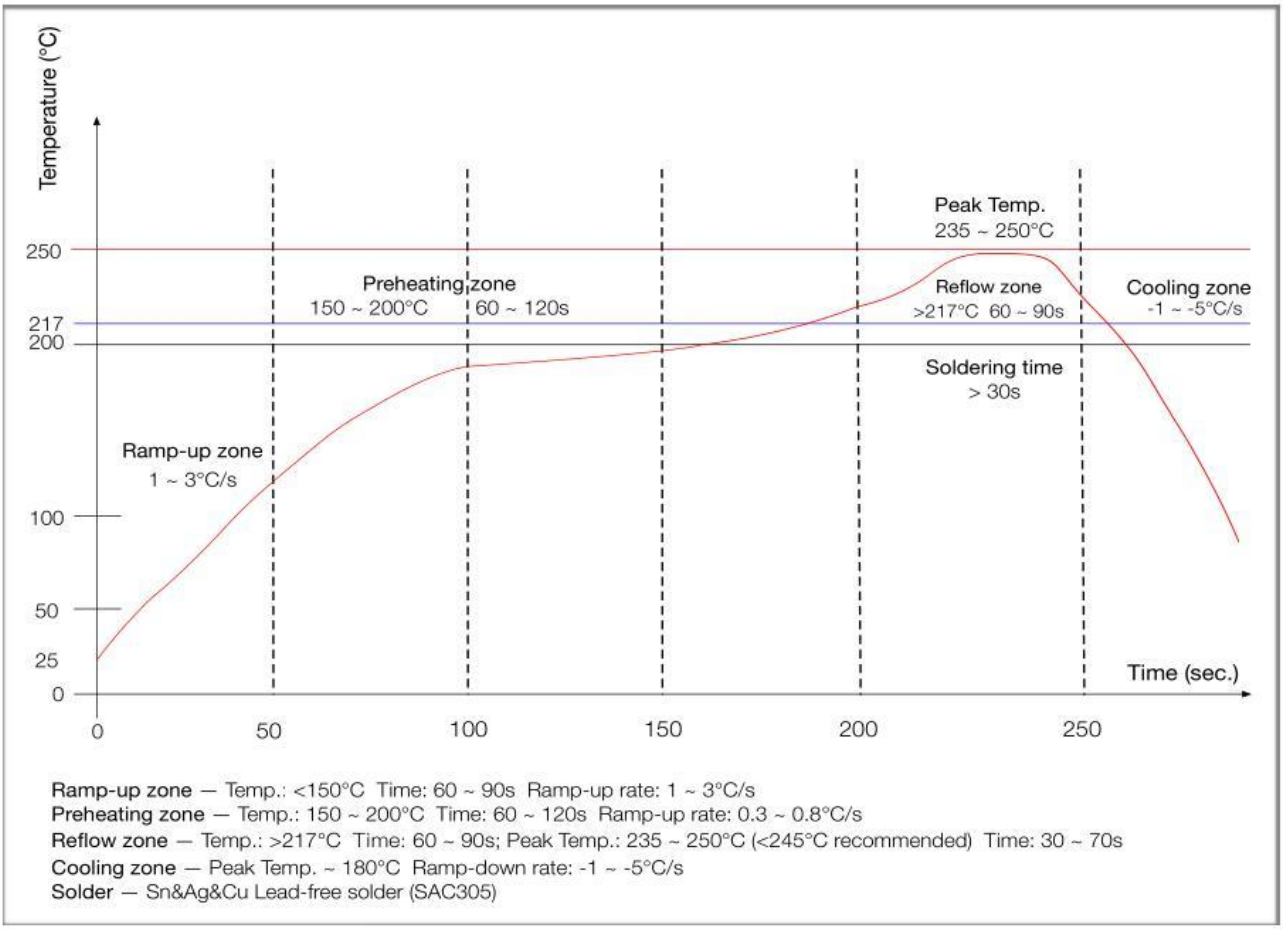


Number	Number of Pins	Lead - free (RoHS) **(1)**	REACH	Moisture Sensitivity Level **(2)**	Plating Information
X2B1	68	YES	YES	Level-3-260C-168 HR	ENIG

(1) Lead - free (RoHS): TDO's term "lead - free" means that semiconductor products meet the current RoHS requirements for all 6 substances, including that the weight percentage of lead in homogeneous materials shall not exceed 0.1%. If designed for high - temperature soldering, TDO's lead - free products are applicable to the specified lead - free process.

(2) Moisture Sensitivity Level: Humidity sensitivity level and peak soldering temperature classified according to JEDEC industry standards.

6. Reflow Profile



Ramp-up zone — Temp.: <150°C Time: 60 ~ 90s Ramp-up rate: 1 ~ 3°C/s
Preheating zone — Temp.: 150 ~ 200°C Time: 60 ~ 120s Ramp-up rate: 0.3 ~ 0.8°C/s
Reflow zone — Temp.: >217°C Time: 60 ~ 90s; Peak Temp.: 235 ~ 250°C (<245°C recommended) Time: 30 ~ 70s
Cooling zone — Peak Temp. ~ 180°C Ramp-down rate: -1 ~ -5°C/s
Solder — Sn&Ag&Cu Lead-free solder (SAC305)