BES2300-YP

Product Specification Rev 1.0

ANC Bluetooth Audio Platform with IBRT for TWS

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Datasheet Status

Datasheet Status	Product Status	Revision Control	Description
Draft	Development	Rev 0.01 - 0.49	Datasheets contain pre-tapeout information from the objective design specification and is only for internal use.
Preliminary	Qualification	Rev 0.50 - 0.99	Datasheets contain information on post-tapeout and pre-volume production products, and a revision of this document or supplementary information may be published at a later date. BESTECHNIC may make changes to these specifications at any time without notice.
Released	Production	Rev1.xx	Datasheets contain information on volume production products. BESTECHNIC may make changes to these specifications at any time without notice.

Revision History

Bars appearing in the margin (as shown here) indicate where technical changes have occurred for this revision. The following table lists the technical content changes for all revisions.

Revision	Date	Description
0.10	20/01/2019	Initial definition
0.11	12/04/2019	Update figure 1-1
0.20	16/04/2019	Update Feature
0.21	18/04/2019	Verify IBRT
0.22	18/04/2019	Ball Map modify
0.23	22/04/2019	Ball Map and pin list modify
0.24	23/04/2019	Update Figure 2-1 and ball map
0.26	16/07/2019	Update BT characteristics
0.27	12/08/2019	Update package size
0.28	09/12/2019	Update electrical parameters
0.29	27/04/2020	Update reset pin description
0.30	24/10/2020	Update electrical parameters
1.0	04/01/2021	Update BT features

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1 General Description

BES2300-YP is a highly integrated SoC with Bluetooth 5.2 dual-mode and high performance Cortex-M4F 300MHz Dual-Core for wireless audio and voice application. It is also optimized for TWS and IBRT (Intelligent Bluetooth Retransmission) application, which is BES's stereo connection technology between Cell Phone, primary and secondary Voice Box.

BES2300-YP minimizes the external components and BOM cost by highly integrating RF transceiver, high performance audio codec and Cap-less headphone driver. It also integrates serial flash and powerful Dual-core Cortex-M4F MCU to support various software features and product customization. BES2300-YP is manufactured with advanced low power CMOS process and assembled with a 4.5*6.2mm 80-ball BGA package.

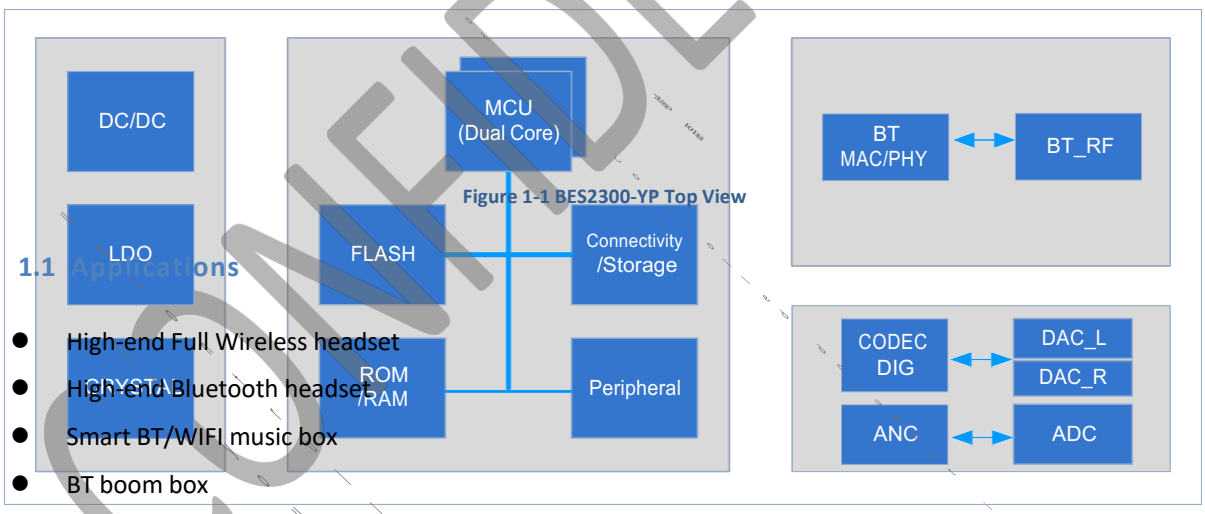


Figure 1-1 BES2300-YP Top View

1.1 Applications

- High-end Full Wireless headset
- High-end Bluetooth headset
- Smart BT/WIFI music box
- BT boom box
- Other portable audio device
- IOT platform

1.2 Features

CPU Features

- CMOS Single-chip Fully-integrated RF, PMU, Audio CODEC and Cortex-M4F CPU
- Up to 300MHz Dual-core ARM Cortex-M4F Processor
- 4MB Serial Flash On-chip for Custom Program
- Dual-core Cortex-M4F with On-chip Boot-ROM and RAM
- Security Boot to Protect Custom IP

BT Features

- Bluetooth 5.2 dual-mode compliant

Audio Features

- Support BES Intelligent Bluetooth Retransmission (IBRT)
- Support FF/Hybrid ANC
- Dual MICs noise reduction
- Echo Cancellation
- Support low power voice activity detection
- Multi-band EQ and Bass enhancement
- Immersive audio with 3D or virtual surround sound
- Support Active Crossover
  - ✧ Crossover filter: DSP Adjustable
  - ✧ Active Crossover Two-way application: Sports Bluetooth & TWS Bluetooth
- Support USB Audio Playback
- Support TWS
- HiFi Stereo Audio DAC:
  - ✧ 120dB SNR
  - ✧ 110dB DNR
  - ✧ Sample rates from 8 kHz to 384 kHz
- HiFi Stereo Audio ADC:
  - ✧ 100dB SNR
  - ✧ Sample rates from 8 kHz to 384 kHz
- 3D recording
- Support dual/single Mic noise suppression
- Support ambient awareness
- Support talk through
- 24-bit audio processing

Interface Features

- USB 2.0 HS device

PMU Features

- 3.1V-5.5V Input for VBAT
- Internal LPO for low power mode.
- DCXO with internal oscillator circuit
- Internal temperature sensor

2 Platform Feature

BES2300-YP is designed for high-resolution wireless audio MCU system as shown in Figure 2-1.

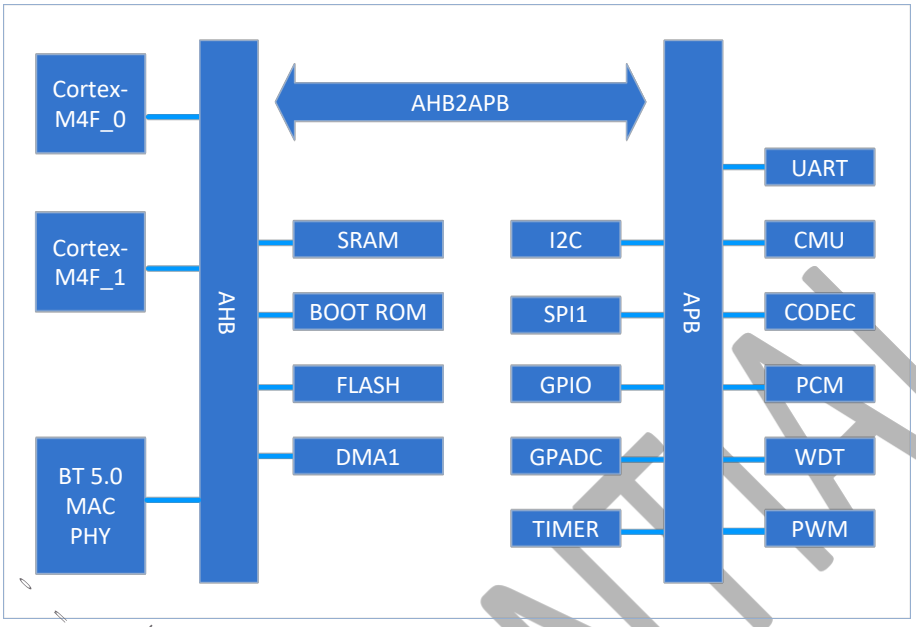


Figure 2-1 Platform Architecture

2.1 MCU Subsystem

BES2300-YP is embedded with the ARM Cortex-M4F processor, which provides best trade-off between system performance and power consumption. For large amount of data transfer, high performance Direct Memory Access (DMA) is implemented, which greatly enhances the data movement speed while reducing MCU processing load.

- Dual-core Cortex-M4F high performance processor with float and HW DSP instruction
- I cache and D cache
- High performance multi-layer AMBA bus
- Operating frequency up to 300MHz
- On-chip boot ROM for factory flash programming
- Security boot support M4
- Watchdog Timer (WDT) for system crash recovery
- General-purpose Timers
- DMA for audio/voice data transfer

2.2 Memory

BES2300-YP integrates internal memory and serial flash on-chip with various operating frequencies.

- Internal ROM 448KB for critical constants and code
- Internal SRAM 992KB for critical data and code
- BT shared SRAM 64KB

- On-chip serial flash 4MB for custom program

2.3 System Peripherals

BES2300-YP is embedded with necessary peripheral blocks, and supports UART or USB download.

- Clock Management Unit (CMU) provides general controls over the whole system
- UART with configurable baud rate
- I2C master/slave peripheral interface
- General Purpose Input Output (GPIO) with independent interruptions
- Pulse Width Modulation (PWM)
- Several timers: RTC timer, WDT, general purpose timer
- USB 2.0 HS device and USB Type C compliant
- Sony/Philips Digital Interface Format (SPDIF) in/out
- Real Time Clock (RTC)

2.4 Power Management

BES2300-YP integrates Power Management Unit (PMU), which supports 3.1V~5.5V input for VBAT, DCXO with internal oscillator circuit, power on reset control, internal 32kHz OSC for standby and sleep state, internal LPOs supporting for low power mode.

BES2300-YP offers various low power features to reduce system consumption. Features include standby mode with 32 kHz clock, power down mode for individual peripherals and processor sleep mode. In addition, BES2300-YP is also fabricated using the advanced low leakage CMOS process in order to provide ultra-low leakage solution.

BES2300-YP also includes 7 linear regulators (LDOs):

- LDO_MEM generates a 1.2~2.7V supply rail for on-chip memory;
- LDO_USB generates a 2.4~3.6V supply rail for USB2.0 interface;
- LDO_VIO generates a 1.2~3.3V supply rail for the general purpose IOs;
- LDO_CODEC generates a 1.2~2V supply rail for the Codec units;
- LDO_ANA generates a 1.0~1.8V supply rail for the analog building blocks on-chip;
- LDO_CORE generates 0.3~1.3V supply rail for the digital logics.

BES2300-YP supports three switch-mode DCDCs, all of them are single–inductor–single–output (SISO) Buck.

2.5 Audio Interface

The audio interface circuit consists of:

- Stereo/dual-mono audio codec
- Four 24-bit high-quality ADC channels with sample rates from 8 kHz to 384 kHz
- Two 32-bit high-quality DAC channels with sample rates from 8 kHz to 384 kHz

- One low power ADC and voice detection unit for VAD application
- SPDIF interface 1 input and 1 output
- 1 configurable I2S interface

3 Bluetooth Modem Description

3.1 Radio

- Integrated on-chip Bluetooth TX/RX switch
- Fully integrated RF synthesizer without any external component
- High power output (10dBm) Class2 and class3 transmission supported
- Supports GFSK, π/4 DQPSK and 8DPSK modulation
- High performance in receiver sensitivity, -96.5dBm@GFSK, -95.5dBm@π/4 DQPSK, -88.5dBm@8DPSK
- Integrated AGC and RSSI for signal detection

3.2 Auxiliary feature

- Power management supports low power mode
- Internal LPO for Bluetooth sniff mode

3.3 Bluetooth Stack

- Compliant with Bluetooth 5.2 dual-mode

4 Electrical Characteristics

4.1 Electrical Characteristics

Table 4-1 Operating Conditions [a]

Symbol	Description	Min	Typ	Max	Unit
V_{BAT}	Supply Voltage from battery or LDO	3.1	3.8	5.5	V
T_{amb}	Ambient Temperature	-20	27	+80	°C
V_{IL}	CMOS Low Level Input Voltage	0		0.3*V_{IO} [b]	V
V_{IH}	CMOS High Level Input Voltage	0.7*V_{IO}		V_{IO}	V
V_{TH}	CMOS Threshold Voltage		0.5*V_{IO}		V

(a) Minimum input voltage of 3.1V is required in the recommended operation conditions.

(b) V_{IO}=1.8V

Table 4-2 Absolute Maximum Ratings [c]

Symbol	Description	Min	Typ	Max	Unit
T_{amb}	Ambient Temperature	-30		+80	°C
I_{IN}	Input Current	-10		+10	mA
V_{IN}	Input Voltage	-0.3		V_{IO} [b]+0.3	V
V_{lna}	LNA Input Level			25	dBm
V_{BAT}	Supply Voltage			6 [a]	V

(a) Standard maximum input voltage is 6V.

(b) V_{IO}=1.8V

(c) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operations of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Table 4-3 Power Consumption [a]

Symbol	Description	Min	Typ	Max	Unit
Phone call	ESCO 2EV3 with one retransmitted	/	6	/	mA
Play audio	SBC bit pool 39 @2mW	/	5.5	/	mA
Play audio	AAC @2mW	/	5	/	mA
Power off	Soft power off mode	/	3	/	uA
Current Mute		/	4	/	mA
Current Idle		/	400	/	uA

(a) The power consumption is in the DCDC mode and VBAT=3.8V

4.2 Bluetooth Radio Electrical Characteristics

Table 4-4 Receiver Characteristics - Basic Data Rate [a]

Symbol	Description	Min	Typ	Max	Unit

performance	2500MHz–3000MHz	-27	-22	/	dBm
	3000MHz–12.5GHz	-10	-5	/	dBm
Intermodulation		-39	-31	/	dBm
Spurious output level		/	-135	/	dBm/Hz

(a) VBAT = 3.8 V Temp = 27°C

(b) Limited by measurement equipment maximum output level, which is 0dbm.

Table 4-5 Transmitter Characteristics - Basic Data Rate [a]

Parameter	Condition	Min	Typ	Max	Unit
General specifications					
Maximum RF transmit power		8.5	10	11.5	dBm
RF power control range		2	4	8	dB
20dB band width		/	0.9	1	MHz
Adjacent channel transmit power	$F=F_0$ + 1MHz	/	-19	/	dBm
	$F=F_0$ - 1MHz	/	-17	/	dBm
	$F=F_0$ + 2MHz	/	-48	-40	dBm
	$F=F_0$ - 2MHz	/	-47	-40	dBm
	$F=F_0$ + 3MHz	/	-50	-40	dBm
	$F=F_0$ - 3MHz	/	-50	-40	dBm
	$F=F_0$ + >3MHz	/	-55	-40	dBm
	$F=F_0$ - >3MHz	/	-55	-40	dBm
	$F=F_0$ - >3MHz	/	-55	-40	dBm
∆f1avg Maximum modulation		140	160	180	kHz
∆f2max Minimum modulation		120	145	180	kHz
∆f2avg/∆f1avg		0.80	0.88	/	/
ICFT		-75	0	+75	kHz
Drift rate		/	/	/	kHz/50us

Parameter	Condition	Min	Typ	Max	Unit
Drift (1 slot packet)		-25	0	25	kHz
Drift (5 slot packet)		-40	0	40	kHz
Harmonic Spur(b)	3GHz~20GHz	/	-50	-30	dBm
harmonic spur(c)	3GHz~20GHz	/	-30	-15	dBm

(a) VBAT = 3.8 V Temp = 27°C

(b) With external π type matching network

(c) *Without external matching network*

Table 4-6 Receiver Characteristics - Enhanced Data Rate (a)

Parameter	Condition	Min	Typ	Max	Unit
π/4 DQPSK					
Sensitivity with dirty transmit off@0.01% BER		-96	-95.5	-93	dBm
Sensitivity with dirty transmit on@0.01% BER		-96	-95	-93	dBm
Maximum received signal@0.1% BER		/	/	0(b)	dBm
C/I co-channel		/	11	13	dB
Adjacent channel selectivity C/I	$F=F_0+1MHz$	/	-8	0	dB
	$F=F_0-1MHz$	/	-8	0	dB
	$F=F_0+2MHz$	/	-42	-35	dB
	$F=F_0-2MHz$	/	-42	-35	dB
	$F=F_0+3MHz$	/	/	/	dB
	$F=F_0-3MHz$	/	-45	-40	dB
Adjacent channel selectivity C/I	$F=F_{image}(F_0+3MHz)$	/	-27	-10	dB
8DPSK					
Sensitivity with dirty transmit off@0.01% BER		/	-88.5	-85	dBm
Sensitivity with dirty transmit off@0.01% BER		/	-87.5	-85	dBm
Maximum received signal@0.1% BER		0	-87.5	/	dBm
C/I c-channel		/	20	21	dB
Adjacent channel selectivity C/I	$F=F_0+1MHz$	/	-1	5	dB
	$F=F_0-1MHz$	/	-1	5	dB
	$F=F_0+2MHz$	/	-36	-25	dB
	$F=F_0-2MHz$	/	-36	-25	dB
	$F=F_0+3MHz$	/	/	/	dB
	$F=F_0-3MHz$	/	-38	-30	dB
Adjacent channel selectivity C/I	$F=F_{image}(F_0+3MHz)$	/	-25	-5	dB

(a) VBAT = 3.8 V Temp = 27°C

(b) Limited by measurement equipment maximum output level, which is 0dbm.

Table 4-7 Transmitter Characteristics - Enhanced Data Rate (a)

Parameter	Condition	Min	Typ	Max	Unit
Maximum RF transmit power		6.5	8	9	dBm
Relative transmit control		/	-2	/	dB
π/4 DQPSK max w_0		-10	0	10	kHz

	$F=F_0$ + 3MHz	/	-41	-40	dBm
	$F=F_0$ - 3MHz	/	-41	-40	dBm
	$F=F_0$ +/- > 3MHz	/	-44	-40	dBm
EDR differential phase encoding		/	99	100	%

(a) VBAT = 3.8 V Temp = 27°C

Table 4-8 Bluetooth LE Receiver Specifications

Parameter	Description	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
Sensitivity with dirty transmit off	PER < 30.8%	/	-95	/	dBm
Sensitivity with dirty transmit on	PER < 30.8%	/	-94	/	dBm
Max. Usable Signal	PER < 30.8%	-5	0	0(a)	dBm
C/I Co-channel	Co-channel selectivity (PER <30.8%)	/	13	21	dB
C/I 1MHz	Adjacent channel selectivity (PER <30.8%)		-6	15	dB
C/I 2MHz	2nd adjacent channel selectivity (PER< 30.8%)	/	-23	-17	dB
C/I ≧3MHz	3rd adjacent channel selectivity (PER < 30.8%)	/	-35	-27	dB
C/I Image channel	Image channel selectivity (PER <30.8%)	/	-22	-9	dB
C/I Image 1MH	1MHz adjacent to image channel selectivity (PER < 30.8%)	/	-30	-15	dB
Inter-modulation		-50	-36	/	dBm
Out-of-band Blocking	30MHz to 2000MHz	-30	-10	/	dBm
	2001MHz to 2339MHz	-35	-25	/	dBm
	2501MHz to 3000MHz	-35	-25	/	dBm

(a) Limited by measurement equipment maximum output level, which is 0dbm.

Table 4-9 Bluetooth LE Transmitter Specifications

Parameter	Description	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
Output Power	At max power output level	-20	7	10	dBm
Carrier Frequency Offset and Drift	Frequency offset	-150	+/-3	150	kHz
	Frequency drift	-50	+/-3	50	kHz
	Max. drift rate	-20	+/-3	20	Hz/us
Modulation Characteristic	△f1avg	225	260	275	kHz
	△f2max (For at least 99% of all △f2max)	185	208	/	kHz
	△f2avg/△f1avg	0.8	0.88	/	Hz/Hz
In-band Spurious Emission	±2M offset	/	-46	-20	dBm
	>±3MHz offset	/	-48	-20	dBm

4.3 Audio Codec Electrical Characteristics

Table 4-10 Digital to Analogue Converter under 1.95V [b]

Parameter	Conditions			Min	Typ	Max	Unit
Resolution				/	/	32	Bits
Output Sample Rate, F_{sample}				8	/	384	kHz
SNR[a]	f_{in}=1kHz B/W=20Hz~20kHz	**F_{sample}**	**Load**				
	A-Weighted	48kHz	32Ω	/	120	/	dB
	1Vrms Output	48kHz	16Ω	/	120	/	dB
THD+N		**F_{sample}**	**Load**				
		8kHz	100kΩ	/	-100	-95	dB
	f_{in}=1kHz	8kHz	32Ω	/	-100	-95	dB
	B/W=20Hz~20kHz	8kHz	16Ω	/	-100	-95	dB
	1Vrms Output	48kHz	100kΩ	/	-100	-95	dB
		48kHz	32Ω	/	-100	-95	dB
		48kHz	16Ω	/	-100	-98	dB
Digital Gain	Digital Gain Resolution = 1dB			-70	/	24	dB
Analogue Gain	Analogue Gain Resolution = 0.75dB			-18	/	3	dB
Output Voltage	600-Ohm loading			/	/	1000	mV rms
IMD	SMTPE			/	93	/	dB
Freq. Response	0.02-20kHz 30mW output			/	0.086	/	dB
Phase	1kHz sine wave			/	0.002	/	Deg
Pop Up Noise				/	<0.1	/	mV
Noise Floor	A-WT Noise Gating			/	0.8	/	uV rms
Noise Floor	Audio PA on A-WT			/	3	/	uV rms
Crosstalk	100Hz, 1Vrms Output			/	122	/	dB
Crosstalk	1kHz, 1Vrms Output			/	130	/	dB
Crosstalk	10kHz, 1Vrms Output			/	118	/	dB
DNR	A-Weight, 32Ω			/	110	/	dB

(a) SNR is the ratio of output level with a 1-kHz full-scale input, to the output level playing an all-zero signal, measured A-weighted over a 20-Hz to 20-kHz bandwidth.

(b) The BES2300-YP provides a digital noise gate function for each of the output signal paths. The noise gate ensures best noise performance when the signal path is idle. When the noise gate is enabled, and the applicable signal level is below the noise gate threshold, then the noise gate is activated, causing the signal path to be muted.

Table 4-11 Codec - Analogue to Digital Converter under 1.95V

Parameter	Conditions		Min	Typ	Max	Unit
Resolution			/	/	24	Bits
Output Sample Rate, F_{sample}			8	/	384	kHz
SNR	f_{in}=1kHz B/W=20Hz~20kHz A-Weighted 0.7Vrms Input	F_{sample} 48kHz	/	100	/	dB
THD+N	f_{in}=1kHzB/W=20Hz~20kHz 0.6Vrms Input	F_{sample} 48kHz	/	-95	/	dB
Digital Gain	Digital Gain Resolution = 1dB		-30	/	30	dB
Analogue Gain	Analogue Gain Resolution = 3dB		-9	/	12	dB

4.4 BUCK Electrical Characteristics

Table 4-12 DCDC Characteristics[a]

Parameter	Conditions	Min	Typ	Max	Unit
Input voltage		3.1	4	5.5	V
Output voltage1 (v_{core})			0.9		V
Output voltgae2 (V_{codec})			1.5		V
Max output current core		150			mA
Max output current ana		150			mA
Active status current			200		uA
Sleep status current			2		uA
Line regulation			1		%
Load regulation (dc)	1mA-100mA		0.06		mV/mA
Load regulation (step)			0.17		mV/mA
Switch frequency	Internal_freq<1:0>=10		3		MHz
Pwm mode ripple			10		mV
Burst mode ripple			20		mV
Efficiency (pwm mode)	I=10mA		85*		%
Efficiency (burst mode)	I=10mA		85		%
Leakage current	Power down		3		uA

(a) Efficiency depends on inductor

5 Pin Map & Application Schematic

5.1 Pin Description

	A	B	C	D	E	F	G	H	J	K	L	M	
10	VCODEC_HPPA	VMEM	VBAT	LX3	LX2	PGND	LX1	VCORE	VANA_BUCK	VIO	USB_DN	USB_DP	10
9	LOUT_RP	VCHG_R	VBAT_SENSE	LED1	GPIO_20	GPIO_21	MIC5_P	MIC5_N	VANA	GPIO_26	VUSB	GPIO_17	9
8	LOUT_RN	POWKEY									VUSB_CAP	GPIO_16	8
7	LOUT_LN	RESET									GPIO_15	GPIO_27	7
6	LOUT_LP	ADC1/LED2				REFN_R	REFN_L	AVSS_GMC	AVSS_REFN		VANA	NC	6
5	VCODEC	ADC0				GND	GND	GND	GND		NC	NC	5
4	GPIO_22	VMIC2									GND	GPIO_25	4
3	GPIO_23	VMIC3									VPA_BT	BT_RF	3
2	MIC1_N	MIC4_N	MIC4_P	GPIO_10	GPIO_11	GPIO_12	GPIO_13	GPIO_00	GPIO_01	GPIO_03	GND	GND	2
1	MIC1_P	MIC2_P	MIC2_N	MIC3_N	MIC3_P	VCM_CAP	GPIO_14	XTAL_VDD	GPIO_02	XTAL_IN	XTAL_OUT	GND	1
	A	B	C	D	E	F	G	H	J	K	L	M	

Figure 5-1 BES2300-YP Pinout Diagram

Table 5-1 BES2300-YP Pins Description

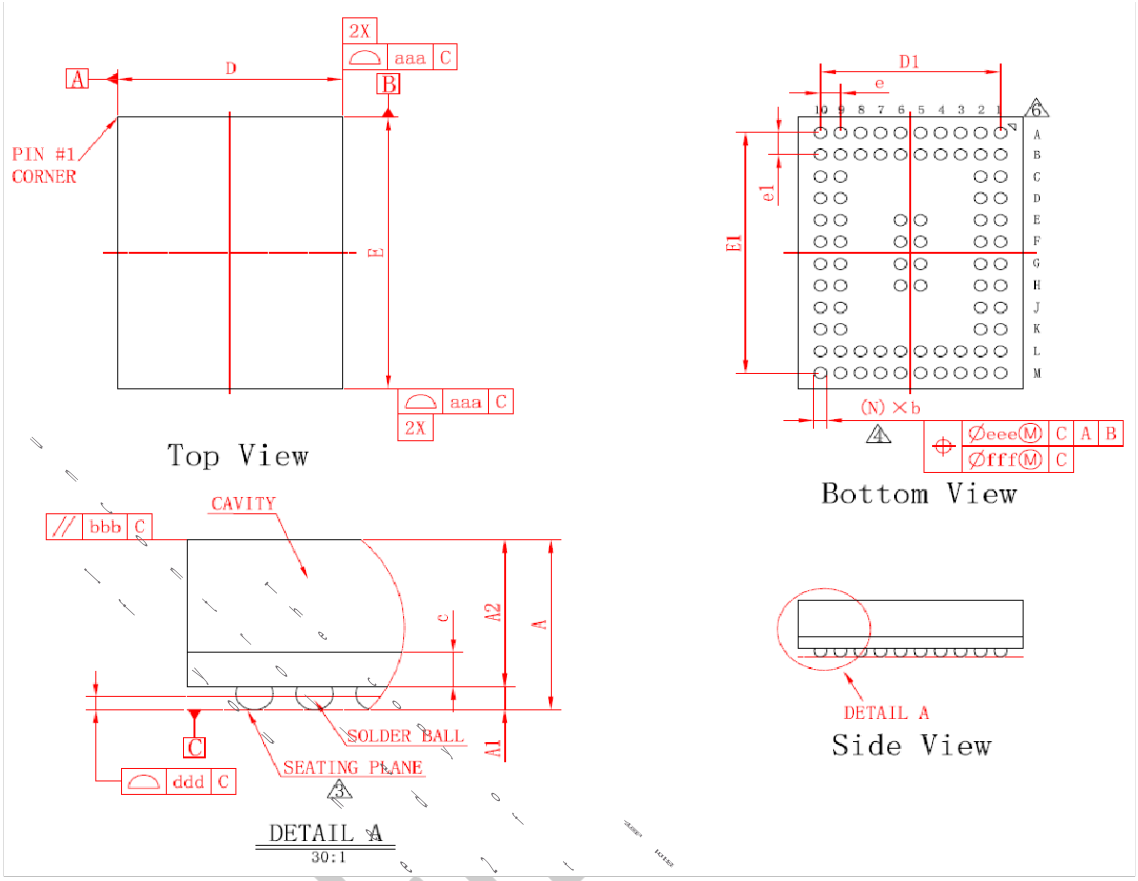
Pin	NO.	Typ	Description
Clock Signals			
XTAL_OUT	L1	Analog	Reference 26MHz crystal port
XTAL_IN	K1	Analog	Reference 26MHz crystal port
PMU			
VBAT_SENSE	C9	Analog	VBAT sense pin
VMEM	B10	Analog	1.2~2.7V internal memory ldo with decap
VIO	K10	Analog	1.2~3.3V gpio ldo with decap
VANA	J9	Analog	1.0~1.8V analog ldo with decap
VCODEC	A5	Analog	1.2~2V codec ldo with decap
VPA_BT	L3	Analog	BT_RFPA power supply
VANA	L6	Analog	BT analog power supply
XTAL_VDD	H1	Analog	26MHz reference crystal power supply
VCORE	H10	Analog	0.3~1.3V digital core ldo with decap
LX3	D10	Analog	Buck dcdc switch pin3
Vcodec_hppa	A10	Analog	Audio PA power supply
LX1	G10	Analog	Buck dcdc switch pin1
LX2	E10	Analog	Buck dcdc switch pin2
VANA_BUCK	J10	Analog	Buck dcdc analog output pin

Pin	NO.	Typ	Description
VBAT	C10	Analog	Chip power supply
VUSB_CAP	L8	Analog	0.9v ldo with decap
VUSB	L9	Analog	2.4~3.9V usb ldo with decap
PMU Interface			
VCHG_R	B9	Analog	Vbus voltage detector
ADC0	B5	Analog	GPADC
LED2	B6	Analog	LED Driver
LED1	D9	Analog	LED driver
Digital Interface			
POWKEY	B8	I	Chip power on input, high level/ high pules(min 10ms) is active
RESET	B7	I	Chip reset pin, reset if the duration of reset above 2v > 500ms
GPIO_00	H2	I/O	I2S_SDI
GPIO_01	J2	I/O	I2S_SDO
GPIO_02	J1	I/O	I2S_WS
GPIO_03	K2	I/O	I2S_SCK
GPIO_15	L7	I/O	GPIO
GPIO_26	K9	I/O	GPIO
GPIO_10	D2	I/O	SSD_D2
GPIO_27	M7	I/O	GPIO
GPIO_11	E2	I/O	SSD_D3
GPIO_12	F2	I/O	SSD_CMD
GPIO_13	G2	I/O	SSD_CLK
GPIO_14	G1	I/O	SSD_D0
GPIO_20	E9	I/O	UART1_RXD
GPIO_21	F9	I/O	UART1_TXD
GPIO_22	A4	I/O	GPIO
GPIO_23	A3	I/O	GPIO
GPIO_25	M4	I/O	GPIO
GPIO_17	M9	I/O	UART0_TXD/GPIO_17
GPIO_16	M8	I/O	UART0_RXD/GPIO_16
Audio interface			
MIC1_N	A2	Analog	MIC 1 N port
MIC 1_P	A1	Analog	MIC 1 P port
MIC 2_N	C1	Analog	MIC 2 N port
MIC 2_P	B1	Analog	MIC 2 P port
MIC 3_N	D1	Analog	MIC 3 N port
MIC 3_P	E1	Analog	MIC 3 P port
MIC4_N	B2	Analog	MIC 4 N port
MIC4_P	C2	Analog	MIC 4 P port
MIC5_N	H9	Analog	MIC 5 N port
MIC5_P	G9	Analog	MIC 5 P port
VMIC2	B4	Analog	MIC BIAS2 decap

Pin	NO.	Typ	Description
VMIC3	B3	Analog	MIC BIAS3 decap
LOUT_LN	A7	Analog	Speaker output negative, left
LOUT_LP	A6	Analog	Speaker output positive, left
LOUT_RN	A8	Analog	Speaker output negative, right
LOUT_RP	A9	Analog	Speaker output positive, right
VCM_CAP	F1	Analog	Decoupling of audio reference
RF Interface			
BT_RF	M3	Analog	Bluetooth transmitter output /receiver input
USB Interface			
USB_DN	L10	Analog	USB data minus
USB_DP	M10	Analog	USB data plus
Ground			
PGND	F10	Analog	PMU GND
GND	E5	Analog	Chip GND
GND	F5	Analog	Chip GND
GND	G5	Analog	Chip GND
GND	H5	Analog	Chip GND
GND	L2	Analog	Chip GND
GND	M2	Analog	Chip GND
GND	M1	Analog	Chip GND
GND	L4	Analog	Chip GND
AVSS_GMC	G6	Analog	For MIC5 Low power ADC GND
AVSS_REFN	H6	Analog	Audio reference GND
REFN_R	E6	Analog	Speaker output reference GND, right
REFN_L	F6	Analog	Speaker output reference GND, left
NC			
NC	M5、M6、L5	NC	Leave unconnected

6 Package Dimensions

6.1 BGA Dimensions



symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.040	1.140	1.240	0.041	0.045	0.049
A1	0.130	0.180	0.230	0.005	0.007	0.009
A2	0.910	0.960	1.010	0.036	0.038	0.040
c	0.220	0.260	0.300	0.009	0.010	0.012
D	4.400	4.500	4.600	0.173	0.177	0.181
E	6.100	6.200	6.300	0.240	0.244	0.248
D1	—	3.600	—	—	0.142	—
E1	—	5.500	—	—	0.217	—
e	—	0.400	—	—	0.016	—
e1	—	0.500	—	—	0.020	—
b	0.200	0.250	0.300	0.008	0.010	0.012
aaa	0.100			0.004		
bbb	0.100			0.004		
ddd	0.080			0.003		
eee	0.150			0.006		
fff	0.050			0.002		
Ball Diam	0.250			0.010		
N	80			80		
MD/ME	10/12			10/12		

TECHNOLOGY SPECIFICATION
1. BALL PAD OPENING: 0.230mm;
2. SMD(SOLD MASK DEFINE) ;
3. PRIMARY DATUM C AND SEATING PLANE ARE THE SOLDER BALLS;
4. DIMENSION b IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C;
5. SPECIAL CHARACTERISTICS C CLASS: bbb, ddd;
6. THE PATTERN OF PIN 1 FIDUCIAL IS FOR REFERENCE ONLY;

Figure 6-1 BES2300-YP Dimension

7 SMT Caution

7.1 Land Pad and Stencil Design

Land Pattern Guidelines for BGA-80B

- The PCB BGA land pads have to be designed to ensure solder joint reliability and provide optimum manufacturability. The two basic types of BGA land pad design are:
  1) The Solder mask defined land pad (SMD)
  2) The Non-solder mask defined land pad (NSMD); recommended type for PCB
- The SMD type of BGA land pad design is characterized by the copper pad being larger than the solder mask opening above this pad. Thus the solder joint area of the land pad is defined by the opening in the solder mask.

Stencil Guideline for BGA-80B

- The stencils for BGA pitches at or below 0.65 mm have to consider other factors as well. Usually on a PCB, there may be other small size and small pitch components which prevent the stencil opening size to be reduced. Instead, the total stencil thickness is decreased. Typically, stencils are from 0.075 to 0.125 mm thick.

7.2 Solder Reflow Profile

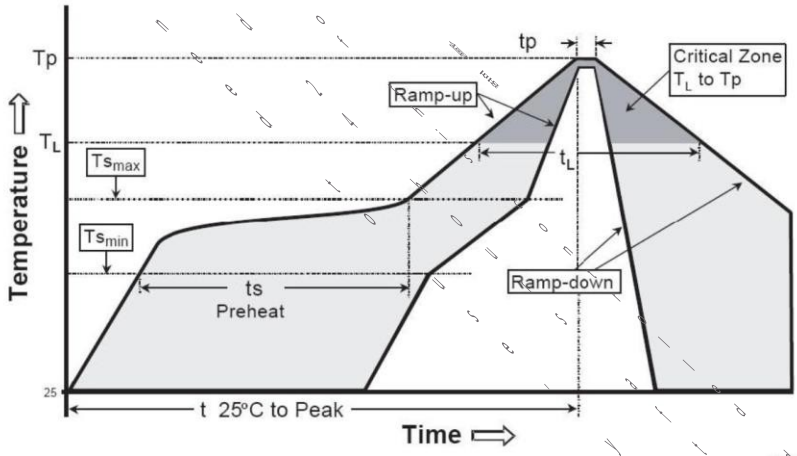


Figure 7-1 Solder Reflow Profile

Table 7-1 Package Peak Reflow Temperature - Sn/Pb

Package Thickness	Volume mm³< 350	Volume mm³≥ 350
< 2.5 mm	240 + 0°C / -5°C	225 + 0°C / -5°C
≥2.5 mm	225 + 0°C / -5°C	225 + 0°C / -5°C

Table 7-2 Package peak reflow temperature - Pb-Free [a]

Package Thickness	Volume mm³< 350	Volume mm³ 350 -2000	Volume mm³> 2000
< 1.6 mm	260 + 0°C(a)	260 + 0°C	260 + 0°C
1.6mm to 2.5 mm	260 + 0°C	250 + 0°C	245 + 0°C
≥2.5 mm	250 + 0°C	245 + 0°C	245 + 0°C

(a) Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature(this means Peak reflow temperature +0 ℃.For example 260 ℃+ 0 ℃) at the rated MSL level.

Table 7-3 Solder Reflow Profile Feature

Profile Feature		Specification
Average Ramp-Up Rate (t_{smax} to t_p)		3°C/second max.
Pre_heat	Temperature Min (T_{smin})	150°C
	Temperature Min (T_{smax})	200°C
	Time (t_s)	60-120 seconds
Time Maintained above	Temperature (T_L)	217°C
	Time (t_L)	60-150 seconds
Peak/Classification Temperature (T_p)		260°C
Time within 5°C of Actual Peak Temperature (t_p)		20-40 seconds
Ramp-Down Rate 6		6°C/second max.
Time 25°C to Peak Temperature 8		8 minutes max.

7.3 RoHS Compliant

The products meet the requirements of Directive 2011/65/EU of Europe Parliament and of the Council on the Restriction of Hazardous Substance (RoHS). The products are free from halogenated or antimony trioxide-based flame retardants and other hazardous chemicals.

7.4 ESD Sensitivity

Electrostatic discharge (ESD) occurs naturally in laboratory and factory environments. An established high-voltage potential is always at risk of discharging to a lower potential. If this discharge path is through a semiconductor device, destructive damage may result. ESD countermeasures and handling methods must be developed and used to control the factory environment at each manufacturing site. BES products must be handled according to the ESD Association standard: ANSI/ESD S20.20-1999, Protection of Electrical and Electronic Parts, Assemblies, and Equipment.

BES2300-YP ESD ratings will be available in Product Reliability Report of BES2300-YP.

7.5 Storage Alert

1. Calculated shelf life in vacuum sealed bag 24 months at<40°Cand 90% relative humidity (RH).
2. The out-of-bag duration is the time a device can be on the factory floor before being installed onto a PCB. It is defined by the device MSL rating. Refer to 9.4 moisture sensitivity level.

8 Ordering Information

Part Number	Type	Package Size	Packing	MoQ(ea) [a]
BES2300-YP	BGA-80B	6.2 X 4.5X 1.14mm 0.4/0.5mm Pitch	Tape & Reel	3K

(a) MoQ: Minimum order quantity

9 Tape and Reel Information

9.1 Tape Orientation

General orientation of BES2300-YP BGA-80B package in the carrier tape.

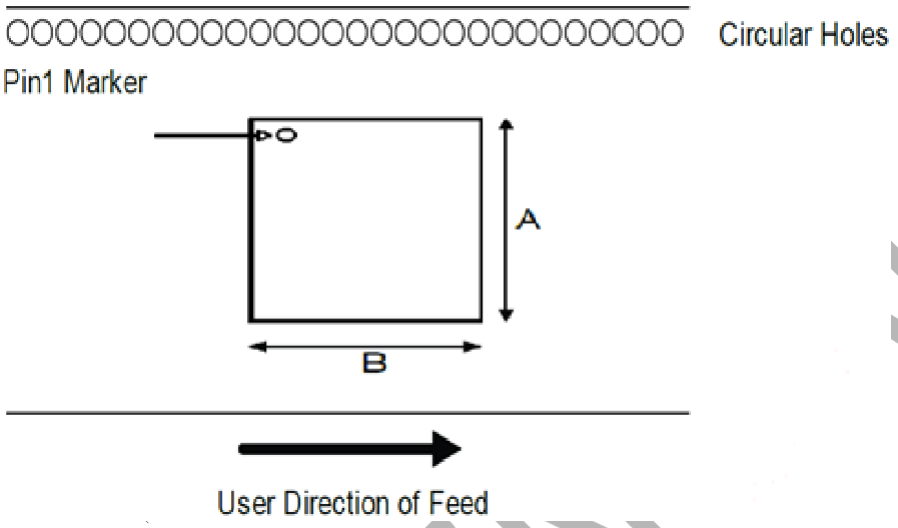


Figure 9-1 Tape Orientation

9.2 Reel Dimensions

The dimension of the reel for BES2300-YP.

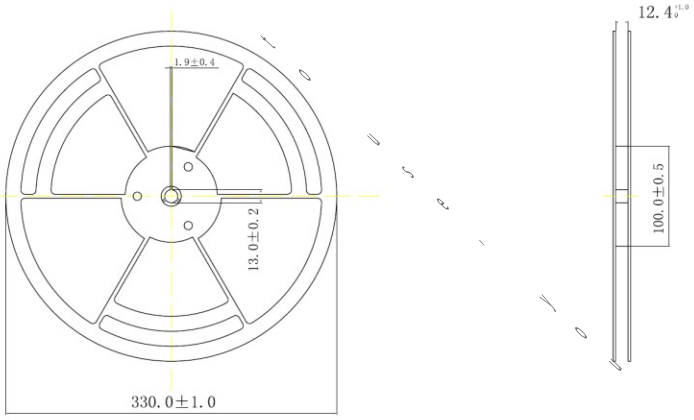


Figure 9-2 Reel Dimensions [(a)(b)]

(a) All dimensions in millimeters

(b) Reel color: Black, Each Plate products in 3000.

9.3 Tape Dimensions

The dimensions of the tape for BES2300-YP BGA-80B.

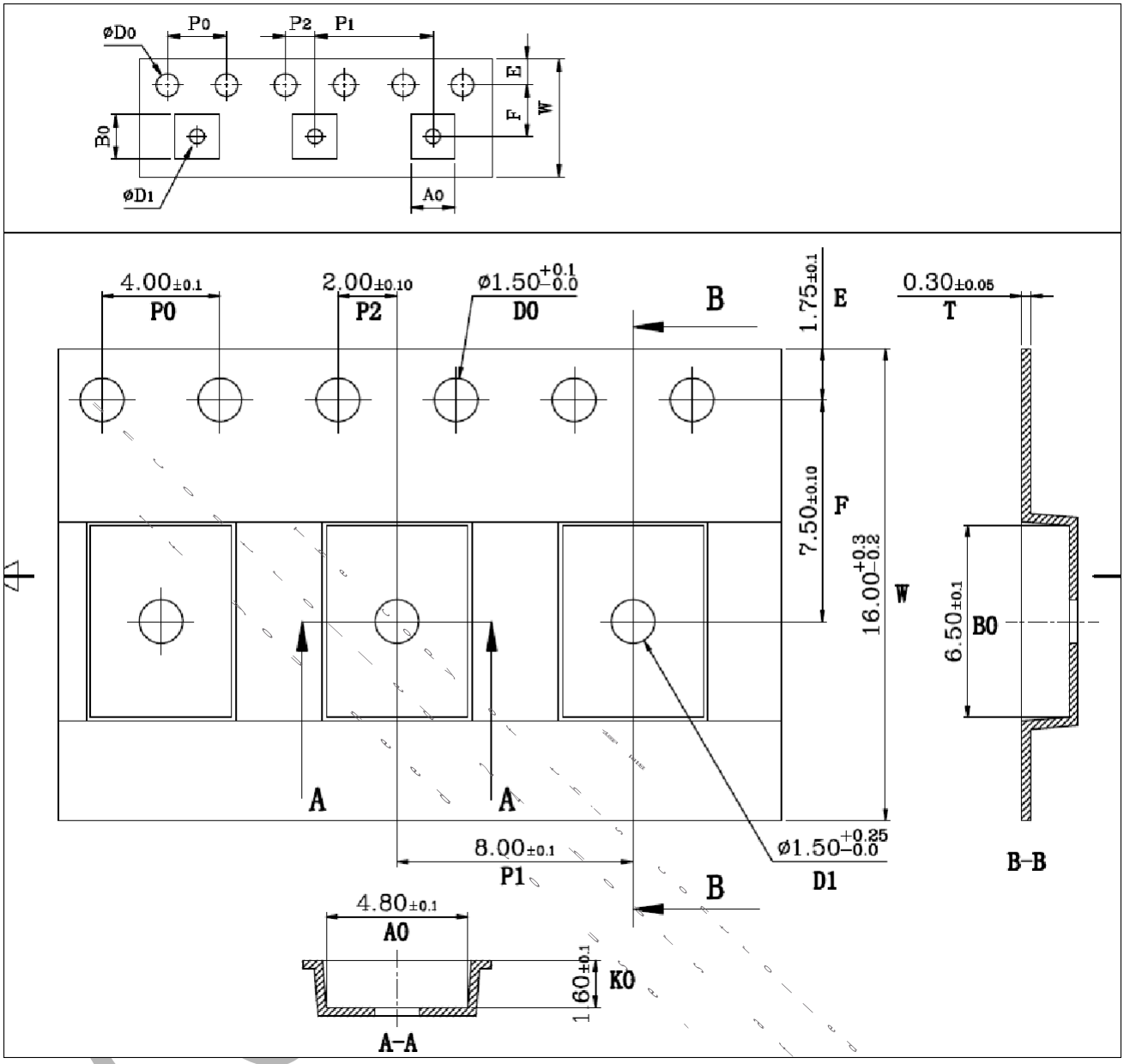


Figure 9-3 Tape Dimensions [a]

(a) All dimensions in millimeters

9.4 Moisture Sensitivity Level

BES2300-YP is qualified to moisture sensitivity level MSL3 in accordance with JEDEC J-STD-020.