
BK7231 Datasheet

802.11 b/g/n SoC



Beken Corporation
Building 41, 1387 Zhangdong Road, Shanghai, China
Tel: 86-21-51086811
www.bekencorp.com

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1. Revision History

Version	Description	Date	Author
v0.6 EN	Translate from v0.6 Chinese version	Mar/1/2018	Weifeng
V1.0	Formal release	Jun/6/2018	Beken

Figure 1 Revision History

2. Introduction

BK7231 is a 2.4 GHz 802.11b/g/n SoC, which integrates all hardware and software components of 802.11b/g/n including physical, MAC and application layer. The powerful ARM9 MCU and abundant memory resource make it suitable for flexible application with complex network protocol.

BK7231 provides SDIO, SPI, dual UART, I2C and full speed USB interface. It has also multi-channel ADC and clock signal output.

BK7231 has few external RF matching component as the Balun and TX/RX switch is integrated on chip.

BK7231 has a wealth of power management feature to enable low power application. There are internal wake up timer and all GPIO configurable as interrupt source, which could be used to wake up MCU either in sleep mode and active mode.

3. Features

- 802.11 b/g/n 1x1 Compliant
- 20/40 MHz bandwidth and STBC
- Working mode STA, AP, Direct and Repeater
- SGI, Green-Field Preamble and A-MPDU
- Support WPA, WPA2 and WAPI
- Support 802.11e and WMM-PS
- Up to 120 MHz for ARM968E-S MCU
- In package 2Mbyte FLASH
- On chip 256 Kbyte data RAM
- 50 MHz SDIO interface and SPI
- Full speed USB host and device
- Dual high speed UART
- High speed I2C
- Multi-channel 10bit ADC
- Six 16-bits timer with PWM mode
- Clock signal output

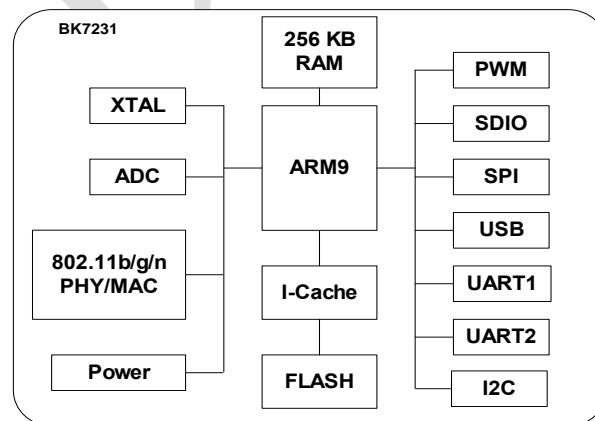


Figure 2 BK7231 Block Diagram

4. Pin Description

BK7231 has QFN5x5 32pin and QFN5x5 40pin package.

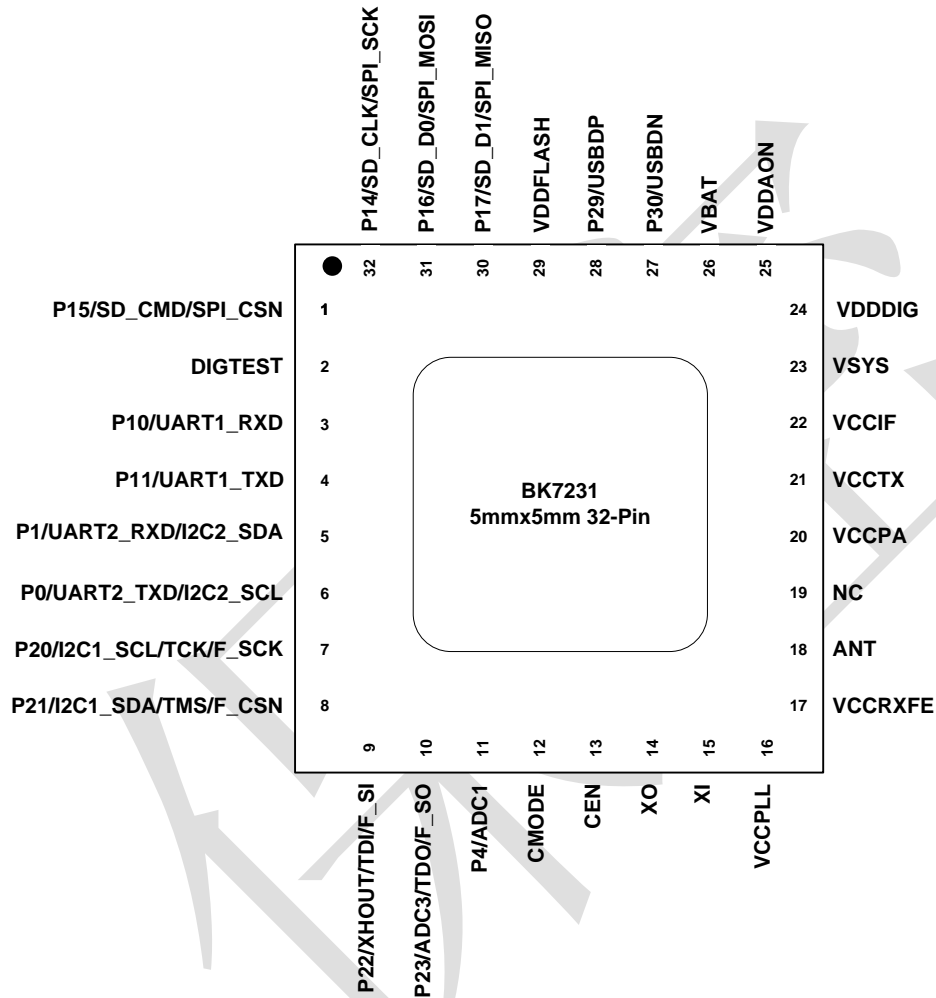


Figure 3 BK7231 32PIN Definition

Figure 4 BK7231 32PIN Description

32PIN	Name	Pin Type	Description
1	P15/SD_CMD/SPI_CSN	IO	GPIO or SD_CMD or SPI CSN
2	DIGTEST	I	Chip Mode Selection: 0 or NC: Working mode 1: Download FLASH (P4=1, P14=0/NC, supply power to VDDFLASH)
3	P10/UART1_RXD	IO	GPIO or UART1 RXD
4	P11/UART1_TXD	IO	GPIO or UART1 TXD
5	P1/UART2_RXD/I2C2_SDA	IO	GPIO or UART2 RXD or I2C2 SDA
6	P0/UART2_TXD/I2C2_SCL	IO	GPIO or UART2 TXD or I2C2 SCL
7	P20/I2C1_SCL/TCK/F_SCK	IO	GPIO or I2C1 SCL or JTAG TCK or Flash download port clock signal
8	P21/I2C1_SDA/TMS/F_CSN	IO	GPIO or I2C1 SDA or JTAG TMS or Flash download chip enable signal
9	P22/XHOUT/TDI/F_SI	IO	GPIO or Crystal clock output or JTAG TDI or FLASH download data input
10	P23/ADC3/TDO/F_SO	IO	GPIO or ADC or JTAG TDO or FLASH download data output
11	P4/ADC1	IO	GPIO or ADC. Must be pulled high on FLASH download mode
12	CMODE	I	Code load/read mode: 1: Code is loaded from SDIO or USB 0: Code is read from internal FLASH(default)
13	CEN	I	Chip enable, active high
14	XO	O	26/40 MHz Crystal output, Vdc~0.6V, Vpp~1V
15	XI	I	26/40 MHz Crystal input, Vdc~0.6V, Vpp~0.7V
16	VCCPLL	I	RF PLL power supply. Supplied by VSYS after RC filter
17	VCCRxFE	I	RF receiver power supply. Supplied by VSYS



18	ANT	IO	2.4 GHz RF signal port
19	NC	X	NC
20	VCCPA	I	RF PA power supply. Supplied by VSYS
21	VCCTX	I	RF transmitter power supply. Supplied by VSYS
22	VCCIF	I	IF power supply. Supplied by VSYS
23	VSYS	O	System LDO output, ~3.0 V
24	VDDDIG	O	Digital LDO output, ~1.2 V
25	VDDAON	O	Always on LDO output, ~1.2 V
26	VBAT	I	Chip power supply, 3.0~3.6V
27	P30/USBDN	IO	GPIO or USB DN
28	P29/USBDP	IO	GPIO or USB DP
29	VDDFLASH	I	Flash power supply. NC on working mode, and supply power to it on FLASH download mode
30	P17/SD_D1/SPI_MISO	IO	GPIO or SD Card DATA1 or SPI MISO
31	P16/SD_D0/SPI_MOSI	IO	GPIO or SD Card DATA0 or SPI MOSI
32	P14/SD_CLK/SPI_SCK	IO	GPIO or SD Card Clock or SPI Clock

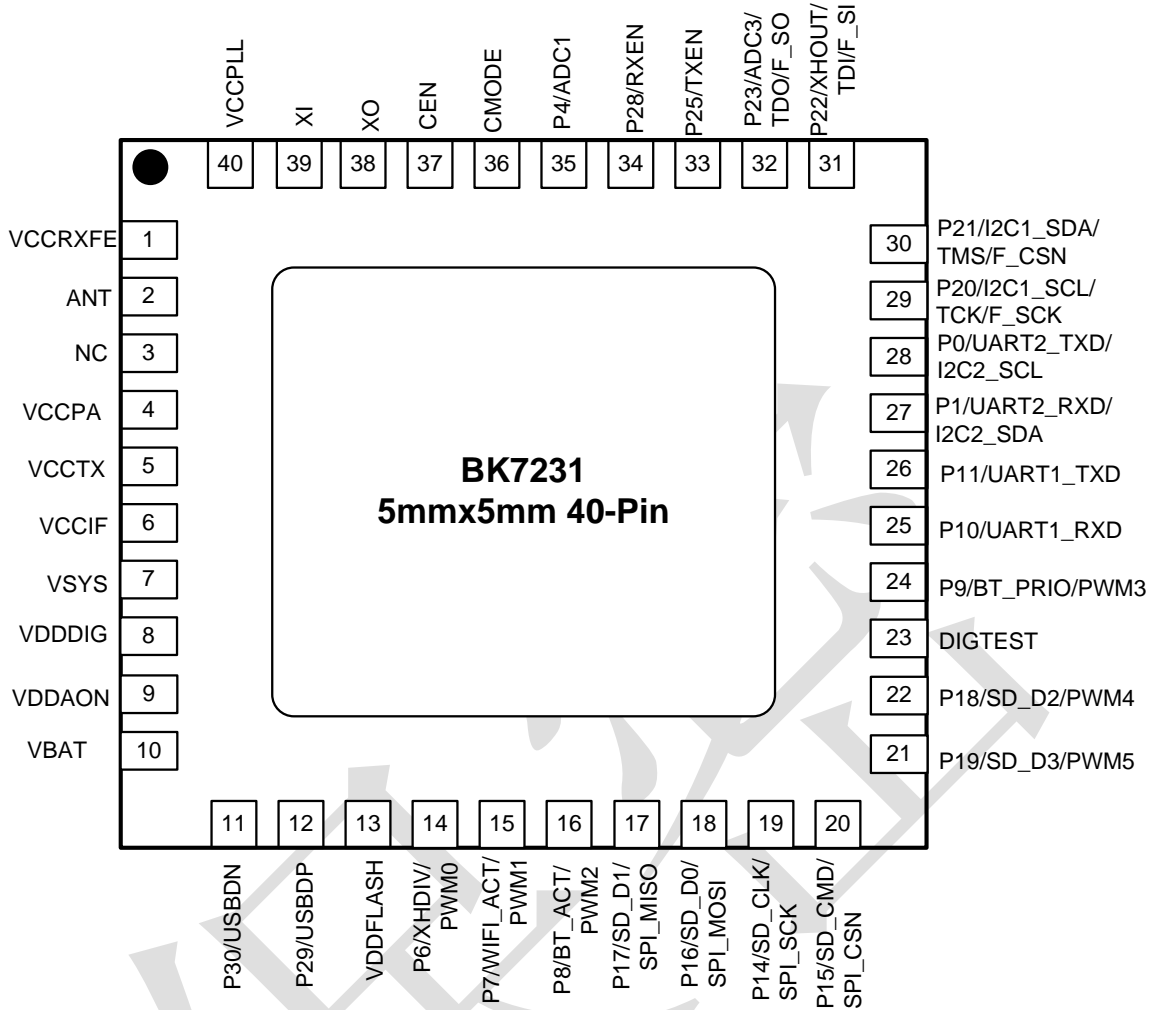


Figure 5 BK7231 40PIN Definition

Figure 6 BK7231 40PIN Description

40PIN	Name	Pin Type	Description
1	VCCR_XFE	I	RF receiver power supply. Supplied by VSYS
2	ANT	IO	2.4 GHz RF signal port
3	NC	X	NC
4	VCC_PA	I	RF PA power supply. Supplied by VSYS
5	VCCTX	I	RF transmitter power supply. Supplied by VSYS
6	VCCIF	I	IF power supply. Supplied by VSYS
7	VSYS	O	System LDO output, ~3.0 V



8	VDDDIG	O	Digital LDO output, ~1.2 V
9	VDDAON	O	Always on LDO output, ~1.2 V
10	VBAT	I	Chip power supply, 3.0~3.6V
11	P30/USBDN	IO	GPIO or USB DN
12	P29/USBDP	IO	GPIO or USB DP
13	VDDFLASH	I	Flash power supply. NC on working mode, and supply power to it on FLASH download mode
14	P6/XHDIV/PWM0	IO	GPIO or Crystal Clock output divided by 1/2/4/8 or PWM0
15	P7/WIFI_ACT/PWM1	IO	GPIO or Wi-Fi Active indicator or PWM1
16	P8/BT_ACT/PWM2	IO	GPIO or Bluetooth Active input or PWM2
17	P17/SD_D1/SPI_MISO	IO	GPIO or SD Card DATA1 or SPI MISO
18	P16/SD_D0/SPI_MOSI	IO	GPIO or SD Card DATA0 or SPI MOSI
19	P14/SD_CLK/SPI_SCK	IO	GPIO or SD Card Clock or SPI Clock
20	P15/SD_CMD/SPI_CSN	IO	GPIO or SD_CMD or SPI CSN
21	P19/SD_D3/PWM5	IO	GPIO or SD Card DATA3 or PWM5
22	P18/SD_D2/PWM4	IO	GPIO or SD Card DATA2 or PWM4
23	DIGTEST	I	Chip Mode Selection: 0 or NC: Working mode 1: Download FLASH (P4=1, P14=0/NC, supply power to VDDFLASH)
24	P9/BT_PRIO/PWM3	IO	GPIO or Bluetooth Priority input or PWM3
25	P10/UART1_RXD	IO	GPIO or UART1 RXD
26	P11/UART1_TXD	IO	GPIO or UART1 TXD
27	P1/UART2_RXD/I2C2_SDA	IO	GPIO or UART2 RXD or I2C2 SDA
28	P0/UART2_TXD/I2C2_SCL	IO	GPIO or UART2 TXD or I2C2 SCL
29	P20/I2C1_SCL/TCK/F_SCK	IO	GPIO or I2C1 SCL, or JTAG TCK or Flash download port clock signal
30	P21/I2C1_SDA/TMS/F_CSN	IO	GPIO or I2C1 SDA or JTAG TMS or Flash download chip enable signal
31	P22/XHOUT/TDI/F_SI	IO	GPIO or Crystal clock output or JTAG

			TDI or FLASH download data input
32	P23/ADC3/TDO/F_SO	IO	GPIO or ADC or JTAG TDO or FLASH download data output
33	P25/TXEN	IO	GPIO or RF transmit active indicator
34	P28/RXEN	IO	GPIO or RF receiver active indicator
35	P4/ADC1	IO	GPIO or ADC. Must be pulled high on FLASH download mode
36	CMODE	I	Code load/read mode: 1: Code is loaded from SDIO or USB 0: Code is read from internal FLASH(default)
37	CEN	I	Chip enable, active high
38	XO	O	26/40 MHz Crystal output, Vdc~0.6V, Vpp~1V
39	XI	I	26/40 MHz Crystal input , Vdc~0.6V, Vpp~0.7V
40	VCCPLL	I	RF PLL power supply. Supplied by VSYS after RC filter

5. Peripheral

5.1. UART

BK7231 has two sets of UART. The maximum baud rate can be up to 6 Mbps. It supports 5, 6, 7 and 8 bits data mode, and supports even, odd or none parity check. The stop bit can be either 1 or 2 bits.

5.2. SPI

BK7231 supports one high speed SPI interface with maximum 50 MHz clock speed. It has both master and slave mode. The receive data could be latched on either rising edge or falling edge of clock signal. The transmit data could be set by MSB or LSB first.

SPI has dedicated DMA channel that could work on high speed without MCU load.

5.3. SDIO

BK7231 SDIO has both master and slave mode, and one bit to four bits mode with maximum 50 MHz clock speed. SDIO could be used as master mode to read external SD card or used by external host to communicate with chip as slave mode.

SDIO has dedicated DMA channel that could work on high speed without MCU load.

5.4. I2C

BK7231 supports two sets of I2C with normal 400 kHz clock speed.

5.5. USB

BK7231 has full speed USB 2.0, with both host and device mode.

USB has dedicated DMA channel that could work on high speed without MCU load.

5.6. ADC

BK7231 has multi-channel ADC and supports 10-13 bits output with internal average filter. Single, continuously and software read mode are supported.

5.7. PWM

BK7231 QFN5x5 40PIN package has six PWM output, but QFN5x5 32PIN has none.

5.8. GPIO

BK7231 has many GPIO and anyone could be set an interrupt source to interrupt system at active mode or wake up system from sleep mode.

The GPIO has peripheral function as table below.

GPIO Name	Peripheral function
P0	UART2_TXD/I2C2_SCL
P1	UART2_RXD/I2C2_SDA
P4	ADC1
P6	XHDIV/PWM0 (QFN40)
P7	WIFI_ACT/PWM1 (QFN40)
P8	BT_ACT/PWM2 (QFN40)
P9	BT_PRIO/PWM3 (QFN40)
P10	UART1_RXD
P11	UART1_TXD
P14	SD_CLK/SPI_SCK
P15	SD_CMD/SPI_CSN
P16	SD_D0/SPI_MOSI
P17	SD_D1/SPI_MISO
P18	SD_D2/PWM4 (QFN40)
P19	SD_D3/PWM5 (QFN40)
P20	I2C1_SCL/JTAG_TCK
P21	I2C1_SDA/JTAG_TMS
P22	XHOUT/JTAG_TDI

P23	ADC3/JTAG_TDO
P25	TXEN (QFN40)
P28	RXEN (QFN40)
P29	USBDP
P30	USBDN

Figure 7 GPIO Peripheral Function

5.9. FLASH Download

Flash download data PINs are P20/F_SCK, P21/F_CSN, P22/F_SI, P23/F_SO.

The mode selection is as table below.

Mode selection\Pin	DIGTEST	P14	P4	VDDFLASH
Normal Working Mode	0/NC	X	X	NC
Flash Download Mode	1	0/NC	1	Supply power

Figure 8 BK7231 Operation Mode

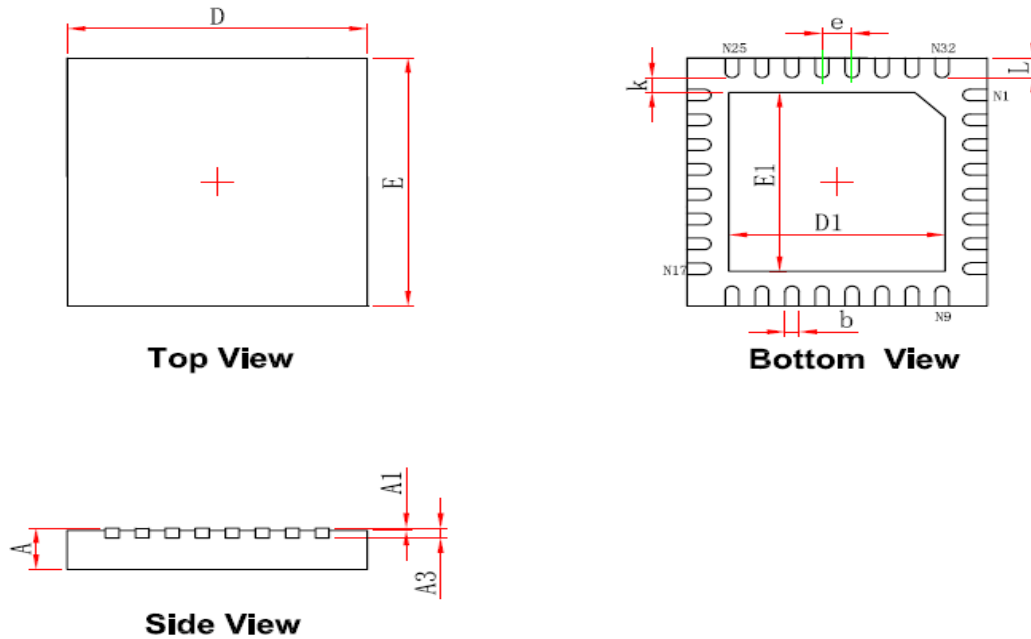
6. Characteristics

Parameters	Condition	Min.	Typ.	Max.	Unit
DC					
Operation Voltage	VBAT-pin	3.0	3.3	3.6	V
Operation Temperature		-20		85	°C
Storage Temperature		-40		150	°C
Transmit current	12dBm		170		mA
Receiver current	Full on		110		mA
Stop current	MCU stop		100		uA
Deep-sleep current	All power off, could be only woke up by GPIO or internal timer		10		uA
AC					
Crystal Frequency			26		MHz
Crystal Frequency Offset			10	20	ppm
Operation Frequency Band		2412		2484	MHz
Sensitivity	HT40 MCS7		-69		dBm
	HT20 MCS7		-71		dBm
	54 Mbps OFDM		-74		dBm
	2 Mbps DSSS		-93		dBm
ACS	54 Mbps OFDM		17		dB
	11 Mbps DSSS		41		dB
TX Power	HT40 MCS7		10		dBm
	HT20 MCS7		11		dBm
	54 Mbps OFDM		12		dBm
	11 Mbps DSSS,		18		dBm
SAR ADC			10		bit

Figure 9 Electric Characteristics

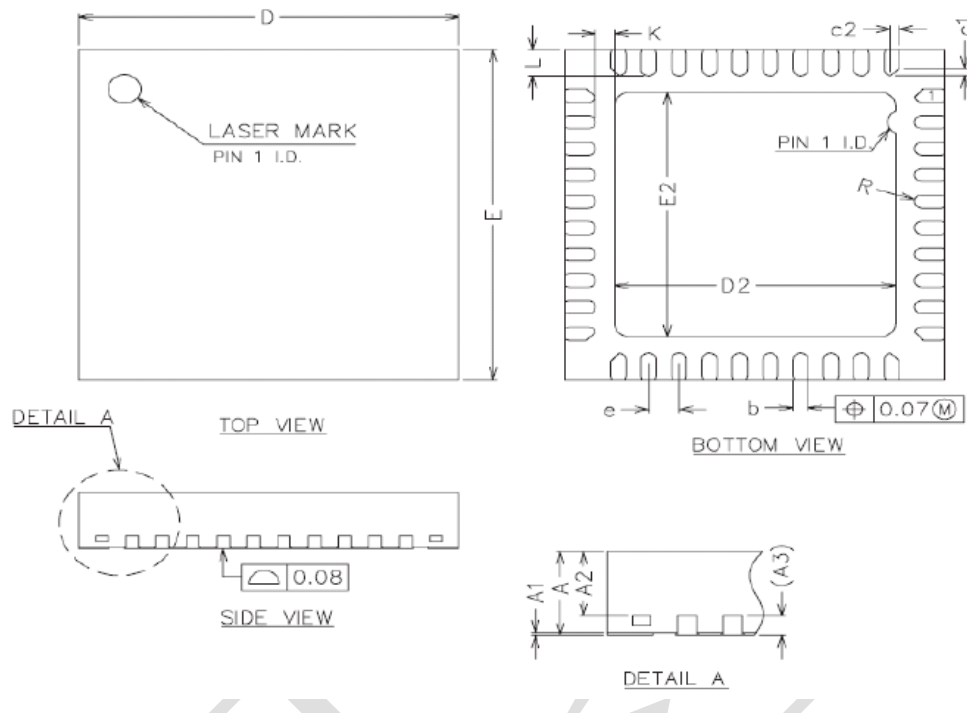
7. Package

7.1. QFN5x5 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	4.924	5.076	0.194	0.200
E	4.924	5.076	0.194	0.200
D1	3.300	3.500	0.130	0.138
E1	3.300	3.500	0.130	0.138
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

Figure 10 QFN 5x5 32pin Package

7.2. 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 QFN 5x5 40pin Package

8. Solder Reflow Profile

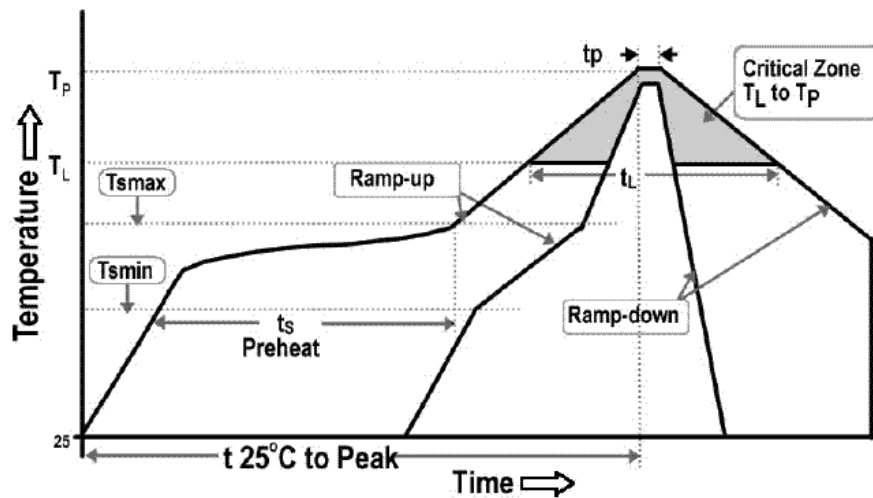


Figure 12 Classification Reflow Profile

Profile Feature		Specification
Average Ramp-Up Rate (tsmax to tp)		3°C/second max.
Pre_heat	Temperature Min (Tsmin)	150°C
	Temperature Max (Tmax)	200°C
	Time (ts)	60-180 seconds
Time Maintained above	Temperature (TL)	217°C
	Time (tL)	60-150 seconds
Peak/Classification Temperature (Tp)		260°C
Time within 5°C of Actual Peak Temperature (tp)		20-40 seconds
Ramp-Down Rate 6		6°C/second max.
Time 25°C to Peak Temperature 8		8 minutes max.

RoHS Compliant

The product does not contain lead, mercury, cadmium, hexavalent chromium, PBB&PBDE content in accordance with directive 2002/95/EC(RoHS).

ESD Sensitivity

Integrated circuits are ESD sensitive and can be damaged by static electricity. Proper ESD Techniques should be used when handling these devices.

9. Order Information

Part number	Package	Packing	MPQ(ea)
BK7231QN32D	QFN32_5X5	Tape Reel	3K
BK7231QN40A	QFN40_5X5	Tape Reel	3K

Figure 13 Order Information