

YHM4001A/4002A

Voltage Modulation Communication Over Smart Power Switch

Features

- Input voltage range: 2.5V ~ 5.5V
- Any of VIN, VOUTL, VOUTR and VDD may supply the chip
- Min Power Path On-resistance: typical 60mΩ each
- Max 1.5A continuous current capability
- Max 12.5K bps for physical signal traffic for VMC (Voltage Modulation Communication)
- Power Path On/Off and discharge control
- Optional active low (YHM4001A default reg bit on after POR) or high (YHM4002A default reg bit off after POR) for power switch
- 10-bits ADC for current sensing through each power path, additional impedance & passive load short and VIN/VOUTL/VOUTR voltage detection
- Cable impedance and contact quality detection
- Active Short protection or high accuracy OCP
- Reverse current detection and protection
- Watch dog time-out to turn off power path and Reset MCU or AP as well
- Direct Single Wire Communication Support such as support 1.2Mbps Half Duplex UART Traffic
- Simple VIN Command Detection for direct RSTB logic control and UART path on/off control
- OTP (Over Temperature Protection)
- Robust ESD capability
- >2kV HBM & >1kV CDM
- 15kV air discharge & 8kV contact discharge under IEC 61000-4-2 with TVS

Applications

- Mobile Phone, AR/VR Device, TWS Charging Box/Earbuds, Wearable Watch/Band and Smart IOT devices etc.

General Description

The YHM4001A and YHM4002A handle special bidirectional on-power line data traffic based on YHMICROS' Voltage Modulation Communication protocol with Smart Capacitance Hysteresis Capture technology.

YHM4001A active low default on to typically work in tiny portable device such as earbud side. YHM4002A active high default off to typically work in power output side such as TWS charging box side.

YHM4001A/4002A adopt special technology to measure the current through power path with high accuracy.

The chips integrate high side current source and ADC for VIN, VOUTL, VOUTR pins' passive impedance and active voltages.

The low side current source, power path on/off and through current comparison and VMC Implement Unit will help data traffic between master and slave sides.

These chips also support watch dog function, once MCU or AP crash, the power path will be forced off, even may use RSTB pin to reset MCU or AP as well.

I²C Interruption INTB may bypass to VIN, VOUTL or VOUTR for direct single wire communication between Master and Slave MCU/SOC.

The YHM4001A/4002A as master may do slave presence and in-existent detection and interruption.

The YHM4001A/YHM4002A come in a 3x3 array, 9-bump, 0.4mm pitch, 1.205mmx1.25mm wafer-level package (WLP) and a 2mmx3mm, 8-PIN, 0.5mm pitch DFN package.

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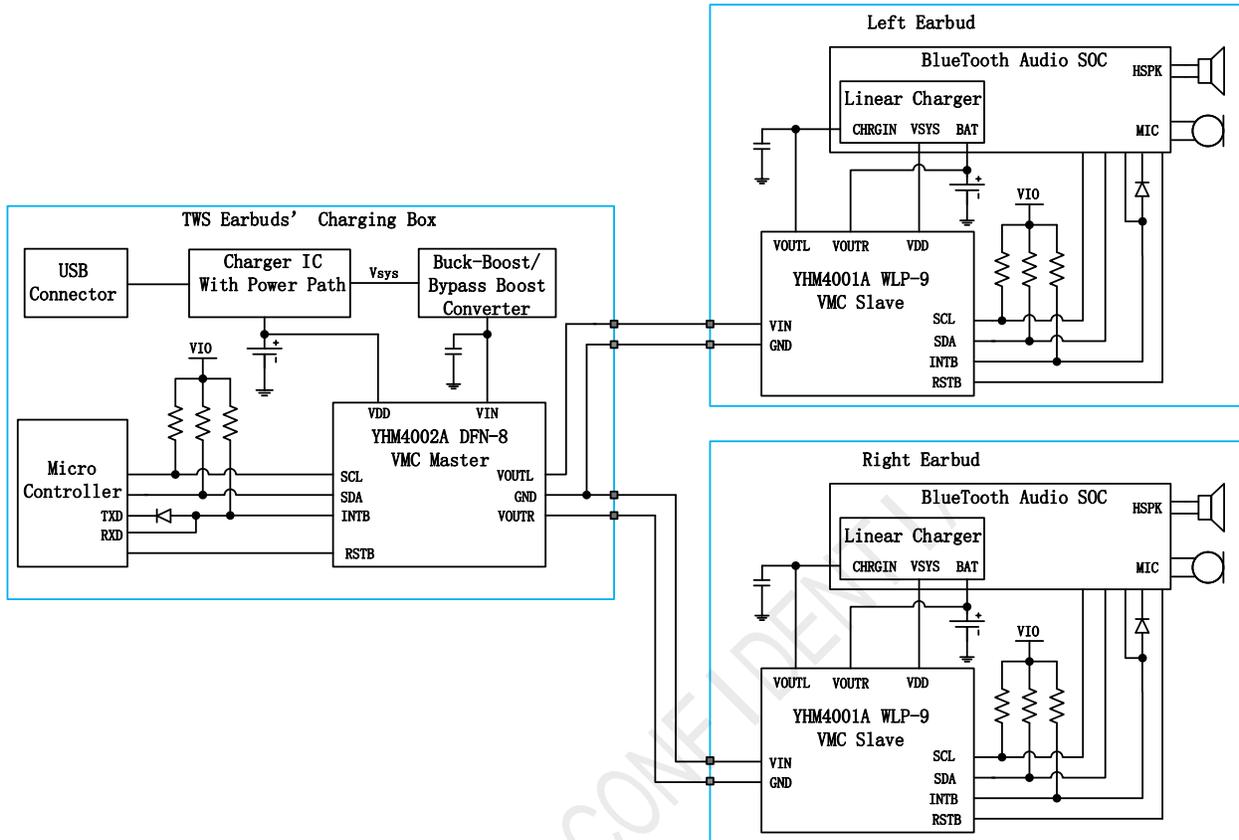


Fig 1. YHM4001A/2 Typical Application in TWS Charging Box and Ear Buds

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YHM4001A/YHM4002A Pin Configurations

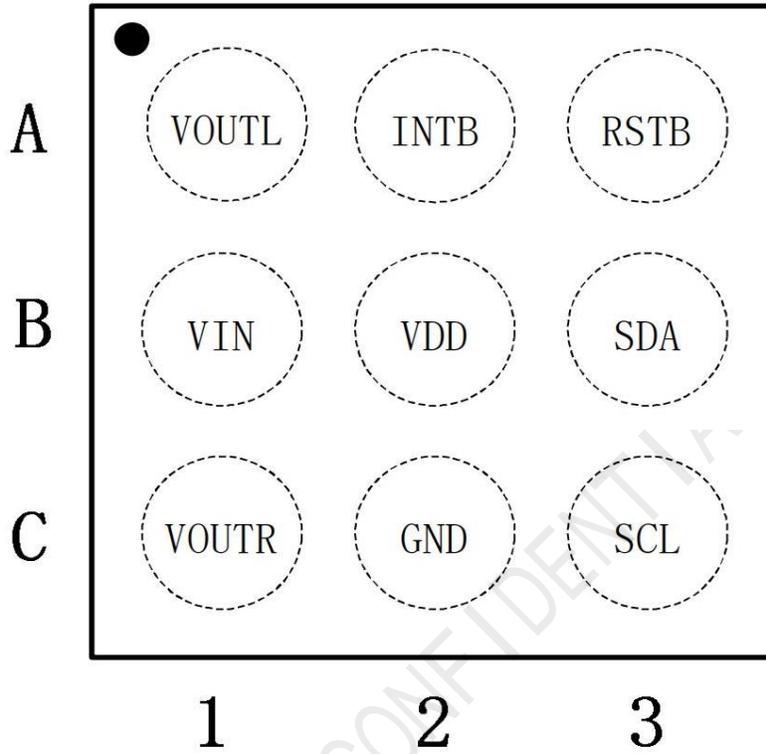


Fig 3. YHM4001A/4002A WLP-9 Pin Assignment (Top Through View)

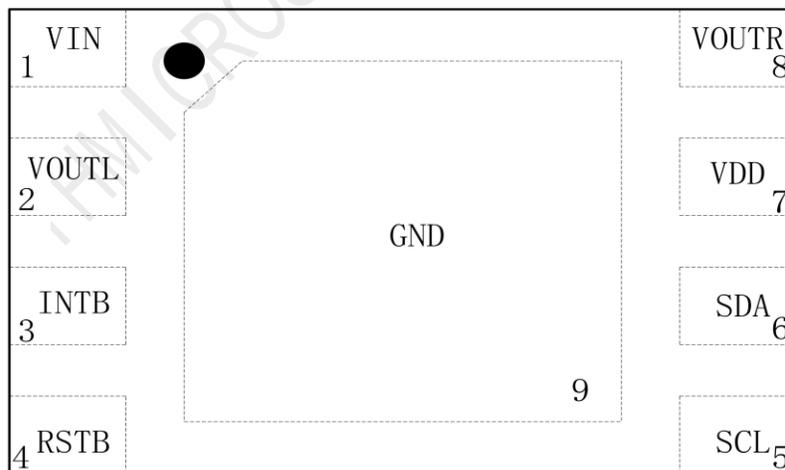


Fig 4. YHM4001A/YHM4002A DFN-8 Pin Assignment (Top Through View)

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YHM4001A/YHM4002A DFN and WLP Pin Descriptions

DFN	WLP	Name	Description
1	B1	VIN	Power Input: Power Path Input and Chip Supply
2	A1	VOU TL	Power Output: Power Path Output to Left Load
3	A2	INTB	Interruption viz Open-drain output Pull down to ground when any FLG register alarms. Act as ENB function while SCL tied to GND. Way to VIN or VOU TL or VOU TR for Direct Single Wire Communication
4	A3	RSTB	Signal Output: Support Open drain output, Push-Pull output, Weak pull up and pull down output based on VIN command detection, Watch dog or I ² C command
5	C3	SCL	Serial Clock Input: Be used to synchronize data movement on the I2C serial interface. Tied GND for ENB function by INTB pin. Open-drain output and requires an external pull-up resistor
6	B3	SDA	Serial Data Input/Output: Input / Output pin for the 2-wire serial interface. Open-drain output and requires an external pull-up resistor
7	B2	VDD	Chip Supply while VIN less than VDD
8	C1	VOU TR	Power Output: Power Path Output to Right Load
9	C2	GND	Ground

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1 Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may no function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters		Min.	Max.	Unit
VIN	VIN to GND		-0.3	6.0	V
VOUTL, VOUTR	VOUT to GND		-0.3	VIN+0.3	V
INTB	INTB to GND		-0.3	VIN+0.3	V
VDD	VDD to GND		-0.3	6.0	V
V _{IO}	Maximum DC Voltage Allowed on RSTB, SCL, SDA		-0.3	6.0	V
I _{IN}	Switch I/O Current (Continuous) each path			1.5	A
t _{PD}	Total Power Dissipation at T _A =25°C			900	mW
T _{STG}	Storage Junction Temperature		-65	+150	°C
T _J	Operating Junction Temperature			+150	°C
T _L	Lead Temperature (Soldering, 10 Seconds)			+260	°C
θ _{JA}	Thermal Resistance, Junction-to-Ambient (100mm ² pad of 1 oz. copper)			80 ⁽¹⁾	°C/W
VIN, VOUTL and VOUTR	Electrostatic Discharge Capability	Human Body Model, EIA/JESD22-A114	2		kV
		Charged Device Model, JESD22-C101	1		
	IEC61000-4-2 System Level	Air Discharge	12		
		Contact Discharge	8		
All Other Pins	Human Body Model, EIA/JESD22-A114		2		

Note 1. Refer to JEDEC JESD51-7, use a 4-layer board

2 Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance.

Parameters	Min.	Max.	Unit
Supply Voltage: VIN	2.8	5.5	V
Supply Voltage: VDD	2.8	5.5	V
V _{MAX} =Highest one of VIN, VDD, VOUTL and VOUTR	2.8	5.5	V
I ² C: SDA and SCL	1.5	5.5	V
I/O pins: RSTB, INTB, SDA, SCL	0	5.5	V
Ambient Operating Temperature, T _A	-40	85	°C
VOUT Load Capacitor (Slave)	0.01	0.1	μF

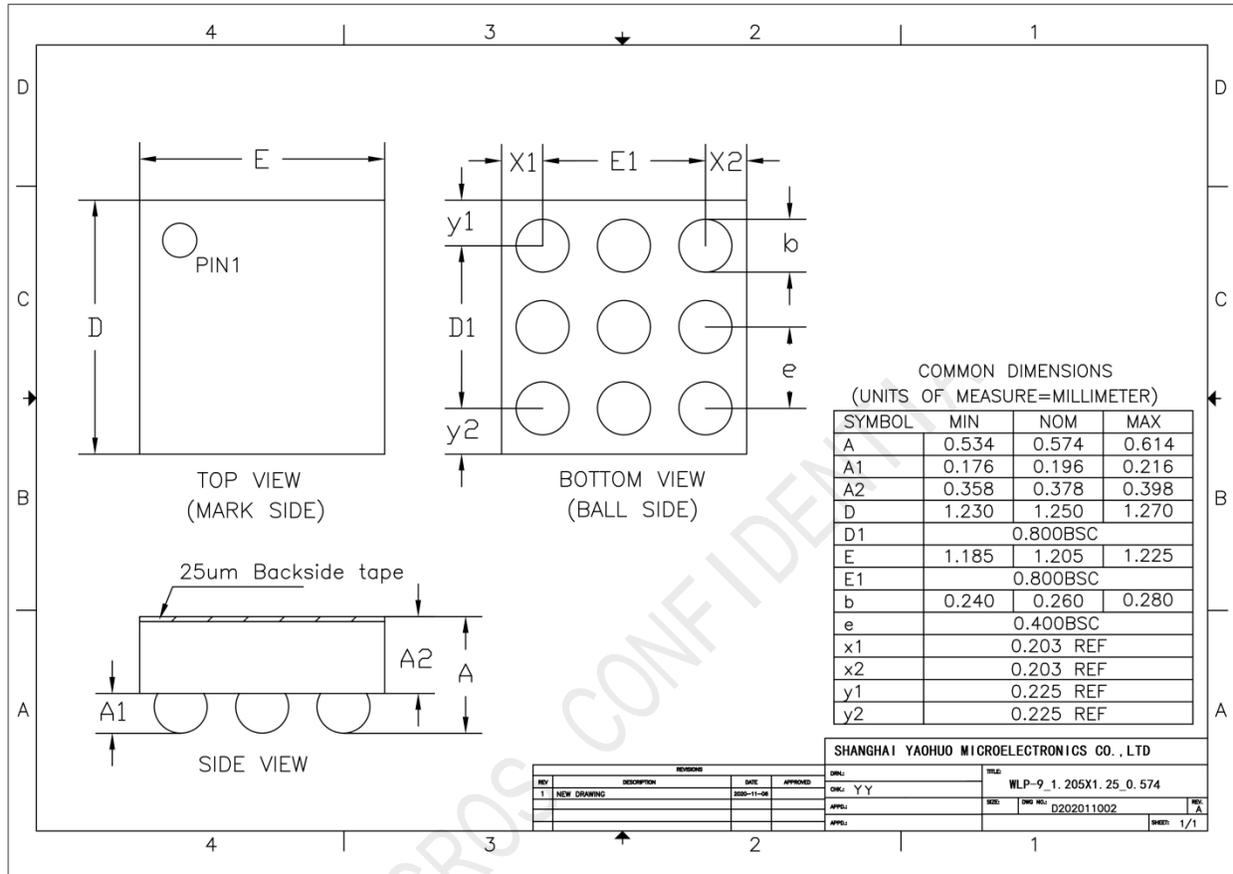
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Package Dimensions

WLCSP-9 1.205x1.25x0.574

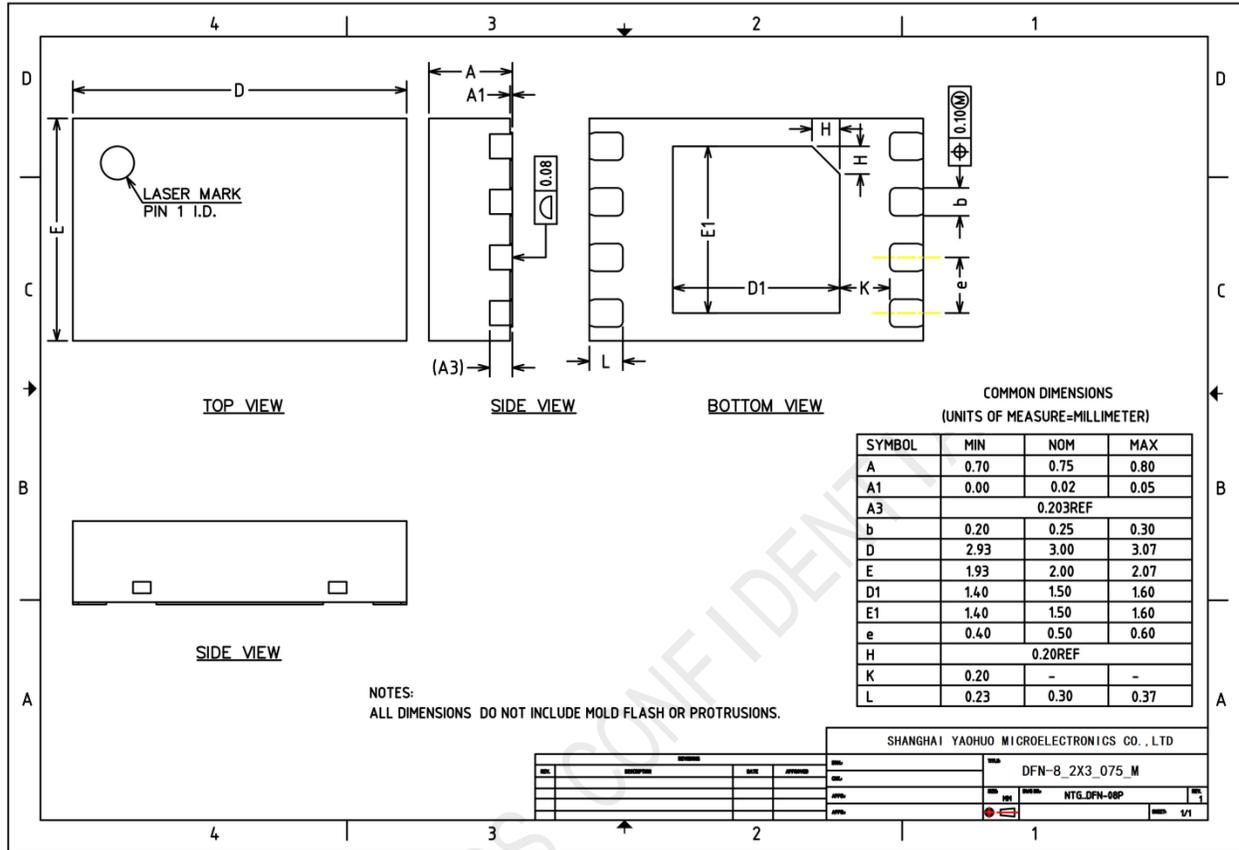


YHM4001A/4002A



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DFN-8 2mmx3mmx0.75mm



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Ordering Information

Part Number	Temp Range	Pin Package	Top Mark	MOQ
YHM4001AW9T	-40°C to 85°C	9 WLCSP	YH41 YYWW LOTI	3000
YHM4002AW9T	-40°C to 85°C	9 WLCSP	YH42 YYWW LOTID	3000
YHM4002AD8T	-40°C to 85°C	8 DFN	YH4002 YYWW	3000

T = Tape and reel.

YYWW: Date Code. YY = year, WW = week.

LOTI: The last three number of LOTID.

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