

YHM2012

2A High Voltage Load Switch with Current Sense



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
- Output Discharge
- Short Circuit Protection
- Tiny 6-bumps WLCSP 1.17mm x 0.815mm

Applications

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

General Description

YHM2012 is a low 40mΩ (TYP) on-resistance high current integrated MOSFET load switch 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. YHM2012 device enters constant current mode when the output load exceeds the over current threshold. The over current threshold is programed by R_{SNS} .

YHM2012 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.

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2A High Voltage Load Switch with Current Sense

Typical Application

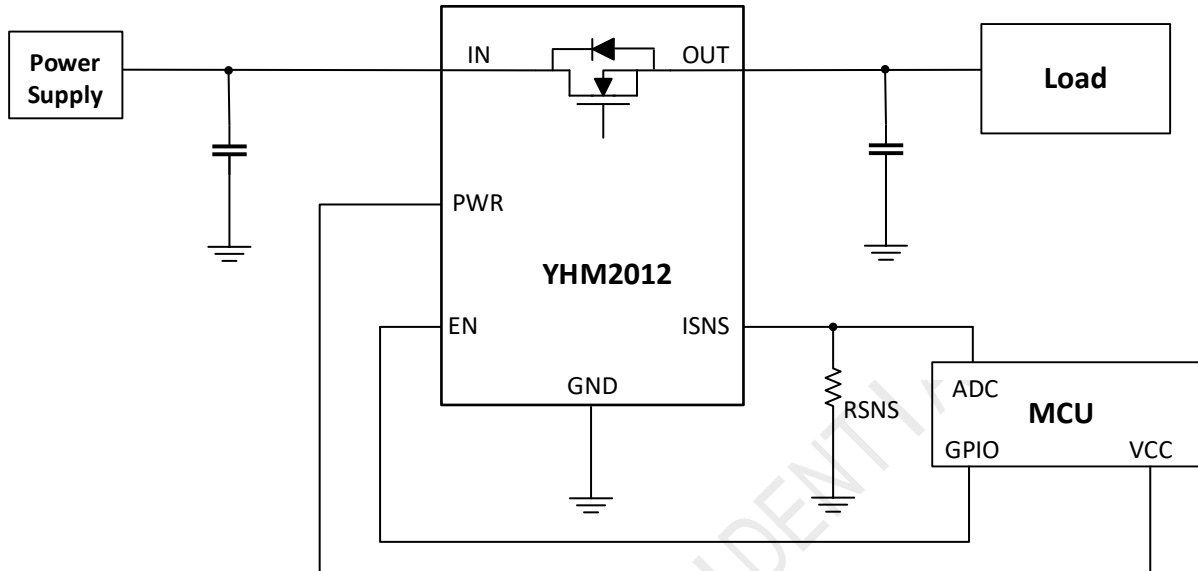


Fig 1. Load switch with OCP/SCP/Current sense Application Diagram

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2A High Voltage Load Switch with Current Sense

Internal Block Diagram

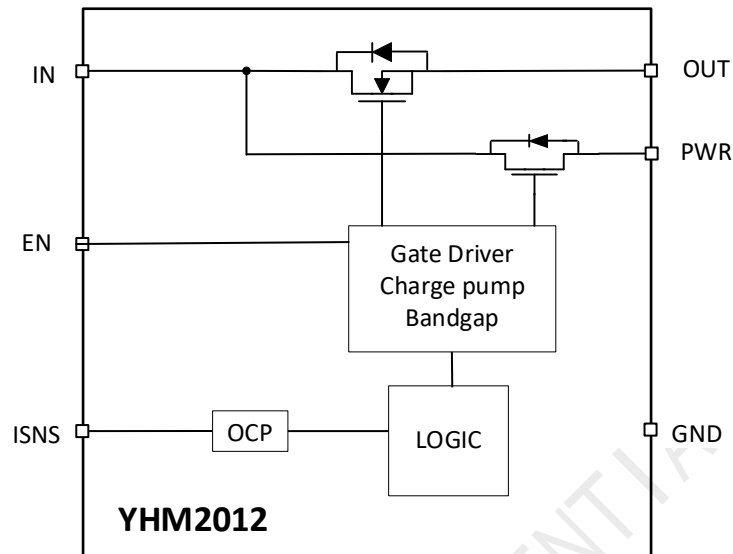


Fig 2. YHM2012 Functional Block Diagram

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2A High Voltage Load Switch with Current Sense

YHM2012 Pin Configurations

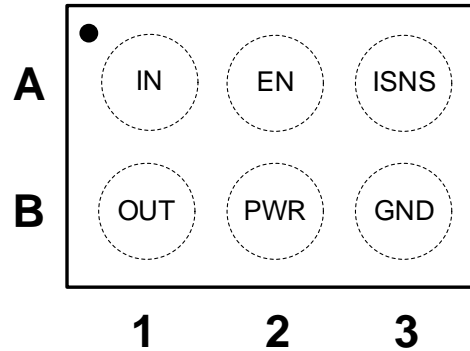


Fig 3. YHM2012 WLP-6 Pin Assignment (Top Through View)

YHM2012 WLP Pin Descriptions

Bump	Name	Description
A1	IN	Power Input.
A2	EN	Chip enable.
A3	ISNS	Resistor connected to program OCP threshold.
B1	OUT	Power Output.
B2	PWR	Aux power from VIN for 20mA load.
B3	GND	Device Ground.

2A High Voltage Load Switch with Current Sense

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 _{PWR}	PWR Current		20	mA
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	PWR Pins	± 1	kV
		All Pins	± 6.5	
	Charged Device Model, JESD22-C101	All Pins	± 1	

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

2A High Voltage Load Switch with Current Sense

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	28	V
Other Pin	1.6	5.5	V
Ambient Operating Temperature, T_A	-40	85	°C
V_{IN} Capacitor	0.1		μ F
V_{OUT} Load Capacitor	1	100	μ F
Operating Temperature Range	-40	85	°C

2. Detailed Electrical Characteristics

$V_{IN} = 3.6V$ to $28V$, $C_{IN} = 0.1\mu F$, $T_A = -40^\circ C$ to $+85^\circ C$, typical values are at $V_{IN} = 5V$, $I_{IN} \leq 3A$, $T_A = +25^\circ C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
INPUT OPERATION						
Input Voltage Range	V_{IN}		3.6		28	V
Input Quiescent Current	I_{INQ}	$V_{IN} = 5V$, EN=High		53		μ A
Shutdown Current	I_{OFF}	$V_{IN} = 5V$, EN=Low		40		μ A
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}	$V_{IN} = 5V$, $I_{OUT} = 0.5A$, $T_A = +25^\circ C$		40		m Ω
OVER-CURRENT PROTECTION						
OCP Threshold	I_{OCP}	$R_{SNS}=5.4k\Omega$, $T_A= 25^\circ C$		1		A
		Accuracy, $T_A = 0^\circ C$ to $+65^\circ C$	-10%		10%	
OCP Response Time	t_{OCP}			45		μ s
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}	$V_{IN} = 5V$, $R_L = 100\Omega$, $C_{LOAD} = 100\mu F$, V_{OUT} from $0.1 \times V_{IN}$ to $0.9 \times V_{IN}$		3		ms
Switch Turn-Off Time	t_{OFF1}	$V_{IN} > V_{IN_OVLO}$ to $V_{OUT} = 0.8 \times V_{IN}$, $R_L = 100\Omega$, V_{IN} rising at $2V/\mu s$		50		ns
LOGIC						
EN High Threshold Voltage	V_{EN_H}		0.6			V
EN Low Threshold Voltage	V_{EN_L}				0.3	V
THERMAL SHUTDOWN						

YHM2012



2A High Voltage Load Switch with Current Sense

Thermal Shutdown				150		°C
Thermal Shutdown Hysteresis				15		°C

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

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4. Detailed Description

4.1 General Introduction

YHM2012 is a low 40mΩ (TYP) on-resistance high current integrated MOSFET load switch 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. YHM2012 device enters constant current mode when the output load exceeds the over current threshold. The over current threshold is programed by R_{SNS} .

4.2 UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circuit. When V_{IN} is falling, the output remains connected from the input until V_{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 over-voltage protection threshold is default 22V. There are other OTP versions for 6V/11V/16V OVP and no OVP.

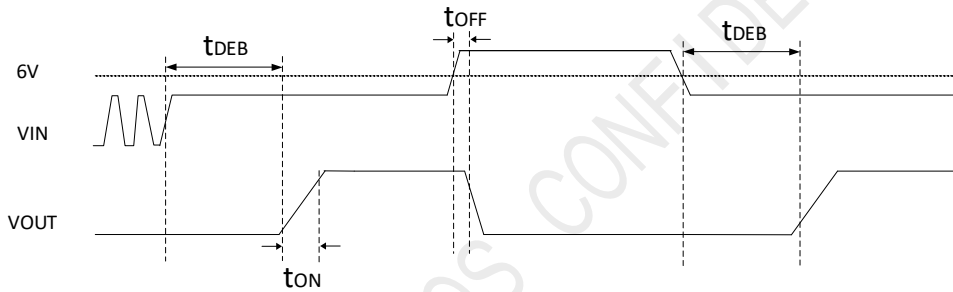


Fig 4. Timing for OVLO trip

4.4 OCP (Over Current Protection)

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

$$R_{SNS} = 2.7K / I_{OCP}$$

Connect an ADC to $ISNS$ pin to measure the voltage on R_{SNS} can get the current flow through the switch. The output current can be determined by $ISNS$ pin voltage using the following equation:

$$I_{OUT} = V_{ISNS} \times 9000 / R_{SNS}$$

4.5 Aux Power

The chip features an aux power for standby MCU even the chip is off by pull EN to ground. The PWR is the same voltage as input power and only supply 20mA current. If the input voltage exceeds 5.8V, PWR output if off.

4.6 Thermal Protection

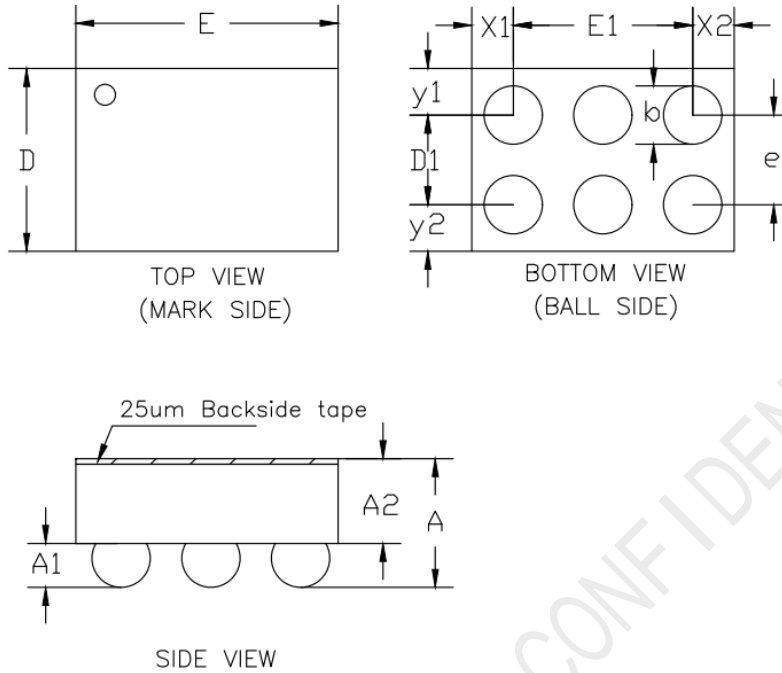
The internal FET turns off when the junction temperature exceeds +150°C (TYP). The device exits thermal shutdown after the junction temperature cools down by 15°C (TYP).

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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		

YHM2012



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Ordering Information

Part Number	Temp Range	Pin Package	Top Mark	MOQ
YHM2012W6T	-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.

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