Miniature narrow band radio transceiver

STD-601 434 MHz

Operation Guide

Version 3.0 (May. 2016)

- This product requires electrical and radio knowledge for setup and operation.
- To ensure proper and safe operation, please read this operation guide thoroughly prior to use.
- Please keep this operation guide for future reference.

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Contents

1. Outline

The STD-601 434MHz is a miniature radio transceiver module designed for industrial remote control and telemetry applications. The parameters such as RF power, data rate and channel can be set through the use of dedicated serial commands.
The STD-601 operates on the 434MHz and conforms to the EN 300 220 standard.
The transceiver uses a transparent input/output interface, enabling users to use their own protocols.

2. Features and applications

Features

- Small 20 x 32 x 5 mm SMD
- RF output power selectable 10 / 5 / 1 mW
- RF bit rate 4.8 / 9.6 kbps
- Low consumption current: TX 26 mA (10 mW) / RX 19 mA at 3 V
- Transparent interface for data input and output (asynchronous)
- Internal level shifter that allows easy interface with external controllers
- R&TTE (EN 300 220) compliance

Applications

- Industrial telecontrol systems
- Telemetry systems

3. Specifications

General specifications

All values were measured with the antenna ports terminated into 50 ohm and at 25 degree C +/- 5 degree C unless otherwise noted.

Item	Specification
Applicable standard	EN300 220
Communication method	Simplex, Half-duplex
Emission type	F1D (Binary GFSK)
Oscillation type	PLL control (RFIC)
Operation frequency	433.0750- 434.7750 MHz
Channel spacing	25 kHz
Number of channels	137
PLL reference frequency	30 MHz, TCXO
Antenna impedance	50 ohm (nominal)
Dimensions	20 × 32 × 5 (W x D x H) mm, Not including connector pins
Weight	4.5 g

Interface specifications

Item	Specification			Unit	Remarks
UART interface for command setting	Bit rate: 9.6 / 19.2 / 38.4			kbps	
	No parity Data length: 8 bits, Stop bit : 1 bit				
	Output	TXD	L = 0 to 0.4 H = Vcc x 0.67 to Vcc *1	V	UART
	Input	RXD	L = 0 to 0.15 H = Vcc - 0.4 to Vcc *1	V	UART
RX data output	DO		L = 0 to 0.4 H = Vcc x 0.67 to Vcc *1	V	
TX data input	DI		L = 0 to 0.15 H = Vcc -0.4 to Vcc *1	V	
Interrupt output	INT		L = 0 to 0.4 H = Vcc x 0.67 to Vcc*1	V	
TX select / RX select	TXSEL RXSEL		L = 0 to 0.15 H = Vcc - 0.4 to Vcc*1	V	Low active
Pulse width for input/output data	DO DI		208 us to 10 ms		RF bit rate 4800 bps
	DO DI		104 us to 10 ms		RF bit rate 9600 bps
Data polarity			Positive		DO output corresponding to DI input

*1 " H" level depends on the Vcc voltage.

* The input terminals should be driven with an open-drain or a CMOS output. .

Electrical specification

All values were measured with 10mW setting at 434.0 MHz unless otherwise noted.

Common to transmitter and receiver

Item	Conditions	MIN	TYP	MAX	Unit	Remarks
Operating voltage		3.0		5.0	V	
Frequency stability	-20 to + 65°C	-3		3	ppm	Reference temp.=25°C
RF bit rate		4.8		9.6	kbps	Set by command
Guaranteed operating temperature range		-20		65	°C	No dew condensation
Operating ambient temperature range *2		-30		75	°C	No dew condensation
Storage temperature range		-30		80	°C	No dew condensation
Frequency drift		-1		1	ppm / year	
Initial frequency tolerance		-1.5		1.5	ppm	

*2 The temperature range where transmission and reception are possible, but the specification is not guaranteed in the ranges over the Guaranteed operating temperature range.

Transmitter part

Item	Conditions	MIN	TYP	MAX	Unit	Remarks
RF output power	10 mW setting	8.0	9.0	10	mW	Conducted 50 Ω
Deviation Frequency stability	4800 bps	±2.0	±2.2	±2.4	kHz	
	9600 bps	±3.55	±3.75	±3.95	kHz	
Spurious emission	47-74 MHz, 87.5-118 MHz, 174-230 MHz, 470-862 MHz			-54	dBm	Conducted 50 Ω RF output power :10 mW
	Other frequencies below 1000 MHz			-37		
	Frequencies above 1000 MHz			-30		
TX current consumption	Vcc=3.0 V	20	26	32	mA	RF output power :10 mW
Adjacent CH power	Ch:25 kHz, BW:16 kHz			-37	dBm	RF bit rate 9600 bps

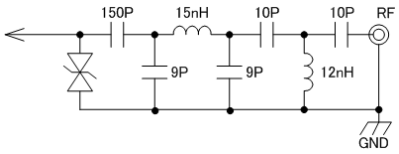
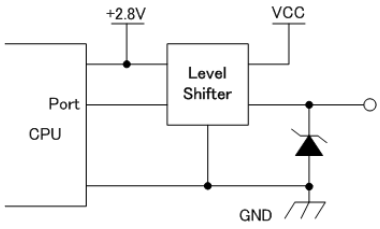
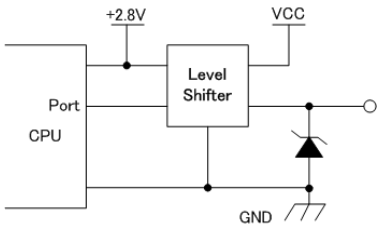
Receiver part

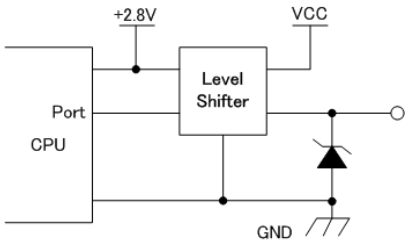
Item	Conditions	MIN	TYP	MAX	Unit	Remarks
Receiver type	Single superheterodyne					
IF frequency			468.75		kHz	
Max. input level				0	dBm	
Receiver sensitivity	9600 bps		-113	-111	dBm	BER: ≤ 1%
	4800 bps		-117	-115		
Spurious response	Lo-IF		50		dB	
Adjacent CH selectivity	Ch: 25 kHz		50		dB	RF bit rate 9600 bps
	Ch: 12.5 kHz		50		dB	RF bit rate 4800 bps
Intermodulation	f-200k, f-100k		50		dB	
Blocking	±2 MHz, ±10MHz		70		dB	
Spurious radiation	< 1000 MHz		-60	-57	dBm	Conducted 50Ω
	> 1000 MHz		-60	-47	dBm	Conducted 50 Ω
RSSI dynamic range		-110		-20	dBm	RSSI level can be obtained by command
RSSI accuracy	With -110 to -20 dBm	-5		5	dB	
RX current consumption	Vcc=3.0 V	17	19	22	mA	

Actuation time

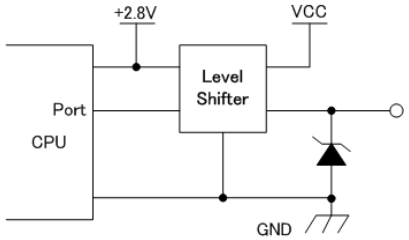
Item		MIN	TYP	MAX	Unit
Start-up	Power on -> Transmission		350	500	ms
	Power on -> Reception		350	500	ms
TX/RX switching	Transmission -> Reception		10	20	ms
	Reception -> Transmission		10	20	ms

4. Terminal specifications

<table>
<tr><th rowspan="2">Terminal No.</th><th rowspan="2">Terminal name</th><th rowspan="2">Input/ Output</th><th colspan="2">Input/Output level (V)</th><th rowspan="2">Internal equivalent circuit</th></tr>
<tr><th>Low</th><th>Hi</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">RF</td><td>Input/Output</td><td>-</td><td>-</td><td rowspan="2"> 
</td></tr>
<tr><td colspan="3">RF input/ output terminal.
When in the TX mode, this terminal functions as an RF output and when in the RX mode, functions as an RF input.
Nominal 50 Ω.</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">GND</td><td>-</td><td>-</td><td>-</td><td rowspan="2"></td></tr>
<tr><td colspan="3">GND terminal common to RF and VCC.
The GND terminal should be connected to a wide GND plane.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">VCC</td><td>Input</td><td>3.0</td><td>5.0</td><td rowspan="2"></td></tr>
<tr><td colspan="3">Power supply terminal.
Connect to the regulated +3.0 to 5.0V DC.</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">TXSEL</td><td>Input</td><td>0 to 0.15</td><td>Vcc-0.4 to Vcc</td><td rowspan="2"> 
</td></tr>
<tr><td colspan="3">TX select terminal. Active low.
Transmission is enabled when connecting this terminal to GND. When this terminal is active, set the RXSEL terminal to High or open.</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">RXSEL</td><td>Input</td><td>0 to 0.15</td><td>Vcc-0.4 to Vcc</td><td rowspan="2"> 
</td></tr>
<tr><td colspan="3">RX select terminal. Active low.
Reception is enabled when connecting this terminal to GND. When this terminal is active, set the TXSEL terminal to High or open.</td></tr>
<tr><td>6</td><td>NC</td><td colspan="3">Do not connect.</td><td></td></tr>
<tr><td>7</td><td>NC</td><td colspan="3">Do not connect.</td><td></td></tr>
</table>

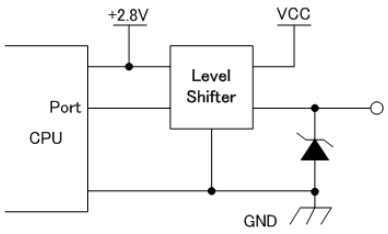
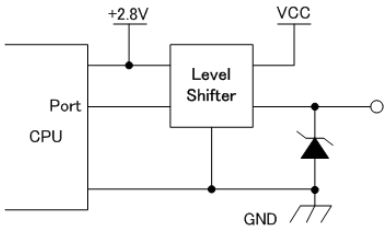
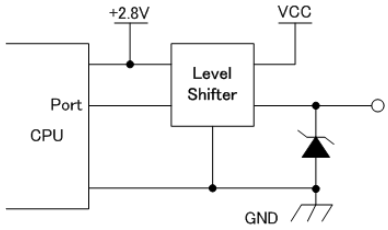
<table>
<tr><th>Terminal No.</th><th>Terminal name</th><th>Input/ Output</th><th colspan="2">Input/Output level (V)</th><th>Internal equivalent circuit</th></tr>
<tr><td rowspan="2">8-10</td><td rowspan="2">GND</td><td>-</td><td>-</td><td>-</td><td rowspan="2"></td></tr>
<tr><td colspan="3">GND terminal.
All the GND terminals should be connected to a wide GND plane.</td></tr>
<tr><td>11</td><td>NC</td><td colspan="3">Do not connect.</td><td></td></tr>
<tr><td>12</td><td>NC</td><td colspan="3">Do not connect.</td><td></td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">RXD</td><td>Input</td><td>0 to 0.15</td><td>Vcc -0.4 to Vcc</td><td rowspan="2"> 
</td></tr>
<tr><td colspan="3">UART input terminal
Make sure to perform communication with the bit rate previously set.

<table>
<tr><th colspan="2">Default settings for UART communication</th></tr>
<tr><td>Bit rate</td><td>19.2 kbps *</td></tr>
<tr><td>Data length</td><td>8 bits</td></tr>
<tr><td>Parity</td><td>none</td></tr>
<tr><td>Stop bits</td><td>1 bit</td></tr>
</table>

* Can be changed with the command (See 10.8 "@U" UART bit rate setting).</td></tr>
<tr><td rowspan="2">14</td><td rowspan="2">TXD</td><td>Output</td><td>0 to 0.4</td><td>Vcc x 0.67 to Vcc</td><td rowspan="2"> 
</td></tr>
<tr><td colspan="3">UART output terminal
Make sure to perform communication with the bit rate previously set.

<table>
<tr><th colspan="2">Default settings for UART communication</th></tr>
<tr><td>Bit rate</td><td>19.2 kbps *</td></tr>
<tr><td>Data length</td><td>8 bits</td></tr>
<tr><td>Parity</td><td>none</td></tr>
<tr><td>Stop bits</td><td>1 bit</td></tr>
</table>

* Can be changed with the command (See 10.8 "@U" UART bit rate setting).</td></tr>
</table>

Terminal No.	Terminal name	Input/ Output	Input/Output level (V)		Internal equivalent circuit
			Low	Hi	
15	INT	Output	0 to 0.4	Vcc x 0.67 to Vcc	
		Error output terminal Outputs High level when receiver image rejection calibration is required or if an initial setting error occurs. For error details, check the error code output from the TXD terminal. (See *10.12 Error response*)			
16	NC	Do not connect			
17	DI	Input	0 to 0.15	Vcc -0.4 to Vcc	
		Transmission data input terminal Input data corresponding to the RF bit rate set with the command.			
18	DO	Output	0 to 0.4	Vcc x 0.67 to Vcc	
		Received data output terminal Take out data corresponding to the RF bit rate set with the command.			
19-20	GND	-	-	-	
		GND terminal. Both GND terminals should be connected to a wide GND plane.			

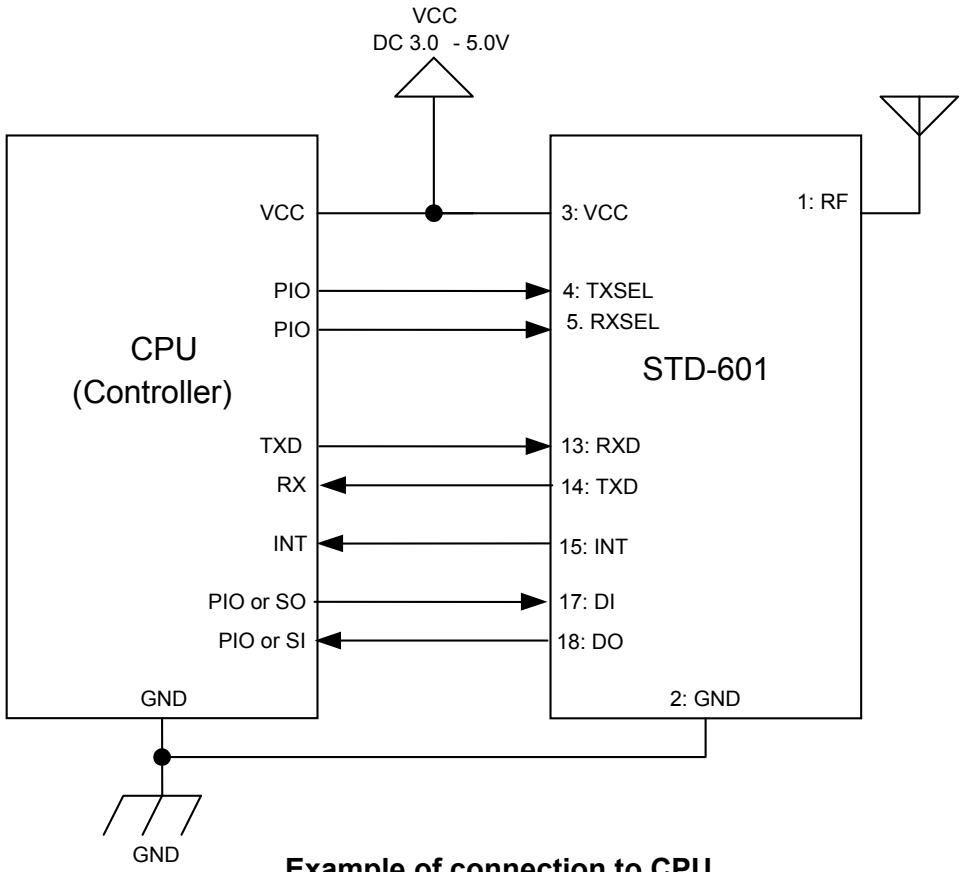
Logic high at the input terminals: Vcc or open drain.
Logic low at the input terminals: GND

5. Frequency channel table

Default = 74 (0x4A)ch 434.0000 MHz

CH		Frequency [MHz]	CH		Frequency [MHz]	CH		Frequency [MHz]	CH		Frequency [MHz]
Dec	Hex		Dec	Hex		Dec	Hex		Dec	Hex	
0	00	433.0750	35	23	433.5125	70	46	433.9500	105	69	434.3875
1	01	433.0875	36	24	433.5250	71	47	433.9625	106	6A	434.4000
2	02	433.1000	37	25	433.5375	72	48	433.9750	107	6B	434.4125
3	03	433.1125	38	26	433.5500	73	49	433.9875	108	6C	434.4250
4	04	433.1250	39	27	433.5625	74	4A	434.0000	109	6D	434.4375
5	05	433.1375	40	28	433.5750	75	4B	434.0125	110	6E	434.4500
6	06	433.1500	41	29	433.5875	76	4C	434.0250	111	6F	434.4625
7	07	433.1625	42	2A	433.6000	77	4D	434.0375	112	70	434.4750
8	08	433.1750	43	2B	433.6125	78	4E	434.0500	113	71	434.4875
9	09	433.1875	44	2C	433.6250	79	4F	434.0625	114	72	434.5000
10	0A	433.2000	45	2D	433.6375	80	50	434.0750	115	73	434.5125
11	0B	433.2125	46	2E	433.6500	81	51	434.0875	116	74	434.5250
12	0C	433.2250	47	2F	433.6625	82	52	434.1000	117	75	434.5375
13	0D	433.2375	48	30	433.6750	83	53	434.1125	118	76	434.5500
14	0E	433.2500	49	31	433.6875	84	54	434.1250	119	77	434.5625
15	0F	433.2625	50	32	433.7000	85	55	434.1375	120	78	434.5750
16	10	433.2750	51	33	433.7125	86	56	434.1500	121	79	434.5875
17	11	433.2875	52	34	433.7250	87	57	434.1625	122	7A	434.6000
18	12	433.3000	53	35	433.7375	88	58	434.1750	123	7B	434.6125
19	13	433.3125	54	36	433.7500	89	59	434.1875	124	7C	434.6250
20	14	433.3250	55	37	433.7625	90	5A	434.2000	125	7D	434.6375
21	15	433.33750	56	38	433.7750	91	5B	434.2125	126	7E	434.6500
22	16	433.3500	57	39	433.7875	92	5C	434.2250	127	7F	434.6625
23	17	433.3625	58	3A	433.8000	93	5D	434.2375	128	80	434.6750
24	18	433.3750	59	3B	433.8125	94	5E	434.2500	129	81	434.6875
25	19	433.3875	60	3C	433.8250	95	5F	434.2625	130	82	434.7000
26	1A	433.4000	61	3D	433.8375	96	60	434.2750	131	83	434.7125
27	1B	433.4125	62	3E	433.8500	97	61	434.2875	132	84	434.7250
28	1C	433.4250	63	3F	433.8625	98	62	434.3000	133	85	434.7375
29	1D	433.4375	64	40	433.8750	99	63	434.3125	134	86	434.7500
30	1E	433.4500	65	41	433.8875	100	64	434.3250	135	87	434.7625
31	1F	433.4625	66	42	433.9000	101	65	434.3375	136	88	434.7750
32	20	433.4750	67	43	433.9125	102	66	434.3500			
33	21	433.4875	68	44	433.9250	103	67	434.3625			
34	22	433.5000	69	45	433.9375	104	68	434.3750			

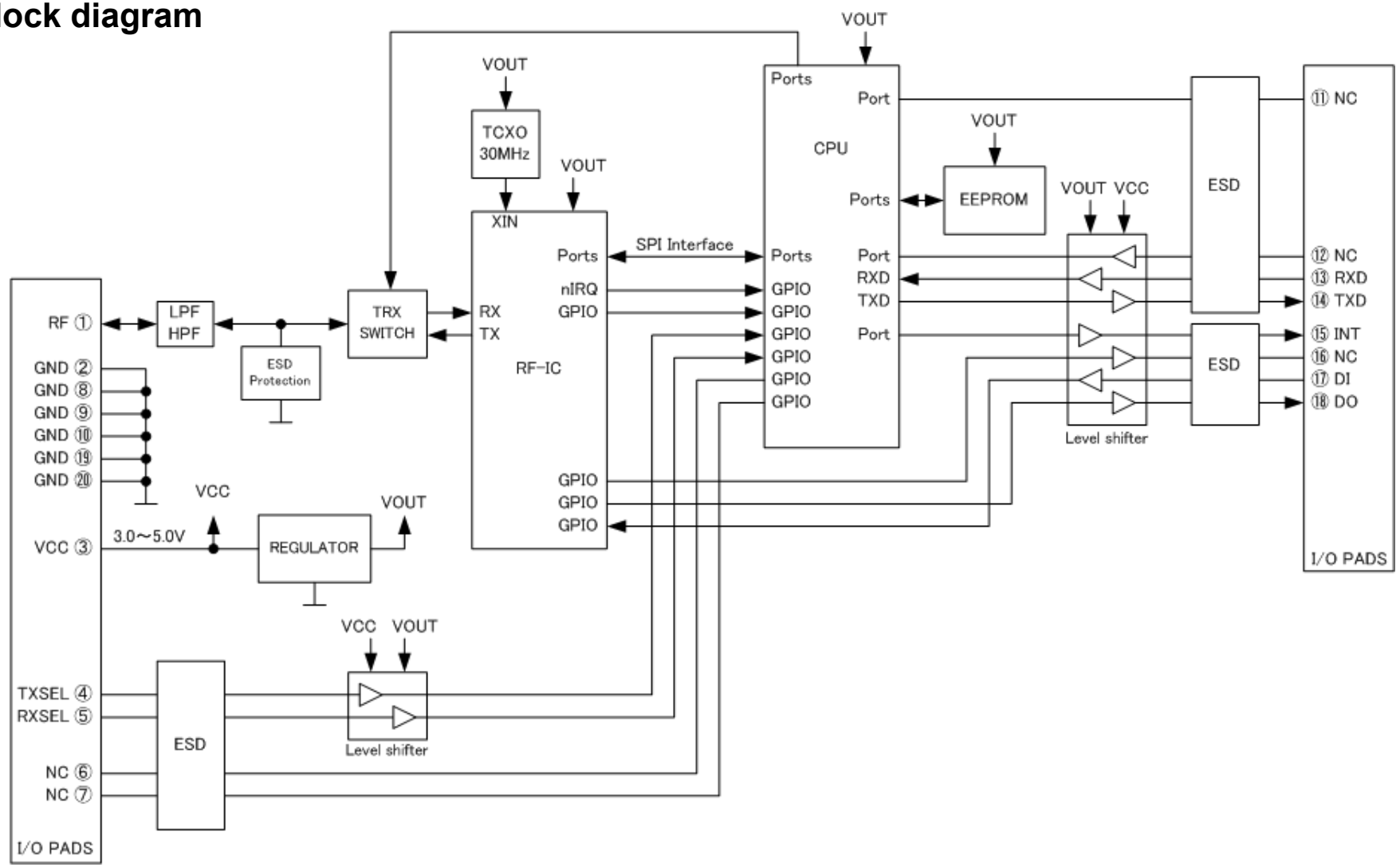
6. Connection diagram



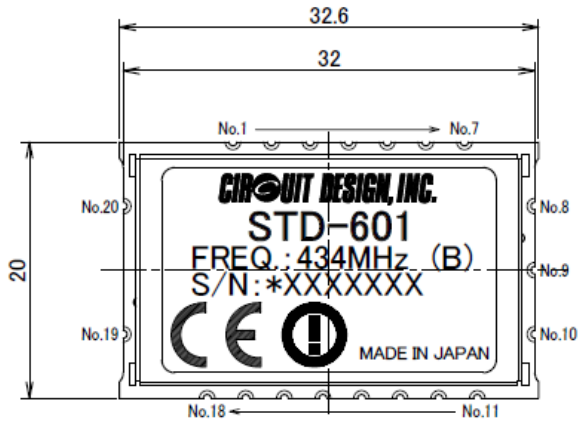
Example of connection to CPU

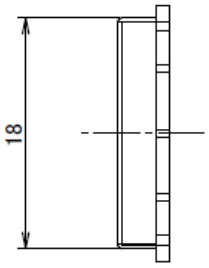
* The same VCC should be used for the STD-601 and the controller.
* The length of connection wire between the STD-601 and the controller should be within 20 cm.

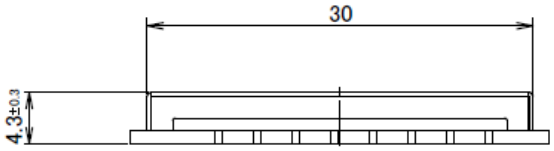
7. Block diagram

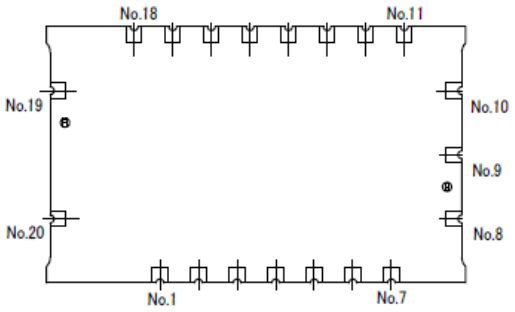


8. External dimensions



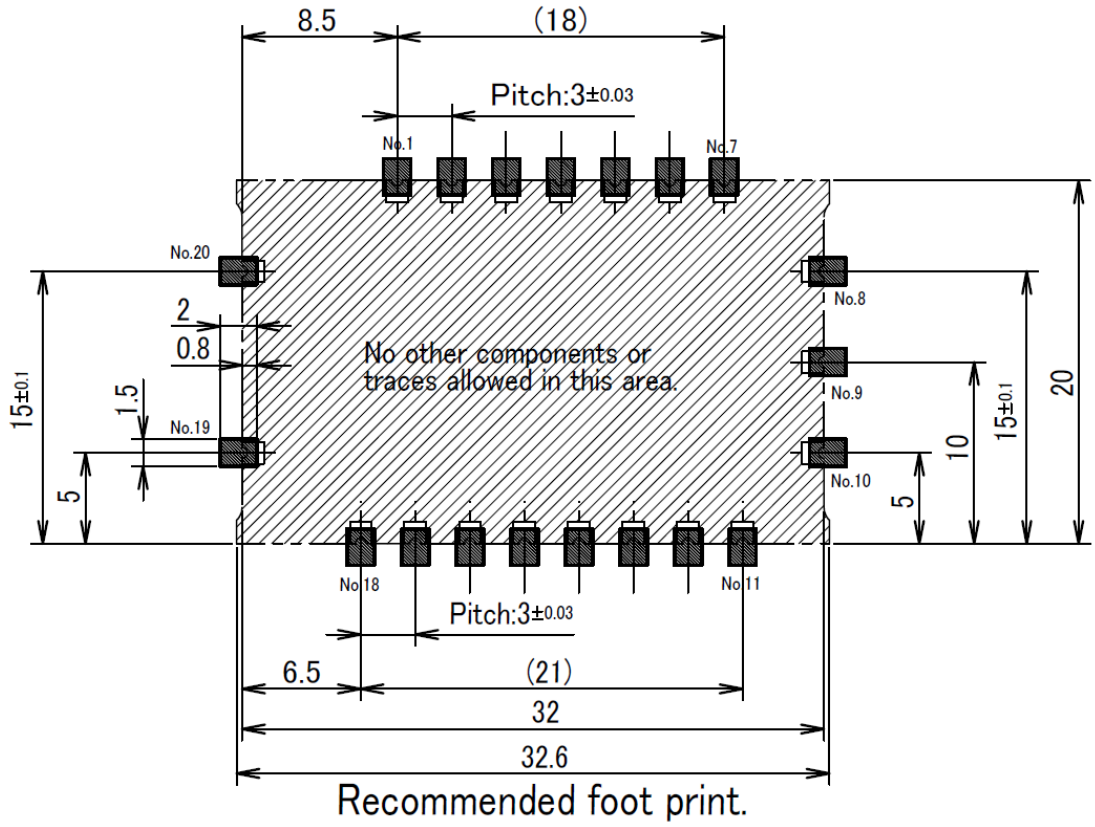






PIN No.	NAME
1	RF
2	GND
3	VCC
4	TXSEL
5	RXSEL
6	NC
7	NC
8	GND
9	GND
10	GND
11	NC
12	NC
13	RXD
14	TXD
15	INT
16	NC
17	DI
18	DO
19	GND
20	GND

9. Recommended foot print



Do not place traces, ground or components on the mounting surface (above shadow area).

Connect the GND terminals to a wide GND plane. Those GND terminals function as a ground not only for the power supply but also for RF.

10. Commands and responses

10.1 Control commands & responses

Control command basic format

Prefix ('@') + command name + value + [CR]

Prefix: **'@' = 40h**, a code that indicates the start of the command string.
Command name: An ASCII code of one character.
Value: An ASCII code of two characters corresponding to each command.

Control response basic format

Prefix ('*') + command name + value + [CR] + [LF]

Prefix: **'*'=2Ah**, a code that indicates the start of the response string.
Command name: An ASCII code of one character corresponding to the received command.
Value: An ASCII code of two characters corresponding to each command.

* When issuing commands, unless otherwise stated, make sure that neither TXSEL nor RXSEL is selected.

*When issuing the default setting commands ('@D','@G','@H', '@O'), confirm that the power supply is stable. Turning off the power during the command issue may damage the data to be stored.

10.2 "@C" Frequency channel setting

Sets the channel to be used.
Specify the channel following **'@C'** with the ASCII code of two characters.

The default setting is 4Ach (434.0MHz). The default channel can be changed with the "@D" command.

Value: '0''0' - '8''8' (ASCII codes indicating the channel numbers of 0 to 136)

Example: Change the channel to **0Fh.**

Control command: @C0F
Control response: *C0F

10.3 "@D" Default frequency channel setting

Changes the current and default frequency channel.
Specify the channel following **'@D'** with the ASCII code of two characters.
The default setting is enabled when the power is turned on again.

Value: '0''0' - '8''8' (ASCII codes indicating the channel numbers of 0 to 136)

Example: Change the current and default channel to **4Dh.**

Control command: @D4D
Control response: *D4D

10.4 "@B" RF bit rate setting

Sets the RF bit rate.
Specify the RF bit rate following **'@B'** with the ASCII code of two characters.

The default setting is 9.6 kbps. The default setting can be changed with the "@G" command.

Value: '4''8' : 4.8 kbps
'9''6' : 9.6 kbps

Example: Change the RF bit rate to 4.8 kbps.

Control command: @B48
Control response: *B48

10.5 "@G" Default RF bit rate setting

Changes the current and default RF bit rate.
Specify the RF bit rate following **'@G'** with the ASCII code of two characters.
The default setting is enabled when the power is turned on again.

Value: '4''8' : 4.8 kbps
'9''6' : 9.6 kbps

Example: Change the current and default RF bit rate to 4.8 kbps.

Control command: @G48
Control response: *G48

10.6 "@P" RF transmit power setting

Sets the RF transmit power.
Specify the RF transmit power following **'@P'** with the ASCII code of two characters.
The default setting is 10 mW. The default setting can be changed with the "@H" command.

Value: '1''0' : 10 mW
'0''5' : 5 mW
'0''1' : 1 mW

Example: Change the RF transmit power to 5 mW. .

Control command: @P05
Control response: *P05

10.7 "@H" Default RF transmit power setting

Changes the current and default RF transmit power.
Specify the RF transmit power following **'@H'** with the ASCII code of two characters.
The default setting is enabled when the power is turned on again.

Value: '1"0' : 10 mW
'0"5' : 5 mW
'0"1' : 1 mW

Example: Change the current and default RF transmit power to 5 mW.

Control command: @H05
Control response: *H05

10.8 "@U" UART bit rate setting

Sets the UART bit rate.
Specify the UART bit rate following **'@U'** with the ASCII code of two characters.
The default setting is 19.2 kbps. The default setting can be changed with the "@O" command.

Value: '9"6' : 9.6 kbps
'1"9' : 19.2 kbps
'3"8' : 38.4 kbps

Example: Change the UART bit rate to 9.6 kbps.

Control command: @U96
Control response: *U96

10.9 "@O" Default UART bit rate setting

Changes the current and default UART bit rate.
Specify the UART bit rate following **'@O'** with the ASCII code of two characters.
The default setting is enabled when the power is turned on again.

Value: '9"6' : 9.6 kbps
'1"9' : 19.2 kbps
'3"8' : 38.4 kbps

Example: Change the current and default UART bit rate to 9.6 kbps.

Control command: @O96
Control response: *O96

Caution: The newly-set default UART bit rate is enabled just after the power is turned on again and UART communication can not be established with the old UART bit rate anymore.

10.10 "@R" RSSI acquisition (enabled only in the reception)

Reads out the RSSI level.
Input **'@R'** only without the value.

Example: Reads out the RSSI level.

Control command: @R
Control response: *R64

The absolute value of the RSSI level is returned in hexadecimal.
The RSSI level can be obtained by decimalizing the value part of the control response and adding "- (minus)" . *R64 is -100 dBm.

* If the '@R' command is issued in any state other than reception, the error response '*E01* will be returned.

10.11 "@K" Image rejection calibration

Performs calibration on the image rejection of the receiver part. Calibration is required if the temperature changes more than 20 °C .

If there is a temperature change of more than 20 °C after the last calibration, the error response '*E10' is returned and High level is output at the INT terminal to warn of the need for calibration. It takes about 120 ms for calibration.

Example: Performs the image rejection calibration

Control command: @K
Control response: *K

* Even if calibration is not performed, the receiver sensitivity will be maintained but the receiver characteristics against the image frequency of ' RX frequency - IF-IF (RX frequency-937.5 kHz)' may be degraded.

10.12 Error responses

If there is an error in the format of the command issued, an error code of the type shown below is sent in response.

・Format

Prefix ('*') + response name ('E') + value + [CR]

Prefix: **'*'=2Ah**, a code that indicates the start of the response string.
Response name: A single ASCII character 'E'.
Value: an ASCII code of two characters shown in the error code list.

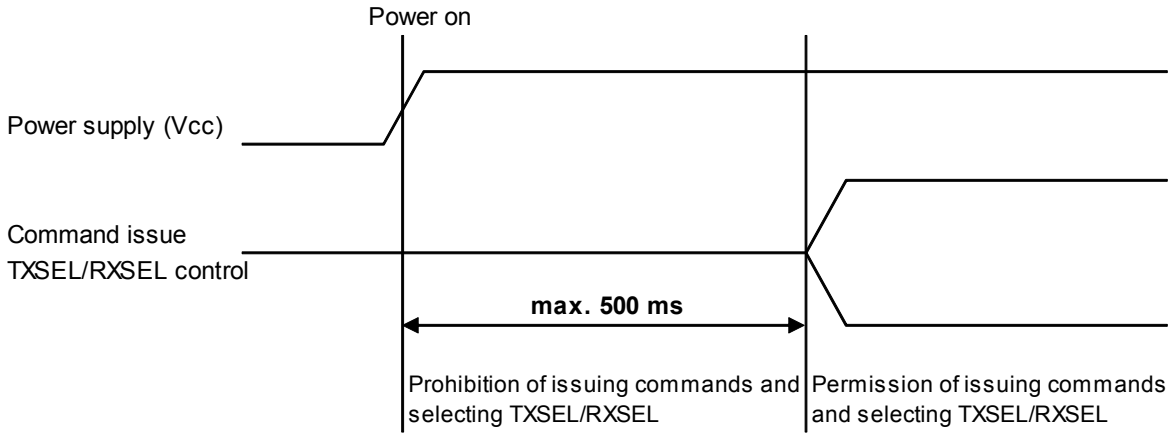
・Error code list

Value	Error name	Description
‘0’’1’	Command format error	The issued command format is wrong.
‘0’’2’	Out of channel setting range	The specified channel is outside the setting range.
‘0’’3’	Initial setting error	Initialization failed. Turn the power on again.
‘0’’4’	Command setting error	Communication error between RFIC and CPU occurs. Perform setting again.
‘1’’0’	Image rejection calibration request	Image rejection calibration is needed due to the temperature change.

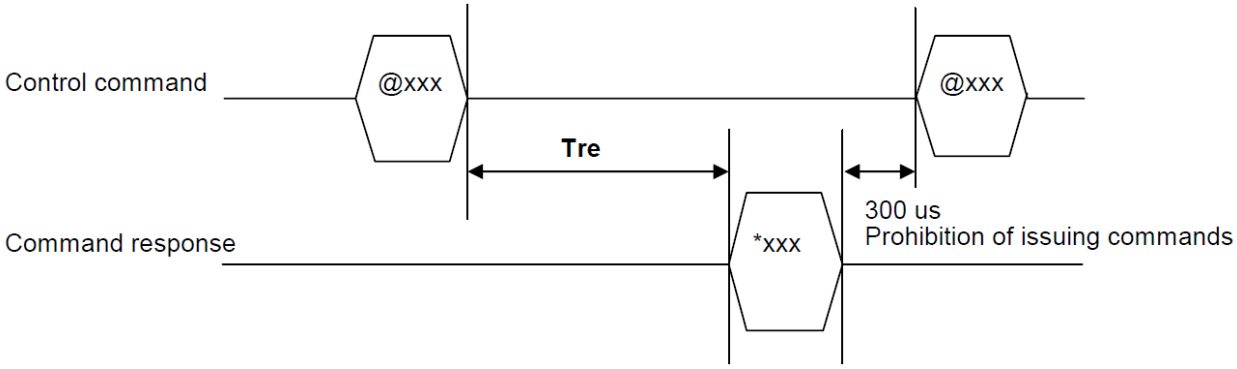
If the error code '03' or '04' frequently occurs, it is possible that the power supply is not stable or the module is damaged. Please contact Circuit Design, Inc. or the distributors.

11. Command timing

Period when issuing commands and selecting TX/RX are prohibited when turning on power

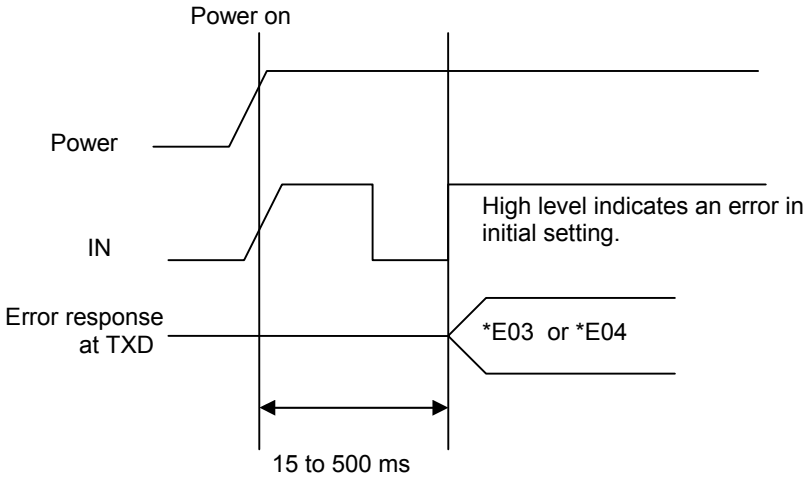


Control command and response timing



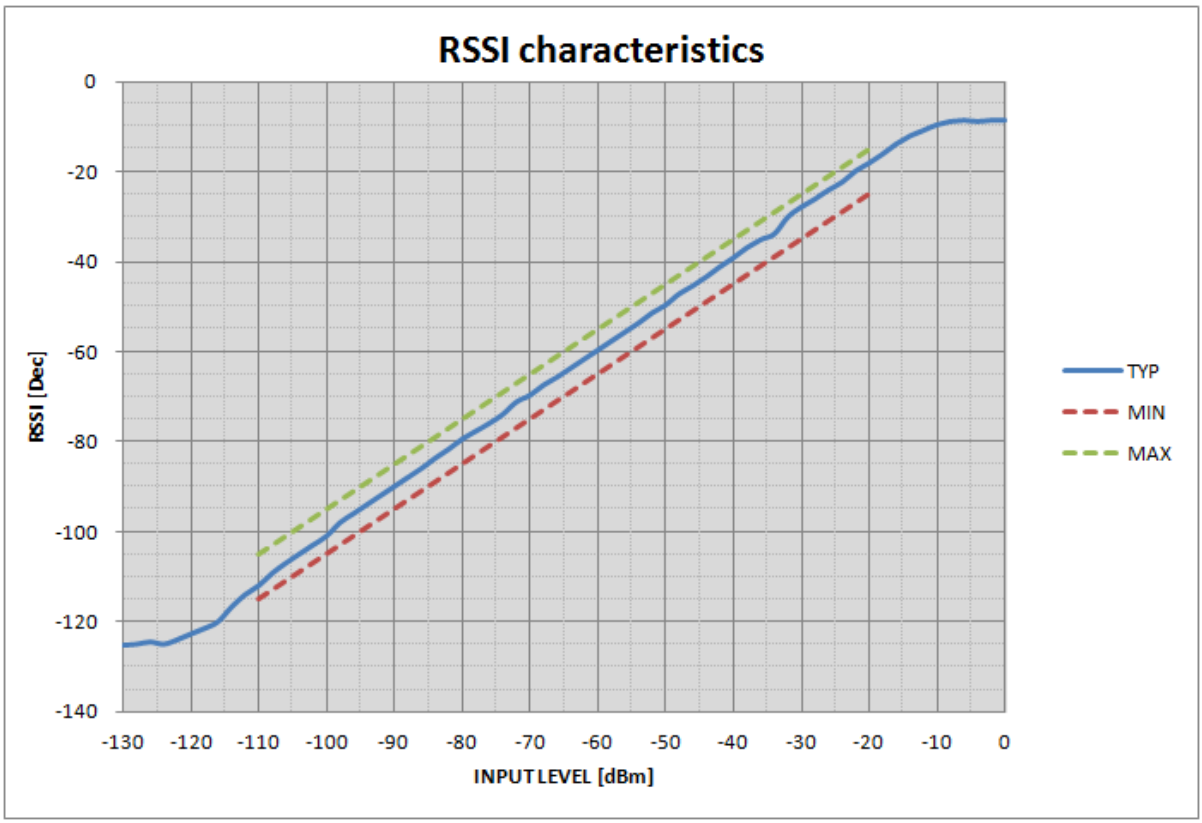
Command	Tre (Response time)	Unit	Command	Tre (Response time)	Unit
@Cxx	600	us	@Dxx	8.8	ms
@Bxx	3.5	ms	@Gxx	8.8	ms
@Pxx	700	us	@Hxx	8.2	ms
@Uxx	100	us	@Oxx	77	ms
@R	1.5	ms	@K	100 to 120	ms

Initial setting error output timing



12. RSSI characteristics

Measurement frequency: 434.0000 MHz / Modulation: Unmodulated
Measurement temperature: 25°C±5°C
RSSI levels were obtained with the @R command.



* RSSI accuracy is within ± 5 dB in the input level range of from -110dBm to -20dBm.

13. RF data format

Data frame structure

A general data frame consists of Preamble, ID code, User data and Data-check and is transmitted/received as a packet data. The data format below shows the one used for the STD-601 evaluation board.

Preamble	ID code					User data	Data-check		Dummy data	
11001100....	CH	01	02	03	04				CC	CC
Repeated 0xCC > 10 ms	1 byte	ID 4bytes				18 bytes	CRC 2bytes		2 bytes	

Example data format

Preamble
A preamble is a dummy data to match the timing between transmission and reception. At the start of data transmission, the transmitter transmits data including alternate low and high signals for a certain period of time. A recommended preamble pattern is **11001100....of more than 10 ms (more than 20 ms is better).**

ID code
An ID code is a unique code to identify own system from other systems. The receiver determines if the received data is sent to itself. To avoid erroneous reception, it is recommended to use an ID code with appropriate length.

User data
A user data is data the user intends to send/receive. To prevent data from being garbled, it is recommended to use data that has periodical transitions between 1 and 0.

Data-check
A data-check (such as CRC) is used to check if the transferred data has errors or not. The receiver determines if the received data is valid or not.

Dummy data
Following the data-check, a dummy data can be added as needed.

* The wireless communication of the STD-601 is asynchronous. UART is widely used since it has advantages of easy data synchronization and periodic data transition with start/stop bits.

14. Image rejection calibration

The STD- 601 uses a low-IF RFIC. Since an image signal occurs at 937.5 kHz below the receiving frequency in reception, image rejection is performed in the RFIC.
Since image rejection is affected by variation in temperature, calibration is required when the temperature has changed more than 20 °C after power-on.
If calibration is required, the STD-601 returns an error response of "*E10" via UART and outputs High at the INT terminal (Request for image rejection calibration).

Calibration can be done with the "@K" command regardless of whether the image rejection calibration is requested or not. It takes approx. 120 ms.
Re-calibration request is output if the temperature has changed more than 20 °C after the last image calibration.

* If calibration is not performed on the request, the receiver sensitivity is still maintained but the receiver's blocking characteristics against the image frequency will be degraded.

* It takes 200 ms for the STD-601 to internally obtain temperature information needed for the image rejection calibration request. If a command issue or TX/RX switching is constantly repeated within a duration of 200 ms, a request for image rejection calibration cannot be generated due to missing of temperature information.

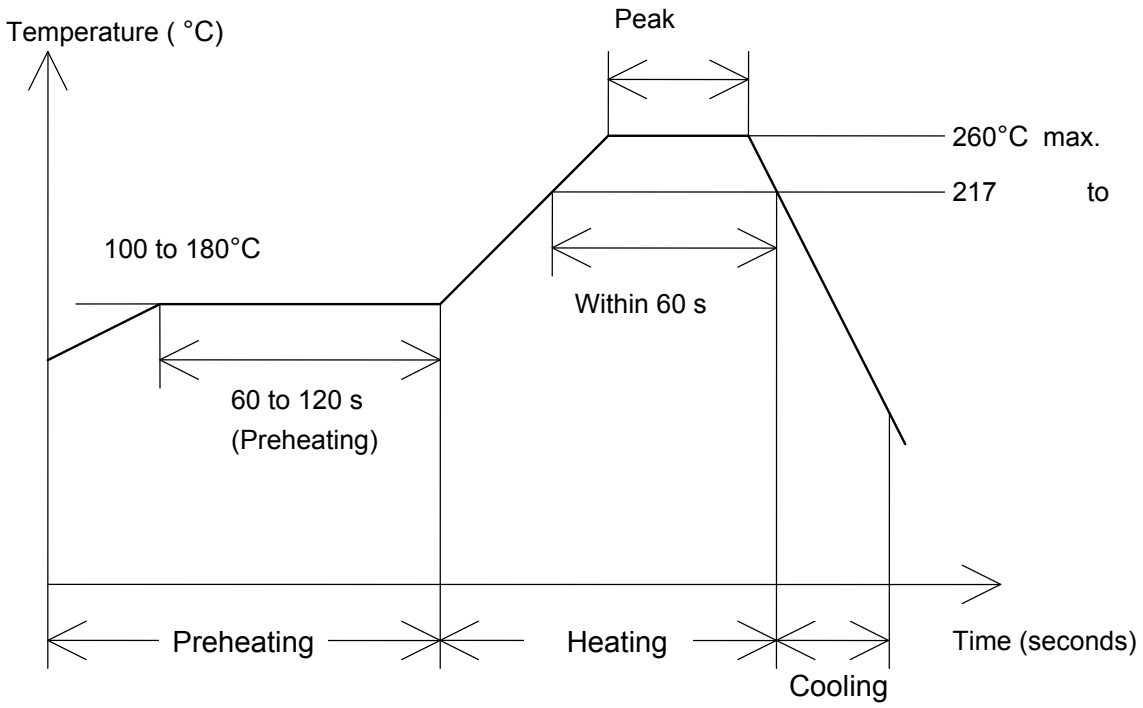
15. Caution for use in continuous transmission and reception

The STD-601 performs internal VCO calibration for stable operation when it starts transmission or reception. For continuous transmission or reception, it is required to perform re-calibration of the VCO periodically, especially under the circumstances of considerable change in temperature. As a guide, a temperature change of more than 10 °C requires re-calibration. If re-calibration is not performed, unstable VCO operation may cause PLL unlock that will result in communication error.

Re-calibration can be automatically performed by resetting the TXSEL or RXSEL.

If the STD-601 is used in continuous transmission or reception and temperature monitoring is not possible, make sure to perform re-calibration periodically (e.g. every 10 minutes) by switching the TXSEL or RXSEL from Low to High and back to Low again. It takes about 10 ms to switch TX/RX.

16. Lead-free reflow profile



Setting standard for reflow profile

1. Peak temperature : < 260°C for less than 10 sec
2. Time over 217-220°C : 60 sec
3. Number of reflow cycles : 1

N_2 reflow, conducting reflow soldering in a nitrogen atmosphere, increases the solder flow too greatly, enabling wicking to occur.

The above profile is an ordinal example. Make sure that the profile is optimized according to the soldering conditions such as equipment.

Regulatory compliance information

DoC and restrictions for CE

R&TTE Declaration of Conformity (DoC)

Hereby, Circuit Design, Inc., declares that this STD-601 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

The product is in conformity with the following standards and/or other normative documents:

EN 300 220-2, Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive Receiver category: 2

EN 301 489-3, Electromagnetic Compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific Conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

EN 60950-1, Safety of Information Technology Equipment.

EN 62311, Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz-300 GHz).

Place and date of issue: Nagano, Japan June 8, 2015

S igned by: Masayasu Komiyama

Masayasu Komiyama, Executive General manager, Engineering Div.

Remark:
This module is for a portable application. The final system integrator will need to conduct full EMC testing in accordance with EN301 489-3 in the final use configuration.
Also the final system needs to fulfill the safety requirements in the final product configuration.

Cautions:
Antenna
The conformity assessment of the STD-601 was performed using the following antenna:

1/4 λ whip antenna 2.14 dBi

Only antennas with same type and lesser gain can be used with this module. If you use an antenna other than the recommended antennas, further radio conformity assessment may be required.

Enclosure
To fulfill the requirements of EMC and safety requirements, the STD-601 should be mounted on the circuit boards of the final products and must be enclosed in the cases of the final products. No surface of the STD-601 should be exposed.

Exposure to radio frequency radiation
This module must not be co-located or operating in conjunction with any other antenna or transmitter.

Conformity assessment of the final product
The manufacturer of the final product is responsible for ascertaining the conformity of the final product to the requirements of the R&TTE Directive.

Important notice

- Customers are advised to consult with Circuit Design sales representatives before ordering. Circuit Design believes the provided information is accurate and reliable. However, Circuit Design reserves the right to make changes to this product without notice.
- Circuit Design products are neither designed nor intended for use in life support applications where malfunction can reasonably be expected to result in significant personal injury to the user. Any use of Circuit Design products in such safety-critical applications is understood to be fully at the risk of the customer and the customer must fully indemnify Circuit Design, Inc for any damages resulting from any improper use.
- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.

Cautions

- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with soot or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a great effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The GND for the radio module will also affect communication performance. If possible, ensure that the case GND and the circuit GND are connected to a large GND pattern.

Warnings

- Do not take apart or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.

Revision History

Version	Date	Description
0.91	June 2015	Preliminary
1.0	June 2015	
2.0	Mar. 2016	Correction of erroneous description (interface voltage), addition of notes (P13,P26)
3.0	May 2016	Correction of erroneous description (IF frequency)