

## ET52H24XX - High Input Very-Low I<sub>Q</sub> 200mA LDO

### General Description

The ET52H24XX is a low dropout linear regulator that operates from 2.7V to 24V and deliver 200mA output current.

The ET52H24XX features high power supply rejection, low noise, and achieves excellent line and load transient response with a small 2.2uF ceramic output capacitor. The output noise is 8μVrms, independent of the output voltage for the fixed options of 5V or less.

ET52H24XX series are offered SOT23-6(1.6mm × 2.9mm), SOT23-5(1.6mm × 2.9mm) packages. It operates over an operating temperature range of -40°C to +125°C.

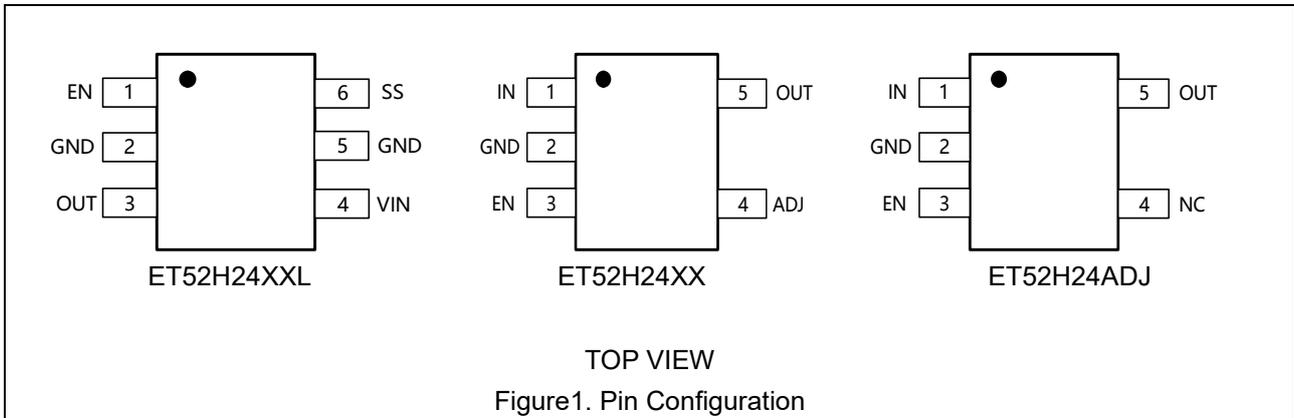
### Features

- High Input Voltage: 2.7 to 24V
- 200mA Output Current
- Fixed Output Voltage Options: 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 5V and ADJ.
- Output Voltage Accuracy: ±0.8% at +25°C
- Low Dropout Voltage: 80mV@100mA
- User-programmable Soft Start
- Low Quiescent Current: 66uA (Typ.)
- High PSRR: 90dB at 1kHz, 70dB at 100kHz, 63dB at 1MHz
- Part No. and Package Information

Part No.	Package	Packing Option	MSL
ET52H24XXL	SOT23-6(1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3
ET52H24XX	SOT23-5(1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3
ET52H24ADJ	SOT23-5(1.6mm × 2.9mm)	Tape and Reel, 3K/Reel	3

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## Pin Configuration

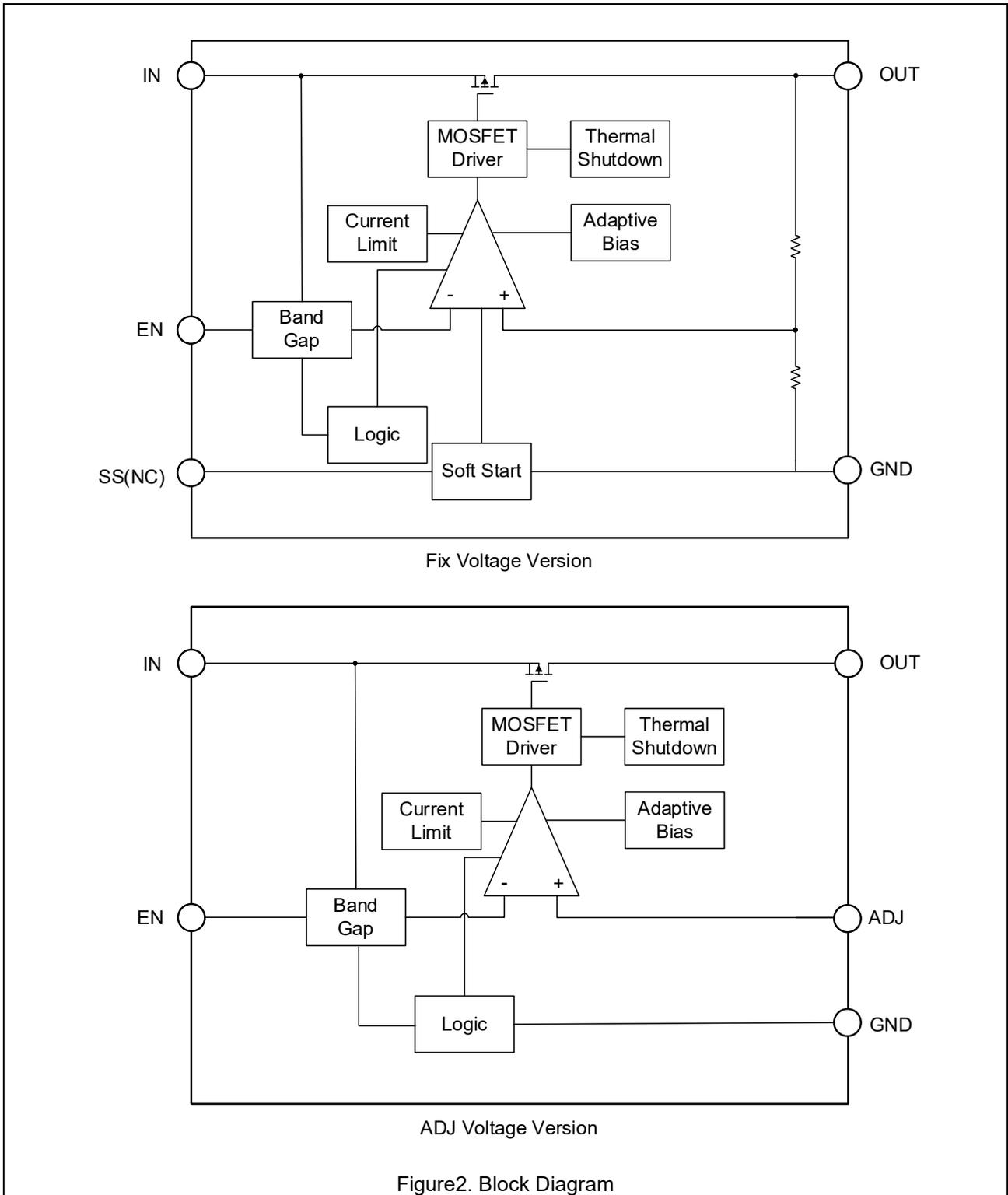


## Pin Function

Pin No.			Pin Name	Pin Function
SOT23-6	SOT23-5	SOT23-5		
XXL	XX	ADJ		
2,5	2	2	GND	Ground
4	1	1	IN	Supply Input Pin
3	5	5	OUT	Output Pin
1	3	3	EN	Enable Pin
6			SS	Soft Start Pin
	4		NC	No Connection
		4	ADJ	Output Adjust Pin

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## Block Diagram



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## Functional Description

### Input Capacitor

A 2.2uF 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 minimum output capacitance is 2.2uF. A ceramic capacitor is recommended, 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 the output capacitor as close as possible to OUT and GND pins.

### Dropout Voltage

The ET52H24XX uses a PMOS pass transistor to achieve low dropout. When  $(V_{IN} - V_{OUT})$  is less than the dropout voltage ( $V_{DO}$ ), 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.

### Low Quiescent Current

The ET52H24XX consuming only around 66µA for 12V input Voltage, provides great power saving in portable and low power applications.

### Current Limit Protection

When output current of VOUT pin is higher than current limit threshold or the VOUT pin is direct short to GND, the current limit protection will be triggered and clamp the output current at a predesigned level to prevent over-current and thermal damage.

### Soft Start

Soft start the ET52H24XX uses an internal soft start (SS pin open) to limit the inrush current when the output is enabled. The start-up time for the 5V option is approximately 340us from the time the EN active threshold is crossed to when the output reaches 90% of the final value.

$$SS_{TIME} \text{ (sec)} = t_{START-UP} \text{ at } 0pF + (0.6 \times C_{SS})/I_{SS}$$

where:  $t_{START-UP}$  at 0pF is the start-up time at  $C_{SS} = 0pF$  (typically 380us).  $C_{SS}$  is the soft start capacitor (F).  $I_{SS}$  is the soft start current (typically 1uA).

### 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.

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## Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V <sub>IN</sub>	Input Voltage <sup>(1)</sup>	-0.3~26	V
V <sub>EN</sub>	Chip Enable Input	-0.3~26	V
V <sub>OUT</sub>	Output Voltage	-0.3~26	V
T <sub>J</sub>	Maximum Junction Temperature	-40 to 150	°C
T <sub>STG</sub>	Storage Temperature	-40~150	°C
T <sub>L</sub>	Lead Temperature (Soldering, 10 sec)	200	°C
V <sub>ESD</sub>	Human Body Model Capability <sup>(2)</sup>	±8000	V
	Charged Device Model(CDM) Capability <sup>(2)</sup>	±2000	V

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.

**Note2:** HBM tested per JEDEC JS-001;

**Note3:** CDM tested per JEDEC JS-002;

## Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
R <sub>θJA</sub>	SOT23-6	Thermal Characteristics, Thermal Resistance, Junction-to-Air	200	°C/W
	SOT23-5		200	
P <sub>D</sub>	SOT23-6	Power Dissipation@25°C PCB Board Dimension: 40mm x 40mm (2layer) Copper:1OZ	600	mW
	SOT23-5		600	

## Recommended Operating Conditions

Symbol	Items	Rating	Unit
V <sub>IN</sub>	Input Voltage	2.7 to 24	V
I <sub>OUT</sub>	Output Current	0 to 200	mA
T <sub>A</sub>	Operating Ambient Temperature	-40 to 125	°C
C <sub>IN</sub>	Effective Input Ceramic Capacitor Value	2.2	μF
C <sub>OUT</sub>	Effective Output Ceramic Capacitor Value	2.2	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

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## Electrical Characteristics

( $V_{IN} = V_{OUT} + 1V$ ,  $I_{OUT} = 1mA$ ,  $C_{IN} = 2.2\mu F$ ,  $C_{OUT} = 2.2\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{IN}^{(3)}$	Input Voltage Range		2.7		24	V
$V_{OUT}$	Output Voltage Accuracy	$V_{IN} = 12V$ , $V_{OUT} = 3.3V$ , $I_{OUT} = 10mA$	-0.8		+0.8	%
IQ-on	Quiescent Current	$V_{IN} = 12V$ , No Load		66	110	$\mu A$
IQ-off	Stand by Current	$V_{IN} = 12V$ , $V_{EN} = 0V$		4		
$I_{OUT}$	Maximum Output Current			200		mA
$I_{LIM}$	Limit Current	$V_{IN} = V_{OUT} + 1V$		400		mA
Reg <sub>Line</sub>	Line Regulation	$V_{OUT} + 1 \leq V_{IN} \leq 24V$ $I_{OUT} = 1mA$		0.006		%/V
Reg <sub>LOAD</sub>	Load Regulation	$1mA \leq I_{OUT} \leq 200mA$ , $V_{IN} = V_{OUT} + 1V$ , $V_{OUT} = 3.3V$		20		mV
$V_{DROP}^{(4)}$	Dropout Voltage	$I_{OUT} = 100mA$ , $V_{OUT} = 3.3V$		80	100	mV
PSRR <sup>(5)</sup>	Power Supply Rejection Ratio	$V_{IN} = V_{OUT} + 2V$ , $f = 1kHz$ , $V_{OUT} = 3.3V$ $I_{OUT} = 10mA$		90		dB
$e_N^{(5)}$	Output Noise Voltage	$V_{IN} = V_{OUT} + 2V$ , $I_{OUT} = 10mA$ , $f = 10Hz$ to $100kHz$ ,		8		$\mu V_{rms}$
$V_{IH}$	EN Pin High Threshold Voltage	$V_{EN}$ Rising Until the Output is Enabled	1.5			V
$V_{IL}$	EN Pin Low Threshold Voltage	$V_{EN}$ Falling Until the Output is Disabled			0.4	V
$T_{ON}$	Output Turn-on Time	From $V_{EN} > V_{ENH}$ to $0.9 \times V_{OUT(NOM)}$		340		$\mu s$
$T_{TSD}$	Thermal Shutdown Temperature	Temperature Increasing from $T_A = +25^\circ C$		165		$^\circ C$
$T_{HYS}$	Thermal Shutdown Hysteresis	Temperature Falling from $T_{TSD}$		35		$^\circ C$

**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:**  $V_{DROP}$  FT test method: test the  $V_{OUT}$  voltage at  $V_{SET} + V_{DROPMAX}$  with 100mA output current.

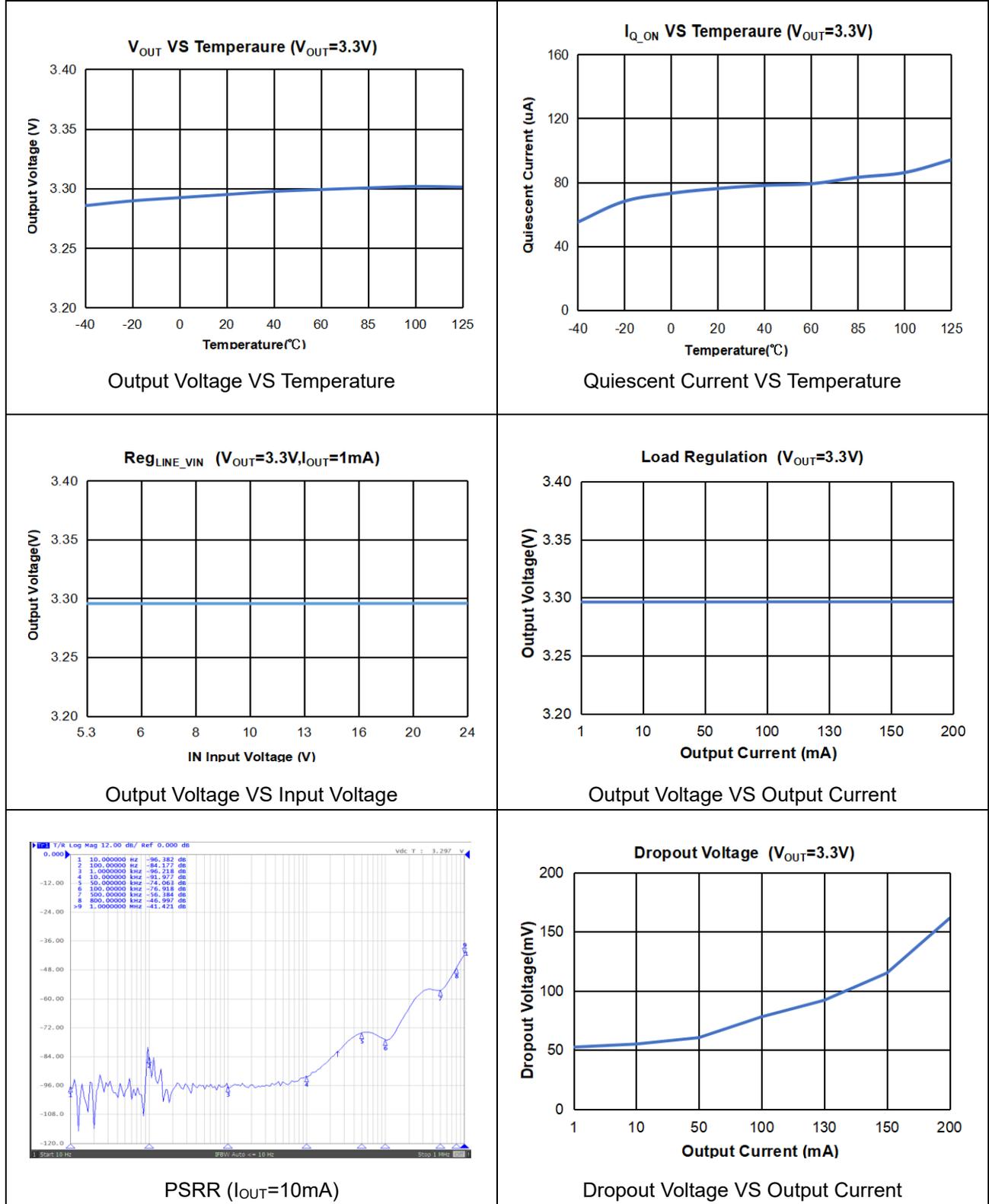
**Note5:** Guaranteed by design and characterization. not a FT item.

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## Typical Characteristics

### Voltage Version 3.3V

( $V_{IN} = 12V$ ,  $I_{OUT} = 1mA$ ,  $C_{IN} = 2.2\mu F$ ,  $C_{OUT} = 2.2\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

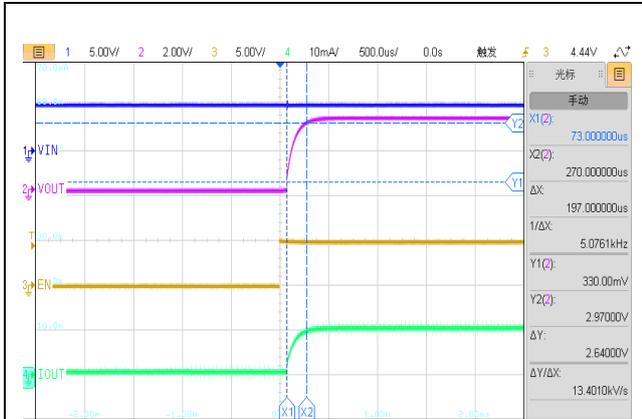


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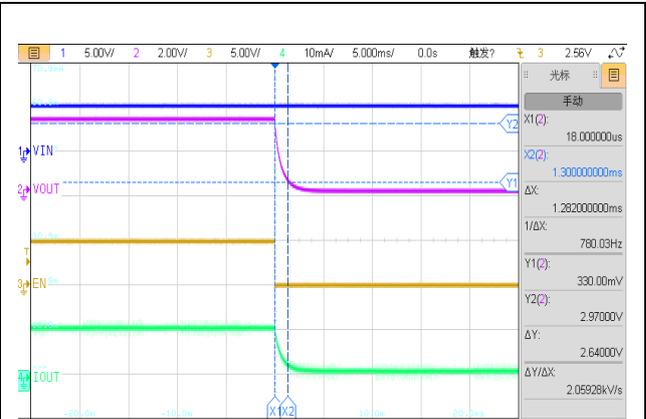
## Typical Characteristics (Continued)

### Voltage Version 3.3V

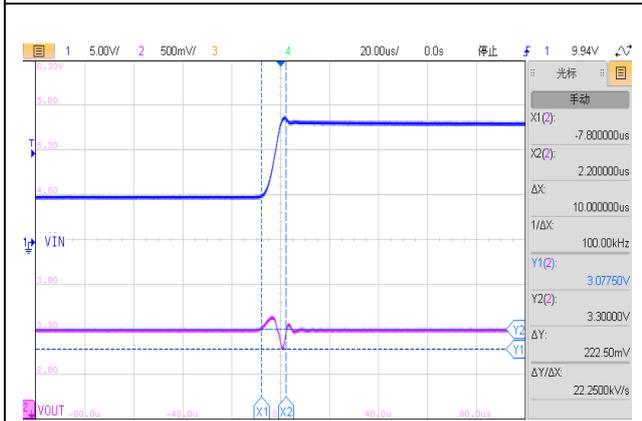
( $V_{IN} = 12V$ ,  $I_{OUT} = 1mA$ ,  $C_{IN} = 2.2\mu F$ ,  $C_{OUT} = 2.2\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)



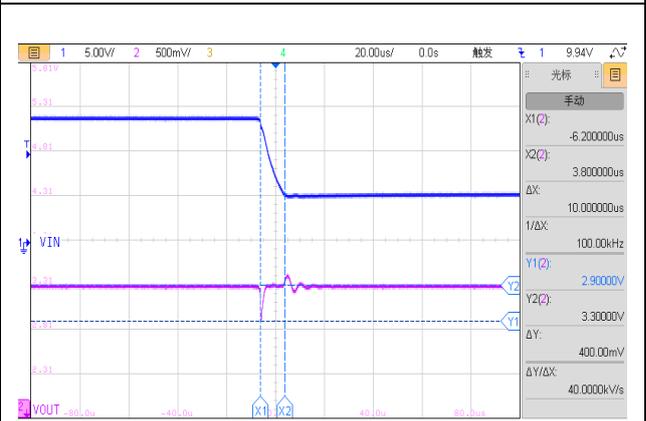
$T_{ON}$  ( $I_{OUT} = 10mA$ )



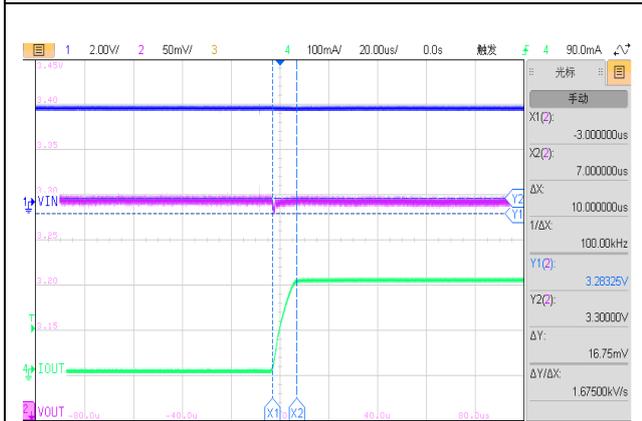
$T_{OFF}$  ( $I_{OUT} = 10mA$ )



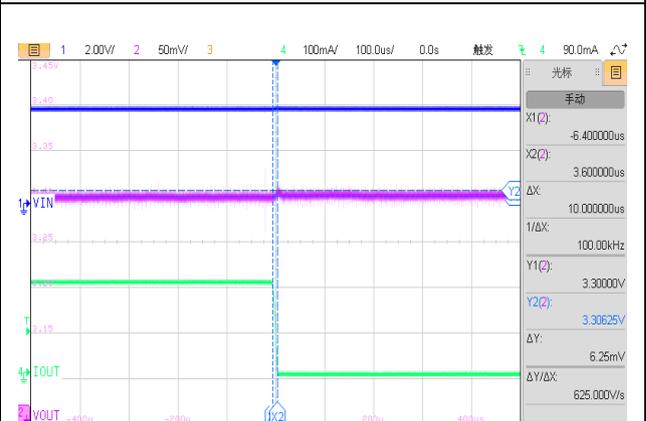
Input-Transient (5.3~13.3V,  $t_r = 10\mu s$ ,  $I_{OUT} = 1mA$ )



Input-Transient (13.3~5.3V,  $t_f = 10\mu s$ ,  $I_{OUT} = 1mA$ )



Load-Transient ( $V_{IN} = 5.3V$ ,  $I_{OUT} = 1\sim 200mA$ ,  $t_r = 10\mu s$ )



Load-Transient ( $V_{IN} = 5.3V$ ,  $I_{OUT} = 200\sim 1mA$ ,  $t_f = 10\mu s$ )

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## Application Circuits

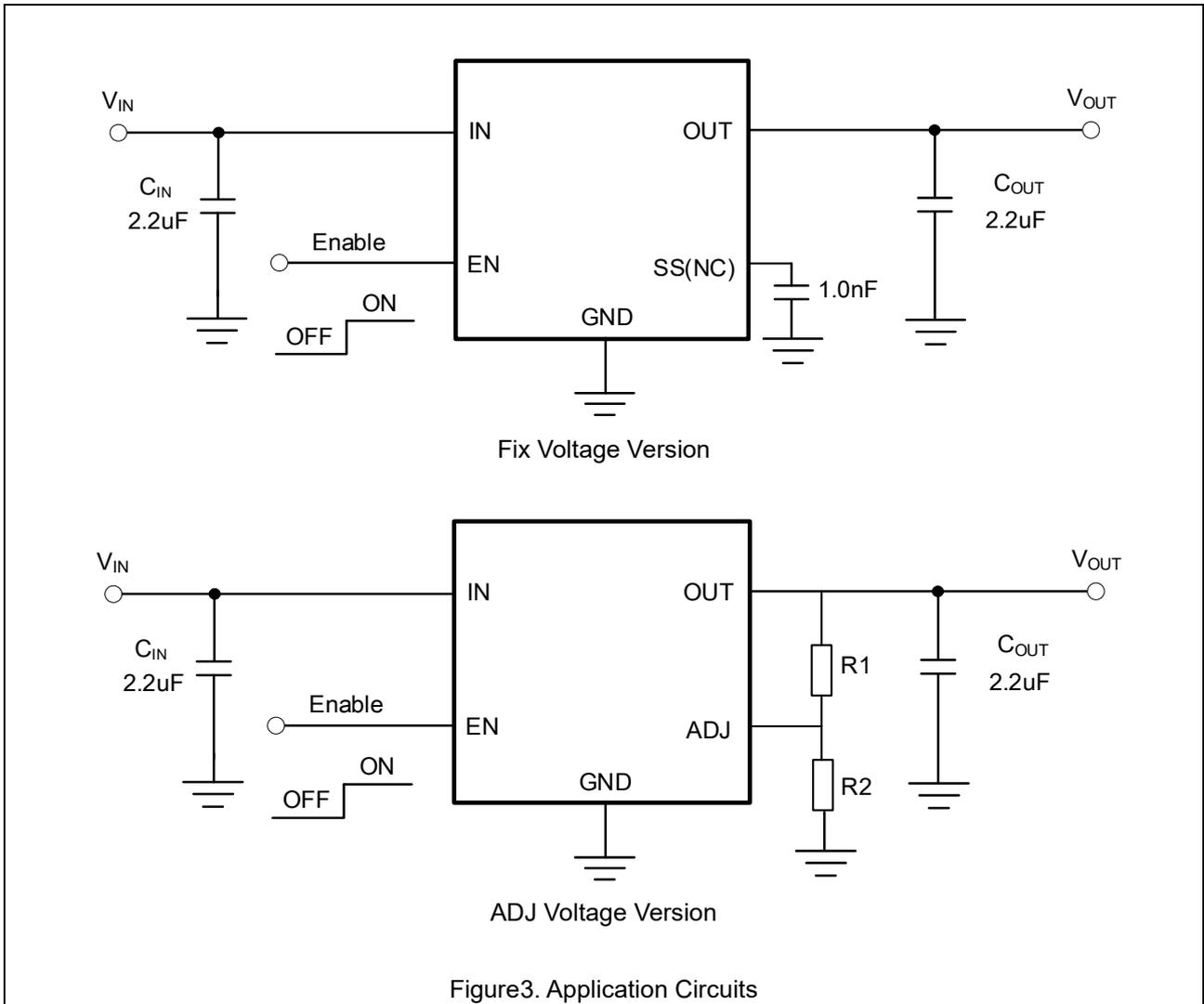
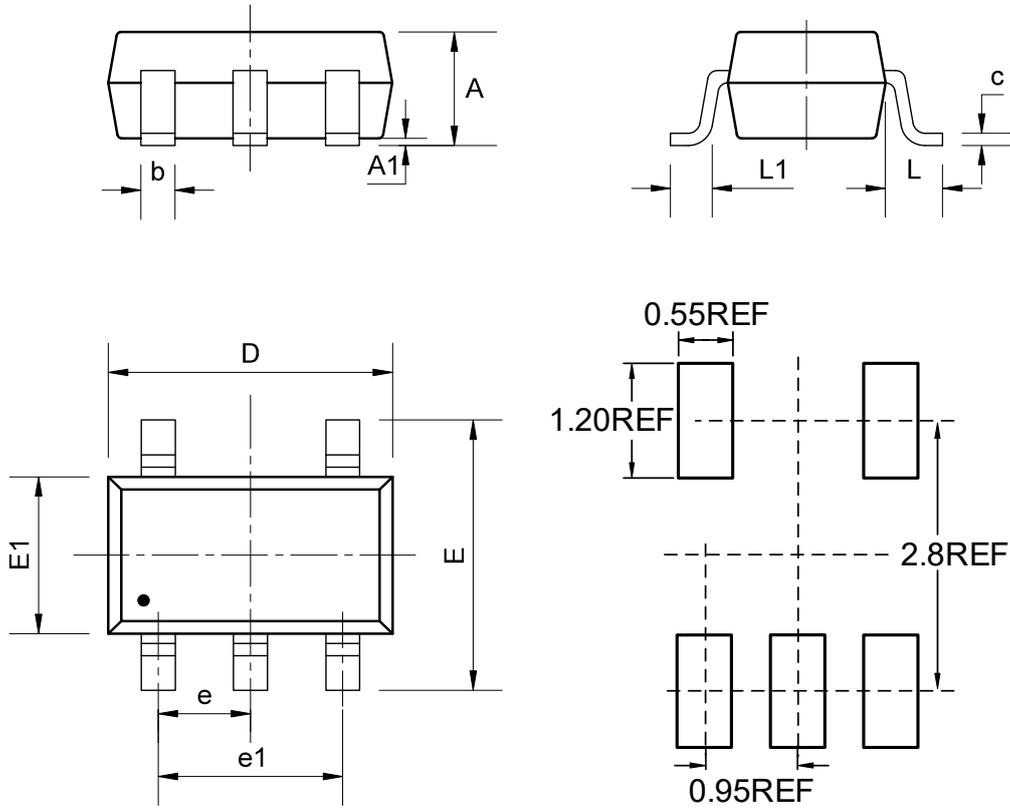


Figure3. Application Circuits

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## Package Dimension

SOT23-5(1.6mm × 2.9mm)



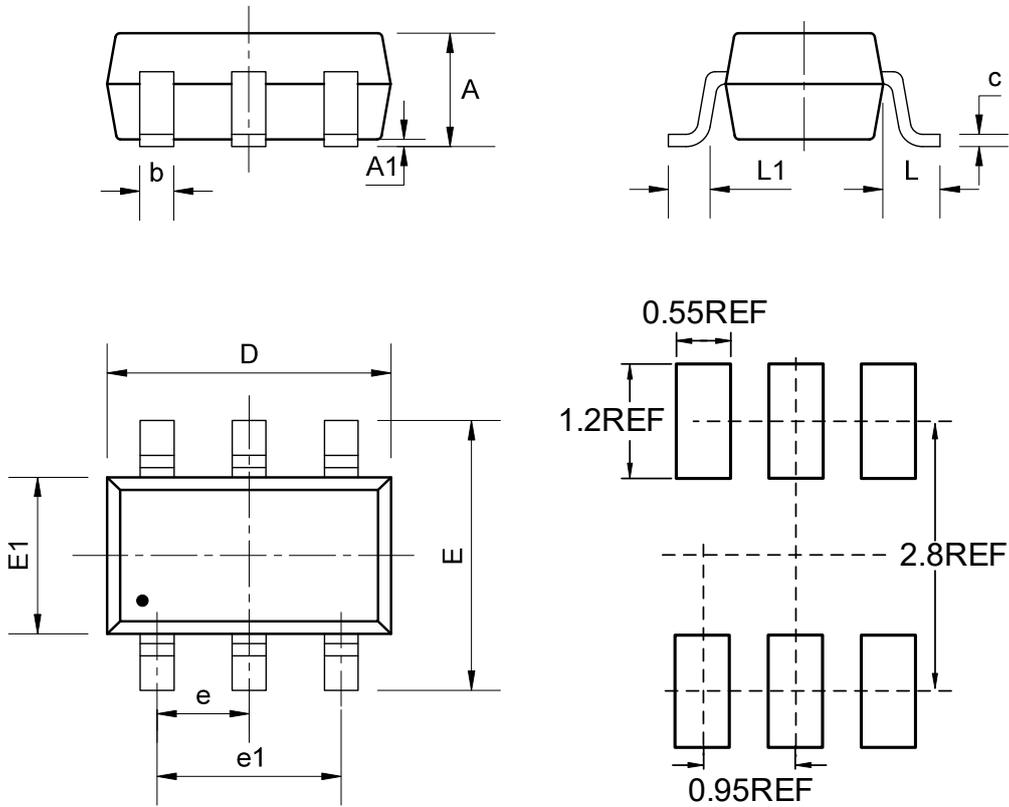
### COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.25
A1	0	-	0.15
b	0.36	-	0.50
c	0.12	-	0.20
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

# ET52H24XX

SOT23-6(1.6mm × 2.9mm)



## COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.25
A1	0	-	0.15
b	0.36	-	0.50
c	0.12	-	0.20
D	2.75	2.9	3.05
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
E	2.60	2.80	3.00
E1	1.45	1.6	1.75
L	0.60REF		
L1	0.30	0.45	0.60

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## Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2025-11-04	Official Version	Huchengyu	Yangxiaoxu	Yangxiaoxu