
VS2156T

IEEE 802.11a/b/g/n/ac 1T1R+BT5.2 Combo Module

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1. Device Overview

1.1 Features

1.1.1 General Features

- Supports battery voltage range from 3.0V to 4.8V supplies with internal switching regulator
- 1 antennas to support 1T1R technology and Bluetooth
- WPA and WPA2 support for powerful encryption and authentication
- AES and TKIP in hardware for faster data encryption and IEEE 802.11i compatibility
- Reference WLAN subsystem provides Cisco Compatible Extensions(CCX,CCX 2.0 CCX 3.0 ,and CCX 4.0)
- Reference WLAN subsystem provides Wi-Fi Protected Setup (WPS)Support external crystal and internal crystal
- Support standard SDIO v3.0(including DDR50 mode at 50Mhz and SDR104 mode at 208Mhz ,b-bit and 1bit)interfaces.
- Backward compatible with SDIO v2.0 host interfaces.
- Interface support ,host controller interface(HCI) using a high speed UART interface and PCM for audio data .12.0mm*12.0mm LGA package

1.1.2 IEEE 802.11x Key Features

- IEEE 802.11ac compliant
- Single-stream spatial multiplexing up to 433.3 Mbps data rate .
- Programmable data rates from MCS0–MCS9 in 20, 40, and 80 MHz channels, as specified in IEEE 802.11ac
- Full IEEE 802.11a/b/g/n legacy compatibility with enhanced performance
- TX and RX low-density parity check (LDPC) support for improved range and power efficiency
- Supports explicit IEEE 802.11ac transmit beamforming
- Supports Optional Short GI and Green Field modes in TX and RX
- Supports IEEE 802.15.2 external coexistence interface to optimize bandwidth utilization with other co-located wireless technologies such as LTE or GPS.

1.1.3 Bluetooth Key Features

- Complies with Bluetooth Core Specification Version 4.2 with provisions for supporting future specifications.Bluetooth Class 1 or Class 2 transmitter operation
- Supports multiple simultaneous Advanced Audio Distribution Profiles (A2DP) for stereo sound
- Low power consumption improves battery life of handheld
- Adaptive frequency hopping(AFH) for reducing radio frequency interference
- Automatic frequency detection for standard crystal and TCXO values

1.2 Descriptions

The VS2156T module is a complete dual-band (2.4 GHz and 5 GHz) Wi-Fi 1 × 1 MAC/baseband/Radio System-on-a-Module. It provides the highest level of integration for IoT applications handheld wireless systems. In IEEE 802.11ac mode, the WLAN operation supports rates of MCS0–MCS9 (up to 256 QAM) in 20 MHz, 40MHz, and 80 MHz channels for data rates up to 433.3 Mbps. In addition, all the IEEE 802.11a/b/g/n rates are supported.

1.3 Functional Block Diagram

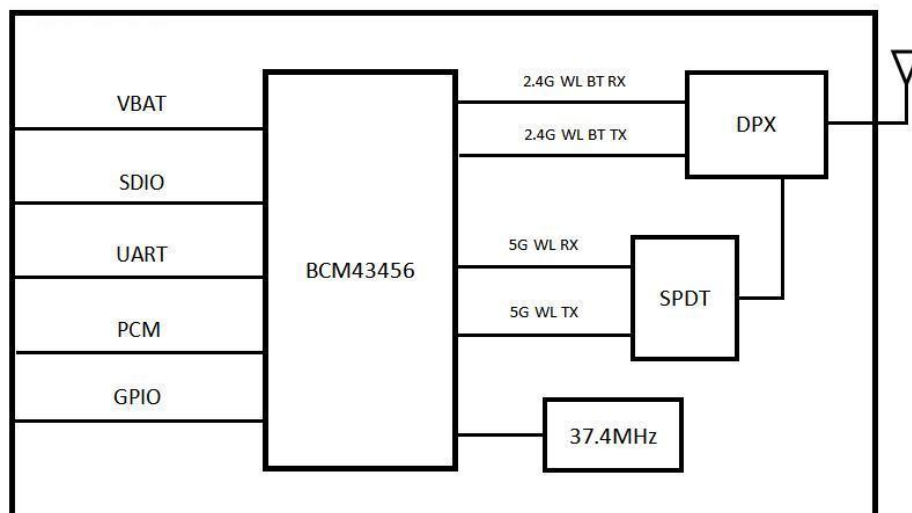


Figure 1. Block Diagram of VS2156T

2. Pin Configuration and Functions

2.1 Module Pin Diagram

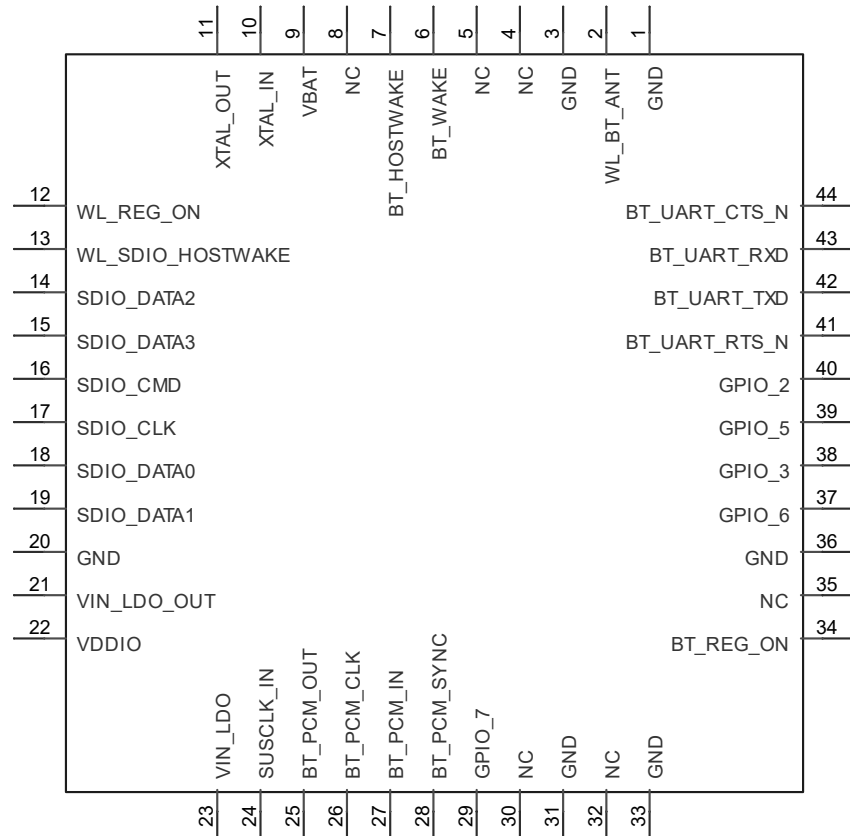


Figure 2.Pin Diagram of VS2156T

2.2 Pin Functions

Pin	Name	Description
1	GND	Ground
2	WL_BT_ANT	WLAN/BT RF TX/RX path
3	GND	Ground
4	NC	No connected
5	NC	No connected
6	BT_WAKE	BT Device Wake
7	BT_HOSTWAKE	BT Host Wake
8	NC	No connected
9	VBAT	3.3V power supply
10	XTAL_IN	No connected
11	XTAL_OUT	No connected

12	WL_REG_ON	Used by PMU to power up or power down the internal regulators used by the WLAN section. Also, when deasserted, this pin holds the WLAN section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
13	WL_SDIO_HOSTWAKE	WL Host Wake
14	SDIO_DATA2	SDIO Data Line 2
15	SDIO_DATA3	SDIO Data Line 3
16	SDIO_CMD	SDIO Command Input
17	SDIO_CLK	SDIO Clock Input
18	SDIO_DATA0	SDIO Data Line 0
19	SDIO_DATA1	SDIO Data Line 1
20	GND	Ground
21	VIN_LDO_OUT	Internal Buck voltage generation pin
22	VDDIO	1.8V-3.3V VDDIO supply for WLAN and BT
23	VIN_LDO	Internal Buck voltage generation pin
24	SUSCLK_IN	External 32K or RTC clock
25	BT_PCM_OUT	PCM data Out
26	BT_PCM_CLK	PCM Clock
27	BT_PCM_IN	PCM data Input
28	BT_PCM_SYNC	PCM Synchronization control
29	GPIO_7	SDIO mode selection pin 1.8V:pull up, connect to 1.8V 3.3V:pull down, connect to GND with using a 10K resistor or less
30	NC	No connected
31	GND	Ground
32	NC	No connected
33	GND	Ground
34	BT_REG_ON	Used by PMU to power up or power down the internal regulators used by the Bluetooth section. Also, when deasserted, this pin holds the Bluetooth section in reset. This pin has an internal 200k ohm pull down resistor that is enabled by default. It can be disabled through programming
35	NC	No connected
36	GND	Ground
37	GPIO_6	GPIO configuration pin
38	GPIO_3	GPIO configuration pin

39	GPIO_5	GPIO configuration pin
40	GPIO_2	GPIO configuration pin
41	BT_UART_RTS_N	High-Speed UART RTS
42	BT_UART_TXD	High-Speed UART Data Out
43	BT_UART_RXD	High-Speed UART Data In
44	BT_UART_CTS_N	High-Speed UART CTS

3. Specifications

3.1 General Characteristics

Category	Descriptions
Dimension	L*W*H :12.0mm (±0.2mm)*12.0mm (±0.2mm)*2.1mm (±0.1mm)
Chip-set	BCM43456
Standard	IEEE 802.11a/b/g/n/ac+BT 5.2
Modulation Type	CCK, OFDM(16 QAM/64 QAM/256 QAM)
Frequency Band	2400~2500MHz,4900-5845MHz
Interface	WLAN:SDIO, Bluetooth:UART
Spread Spectrum	DSSS
Transmission Distance	Indoor up to 100m, outdoor up to 300m (limited in an environment)
Data Security	WEP,WPA/WPA2
Transmit Power	2.4G: 11b 11Mbps:18±2dBm 11g 54Mbps:16±2dBm 11n HT20 MCS7:15±2dBm 11n HT40 MCS7:14±2dBm 5G: 11a 54Mbps:15±2dBm 11n HT20 MCS7:15±2dBm 11n HT40 MCS7:13±2dBm 11ac VHT20 MCS8:14±2dBm 11ac VHT40 MCS9:13±2dBm 11ac VTH80 MCS9:12±2dBm
Rx Sensitivity	2.4G: 11b 11M:-87dBm@8% PER 11g 54M: -76dBm@10% PER 11n HT20 MCS7: -74dBm@10% PER 11n HT40 MCS7: -71dBm@10% PER 5G:

	11a 54M:-73dBm@10% PER 11n HT20 MCS7: -71dBm@10% PER 11n HT40 MCS7: -68dBm@10% PER 11ac VTH20 MCS8:-66dBm@10% PER 11ac VTH40 MCS9:-63dBm@10% PER 11ac VTH80 MCS9:-59dBm@10% PER
Data Rate	802.11b [11,5.5,2 and 1Mbps] 802.11g [54,48,36,24,18,12,9&6Mbps] 802.11n HT20:up to 72.2Mbps 802.11n HT40:up to 150Mbps 802.11ac VHT80:up to 433.3Mbps
Frequency Error	2.4GHz:<±25 ppm(11b),<±20 ppm(11g/n);5GHz:<±20 ppm
Ambient Temperature	-20℃~75℃
Storage Temperature	-40℃~125℃
Antenna	External PF antenna
Operating System	Linux
Operating Voltage	VBAT: 3.0 ~ 4.8V ; typical: 3.6V VIO : 1.8 ~ 3.3V

3.2 RF Characteristics

All measurements are made under nominal supply voltage & room temperature, and conducted conditions at antenna port rather than antenna.

3.2.1 Receiver RF Specifications

Parameter	Conditions		Min.	Nom.	Max.	Unit
Receive Input Frequency						
2.4GHz	802.11b/g/n mode		2400	-	2500	MHz
Receiver Sensitivity						
802.11b	1Mbps	FER<8%, Packet size= 1,024bytes	-	-	-82	dBm
	2Mbps		-	-	-80	dBm
	5.5Mbps		-	-	-78	dBm
	11Mbps		-	-	-76	dBm
802.11g	6Mbps	PER<10%, Packet size= 1,024bytes	-	-	-82	dBm
	9Mbps		-	-	-81	dBm
	12Mbps		-	-	-79	dBm
	18Mbps		-	-	-77	dBm
	24Mbps		-	-	-74	dBm
	36Mbps		-	-	-70	dBm
	48Mbps		-	-	-66	dBm
	54Mbps		-	-	-65	dBm

802.11n (HT20)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-80	dBm
	MCS1.		-	-	-77	dBm
	MCS2		-	-	-75	dBm
	MCS3.		-	-	-72	dBm
	MCS4.		-	-	-68	dBm
	MCS5.		-	-	-64	dBm
	MCS6.		-	-	-63	dBm
	MCS7.		-	-	-62	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-77	dBm
	MCS1.		-	-	-74	dBm
	MCS2		-	-	-72	dBm
	MCS3.		-	-	-69	dBm
	MCS4.		-	-	-65	dBm
	MCS5.		-	-	-61	dBm
	MCS6.		-	-	-60	dBm
	MCS7.		-	-	-59	dBm
Maximum Input Level						
802.11b	FER<8%		-10	-	-	dBm
802.11g	FER<10%		-20	-	-	dBm
802.11n	FER<10%		-30			dBm

Parameter	Conditions		Min.	Nom.	Max.	Unit
Receive Input Frequency						
5GHz	802.11a/n/ac mode		4900	-	5845	MHz
Receiver Sensitivity						
802.11a	6Mbps	FER<10%, Packet size= 1,024bytes	-	-	-82	dBm
	9Mbps		-	-	-81	dBm
	12Mbps		-	-	-79	dBm
	18Mbps		-	-	-77	dBm
	24Mbps		-	-	-74	dBm
	36Mbps		-	-	-70	dBm
	48Mbps		-	-	-66	dBm
	54Mbps		-	-	-65	dBm
802.11n (HT20)	6Mbps	PER<10%, Packet size= 4,096bytes	-	-	-80	dBm
	9Mbps		-	-	-77	dBm
	12Mbps		-	-	-75	dBm
	18Mbps		-	-	-72	dBm
	24Mbps		-	-	-68	dBm
	36Mbps		-	-	-64	dBm

	48Mbps		-	-	-63	dBm
	54Mbps		-	-	-62	dBm
802.11n (HT40)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-77	dBm
	MCS1.		-	-	-74	dBm
	MCS2		-	-	-72	dBm
	MCS3.		-	-	-69	dBm
	MCS4.		-	-	-65	dBm
	MCS5.		-	-	-61	dBm
	MCS6.		-	-	-60	dBm
	MCS7.		-	-	-59	dBm
802.11ac (VHT80)	MCS0.	PER<10%, Packet size= 4,096bytes	-	-	-76	dBm
	MCS1.		-	-	-73	dBm
	MCS2		-	-	-71	dBm
	MCS3.		-	-	-68	dBm
	MCS4.		-	-	-64	dBm
	MCS5.		-	-	-60	dBm
	MCS6.		-	-	-59	dBm
	MCS7.		-	-	-58	dBm
	MCS8.		-	-	-53	dBm
	MCS9.		-	-	-51	dBm
Maximum Input Level						
802.11a	FER<10%		-30	-	-	dBm
802.11n	FER<10%		-30	-	-	dBm
802.11ac	FER<10%		-30	-	-	dBm

3.2.2 Transmitter RF Specifications

Parameter	Condition	Min.	Nom.	Max.	Unit.
Receive Input Frequency					
802.11b/g/n	2.4GHz	2400	-	2500	MHz
Transmit Power					
802.11b	11Mbps	16	18	20	dBm
802.11g	54Mbps	14	16	18	dBm
802.11n	HT20, MCS7	13	15	17	dBm
	HT40, MCS7	12	14	16	dBm
Spectrum Mask					
802.11b	$f_c - 22\text{MHz} < f < f_c - 11\text{MHz} \& f_c + 11\text{MHz} < f < f_c + 22\text{MHz}$	-	-	-30	dBr
	$f_c - 55\text{MHz} < f < f_c - 22\text{MHz} \& f_c + 22\text{MHz} < f < f_c + 55\text{MHz}$	-	-	-50	dBr
802.11g	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr

	$f_c \pm 30\text{MHz}$	-	-	-40	dBr
802.11n	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr
	$f_c \pm 30\text{MHz}$	-	-	-45	dBr
Center Frequency Tolerance					
802.11b		-25	-	+25	pmm
802.11g/n		-20	-	+20	pmm
EVM(Error Vector Magnitude)*					
802.11b	1Mbps	-	-	35	%
	2Mbps	-	-	35	%
	5.5Mbps	-	-	35	%
	11Mbps	-	-	35	%
802.11g	6Mbps	-	-	-5	%
	9Mbps	-	-	-8	dB
	12Mbps	-	-	-10	dB
	18Mbps	-	-	-13	dB
	24Mbps	-	-	-16	dB
	36Mbps	-	-	-19	dB
	48Mbps	-	-	-22	dB
	54Mbps	-	-	-25	dB
802.11n	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB
	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-28	dB

Remarks

EVM :

<Test condition>

Method: composite EVM method.

Phase correction: Symbol-by-symbol correction.

Channel estimation: Raw channel estimate Raw Long Symbols.

Symbol timing correction: on.

Frequency Sync: Long training symbol.

Parameter	Condition	Min.	Nom.	Max.	Unit.
Receive Input Frequency					
802.11a/n/ac	5GHz	4900	-	5845	MHz
Transmit Power					

802.11a	54Mbps	13	15	17	dBm
802.11n	HT20, MCS7	13	15	17	dBm
	HT40, MCS7	11	13	15	dBm
802.11ac	VHT20,MCS8	12	14	16	dBm
	VHT40,MCS9	11	13	15	dBm
	VHT80,MCS9	10	12	14	dBm
Spectrum Mask					
802.11a	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr
	$f_c \pm 30\text{MHz}$	-	-	-40	dBr
802.11n	$f_c \pm 9\text{MHz}$	-	-	0	dBr
	$f_c \pm 11\text{MHz}$	-	-	-20	dBr
	$f_c \pm 20\text{MHz}$	-	-	-28	dBr
	$f_c \pm 30\text{MHz}$	-	-	-45	dBr
802.11ac(VHT80)	$f_c \pm 39\text{MHz}$	-	-	0	dBr
	$f_c \pm 41\text{MHz}$	-	-	-20	dBr
	$f_c \pm 80\text{MHz}$	-	-	-28	dBr
	$f_c \pm 120\text{MHz}$	-	-	-40	dBr
Center Frequency Tolerance					
802.11a/n/ac		-20	-	+20	pmm
EVM(Error Vector Magnitude)*					
802.11a	6Mbps	-	-	-5	%
	9Mbps	-	-	-8	dB
	12Mbps	-	-	-10	dB
	18Mbps	-	-	-13	dB
	24Mbps	-	-	-16	dB
	36Mbps	-	-	-19	dB
	48Mbps	-	-	-22	dB
	54Mbps	-	-	-25	dB
802.11n	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB
	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-28	dB
802.11ac	MCS0.	-	-	-5	dB
	MCS1.	-	-	-10	dB
	MCS2	-	-	-13	dB
	MCS3.	-	-	-16	dB

	MCS4.	-	-	-19	dB
	MCS5.	-	-	-22	dB
	MCS6.	-	-	-25	dB
	MCS7.	-	-	-27	dB
	MCS8.	-	-	-30	dB
	MCS9.	-	-	-32	dB
Remarks					
EVM : <Test condition> Method: composite EVM method. Phase correction: Symbol-by-symbol correction. Channel estimation: Raw channel estimate Raw Long Symbols. Symbol timing correction: on. Frequency Sync: Long training symbol.					

3.2.3 Bluetooth RF Specifications

Parameter	Conditions	Minimum	Typical	Maximum	Unit
Frequency range		2402		2480	MHz
RX sensitivity	GFSK	-	-88	-	dBm
	$\pi/4$ -DQPSK	-	-95	-	dBm
	8-DPSK	-	-88	-	dBm
Output power	GFSK	-	12	-	dBm
	QPSK	-	8	-	dBm
	8PSK	-	8	-	dBm

4. Application, Implementation, and Layout

4.1 Wi-Fi Application Diagram

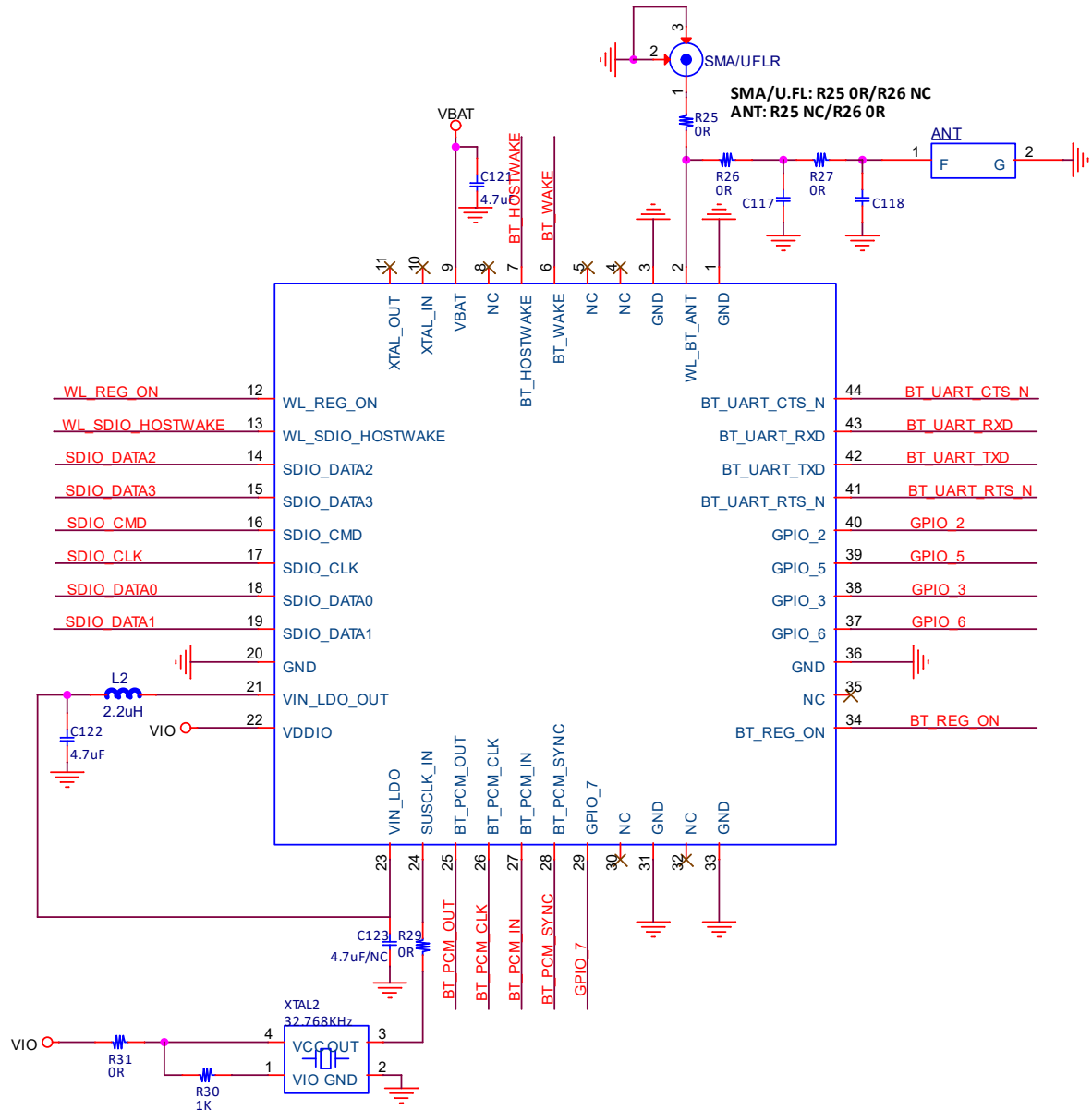


Figure 3. Application Circuit Diagram of VS2156T

5. Mechanical Size, Package and Layout Recommendation

5.1 Mechanical Size

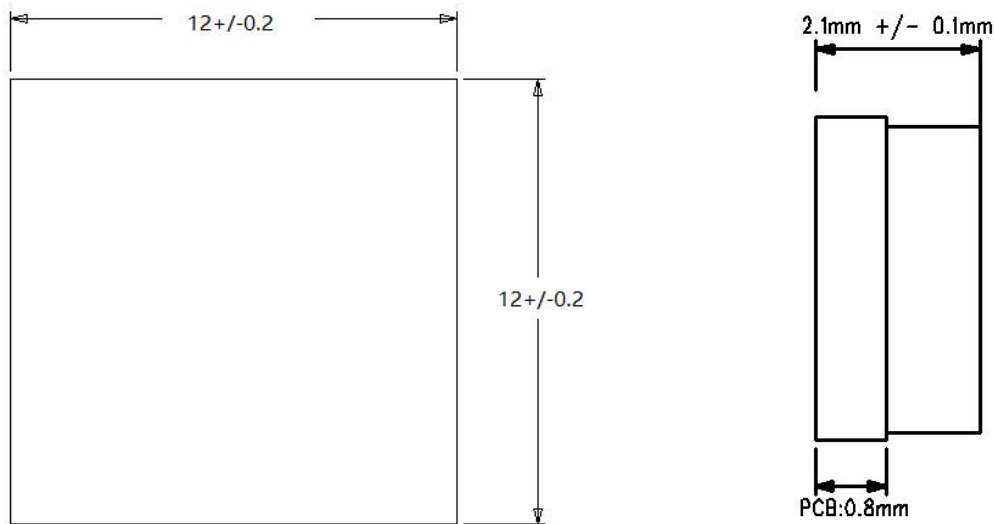
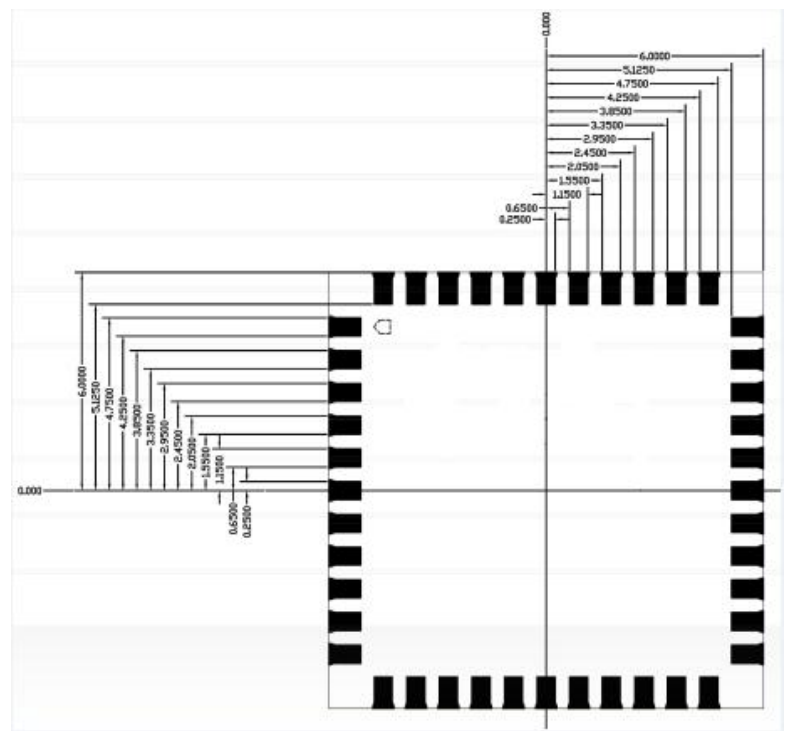


Figure 4. Mechanical Size of VS2156T

5.2 Layout Recommendation

(Unit: mm)



< BOTTOM VIEW >

5.3 Package Information

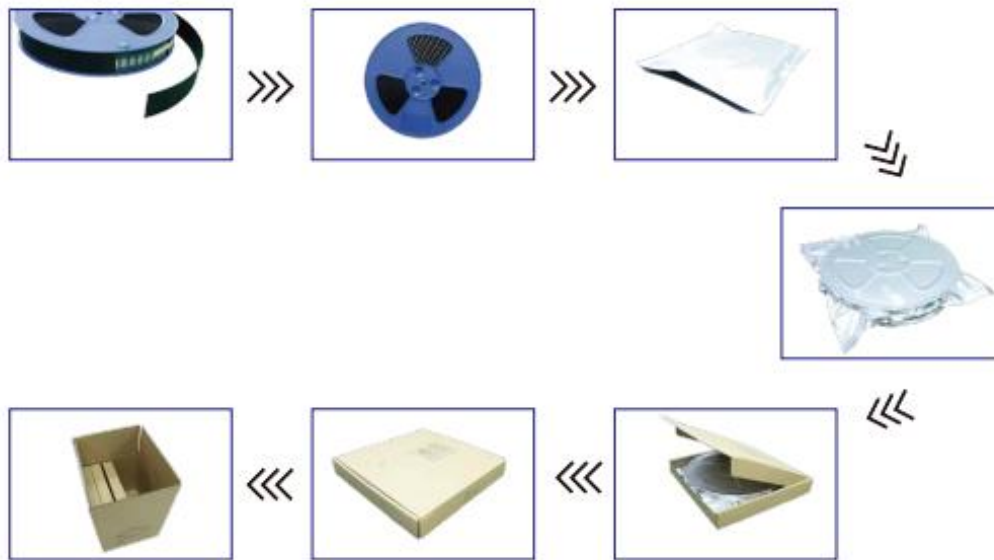


Figure 5. Brief Packaging Process of VS2156T Modules

6. Thermal Reflow

Referred to IPC/JEDEC standard.

Peak temperature: $<250^{\circ}\text{C}$

Number of times: ≤ 2

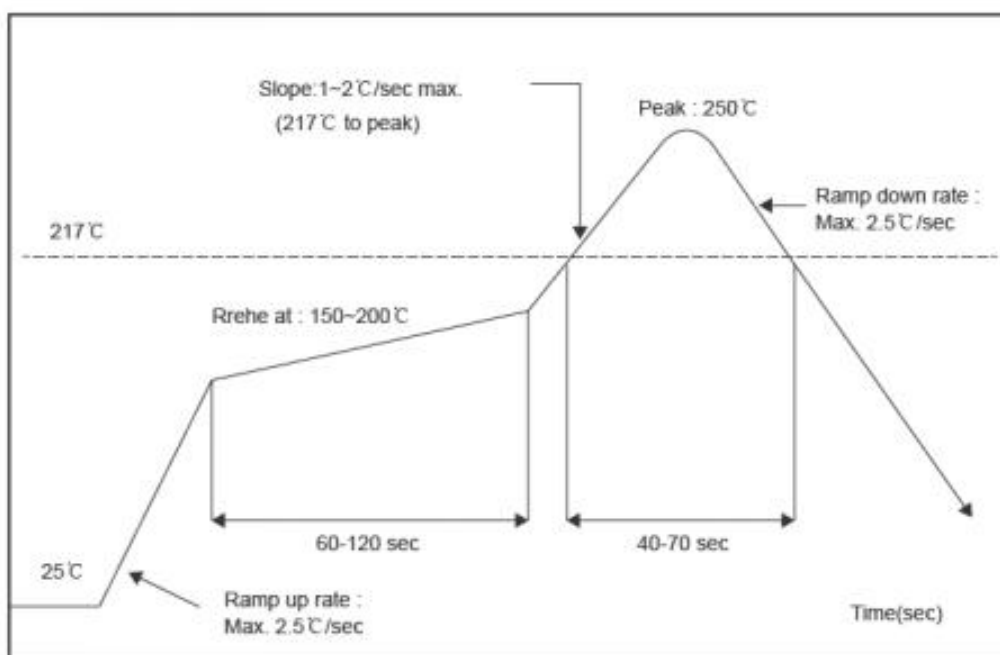


Figure 6. Recommended Reflow for Lead Free Solder

Note: The module is recommended not to go through reflow oven twice.