

To Be Discontinued

W-LAN+Bluetooth Combo Module Data Sheet

Cypress Chipset
for 802.11a/b/g/n/ac + Bluetooth 4.1

Tentative P/N : LBEE5ZZ1CK-TEMP

Preliminary
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The revision history of the product specification

Revised No.	Date	Note
-	2014/03/28	First Issue
B	2015/02/11	p4:Adding tolerance p13~20:change output power
C	2016/4/14	P23 :correction output power setting
D	2017/3/3	Changed IC Part Number P3:Added Certification information P5:Added Label information P28:Added reference circuit P29:Added Packing information
E	2017/4/12	Revised BT version P3:1. SCOPE P27:11.10 DC/RF Characteristics for Bluetooth (LE)

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Please be aware that an important notice concerning availability, standard warranty and use in critical applications of Murata products and disclaimers thereto appears at the end of this specification sheet.

1. SCOPE

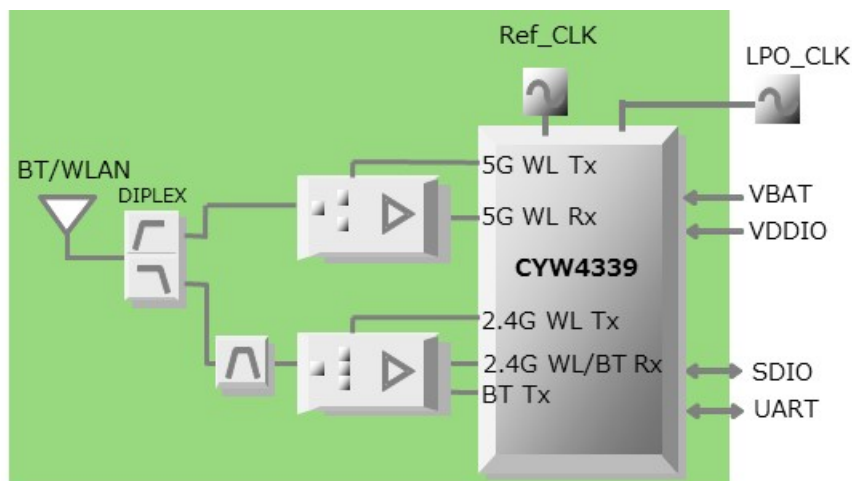
This specification is applied to the IEEE802.11a/b/g/n/ac W-LAN + Bluetooth 4.1 combo module.

- Module size : 33.0 x 18.0 mm typ., t = 7.55 mm max.
- IC/Firmware : Cypress CYW4339
- WLAN Host I/F : SDIO3.0
- Bluetooth Host I/F : UART
- Reference Clock : 37.4MHz Crystal Oscillator embedded
- ROM : Internal OTP
- Weight : 2.47g
- RoHS : This module is compliant with the RoHS directive.

2. Part Number

Sample Part Number
LBEE5ZZ1CK-TEMP

3. Block Diagram



4. Certification Information

4.1. Radio Certification

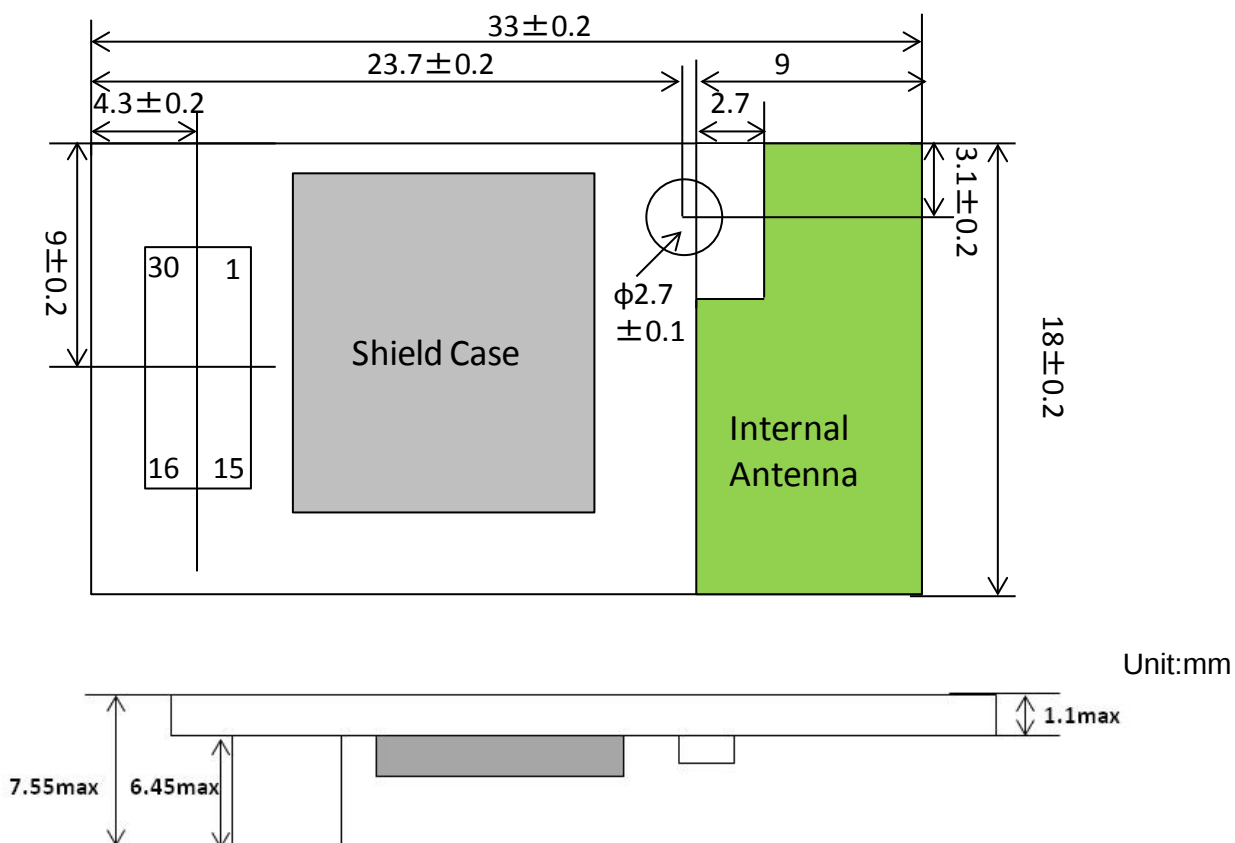
USA/Canada

FCC ID : VPYLB1CK982

IC : 772C-LB1CK982

5. Dimensions, Marking and Terminal Configuration

Dimensions



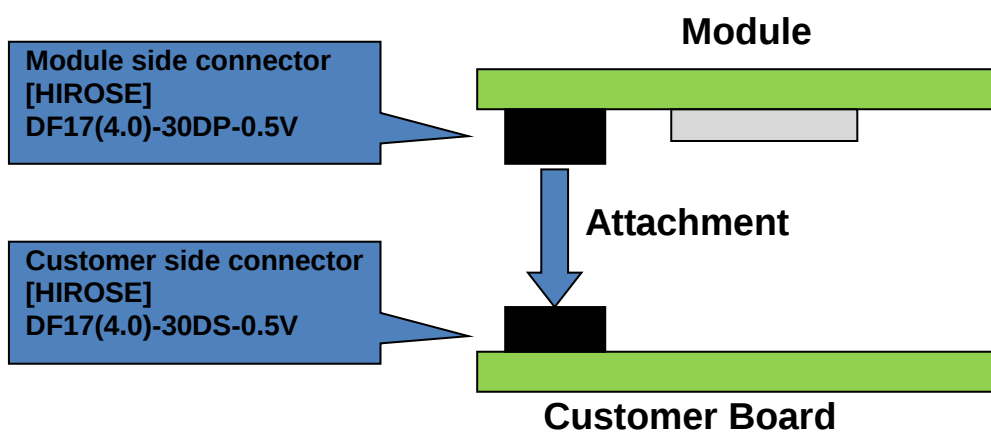
Indication

< connector >

P/N: DF17(4.0)-30DP-0.5V (mounted on Murata module)

P/N: DF17(4.0)-30DS-0.5V (need to place on Customer board)

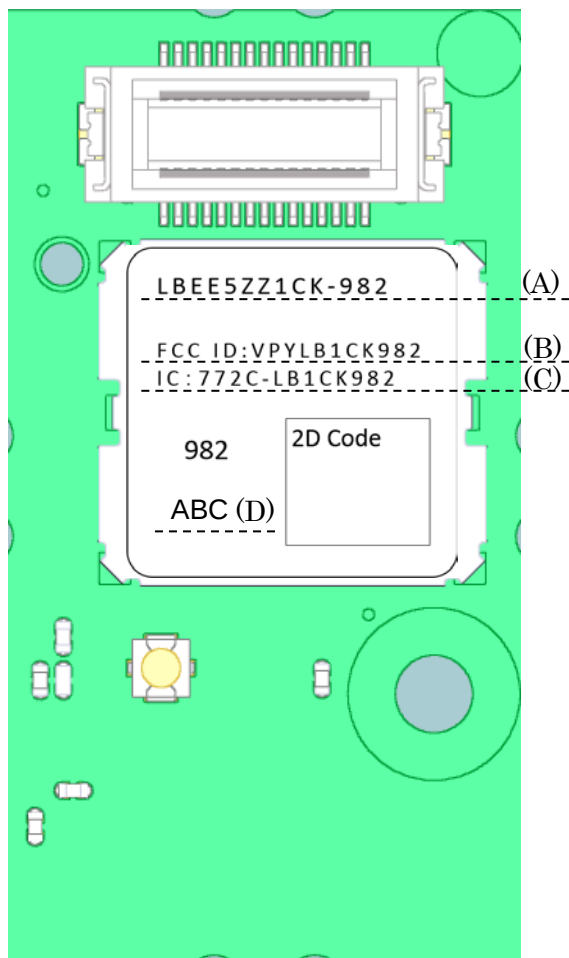
Maker: HIROSE Electric



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Marking
<Top side>



Marking	Meaning
(A)	Part Number
(B)	FCC ID
(C)	IC ID
(D)	Trace Number

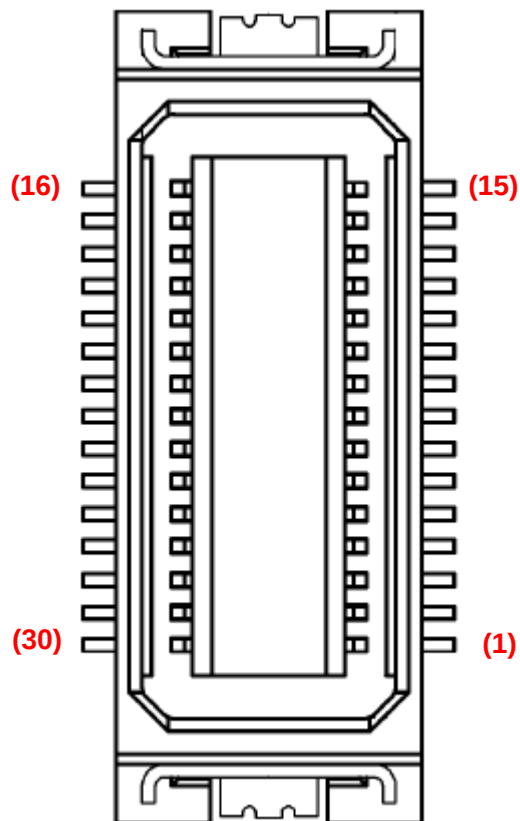
Terminal Configurations

No.	Terminal Name	Type	Connection to IC Terminal	Description
1	VBAT	PI	SR_VDDBATP5V LDO_VDDBAT5V	Power VBAT
2	VBAT	PI	SR_VDDBATP5V LDO_VDDBAT5V	Power VBAT
3	GND	-	-	-
4	VIO	PI	PMU_VDDIO VDDIO VDDIO_SD	I/O supply for PMU, WLAN, SDIO
5	GND	-	-	-
6	WLAN_REG_ON	I	WL_REG_ON	Used by PMU to power up or power down the internal CYW4339 regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull-down resistor that is enabled by default. It can be disabled through programming.
7	BT_REG_ON	I	BT_REG_ON	Used by PMU to power up, or power down the internal CYW4339 regulators used by BT section. Also when deasserted, this pin holds the BT/FM section in reset. This pin has an internal 200kohm pull-down resistor that is enabled by default. It can be disabled by programming.
8	WLAN_HOST_WAKE	I/O	GPIO_0	This pin can be programmed by S/W to be a GPIO, or WLAN_HOST_WAKE output indicating that host wake-up should be performed.
9	GND	-	-	-
10	BT_UART_RTS_N	O	BT_UART_RTS_N	UART request-to-send. Active-low request to send signal for HCI UART I/F
11	BT_UART_TXD	O	BT_UART_TXD	UART signal output. Serial data output for the HCI UART I/F
12	BT_UART_RXD	I	BT_UART_RXD	UART signal input. Serial data input for the HCI UART I/F
13	BT_UART_CTS_N	I	BT_UART_CTS_N	UART clear_to_send. Active low. Clear to send signal for HCI UART I/F
14	GND	-	-	-
15	SLEEP_CLK	I	LPO_IN	External Sleep clock input(32.768kHz)
16	GND	-	-	-
17	BT_DEV_WAKE	I/O	BT_DEV_WAKE	DEV_WAKE of general purpose I/O signal
18	BT_HOST_WAKE	I/O	BT_HOST_WAKE	HOST_WAKE of general purpose I/O signal
19	GND	-	-	-
20	SDIO_D2	I/O	SDIO_DATA2	SDIO Data Line 2
21	GND	-	-	-
22	SDIO_D3	I/O	SDIO_DATA3	SDIO Data Line 3
23	GND	-	-	-
24	SDIO_CMD	I/O	SDIO_CMD	SDIO Command Line
25	GND	-	-	-
26	SDIO_CLK	I	SDIO_CLK	SDIO Clock Input
No.	Terminal Name	Type	Connection to IC Terminal	Description

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27	GND	-	-	-
28	SDIO_D0	I/O	SDIO_DATA0	SDIO Data Line 0
29	GND	-	-	-
30	SDIO_D1	I/O	SDIO_DATA1	SDIO Data Line 1

Terminal Configuration looked from a board implementation side of the customer



6. Rating

Parameter		min.	max.	Unit
Storage Temperature		-40	85	deg.C
Supply Voltage	VBAT	0	+5	V
	VIO	0	+3.9	V

* Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability. No damage assuming only one parameter is set at limit at a time with all other parameters are set within operating condition.

7. Operating Condition

7.1. Operating condition

Parameter		min.	typ.	max.	unit
Operating Temperature*1		-20	25	80	deg.C
Supply Voltage	VBAT	3.2	3.6	4.4	V
	VIO	1.71	1.8	1.89	V

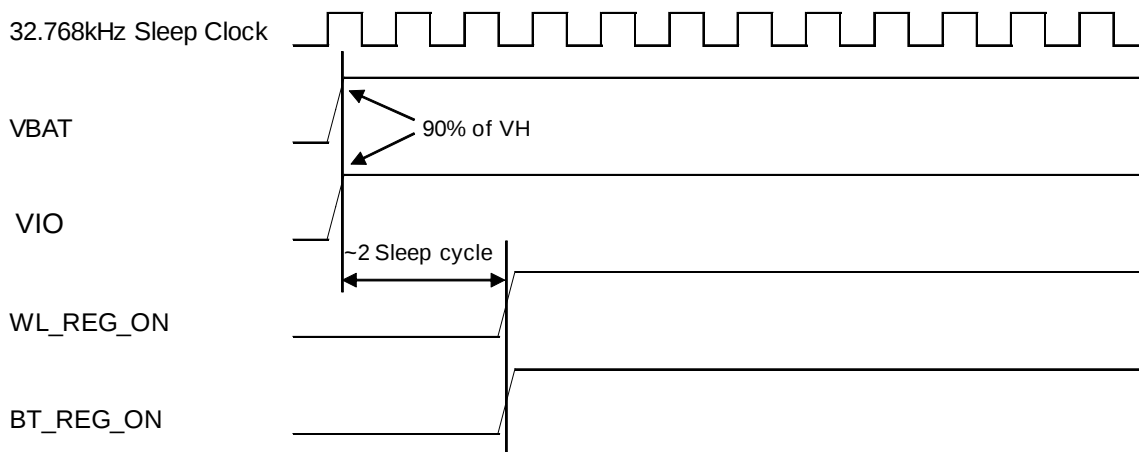
* Surface temperature of shield case

7.2. Power Up Sequence

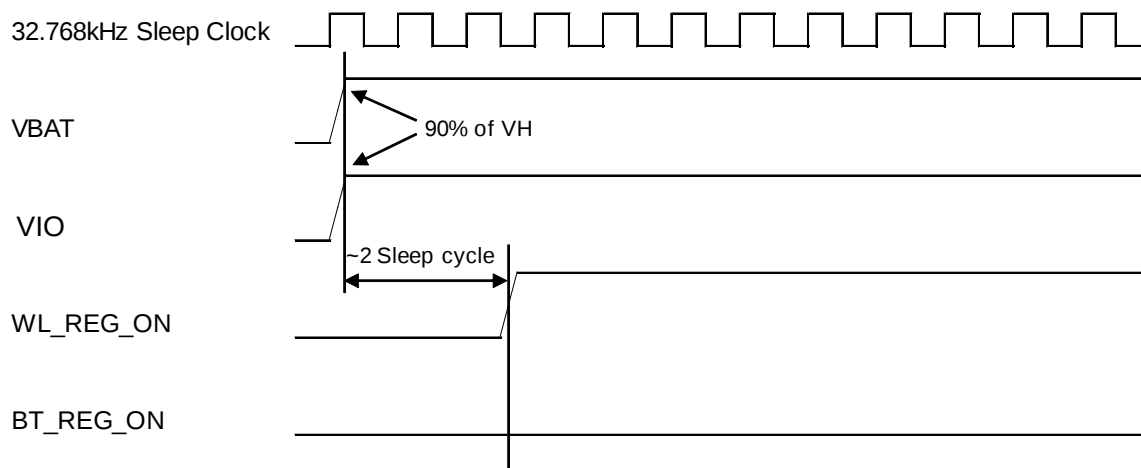
-VBAT should not rise 10%-90% faster than 40 microsecond.

-VBAT should be up before or at the same time as VIO. VIO should NOT be present fast or be held high before VBAT is high.

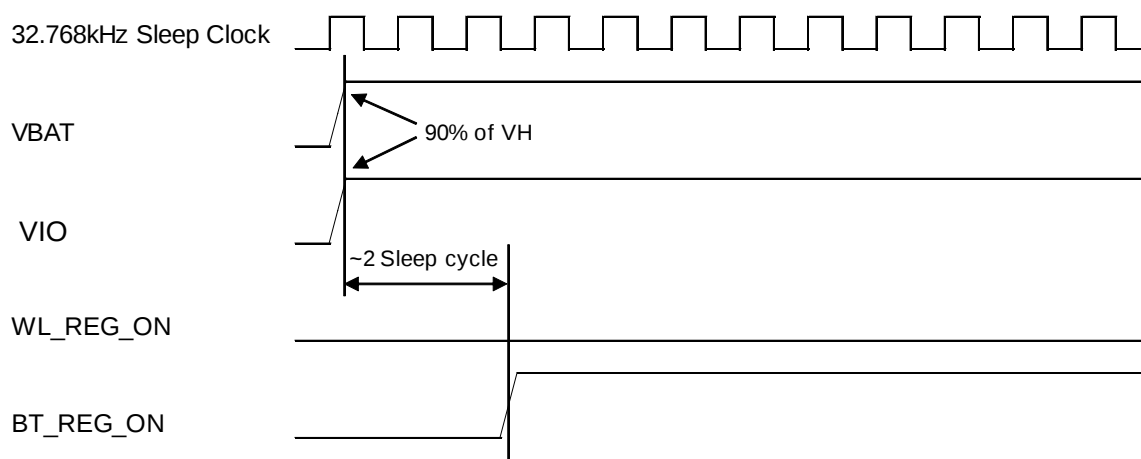
7.2.1 Power On Sequence for WLAN ON and BT ON



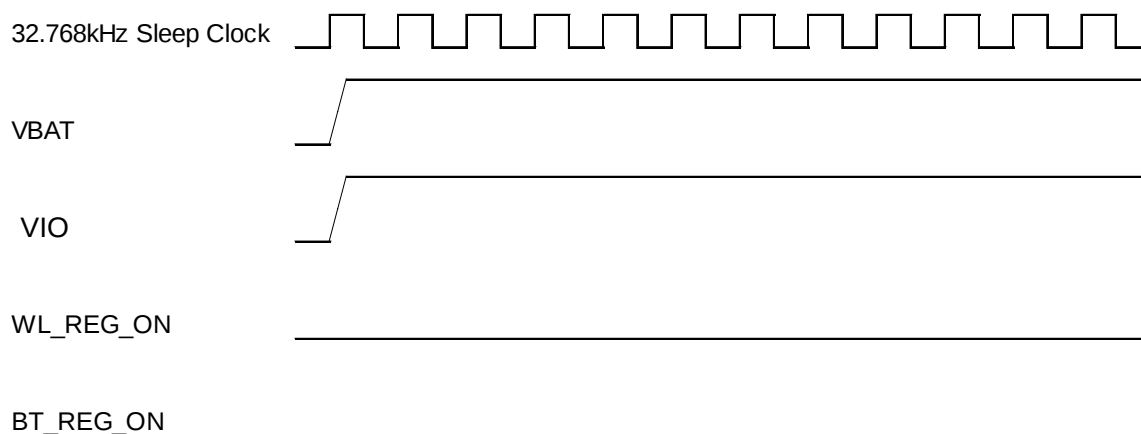
7.2.2 Power On Sequence for WLAN ON and BT OFF



7.2.3 Power On Sequence for WLAN OFF and BT ON



7.2.4 Power On Sequence for WLAN OFF and BT OFF



8 External LPO Signal Requirement

Parameter	External LPO Clock	Unit
Nominal input frequency	32.768	kHz
Frequency accuracy	+/-200	ppm
Duty cycle	30-70	%
Input signal amplitude	200 - 1800	mVp-p
Signal type	Square-wave or sine-wave	-
Input impedance ^a	> 100k < 5	ohm pF
Clock jitter (during initial start-up)	<10,000	ppm

a)When power is applied or switch off.

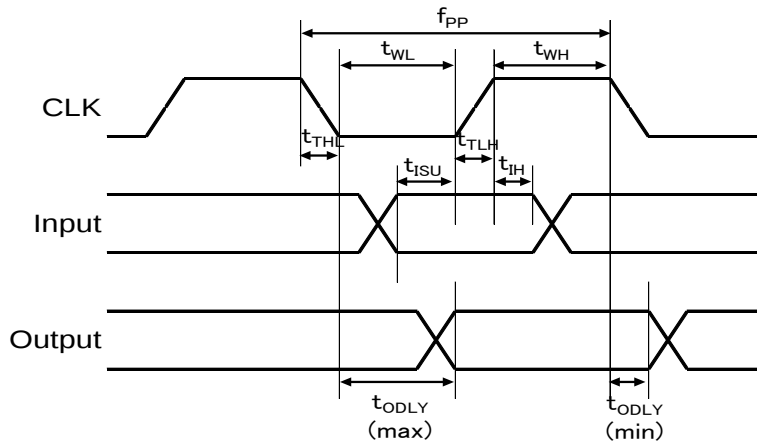
9. Digital I/O Requirements

Digital I/O Pins	Sym	min.	typ.	max.	unit
SDIO Interface I/O Pins@1.8V					
Input high voltage	VIH	1.27	-	-	V
Input low voltage	VIL	-	-	0.58	V
Output high voltage@2mA	VOH	1.40	-	-	V
Output low voltage@2mA	VOL	-	-	0.45	V
Other Digital I/O Pins@1.8V					
Input high voltage	VIH	0.65 x VIO	-	-	V
Input low voltage	VIL	-	-	0.35 x VIO	V
Output high voltage@2mA	VOH	VIO-0.45	-	-	V
Output low voltage@2mA	VOL	-	-	0.45	V

10 Interface timing

10.1 WLAN SDIO Timing

10.1.1 SDIO Timing(Default Mode)



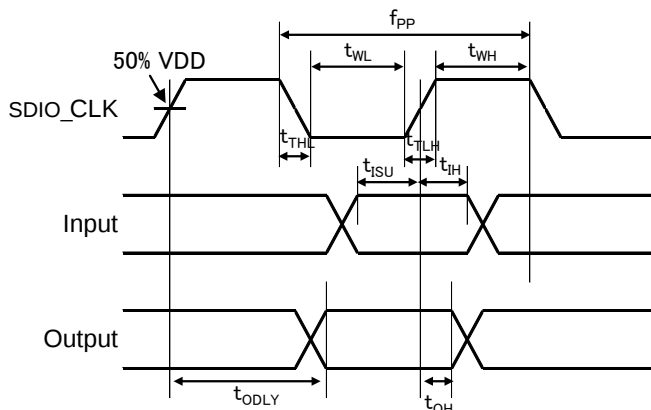
SDIO Bus Timing^(a) parameters (default Mode)

Parameter	Symbol	Min	Typ	Max	Unit
SDIO CLK (All values are referred to minimum VIH and maximum VIL ^(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 ≤ 40pF load on CMD and Data.

(b). Min (V_{ih}) = 0.7*V_{IO} and max (V_{il}) = 0.2*V_{IO}.

10.1.2 SDIO Timing(High Speed Mode)



SDIO Bus Timing^(a) parameters (High-Speed Mode)

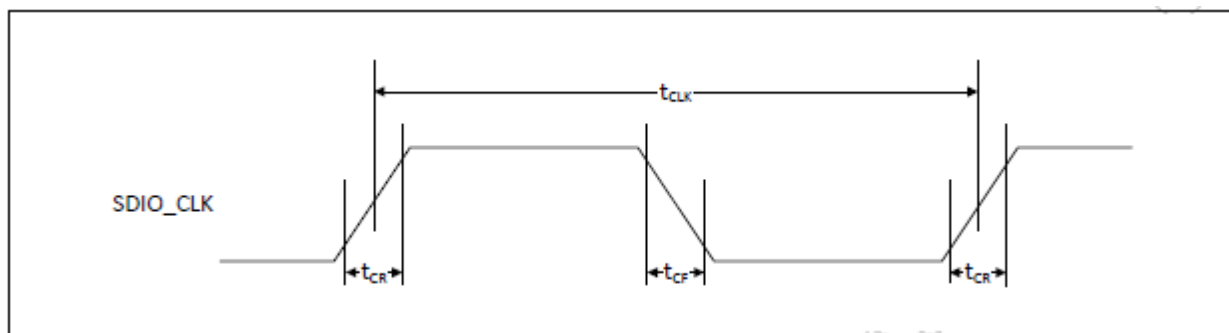
Parameter	Symbol	Min	Typ	Max	Unit
SDIO CLK (All values are referred to minimum VIH and maximum VIL ^(b))					
Frequency-Data Transfer Mode	fPP	0	-	50	MHz
Frequency-Identification Mode	fOD	0	-	400	kHz
Clock Low Time	tWL	7	-	-	ns
Clock High Time	tWH	7	-	-	ns
Clock Rise Time	tTLH	-	-	3	ns
Clock low Time	tTHL	-	-	3	ns
Inputs: CMD, DAT (referenced to CLK)					
Input Setup Time	tISU	6	-	-	ns
Input Hold Time	tIH	2	-	-	ns
Outputs: CMD, DAT (referenced to CLK)					
Output Delay time-Data Transfer Mode	tODLY	-	-	14	ns
Output Hold time	tOH	2.5	-	-	ns
Total System Capacitance (each line)	CL	-	-	40	pF

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

(b). Min (Vih) = $0.7 \cdot V_{IO}$ and max (Vil) = $0.2 \cdot V_{IO}$.

10.1.3 SDIO timing(SDR mode)

Clock Timing



SDIO Bus Clock Timing Parameters(SDR Modes)

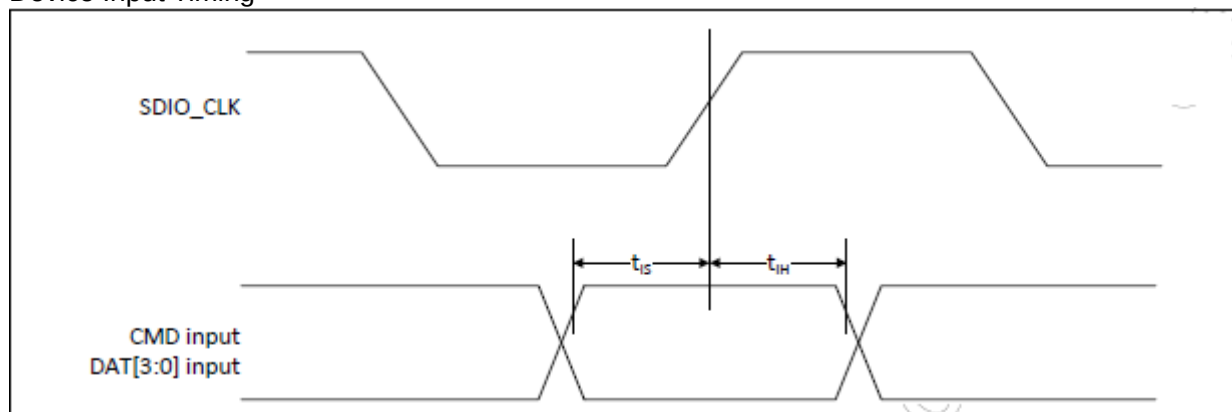
Parameter	Symbol	Min	Max	Unit	Comments
-	tclk	40	-	ns	SDR12 mode
		20	-	ns	SDR25 mode
		10	-	ns	SDR50 mode
		4.8	-	ns	SDR104 mode
-	tcr, tcf	-	$0.2 \cdot t_{clk}$	ns	tcr, tcf < 2.00ns(max)@100MHz, Ccard=10pF tcr, tcf < 0.96ns(max)@208MHz, Ccard=10pF
Clock duty cycle	-	30	70	%	ns

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Device Input Timing

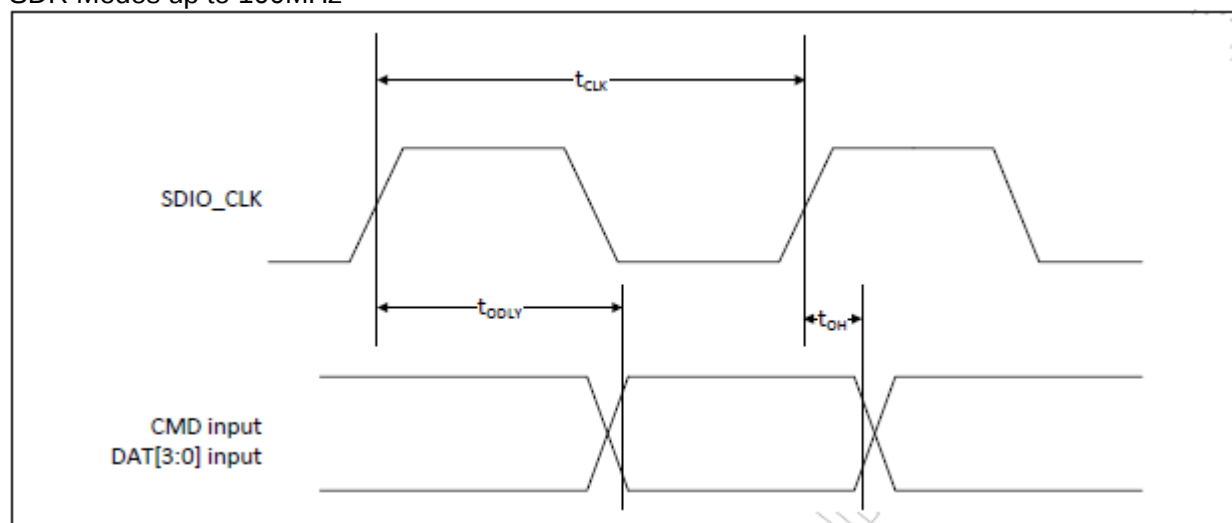


SDIO Bus Input Timing Parameters(SDR Modes)

Symbol	Min	Max	Unit	CommentsUnit
SDR104 Mode				
t_{IS}	1.4	-	ns	Ccard=10pF, VCT=0.975V
t_{IH}	0.8	-	ns	Ccard=5pF, VCT=0.975v
SDR50 Mode				
t_{IS}	3.0	-	ns	Ccard=10pF, VCT=0.975V
t_{IH}	0.8	-	ns	Ccard=5pF, VCT=0.975V

Device Output Timing

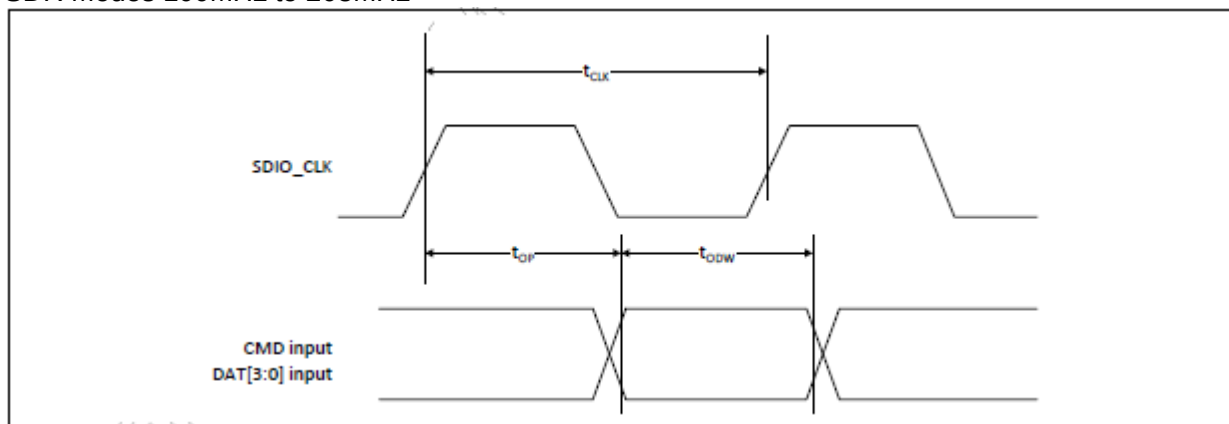
SDR Modes up to 100MHz



SDIO Bus Output Timing Parameters(SDR Modes up to 100MHz)

Symbol	Min	Max	Unit	CommentsUnit
t_{ODLY}	-	7.5	ns	$t_{CLK} > 10ns$ Cl=30pF using driver tyoe B for SDR50
t_{ODLY}	-	14.0	ns	$t_{CLK} > 20ns$ Cl=40pF using for SDR12, SDR25
t_{OH}	1.5	-	ns	Hold time at the $t_{ODLY}(\min)$ Cl=15pF

SDR Modes 100MHz to 208MHz



SDIO Bus Output Timing Parameters(SDR Modes 100MHz up to 208MHz)

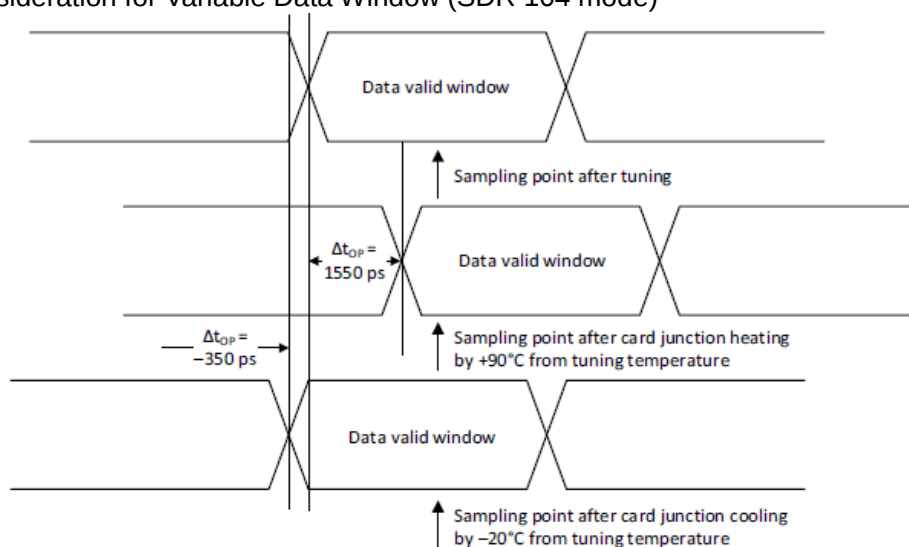
Symbol	Min	Max	Unit	Comments
top	0	2	UI	Card output phase
Δtop	-350	+1550	ps	Delay variation due to temp change after tuning
todw	0.60	-	UI	todw=2.88ns@208MHz

$\Delta\text{top}=+1550$ ps for junction temperature of $\Delta\text{top}=90$ degrees during operation

$\Delta\text{top}=-350$ ps for junction temperature of $\Delta\text{top}=-20$ degrees during operation

$\Delta\text{top}=+2600$ ps for junction temperature of $\Delta\text{top}=-20$ to $+125$ degrees during operation

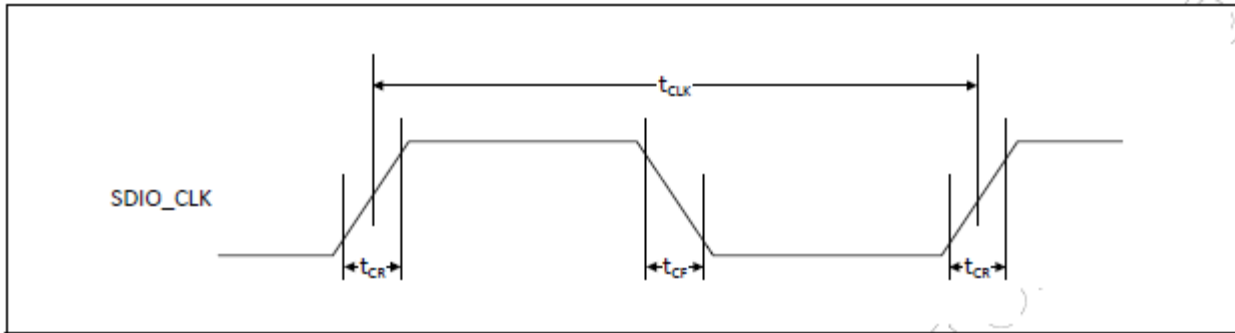
Δtop Consideration for Variable Data Window (SDR 104 mode)



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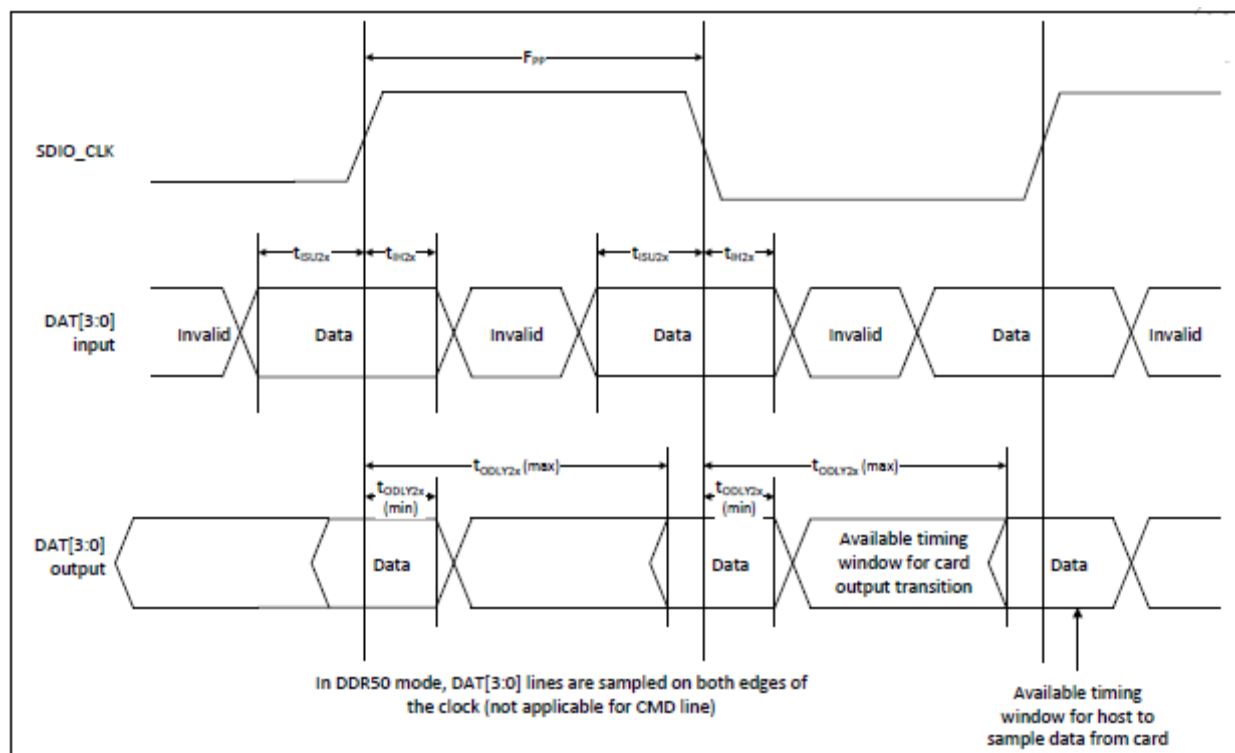
10.1.4 SDIO Timing(DDR50 mode)



SDIO Bus Clock Timing Parameters(DDR50 Mode)

parameter	Symbol	Min	Max	Unit	Comments
-	tclk	20	-	ns	DDR50 mode
-	tcr, tcf	-	0.2xtclk	ns	tcr, tcf<4.00ns(max)@50MHz, Ccard=10pF
Clock duty cycle	-	45	55	%	-

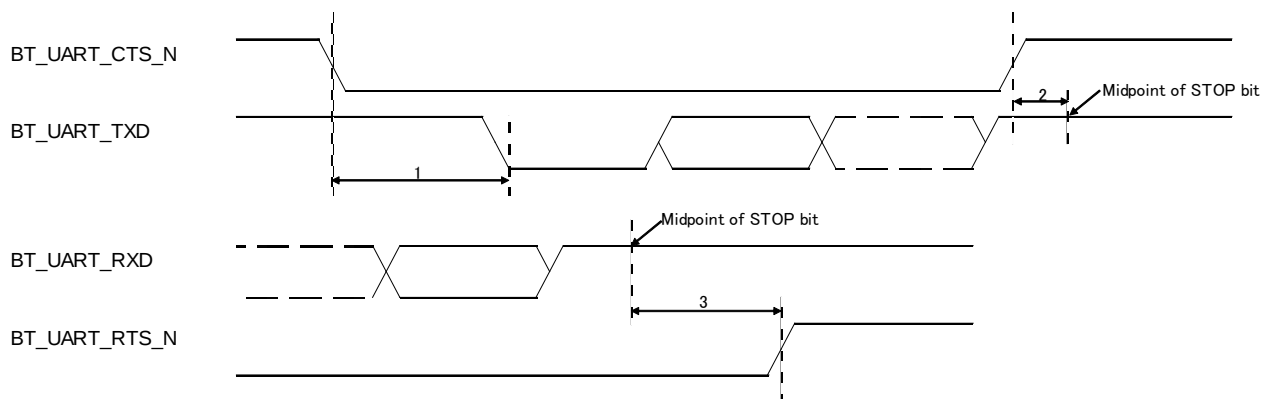
Data Timing, DDR50 Mode



SDIO Bus Timing Parameters(DDR50 Mode)

parameter	Symbol	Min	Max	unit	Comments
Input CMD					
Input setup time	tisu	6	-	ns	Ccard<10pF(1 Card)
Input hold time	tih	0.8	-	ns	Ccard<10pF(1 Card)
Output CMD					
Output delay time	todly	-	13.7	ns	Ccard<30pF(1 Card)
Output hold time	toh	1.5	-	ns	Ccard<15pF(1 Card)
Input DAT					
Input setup time	tisu2x	3	-	ns	Ccard<10pF(1 Card)
Input hold time	tih2x	0.8	-	ns	Ccard<10pF(1 Card)
Output DAT					
Output delay time	todly2x	-	7.0	ns	Ccard<25pF(1 Card)
Output hold time	todly2x	1.5	-	ns	Ccard<15pF(1 Card)

10.2 Bluetooth UART Timing



Reference	Description	Min	Typ	Max	Unit
1	Delay time, UART_CTS low to UART_TXD valid	-	-	1.5	Bit periods
2	Setup time, UART_CTS high before midpoint of stop bit	-	-	0.5	Bit periods
3	Delay time, midpoint of stop bit to UART_RTS high	-	-	0.5	Bit periods

11 ELECTORICAL CHARACTERISTICS

11.1 DC/RF Characteristics for IEEE802.11b - 2.4G

Normal Condition : 25deg.C, VBAT=3.6V.

11Mbps mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11b-2.4GHz			
Mode	DSSS / CCK			
Channel frequency	2412 to 2472 MHz			
Data rate	1, 2, 5.5, 11Mbps			
Power setting (Tx power, in dBm)	17			
Current Consumption	Min.	Typ.	Max.	unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	100	mA
Transmitter	Min.	Typ.	Max.	Unit
Power Levels	15	17	19	dBm
Spectrum Mask				
(a) 1st side lobes	-	-	-30	dBr
(b) 2nd side lobes	-	-	-50	dBr
Power-on/off ramp	-	-	2.0	Usec
RF Carrier Suppression	15		-	dB
Modulation Accuracy	-	-	35	%
Spurious Emissions (BW=100kHz)				
(a) $10\text{MHz} \leq f < 2387\text{MHz}$	-	-	-36	dBm
(b) $2387\text{MHz} \leq f < 2400\text{MHz}$	-	-	-30	dBm
(c) $2483.5\text{MHz} < f \leq 2496.5\text{MHz}$	-	-	-47	dBm
(d) $2496.5\text{MHz} < f \leq 8\text{GHz}$	-	-	-47	dBm
Receiver	Min.	Typ.	Max.	Unit
Minimum Input Level ($\text{FER} \leq 8\%$)	-	-	-76	dBm
Maximum Input Level ($\text{FER} \leq 8\%$)	-10	-	-	dBm
Adjacent Channel Rejection ($\text{FER} \leq 8\%$)	35	-	-	dB

11.2 DC/RF Characteristics for IEEE802.11g - 2.4G

Normal Condition : 25deg.C, VBAT =3.6V.

54Mbps mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11g-2.4GHz			
Mode	OFDM			
Channel frequency	2412 to 2472 MHz			
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps			
Power setting (Tx power, in dBm)	14			
Current Consumption	Min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	300	mA
(b) Rx mode	-	-	100	mA
Transmitter	Min.	Typ.	Max.	Unit
Power Levels	12	14	16	dBm
Spectrum Mask				
(a) at fc +/- 11MHz	-	-	-20	dBr
(b) at fc +/- 20MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-30MHz	-	-	-40	dBr
Constellation Error	-	-	-25	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	Min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-65	dBm
Maximum Input Level (PER $\leq$ 10%)	-20	-	-	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.3 DC/RF Characteristics for IEEE802.11n - 2.4GHz

Normal Condition : 25deg.C, VBAT =3.6V.

65Mbps (MCS7) mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11n-2.4GHz			
Mode	OFDM			
Channel frequency	2412 to 2472 MHz			
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps			
Power setting (Tx power, in dBm)	13			
Current Consumption	Min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	300	mA
(b) Rx mode	-	-	100	mA
Transmitter	Min.	Typ.	Max.	Unit
Power Levels	11	13	15	dBm
Spectrum Mask				
(a) at fc +/- 11MHz	-	-	-20	dBr
(b) at fc +/- 20MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-30MHz	-	-	-45	dBr
Constellation Error	-	-	-27	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	Min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-64	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.4 DC/RF Characteristics for IEEE802.11a - 5GHz

Normal Condition : 25deg.C, VBAT =3.6V.

54Mbps mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11a-5GHz			
Mode	OFDM			
Channel frequency	5180 - 5825MHz			
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps			
Power setting (Tx power, in dBm)	12			
Current Consumption	min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	110	mA
Transmitter	min.	Typ.	Max.	Unit
Power Levels	10	12	14	dBm
Spectrum Mask				
(a) at fc +/- 11MHz	-	-	-20	dBr
(b) at fc +/- 20MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-30MHz	-	-	-40	dBr
Constellation Error	-	-	-25	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-65	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.5 DC/RF Characteristics for IEEE802.11n(HT 20MHz) - 5GHz

Normal Condition : 25deg.C, VBAT =3.6V.

65Mbps (MCS7 – HT 20MHz) mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11n-5GHz			
Mode	OFDM			
Channel frequency	5180 - 5825MHz			
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps			
Power setting (Tx power, in dBm)	12			
Current Consumption	min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	110	mA
Transmitter	min.	Typ.	Max.	Unit
Power Levels	10	12	14	dBm
Spectrum Mask				
(a) at fc +/- 11MHz	-	-	-20	dBr
(b) at fc +/- 20MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-30MHz	-	-	-40	dBr
Constellation Error (measured at enhanced mode)	-	-	-27	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-64	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.6 DC/RF Characteristics for IEEE802.11n(HT 40MHz) - 5GHz

Normal Condition : 25deg.C, VBAT =3.6V.

135Mbps (MCS7 – HT 40MHz) mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11n-5GHz			
Mode	OFDM			
Channel frequency	5190 - 5795MHz			
Data rate	13.5, 27, 40.5, 54, 81, 108, 121.5, 135Mbps			
Power setting (Tx power, in dBm)	11.5			
Current Consumption	min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	110	mA
Transmitter	min.	Typ.	Max.	Unit
Power Levels	9.5	11.5	13.5	dBm
Spectrum Mask				
(a) at fc +/- 11MHz	-	-	-20	dBr
(b) at fc +/- 20MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-30MHz	-	-	-40	dBr
Constellation Error (measured at enhanced mode)	-	-	-27	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-61	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.7 **DC/RF Characteristics for IEEE802.11ac(VHT 40MHz) - 5GHz**

Normal Condition : 25deg.C, VBAT =3.6V.

180Mbps (MCS9 – VHT 40MHz) mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11ac-5GHz			
Mode	OFDM			
Channel frequency	5190 - 5795MHz			
Data rate	13.5,27,40.5,54,81,108,121.5,135,160,180Mbps			
Power setting (Tx power, in dBm)	11.5			
Current Consumption	min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	130	mA
Transmitter	min.	Typ.	Max.	Unit
Power Levels	9.5	11.5	13.5	dBm
Spectrum Mask				
(a) at fc +/- 21MHz	-	-	-20	dBr
(b) at fc +/- 40MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-60MHz	-	-	-40	dBr
Constellation Error (measured at enhanced mode)	-	-	-32	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-54	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.8 **DC/RF Characteristics for IEEE802.11ac(VHT 80MHz)-5GHz**

Normal Condition : 25deg.C, VBAT =3.6V.

390Mbps (MCS9 – VHT 80MHz) mode unless otherwise specified.

Items	Contents			
Specification	IEEE802.11ac-5GHz			
Mode	OFDM			
Channel frequency	5210 - 5775MHz			
Data rate	29.3,58.5,87.8,117,175.5,234,263.3,292.5,351,390Mbps			
Power setting (Tx power, in dBm)	11			
Current Consumption	min.	Typ.	Max.	Unit
(a) Tx mode (99% Tx mode)	-	-	350	mA
(b) Rx mode	-	-	160	mA
Transmitter	min.	Typ.	Max.	Unit
Power Levels	9	11	13	dBm
Spectrum Mask				
(a) at fc +/- 41MHz	-	-	-20	dBr
(b) at fc +/- 80MHz	-	-	-28	dBr
(c) at fc $\geq$ +/-120MHz	-	-	-40	dBr
Constellation Error (measured at enhanced mode)	-	-	-32	dB
Spurious Emissions (BW=100kHz)				
(a) 10MHz $\leq$ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz $\leq$ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f $\leq$ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f $\leq$ 8GHz	-	-	-47	dBm
Receiver	min.	Typ.	Max.	Unit
Minimum Input Level (PER $\leq$ 10%)	-	-	-51	dBm
Adjacent Channel Rejection (FER $\leq$ 10%)	-1	-	-	dB

11.9 DC/RF Characteristics for Bluetooth

Normal conditions : 25 deg.C, VBAT = 3.6V

Items	Contents			
Bluetooth specification (power class)	Version 2.1+EDR (Class1)			
Channel frequency (spacing)	2402 to 2480 MHz (1MHz)			
Current Consumption	Min.	Typ.	Max.	Unit
(a) DH5 Packet 50% Rx/Tx slot duty cycle	-	-	90	mA
(b) 2DH5 Packet 50% Rx/Tx slot duty cycle	-	-	80	mA
(c) 3DH5 Packet 50% Rx/Tx slot duty cycle	-	-	80	mA
Transmitter	Min.	Typ.	Max.	Unit
Output Power *1	7	11	15	dBm
Frequency range	2400	-	2483.5	MHz
20dB bandwidth	-	-	1	MHz
Adjacent Channel Power *2	-	-	-	-
(a) [M-N] =2	-	-	-20	dBm
(b) [M-N] ≥3	-	-	-40	dBm
Modulation characteristics	-	-	-	-
(a) Modulation Δf1avg	140	-	175	kHz
(b) Modulation Δf2max	115	-	-	kHz
(c) Modulation Δf2avg / Δf1avg	0.8	-	-	-
Carrier Frequency Drift	-	-	-	-
(a) 1slot	-25	-	+25	kHz
(b) 3slot / 5slot	-40	-	+40	kHz
(c) Maximum drift rate	-20	-	+20	kHz/50us
EDR Relative Power	-4	-	+1	dB
EDR Carrier Frequency Stability and Modulation Accuracy	-	-	-	-
(a) ωi	-75	-	+75	kHz
(b) ωi+ωo	-75	-	+75	kHz
(c) ωo	-10	-	+10	kHz
(d) RMS DEVM (DQPSK)	-	-	20	%
(e) Peak DEVM (DQPSK)	-	-	35	%
(f) 99% DEVM (DQPSK)	-	-	30	%
(g) RMS DEVM (8DPSK)	-	-	13	%
(h) Peak DEVM (8DPSK)	-	-	25	%
(i) 99% DEVM (8DPSK)	-	-	20	%
Spurious Emissions (BW=100kHz)	-	-	-	-
(a) 10MHz ≤ f < 2387MHz	-	-	-36	dBm
(b) 2387MHz ≤ f < 2400MHz	-	-	-30	dBm
(c) 2483.5MHz < f ≤ 2496.5MHz	-	-	-47	dBm
(d) 2496.5MHz < f ≤ 8GHz	-	-	-47	dBm
Receiver	Min.	Typ.	Max.	Unit
Sensitivity (BER≤0.1%)	-	-	-80	dBm
C/I Performance (BER≤0.1%) *3	-	-	-	-
(a) co-channel	-	-	11	dB
(b) 1MHz	-	-	0	dB
(c) 2MHz	-	-	-30	dB
(d) 3MHz	-	-	-40	dB
(e) image (+4MHz)	-	-	-9	dB
(f) image +/- 1MHz	-	-	-20	dB
Maximum Input Level (BER≤0.1%)	-20	-	-	dBm
EDR Sensitivity (BER≤0.007%)	-	-	-	-
(a) 8DPSK	-	-	-77	dBm

*1: Up to three spurious responses within Bluetooth limits are allowed.

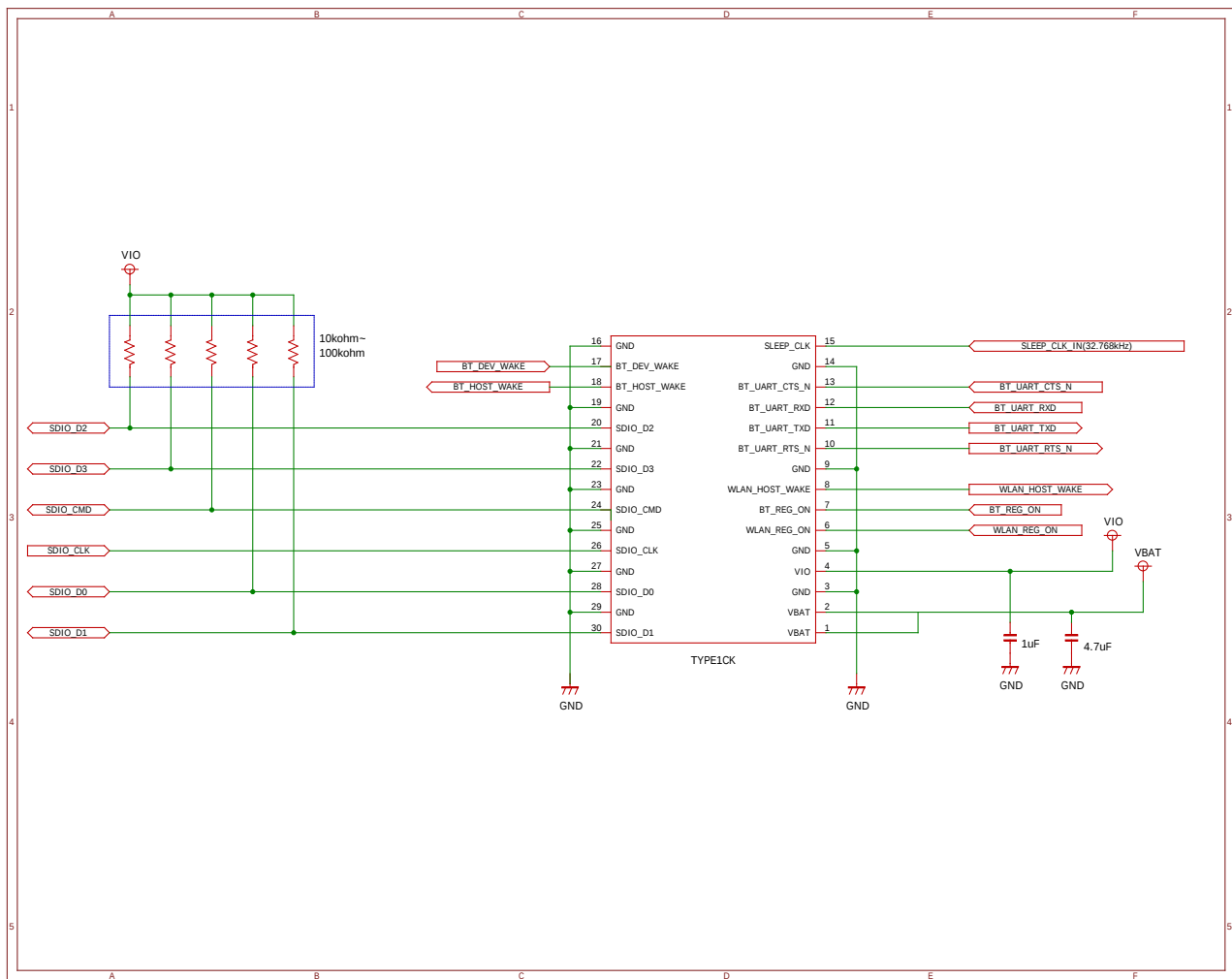
*2: Up to five spurious responses within Bluetooth limits are allowed.

11.10 DC/RF Characteristics for Bluetooth (LE)

Normal conditions : 25 deg.C, VBAT = 3.6V

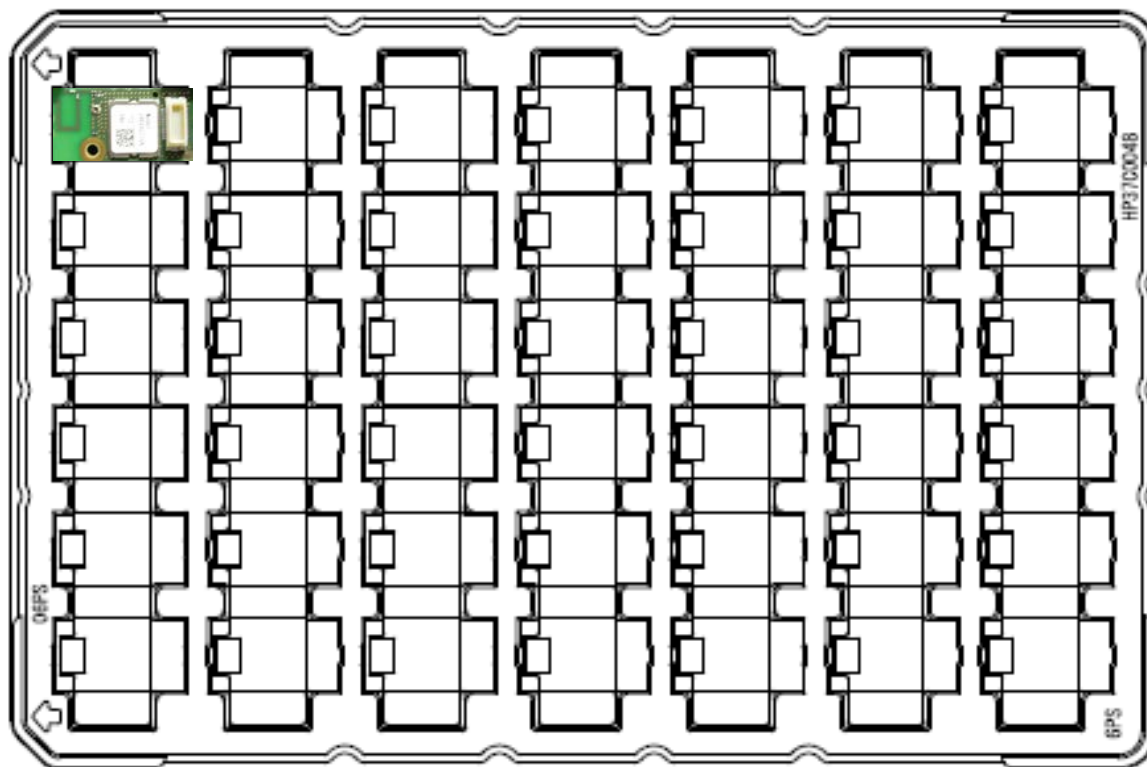
Items	Contents			
Bluetooth specification (power class)	Version 4.1(LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Item / Condition	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power ^{*1}	-	-	10	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	225	-	275	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	185	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	20	kHz
Receiver sensitivity (PER < 30.8%)	-	-	-70	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

12 REFERENCE CIRCUIT



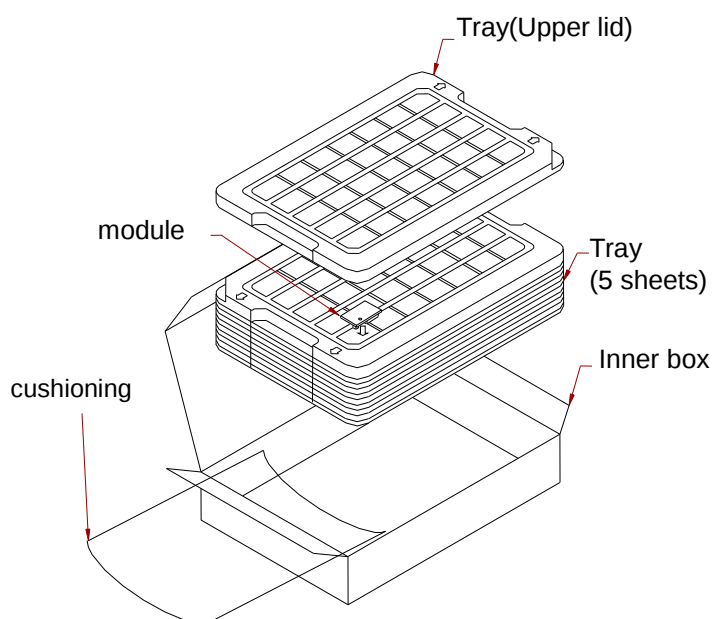
13 Packing Information

The products shall be packed in the below tray.



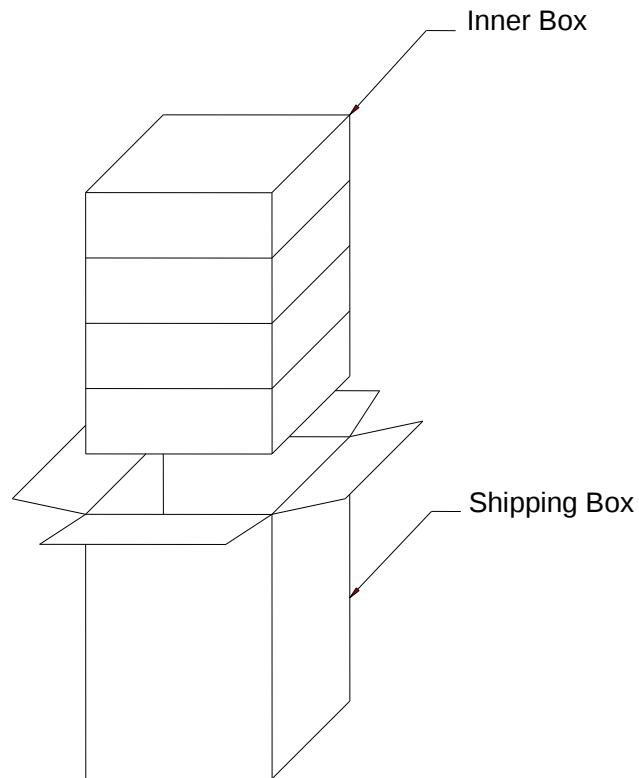
Number of the products in the carton is 210pcs.
There is the 42pcs per tray and 5pile number of the tray which stored the product.
Finally, a dummy tray is put on the topmost part of trays.

Packing in a inner box



Shipping box

Preliminary
< Specification may be changed by Murata without notice >
Murata Manufacturing Co., Ltd.



- Please keep any packaging below 40 deg.C until using it up, because a tray is potentially deformed with storage over the temperature.
- Please don't stack the shipping box over 1.5m height to avoid any physical problem.
- Four inner boxes is general number in a shipping box, but it may be dummy for some of inner boxes.
- One inner box has 210pcs as standard q'ty.
- MOQ is 840pcs, which are constructed two inner boxes.

NOTICE

1. Storage Conditions :

Please use this product within 6month after receipt.

- The product shall be stored without opening the packing under the ambient temperature from 5 to 35deg.C and humidity from 20 to 70%RH.

(Packing materials, in particular, may be deformed at the temperature over 40deg.C.)

- The product left more than 6months after reception, it needs to be confirmed the solderbility before used.
- The product shall be stored in non corrosive gas (Cl₂, NH₃, SO₂, NO_x, etc.).
- Any excess mechanical shock including, but not limited to, sticking the packing materials by sharp object and dropping the product, shall not be applied in order not to damage the packing materials.

2. Handling Conditions :

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle with care if products may have cracks or damages on their terminals, the characteristics of products may change. Do not touch products with bear hands that may destroy by static electrical charge.

3. Cleaning :

Since this Product is Moisture Sensitive, any cleaning is not permitted.

4. Operational Environment Conditions :

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned. However, if products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl₂, NH₃, SO_x, NO_x etc.).
- In an atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there are possibilities for products to be used under the preceding clause, consult with Murata before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

5. Input Power Capacity :

Products shall be used in the input power capacity as specified in this specifications.

Inform Murata beforehand, in case that the components are used beyond such input power capacity range.

PRECONDITION TO USE OUR PRODUCTS

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

Please make sure that your product has been evaluated and confirmed from the aspect of the fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is its conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

WE HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements. Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS IN SUCH APPLICATIONS.

- Aircraft equipment. - Aerospace equipment - Undersea equipment.
- Power plant control equipment - Medical equipment.
- Transportation equipment (vehicles, trains, ships, elevator, etc.).
- Traffic signal equipment. - Disaster prevention / crime prevention equipment.
- Burning / explosion control equipment
- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

We expressly prohibit you from analyzing, breaking, reverse-engineering, remodeling altering, and reproducing our product. Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.

Please do not use our products, our technical information and other data provided by us for the purpose of developing of mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein. When you are not able to return the signed version of specification sheet or approval sheet within 30 days from receiving date of specification sheet or approval sheet, it shall be deemed to be your consent on the content of specification sheet or approval sheet. Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status. We reject any liability or product warranty for engineering samples. In particular we disclaim liability for damages caused by

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- deviation or lapse in function of engineering sample,
- improper use of engineering samples.

We disclaim any liability for consequential and incidental damages.

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