



SUNRISE Technology

SPECIFICATION

SPEC. NO. : _____ REV : 1.0

DATE : 2017.08.02

PRODUCT NAME : FB00000

	APPROVED	CHECKED	PREPARED	DCC ISSUE
NAME				

SUNRISE

FB00000

WiFi 802.11 a/b/g/n
Module Spec Sheet

Revision History

Date	Revision Content	Revised By	Version
2017/08/02	- Preliminary	Eric	1.0
2018/06/14	- Fixed RF output power value	Eric	1.0

Contents

Contents	3
1. Introduction.....	4
2. Features.....	5
3. Deliverables	6
3.1 Deliverables.....	6
4. General Specification	7
4.1 General Specification.....	7
4.2 Voltages.....	7
4.2.1 Absolute Maximum Ratings.....	7
4.2.2 Recommended Operating Rating.....	7
5. Wi-Fi RF Specification.....	8
5.1 2.4GHz RF Specification.....	8
5.2 5GHz RF Specification.....	10
6. Pin Assignments.....	12
6.1 Pin Outline	12
6.2 Pin Definition	12
7. SDIO Pin Assignments.....	14
7.1 SDIO Pin Description.....	14
8. Host Interface Timing Diagram.....	15
8.1 Power-up Sequence Timing Diagram	15
8.2 SDIO Default Mode Timing Diagram.....	17
8.3 SDIO High Speed Mode Timing Diagram	18
8.4 SDIO Bus Timing Specifications in SDR Modes	19
8.5 SDIO Bus Timing Specifications in DDR50 Mode.....	21
9. Recommended Reflow Profile	23
APPENDIX A: CERTIFICATION NOTICES.....	24
APPENDIX B: LABEL FOR FINISHED PRODUCT.....	26

1. Introduction

SUNRISE Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi functionalities. The highly integrated module makes the possibilities of web browsing, VoIP applications. With seamless roaming capabilities and advanced security, also could interact with different vendors' 802.11a/b/g/n Access Points in the wireless LAN.

The wireless module complies with IEEE 802.11 a/b/g/n standard to connect to the wireless LAN. The integrated module provides SDIO interface for Wi-Fi.

2. Features

- IEEE 802.11a/b/g/n dual-band radio with virtual-simultaneous dual-band operation
- Supports 20 MHz channels with optional SGI
- Supports standard SDIO v3.0 and backward compatible with SDIO v2.0 host interfaces.
 - SDIO v3.0(4-bit) — up to 208 MHz clock rate in SDR104 mode

3. Deliverables

3.1 Deliverables

The following products and software will be part of the product.

- Module with packaging
- Evaluation Kits
- Software utility for integration, performance test.
- Product Datasheet.
- Agency certified pre-tested report with the adapter board.

4. General Specification

4.1 General Specification

Model Name	FB00000
Product Description	Support Wi-Fi 802.11 a/b/g/n functionalities
Dimension	L x W x H: 12 x 12 x 1.5 (typical) mm
WiFi Interface	SDIO v2.0/v3.0
Operating temperature	-30 °C to 85 °C
Storage temperature	-40 °C to 85 °C
Humidity	Operating Humidity 10% to 95% Non-Condensing

4.2 Voltages

4.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	6	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	3.9	V

4.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

	Min.	Typ.	Max.	Unit
Operating Temperature	-30	25	85	deg.C
VBAT	3.13	3.6	4.8	V
VDDIO	1.71	1.8	3.63	V

5. Wi-Fi RF Specification

5.1 2.4GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25 °C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n, WiFi compliant
Frequency Range	2.412 GHz ~ 2.462 GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz : Ch1 ~ Ch11
Modulation	802.11b : DQPSK, DBPSK, CCK 802.11g/n : 64-QAM, 16-QAM, QPSK, BPSK 802.11a : 64-QAM, 16-QAM, QPSK, BPSK
Output Power	802.11b /CCK : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -9dB
	802.11g /64-QAM(R=3/4) : 22.5 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
	802.11n /64-QAM(R=5/6) : 22.5 dBm $\pm$ 1.5 dB @ EVM $\leq$ -28dB
Receive Sensitivity (11b) @8% PER	- 1Mbps PER @ -96 dBm, typical
	- 2Mbps PER @ -90 dBm, typical
	- 5.5Mbps PER @ -88 dBm, typical
	- 11Mbps PER @ -87 dBm, typical
Receive Sensitivity (11g) @10% PER	- 6Mbps PER @ -90 dBm, typical
	- 9Mbps PER @ -88 dBm, typical
	- 12Mbps PER @ -87 dBm, typical
	- 18Mbps PER @ -85 dBm, typical
	- 24Mbps PER @ -83 dBm, typical
	- 36Mbps PER @ -80 dBm, typical
	- 48Mbps PER @ -76 dBm, typical
	- 54Mbps PER @ -74 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -85 dBm, typical
	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -80 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -75 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -71 dBm, typical

Receive Sensitivity (11a,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -87 dBm, typical
	- MCS=2 PER @ -86 dBm, typical
	- MCS=3 PER @ -82 dBm, typical
	- MCS=4 PER @ -79 dBm, typical
	- MCS=5 PER @ -75 dBm, typical
	- MCS=6 PER @ -73 dBm, typical
	- MCS=7 PER @ -72 dBm, typical
	- MCS=8 PER @ -67 dBm, typical
Maximum Input Level	802.11b : -10dBm
	802.11g/n : -20dBm
	802.11a : -30dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

5.1 5GHz RF Specification

Conditions : VBAT=3.6V ; VDDIO=3.3V ; Temp:25 °C

Feature	Description
WLAN Standard	IEEE 802.11a/b/g/n Wi-Fi compliant
Frequency Range	5.180 GHz ~ 5.240 GHz
Number of Channels	4 Channels ¹
Modulation	802.11a/n : 64-QAM,16-QAM, QPSK, BPSK
Output Power	802.11a /64-QAM(R=3/4) : 12.5 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB
Receive Sensitivity (11a, 20MHz) @10% PER	- 6Mbps PER @ -91 dBm, typical
	- 9Mbps PER @ -89 dBm, typical
	- 12Mbps PER @ -88 dBm, typical
	- 18Mbps PER @ -86 dBm, typical
	- 24Mbps PER @ -82 dBm, typical
	- 36Mbps PER @ -79 dBm, typical
	- 48Mbps PER @ -74 dBm, typical
	- 54Mbps PER @ -73 dBm, typical
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -90 dBm, typical
	- MCS=1 PER @ -88 dBm, typical
	- MCS=2 PER @ -85 dBm, typical
	- MCS=3 PER @ -82 dBm, typical
	- MCS=4 PER @ -78 dBm, typical
	- MCS=5 PER @ -74 dBm, typical
	- MCS=6 PER @ -72 dBm, typical
	- MCS=7 PER @ -71 dBm, typical

Receive Sensitivity (11a,20MHz) @10% PER	- MCS=0 PER @ -89 dBm, typical
	- MCS=1 PER @ -87 dBm, typical
	- MCS=2 PER @ -84 dBm, typical
	- MCS=3 PER @ -81 dBm, typical
	- MCS=4 PER @ -77 dBm, typical
	- MCS=5 PER @ -73 dBm, typical
	- MCS=6 PER @ -71 dBm, typical
	- MCS=7 PER @ -70 dBm, typical
	- MCS=8 PER @ -66 dBm, typical
Maximum Input Level	802.11a/n : -20dBm
Antenna Reference	Small antennas with 0~2 dBi peak gain

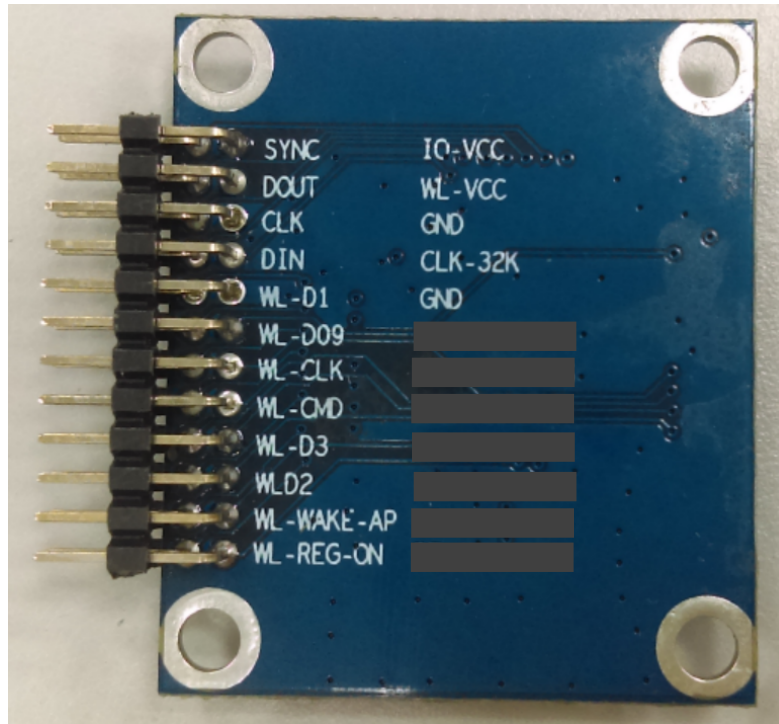
¹5GHz Channel table

Band (GHz)	Operating Channel Numbers	Channel center frequencies(MHz)
5.18GHz~5.24GHz	36	5180
	40	5200
	44	5220
	48	5240

6. Pin Assignments

6.1 Pin Outline

< BOTTOM VIEW >



6.2 Pin Definition

NO	Name	Type	Description
1	WL-REG-ON	I/O	
2	NC	—	
3	WL-WAKE-AP	I	
4	NC	—	
5	WL-D2	O	
6	NC	—	
7	WL-D3	O	
8	NC	—	
9	WL-CMD	I	
10	NC	—	
11	WL-CLK	I	
12	NC	—	
13	WL-D09	O	

14	NC	—	
15	WL-D1	I/O	
16	GND	—	
17	DIN	I	
18	CLK32K	I	
19	CLK	I	
20	GND	—	
21	DOUT	O	
22	WL-VCC	P	
23	SYNC	I	
24	IO-VCC	P	

7. SDIO Pin Assignments

The SDIO interface also has the ability to map the interrupt signal on to a GPIO pin for applications requiring an interrupt different from the one provided by SDIO interface. The ability to force control of gated clocks from within the device is also provided.

The following three functions are supported:

- ❖ Function 0 Standard SDIO function (Max BlockSize / ByteCount = 32B)
- ❖ Function 1 Backplane Function to access the internal System On Chip (SOC) address space (Max BlockSize / ByteCount = 64B)
- ❖ Function 2 WLAN Function for efficient WLAN packet transfer through DMA (Max BlockSize/ByteCount=512B)

7.1 SDIO Pin Description

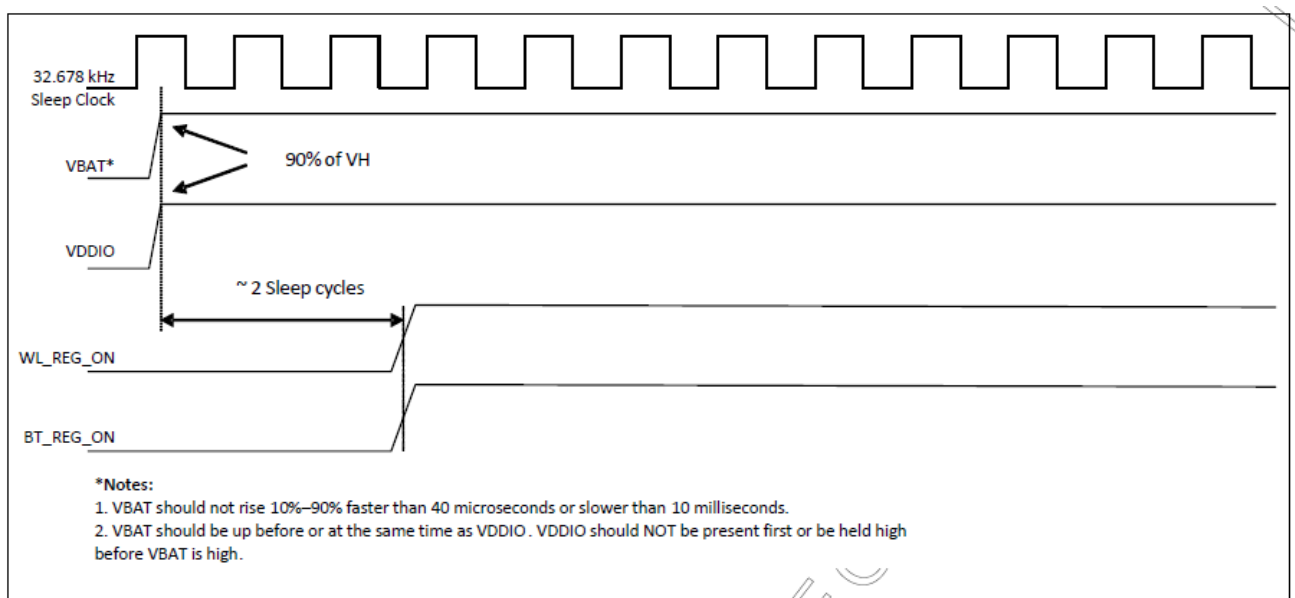
SD 4-Bit Mode	
DATA0	Data Line 0
DATA1	Data Line 1 or Interrupt
DATA2	Data Line 2 or Read Wait
DATA3	Data Line 3
CLK	Clock
CMD	Command Line

8. Host Interface Timing Diagram

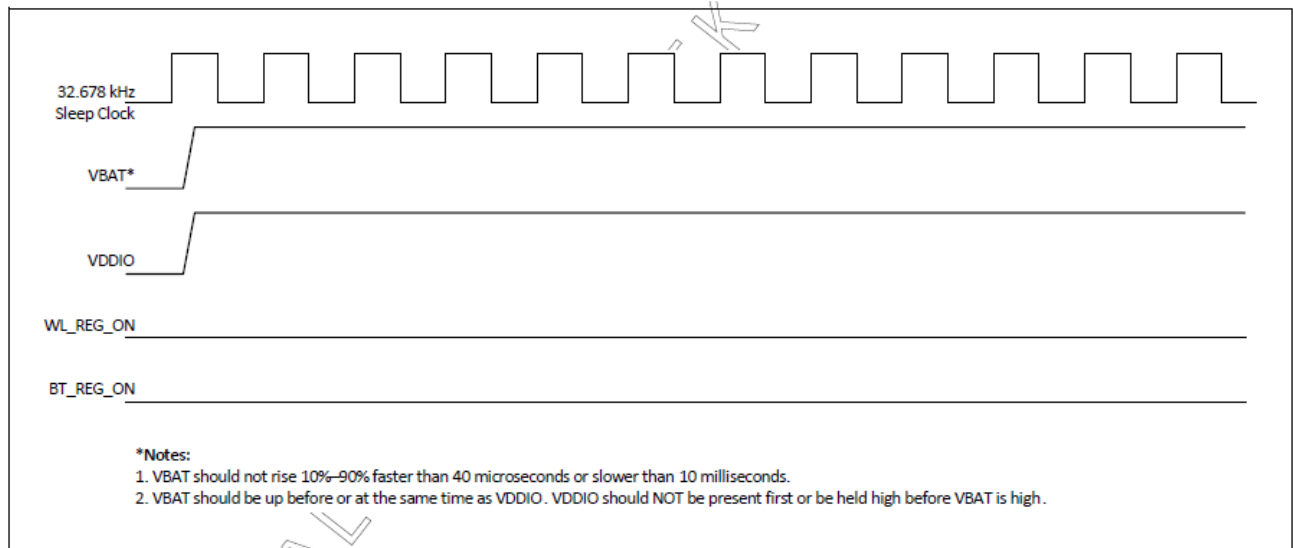
8.1 Power-up Sequence Timing Diagram

The module has signals that allow the host to control power consumption by enabling or disabling the WLAN and internal regulator blocks. These signals are described below. Additionally, diagrams are provided to indicate proper sequencing of the signals for various operating states. The timing value indicated are minimum required values: longer delays are also acceptable.

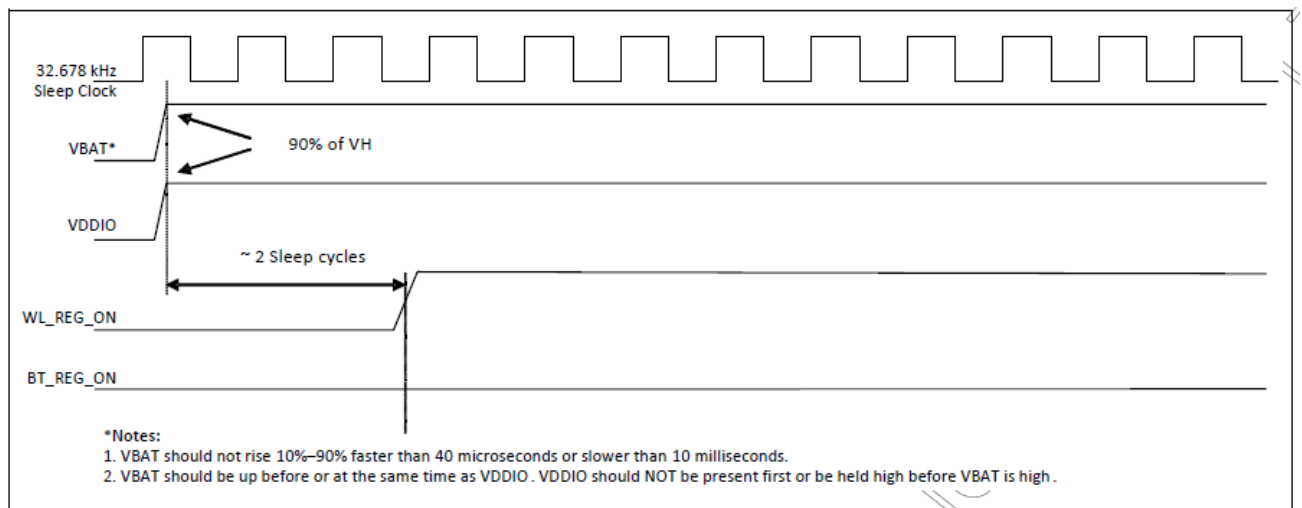
- ※ WL_REG_ON: Used by the PMU to power up or power down the internal regulators used by the WLAN section. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset.



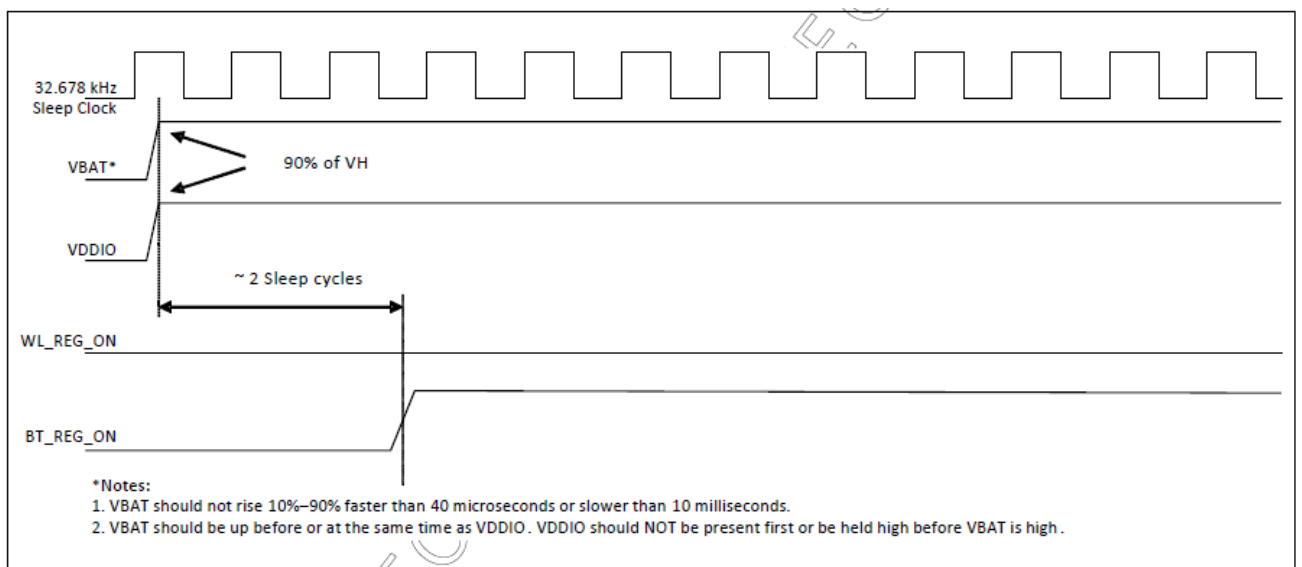
WLAN=ON



WLAN=OFF

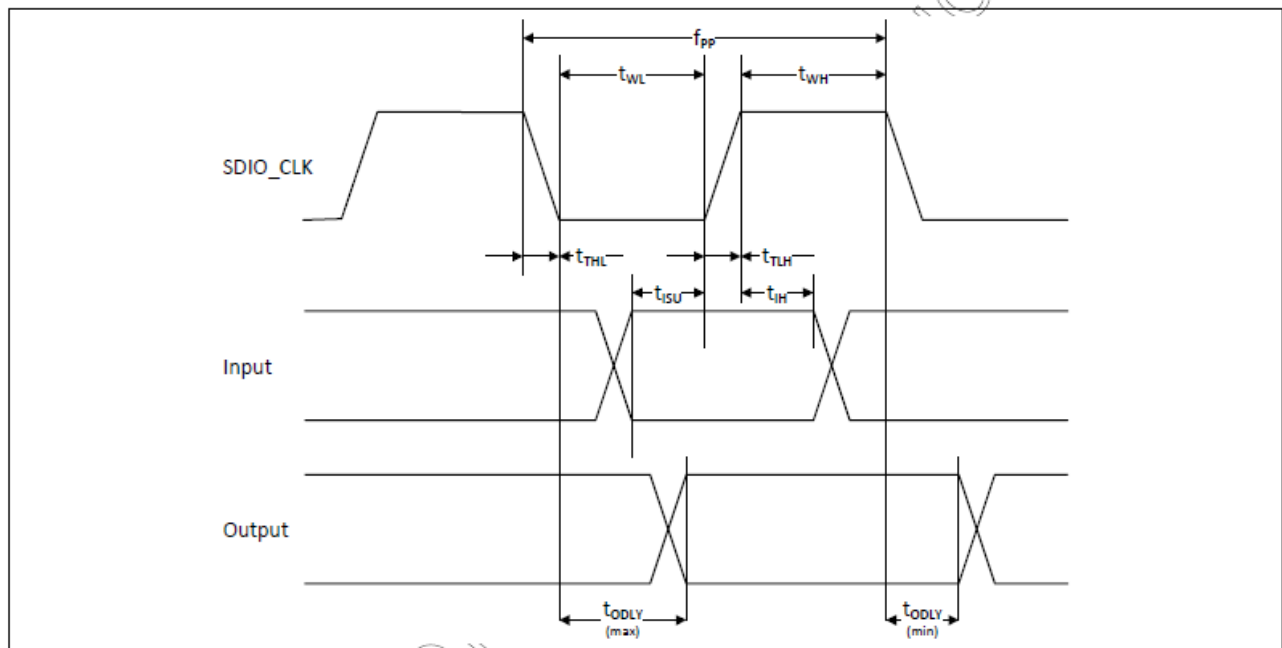


WLAN=ON



WLAN=OFF

8.2 SDIO Default Mode Timing Diagram

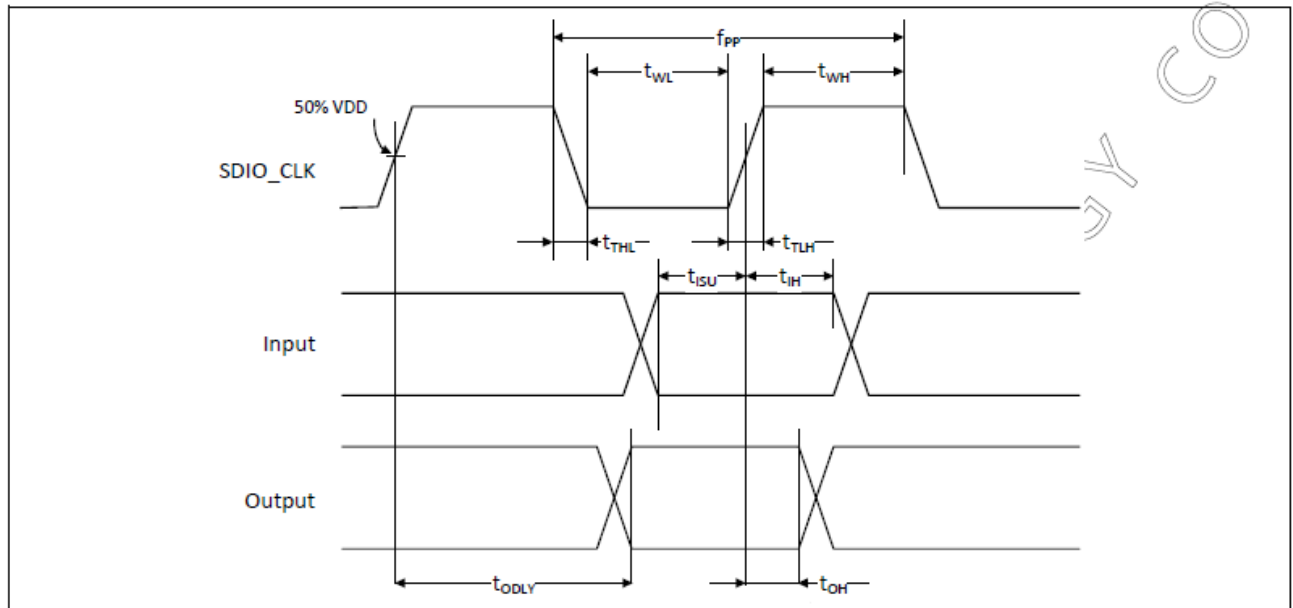


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer mode	f_{pp}	0	–	25	MHz
Frequency – Identification mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	10	–	–	ns
Clock high time	t_{WH}	10	–	–	ns
Clock rise time	t_{TLH}	–	–	10	ns
Clock low time	t_{THL}	–	–	10	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup time	t_{ISU}	5	–	–	ns
Input hold time	t_{IH}	5	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer mode	t_{ODLY}	0	–	14	ns
Output delay time – Identification mode	t_{ODLY}	0	–	50	ns

a. Timing is based on $CL \leq 40pF$ load on CMD and Data.

b. $\min(V_{IH}) = 0.7 \times V_{DDIO}$ and $\max(V_{IL}) = 0.2 \times V_{DDIO}$.

8.3 SDIO High Speed Mode Timing Diagram



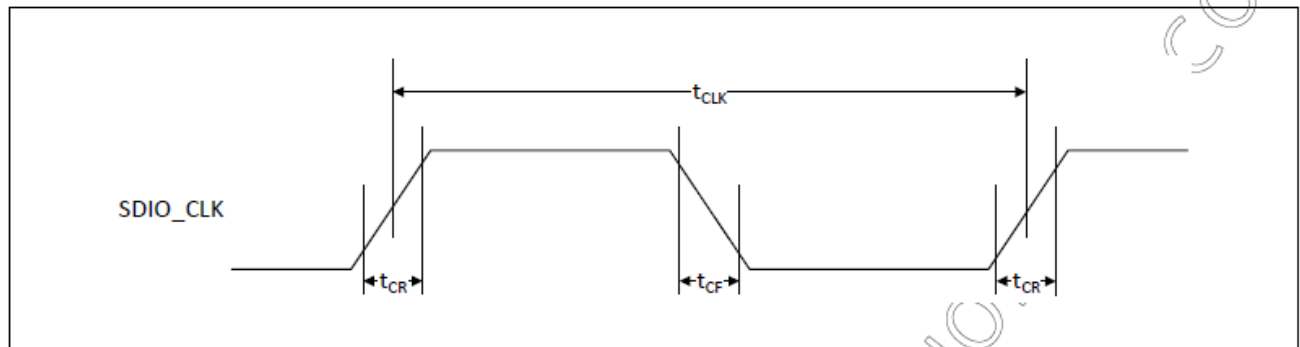
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (all values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer Mode	f_{PP}	0	–	50	MHz
Frequency – Identification Mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	7	–	–	ns
Clock high time	t_{WH}	7	–	–	ns
Clock rise time	t_{TLH}	–	–	3	ns
Clock low time	t_{THL}	–	–	3	ns
Inputs: CMD, DAT (referenced to CLK)					
Input setup Time	t_{ISU}	6	–	–	ns
Input hold Time	t_{IH}	2	–	–	ns
Outputs: CMD, DAT (referenced to CLK)					
Output delay time – Data Transfer Mode	t_{ODLY}	–	–	14	ns
Output hold time	t_{OH}	2.5	–	–	ns
Total system capacitance (each line)	CL	–	–	40	pF

a. Timing is based on $CL \leq 40$ pF load on CMD and Data.

b. $\min(V_{ih}) = 0.7 \times V_{DDIO}$ and $\max(V_{il}) = 0.2 \times V_{DDIO}$.

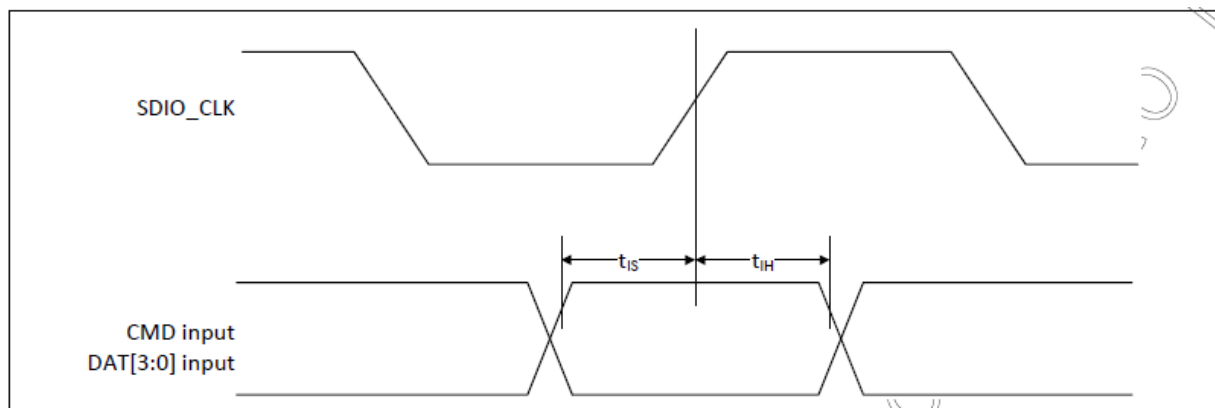
8.4 SDIO Bus Timing Specifications in SDR Modes

Clock timing (SDR Modes)



Parameter	Symbol	Minimum	Maximum	Unit	Comments
–	t_{CLK}	40	–	ns	SDR12 mode
		20	–	ns	SDR25 mode
		10	–	ns	SDR50 mode
		4.8	–	ns	SDR104 mode
–	t_{CR}, t_{CF}	–	$0.2 \times t_{CLK}$	ns	$t_{CR}, t_{CF} < 2.00$ ns (max) @100 MHz, $C_{CARD} = 10$ pF $t_{CR}, t_{CF} < 0.96$ ns (max) @208 MHz, $C_{CARD} = 10$ pF
Clock duty	–	30	70	%	–

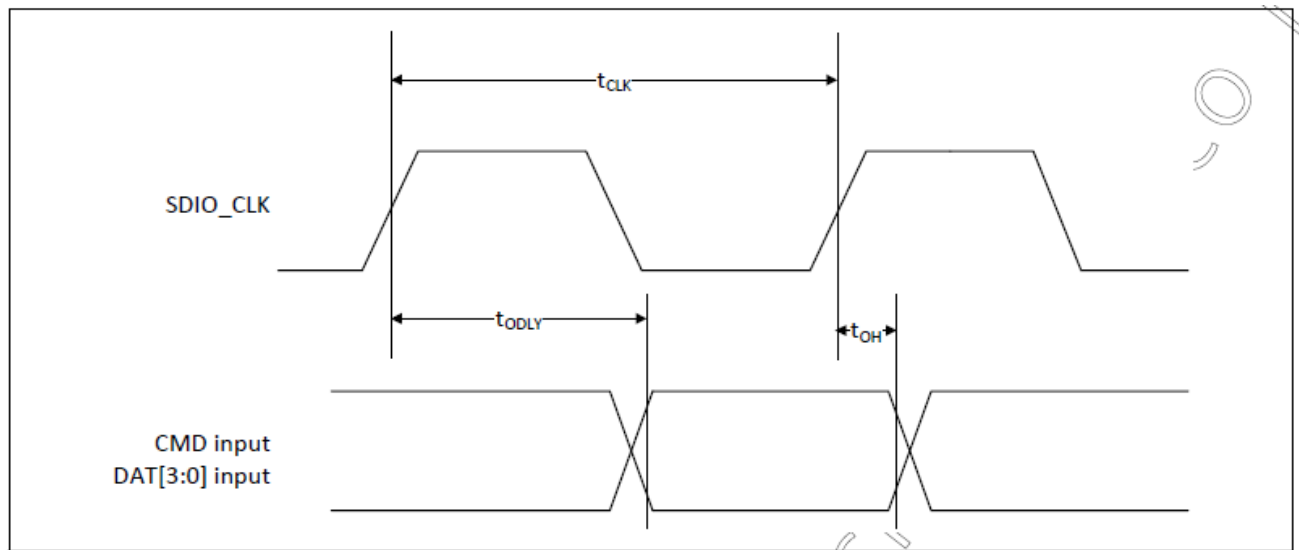
Card Input timing (SDR Modes)



Symbol	Minimum	Maximum	Unit	Comments
SDR104 Mode				
t_{IS}	1.70 ^a	–	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	–	ns	$C_{CARD} = 5$ pF, VCT = 0.975V
SDR50 Mode				
t_{IS}	3.00	–	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	–	ns	$C_{CARD} = 5$ pF, VCT = 0.975V

a. SDIO 3.0 specification value is 1.40 ns.

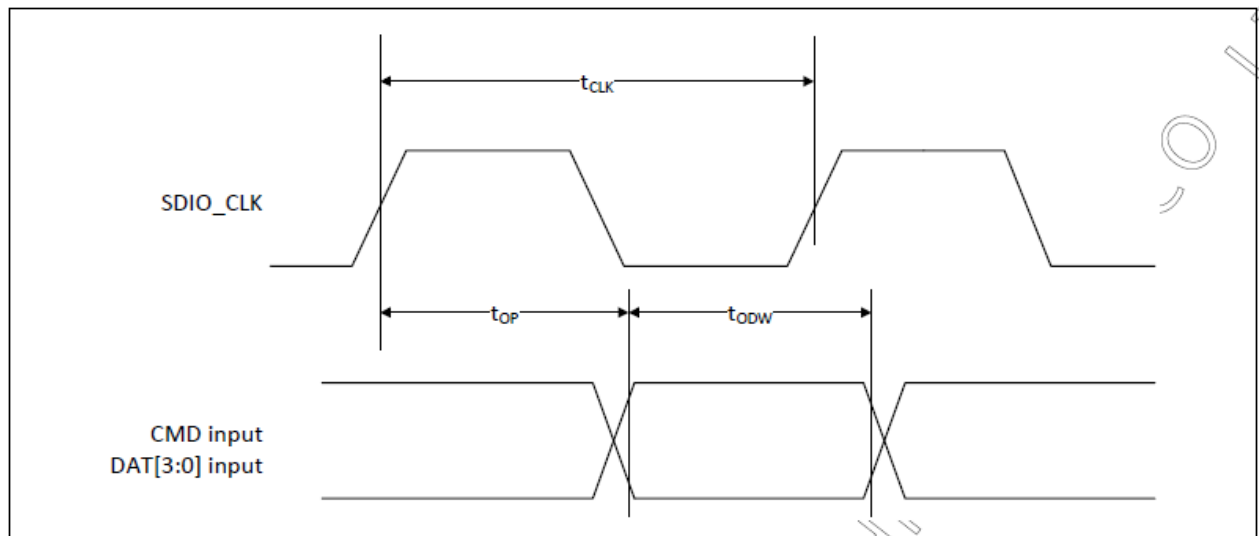
Card output timing (SDR Modes up to 100MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	–	7.85 ^a	ns	$t_{CLK} \geq 10$ ns $C_L = 30$ pF using driver type B for SDR50
t_{ODLY}	–	14.0	ns	$t_{CLK} \geq 20$ ns $C_L = 40$ pF using for SDR12, SDR25
t_{OH}	1.5	–	ns	Hold time at the t_{ODLY} (min) $C_L = 15$ pF

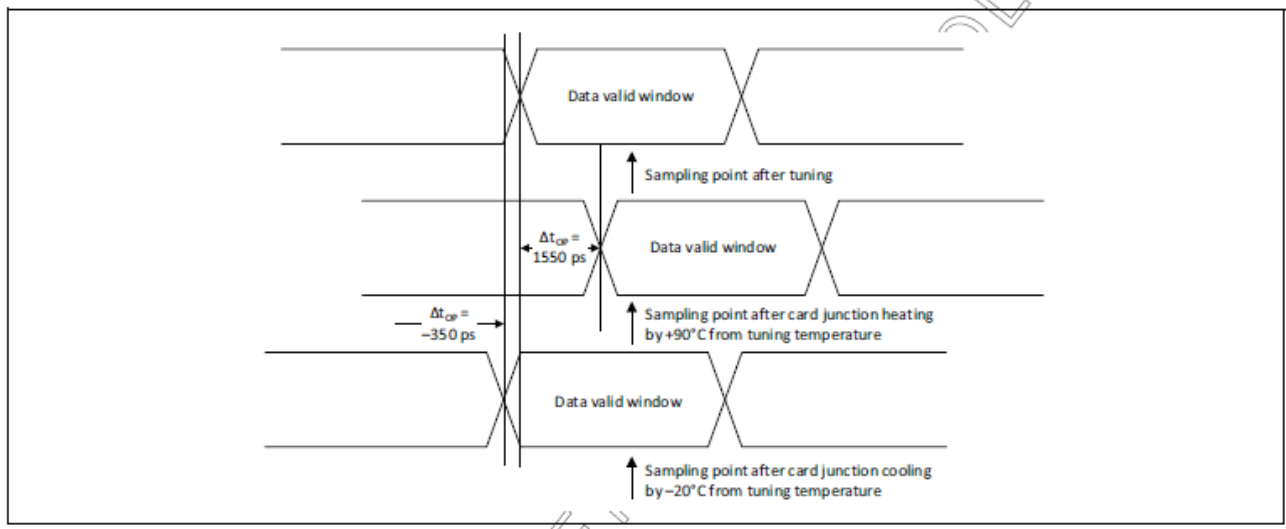
a. SDIO 3.0 specification value is 7.5 ns.

Card output timing (SDR Modes 100MHz to 208MHz)

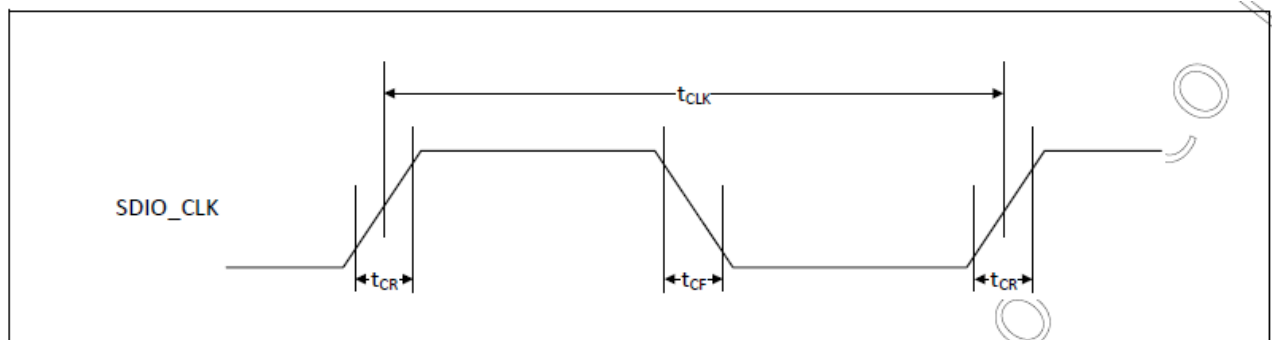


Symbol	Minimum	Maximum	Unit	Comments
t_{OP}	0	2	UI	Card output phase
Δt_{OP}	–350	+1550	ps	Delay variation due to temp change after tuning
t_{ODW}	0.60	–	UI	$t_{ODW} = 2.88$ ns @ 208 MHz

- $\Delta t_{OP} = +1550$ ps for junction temperature of $\Delta t_{OP} = 90$ degrees during operation
- $\Delta t_{OP} = -350$ ps for junction temperature of $\Delta t_{OP} = -20$ degrees during operation
- $\Delta t_{OP} = +2600$ ps for junction temperature of $\Delta t_{OP} = -20$ to $+125$ degrees during operation

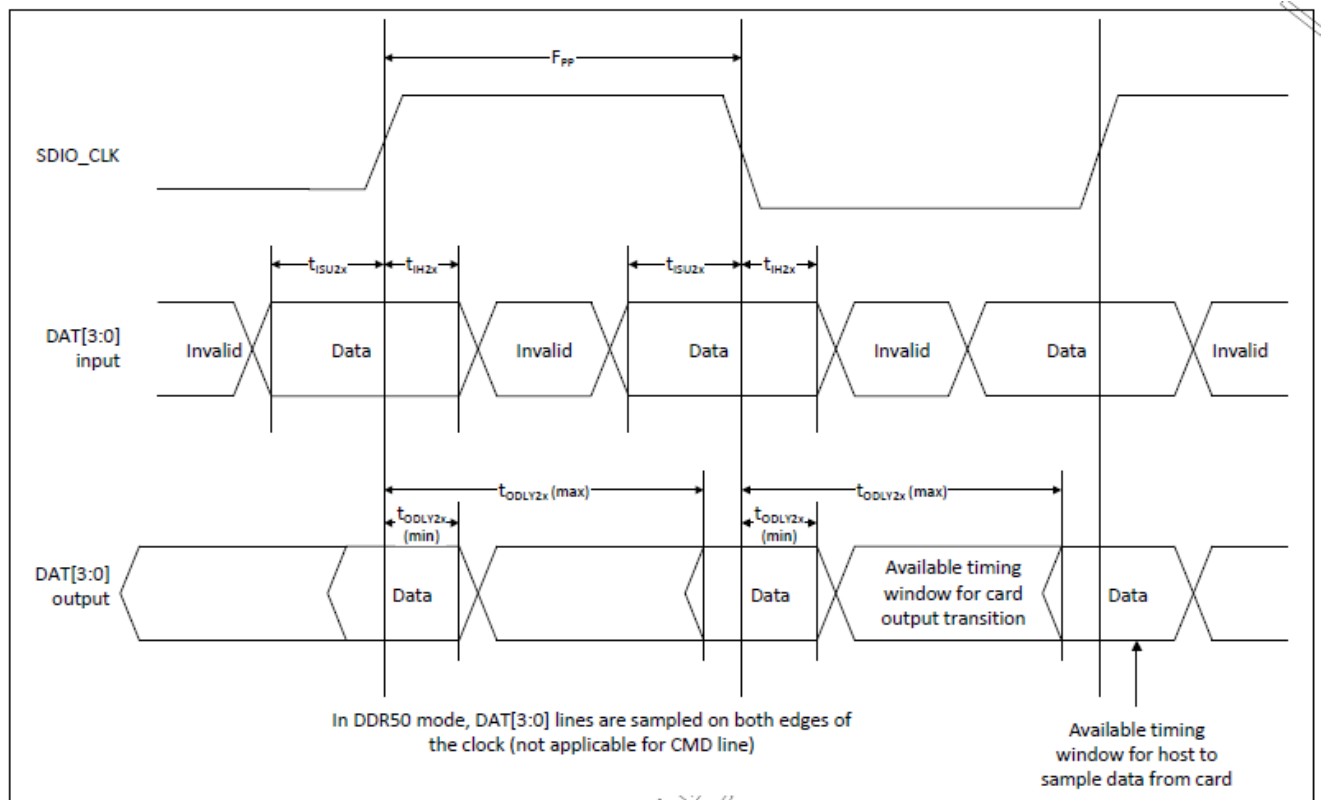
Δt_{OP} Consideration for Variable Data Window (SDR 104 Mode)


8.5 SDIO Bus Timing Specifications in DDR50 Mode



Parameter	Symbol	Minimum	Maximum	Unit	Comments
–	t_{CLK}	20	–	ns	DDR50 mode
–	t_{CR}, t_{CF}	–	$0.2 \times t_{CLK}$	ns	$t_{CR}, t_{CF} < 4.00 \text{ ns (max) @ 50 MHz, } C_{CARD} = 10 \text{ pF}$
Clock duty	–	45	55	%	–

Data Timing



Parameter	Symbol	Minimum	Maximum	Unit	Comments
Input CMD					
Input setup time	t_{ISU}	6	—	ns	$C_{CARD} < 10pF$ (1 Card)
Input hold time	t_{IH}	0.8	—	ns	$C_{CARD} < 10pF$ (1 Card)
Output CMD					
Output delay time	t_{ODLY}	—	13.7	ns	$C_{CARD} < 30pF$ (1 Card)
Output hold time	t_{OH}	1.5	—	ns	$C_{CARD} < 15pF$ (1 Card)
Input DAT					
Input setup time	t_{ISU2x}	3	—	ns	$C_{CARD} < 10pF$ (1 Card)
Input hold time	t_{IH2x}	0.8	—	ns	$C_{CARD} < 10pF$ (1 Card)
Output DAT					
Output delay time	t_{ODLY2x}	—	7.85 ^a	ns	$C_{CARD} < 25pF$ (1 Card)
Output hold time	t_{ODLY2x}	1.5	—	ns	$C_{CARD} < 15pF$ (1 Card)

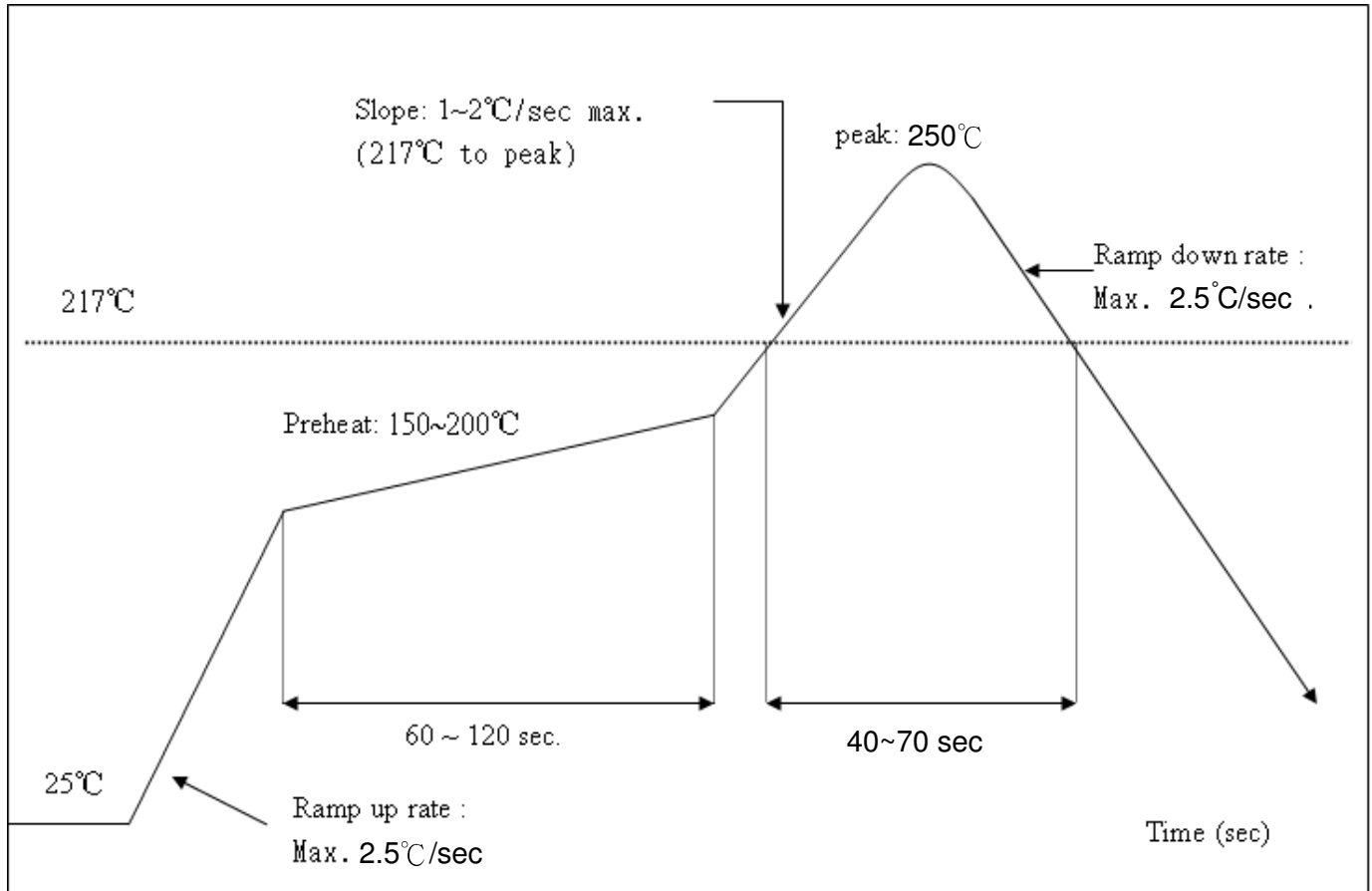
a. SDIO 3.0 specification value is 7.0 ns.

9. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



APPENDIX A: CERTIFICATION NOTICES

The final end product must be labeled in a visible area with the following: "Contains FCC ID: 2AMPP-FB00000 and IC: 11471A-FB00000"

This module has been granted modular approval for mobile applications. OEM integrators for host products may use the module in their final products without additional FCC / IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC / IC approvals must be obtained.

- The host product with the module installed must be evaluated for simultaneous transmission requirements.
- The users manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC / IC RF exposure guidelines.
- To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 2dBi.

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation of the device.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body and this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

When using IEEE 802.11a wireless LAN, this product is restricted to indoor use, due to its operation in the 5.15 to 5.25GHz frequency range. The FCC requires this product to be used indoors for the frequency range of 5.15 to 5.25GHz to reduce the potential for harmful interference to co channel mobile satellite systems.

High-power radar is allocated as the primary user of the 5.25 to 5.35GHz and 5.65 to 5.85GHz bands. These radar stations can cause interference with and/or damage to this device.

Canada, Industry Canada (IC) Notices

"This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device."

Canada, avis d'Industry Canada (IC)

"Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

Exposure of humans to RF fields (RSS-102)

The computers employ low gain integral antennas that do not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's Web site at <http://www.hc-sc.gc.ca/>

The radiated energy from the antennas connected to the wireless adapters conforms to the IC limit of the RF exposure requirement regarding IC RSS-102, Issue 4 clause 4.1.

Conformité des appareils de radiocommunication aux limites d'exposition humaine aux radiofréquences (CNR-102)

L'ordinateur utilise des antennes intégrales à faible gain qui n'émettent pas un champ électromagnétique supérieur aux normes imposées par Santé Canada pour la population. Consultez le Code de sécurité 6 sur le site Internet de Santé Canada à l'adresse suivante : <http://www.hc-sc.gc.ca/>

L'énergie émise par les antennes reliées aux cartes sans fil respecte la limite d'exposition aux radiofréquences telle que définie par Industrie Canada dans la clause 4.1 du document CNR-102, version 4.

APPENDIX B: LABEL FOR FINISHED PRODUCT

Contains Transmitter Module FCC ID: 2AMPPFB00000 and IC D: 11471A-FB00000
or

Contains FCC ID: 2AMPPFB00000 and IC D: 11471A-FB00000

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause the device.undesired operation of