

DESCRIPTION

The CM2025 is a highly integrated single-chip Bluetooth audio solution targeting Bluetooth gaming headsets and wireless microphone markets with high performance and low power consumption.

CM2025 adopts ARM Cortex-M4F core and a rich set of interfaces such as USB, SPI, UART, TWI, PWM, I2S TX/RX, capacitive touch key to accomplish various Bluetooth audio applications.

CM2025 integrates BT v5.3 dual mode to BT classic and LE audio connection, which is fully backward compatible to v5.0/4.2/2.1 Bluetooth specifications. Both links in BR/EDR and LE can be active simultaneously for bidirectional HD voice transmission.

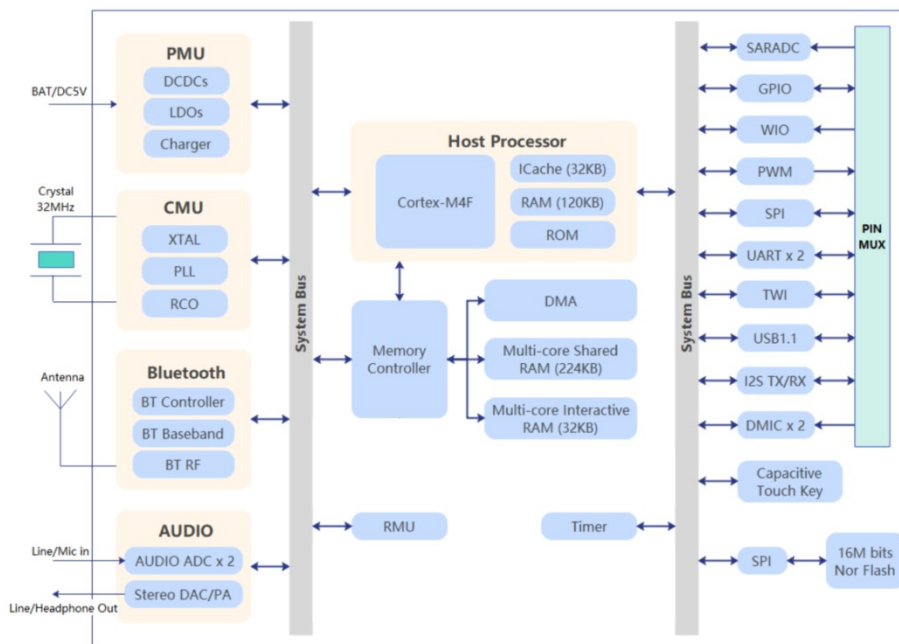
CM2025 owns a power management unit (PMU) to establish a stable power source and linear battery charger with maximum 300mA charging current that allows CM2025 to recharge the battery over USB.

Besides, with implementing Cmedia Xear™ Sound Technology- Surround HP and AI noise cancellation, to provide users the best auditory experience at near end, and transmit good voice quality to far end by filtering out the annoying sounds around, like keyboard typing, mouse clicking, fan sound, fan blades running, etc.

FEATURES

- ARM Cortex-M4F with Floating Point Unit (FPU) 96MHz
- Internal 16M bits SPI serial Flash
- Support Bluetooth v5.3 and backward compatible
- Support BT dual-mode and link for BR/EDR and LE audio
- Bluetooth transmitting output max. power: 13dBm
- Bluetooth receiving sensitivity: -96dBm@GFSK, -94dBm@ $\pi/4$ DQPSK, -88dBm@8DPSK modulation
- Support SBC/AAC/LC3 BT audio transmission format
- Support bidirectional voice transmission, sampling rate 32KHz/48KHz for up/down stream
- Playback path latency is 25ms in LE audio mode
- Support USB 2.0 Full Speed with UAC 1.0
- Audio data supports up to 8~192K/24-bits sampling rate
- Build in 24-bit DAC/ADC with 8K~96K sampling rate
- Build in stereo ADC, SNR 102dB, THD+N<-90dB
- Build in stereo DAC, SNR 120dB, THD+N<-100dB
- Build in stereo 22mW PA for headphone
- Fully configurable PEQ, up to 20 segments
- Support I2S TX and RX, sampling rate up to 192KHz
- Support Serial Interface: SPI, UART*2, TWI
- Support 16 GPIO, 3 wake-up IO, 4 PWM for LED controller
- Support Li-Ion battery and 5V power supply
- Operating voltage: I/O 1.8~3.3V, Core 1.1V
- Integrated battery charger up to 300mA with fast charge
- Ultra-low-power: 3uA @ suspend; 10mA @active

BLOCK DIAGRAM



Release notes

Revision	Date	Description
0.1	2023/11/17	Preliminary version

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1 Description and overview

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2 Ordering information

Product	Package Marking	Package Type	Transport Media	Storage Temperature
CM2025	CM2025	QFN-44 (4mm x 5mm)	Tray	-55 to 150°C

3 Features

3.1 System

- 3.1.1 ARM Cortex-M4F with Floating Point Unit (FPU) 96MHz
- 3.1.2 Internal 120KB RAM for data and program
- 3.1.3 Internal 224KB RAM
- 3.1.4 Internal ROM for firmware implementation
- 3.1.5 Internal 16Mbits QSPI serial Flash
- 3.1.6 Support USB and UART mass production and upgrade program

3.2 BT Compliance

- 3.2.1 Support Bluetooth v5.3 specification and backward compatible with V5.2/5.0/4.2/2.1
- 3.2.2 Support BT5.3 dual-mode and dual-link for BR/EDR and LE audio
- 3.2.3 Max transmitting output power: 13dBm
- 3.2.4 Bluetooth receiving sensitivity: -96dBm@GFSK, -94dBm@ $\pi/4$ DQPSK, -88dBm@8DPSK, -98dBm@BLE mode 1Mbps, -95dBm@BLE mode 2Mbps
- 3.2.5 Support LE 1M/2M PHY
- 3.2.6 Support long range BLE
- 3.2.7 Support bidirectional voice transmission, sampling rate 32KHz/48KHz for up/down stream
- 3.2.8 The playback latency is about 25ms in LE audio mode

3.3 USB Compliance

- 3.3.1 USB 2.0 Full Speed
- 3.3.2 USB Audio Class 1.0
- 3.3.3 Audio data supports up to 24-bits data length and 8k~192k sampling rate

3.4 Audio Paths and Interface

- 3.4.1 Build in 2 channels 24-bit input sigma-delta ADC, SNR 102dB, THD+N<-90dB
- 3.4.2 ADC supports sample rate 8KHz to 96KHz
- 3.4.3 Support 2 channels analog/digital microphone
- 3.4.4 Build in stereo 24-bit input sigma-delta DAC, SNR 120dB, THD+N<-100dB, Noise<2uVrms
- 3.4.5 Build in stereo 22mW PA for headphone
- 3.4.6 DAC supports sample rate 8KHz to 96KHz
- 3.4.7 Support I2S TX/RX Master and Slave mode, sampling rate from 8KHz to 192KHz

3.5 Audio Processing

- 3.5.1 Fully configurable PEQ, up to 20 segments
- 3.5.2 Xear™ Surround Sound Technology Driver

3.6 Physical Interface

- 3.6.1 Support 16 GPIO, 3 wake-up IO
- 3.6.2 Support 4 PWM for lamp controller

- 3.6.3 Serial Interface: SPI, UART*2, TWI
- 3.6.4 Integrated 10bit SAR A/D converter
- 3.6.5 Support capacitive touch key

3.7 Power Management

- 3.7.1 Operating voltage: I/O 1.8~3.3V, Core 1.1V
- 3.7.2 Support Li-Ion battery and 5V power supply
- 3.7.3 Integrated linear battery charger up to 300mA with fast charge
- 3.7.4 Integrated 2*DC-DC buck converters
- 3.7.5 Low Power Consumption:
 - LE Audio: 10mA@Vbat = 3.8V
 - A2DP: 4.8mA@Vbat = 3.8V
 - HFP: 6.4mA@Vbat=3.8V
 - Fully charged mode: <math><4\mu\text{A}</math>@Vbat = 3.8V
 - Shutdown mode: <math><3\mu\text{A}</math>@Vbat = 3.8V

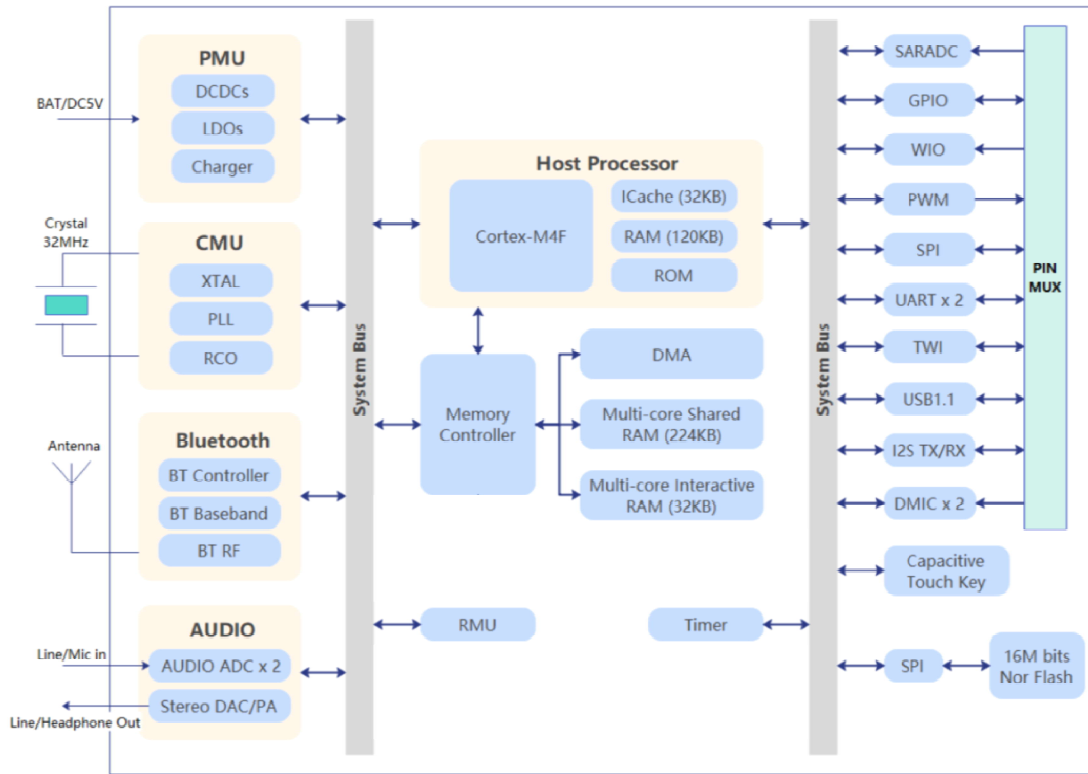
3.8 Others

- 3.8.1 Package QFN-44 (4mm*5mm, Pitch 0.35mm)

4 Applications

- 4.1 Wireless gaming headset/headphone
- 4.2 Wireless music and communication headset/headphone
- 4.3 Wireless microphone

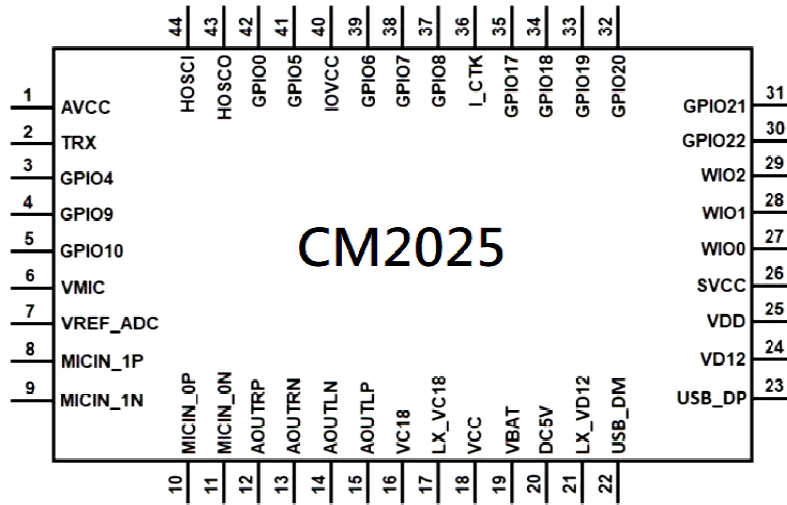
5 Block Diagram



CM2025 Functional Block Diagram

6 System Description

6.1 Pin-Out



6.2 Pin Description

Pin	Pin Name	Function Multiplex	IO Type	PAD Drive Level	Initial State	Description
BT/RF						
2	TRX		RF			Bluetooth antenna IO
USB Interface						
22	GPIO2	USB_DM TA_GRANT UART0_RX UART1_RTS TWI_SDA SPI1_MOSI PWM3 DMIC_CLK I2STX_DOUT I2SRX_DIN	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	X	USB Interface or General purpose I/O Power Domain: VCC
23	GPIO1	USB_DP BT_ACCESS UART0_TX UART1_CTS TWI_SCL SPI1_CLK PWM2 DMIC_DAT I2STX_LRCLK I2SRX_LRCLK	AIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	X	USB Interface or General purpose I/O Power Domain: VCC
Audio Interface						
8	MICIN_1P		AI			Microphone or line input
9	MICIN_1N		AI			Microphone or line input

10	MICIN_OP		AI			Microphone or line input
11	MICIN_ON		AI			Microphone or line input
12	AOUTRP		AO			Right channel of AUDIO Analog output
13	AOUTRN		AO			Right channel of AUDIO Analog output
14	AOUTLN		AO			Left channel of AUDIO Analog output
15	AOUTLP		AO			Left channel of AUDIO Analog output
Power/GND						
1	AVCC		PWR			
6	VMIC					Microphone power
7	VREF_ADC					Reference voltage of audio ADC
16	VC18		PWR			1.8V voltage
17	LX_VC18		PWR			LX_VC18
18	VCC		PWR			3.1V voltage
19	VBAT		PWR			Battery Voltage input
20	DC5V	GPIO UART1_TX UART1_RX UART0_TX UART0_RX	PWR			5.0V Voltage
21	LX_VD12		PWR			LX_VD12
24	VD12		PWR			1.2V voltage
25	VDD		PWR			1.1V voltage
26	SVCC		PWR			
40	IOVCC		PWR			IO power supply: 1.8V or VCC
Miscellaneous						
3	GPIO4	BT_ACCESS UART1_TX TWI_SDA SPI1_CLK PWM0 DMIC_CLK I2STX_LRCLK I2SRX_LRCLK RC32KHz_OUT 32MHz_OUT VMIC1	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
4	GPIO9	ANT_SW0 UART0_TX UART1_TX TWI_SDA SPI1_SS PWM0 DMIC_DAT I2STX_DOUT I2SRX_DIN	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC

5	GPIO10	PTA_GRANT UART0_TX UART1_TX TWI_SCL SPI1_MOSI PWM1 DMIC_CLK I2STX_MCLK I2SRX_MCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
30	GPIO22	BT_ACCESS UART0_RX UART1_RX TWI_SDA PWM1 DMIC_DAT I2STX_DOUT I2SRX_DIN RC32KHz_OUT 32MHz_OUT	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	H	General purpose I/O Power Domain: VCC
31	GPIO21	BT_REQ UART0_TX UART1_TX TWI_SCL PWM0 DMIC_CLK I2STX_DOUT I2SRX_DIN RC32KHz_OUT 32MHz_OUT	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	L	General purpose I/O Power Domain: VCC
32	GPIO20	BT_REQ UART0_TX UART1_TX TWI_SCL SPI1_SS PWM2 DMIC_CLK I2STX_MCLK I2SRX_MCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
33	GPIO19	ANT_SW1 UART0_RX UART1_RTS TWI_SCL SPI1_MISO PWM3 DMIC_CLK I2STX_DOUT I2SRX_DIN	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
34	GPIO18	BT_ACESSE UART0_TX UART1_CTS TWI_SDA SPI1_MOSI PWM0 DMIC_DAT I2STX_BCLK I2SRX_BCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC

35	GPIO17	BT_REQ UART0_RX UART1_RX TWI_SCL SPI1_CLK PWM2 DMIC_DAT I2STX_LRCLK I2SRX_LRCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
37	GPIO8	LRADC2 UART0_RX UART1_RX TWI_SDA SPI1_MISO PWM2 DMIC_CLK I2STX_LRCLK I2SRX_LRCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
38	GPIO7	BT_REQ UART0_TX UART1_TX TWI_SCL SPI1_MOSI PWM1 DMIC_DAT I2STX_MCLK I2SRX_MCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
39	GPIO6	PTA_GRANT UART0_RX UART1_RTS TWI_SDA SPI1_SS PWM3 DMIC_DAT I2STX_DOUT I2SRX_DIN	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
41	GPIO5	ANT_SW2 UART0_TX UART1_CTS TWI_SCL SPI1_CLK PWM1 DMIC_CLK I2STX_BCLK I2SRX_BCLK	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC
42	GPIO0	LRADC2 UART0_TX UART1_TX TWI_SDA SPI1_SS PWM3 DMIC_CLK I2STX_BCLK I2SRX_BCLK RC32KHz_OUT 32MHz_OUT	DIO	L1: 2mA L2: 4mA L3: 6mA L4: 10mA	Z	General purpose I/O Power Domain: IOVCC

27	WIO0	GPIO ONOFF	DIO		Z	Wake-up I/O Power Domain: SVCC
28	WIO1	GPIO LRADC1	DIO		Z	Wake-up I/O Power Domain: SVCC
29	WIO2	GPIO RESET	DIO		Z	Wake-up I/O Power Domain: SVCC
43	HOSCO		AO			32MHz clock output
44	HOSCI		AI			32MHz clock input
36	I_CTK		AI			Capacitive touch key
45	EPAD		GND			Exposed pad as ground

7 Electrical Characteristics

7.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ	Max.	Unit
Supply Voltage	DC5V	-0.3	-	6.5	V
	BAT	-0.3	-	5.0	V
Input Voltage	3.3V IO	-0.3	-	3.6	V
	1.8V IO	-0.3	-	1.98	V
Operating ambient temperature	T _A	-40	-	+85	°C
Storage temperature	T _S	-55	-	+150	°C
ESD Protection(Human Body Model)	HBM	3000			V

Note:

Even if one of the above parameters exceeds the absolute maximum ratings momentarily, the quality of the product may be degraded. The absolute maximum ratings, therefore, specify the value exceeding, which the product may be physically damaged. Use the product well within these ratings.

7.2 Recommended Operational Conditions

Supply Voltage	Min.	Typ	Max.	Units
DC5V	4.3	5	6	V
BAT (Li)	3.0	3.8	4.5	V
VCC	2.8	3.1	3.4	V
SVCC	2.6	2.8	3.0	V
AVCC (AVCC_RTXRF_int)	2.6	2.8	3.0	V
VC18	1.62	1.8	1.98	V
VDD	0.81	1.1	1.21	V
VD12	1.26	1.4	1.6	V
IOVCC	1.62	1.8/3.1	3.4	V
Operating ambient temperature	-	25	-	°C

7.3 DC Characteristics

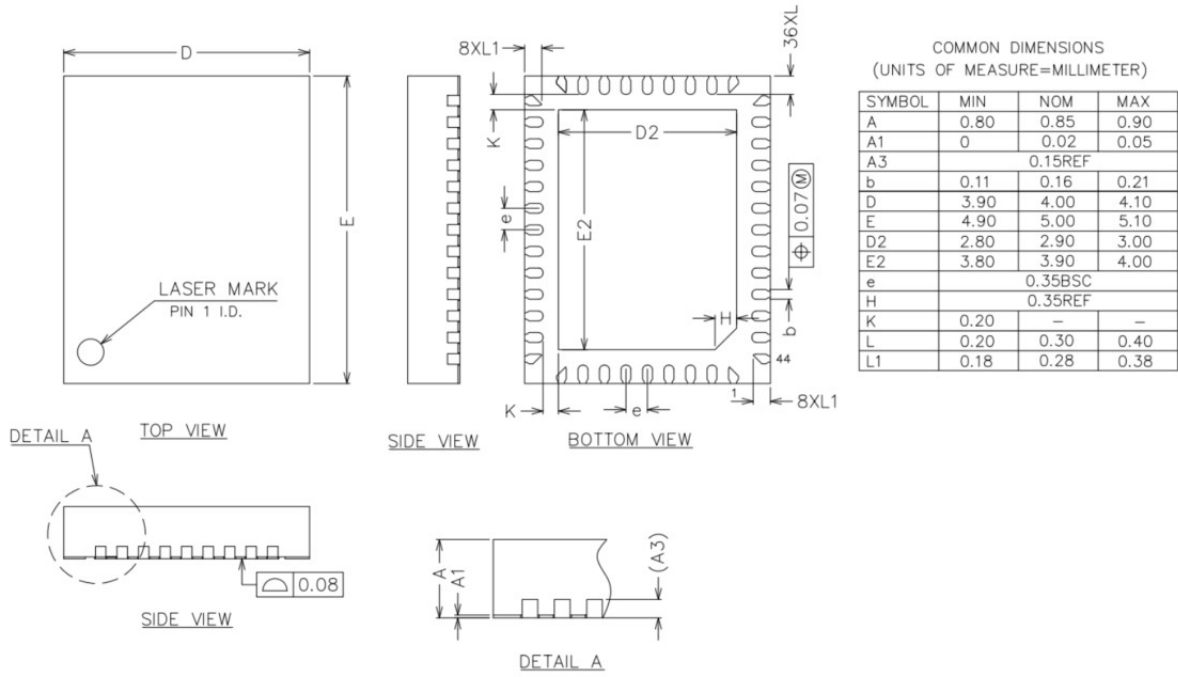
Parameter	Symbol	Min.	Max.	Units	Units
Low-level input voltage	VIL		0.6	V	3.1V GPIO pin IOVCC = 3.1V Tamb = -10 to 70 °C
High-level input voltage	VIH	2.4		V	
Low-level output voltage	VOL		0.6	V	
High-level output voltage	VOH	2.4		V	
Low-level input voltage	VIL		0.3	V	1.8V GPIO pin IOVCC = 1.8V Tamb = -10 to 70 °C
High-level input voltage	VIH	1.5		V	
Low-level output voltage	VOL		0.3	V	
High-level output voltage	VOH	1.5		V	

7.4 Power Consumption

(TBC)

7.5 Battery Charge

Parameter	Min.	Typ	Max.	Units
Input Voltage	BAT+0.1	5	6	V
Charge Current (CC Mode)	10	60	300	mA
Trickle Charge Current	2	20	40	mA
Trickle Charge Threshold Voltage	-	3.0	-	V
Regulated Output (Float) Voltage	3.3	4.2	4.7	V

8 Package Information


— End of Datasheet —

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