YHM2032

Dual Output Load Switch With Reverse Current Blocking

YHM2032 DS_Rev 0.0

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Dual Output Load Switch With Reverse Current Blocking

Features

- Low Input Voltage: 1.6V to 5.5V.
- Enable and Disable Switch from EN pins.
  - YHM2032: Active Low.
  - YHM2032A: Active High.
- 20uA Supply Current
- 500nA Shutdown Current
- Ultra-Low On-State Resistance (R_{ON})
  - R_{ON} = 76mΩ at V_{IN} = 5.0V
  - R_{ON} = TBDmΩ at V_{IN} = 3.6V
  - R_{ON} = TBDmΩ at V_{IN} = 2.5V
  - R_{ON} = 76mΩ at V_{IN} = 1.8V
- 2A Maximum Total Continuous Current
- Quick Output Discharge
- Reverse Current Blocking for Both Channels.
- Tiny 2mm x 2mm DFN-6 Package.

Applications

- Wearables
- Smartphones
- Tablets
- Portable Device

General Description

The YHM2032 is a dual output, ultra-small, low R_{ON} and active low or high(A version) load switch. The device contains a N-channel MOSFET that operates over an input voltage range of 1.6V to 5.5V. The switch is controlled by EN pins.

YHM2032 device has hard short protection for some abnormal situation.

An internal reverse voltage comparator disables the power switch when the output voltage is driven higher than the input to protect devices on the input side of the switch.

If application power path needs 2A capability, YHM2032 can short two EN pins and two OUT pins to support this usage.

YHM2032 is available in a 2mm x 2mm DFN-6 package.

Internal Block diagram

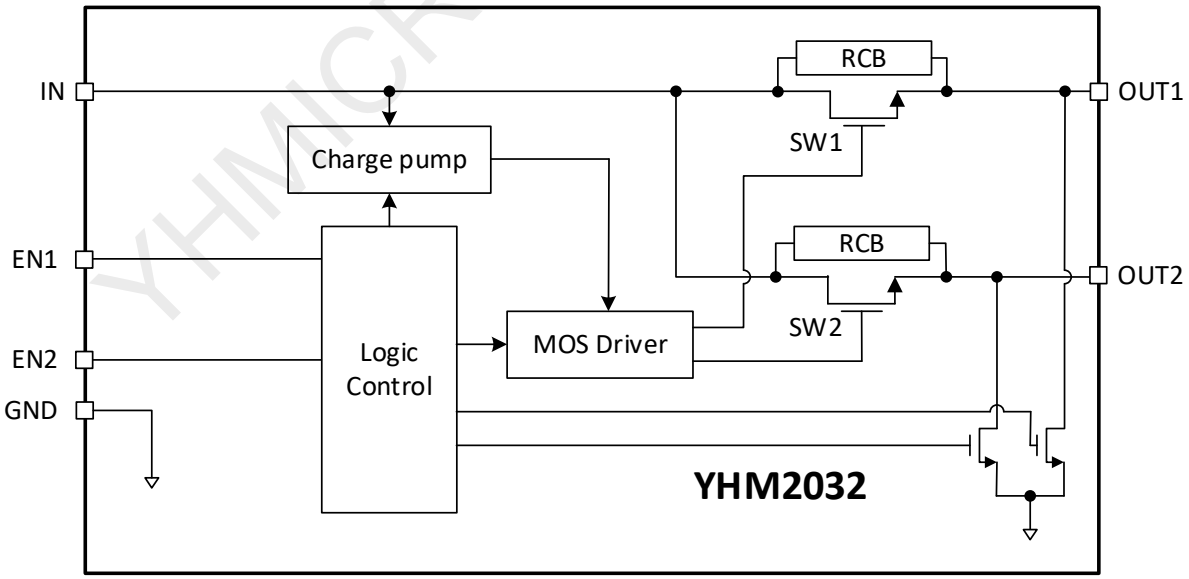


Figure 1. YHM2032 Internal Block Diagram

YHM2032 Pin Configurations

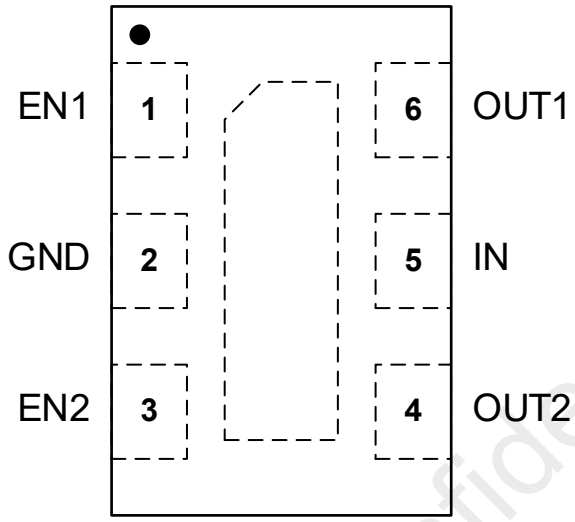


Figure 2. YHM2032 DFN-6 Pin Assignment (Top Through View)

YHM2032 Pin Descriptions

DFN	Name	Description
1	EN1	Enable control for output 1. · EN=0 close for YHM2032. · EN=1 close for YHM2032A.
2	GND	Ground.
3	EN2	Enable control for output 2. · EN=0 close for YHM2032. · EN=1 close for YHM2032A.
4	OUT2	Output 2. Internal pull down to GND when switch off.
5	IN	Input and Power Supply. Bypass this input with 1μF or greater ceramic capacitor to ground.
6	OUT1	Output 1. Internal pull down to GND when switch off.

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.

Disclaimer: YHMICROS reserves the right to make any change in circuit design, specification or other related things if needed without notice at any time.

Symbol	Parameters		Min.	Max.	Unit
V_{IN}	IN to GND		-0.3	6	V
V_{OUT}	OUT1/2 to GND		-0.3	6	V
V_{EN}	EN1/2 to GND		-0.3	6	V
I_{OUT}	Continuous Output Current for each output			1500	mA
I_{IN}	Continuous Input Current			2500	mA
T_{STG}	Storage Junction Temperature		-65	+150	°C
T_J	Operating Junction Temperature			+150	°C
T_L	Lead Temperature (Soldering, 10 Seconds)			+260	°C
All Pins	Electrostatic Discharge Capability	Human Body Model, EIA/JESD22-A114	2		KV
		Charged Device Model, JESD22-C101	1		

2 Recommend Operation Range

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
Input Voltage: V_{IN}	1.6	5.5	V
Peak Output Current: $I_{OUT1/2}$		1.2	A
Ambient Temperature Range	-40	85	°C

3 Electrical Characteristics

Condition: V_{IN} = 1.8V, T_A = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted. (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}		1.6		5.5	V
Quiescent Supply Current	I_{IN}	T_A = 25°C, I_{OUT}= 0		13		μA
		-40°C ≤ T_A ≤ 85°C, I_{OUT}= 0			20	
Shutdown Current	I_{SHDN}	V_{EN} = 1.2V or V_{EN} = 0V(A version), V_{OUT} = 0		0.1	0.5	uA
IN UVLO Threshold	V_{UVLO}	VIN rising		1.5		V
IN UVLO Hysteresis	V_{UVLO_HYS}			100		mV
EN Logic High Threshold	V_{IH}		0.9			V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
EN Logic Low Threshold	V_{IL}				0.4	V
Output Pull-Down Resistance	R_{PD}	V_{IN} = 1.8V, V_{EN} = 1.2V or V_{EN} = 1.2V(A version), I_{OUT} = 0			500	Ω
Output One Shot Pull-Down Time	t_{PD}			20		ms
On Resistance	R_{ON}	V_{IN} = 5V, I_{OUT} = 200mA		76		mΩ
		V_{IN} = 3.6V, I_{OUT} = 200mA		TBD		
		V_{IN} = 2.5V, I_{OUT} = 200mA		TBD		
		V_{IN} = 1.8V, I_{OUT} = 200mA		76		
RCB Active Voltage	V_{RCB}	V_{OUT} - V_{IN}		20		mV
RCB Activation Time	t_{RCB}			400		μs
Short Protection Response Time	t_{ACT}			1		μs
Short Protection Active Time	t_{SHORT}			20		μs
Short Protection Recover Time	t_{REC}			100		ms
Thermal Shutdown	T_{SHDN}			150		ºC
Thermal Hysteresis	T_{HYS}			20		ºC
SWITCHING SPECIFICATIONS (C_{Load} = 0.1μF, R_{Load} = 10Ω. Ta = 25ºC All timing is 10% to 90% for rise time and 90% to 10% for fall time).						
Turn On Delay Time	t_{DELAY}	Time from V_{EN} < V_{IL} or V_{EN} > V_{IH}(A version) to V_{OUT} = 0.1 × V_{IN}		500		μs
Soft Start Time (Rise Time)	t_{SS}			3		ms
Turn Off Delay Time	t_{OFF}	Time from V_{EN} > V_{IH} or V_{EN} > V_{IH}(A version) to V_{OUT} = 0.9 × V_{IN}		40		μs
Fall Time	t_{FALL}			10		μs

Note 1: All specifications are 100% production tested at TA = +25°C, unless otherwise noted. Specifications are over TA = -40°C to +85°C and are guaranteed by design.

Note 2: Guaranteed by design; not production test.

4 Description

4.1 General Introduction

The YHM2032 is a dual output, ultra-small, low R_{ON} and active low or high(A version) load switch. The device contains a N-channel MOSFET that operates over an input voltage range of 1.6 to 5.5V. The total input current is 2A, and each output supports 1A continuous current at the same time.

4.2 Switch Enable Control

When VIN rise above 1.5V, the switch statuses are following below table. SW1 and SW2 are controlled independently. turns on after a delay time with soft start function. Turn off the switch would enable quick output discharge function, which means a discharge resistor is connected between OUT and GND.

		Switch Status	
YHM2032 Version		YHM2032	YHM2032A
ENn	>V_{IH}	OFF	ON
	<V_{IL}	ON	OFF

Table 1. Switch Control

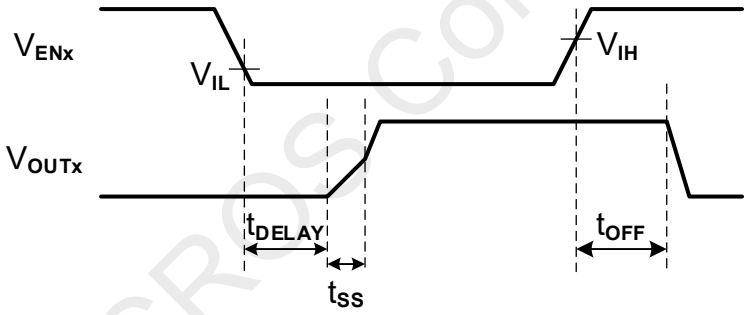


Figure 3. YHM2032 Power Up and Power Down Sequence

(Active low version as an example)

4.3 Soft Start (SS)

YHM2032 integrated soft start function to avoid large inrush current during switches change from OFF to ON period. During this period, the current following through each switch is regulated in low level. Soft start time is about 500us after delay time from EN goes low or high. The inrush current may be become large after this time if the output capacitor is too large.

4.4 Short Protection

YHM2032 has OUT1/2 short to GND protection. If the device detects the output current larger than I_{SHORT} when switch on, YHM2032 will regulate the corresponding switch current to a small one within a very short time (t_{ACT}) (typical: 1us) and turn off switch after t_{SHORT}. (Typical: 20us) This function is independent of current regulation. The device will try to close switch after t_{REC} (Typical 100ms) if the other conditions do not change. The SS period is added.

4.5 Reverse Current Protection

The reverse voltage protection turns off the N-channel MOSFET whenever the output voltage exceeds the input voltage by 20mV (TYP) for 5ms (TYP). This prevents damage to devices on the input side of the YHM2032. The YHM2032 device allows the N-channel MOSFET to turn on once the output voltage goes below the input voltage.

4.6 Thermal shutdown

When the part is in current regulation mode, to protect the chip from over temperature, the power path will be turned off when the junction temperature exceeds 150°C. The power path switch will be turned on and enter SS status again when temperature drop below 130°C. The device power dissipation capability is dependent on-board design and layout.

5 Application information

YHM2032 is designed to operate with an input range of 1.6V to 5.5V. The power supply must be well regulated and placed as close to the device terminal as possible. The power supply must be able to withstand all transient load current steps. In most situations, using an input capacitance (C_{IN}) of 1μF is sufficient to prevent the supply voltage from dipping when the switch is turned on. In cases where the power supply is slow to respond to a large transient current or large load current step, additional bulk capacitance may be required on the input. Placing a high-value electrolytic capacitor on the output pin is recommended when large transient currents are expected on the output.

YHM2032 supports two different application requirements. The detail descriptions are below.

5.1 1:2 Loadswitch with Independently RCB

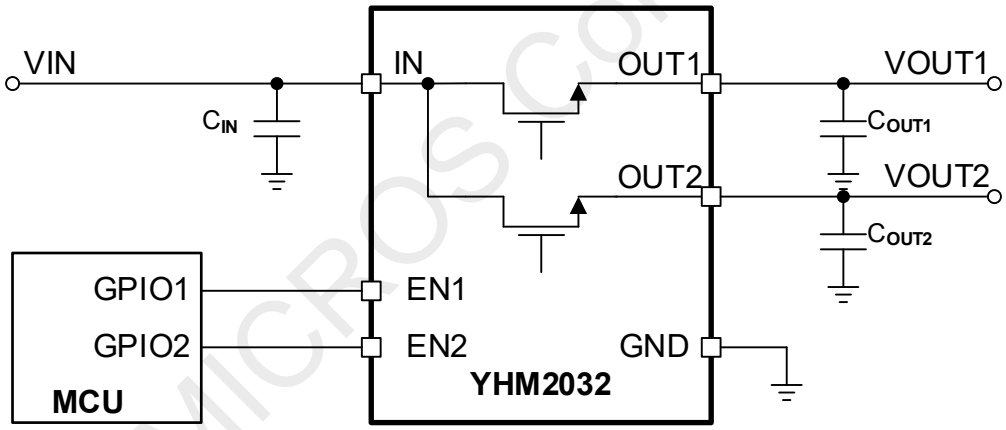


Figure 4. 1:2 Load Switch with Reverse Current Blocking.

In this application, two MCU GPIOs control SW1 and SW2 independently with table 1. The device does not control current which following through both switches. But output short to GND protection still works. RCB function for both channels is independently.

5.2 1:1 2A Loadswitch with RCB

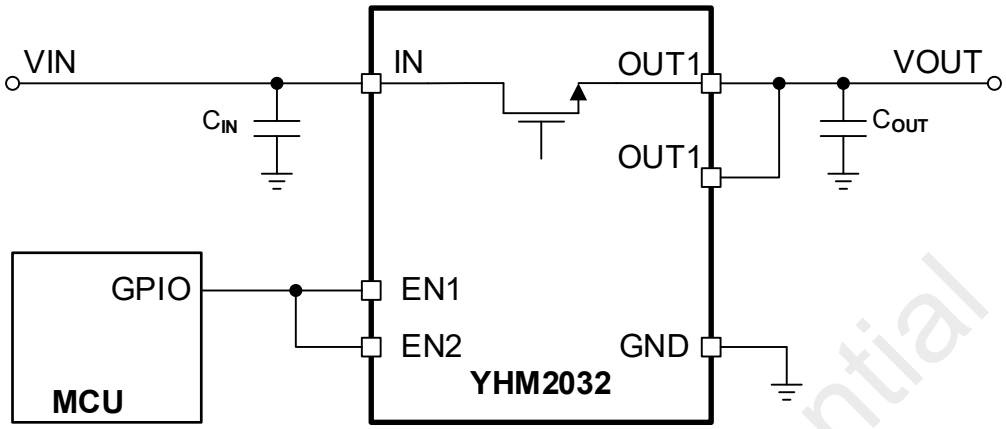


Figure 5. 1:1 2A Load Switch with Reverse Current Blocking.

In this application, YHM2032's EN1/2 and OUT1/2 are shorted together for each. One MCU GPIO control both switch with table 1 at same time. The device does not control current which following through both switches. But output short to GND protection works. RCB function are also available.

Please note output will be discharged when the switch is OFF. This action will be released after 20ms. This function is available in both applications above.

6 Parameter Measurement Information

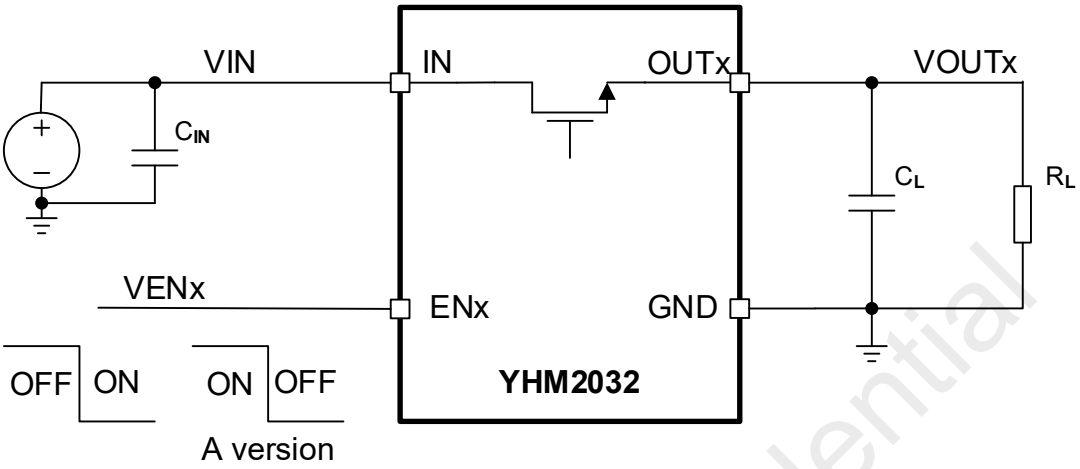
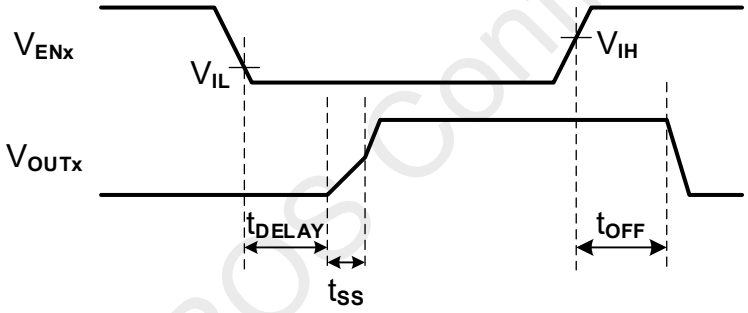


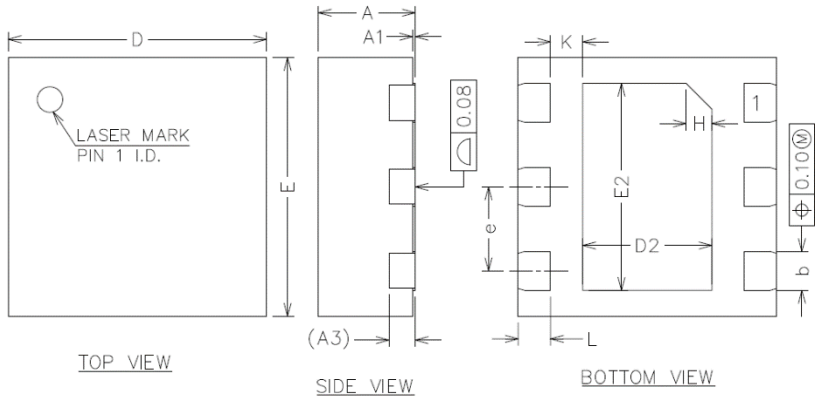
Figure 6. Test Circuit for Power Sequence



(Active low as an example)

7 Package Dimensions

DFN-6 2mm x 2mm



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A3		0.20REF	
b	0.25	0.30	0.35
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	1.50	1.60	1.70
e	0.55	0.65	0.75
K	0.15	0.25	0.35
L	0.20	0.25	0.30
H		0.20REF	

SIDE VIEW

8 Order Information

Part Number	Package	Active Logic	Top Mark (Note 1)	MOQ
YHM2032S6T	6 Pin DFN	L	Y2032/YYWW	4000
YHM2032AS6T	6 Pin DFN	H	2032A/YYWW	4000

Note 1: YYWW: Date Code. YY = Year, WW = Week.

Datasheet Change History

Rev	Date	Changes
0.0	2/18/2022	Initial Version