DESCRIPTION

The A6500B is designed for portable applications with demanding performance and space requirements.

The A6500B performance is optimized for battery-powered systems to deliver ultra-low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the battery life.

The A6500B also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices.

The A6500B consumes only 0.1μA current in shutdown mode and has fast turn-on time (Typical 100μs). The other features include ultra-low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio.

The A6500B is available in SOT-25, SC70-5 and DFN4 packages.

ORDERING INFORMATION

Package Type	Part Number	
SOT-25 SPQ: 3,000pcs/Reel	E5	A6500BE5R-XX
		A6500BE5VR-XX
SC70-5 SPQ: 3,000pcs/Reel	C5	A6500BC5R-XX
		A6500BC5VR-XX
DFN4(1x1) SPQ: 5,000pcs/Reel	J4	A6500BJ4R-XX
		A6500BJ4VR-XX
Note	XX: Output Voltage 18=1.8V, 28=2.8V, 33=3.3V V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

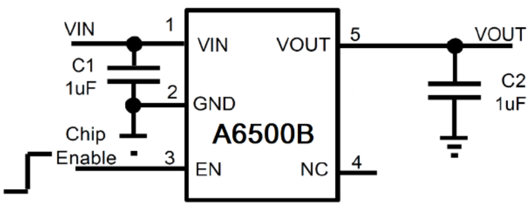
FEATURES

- Ultra-low Noise
- Ultra-Fast Transient Response
- High PSRR: -87dB @ 217Hz
  -83dB @ 1KHz
  -54dB @ 1MHz
- 0.1μA Standby Current When Shutdown
- Low Dropout: 240mV@500mA (V_{OUT} =2.8V)
- Wide Operating Voltage Ranges:1.8V to 5.5V
- Current Limiting and Short Circuit Current Protection
- Thermal Shutdown Protection
- Only 1μF Output Capacitor Required for Stability
- Fast output discharge

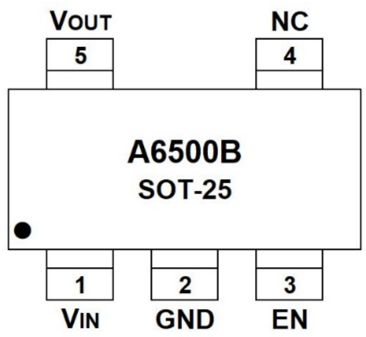
APPLICATIONS

- Cellular and Smart Phones
- Cordless Telephones
- Camera and Machine Vision Modules
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instruments
- PCMCIA Cards
- Portable Information Appliances

TYPICAL APPLICATION

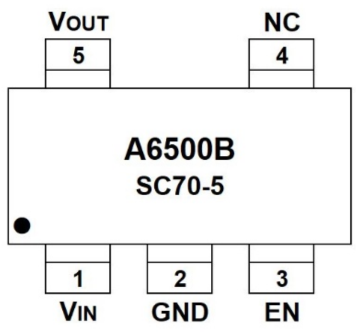


PIN DESCRIPTION



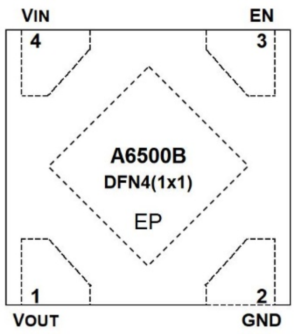
SOT-25, E5

Top View



SC70-5, C5

Top View



DFN4(1x1), J4

Top View

Pin #			Symbol	Function
SOT-25	SC70-5	DFN4 (1x1)		
1	1	4	V_{IN}	Power Input Voltage.
2	2	2	GND	Ground.
3	3	3	EN	Chip Enable Pin, this pin has an internal pull-down resistor.
4	4		NC	No Connection.
5	5	1	V_{OUT}	Output Voltage.
		Exposed Pad	EP	The exposed pad should be connected to a large ground plane to maximize thermal performance.

ABSOLUTE MAXIMUM RATINGS (1)

V_{IN}, Input Supply Voltage	-0.3V ~ +6V
EN Pin Input Voltage	-0.3V ~ V_{IN}
Output Voltages	-0.3V ~ V_{IN}+0.3V
Output Current	500mA
Maximum Junction Temperature	150℃
Operating Temperature Range (2)	-40℃ ~ +85℃
Storage Temperature Range	-65℃ ~ +125℃
Lead Temperature (Soldering, 10s)	300℃

Stresses above may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

(2) The A6500B is guaranteed to meet performance specifications from 0°C to 70°C. Specifications over the –40°C to 85°C operating temperature range are assured by design, characterization, and correlation with statistical process controls.

THERMAL CHARACTERISTICS

Parameter		Symbol	Max	Units
Thermal resistance*	SOT-25	θ_{JA}	250	℃/W
	SC70-5		333	
	SOT-25	θ_{JC}	130	℃/W
	SC70-5		170	℃/W

*Thermal Resistance is specified with approximately 1 square of 1 Oz copper.

ELECTRICAL CHARACTERISTICS (1)

V_{IN} = V_{OUT} +1V, EN= V_{IN}, C_{IN} = C_{OUT} =1µF, T_A =25℃,unless otherwise noted.

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Units
Input Voltage		V_{IN}		1.8	-	5.5	V
Output Voltage Accuracy		ΔV_{OUT}	V_{IN} = V_{OUT} +1V, I_{OUT} =1mA	-2	-	+2	%
Current Limit		I_{LIM}	R_{LOAD} =1Ω	500	-	-	mA
Short Circuit Current		I_{SHORT}	V_{OUT} =0V	-	200	-	mA
Quiescent Current		I_Q	V_{EN} >1.2V, I_{OUT}=0mA	-	45	70	µA
Dropout Voltage		V_{DROP}	I_{OUT} =500mA, V_{OUT}=3.3V	-	220	320	mV
			I_{OUT} =500mA, V_{OUT}=2.8V	-	240	360	
			I_{OUT} =500mA, V_{OUT}=1.8V	-	360	520	
			I_{OUT} =500mA, V_{OUT}=1.0V	-	700	1000	
Line Regulation (2)		ΔV_{LINE}	V_{IN} = V_{OUT} +1V ~ +5.5V, I_{OUT} =1mA	-	0.03	0.17	%/V
Load Regulation (3)		ΔV_{LOAD}	1mA < I_{OUT} <300mA, V_{IN} = V_{OUT} +1V	-	0.002	-	%/mA
Output Voltage Temperature Coefficient (4)		TC_{VOUT}	I_{OUT} =1mA	-	±60	-	ppm/℃
Standby Current		I_{STBY}	V_{EN} =GND, Shutdown	-	0.1	1	µA
EN Input Bias Current		I_{IBSD}	V_{EN} =GND or V_{IN}	-	0.1	1	µA
EN Input Threshold	Logic Low	V_{IL}	V_{IN} = +3V ~ +5.5V, Shutdown	-	-	0.4	V
	Logic High	V_{IH}	V_{IN} = +3V ~ +5.5V, Start up	1.2	-	-	V
Output Noise Voltage		e_{NO}	10 ~ 100kHz, C_{OUT}=1µF, I_{OUT}=100mA, V_{OUT}=2.8V		50	-	µV_{RMS}
			10 ~ 100kHz, C_{OUT}=1µF, I_{OUT}=100mA, V_{OUT}=2.8V		38	-	
Power Supply Rejection Ratio	f=217Hz	P_{SRR}	I_{OUT}=10mA V_{OUT}=1.8V V_{IN}=2.8V		-87	-	dB
	f=1KHz				-83	-	
	f=10KHz				-72	-	
	f=1MHz				-54	-	
Thermal Shutdown Temperature		T_{SD}	Shutdown Temp increasing		170	-	℃
Thermal Shutdown Hysteresis		T_{SDHY}			25	-	℃

(1) Production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

(2) Line regulation is calculated by $\Delta V_{LINE} = \left\{\frac{V_{OUT1}-V_{OUT2}}{\Delta V_{IN} X\ V_{OUT(normal)}}\right\} X100$

Where V_{OUT1} is the output voltage when V_{IN} =5.5V, and V_{OUT2} is the output voltage when V_{IN} =4.3V, ΔV_{IN} =1.2V, V_{OUT} (normal) =3.3V.

(3) Load regulation is calculated by $\Delta V_{LOAD} = \left\{\frac{V_{OUT1}-V_{OUT2}}{\Delta I_{OUT} X\ V_{OUT(normal)}}\right\} X100$

Where V_{OUT1} is the output voltage when I_{OUT}=1mA, and V_{OUT2} is the output voltage when I_{OUT}=300mA, ΔI_{OUT}=299mA, V_{OUT} (normal) =2.8V.

(4) The temperature coefficient is calculated by $TC_{V_{OUT}} = \frac{\Delta V_{OUT}}{\Delta T\ X\ V_{OUT}}$

TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Quiescent Current vs. Temperature

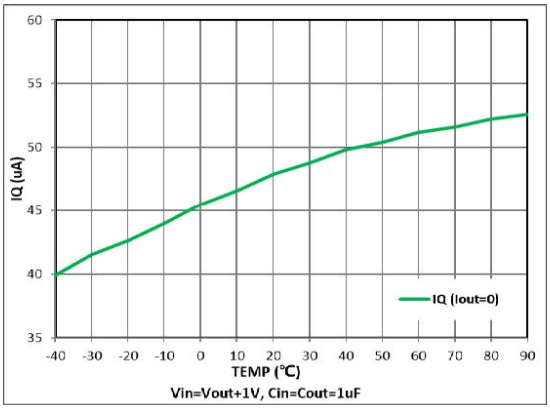


Fig.2 Dropout Voltage vs. Output

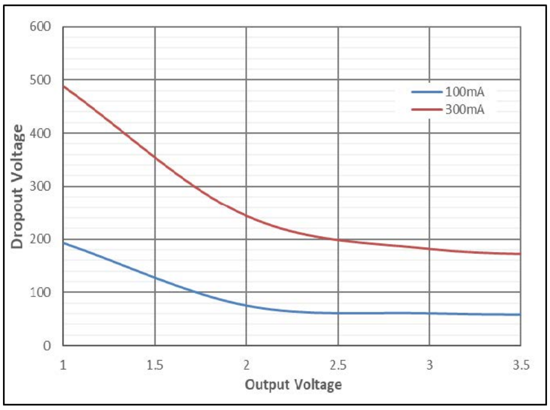


Fig.3 Output Dropout Voltage vs. Load Current (V_{OUT}=2.8V)

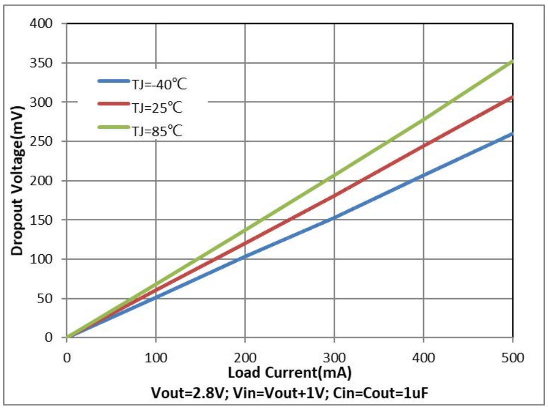


Fig.4 Dropout Voltage vs. Load Current (V_{OUT}=1.8V)

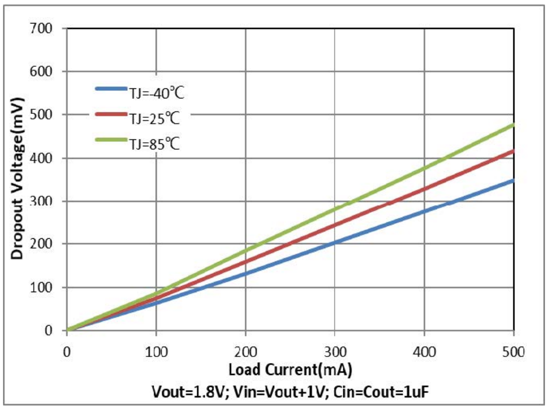


Fig.5 Power-Supply Ripple Rejection vs. Frequency (V_{OUT} =2.8V)

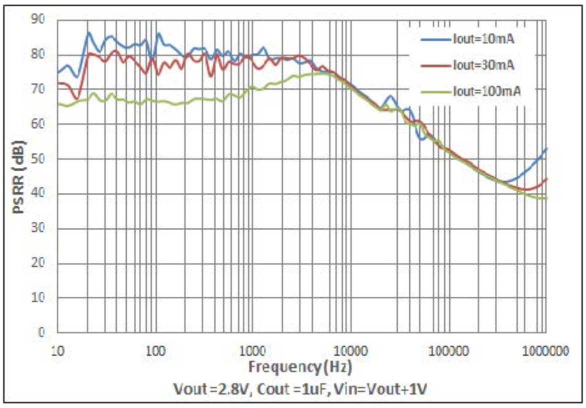


Fig.6 Power-Supply Ripple Rejection vs. Frequency (V_{OUT} =1.8V)

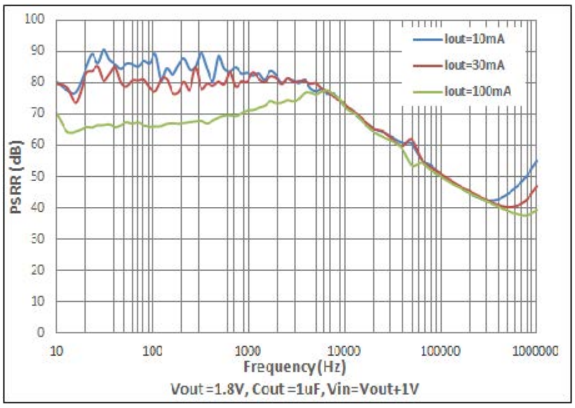


Fig.7 EN Start (V_{OUT} =1.8V)

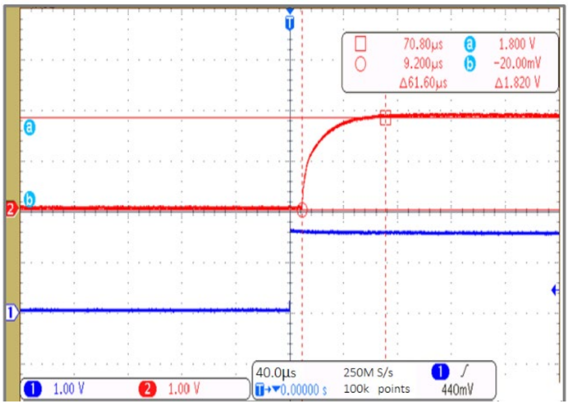


Fig.8 EN Shutdown (V_{OUT} =1.8V)

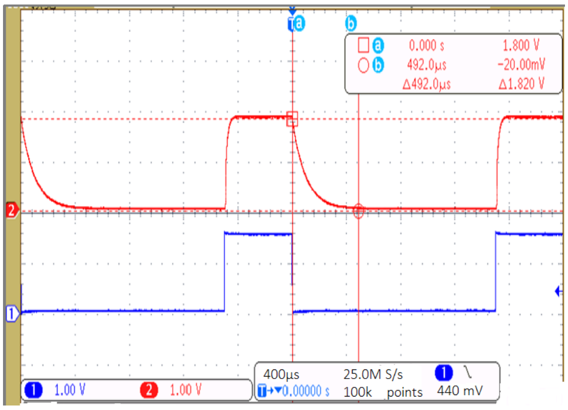


Fig.9 Load Trans 1mA – 300mA (V_{OUT} = 1.8V)

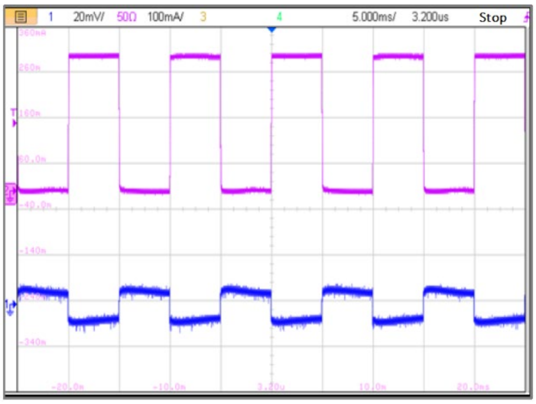


Fig.10 Load Trans 1mA – 300mA (V_{OUT} = 2.8V)

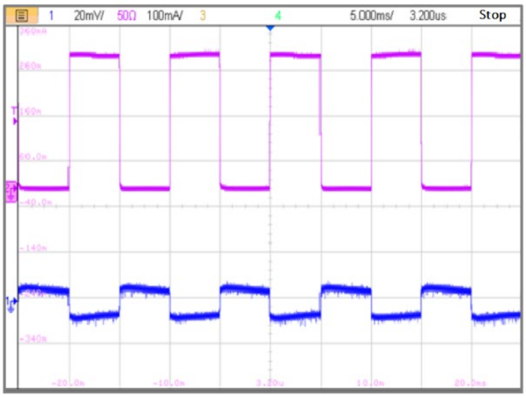


Fig.11 Line Trans 2.8V~5.5V (V_{OUT} =1.8V, I_{OUT}=1mA)

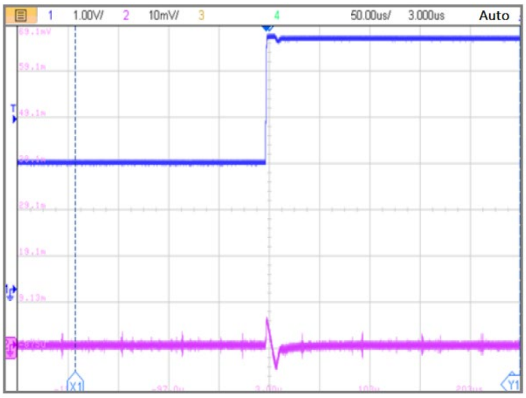
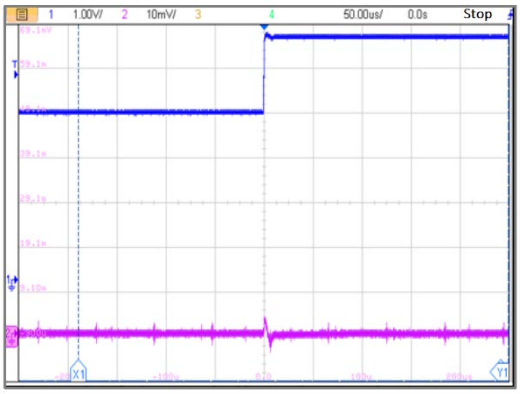
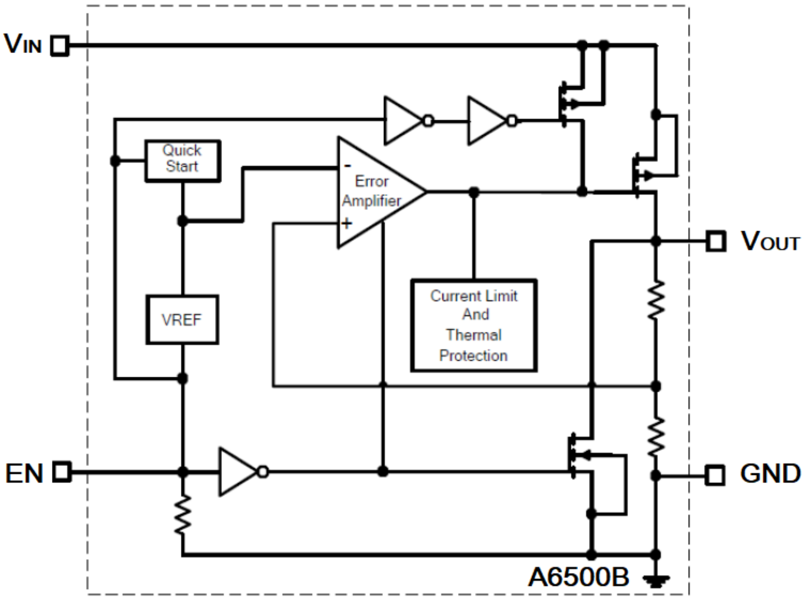


Fig.12 Line Trans 3.8V~5.5V (V_{OUT} =2.8V, I_{OUT}=1mA)



BLOCK DIAGRAM



DETAILED INFORMATION

Applications Information

Like any low-dropout regulator, the external capacitors used with the A6500B must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the A6500B input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better P_{SRR} and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. Generally, 1.0-μF X7R-type ceramic capacitors are recommended because these capacitors have minimal variation in value and equivalent series resistance (ESR) over temperature. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and P_{SRR}. The output capacitor should be located not more than 0.5 inch from the V_{OUT} pin of the A6500B and returned to a clean analog ground.

Enable Function

The A6500B features an LDO regulator enable/disable function. To assure the LDO regulator will switch on; the EN turn on control level must be greater than 1.2 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4 volts. For to protect the system, the A6500B have a quick discharge function. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

Thermal Considerations

Thermal protection limits power dissipation in A6500B. When the operation junction temperature exceeds 170°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turns on again after the junction temperature cools by 25°C.

For continue operation, do not exceed absolute maximum operation junction temperature 125°C. The power dissipation definition in device is:

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

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, TA is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of A6500B, where $T_{J(MAX)}$ is the maximum junction temperature of the die (125°C), and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (θ_{JA} is layout dependent) for SOT-25 package is 250°C/W, on standard JEDEC 51-3 thermal test board. The maximum power dissipation at T_A = 25°C can be calculated by following formula:

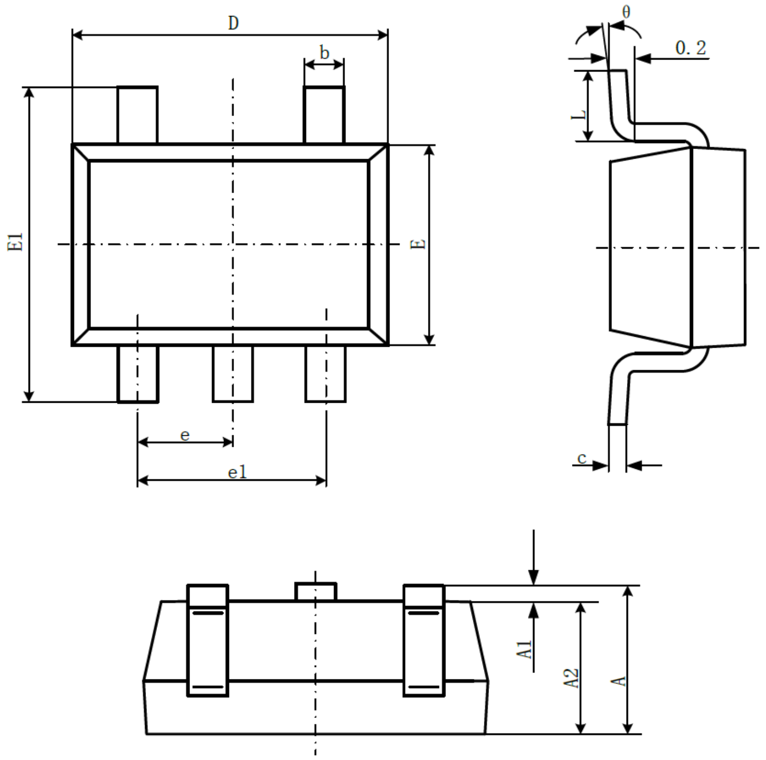
$$P_{D(MAX)} = (125°C-25°C)/250 = 400mW\ (SOT\text{-}25)$$

Layout considerations

To improve ac performance such as P_{SRR}, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for V_{IN} and V_{OUT}, with each ground plane connected only at the GND pin of the device.

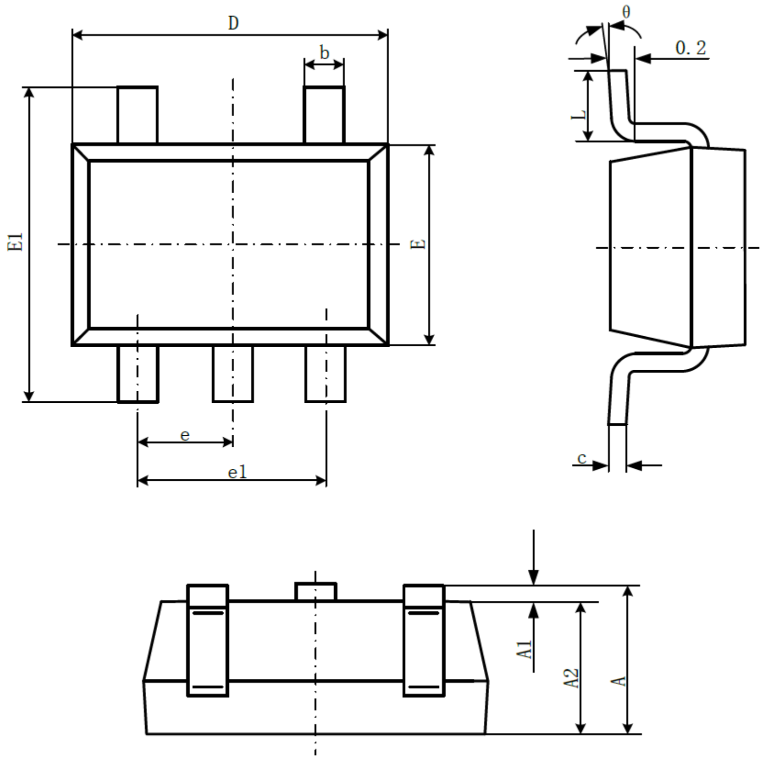
PACKAGE INFORMATION

Dimension in SOT-25 (Unit: mm)



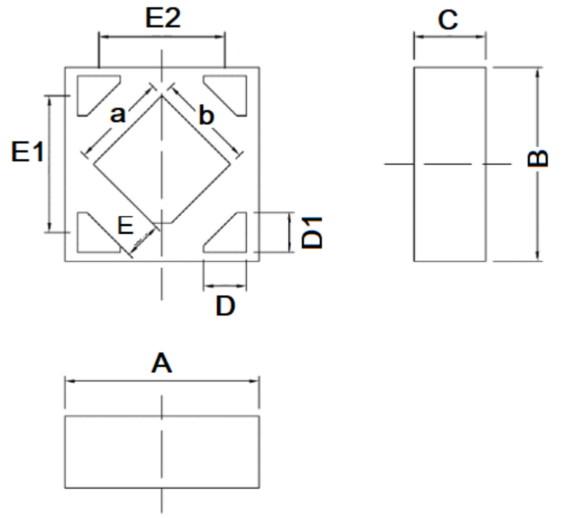
Symbol	Min.	Max.
A	0.889	1.295
A1	0.000	0.152
A2	0.889	1.143
b	0.356	0.559
c	0.080	0.254
D	2.692	3.099
E	1.397	1.803
E1	2.591	2.997
e	0.838	1.041
e1	1.676	2.082
L	0.300	0.610
θ	0°	8°

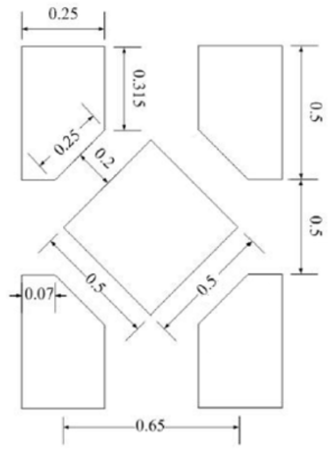
Dimension in SC70-5 (Unit: mm)



Symbol	MILLIMETERS	
	Min.	Max.
A	0.800	1.100
A1	0.000	0.100
A2	0.800	1.000
b	0.150	0.300
c	0.100	0.250
D	1.850	2.200
E	1.150	1.350
E1	1.800	2.400
e	0.650 BSC	
e1	1.300 BSC	
L	0.20 BSC	
θ	0°	8°

Dimension in DFN4 (1x1) (Unit: mm)





RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	MILLIMETERS	
	Min.	Max.
A	0.950	1.050
a	0.440	0.540
B	0.950	1.050
b	0.440	0.540
C	0.320	0.420
D	0.170	0.270
D1	0.175	0.275
E	0.140	0.240
E1	0.625	0.725
E2	0.600	0.700

IMPORTANT NOTICE

AiT Semiconductor Inc. (AiT) reserves the right to make changes to any its product, specifications, to discontinue any integrated circuit product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

AiT Semiconductor Inc.'s integrated circuit products are not designed, intended, authorized, or warranted to be suitable for use in life support applications, devices or systems or other critical applications. Use of AiT products in such applications is understood to be fully at the risk of the customer. As used herein may involve potential risks of death, personal injury, or servere property, or environmental damage. In order to minimize risks associated with the customer's applications, the customer should provide adequate design and operating safeguards.

AiT Semiconductor Inc. assumes to no liability to customer product design or application support. AiT warrants the performance of its products of the specifications applicable at the time of sale.