ET5H2XXB - High Input Very-Low IQ 300mA LDO

General Description

ET5H2XXB is the high input very low IQ 300mA LDO that fixed output from 1.8V to 5V, is designed specifically for portable battery-powered applications which require ultra-low quiescent current. The very-low consumption of type 2.5uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

ET5H2XXB series are offered SOT89-3 package

Features

- Wide input voltage range from 2.5V to 36V
- Up to 300mA load current
- Very low I_Q is 2.5μA typical
- Fixed output voltages are 1.8V,2.5V,2.8V,3.0V,3.3V,3.6V,5.0V,etc
- Low dropout is 1000mV at 300mA load @V_{OUT}=3.3V
- Excellent load/line transient response
- High ripple rejection: 60dB at 1KHz
- Packages is SOT89-3
- MSL 3

Device information

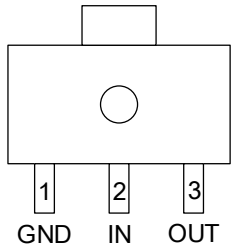
ET 5H2 XX X

XX Output Voltage		**X Package**	
XX	Output X.XV For example, 18 is 1.8V output	B	SOT89-3

Mark Specification Label

Part No.	Marking	V_{OUT}
ET5H218B	18B	1.8V
ET5H225B	25B	2.5V
ET5H228B	28B	2.8V
ET5H230B	30B	3.0V
ET5H233B	33B	3.3V
ET5H236B	36B	3.6V
ET5H250B	50B	5.0V

Pin Configuration

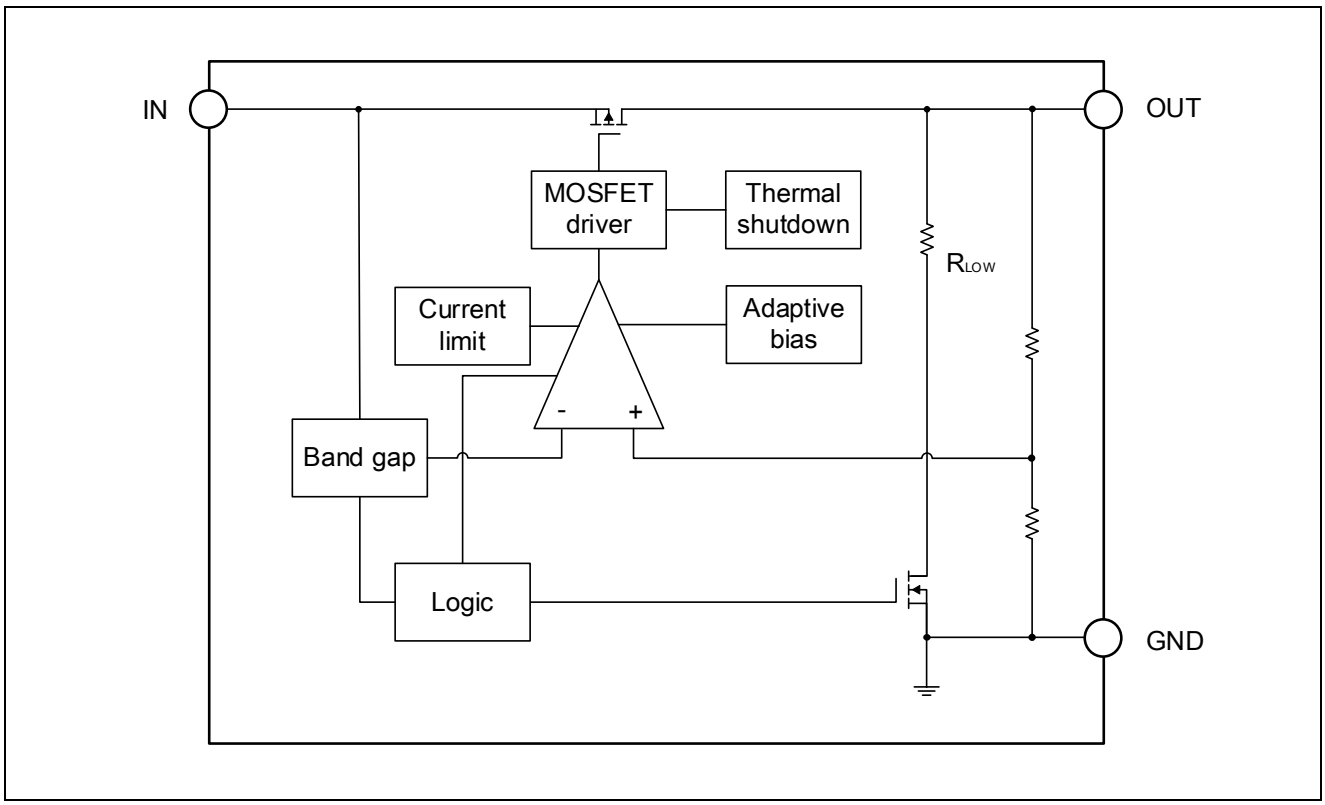


Top View

Pin Function

Pin No.	Pin Name	Pin Function
1	GND	Ground.
2	IN	Supply input pin.
3	OUT	Output pin.

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.

Dropout Voltage

The ET5H2XXB uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (VDO), 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. VDO 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 180°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 150°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.

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 180°C and T_A is the ambient temperature. The junction to ambient thermal resistance (θ_{JA}) is layout dependent.

For SOT89-3 package, the thermal resistance (θ_{JA}) is135°C/W on the test board. The maximum power dissipation at T_A = 25°C can be calculated by the following formula:

$P_{D(MAX)}$ = (150°C - 25°C) / (135°C /W) = 0.925W for SOT89-3 package

Current-Limit Protection

The ET5H2XXB 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. 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.

Absolute Maximum Ratings

Symbol	Rating	Value	Unit
V_{IN}	Input Voltage(1)	0~44	V
V_{OUT}	Output Voltage	0.8~6	V
$T_{J(MAX)}$	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:

ESD Human Body Model tested per EIA/JESD22-A114;

CDM tested per JESD22-C101;

Latch up Current Maximum Rating tested per JEDEC78.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOT89-3	Thermal Characteristics, Thermal Resistance, Junction-to-Air	135	°C/W
P_D	SOT89-3	Power Dissipation @25°C PCB board dimension: 40mm x 40mm (2layer) Copper :1OZ	920	mW

Recommended Operating Conditions

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	2.5 to 36	V
I_{OUT}	Output Current	0 to 300	mA
T_A	Operating Ambient Temperature	-40 to 85	°C
C_{IN}	Effective Input Ceramic Capacitor Value	1 to 10	uF
C_{OUT}	Effective Output Ceramic 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} = 10mA, C_{IN} = C_{OUT} = 1.0μF, unless otherwise noted. Typical values are at T_A = +25°C.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Operating Input Voltage[3]		2.5		12	V
V_{OUT}	Output Voltage	T_A = +25°C	-2%		+2%	V
		-40°C ≤ T_A ≤ 85°C	-3%		+3%	
I_Q	Quiescent Current	I_{OUT} = 0mA		2.5	4.5	μA
I_{Q_OFF}	Standby Current	V_{EN} = 0V, T_A = 25°C		0.1	1	μA
$Line_{REG}$	Line Regulation	V_{IN} = V_{OUT} +1V to 12V, I_{OUT} = 10mA (ΔV_{OUT} / ΔV_{IN} / V_{OUT})		0.05	0.20	%/V
V_{DROP}	Dropout Voltage I_{OUT}=300mA[4]	V_{OUT}=1.8V		1350	1650	mV
		V_{OUT} = 2.5V		1150	1450	
		V_{OUT} = 2.8V		1100	1400	
		V_{OUT} = 3.0V		1050	1350	
		V_{OUT} = 3.3V		1000	1300	
		V_{OUT} = 3.6V		950	1250	
		V_{OUT} = 5V		900	1200	
$Load_{REG}$	Load Regulation	1mA ≤ I_{OUT} ≤ 300mA, V_{IN} =V_{OUT}+3V			40	mV
I_{LMT}	Current Limit	V_{IN} =V_{OUT}+2V	300	450		mA
PSRR	Power Supply Rejection Ratio[5]	f = 1 kHz， V_{IN} =V_{OUT}+1V I_{OUT} = 20mA		60		dB
e_N	Output Noise Voltage[5]	V_{IN} = V_{OUT}+2V, I_{OUT} = 1mA, f = 10Hz to 100KHz, V_{OUT} =3V, C_{OUT} = 1μF		100		μVrms
T_{SD}	Thermal Shutdown Temperature[5]	Temperature Increasing from T_A=+25°C		180		°C
T_{SDH}	Thermal Shutdown Hysteresis[5]	Temperature Falling from TSD		30		°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.

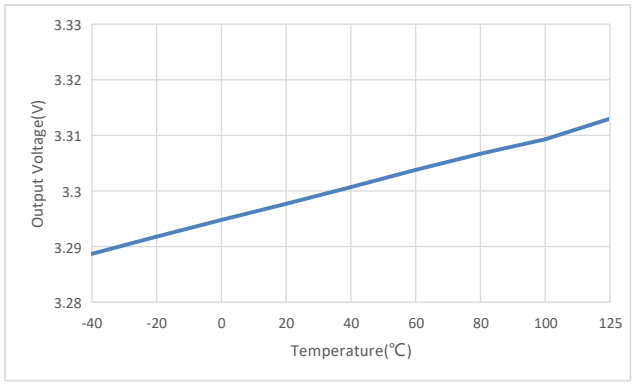
Note4. V_{DROP} FT test method: test the V_{OUT} voltage at V_{SET}+$V_{DROPMAX}$ with 300mA output current.

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

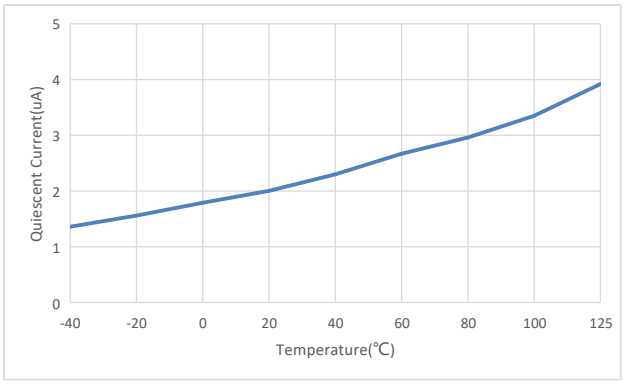
Typical Characteristics

VOLTAGE VERSION 3.3V

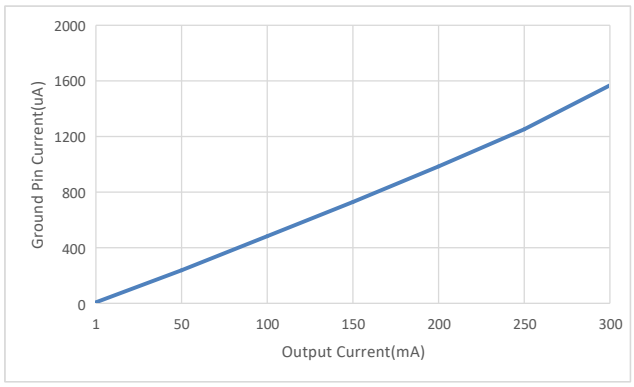
(V_{IN} =V_{OUT} + 2V, I_{OUT} = 10mA, C_{IN} = C_{OUT} = 1.0μF, Typical values are at T_A = 25°C, unless otherwise noted.)



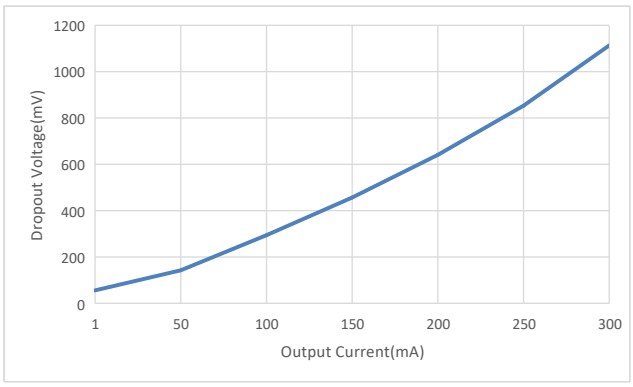
Output Voltage VS Temperature



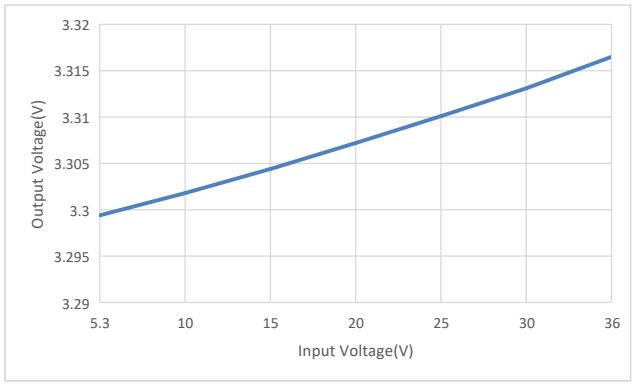
Quiescent Current VS Temperature



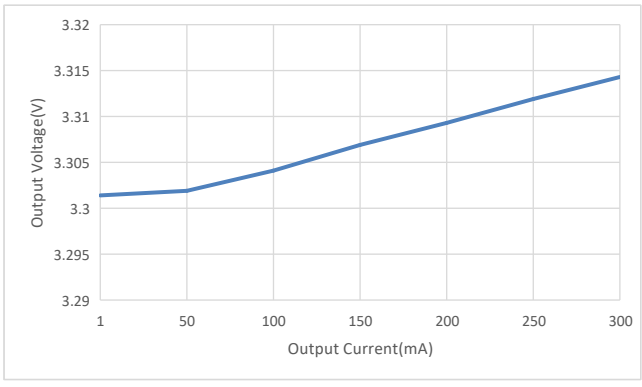
Ground Pin Current VS Output Current



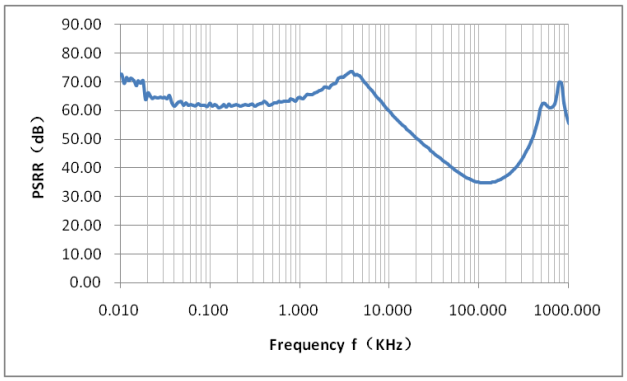
Dropout Voltage VS Output Current



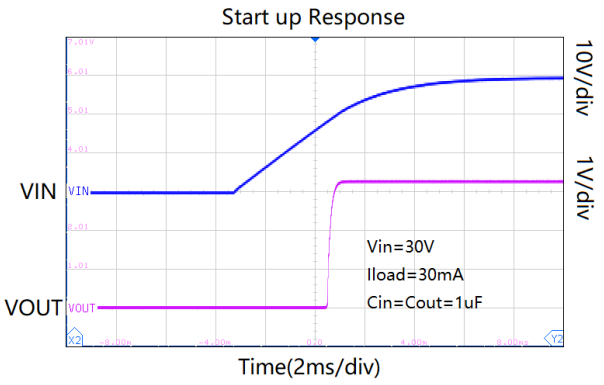
Output Voltage VS Input Voltage



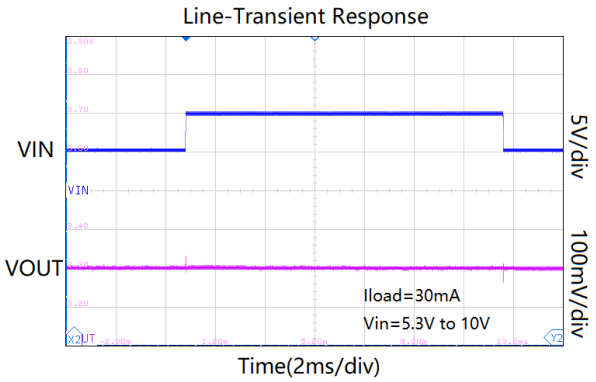
Output Voltage VS Output Current



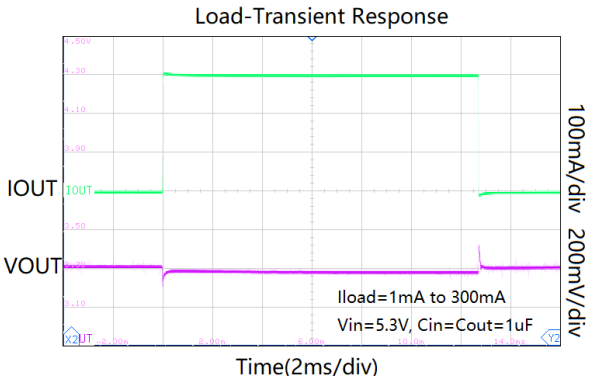
PSRR



Start-up Response

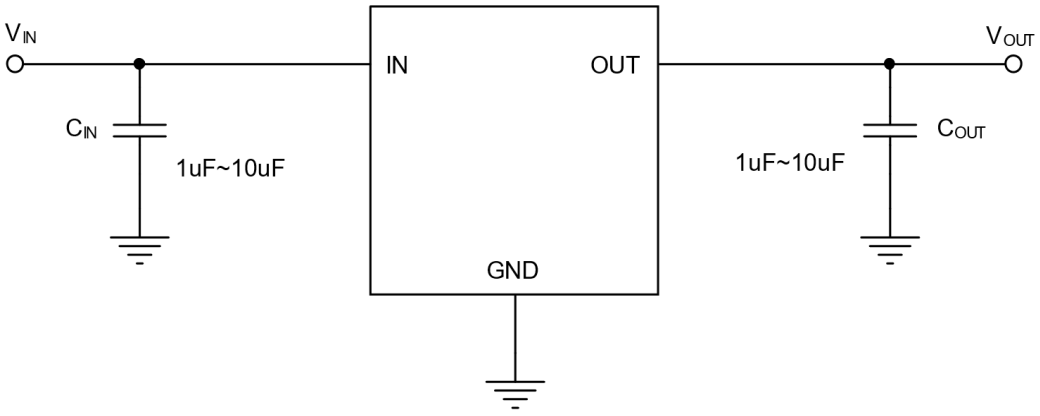


Line-Transient Response



Load-Transient Response

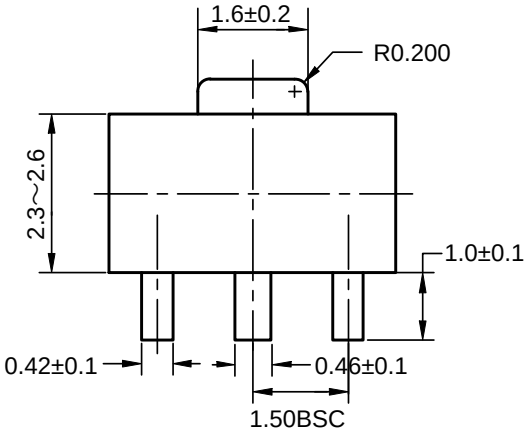
Application Circuits



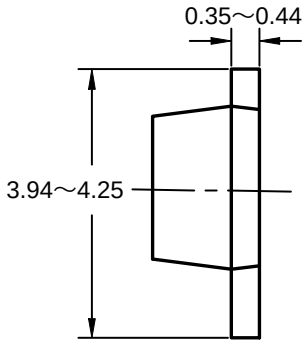
Note: This circuit is for reference only, suggest continuous input voltage not exceeding 12V use.

Package Dimension

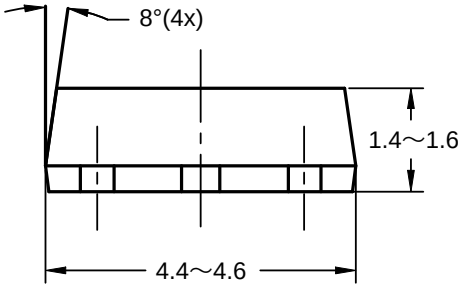
SOT89-3



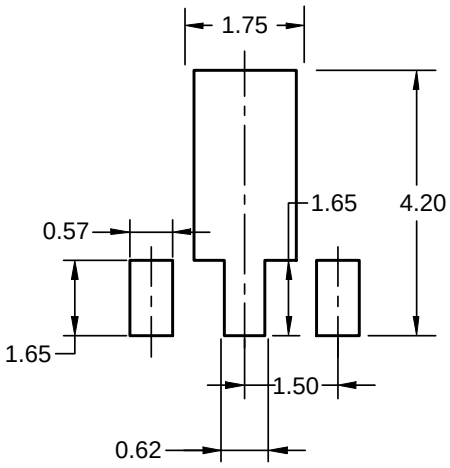
Top View



Side View



Side View



Recommended Land Pattern

Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2019-05-13	Preliminary Version	Liuxm	Liuxm	Zhujl
1.0	2019-10-22	Released Version	Liuxm	Liuxm	Zhujl
1.1	2023-10-5	XXB 12V version	Shibo	Liuxm	Liujy
1.2	2025-2-26	XXB 36V version	Shibo	Liuxm	Liujy
1.3	2025-8-21	180℃版本	Shibo	Liuxm	Liujy