YHM2010M

Hybrid Switch for OVP/OCP and Communication

Features

- Input voltage range: 3.6V ~ 28V
- Both IN and ISNS may supply the chip
- Low on-resistance for IN-OUT: typical 40mΩ
- IN-COM for 10Mbps bit rate Communication
- Over voltage protection: 5.8V
- Super-fast OVP response time: typical 50ns
- Over Current Protection
- Short Circuit Protection
- Over Temperature Protection with external NTC
- Tiny 6-bumps WLCSP 1.17mm x 0.815mm

Applications

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

General Description

YHM2010M over-voltage protection devices feature a low 40mΩ (TYP) on-resistance high current integrated MOSFET which actively protect low-voltage systems against voltage supply faults up to +28VDC. 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. YHM2010M device enters hiccup mode when the output load exceeds the over current threshold. The over current threshold is 2.35A.

YHM2010M has two outputs, OUT supports 2A current for power supply, COM supports 10Mbps digital signal communication when the chip is powered by ISNS pin.

YHM2010M has an NTC pin to support over Temperature Protection. It turns off when detected ambient temperature via external NTC resistor exceeds a pre-programmed threshold. Once turned off, it cannot be turned on until VIN is disconnected and reconnected again.

YHM2010M is available in tiny 6-bumps WLCSP 1.17mm x 0.815mm, 0.4mm pitch, and operates over an ambient temperature range of -40°C to +85°C.

Typical Application

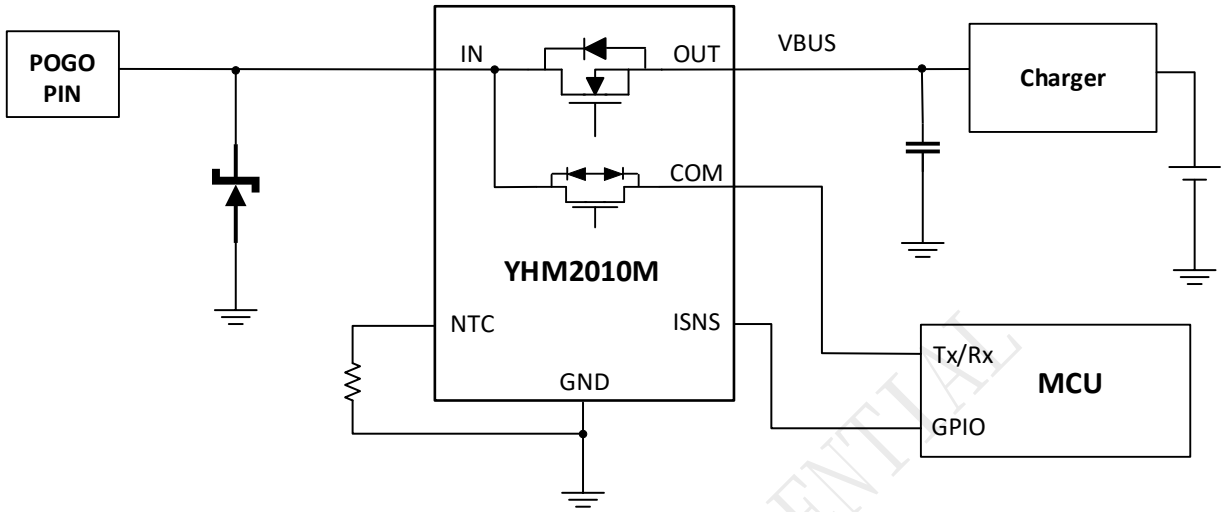


Fig 1. POGO Pin Communication and OVP Application Diagram

Internal Block Diagram

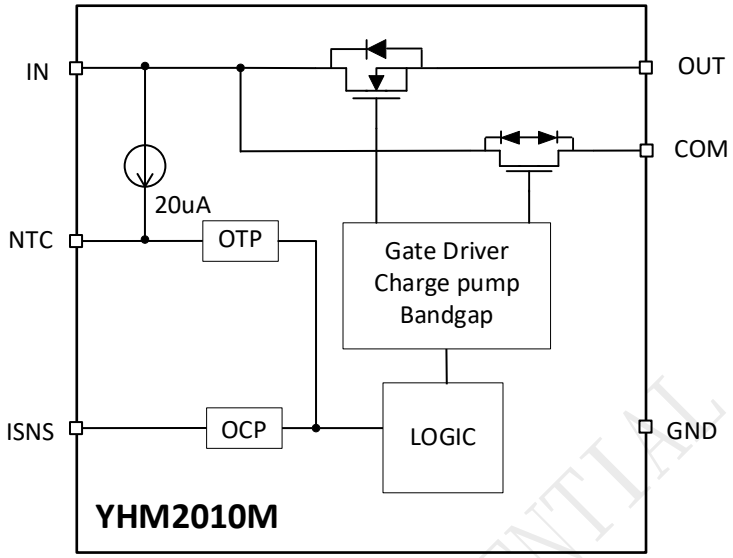


Fig 2. YHM2010M Functional Block Diagram

YHM2010M Pin Configurations

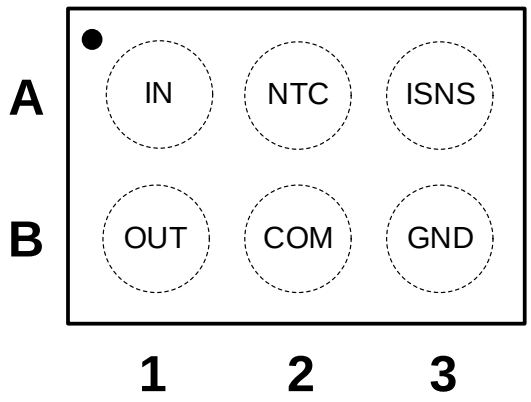


Fig 3. YHM2010M WLP-6 Pin Assignment (Top Through View）

YHM2010M WLP Pin Descriptions

Bump	Name	Description
A1	IN	Power Input.
A2	NTC	Connect NTC for temperature protection or keep floating if not use this function.
A3	ISNS	Connect to system GPIO for communication function.
B1	OUT	Power Output.
B2	COM	Communication Output.
B3	GND	Device Ground.

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_{IN}	IN to GND		-0.3	29	V
V_{OUT}	OUT to GND		-0.3	V_{IN}+0.3	V
V_{ISNS}	ISNS to GND		-0.3	6.0	V
I_{IN}	Input Current (Continuous)			2.2	A
I_{OUT}	OUT Current			2.2	A
I_{COM}	COM Current			0.1	A
t_{PD}	Total Power Dissipation at T_A = 25°C			TBD	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
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	All Pins		±3500	kV
	Charged Device Model, JESD22-C101	All Pins		±2000	

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

1. 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}	3.6	29	V
Supply Voltage: V_{ISNS}	1.6	5.5	V
Ambient Operating Temperature, T_A	-40	85	°C
V_{OUT} Load Capacitor	1	100	μF
Operating Temperature Range	-40	85	°C

2. Detailed Electrical Characteristics

V_{IN} = 3.6V to 28V, 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}		3.7		28	V
Input Supply Current	I_{IN}	V_{IN} = 5V, NTC floating		32		μA
Under-Voltage Lockout	V_{IN_UVLO}	V_{IN} falling		3.5		V
Under-Voltage Lockout Hysteresis	V_{IN_HYS}			0.1		V
OVER-VOLTAGE PROTECTION						
OUT OVLO threshold	$V_{IN\_OUT\_OVLO}$	V_{IN} rising		5.8		V
COM OVLO threshold	$V_{IN\_COM-OVLO}$	V_{IN} rising		5.8		V
OUT Switch On-Resistance	R_{ON1}	V_{IN} = 5V, I_{OUT} = 0.5A, T_A = +25°C		40		mΩ
COM Switch On-Resistance	R_{ON2}	V_{ISNS} = 1.8V, I_{COM} = 5mA, T_A = +25°C		60		Ω
ISNS Supply Current	I_{VDD}	V_{ISNS} = 1.8V, V_{IN} = 1.8V, NTC floating		15		uA
OVER-CURRENT PROTECTION						
OCP Threshold	I_{OCP}	T_A= 25°C		2.35		A
OCP Response Time	t_{OCP}			45		us
OCP Auto-restart Time	t_{OCP_RST}			100		ms
TIMING CHARACTERISTICS						
Debounce Time	t_{DEB}	De-bounce Time for start rising		3		ms
Switch Turn-On Time	t_{ON1}	V_{IN} = 5V, R_L = 100Ω, C_{LOAD} = 100uF, V_{OUT} from 0.1 × V_{IN} to 0.9 × V_{IN}		3		ms
Switch Turn-Off Time	t_{OFF1}	V_{IN} > V_{IN_OVLO} to V_{OUT} = 0.8 × V_{IN}, R_L = 100Ω, V_{IN} rising at 2V/μs		50		ns
THERMAL SHUTDOWN						
Thermal Shutdown				150		°C
Thermal Shutdown Hysteresis				15		°C

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

4. Detailed Description

4.1 General Introduction

YHM2010M is a dual output over-voltage protection device. One is a low 40mΩ (TYP) on-resistance high current path, the other is 60Ω (TYP) on-resistance communication path. Both the two output can actively protect low-voltage systems against voltage supply faults up to +28VDC. 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 default 5.8V.

YHM2010M device enters hiccup mode when the output load exceeds the over current threshold. The over current threshold is 2.35A.

The communication path of COM features 10Mbps bandwidth which means the device support digital signal communication when powered by ISNS pin.

4.2 UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit. When VIN is falling, the output remains connected from the input until IN voltage is below 3.5V (TYP). This circuit has a 100mV hysteresis to provide noise immunity to transient conditions.

4.3 OVLO (Over-Voltage Lockout)

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

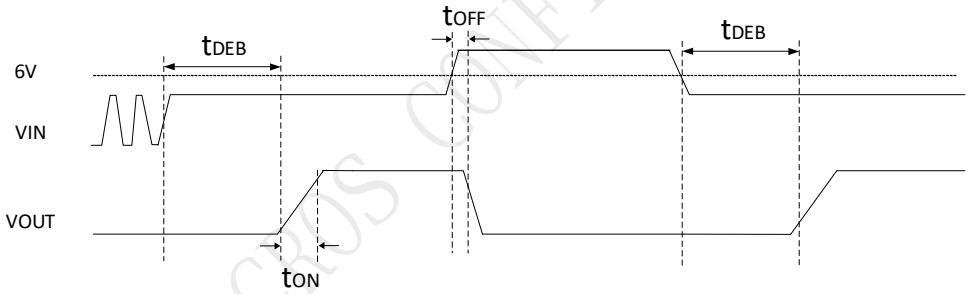


Fig 4. Timing for OVLO trip

4.4 OCP (Over Current Protection)

The chip enters hiccup mode when the output load exceeds the over current threshold. The OCP threshold is 2.35A.

4.5 Communication Functionality

Both IN and ISNS may supply YHM2010M. YHM2010M would be powered by ISNS if ISNS voltage is higher than 1.5V. By this, YHM2010M supports digital signal transmission through IN and COM when the device is powered by ISNS. Typically, ISNS is recommended to be driven by GPIO typically. For example, ISNS=1.8V would power YHM2010M even when V_{IN}=0. It is necessary to remove input and output capacitor when communication is required.

4.6 Over Temperature Protection

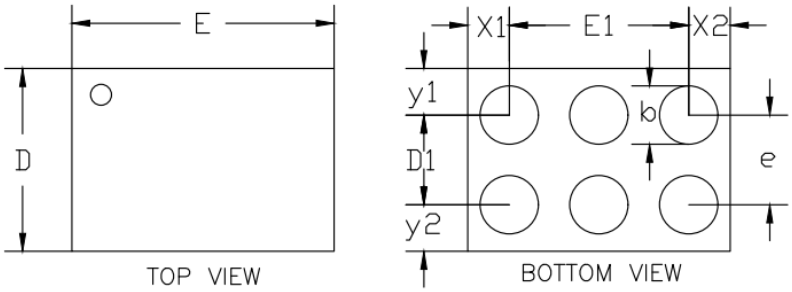
YHM2010M has an internal 20μA current source on NTC pin. When the voltage on NTC pin is below 300mV, the chip turns off. Once turned off, it cannot be turned on until VIN is disconnected and reconnected again. Choose a NTC to program the temperature protection threshold. Recommend 100Kohm NTC (Beta=3950) for 75°C protection. Keep floating if not use this function to save power.

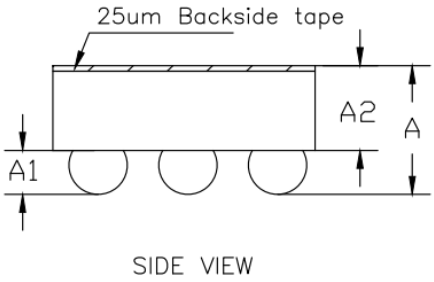
4.7 Thermal Protection

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 15°C (TYP).

Package Dimensions

WLCSP-6 1.17mm x 0.815mm x 0.574mm





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	0.795	0.815	0.835
D1		0.400BSC	
E	1.150	1.170	1.190
E1		0.800BSC	
b	0.240	0.260	0.280
e		0.400BSC	
x1		0.185 REF	
x2		0.185 REF	
y1		0.208 REF	
y2		0.208 REF	

Ordering Information

Part Number	Temp Range	Pin Package	Top Mark	MOQ
YHM2010MW6T	-40°C to 85°C	6 WLCSP	YWW LOT	3000

T = Tape and reel.
YWW: Date Code. Y = year, WW = week.
LOT: The last three number of LOTID.