ET68H41XX - High Input Very-Low I_Q 800mA LDO

General Description

ET68H41XX is a high input very low I_Q 800mA LDO with high power supply rejection ratio (PSRR).

It operates from 3V~40V. The quiescent current is 10uA with no load.

The devices feature integrated short-circuit, over-current and over-temperature protection. They are quite suitable for standby microprocessor control-unit systems.

ET68H41XX have a fast response to line transients and load transients, and ensure that no overshoot voltage during start-up and short-circuit recovery of the ET68H41XX.

The ET68H41XX family are available in standard fixed output voltages of 3.0V (ET68H4130), 3.3V (ET68H4133), 3.6V (ET68H4136), 5.0V (ET68H4150), and adjustable output voltages from 0.6V to 12V.

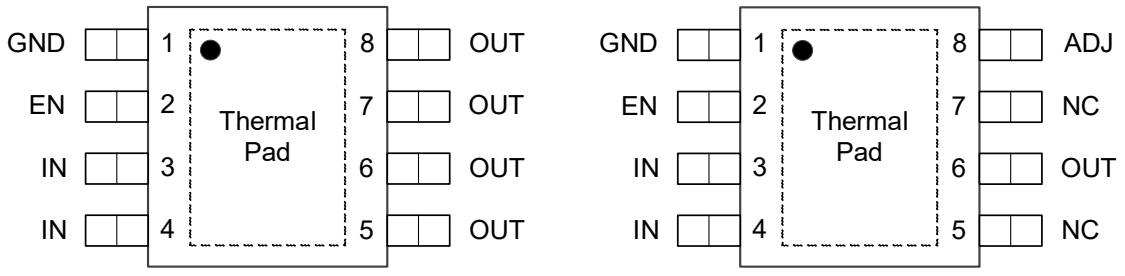
The fixed output voltage version and the adjustable output voltage version of ET68H41XX are available in the ESOP8 package.

Features

- Input Voltage Range from 3V to 40V
- 800mA Load Current
- I_Q is 10uA μA Typical
- ADJ Output Voltage Range 0.6~12V
- Low Dropout is 1500mV at 800mA Load @V_{OUT} = 5V
- Over-temperature Protection
- Current-limit Protection
- Part No. and Package Information

Part No.	Package	MSL
ET68H41XXM	ESOP8	3
ET68H41ADJM	ESOP8	3

Pin Configuration



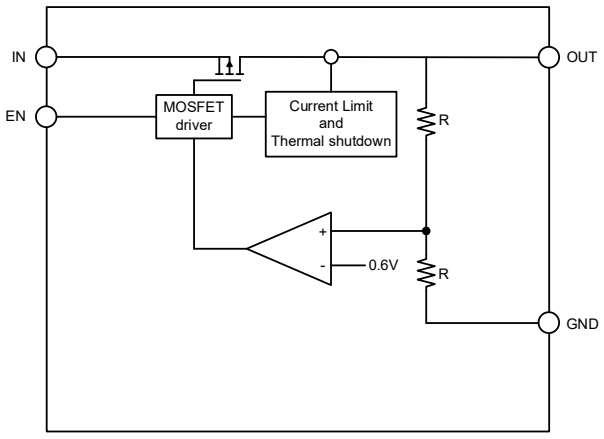
Fixed Output Version Adjustable Output Version

Figure1. Pin Configuration

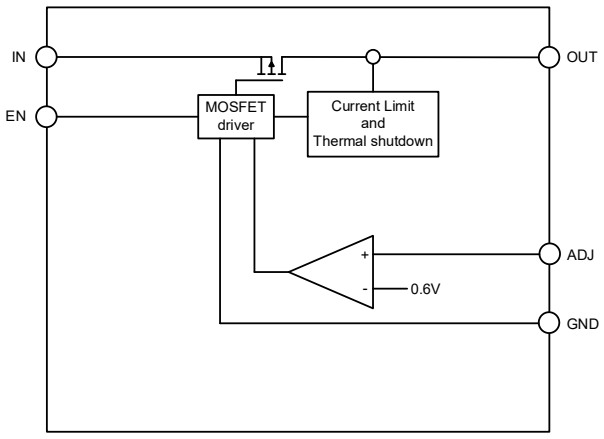
Pin Function

Pin No.		Pin Name	Pin Function
Fixed	Adjustable		
1	1	GND	Ground Pin
2	2	EN	Enable Input Pin
3, 4	3, 4	IN	Input Pin
5, 6, 7, 8	6	OUT	Output Pin
-	5, 7	NC	No Connection
-	8	ADJ	Set the Output Voltage

Block Diagram



Fixed Output Version



Adjustable Output Version

Figure2. Block Diagram

Functional Description

Input Capacitor

A 1μF~10uF ceramic capacitor is recommended to connect between IN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both IN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

Enable

The ET68H41XX delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

Dropout Voltage

TheET68H41XX uses a PMOS pass transistor to achieve low dropout. When (V_{IN} - V_{OUT}) is less than the dropout voltage (V_{DROP}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. V_{DO} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN} - V_{OUT}) approaches dropout operation.

Adjustable Output Voltage

One can select an output voltage between 0.6V to 12V by using an external resistor divider. Calculate the output voltage using the following equation, where V_{FB} = 0.6V, R2 ≥ 100kΩ.

$$V_{OUT} = V_{FB} \times (1 + R1 / R2)$$

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 165°C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 135°C, the output circuitry is again enabled.

Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the (V_{IN} - V_{OUT}) voltage and the load current. For reliable operation, limit junction temperature to 150°C maximum.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance. For recommended operating condition specifications the maximum junction temperature is 150°C and T_A is the ambient temperature. The junction to ambient thermal resistance, θ_{JA} is layout dependent. The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance(θ_{JA}).

Current-Limit Protection and Short Circuit Protection

The ET68H41XX provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

Layout Guidelines

- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.
- Do not place a thermal via directly beneath the thermal pad of the DRV package. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.

ON/OFF Input Operation

The ET68H41XX is turned on by setting the EN pin higher than V_{IH} threshold, and is turned off by pulling it lower than V_{IL} threshold. IN port needs to be powered on before the EN port. The recommended sequence diagram:

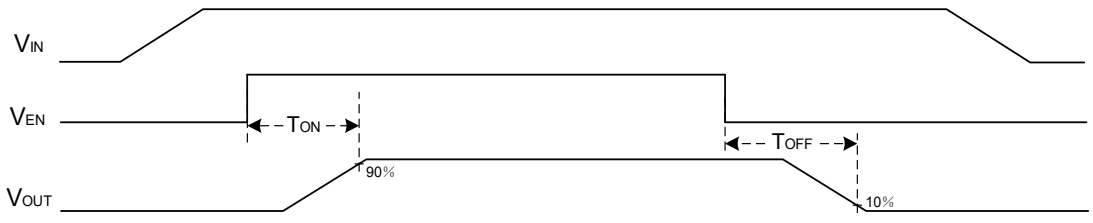


Figure3. Recommended Sequence Diagram

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}[(1)]	Input Voltage	-0.3 ~ 40	V
V_{OUT}	Output Voltage, OUT to GND	-0.3 ~ 14	V
	Output Voltage, OUT to IN	-55 ~ 0.3	V
V_{EN}	Chip Enable Input Voltage	-0.3 ~ 40	V
$T_{J(MAX)}$	Maximum Junction Temperature	150	°C
T_{STG}	Storage Temperature	-65 ~ 150	°C
V_{ESD} [(2)]	HBM Capability	±6000	V
	CDM Capability	±2000	V
L_U[(2)]	Latch Up Current Maximum Rating	±200	mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1: Refer to Electrical Characteristics and Application Information for Safe Operating Area and IN port needs to be powered on before the EN port.

Note2: This device series incorporates ESD protection and is tested by the following methods:

HBM tested per JEDEC JS-001;

CDM tested per JEDEC JS-002;

Latch up Current Maximum Rating tested per JEDEC JESD78F.

Thermal Characteristics

Symbol	Ratings	Value	Unit
$R_{\theta JA}$	Thermal Characteristics, Thermal Resistance, Junction-to-Air	45	°C/W
P_D	Max Power Dissipation @25°C	2.2	W

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	3 to 40	V
I_{OUT}	Output Current	0 to 800	mA
T_J	Operating Junction Temperature	-40 to 125	°C
C_{IN}	Input Capacitor Value	1 to 10	uF
C_{OUT}	Output Capacitor Value	1 to 10	uF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

Electrical Characteristics

(V_{IN} = V_{OUT} + 2V; I_{OUT} = 1mA, C_{IN} = 1μF, C_{OUT} = 10μF, T_J = -40°C ~ 125°C unless otherwise noted. Typical values are at T_A = 25°C.) (3)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}(4)	Operating Input Voltage		3.0		40	V
I_Q(5)	Quiescent Current	I_{OUT} = 0mA, 25°C		10	20	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V, 25°C		0.1	1	μA
V_{OUT}	Output Voltage	I_{OUT} = 10mA, 25°C	-2%		2%	V
I_{OUT_MAX}	Output Current		0.8			A
V_{FB}	Feedback Voltage	25°C		0.6		V
V_{DROP}(6) (8)	Dropout Voltage	V_{OUT} = 5V, I_{OUT} = 100mA		150		mV
		V_{OUT} = 5V, I_{OUT} = 150mA		200		mV
		V_{OUT} = 5V, I_{OUT} = 800mA		1500		mV
Reg_{LINE} (8)	Line Regulation	V_{OUT} + 2V ≤ V_{IN} ≤ 40V I_{OUT} = 10mA	-0.01		0.01	%/V
Reg_{LOAD} (8)	Load Regulation	1mA ≤ I_{OUT} ≤ 800mA, V_{OUT} = 5V V_{IN} = V_{OUT} + 2V		7		mV
I_{LMT}	Current Limit	V_{IN} = V_{OUT} + 2V		1.1		mA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage “H”	1.0			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage “L”			0.4	V
PSRR(7)	Power Supply Rejection Ratio	f = 1kHz, V_{IN} = V_{OUT} + 2V, V_{OUT} = 5V, I_{OUT} = 10mA		65		dB
e_N(7)	Output Noise Voltage	V_{OUT} = 5V, I_{OUT} = 10mA, f = 10Hz to 100KHz		250		μV_{rms}
T_{TSD}(7)	Thermal Shutdown Temperature	Temperature Increasing from T_A = 25°C		165		°C
T_{HYS}(7)	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}		30		°C

Note3: Here V_{IN} means internal circuit can work normal. If V_{IN} < V_{OUT}, Output voltage follows V_{IN}(I_{OUT} = 1mA), circuit is safety.

Note4: The minimum operating voltage is 3.0V. V_{DROP} = $V_{IN(min)}$ - V_{OUT}.

Note5: R2 needs to be greater than or equal to 100kΩ.

Note6: V_{DROP} FT test method: test the V_{OUT} voltage at V_{SET} + $V_{DROPMAX}$ with 800mA output current.

Note7: Guaranteed by design and characterization. Not a FT item.

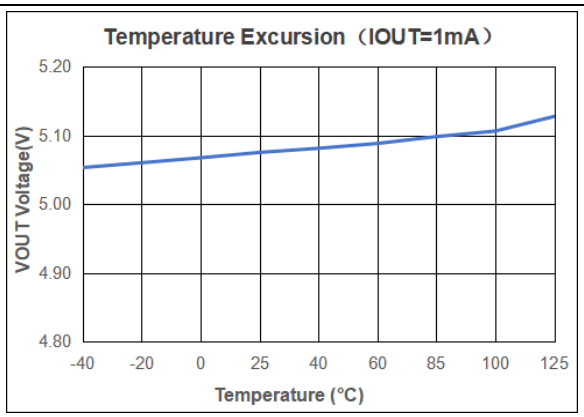
Note8: At high temperatures, the maximum load current can be calculated according to the following formula：

$$I_{OUT_MAX} = (T_J - T_A) / R_{\theta JA} / (V_{IN} - V_{OUT})$$

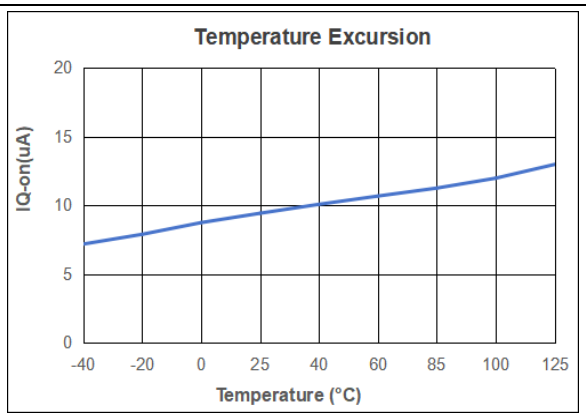
Typical Characteristics

V_{OUT} = 5V

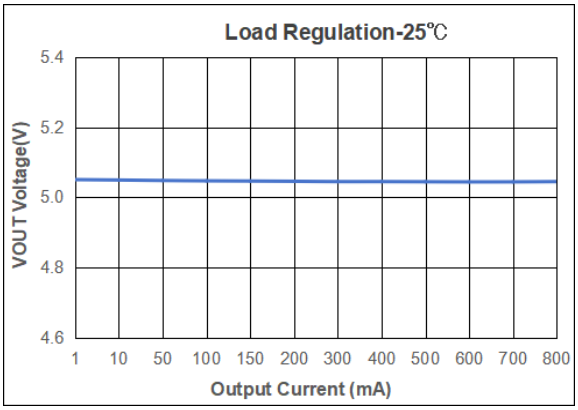
(V_{IN} = V_{OUT} + 2V; I_{OUT} = 1mA, C_{IN} = 1μF, C_{OUT} = 10μF, T_J = -40°C ~ 125°C unless otherwise noted. Typical values are at T_A = 25°C.)



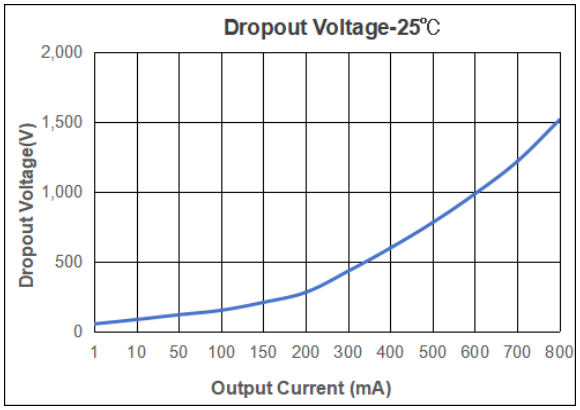
Output Voltage VS Temperature



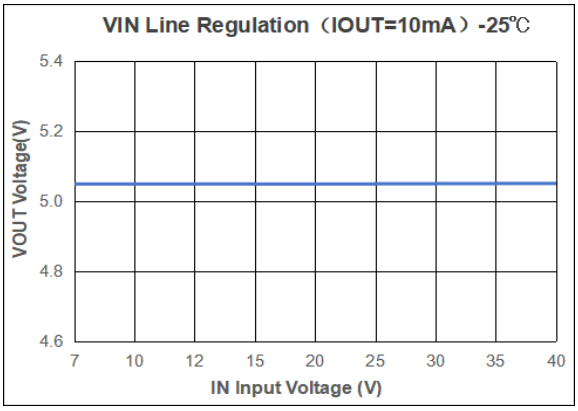
Supply Current VS Temperature



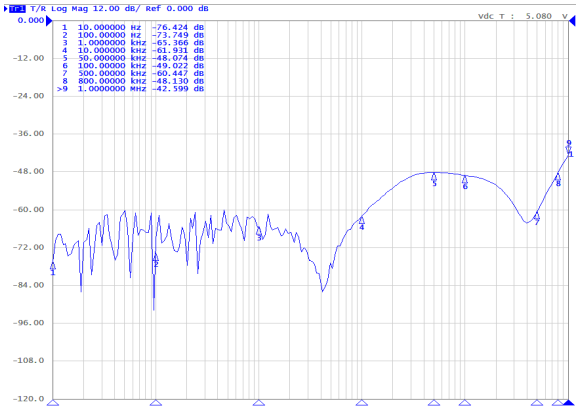
Output Voltage VS Output Current



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage



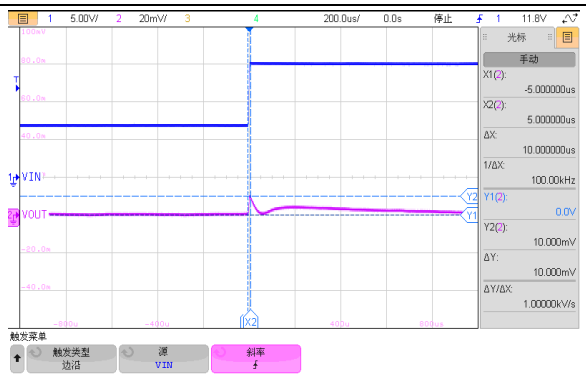
PSRR

V_{IN} = V_{OUT} + 2V, V_{pp} = 400mV, I_{OUT} = 10mA

Typical Characteristics (Continued)

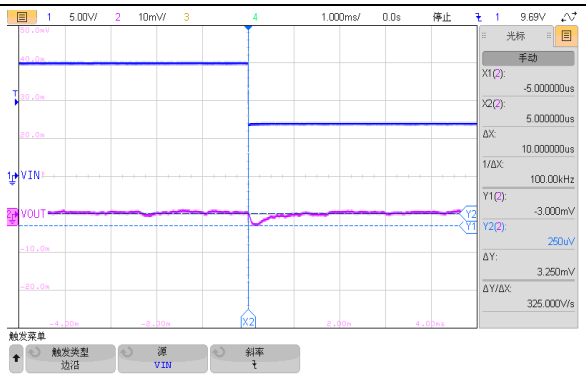
V_{OUT} = 5V

(V_{IN} = V_{OUT} + 2V; I_{OUT} = 1mA, C_{IN} = 1μF, C_{OUT} = 10μF, T_J = -40°C ~ 125°C unless otherwise noted. Typical values are at T_A = 25°C.)



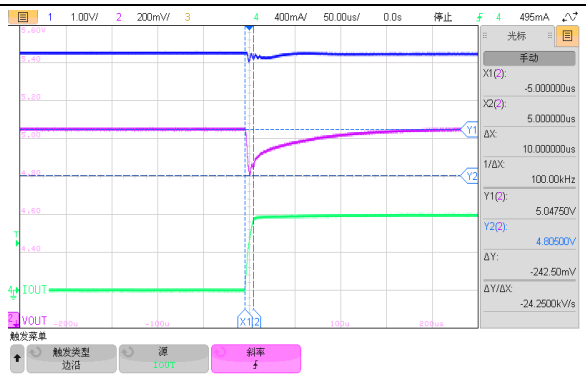
Line Transient Response

V_{IN} = 7V ~ 15V, V_{OUT} = 5V, I_{OUT} = 1mA



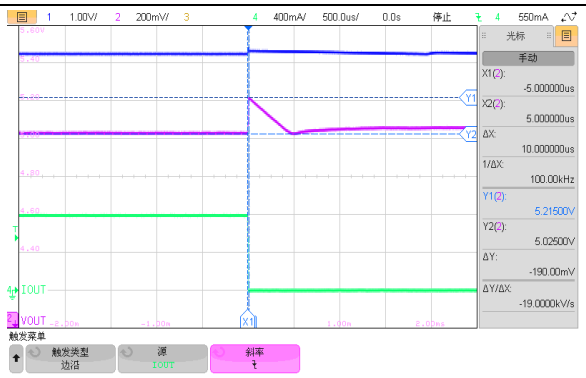
Line Transient Response

V_{IN} = 15V ~ 7V, V_{OUT} = 5V, I_{OUT} = 1mA



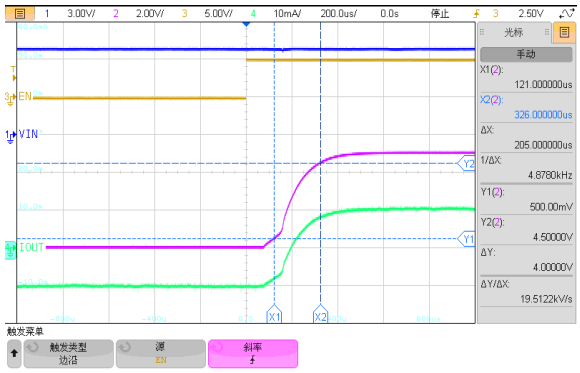
Load Transient Response

V_{IN} = 7V, V_{OUT} = 5V, I_{OUT} = 1mA ~ 800mA



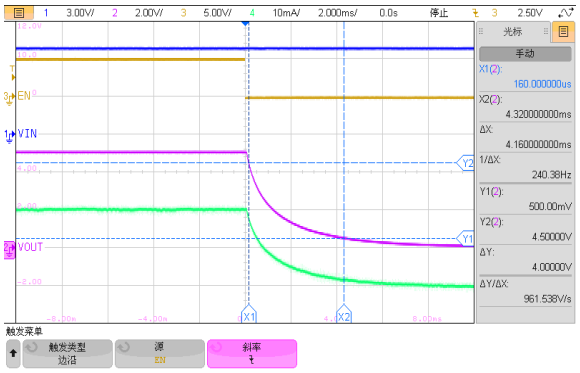
Load Transient Response

V_{IN} = 7V, V_{OUT} = 5V, I_{OUT} = 800mA ~ 1mA



Turn-on Time

V_{IN} = 7V, V_{OUT} = 5V, I_{OUT} = 20mA



Turn-off Time

V_{IN} = 7V, V_{OUT} = 5V, I_{OUT} = 20mA

Application Circuits

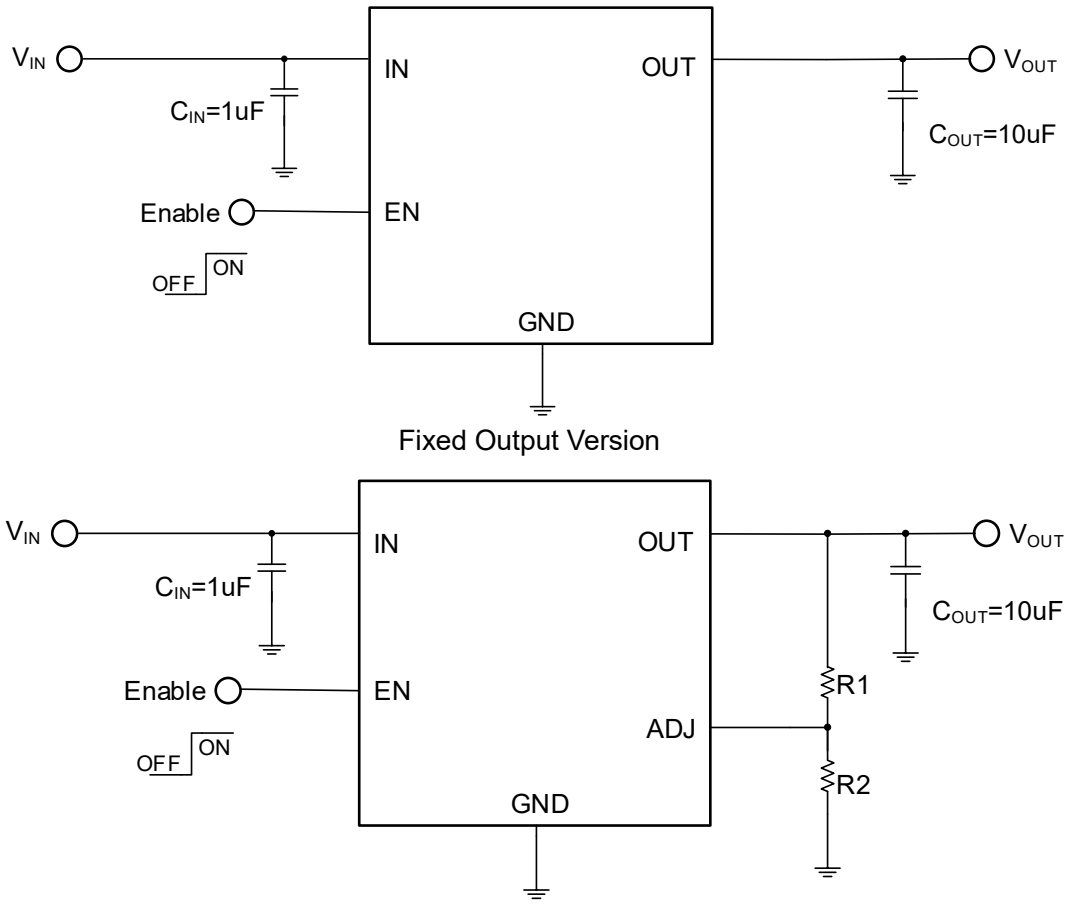
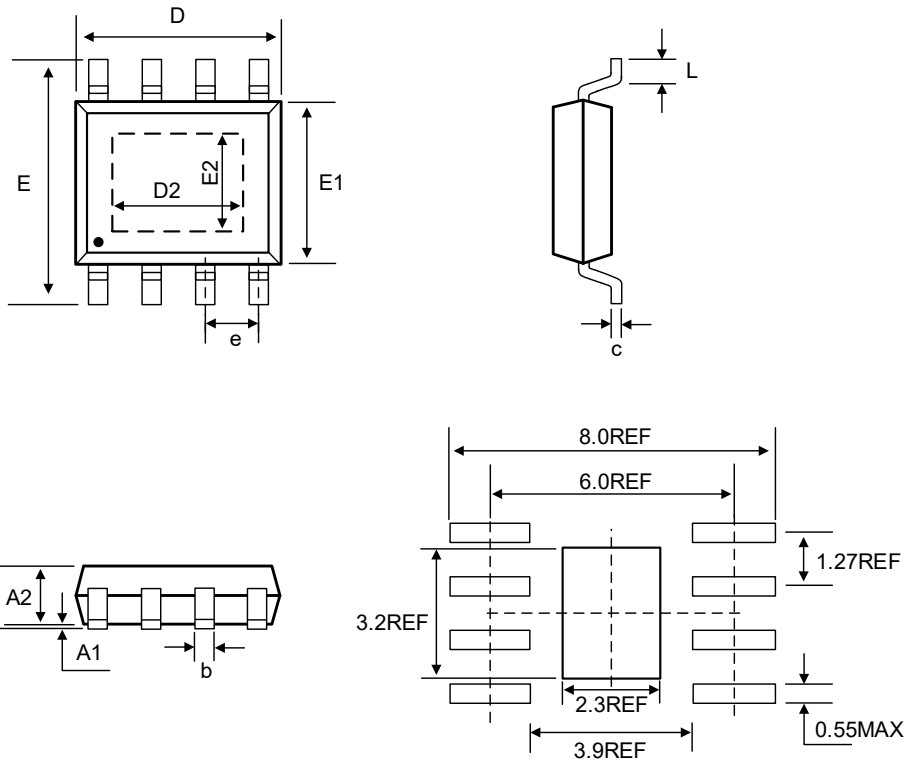


Figure4. Typical Application Circuit

Note: V_{OUT} = 0.6 × (1 + R1 / R2). R2 ≥ 100kΩ.

Package Dimension

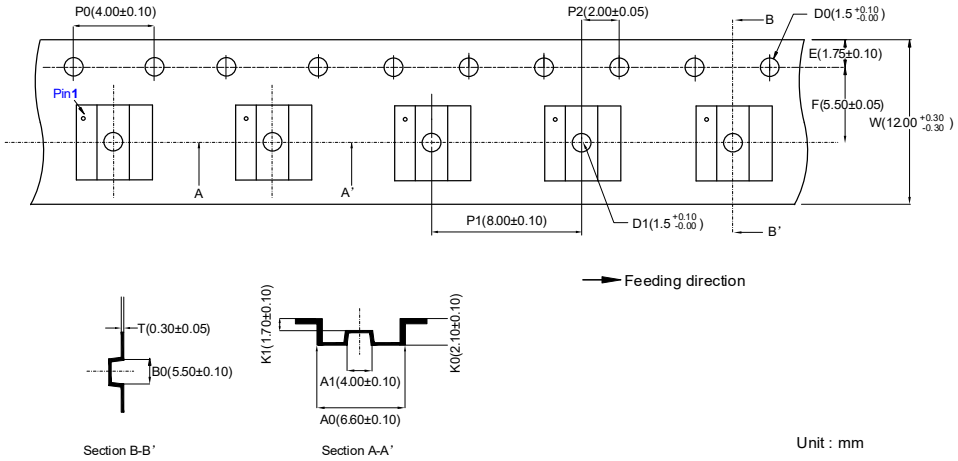


COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.90
A1	0.00	-	0.30
A2	1.20	1.40	1.60
b	0.35	-	0.51
c	0.15	-	0.27
D	4.70	4.90	5.10
E	5.80	6.00	6.20
D2	3.00	3.25	3.50
E1	3.70	3.90	4.10
E2	2.10	2.30	2.50
e	1.27BSC		
L	0.35	0.60	0.85

Tape Information



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2025-12-15	Preliminary Version	Xu tao	Yang xiaoxu	Liu jiaying
1.0	2026-03-16	Original Version	Yu yifan	Yang xiaoxu	Liu jiaying
1.1	2026-08-07	Correct Words	Xu tao	Yang xiaoxu	Liu jiaying