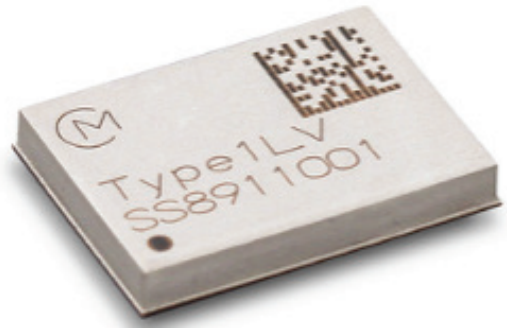
Datasheet

Type 1LV Wi-Fi® + Bluetooth® Module

Infineon CYW43012 Chipset for 802.11a/b/g/n, 11ac-friendly + Bluetooth 5.0 Datasheet - Rev. Q

- Design Name: Type 1LV
- Module P/N: LBEE59B1LV-278



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About This Document

Type 1LV is a small and high-performance module based on Infineon CYW43012 combo chipset which supports Wi-Fi 802.11a/b/g/n + Bluetooth 5.0 BR/EDR/LE. This datasheet describes Type 1LV module in details.

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.

Audience & Purpose

Intended audience includes any customer looking to integrate this module into their product; specifically RF, hardware, software, and systems engineers.

Document Conventions

Table 1 describes the document conventions.

Table 1: Document Conventions

Conventions	Description
	Warning Note Indicates very important note. Users are strongly recommended to review.
	Info Note Intended for informational purposes. Users should review.
	Menu Reference Indicates menu navigation instructions. **Example**: Insert➔Tables➔Quick Tables➔Save Selection to Gallery
	External Hyperlink This symbol indicates a hyperlink to an external document or website. **Example**: Murata Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. **Example**: Scope Click on the text to open the link.
`Console input/output or code snippet`	**Console I/O or Code Snippet** This text ***Style*** denotes console input/output or a code snippet.
`# Console I/O comment` `// Code snippet comment`	**Console I/O or Code Snippet Comment** This text ***Style*** denotes a console input/output or code snippet comment. • Console I/O comment (preceded by "#") is for informational purposes only and does not denote actual console input/output. • Code Snippet comment (preceded by "//") may exist in the original code.

1 Scope

This specification characterizes the IEEE 802.11a/b/g/n, IEEE 802.11 ac WLAN + Bluetooth 5.0 combo module.

2 Key Features

- Infineon CYW43012 inside
- Supports IEEE 802.11a/b/g/n specification: Dual band 2.4 GHz and 5 GHz, 11ac-friendly
- Supports Bluetooth specification version 5.0.
- For supported Bluetooth functions, refer to Bluetooth SIG site
- WLAN interface: SDIO 2.0 and SDIO 3.0 (SDR40 at 80 MHz and DDR40 at 40MHz)
- Bluetooth interface: HCI UART
- Temperature range: -20 °C to 70 °C
- Dimensions: 10.0 x 7.2 x 1.4 mm
- Weight: 0.23 g
- MSL: 3
- Surface mount type
- RoHS compliant.
- MAC/BD address are embedded

3 Ordering Information

Table 2 describes the ordering information.

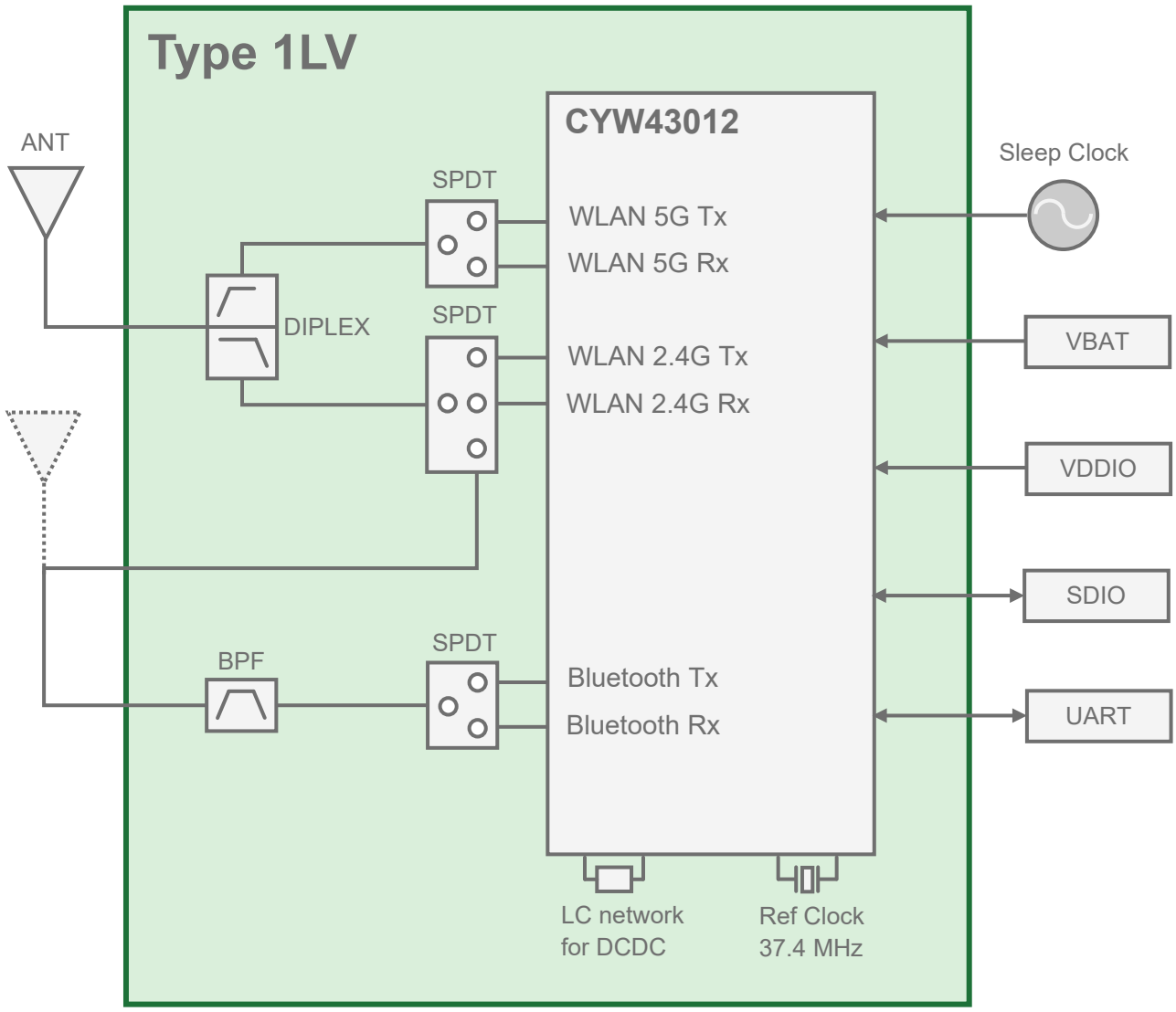
Table 2: Ordering Information

Ordering Part Number	Description
LBEE59B1LV	Module order
LBEE59B1LV-TEMP	Sample module order (If module samples are not available through distribution, contact Murata referencing this part number)
EAR00323	Embedded Artists Type 1LV M.2 EVB (default EVB available through distribution)
LBEE59B1LV-TEMP-D	Murata Type 1LV EVK (contact Murata as this is special order item)

4 Block Diagram

Figure 1 shows the Type 1LV block diagram.

Figure 1: Block Diagram



5 Certification Information

This section lists the certification information.

5.1 Radio Certification

Table 3 describes the radio certification for 1LV module.

Table 3: Certification Information

Country	ID	Country Code
USA (FCC)	VPYLBEE59B1LV	US/0
Canada (IC)	772C-LBEE59B1LV	CA/0
Europe	EN300328/301893 v2.1.1, EN300440 v2.2.1 conducted test report is prepared.	DE/0
Japan	Japanese type certification is prepared. R 001-P01338	JP/0

Please follow installation manual of Section 16.

Each country codes are defined by Murata Blob/Nvram file. Murata prepared 4 kinds of Blob files.

- STA/Indoor: US/CA/DE/JP
- STA/Outdoor: US/CA/DE/JP
- AP/Indoor: US/CA/DE/JP
- AP/Outdoor: US/CA/DE

For more details, please ask your contact person from Murata.

5.2 Bluetooth Qualification

- QDID: 125836
- For supported Bluetooth functions, refer to Bluetooth SIG site

6 Dimensions, Markings and Terminal Configurations

This section has information on dimensions, markings, and terminal configurations for Type 1LV.

Figure 2 shows the dimensions, markings, and terminal configurations. **Table 4** and **Table 5** describes the Type 1LV markings and dimensions.

Figure 2: Dimensions, Markings and Terminal Configurations

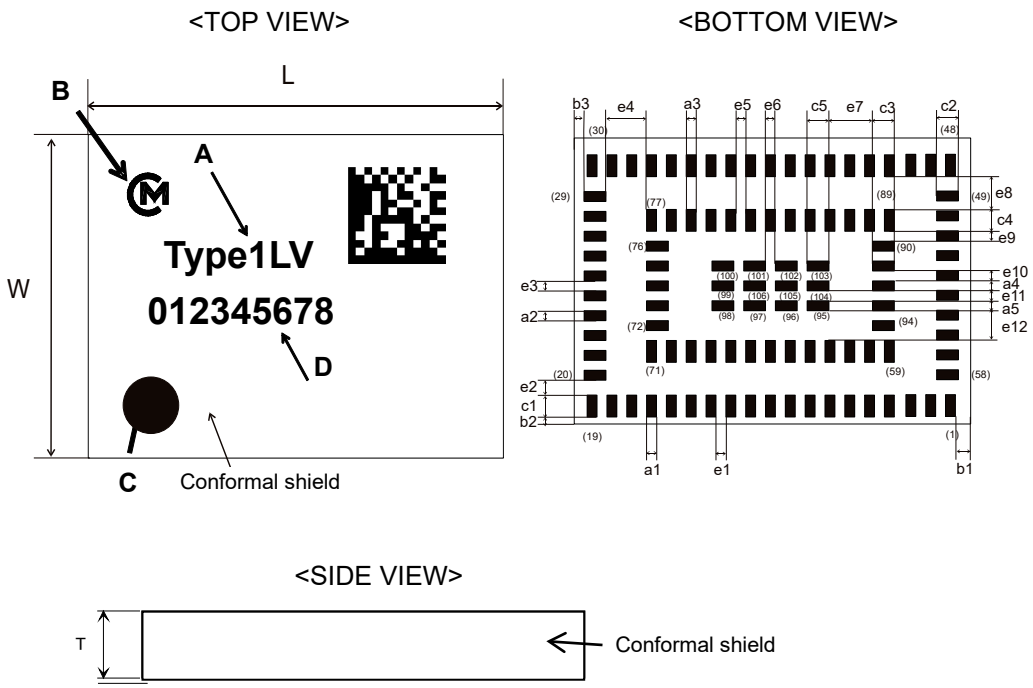


Table 4: Markings

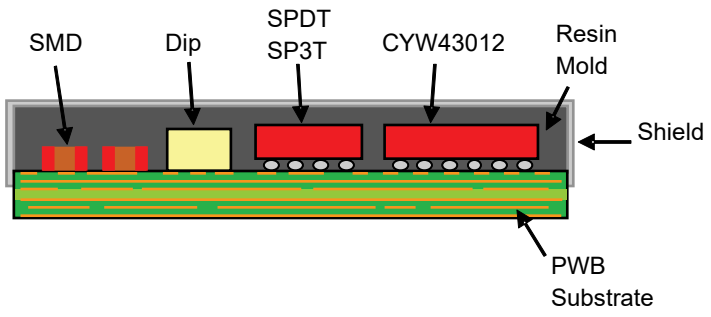
Marking	Meaning
A	Module Type
B	Murata Logo
C	Pin 1 Marking
D	Inspection Number

Table 5: Dimensions

Mark	Dimensions (mm)	Mark	Dimensions (mm)	Mark	Dimensions (mm)
L	10.0 +/- 0.2	W	7.2 +/- 0.2	T	1.4 maximum
a1	0.25 +/- 0.1	a2	0.25 +/- 0.1	a3	0.25 +/- 0.1
a4	0.25 +/- 0.1	a5	0.25 +/- 0.1	b1	0.375 +/- 0.2
b2	0.30 +/- 0.2	b3	0.30 +/- 0.2	c1	0.55 +/- 0.1
c2	0.55 +/- 0.1	c3	0.55 +/- 0.1	c4	0.55 +/- 0.1
c5	0.55 +/- 0.1	e1	0.25 +/- 0.1	e2	0.375 +/- 0.1
e3	0.25 +/- 0.1	e4	1.025 +/- 0.1	e5	0.25 +/- 0.1
e6	0.25 +/- 0.1	e7	1.100 +/- 0.1	e8	0.825 +/- 0.1
e9	0.25 +/- 0.1	e10	0.25 +/- 0.1	e11	0.25 +/- 0.1
e12	0.75 +/- 0.1				

Figure 3 shows Type 1LV structure.

Figure 3: Structure



7 Module Pin Descriptions

This section has the pin descriptions of Type 1LV and pin assignments layout descriptions.

7.1 Module Pin Layout

The pin assignment top view is shown in **Figure 4**.

Figure 4: Pin Layout Top View

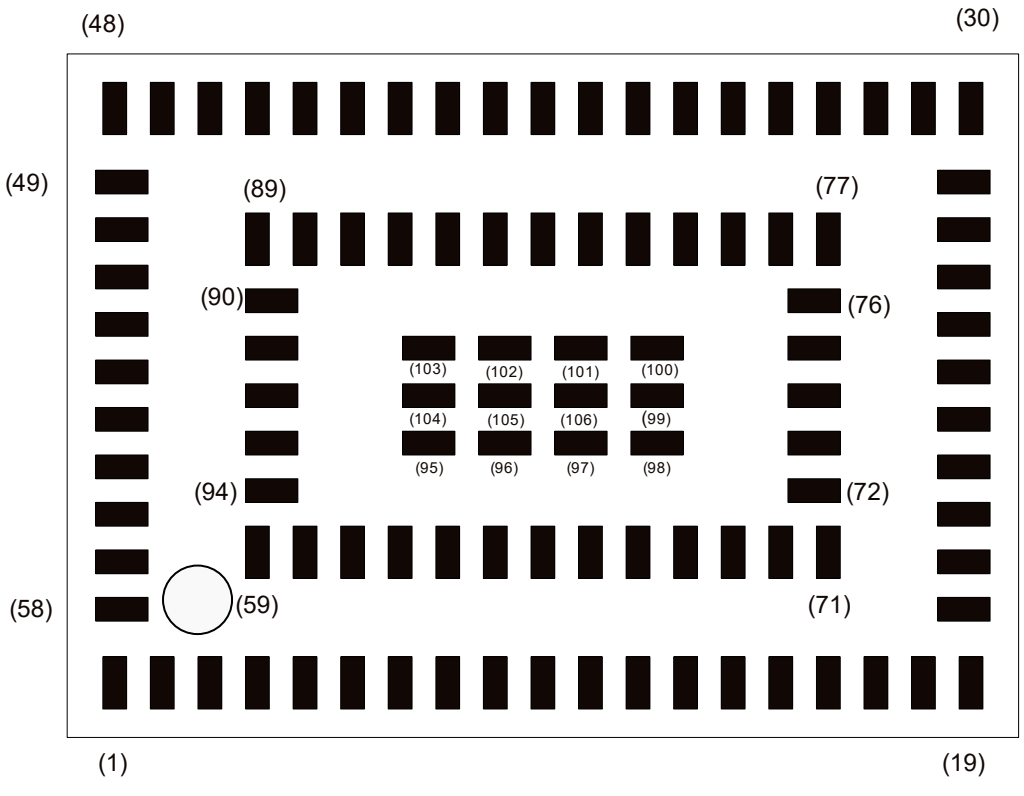


Table 6 illustrates the terminal configurations.

Table 6: Terminal Configurations

No.	Pin Name	No.	Pin Name	No.	Pin Name	No.	Pin Name
1	GND	25	SDIO_DATA_3	49	BT_RF_OUT	73	GND
2	GND	26	SDIO_CMD	50	GND	74	SFL_IO0
3	GND	27	GND	51	BT_RF_IN	75	SFL_IO3
4	VDDIO_SFL	28	VDDOUT_VDDIO	52	GND	76	SFL_IO2
5	BT_HOST_WAKE	29	BT_GPIO_0	53	GND	77	SFL_CLK
6	GND	30	GND	54	RF_SW_CTRL_6	78	SFL_IO1
7	WL_HOST_WAKE	31	BT_UART_TXD	55	RF_SW_CTRL_10	79	SFL_CS
8	WL_GPIO_1	32	BT_UART_RXD	56	RF_SW_CTRL_5	80	EXT_LPO
9	BT_REG_ON	33	BT_UART_RTS	57	GND	81	CLK_REQ
10	WL_REG_ON	34	BT_UART_CTS	58	ANT0	82	BT_PCM_OUT
11	GND	35	VDDIO	59	GND	83	BT_PCM_SYNC
12	VOUT_3P3	36	GND	60	GND	84	BT_PCM_IN
13	VBAT	37	P9	61	WL_GPIO_15	85	BT_PCM_CLK
14	VBAT	38	P11	62	WL_GPIO_13	86	BT_I2S_WS
15	GND	39	P13	63	WL_ GPIO_12	87	BT_I2S_CLK
16	RF_SW_CTRL_8	40	P5	64	WL_GPIO_14	88	BT_I2S_DI
17	RF_SW_CTRL_12	41	P6	65	GND	89	BT_I2S_DO
18	RF_SW_CTRL_11	42	P8	66	WL_GPIO_5	90	BT_GPIO_2
19	GND	43	P7	67	WL_GPIO_4	91	BT_GPIO_5
20	GND	44	P12	68	WL_GPIO_3	92	BT_GPIO_4
21	SDIO_DATA_2	45	P0	69	WL_GPIO_2	93	BT_GPIO_3
22	SDIO_DATA_1	46	P1	70	NC	94-106	GND
23	SDIO_DATA_0	47	GND	71	WL_GPIO_6		
24	SDIO_CLK	48	GND	72	GND		

7.2 Pin Descriptions

Table 7 describes Type 1LV pins.

Table 7: Pin Descriptions

No.	Pin name	Type	Connection to IC Pin Name	Description
1	GND	-	GND	Ground
2	GND	-	GND	Ground
3	GND	-	GND	Ground
4	VDDIO_SFL	I	VDDIO_SFL	DC supply voltage for SFLASH I/O
5	BT_HOST_WAKE	O	BT_HOST_WAKE	Bluetooth host wake
6	GND	-	GND	Ground
7	WL_HOST_WAKE	I/O	GPIO_0	WL_HOST_WAKE
8	WL_GPIO_1	I/O	GPIO_1	WLAN general-purpose I/Os
9	BT_REG_ON	I	BT_REG_ON	Used by the PMU to power-up or power-down the internal regulators used by the Bluetooth section
10	WL_REG_ON	I	WL_REG_ON	Used by the PMU to power up or power down the internal regulators used by the WLAN section
11	GND	-	GND	Ground
12	VOUT_3P3	O	VDDOUT_RF3P3 VDDIO_RF1	Output of 3.3V RF LDO

No.	Pin name	Type	Connection to IC Pin Name	Description
13	VBAT	I	SR_VDDBAT5 LDO_VDDBAT5 WRF_GENTRAL_VDD_V5P0 WRF_TX_VDD_V5P0 ET_LINREG_VDD_V5P0 ET_SWREG_VDD_V5P0	Power Supply
14	VBAT			
15	GND		GND	Ground
16	RF_SW_CTRL_8	O	RF_SW_CTRL_8	Programmable RF switch-control lines
17	RF_SW_CTRL_12	O	RF_SW_CTRL_12	Programmable RF switch-control lines
18	RF_SW_CTRL_11	O	RF_SW_CTRL_11	Programmable RF switch-control lines
19	GND	-	GND	Ground
20	GND	-	GND	Ground
21	SDIO_DATA_2	I/O	SDIO_DATA_2	SDIO data line 2
22	SDIO_DATA_1	I/O	SDIO_DATA_1	SDIO data line 1
23	SDIO_DATA_0	I/O	SDIO_DATA_0	SDIO data line 0
24	SDIO_CLK	I	SDIO_CLK	SDIO clock
25	SDIO_DATA_3	I/O	SDIO_DATA_3	SDIO data line 3
26	SDIO_CMD	I/O	SDIO_CMD	SDIO command line
27	GND		GND	Ground
28	VDDOUT_VDDIO	O	VDDOUT_VDDIO OTP_VDD1P8 VDDP_RF1 VDDP_SFL	Output for 1.8V power switch
29	BT_GPIO_0	I/O	BT_GPIO_0	Bluetooth general-purpose I/Os
30	GND		GND	Ground
31	BT_UART_TXD	O	BT_UART_TXD	UART serial output
32	BT_UART_RXD	I	BT_UART_RXD	UART serial input
33	BT_UART_RTS	O	BT_UART_RTS_N	UART request-to-send
34	BT_UART_CTS	I	BT_UART_CTS_N	UART clear-to-send
35	VDDIO	I	VDDIO PMU_VDDIOA PMU_VDDIOP STRAP_OFF_1P8 VDD18_FLL,BT_VDDO BT_VDDO_HIB PAD_ADC_AVDDC	Power supply
36	GND		GND	Ground
37	P9	I/O	P9	Programmable LHL/HIB pads
38	P11	I/O	P11	Programmable LHL/HIB pads
39	P13	I/O	P13	Programmable LHL/HIB pads
40	P5	I/O	P5	Programmable LHL/HIB pads P5 is used as BT_DEV_WAKE
41	P6	I/O	P6	Programmable LHL/HIB pads
42	P8	O	P8	Programmable LHL/HIB pads *Output Only
43	P7	I/O	P7	Programmable LHL/HIB pads P7 is used as WL_DEV_WAKE
44	P12	I/O	P12	Programmable LHL/HIB pads
45	P0	I/O	P0	Programmable LHL/HIB pads
46	P1	I/O	P1	Programmable LHL/HIB pads
47	GND		GND	Ground
48	GND		GND	Ground
49	BT_RF_OUT	I/O		Bluetooth Antenna

No.	Pin name	Type	Connection to IC Pin Name	Description
50	GND		GND	Ground
51	BT_RF_IN	I/O	(SP3T)	BT/WiFi one antenna: Routed to BT_RF_OUT Separate BT/WiFi antenna: connect to 50 Ω terminal.
52	GND		GND	Ground
53	GND		GND	Ground
54	RF_SW_CTRL_6	O	RF_SW_CTRL_6	NC
55	RF_SW_CTRL_10	O	RF_SW_CTRL_10	Programmable RF switch-control lines
56	RF_SW_CTRL_5	O	RF_SW_CTRL_5	NC
57	GND		GND	Ground
58	ANT0	I/O		
59	GND		GND	Ground
60	GND		GND	Ground
61	WL_GPIO_15	I/O	GPIO_15	Programmable GPIO lines
62	WL_GPIO_13	I/O	GPIO_13	Programmable GPIO lines
63	WL_GPIO_12	I/O	GPIO_12	Programmable GPIO lines
64	WL_GPIO_14	I/O	GPIO_14	Programmable GPIO lines
65	GND		GND	Ground
66	WL_GPIO_5	I/O	GPIO_5	Programmable GPIO lines
67	WL_GPIO_4	I/O	GPIO_4	Programmable GPIO lines
68	WL_GPIO_3	I/O	GPIO_3	Programmable GPIO lines
69	WL_GPIO_2	I/O	GPIO_2	Programmable GPIO lines
70	NC	I	JTAG_SEL	Wi-Fi JTAG interface is intended to be used by Cypress's internal teams only
71	WL_GPIO_6	I/O	GPIO_6	Programmable GPIO lines
72	GND		GND	Ground
73	GND		GND	Ground
74	SFL_IO0	I/O	SFL_IO0	SFLASH data line 0
75	SFL_IO3	I/O	SFL_IO3	SFLASH data line 3
76	SFL_IO2	I/O	SFL_IO2	SFLASH data line 2
77	SFL_CLK	O	SFL_CLK	SFLASH clock
78	SFL_IO1	I/O	SFL_IO1	SFLASH data line 1
79	SFL_CS	O	SFL_CS	SFLASH chip select
80	EXT_LPO	I	LPO_IN	External sleep-clock input(32.768kHz)
81	CLK_REQ	I/O	CLK_REQ	Reference clock request
82	BT_PCM_OUT	O	BT_PCM_OUT	PCM data output
83	BT_PCM_SYNC	I/O	BT_PCM_SYNC	PCM sync, can be master (output) or slave (input)
84	BT_PCM_IN	I	BT_PCM_IN	PCM data input
85	BT_PCM_CLK	I/O	BT_PCM_CLK	PCM clock, can be master (output) or slave (input)
86	BT_I2S_WS	I/O	BT_I2S_WS	I^2S serial word select
87	BT_I2S_CLK	I/O	BT_I2S_CLK	I^2S serial clock
88	BT_I2S_DI	I	BT_I2S_DI	I^2S serial data input
89	BT_I2S_DO	O	BT_I2S_DO	I^2S serial data output
90	BT_GPIO_2	I/O	BT_GPIO_2	Bluetooth general-purpose I/Os
91	BT_GPIO_5	I/O	BT_GPIO_5	Bluetooth general-purpose I/Os
92	BT_GPIO_4	I/O	BT_GPIO_4	Bluetooth general-purpose I/Os
93	BT_GPIO_3	I/O	BT_GPIO_3	Bluetooth general-purpose I/Os
94-106	GND	-	GND	Ground

8 Absolute Maximum Ratings

The absolute maximum ratings are shown in **Table 8.**

Table 8: Absolute Maximum Ratings

Parameter		Minimum	Maximum	Unit
Storage Temperature		-40	85	°C
Supply Voltage	VBAT	-0.5	5.0	V
	VDDIO	-0.5	2.2	V
	VDDIO_SFL	-0.5	4.1	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.

9 Operating Conditions

The operating conditions are shown in **Table 9**.

Table 9: Operating Conditions

Parameter		Minimum	Typical	Maximum	Unit
Operating Temperature		-20	25	+70	°C
Supply Voltage	VBAT	3.2		4.4	V
	VDDIO	1.62	1.8	1.98	V
	VDDIO_SFL	1.62/2.97	1.8/3.3	1.98/3.46	V

Functionality is guaranteed but the specifications require the derating at over-temperatures, over-voltage condition.

10 External Sleep Clock Requirement

External LPO requirements are shown in **Table 10**.

Table 10: External LPO Requirement

Parameter	External LPO Clock	Unit
Nominal input frequency	32.768	kHz
Frequency accuracy	+/-250	ppm
Duty cycle	30-70	%
Input signal amplitude	500 - 1800	mVp-p
Signal type	Square-wave or sinewave	
Input impedance[1]	> 100k	Ω

[1] When the power is applied or switched off

11 Power-On Sequences

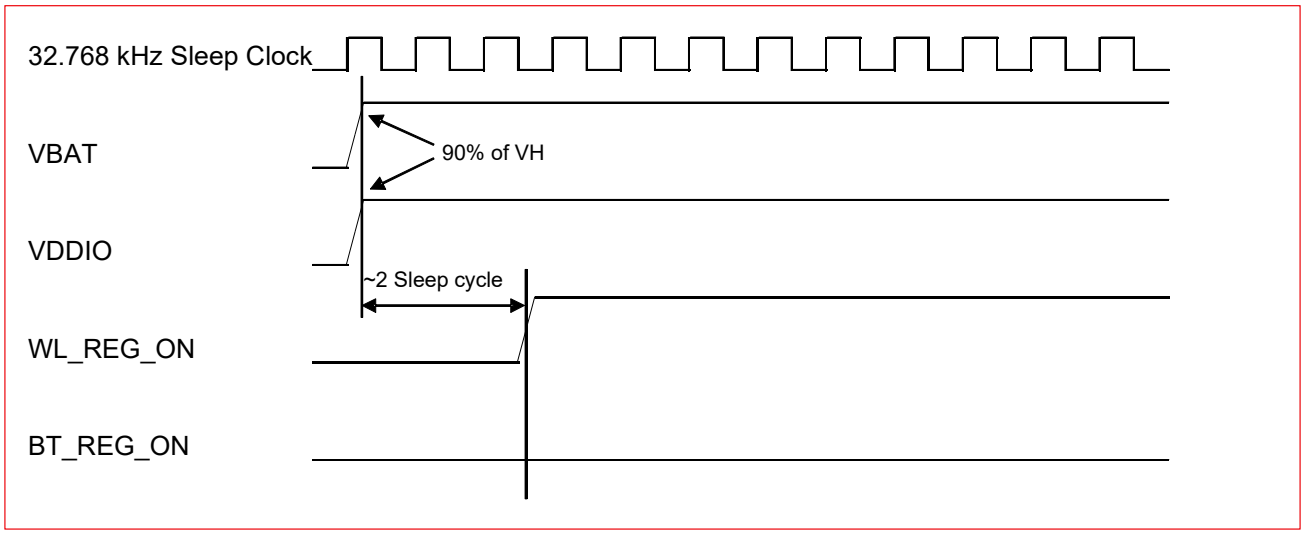
This section describes the power-on sequences along with their parameters.

- VBAT should not rise 10%-90% faster than 40 microseconds.
- VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

11.1 Power-On Sequence for WLAN ON and BT ON

Figure 5 shows the power-on sequence signals for WLAN ON and BT ON.

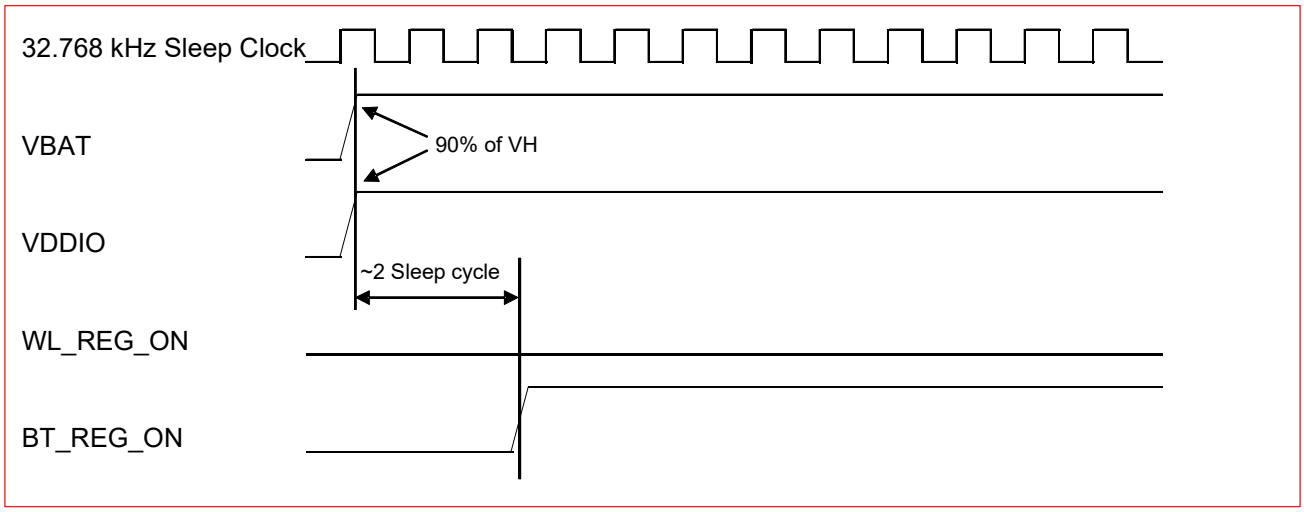
Figure 5: Power-On Sequence Graph - WLAN ON and BT ON



11.2 Power-On Sequence for WLAN ON and BT OFF

Figure 6 shows the power-on sequence signals for WLAN ON and BT OFF.

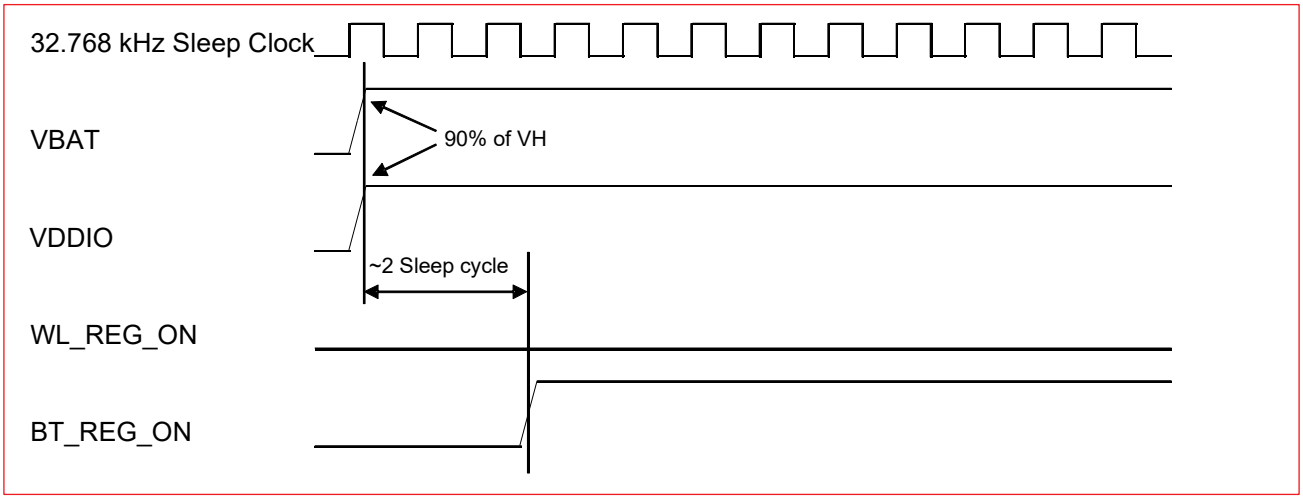
Figure 6: Power-On Sequence Graph - WLAN ON and BT OFF



11.3 Power-On Sequence for WLAN OFF and BT ON

Figure 7 shows the power-on sequence signals for WLAN OFF and BT ON.

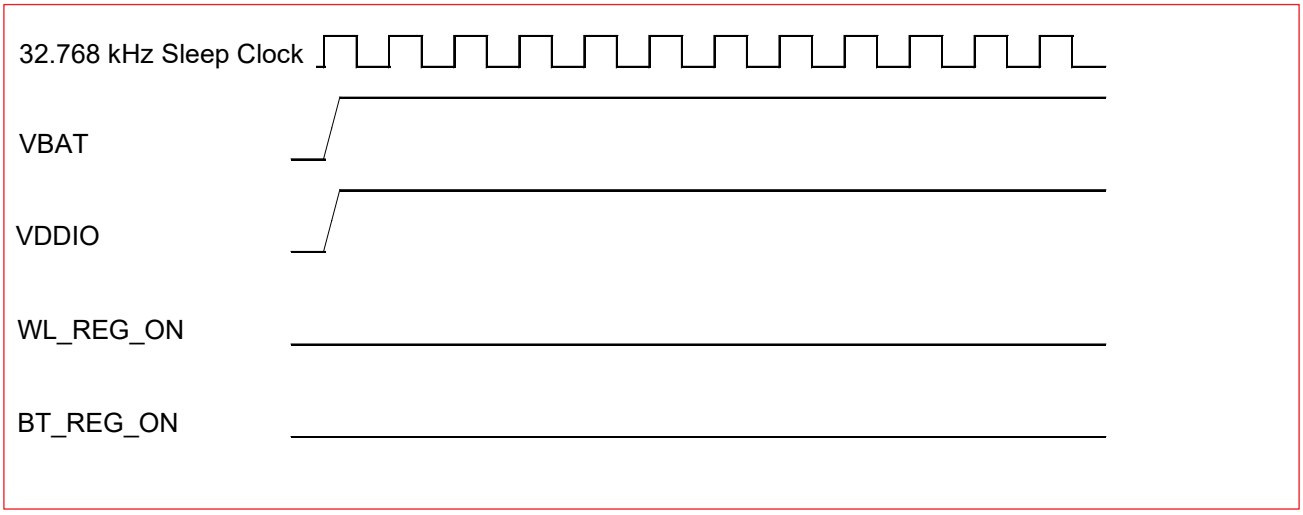
Figure 7: Power-On Sequence Graph - WLAN OFF and BT ON



11.4 Power-On Sequence for WLAN OFF and BT OFF

Figure 8 shows the power-on sequence for WLAN OFF and BT OFF.

Figure 8: Power-On Sequence Graph - WLAN OFF and BT OFF



12 Digital I/O Requirements

This section describes the digital input/output pins and related parameters.

Table 11 describes the symbols, units, and the minimum and maximum levels of digital I/O pins.

Table 11: Digital I/O Pins

Digital I/O Pins	Symbol	Minimum	Typical	Maximum	Unit
For VDDIO = 1.8V					
Input high voltage	VIH	0.65xVDDIO			V
Input low voltage	VIL			0.35xVDDIO	V
Output high voltage @2 mA	VOH	VDDIO-0.45			V
Output low voltage @2 mA	VOL			0.45	V

Table 12 describes the symbols, units, and the minimum and maximum levels of WLAN/BT control pins.

Table 12: BT/WL_REG_ON Pins

BT/WL_REG_ON	Symbol	Minimum	Typical	Maximum	Unit
Input high voltage	VIH	1		4.4	V
Input low voltage	VIL	VSS		0.3	V
Pull-down resistance (internal)	RPD		50		kΩ
Leakage discharged Current	ILEAK_DIS		28		nA
REG OFF time	TREG_OFF	2			ms

13 Interface Timing and AC Characteristics

This section describes the interface timing for SDIO, Bluetooth, and PCM, their speed modes, related parameters, and graphs.

13.1 Bluetooth UART Timing

Figure 9 and **Table 13** show the Bluetooth UART timing diagram and related parameters.

Figure 9: Bluetooth UART Timing

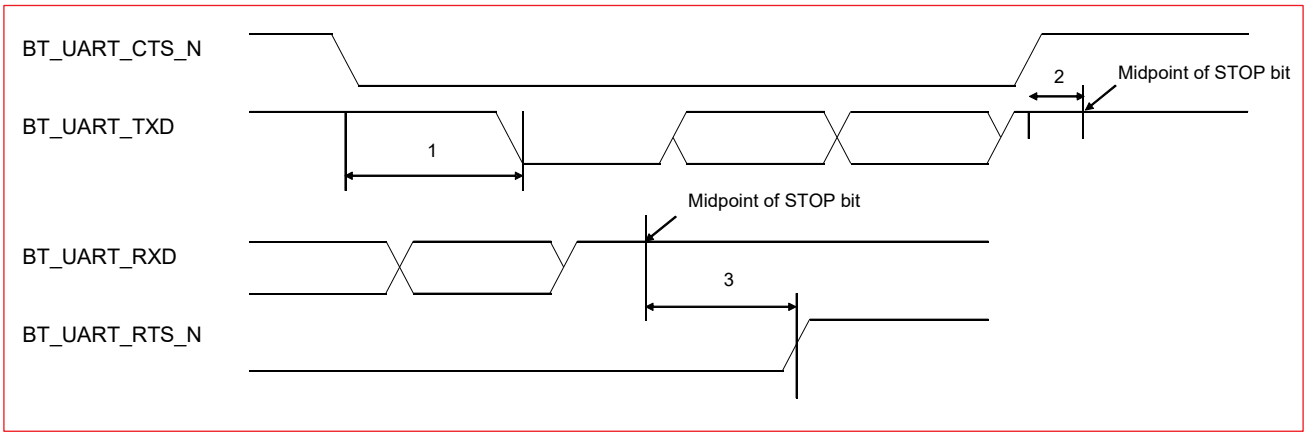


Table 13: UART Timing Parameters – Default Mode

Reference	Description	Minimum	Typical	Maximum	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

13.2 SDIO Timing

This section describes the SDIO timings for different modes.

13.2.1 SDIO Timing - Default Mode

The SDIO default timing diagram and related parameters are shown in **Figure 10** and **Table 14**.

Figure 10: SDIO Timing Diagram - Default Mode

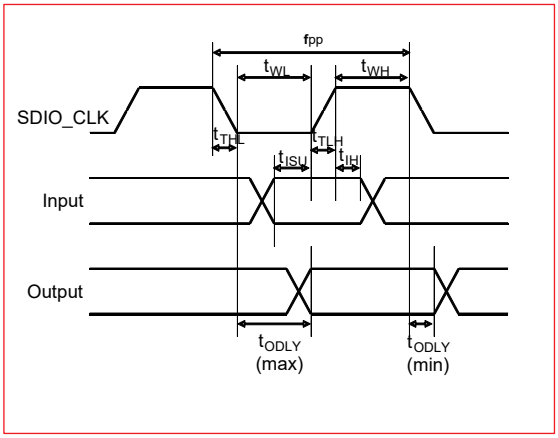


Table 14: SDIO Bus Timing Parameters - Default Mode

Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum VIH and maximum VIL)					
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

Timing is based on CL ≤ 40 pF load on CMD and Data.
Minimum (Vih) = 0.7*VDDIO and maximum (Vil) = 0.2*VDDIO

13.2.2 SDIO Timing - High Speed Mode

SDIO high speed timing diagram and parameters are shown in **Figure 11** and **Table 15**.

Figure 11: SDIO Timing Diagram - High Speed Mode

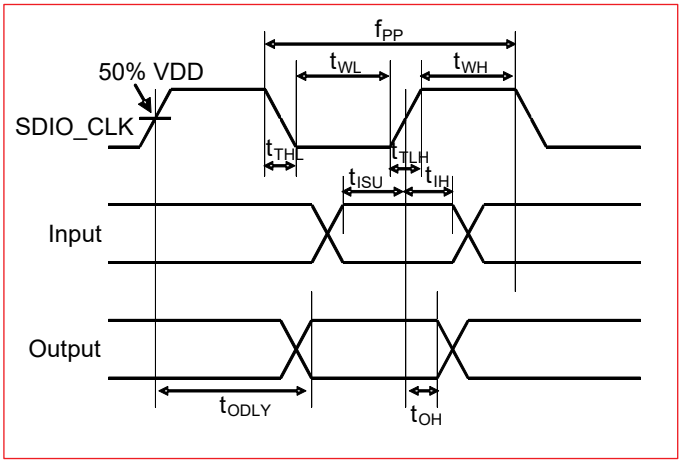


Table 15: SDIO Bus Timing Parameters - High Speed Mode

Parameter	Symbol	Minimum	Typical	Maximum	Unit
SDIO CLK (All values are referred to minimum VIH and maximum VIL					
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

Timing is based on CL ≤ 40 pF load on CMD and Data
Minimum (Vih) = 0.7*VDDIO and maximum (Vil) = 0.2*VDDIO

13.2.3 SDIO BUS Timing Specifications in SDR Modes

This section describes the SDIO bus timing specifications in SDR modes.

13.2.3.1 Clock Timing

Figure 12 shows the clock timing diagram.

Figure 12: Clock Timing - SDR Modes

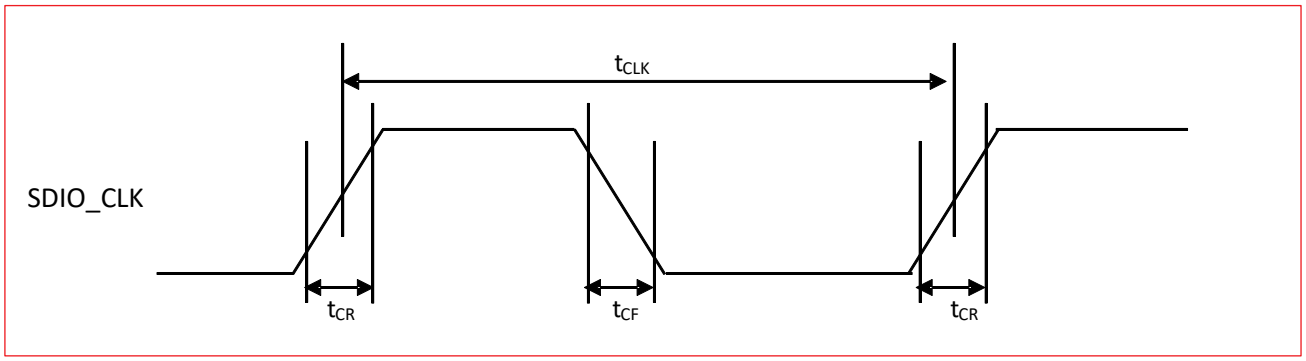


Table 16 describes the clock timing parameters.

Table 16: SDIO Clock Timing Parameters - SDR Modes

Parameter	Symbol	Minimum	Maximum	Unit	Comments
	t_{CLK}	40		ns	SDR12 mode
		20		ns	SDR25 mode
	t_{CR}, t_{CF}		0.2 x t_{CLK}	ns	t_{CR},t_{CF} < 2.00 ns (maximum) @100 MHz cCARD = 10 pF
Clock duty cycle		30	70	%	

13.2.3.2 Card Input Timing

Figure 13 shows the card input timing diagram.

Figure 13: Card Input Timing - SDR Modes

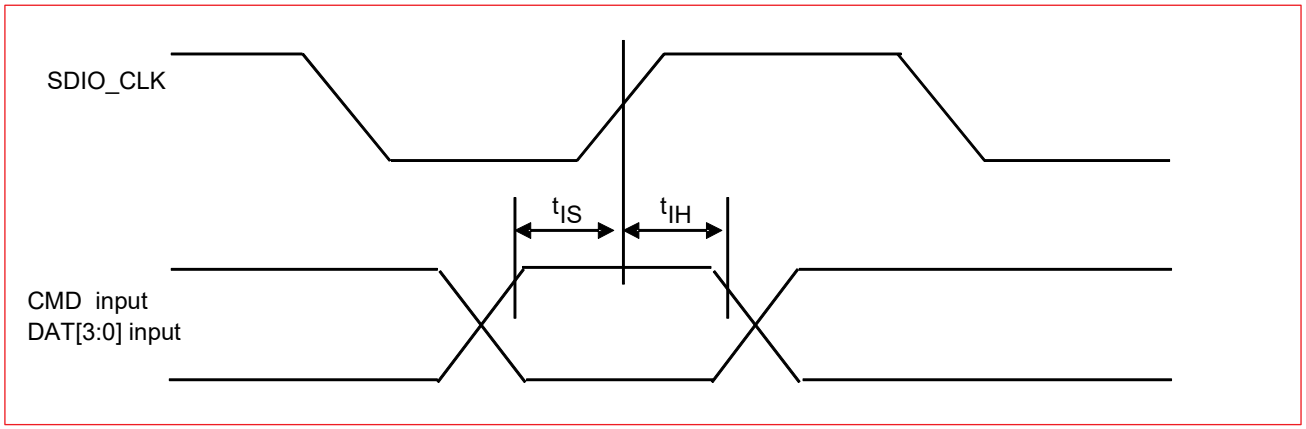


Table 17 shows the SDIO input timing parameters.

Table 17: SDIO Bus Input Timing Parameters - SDR Modes

Symbol	Minimum	Maximum	Unit	Comments
SDR50 Mode				
t_{IS}	3.0		ns	c_{CARD} = 10 pF, VCT = 0.975V
t_{IH}	0.8		ns	c_{CARD} = 5 pF, VCT = 0.975V

13.2.3.3 Card Output Timing

Figure 14 shows the card output timing diagram (up to 50 MHz).

Figure 14: Card Output Timing - SDR Modes (up to 50 MHz)

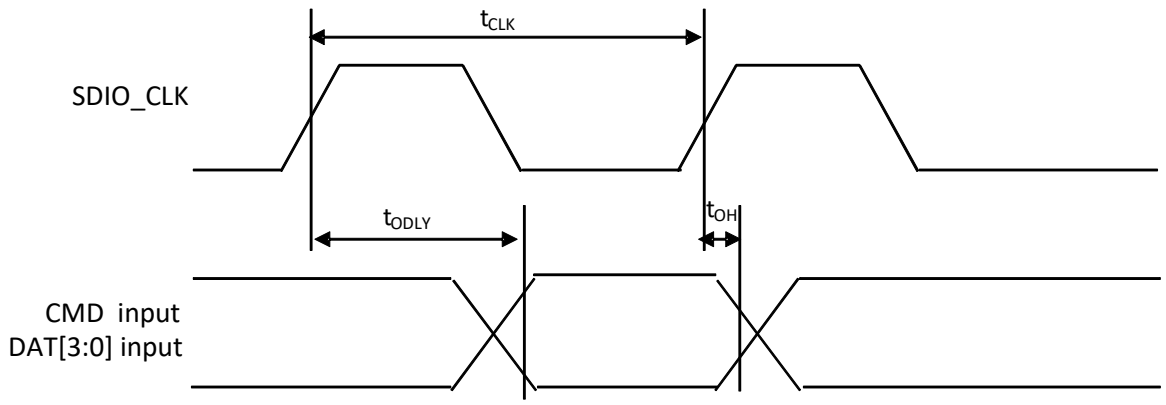


Table 18 describes the SDIO output timing parameters.

Table 18: SDIO Bus Output Timing Parameters - SDR Modes (up to 50 MHz)

Symbol	Minimum	Maximum	Unit	Comments
t_{ODLY}		14.0	ns	t_{CLK} ≧ 20 ns CL = 40 pF using for SDR12, SDR25
t_{OH}	1.5		ns	Hold time at the t_{ODLY} (min) CL = 15 pF

14 DC/RF Characteristics

This section describes the DC/RF characteristics.

14.1 DC/RF Characteristics for IEEE 802.11b - 2.4 GHz

Table 19: Characteristics Values for IEEE 802.11b - 2.4 GHz

Contents	Items
Specification	IEEE 802.11b
Mode	DSSS / CCK
Channel Frequency	2412 to 2472 MHz
Data rate	1, 2, 5.5, 11 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 17 dBm, 11 Mbps mode unless otherwise specified.

Table 20: DC/RF Characteristics for IEEE 802.11b - 2.4 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx Mode (1024 byte, 20 µs interval)[2]		200		mA
• Rx Mode		20		mA
Tx Characteristics[2]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	15	17	19	dBm
Spectrum Mask margin				
• 1st side lobes (-30 dBr)	0			dB
• 2nd side lobes (-50 dBr)	0			dB
Power-on and Power-down ramp			2.0	µs
RF Carrier Suppression	15			dB
Modulation Accuracy (EVM)			35	%
Frequency Tolerance	-20		20	ppm
Out band Spurious Emissions				
• 30-1000 MHz			-36	dBm
• 1000-12750 MHz			-30	dBm
• 1800-1900 MHz			-47	dBm
• 5150-5300 MHz			-47	dBm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-76	dBm
Adjacent Channel Rejection (FER ≤ 8%)	35			dB

[2] Defined when output power setting is 17 dBm at Murata module antenna pad.

14.2 DC/RF Characteristics for IEEE 802.11g - 2.4 GHz

Table 21: Characteristics Values for IEEE 802.11g - 2.4 GHz

Contents	Items
Specification	IEEE 802.11g
Mode	OFDM
Channel Frequency	2412 to 2472 MHz
Data rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 14 dBm, 54 Mbps mode unless otherwise specified.

Table 22: DC/RF Characteristics for IEEE 802.11g - 2.4 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx Mode (1024 byte, 20 µs interval)[3]		150		mA
• Rx Mode		20		mA
Tx Characteristics[3]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	12	14	16	dBm
Spectrum Mask Margin				
• 9 MHz to 11 MHz (0 ~ -20 dBr)	0			dB
• 11 MHz to 20 MHz (-20 ~ -28 dBr)	0			dB
• 20 MHz to 30 MHz (-28 ~ -40 dBr)	0			dB
• 30 MHz to 33 MHz (-40 dBr)	0			dB
Constellation Error (EVM)			-25	dB
Frequency Tolerance	-20		20	ppm
Out Band Spurious Emissions				
• 30-1000 MHz			-36	dBm
• 1000-12750 MHz			-30	dBm
• 1800-1900 MHz			-47	dBm
• 5150-5300 MHz			-47	dBm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-65	dBm
Adjacent Channel Rejection (PER ≤10%)	-1			dB

[3] Defined when output power setting is 14 dBm at Murata module antenna pad.

14.3 DC/RF Characteristics for IEEE 802.11n - 2.4 GHz

Table 23: Characteristics Values for IEEE 802.11n - 2.4 GHz

Contents	Items
Specification	IEEE 802.11n
Mode	OFDM
Channel Frequency	2412 to 2472 MHz
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 13 dBm, MCS7 unless otherwise specified.

Table 24: DC/RF Characteristics for IEEE 802.11n - 2.4 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx Mode (1024 byte, 20 µs interval)[4]		140		mA
• Rx Mode		20		mA
Tx Characteristics[4]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	11	13	15	dBm
Spectrum Mask Margin				
• 9 MHz to 11 MHz (0 ~ -20 dBr)	0			dB
• 11 MHz to 20 MHz (-20 ~ -28 dBr)	0			dB
• 20 MHz to 30 MHz (-28 ~ -45 dBr)	0			dB
• 30 MHz to 33 MHz (-45 dBr)	0			dB
Constellation Error (EVM)			-27	dB
Frequency Tolerance	-20		20	ppm
Out Band Spurious Emissions				
• 30-1000 MHz			-36	dBm
• 1000-12750 MHz			-30	dBm
• 1800-1900 MHz			-47	dBm
• 5150-5300 MHz			-47	dBm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-64	dBm
Adjacent Channel Rejection (PER ≤10%)	-2			dB

[4] Defined when output power setting is 13 dBm at Murata module antenna pad.

14.4 DC/RF Characteristics for IEEE 802.11a - 5 GHz

Table 25: Characteristics Values for IEEE 802.11a - 5 GHz

Contents	Items
Specification	IEEE 802.11a
Mode	OFDM
Channel Frequency	5180 to 5825 MHz
Data rate	6, 9, 12, 18, 24, 36, 48, 54 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 13 dBm, 54 Mbps unless otherwise specified.

Table 26: DC/RF Characteristics for IEEE 802.11a - 5 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx Mode (1024 byte, 20 µs interval)[5]		230		mA
• Rx Mode		20		mA
Tx Characteristics[5]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	11	13	15	dBm
Spectrum Mask Margin				
• 9 MHz to 11 MHz (0 ~ -20 dBr)	0			dB
• 11 MHz to 20 MHz (-20 ~ -28 dBr)	0			dB
• 20 MHz to 30 MHz (-28 ~ -40 dBr)	0			dB
• 30 MHz to 33 MHz (-40 dBr)	0			dB
Constellation Error (EVM)			-25	dB
Frequency Tolerance	-20		20	ppm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-65	dBm
Adjacent Channel Rejection (PER ≤10%)	-1			dB

[5] Defined when output power setting is 13 dBm at Murata module antenna pad.

14.5 DC/RF Characteristics for IEEE 802.11n (HT20) - 5 GHz

Table 27: Characteristics Values for IEEE 802.11n (HT20) - 5 GHz

Contents	Items
Specification	IEEE 802.11n
Mode	OFDM
Channel Frequency	5180 to 5825 MHz
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 12 dBm, MCS7 unless otherwise specified.

Table 28: DC/RF Characteristics for IEEE 802.11n (HT20) - 5 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx Mode (1024 byte, 20 µs interval)[6]		210		mA
• Rx Mode		20		mA
Tx Characteristics[6]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	10	12	14	dBm
Spectrum Mask Margin				
• 9 MHz to 11 MHz (0 ~ -20 dBr)	0			dB
• 11 MHz to 20 MHz (-20 ~ -28 dBr)	0			dB
• 20 MHz to 30 MHz (-28 ~ -45 dBr)	0			dB
• 30 MHz to 33 MHz (-45 dBr)	0			dB
Constellation Error (EVM)			-27	dB
Frequency Tolerance	-20		20	ppm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-64	dBm
Adjacent Channel Rejection (PER ≤10%)	-2			dB

[6] Defined when output power setting is 12 dBm at Murata module antenna pad.

14.6 DC/RF Characteristics for IEEE 802.11ac (VHT20) - 5 GHz

Table 29: Characteristics Values for IEEE 802.11ac (VHT20) - 5 GHz

Contents	Items
Specification	IEEE 802.11ac
Mode	OFDM
Channel Frequency	5180 to 5825 MHz
Data rate	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 78 Mbps

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V, Output power setting = 10 dBm, MCS8 unless otherwise specified.

Table 30: DC/RF Characteristics for IEEE 802.11ac (VHT20) - 5 GHz

Items	Contents			
DC Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
DC Current				
• Tx mode (1024 byte, 20 µs interval)[7]		190		mA
• Rx Mode		20		mA
Tx Characteristics[7]	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power	8	10	12	dBm
Spectrum Mask Margin				
• 9 MHz to 11 MHz (0 ~ -20 dBr)	0			dB
• 11 MHz to 20 MHz (-20 ~ -28 dBr)	0			dB
• 20 MHz to 30 MHz (-28 ~ -45 dBr)	0			dB
• 30 MHz to 33 MHz (-45 dBr)	0			dB
Constellation Error (EVM)			-32	dB
Frequency tolerance	-20		20	ppm
Rx Characteristics	**Minimum**	**Typical**	**Maximum**	**Unit**
Minimum Input Level Sensitivity			-59	dBm
Adjacent Channel Rejection (PER ≤10%)	-7			dB

[7] Defined when output power setting is 10 dBm at Murata module antenna pad.

14.7 DC/RF Characteristics for Bluetooth

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V

Table 31: DC/RF Characteristics for Bluetooth

Items	Contents			
Bluetooth specification (power class)	Version 5.0 + EDR (Class1)			
Channel frequency (spacing)	2402 to 2480 MHz (1 MHz)			
Current Consumption	**Minimum**	**Typical**	**Maximum**	**Unit**
• Tx = Rx = DH5 (fully occupied)		25		mA
• Tx = Rx = 2DH5 (fully occupied)		22		mA
• Tx = Rx = 3DH5 (fully occupied)		22		mA
Transmitter	**Minimum**	**Typical**	**Maximum**	**Unit**
Output Power@DH5	6		13	dBm
Frequency range	2400		2483.5	MHz
20 dB bandwidth			1	MHz
Adjacent Channel Power[8]				
• [M-N] = 2			-20	dBm
• [M-N] ≥ 3			-40	dBm
Modulation Characteristics				
• Modulation $\Delta f1_{avg}$	140		175	kHz
• Modulation $\Delta f2_{max}$	115			kHz
• Modulation $\Delta f2_{avg}$ / $\Delta f1_{avg}$	0.8			
Carrier Frequency Drift				
• 1slot	-25		25	kHz
• 3slot / 5slot	-40		40	kHz
• Maximum drift rate			20	kHz/50μs
EDR Relative Power	-4		1	dB
EDR Carrier Frequency Stability and Modulation Accuracy				
• ωi	-75		75	kHz
• ωi+ωo	-75		75	kHz
• ωo	-10		10	kHz
• RMS DEVM (DQPSK)			20	%
• Peak DEVM (DQPSK)			35	%
• 99% DEVM (DQPSK)			30	%
• RMS DEVM (8DPSK)			13	%
• Peak DEVM (8DPSK)			25	%
• 99% DEVM (8DPSK)			20	%
Spurious Emissions				

[8] Up to three spurious responses within Bluetooth limits are allowed.

Items	Contents			
• 10 MHz ≤ f < 2387 MHz			-36	dBm
• 2387 MHz ≤ f < 2400 MHz			-30	dBm
• 2483.5 MHz < f ≤ 2496.5 MHz			-47	dBm
• 2496.5 MHz < f ≤ 8 GHz			-47	dBm
Receiver	**Minimum**	**Typical**	**Maximum**	**Unit**
BDR Sensitivity (BER ≤ 0.1%)			-80	dBm
EDR Sensitivity (BER ≤ 0.007%) @ 8DPSK			-77	dBm
C/I Performance (BER ≤ 0.1%)[9]				
• co-channel			11	dB
• 1 MHz			0	dB
• 2 MHz			-30	dB
• 3 MHz			-40	dB
• image (+4 MHz)			-9	dB
• image +/- 1 MHz			-20	dB
Maximum Input Level (BER ≤ 0.1%)	-20			dBm

[9] Up to five spurious responses within Bluetooth limits are allowed.

14.8 DC/RF Characteristics for Bluetooth Low Energy

Conditions: 25 °C, VBAT = 3.3V, VDDIO = 1.8V

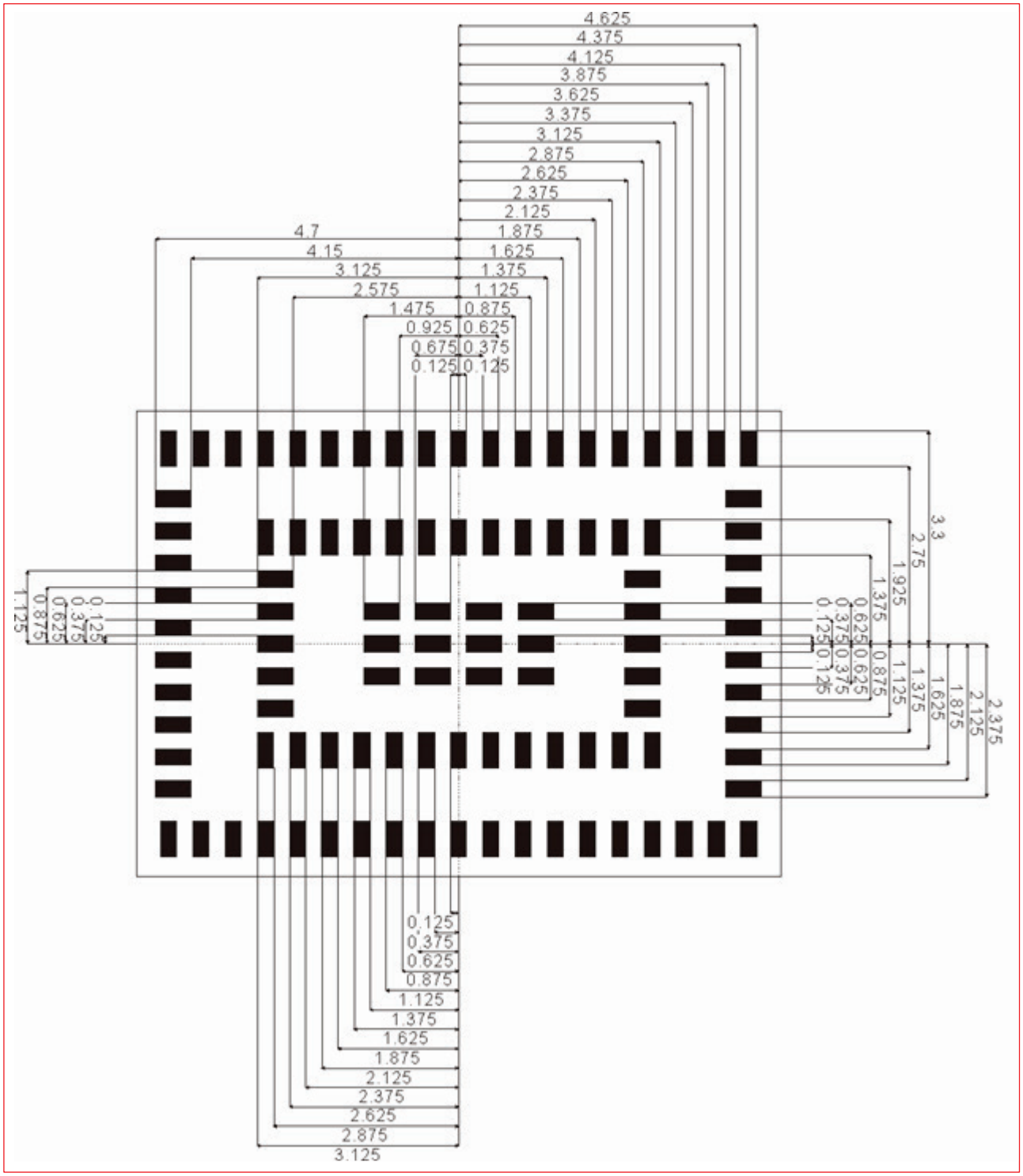
Table 32: DC/RF Characteristics for Bluetooth Low Energy

Items	Contents			
Bluetooth specification (power class)	Version 5.0 (LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2 MHz)			
Number of RF Channel	40			
Items/Conditions	**Minimum**	**Typical**	**Maximum**	**Unit**
Center Frequency	2402		2480	MHz
Channel Spacing		2		MHz
Number of RF channel		40		
Output power	2		9	dBm
Modulation Characteristics				
• $\Delta f1_{avg}$	225		275	kHz
• $\Delta f2_{max}$ (at 99.9%)	185			kHz
• $\Delta f2_{avg} / \Delta f1_{avg}$	0.8			
Carrier Frequency Offset and Drift				
• Frequency Offset			150	kHz
• Frequency Drift			50	kHz
• Drift rate			20	kHz
Receiver sensitivity (PER < 30.8%)			-70	dBm
Maximum input signal level (PER < 30.8%)	-10			dBm
PER Report Integrity (-30 dBm input)	50		65.4	%

15 Land Pattern

Figure 15 shows the top view of land pattern of Type 1LV module.

Figure 15: Land Pattern



To avoid the short-circuit between the side shielding and a solder on the module land after the reflow, please locate the module land away from module outline as above figure.

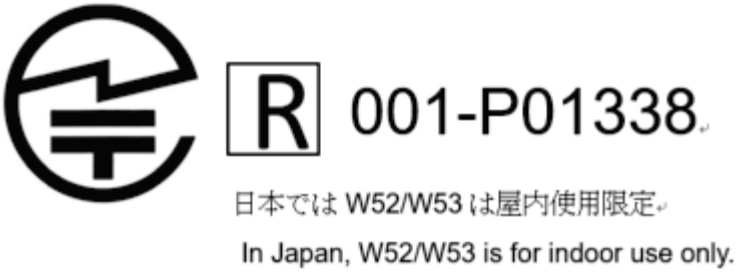
16 Radio Regulatory Certification by Country for VPYLBEE59B1LV

This section includes regulatory certification information all the following countries:

- Japan
- FCC
- ISED

16.1 Japan

- Application Model Name: Type1LV
- Certification Number: 001-P01338



特定無線設備の種別 Classification of Specified Radio Equipment	**Japanese Version** 証明規則第 2 条第 1 項第 19 号の無線設備 2.4GHz 帯高度化省電力データ通信システム **English Version** Radio equipment for Article 2-1-19 of Certification Ordinance
	Japanese Version 証明規則第 2 条第 1 項第 19 号の 3 の無線設備 5GHz 帯小電力データ通信システム（Ⅰ） **English Version** Radio equipment for Article 2-1-19-3 of Certification Ordinance
	Japanese Version 証明規則第 2 条第 1 項第 19 号の 3 の 2 の無線設備 5GHz 帯小電力データ通信システム（Ⅱ） **English Version** Radio equipment for Article 2-1-19-3-2 of Certification Ordinance

16.1.1 Power Levels for Japan

Table 33 and **Table 34** show the per antenna port power table for 2.4GHz for WLAN and Bluetooth. **Table 35** shows the per antenna port power table for 5 GHz for WLAN.

Table 33: Japan Power Level 2.4 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Typical Output Power [dBm]
IEEE 802.11b	All Rate	1 ~ 13	17
IEEE 802.11g	6/9 Mbps	1 ~ 13	17
	12/18/24 Mbps	1 ~ 13	16
	36/48 Mbps	1 ~ 13	15
	54 Mbps	1 ~ 13	14
IEEE 802 11n(HT20)	MCS0 - 2	1 ~ 13	17
	MCS3	1 ~ 13	16
	MCS4 - 5	1 ~ 13	15
	MCS6	1 ~ 13	14
	MCS7	1 ~ 13	13

Table 34: Japan Power Level 2.4 GHz BT/BLE Per Antenna Port

Mode	Maximum Tune Up Tolerance [dBm]
BR	13
EDR	9
LE	9
LE (2M)	9

Table 35: Japan Power Level 5 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Total Output power [dBm]
IEEE 802.11a	6/9/12/18 Mbps	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	24/36 Mbps	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	48 Mbps	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
	54 Mbps	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 144	13
		(W58) 149 ~ 165	13
IEEE 802.11n (HT20)	MCS0 - 2	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS3 - 4	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS5	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14

Mode	Rate	Channel	Total Output power [dBm]
	MCS6	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 144	13
		(W58) 149 ~ 165	13
	MCS7	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 144	12
		(W58) 149 ~ 165	12
IEEE 802.11ac (VHT20)	MCS0 -2	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS3 – 4	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS5	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
	MCS6	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 144	13
		(W58) 149 ~ 165	13
	MCS7	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 144	12
		(W58) 149 ~ 165	12
	MCS8	(W52/W53) 36 ~ 64	10
		(W56) 100 ~ 144	10
		(W58) 149 ~ 165	10

The same Bluetooth power table shown in **Table 34** applies for Japan, FCC, ISED, and Europe.

16.1.2 Theory of Operation for Japan

Table 36 shows the theory of operation for Japan.

Table 36: Japan Theory of Operation for WLAN

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11/b/g/n (HT20)	2412 - 2472 MHz	Active/Passive	Yes
W52	11a/n/ac ((V)HT20)	5180 - 5240 MHz	Active/Passive	Yes
W53	11a/n/ac ((V)HT20)	5260 - 5320 MHz	Passive	No
W56	11a/n/ac ((V)HT20)	5500 - 5700 MHz	Passive	No

16.2 FCC

- **Model Name:** Type1LV
- **FCC ID:** VPYLBEE59B1LV

This module is not sold to general end users directly. Therefore, there is no user manual of module. For the details about this module, please refer to the specification sheet of module.

This module should be installed in the host device according to the interface specification (installation procedure).

16.2.1 Information to Display on Host Device and User Manual

16.2.1.1 Information on Host Device

The following information must be indicated on the host device of this module.

- Contains Transmitter Module FCC ID: VPYLBEE59B1LV

Or

- Contains FCC ID: VPYLBEE59B1LV

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.

If it cannot be described on the host product, it must be listed on both the host product manual and on the host product package or removable label.

16.2.1.2 Information in User Manual

The following statements must be described on the user manual of the host device of this module.

- **FCC CAUTION:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

16.2.2 Compliance with FCC requirement 15.407(c)

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

Frequency Tolerance: ±20 ppm

16.2.3 Equipment Installation for FCC

There are two types of installation for host device.

16.2.3.1 Mobile Equipment

Equipment used at position in which the spaces between human body and antenna exceeded 20 cm. When installing it in a mobile equipment. Please describe the following warning to the manual.

If mobile equipment uses only BT/BLE or low power Wi-Fi:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

In the case of conditions other than the above

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person's body.

16.2.3.2 Portable Equipment

Equipment for which the spaces between human body and antenna are used within 20 cm. When installing it in a portable equipment. Please describe the following warning to the manual.

The available scientific evidence does not show that any health problems are associated with using low power wireless devices. There is no proof, however, that these low power wireless devices are absolutely safe. Low power Wireless devices emit low levels of radio frequency energy (RF) in the microwave range while being used. Whereas high levels of RF can produce health effects (by heating tissue), exposure of low-level RF that does not produce heating effects causes no known adverse health effects. Many studies of low-level RF exposures have not found any biological effects. Some studies have suggested that some biological effects might occur, but such findings have not been confirmed by additional research. LBEE59B1LV has been tested and found to comply with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines.

It is necessary to take a SAR test with your set mounting this module. Class II permissive change application is necessary using the SAR report. Please contact Murata.

16.2.4 Antenna

Please refer to the Hardware Application Note document supplied by Murata or please contact Murata for the detail designation of how to design the Antenna trace. The recommended antenna for Type 1LV module is shown below.

Items	Description
Antenna Model Name	Type1LV-Antenna

Antenna type	Monopole pattern antenna
Antenna manufacture	Murata Manufacturing Co. Ltd.
Antenna gain	+0.9 dBi @ 2.4 GHz +2.0 dBi @ 5 GHz
Frequency	2400-2483.5 MHz, 5150-5850 MHz

16.2.5 Installation Procedure

This section describes the installation procedure. **Table 37** shows the antenna trace.

Table 37: FCC Antenna Trace

		Minimum	Typical	Maximum	Unit
Supply Voltage	VBAT	3.1	3.3	3.5	V
	VIO		1.8 or 3.3		V

VIO don't influence the RF characteristic.

16.2.6 Power Levels for FCC

Table 38 shows the per antenna port power table for 2.4 GHz WLAN. **Table 39** shows the per antenna port power table for 5GHz WLAN.

Table 38: FCC Power Level 2.4 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
IEEE 802.11b	All Rate	1 ~ 11	19
IEEE 802.11g	6/9 Mbps	1 ~ 11	19
	12/18/24 Mbps	1 ~ 11	18
	36/48 Mbps	1 ~ 11	17
	54 Mbps	1 ~ 11	16
IEEE 802 11n(HT20)	MCS0 - 2	1 ~ 11	19
	MCS3	1 ~ 11	18
	MCS4 - 5	1 ~ 11	17
	MCS6	1 ~ 11	16
	MCS7	1 ~ 11	15

Table 39: FCC Power Level 5 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
IEEE 802.11a	6/9/12/18 Mbps	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	24/36 Mbps	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	48 Mbps	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	54 Mbps	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
IEEE 802.11n (HT20)	MCS0 - 2	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 - 4	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
IEEE 802.11ac(VHT20)	MCS0 -2	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 – 4	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
	MCS8	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 144	12
		(W58) 149 ~ 165	12

16.2.7 Theory of Operation for FCC

Table 40 shows the theory of operation for WLAN.

Table 40: FCC Theory of Operation for WLAN

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11/b/g/n (HT20)	2412 - 2462 MHz	Active/Passive	Yes
W52	11a/n/ac ((V)HT20)	5180 - 5240 MHz	Active/Passive	Yes
W53	11a/n/ac ((V)HT20)	5260 - 5320 MHz	Passive	No
W56	11a/n/ac ((V)HT20)	5500 - 5720 MHz	Passive	No
W58	11a/n/ac ((V)HT20)	5745 - 5825 MHz	Active/Passive	Yes

End users cannot modify the software because F/W & driver are installed in device.

16.3 ISED

- **PMN:** Type1LV
- **HVIN:** Type1LV
- **IC Number:** 772C-LBEE59B1LV

This module is not sold to general end users directly. Therefore, there is no user manual of module. For the details about this module, please refer to the specification sheet of module.

This module should be installed in the host device according to the interface specification (installation procedure).

16.3.1 Information to Display on Host Device and User Manual

16.3.1.1 Information on Host Device

The following information must be indicated on the host device of this module.

- Contains IC: 772C-LBEE59B1LV

16.3.1.2 Information in User Manual

The following statements must be described on the user manual of the host device of this module:

English Version

This device complies with Industry Canada's applicable license-exempt RSSs. 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.

French Version

Le présentappareilestconformeaux CNR d'IndustrieCanada applicablesaux appareilsradio exempts de licence. L'exploitationestautoriséeaux deuxconditions suivantes:

1. l'appareilne doitpas produirede brouillage;
2. l'utilisateurde l'appareildoitaccepter tout brouillageradioélectriquesubi, mêmesile brouillageestsusceptible d'encompromettrele fonctionnement.

English Version

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

French Version

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur

RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

If it is difficult to describe this statement on the host product due to the size, please describe in the User's manual.

In case of the final product which can be carried around to outdoor, the following indication is necessary to the final product:

- When the AP function is used in W52
- At the time of a channel setting of W52, please indicate “for indoor use only”. During connecting, please show the channel number which connects.
- And please indicate that the end user may find out "for indoor use only channel".
- When the STA function is used in channel 52, at the time of the channel 52 setting, please indicate “for indoor use only channel”.
- During connecting, please show the channel number which connects.
- And please indicate that the end user may find out "for indoor use only channel".

16.3.2 Antenna Installation in End Product

If the antenna of the end product is removed, please describe the follow warning on the manual of the end product which contains this module.

English Version

This radio transmitter (IC Number: 772C-LBEE59B1LV) identify the device by certification number or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

- 2.4 GHz Monopole Gain: +0.9 dBi
- 5 GHz Monopole Gain: +2.0 dBi

French Version

Le présentémetteurradio (IC Number: 772C-LBEE59B1LV) a étéapprouvépar IndustrieCanada pour fonctionneravec les types d'antenneénumérésci-dessouset ayantun gain admissible maximal. Les types d'antennenon

inclusdanscetteliste, et dontle gain estsupérieurau gain maximal indiqué, sontstrictementinterditspour l'exploitationde l'émetteur. Type d'antenne • 2.4 GHz Monopole Gain: +0.9 dBi • 5 GHz Monopole Gain: +2.0 dBi

If the final product uses the following frequency, please note that there is a limit.

English Version For indoor use only(5150-5250 MHz band and channel 52)
French Version Pour usage intérieurseulement (5150-5250 MHz band and channel 52)

English Version High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.
French Version Les radars de haute puissance sont désignés utilisateurs principaux (c.-à-d., qu'ils ont la priorité) pour les bandes 5250-5350 MHz et 5650-5850 MHz, et ces radars pourraient causer du brouillage et/ou des dommages aux dispositifsLAN-EL.

16.3.3 Equipment Installation for ISED

There are two types of installation for host device.

16.3.3.1 Mobile Equipment

Equipment used at position in which the spaces between human body and antenna exceeded 20 cm. When installing it in a mobile equipment, please describe the following warning to the manual.

English Version This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20 cm or more away from person's body.
French Version Cetéquipementestconformeaux limitesd'expositionaux rayonnementsénoncéespour un environnementnon contrôléet respecteles règlesd'expositionaux fréquencesradioélectriques(RF) CNR-102 de l'IC. Cetéquipementdoitêtreinstalléet utiliséengardantunedistance de 20 cm ouplus entre le radiateuret le corps humain.

16.3.3.2 Portable Equipment

Equipment for which the spaces between human body and antenna are used within 20 cm. When installing it in a portable equipment, please describe the following warming to the manual.

- It is necessary to take a SAR test with your set mounting this module.
- Class II permissive change application is necessary using the SAR report.
- Please contact Murata.

16.3.4 Antenna

Please refer to the Hardware Application Note document supplied by Murata or please contact Murata for the detail designation of how to design the antenna trace.

16.3.5 Installation Procedure

This section describes the installation procedure. **Table 41** shows the antenna trace.

Table 41: ISED Antenna Trace

		Minimum	Typical	Maximum	Unit
Supply Voltage	VBAT	3.1	3.3	3.5	V
	VDDIO		1.8 or 3.3		V

VDDIO do not influence the RF characteristic.

16.3.6 Power Levels for ISED

Table 42 shows the per antenna port power table for 2.4 GHz WLAN. **Table 43** shows the per antenna port power table for 5GHz WLAN.

Table 42: ISED Power Level 2.4 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
IEEE 802.11b	All Rate	1 ~ 11	19
IEEE 802.11g	6/9 Mbps	1 ~ 11	19
	12/18/24 Mbps	1 ~ 11	18
	36/48 Mbps	1 ~ 11	17
	54 Mbps	1 ~ 11	16
IEEE 802 11n(HT20)	MCS0 ~ 2	1 ~ 11	19
	MCS3	1 ~ 11	18
	MCS4 ~ 5	1 ~ 11	17
	MCS6	1 ~ 11	16
	MCS7	1 ~ 11	15

Both indoor and outdoor can be used.

Table 43: ISED Power Level 5 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
IEEE 802.11a (At the time of indoor use)	6/9/12/18 Mbps	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	24/36 Mbps	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	48 Mbps	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
	54 Mbps	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
IEEE 802.11a (At the time of outdoor use)	6/9/12/18 Mbps	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	24/36 Mbps	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	48 Mbps	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	54 Mbps	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
IEEE 802.11ac (HT20) (At the time of indoor use)	MCS0 -2	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 - 4	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
IEEE 802.11n (HT20) (At the time of outdoor use)	MCS0 – 2	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 – 4	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	16

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
IEEE 802.11ac (VHT20) (At the time of indoor use)	MCS0 -2	(W52/W53) 36 ~ 64	18
		(W56) 100 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 - 4	(W52/W53) 36 ~ 64	17
		(W56) 100 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52/W53) 36 ~ 64	16
		(W56) 100 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 144	14
		(W58) 149 ~ 165	14
	MCS8	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 144	12
		(W58) 149 ~ 165	12
IEEE 802.11ac (VHT20) (At the time of outdoor use)	MCS0 - 2	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	18
		(W56) 100 ~ 116, 132 ~ 144	18
		(W58) 149 ~ 165	18
	MCS3 - 4	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	17
		(W56) 100 ~ 116, 132 ~ 144	17
		(W58) 149 ~ 165	17
	MCS5	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	16
		(W56) 100 ~ 116, 132 ~ 144	16
		(W58) 149 ~ 165	16
	MCS6	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	15
		(W56) 100 ~ 116, 132 ~ 144	15
		(W58) 149 ~ 165	15
	MCS7	(W52) 36 ~ 48	N/A

Mode	Rate	Channel	Maximum Tune Up Tolerance [dBm]
		(W53) 52	N/A
		(W53) 56 ~ 64	14
		(W56) 100 ~ 116, 132 ~ 144	14
		(W58) 149 ~ 165	14
	MCS8	(W52) 36 ~ 48	N/A
		(W53) 52	N/A
		(W53) 56 ~ 64	12
		(W56) 100 ~ 116, 132 ~ 144	12
		(W58) 149 ~ 165	12

16.3.7 Theory of Operation for ISED

Table 44 shows the theory of operation for WLAN.

Table 44: ISED Theory of Operation for WLAN

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11/b/g/n (HT20)	2412 - 2462 MHz	Active/Passive	Yes
W52	11a/n/ac ((V)HT20)	5180 - 5240 MHz	Active/Passive	Yes
W53	11a/n/ac ((V)HT20)	5260 - 5320 MHz	Passive	No
W56	11a/n/ac ((V)HT20)	5500 - 5720 MHz	Passive	No
W58	11a/n/ac ((V)HT20)	5745 - 5825 MHz	Active/Passive	Yes

End users cannot modify the software because F/W & driver are installed in device.

16.3.8 Compliance with IC requirement RSS-210 A9.4.4

English Version

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

French Version

Conformité à la norme CNR-210 A9.4.4

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

16.4 Europe

16.4.1 Power Levels for Europe

Table 45 and **Table 46** show the per antenna port power table for WLAN for 2.4 GHz and 5 GHz.

Table 45: Europe Power Level 2.4 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Typical Output Power [dBm]
IEEE 802.11b	All Rate	1 ~ 13	15.5
IEEE 802.11g	6/9 Mbps	1 ~ 13	17
	12/18/24 Mbps	1 ~ 13	16
	36/48 Mbps	1 ~ 13	15
	54 Mbps	1 ~ 13	14
IEEE 802 11n(HT20)	MCS0 - 2	1 ~ 13	17
	MCS3	1 ~ 13	16
	MCS4 - 5	1 ~ 13	15
	MCS6	1 ~ 13	14
	MCS7	1 ~ 13	13

Table 46: Europe Power Level 5 GHz WLAN Per Antenna Port

Mode	Rate	Channel	Total Output power [dBm]
IEEE 802.11a	6/9/12/18 Mbps	(W52) 36 ~ 48	16
		(W53) 52 ~ 64	15.5
		(W56) 100 ~ 140	15.5
		(W58) 149 ~ 165	11
	24/36 Mbps	(W52/W53) 36 ~ 64	15
		(W56) 100 ~ 140	15
		(W58) 149 ~ 165	11
	48 Mbps	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 140	14
		(W58) 149 ~ 165	11
	54 Mbps	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 140	13
		(W58) 149 ~ 165	11
IEEE 802.11n (HT20)	MCS0 - 2	(W52) 36 ~ 48	16
		(W53) 52 ~ 64	14.5
		(W56) 100 ~ 140	14.5
		(W58) 149 ~ 165	11
	MCS3 - 4	(W52) 36 ~ 48	15
		(W53) 52 ~ 64	14.5
		(W56) 100 ~ 140	14.5
		(W58) 149 ~ 165	11
	MCS5	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 140	14
		(W58) 149 ~ 165	11
	MCS6	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 140	13
		(W58) 149 ~ 165	11
	MCS7	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 140	12

Mode	Rate	Channel	Total Output power [dBm]
		(W58) 149 ~ 165	11
IEEE 802.11ac (VHT20)	MCS0 -2	(W52) 36 ~ 48	16
		(W53) 52 ~ 64	14.5
		(W56) 100 ~ 140	14.5
		(W58) 149 ~ 165	11
	MCS3 – 4	(W52) 36 ~ 48	15
		(W53) 52 ~ 64	14.5
		(W56) 100 ~ 140	14.5
		(W58) 149 ~ 165	11
	MCS5	(W52/W53) 36 ~ 64	14
		(W56) 100 ~ 140	14
		(W58) 149 ~ 165	11
	MCS6	(W52/W53) 36 ~ 64	13
		(W56) 100 ~ 140	13
		(W58) 149 ~ 165	11
	MCS7	(W52/W53) 36 ~ 64	12
		(W56) 100 ~ 140	12
		(W58) 149 ~ 165	11
	MCS8	(W52/W53) 36 ~ 64	10
		(W56) 100 ~ 140	10
		(W58) 149 ~ 165	10

16.4.2 Theory of Operation for Europe

Table 47 shows the theory of operation for Europe.

Table 47: Europe Theory of Operation for WLAN

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11/b/g/n (HT20)	2412 - 2472 MHz	Active/Passive	Yes
W52	11a/n/ac ((V)HT20)	5180 - 5240 MHz	Active/Passive	Yes
W53	11a/n/ac ((V)HT20)	5260 - 5320 MHz	Passive	No
W56	11a/n/ac ((V)HT20)	5500 - 5700 MHz	Passive	No
W58	11 a/n/ac ((V)HT20)	5745 – 5825 MHz	Active/Passive	Yes

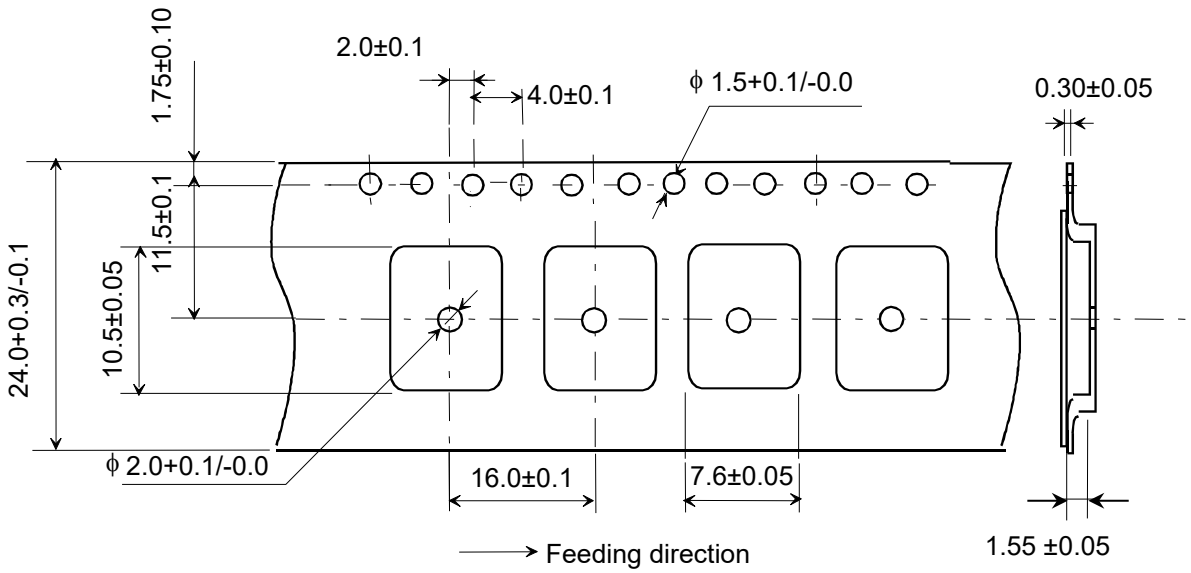
17 Tape and Reel Packing

This section has the tap and reel packing details.

17.1 Dimensions of Tape (Plastic Tape)

Figure 16 shows the tape and reel packing.

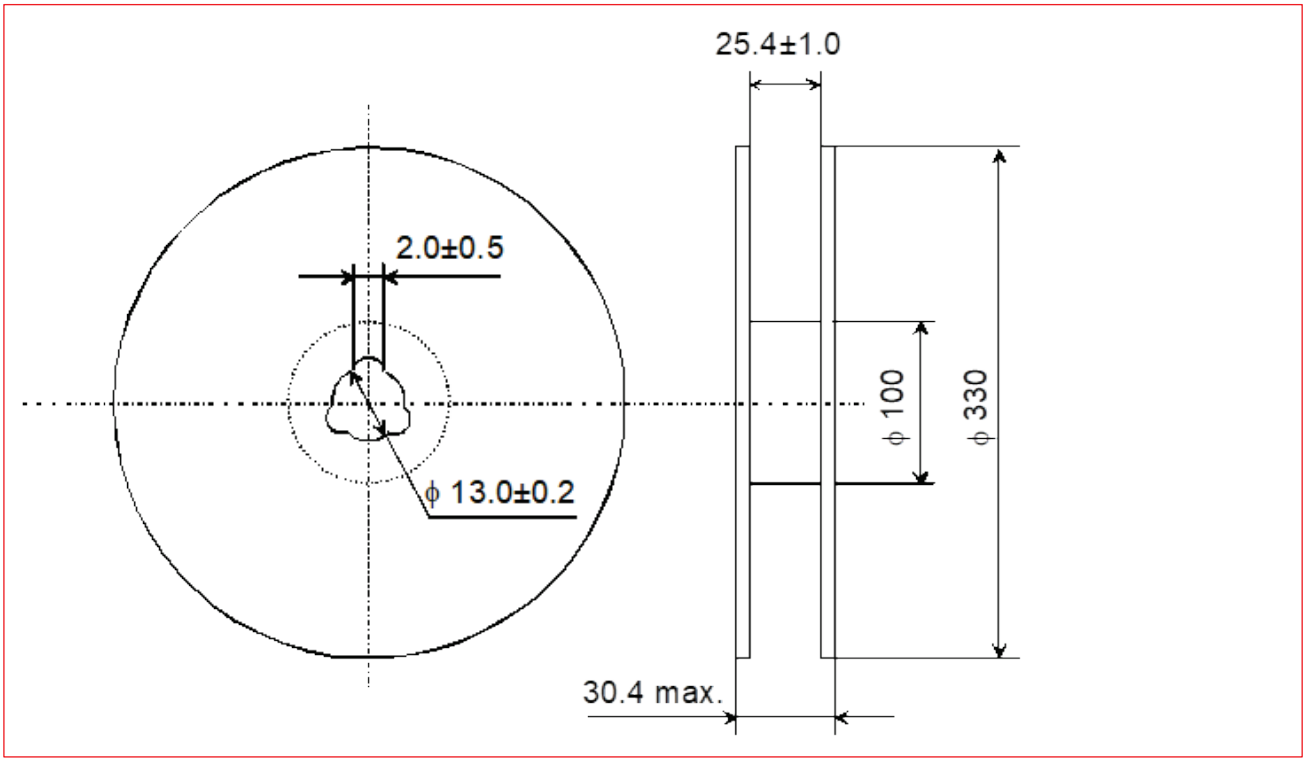
Figure 16: Tape and Reel Packing



17.2 Dimensions of Reel

Figure 17 shows the dimension of the reel.

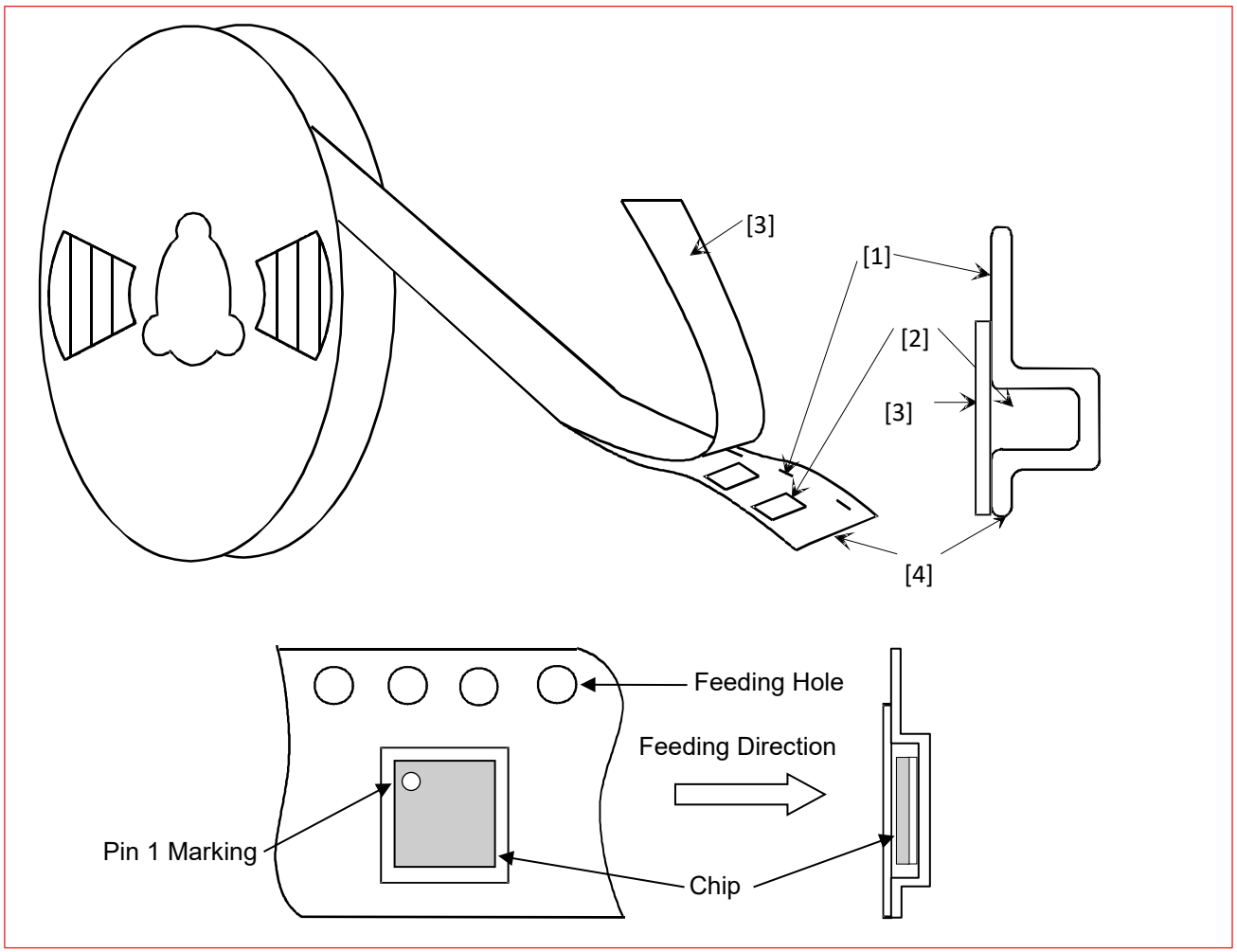
Figure 17: Dimension of Reel



17.3 Taping Diagram

Figure 18 shows the taping diagram.

Figure 18: Taping Diagram



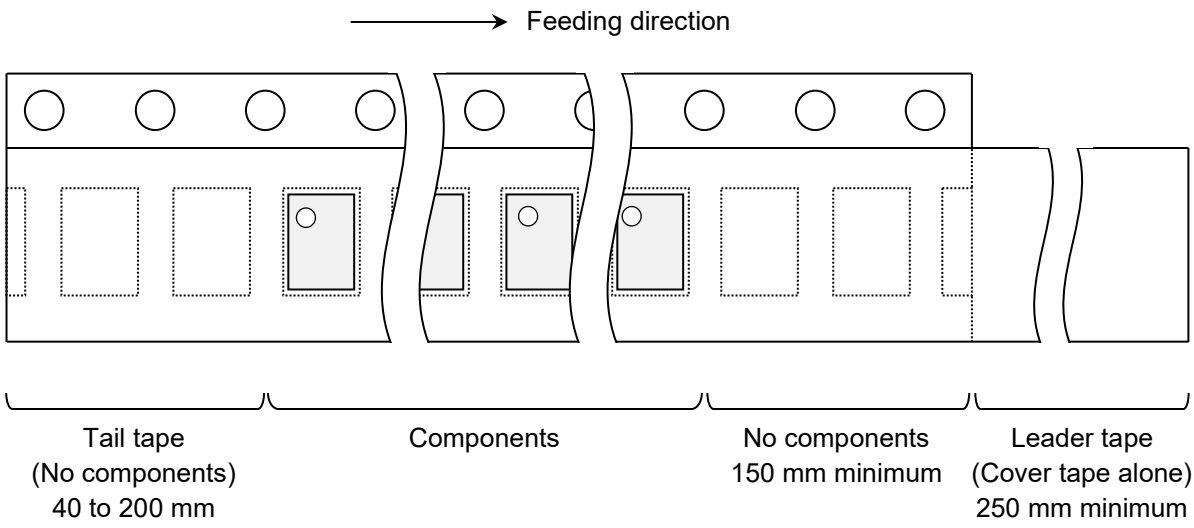
The taping specifications are described in **Table 48**.

Table 48: Taping Specifications

Mark	Description
1	Feeding Hole. As specified in Dimensions of Tape (Plastic tape)
2	Hole for chip. As specified in Dimensions of Tape (Plastic tape)
3	Cover tape. 62 µm in thickness
4	Base tape. As specified in Dimensions of Tape (Plastic tape)

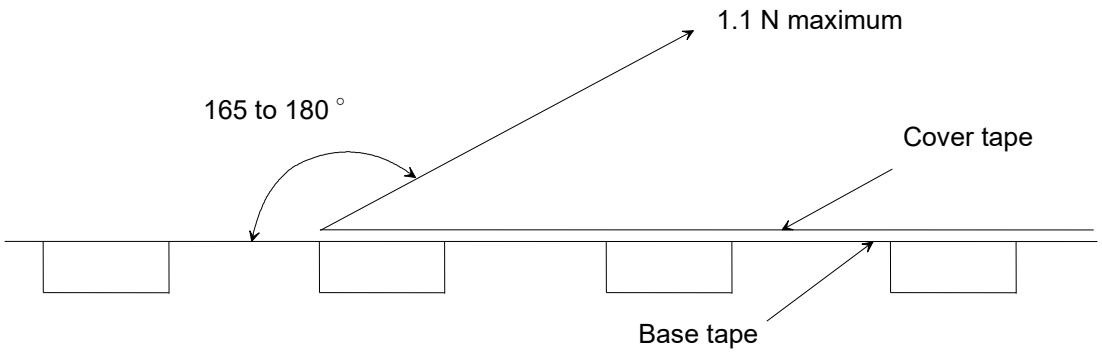
Figure 19 shows the leader and tail tape.

Figure 19: Leader and Tail Tape



- The tape for chips is wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.
- The cover tape and base tape are not adhered at no components area for 250 mm minimum.
- Tear off strength against pulling of cover tape: 5 N minimum.
- Packaging unit: 1000 pcs./ reel
- material - Base tape: Plastic
- Real: Plastic
- Cover tape, cavity tape and reel are made the anti-static processing.
- Peeling off force: 1.1 N maximum in the direction of peeling as shown in **Figure 20**.

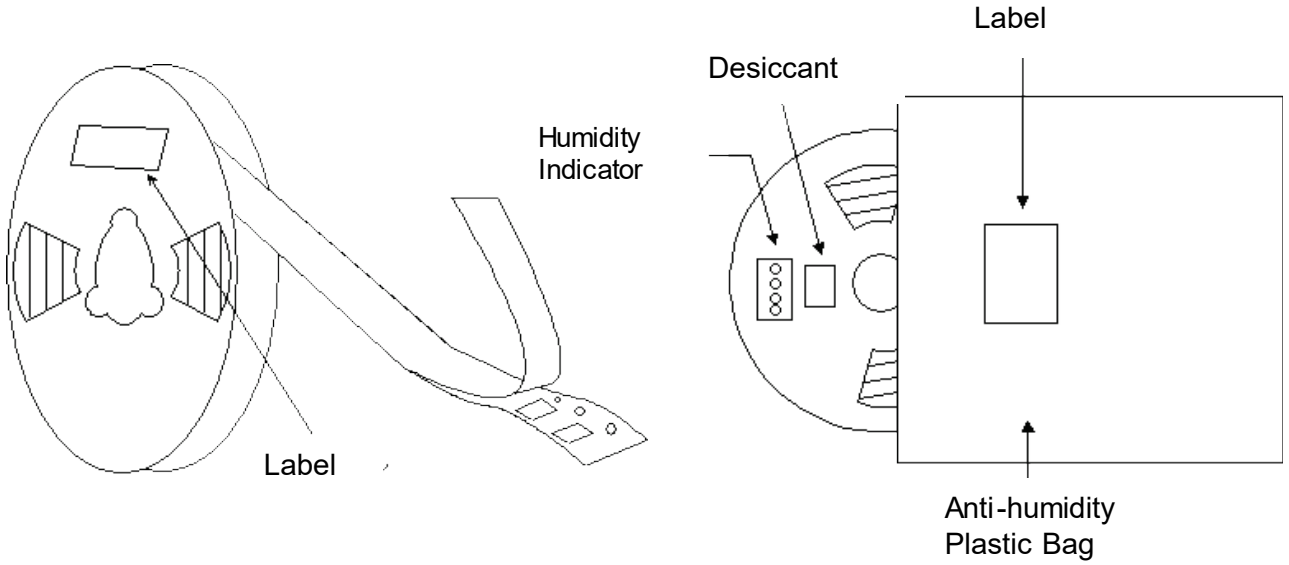
Figure 20: Peeling Force



17.4 Package (Humidity Proof Packaging)

Figure 21 shows the packaging diagram.

Figure 21: Packaging



Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

18 Notice

18.1 Storage Conditions

Please use this product within 6 months after receipt.

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

Packing materials may be deformed at the temperature over 40 °C

- The solderability of the product left idle for more than 6 months after receipt needs to be confirmed before it is used.
- The product *must be* stored in noncorrosive gas (Cl_2, NH_3, SO_2, NO_X, etc.).
- Any excess mechanical shock including, but not limited to, sticking the packing materials by sharp object, and dropping the product, *must not be* applied as that will damage the packing materials.

This product is applicable to MSL3 (Based on JEDEC Standard J-STD-020)

- After the packing is opened, the product *must be* stored at <30 °C / <60 %RH and the product *should be* used within 168 hours after opening.
- When the color of the indicator in the packing is changed, the product *should be* baked before soldering.
  - **Baking condition:** 125 +5/-0 °C, 24 hours, 1 time

The products must be baked on the heat-resistant tray because the material (Base Tape, Reel Tape and Cover Tape) is not heat-resistant.

18.2 Handling Conditions

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

Handle with care if you suspect that products may have cracks or damages on their terminals. If there is any such damage, the characteristics of products may change. *Do not touch* products with bare hands as that may cause poor solderability and destroy solderability by static electrical charge.

18.3 Standard PCB Design (Land Pattern and Dimensions)

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions should be as per Murata's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set.

When using non-standard lands, contact Murata in advance.

18.4 Notice for Chip Placer

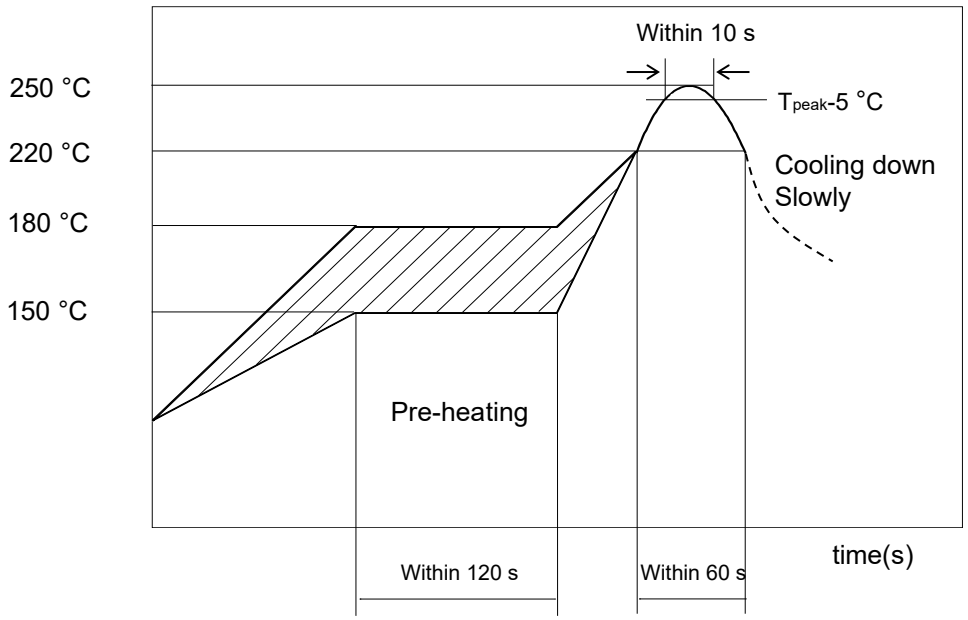
When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products on the PCB, be aware that mechanical chucking may damage products.

18.5 Soldering Conditions

The recommendation conditions of soldering are as in **Figure 22**.

Soldering must be carried out by the above-mentioned conditions to prevent products damage. Set up the highest temperature of reflow within 260 °C. Contact Murata before use concerning other soldering conditions.

Figure 22: Reflow Soldering Standard Conditions (Example)



- Please use the reflow within 2 times.
- Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt. % or less.

18.6 Cleaning

Since this Product is Moisture Sensitive, cleaning is not recommended. If any cleaning process is done the customer is responsible for any issues or failures caused such process.

18.7 Operational Environment Conditions

Murata products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity, and pressure). Therefore, there is no problem in using the products under the above-mentioned conditions. However, using the products under the following circumstances may damage products and cause electricity leakage and abnormal temperature may occur:

- In atmosphere containing corrosive gas (Cl_2, NH_3, SO_X, NO_X etc.).
- In atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there is any chance of using the products under the conditions listed above, consult with Murata before actual use.

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

18.8 Input Power Capacity

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

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

19 Preconditions 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.

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- Power plant control equipment.
- Medical equipment.
- Traffic signal equipment.

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

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Revision History

Revision Code	Date	Changed Item	Comment
	2017.07.07	First Issue	
A	2017.10.02	4. Block Diagram 7.1. Module Pin Layout	• Update • Update
B	2017.10.10	Cover 1. Scope	• Added 11ac • Added 11ac on Scope
C	2018.04.04	16. Reference Circuit	• Addition
D	2018.06.01	9. Operating Conditions 14. DC/RF Characteristics	• Updated Supply voltage condition • Update
E	2018.08.02	1. Scope 14. RC/RF Characteristics 16. Reference Circuit 18. Tape and Reel Packing	• Updated Wright/MSL information • Updated BT output power spec • Updated Reference schematic (Added (*5)) • Addition
F	2018.10.25	1. Scope 6. Dimensions, Marking and Terminal Configurations 8. Operating Conditions 12. Digital I/O Requirements	• Added “MAC/BD address are embedded. • Updated Marking information • Updated VDDIO_SFL spec • Added BT/WL_REG_ON
G	2018.12.28	16. Reference Circuit	• Revision
H	2019.03.26	6. Dimensions, Marking and Terminal Configurations	• Corrected Demotions (Added a5, c5)
I	2019.04.24	18. Precondition To Use Our Products	• Update
J	2019.07.05	5. Certification Information Appendix: Added User manual for Japan certification	• Addition • Addition
K	2019.09.26	5. Certification Information 6. Dimensions, Marking and Terminal Configurations	• Addition • Added e12 number
L	2019.10.17	6. Dimensions, Marking and Terminal Configurations 16. Reference Circuit	• Added pin 80 (corrected) • Added pin64 (corrected)
M	2019.11.21	Updated based on the latest Infineon IC datasheet (Rev.L). 7.1. Module Pin Layout 7.2. Pin Descriptions 13. Interface Timing Characteristics	• Update • Update • Update • Removed PCM/I2S interface timing
N	2021.03.25	6. Dimensions, Marking and Terminal Configurations	• Corrected marking information.
O	2022.06.10	Silicon manufacturer name is revised	• Revision
P	2023.03.23	Delete “friendly” from 11 ac-friendly	•
Q	2023.10.10	2. Key Features 3. Part Number 16. Reference Circuit Appendix	• Updated information • Added Embedded Artists’ M.2 module information. Renamed section. • Moved section to HW app note.

Revision Code	Date	Changed Item	Comment
			• Moved Appendix information into Sections 16 and 17. Updated to new format