Features

- Input Voltage Range: 1.65V to 5.5V.
- Low Rdson: 100mΩ @ VIN = 5V
- Three Fixed EN control type.
- EN Delay time and Edge Selection:
  - YHM2056: Programmed
  - YHM2057/8: Fixed
- YHM2056 Support ACMD communication.
- Ultra-Low I_Q: 100nA
- Maximum I_{OUT}: 1A
- Optional Output Discharge Function.
- Tiny Package,
  - Tiny 4-bumps 0.67mm x 0.75mm WLCSP

Applications

- Medical device
- Wearable device
- IOT device
- Handset Device

General Description

The YHM2056/7/8 series is 1A delay load switches with push button timing control. The voltage range is 1.65V to 5.5V. The device is designed with ultra-low power consumption for battery powered portable devices or long standby devices.

The YHM2056/7/8 series switch on/off is controlled by EN pin or ACMD command. The YHM2056's delay time varied from 1s to 12s when it is controlled by EN pin. And the YHM2057/8's delay time is fixed.

The YHM2056/7/8 has optional output discharge function which is selected by different versions.

The YHM2046 has one internal watchdog. If it is timeout, the device will open switch for a while and re-close again.

The YHM2056/7/8 is available in tiny 4 bumps 0.67mm x 0.75mm WLCSP. It operates over an ambient temperature range of - 40°C to + 85°C.

Typical Application

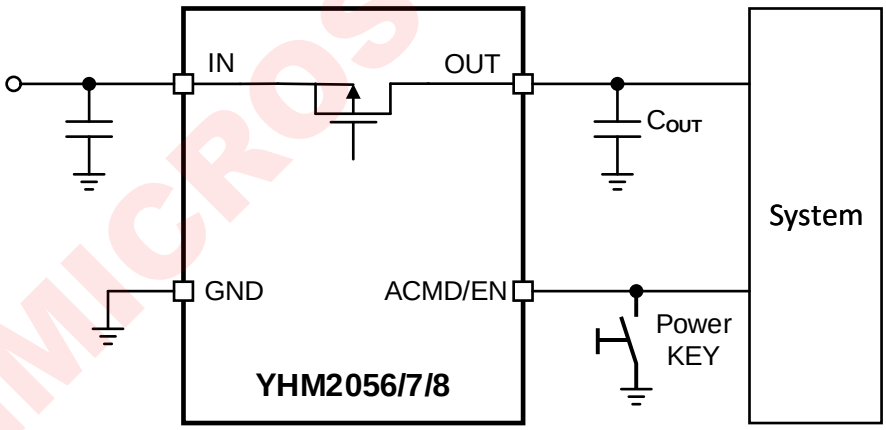


Figure 1. YHM2056/7/8 Typical Application Diagram

Internal Block Diagram

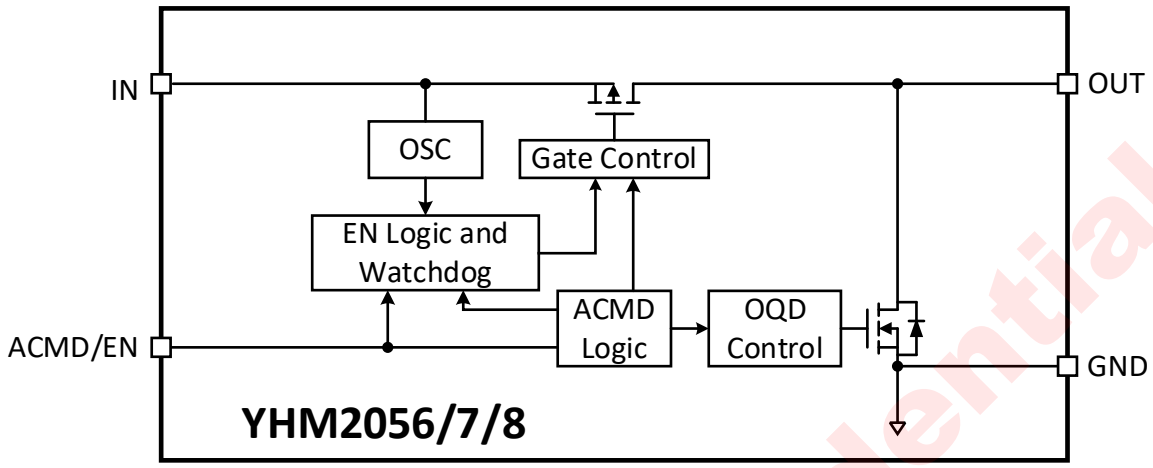


Figure 2. YHM2056/7/8 Functional Block Diagram

Pin Configurations

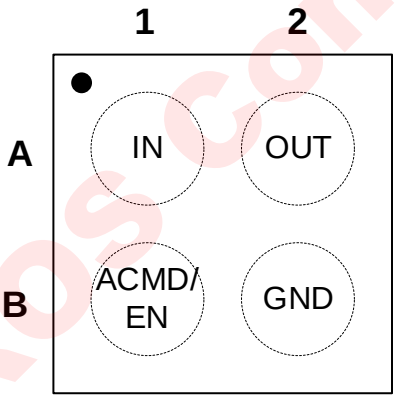


Figure 3. YHM2056/7/8 Pin Assignment. (Top Through View)

YHM2056/7/8 Pin Descriptions

WLP	Name	Description
A1	IN	Device Power supply and voltage input pin.
A2	OUT	Voltage output pin.
B1	ACMD/EN	ACMD and EN Pin. EN logic is shown in section 4.2 ACMD is only available in YHM2056
B2	GND	Ground

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_{IN}	IN to GND		-0.3	6	V
V_{OUT}	OUT to GND		-0.3	6	V
$V_{ACMD/EN}$	ACMD/EN to GND		-0.3	6	V
I_{OUT}	Output Current			1.5	A
T_{STG}	Storage Temperature Range		-65	+150	°C
T_J	Maximum Junction Temperature			+150	°C
ESD	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	All Pins	6.5		KV
	Charged Device Model, JESD22-C101	All Pins	2		

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
Input Voltage: V_{IN}	1.65	5.5	V
Output Current: I_{OUT}		1	A
Operating Ambient Temperature Range	-40	85	°C

3 Electrical Characteristics

Condition: V_{DD} = 5V, T_A = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	V_{IN}		1.65		5.5	V
Under Voltage Lockout Threshold	V_{UVLO}	V_{IN} Rising			1.2	V
Output Current	I_{OUT}				1	A
Quiescent Current	I_Q	EN = V_{IN}.		100	300	nA
Shut Down Current	I_{SHUT}	Switch OFF		10	80	nA
Switch on Resistance	R_{ON}	I_{OUT} = 500mA, V_{IN} = 5V		80	160	mΩ
EN Input Logic High	V_{IH}		0.9			V
EN Input Logic Low	V_{IL}				0.3	V
EN Pull Up Resistance	R_{PU}			10		MΩ
EN Push Delay Time Accuracy	A_{tPUSH}		-10		10	%
OUT Rising Time	t_R	RL = 10Ω, COUT = 0.1μF		400		μs
OUT Falling Time	t_F	RL = 10Ω, COUT = 0.1μF		20		μs
OUT Pull Low Time	t_{PL}	For YHM2058	180	200	220	ms
Reset Time	t_{RESET}	RSTPL_TIME[2:0] = 3	180	200	220	ms
Time out Time	t_{TOUT}	TIME_OUT[2:0] = 4	0.9	1	1.1	s

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
ACMD Characteristics(YHM2056 Only)						
ACMD Pin Input Logic High	V_{IH_ACMD}		0.9			V
ACMD Pin Input Logic Low	V_{IL_ACMD}				0.3	V
Bit Period	t_{BIT}		270	300	330	ns
Logic 0	t_{LOG0}			8		t_{BIT}
Logic 1	t_{LOG1}			26		t_{BIT}
Logic Z	t_{LOGZ}			80		t_{BIT}
ACMD Rising Time	t_{SRISE}				0.5	t_{BIT}
ACMD Falling Time	t_{SFALL}				0.5	t_{BIT}
Two Bit interval	t_{INTV}		1		6000	t_{BIT}
Read Enable time	t_{RL}			1		μs

4 Detailed Description

4.1 General Introduction

The YHM2056/7/8 series is a nano-power delay load switches with button control. It works in a wide voltage range from 1.65V to 5.5V to support low voltage power rail application. The devices integrate an 80mohm PMOS FET power switch which provides up to 1A load current. The device's output has three functions selected by factory. The YHM2056 has ACMD communication function which can change EN timing and control switch by internal registers. YHM2051/2/3/4/5 series works in ambient temperature range from -40°C to 85°C with 4-bump WLP package.

4.2 EN Control Timing

The YHM2056 changes its status when the device detects one low voltage pulse on EN pin. For example, if the switch status is ON at beginning, when one EN low voltage pulse comes and the pulse width is larger than t_{PUSH}, the switch status will change status to OFF when the low voltage pulse width is reached the t_{PUSH}. When the second EN low voltage pulse comes and the pulse width matches requirement, the switch status will change to ON again when the low voltage pulse width is reached the t_{PUSH}. Please see the details in figure 4.

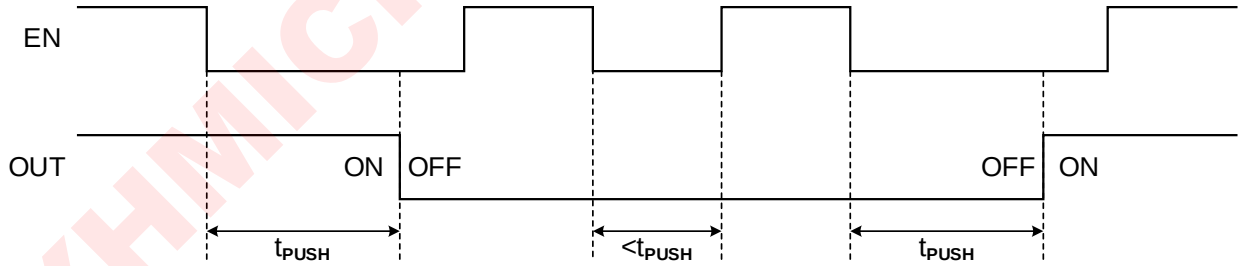


Figure 4. YHM2056 EN Control Timing

YHM2057 power switch will turn off switch when ACMD/EN pin changes to 0 for 1s and turn on switch when ACMD/EN pin change to logic 1 immediately. If the time from falling edge is shorter than 1s, the switch status does not change and the timer is reset. Please see the details in figure 5.

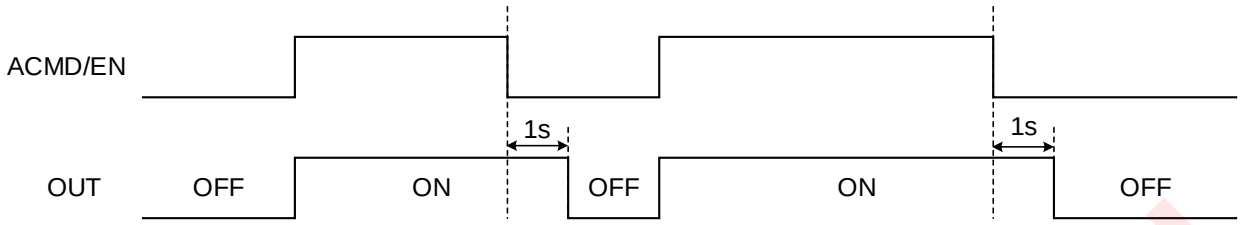


Figure 5. YHM2057 EN Control Timing

YHM2058 changes the power switch to OFF status for 200ms and then changes to ON status automatically when the device detects ACMD/EN pin low voltage pulse the width is larger than 9s. Please see the details in figure 6.

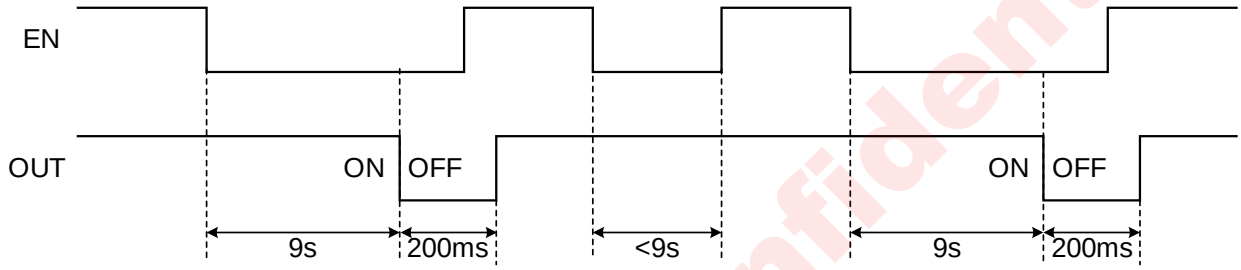


Figure 6. YHM2058 EN Control Timing

4.3 Fast Output discharge

The YHM2056/7/8 has output discharge function. The VOUT connects to GND with about 80ohm resistor during sleep state or shutdown state. This function can be set by register bit ODS_EN.

4.4 Watchdog

YHM2056 integrated one watchdog function. If this watchdog is enabled by system, it must be fed periodically with ACMD command. Otherwise, the device turns OFF for a short time and then close switch again. The timeout is defined in TIME_OUT[2:0] registers and turn off time is defined in RSTPL_TIME[2:0] registers.

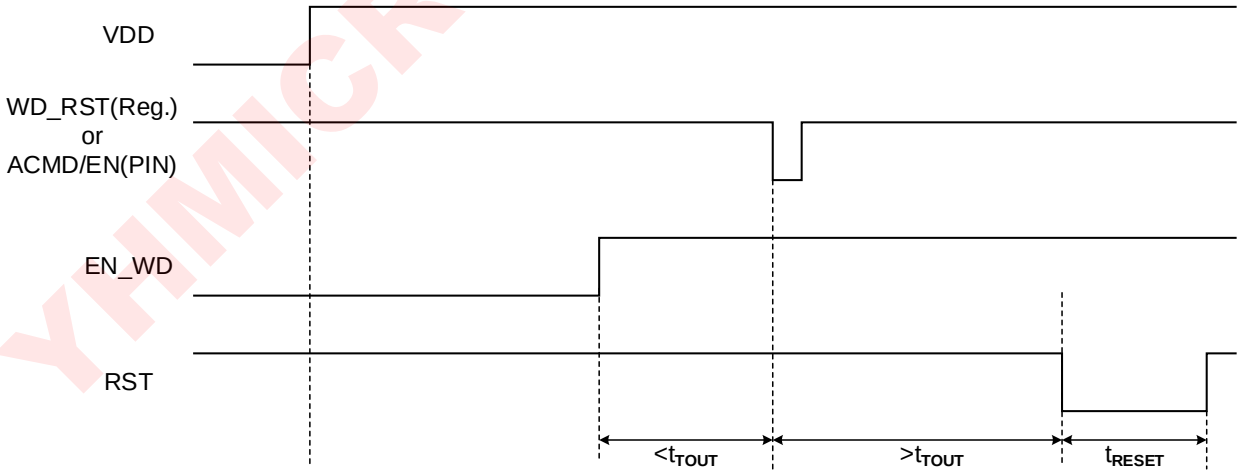


Figure 7. YHM2056 Watchdog Timing

4.5 Register Map and Description(For YHM2056 only)

4.5.1 Register Map

ADDRESS	NAME	B7	B6	B5	B4	B3	B2	B1	B0
00H	ID	MOD[1:0]		OPTION_ID[2:0]			VER[2:0]		
03H	WATCH DOG	RESV		TIME_OUT[2:0]			RSTPL_TIME[2:0]		
04H	CTRL	RESV			SWC_CTRL	SW_EN	EN_WD	WD_RST	CHIP_EN
05H	DEV CFG1	RESV			PUSH_TIME[2:0]			RESV	
07H	DEV CFG2	RESV			ODS_EN	RESV			

4.5.2 Register Detail

Name: ID
Address: 00H

BIT	B7	B6	B5	B4	B3	B2	B1	B0
Field	MOD[1:0]		OPTION_ID[2:0]			VER[2:0]		
Default	1	0	0	0	1	0	0	0
Access Type	R							

BIT Field	BITS	Description
MOD	7:6	Device Model: 0x2
OPTION_ID	5:3	Device ID: 0x1
VER	2:0	Si Version: 0x0

Name: WATCHDOG
Address: 02H

BIT	B7	B6	B5	B4	B3	B2	B1	B0
Field	-	-	TIME_OUT[2:0]			RSTPL _TIME[2:0]		
Default	-	-	0	0	0	0	0	0
Access Type	-	-	R/W	R/W	R/W	R/W	R/W	R/W

BIT Field	BITS	Description
TIME_OUT	5:3	t_{TOUT} configuration: TIME_OUT: 0 → t_{TOUT} 20s; 1 → 10s; 2 → 5s; 3 → 2s; 4 → 1s; 5 → 500ms; 6 → 200ms; 7 → 100ms
RSTPL _TIME	2:0	t_{TOUT} configuration: RSTPL_TIME: 0 → t_{RESET} 20ms; 1 → 100ms; 2 → 200ms; 3 → 500ms; 4 → 1s; 5 → 2s; 6 → 5s; 7 → 10ms

Name: CTRL
Address: 04H

BIT	B7	B6	B5	B4	B3	B2	B1	B0
Field	-	-	-	SWC_CTRL	SW_EN	EN_WD	WD_RST	CHIP_EN
Default	-	-	-	0	1	0	0	0
Access Type	Do Not Change			R/W	R/W	R/W	R/W	R/W

BIT Field	BITS	Description
SWC_CTRL	4	ACMD control switch bit: 0: EN control switch status. 1: ACMD control switch status.
SW_EN	3	Switch control bit: 0: Switch is OFF. 1: Switch is ON.
EN_WD	2	Watchdog control bit: 0: Disable. 1: Enable.
WD_RST	1	Reset watchdog timer, set 1 to reset watchdog timer and it is automatic clear after timer is reset.
CHIP_EN	0	Device control bit: 0: Device is OFF and in low power status. 1: Device is ON.

Name: DEV CFG 1
Address: 05H

BIT	B7	B6	B5	B4	B3	B2	B1	B0
Field	-			PUSH_TIME[2:0]			-	-
Default	-	-	-	0	0	0	-	-
Access Type	Do Not Change			R/W	R/W	R/W	Do Not Change	

BIT Field	BITS	Description
PUSH_TIME	4:2	Delay time setting.

PUSH_TIME	t_{PUSH}(s)	PUSH_TIME	t_{PUSH}(s)
0	1	4	7
1	2	5	9
2	3	6	10
3	5	7	12

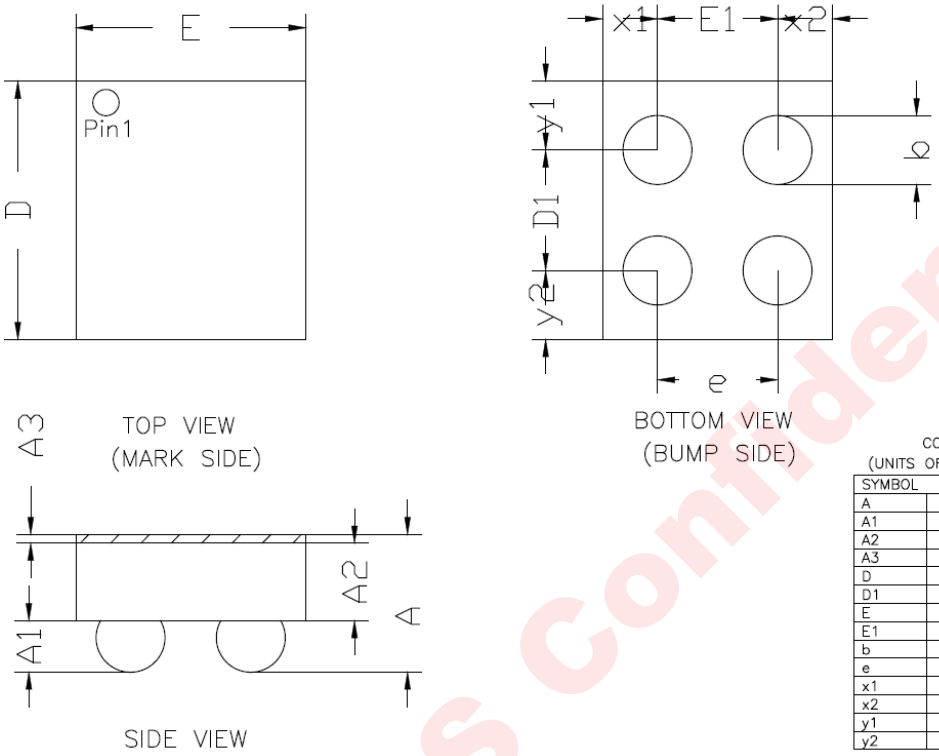
Name: DEV CFG 2
Address: 07H

BIT	B7	B6	B5	B4	B3	B2	B1	B0
Field	-	-	-	ODS_EN	-	-	-	-
Default	-	-	-	0	-	-	-	-
Access Type	Do Not Change			R/W	Do Not Change			

BIT Field	BITS	Description
ODS_EN	4	Output quick discharge configuration: 0: Output discharge disable. 1: Output discharge enable.

5 Package Dimensions

0.67mm x 0.75mm WLCSP



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.352	0.400	0.448
A1	0.130	0.150	0.170
A2	0.200	0.225	0.250
A3	0.022	0.025	0.028
D	0.730	0.750	0.770
D1		0.350BSC	
E	0.650	0.670	0.690
E1		0.350BSC	
b	0.180	0.200	0.220
e		0.350	
x1		0.160 REF	
x2		0.160 REF	
y1		0.200 REF	
y2		0.200 REF	

6 Ordering Information

Part Number	Package	Address	Top Mark (Note 1)	MOQ
YHM2056W4T	4 WLCSP	0b101010	xx	5000
YHM2057W4T	4 WLCSP	NA	xx	5000
YHM2058W4T	4 WLCSP	NA	xx	5000

T = Tape and reel.

Note 1: Letter x is production date code.

7 Datasheet Change History

Rev	Date	Changes
0.0	Oct.2024	Initial Version