YHM2025

200mA Ultra-Low I_Q LDO

V1.0

Features

- Input voltage range: 1.7V ~ 5.5V
- Fixed VOUT:
  1.2V/1.3V/1.5V/1.8V/2V/2.2V/2.5V/2.8V/2.85V/2.9V/3V/3.2V/3.3V/3.5V/3.6V/4V.
- Output accuracy: 1.5% in working temperature range.
- Low Quiescent current: 40nA
- Low Shutdown current: 9nA
- 200mA Output Current Capability
- Over Current protection.
- Optional Output Discharge.
- Thermal Shutdown
- Robust ESD immunity capability
  - HBM > ±5KV
  - CDM > ±2KV
- Two Packages:
  - Tiny 1mm x 1mm DFN4
  - SOT23-5 Pin

Applications

- IOT device.
- Portable device.
- Wearable medical device.
- Battery power device.

General Description

YHM2025 is a tiny LDO with very low IQ. It has 200mA output current capability and only 40nA working power consumption when I_{OUT} = 0. The device is designed to work with 1μF input and output ceramic capacitor. It is very suitable for battery powered device with ultra-long standby time.

YHM2025 has over current protection and thermal shutdown functions to protect system and itself when the application in abnormal situation.

YHM2025 is available in tiny 4-Pin 1mm x 1mm DFN and SOT23-5 packages, and operates over an ambient temperature range of -40°C to +85°C.

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Typical Application

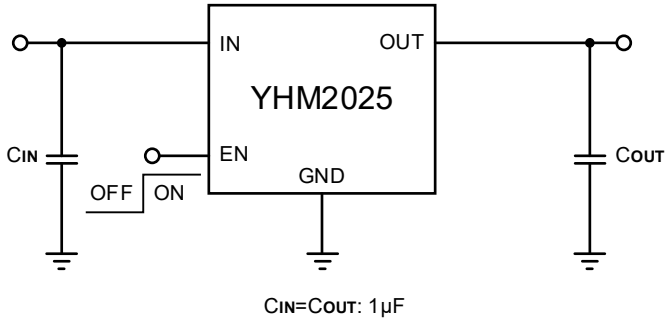

Figure 1. Application Diagram

Internal Block Diagram

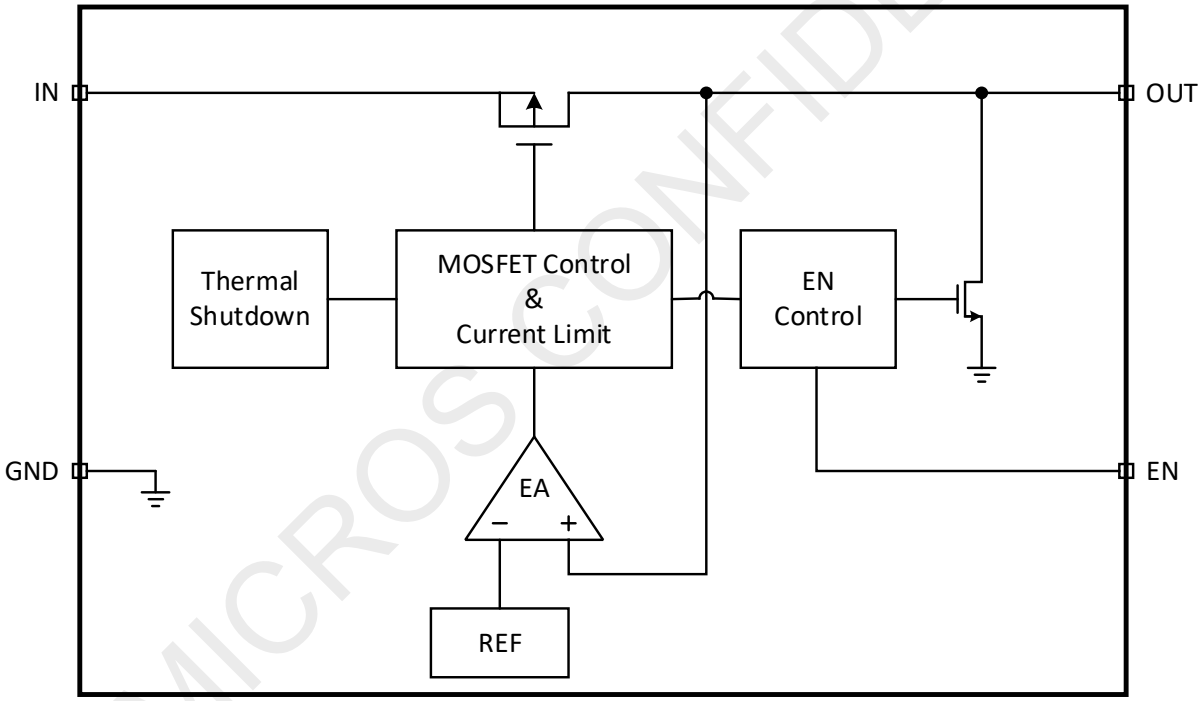

Figure 2. YHM2025 Functional Block Diagram

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Pin Configurations

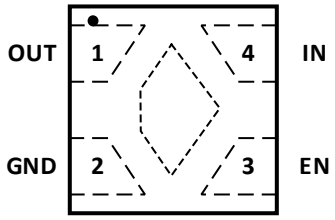

Figure 3. YHM2025 DFN-4 Pin Assignment (Top Through View)

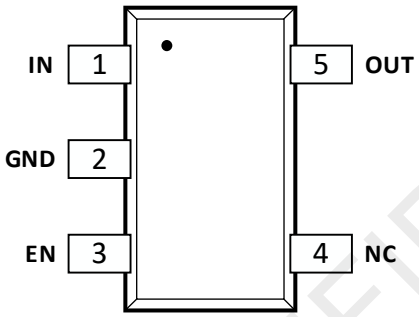

Figure 4. YHM2025 SOT23-5 Pin Assignment (Top View)

YHM2025 Pin Descriptions

DFN4	SOT23-5	Name	Description
4	1	IN	Power Input.
1	5	OUT	Power Output.
3	3	EN	Enable control. No Internal pull up or pull down. Do not leave floating.
2	2	GND	Ground Connection.
-	4	NC	Not Connect.

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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_{EN}	EN to GND		-0.3	6	V
I_{IN}	Input Current (Continuous)			500	mA
I_{OUT}	Output Current			500	mA
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	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}	1.7	5.5	V
Enable Voltage: V_{EN}	0	5.5	V
Output Voltage: V_{OUT}	1.2	4	V
Operating Temperature Range	-40	85	°C

3 Electrical Characteristics

Condition: V_{IN} = V_{SET} + 1V, I_{OUT} = 1mA, T_A = - 40°C ~ 85°C, unless otherwise noted. Typical value at T_A = +25°C and V_{SET} = 3V, C_{IN} = C_{OUT} = 1μF.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Voltage Range	V_{IN}		1.7		5.5	V
EN Logic Voltage	V_{ENH}		1.1			V
	V_{ENL}				0.28	
EN Pin Leakage Current	I_{EN}	V_{EN} = V_{IN}, 1.7V ≤ V_{IN} ≤ 5.5V		1		nA
Output Discharge Resistor	R_{DIS}			150		Ω
Thermal Shutdown Threshold	T_{SD}			150		°C
Thermal Hysteresis	T_{HYS}			20		°C
Output Current	I_{OUT}	V_{IN} ≥ 1.9V	200			mA
		1.7V ≤ V_{IN} ≤ 1.9V	150			
UVLO Threshold	V_{UVLO}	V_{IN} rising		1.6		V
UVLO Hysteresis	V_{UVLO_HYS}			100		mV
Input Quiescent Current	I_Q	I_{OUT} = 0, T_A = 25°C		40		nA

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Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Shutdown Current	I_{SHUT}	EN = 0. V_{IN} = 5V, T_A = 25°C		9		nA
GND Current Ratio	I_{GND}/I_{OUT}	3μA < I_{OUT} < 5mA		2		%
		5mA < I_{OUT} < 50mA		0.5		
		I_{OUT} > 50mA		0.25		
Output Voltage Accuracy	A_{OUT}	I_{OUT} = 10mA, V_{SET} ≥ 1.5V, T_A = 25°C	-0.9		0.9	%
		I_{OUT} = 10mA, V_{SET} ≥ 1.5V,	-1.5		1.5	
		I_{OUT} = 10mA, V_{SET} = 1.2V, T_A = 25°C	15		15	mV
		I_{OUT} = 10mA, V_{SET} = 1.2V,	20		20	
Dropout Voltage (1)	V_{DO}	V_{SET} = 3V, I_{OUT} = 200mA			300	mV
GND Current at Dropout	I_{GNDDR}	I_{OUT} = 0mA, V_{OUT} = 0.95 x V_{SET}		40		nA
Line Regulation	LineRe	V_{IN} = V_{SET} + 1V~5V, ΔV_{IN} = 1V. I_{OUT} = 200mA.		0.1		%/V
Load Regulation	LoadRe	I_{OUT} = 1mA to 200mA		0.008		%/mA
Output Current Limit	I_{Lim}	V_{OUT} = 0.9 x V_{SET}	280			mA
Short circuit current	I_{SC}	V_{OUT} = 0		60		mA
Power Supply Rejection Ration	PSRR	I_{OUT} = 20mA, V_{SET} = 3V, f = 1KHz		55		dB
Output Voltage Noise	V_{NOISE}	BW = 10Hz to 100KHz, I_{OUT} = 20mA		60		μV_{RMS}

Note 1: Dropout Voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} = V_{SET} x 95%.

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4 Typical Operating Characteristics

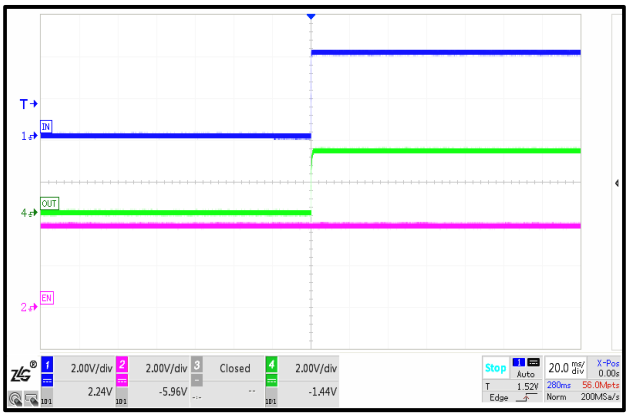

Figure 5. Start-Up with EN before IN (I_{OUT}=0mA)

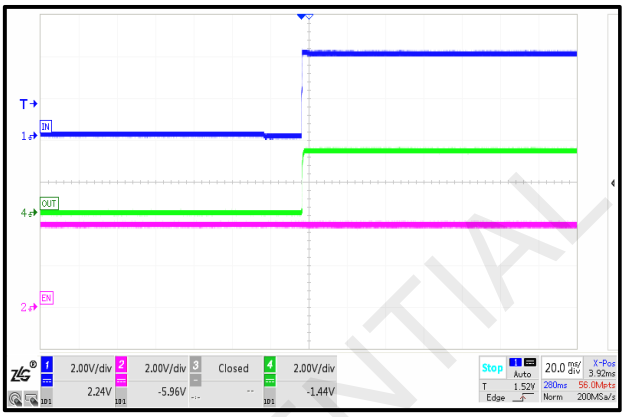

Figure 6. Start-Up with EN before IN (I_{OUT}=200mA)

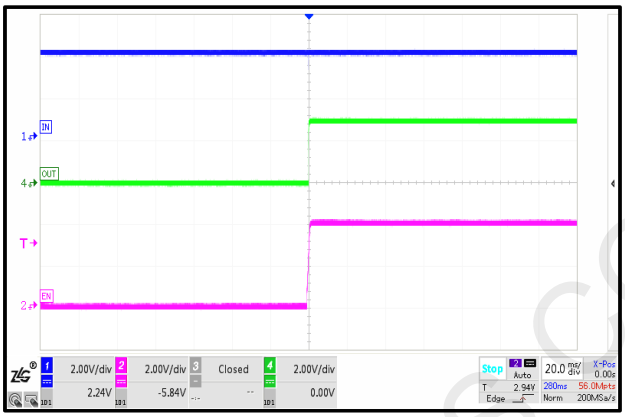

Figure 7. Start-Up with IN before EN (I_{OUT}=0mA)

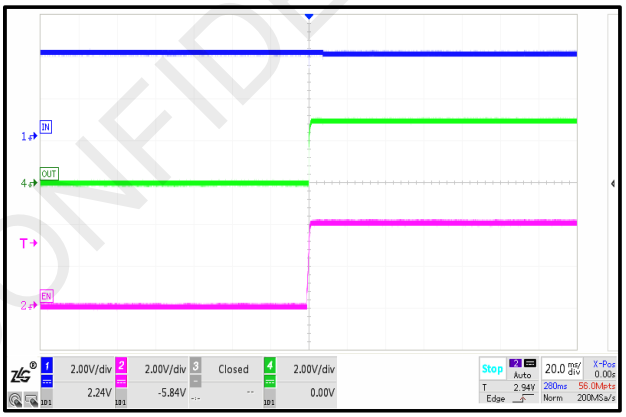

Figure 8. Start-Up with IN before EN (I_{OUT}=200mA)

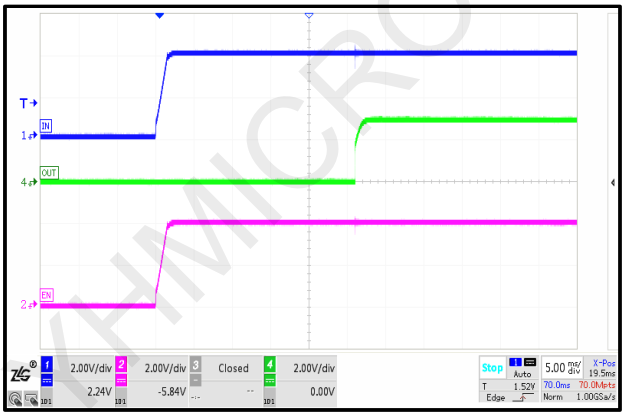

Figure 9. Start-Up with EN tied to IN(I_{OUT}=0mA)

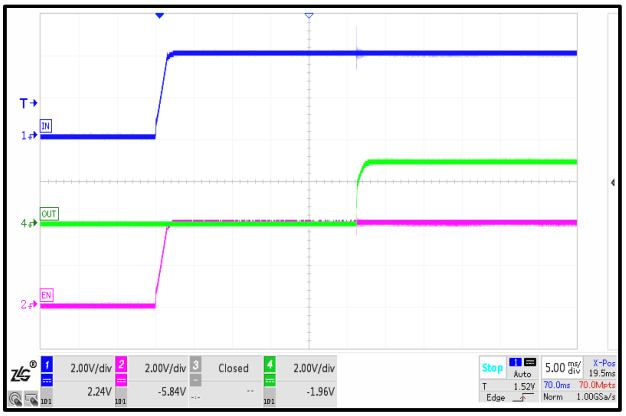

Figure 10. Start-Up with EN tied to IN (I_{OUT}=200mA)

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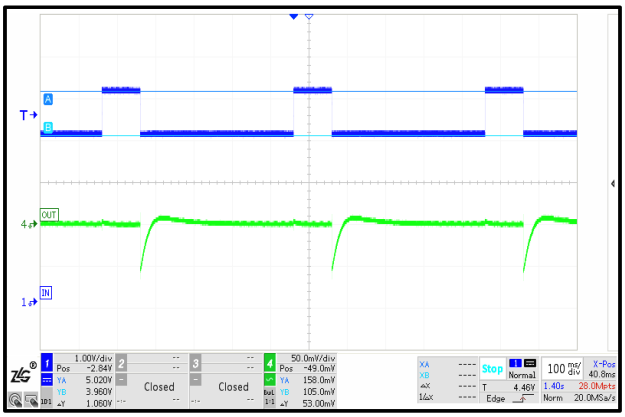
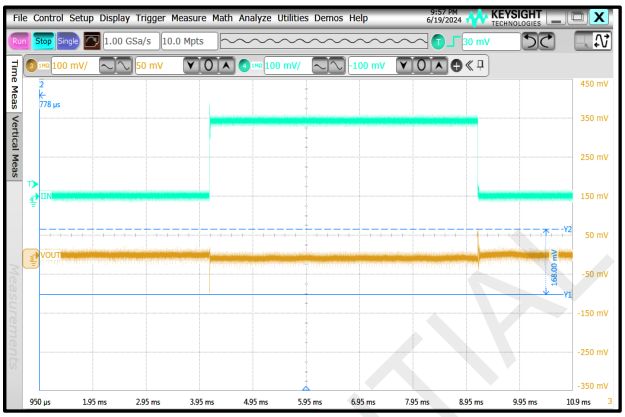


(4V~5V with 5μs t_R/t_F @ I_{OUT}=100mA)

Figure 11. Line Transient



(1mA~200mA with 5μs t_R/t_F time)

Figure 12. Load Transient

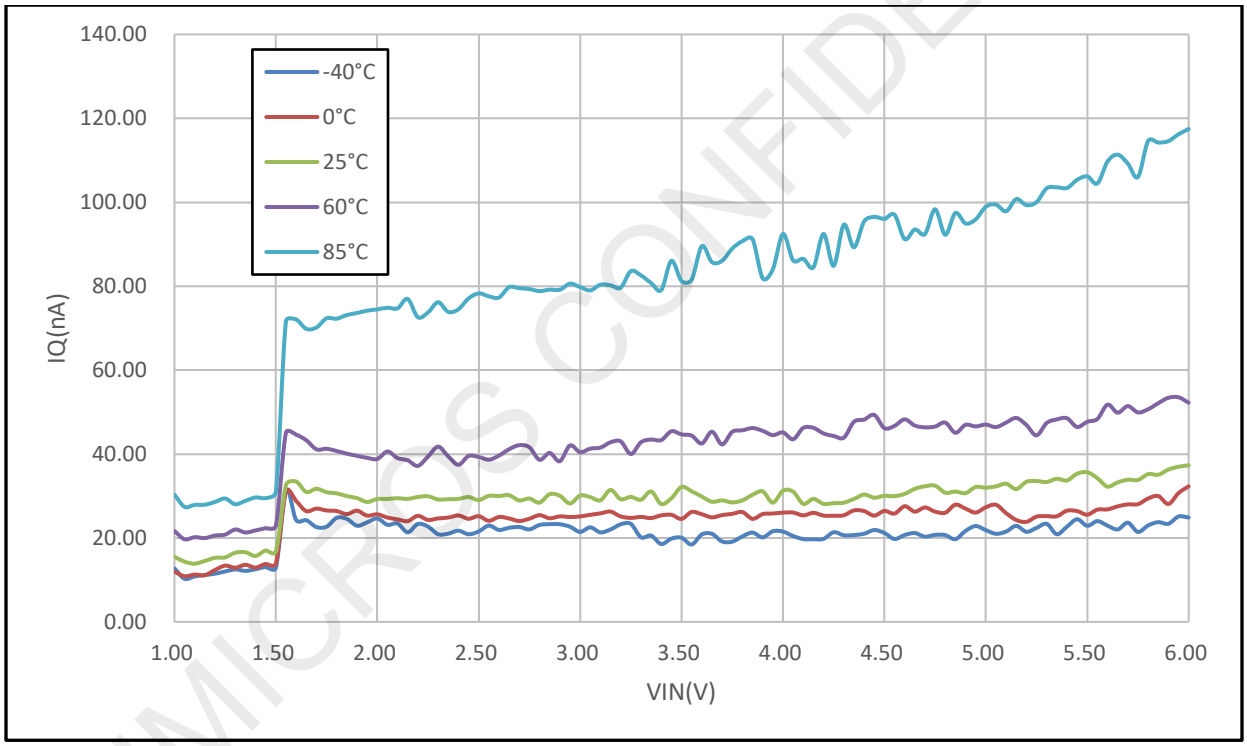


Figure 13. I_Q vs VIN (V_{SET}=1.2V)

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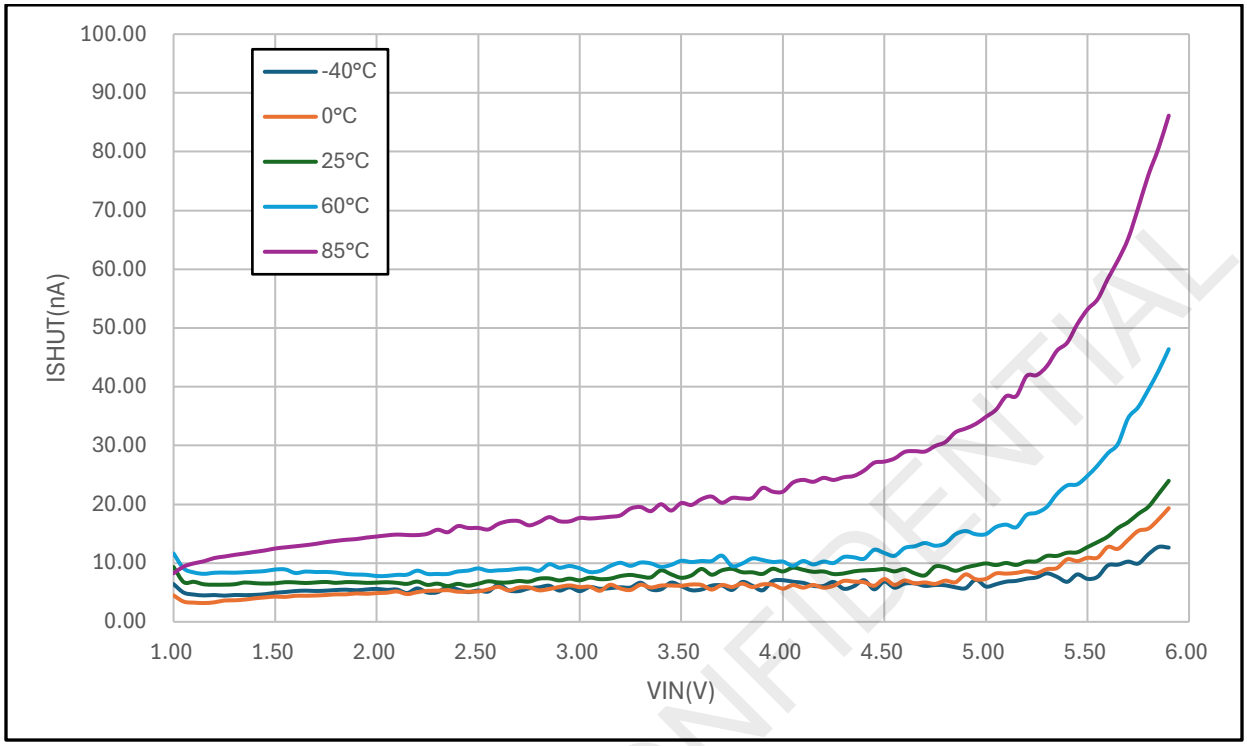

Figure 14. I_{SHUT} vs VIN (V_{SET}=1.2V)

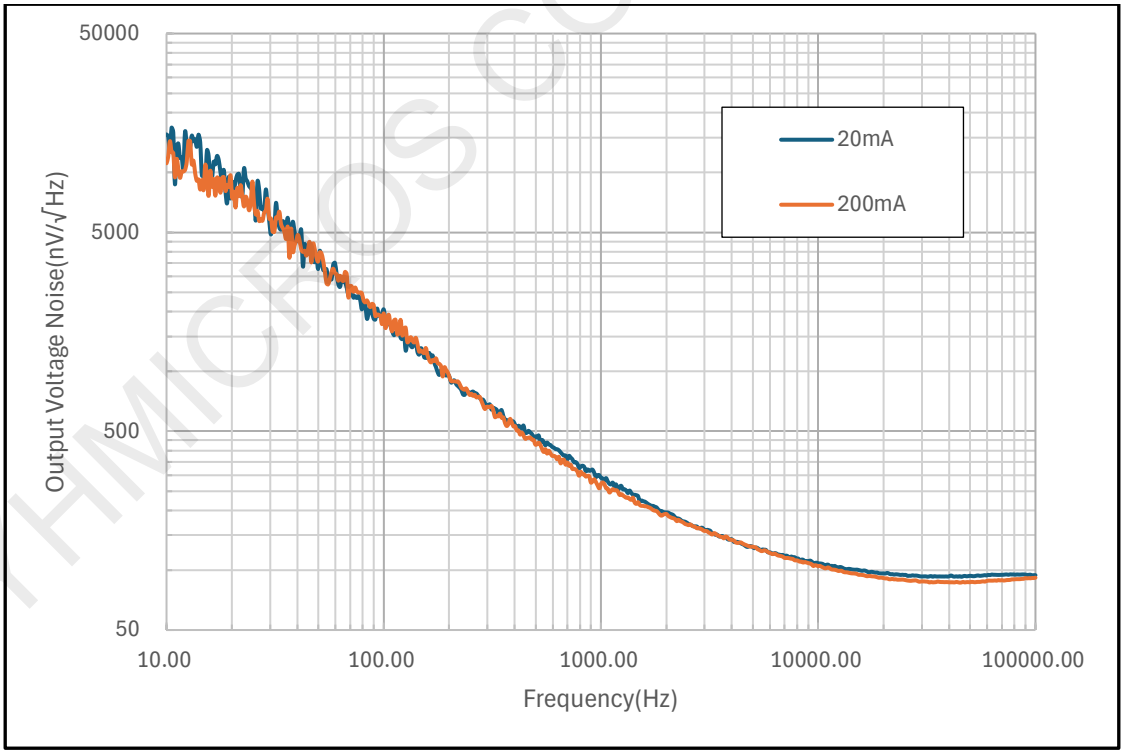

Figure 15. Output Voltage Noise

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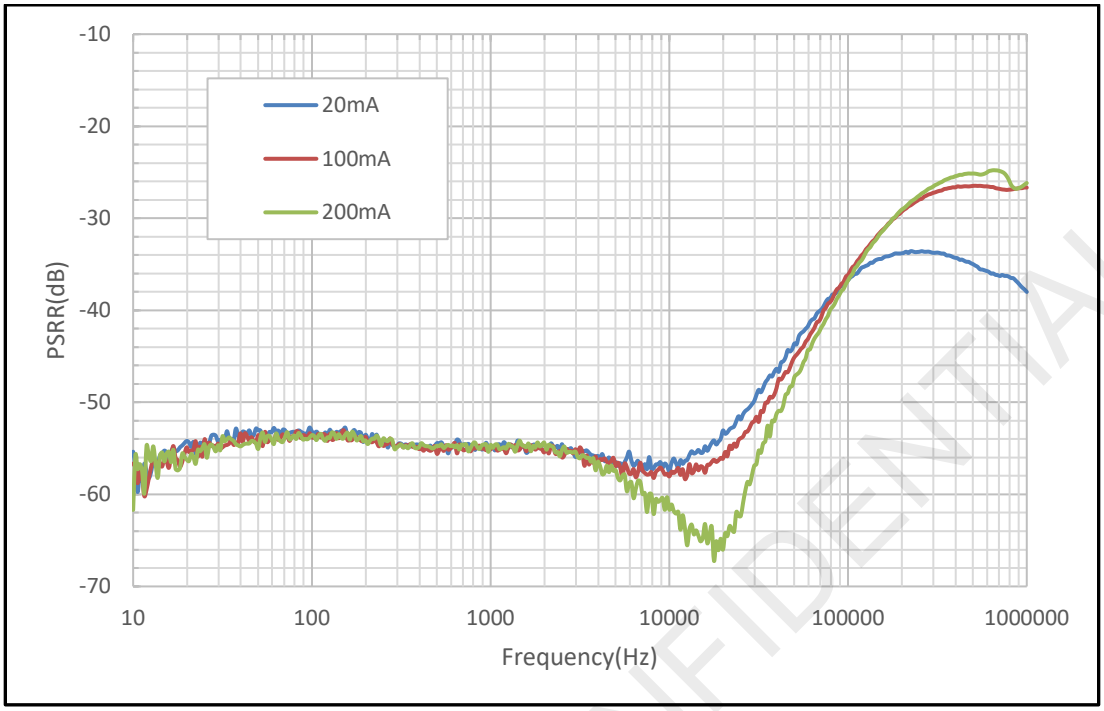

Figure 16. PSRR

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5 Detailed Description

5.1 General Introduction

The YHM2025 is a 200mA output current linear voltage regulator with ultra-low quiescent current. YHM2025 also has good transient performance even its work current is about 40nA. This makes YHM2025 is very suitable for battery powered application with long standby time.

YHM2025 has over current protection, thermal shutdown functions for abnormal situation and optional output discharge for different application.

5.2 UVLO (Under-Voltage Lockout)

The device has a built-in under-voltage lockout (UVLO) circui. When V_{IN} is rising, the output remains disconnected from the input until IN voltage is above 1.6V (TYP). The UVLO has a 100mV hysteresis to provide noise immunity to transient conditions.

5.3 OCP (Over Current Protection)

The device has OCP circuit which works in brickwall-foldback scheme. The device regulates output current to I_{LIM} when the OCP limitation is triggered. The output voltage drops if the R_{LOLD} keep decreasing but output current almost keeps same. When output voltage drops below short protection voltage, the regulated output current will scale down to I_{SC}. The device will turn back when the heavy load removed.

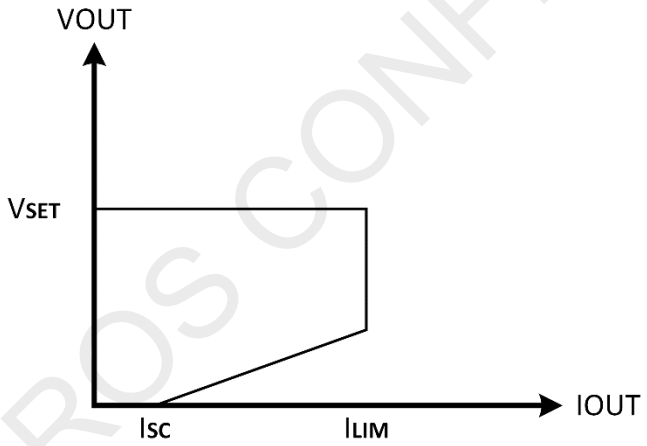

Figure 17. OCP Behavior

5.4 Thermal Shutdown

The device has thermal shutdown function. When the junction temperature exceeds T_{SD}, the device turns off internal MOSFET to protect itself. The device exits thermal shutdown after junction temperature cools down below T_{SD}-T_{HYS}. And then the device full works after a soft start period.

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5.5 SS function

To avoid high inrush current, YHM2025 integrated soft-start function. When EN status changes from logic 0 to logic 1 or from thermal shutdown mode, YHM2025 will slowly pump to target voltage in 1ms.

5.6 Output discharge

The device has output discharge function. The VOUT connects to GND with about 150ohm resistor when EN=0 shutdown mode. This function is NOT available in A version device.

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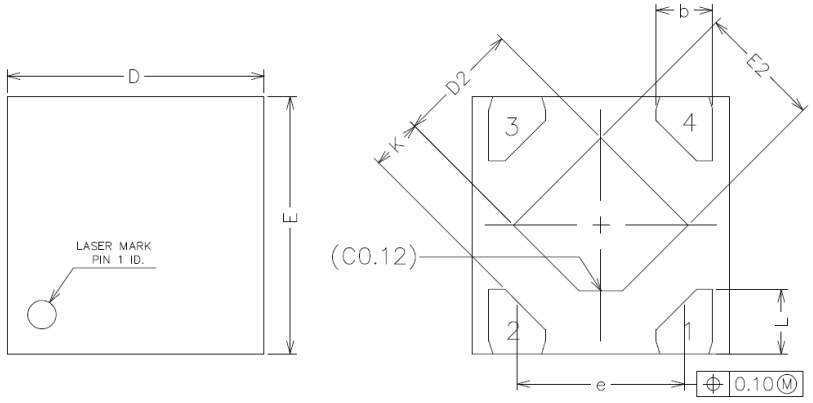
6 Package Dimensions

DFN-4

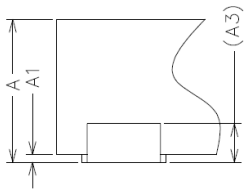


TOP VIEW

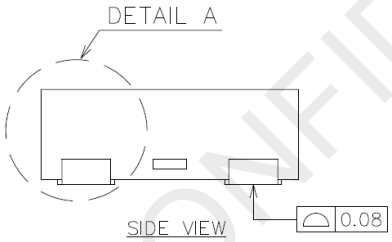
BOTTOM VIEW

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	0.00	0.02	0.05
A3		0.10REF	
b	0.17	0.22	0.27
D	0.95	1.00	1.05
E	0.95	1.00	1.05
D2	0.43	0.48	0.53
E2	0.43	0.48	0.53
L	0.20	0.25	0.30
e	0.60	0.65	0.70
K	0.15	–	–



DETAIL A



NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSION.

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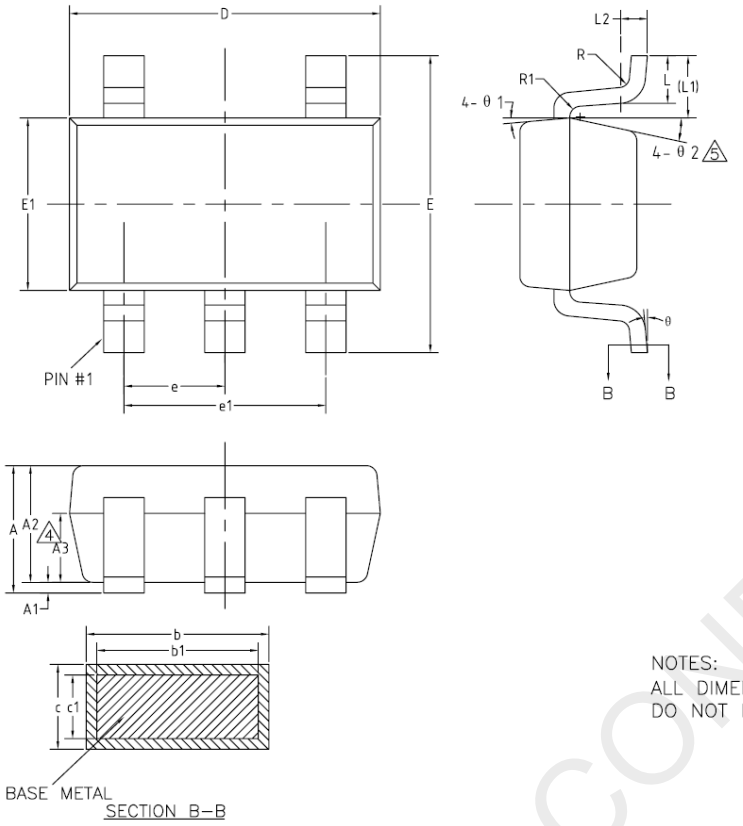
SOT23-5



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

	SYMBOL	MIN	NOM	MAX
3	A	–	–	1.25
	A1	0	–	0.15
	A2	1.00	1.10	1.20
	A3	0.60	0.65	0.70
	b	0.36	–	0.50
	b1	0.36	0.38	0.45
	c	0.14	–	0.20
	c1	0.14	0.15	0.16
	D	2.826	2.926	3.026
	E	2.60	2.80	3.00
	E1	1.526	1.626	1.726
5	e	0.90	0.95	1.00
5	e1	1.80	1.90	2.00
	L	0.35	0.45	0.60
	L1	0.59REF		
	L2	0.25BSC		
	R	0.10	–	–
	R1	0.10	–	0.25
	θ	0°	–	8°
	θ 1	3°	5°	7°
5	θ 2	6°	–	14°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MO-178 AA
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

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7 Ordering Information

Part Number	Package	Output Voltage (V)	Top Mark (Note 1)	Output Discharge	MOQ
YHM2025D4T12	4 DFN	1.2	xx	Enable	3000
YHM2025D4T13	4 DFN	1.3	xx	Enable	3000
YHM2025D4T15	4 DFN	1.5	xx	Enable	3000
YHM2025D4T18	4 DFN	1.8	xx	Enable	3000
YHM2025D4T20	4 DFN	2	xx	Enable	3000
YHM2025D4T22	4 DFN	2.2	xx	Enable	3000
YHM2025D4T25	4 DFN	2.5	xx	Enable	3000
YHM2025D4T28	4 DFN	2.8	xx	Enable	3000
YHM2025D4T285	4 DFN	2.85	xx	Enable	3000
YHM2025D4T29	4 DFN	2.9	xx	Enable	3000
YHM2025D4T30	4 DFN	3	xx	Enable	3000
YHM2025D4T32	4 DFN	3.2	xx	Enable	3000
YHM2025D4T33	4 DFN	3.3	xx	Enable	3000
YHM2025D4T35	4 DFN	3.5	xx	Enable	3000
YHM2025D4T36	4 DFN	3.6	xx	Enable	3000
YHM2025D4T40	4 DFN	4	xx	Enable	3000
YHM2025AD4T18	4 DFN	1.8	xx	Disable	3000
YHM2025S5T12	5 SOT23	1.2	2025x YYWW	Enable	3000
YHM2025S5T13	5 SOT23	1.3	2025x YYWW	Enable	3000
YHM2025S5T15	5 SOT23	1.5	2025x YYWW	Enable	3000
YHM2025S5T18	5 SOT23	1.8	2025x YYWW	Enable	3000
YHM2025S5T20	5 SOT23	2	2025x YYWW	Enable	3000
YHM2025S5T22	5 SOT23	2.2	2025x YYWW	Enable	3000
YHM2025S5T25	5 SOT23	2.5	2025x YYWW	Enable	3000
YHM2025S5T28	5 SOT23	2.8	2025x YYWW	Enable	3000
YHM2025S5T285	5 SOT23	2.85	2025x YYWW	Enable	3000
YHM2025S5T29	5 SOT23	2.9	2025x YYWW	Enable	3000
YHM2025S5T30	5 SOT23	3	2025x YYWW	Enable	3000
YHM2025S5T32	5 SOT23	3.2	2025x YYWW	Enable	3000
YHM2025S5T33	5 SOT23	3.3	2025x YYWW	Enable	3000
YHM2025S5T35	5 SOT23	3.5	2025x YYWW	Enable	3000
YHM2025S5T36	5 SOT23	3.6	2025x YYWW	Enable	3000

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YHM2025S5T40	5 SOT23	4	2025x YYWW	Enable	3000

Note1: T = Tape and reel. xx,x is internal letter for tracking. YY: Year. WW: Week.

Note2: Contact YHMicros Sales team if have more special version request that is not listed above.

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