Datasheet

for

RTX1090/RTX1090R1 DECT communication module – support for multi-level modulation

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Additional information:
Ref: LKN, TBJ, FVA
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1 Document info

1.1 Document scope

This datasheet provides the technical description of the RTX1090 DECT communication module from RTX A/S. It is intended as the technical documentation that accompanies the associated quotation on delivery of RTX1090 modules (stand-alone hardware delivery). The module operates in the DECT frequency band[1] and supports both standard DECT/CAT-iq™ solutions, as well as customized solutions designed to co-exist in the DECT frequency band. The modules are delivered with a standard RTX production test software. Customized firmware for specific applications must be specified and quoted separately.

Typical applications for the module are:

- Wireless intercoms
- Wireless microphones
- Wireless speakers
- General purpose audio transmission
- Data transmission and telemetry

The target readers of this datasheet are customer system engineers, system architects, and component selection decision makers deploying the module with a RTX product solution.

1.2 References

Readers of this datasheet may find additional information and supportive specifications in the following documents.

Reference	Name
1	Application note for RTX1090 RF output power considerations

1.3 Terms and abbreviations

Abbreviation	Description
ADC	Analog to Digital Converter
ARIB	Association of Radio Industries and Businesses
ARM	Advanced RISC Machine
CAT-iq	Cordless Advanced Technology—internet and quality
CELT	Constrained Energy Lapped Transform
COMP	Comparator
CTS	Clear to Send
D8PSK	Differential 8-ary Phase Shift Keying
DBPSK	Differential Binary Phase Shift Keying
DECT	Digital Enhanced Cordless Telecommunications
DMA	Direct Memory Access
DQPSK	Differential Quadrature Phase Shift Keying
DSP	Digital Signal Processor
EMC	Electromagnetic Compatibility
ESD	Electrostatic Sensitive Device
ETSI	European Telecommunications Standards Institute
FP	DECT Fixed Part
FIFO	First in First out
GFSK	Gaussian Frequency Shift Keying
GND	Ground
GPIO	General Purpose Input/Output
I/O	Input/Output

[1] The RTX1090 DECT communication module supports operation in multiple geographical areas and operates in the frequency range from 1880MHz to 1930MHz.

Abbreviation	Description
LED	Light Emitting Diode
LGA	Land Grid Array
MSL	Moisture Sensitivity Level
MAC	Media Access Control
NiHM	Nickel Metal Hydride
NTC	Negative Temperature Coefficient
PAEC	Perceptual Acoustic Echo Cancellation
PCB	Printed Circuit Board without Components
PCBA	Printed Circuit Board with Components
PCM	Pulse Code Modulation
PDM	Pulse Density Modulation
PHY	Physical Layer
PON	Power on
PP	DECT Portable Part
PSRR	Power Supply Rejection Ratio
RF	Radio Frequency
REACH	Registration, Evaluation, Authorization and Restriction of Chemical substances
RoHS	Restriction of Hazardous Substances
RTS	Request to Send
RTX1090	Product name of the RTX 1.9GHz DECT module
RTX1090R1	Product name of the RTX 1.9GHz DECT module, supporting increased temperature range
SAR	Specific Absorption Rate
Sheersound™	Supreme and unique audio codec developed by RTX
SOCN	State of Charge Negative Polarity
SOCP	State of Charge Positive Polarity
SPI	Serial Peripheral Interface
SWDIO	Serial Wire Debug Input/Output
SWCLK	Serial Wire Clock
TCE	Exponential temperature coefficient
TDMA	Time Division Multiple Access
TELEC	Telecom Engineering Center
UART	Universal Asynchronous Receive and Transmit
UL	Underwriters Laboratories
ULE	Ultra Low Energy
ULP	Ultra Low Power
VBAT	Input for fixed and battery supplies
VBUS	Input for USB supplies
VRF	Voltage for RF supply
VSUPPLY	Internal linear regulator generating 3.45V, sourcing from VBAT or VBUS

1.4 Document history

Revision	Resp.	Date	Comments
1.0	LKN/BKI	11-May-2020	First published version.
1.1	LKN/BKI	14-Aug-2020	Added comments regarding 3V3 output voltage.
1.2	PBB/BKI	04-Nov-2020	Added reset levels.
1.3	LTH/BKI	16-Dec-2020	RF power tolerances added.
1.4	PBB/BKI	18-Mar-2021	Added Reset state for pins.
1.5	LKN/BKI	18-Jun-2021	Corrected typo in subsection 10.1.
1.6	LKN/FVA/BKI	08-Oct-2021	Added part number and footnotes to better explain voltage for VRF_PA2 and figure showing module feed direction from reel.
1.7	TBJ/BKI	13-Jan-2022	Updated figure 7.
1.8	PBB/BKI	04-Mar-2022	Reset, PON, VRF_PA2 voltages. Current removed. Updated product picture.

Revision	Resp.	Date	Comments
1.9	TBJ/BKI	28-Jun-2023	Updated compliance references.
2.0	FVA/TBJ/BKI	09-Oct-2023	Updated to include module variant RTX1090R1.
2.1	KHR/BKI	22-Nov-2023	Grammatic update.
2.2	KHR/PBB/BKI	10-Sept-2024	General update for RTX1090R1. Added Abs. max values, ESD and MSL storage info.
2.3	KHR/BKI	23-Sept-2024	Footnote 15 has been updated.

2 Concept

The RTX1090 is a generic DECT communication module[2] with support for multi-level modulation that allows wireless applications to operate in the frequency band, normally used by DECT/CAT-iq based cordless telephones, headsets, etc. The module is a hardware host for RTX product solution firmware.

When obtaining the module from RTX, the module will be bundled with a software delivery. When bundled with software, RTX will ship both the modules containing the production test firmware and a dedicated firmware for the customers to load during production. RTX can develop dedicated firmware based on one of our standard firmware platforms, under a separate agreement between the customer and RTX.

The rest of this datasheet describes the hardware. For discussions of specific software needs, please consult your RTX contact or the sales team via sales@rtx.dk.

2.1 Ordering information

Name	Part number	Temp. range	Size (mm)	SW included	Shipment form	Pack quantities
RTX1090	95104500	Standard	15,4 x 21,6 x 2,6	Stand-alone	Tape & Reel	1000
RTX1090R1	95106014	Extended	15,4 x 21,6 x 2,6	Stand-alone	Tape & Reel	1000

2.2 Module description

The RTX1090/RTX1090R1 is a DECT module based on a Renesas Electronics DA14495 chip set. The module offers full DA14495 feature set and requires only a motherboard with antenna(s) and power supply in its basic form. Please note that the RTX1090 module only provides digital audio interfaces, and hence, if an analog audio interface is required, a codec and analog circuits need to be added to the motherboard as well. All DA14495 software supported pins are connected to a module board contact point. The contact points are placed at the bottom of the module using LGA technology. The module is delivered with the necessary DA14495 parameters tested and calibrated. Furthermore, the module is delivered with a basic RTX firmware, and customers can update the firmware with specific application software.

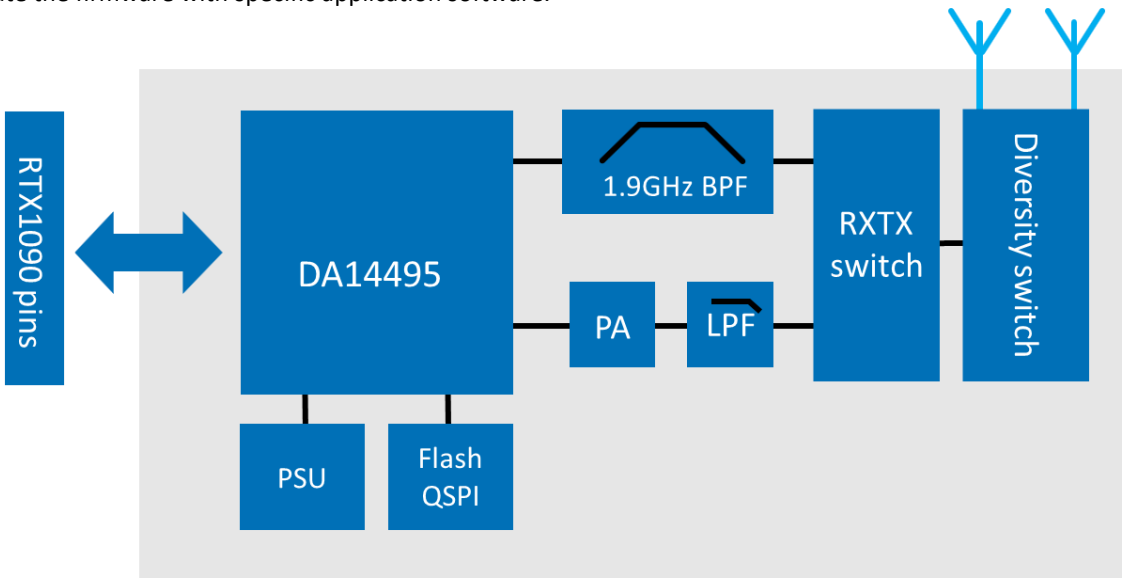


Figure 1: RTX1090 module main blocks

This datasheet describes module pin out, pin description, electrical specifications, mechanical specifications, labeling, and packaging.

[2] Operation frequency is 1880MHz to 1930MHz.

3 Module features

The RTX1090 module features a small footprint with fully integrated radio transceivers with RF power amplifier, antenna diversity, and baseband processor for DECT-based audio applications using Zero Blind Slot, DECT (EU), DECT 6.0 (US), J-DECT (Japan) and countries that can be derived from these regulatory requirements.

The RTX1090 module is based on the Renesas Electronics DA14495 CMOS IC with an external RF power amplifier. The general HW related key figures for the module are listed below.

Do note that actual deployed features will depend on the specific product firmware.

3.1 Zero Blind Slot

The RTX1090 module utilizes a Zero Blind Slot radio, i.e., a DECT radio which can utilize all the 24 slots in the DECT 10ms TDMA structure[3]. Consequently, this brings the following advantages:

- The agility of the interference avoidance mechanism is increased, which improves performance especially in high-density applications with significant DECT interference.

- The capacity of the system is greatly increased, as the FP can have twice the number of active connections, e.g., allowing more simultaneous channels in an intercom application. The capacity can even be increased further by utilizing a higher modulation (up to D8PSK) and/or optimizing the DECT protocol to a specific application.

3.2 Multi-level modulation

Most standard DECT radios only support one modulation form (GFSK), but the DECT standard defines a few additional modulation forms, hence providing a higher bit rate. The RTX1090 module supports multi-level modulation up to D8PSK for bit rates from 1.152Mbit/s up to 3.456Mbit/s.

[3] As opposed to a blind slot radio, which is only capable of utilizing every second slot in the DECT 10ms TDMA structure. Because the radio frequency synthesizers in a blind slot radio is not fast enough to switch carrier frequency on slot-to-slot basis.

4 Mechanical specification

The module is a rectangular PCB which is to be soldered onto a motherboard, using contact points at the bottom of the module PCB (i.e., the module employs LGA technology for the contact points). The component side of the module is covered by a shield, which is convenient for vacuum pick and place manufacturing equipment.

The module measures 15.4 x 21.6mm, and the module height is 2.60mm nom. (min: 2.20mm, max:2.84mm)[4]. The module has 88 contact points[5], each of which is made as a single solder point. The module does not have any buttons, LED, connectors, or a display.

The dimensions of the module are outlined in millimeters in figure 2 below. Please notice the three (3) guidance markings (two at the top of the module, and one at the bottom). Please refer to the footprint overview on the next page for dimensions and location of the soldering points.

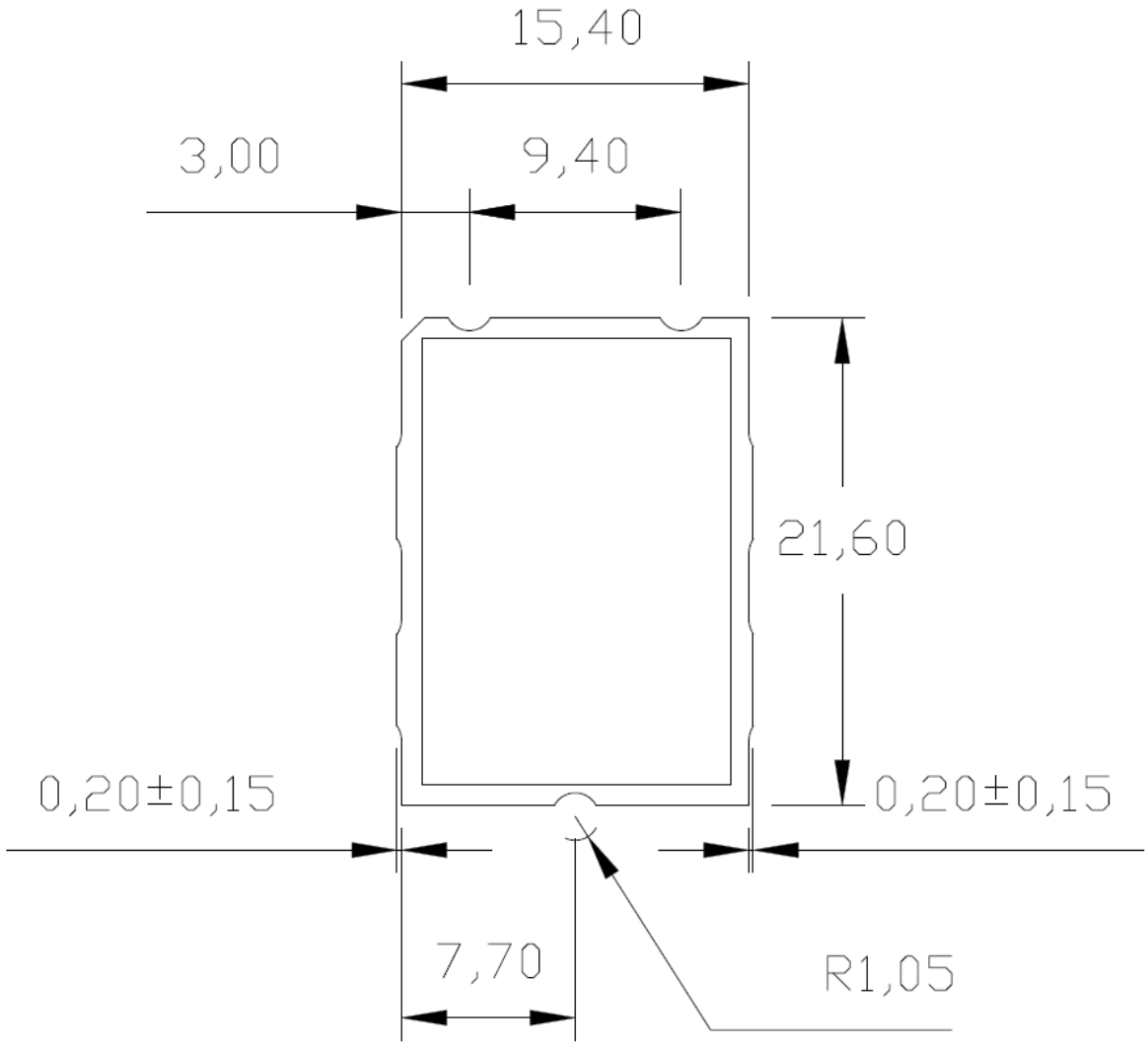


Figure 2: Module dimensions

[4] When the module is mounted on a carrier board, lift from the solder will elevate the module with typical 0.04mm. The elevation caused by soldering is included.
[5] The contact points are arranged in an 8x11 matrix structure as outlined in the module solder footprint, and the diameter of the pads is 0.8mm.

The module solder footprint (top view) including outlining of pin-numbering. The solder pad is 0.8mm in diameter:

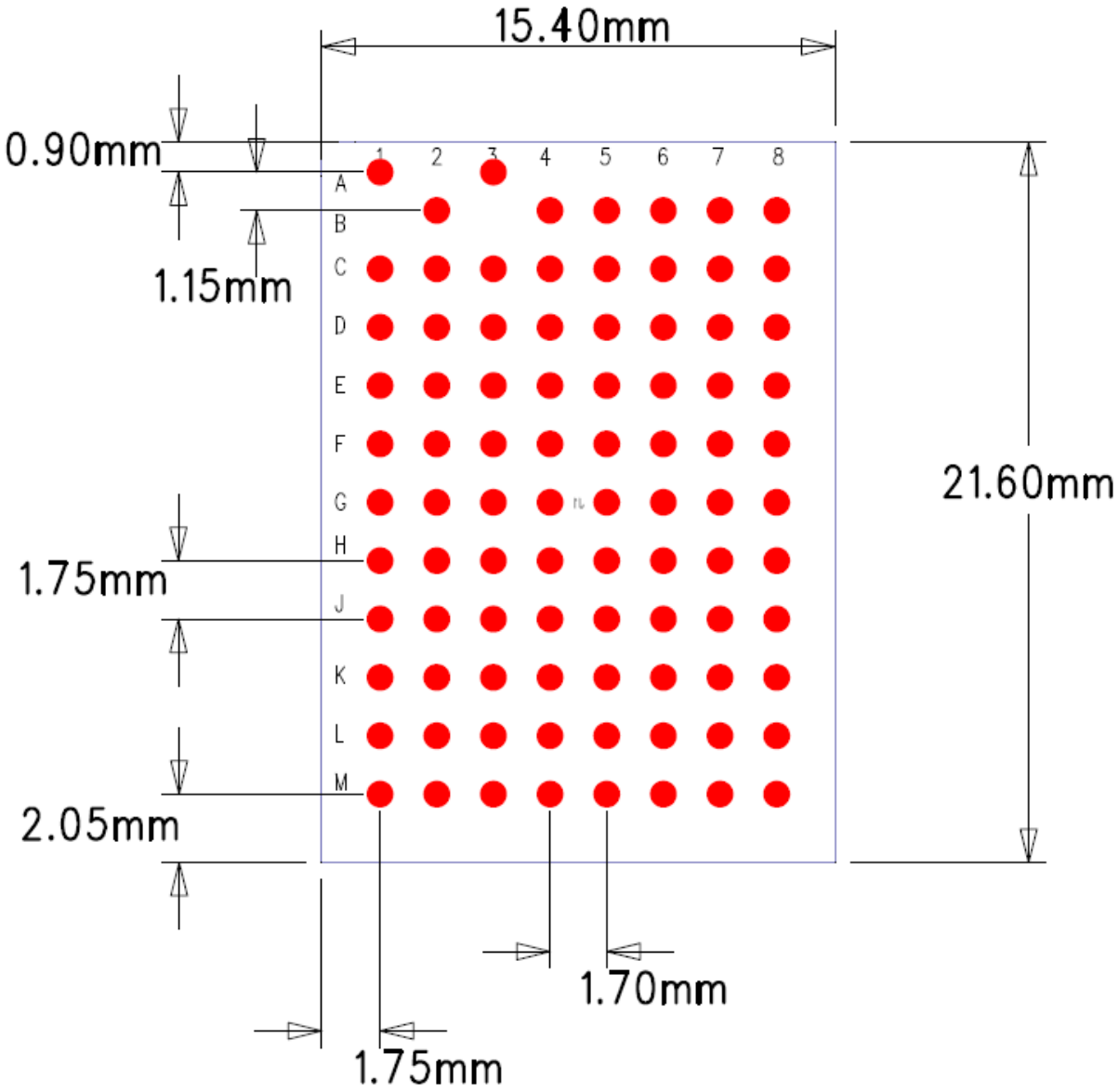


Figure 3: Module solder footprint

5 Hardware specification

The design is based on the following main components:

Description	Module
Baseband	DA14495 (Renesas Electronics)
PA	Skyworks SKY77762
Flash	32Mbit Quad SPI Flash

Table 1: Main components

The Quad SPI Flash memory is used to store the firmware and a non-volatile storage area for storage of tuning and other parameters on the module.

5.1 Electrical specification

The RTX1090 current consumption and power supply requirements depend on the software application (processing load, etc.). Before designing power supply circuitry, please consult your RTX contact. Specifications for typical use are given below.

5.1.1 Indicative current consumption

The actual current consumption for the module depends on the application and peripherals connected. Below is an example for a DECT legacy test setup. Before making assumptions on actual power consumption, please consult your RTX contact, because it is highly dependent on the software features and system load your application will cause e.g., use of core processor and DSP, LED drivers, audio codec front-end, etc.

Description	Conditions	Min.	Typ.*	Max.	Units
FP off mode			1		μA_{rms}
PP off mode			1		μA_{rms}
FP talk mode	Dual Slot		38		mA_{rms}
PP talk mode	Dual Slot		32		mA_{rms}
FP registration mode			13		mA_{rms}
PP registration mode			19		mA_{rms}
FP idle mode			12		mA_{rms}
PP idle mode			13		mA_{rms}

Table 2: Current consumption (RTX1090)

*) Measured values using RTX1090 EVK with VRF = 3.0V, VBAT = 3.9V – power source: rechargeable battery, no LED, no CODEC and DSP idling. Please note that performance data will vary depending on the application.

5.1.2 Recommended operating conditions

Parameter	Description	Min.	Typ.	Max.	Abs. max	Unit
V_{BAT}	Supply voltage on pin VBAT (RTX1090)	3.1		5.0	5.5	V
	Supply voltage on pin VBAT (RTX1090R1)	3.17		5.0	5.5	V
V_{BUS}	Supply voltage on pin VBUS_CHARGE	4.2		5.75	6.5	V
V_{ESD_CDM}	ESD to any pin (Charged Device Model)				250[6]	V
V_{ESD_HBM}	ESD to any pin (Human Body Model)				1.0[7]	kV
V_{DDIO0}	Supply voltage for I/O bank	1.6		3.45		V
V_{DDIO1}	Supply voltage for I/O bank	1.6		3.45		V
V_{DDIO2}	Supply voltage for I/O bank	1.6		3.45		V
V_{RF_PA2}	Supply for RF power amplifier[8]	3.0	3.3	4.6		V
V_{PON}	Voltage on P0_15/PON			5	5.5	V
V_{PIN_LOW}	Low input voltage on a pin	GND		0.3* VDDIO_x	-0.3	V
V_{PIN_HIGH}	High input voltage on a pin	0.7* VDDIO_x		VDDIO_x	VDDIO_x+0.2	V
T_A **Standard**	Ambient temperature operating range Standard version(s)	-20		60		°C
T_A **Extended**	Ambient temperature operating range Extended version (RTX1090R1)	-40		75		°C
Humidity	Non-condensing	30		95		%

Table 3: Recommended operating conditions

ESD HANDLING: Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this module.

[6] Non RF pins can handle 500V ESD CDM
[7] Non RF pins can handle 2000V ESD HBM
[8] Please note that the optimal VRF_PA2 voltage depends on the application SW loaded into the module. A typical voltage for the VRF_PA2 supply is 3.3VDC (as outlined in Table 3~~Table 3~~ above).

5.1.3 DC characteristics

Parameter	Description	Min.	Typ.	Max.	Unit
$Vout_{VDD1V8}$	Output voltage for VDD_1V8	1.71	1.8	1.89	V
$Imax_{VDD1V8}$	Maximum output current for VDD_1V8[9]	100			mA
$Vout_{VDD3V3}$	Output voltage for VDD_3V3[10]	3.13	3.3	3.45	V
$Imax_{VDD3V3}$	Maximum output current for VDD_3V3[11]	100			mA
$Vout_{VSUPPLY}$	Output voltage for VSUPPLY[10]	3.28	3.45	3.62	V
$Imax_{VSUPPLY}$	Maximum output current for VSUPPLY[12]	250			mA
Icharge	Maximum current draw on VBUS for charging on VBAT[13]	360	400	460	mA

Table 4: DC characteristics

5.1.4 Common electrical specifications – GPIO pads

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
V_{IH_reset}	High level for RESET inactive		0.80			V
V_{IL_reset}	Low level for RESET active				0.16	V
V_{IH_pon}	High input level for PON		0.75			V
$V_{IL\ pon}$	Low input level for PON				0.35	V

Table 5: Electrical specifications - recommended operation conditions

5.1.5 Electrical specifications – DC characteristics

Parameter	Description	Min.[14]	Typ.	Max.	Unit
V_{OH}	High level input voltage	0.8*VDDIO_x			V
V_{OL}	Low level input voltage			0.2*VDDIO_x	V
Total sink current of IOs	Drive strength of GPIO, dependent of VDDIO supply	3		8	mA
I_{LED}	Drive strength of LED pins with back drive protection to VSUPPLY			16	mA

Table 6: Electrical specifications - DC characteristics

[9] Without subtracting current consumption from internal module usage (i.e., flash = 25 mA)
[10] This assumes an input voltage on VBAT/VBUS above the specified regulated voltage output (i.e., 3.3V for VDD_3V3 and 3.45V for VSUPPLY). Otherwise, the LDO internally in the module for the output will enter 'pass through' mode, and the output of the LDO will follow the supply voltage, hence losing any features inherited to regulation (i.e., PSRR). For more details see ref. 1.
[11] Without subtracting current consumption from internal module usage (e.g., VDDIO).
[12] Without subtracting current consumption from VDD_1V8 and VDD_3V3.
[13] Charge current can be adjusted in 14 intervals ranging from 5 to 400mA.
[14] VDDIO_x = 2.8V, Iout = 4mA or 8mA.

5.1.6 Electrical specifications – Radio

Condition: Vbat = TBD modulation = TBD, temp = TBD, SW release = TBD

Parameter	Description	Min.	Typ.	Max.	Unit
P_{out}	Output power range[15]	4		26	dBm
P_{step}	Output power step size	TBD	1	TBD	dB
$P_{tolernce}$	Output power variation from nominal selected power level (standard T_a range)[16]		TBD		dB
$P_{tolernce}$	Output power variation from nominal selected power level (extreme T_a range)[16]		TBD		dB
P_{spur_2}	second harmonic power level (fundamental power 22.5dBm)			-30	dBm
P_{spur_3}	Third harmonic power level (fundamental power 22.5dBm)			-30	dBm
P_{spur_4}	Fourth harmonic power level (fundamental power 22.5dBm)			-30	dBm
P_{spur_5}	Fifth harmonic power level (fundamental power 22.5dBm)			-30	dBm
P_{spur_6}	Sixth harmonic power level (fundamental power 22.5dBm)			-30	dBm
P_{spur_other1}	30-1870 MHz		TBD	-36	dBm
$P_{spur\_ other2}$	1910 – 12750MHz		TBD	-30	dBm
$EVM_{\pi/2\text{-}DBPSK}$			TBD	0.14	
$EVM_{\pi/4\text{-}DQPSK}$			TBD	0.14	
EVM_{D8PSK}			TBD	0.09	
$P_{SENS\_GFSK\_25}$	Vbat = 3.7V, @BER = 0.001 GFSK TA = 25°C		TBD		
$P_{SENS\_GFSK\_range}$	Vbat = 3.7V, @BER = 0.001, GFSK, standard T_a range		TBD		
$P_{SENS\_GFSK\_cold}$	Vbat = 3.7V, @BER = 0.001, GFSK, TA = -40 to -20°C (RTX1090R1 only)		TBD		
$P_{SENS\_GFSK\_hot}$	Vbat = 3.7V, @BER = 0.001, GFSK, TA = 60 to 75°C (RTX1090R1 only)		TBD		
$P_{SENS\_\pi/2\text{-}DBPSK\_25}$	Vbat = 3.7V, @BER = 0.001, π/2-DBPSK, TA = 25°C		TBD		
$P_{SENS\_\pi/2\text{-}DBPSK\_range}$	Vbat = 3.7V, @BER = 0.001, π/2-DBPSK, standard T_a range		TBD		
$P_{SENS\_\pi/2\text{-}DBPSK\_cold}$	Vbat = 3.7V, @BER = 0.001, π/2-DBPSK, TA = -40 to -20°C (RTX1090R1 only)		TBD		
$P_{SENS\_\pi/2\text{-}DBPSK\_hot}$	Vbat = 3.7V, @BER = 0.001, π/2-DBPSK, TA = 60 to 75°C (RTX1090R1 only)		TBD		
$P_{SENS\_\pi/4\text{-}DQPSK\_25}$	Vbat = 3.7V, @BER = 0.001, π/4-DQPSK, TA = 25°C		TBD		
$P_{SENS\_\pi/4\text{-}DQPSK\_range}$	Vbat = 3.7V, @BER = 0.001, π/4-DQPSK, standard T_a range		TBD		
$P_{SENS\_\pi/4\text{-}DQPSK\_cold}$	Vbat = 3.7V, @BER = 0.001, π/4-DQPSK, TA = -40 to -20°C (RTX1090R1 only)		TBD		
$P_{SENS\_\pi/4\text{-}DQPSK\_hot}$	Vbat = 3.7V, @BER = 0.001, π/4-DQPSK, TA = 60 to 75°C (RTX1090R1 only)		TBD		
$P_{SENS\_D8PSK\_25}$	Vbat = 3.7V, @BER = 0.001, D8PSK, TA = 25°C		TBD		
$P_{SENS\_D8PSK\_range}$	Vbat = 3.7V, @BER = 0.001, D8PSK, standard T_a range		TBD		
$P_{SENS\_D8PSK\_cold}$	Vbat = 3.7V, @BER = 0.001, D8PSK, TA = -40 to -20°C (RTX1090R1 only)		TBD		

[15] Range is configured via SW to comply with regulatory requirements. Max. allowed power in EU/JP: 24dBm and US: 23.5dBm EIRP (if antenna gain is above 3dB, then the power level shall be reduced. For more information, please refer to reference no. 1.
[16] To obtain optimum variation from nominal power level, please refer to reference no. 1.

Parameter	Description	Min.	Typ.	Max.	Unit
$P_{SENS\_D8PSK\_hot}$	Vbat = 3.7V, @BER = 0.001, D8PSK, TA = 60 to 75°C (RTX1090R1 only)		TBD		
$P_{BL\_GFSK\_1}$	Blocker power level 25-1780MHz. P_fund: -80dBm, GFSK, BER@0.001	-23	> -5		dBm
$P_{BL\_GFSK\_2}$	Blocker power level 1780-1875MHz. P_fund: -80dBm, GFSK, BER@0.001	-33	TBD		
$P_{BL\_GFSK\_3}$	Blocker power level 1876-18XXMHz. P_fund: -80dBm, GFSK, BER@0.001	-43	TBD		
$P_{BL\_GFSK\_4}$	Blocker power level 18xx-18XXMHz. P_fund: -80dBm, GFSK, BER@0.001	-43	TBD		
$P_{BL\_GFSK\_5}$	Blocker power level 1905-2000MHz. P_fund: -80dBm, GFSK, BER@0.001	-33			
$P_{BL\_GFSK\_6}$	Blocker power level 2000-2400MHz. P_fund: -80dBm, GFSK, BER@0.001	-23			
$P_{BL\_GFSK\_7}$	Blocker power level 2400-2500MHz. P_fund: -80dBm, GFSK, BER@0.001	-23			
$P_{BL\_GFSK\_8}$	Blocker power level 2500-5x00MHz. P_fund: -80dBm, GFSK, BER@0.001	-23			
$P_{BL\_GFSK\_9}$	Blocker power level 5x00-6000MHz. P_fund: -80dBm, GFSK, BER@0.001	-23			
$P_{BL\_GFSK\_10}$	Blocker power level 6-12.75GHz. P_fund: -80dBm, GFSK, BER@0.001	-23	> -5		

5.2 Module pin specification

The pin-out specification is listed in the following table.

Pin	Port name	Function	Direction	Reset state[17]	DA14495 pin no.
A1	A1	Antenna 1	Input/output		
A3	A2	Antenna 2	Input/output		
B2	GND	GND			
B4	GND	GND			
B5	GND	GND			
B6	VRF_PA2	RF PA2 supply	Input		
B7	P2_6	GPIO LED_0	Input/output	I-PU	B10
B8	GND	GND			
C1	GND	GND			
C2	GND	GND			
C3	GND	GND			
C4	P2_2	GPIO	Input/output	I-PD	B8
C5	P2_3	GPIO	Input/output	I-PD	B9
C6	GND	GND			
C7	GND	GND			
C8	P2_7	GPIO LED_1	Input/output	I-PU	B11
D1	P2_4	GPIO	Input/output	I-PD	C9
D2	P2_5	GPIO	Input/output	I-PD	A10
D3	P2_0	GPIO	Input/output	I-PD	B7
D4	P2_1	GPIO	Input/output	I-PD	C8
D5	P2_10	GPIO	Input/output	I-PD	C11
D6	P2_11	GPIO. If high during reset: Test mode entered.	Input/output	I-PD	D11

[17] Whenever Reset is active this is the pin state. I: Input. PU: Pull-Up. PD: Pull-Down. F: Floating.

Pin	Port name	Function	Direction	Reset state[17]	DA14495 pin no.
D7	P1_5	P1_5 QSPI2_IO2	Input/output QSPI2 data I/O 2	I-PD	F11
D8	GND	GND			
E1	GND	GND			
E2	P0_15	P0_15/ PON	Input	I-PD	K3
E3	P0_14	P0_14/ ADC0/ NTC	Input/output Analog input	I-PD	F2
E4	P2_9	GPIO	Input/output	I-PD	C10
E5	GND	GND			
E6	P1_6	GPIO	Input/output	I-PD	E11
E7	P1_4	P1_4 QSPI2_IO1	Input/output QSPI2 Data I/O 1	I-PD	G11
E8	P2_8	GPIO LED_2	Input/output	I-PU	D10
F1	$\overline{\text{RESET}}$	Reset	Input	I-PU	C2
F2	P0_13	P0_13/ ADC1/ COMP	Input Analog input	I-PD	G2
F3	GND	GND			
F4	P1_9	Reserved, do not connect	Do not connect		
F5	P1_8	Reserved, do not connect	Do not connect		
F6	P1_7	Reserved, do not connect	Do not connect		
F7	P1_3	P1_3 QSPI2_CS	Input/output QSPI2 chip select	I-PU	H11
F8	VDDIO_2	Supply for GPIO bank 2	Input		A9
G1	GND	GND			
G2	P0_12	P0_12/ SPDIF_IN	Input Analog input	I-PD	K4
G3	P0_5	GPIO	Input/output	I-PD	K5
G4	P0_10	GPIO	Input/output	I-PD	K8
G5	GND	GND			
G6	GND	GND			
G7	P1_2	P1_2 QSPI2_IO3	Input/output QSPI2 Data I/O 3	I-PD	H12
G8	GND	GND			
H1	P0_11	P0_11/ BXTAL	Input/output	I-PD	J3
H2	P0_3	GPIO	Input/output	I-PD	L3
H3	P0_2	GPIO. If high during reset: Wait loop mode for HW debug.	Input/output	I-PD	L4
H4	GND	GND			
H5	P1_11	GPIO	Input/output	I-PD	J11
H6	P1_10	GPIO	Input/output	I-PD	K11
H7	P1_1	P1_1 QSPI2_SCK	Input/output QSPI2 clock	I-PD	J12
H8	VDDIO_1	Supply for GPIO bank 1	Input		L12
J1	GND	GND			
J2	P0_1	GPIO	Input/output	I-PD	L5
J3	P0_0	GPIO. If low during reset: UART Boot mode	Input/output	I-PU	L6
J4	P0_9	GPIO	Input/output	I-PD	K9
J5	P1_12	GPIO	Input/output	I-PD	K10

Pin	Port name	Function	Direction	Reset state[17]	DA14495 pin no.
J6	GND	GND			
J7	P1_0	P1_0 QSPI2_IO0	Input/output QSPI2 Data I/O 0	I-PD	K12
J8	VDDIO_0	Supply for GPIO bank 0	Input		M9
K1	VDD_1V8	1V8 digital supply	Output		J1
K2	GND	GND			
K3	P0_4	GPIO / 32k xtal out	Input/output	I-PD	L7
K4	P0_8	GPIO	Input/output	I-PD	L10
K5	GND	GND			
K6	SWDIO	ARM debug (for debug purposes only)	Input/output	I-PU	L8
K7	SWCLK	ARM debug (for debug purposes only)	Input	I-PD	L9
K8	GND	GND			
L1	VDD_3V3	3V3 digital supply	Output		J2
L2	SOCN	Battery fuel gage	Input		K2
L3	SOCP	Battery fuel gage	Input		L2
L4	GND	GND			
L5	P0_6	GPIO / 32k_xtal1	Input/output Analog in	I-PD	M11
L6	GND	GND			
L7	P0_7	GPIO / 32k_xtal2	Input/output Analog out	I-PU	M12
L8	VDD_USB	Supply to USB_LDO	Output		M6
M1	VSUPPLY	LED supply	Output		K1
M2	GND	GND			
M3	VBAT	Main supply	Input		L1/M1
M4	VBUS_CHARGE	VBUS / VCHARGE	Input		M5
M5	GND	GND			
M6	USB_DM	USBN	Input/output	F	M7
M7	USB_DP	USBP	Input/output	F	M8
M8	GND	GND			

Table 7: RTX1090 pin description

6 Design guidelines

The following section contains guidelines and practical advice to system designers, to obtain the best performance using the RTX1090 module.

6.1 External parts

Outside the RTX1090, a power supply and antenna circuit shall be designed. This design is the responsibility of the customer. RTX can participate in review of the carrier board design (antenna circuit, power supply, module placement, etc.) and provide the customer with suggestions and best practice advice to optimize the performance and design.

The RTX1090 features multiple applications, thus the need for external parts depends on the application. Hence, the exact needs and recommendations are application specific, thus only guidelines are provided below. It is always recommended to consult your RTX contact for the specific needs.

6.1.1 Antennas

It is recommended to start the antenna design when making the initial mechanical design, because a good antenna can make a significant difference to the end product range performance. The following antenna design items should at least be considered during the mechanical design phase:

- Well separated from other electronics and each other
- Placed in non-shielded environment
- Impedance matched in representative environment

The RTX1090R1 module has modular approvals for USA and Japan with the following antenna requirements: PCB antenna usage as on the RTX1x90EVK, with maximum gain of 6dBi and dimensions 28 mm long and 6,5 mm wide.

6.1.2 Module placement on carrier board

Although the module is small, it would be beneficial to consider mechanical forces close to the module (e.g., placing a push button close to the module could cause the module soldering to break due to repeated use of the button i.e., the mechanical force on the carrier board could cause the carrier board to bend slightly).

6.1.3 Power supply

Please refer to the guidance delivered with the specific product firmware.

6.2 Test interface

The module has a UART test interface, which supports the RTX UART interface specification as this interface will be used during the RTX development and production. In addition to this interface, an ARM debug interface is available. This ARM debug interface will be used during development at RTX as well. For details regarding this interface, please see reference no. 1. The UART interface is reserved for development, verification, production test purpose, and normal UART communication. The UART interfaces is available for the application design. It is recommended to include exclusive access to the UART for monitoring and control of the application during, e.g., product approval.

The following connections will be available.

Function	Pin name
Ground	GND
UART RX	J2
UART TX	J3
ARM debug interface	K6, K7

Table 8: Test and debugging interface

7 Soldering profile

As shown below, the RTX1090 should be soldered using a standard reflow soldering profile and standard solder paste (Sn96.5 / Ag3 / Cu0.5 alloy). Solder paste supplier is Indium Corporation. Adjustments to the profile may be necessary, depending on the process requirements. Consequently, the following information represents a typical starting point for the optimization process in relation to the specific solder profile for use in the specific product.

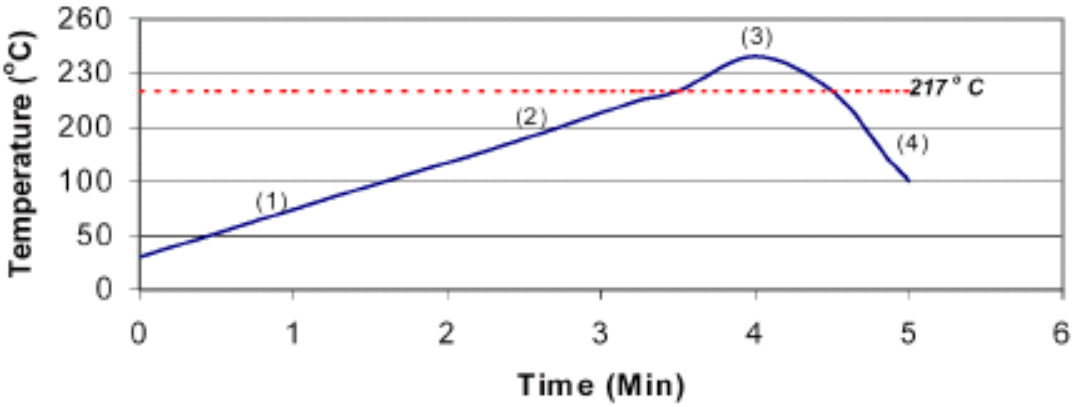


Figure 4: Solder paste composition

7.1 Preheat

The temperature rise from room temperature to 150 degrees shall be made for 30 seconds or longer - typically 90 – 120 seconds. A linear ramp rate of 0.5 – 2.0 degrees/second allows gradual evaporation of volatiles.

7.2 Soak or dry-out

When 150 degrees is reached, the temperature rises to 190 degrees with a continued linear ramp of 0.5 – 2.0 degrees/second - typically 90 – 120 seconds. This stage serves to activate the flux and stabilize the temperature across the board. The uniform heating allows a more linear ramp rate right up to liquid temperature.

7.3 Reflow

The linear ramp rate of 0.5 – 2.0 degrees/second is continued up to the point of liquidus. When liquidus is reached, the temperature should rise with about 1 - 2 degrees/second to a spike 15 - 43 degree above liquidus to form a quality solder joint. Time above liquidus should be 30 - 90 seconds to reduce excessive inter-metallic compound. Thermal damage and charring of the post-reflow residue can also result from excessive time above liquidus and/or too high a peak temperature.

7.4 Cooling

A rapid cooldown of < 4 degrees/second is desired to form a fine grain structure. Slow cooling will form a large grain structure, which typically exhibits poor fatigue resistance. If excessive cooling > 4 degrees/second is used, both the component and the solder joint can be stressed due to a high TCE mismatch. Stencil thickness of 0.150mm is recommended.

8 Packaging of module

The RTX1090 module is delivered in a tape on reel solution (see chapter 11 for details).

Module software
Production software only. Module is intended to be programmed when deployed in actual product.

Packaging material and quantity
The RTX1090 module is delivered as a tape and reel cassette with 1000 pcs. per cassette.

Packaging floor and shelf-life
The tape and reel cassettes are sealed in an anti-static bag with an anti-moisture pad and a humidity indicator. The shelf and store life are defined to be MSL level-3 according to the IPC/JEDEC standard J-STD-033B.1. This means 168 hours of floor life and typically 5 years (minimum 1 year) of shelf life before baking is needed. The anti-moisture pad inside the sealed anti-static bag will tell if baking is necessary.

9 Standard and approvals

The RTX1090/R1 is designed to meet the standards listed below when integrated in target applications. Conformance with the standards is dependent on the software application, the product type, and its application context. Therefore, please be aware that this section cannot be used as a confirmed list across all possible product use cases.

Please consult your RTX contact and align on the requirements for your specific firmware configuration.

9.1 Radio, EMC, and safety

Japan type approvals	Japan standard
Radio and EMC	ARIB STD T-101 TELEC-T254

Table 9: Japan type approvals

EU type approvals	EU standard
Radio	ETSI EN 301 406 V2.2.2:2016
EMC	ETSI EN 301 489-1 V2.2.3:2019, EN 301 489-6 V2.2.1:2019
Safety	IEC/EN 62368-1:2020 + A11:2020
RoHS	2011/65/EU + 2015/863/EU (the RoHS Directive)
SAR	EN 50385 (Confirmation Certificate or SAR Impact assessment may be enough)
Environmental	Comply with European RoHS & REACH requirements

Table 10: EU type approvals

US type approvals	US standard
Radio and EMC	FCC Part 15, subpart D. (1920 – 1930 MHz)
SAR	FCC guideline (OET bulletin 65 Suppl. C: 2001)
UL	UL94 V-0

Table 11: US type approvals

9.2 Environmental

Parameter	Requirement
Temperature	RTX1090 : -20°C to 60°C RTX1090R1 : -40°C to 75°C
Humidity	30 - 95%, non-condensing
Environmental stress (RTX1090R1 only)	• IEC 60945 section 8.7 (2-5 Hz and up to 100 Hz @ 7 m/s^2, with frequency sweep for resonances) • MIL-STD-810H, Method 516.8, Option 1: Procedure I, Functional Shock or Crash Hazard Shock Test: 18 Terminal-peak sawtooth pulse at 30g for 18msec. • MIL-STD-810 H, Methods 514.8, Vibration, Proc. I, General Vibration • MIL-STD-810 H, Methods 516.8, Transit Drop: Drop from 122 cm height @all faces, edges, corners. • MIL-STD-167-1A, 5.1.2.4.2 Exploratory vibration test, 4-33 Hz sweep, 2-hour test at 33 Hz.

Table 12: Environmental

10 Product labeling

Figure 5: Product labeling RTX1090

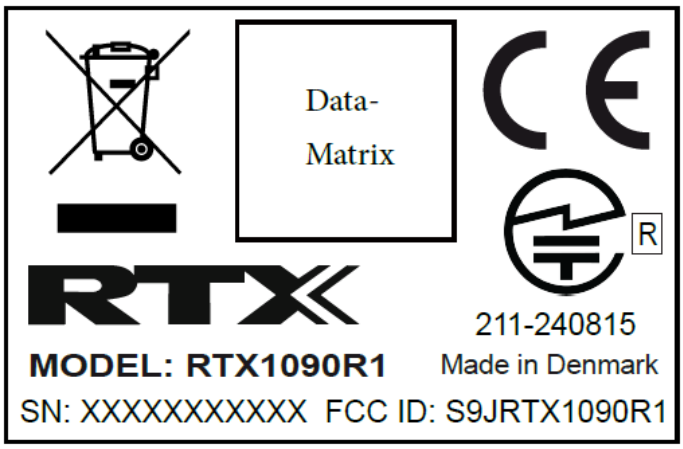


Figure 6. Product labelling RTX1090R1 - size: 17 (L) x 11 (H) mm

10.1 Serial number definition

The serial number uses the syntax ”YYWWAXXXXXX” based on the following information:

- Digit 1-4: YY = production year, WW = production week
- Digit 5: A = a (unique RTX1090 identifier)
- Digit 6-11: XXXXXX = serial number incrementing by one for each unit

Hence, from the label example above, the following information can be extracted:

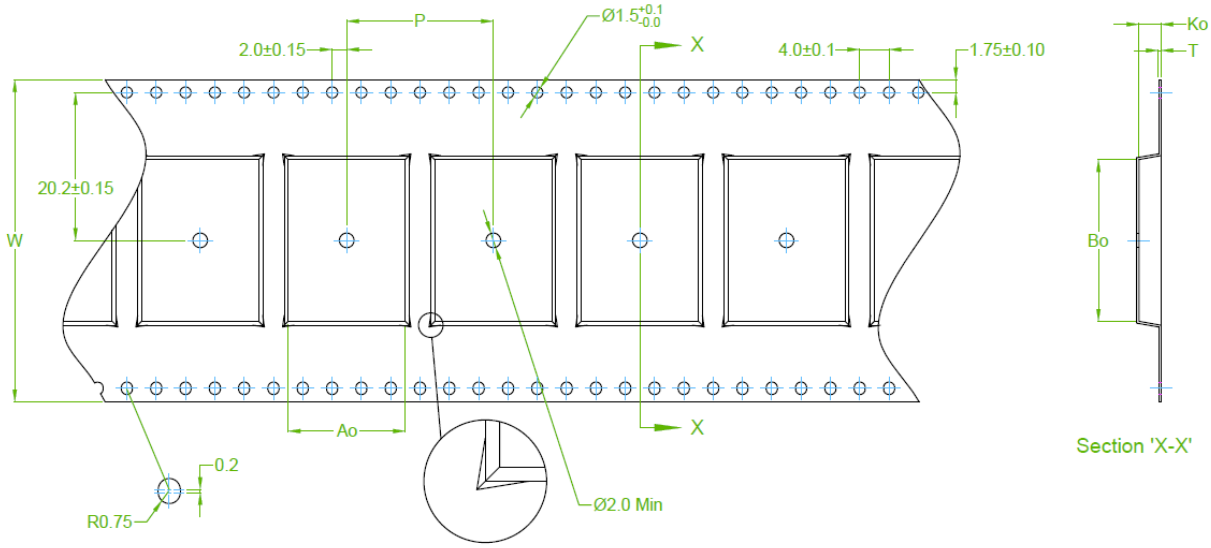
- Production year = 2018
- Production week = 35
- Serial number = 000001

10.2 Barcode

ECC200 data matrix: product serial number

11 Tape and reel specification

Measurements of the tape and reel solution is provided in figure 7 below. The module is placed in the chambers with the shield, and the label is visible through the clear protective membrane.



DIMENSIONS	
Ao	16.00 ±0.10
Bo	22.10 ±0.10
Ko	3.00 ±0.10
P	20.00 ±0.10
T	0.30 ±0.05
W	44.00 ±0.30

NOTES:

ALL DIMENSIONS IN MILLIMETRES
10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ± 0.20
MATERIAL: CONDUCTIVE POLYSTYRENE
CAMBER NOT TO EXCEED 1.0mm IN 250mm

Figure 7: Tape and reel specification

The module is placed in the chambers as outlined in figure 8 below i.e., with the cut corner placed in the lower left corner according to the feeding direction.

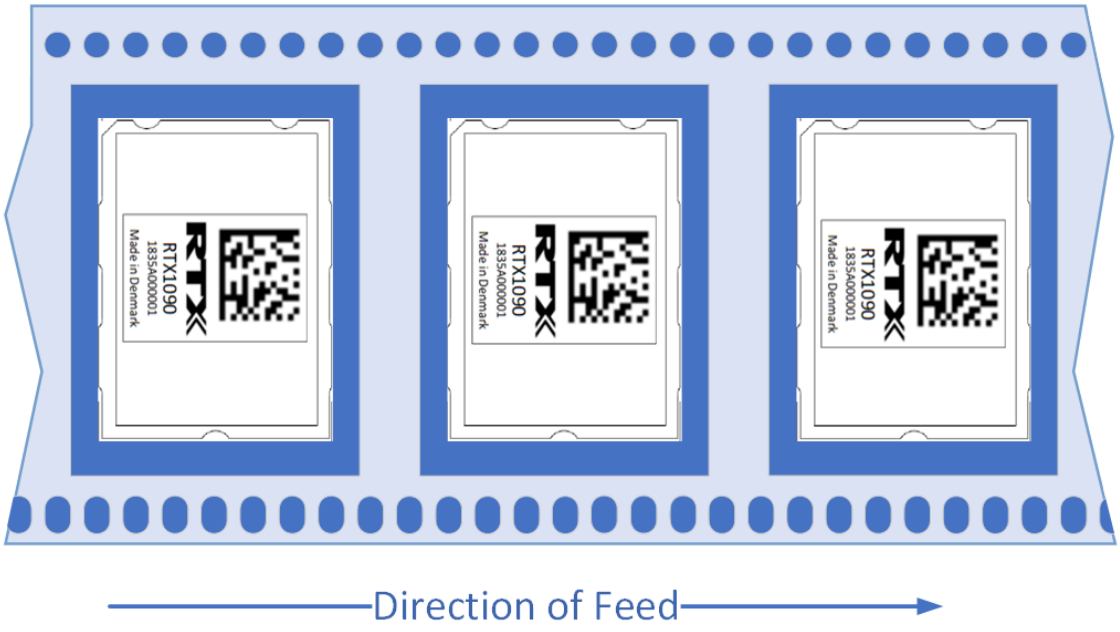


Figure 8: Module feed direction from reel

12 Environmental declaration

BOM check https://www.bomcheck.net/ is used for declaration of ROHS/REACH. Please request the latest declaration from your RTX contact.

13 Life cycle notifications

Any life cycle notifications related to the module will be available at ww.rtx.dk. Customers having ordered the module for production purpose within the last 12 months will be notified.

In the case of an End-of-life (EOL) notification, the period, from the EOL notification to Last Time Buy, will be a minimum of six months.