

RAK535

Product Specification

USB High Gain WIFI Module
802.11 a/b/g/n

Version: V1.0

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1. Product Overview

The module **RAK535** provides wireless modem functionality for CE applications utilizing direct sequence spread spectrum and OFDM/CCK technology. The module support IEEE 802.11a/b/g/n protocol. The module integrates all wifi functionality in a package friendly to low-cost PCB design, requiring only a external 3.3V power supply and connection to antenna.

The module is based on Qualcomm Atheros AR1021X which is highly integrated,system-on-a-chip solution for 2.4/5GHz IEEE 802.11n 2x2 MIMO WLAN with internal PA and LNA. **RAK535** have high gain in 5.8GHz Band achieving 20db(100mW).

1.1 Application scope

The wireless module is compliant to IEEE 802.11b and IEEE 802.11a/g and IEEE 802.11n standard. The data rate of 802.11b is up to 11Mbps and fallback rates of 5.5, 2, 1Mbps.The data rate of 802.11a/g is up to 54Mbps and fallback rates of 48,36,24,18,12,9, 6Mbps.The data rate of 802.11n HT20 with 800ns GI is up to 65Mbps and fallback rates of 58.5,52, 39, 26, 19.5, 13, 6.5Mbps; the data rate of 802.11n HT20 with 400ns GI is up to72.2Mbps and fallback rates of 65, 57.8, 43.3, 28.9, 21.7, 14.4, 7.2Mbps. The data rate of802.11n HT40 with 800ns GI is up to 135Mbps and fallback rates of 121.5, 108, 81, 54,40.5, 27, 13.5Mbps.

1.2 Regulation of Each Countries

The Product must be complied with the radio requirement of -USA: FCC Part15C compatible-EN 300328, EN301489 certified before marketing Europe.

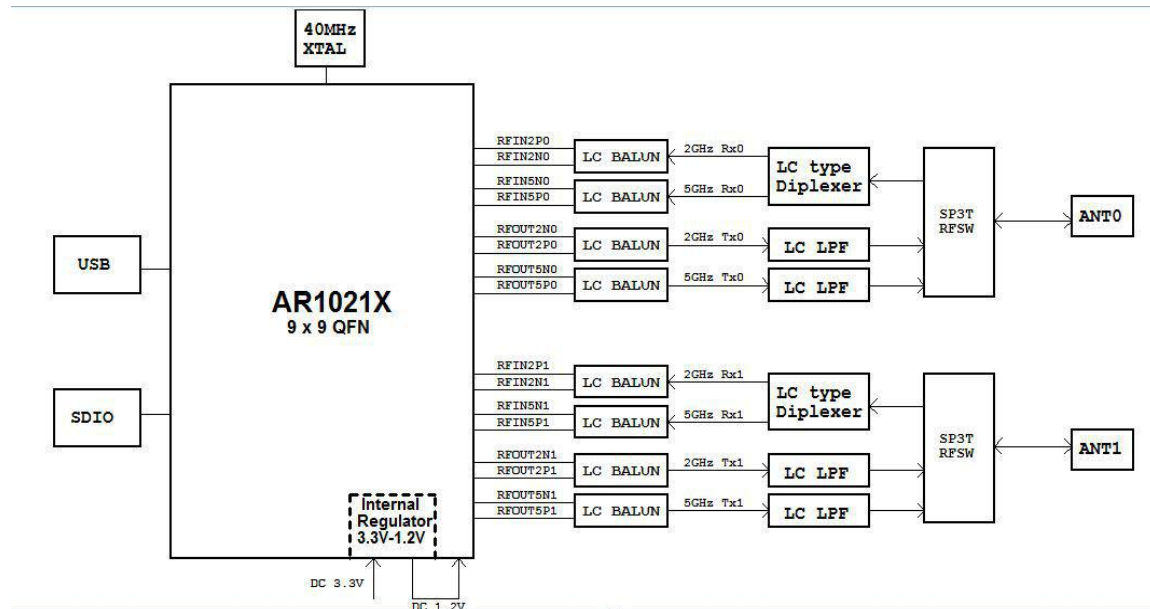
Country	Standard	ID/MARK
US	FCC P15C	TBD
CE	EN 300328 V1.7.1/ 301489-1and-17/60950-1	TBD

Note: Above regulations are representative examples. The module should get an approval by more countries.

2. Module Hardware Overview

2.1 Block Diagram

The general Hardware architecture is shown below Figure:



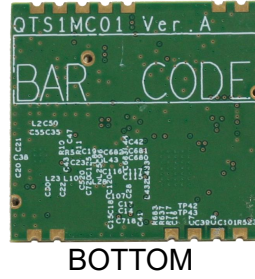
Module Block Diagram

2.2 Features

- ❑ IEEE802.11a/ b/g/n (2X2) based on QualcommAtheros AR1021X solution
- ❑ USB 2.0 Interface, High and Full Speeds supported.
- ❑ Module is powered by the host with a 3.3V +/- 10% supply.
- ❑ 4 layers through hole PCB design with high Tg (170 degrees) FR4 material.

2.3 Interface

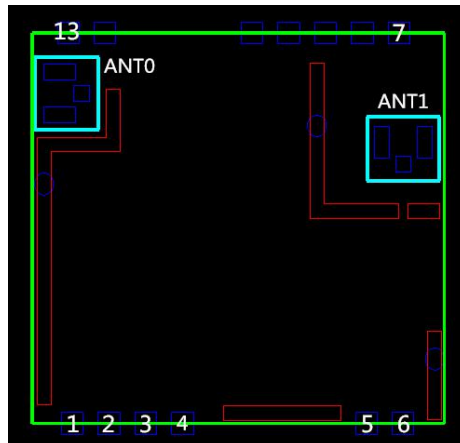
Picture



Interface

Interface: Half Hole, Stamp

Pin definition



Pin	Description
1	GND
2	USB_DP
3	USB_DN
4	3.3V
5	GND
6	GND
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	NC

3. Electrical Specification

3.1 Recommended operating rating

Element	Symbol	Min	Typ	Max	Unit
DC supply voltage	UV+	3.0	3.3	3.6	(V)

3.2 DC Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
STBY 3.3V	Supply voltage	3.0	3.3	3.6	(V)
	Power Saving	--	450	--	(uA)
	Standby	--	212	--	(mA)
	Continuous Tx Current 2.4GHz(Dual Chain)	--	710	--	(mA)
	Continuous Rx Current 2.4GHz(Dual Chain)	--	256	--	(mA)
	Continuous Tx Current 5GHz(Dual Chain)	--	810	--	(mA)
	Continuous Rx Current 5GHz(Dual Chain)	--	260	--	(mA)

3.3 Environment Storage Condition

Environment condition	
Temperature	Operating Temperature: -10 deg.C ~70 deg.C
	Storage Temperature: -40 deg.C ~80 deg.C
Humidity	Operating Humidity: 5% ~95% (Non-condensing)
	Storage Humidity: 5% ~95% (Non-condensing)

4. RF Specification

4.1 IEEE 802.11b

Items	Contents			
Specification	IEEE 802.11b			
Modulation technique	DSSS/CCK			
Channel	CH1 ~ CH13			
Data rate	1,2,5.5,11Mbps			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels(SISO)				
1)Target Power@1Mbps	15	17	19	dBm
2)Target Power@2Mbps	15	17	19	dBm
3)Target Power@5.5Mbps	15	17	19	dBm
4)Target Power@11Mbps	15	17	19	dBm
2. Spectrum Mask@Target Power				
1) $f_c - 33\text{MHz} < f < f_c - 22\text{MHz}$	-	-	-50	dBr
2) $f_c - 22\text{MHz} < f < f_c - 11\text{MHz}$	-	-	-30	dBr
3) $f_c + 11\text{MHz} < f < f_c + 22\text{MHz}$	-	-	-30	dBr
4) $f_c + 22\text{MHz} < f < f_c + 33\text{MHz}$	-	-	-50	dBr
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) 1Mbps	-	-	-10	dB
2) 2Mbps	-	-	-10	dB
3) 5.5Mbps	-	-	-10	dB
4) 11Mbps	-	-	-10	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) 1Mbps(PER \leq 8%)	-	-97	-94	dBm
2) 2Mbps(PER \leq 8%)	-	-94	-90	dBm
3) 5.5Mbps(PER \leq 8%)	-	-92	-89	dBm
4) 11Mbps(PER \leq 8%)	-	-90	-87	dBm
6. Maximum Input Level (PER \leq 8%)	-10	-	-	dBm

4.2 IEEE 802.11g

Items	Contents			
Specification	IEEE 802.11g			
Modulation technique	OFDM			
Channel	CH1 ~ CH13			
Data rate	6,9,12,18,24,36,48,54Mbps			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels(SISO)				
1)Target Power@6Mbps	15	17	19	dBm
2)Target Power@9Mbps	15	17	19	dBm
3)Target Power@12Mbps	15	17	19	dBm
4)Target Power@18Mbps	15	17	19	dBm
5)Target Power@24Mbps	15	17	19	dBm
6)Target Power@36Mbps	14	16	18	dBm
7)Target Power@48Mbps	13	15	17	dBm
8)Target Power@54Mbps	12	14	16	dBm
2. Spectrum Mask@Target Power				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB
3) at $f_c > \pm 30\text{MHz}$	-	-	-40	dB
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) 6Mbps	-	-	-5	dB
2) 9Mbps	-	-	-8	dB
3) 12Mbps	-	-	-10	dB
4) 18Mbps	-	-	-13	dB
5) 24Mbps	-	-	-16	dB
6) 36Mbps	-	-	-19	dB
7) 48Mbps	-	-	-22	dB
8) 54Mbps	-	-33	-25	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) 6Mbps(PER < 10%)	-	-94	-90	dBm
2) 9Mbps(PER < 10%)	-	-93	-89	dBm
3) 12Mbps(PER < 10%)	-	-92	-88	dBm
4) 18Mbps(PER < 10%)	-	-90	-86	dBm
5) 24Mbps(PER < 10%)	-	-86	-82	dBm
6) 36Mbps(PER < 10%)	-	-83	-79	dBm
7) 48Mbps(PER < 10%)	-	-78	-75	dBm
8) 54Mbps(PER < 10%)	-	-75	-72	dBm
6. Maximum Input Level (PER < 10%)	-20	-	-	dBm

4.3 IEEE 802.11n HT20(2.4G)

Items	Contents			
Specification	IEEE 802.11n HT20			
Modulation technique	OFDM			
Channel	CH1 ~ CH13			
Data rate	MCS0 ~ MCS15			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels				
1)Target Power@MCS0	15	17	19	dBm
2)Target Power@MCS1	15	17	19	dBm
3)Target Power@MCS2	15	17	19	dBm
4)Target Power@MCS3	15	17	19	dBm
5)Target Power@MCS4	14	16	18	dBm
6)Target Power@MCS5	13	15	17	dBm
7)Target Power@MCS6	12	14	16	dBm
8)Target Power@MCS7	11	13	15	dBm
2. Spectrum Mask@14dBm				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB
3) at $f_c > \pm 30\text{MHz}$	-	-	-45	dB
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) MCS0	-	-	-5	dB
2) MCS1	-	-	-10	dB
3) MCS2	-	-	-13	dB
4) MCS3	-	-	-16	dB
5) MCS4	-	-	-19	dB
6) MCS5	-	-	-22	dB
7) MCS6	-	-	-25	dB
8) MCS7	-	-31	-28	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) MCS0(PER < 10%)	-	-94	-90	dBm
2) MCS1(PER < 10%)	-	-91	-87	dBm
3) MCS2(PER < 10%)	-	-89	-85	dBm
4) MCS3(PER < 10%)	-	-85	-82	dBm
5) MCS4(PER < 10%)	-	-81	-77	dBm
6) MCS5(PER < 10%)	-	-77	-73	dBm
7) MCS6(PER < 10%)	-	-75	-70	dBm
8) MCS7(PER < 10%)	-	-73	-67	dBm
6. Maximum Input Level (PER < 10%)	-20	-	-	dBm

4.4 IEEE 802.11n HT40(2.4G)

Items	Contents			
Specification	IEEE 802.11n HT40			
Modulation technique	OFDM			
Channel	CH3 ~ CH11			
Data rate	MCS0 ~ MCS15			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels				
1)Target Power@MCS0	14	16	18	dBm
2)Target Power@MCS1	14	16	18	dBm
3)Target Power@MCS2	14	16	18	dBm
4)Target Power@MCS3	14	16	18	dBm
5)Target Power@MCS4	13	15	17	dBm
6)Target Power@MCS5	12	14	16	dBm
7)Target Power@MCS6	11	13	15	dBm
8)Target Power@MCS7	10	12	14	dBm
2. Spectrum Mask@14dBm				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB
3) at $f_c > \pm 30\text{MHz}$	-	-	-45	dB
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) MCS0	-	-	-5	dB
2) MCS1	-	-	-10	dB
3) MCS2	-	-	-13	dB
4) MCS3	-	-	-16	dB
5) MCS4	-	-	-19	dB
6) MCS5	-	-	-22	dB
7) MCS6	-	-	-25	dB
8) MCS7	-	-32	-28	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) MCS0(PER < 10%)	-	-91	-87	dBm
2) MCS1(PER < 10%)	-	-88	-84	dBm
3) MCS2(PER < 10%)	-	-86	-82	dBm
4) MCS3(PER < 10%)	-	-82	-79	dBm
5) MCS4(PER < 10%)	-	-79	-74	dBm
6) MCS5(PER < 10%)	-	-74	-70	dBm
7) MCS6(PER < 10%)	-	-72	-69	dBm
8) MCS7(PER < 10%)	-	-70	-65	dBm
6. Maximum Input Level (PER < 10%)	-20	-	-	dBm

4.5 IEEE 802.11a

Items	Contents			
Specification	IEEE 802.11a			
Modulation technique	OFDM			
Channel	5180 ~ 5825MHz			
Data rate	6,9,12,18,24,36,48,54Mbps			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels(SISO)				
1)Target Power@6Mbps	18	20	22	dBm
2)Target Power@9Mbps	18	20	22	dBm
3)Target Power@12Mbps	18	20	22	dBm
4)Target Power@18Mbps	18	20	22	dBm
5)Target Power@24Mbps	18	20	22	dBm
6)Target Power@36Mbps	15	17	19	dBm
7)Target Power@48Mbps	14	16	18	dBm
8)Target Power@54Mbps	13	15	17	dBm
2. Spectrum Mask@Target Power				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dBr
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dBr
3) at $f_c > \pm 30\text{MHz}$	-	-	-40	dBr
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) 6Mbps	-		-5	dB
2) 9Mbps	-		-8	dB
3) 12Mbps	-		-10	dB
4) 18Mbps	-		-13	dB
5) 24Mbps	-		-16	dB
6) 36Mbps	-		-19	dB
7) 48Mbps	-		-22	dB
8) 54Mbps	-	-30	-25	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) 6Mbps(PER < 10%)	-	-94	-90	dBm
2) 9Mbps(PER < 10%)	-	-93	-89	dBm
3) 12Mbps(PER < 10%)	-	-92	-88	dBm
4) 18Mbps(PER < 10%)	-	-89	-85	dBm
5) 24Mbps(PER < 10%)	-	-86	-82	dBm
6) 36Mbps(PER < 10%)	-	-82	-78	dBm
7) 48Mbps(PER < 10%)	-	-78	-74	dBm
8) 54Mbps(PER < 10%)	-	-77	-72	dBm
6. Maximum Input Level (PER < 10%)	-30	-	-	dBm

4.6 IEEE 802.11n HT20(5G)

Items	Contents			
Specification	IEEE 802.11a/n HT20			
Modulation technique	OFDM			
Channel	5180 ~ 5825MHz			
Data rate	MCS0 ~ MCS15			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels				
1)Target Power@MCS0	18	20	22	dBm
2)Target Power@MCS1	16	18	20	dBm
3)Target Power@MCS2	16	18	20	dBm
4)Target Power@MCS3	16	18	20	dBm
5)Target Power@MCS4	15	17	19	dBm
6)Target Power@MCS5	14	16	18	dBm
7)Target Power@MCS6	13	15	17	dBm
8)Target Power@MCS7	12	14	16	dBm
2. Spectrum Mask@14dBm				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB
3) at $f_c > \pm 30\text{MHz}$	-	-	-45	dB
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) MCS0	-		-5	dB
2) MCS1	-		-10	dB
3) MCS2	-		-13	dB
4) MCS3	-		-16	dB
5) MCS4	-		-19	dB
6) MCS5	-		-22	dB
7) MCS6	-		-25	dB
8) MCS7	-	-30	-28	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) MCS0(PER < 10%)	-	-93	-89	dBm
2) MCS1(PER < 10%)	-	-91	-87	dBm
3) MCS2(PER < 10%)	-	-88	-84	dBm
4) MCS3(PER < 10%)	-	-83	-79	dBm
5) MCS4(PER < 10%)	-	-80	-76	dBm
6) MCS5(PER < 10%)	-	-76	-72	dBm
7) MCS6(PER < 10%)	-	-75	-70	dBm
8) MCS7(PER < 10%)	-	-73	-67	dBm
6. Maximum Input Level (PER < 10%)	-30	-	-	dBm

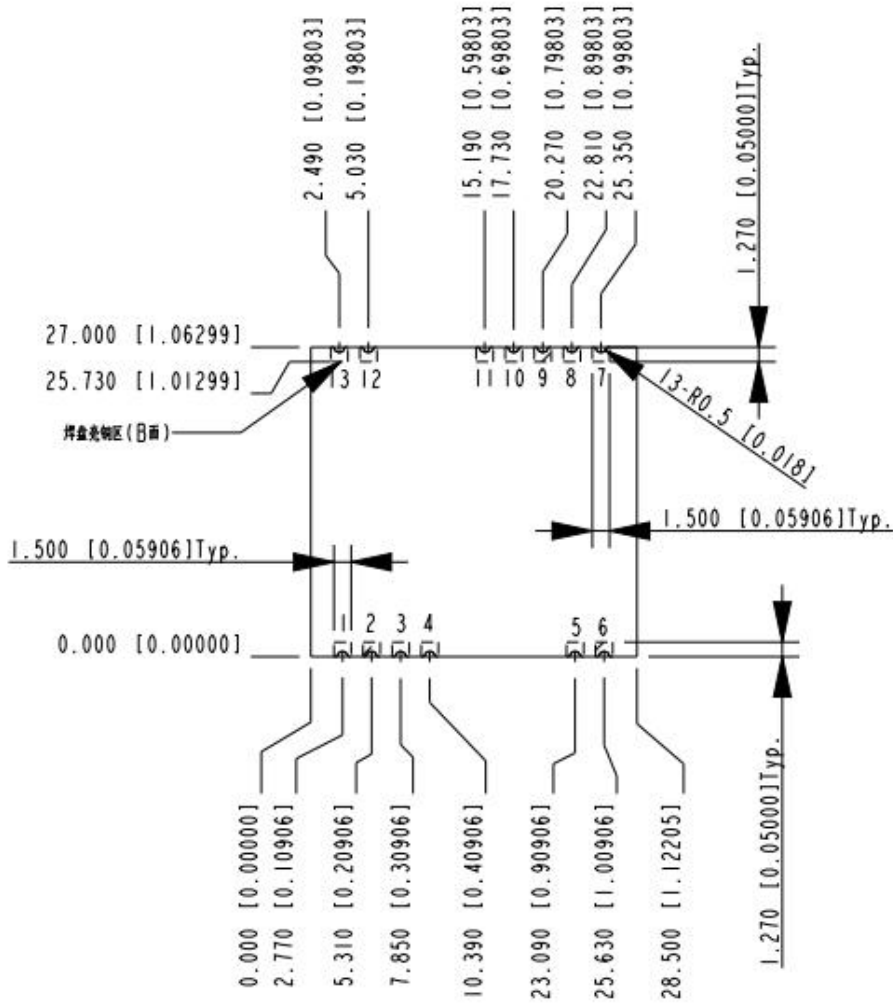
4.7 IEEE 802.11n HT40(5G)

Items	Contents			
Specification	IEEE 802.11a/n HT40			
Modulation technique	OFDM			
Channel	5190 ~ 5815MHz			
Data rate	MCS0 ~ MCS15			
TX Characteristics	Min.	Typ.	Max.	Unit
1. Power Levels				
1)Target Power@MCS0	16	18	20	dBm
2)Target Power@MCS1	15	17	19	dBm
3)Target Power@MCS2	15	17	19	dBm
4)Target Power@MCS3	15	17	19	dBm
5)Target Power@MCS4	14	16	18	dBm
6)Target Power@MCS5	13	15	17	dBm
7)Target Power@MCS6	12	14	16	dBm
8)Target Power@MCS7	11	13	15	dBm
2. Spectrum Mask@14dBm				
1) at $f_c \pm 11\text{MHz}$	-	-	-20	dB
2) at $f_c \pm 20\text{MHz}$	-	-	-28	dB
3) at $f_c > \pm 30\text{MHz}$	-	-	-45	dB
3. Frequency Error	-20	-	+20	ppm
4. Modulation Accuracy(EVM)@Target Power				
1) MCS0	-	-	-5	dB
2) MCS1	-	-	-10	dB
3) MCS2	-	-	-13	dB
4) MCS3	-	-	-16	dB
5) MCS4	-	-	-19	dB
6) MCS5	-	-	-22	dB
7) MCS6	-	-	-25	dB
8) MCS7	-	-31	-28	dB
RX Characteristics	Min.	Typ.	Max.	Unit
5. Minimum Input Level Sensitivity				
1) MCS0(PER < 10%)	-	-89	-85	dBm
2) MCS1(PER < 10%)	-	-87	-83	dBm
3) MCS2(PER < 10%)	-	-84	-80	dBm
4) MCS3(PER < 10%)	-	-80	-76	dBm
5) MCS4(PER < 10%)	-	-77	-73	dBm
6) MCS5(PER < 10%)	-	-73	-69	dBm
7) MCS6(PER < 10%)	-	-71	-67	dBm
8) MCS7(PER < 10%)	-	-70	-64	dBm
6. Maximum Input Level (PER < 10%)	-30	-	-	dBm

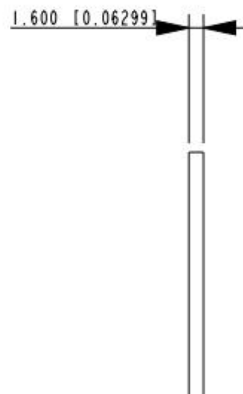
5. Mechanical Specifications

PCB Assembly Dimension:

Module Dimension (W x L x H): 28.5mm x 27mm x 4.0mm

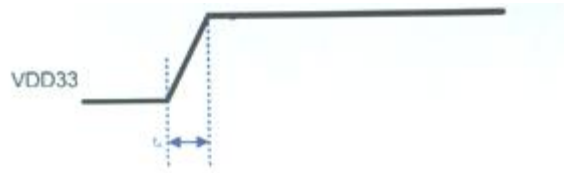


PCB Dimension:



6. Reset Timing

The module timing when power off and power on .



Reset Timing Parameter Requirement

Symbols	Descriptions	Max Value (mS)
T _A	Rise time of VDD3V3 to 90% of 3.3V	25

7. Manufacturing Guidance

The following figure shows the temperature graph when manufacture by reflow soldering method.

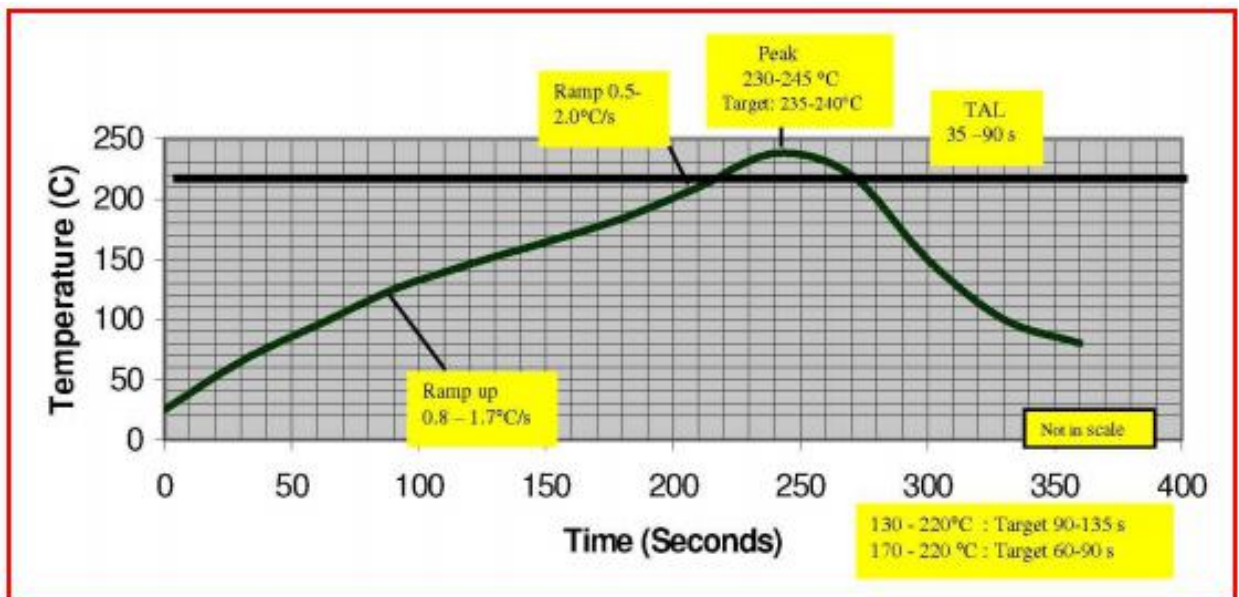


Figure Recommended Reflow Soldering Temperature Graph

Note: as shown in the above figure, it is based on the SAC305 lead-free tin paste (3% silver, 0.5% copper). Alpha OM-338 lead-free cleaning-free flux is recommended. This figure is mainly used for guidance. The entire process time is subject to thermal pad number of assembly board and device Intensity.

8. Order Information

8.1 Product Information

Products

P.N	Description	Single Tray Packing	Minimum Package
RAK535BS	Supply driver under Linux&Andriod OS, External Antenna,2T2R	60pcs/tray	600pcs

8.2 Others

Product Models: RAK535 (Pb Free)Tray

9 Revision History

Revision	Description	Date
V1.0	Initial Draft	2015-08-25