BK9520 Chipset Datasheet

Short Description

BK9521 Transmitter & BK9522 Receiver

V1.2

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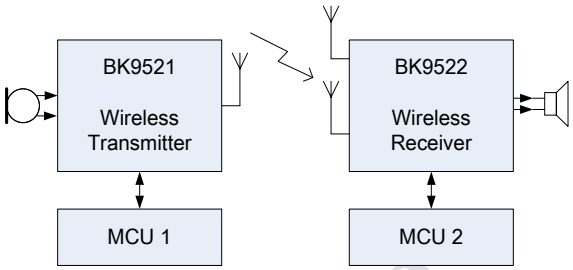
Table of Content

1. Overview

BK9520 Chipset is designed for high quality audio transmission, which includes the BK9521 transmitter and the BK9522 receiver. It covers V band 160~270MHz and U band 500~980MHz.



BK9520 utilize pi/4 DQPSK modulation and high performance audio ADC and DAC, together with ultra low latency audio codec it realizes high quality digital audio transmission. Integrated with all component from RF to baseband and audio, BK9520 make the system small, robust and easy for production. Thanks for its novel digital coding and transmission technology, BK9520 remove the compander required by traditional analog system, that make the system robust for interference.

BK9521 Features	BK9522 Features
Transmitter Power:14 dBm(V);10 dBm (U)	Sensitivity:-96 dBm(V);-96 dBm (U)
Microphone Gain:0~47.5 dB, step 0.5 dB	Dual Antenna, Auto Switch and Selection
Audio AGC and Limiter	RF AGC and AFC
TX Audio Signal Strength Indicator(GPIO3)	RX Audio Signal Strengthen Indicator Synchronization Status Indicator
	Digital Squelch. Eight band Equalizer. Active Anti-Howling
External PCM Interface (mono)	
Package: QFN 4x4 32-Pin	Package: QFN 4x4 32-Pin,5x5 40-Pin
Operation Voltage:2.8 ~ 3.6 V Operation Frequency: 160 ~ 270 MHz(V); 500 ~ 980 MHz(U) Crystal Frequency: 24.576 MHz, Crystal Tuning Range:+/-20 ppm Modulation: pi/4 DQPSK; Occupied Bandwidth:300 kHz; Data Rate:204.8Ksps Latency: Less than 3 ms from Microphone input to Earpiece output Audio SNR: 96 dB, Audio Bandwidth:30 ~ 20 kHz Control Data Channel:7 kbps; 32 Bit Encryption Code for Both Audio and Data	

Figure 1 BK9521、BK9522 Features

2. Pin Information

Figure 2 BK9521 Transmitter Package

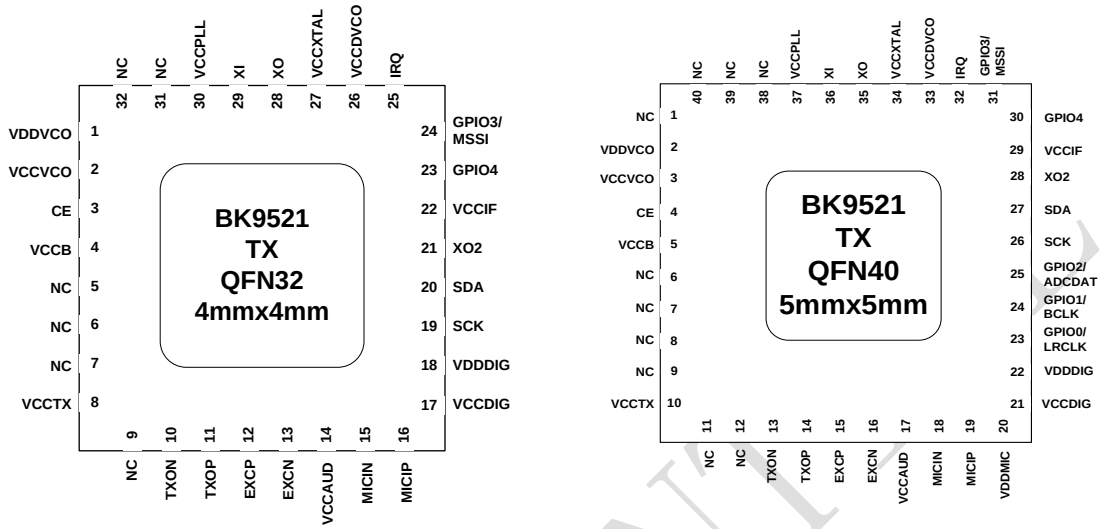


Figure 3 BK9521 QFN32 and QFN40 Pin Description

BK9521 Pin Name	QFN32 No.	QFN40 No.	Description
NC		1	Not connect
VDDVCO	1	2	VCO regulator output
VCCVCO	2	3	VCO power supply input
CE	3	4	Chip enable, Active high
VCCB	4	5	Bias power supply input
NC	5	6	Not connect
NC	6	7	Not connect
NC	7	8	Not connect
NC		9	Not connect
VCCTX	8	10	TX power supply input
NC	9	11	Not connect
NC		12	Not connect
TXON	10	13	TX output negative
TXOP	11	14	TX output positive
EXCP	12	15	Audio ADC external capacitor positive
EXCN	13	16	Audio ADC external capacitor negative
VCCAUD	14	17	Audio power supply input

MICIN	15	18	Microphone input negative
MICIP	16	19	Microphone input positive,
VDDMIC		20	MIC regulator output
VCCDIG	17	21	Digital power supply input
VDDDIG	18	22	Digital regulator output
GPIO0/LRCLK		23	GPIO0, or DSP/PCM mode left/right clock
GPIO1/BCLK		24	GPIO1, or DSP/PCM mode bit clock
GPIO2/ADCDAT		25	GPIO2, or DSP/PCM mode data input
SCK	19	26	I2C clock
SDA	20	27	I2C data
XO2	21	28	1/2 crystal frequency,12.288 MHz clock output
VCCIF	22	29	IF power supply input
GPIO4	23	30	GPIO4
GPIO3/MSSI	24	31	GPIO3, or microphone signal strength indicator
IRQ	25	32	Interrupt to MCU, Active high
VCCDVCO	26	33	Digital VCO power supply input
VCCXTAL	27	34	Crystal power supply input
XO	28	35	Crystal output
XI	29	36	Crystal input
VCCPLL	30	37	PLL power supply input
NC	31	38	Not connect
NC	32	39	Not connect
NC		40	Not connect

Figure 4 BK9522 Receiver Package

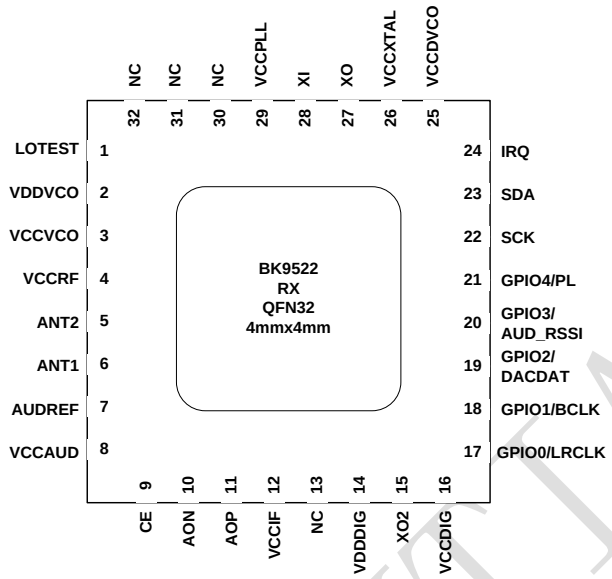


Figure 5 BK9522 QFN32 and QFN40 Pin Description

BK9522 Pin Name	Pin No.	Description
LOTEST	1	LO test output
VDDVCO	2	VCO regulator output
VCCVCO	3	VCO power supply input
VCCRF	4	RF power supply input
ANT2	5	Antenna 2
ANT1	6	Antenna 1
AUDREF	7	Audio reference voltage
VCCAUD	8	Audio power supply input
CE	9	Chip enable, Active high
AON	10	Audio output negative
AOP	11	Audio output positive
VCCIF	12	IF power supply input
NC	13	Not connect
VDDDIG	14	Digital regulator output
XO2	15	1/2 crystal frequency,12.288 MHz clock output
VCCDIG	16	Digital power supply input
GPIO0/LRCLK	17	GPIO0, or DSP/PCM mode left/right clock 道
GPIO1/BCLK	18	GPIO1, or DSP/PCM mode bit clock

GPIO2/DACDAT	19	GPIO2, or DSP/PCM mode data
GPIO3/AUD_RSSI	20	GPIO3, or RX audio signal strength indicator
GPIO4/PL	21	GPIO4, or wireless phase lock indicator
SCK	22	I2C clock
SDA	23	I2C data
IRQ	24	Interrupt to MCU, Active high
VCCDVCO	25	Digital VCO power supply input
VCCXTAL	26	Crystal power supply input
XO	27	Crystal output
XI	28	Crystal input
VCCPLL	29	PLL power supply input
NC	30	Not connect
NC	31	Not connect
NC	32	Not connect

3. Function Description

3.1. Frame Structure

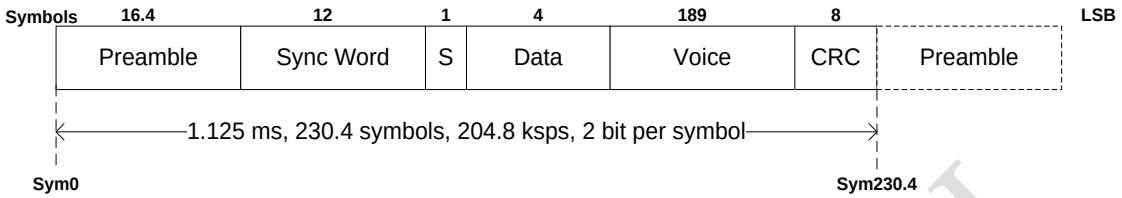


Figure 6 Frame Structure

3.2. I2C Interface

As I2C slave,BK9520 uses the its device ID (Device ID ,BK9521=0x21,BK9522=0x22) as the start byte of I2C.

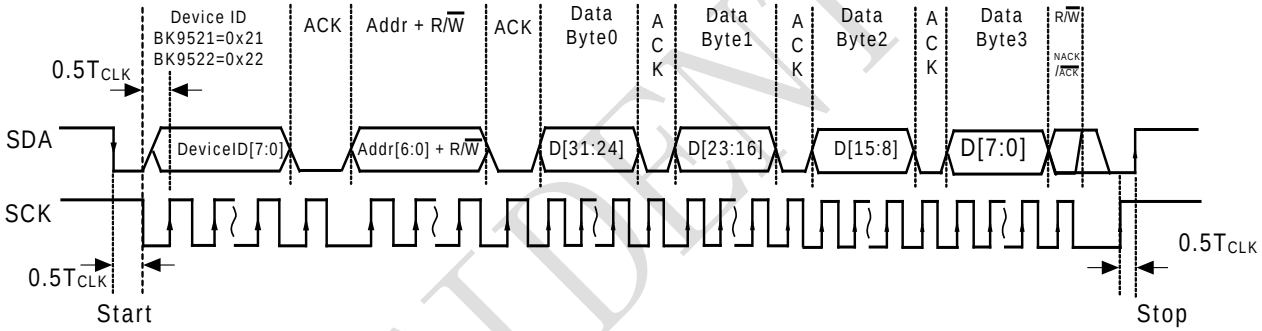


Figure 7 I2C Timing

REG10[15:0] has the complete device ID, which can be read by I2C to know whether the chip is ready or not. For BK9521 REG10[15:0] is 0x9521,and for BK9522 REG10[15:0] is 0x9522.

3.3. Basic Function

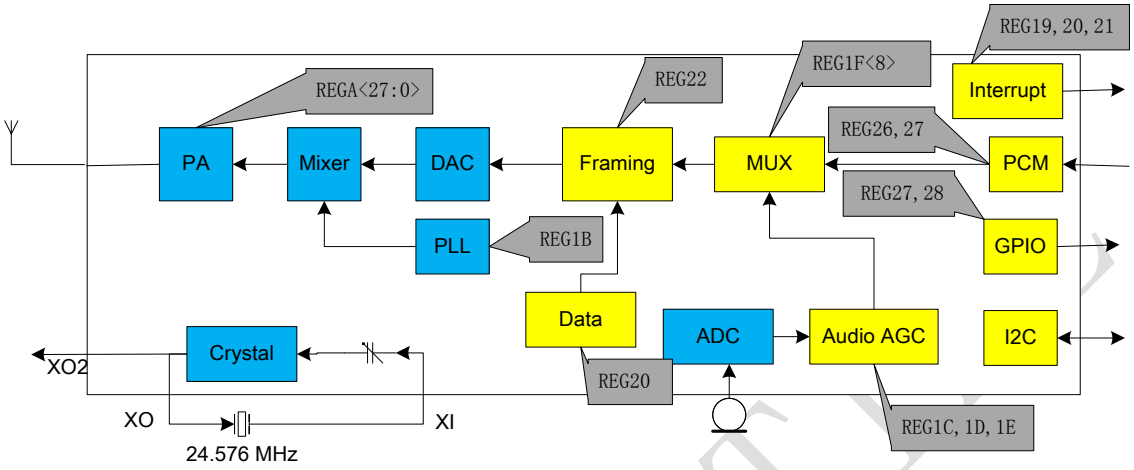


Figure 8 BK9521 Block Diagram

BK9521 translates the microphone input to digital audio and encode it, and gets the data from I2C (REG20[15:8]),then package them into a 1.125ms frame and transmits.

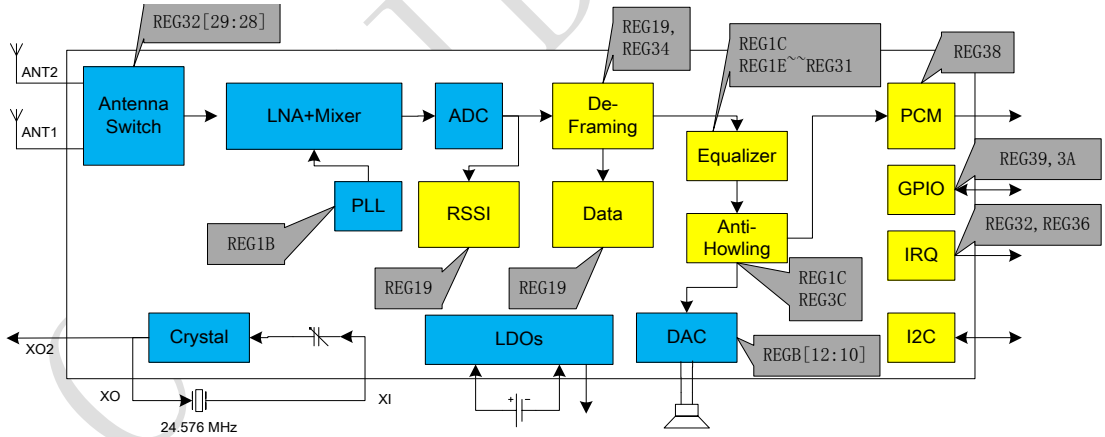


Figure 9 BK9522 Block Diagram

BK9522 receives the packet, and get the audio and control data. The audio data will be decoded and equalized. Anti-howling operation could be also applied to the audio signal before played out through DAC.

4. Electrical Characteristics

4.1. BK9521

DC Characteristics					
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**
Operation Voltage	V_{CC}	2.8*	3	3.6	V
Operation Temperature	T_O	–20	25	80	°C
Active Current (V_{CC}=3V,14dBm,VBAND)	$I_{TX,VBAND}$		125		mA
Active Current (V_{CC}=3V,10dBm,UBAND)	$I_{TX,UBAND}$		100		mA
CE=0,Shut down Current	I_{PD}		1.2		μA

***The chip can work on 2.2V, but performance can't be guaranteed**

Transmitter Performance					
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**
Crystal Frequency	F_{CLK}		24.576		MHz
Crystal Temperature Offset	F_{PPM1}	-10		10	ppm
Crystal Initial Offset	F_{PPM2}	-15		15	ppm
Operation Frequency (V)	F_{VBAND}	160		270	MHz
Operation Frequency (U)	F_{UBAND}	500		980	MHz
Output Power (V)	P_{VBAND}		14		dBm
Output Power (U)	P_{UBAND}		10		dBm
EVM	EVM		6		%
Occupied Bandwidth (99%)	BW			300	kHz
Adjacent Channel Power Ratio (600kHz)	ACPR		60		dBc
Microphone Input (Single ended THD<1%)	V_{IN}		0.3	1.5	V_{rms}
Audio Frequency (+-2dB)	Fin	30		20K	Hz
System Latency	T_{DELAY}			3	ms
I2C Clock Frequency	F_{SCK}			8	MHz

4.2. BK9522

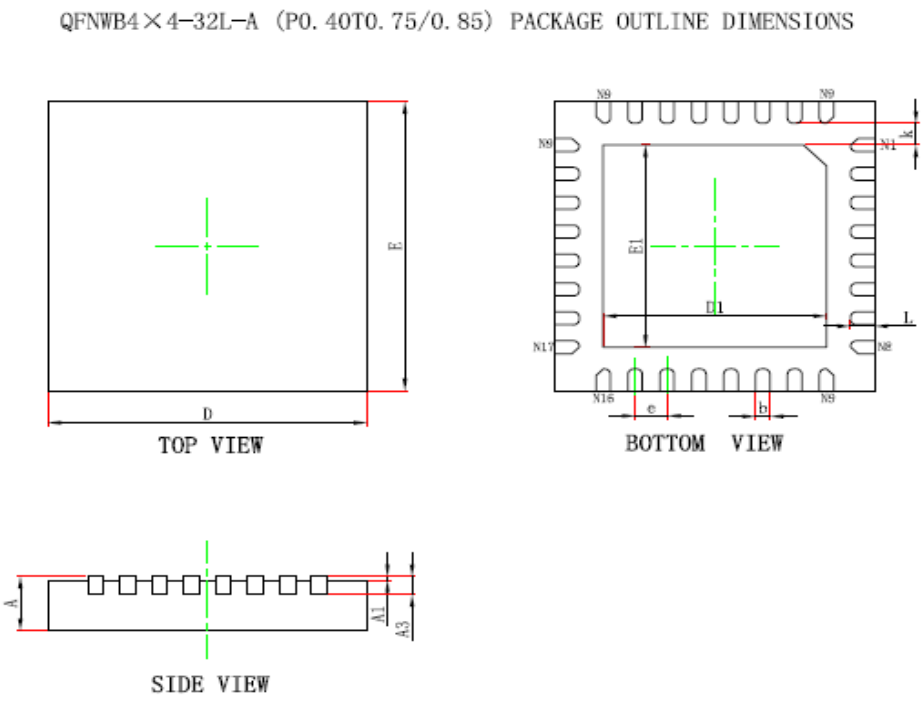
DC Characteristics					
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**
Operation Voltage	V_{CC}	2.8*	3	3.6	V
Operation Temperature	T_O	–20	25	80	°C
Active Current (V_{CC}=3V,14dBm,VBAND)	$I_{RX,VBAND}$		72		mA
Active Current (V_{CC}=3V,10dBm,UBAND)	$I_{RX,UBAND}$		85		mA
CE=0,Shut down Current	I_{PD}		1.2		μA

***The chip can work on 2.2V, but performance can't be guaranteed**

Receiver Performance					
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**
Crystal Frequency	F_{CLK}		24.576		MHz
Crystal Load Cap.	CL			10	pF
Crystal Sensitivity	TS	5		20	ppm/pF
Crystal Temperature Offset	F_{PPM1}	-15		15	ppm
Crystal Initial Offset	F_{PPM2}	-10		10	ppm
Operation Frequency(V)	F_{VBAND}	160		270	MHz
Operation Frequency(U)	F_{UBAND}	500		980	MHz
Sensitivity(V)	S_{VBAND}		-96		dBm
Sensitivity(U)	S_{UBAND}		-96		dBm
Max Input	S_{MAX}			10	dBm
IIP3 (f1=600K,f2=1200K)	IIP3	-15			dBm
ACS （600K）	ACS	50			dB
Audio Output Amplitude (Differential)	Vout		0.9		Vrms
Audio Output Load	Rload		600		Ohm
Audio Frequency (+-2dB)	Fin	30		20k	Hz
Audio SNR(1kHz,A-Weighted)	SNR		96		dB
Total Harmonic Distortion (1kHz,Vmic=-30dBV,48 kHz ）	THD_{48k}		0.03		%
Total Harmonic Distortion (1kHz,Vmic=-30dBV,28 kHz）	THD_{28k}		0.05		%
System Latency(48 kHz)	T_{48k}		2.2		ms
System Latency(48 kHz, with Anti-Howling)	$T_{48k、5Hz}$		4		ms
System Latency(28 kHz)	T_{28k}		4		ms
System Latency(28 kHz, with Anti-Howling)	$T_{28k、5Hz}$		6.2		ms
I2C Clock Frequency	F_{SCK}			8	MHz

5. Package Information

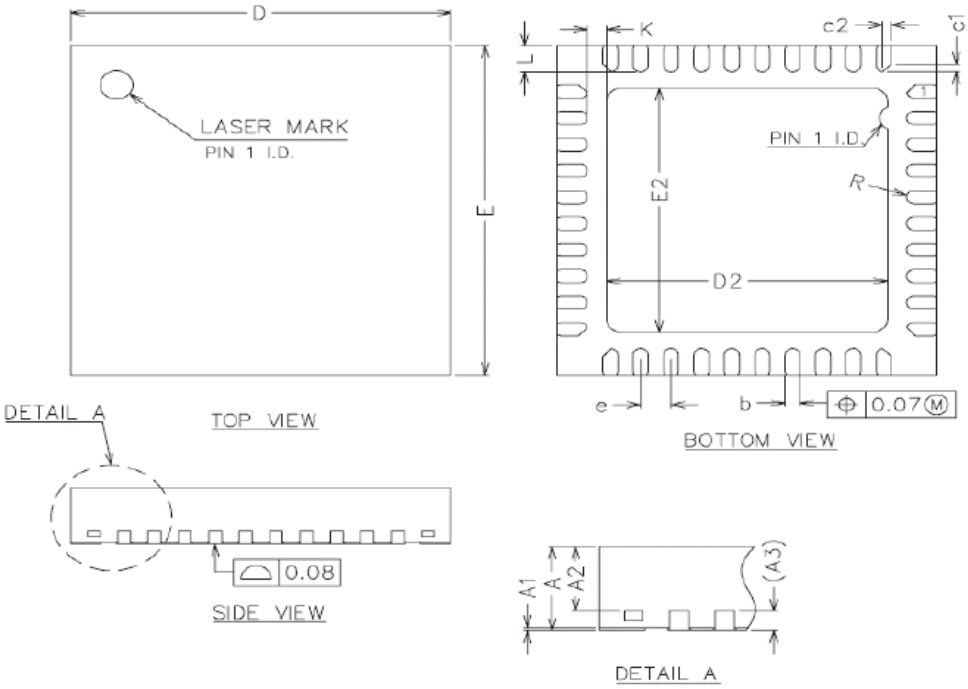
5.1. QFN4x4 32pin



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	3.924	4.076	0.154	0.160
E	3.924	4.076	0.154	0.160
D1	2.700	2.900	0.106	0.114
E1	2.700	2.900	0.106	0.114
k	0.200MIN.		0.008MIN.	
b	0.150	0.250	0.006	0.010
e	0.400TYP.		0.016TYP.	
L	0.224	0.376	0.009	0.015

Figure 10 QFN4x4 32pin Package

5.2. QFN5x5 40pin



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
A2	0.50	0.65	0.60
A3		0.20REF	
b	0.15	0.20	0.25
D	4.90	5.00	5.10
E	4.90	5.00	5.10
D2	3.60	3.70	3.80
E2	3.60	3.70	3.80
e	0.35	0.40	0.45
K	0.20	–	–
L	0.35	0.40	0.45
R	0.075	–	–
C1	–	0.12	–
C2	–	0.12	–

Figure 11 QFN5x5 40pin Package

6. Order Information

Part number	Package	Packing	MPQ
BK9521Q32	QFN32_4X4	Tape Reel	3K
BK9521Q40	QFN40_5X5	Tape Reel	3K
BK9522QB	QFN32_4X4	Tape Reel	3K

7. Revision History

Version	Comments	Date	Author
v1.2	Translate from v1.2 version with short description	06/23/2017	Weifeng