DESCRIPTION

The CM3109 is Cmedia single-chip of USB 2.0 compliant full-speed controller with a high performance integrated circuit design to support Teams button and LED functionality in peripheral devices. It enables seamless interaction with the Teams client, ensuring reliable communication with an enhanced user experience.

The CM3109 integrates stereo DAC and mono ADC audio engines. It achieves the audio performance with DAC SNR up to 98 dB and ADC SNR up to 98 dB at 48 kHz / 16-bits operation.

To enable flexible acoustic tuning and sound differentiation, the CM3109 features a hardware-based DAC 10-band equalizer.

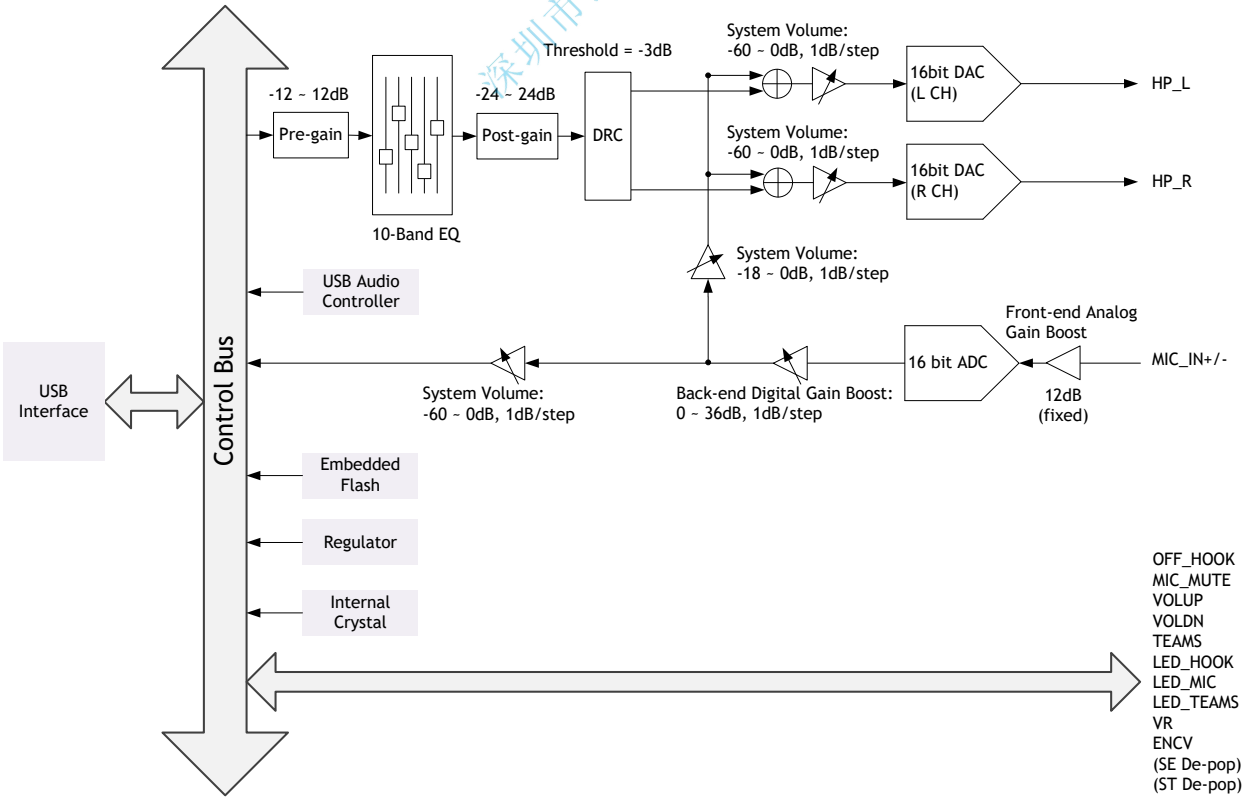
Designed for headset applications compliant with Teams-defined protocols, the CM3109 supports call control functions and seamless integration with unified communication platforms.

Packaged in a compact QFN-20 (3 × 3 mm) package and optimized for low power consumption, the CM3109 helps reduce PCB area and overall BOM cost, making it well suited for compact and cost-effective USB audio designs.

FEATURES

- USB 2.0 Spec. Full-Speed compliant
- USB Audio Device Class Spec. 1.0 compliant
- USB HID Device Class Spec. 1.1 compliant
- 2-channel DACs and 1-channel ADC
- 16-bits data resolution and 48 kHz sample rate
- Hardware-based DAC 10-band equalizer with peak filter, high/low pass filter, high/low shelf filter and notch filter
- Supports Dynamic Range Control (DRC)
- USB suspend/resume/remote wakeup
- Embedded oscillator for crystal-less design
- Independent voltage bias pin for microphone and side-tone function
- Implemented 5 dedicated Teams HID hot key controls for Volume Up, Volume Down, MIC Mute, Off-Hook and Teams
- Implemented 3 LED indicators for MIC Mute, Off-Hook and Teams status
- Supports variable resistor or rotary encoder with push-button switch for playback volume control
- Small size (3mm x 3mm) of 20-pin QFN Package

BLOCK DIAGRAM



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Release notes

Revision	Date	Description
0.90	2026/2/9	- Preliminary release
0.91	2026/4/30	- Update Block Diagram - Update Features - Update Pin Description

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1 Description and Overview

The CM3109 is the single-chip of USB 2.0 compliant full-speed protocol controller with highly integrated audio codec functionality for USB communication headset of USB featured consumer audio applications.

The CM3109 integrates two-channel DACs with single-ended outputs and common-mode voltage bias, and one-channel ADC supporting both single-ended and differential input modes. It supports 16-bits audio resolution with a sampling rate of 48 kHz. The device provides better audio performance, achieving DAC (DAC in common-mode voltage bias mode, VC mode) and ADC (ADC in differential mode) SNR up to 98 dB at 48 kHz / 16-bits operation, making it suitable for high-quality audio playback and voice capture applications.

To enable flexible acoustic tuning and product differentiation, the CM3109 features a hardware-based DAC 10-band equalizer, supporting various filter types including peak, notch, high-pass, low-pass, and high/low shelf filters. In addition, the device supports the Xear-EQ software application to allow users to adjust gain values for individual frequency bands. External EQ mode selection key and LED for EQ mode indicator are supported, allowing real-time audio effect switching through device-side control without reliance on host-side software processing.

The CM3109 is compliant with USB Audio Device Class Specification 1.0 and USB HID Device Class Specification 1.1, and operates as a USB 2.0 Full-Speed device, ensuring driver-free compatibility with mainstream operating systems. Standard USB functions such as suspend, resume, and remote wakeup are supported.

The CM3109 is packaged in a 20-pin QFN (3 × 3 mm) package with an embedded oscillator for crystal-less design, the dedicated voltage bias pin for microphone and side-tone functions, GPIO-based LED indicator control, and flexible external control interfaces such as variable resistors and rotary encoders with push-button switch for playback volume adjustment.

Additionally, CM3109 is offering the human interface devices (HID) control pins that are dedicated for Teams communication, such as volume up, volume down, microphone mute, Off-Hook and Teams, and attached with the status indicators of microphone mute, Off-Hook and Teams. With turn-key reference design, the CM3109 can be easily and quickly to deliver the quality USB audio applications or peripherals to the market.

2 Ordering Information

Part Number	Package Marking	Package Type	Transport Media
CM3109	CM3109	QFN-20 (3mm x 3mm)	Tape and Reel

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3 Features

3.1 USB Compliance

- USB 2.0 full-speed compliant
- USB audio class 1.0 compliant
- USB human interface devices (HID) class 1.1 compliant
- Supports USB suspend/resume/remote wakeup functions
- Supports control, interrupt and isochronous data transfers

3.2 Audio Engine and Codec

- Playback Stream:
  - Stereo DAC with Headphone Output:
    - Sample Rates: 48 kHz
    - Bit Depth: 16 bits
    - THD+N (VC Mode): -85 dB
    - SNR (VC Mode): -97 dB
    - Dynamic Range (VC Mode): -97 dB
    - System Volume Range: -60 dB ~ 0 dB, 1 dB/step
    - Single-ended/Common-Mode Voltage Bias Mode (VC Mode) Selection for Output
- Recording Stream:
  - Mono ADC with Microphone Input
    - Sample Rates: 48 kHz
    - Bit Depth: 16 bits
    - THD+N (Differential Mode): -75 dB
    - SNR (Differential Mode): -99 dB
    - Dynamic Range (Differential Mode): -99 dB
    - System Volume Range: -60 dB ~ 0 dB, 1 dB/step
    - Front-end analog gain boost: up to +12 dB (fixed)
    - Back-end digital gain boost: 0 dB ~ 36 dB, 1dB/step (adjustable)
    - Single-ended/Differential Mode Selection for Input
    - Independent Microphone Bias
- Side-tone:
  - Internal mixer path with independent physical digital gain control: -30 dB ~ -12 dB (mapping with system volume range is -18 dB ~ 0 dB), 1 dB/step

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Side-tone System Volume Range and Physical Digital Gain Control			
System Volume Range (dB)	Physical Digital Gain (dB)	System Volume Range (dB)	Physical Digital Gain (dB)
0	-12	-12	-24
-1	-13	-13	-25
-2	-14	-14	-26
-3	-15	-15	-27
-4	-16	-16	-28
-5	-17	-17	-29
-6	-18	-18	-30
-7	-19		
-8	-20		
-9	-21		
-10	-22		
-11	-23		

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3.3 Hardware EQ Capabilities

- Provides 10-band hardware-based equalizer for DAC audio playback
- Supports single EQ mode
- Each EQ band supports programmable center frequency, gain, Q factor, and filter type
- Supported filter types include:
  - Low-Pass Filter (LPF)
  - High-Pass Filter (HPF)
  - Peak Filter
  - Low Shelf Filter
  - High Shelf Filter
  - Notch Filter
- Each band supports independent reset to default settings
- Supports Pre-gain control (-12 dB ~ +12dB) of signal attenuation before EQ processing
- Supports Post-gain control (-24dB ~ +24dB) of signal compensation after EQ processing
- Supports USB-based EQ parameter update with real-time (online) effect
- EQ settings can be stored in internal flash memory

3.4 Teams Application

- Supports 5 + 3 mode (5 Teams HID hot keys and 3 Teams dedicated indicators)
  - HID hot key
    - Off-Hook
    - Microphone mute
    - Volume up
    - Volume down
    - Teams
  - LED indicator
    - Off-Hook LED indicator
    - Microphone mute LED indicator
    - Teams LED indicator
- Support 4 + 2 mode
  - HID hot key
    - Off-Hook
    - Microphone mute
    - Volume up
    - Volume down
  - LED indicator
    - Off-Hook LED indicator
    - Microphone mute LED indicator

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3.5 General

- Embedded USB 2.0 transceiver and Power-On reset circuit
- On-Chip oscillator and crystal-less design
- Supports Dynamic Range Control (DRC) with enable/disable before DAC ouput (Threshold = -3dB)
- Optional configuration for the specific USB VID/PID/Product String/Manufacture String/Serial Number, and Initial/Minmum/Maximum volume settings
- Single 5V power supply with embedded 5V to 1.8V / 3.3V regulator
- Supports variable resistor or rotary encoder with push-button switch for playback volume control
- Compliant with USB IF certification
- Small size (3mm x 3mm) of standard 20-Pin QFN Package

4 Applications

- USB Generic Headset
- USB Communication Headset
- USB Audio Dongle
- USB Featured Consumer Audio Applications

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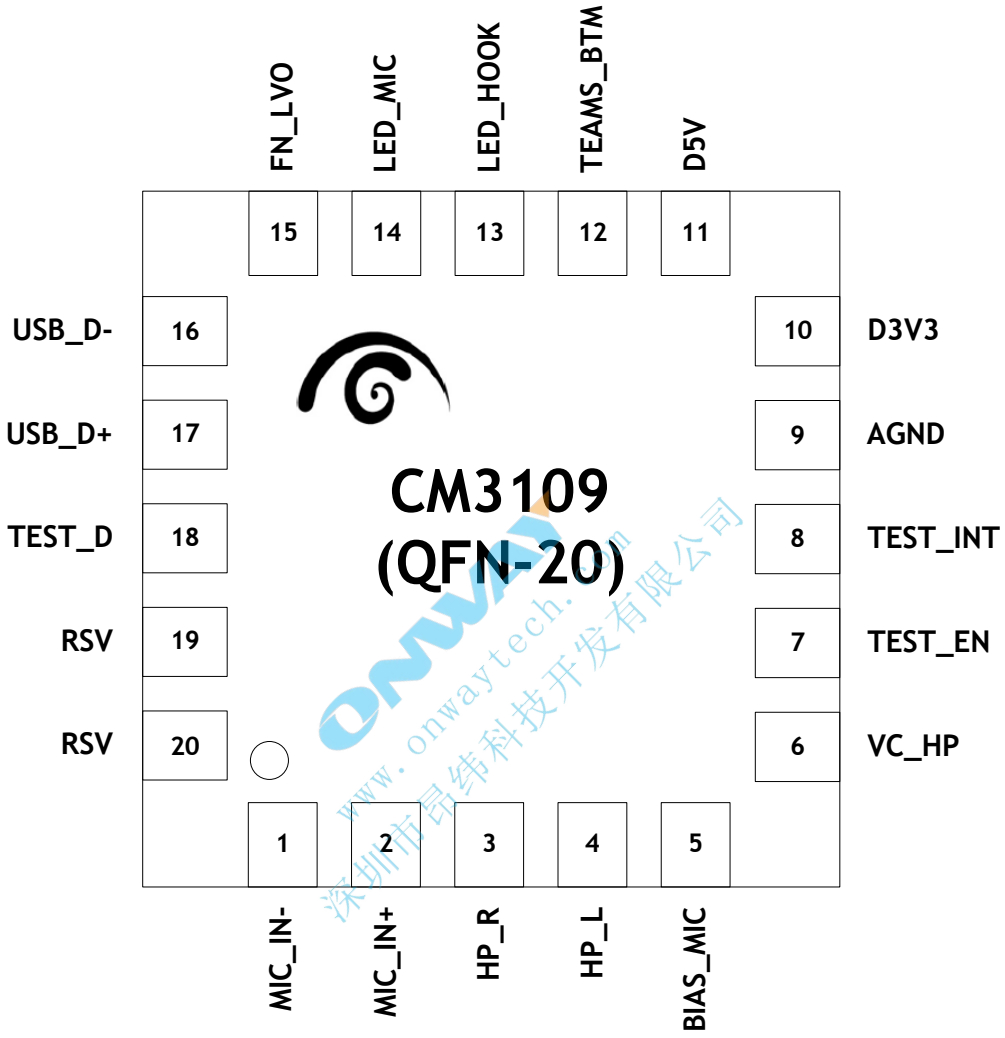
5 Pin Assignment

5.1 Pin-out Diagram



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5.2 Pin Description

Pin No.	Pin Name	I/O	Description
USB2.0 Bus Interface			
17	USB_D+	AIO	3.3V USB 2.0 Data Positive (USB D+ Signal) Without external pull high/low resistance
16	USB_D-	AIO	3.3V USB 2.0 Data Negative (USB D- Signal) Without external pull high/low resistance
Power/Ground			
9	AGND	GND	Analog GND
10	D3V3	AO	3.3V Regulator Output
11	D5V	AI	5V Power Input
Analog Audio Interface			
1	MIC_IN-	AI/DO	This pin is primarily used as the negative microphone input (MIC_IN−), and can also be configured as a shared multifunction pin. It supports two selectable modes as follows: ● **MIC_IN− (Negative microphone input):** In normal operation, when the ADC is configured in differential input mode, this pin functions as the negative microphone input. ● **SE De-pop (Single-Ended De-pop):** De-pop control signal for DAC single-ended mode (refer to the reference schematic), When the ADC is configured in single-ended input mode, this pin becomes available and can be configured as a de-pop control signal based on application requirements. When the DAC operates in single-ended mode, plug-in/out or power-off events may introduce audible pop noise. An optional de-pop control signal output is provided to interface with the shutdown pin of an external headphone amplifier or de-pop circuit, enabling hardware-level pop noise suppression through external component design.

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2	MIC_IN+	AI	This pin serves as the primary microphone input signal source and is used in both single-ended and differential modes. ● **MIC IN:** When the ADC is configured in single-ended mode, this pin is used as the microphone input. ● **MIC_IN+ (Positive microphone input):** When the ADC is configured in differential mode, this pin functions as the positive input of the microphone.
3	HP_R	AO	Headphone Out: Right Channel
4	HP_L	AO	Headphone Out: Left Channel
5	BIAS_MIC	AO	Microphone Bias Output
6	VC_HP	AO	1.28V Common-Mode Voltage Output Provides a mid-supply reference voltage for Headphone Out
ADC/GPIO/HID Interface			
12	TEAMS_BTM	DI	This is a multifunction ADC pin that simultaneously supports external hot key and Jack detect: ● **OFF_HOOK:** ➢ Short Press: ✓ Answer incoming call ✓ End active call ✓ Launch UI ✓ Leave meeting ➢ Long Press: ✓ Reject incoming call ➢ [4 Key + 2 LED Configuration] ✓ Short Press: Join meeting ✓ Long Press: Raise hand (in meeting) ● **MIC_MUTE:** ➢ Short Press: ✓ Toggle microphone mute/unmute ● **VOLUP:** ➢ Short Press: ✓ Increase volume (step up) ● **VOLDN:** ➢ Short Press: ✓ Decrease volume (step down)

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			● **TEAMS (5 Key + 3 LED Configuration Only):** ➢ Short Press: ✓ Launch Teams UI ✓ Join meeting ➢ Long Press: ✓ Raise hand (in meeting) ● **JACK_DET:** Jack detect input pin. Used to detect the insertion or removal of a 3.5 mm audio plug. This signal can be used to control audio path switching or to enable/disable side-tone, helping prevent audio feedback (howling). If side-tone is always disabled, this function can be ignored and is not required for USB headset applications.
13	LED_HOOK	DO	Off-hook LED indicator behavior is as follows: ➢ Flashing: Incoming call / Meeting notification ➢ Solid ON: In call / In meeting ➢ Solid OFF: Idle / Call ended ➢ [4 Key + 2 LED Configuration Only] ➢ Flashing: Meeting notification
14	LED_MIC	DO	LED indicator for microphone mute ➢ Solid ON: Microphone muted ➢ Solid OFF: Microphone active
15	FN_LVO	AI/DI	Selectable Function (3-in-1): LED_TEAMS / ENCV / VR This pin is a shared pin and can be configured to operate as one of the following functions: ● **LED_TEAMS (5 Key + 3 LED Configuration Only):** ➢ Solid ON: After Teams account sign-in ➢ Flashing: Meeting notification ● **ENCV:** When configured for this function, the pin serves as a rotary encoder input (refer to the reference schematic), specifically used for playback volume control ● **VR:** When configured for this function, the pin serves as a variable resistor (potentiometer) input (refer to the reference schematic) for local/device-side playback volume control. This control operates independently from the

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			system (no synchronization) and uses a dedicated digital gain, with a gain range of -60 dB ~ 0 dB
Test Mode			
7	TEST_EN	DI	Test purpose with inernal pull low
8	TEST_INT	DI	Test purpose with inernal pull low
18	TEST_D	DIO	Test purpose with inernal pull low
19	RSV	DI	Reserved pin
20	RSV	DI	Reserved pin

NOTES:

AI: Analog Input

AO: Analog Output

AIO: Analog Input and Output

DI: Digital Input

DO: Digital Output

DIO: Digital Input and Output

GND: Ground

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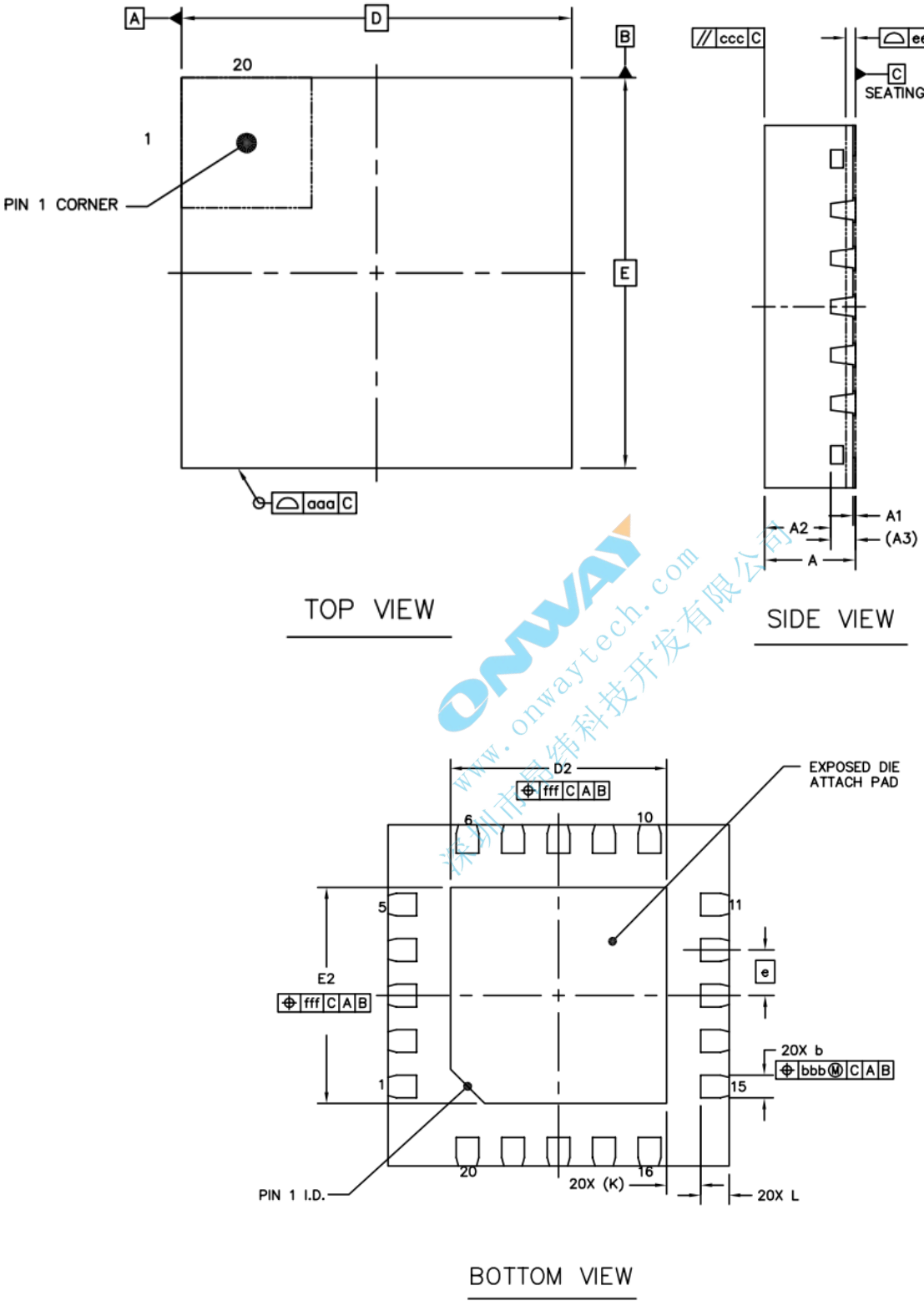
6 Package Dimension (QFN-20, 3mm x 3mm)



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Parameter		Symbol	Min	Nom	Max
Total thickness		A	0.7	0.75	0.8
Stand off		A1	0	0.02	0.05
Mold thickness		A2	—	0.55	—
L/F thickness		A3		0.203 REF	
Lead width		b	0.15	0.2	0.25
Body size	X	D		3 BSC	
	Y	E		3 BSC	
Lead pitch		e		0.4 BSC	
EP size	X	D2	1.8	1.9	2
	Y	E2	1.8	1.9	2
Lead length		L	0.15	0.25	0.35
Lead tip to exposed pad edge		K		0.3 REF	
Package edge tolerance		aaa		0.1	
Mold flatness		ccc		0.1	
Coplanarity		eee		0.08	
Lead offset		bbb		0.07	
Exposed pad offset		fff		0.1	

Unit: mm. BSC = Basic Spacing between Centers; REF = Reference only.

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— End of Datasheet —

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C-MEDIA ELECTRONICS INC.
6F., 100, Sec. 4, Civil Boulevard, Taipei, Taiwan 106 R.O.C.
TEL：+886-2-8773-1100
FAX：+886-2-8773-2211
E-MAIL：sales@cmedia.com.tw

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