FUJITSU Component Wireless Module

Doppler Radar Sensor

FWM7RAZ01 User's Guide

Rev 1.6

Dec 12, 2019

FUJITSU COMPONENT LIMITED

The above Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated (1)for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2)for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite), hereinafter referred to as "High Safety Required Use".
You shall not use this Product without securing the sufficient safety or reliability required for the High Safety Required Use. If you wish to use this Product for High Safety Required Use, please consult with our sales representatives in charge before such use.

Contents

1. Introduction

In this users' guide, the information of the parameter to be noticed and the procedure to determine the external components to be implemented to use Doppler Radar Sensor are described.

Please test and evaluate your actual use condition since the contents of this users' guide does not cover the all the condition of the actual use.

Please refer to "Doppler Radar Sensor FWM7RAZ01 Data Sheet" for the detailed FWM7RAZ01 specifications.

2. Block diagram

Fig. 1 shows the block diagram of FWM7RAZ01.
This users' guide contains, the procedure of Gain and noise calculation of RF transceiver, Tx/Rx antenna and IF amplifier enclosed by dotted line, and the gain setting of the external amplifier based on the actual application.

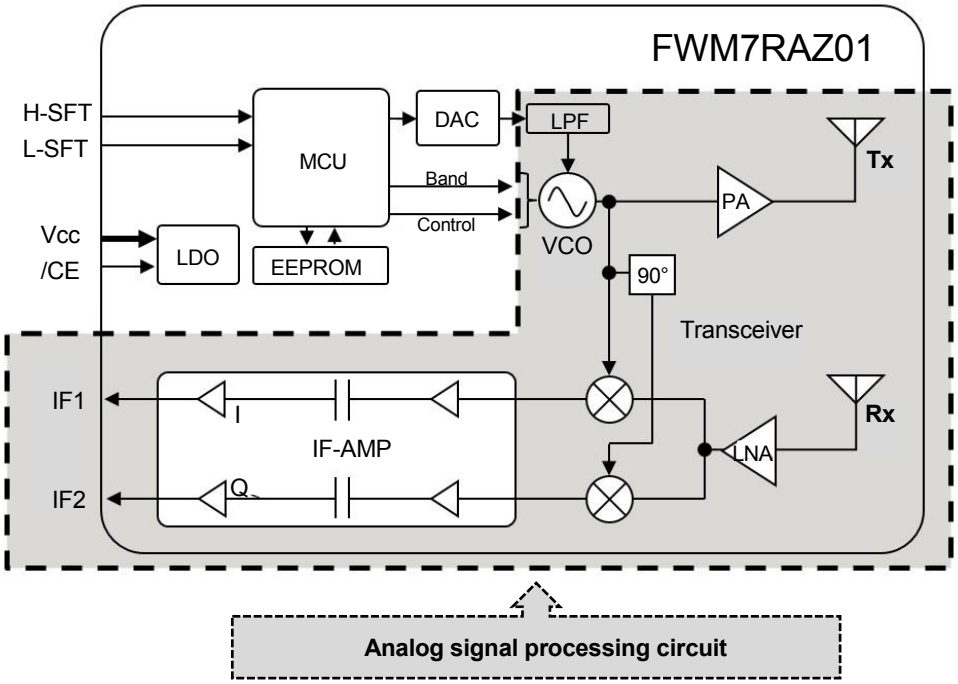


Fig. 1 Block diagram

3. Signal gain

3-1. Gain between power feed point of Tx and Rx (Propagation Loss)

This Doppler Radar Sensor receive the radio wave, which the Doppler Radar Sensor transmitted, reflected from object.
The attenuation at the reflection depends on the cross section and material of the object.

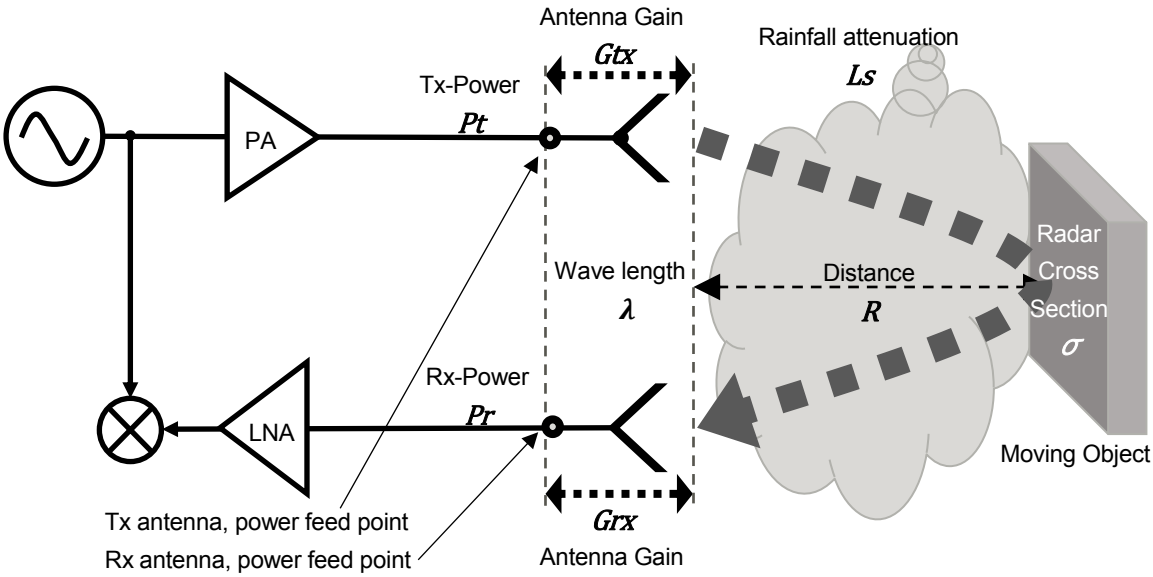


Fig.2 Reflection and propagation conditions

In case the object consists of metal, the signal level between Tx antenna power feed point and Rx antenna power feed point is generally calculated by the formula (1) below.

$$P_r = \frac{P_t\, G_{tx}\, G_{rx}\, \lambda^2\, \sigma}{(4\pi)^3\, R^4\, Ls} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (1)$$

Physical Constants

- Light speed : $C\ [m/s] = 2.998 \times 10^8$
- RF(carrier) : $F_C[Hz] = 2.4 \times 10^{10}$
- Wave length : $\lambda\ [m] = \frac{C}{F_c} = 1.24 \times 10^{-2}$

FWM7RAZ01 eigenvalues

- PA Tx power : $P_t[W] = -1dBm = 0.0008$[W]
- Tx antenna gain : $G_{tx} = G_{rx} = 12dBi = 15.8$
  Note) Gain is max value.

Application dependent parameters

- Distance to object : $R\ [m]$
- Rainfall attenuation : $L_s\ [dB]$
- Radar Cross Section (RCS) : $\sigma\ [m^2]$
  (Caution) **This RCS is not equal to a cutting cross section**
  The measure of a target's ability to reflect radar signals in the direction of the radar receiver.

Samples of RCS (σ)

0.01m²	= Crow
0.5m²	**= Adult man**, Coke can
1～5m²	= Car
A few hundred m²	= 1m² Metal plate

（Please note that it varies depending on the shape and material of the object.）

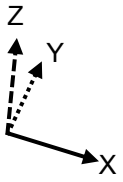
（example） Parameter $\sigma = 0.5m^2$ **as adult man,** $R = 10m, Ls = 1 (= 0dB)$
Result $P_r = -91.1dBm = 7.74 \times 10^{-13}$ ***[W]***

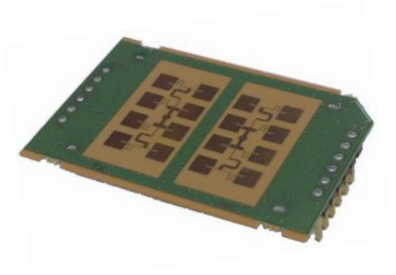
The receiving signal level is subject to the reflection by object direction or side wall. Please test and evaluate under condition of actual use.

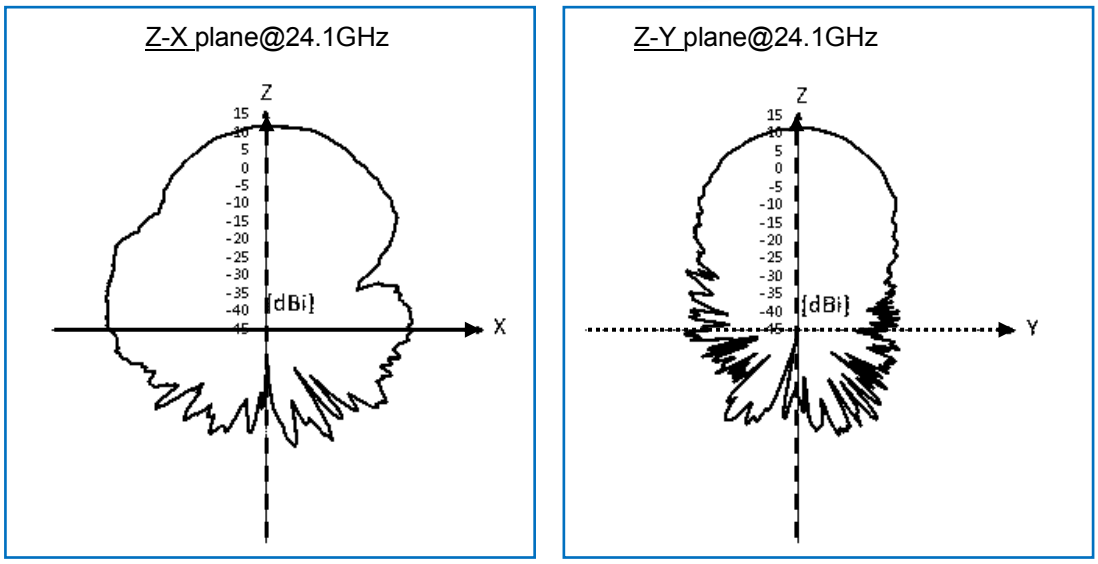
3-2. Gain and Directional characteristics of Tx and Rx antenna

Antenna on FWM7RAZ01 is the directional type which gain is 12dBi max.
Fig. 3 shows Radiation pattern

2×4 Patch Antenna
Gtx = Grx = +12 dBi (max)







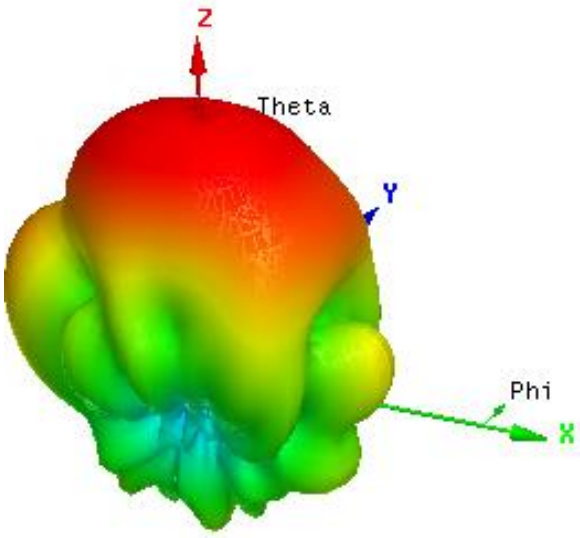


Fig. 3 Directional characteristics of antenna

- The directivity is the maximum in Z-direction. Please embed FWM7RAZ01 according to the direction to detect.
- The misdetection will occur if there is a vibrating or moving obstacle between antenna and object. The radio characteristics is influenced if there is a moving metal or radio wave absorbent.
  Please consider these factors to determine the layout.

3-3. Gain of Rx circuitry

Voltage gain from power feed point of Rx antenna(LNA input) to IF amplifier output is calculated by the formula (2).

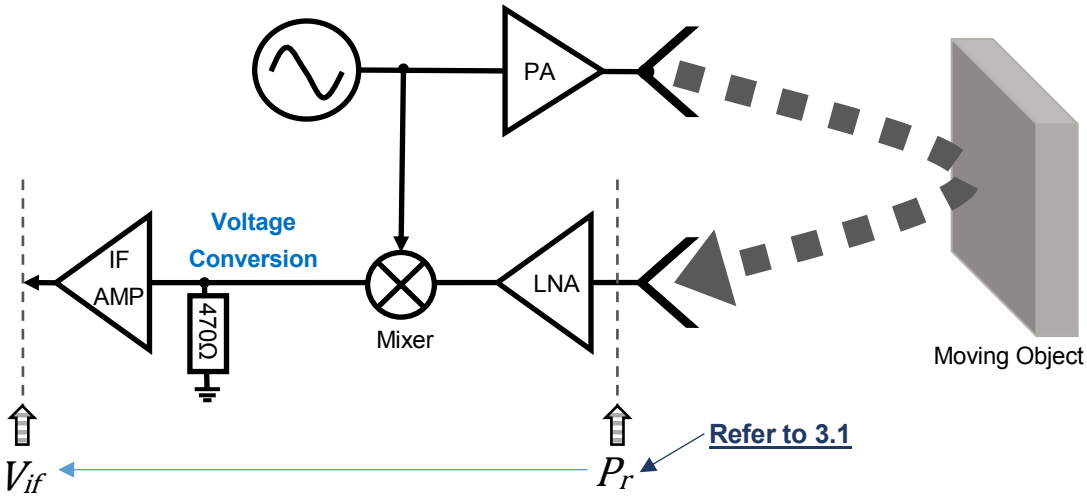


Fig. 4 Gain of Rx circuitry

$$V_{if} = 1533\sqrt{P_r}\ \text{[Vrms]} \quad \ldots\ldots\ldots\ldots\ldots\ (2)$$

Using P_r value calculated at Example (adult man) in section 3-1, the output voltage at IF1(I) and IF2(Q) is resulted as,

V_{if} = 1.35 [mVrms]

It is recommended to implement the external amplifier before the signal processing of FWM7RAZ01 IF output since IF output voltage (amplitude) level is very low in example. Please calculate the necessary gain with considering the distance to object and size of object at the implementation of the external amplifier.

3-4. Implementation of external amplifier (example)

Terminals of IF(I) and IF(Q) output can be connected to the eternal amplifier directory(DC connection). Maximum output is 3.3Vp-p (Bias voltage = 1.65Vdc).

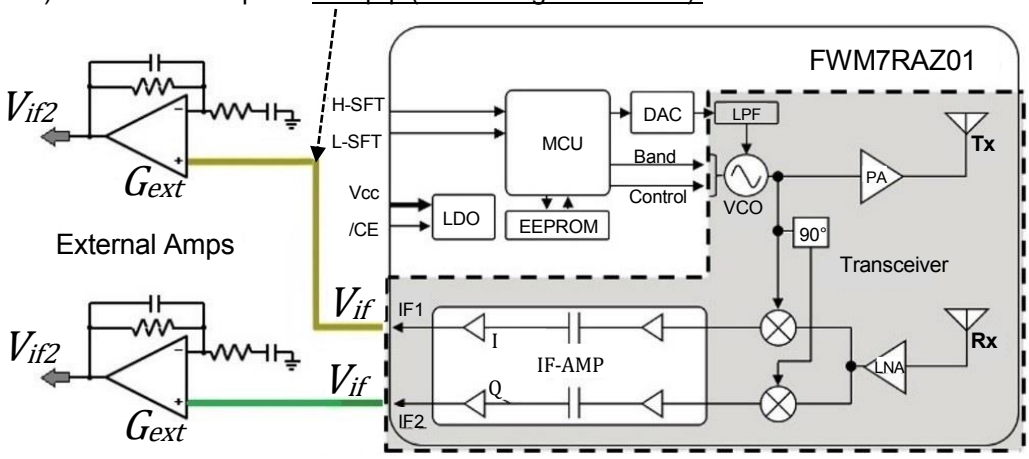


Fig. 5 Connection of external amplifier (example)

4. Relation between noise level at IF output and detectable distance

The detectable distance depend on the signal to noise ratio at IF output terminal.
External amplifier may be necessary as amplitude of IF output is small.
IF noise level inside this module(S/N) shall be well considered when the external amplifier is added since the external amplifier amplify not only the desired wave but also the noise.
Noise at IF1/2(I/Q) output arise from RF circuitry block and IF amplifier block.

P_{mix_noise} is the noise power at output of 50 ohm mixer.

V_{if_noise} is the effective value of the voltage of the converted input noise of IF amplifier, and calculated by the formula (3) and (4) below.

$$P_{mix\_noise} = kTBFG_{rf} \quad [W] \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (3)$$

$$V_{if\_noise} = G_{if}\sqrt{470\,P_{mix\_noise} + (E_n)^2} \quad [Vrms] \quad \cdots\cdots \quad (4)$$

Physical Constants

- Boltzmann constant $: k = 1.38 \times 10^{-23}$
- Absolute temp.(room temp. 25℃) $: T[k] = 298.15$

FWM7RAZ01 eigenvalue

- Noise factor(positive number) $: F = 2.5$
- RF power gain $: G_{rf} = 17dB = 50$
- IF-amp voltage gain $: G_{if} = 20dB = 10$
- IF band width $: B$ [Hz]
- IF-amp input conversion noise $: E_n[Vrms] = 3.56 \times 10^{-7}$ (at B=1Hz - 1kHz)
  $= 9.25 \times 10^{-7}$ (at B=1Hz - 10kHz)
  $= 25.9 \times 10^{-7}$ (at B=1Hz -100kHz)

Application dependent parameter

- IF band width $: B[Hz]$ ← with consideration for object max. speed

V_{if_noise} Calculation example

IF band width: B	Converted speed	Noise level: V_{if_noise}
1Hz - 1kHz	0.022 - 22km/h	0.6 uVrms
1Hz - 10kHz	0.022 - 223km/h	1.8 uVrms
1Hz - 100kHz	0.022 - 2234km/h	5.6 uVrms

It is recommended to use the amplifier with the noise as low as possible since the noise of the external amplifier connected to IF1/2(I/Q) terminals is added.

5. Relation between IF signal frequency and object speed

The faster Object moves, the bigger the frequency difference between Tx and Rx. Then, higher the IF frequency. The relation between IF signal frequency and object speed is shown by the formula (5) below.

$$V_{speed} = \frac{C\, F_{if}}{2\, F_c} \quad [m/s] \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots (5)$$

- IF frequency : $F_{if}[Hz]$
- RF(carrier) frequency : $F_C\ [Hz] = 2.4 \times 10^{10}$
- Speed of light : $C\ \ [m/s] = 2.998 \times 10^{8}$

The table below is the calculation example of the formula (5).

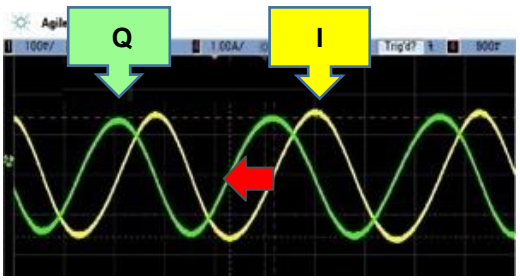
Calculation example

IF frequency	Calculated speed	Remarks
45Hz	1km/h	Swimming speed
224Hz	5km/h	Walking speed
540Hz	12km/h	Bicycle speed
2240Hz	50km/h	Car speed
4480Hz	100km/h	Car speed on high way

6. Relation between IF signal phase and moving object

6-1. Output signal waveform of IF(I-signal) and IF(Q-signal)

This module outputs I-signal and Q-signal those phase different by 90 degrees as IF signal by the orthogonal modulation/demodulation circuitry consisting of mixer, VCO, and phase shifter.
The frequencies corresponding to the object speed. The wave forms between I-signal and q-signal are almost same each other.

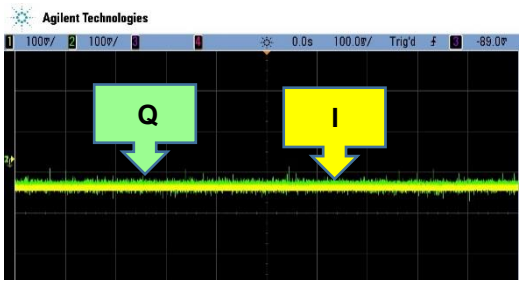


(Tx radio frequency) < (Rx radio frequency)

→ Q lead I by 90 degrees

(Tx radio frequency) > (Rx radio frequency)

→ Q lag behind I by 90 degrees



(Tx radio frequency) = (Rx radio frequency)

→ Neither Q nor I has signal (=DC)

Both Q and I has 0Hz when movin

Fig. 6 Wave forms of "I" and "Q"

As shown in Fig.6, by Doppler effect, when Rx frequency get higher than Tx frequency, Q-signal leads to I-Signal by 90 degrees, when lower, Q-signal lags to I-signal by 90 degrees. This correlation is same for different frequency.
In case the object not moving only, only DC signal (0Hz) is output.

6-2. Application – Approaching/receding judgement by IF1/2(I/Q) output

As mentioned above, it is possible to judge if the object is approaching or receding. Fig.7 shows the waveform observed as I-signal and Q-signal on Oscilloscope, when there is the object with a movement back-and-forth in front of sensor module, ie hands move back-and-forth.

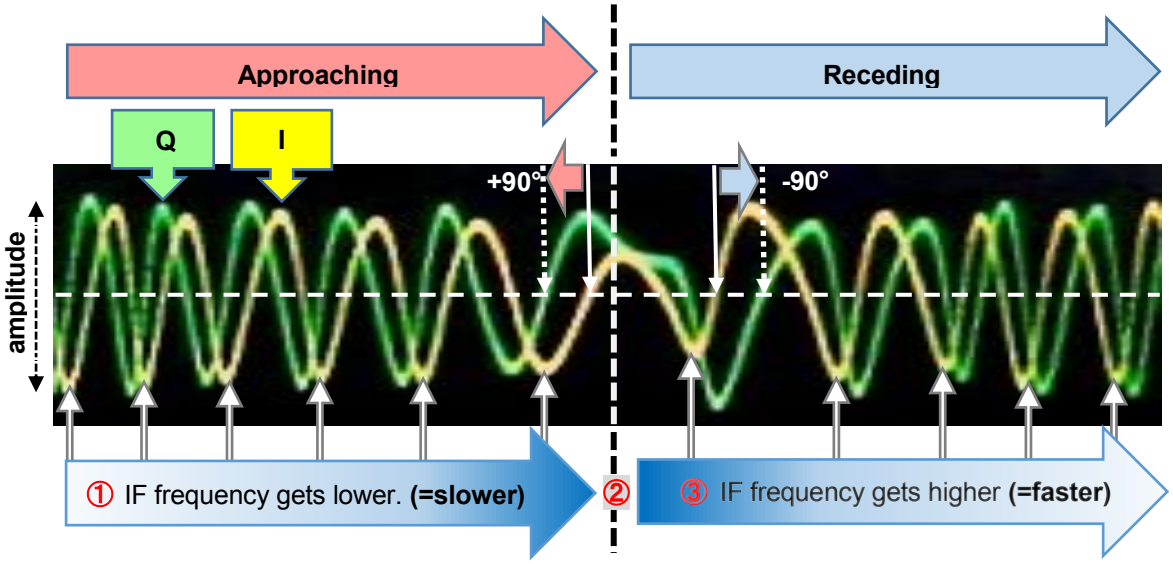


Fig.7 Approaching/receding judgement

The waveform above shows the back-and-forth movement as below.

① The object is approaching to FWM7RAZ01 with decreasing the speed. (approaching)
② The speed gets Zero at the center (stop)
③ The object is receding with increasing the speed to opposite direction. (receding)

The approaching/receding can be judged by Plus/Minus of the phase difference 90 degrees between I-signal and Q-signal.
In the measurement above Fig.7, since the distance is 50cm of short range, the waveform is the IF1(I)/IF2(Q) directly observed without the external amplifier.

7. FCC and ISED statement

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

[for FCC]

FCC CAUTION Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15.245 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: —Reorient or relocate the receiving antenna. —Increase the separation between the equipment and receiver. —Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. —Consult the dealer or an experienced radio/TV technician for help. The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Company Name may void the user's authority to operate the equipment.

FCC Radiation Exposure Considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body. If the device built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by §2.1091

[for ISED]

[English] This device complies with Innovation, Science and Economic Development Canada's licence-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] Cet appareil est conforme aux flux RSS exemptés de licence d'Innovation, Science et Développement économique Canada. L'opération est soumise aux deux conditions suivantes: (1) Cet appareil ne doit pas provoquer d'interférence; et (2) Cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

ISEDC Radiation Exposure Statement

[English] Radiation Exposure Statement: This equipment complies with the IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.
[French] Énoncé d'exposition aux rayonnements: Cet équipement est conforme aux limites d'exposition aux rayonnements ioniques RSS-102 Pour un environnement incontrôlé. Cet équipement doit être installé et utilisé avec un Distance minimale de 20 cm entre le radiateur et votre corps.

OEM Warning statement (Module)

The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC/IC identification number：

[English] If using a permanently affixed label, the modular transmitter must be labeled with its own FCC/IC identification number, and, if the FCC/IC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: SQK-7RAZXX, IC: 337L-7RAZXX” Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.
[French] Si vous utilisez une étiquette collée en permanence, le transmetteur modulaire doit porter son propre numéro d'identification FCC / IC, et si le numéro d'identification FCC / IC n'est pas visible lorsque le module est installé dans un autre appareil, l'extérieur de l'appareil dans sur lequel le module est installé doit également afficher une étiquette faisant référence au module inclus. Cette étiquette extérieure peut utiliser les libellés suivants: «Contient le module émetteur, ID FCC: SQK-7RAZXX, IC: 337L-7RAZXX». Tout libellé similaire exprimant le même sens peut être utilisé. Le bénéficiaire peut soit fournir une telle étiquette, dont un exemple doit être inclus dans la demande d’autorisation d’équipement, soit fournir des instructions adéquates ainsi que le module qui explique cette exigence. Dans ce dernier cas, une copie de ces instructions doit être jointe à la demande d’autorisation d’équipement.

Information on test modes and additional testing requirements.

The modular transmitter has been fully tested by the module grantee on the required number of channels, it should not be necessary for the host installer to re-test all the available settings. It is recommended that the host product manufacturer, installing the modular transmitter, perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits.
The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.
If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Section 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected.

Additional testing, Part 15 subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part15 digital device.
The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369.

8. Revision history

Rev.	Date	Remark
1.3	Nov 7, 2018	Created first edition based on Japanese edition, revision 1.3 dated Nov 07, 2018
1.4	Apr 17, 2019	Section 2, 3: Changed to the characters which can search for the characters of the Fig.1,2,4 and 5. Section 3-4: Revised description of the Maximum output of $V_{if.}$ Other Changes: The following description has been revised. "power supply point" => "power feed point" "broken line" => "dotted line"
1.5	Nov 20, 2019	Section 7: Added the FCC and ISED statement.
1.6	Dec 12, 2019	Section 7: Revised and Added the FCC statement.

Doppler Radar Sensor

FWM7RAZ01-2003xx(for USA/Canada) Data Sheet

Rev 0.2(Draft)

Mar. 28, 2019

FUJITSU COMPONENT LIMITED

1. Introduction

This data sheet is written for FWM7RAZ01 as a Doppler Radar Sensor.

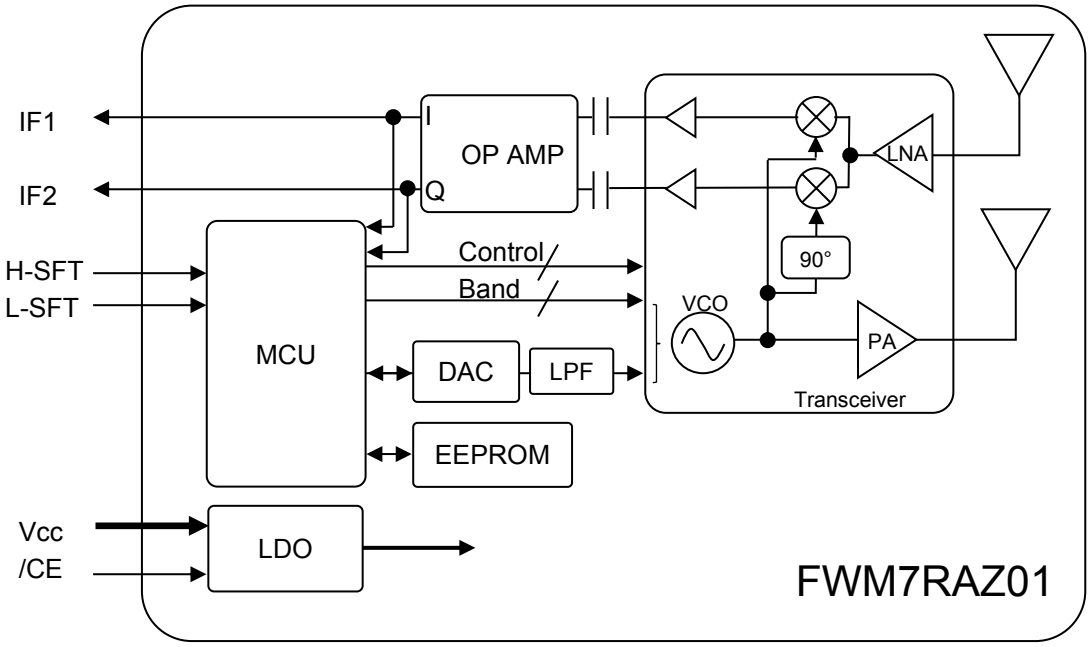
2. Features

FWM7RAZ01 is a Doppler Radar Sensor and suitable for the compact and low power applications used 24GHz radio band.

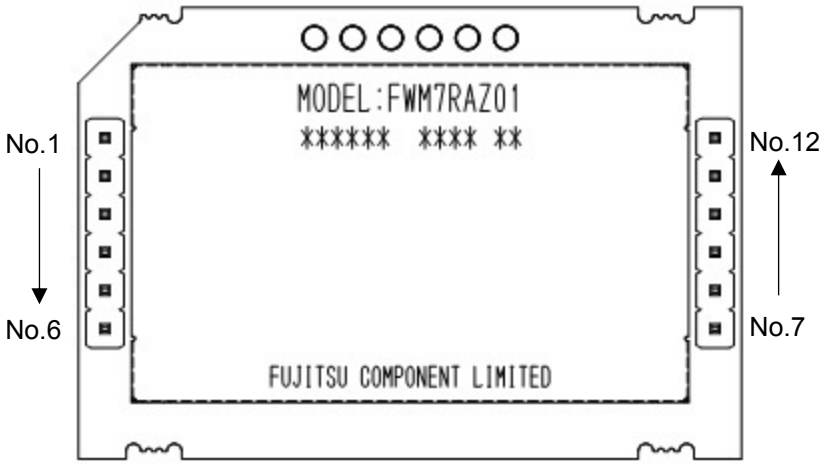
This main specifications are following.

Host Interface	: IF (I/Q), PIO
Compliant	: FCC Part 15.245 ISED RSS-210 Issue 9, Annex F
Frequency range	: 24.075GHz - 24.175GHz
Channel numbers	: 3 channels selectable (24.110GHz, 24.126GHz, 24.142GHz)
Detector method	: Doppler
Integrated antenna	: 2x4 Patch Array Antenna
Module size	: 30 x 44 x 9.5mm
Wide operating voltage range	: DC+3.4V~5.5V
Operational temperature	: -20 ~ +85degC
Certification of construction	: FCC/ISED (for USA/Canada)
RoHS compliant	

3. Block diagram



4. Pin Description



Pin No.	Pin Name	I/O	Status		Description
			Vcc > 3.4V		
			/CE=L	/CE=H	
1	Rev1	In	Hi-Z	Hi-Z	Reserved pin (Not connected)
2	/CE	IH	Pull-up to Vcc	Pull-up to Vcc	Enable (Low Active) This pin is pulled up to Vcc by 10KΩ internally.
3	Vcc	Po	-	-	Power-Supply DC+3.4~+5.5V
4	GND	-	-	-	GND
5	IF1	Aout	Vcc/2	Hi-Z	I output
6	IF2	Aout	Vcc/2	Hi-Z	Q output
7	Rev2	Dout		Hi-Z	Reserved pin (Not connected)
8	L-SFT	IL	Pull-down	Pull-down	Channel selection This pin is pulled down to GND by 100KΩ internally.
9	GND	-	-	-	GND
10	Rev3	In	Hi-Z	Hi-Z	Reserved pin (Not connected)
11	H-SFT	IL	Pull-down	Pull-down	Channel selection This pin is pulled down to GND by 100KΩ internally.
12	Rev4	-	Hi-Z	Hi-Z	Reserved pin (Not connected)

*1,2,7,8,10,11 and12 pins are 5V-torelant type that is acceptable for 5.5V voltage.

I/O type	Pin description
In	Digital input pin
IH	Input pin pulled up
IL	Input pin pull down
Aout	Analog output pin
Dout	Digital output pin
Po	Power supply

5. Electrical Characteristics

5-1. Absolute Maximum Ratings

Items	Symbol	Min	Typ.	Max	Unit
Vcc Power-supply voltage	Vcc max	-0.3	-	6.0	V
/CE input voltage	Vce max	-0.3	-	Vcc	V
H-SFT, L-SFT input voltage	Vsft max	-0.3	-	Vcc	V
Storage temperature*1,2	Tstg max	-40	-	+85	degC

*1: Storage temperature in product only

*2: No condensation

5-2. Operating Conditions

Items	Symbol	Min	Typ.	Max	Unit
Power supply voltage	Vcc	3.4	3.5	5.5	V
Ambient temperature*	Ta	-20	+25	+85	degC

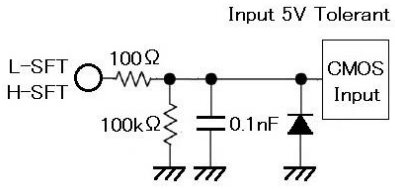
*No condensation

5-3. DC electrical characteristics

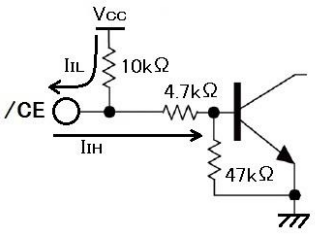
3.4V≦Vcc≦5.5V, -20degC≦TA≦85degC

Items		Symbol	Condition		Min	Typ.	Max	Unit
H-SFT, L-SFT 5VTollerant Digital input		V_{IH}	-		2.7	-	5.5	V
		V_{IL}			-0.3	-	0.6	
		I_{IL}			-2		+60	μA
/CE Digital input	Full Operation	V_{IL}	-		-	-	0.45	V
		I_{IL}	/CE =0V	Vcc= 3.4V	-0.4	-	-	mA
				Vcc= 5.5V	-0.6	-	-	
	Disable	V_{IH}	-		2.5	-	Vcc	V
		I_{IH}	Vcc=/CE=3.4V		-	-	0.9	mA
			Vcc=/CE=5.5V		-	-	1.7	
IF1, IF2 Output Swing Voltage		V_{OPEN}	Open		0	-	3.4	Vp-p
		V_{LOAD}	RL= 2KΩ		0	-	3.2 *	
			RL=600Ω		0	-	3.1 *	

*Reference Value



L-SFT, H-SFT pins internal equivalent circuit



/CE pin internal equivalent circuit

5-4. RF Transmitter characteristics

3.4V≦Vcc≦5.5V

Items	Symbol	Condition		Min	Typ.	Max	Unit
Transmit frequency	F_{MID}	H-SFT=L-SFT at 25degC		24.123	24.126	24.129	GHz
	F_{LOW}	H-SFT= Low L-SFT= High at 25degC		24.107	24.110	24.113	GHz
	F_{HIGH}	H-SFT= High L-SFT = Low at 25degC		24.139	24.142	24.145	GHz
Temperature drift	F_{DRIFT}	Δf	-20degC	-	-	+30	MHz
			85degC	-30	-	-	
Transmit power(EIRP)	P_{EIRP}	at 25degC		+9	+11	+13	dBm

5-5. RF Receiver characteristics

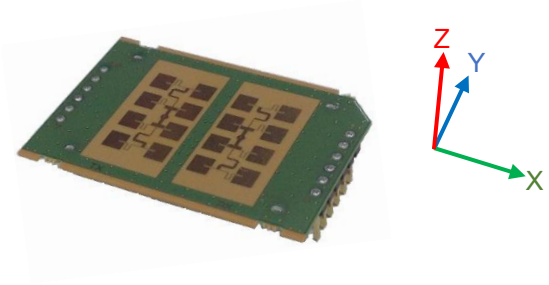
3.4V≦Vcc≦5.5V, -20degC≦TA≦85degC

Items	Condition	Min	Typ.	Max	Unit
Voltage conversion gain	Rx-Ant to IF1/IF2	-	48	-	dB
I/Q phase balance	-	-	90	-	°
IF frequency range	-	1	-	1M	Hz

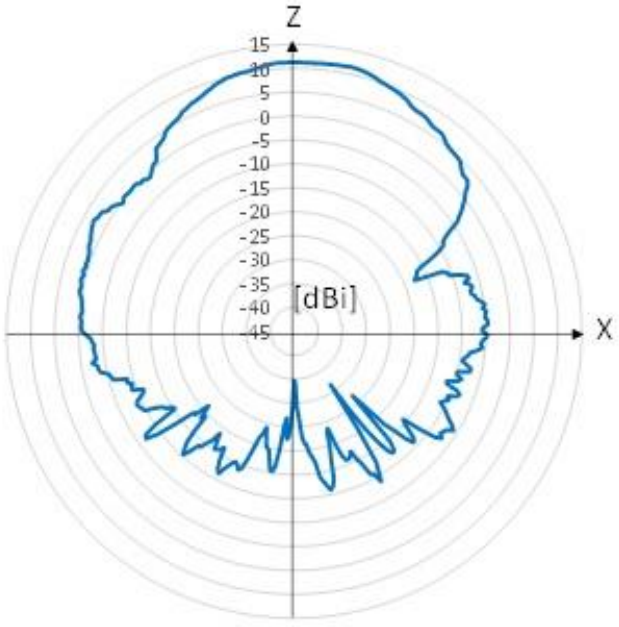
5-6. Antenna characteristics

Items		Condition	Min	Typ.	Max	Unit
Full beam width @-3dB	azimuth	horizontal	-	45	-	°
	elevation	vertical	-	38	-	°
Antenna Gain		24.1GHz	-	12	-	dBi

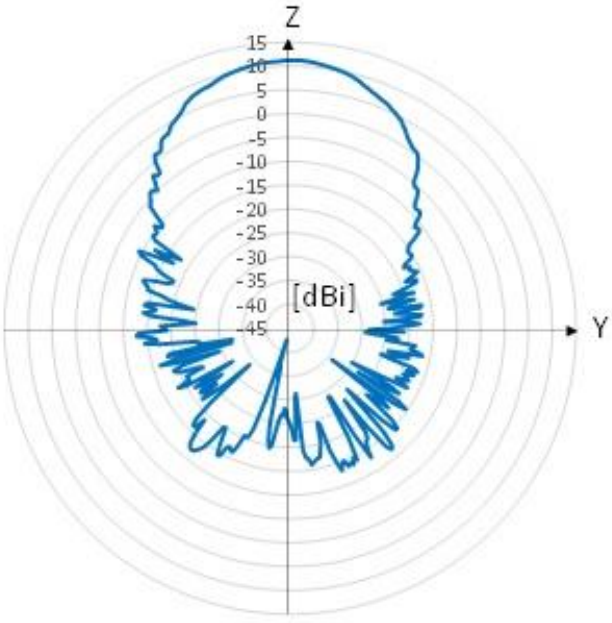
Appearance

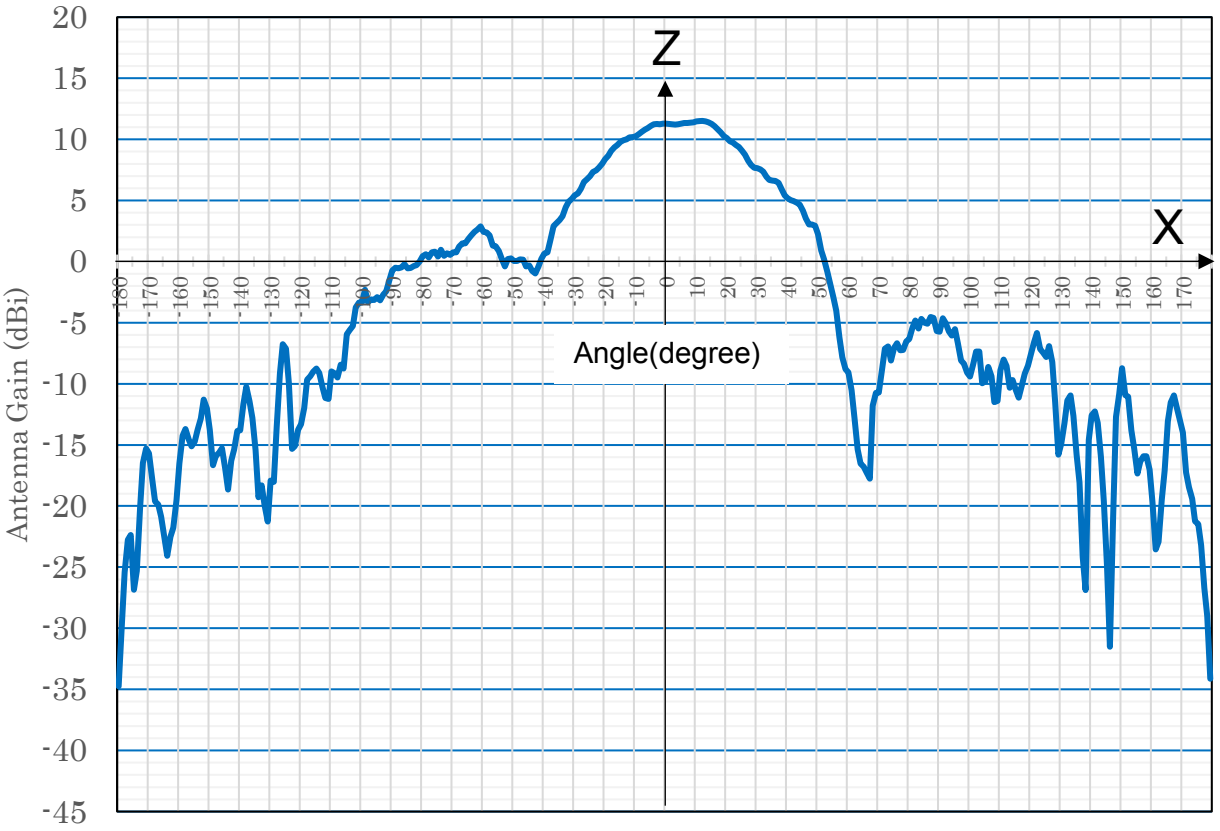


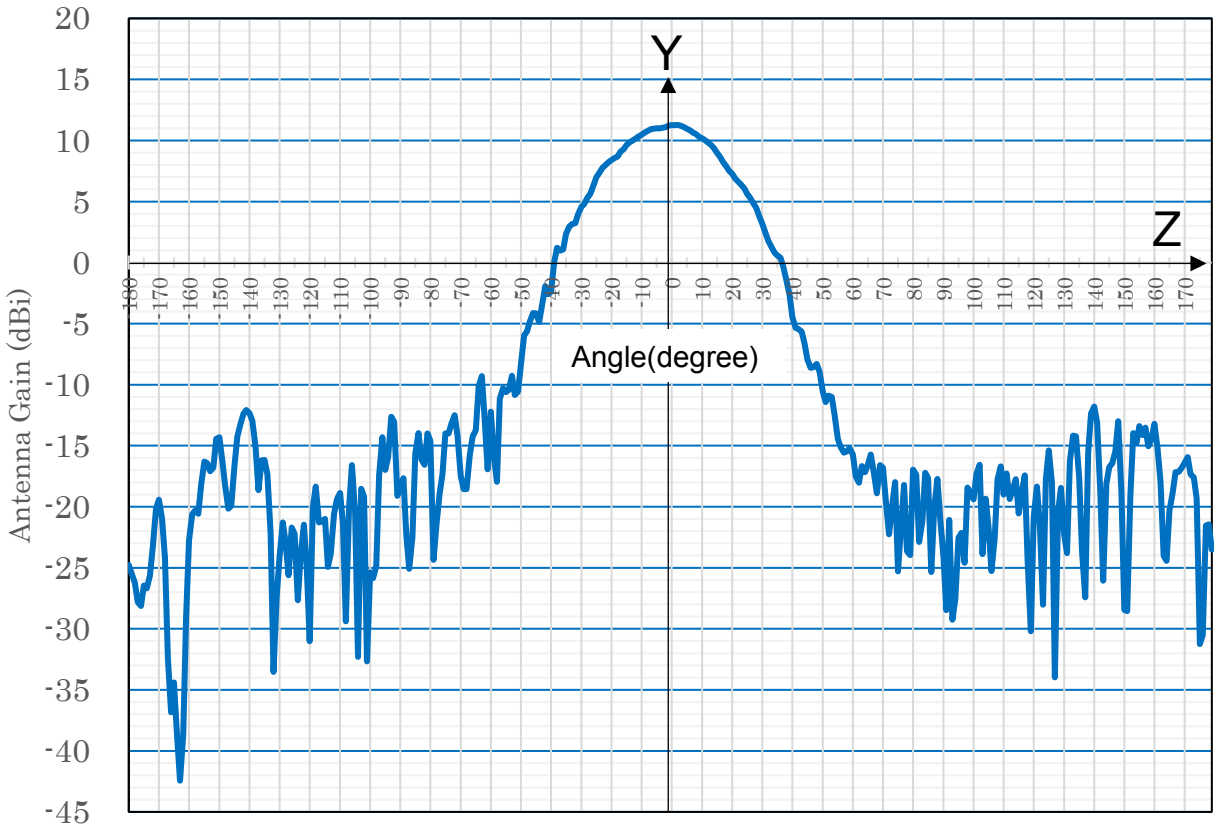
Z-X plane



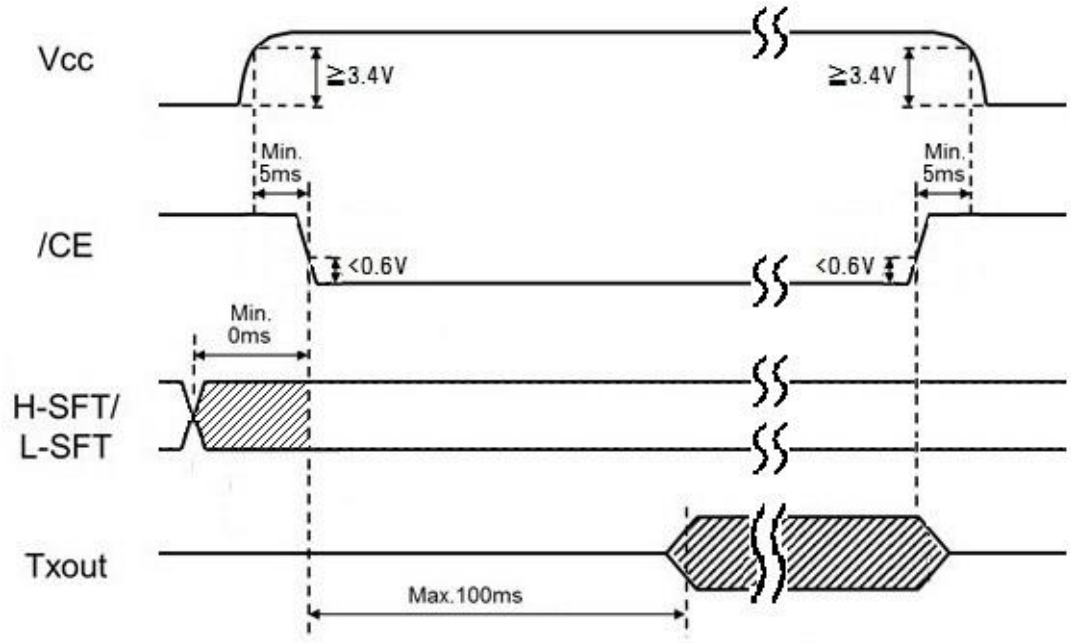
Y-Z plane




Z
X
Angle(degree)
Antenna Gain (dBi)
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45


Y
Z
Angle(degree)
Antenna Gain (dBi)
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45

5-7. Power-On/Off Sequence



5-8. Current consumption

3.4V≦Vcc≦5.5V, -20degC≦TA≦85degC

Item	Condition			Min	Typ.	Max	Unit
Current consumption	Full Operation	/CE<V_{IL}		-	61.0	-	mA
	Disable	/CE=Open	Vcc=3.4V	-	0.2	0.5	
			Vcc=5.5V	-	0.4	0.8	

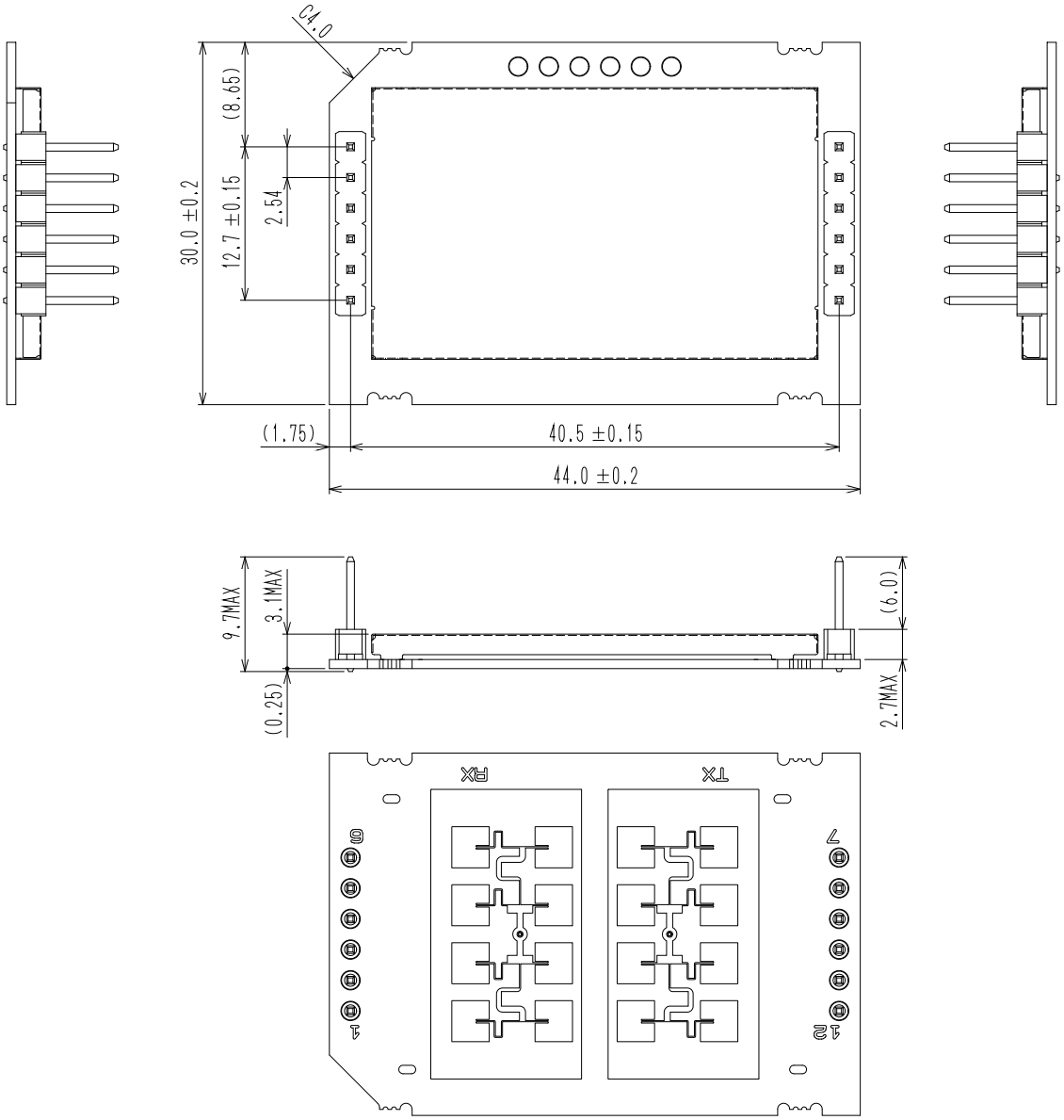
5-9. Channel configuration

The transmit frequency can be changed by the setting of Pin No.8 and No.11.

No.8 (L-SFT)	No.11 (H-SFT)	Channel Status	Transmit Freq.	Unit
High	Low	Lower channel	24.110	GHz
High	High	Middle channel	24.126	
Low	Low			
Low	High	Higher channel	24.142	

6. Mechanical Characteristics

6-1. Appearance and Dimensions



Unit: mm

6-2. Pin socket

Square pillar pin-header (2.54mmpin-to-pin pitch)

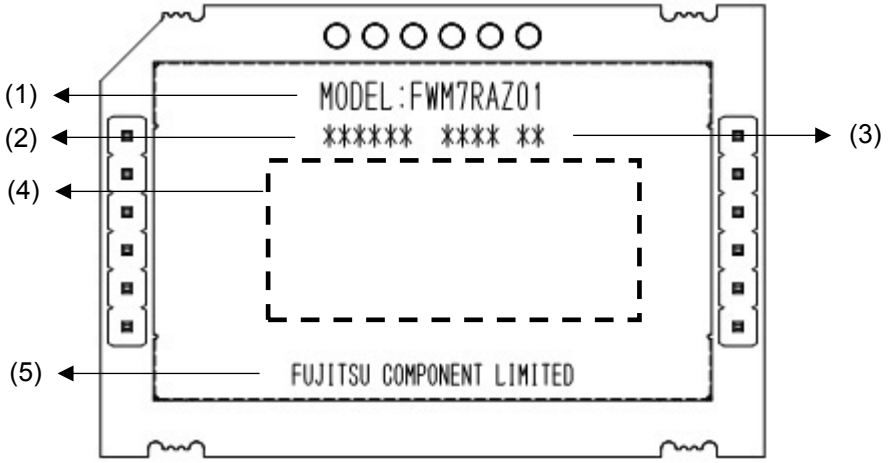
(Reference pins socket models)

HKP-6FDS2 : Made by Honda Tsushin Kogyo Co., Ltd.

FSS-41085-06 : Made by Hirosugi-Keiki Co., Ltd.

6-3. Marking (TBD)

Marking Samples



(1) Module Name : FWM7RAZ01S*

* Suffix: S1~ is just for the sample.

(2) FCL Identification number : 2003** For USA/Canada

(3) Lot Number : 8 Y 00 xx

Revision Number: AA~

Serial : 00~ (Hexadecimal)

Month : 1~9 = Jan to Sep
X = Oct
Y = Nov
Z = Dec

Year : The last digit of year

(4) Certification Marking (TBD)

(5) Company name

Revision Number: A A

Firmware Version

Hardware Version

Hardware Version

Revision	Hardware Version
A	first edition

Firmware Version

Revision	Firmware Version
A	first edition : Ver.1.1

6-4. Soldering Iron Condition

FWM7RAZ01 does not support to reflow soldering nor flow soldering.

When the pin-socket is not used (mount on PCB directly), please follow below conditions

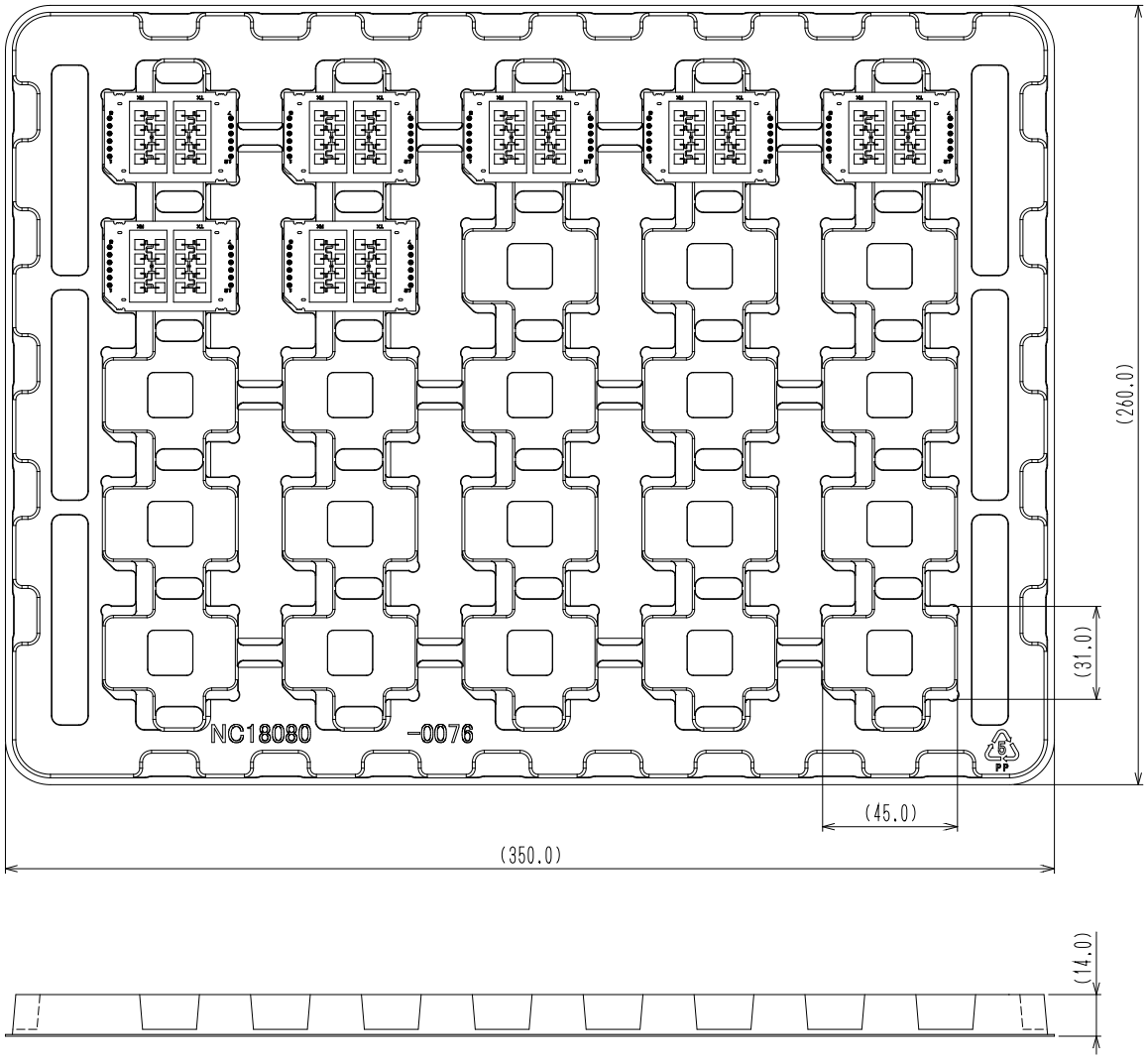
Iron Temperature : 350 degC or lower

Ironing time : Within 3 seconds for 1pin

7. Packing specifications

7-1. Scale of tray

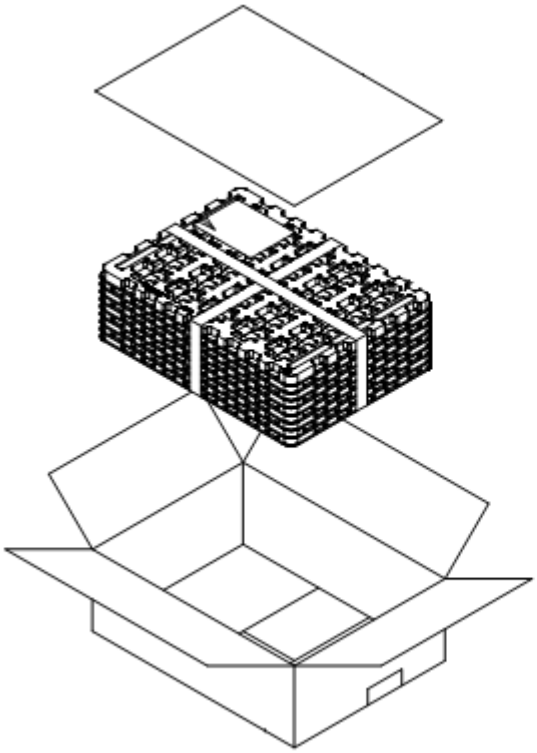
Maximum 25pcs/tray



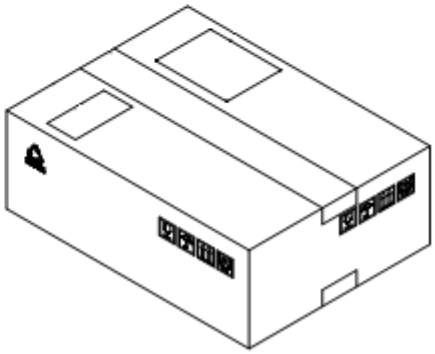
Unit: mm

7-2. Tray packing

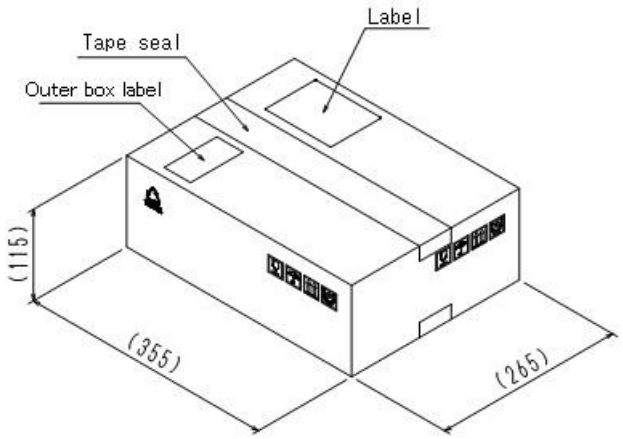
These contain up to 9 trays (included a tray as a top-cover) stacked in the packing box.



Shipping box

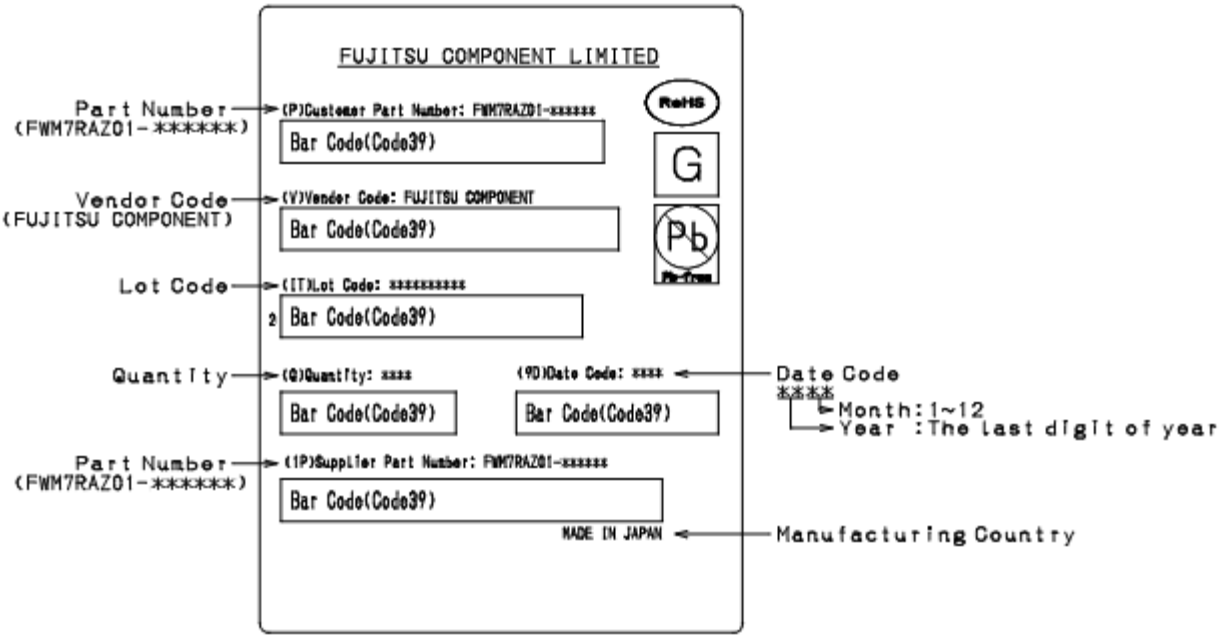


Packed state

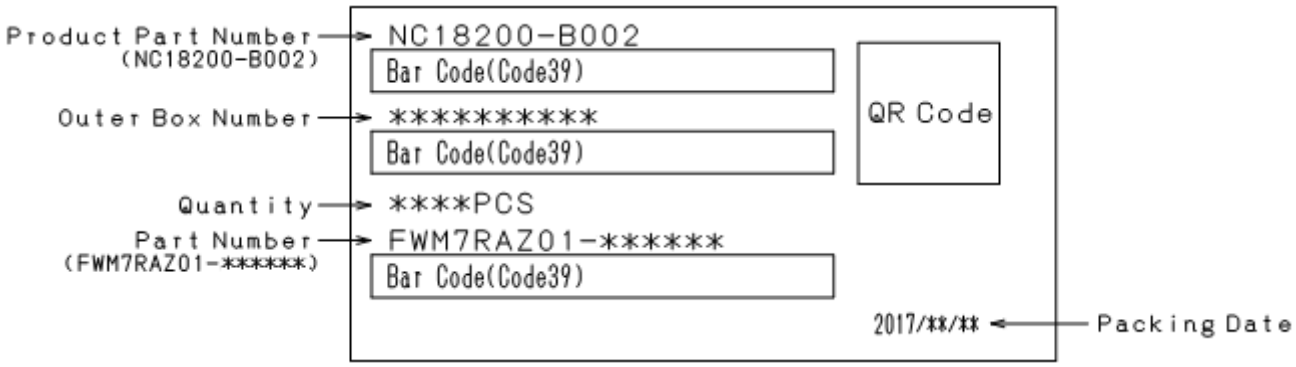


7-3. Label

Example of Label



Outer Box Label



8. Storage condition

It is recommended that the modules is stored at 5~30 degC and < 60% RH, and is used within 6 months from the delivery date.

9. Revision History

Revision	Contents change	Date
0.1 (Draft)	Created draft edition.	Dec.21, 2018
0.2 (Draft)	Section 5-1: Added the notes of Storage temperature. Section 5-2: Added the note of Ambient temperature. Section 5-3: Revised the Items and condition of H-SFT, L-SFT. Revised Specification of V_{IL} in /CE Digital input. Added the condition of I_{IL} in /CE Digital input. Added the Specification of I_{IH} in /CE Digital input. Added the internal equivalent circuits at L-SFT,H-SFT and /CE pins. Revised IF1,IF2 Output Swing Voltage. Section 5-5: Revised Specification of Receive voltage conversion gain. Revised the Items and condition. Section 5-8: Revised the Current Consumption. Section 5-9: Added the Pin No. to table of the Channel configuration.	Mar.28,2019