Datasheet

muRata
INNOVATOR IN ELECTRONICS

Hostless Wi-Fi® 6 + Bluetooth® LE 5.4 / 802.15.4 Tri-Radio Module

NXP Chipset RW612 for 802.11a/b/g/n/ac/ax + Bluetooth LE 5.4 / IEEE 802.15.4 Datasheet - Rev. C

- Design Name: Type 2FR
- P/N: LBES0ZZ2FR

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About This Document

Murata's Type 2FR is a small and very high-performance module based on NXP RW612 combo chipset, supporting IEEE 802.11 a/b/g/n/ac/ax + Bluetooth LE 5.4 / 802.15.4. This data sheet describes Type 2FR module in detail.

Audience & Purpose

The intended audience includes any customer looking to integrate this module into their product. In particular 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 Type 2FR hostless tri-radio IEEE 802.11 a/b/g/n/ac/ax + Bluetooth LE 5.4 / IEEE 802.15.4 IoT module.

2 Key Features

- NXP RW612 inside
- 260 MHz Arm® Cortex® -M33
- Supports IEEE 802.11a/b/g/n/ac/ax specification: Dual band 2.4 GHz and 5 GHz Wi-Fi 6
- SISO with 20 MHz channels; up to MCS9 data rates
- Supports Bluetooth specification version 5.4
- Supports IEEE 802.15.4
- 1.2 MB SRAM; 16MB Flash; External PSRAM interface for system memory expansion up to 128 MB
- 64 GPIOs, FlexSPI, SDIO 3.0, Ethernet, USB, USART, I2C, SPI, I2S, PCM, ACOMP, DAC, ADC, JTAG
- RF signal from pin pad
- Temperature Range: -40 °C to 85 °C
- Dimensions: 12.0 mm x 11.0 mm x 1.55 mm (maximum)
- Weight: 0.54 g
- MSL: 3
- Surface-mount type
- RoHS compliant

3 Ordering Information

The part number and associated ordering information is shown in **Table 2**.

Table 2: Sample Ordering Information

Ordering Part Number	Description
LBES0ZZ2FR-SMP	Type 2FR module sample
LBES0ZZ2FR-580	Type 2FR module
LBES0ZZ2FR-EVK	Type 2FR EVK

4 Product Overview

Type 2FR is a highly integrated wireless module based on NXP RW612 Wireless MCU. It measures just 12mm x 11mm and delivers class-leading integration, efficiency, and multiple radio capabilities. Type 2FR supports dual-band Wi-Fi 6, Bluetooth® Low Energy (LE) 5.4, IEEE 802.15.4, and ethernet. This versatility ensures seamless connectivity and operational efficiency. Further, it supports Matter Network over Wi-Fi, Thread, and ethernet. This simplifies device interoperability and management.

4.1 Block Diagram

Figure 1 shows the block diagram.

Figure 1: Block Diagram
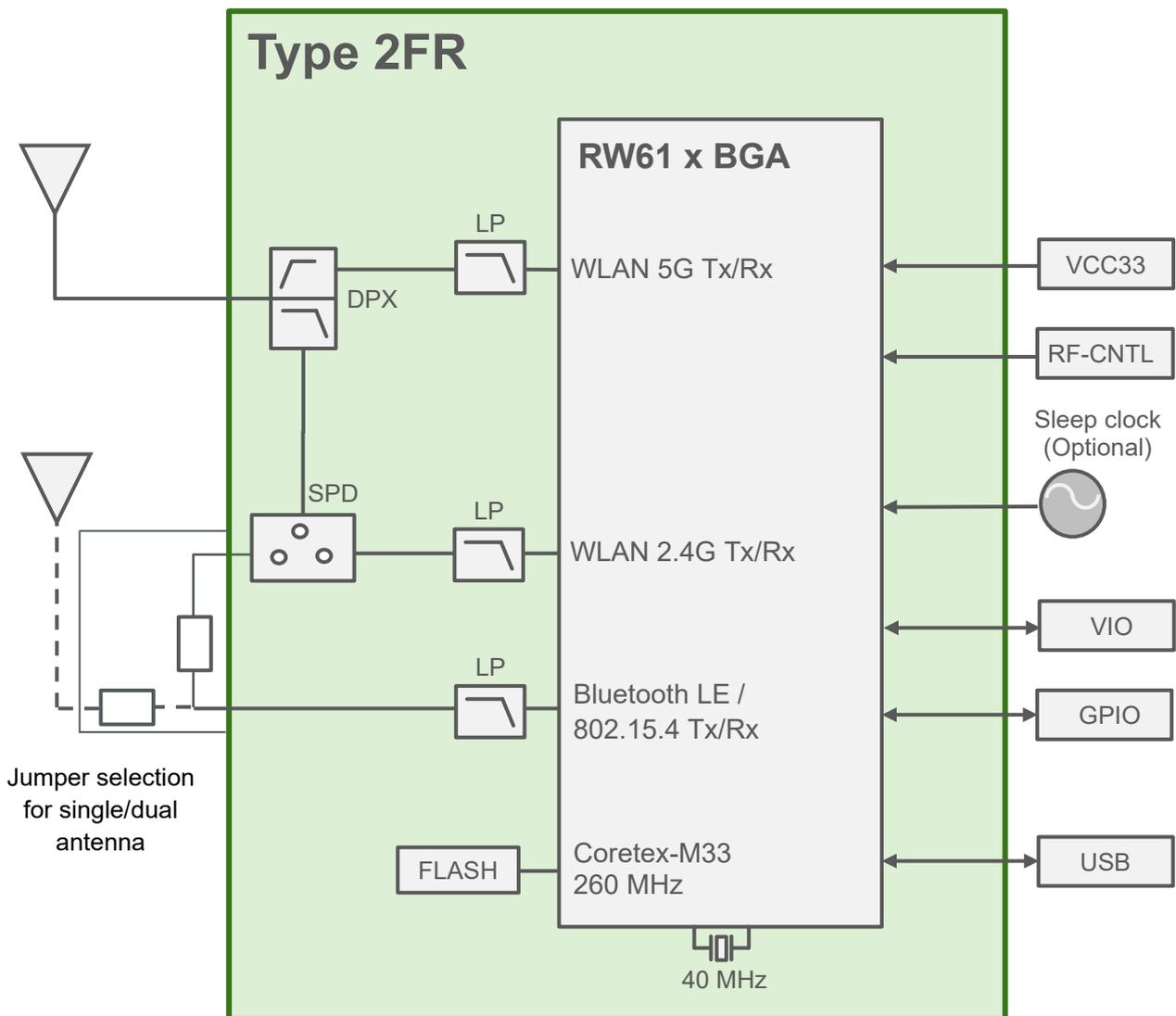
4.2 Microcontroller (MCU)

The NXP RW612 wireless SoC integrates an Arm Cortex-M33 MCU for user applications, see RW612 Datasheet ⧉.

- 260 MHz Arm Cortex-M33 with TrustZone-M

- CoreMark® score: 1,033; 3.97 CoreMark/MHz

- 1.2 MB integrated SRAM

4.3 Memory and Flash

Type 2FR module integrates 16MB flash memory through FlexSPI interface to RW612. The module supports external flash or external memory through FlexSPI interface.

For details, please refer to RW612 Datasheet ⧉ and Type 2FR EVK Schematic ⧉.

4.4 Peripheral Interfaces

Type 2FR supports total 64 GPIOs and rich peripheral interfaces for user application.

- Up to five configurable universal serial interface modules (FlexComm interfaces). Configurable as SPI/I2C/I2S/UART

- SDIO 3.0

- High Speed USB 2.0 On-The-Go (OTG) with integrated PHY

- IEEE 1588 RMII/Fast Ethernet interface

- QVGA (320 x 240) LCD interface supporting SPI and 8080 interfaces

- 16-bit ADC and 10-bit DAC

- 32-bit general purpose timers/PWM

- 4 x digital microphone support

For details, please refer to RW612 Datasheet ⧉.

4.5 Built-in Security Features

Type 2FR inherited all the built-in advanced security features from RW612 chip.

- NXP EdgeLock™ Assurance

- NXP EdgeLock 2GO Trust Provisioning

- Trusted execution environment (TEE) based on Arm TrustZone-M

- Hardware root of trust

- Hardware cryptography accelerators (symmetric, asymmetric, secure hash, KDF, etc.)

- True Random Number Generator (TRNG)

- Physically Unclonable Function (PUF)

- OTP-based device configuration and life cycle management

- Secure boot, software update and debug

- On-chip tamper detection for voltage level and glitch, temperature and reset

For details, please refer to RW612 Datasheet ⬚↗.

4.6 Type 2FR and Type 2FP

Type 2FR and Type 2FP family are based on NXP RW61x family IC. The **Table 3** below shows the comparison of these two modules. Type 2FR and Type 2FP are drop-in replacement for each other.

Table 3: Comparison of Type 2FR and Type 2FP

	Type 2FR	Type 2FP
IC	NXP RW612	NXP RW610
Radios	Dual band Wi-Fi 6(802.11ax) Bluetooth LE 5.4/ IEEE 15.4	Dual band Wi-Fi 6(802.11ax) Bluetooth LE 5.4
Dimensions	12.0 mm x 11.0 mm x 1.55 mm (maximum)	
Footprint	Share the same footprint	
Pin-out	Share the same pin-out	
Antenna	Support the same antenna selections	
Software	Same SDK from NXP	

5 Certification Information

This section describes the radio and Bluetooth certification.

5.1 Radio Certification

Table 4 describes the radio certification information.

Table 4: Radio Certification Information

Country	ID	Country Code	Tx Power Limit File
US	FCC ID: HSW2FR	US	
Canada	IC ID: 4492A-2FR	CA	
Europe		DE	
Japan	TELEC ID: R201-240517	JP	

5.2 Bluetooth Qualification

QDID: TBD

6 Dimensions, Marking, and Terminal Configurations

This section provides information about dimensions, markings, and terminal configuration for Type 2FR and the related parameters. **Figure 2** shows the dimensions, marking, and terminal configurations.

Figure 2: Dimensions, Markings, and Terminal Configurations
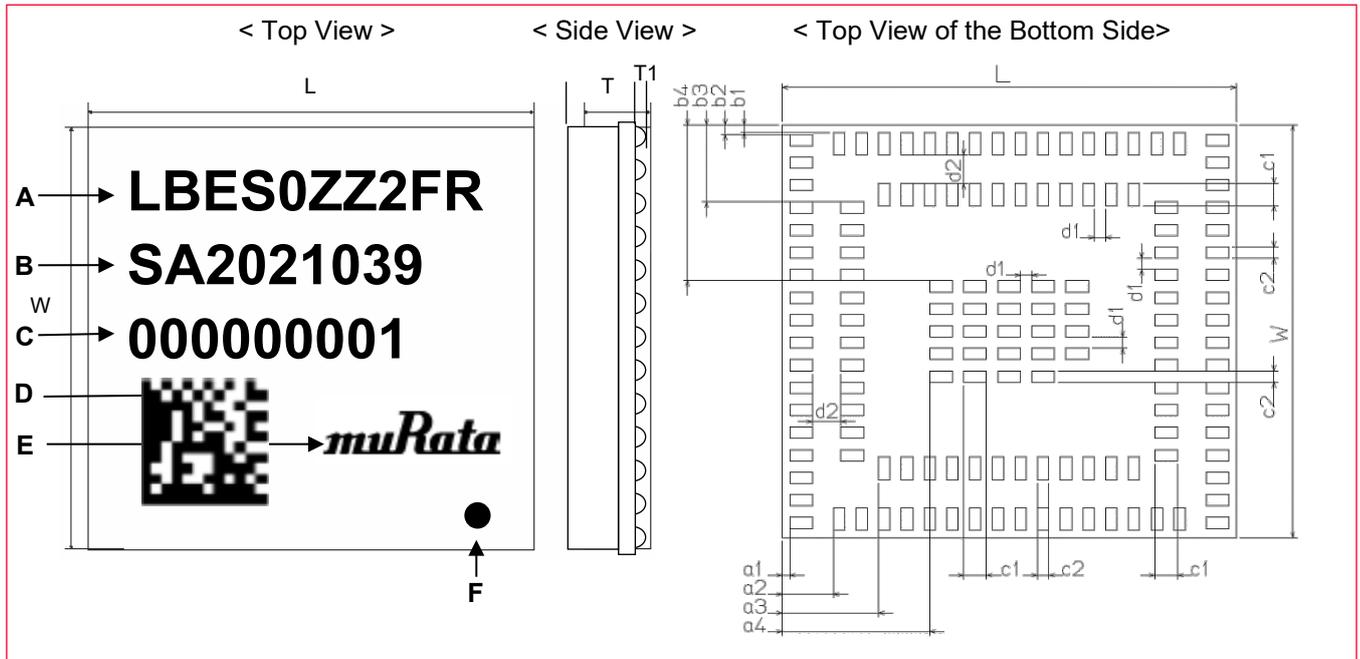
Table 4 describes the marking labels for the top and bottom view as shown in **Figure 2**.

Table 5: Markings (Top View)

Labels	Meaning
A	Module Type
B	Inspection Number
C	Serial Number
D	2D code
E	Murata Logo
F	Pin 1 Marking

Table 6 describes the markings.

Table 6: Markings (Bottom View)

Labels	Dimensions	Labels	Dimensions	Labels	Dimensions
L	12.0 +/- 0.20	W	11.0 +/- 0.20		
T	1.55 maximum	T1	0.04 typical (Bump)		
a1	0.20 +/- 0.20	b1	0.20 +/- 0.20	c1	0.60 +/- 0.10
a2	1.35 +/- 0.20	b2	0.25 +/- 0.20	c2	0.30 +/- 0.10
a3	2.55 +/- 0.20	b3	2.05 +/- 0.20	d1	0.30 +/- 0.10
a4	3.90 +/- 0.20	b4	4.15 +/- 0.20	d2	0.75 +/- 0.10

6.1 Structure

Figure 3 shows the module structure.

Figure 3: Structure
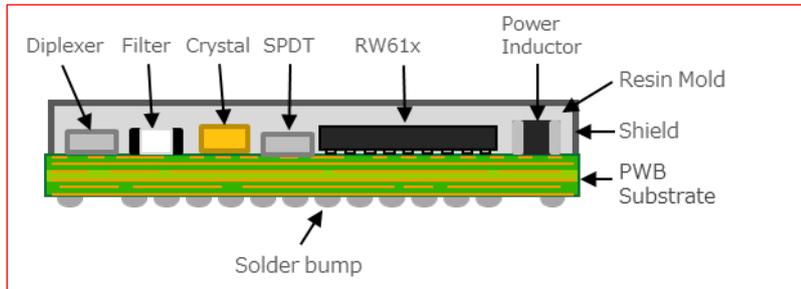
7 Module Pin Descriptions

This section has the Pin descriptions of Type 2FR and pin assignments layout descriptions.

Type 2FR pin-assignment top view is presented in **Figure 4**.

Figure 4: Pin Assignments - Top View
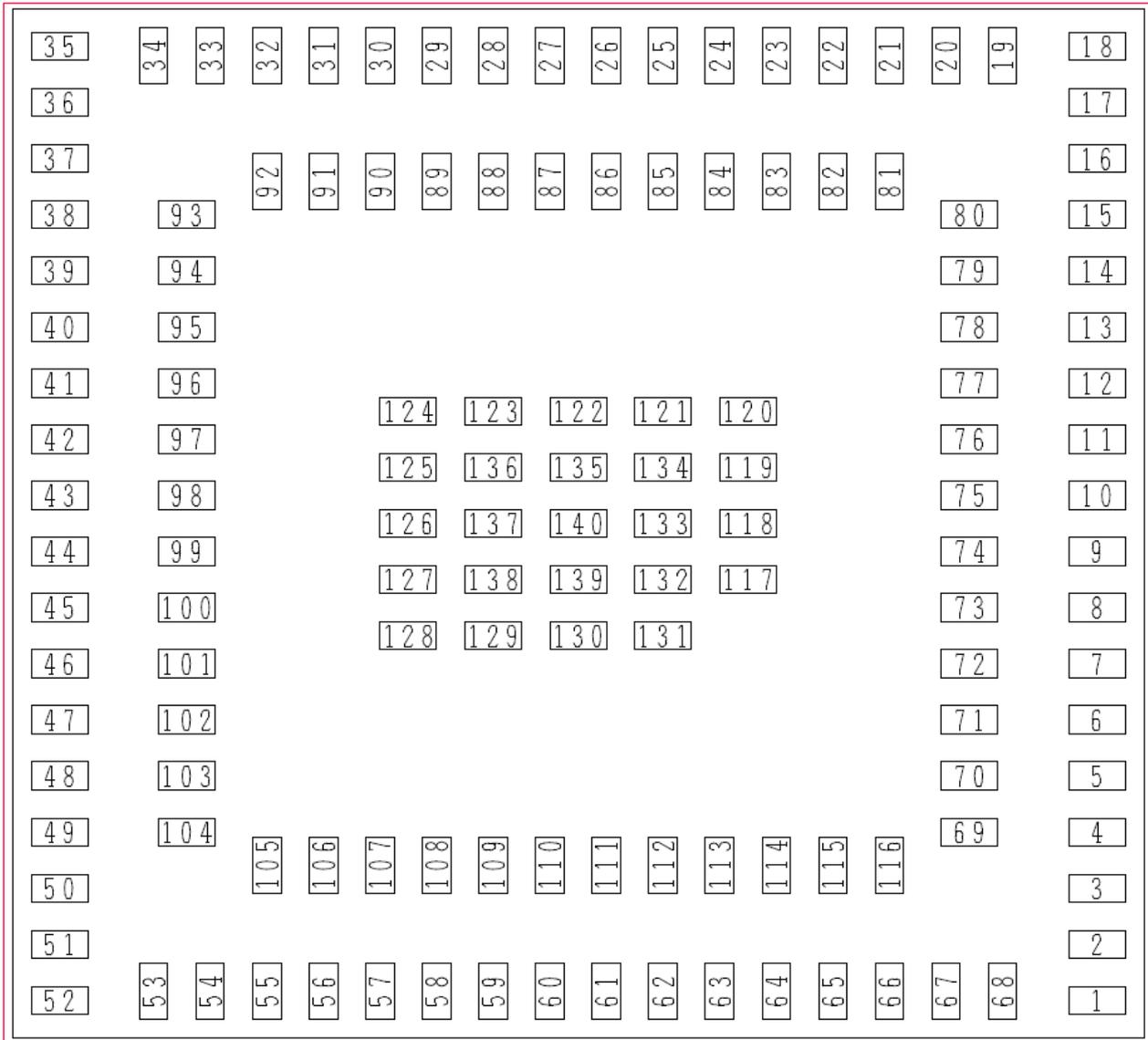
The pin names/terminal names are listed in **Table 7.**

Table 7: Type 2FR Terminal Descriptions

No.	Terminal Name	No.	Terminal Name	No.	Terminal Name
1	GND	48	GPIO_19	95	GPIO_38
2	VIO_RF	49	GPIO_11	96	GPIO_27
3	GND	50	GND	97	GPIO_24
4	RF_CNTL_0	51	VIO_1	98	GPIO_28
5	GND	52	GND	99	GPIO_26
6	RF_MAIN	53	RF_CNTL_1	100	GPIO_15
7	GND	54	GND	101	GPIO_21
8	GPIO_58	55	RF_CNTL_2	102	GPIO_16
9	GPIO_2	56	GND	103	GPIO_10
10	GPIO_4	57	BT_OUT	104	GPIO_1
11	PDn	58	GND	105	GPIO_9
12	GPIO_47	59	RF_CNTL_3	106	GPIO_14
13	GPIO_30	60	GPIO_6	107	GND
14	GPIO_32	61	GPIO_5	108	GPIO_8
15	GPIO_31	62	GPIO_12	109	GPIO_55
16	GND	63	GPIO_51	110	GND
17	VIO_6	64	GPIO_52	111	GPIO_45
18	GND	65	GPIO_7	112	GPIO_54
19	VDD18	66	GND	113	GPIO_53
20	GND	67	BT_IN	114	GND
21	GPIO_62	68	GND	115	GPIO_44
22	GPIO_56	69	EXT_REQ	116	GPIO_50
23	GPIO_3	70	EXT_GNT	117	GND
24	GPIO_57	71	EXT_PRI	118	GND
25	GND	72	EXT_FREQ	119	GND
26	VCC33	73	GPIO_43	120	GND
27	VCC33	74	GPIO_42	121	GND
28	GND	75	GPIO_46	122	GND
29	USB_DP	76	GPIO_60	123	GND
30	USB_DM	77	GPIO_59	124	GND
31	GND	78	GPIO_34	125	GND
32	USB_ID	79	GPIO_33	126	GND
33	USB_VBUS	80	CS_Int_Flash	127	GND
34	VIO_3	81	GPIO_49	128	GND
35	GND	82	GPIO_48	129	GND
36	VIO_2	83	GPIO_63	130	GND
37	VIO_5	84	GND	131	GND
38	GPIO_40	85	GPIO_61	132	GND
39	GPIO_41	86	GND	133	GND
40	GPIO_39	87	GPIO_25	134	GND
41	GPIO_37	88	GPIO_22	135	GND
42	GPIO_29	89	GND	136	GND
43	GPIO_13	90	GND	137	GND
44	GPIO_17	91	GND	138	GND
45	GPIO_20	92	GPIO_23	139	GND
46	GPIO_18	93	GPIO_36	140	GND
47	GPIO_0	94	GPIO_35		

7.1 Pin Descriptions

Table 8 lists the pin descriptions of Type 2FR.

Table 8: Type 2FR Pin Descriptions

No.	Pin name	Connection to IC		Type	Supply Domain	Description
		Ball #	Ball Name			
1	GND			Power		
2	VIO_RF	R6	VIO_RF	Power		
3	GND			Power		
4	RF_CNTL_0	N3	RF_CNTL0	I/O	VIO_RF	Wi-Fi RF front-end control line 0
5	GND			Power		
6	RF_MAIN			RF		Main RF port
7	GND			Power		
8	GPIO_58	G11	GPIO[58]	I/O	VIO_6	
9	GPIO_2	F10	GPIO[2]	I/O	VIO_6	
10	GPIO_4	F8	GPIO[4]	I/O	VIO_6	
11	PDn	E9	PDN	I/O		
12	GPIO_47	E13	GPIO[47]	I/O	VIO_6	
13	GPIO_30	F3	GPIO[30]	I/O	VIO_4	
14	GPIO_32	F2	GPIO[32]	I/O	VIO_4	
15	GPIO_31	D3	GPIO[31]	I/O	VIO_4	
16	GND			Power		
17	VIO_6	B15	VIO_6	Power		
18	GND			Power		
19	VDD18	B12	VDD18	Power		Power from internal DCDC 1.8V for appropriate IO domain
20	GND			Power		
21	GPIO_62	B14	GPIO[62]	I/O	VIO_6	
22	GPIO_56	A14	GPIO[56]	I/O	VIO_6	
23	GPIO_3	C13	GPIO[3]	I/O	VIO_6	
24	GPIO_57	B13	GPIO[57]	I/O	VIO_6	
25	GND			Power		
26	VCC33	R8, R15, B10, A10, B8	VPA[R8], VPA[R15], VBAT[B10], VBAT(A10), AVDD33_USB	Power		Main power supply
27	VCC33	R8, R15, B10, A10, B8	VPA[R8], VPA[R15], VBAT[B10], VBAT(A10), AVDD33_USB	Power		Main power supply
28	GND			Power		
29	USB_DP	D8	USB_DP	I/O		
30	USB_DM	C7	USB_DM	I/O		
31	GND			Power		
32	USB_ID	B7	USB_ID	I/O		
33	USB_VBUS	D6	USB_VBUS	Power		
34	VIO_3	A5	VIO_3	Power		
35	GND			Power		
36	VIO_2	F1	VIO_2	Power		
37	VIO_5	A4	VIO_5	Power		

No.	Pin name	Connection to IC		Type	Supply Domain	Description
		Ball #	Ball Name			
38	GPIO_40	A1	GPIO[40]	I/O	VIO_5	
39	GPIO_41	B1	GPIO[41]	I/O	VIO_5	
40	GPIO_39	A2	GPIO[39]	I/O	VIO_5	
41	GPIO_37	B2	GPIO[37]	I/O	VIO_5	
42	GPIO_29	D2	GPIO[29]	I/O	VIO_4	
43	GPIO_13	G5	GPIO[13]	I/O	VIO_2	
44	GPIO_17	H2	GPIO[17]	I/O	VIO_2	
45	GPIO_20	K2	GPIO[20]	I/O	VIO_2	
46	GPIO_18	K3	GPIO[18]	I/O	VIO_2	
47	GPIO_0	M1	GPIO[0]	I/O	VIO_1	
48	GPIO_19	L3	GPIO[19]	I/O	VIO_2	
49	GPIO_11	M2	GPIO[11]	I/O	VIO_1	
50	GND			Power		
51	VIO_1	K1	VIO_1	Power		
52	GND			Power		
53	RF_CNTL_1	P5	RF_CNTL1	I/O	VIO_RF	
54	GND			Power		
55	RF_CNTL_2	P6	RF_CNTL2	I/O	VIO_RF	
56	GND			Power		
57	BT_OUT			RF		BT/Zigbee from RW610
58	GND			Power		
59	RF_CNTL_3	P7	RF_CNTL3	I/O	VIO_RF	
60	GPIO_6	L5	GPIO[6]	I/O	VIO_1	
61	GPIO_5	L7	GPIO[5]	I/O	VIO_1	
62	GPIO_12	N8	GPIO[12]	I/O	VIO_RF	
63	GPIO_51	M8	GPIO[51]	I/O	VIO_1	
64	GPIO_52	K8	GPIO[52]	I/O	VIO_1	
65	GPIO_7	L9	GPIO[7]	I/O	VIO_1	
66	GND			Power		
67	BT_IN			RF		BT/Zigbee to RF main
68	GND			Power		
69	EXT_REQ	M12	EXT_REQ	I/O	AVDD18	
70	EXT_GNT	L13	EXT_GNT	I/O	AVDD18	
71	EXT_PRI	K13	EXT_PRI	I/O	AVDD18	
72	EXT_FREQ	J13	EXT_FREQ/WCI-2_SOUT	I/O	AVDD18	
73	GPIO_43	H12	GPIO[43]	I/O	VIO_6	
74	GPIO_42	G13	GPIO[42]	I/O	VIO_6	
75	GPIO_46	F12	GPIO[46]	I/O	VIO_6	
76	GPIO_60	E11	GPIO[60]	I/O	VIO_6	
77	GPIO_59	D12	GPIO[59]	I/O	VIO_6	
78	GPIO_34	E3	GPIO[34]	I/O	VIO_4	
79	GPIO_33	G3	GPIO[33]	I/O	VIO_4	
80	CS_Int_Flash			I/O		Connect to GPIO_28 for internal flash CS
81	GPIO_49	D14	GPIO[49]	I/O	VIO_6	
82	GPIO_48	D13	GPIO[48]	I/O	VIO_6	
83	GPIO_63	A15	GPIO[63]	I/O	VIO_6	
84	GND			Power		
85	GPIO_61	A13	GPIO[61]	I/O	VIO_6	
86	GND			Power		

No.	Pin name	Connection to IC		Type	Supply Domain	Description
		Ball #	Ball Name			
87	GPIO_25	E7	GPIO[25]	I/O	VIO_3	
88	GPIO_22	B6	GPIO[22]	I/O	VIO_3	
89	GND			Power		
90	GND			Power		
91	GND			Power		
92	GPIO_23	B5	GPIO[23]	I/O	VIO_3	
93	GPIO_36	B4	GPIO[36]	I/O	VIO_5	
94	GPIO_35	B3	GPIO[35]	I/O	VIO_5	
95	GPIO_38	C3	GPIO[38]	I/O	VIO_5	
96	GPIO_27	C5	GPIO[27]	I/O	VIO_3	
97	GPIO_24	E5	GPIO[24]	I/O	VIO_3	
98	GPIO_28	F4	GPIO[28]	I/O	VIO_4	For external or internal flash CS
99	GPIO_26	F6	GPIO[26]	I/O	VIO_3	
100	GPIO_15	H3	GPIO[15]	I/O	VIO_2	
101	GPIO_21	H4	GPIO[21]	I/O	VIO_2	
102	GPIO_16	J3	GPIO[16]	I/O	VIO_2	
103	GPIO_10	M3	GPIO[10]	I/O	VIO_1	
104	GPIO_1	N2	GPIO[1]	I/O	VIO_1	
105	GPIO_9	M4	GPIO[9]	I/O	VIO_1	
106	GPIO_14	K4	GPIO[14]	I/O	VIO_2	
107	GND			Power		
108	GPIO_8	M6	GPIO[8]	I/O	VIO_1	
109	GPIO_55	K6	GPIO[55]	I/O	VIO_1	
110	GND			Power		
111	GPIO_45	H10	GPIO[45]	I/O	VIO_6	
112	GPIO_54	M10	GPIO[54]	I/O	VIO_1	
113	GPIO_53	L11	GPIO[53]	I/O	VIO_1	
114	GND			Power		
115	GPIO_44	J11	GPIO[44]	I/O	VIO_6	
116	GPIO_50	K12	GPIO[50]	I/O	VIO_6	
117	GND			Power		
118	GND			Power		
119	GND			Power		
120	GND			Power		
121	GND			Power		
122	GND			Power		
123	GND			Power		
124	GND			Power		
125	GND			Power		
126	GND			Power		
127	GND			Power		
128	GND			Power		
129	GND			Power		
130	GND			Power		
131	GND			Power		
132	GND			Power		
133	GND			Power		
134	GND			Power		
135	GND			Power		
136	GND			Power		

No.	Pin name	Connection to IC		Type	Supply Domain	Description
		Ball #	Ball Name			
137	GND			Power		
138	GND			Power		
139	GND			Power		
140	GND			Power		

7.2 Pin States

Table 9: Pin Power Down States (PDn = 0)

Pin	Power down state (PDn = 0)
RF_CNTL_0	Drive low
RF_CNTL_1	Drive high
RF_CNTL_2	Drive low
RF_CNTL_3	Drive high
GPIO_0 ~ GPIO_63	Tristate

8 Absolute Maximum Ratings

Table 10 Shows the absolute maximum rating values.

Table 10: Absolute Maximum Rating

Parameter		Minimum	Maximum	Unit
Storage Temperature		-40	+125	
Supply Voltage	VCC33		3.96	V
I/O Voltage	3.3 I/O Supply		3.96	V
	1.8 I/O Supply		2.16	V

9 Operating Condition

Table 11 shows the operating conditions for Type 2FR module.

Table 11: Operating Conditions

Parameter		Minimum	Typical	Maximum	Unit
Operating Temperature		-40		+85	C
Supply Voltage		3.14	3.3	3.46	V
I/O Voltage	3.3 I/O Supply	3.14	3.3	3.46	V
	1.8 I/O Supply	1.71	1.8	1.89	V

9.1 External Sleep Clock Specifications

Table 12 describes the external sleep clock specifications.

Table 12: External Sleep Clock Specifications

Parameter	Minimum	Typical	Maximum	Unit
Clock frequency range/accuracy • CMOS input clock signal type • ±250 ppm (initial, aging, temperature)		32.768		KHz
Phase noise requirement (@ 100 kHz)		-125		dBc/Hz
Cycle jitter		1.5		ns (RMS)
Slew Rate Limit (10-90%)			100	ns
Duty Cycle Tolerance	20		80	%

9.2 Digital I/O Requirements

Digital I/O requirement parameters for 1.8V operation are listed in **Table 13**.

Table 13: Digital I/O Requirement Parameters - 1.8V Operation

Symbol	Parameter	Condition	Minimum	Typical	Maximum	Unit
VIO	I/O pad supply voltage		1.71	1.8	1.89	V
V_{IH}	Input high voltage		0.7 * VIO		VIO + 0.4	V
V_{IL}	Input low voltage		-0.4		0.3 * VIO	V
V_{HYS}	Input hysteresis`		100			mV
V_{OH}	Output high voltage		VIO - 0.4			V
V_{OL}	Output low voltage				0.4	V

Digital I/O requirement parameters for 3.3V operation are listed in **Table 14**.

Table 14: Digital I/O Requirement Parameters - 3.3V Operation

Symbol	Parameter	Condition	Minimum	Typical	Maximum	Unit
VIO	I/O pad supply voltage		3.14	3.3	3.46	V
V_{IH}	Input high voltage		0.7 * VIO		VIO + 0.4	V
V_{IL}	Input low voltage		-0.4		0.3 * VIO	V
V_{HYS}	Input hysteresis		100			mV
V_{OH}	Output high voltage		VIO - 0.4			V
V_{OL}	Output low voltage				0.4	V

10 DC/RF Characteristics

10.1 Wi-Fi Radio Specification

10.1.1 Wi-Fi Receiver Performance - 2.4 GHz

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

The performance values are preliminary information subject to change based on the final device characterization results.

Table 15: Wi-Fi Receiver Performance - 2.4 GHz

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF frequency range		2400		2483.5	MHz
RF signal bandwidth		20		20	MHz
Receivers Sensitivity					
Receiver Sensitivity 802.11b	20 MHz 1 Mbps		-98.2		dBm
Receiver Sensitivity 802.11b	20 MHz 11 Mbps		-90.9		dBm
Receiver Sensitivity 802.11g	20 MHz 6 Mbps		-92.9		dBm
Receiver Sensitivity 802.11g	20 MHz 54 Mbps		-76.2		dBm
Receiver Sensitivity 802.11n	20 MHz MCS0 Nss1 BCC		-92.9		dBm
Receiver Sensitivity 802.11n	20 MHz MCS7 Nss1 BCC		-74.2		dBm
Receiver Sensitivity 802.11ax	4x3.2 20 MHz MCS0 Nss1 BCC		-92.5		dBm
Receiver Sensitivity 802.11ax	4x3.2 20 MHz MCS9 Nss1 BCC		-67.9		dBm
Receiver Maximum Input Level (MIL)					
Receiver Maximum Input Level DSS	802.11b DSSS MIL		-0.2		dBm
Receiver Maximum Input Level OFDM	802.11b CCK MIL		-0.2		dBm
Receiver Maximum Input Level OFDM	OFDM MIL		-5		dBm

10.1.2 Wi-Fi Receiver Performance - 5 GHz

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

The performance values are preliminary information subject to change based on the final device characterization results.

Table 16: Wi-Fi Receiver Performance - 5 GHz

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF Frequency Range		4900		5895	MHz
RF Signal Bandwidth		20		20	MHz
Receivers Sensitivity					
Receiver Sensitivity 802.11a	20 MHz 6 Mbps		-92.3		dBm

Parameter	Condition	Minimum	Typical	Maximum	Unit
Receiver Sensitivity 802.11a	20 MHz 54 Mbps		-75.3		dBm
Receiver Sensitivity 802.11n	20 MHz MCS0 Nss1 BCC		-91.5		dBm
Receiver Sensitivity 802.11n	20 MHz MCS7 Nss1 BCC		-72.7		dBm
Receiver Sensitivity 802.11ac	20 MHz MCS0 Nss1 BCC		-91.5		dBm
Receiver Sensitivity 802.11ac	20 MHz MCS8 Nss1 BCC		-68.8		dBm
Receiver Sensitivity 802.11ax	4x3.2 20 MHz MCS0 Nss1 BCC		-91.5		dBm
Receiver Sensitivity 802.11ax	4x3.2 20 MHz MCS9 Nss1 BCC		-66.6		dBm

10.1.3 Wi-Fi Transmitter Performance - 2.4 GHz

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 17: Wi-Fi Transmitter Performance - 2.4 GHz

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF Frequency Range	2.4 GHz	2412		2484	MHz
Maximum Linear Output Power With 20 MHz Bandwidth	802.11b 1 Mbps		18		dBm
	802.11b 11 Mbps		18		dBm
	802.11g 6 Mbps		18		dBm
	802.11g 54 Mbps		17		dBm
	802.11n MCS7		16		dBm
	802.11ax MCS9		15		dBm
Transmit Carrier Suppression			-40		dBc
Transmit Frequency Error			-20	20	PPM
Modulation Accuracy	802.11b 1 Mbps			35	%
	802.11b 11 Mbps			35	%
	802.11g 6 Mbps			-5	dB
	802.11g 54 Mbps			-25	dB
	802.11n MCS7			-27	dB
	802.11 ax MCS9			-32	dB

10.1.4 Wi-Fi Transmitter Performance - 5 GHz

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 18: Wi-Fi Transmitter Performance - 5 GHz

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF Frequency Range	5 GHz	4900		5895	MHz
Maximum linear output power with 20 MHz bandwidth	802.11a 6 Mbps		18		dBm
	802.11a 54 Mbps		17		dBm
	802.11n MCS7		16		dBm
	802.11ax MCS9		13		dBm

Parameter	Condition	Minimum	Typical	Maximum	Unit
Transmit Carrier Suppression			-40		dBc
Transmit Frequency Error		-20		20	PPM
Modulation Accuracy	802.11a 6 Mbps			-5	dB
	802.11a 54 Mbps			-25	dB
	802.11n MCS7			-27	dB
	802.11ax MCS9			-32	dB

10.2 Bluetooth LE Radio Specification

10.2.1 Bluetooth LE Receiver Performance

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 19: Bluetooth LE Receiver Performance

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF frequency range		2400		2483.5	MHz
Receivers Sensitivity					
Bluetooth LE 1 Mbps			-97.7		dBm
Bluetooth LE 2 Mbps			-95.5		dBm
Bluetooth LR 125 Kbps			-106		dBm
Bluetooth LR 500 Kbps			-99.3		dBm
Receivers Maximum Input Level (MIL)					
Bluetooth LE 1 Mbps			-3		dBm
Bluetooth LE 2 Mbps			-3		dBm
Bluetooth LR 125 Kbps			-3		dBm
Bluetooth LR 500 Kbps			-3		dBm

10.2.2 Bluetooth LE Transmitter Performance

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 20: Bluetooth LE Transmitter Performance

Parameter	Condition	Minimum	Typical	Maximum	Unit
Center Frequency		2400		2483.5	MHz
Channel Spacing			2		MHz
Number of RF Channels			40		
Max Output Power			12		dBm
Modulation Characteristics					

Parameter	Condition	Minimum	Typical	Maximum	Unit
$\Delta f1_{avg}$		225		275	kHz
$\Delta f2_{max}$ (at 99.9%)		185			kHz
$\Delta f2_{avg}$ / $\Delta f1avg$		0.8			
Carrier Frequency Offset and Drift					
• Frequency offset: | fn – fTX |				150	kHz
• Frequency drift: | f0 – fn |				50	kHz
• Drift rate #0: | f1 – f0 |				20	kHz
• Drift rate #n: | fn – fn-5 |				20	kHz

10.3 IEEE 802.15.4 Radio Specification

10.3.1 Receiver Performance - 802.15.4

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 21: Receiver Performance - 802.15.4

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF Frequency Range		2400		2483.5	MHz
Receiver Sensitivity					
Receiver Sensitivity	Nominal conditions		-104.7		dBm
Receiver Maximum Input Level (MIL)					
Receivers MIL			3		dBm

10.3.2 Transmitter Performance - 802.15.4

Conditions: 25 °C, VCC33 = 3.3V, VIO_RF = 3.3V, at module pad

> The performance values are preliminary information subject to change based on the final device characterization results.

Table 22: Transmitter Performance - 802.15.4

Parameter	Condition	Minimum	Typical	Maximum	Unit
RF Frequency Range		2400		2483.5	MHz
Transmit Maximum Power			12		dBm

11 Land Pattern

We recommend the host PCB land pattern be the same as the module pin pad pattern.

12 Reference Circuit

Please reference to Type 2FR EVK Schematic ⬀ and Type 2FR EVK BOM ⬀.

13 Tape and Reel Packing

This section contains the following topics:

- Dimensions of Tape (Plastic tape)
- Dimensions of Reel
- Taping Diagrams
- Leader and tail tape
- Packaging

13.1 Dimensions of Tape (Plastic Tape)

Figure 5 is a graphical representation of the tape dimension (plastic tape).

Figure 5: Dimensions of Tape (Plastic Tape)
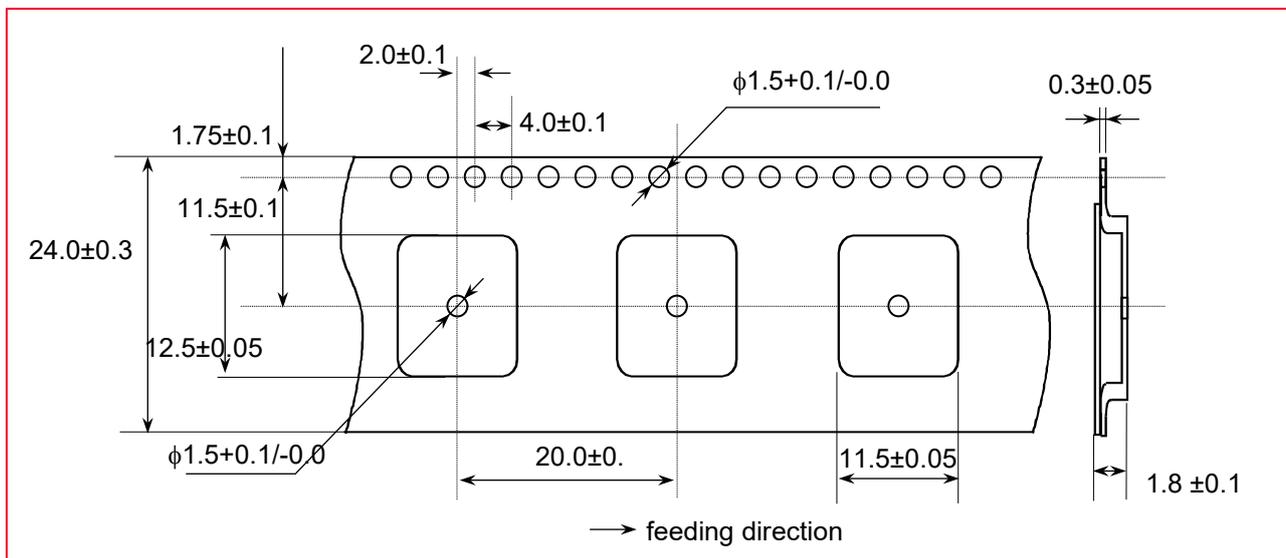
> ℹ Cumulative tolerance of maximum 40 +/- 0.15 mm for every 10 pitches.

13.2 Dimensions of Reel

Figure 6 shows the reel dimensions.

Figure 6: Dimensions of Reel (Unit: Millimeters)
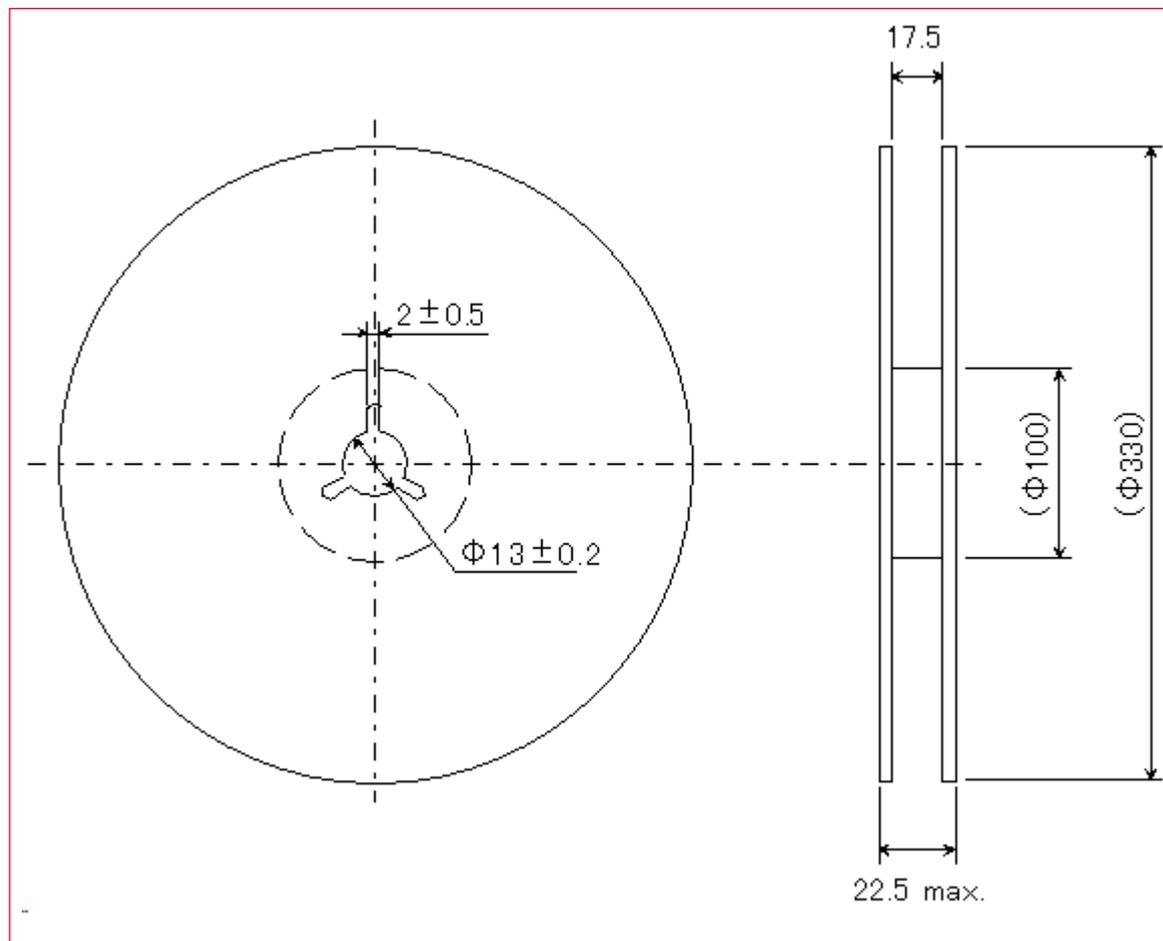
13.3 Taping Diagrams

Figure 7 shows the taping diagrams.

Figure 7: Taping Diagrams
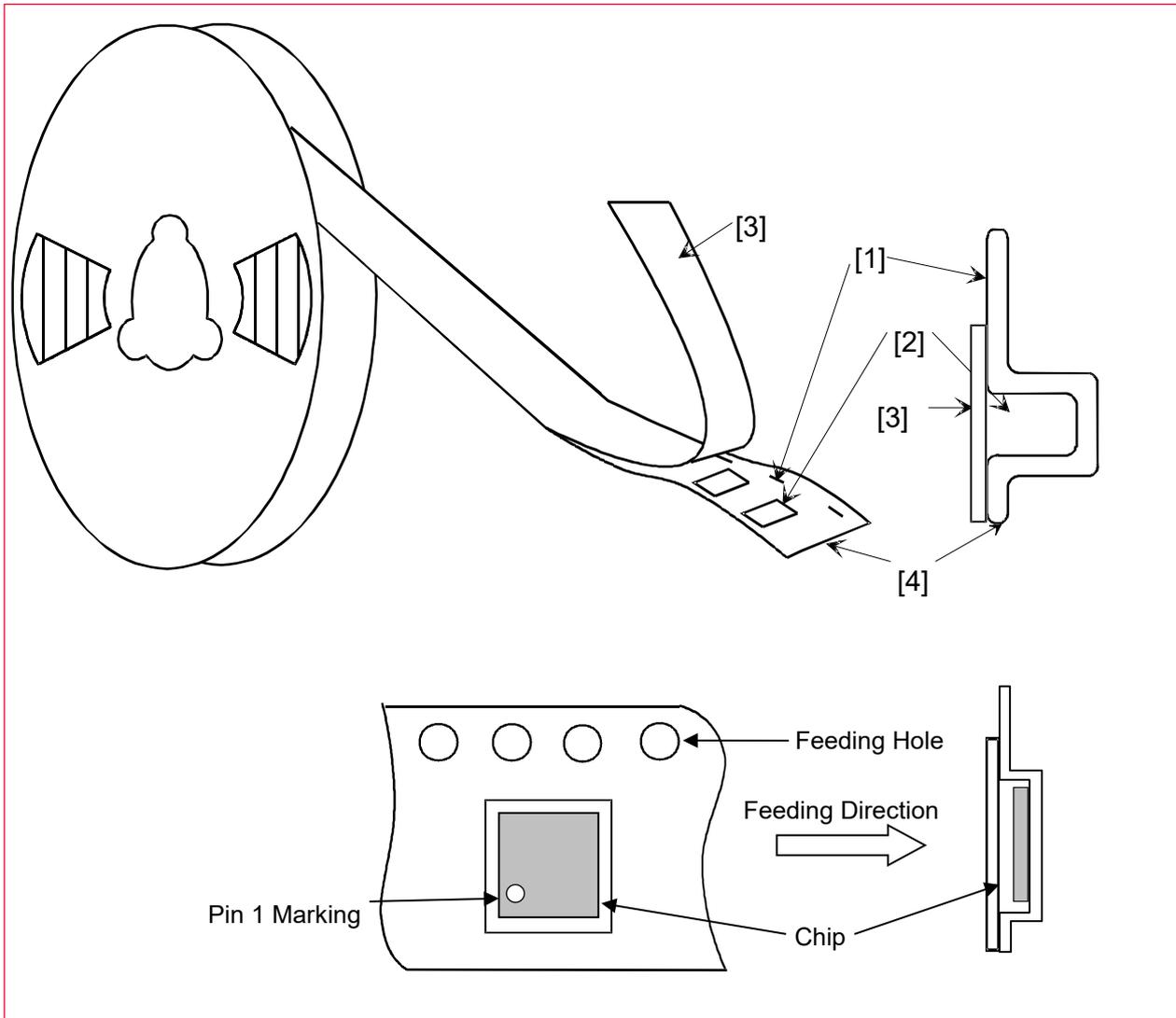
Table 23: Taping Specifications

| 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) ↗.

13.4 Leader and Tail Tape

The leader and tail tape are shown in **Figure 8**.

Figure 8: Leader and Tail Tape
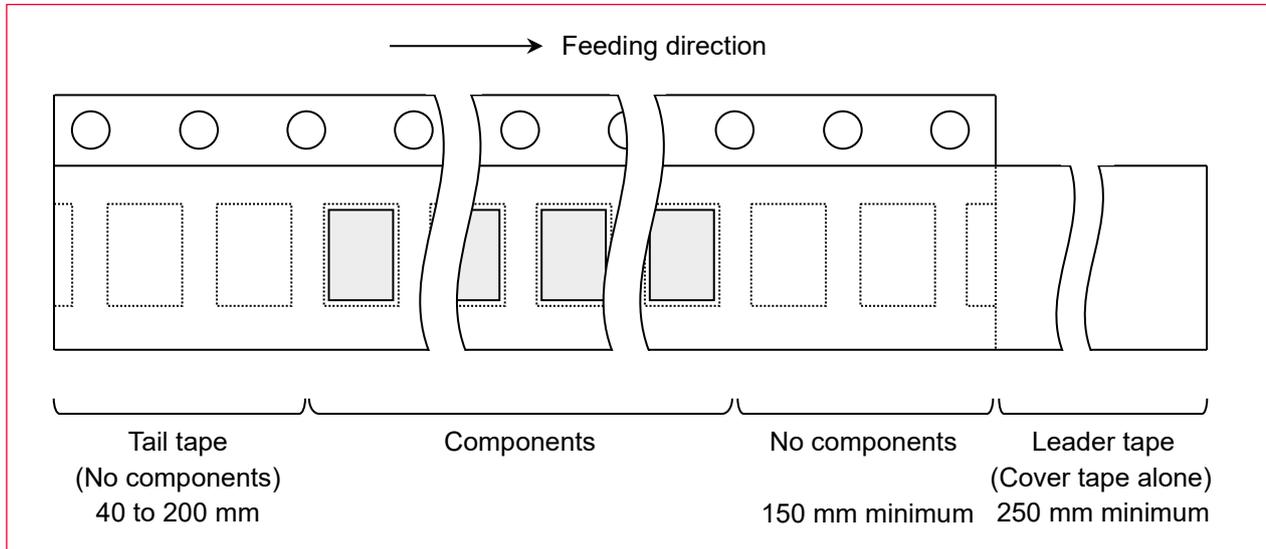
- The tape for chips is wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

- 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 9**.

Figure 9: Peeling Force
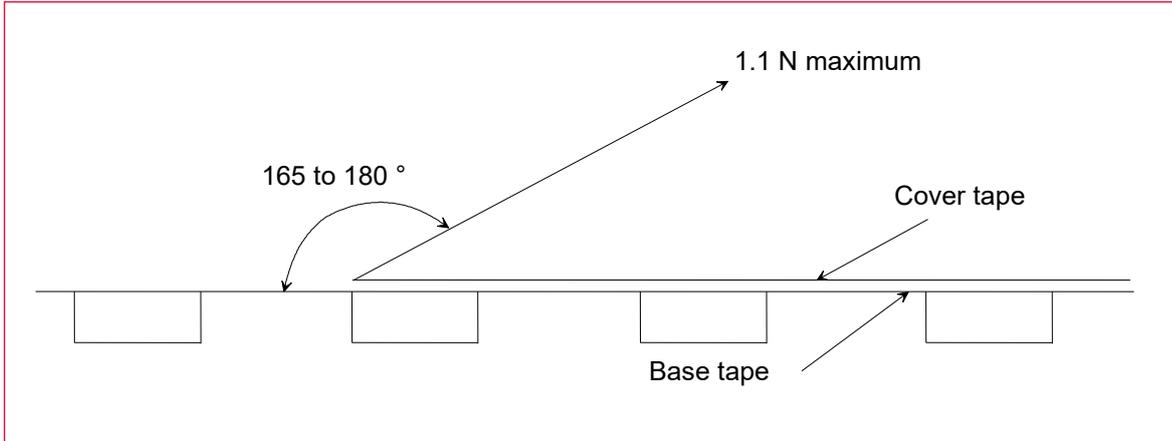
13.5 Packaging (Humidity Proof Packing)

The packaging is shown in **Figure 10**.

Figure 10: Humidity Proof Packing
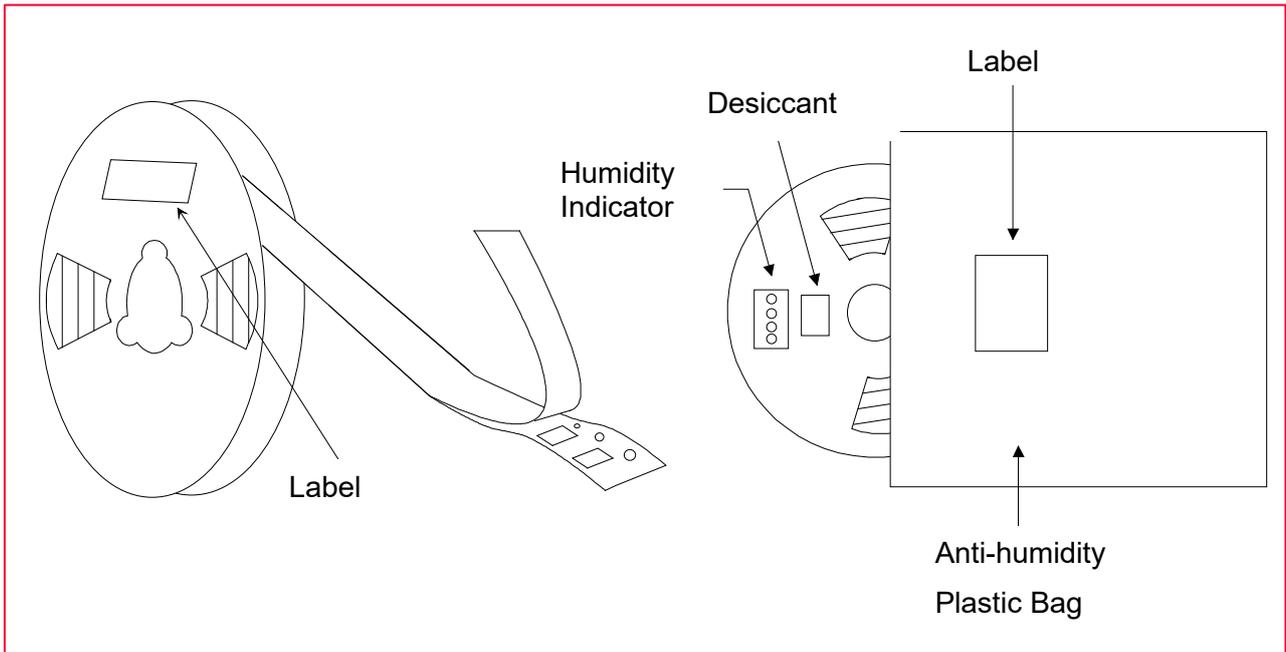
	Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

14 Notice

Please use this product within 6 months after receipt.

- The product shall 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 product left more than 6 months after reception, it needs to be confirmed the solderability before used.

- The product shall 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, shall not be applied in order not to damage the packing materials.

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

- After the packing opened, the product shall be stored at <30 °C / <60 %RH and the product shall be used within 168 hours.

- When the color of the indicator in the packing changed, the product shall be baked before soldering.

  o **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.

14.1 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 bare hands that may result in poor solder ability and destroy by static electrical charge.

14.2 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 is as 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 beforehand.

14.3 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 such damages, make 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.

14.4 Soldering Conditions

The recommendation conditions of soldering are as shown in **Figure 11**.

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

Figure 11: Reflow Soldering Standard Conditions (Example)
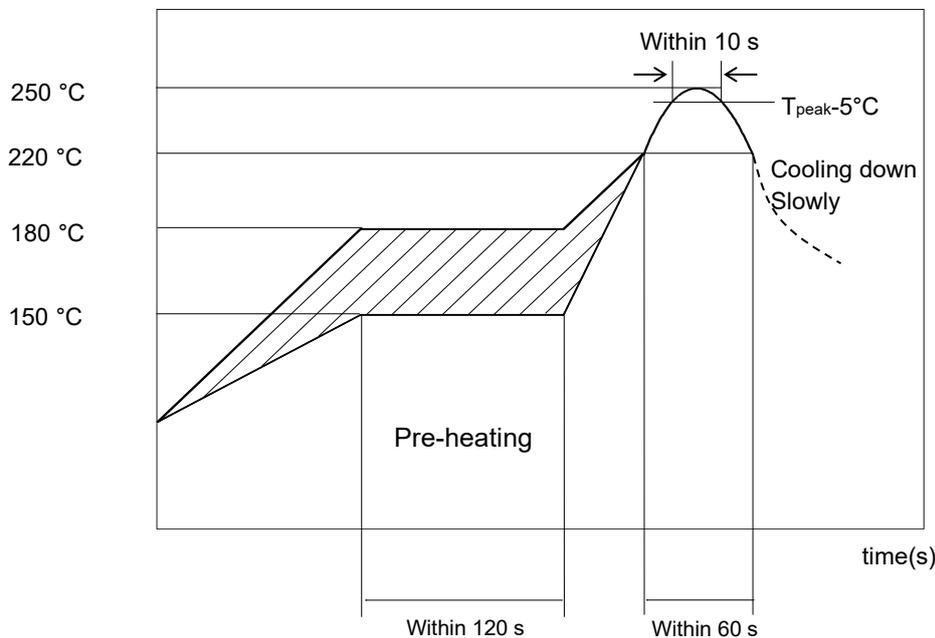
> Please use the reflow within 2 times.
> Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

14.5 Cleaning

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

14.6 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 (Cl_2, NH_3, 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.

15 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.
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- Aerospace equipment.

- Undersea equipment.

- 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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16 References

16.1 RW612 Wireless MCU with Integrated Tri-radio Wi-Fi 6 + Bluetooth Low Energy 5.4 / 802.15.4 Product data sheet, Rev.7, 6 February 2024, NXP

16.2 Type 2FR EVK Schematic, Murata

16.3 Type 2FR EVK BOM, Murata

Revision History

Revision	Date	Author	Change Description
A	Aug 24, 2023	YF	Initial Release
B	Oct 12, 2023	YF	Updated Wi-Fi RF characteristic data
C	Sept 10, 2024	YF	Updated following items: • The Key Features • Module weight • Markings (Table 5) • Added Product Overview section • Certification Information • Tape and Reel Information • Pin State Information • Maximum TX Power Information • Added Reference Circuit Section • Added References • Module Structure Diagram • Added references section. • Corrected reel size: 1000 pcs./ reel