

ETQ6H450 - High Input Low IQ 200mA LDO

General Description

ETQ6H450 is the 5.0V output high input very low I_Q 200mA LDO , it has multiple protections and good heat dissipation effect.

The ETQ6H450 is available in both SOP8 and ESOP8 package options, and operates over an ambient temperature range of -40°C to +125°C.

Features

- Wide Input Voltage Range from 3.0V to 36V
- Fixed Output Voltage 5.0V
- Up to 200mA Load Current
- Very Low I_Q is 4.8μA Typical
- Low Dropout is 600mV @V_{OUT}=5.0V I_{OUT}=200mA
- Excellent Load/Line Transient Response
- High Ripple Rejection: 70dB at 1KHz
- Built-In Over-Current Protection and Thermal Shutdown Circuit
- Built-In Auto-Discharging Circuit
- Built-In Under Voltage Lock-Out
- Automotive AEC-Q100 Grade 1 Qualified
 - Ambient temperature range of -40°C to +125°C
 - ESD HBM 4kV PASS, tested per AEC-Q100-002(EIA/JESD22-A114)
 - ESD CDM 1.5kV PASS, tested per AEC-Q100-011(EIA/JESD22-C101)

Device information

ETQ 6H4 50 X

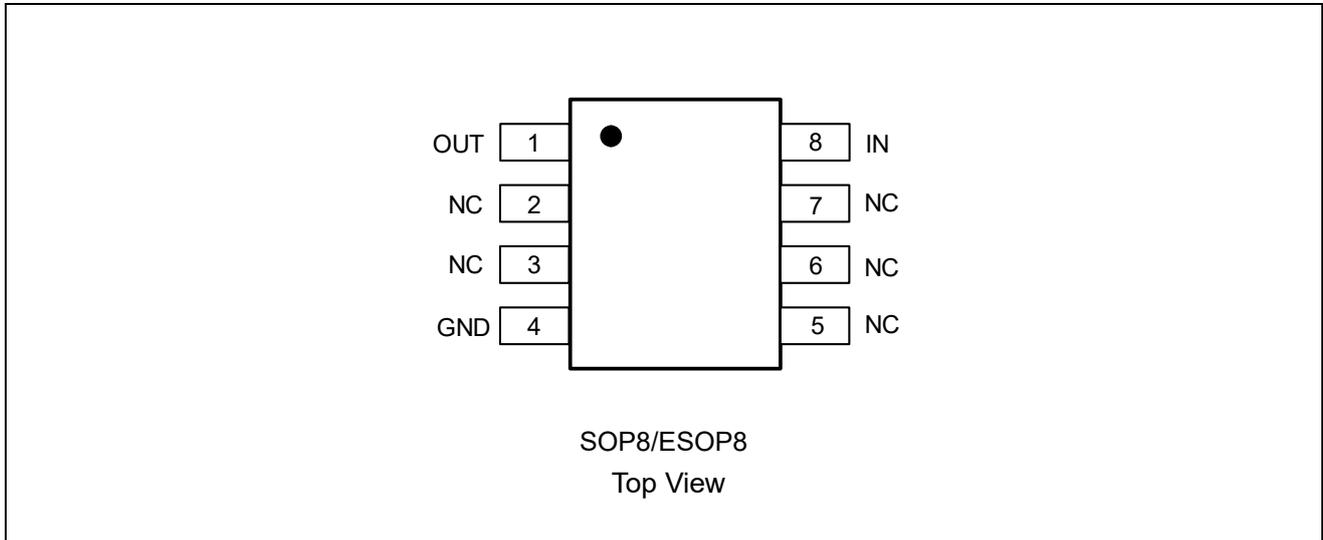
<u>50</u>	Output Voltage	<u>X</u>	Package	Packing Option	MSL Level
50	5.0V Output Voltage	M	SOP8	Tape and Reel,4K	MSL3
		M1	ESOP8	Tape and Reel,4K	MSL3

Applications

- Automotive Constant-Voltage Power Supply
- Automotive Infotainment and Cluster

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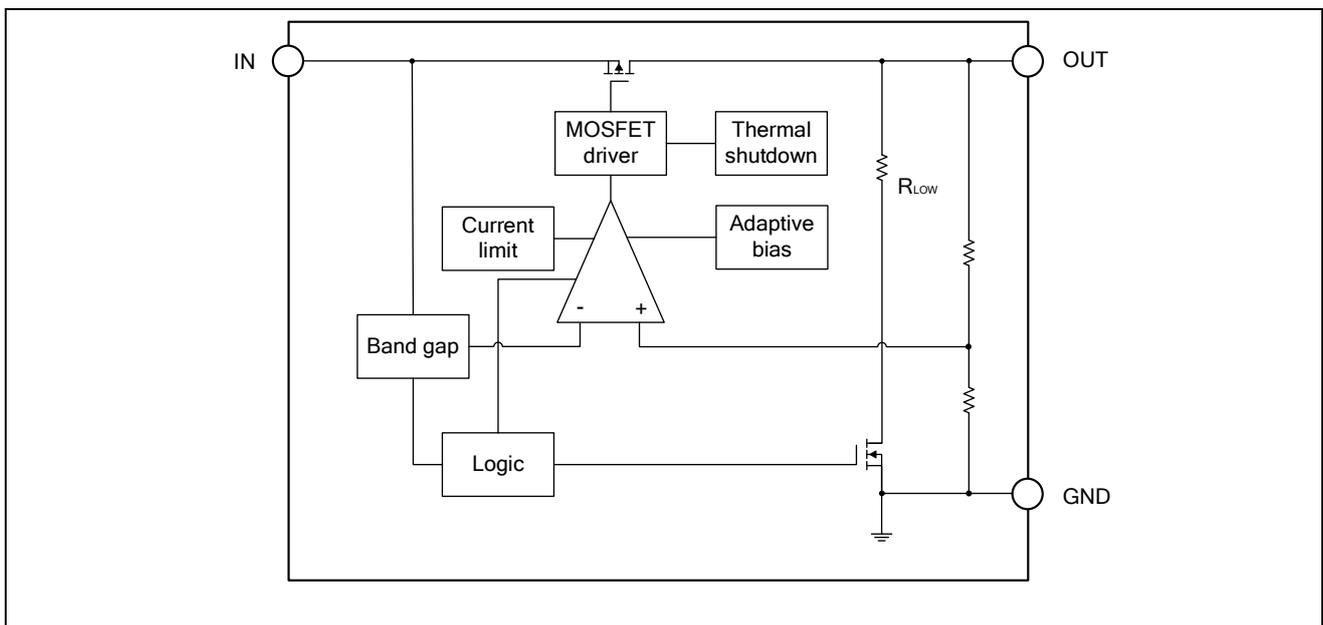
Pin Configuration



Pin Function

Pin Name	Pin Function	
1	OUT	Output Pin
2,3,5,6,7	NC	No Connect
4	GND	Ground Pin
8	IN	Input Pin

Block Diagram



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Functional Description

Input Capacitor

A 1 μ F~10 μ F ceramic capacitor is recommended to connect between V_{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 V_{IN} and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1 μ F to 10 μ F, Equivalent Series Resistance (ESR) is from 5m Ω to 100m Ω , 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 V_{OUT} and GND pins.

Dropout Voltage

The ETQ6H450 uses a PMOS pass transistor to achieve low dropout. When ($V_{IN} - V_{OUT}$) is less than the dropout voltage (V_{DROPO}), 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_{DROPO} 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.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 150 $^{\circ}$ C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125 $^{\circ}$ 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 $^{\circ}$ 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 conditions the maximum junction temperature is 150 $^{\circ}$ C and T_A is the ambient temperature. The junction to ambient thermal resistance (θ_{JA}) is layout dependent.

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Current-Limit Protection

The ETQ6H450 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.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V _{IN}	Input Voltage	-0.3~45	V
V _{OUT}	Output Voltage	-0.3~6	V
T _{J(MAX)}	Maximum Junction Temperature	150	°C
T _{STG}	Storage Temperature	-65~150	°C
V _{ESD}	HBM per AEC-Q100-002(EIA/JESD22-A114)	±4000	V
	CDM per AEC-Q100-011(EIA/JESD22-C101)	±1500	V
I _{LU}	Latch up Current Maximum Rating per AEC-Q100-004(EIA/JESD78E)	±200	mA

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
R _{θJA}	SOP8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	156	°C/W
	ESOP8		TBD	°C/W
P _D	SOP8	Max Power Dissipation @25°C	0.8	W
	ESOP8		TBD	W

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V _{IN}	Input Voltage	3.0 to 36	V
I _{OUT}	Output Current	0 to 200	mA
T _A	Operating Ambient Temperature	-40 to 125	°C
C _{IN}	Effective Input Ceramic Capacitor Value	1 to 10	μF
C _{OUT}	Effective Output Ceramic Capacitor Value	1 to 10	μF
ESR	Input and Output Capacitor Equivalent Series Resistance (ESR)	5 to 100	mΩ

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Electrical Characteristics

($V_{IN} = 7.0V$, $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, $T_A = -40^{\circ}C \sim +125^{\circ}C$, unless otherwise noted. Typical values are at $T_A = +25^{\circ}C$.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{IN}^{(1)(4)}$	Operating Input Voltage		3.0		36	V
V_{UVLO}	Under Voltage Lock Out	V_{IN} Rising	2.0	2.2	2.4	V
V_{OUT}	Output Voltage	$T_A = +25^{\circ}C$	-2%		+2%	V
		$-40^{\circ}C \leq T_A \leq 125^{\circ}C$, $I_{OUT} = 1mA$				
I_{Q_ON}	Quiescent Current	$V_{IN} = 7.0V$, $I_{OUT} = 0mA$		4.8	11	μA
		$V_{IN} = 36V$, $I_{OUT} = 0mA$		6.0	17	
Reg_{LINE}	Line Regulation	$V_{IN} = 7.0V$ to $36V$, $I_{OUT} = 10mA$		0.02	0.20	%/V
Reg_{LOAD}	Load Regulation	$V_{IN} = 7.0V$, $1mA \leq I_{OUT} \leq 200mA$		30	60	mV
$V_{DROP}^{(2)}$	Dropout Voltage	$I_{OUT} = 200mA$		600	1100	mV
I_{LIMIT}	Current Limit	$V_{IN} = 7.0V$, V_{OUT} falling to 90%	200	400	800	mA
I_{SHORT}	Short Current Limit	$V_{IN} = 7.0V$	30	85	155	mA
$PSRR^{(3)}$	Power Supply Rejection Ratio	$f = 1kHz$, $V_{IN} = 7.0V$, $I_{OUT} = 30mA$, $T_A = 25^{\circ}C$	50	70		dB
$e_N^{(3)}$	Output Noise Voltage	$V_{IN} = 7.0V$, $I_{OUT} = 30mA$, $f = 10Hz$ to $100kHz$, $C_{OUT} = 1\mu F$		160	240	μV_{rms}
$V_{TRLN}^{(3)}$	Line Transient	$V_{IN} = 7.0V$ to $10V$ in $10\mu s$, $V_{OUT} = 5.0V$, $I_{OUT} = 1mA$, $T_A = 25^{\circ}C$		5	30	mV
		$V_{IN} = 10V$ to $7.0V$ in $10\mu s$, $V_{OUT} = 5.0V$, $I_{OUT} = 1mA$, $T_A = 25^{\circ}C$		5	30	
$V_{TRLD}^{(3)}$	Load Transient	$I_{OUT} = 1mA$ to $200mA$ in $10\mu s$, $V_{IN} = 7.0V$, $V_{OUT} = 5.0V$, $T_A = 25^{\circ}C$		75	120	mV
		$I_{OUT} = 200mA$ to $1mA$ in $10\mu s$, $V_{IN} = 7.0V$, $V_{OUT} = 5.0V$, $T_A = 25^{\circ}C$		85	140	
$T_{TSD}^{(3)}$	Thermal Shutdown Threshold	Temperature Increasing from $T_A = +25^{\circ}C$		150		$^{\circ}C$
$T_{HYS}^{(3)}$	Thermal Shutdown Hysteresis	Temperature Falling from T_{TSD}		25		$^{\circ}C$

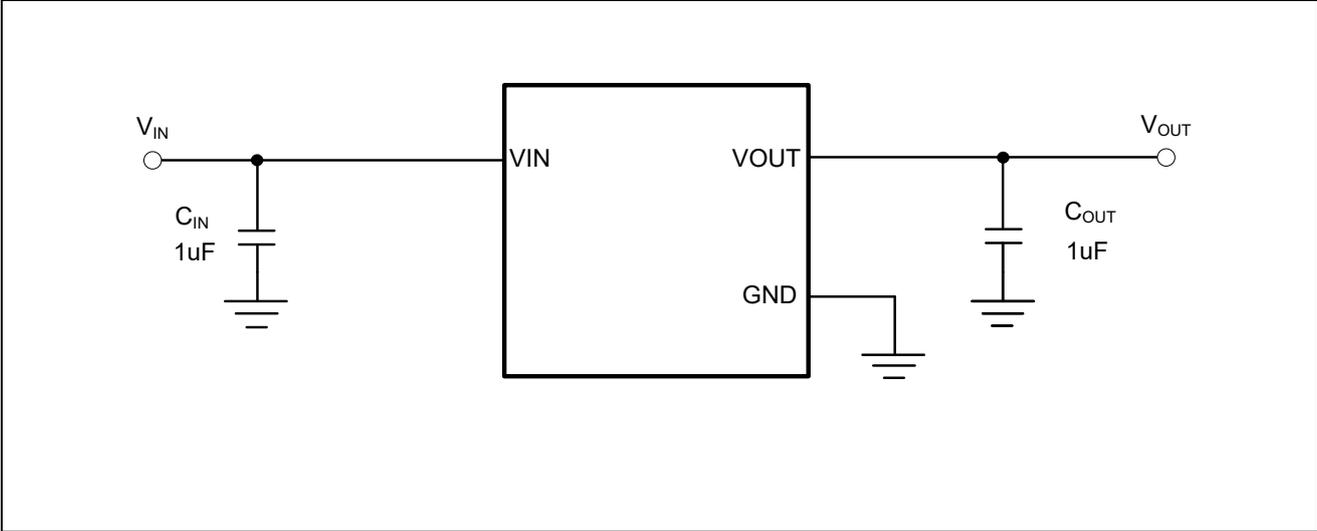
Note1. Here V_{IN} means internal circuit can work normal. If $V_{IN} < V_{OUT}$, Output voltage follows $V_{IN}(I_{OUT} = 1mA)$, circuit is safety.

Note2. V_{DROP} FT test method: test the V_{OUT} voltage at $V_{SET} + V_{DROPMAX}$ with 200mA output current.

Note3. Guaranteed by design and characterization. not a FT item.

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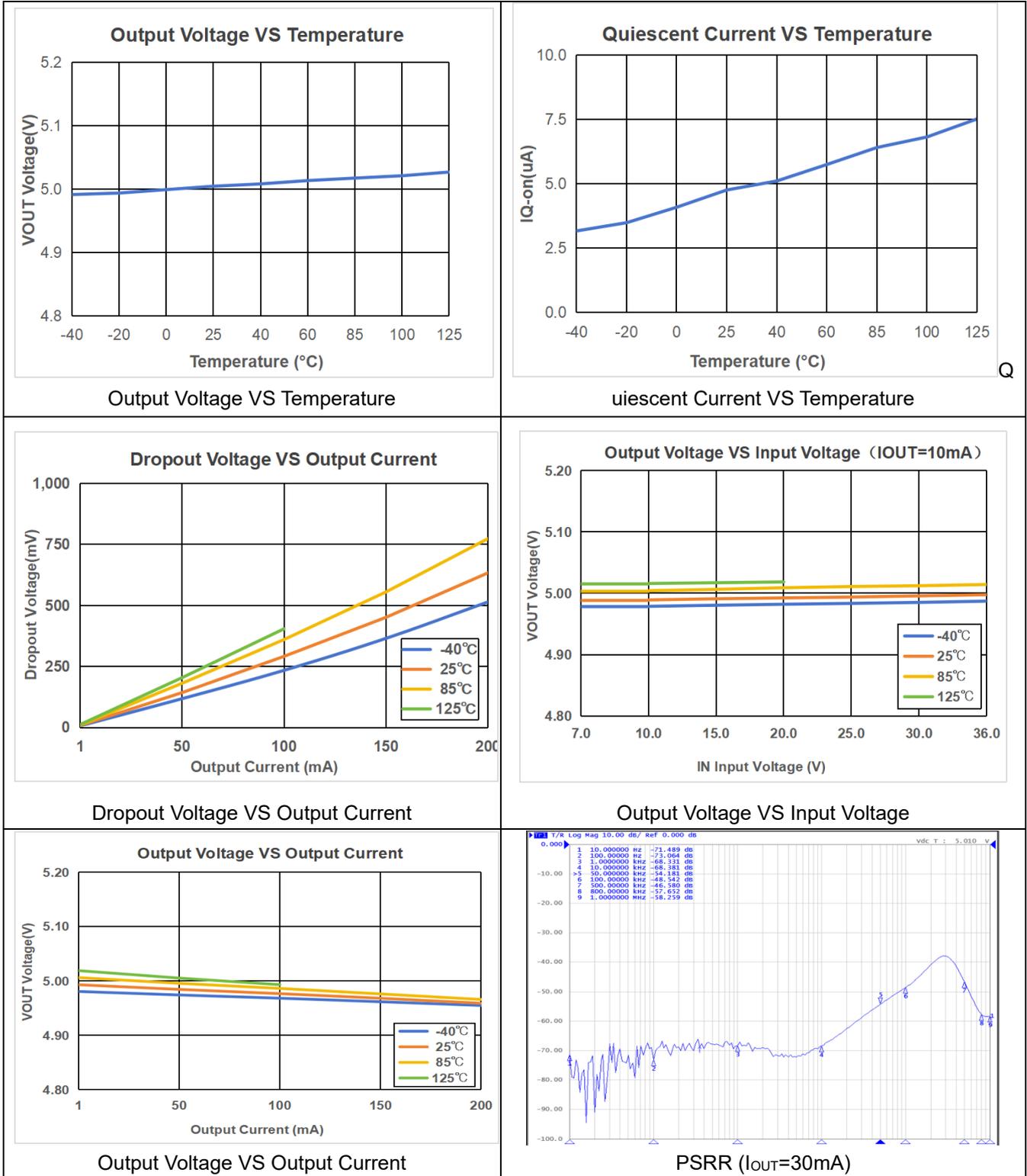
Application Circuits



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Typical Characteristics

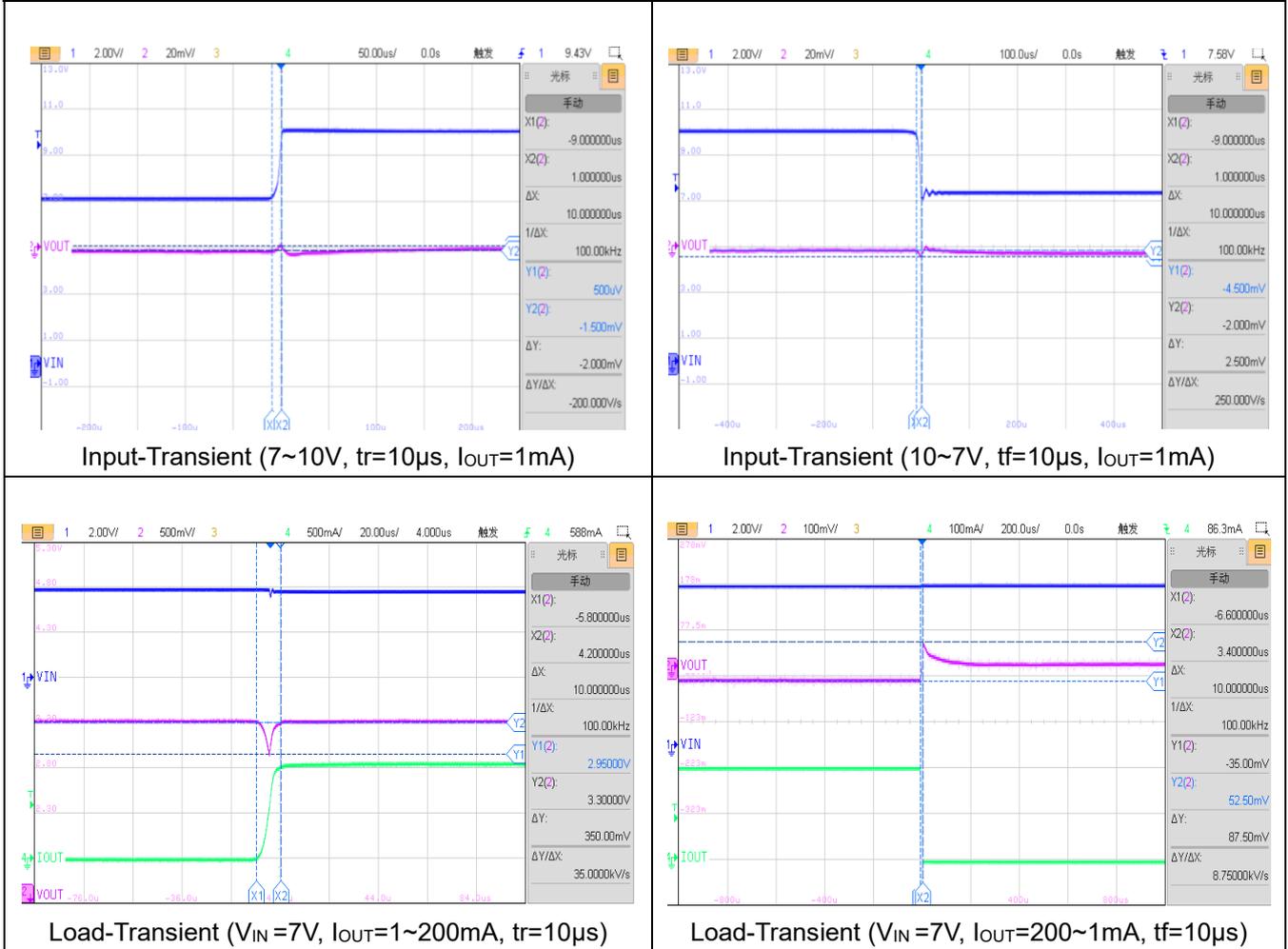
($V_{OUT}=5V$, C_{IN} = Ceramic $1.0\mu F$, C_{OUT} = Ceramic $1.0\mu F$, $T_A= 25^\circ C$)



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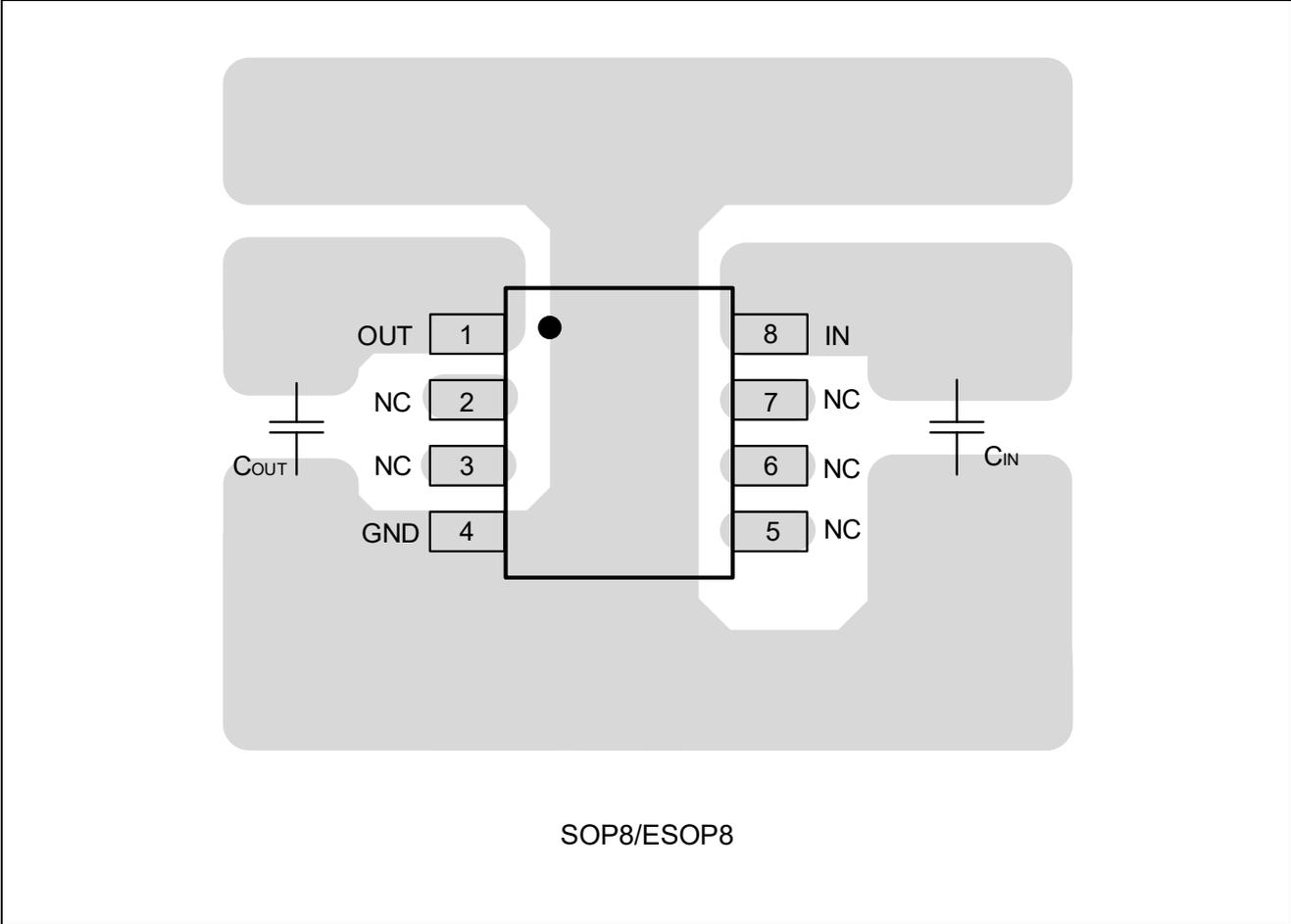
Typical Characteristics (Continued)

($V_{OUT}=5V$, C_{IN} = Ceramic $1.0\mu F$, C_{OUT} = Ceramic $1.0\mu F$, $T_A=25^\circ C$)



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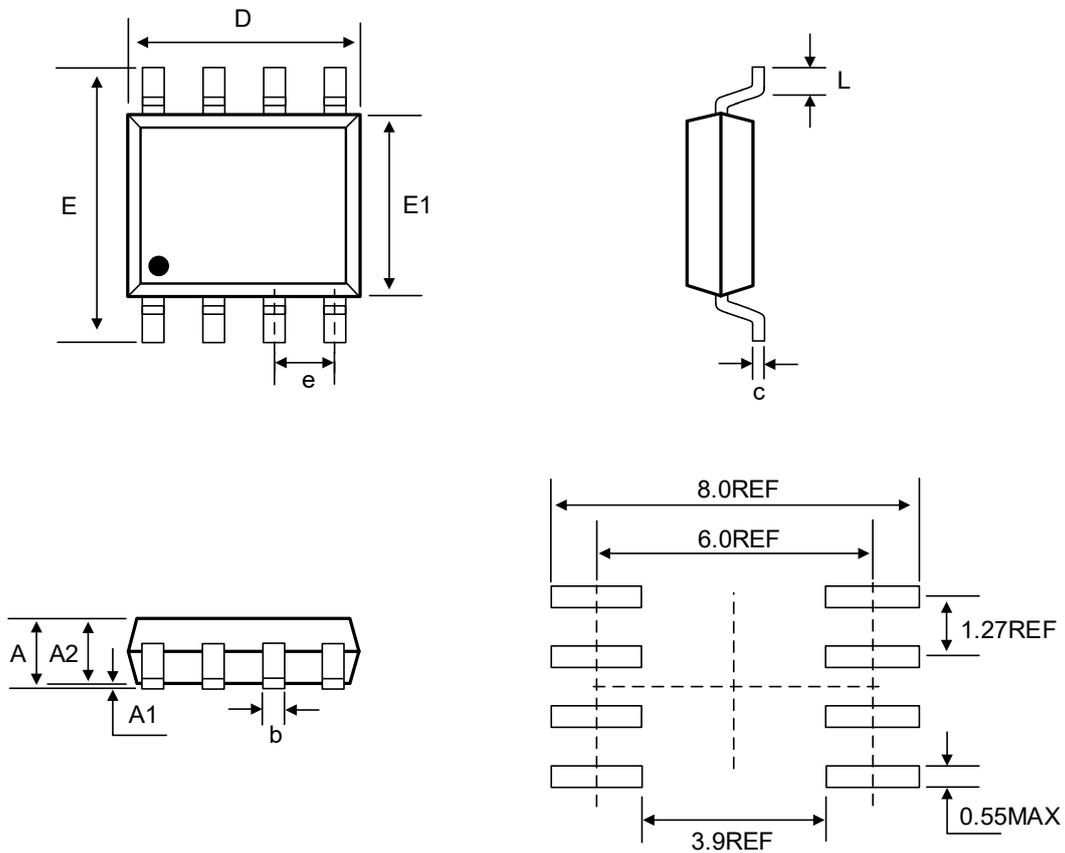
PCB Layout Guide



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Package Dimension

SOP8



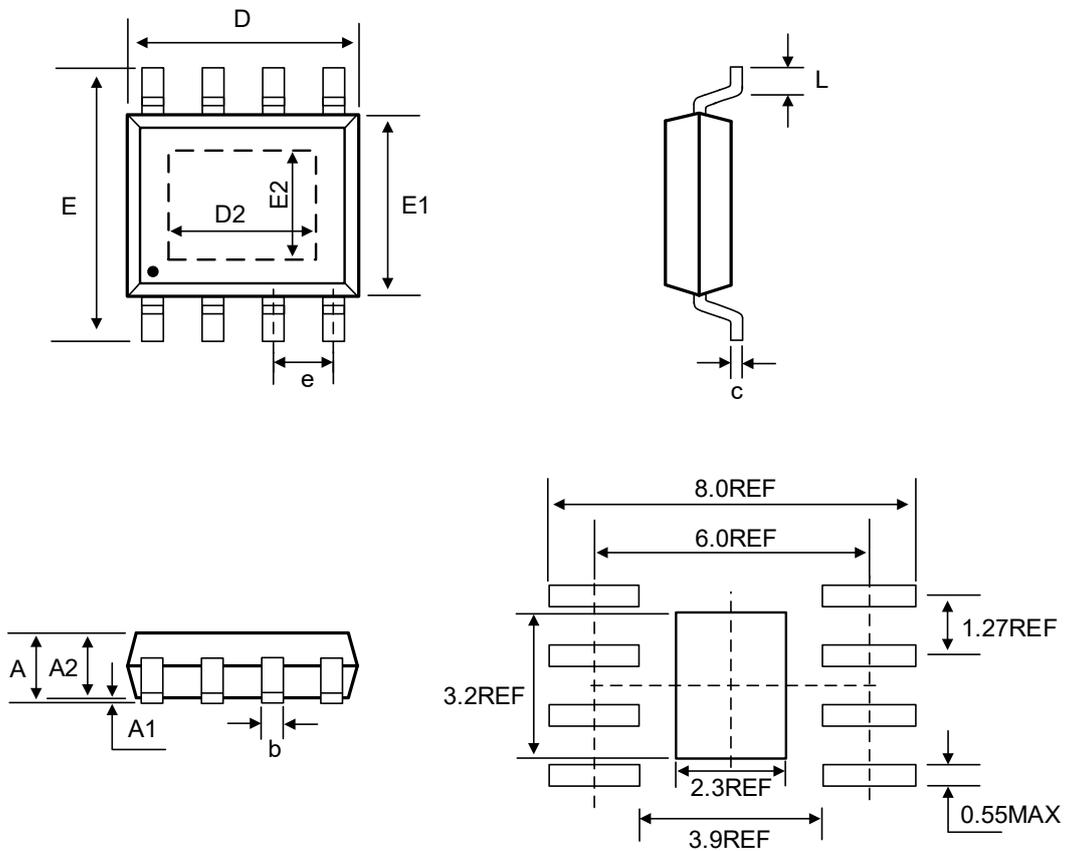
COMMON DIMENSIONS

(Unit: mm)

SYMBOL	MIN	NOM	MAX
A	-	-	1.90
A1	0.00	-	0.30
A2	1.20	1.40	1.60
b	0.35	-	0.47
c	0.15	-	0.27
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.35	0.60	0.85

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ESOP8



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	-	0.47
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

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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2025-9-4	Official Version	Hucy	Yangxx	Liuju