# YHM2008
## Over Voltage Protection Switch with Digital Signal Transmission

**YHMICROS**
炎火微电子

## Features

- Input voltage range: 2.5V ~ 29V
- Low on-resistance: typical 23mΩ
- Fixed 5.8V over voltage protection (OVP) threshold
- Super-fast OVP response time: typical 100ns
- Over temperature protection (OTP)
- Robust ESD and surge immunity capability
  HBM > ±2KV
  CDM > ±1kV
- Tiny 6-bumps WLCSP 1.19mm x 0.87mm

## Applications

- Smart Phone, AR/VR Device, Tablet PC, Wearable etc.

## General Description

YHM2008 over-voltage protection devices feature a low 23mΩ (TYP) on-resistance high current integrated MOSFET which actively protect low-voltage systems against voltage supply faults up to +29VDC. An input voltage exceeding the over-voltage threshold will cause the internal MOSFET to turn off, preventing excessive voltage from damaging downstream devices.

The over-voltage protection threshold is 5.8V, response time is 100ns.

Additionally, YHM2008 internal switch supports 10Mbps digital signal communication when powered by VCOM pin.

YHM2008 is available in tiny 6-bumps WLCSP 1.19mm x 0.87mm, and operates over an ambient temperature range of -40°C to +85°C.

# YHM2008
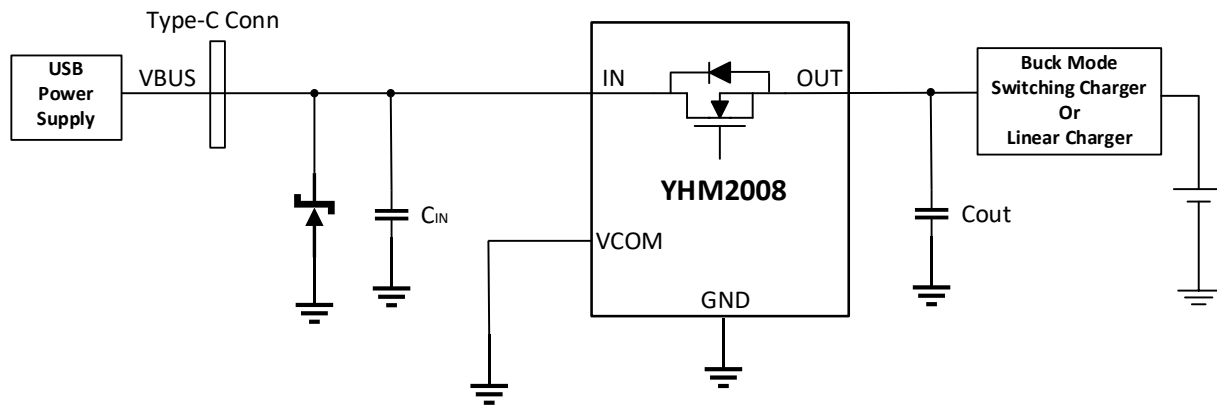## Over Voltage Protection Switch with Digital Signal Transmission

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## Typical Application



**Fig 1. VBUS OVP Application Diagram**

# YHM2008
## Over Voltage Protection Switch with Digital Signal Transmission

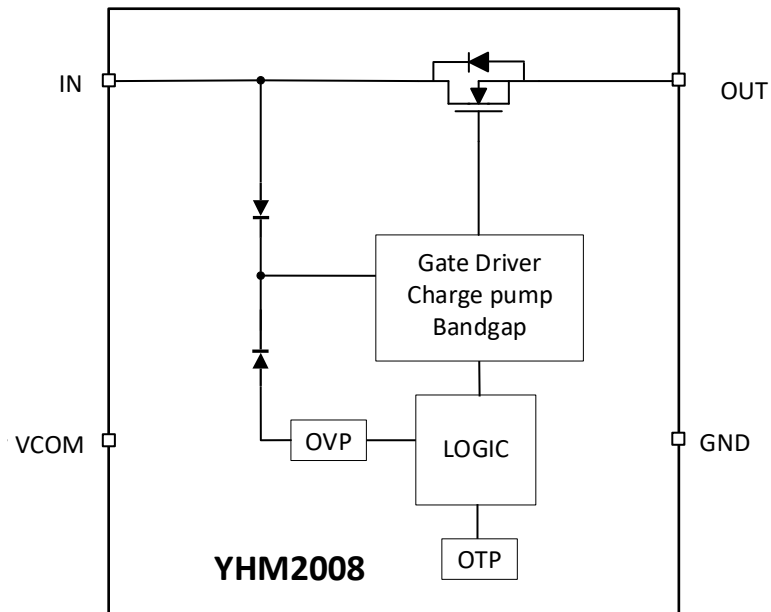### Internal Block Diagram



**Fig 3. YHM2008 Functional Block Diagram**

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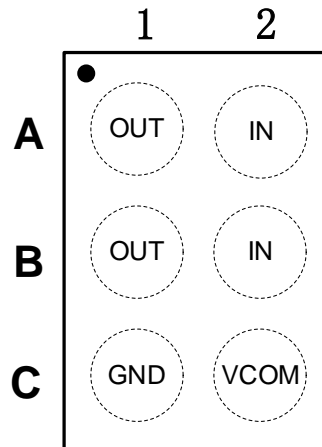
## Pin Configurations



**Fig 4. YHM2008 WLP-6 Pin Assignment (Top Through View）**

## YHM2008 WLP Pin Descriptions

| Bump | Name | Description |
|------|------|-------------|
| A1, B1 | OUT | Power output. |
| A2, B2 | IN | Power Input. |
| C1 | GND | Device Ground. |
| C2 | VCOM | Connect to GPIO for communication or connect to ground if not used communication function. |

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### 1. Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not 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 | Parameter | | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_I$ | IN to GND | | -0.3 | 31 | V |
| $V_{OUT}$ | OUT to GND | | -0.3 | $V_{IN}$+0.3 | V |
| $V_{NC}$ | NC to GND | | -0.3 | 6.0 | V |
| $I_{IN}$ | Switch I/O Current (Continuous) | | | 4.0 | A |
| $t_{PD}$ | Total Power Dissipation at $T_A$ = 25°C | | | | W |
| $T_{STG}$ | Storage Temperature Range | | -65 | +150 | °C |
| $T_J$ | Maximum Junction Temperature | | | +150 | °C |
| $T_L$ | Lead Temperature (Soldering, 10 Seconds) | | | +260 | °C |
| $\theta_{JA}$ | Thermal Resistance, Junction-to-Ambient (1-in. Pad of 2-oz. Copper) | | | 100 | °C/W |
| ESD | Human Body Model, ANSI/ESDA/JEDEC JS-001-2012 | All Pins | 2.0 | | kV |
| | Charged Device Model, JESD22-C101 | All Pins | 1.0 | | |

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

## 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: $V_{IN}$ | 2.5 | 29 | V |
| Supply Voltage: $V_{VCOM}$ | 1.6 | 5.5 | V |
| Ambient Operating Temperature, $T_A$ | -40 | 85 | °C |
| $V_{IN}$ Capacitor (No capacitor for communication function) | 0.1 | | µF |
| $V_{OUT}$ Load Capacitor (No capacitor for communication function) | 1 | 100 | µF |
| Operating Temperature Range | -40 | 85 | °C |

## 3. Detailed Electrical Characteristics

$V_{IN}$ = 2.5V to 29V, $C_{IN}$ = 0.1µF, $T_A$ = -40°C to +85°C, typical values are at $V_{IN}$ = 5V, $I_{IN}$ ≤ 3A, $T_A$ = +25°C, unless otherwise noted.

| PARAMETER | SYMBO | CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **INPUT OPERATION** | | | | | | |
| Input Voltage Range | $V_{IN}$ | | 2.5 | | 29 | V |
| Input Supply Current | $I_{IN}$ | $V_{IN}$ = 5V | | 45 | | µA |
| Under-Voltage Lockout | $V_{IN\_UVLO}$ | $V_{IN}$ rising | | 2.35 | | V |
| Under-Voltage Lockout Hysteresis | $V_{IN\_HYS}$ | | | 20 | | mV |
| **OVER-VOLTAGE** | | | | | | |
| OVLO threshold | $V_{IN\_OVLO}$ | | 5.6 | 5.8 | 6.0 | V |
| OVLO Hysteresis | | | | 140 | | mV |
| Switch On-Resistance | $R_{ON}$ | $V_{IN}$ = 5V, $I_{OUT}$ = 0.5A, $T_A$ = +25°C | | 23 | 40 | mΩ |
| **TIMING CHARACTERISTICS** | | | | | | |
| Debounce Time | $t_{DEB}$ | Time from $V_{IN}$ > 2.5V to the time $V_{OUT}$ starts rising | | 16 | | ms |
| Switch Turn-On Time | $t_{ON}$ | $V_{IN}$ = 5V, $R_L$ = 100Ω, $C_{LOAD}$ = 100uF, $V_{OUT}$ from 0.1 × $V_{IN}$ to 0.9 × $V_{IN}$ | | 0.4 | | ms |
| Switch Turn-Off Time | $t_{OFF}$ | $V_{IN}$ > $V_{IN\_OVLO}$ to $V_{OUT}$ = 0.9 × $V_{IN}$, $R_L$ = 100Ω, $V_{IN}$ rising at 10V/µs | | 100 | | ns |
| **THERMAL SHUTDOWN** | | | | | | |
| Thermal Shutdown | | | | 150 | | °C |
| Thermal Shutdown Hysteresis | | | | 30 | | °C |

**Note 1:** This parameter is guaranteed by design and characterization; not production tested.

## 4. Detailed Description

### 4.1 General Introduction

YHM2008 over-voltage protection devices feature a low 23mΩ (TYP) on-resistance high current integrated MOSFET which actively protect low-voltage systems against voltage supply faults up to +29VDC. An input voltage exceeding the over-voltage threshold will cause the internal MOSFET to turn off, preventing excessive voltage from damaging downstream devices.

The over-voltage protection threshold is 5.8V, response time is 100ns.

### 4.2 UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit. When VIN is rising, the output remains disconnected from the input until VIN voltage is above 2.35V (TYP). This circuit has a 20mV hysteresis to provide noise immunity to transient conditions.

### 4.3 OVLO (Over-Voltage Lockout)

When the voltage at the input exceeds the programmed over-voltage trip point, the device immediately turns off the internal switch disconnecting the load from the abnormal voltage, preventing damage to downstream components. The OVLO threshold is fixed 5.8V.
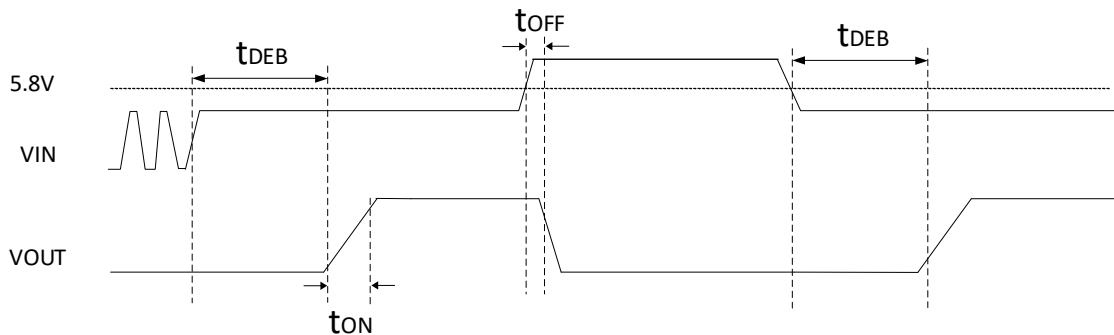


**Fig 5. Timing for OVLO trip**

### 4.4 USB On-The-Go (OTG) Operation

During OTG operation, the YHM2008 is initially disabled and the power FET's bulk diode is forward biased. The bulk diode represents ~0.7V drop across the device, which remains until the VIN voltage increase past 2.5 V, when the device is fully enabled. While the device is disabled and the body diode is forward biased, the max DC current through the diode is 1.8A. This current is limited by the thermal performance of the device (0.7V x 2.1A = 1.48W).

This is purely a transitionary condition as once the voltage at IN exceeds the UVLO voltage of 2.35V (TYP) and the debounce time of 15ms has elapsed, the main power switch will turn fully on, significantly reducing the voltage drop from OUT to IN.

### 4.5 Communication functionality

Both IN and VCOM may supply YHM2008. YHM2008 would be powered by VCOM if VCOM voltage is higher than 1.5V. By this, YHM2008 supports digital signal transmission through IN and OUT when the device is powered by VCOM. Typically, VCOM is recommended to be driven by GPIO typically. It is necessary to remove input and output capacitor when communication is required. If not use communication function, VCOM should be connected to ground.
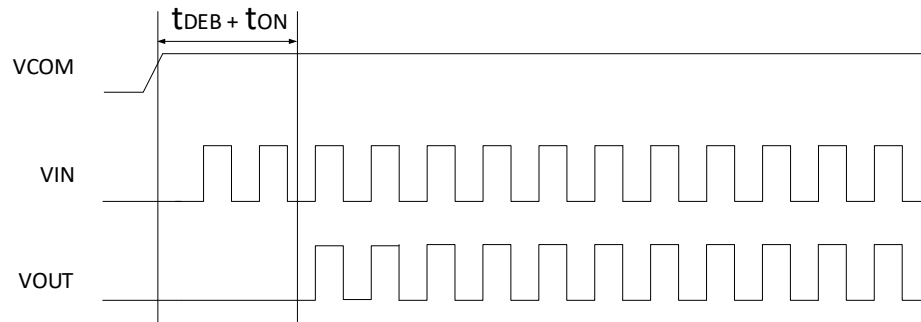
**Fig 6. Timing for VIN communication**
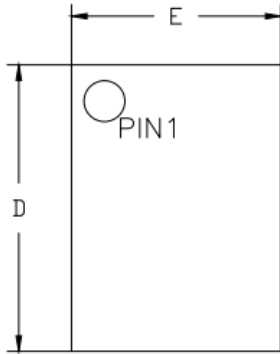
### 4.6 Thermal Protection

The internal FET turns off when the junction temperature exceeds +150°C (TYP). The device exits thermal shutdown after the junction temperature cools down by 30°C (TYP).
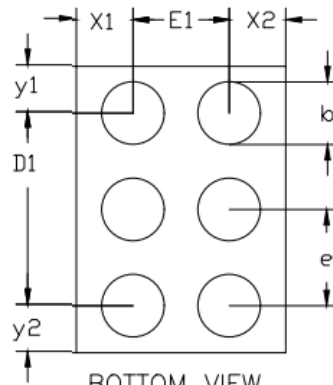
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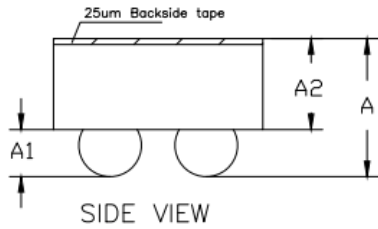
### Package Dimensions

**WLCSP-6   1.19mm x 0.87mm x 0.574mm**



TOP VIEW
(MARK SIDE)

BOTTOM VIEW
(BALL SIDE)

SIDE VIEW

25um Backside tape

| COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER) | | | |
|---|---|---|---|
| SYMBOL | MIN | NOM | MAX |
| A | 0.534 | 0.574 | 0.614 |
| A1 | 0.176 | 0.196 | 0.216 |
| A2 | 0.358 | 0.378 | 0.398 |
| D | 1.170 | 1.190 | 1.210 |
| D1 | 0.800BSC | | |
| E | 0.850 | 0.870 | 0.890 |
| E1 | 0.400BSC | | |
| b | 0.240 | 0.260 | 0.280 |
| e | 0.400BSC | | |
| x1 | 0.235 REF | | |
| x2 | 0.235 REF | | |
| y1 | 0.195 REF | | |
| y2 | 0.195 REF | | |

# YHM2008
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### Ordering Information

| Part Number | Temp Range | Pin Package | Top Mark | MOQ |
|---|---|---|---|---|
| YHM2008W6T | -40°C to 85°C | 6 WLCSP | YWW LL8 | 3000 |

*T = Tape and reel.*
*YWW: Date Code. Y = year, WW = week.*
*LL: The last two number of LOTID.*
*8: YHM2008*

**Email Requests to***: SALES@YHMICROS.COM*

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