YHM2011

OVP/OCP Switch with Over Temperature Protection

Features

- Input voltage range: 3.6V ~ 28V
- Low on-resistance for IN-OUT: typical 40mΩ
- Over voltage protection: Default 6V
- Super-fast OVP response time: typical 50ns
- Programmable Over Current Protection
- Over Temperature Protection with external NTC
- Short Circuit Protection
- Tiny 6-bumps WLCSP 1.17mm x 0.815mm

Applications

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

General Description

YHM2011 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 default 6V. There are other trim versions for 11V/16V /22V OVP and no OVP. YHM2011 device enters hiccup mode when the output load exceeds the over current threshold. The over current threshold is programed by R_{SNS}.

YHM2011 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 temperature recover.

YHM2011 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

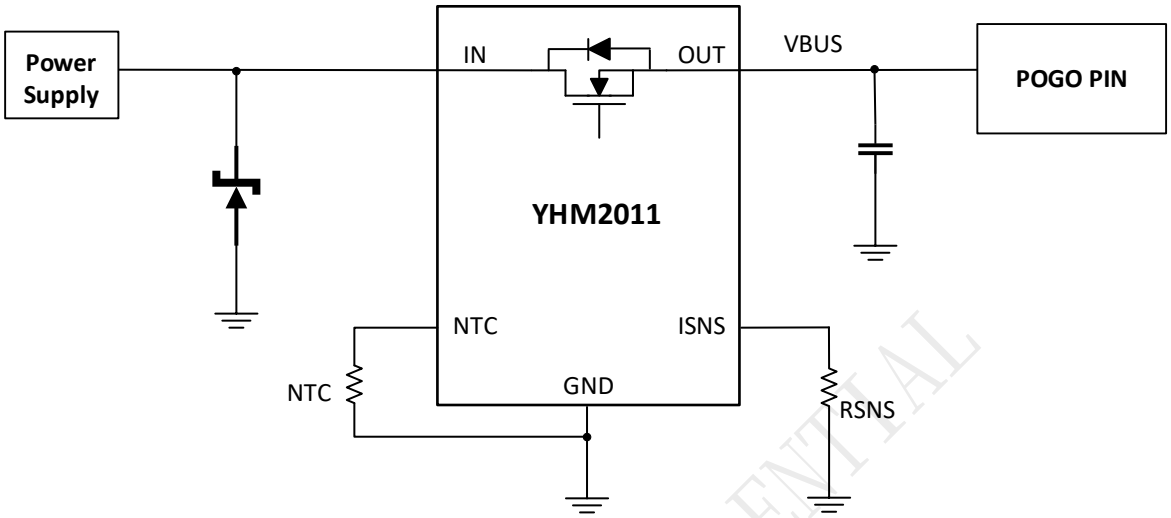


Fig 1. Cable OVP/OCP/OTP Application Diagram

Internal Block Diagram

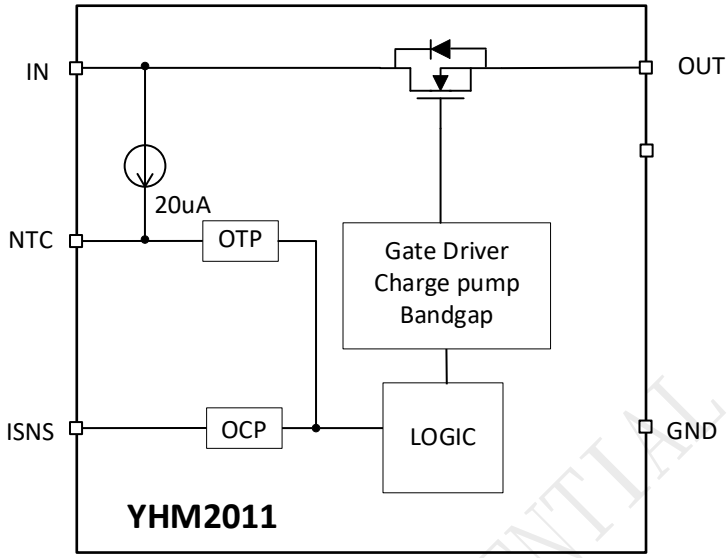


Fig 2. YHM2011 Functional Block Diagram

YHM2011 Pin Configurations

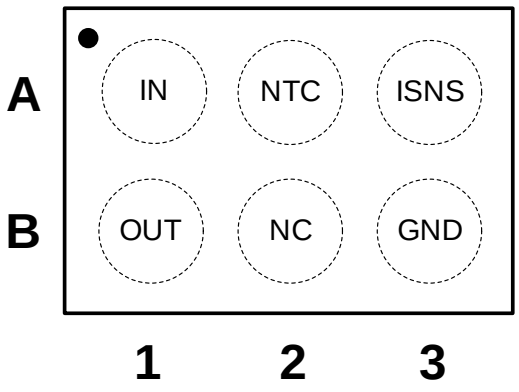


Fig 3. YHM2011 WLP-6 Pin Assignment (Top Through View）

YHM2011 WLP Pin Descriptions

Bump	Name	Description
A1	IN	Power Input.
A2	NTC	Connect NTC for temperature protection or connect a 100KΩ resistor if not use this function.
A3	ISNS	Resistor connected to program OCP threshold.
B1	OUT	Power Output.
B2	PWR	Internal VDD. Can power
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
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	2	±3500	kV
	Charged Device Model, JESD22-C101	All Pins	1	±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}	3.7	29	V
Ambient Operating Temperature, T_A	-40	85	°C
V_{IN} Capacitor	0.1		μF
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		6		V
OUT Switch On-Resistance	R_{ON1}	V_{IN} = 5V, I_{OUT} = 0.5A, T_A = +25°C		40		mΩ
OVER-CURRENT PROTECTION						
OCP Threshold	I_{OCP}	R_{SNS}=5.4KΩ, T_A= 25°C		1		A
		Accuracy, T_A = 0°C to +65°C	-10%		10%	
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

YHM2011 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 default 6V. There are other trim versions for 11V/16V /22V OVP and no OVP. YHM2011 device enters hiccup mode when the output load exceeds the over current threshold. The over current threshold is programed by R_{SNS}.

YHM2011 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 temperature recover.

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 default 6V, and there are OTP versions for 11V/16V and 22V OVP.

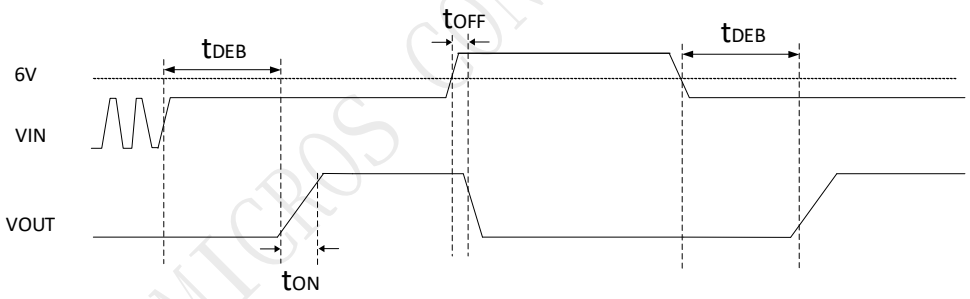


Fig 4. Timing for OVLO trip

4.4 OCP (Over Current Protection)

The chip enters hiccup mode when the output load exceeds the over current threshold. The OCP threshold could be adjusted by single external resister R_{SNS} connected between ISNS and GND.

$$R_{SNS} = 5.4K/ I_{OCP}$$

4.5 Over Temperature Protection

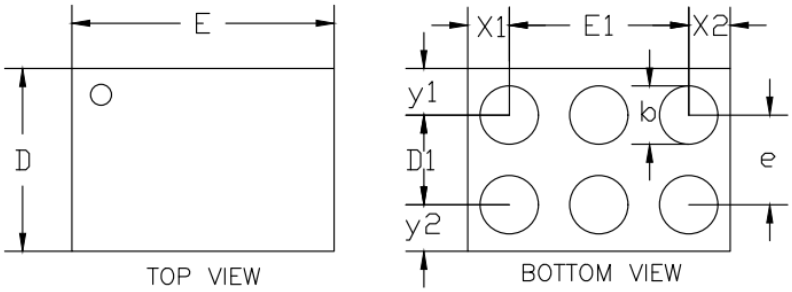
YHM2011 has an internal 20μA current source on NTC pin. When the voltage on NTC pin is below 300mV, the chip turns off. Once turned off, it cannot be turned on until the voltage on NTC pin is above 600mV. Choose a NTC to program the temperature protection threshold. Recommend 100Kohm NTC (Beta=3950) for 75°C protection. Connect a 100KΩ resistor to NTC pin if not use this function.

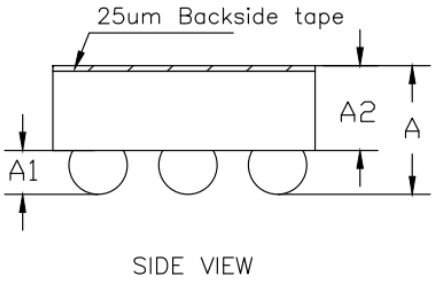
4.6 Thermal Protection

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 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
YHM2011W6T	-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.