

ETQ5H5XXC - High Input Very-Low I_Q 300mA LDO

General Description

ETQ5H5XXC is the high input very low I_Q 300mA LDO with enable function, the very-low consumption of type 2.8μA ensures long battery life and dynamic transient boost feature improves device transient response for automotive device applications.

ETQ5H5XXC offered SOT89-5 package and operates over an ambient temperature range of -40°C to +125°C.

Features

- Wide input voltage range from 3.0V to 40V
- Up to 300mA Load Current
- Very low I_Q is 2.8μA typical
- Fixed Output Voltage are 1.8V, 3.0V, 3.3V, 3.6V, 5.0V, 6.0V, 7.0V, 8.0V, 9.0V, 12V, etc
- Low dropout is 1000mV at 300mA Load @V_{OUT}=3.0~13V
- Excellent load/line transient response
- High Ripple Rejection: 52dB at 1KHz
- Automotive AEC-Q100 Grade 1 Qualified
- Ambient temperature range of -40°C to +125°C.
- Part No. and package

Part No.	Package	Packing Option	MSL
ETQ5H5XXC	SOT89-5	Tape and Reel, 1K/Reel	1

Application

- Automotive device power supply
- Automotive infotainment and cluster

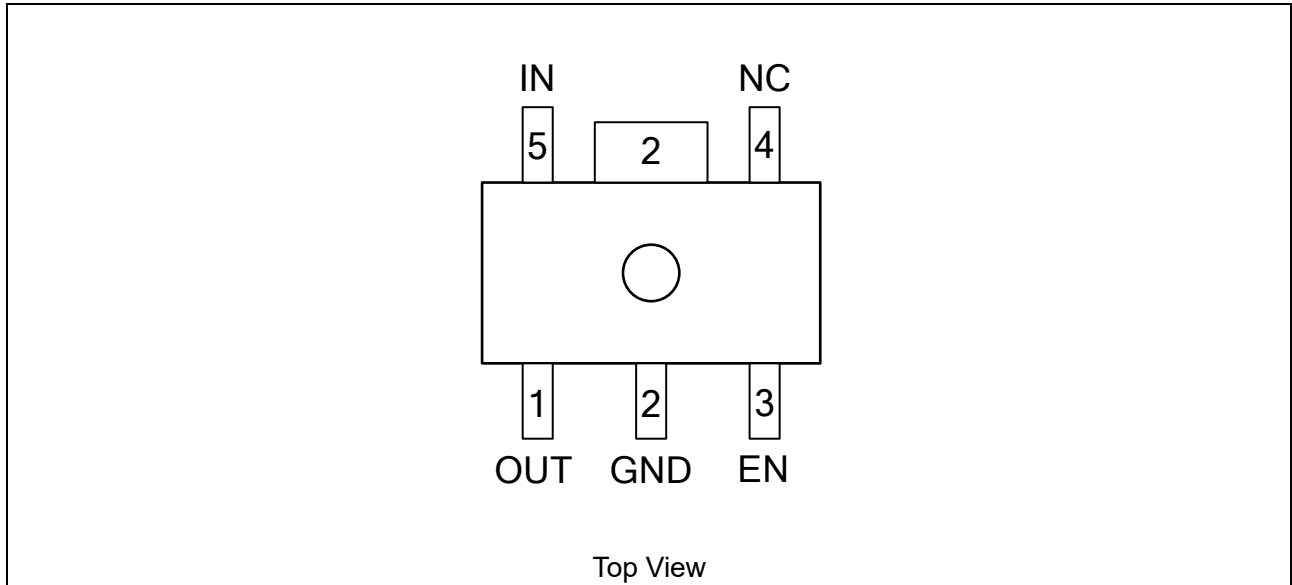
Device Information

ET Q 5H5 XX C

<u>Q</u> AEC-Q100		<u>XX</u> Output Voltage		<u>C</u> Package	
Q	Automotive AEC-Q100 Qualified	XX	X.XV Output Voltage For example, 50 is 5.0V output	C	SOT89-5

ETQ5H5XXC

Pin Configuration

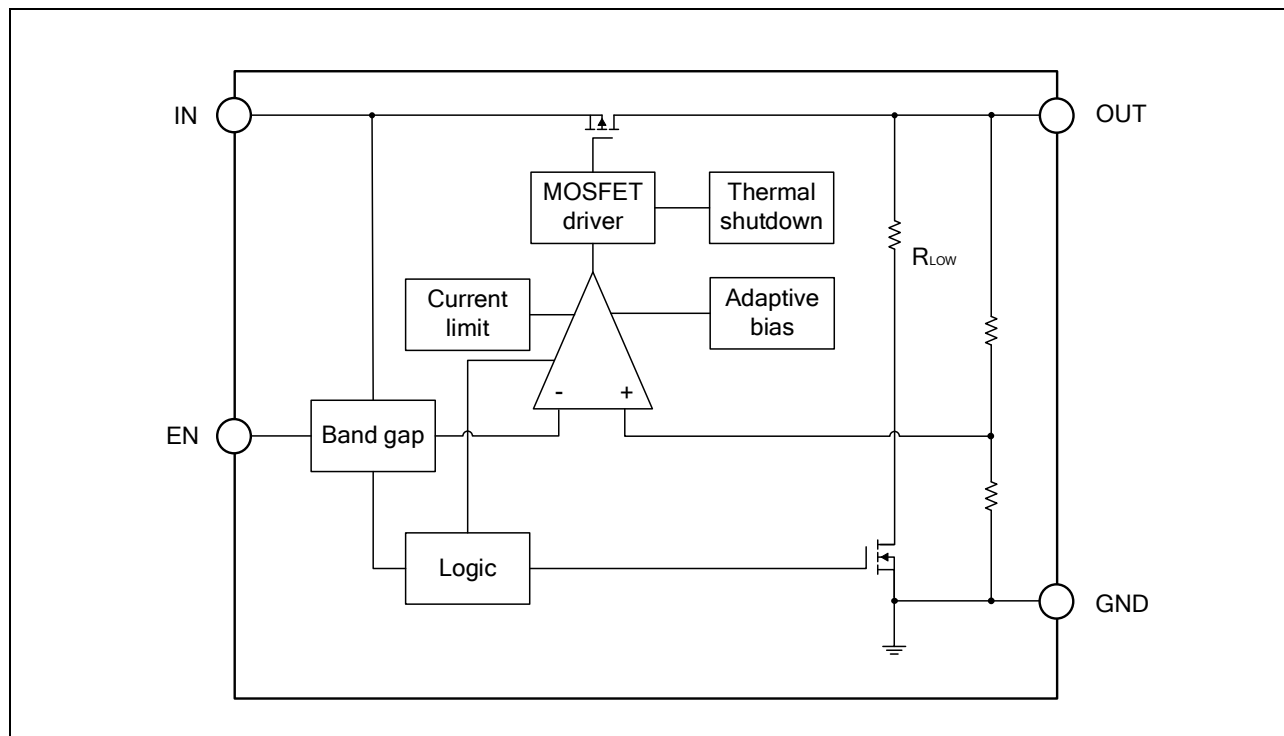


Pin Function

Pin No.	Pin Name	Pin Function
1	OUT	Output pin.
2	GND	Ground pin.
3	EN	Enable control input, active high.
4	NC	No connection.
5	IN	Supply input pin.

ETQ5H5XXC

Block Diagram



Functional Description

Input Capacitor

A 1 μ F~10 μ F 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 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 OUT and GND pins.

Enable

The ETQ5H5XXC delivers 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

The ETQ5H5XXC 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.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C. Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°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. The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, θ_{JA} .

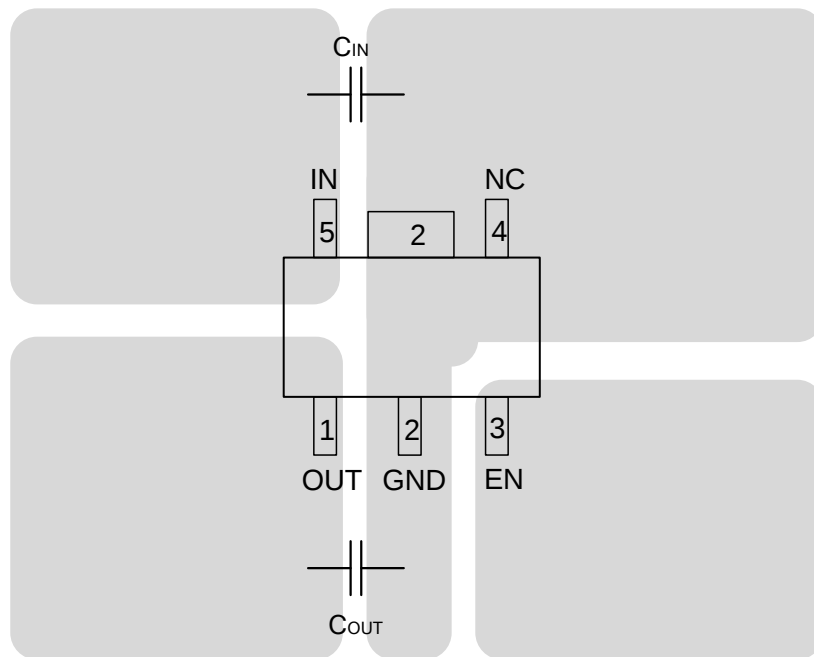
ETQ5H5XXC

Current-Limit Protection

The ETQ5H5XXC 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.



ETQ5H5XXC

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V _{IN} ⁽¹⁾	Input Voltage	-0.3~50	V
V _{OUT}	Output Voltage	0.8~15	V
V _{EN}	Chip Enable Input	-0.3~50	V
T _{JMAX}	Maximum Junction Temperature	150	°C
T _{STG}	Storage Temperature	-65~150	°C
V _{ESD} ⁽²⁾	HBM Capability	±2000	V
	CDM Capability	±1500	V
I _{LU} ⁽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.

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

HBM tested per AEC-Q100-002(EIA/JESD22-A114);

CDM tested per AEC-Q100-011(EIA/JESD22-C101);

Latch up Current Maximum Rating tested per AEC-Q100-004(EIA/JESD78E).

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
R _{θJA}	SOT89-5	Thermal Characteristics, Thermal Resistance, Junction-to-Air	80	°C/W
P _D	SOT89-5	Power Dissipation@25°C, PCB board dimension: 40mm x 40mm (2layer) Copper :1OZ	1500	mW

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V _{IN}	Input Voltage	3.0 to 40	V
I _{OUT}	Output Current	0 to 300	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	5 to 100	mΩ

ETQ5H5XXC

Electrical Characteristics

($V_{IN} = V_{OUT} + 2V$; $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{IN}^{(3)}$	Operating Input Voltage		3.0		40	V
V_{OUT}	Output Voltage	$T_A = +25^\circ C$	- 1.5%		+1.5%	V
		$-40^\circ C \leq T_A \leq 125^\circ C$	-2%		+2%	
I_Q	Quiescent Current	$I_{OUT} = 0mA$		2.8	6.5	μA
I_{Q_OFF}	Standby Current	$V_{EN} = 0V$, $T_A = 25^\circ C$			1	μA
$Line_{REG}$	Line Regulation	$V_{IN} = V_{OUT} + 1V$ to $40V$, $I_{OUT} = 10mA$ ($\Delta V_{OUT} / \Delta V_{IN} / V_{OUT}$)		40	90	mV
$V_{DROP}^{(4)}$	Dropout Voltage $I_{OUT} = 300mA$	$V_{OUT} = 1.8V$, $T_A = 25^\circ C$		950	1450	mV
		$V_{OUT} = 3.0 \sim 13V$, $T_A = 25^\circ C$		1000	1500	
$Load_{REG}$	Load Regulation	$1mA \leq I_{OUT} \leq 300mA$, $V_{IN} = V_{OUT} + 2V$		90	180	mV
I_{LMT}	Current Limit	$V_{IN} = V_{OUT} + 2V$		450	800	mA
I_{SHORT}	Short Current Limit	$V_{OUT} = 0V$		55	120	mA
V_{ENH}	EN Pin Threshold Voltage	EN Input Voltage "H"	1.4			V
V_{ENL}	EN Pin Threshold Voltage	EN Input Voltage "L"			0.4	V
I_{EN}	EN Pin Current	$V_{EN} = 0 \sim 40V$		1		μA
$PSRR^{(5)}$	Power Supply Rejection Ratio	$f = 1 kHz$, $V_{IN} = V_{OUT} + 2V$ $I_{OUT} = 20mA$		52		dB
$e_N^{(5)}$	Output Noise Voltage	$V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 1mA$, $f = 10Hz$ to $100KHz$, $C_{OUT} = 1\mu F$		30* V_{OUT}		μV_{rms}
t_{ON}	Turn-On Time	From assertion of V_{EN} to $V_{OUT} = 90\% V_{OUT(NOM)}$		1		ms
$T_{SD}^{(5)}$	Thermal Shutdown Temperature	Temperature Increasing from $T_A = +25^\circ C$		155		$^\circ C$
$T_{HYS}^{(5)}$	Thermal Shutdown Hysteresis	Temperature Falling from T_{SD}		25		$^\circ C$

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

Note4. V_{DROP} FT test method: test the V_{OUT} voltage at $V_{OUT} + V_{DROP_{MAX}}$ with 300mA output current.

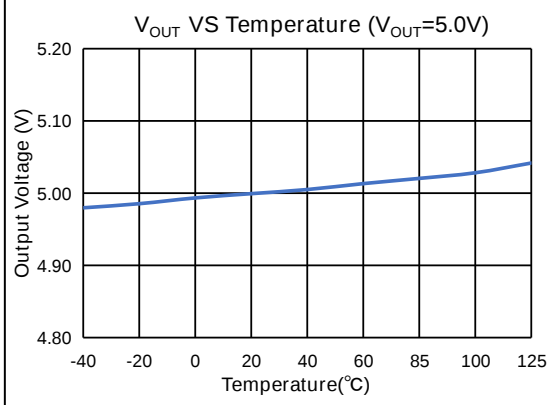
Note5. Guaranteed by design and characterization. not a FT item.

ETQ5H5XXC

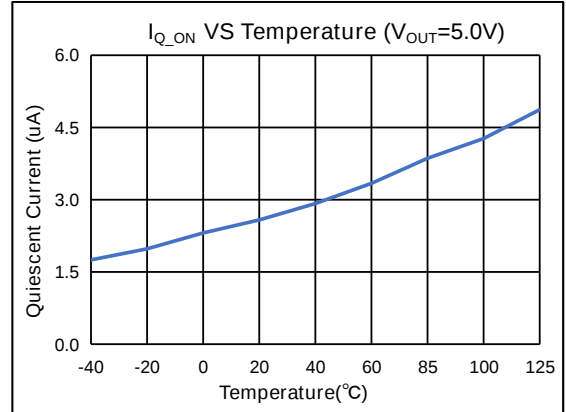
Typical Characteristics

VOLTAGE VERSION 5.0V

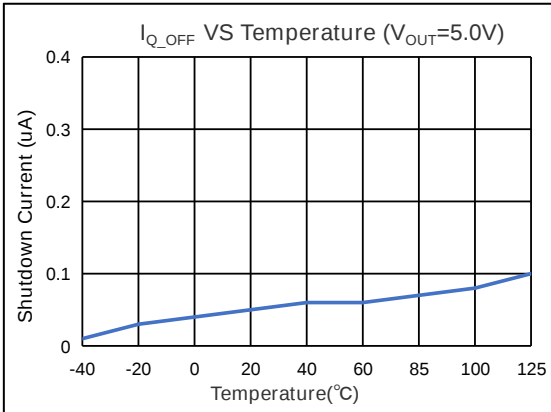
($V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)



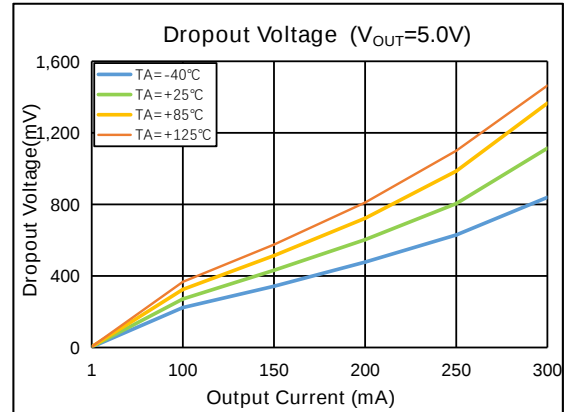
Output Voltage VS Temperature



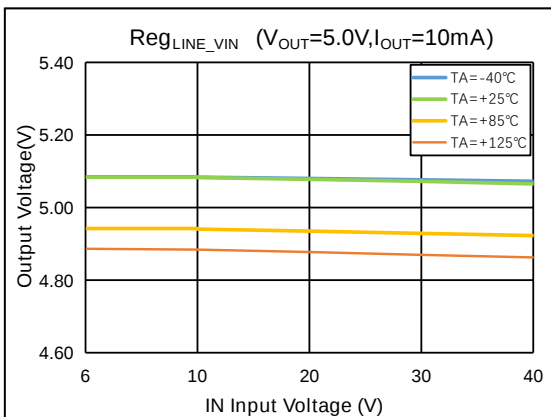
Quiescent Current VS Temperature



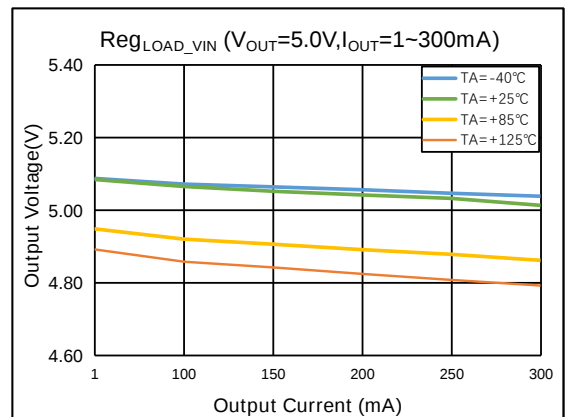
Standby Current VS Temperature



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage



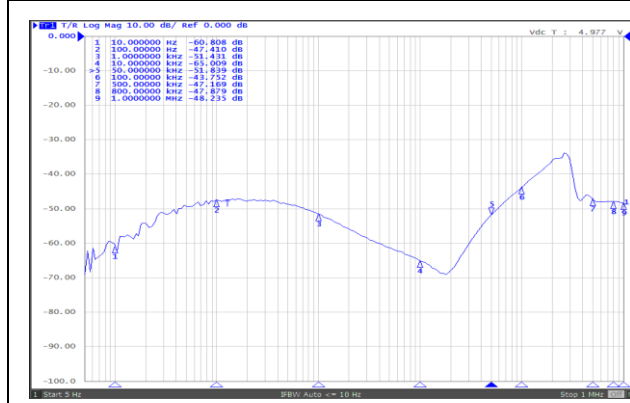
Output Voltage VS Output Current

ETQ5H5XXC

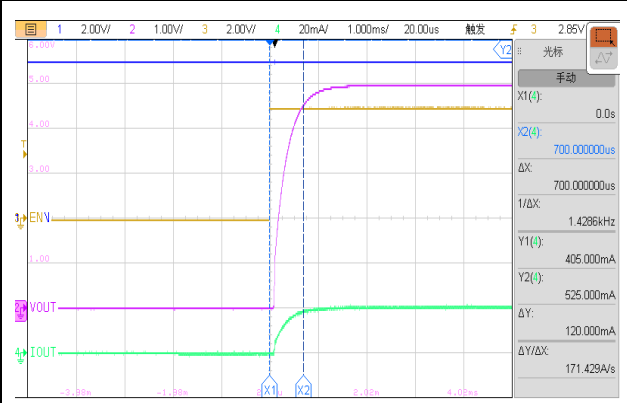
Typical Characteristics (Continued)

VOLTAGE VERSION 5.0V

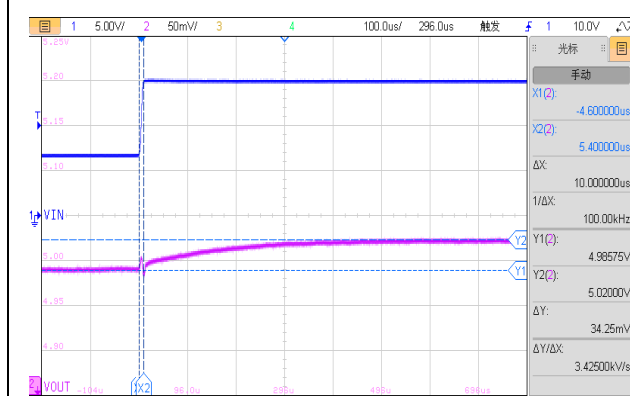
($V_{IN} = V_{OUT} + 2V$, $I_{OUT} = 10mA$, $C_{IN} = C_{OUT} = 1.0\mu F$, unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)



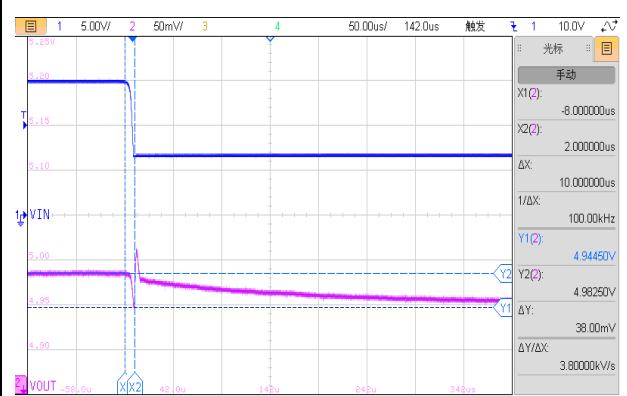
PSRR ($I_{OUT}=20mA$)



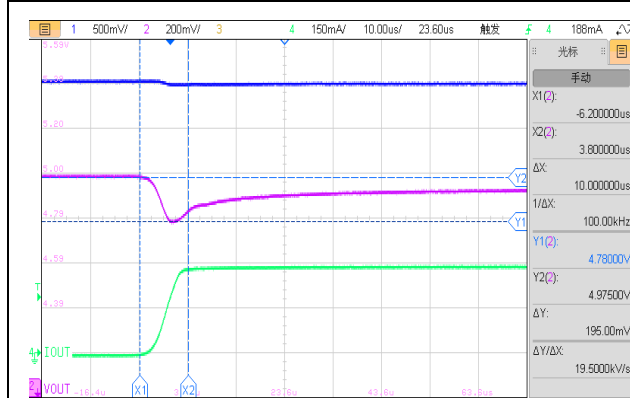
T_{ON} ($I_{OUT}=20mA$)



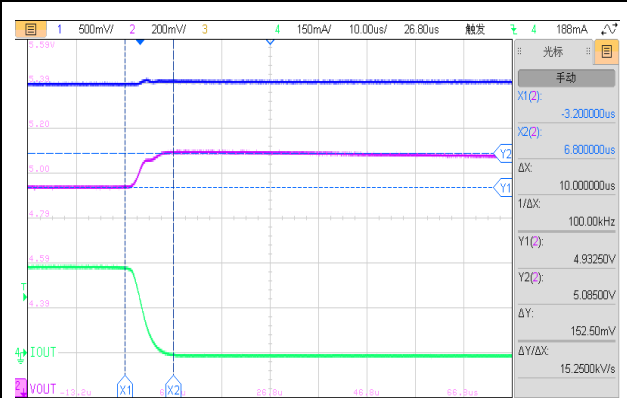
Input-Transient ($7\sim 15V$, $t_r=10\mu s$, $I_{OUT}=1mA$)



Input-Transient ($15\sim 7V$, $t_f=10\mu s$, $I_{OUT}=1mA$)



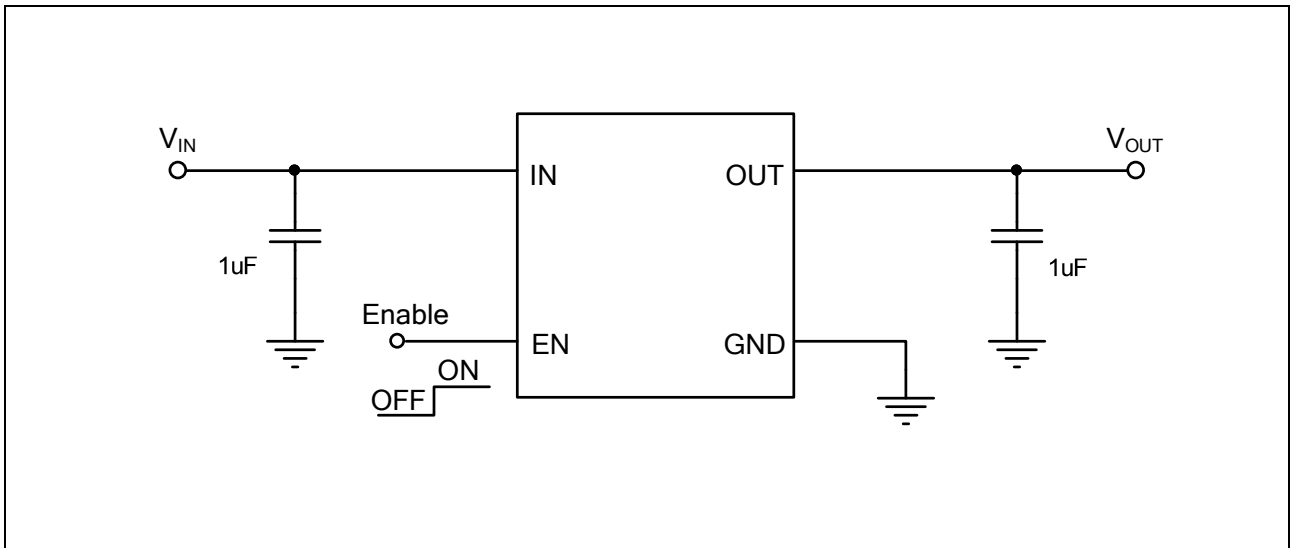
Load-Transient ($V_{IN}=7.0V$, $I_{OUT}=1\sim 300mA$, $t_r=10\mu s$)



Load-Transient ($V_{IN}=7.0V$, $I_{OUT}=300\sim 1mA$, $t_f=10\mu s$)

ETQ5H5XXC

Application Circuits

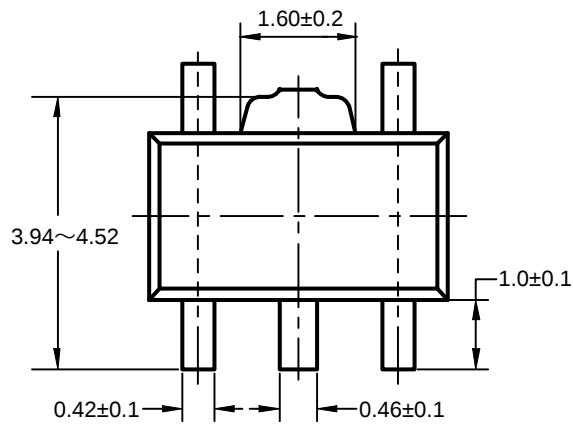


* Typical application circuit for reference only.

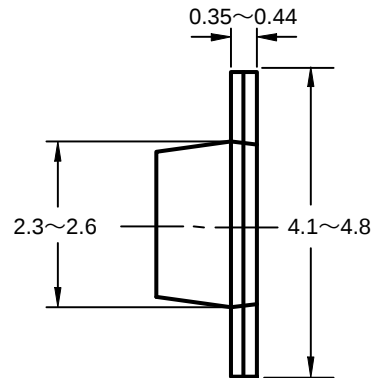
ETQ5H5XXC

Package Dimension

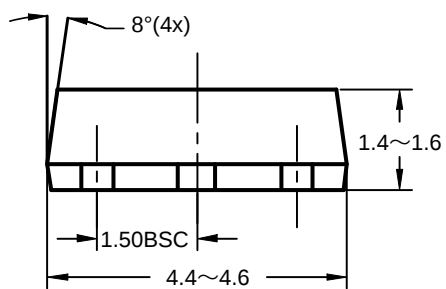
SOT89-5



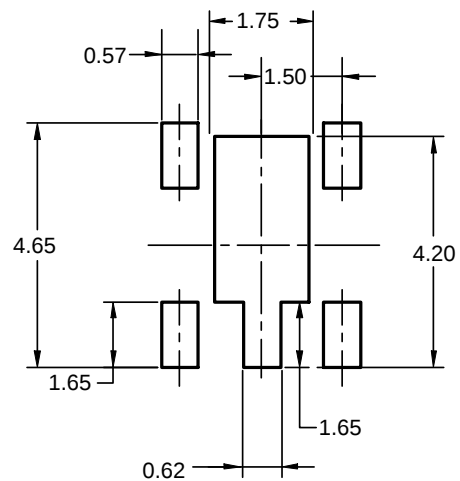
Top View



Side View



Side View

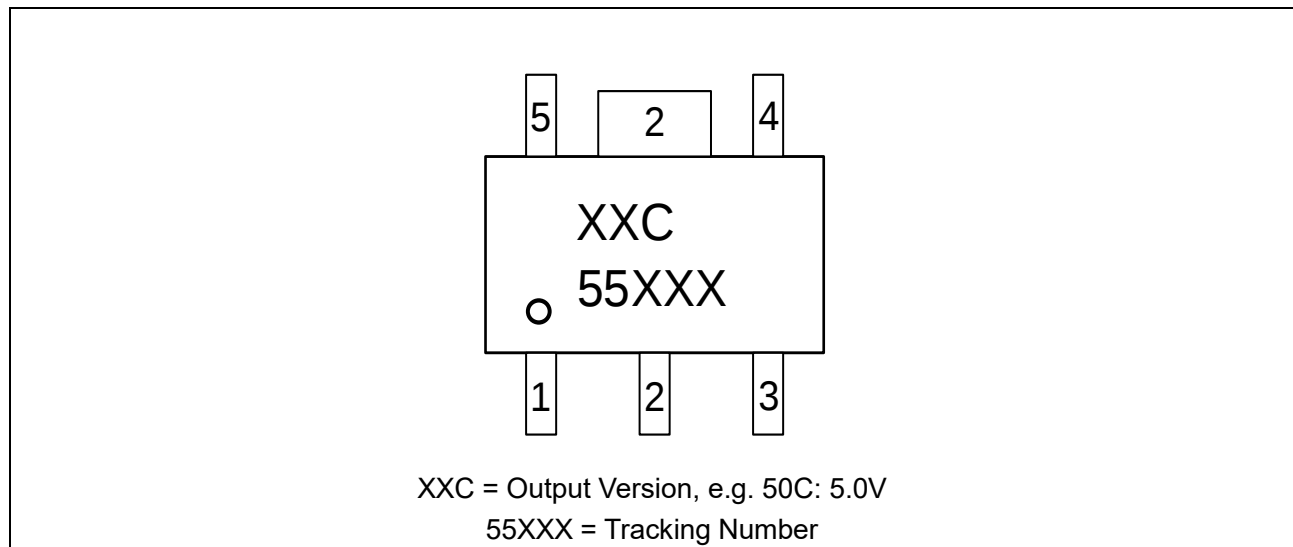


Recommended Land Pattern

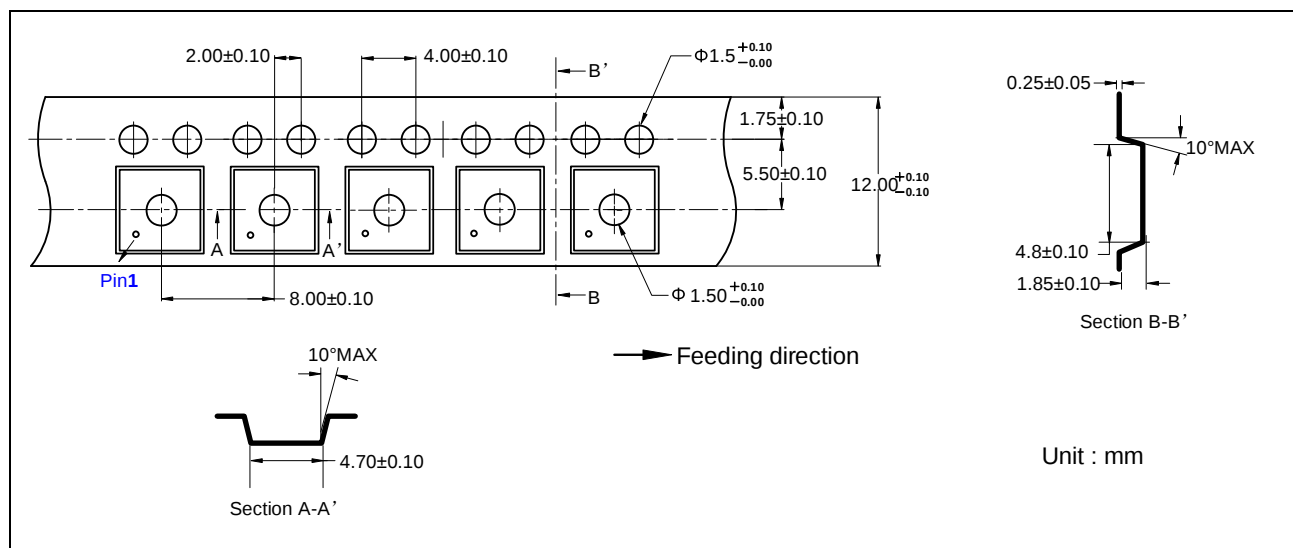
Unit: mm

ETQ5H5XXC

Marking



Tape Information



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2022-11-13	Preliminary Version	Liuxm	Liuxm	Zhuji
0.1	2023-07-21	AEC-Q100 version	Shibo	Liuxm	Zhuji
1.0	2025-02-10	Official Version	Pengjj	Liuxm	Zhuji
1.1	2025-09-10	Update AEC-Q100 Grade	Pengjj	Liuxm	Zhuji