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CTE6256

Data Sheet

Contents

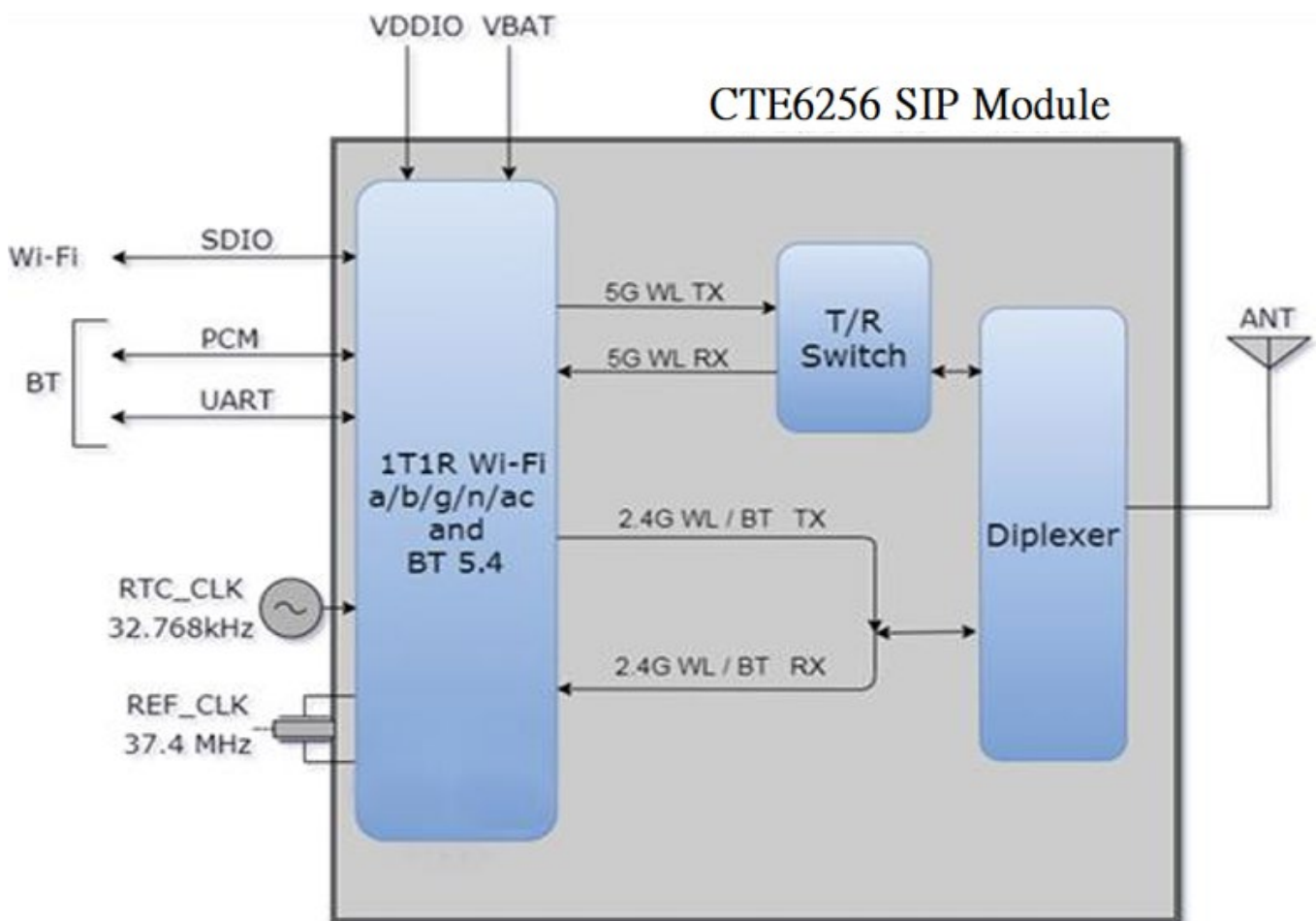
1. Introduction.....	2
1.1 Overview	2
1.2 Product Features.....	3
2. General Specification.....	4
2.1 General Specification	4
2.2 DC Characteristics.....	4
2.2.1 Absolute Maximum Ratings	4
2.2.2 Recommended Operating Rating	5
3. Wi-Fi RF Specification.....	6
3.1 2.4GHz RF Specification.....	6
3.2 5GHz RF Specification.....	8
4. Bluetooth Specification	11
4.1 Bluetooth Specification	11
5. Pin Definition.....	12
5.1 Pin Outline.....	12
5.2 Pin Assignment-U1	13
5.3 Pin Assignment- Module	15
6. Dimensions.....	16
6.1 U1 Dimensions	16
6.2 Module Dimensions.....	16
7. External clock reference.....	17
8. Host Interface Timing Diagram	18
8.1 Power-up Sequence Timing Diagram.....	18
8.2 SDIO Interface Description	20
8.3 PCM Interface Description	27
8.4 UART Interface Description	33
9. Recommended Reflow Profile.....	35
10. Regulatory Information	36
11. Disclaimer	41

1. Introduction

1.1 Overview

CTE6256 is a fully Wi-Fi and Bluetooth functionalities module with seamless roaming capabilities and advance security, also it could interact with different vendors' 802.11a/b/g/n/ac 1x1 Access Points with SISO standard and can accomplish up to speed of 433.3Mbps with single stream in 802.11ac to connect the wireless LAN. Furthermore CTE6256 included SDIO interface for Wi-Fi, UART/ PCM interface for Bluetooth.

In addition, this compact module is a total solution for a combination of Wi-Fi + BT technologies. The module is specifically developed for tablet, OTT box and portable devices.



1.2 Product Features

- Lead Free design which is compliant with ROHS requirements.
 - TX and RX low-density parity check (LDPC) support for improved range and power efficiency.
 - Single-stream spatial multiplexing up to 433.3 Mbps data rate.
 - 20, 40, 80 MHz channels with optional SGI (256 QAM modulation)
 - Supports 1antenna with one for WLAN & Bluetooth shared port. Also, shared Bluetooth and WLAN receive signal path eliminates the need for an external power splitter while maintaining excellent sensitivity for both Bluetooth and WLAN.
 - Supports standard SDIO v3.0, compatible with SDIO v2.0 HOST interfaces.
 - BT host digital interface:
 - HCI UART (up to 4 Mbps)
 - PCM for audio data
 - Complies with Bluetooth Core Specification Version 5.4 with provisions for supporting future specifications. With Bluetooth Class 1 or Class2 transmitter operation.
 - Supports extended synchronous connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets.
 - Adaptive frequency hopping (AFH) for reducing radio frequency interference.
- A simplified block diagram of the module is depicted in the figure above.

2. General Specification

2.1 General Specification

Model Name	CTE6256
Product Description	1Tx/1Rx 802.11 ac/a/b/g/n Wi-Fi + BT 5.4 Module
Dimension ^{note 2}	L x W: 32.8 x 22.06 (typical) mm, H : 3.17 (Maximum)mm
Wi-Fi Interface	SDIO V3.0/ 2.0
BT Interface	UART / PCM
Operating temperature ^{note 1}	-30°C to 85°C
Storage temperature	-40°C to 125°C
Humidity	Operating Humidity : 0 to 100% Non-Condensing

Note 1: The optimal RF performance specified in the data sheet, however, is guaranteed only -20 °C to +75 °C and 3.2V < VBAT < 4.4V without derating performance.

Note 2: The Dimension = L x W: 32.8 x 22.06 (Typ.)mm、 H : 2.87 (Max.) mm (without the shielding cover)

2.2 DC Characteristics

2.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	5	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	3.9	V

Extreme caution must be exercised to prevent electrostatic discharge (ESD) damage.

Symbol	Condition	Minimum ESD Rating	Unit
ESD_HAND_HBM	Human body model contact discharge per JEDEC EID/JESD22-A114	1	kV
ESD_HAND_CDM	Charged device model contact discharge per JEDEC	250	V

	EIA/JESD22-C101		
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2.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

Voltage rails	Min.	Typ.	Max.	Unit
VBAT ^{note 3}	3.0	3.3	4.4	V
VDDIO	1.6	1.8 / 3.3	3.6	V

VBAT current consumption 1A (Peak), when VBAT = 3.3V

Note 3: The optimal RF performance specified in the data sheet, however, is guaranteed only -20 °C to +75 °C and 3.2V < VBAT < 4.4V without derating performance.

The module requires two power supplies: other Digital I/O Pins.

For VDDIO=1.8V	Min.	Max.	Unit
VIL/VIH	0.35×VDDIO	0.65×VDDIO	V
VOL/VOH output@2mA	0.4	VDDIO-0.4	V
For VDDIO=3.3V	Min.	Max.	Unit
VIL/VIH	0.80	2	V
VOL/VOH output@2mA	0.4	VDDIO-0.4	V

3. Wi-Fi RF Specification

3.1 2.4GHz RF Specification

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

Feature		Description			
WLAN Standard		IEEE 802.11b/g/n & Wi-Fi compliant			
Frequency Range		2.400 GHz ~ 2.4835 GHz (2.4GHz ISM Band)			
Number of Channels		2.4GHz: Ch1 ~ Ch13 Note : (The channels to be used should be comply with laws and regulation of each country.)			
Modulation		802.11b : DQPSK、DBPSK、CCK 802.11 g/n : OFDM /64-QAM、16-QAM、QPSK、BPSK			
Output Power , tolerance ± 1.5 dB					
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard					
802.11b	1Mbps	2Mbps	5.5Mbps	11Mbps	
	17	17	17	17	
802.11g	6、9Mbps	12、18Mbps	24Mbps	36Mbps	48Mbps
	16	16	16	16	15
	54Mbps				
	15				
802.11n 20MHz	MCS0~2	MCS3	MCS4	MCS5	MCS6
	17	17	16	15	14
	MCS7				
	14				
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.					
Sensitivity, tolerance ± 2 dB					
CCK modulation PER ≤ 8% 、 OFDM modulation PER ≤ 10%					
802.11b	Data Rate	Spec.(dBm)			
	1Mbps	-96			
	2Mbps	-90			
	5.5Mbps	-88			
	11Mbps	-87			
802.11g	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)	
	6Mbps	-91	24Mbps	-83	

	9Mbps	-88	36Mbps	-80
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	12Mbps	-87	48Mbps	-76
	18Mbps	-85	54Mbps	-73
802.11n_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS4	-77
	MCS1	-85	MCS4	-75
	MCS2	-84	MCS6	-72
	MCS3	-80	MCS7	-71
Maximum Input Level	802.11b : -10 dBm			
	802.11g/n : -20 dBm			

3.2 5GHz RF Specification

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

Feature		Description			
WLAN Standard		IEEE 802.11a/n/ac & Wi-Fi compliant			
Frequency Range ^{Note2}		^{Note1} (5.15~5.35GHz 、 5.47~5.725GHz) 、 5.725~5.85GHz (5GHz UNII Band)			
Number of Channels		5.18~5.35GHz: Ch36 ~ Ch64 5.5~5.72GHz: Ch100 ~ Ch144 5.745~5.825GHz: Ch149 ~ Ch165			
Modulation		802.11a : OFDM /64-QAM、 16-QAM、 QPSK、 BPSK 802.11n : OFDM /64-QAM、 16-QAM、 QPSK、 BPSK 802.11ac : OFDM /256-QAM、 OFDM /64-QAM、 16-QAM、 QPSK、 BPSK			
Output Power , tolerance ± 2 dB					
The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard					
802.11a	Frequency (MHz)	6~9Mbps	12~18Mbps	24Mbps	36Mbps
	5180~5350	17	17	17	16
	5500~5720	17	17	17	16
	5745~5825	17	17	17	16
	Frequency (MHz)	48Mbps	54Mbps		
	5180~5350	16	15		
	5500~5720	16	15		
	5745~5825	16	15		
802.11n 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5180~5350	17	17	16	16
	5500~5720	17	17	16	16
	5745~5825	17	17	16	16
	Frequency (MHz)	MCS6	MCS7		
	5180~5350	15	14		
	5500~5720	15	14		
	5745~5825	15	14		
802.11n 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5180~5350	17	17	16	16
	5500~5720	17	17	16	16
	5745~5825	17	17	16	16

	Frequency (MHz)	MCS6	MCS7		
	5180~5350	15	14		
	5500~5720	15	14		
	5745~5825	15	14		
802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5180~5350	17	17	16	16
	5500~5720	17	17	16	16
	5745~5825	17	17	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5180~5350	15	14	12	
	5500~5720	15	14	12	
	5745~5825	15	14	12	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5180~5350	17	17	16	16
	5500~5720	17	17	16	16
	5745~5825	17	17	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5180~5350	15	14	12	10.5
	5500~5720	15	14	12	10.5
	5745~5825	15	14	12	10.5
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5180~5350	17	17	16	16
	5500~5720	17	17	16	16
	5745~5825	17	17	16	16
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5180~5350	15	14	12	10.5
	5500~5720	15	14	12	10.5
	5745~5825	15	14	12	10.5
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product. Note1: The Wi-Fi 5G Band 2/Band 3 interface function has been disabled by software or firmware Note2 : The channels to be used should be comply with laws and regulation of each country.					
Sensitivity, tolerance ± 2 dB OFDM modulation PER $\leq 10\%$					
802.11a	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)	
	6Mbps	-92	24Mbps	-82	
	9Mbps	-89	36Mbps	-79	
	12Mbps	-88	48Mbps	-75	

	18Mbps	-86	54Mbps	-74
802.11n_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS4	-78
	MCS1	-88	MCS5	-74
	MCS2	-85	MCS6	-73
	MCS3	-82	MCS7	-72
802.11n_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-89	MCS4	-76
	MCS1	-85	MCS5	-71
	MCS2	-83	MCS6	-70
	MCS3	-79	MCS7	-68
802.11ac_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-90	MCS5	-73
	MCS1	-87	MCS6	-71
	MCS2	-84	MCS7	-70
	MCS3	-81	MCS8	-67
	MCS4	-77		
802.11ac_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-70
	MCS1	-83	MCS6	-68
	MCS2	-81	MCS7	-66
	MCS3	-78	MCS8	-65
	MCS4	-75	MCS9	-63
802.11ac_80MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-85	MCS5	-69
	MCS1	-82	MCS6	-65
	MCS2	-78	MCS7	-63
	MCS3	-74	MCS8	-61
	MCS4	-71	MCS9	-60
Maximum Input Level	802.11a/n : -20 dBm			
	802.11ac : -30 dBm			

4. Bluetooth Specification

4.1 Bluetooth Specification

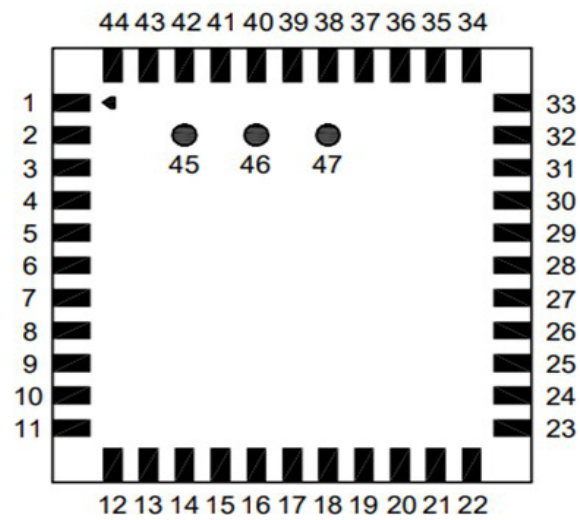
Conditions : VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	Description	
General Specification		
Bluetooth Standard	BDR(1Mbps)、EDR(2、3Mbps)、LE(1Mbps、2Mbps)	
Host Interface	UART	
Frequency Band	2402 MHz ~ 2480 MHz	
Number of Channels	79 channels for classic、40 channels for BLE	
Modulation	GFSK, $\pi/4$ -DQPSK, 8DPSK	
RF Specification		
	CL1 (dBm)	CL2 (dBm)
BDR Output Power	6	2
EDR Output Power	4	2
LE Output Power	5	2
	Typical.	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-88 dBm	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)	-88 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-85 dBm	
Sensitivity @ PER=30.8% for LE (1Mbps)	-90 dBm	
Sensitivity @ PER=30.8% for LE (2Mbps)	-90 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm	
	$\pi/4$ -DQPSK (2Mbps) :-20dBm	
	8DPSK (3Mbps) :-20dBm	

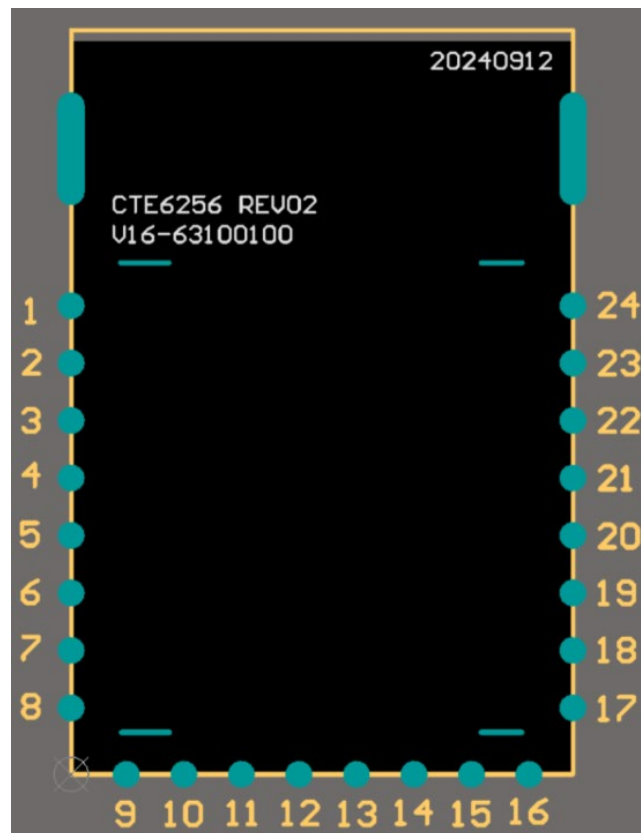
Note*: The Bluetooth output power is able to be configured by firmware (hcd file).

5. Pin Definition

5.1 Pin Outline



U1



Module

5.2 Pin Assignment -U1

NO	Name	Type	Description
1	GND	—	Ground connections
2	WL_BT_ANT	I/O	RF I/O port
3	GND	—	Ground connections
4	NC	—	Floating (Don't connected to ground)
5	NC	—	Floating (Don't connected to ground)
6	BT_WAKE	I	HOST wake-up Bluetooth device
7	BT_HOST_WAKE	O	Bluetooth device to wake-up HOST
8	NC	—	Floating (Don't connected to ground)
9	VBAT	P	Main power voltage source input
10	XTAL_IN	I	Crystal input
11	XTAL_OUT	O	Crystal output
12	WL_REG_ON	I	Power up/down internal regulators used by WiFi section
13	WL_HOST_WAKE	O	WLAN to wake-up HOST
14	SDIO_DATA_2	I/O	SDIO data line 2
15	SDIO_DATA_3	I/O	SDIO data line 3
16	SDIO_DATA_CMD	I/O	SDIO command line
17	SDIO_DATA_CLK	I/O	SDIO clock line
18	SDIO_DATA_0	I/O	SDIO data line 0
19	SDIO_DATA_1	I/O	SDIO data line 1
20	GND	—	Ground connections
21	VIN_LDO_OUT	P	Internal Buck voltage generation pin
22	VDDIO	P	I/O Voltage supply input
23	VIN_LDO	P	Internal Buck voltage generation pin
24	LPO	I	External Low Power Clock input (32.768KHz)
25	PCM_OUT	O	PCM Data output
26	PCM_CLK	I/O	PCM clock
27	PCM_IN	I	PCM data input
28	PCM_SYNC	I/O	PCM sync signal
29	SDIO_VSEL	I	SDIO mode selection pin 1: When VDDIO=1.8V , 0: When VDDIO=3.3V
30	NC	—	Floating (Don't connected to ground)
31	GND	—	Ground connections

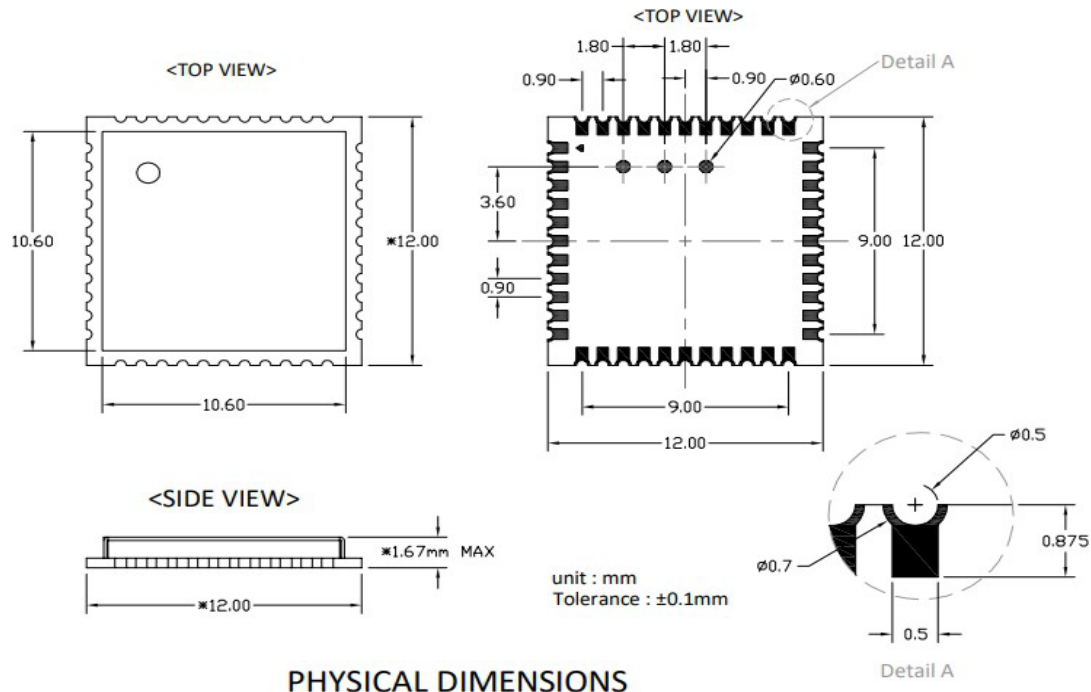
32	NC	—	Floating (Don't connected to ground)
33	GND	—	Ground connections
34	BT_REG_ON	I	Power up/down internal regulators used by BT section
35	NC	—	Floating (Don't connected to ground)
36	GND	—	Ground connections
37	GPIO_6	I/O	GPIO configuration pin
38	GPIO_3	I/O	GPIO configuration pin
39	GPIO_5	I/O	GPIO configuration pin
40	GPIO_2	I/O	GPIO configuration pin
41	UART_RTS_N	O	Bluetooth UART interface
42	UART_TXD	O	Bluetooth UART interface
43	UART_RXD	I	Bluetooth UART interface
44	UART_CTS_N	I	Bluetooth UART interface
45	TP1(NC)	—	Floating (Don't connected to ground)
46	TP2(NC)	—	Floating (Don't connected to ground)
47	TP3(NC)	—	Floating (Don't connected to ground)

5.3 Pin Assignment - Module

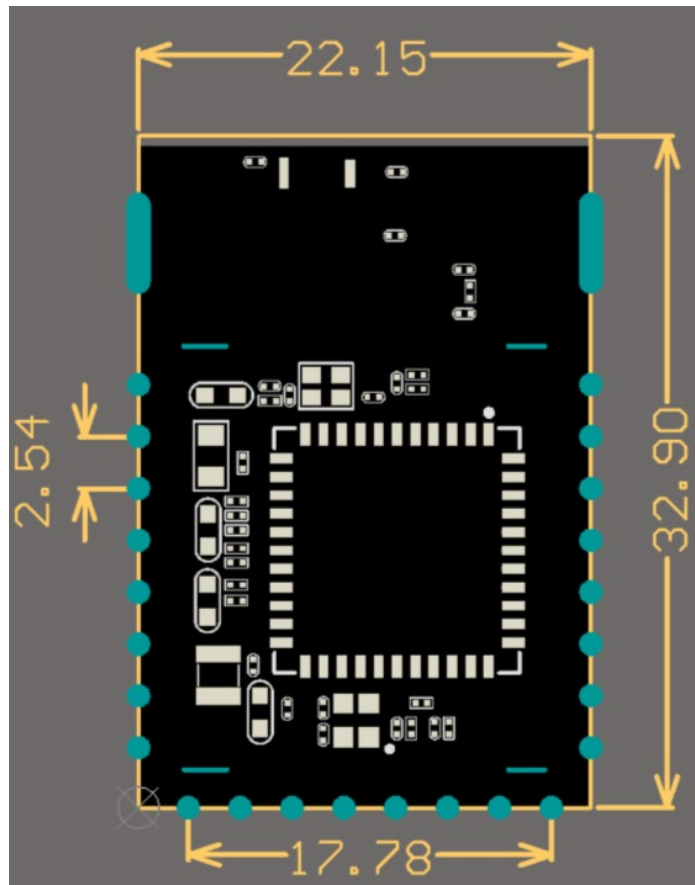
NO	Name	Type	Description
1	GND	—	Ground connections
2	VBAT	P	Main power voltage source input
3	VBAT	P	Main power voltage source input
4	GND	—	Ground connections
5	BT_WAKE	I	HOST wake-up Bluetooth device
6	BT_WAKE_OUT	O	Bluetooth device to wake-up HOST
7	WiFi_REGON	I	Power up/down internal regulators used by WiFi section
8	WL_WAKE_OUT	O	WLAN to wake-up HOST
9	SDIO_DATA_3	I/O	SDIO data line 3
10	SDIO_DATA_2	I/O	SDIO data line 2
11	SDIO_DATA_1	I/O	SDIO data line 1
12	SDIO_DATA_0	I/O	SDIO data line 0
13	SDIO_CMD	I/O	SDIO command line
14	SDIO_CLK	I/O	SDIO clock line
15	GND	—	Ground connections
16	NC	—	Floating (Don't connected to ground)
17	NC	—	Floating (Don't connected to ground)
18	NC	—	Floating (Don't connected to ground)
19	U_CTS	I	Bluetooth UART interface
20	U_RX	I	Bluetooth UART interface
21	U_TX	O	Bluetooth UART interface
22	U_RTS	O	Bluetooth UART interface
23	BT_REGON	I	Power up/down internal regulators used by BT section
24	GND	—	Ground connections

6. Dimensions

6.1 S1 Dimensions



6.2 Module Dimension



7. External clock reference

External LPO signal characteristics

Parameter	Specification	Units
Nominal input frequency	32.768	kHz
Frequency accuracy	+/-30	ppm
Duty cycle	30 - 70	%
Input signal amplitude	400 to 3300	mV, p-p
Signal type	Square-wave or sine-wave	-
Input impedance	>100k	Ω
	<5	pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7V _{io} - V _{io}	V

Input signal amplitude follow VDDIO (1.8V or 3.3V)

External 37.4MHz X'TAL characteristics

Parameter	Specification	Units
Nominal frequency - F ₀	37.4	MHz
Frequency Tolerance - $\Delta F / F_0$ (At 25°C +/- 3°C)	+/- 10	ppm
Operation Temperature Range - Topr	-30 ~ + 85	°C
Freq. Stability(over operating temperature) - TC Ref. to 25°C	+/- 10	ppm
Load capacitance - CL	18	pF
Equivalent Series Resistance – ESR	Max. 60	Ω
Drive Level - DL	Typ. 50, Max. 100	uW
Insulation resistance – IR At 100Vdc	Min. 500	M Ω

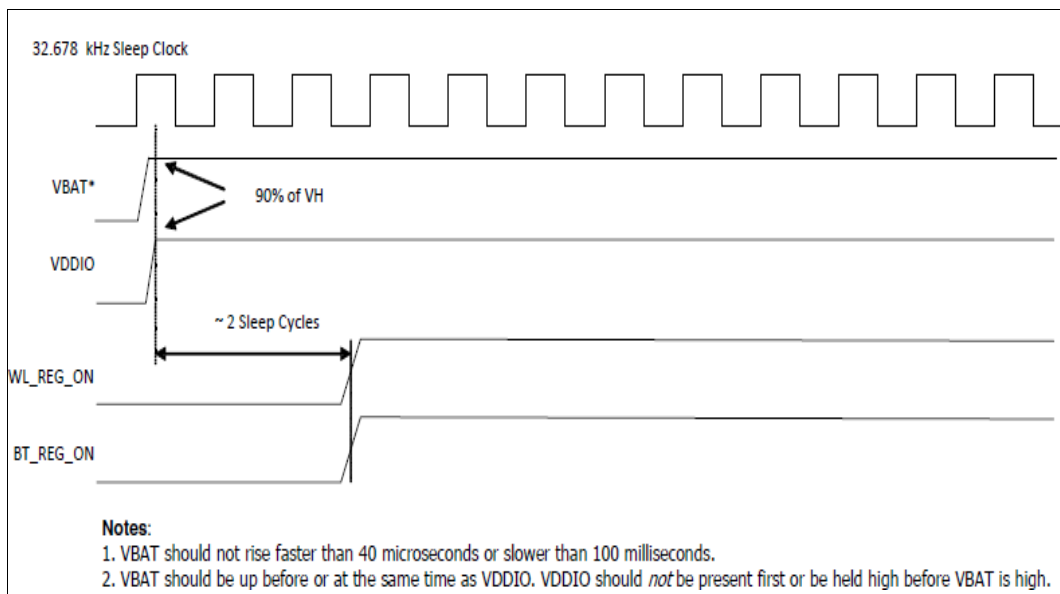
8. Host Interface Timing Diagram

8.1 Power-up Sequence Timing Diagram

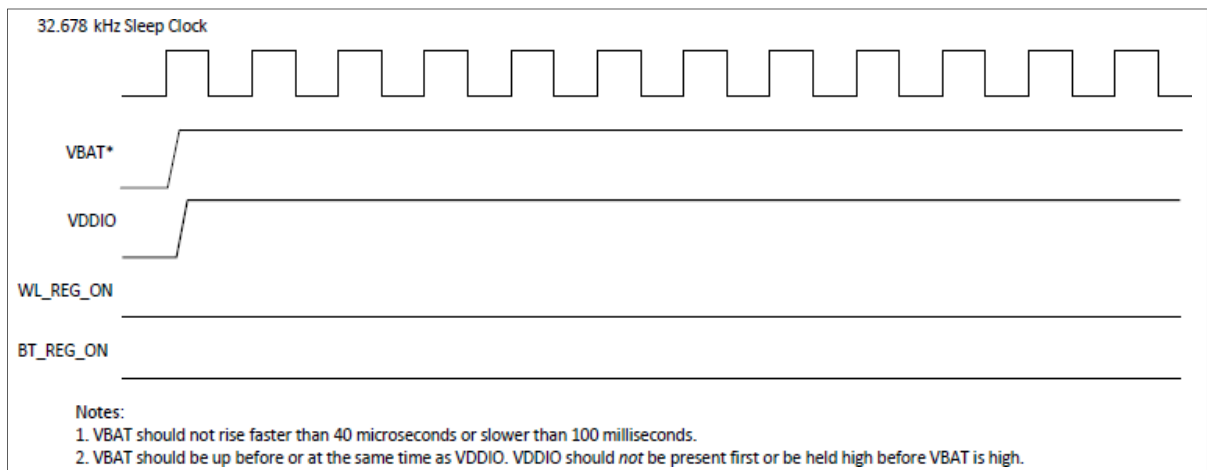
The module has signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN and internal regulator blocks. These signals are described below.

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.

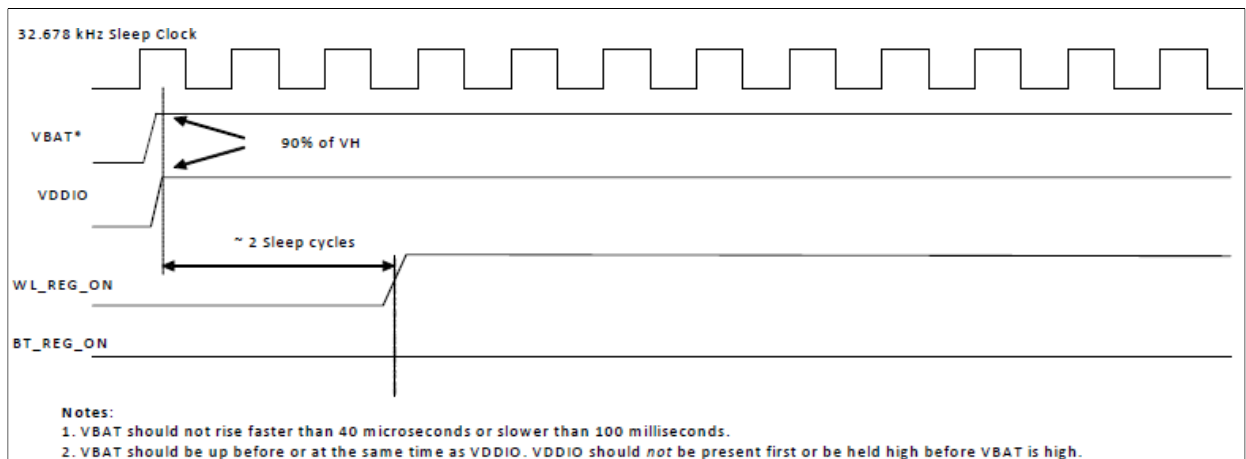
- **WL_REG_ON**: Used by the PMU to power up or power down the internal regulators used by the WLAN section. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low the WLAN section is in reset.
- **BT_REG_ON**: Used by the PMU to power up or power down the internal regulators used by the BT section. Low asserting reset for Bluetooth. This pin has no effect on WLAN and does not control any PMU functions. This pin must be driven high or low (not left floating).



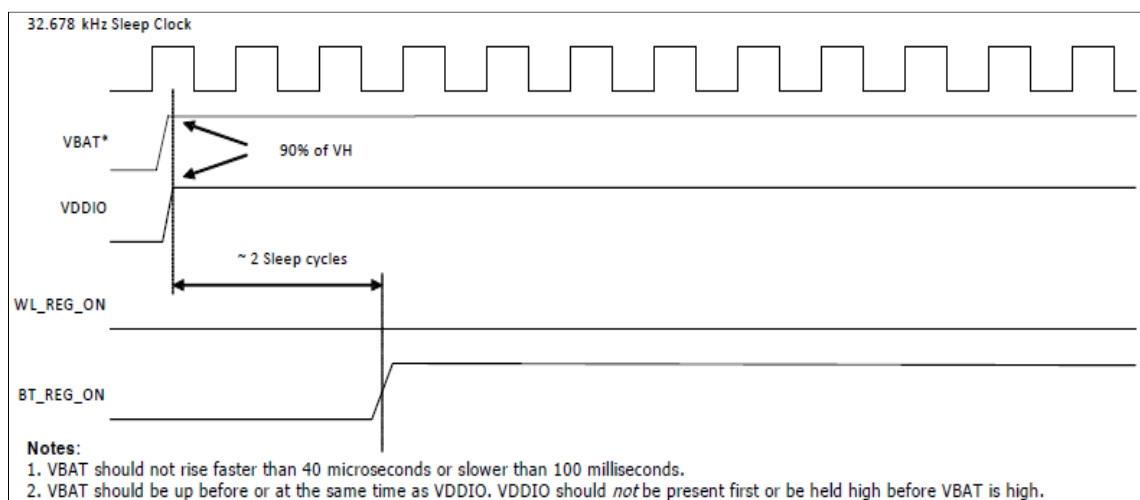
WLAN=ON, Bluetooth=ON



WLAN=OFF, Bluetooth=OFF



WLAN=ON, Bluetooth=OFF



WLAN=OFF, Bluetooth=ON

8.2 SDIO Interface Description

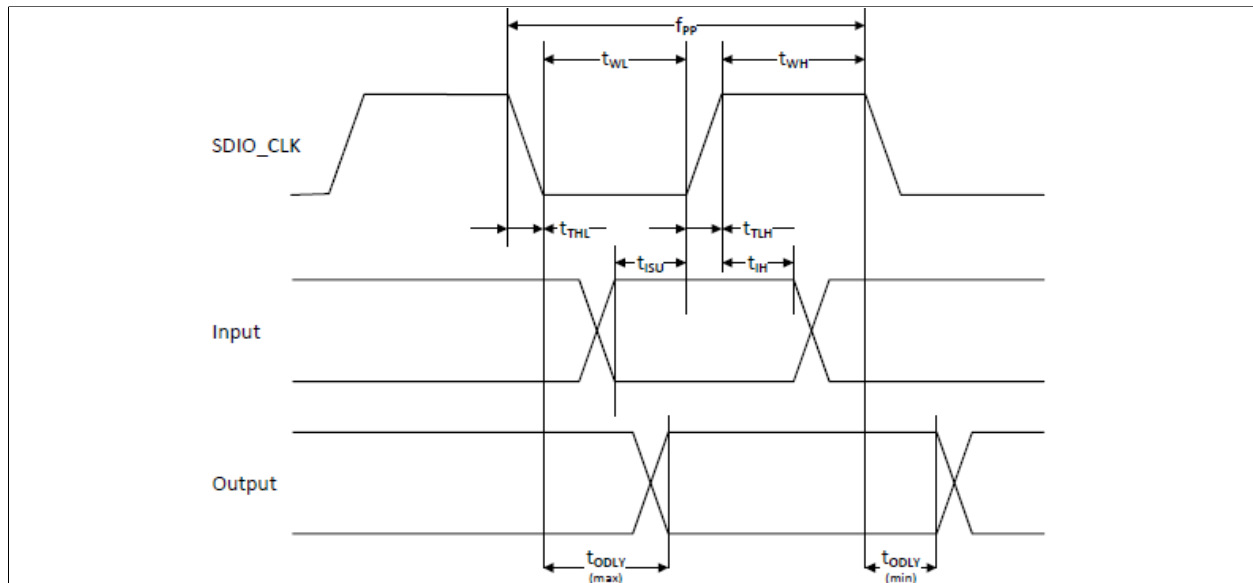
The module supports SDIO version 3.0 for all 1.8V 4-bit UHSI speeds: SDR50(100 Mbps),SDR104(208MHz) and DDR50(50MHz, dual rates) in addition to the 3.3V default speed(25MHz) and high speed (50 MHz). It has the ability to stop the SDIO clock and map the interrupt signal into a GPIO pin. This 'out-of-band' interrupt signal notifies the host when the WLAN device wants to turn on the SDIO interface. The ability to force the control of the gated clocks from within the WLAN chip is also provided.

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

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

SDIO Default Mode Timing Diagram

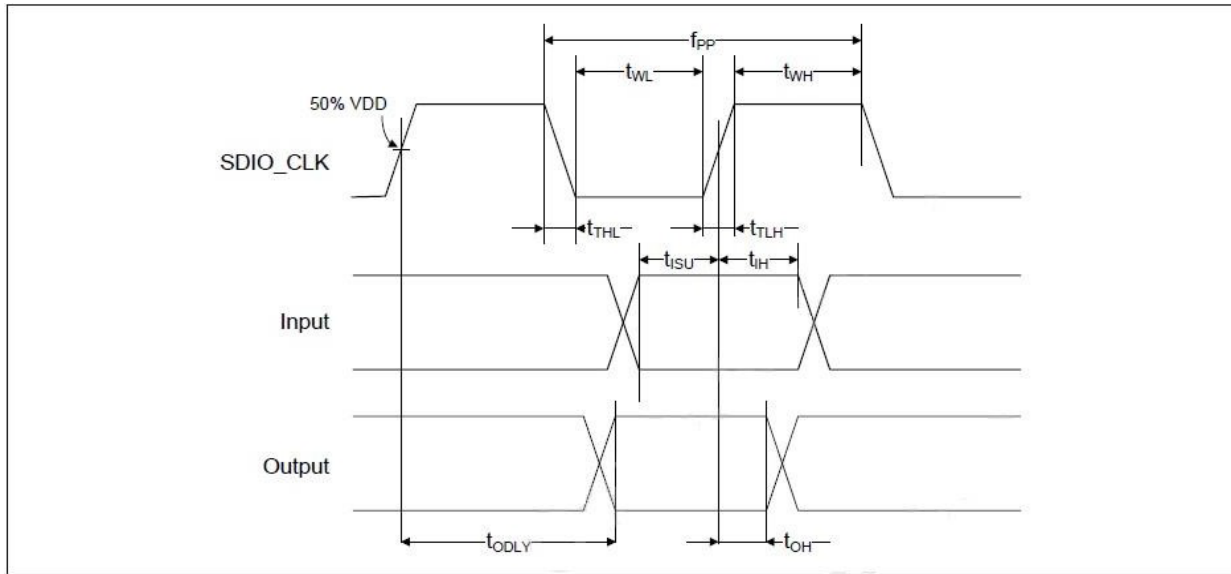


Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer mode	f_{PP}	0	–	25	MHz
Frequency – Identification mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	10	–	–	ns
Clock high time	t_{WH}	10	–	–	ns
Clock rise 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 $C_L \leq 40\text{pF}$ load on CMD and Data.

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

SDIO High Speed Mode Timing Diagram



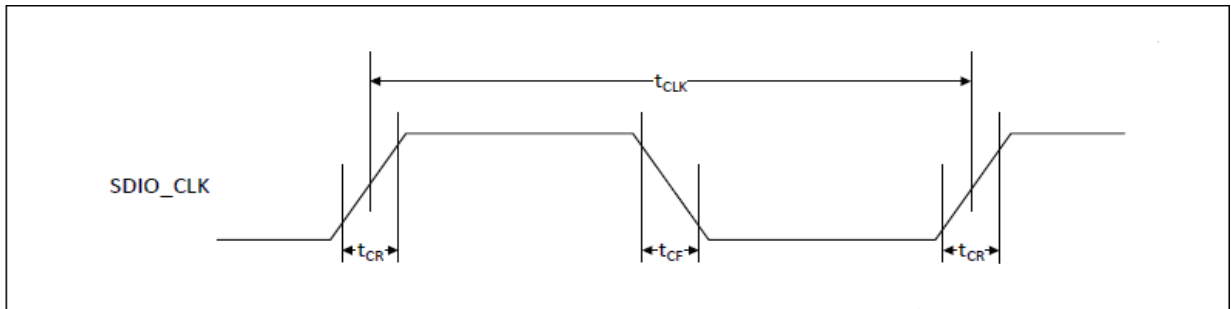
Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (all values are referred to minimum V_{IH} and maximum V_{IL}^b)					
Frequency – Data Transfer Mode	f_{PP}	0	–	50	MHz
Frequency – Identification Mode	f_{OD}	0	–	400	kHz
Clock low time	t_{WL}	7	–	–	ns
Clock high time	t_{WH}	7	–	–	ns
Clock rise time	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 $\max(V_{IL}) = 0.2 \times V_{DDIO}$.

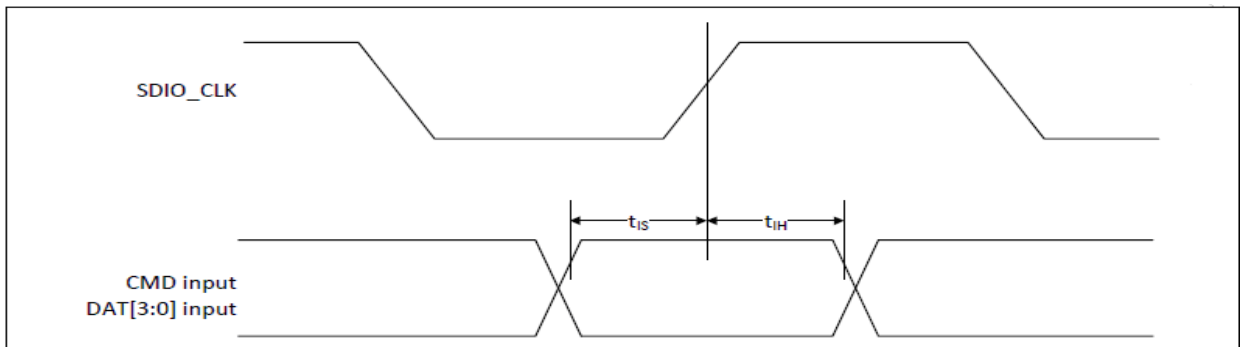
SDIO Bus Timing Specifications in SDR Modes

Clock timing (SDR Modes)



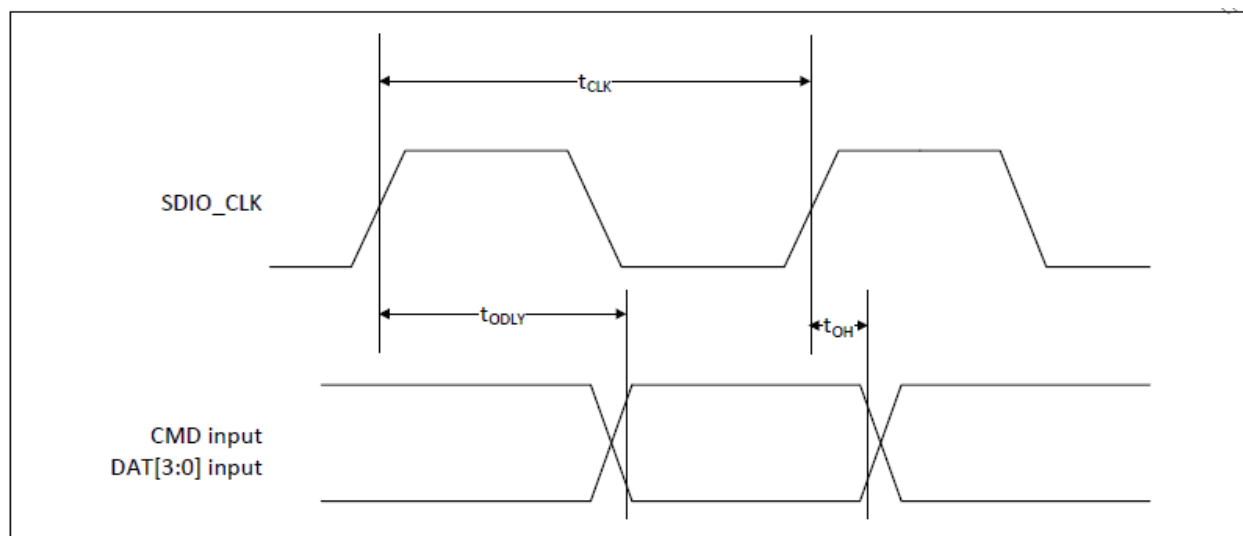
Parameter	Symbol	Minimum	Maximum	Unit	Comments
—	t_{CLK}	40	—	ns	SDR12 mode
		20	—	ns	SDR25 mode
		10	—	ns	SDR50 mode
		4.8	—	ns	SDR104 mode
—	t_{CR}, t_{CF}	—	$0.2 \times t_{CLK}$	ns	$t_{CR}, t_{CF} < 2.00$ ns (max) @100 MHz, $C_{CARD} = 10$ pF $t_{CR}, t_{CF} < 0.96$ ns (max) @208 MHz, $C_{CARD} =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

SDIO Bus Input timing (SDR Modes)



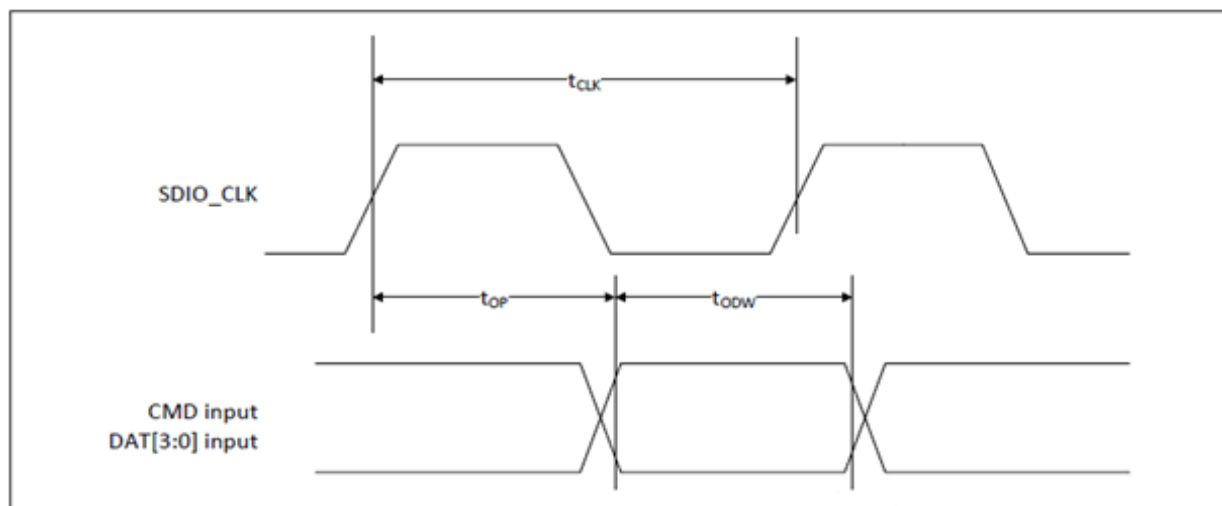
Symbol	Minimum	Maximum	Unit	Comments
SDR104 Mode				
t_{IS}	1.4	—	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	—	ns	$C_{CARD} = 5$ pF, VCT = 0.975V
SDR50 Mode				
t_{IS}	3.00	—	ns	$C_{CARD} = 10$ pF, VCT = 0.975V
t_{IH}	0.80	—	ns	$C_{CARD} = 5$ pF, VCT = 0.975V

SDIO Bus output timing (SDR Modes up to 100MHz)



Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}	–	7.5	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

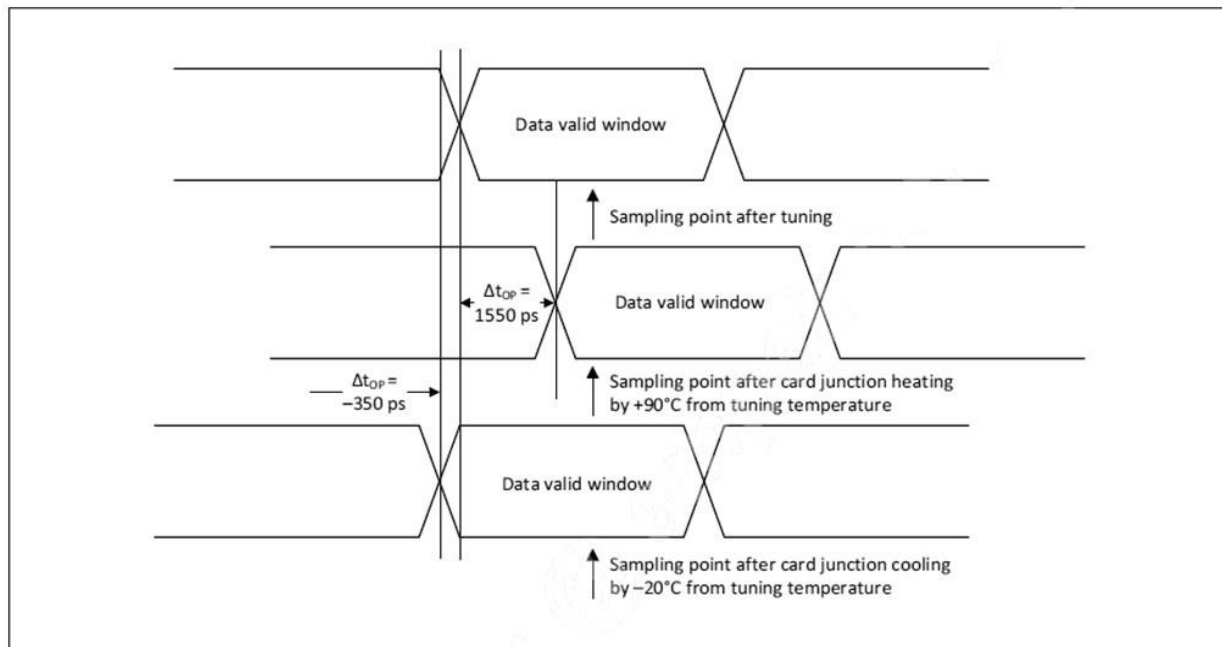
Card output timing (SDR Modes 100MHz to 208MHz)



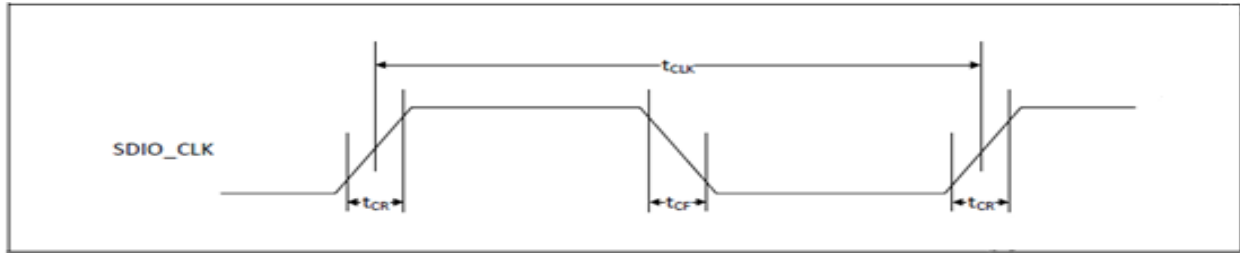
Symbol	Minimum	Maximum	Unit	Comments
t_{OP}	0	2	UI	Card output phase
Δt_{OP}	-350	+1550	ps	Delay variation due to temp change after tuning
t_{ODW}	0.60	—	UI	$t_{ODW}=2.88$ ns @208 MHz

- $\Delta t_{OP} = +1550$ 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)

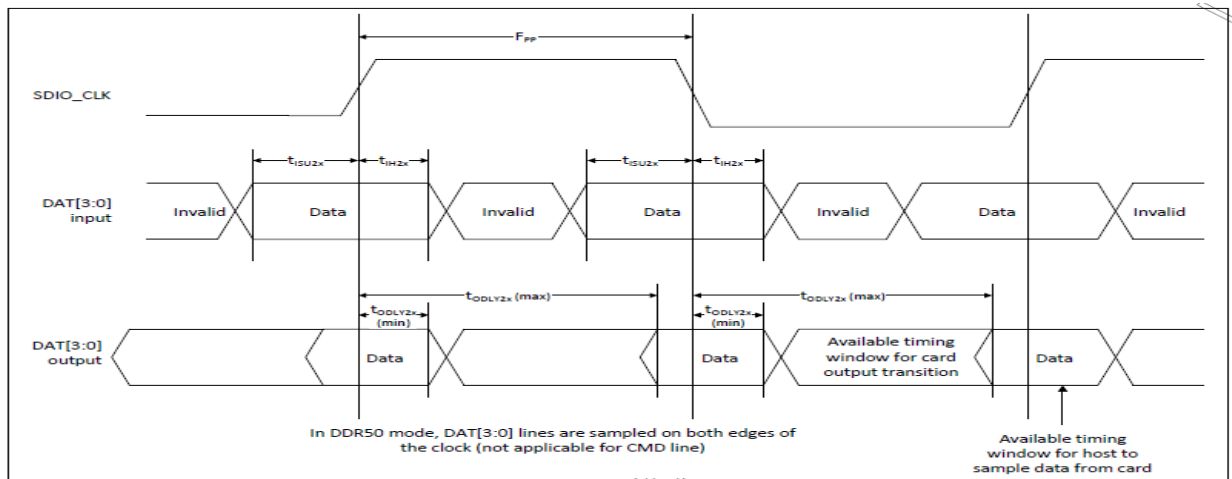


SDIO Bus Timing Specifications in DDR50 Mode



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

Data Timing



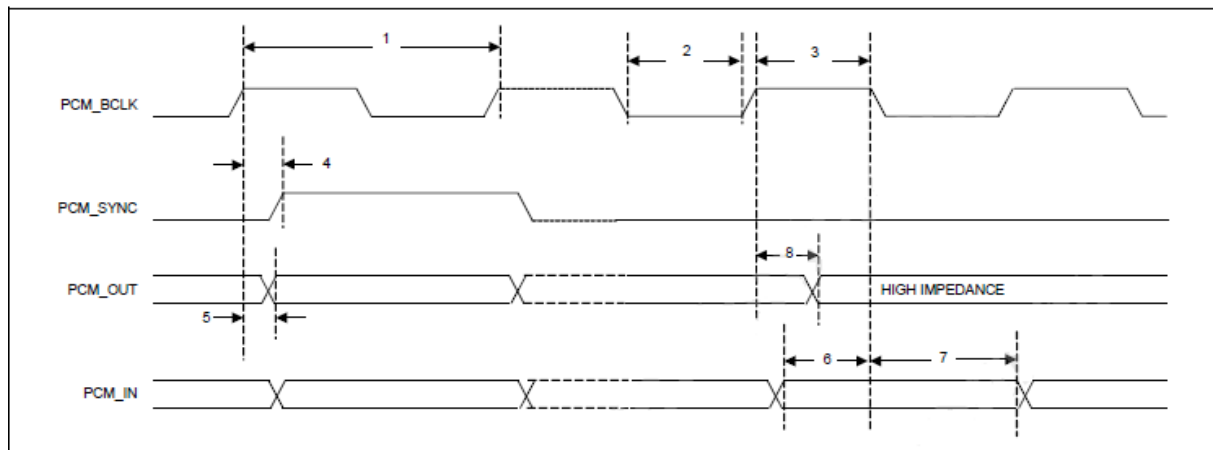
Parameter	Symbol	Minimum	Maximum	Unit	Comments
Input CMD					
Input setup time	t_{ISU}	6	—	ns	$C_{CARD} < 10$ pF (1 Card)
Input hold time	t_{IH}	0.8	—	ns	$C_{CARD} < 10$ pF (1 Card)
Output CMD					
Output delay time	t_{ODLY}	—	13.7	ns	$C_{CARD} < 30$ pF (1 Card)
Output hold time	t_{OH}	1.5	—	ns	$C_{CARD} < 15$ pF (1 Card)
Input DAT					
Input setup time	t_{ISU2x}	3	—	ns	$C_{CARD} < 10$ pF (1 Card)
Input hold time	t_{IH2x}	0.8	—	ns	$C_{CARD} < 10$ pF (1 Card)
Output DAT					
Output delay time	t_{ODLY2x}	—	7.5	ns	$C_{CARD} < 25$ pF (1 Card)
Output hold time	t_{ODLY2x}	1.5	—	ns	$C_{CARD} < 15$ pF (1 Card)

8.3 PCM Interface Description

The PCM Interface on the CTE6256 can connect to linear PCM Codec devices in master or slave mode. In master mode, the CTE6256 generates the PCM_CLK and PCM_SYNC signals, and in slave mode, these signals are provided by another master on the PCM interface and are inputs to the CTE6256. The configuration of the PCM interface may be adjusted by the host through the use of vendor-specific HCI commands.

Short Frame Sync, Master Modem

PCM Timing Diagram (Short Frame Sync, Master Mode)

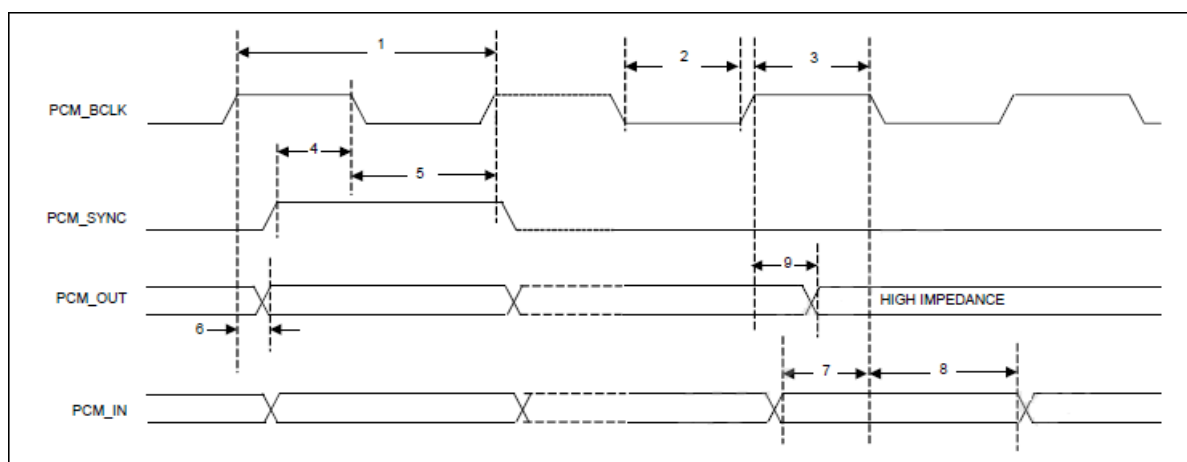


PCM Interface Timing Specifications (Short Frame Sync, Master Mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency		–	12	MHz
2	PCM bit clock low	41	–	–	ns
3	PCM bit clock high	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

Short Frame Sync, Slave Mode

PCM Timing Diagram (Short Frame Sync, Slave Mode)

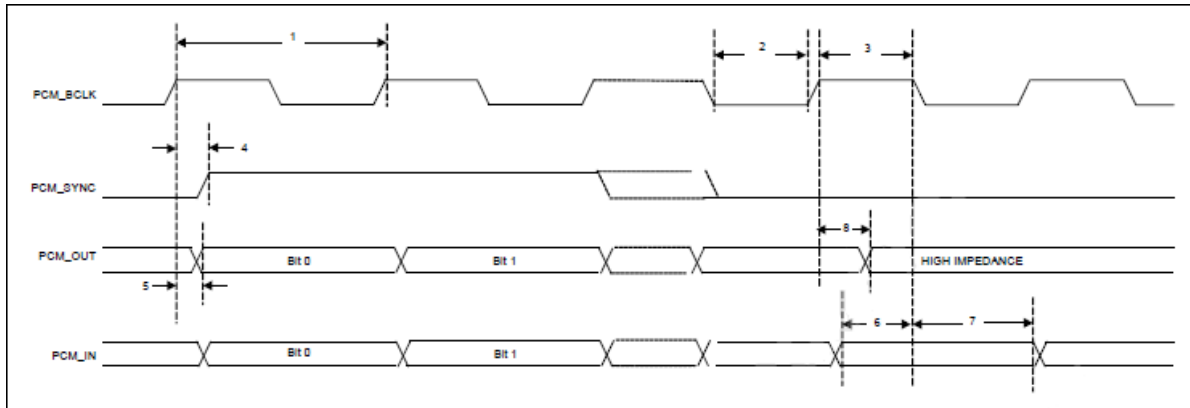


PCM Interface Timing Specifications (Short Frame Sync, Slave Mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	—	—	12	MHz
2	PCM bit clock low	41	—	—	ns
3	PCM bit clock high	41	—	—	ns
4	PCM_SYNC setup	8	—	—	ns
5	PCM_SYNC hold	8	—	—	ns
6	PCM_OUT delay	0	—	25	ns
7	PCM_IN setup	8	—	—	ns
8	PCM_IN hold	8	—	—	ns
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	—	25	ns

Long Frame Sync, Master Mode

PCM Timing Diagram (Long Frame Sync, Master Mode)

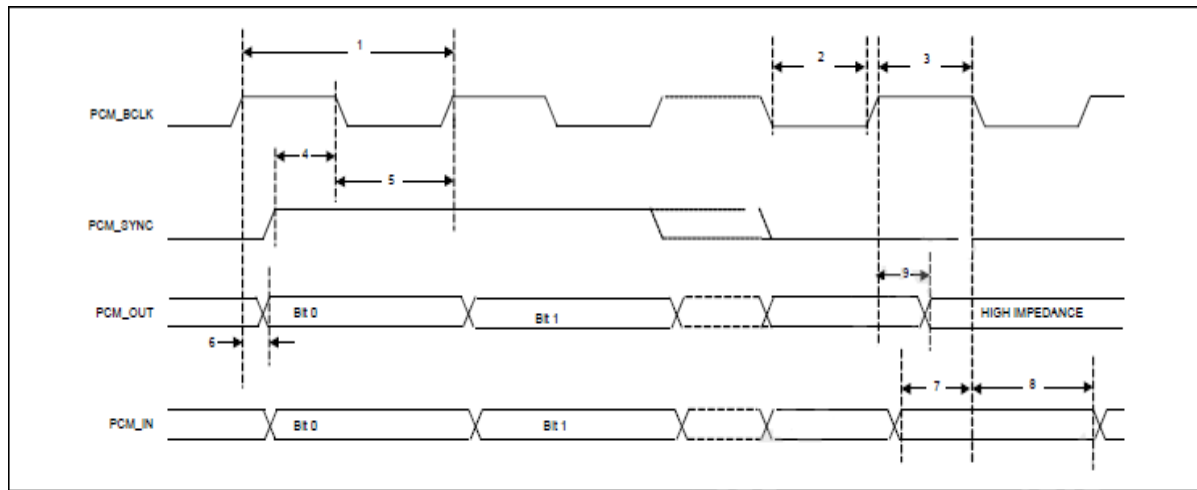


PCM Interface Timing Specifications (Long Frame Sync, Master Mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock low	41	–	–	ns
3	PCM bit clock high	41	–	–	ns
4	PCM_SYNC delay	0	–	25	ns
5	PCM_OUT delay	0	–	25	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns
8	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

Long Frame Sync, Slave Mode

PCM Timing Diagram (Long Frame Sync, Slave Mode)

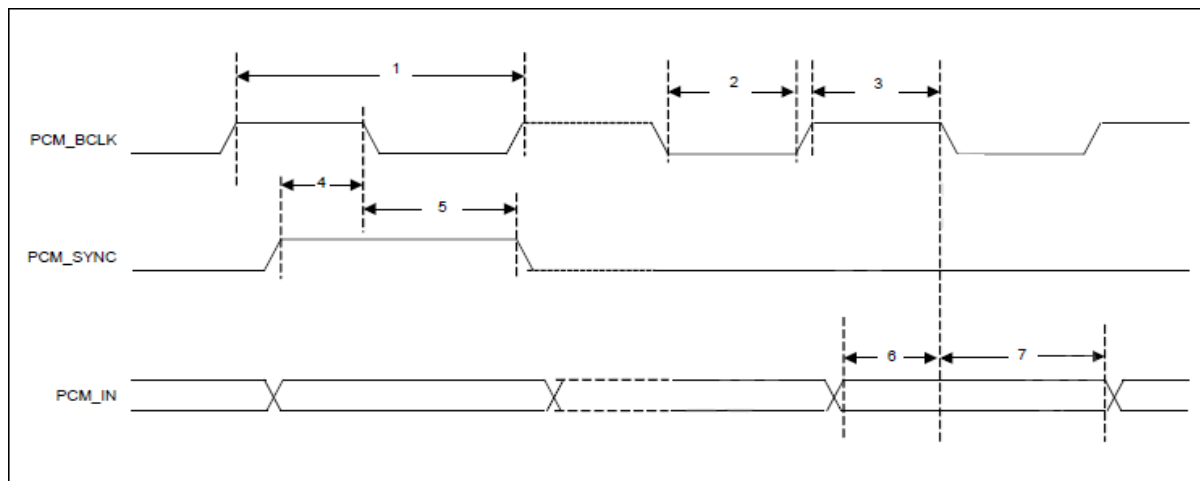


PCM Interface Timing Specifications (Long Frame Sync, Slave Mode)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	12	MHz
2	PCM bit clock low	41	–	–	ns
3	PCM bit clock high	41	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_OUT delay	0	–	25	ns
7	PCM_IN setup	8	–	–	ns
8	PCM_IN hold	8	–	–	ns
9	Delay from rising edge of PCM_BCLK during last bit period to PCM_OUT becoming high impedance	0	–	25	ns

Short Frame Sync, Burst Mode

PCM Burst Mode Timing (Receive Only, Short Frame Sync)

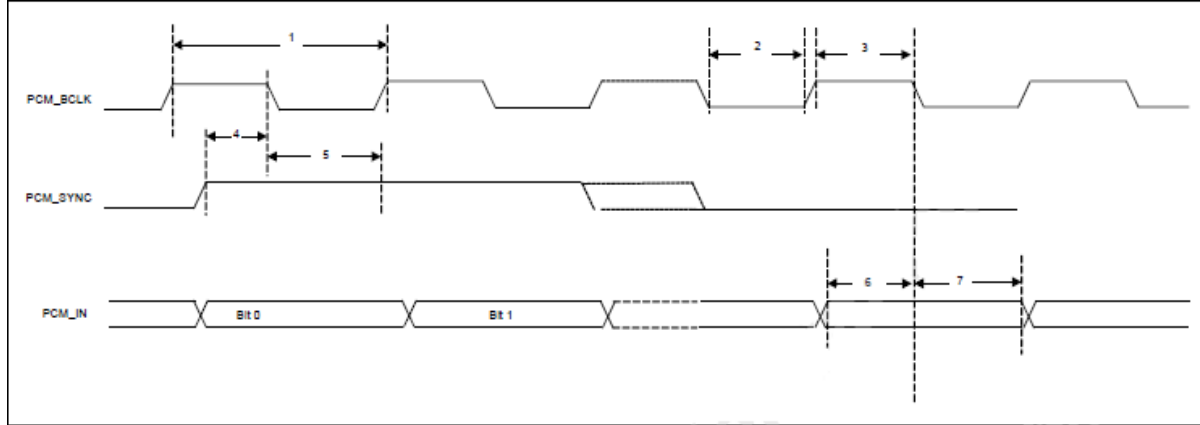


PCM Burst Mode (Receive Only, Short Frame Sync)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	24	MHz
2	PCM bit clock low	20.8	–	–	ns
3	PCM bit clock high	20.8	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns

Long Frame Sync, Burst Mode

PCM Burst Mode Timing (Receive Only, Long Frame Sync)



PCM Burst Mode (Receive Only, Long Frame Sync)

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	PCM bit clock frequency	–	–	24	MHz
2	PCM bit clock low	20.8	–	–	ns
3	PCM bit clock high	20.8	–	–	ns
4	PCM_SYNC setup	8	–	–	ns
5	PCM_SYNC hold	8	–	–	ns
6	PCM_IN setup	8	–	–	ns
7	PCM_IN hold	8	–	–	ns

8.4 UART Interface Description

The UART is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps. The interface features an automatic baud rate detection capability that returns a baud rate selection. Alternatively, the baud rate may be selected through a vendor-specific UART HCI command.

UART has a 1040-byte receive FIFO and a 1040-byte transmit FIFO to support EDR. Access to the FIFOs is conducted through the AHB interface through either DMA or the CPU. The UART supports the Bluetooth UART HCI specification: H4, a custom Extended H4, and H5. The default baud rate is 115.2 Kbaud.

The UART supports the 3-wire H5 UART transport, as described in the Bluetooth specification (Three-wire UART Transport Layer). Compared to H4, the H5 UART transport reduces the number of signal lines required by eliminating the CTS and RTS signals.

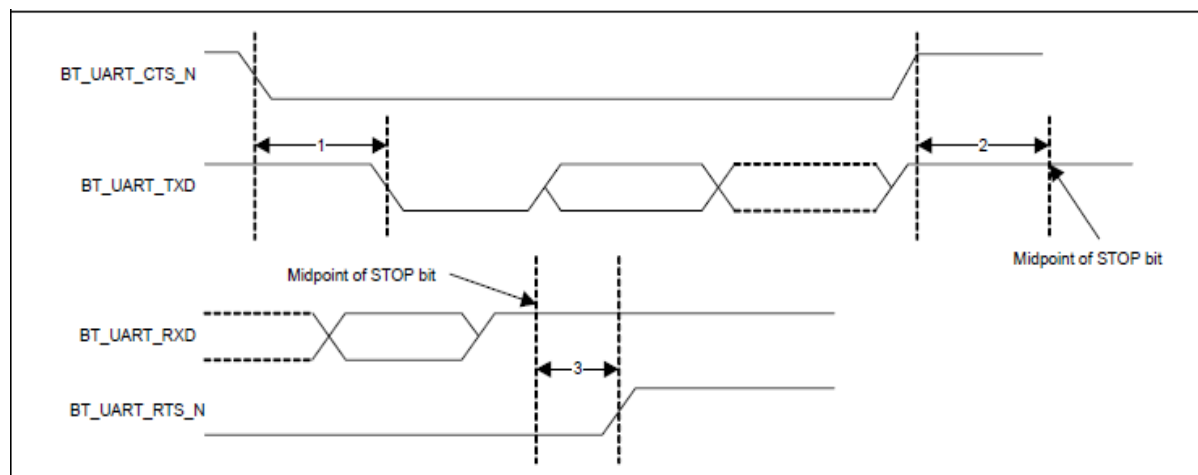
The CTE6256 UART can perform XON/XOFF flow control and includes hardware support for the Serial Line Input Protocol (SLIP). It can also perform wake-on activity. For example, activity on the RX or CTS inputs can wake the chip from a sleep state.

Normally, the UART baud rate is set by a configuration record downloaded after device reset, or by automatic baud rate detection, and the host does not need to adjust the baud rate. Support for changing the baud rate during normal HCI UART operation is included through a vendor-specific command that allows the host to adjust the contents of the baud rate registers. The CTE6256 UARTs operate correctly with the host UART as long as the combined baud rate error of the two devices is within $\pm 2\%$.

Example of Common Baud Rates

<i>Desired Rate</i>	<i>Actual Rate</i>	<i>Error (%)</i>
4000000	4000000	0.00
3692000	3692308	0.01
3000000	3000000	0.00
2000000	2000000	0.00
1500000	1500000	0.00
1444444	1454544	0.70
921600	923077	0.16
460800	461538	0.16
230400	230796	0.17
115200	115385	0.16
57600	57692	0.16
38400	38400	0.00
28800	28846	0.16
19200	19200	0.00
14400	14423	0.16
9600	9600	0.00

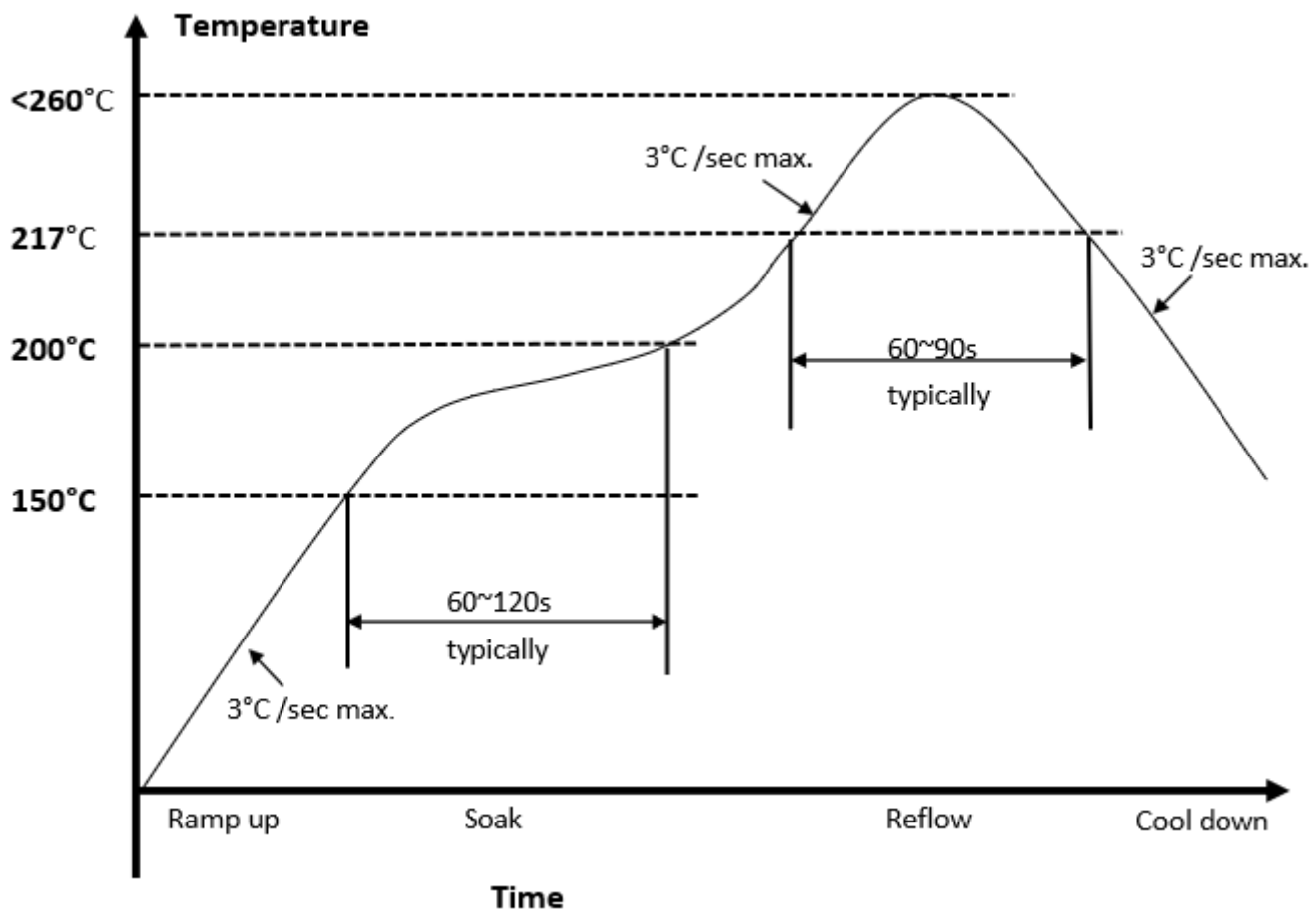
UART Timing



UART Timing Specifications

<i>Ref</i>	<i>Characteristics</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Unit</i>
1	Delay time, BT_UART_CTS_N low to BT_UART_TXD valid	–	–	1.5	Bit periods
2	Setup time, BT_UART_CTS_N high before midpoint of stop bit	–	–	0.5	Bit periods
3	Delay time, midpoint of stop bit to BT_UART_RTS_N high	–	–	0.5	Bit periods

9. Recommended Reflow Profile



1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N₂) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, be sure baking step to remove the moisture from the component.

10. Regulatory Information

10.1 CE RED- (Europe) / UKCA RER –(UK)

EU Declaration of Conformity

Hereby, CTE TECH CORP. declares that the radio equipment type CTE6256 is in compliance with Directive 2014/53/EU.

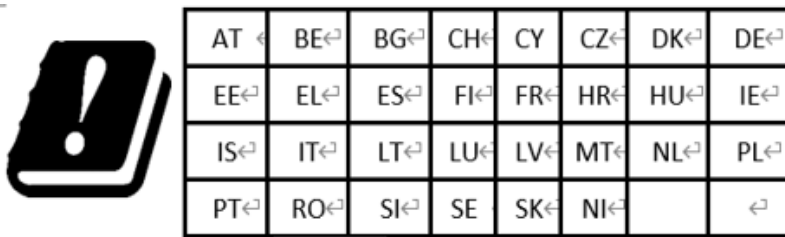
The full text of the EU declaration of conformity is available at the following internet address: <https://www.ctecorp.com.tw/product/meter>

The device is restricted to indoor use only when operating in the 5150 to 5250 MHz frequency range.

RF Exposure warning

This device meets the EU requirements (2014/53/EU) on the limitation of exposure of the general public to electromagnetic fields by way of health protection.

The device complies with RF specifications when the device used at 20 cm from your body.



10.2 FCC - (U.S.A.)

FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT

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.

CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

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.

This device meets all the other requirements specified in Part 15E, Section 15.407 of the FCC Rules.

RF Exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Information for OEMs and host integrators

The OEM or integrator is obligated to adhere to these requirements and restrictions as a condition for using the module's certification.

The OEM or integrator is responsible to perform the required additional host regulatory testing and/or obtaining the required host approvals for compliance.

integrators under the following conditions:

List of applicable FCC rules

This module has been tested for compliance to FCC Part 15 Subpart C (15.247) and Subpart E (15.407).

Summarize the specific operational use conditions

The module is tested for standalone mobile RF exposure use condition. Any other usage conditions such as co-location with other transmitter(s) will need a separate reassessment through a class II permissive change application or new certification.

Limited module procedures

Not applicable, this device is a single modular approval and meets FCC 47 CFR 15.212 requirement.

Trace antenna designs

Not applicable. This module has its own antenna, and does not need a host’s printed board micro strip trace antenna, etc.

RF exposure considerations

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. A separate SAR/Power Density evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

Antennas

This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated.

No.	Technology	Brand	Part No.	Model	Freq. Range (GHz)	Peak Gain (dBi)	Antenna Type
1	Wifi/BT	Unictron	H2U84W1H1S080	H2U84W1H1S080	2400~2500MHz& 5150~5850	2400-2500 MHz 1.4 dBi 5150-5850 MHz 2.3 dBi	Chip

IMPORTANT: The final host product must have an integral antenna which is not removable by the end-user.

Label and compliance information

Label of the end product:

The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2AS3E-CTE6256”. The grantee's FCC ID can be used only when all FCC compliance requirements are met

Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new certification.

Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rule requirements if applicable. As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

10.3 IC (CANADA)

CAN ICES-003(B) / NMB-003(B)

Innovation, Science and Economic Development Canada(ISED) Compliance Statement

This device complies with ISED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) the maximum antenna gain permitted for devices in the band 5725-5825 MHz shall comply with the e.i.r.p. limits specified for point-to-point and non point-to-point operation as appropriate.

(i) les dispositifs fonctionnant dans la bande 5150-5250 MHz sont réservés uniquement pour une utilisation à l'intérieur afin de réduire les risques de brouillage préjudiciable aux systèmes de satellites mobiles utilisant les mêmes canaux;

(ii) le gain maximal d'antenne permis (pour les dispositifs utilisant la bande 5725-5825 MHz) doit se conformer à la limite de p.i.r.e. spécifiée pour l'exploitation point à point et non point à point, selon le cas.

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with greater than 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à plus de 20 cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed and operated with greater than 20cm between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna. As long as **2** conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) L'antenne doit être installée et exploitée avec plus de 20 cm entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut ne pas être coimplanté avec un autre émetteur ou antenne. Tant que les **2** conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or colocation with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

IMPORTANTENOTE

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considérée comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed and operated with greater than 20cm between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains IC: 24983-CTE6256".

Étiquetage du produit final

Ce module émetteur est uniquement autorisé à être utilisé dans un appareil où l’antenne peut être installée de manière à ce que 20 cm puissent être maintenus entre l’antenne et les utilisateurs. Le produit final doit être étiqueté dans une zone visible avec les informations suivantes: “Contient le module d’émission IC: 24983-CTE6256”.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L’intégrateur OEM doit être conscient de ne pas fournir à l’utilisateur final des informations concernant la procédure d’installation ou de suppression de ce module RF dans le manuel de l’utilisateur du produit final qui intègre ce module.
Le manuel de l'utilisateur final doit inclure toutes les informations / avertissements réglementaires requis, comme indiqué dans ce manuel.

This radio transmitter [IC: 24983-CTE6256] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

This radio transmitter [IC: 24983-CTE6256] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio [IC: 24983-CTE6256] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur

No.	Technology	Brand	Part No.	Model	Freq. Range (GHz)	Peak Gain (dBi)	Antenna Type
1	Wifi/BT	Unictron	H2U84W1H1S080	H2U84W1H1S080	2400~2500MHz&5150~5850	2400-2500 MHz 1.4 dBi 5150-5850 MHz 2.3 dBi	Chip

IMPORTANT: The final host product must have an integral antenna which is not removable by the end-user.

10.4 NCC (Taiwan)

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

本模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求最終產品平台廠商(OEM Integrator)於最終產品平台(End Product)上標示:
本產品內含射頻模組，其 NCC 型式認證號碼為:  CCXXxxYYyyyZzW

應避免影響附近雷達系統之操作。

10.5 Anatel Brazil (Brazil)

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para maiores informações, consulte o site da ANATEL – www.anatel.gov.br

10.6 LABEL :



11. Disclaimer

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