150mA Low Supply Current Low Dropout Regulator

FEATURES

- Low I_Q, Typ. 1μA No-Load Supply Current
- Supply Current in Shutdown Mode 0.1μA
- Input Voltage Range : 2.7V to 5.5V
- Output Current Limit Protection
- Dropout Voltage is 250mV @ 150mA Load
- Max. ± 1.5% Output Voltage Accuracy
- Output current possible to output 250mA[*1] ($3.0V_{OUT}$ product, $V_{IN} \geqq V_{OUT}+1V$)[*1]
- Stable with Low Cost Ceramic Capacitors
- Short-Circuit Protection
- SOT23-5 and DFN-4 (1×1) Package

*1 Attention should be paid to the power dissipation of the package when the output current is large.

DESCRIPTION

The AIC1701B is a 150mA low dropout regulator. This product is specifically designed to provide ultra low quiescent current and high output voltage accuracy.

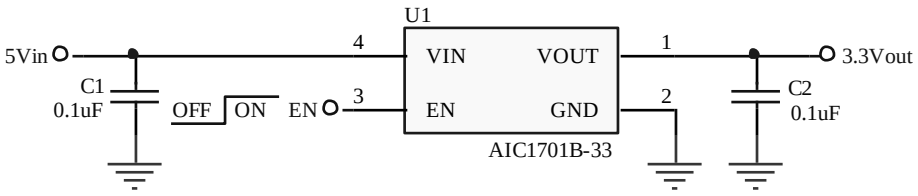
The AIC1701B integrates many functions. The current limit functions protect the device against current over-loads. It can control other converter for power sequence. The AIC1701B can be enabled by other power system. Pulling and holding the EN pin below 0.4V shuts off the output.

The AIC1701B is available in SOT23-5 and DFN-4 (1×1) package which features small size.

APPLICATIONS

- Smart Watch
- Wireless Mouse
- Wireless Sensor Networks
- Unmanned Aircraft
- Data Recorder
- IP Cam
- Dual Band Working Modes Radio

TYPICAL APPLICATION CIRCUIT



AIC1701B Typical Application Circuit for DFN-4(1x1) Package

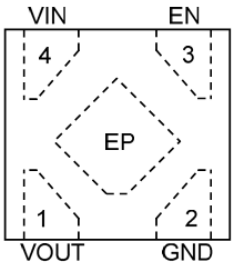
ORDERING INFORMATION

AIC1701B-XXXXXX XX

- PACKING TYPE
  TR: TAPE & REEL
  BG: BAG
- PACKAGE TYPE
  D4B:DFN-4 (1x1)
  U5: SOT23-5
- G: Green Package
- OUTPUT VOLTAGE
  18: 1.8V
  28: 2.8V
  33: 3.3V
  (Please consult AIC sales office or authorized distributors for availability of special output voltages.)

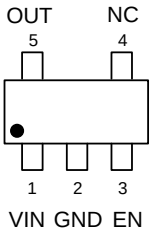
PIN CONFIGURATION

DFN-4 (1x1)
TOP VIEW



Note:
The exposed pad should be connected with GND pin

TOP VIEW
SOT23-5



Example: AIC1701B-18GD4BTR
→ 1.8V Version, in DFN-4 (1x1) Green Package and Tape & Reel Packing Type

●Marking

Part No.	Product Code
AIC1701B-18GD4B	ZH
AIC1701B-28GD4B	ZK
AIC1701B-33GD4B	ZL
AIC1701B-18GU5	FT8
AIC1701B-28GU5	FT1
AIC1701B-33GU5	FT9

ABSOLUTE MAXIMUM RATINGS

VIN Pin Voltage ..... -0.3V to 6V

EN Pin Voltage ..... -0.3V to (V_{IN}+0.3V)

Junction Temperature ..... -40ºC~150ºC

Storage Temperature Range ..... -65ºC~150ºC

Lead Temperature (Soldering, 10 sec) 260ºC

Operating Junction Temperature Range ..... -40ºC~125ºC

Operating Ambient Temperature Range ..... -40ºC~85ºC

Thermal Resistance Junction to Case, θ_{JC}	DFN-4 (1x1)*	65°C/W
	SOT23-5*	130°C/W
Thermal Resistance Junction to Ambient, θ_{JA}	DFN-4 (1x1)*	195°C/W
	SOT23-5*	250°C/W
Power Dissipation @ T_A=25°C & T_J=125°C, P_D	DFN-4 (1x1)	0.5W
	SOT23-5	0.4W

(Assume no Ambient Airflow)

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

*θ_{JA} is measured at 25°C ambient with the component mounted on a high effective thermal conductivity 4-layer board of JEDEC-51-7. θ_{JC} is measured at the exposed pad. The thermal resistance greatly varies with layout, copper thickness, number of layers and PCB size.

■ ELECTRICAL CHARACTERISTICS

(V_{IN} =V_{OUT}+1V, V_{EN}=V_{IN}, T_A=25°C, C_{IN}=C_{OUT}=0.1μF, I_{OUT}=1mA, unless otherwise specified) (Note 1)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Input Supply Voltage		V_{IN}	2.7		5.5	V
Quiescent Current	V_{EN} =V_{IN}, I_{OUT}=0mA	I_{DDQ}		1		μA
Shutdown Current	V_{EN} =0V	I_{SD}		0.1		μA
Output Voltage Accuracy	I_{OUT}=1mA	ΔV_{OUT}	-1.5		+1.5	%
Line Regulation	$V_{OUT(NOM)}$+1V ≤ V_{IN} ≤ 5.5V, I_{OUT} = 5mA	ΔV_{OUT} /ΔV_{IN}	-0.01		+0.01	
Load Regulation	I_{OUT}=1mA~150mA	ΔV_{OUT} /ΔI_{OUT}	-0.02		+0.02	
Output Voltage Temperature Coefficient (Note 2)	-40℃ ≤ T_A ≤ 85℃	ΔV_{OUT} /ΔT_A		100		ppm/℃
Dropout Voltage	V_{OUT}=1.5V, I_{OUT}=150mA	V_{DROP}		520	675	mV
	V_{OUT}=1.8V, I_{OUT}=150mA			400	520	
	V_{OUT}=2.8V, I_{OUT}=150mA			280	365	
	V_{OUT}=3.3V, I_{OUT}=150mA			250	325	
EN Pin Logic Threshold Voltage	Enable	V_{ENH}	1			V
	Disable	V_{ENL}			0.4	
EN Pin Current	V_{EN}=2.5V	I_{EN}		0.3		μA
Current Limit	V_{IN}=5V	I_{LIM}	250			mA
Current Fold-back Protect		I_{SC_FB}		50		mA
Output Discharge Resistance	EN=0V	R_{DIS}		60		Ω

Note 1. Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note 2. Guaranteed by design.

TYPICAL PERFORMANCE CHARACTERISTICS

Test condition: V_{IN} =V_{OUT}+1V, V_{EN}=V_{IN}, T_A=25°C, C_{IN}=C_{OUT}=0.1µF, unless otherwise specified.

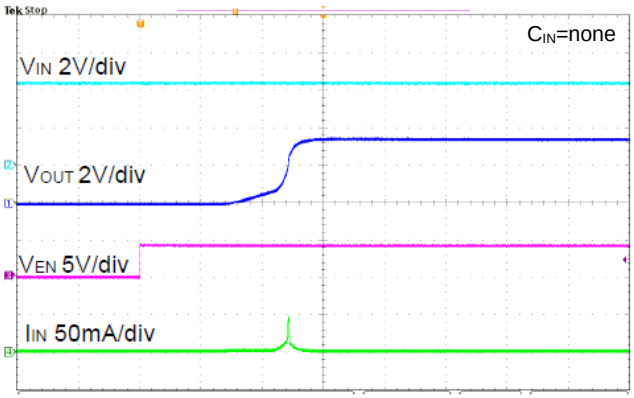


Fig. 1 EN Turn On Inrush Current

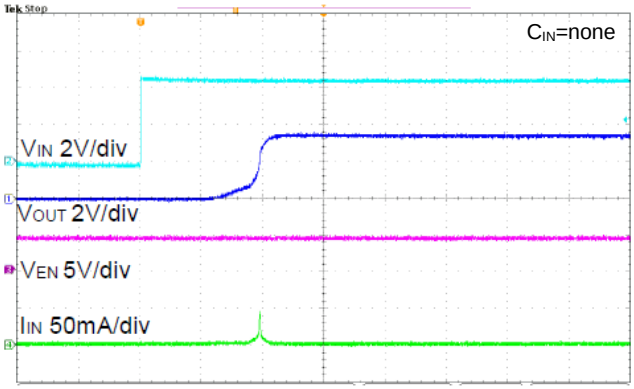


Fig. 2 V_{IN} Turn On Inrush Current

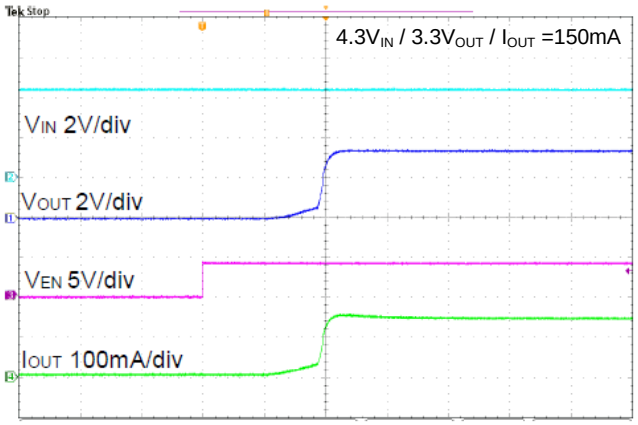


Fig. 3 EN Turn On Waveform

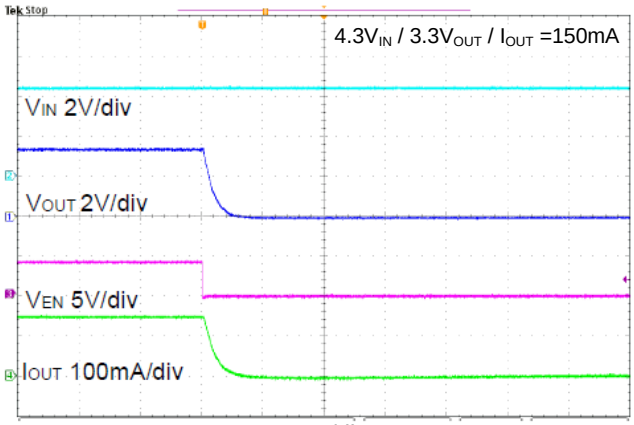


Fig. 4 EN Turn OFF Waveform

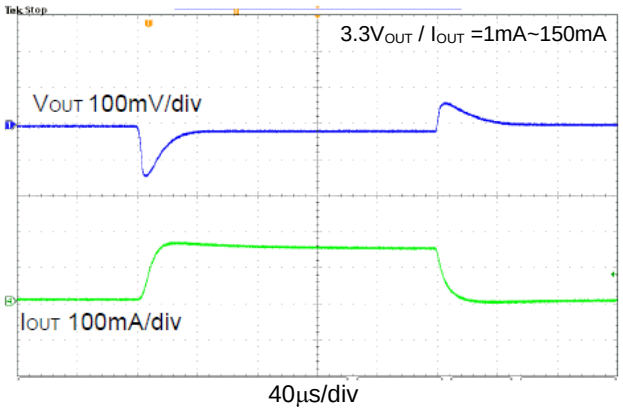


Fig. 5 Load Transient Response

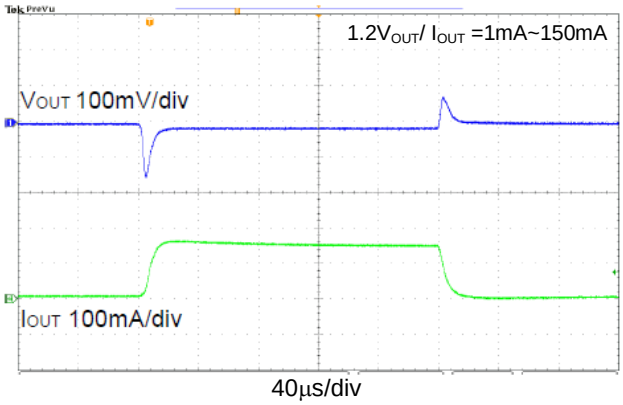


Fig. 6 Load Transient Response

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

Test condition: V_{IN} =V_{OUT}+1V, V_{EN}=V_{IN}, T_A=25°C, C_{IN}=C_{OUT}=0.1µF, unless otherwise specified.

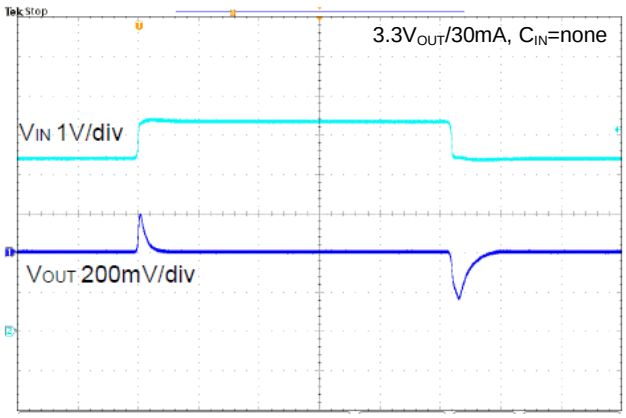


Fig. 7 Line Transient Response

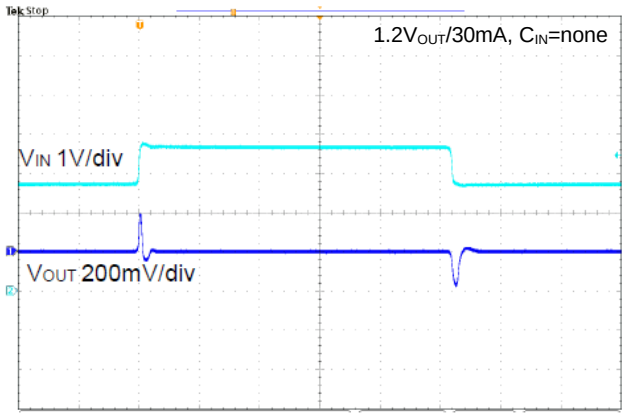


Fig. 8 Line Transient Response

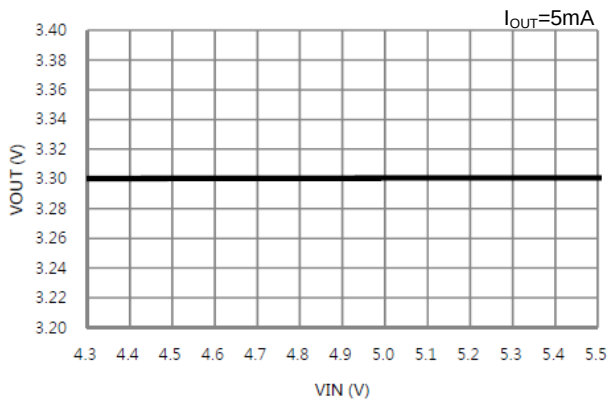


Fig. 9 Output Voltage vs. Input Voltage

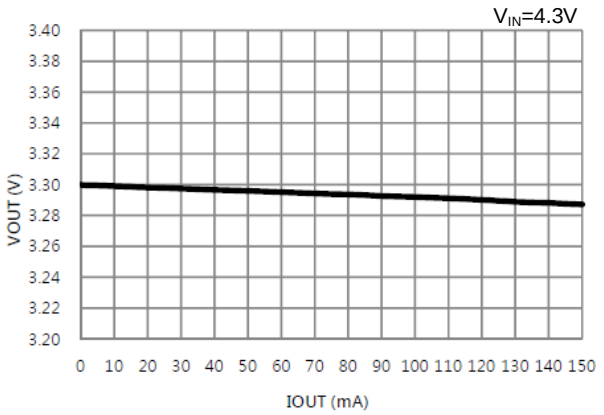


Fig. 10 Output Voltage vs. Output Current

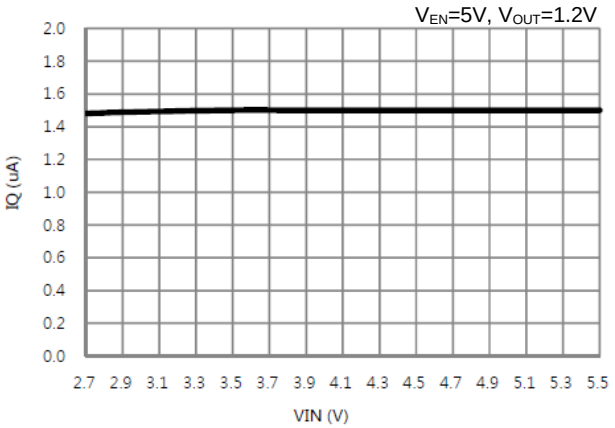


Fig. 11 Quiescent Current vs. Input Voltage

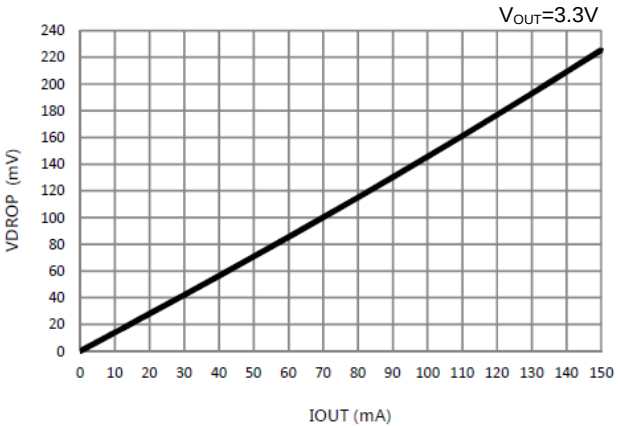


Fig. 12 Dropout Voltage vs. Output Current

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

Test condition: V_{IN} =V_{OUT}+1V, V_{EN}=V_{IN}, T_A=25°C, C_{IN}=C_{OUT}=0.1µF, unless otherwise specified.

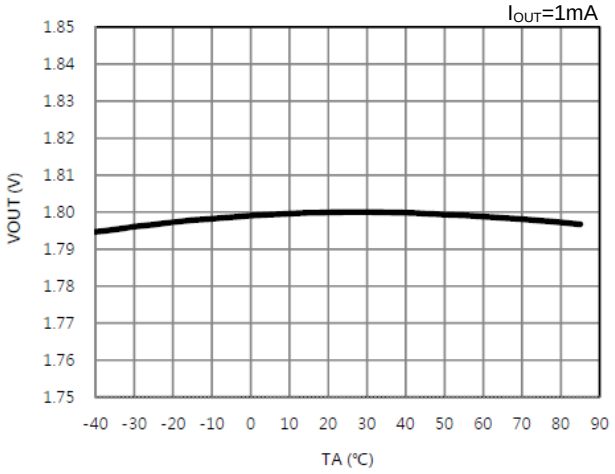


Fig. 13 Output Voltage vs. Temperature

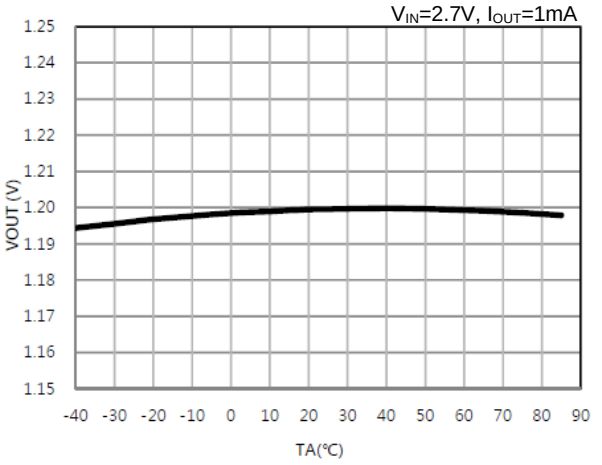


Fig. 14 Output Voltage vs. Temperature

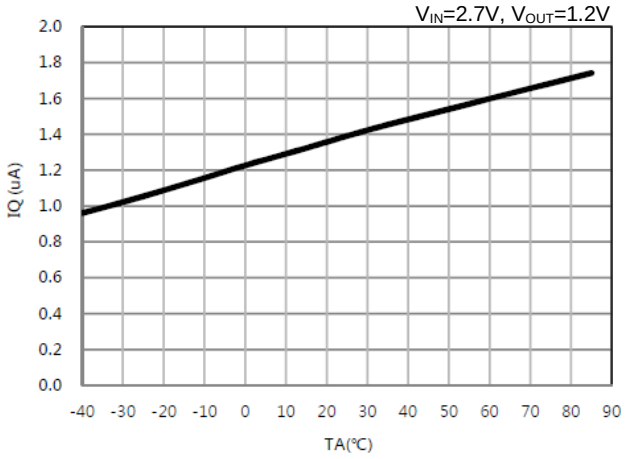


Fig. 15 Quiescent Current vs. Temperature

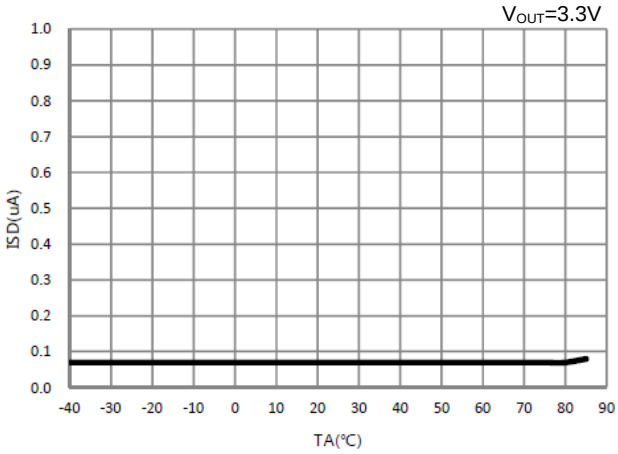
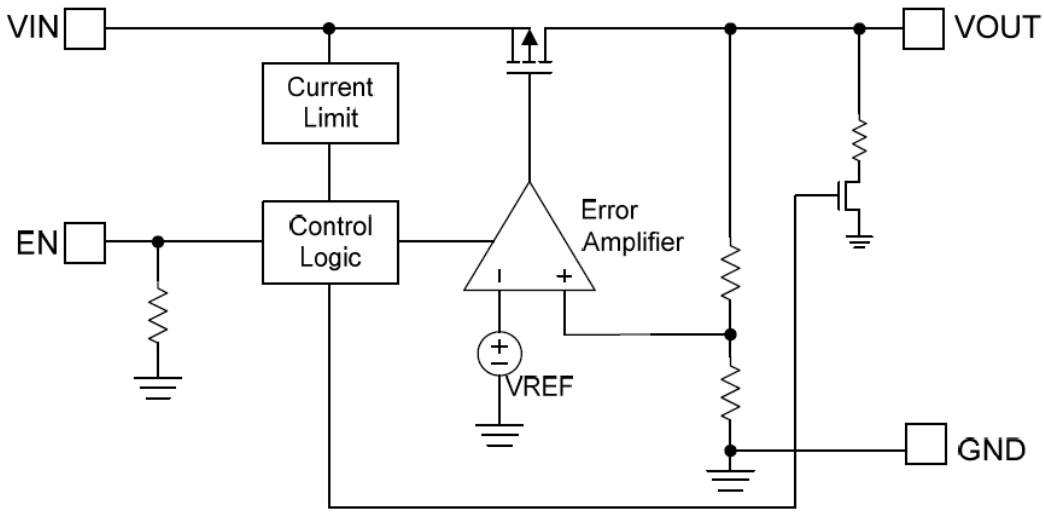


Fig. 16 Shut Down Current vs. Temperature

BLOCK DIAGRAM



Functional Block Diagram of AIC1701B

PIN DESCRIPTION

VIN - Input pin. MOSFET power supply pin.
GND - Ground pin. Connect GND to exposed pad.
EN - On/Off control input. Drive EN above 1V to turn the device on, and drive EN below 0.4V to turn the device off.
VOUT - Output pin. Regulated voltage output.

APPLICATION INFORMATION

The AIC1701B is a 150mA low dropout regulator. This product is specifically designed to provide ultra low quiescent current and high output voltage accuracy.

Output and Input Capacitor

The AIC1701B regulator is designed to be stable with a wide range of output capacitors. The ESR of the output capacitor affects stability. Larger value of the output capacitor decreases the peak deviations and improves transient response for larger current changes.

The capacitor types (aluminum, ceramic, and tantalum) have different characterizations such as temperature and voltage coefficients. All ceramic capacitors are manufactured with a variety of dielectrics, each with different behavior across temperature and applications. Common dielectrics used are X5R, X7R and Y5V. It is recommended to use 0.1µF to 1µF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ ESR range between device outputs and ground for stability. The ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability.

There are no requirements for the ESR on the input capacitor, but its voltage and temperature coefficient have to be considered for device application environment.

Protection Features

In order to prevent overloading from damaging the device, AIC1701B has internal current limiting functions designed to protect the device.

Thermal Consideration

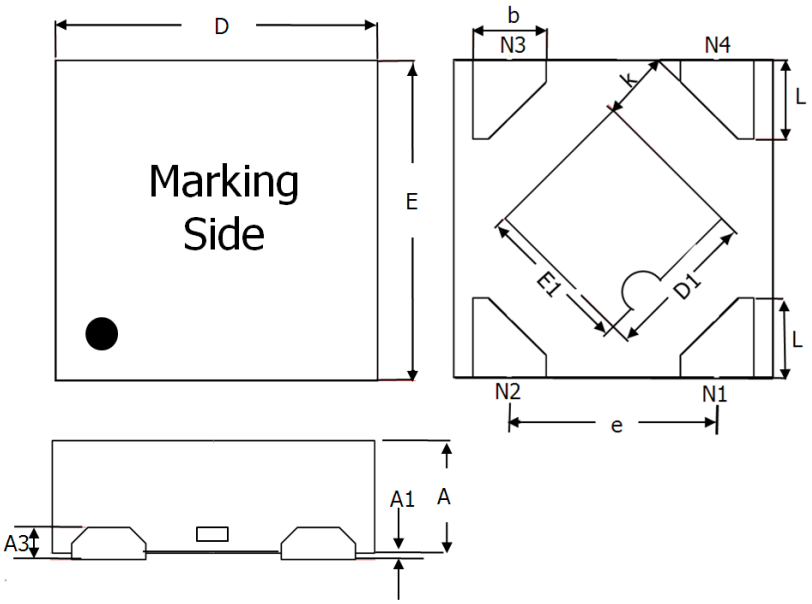
The power handling capability of the device will be limited by allowable operation junction temperature (125ºC). The power dissipated by the device will be estimated by $P_D=I_{OUT}\times(V_{IN}-V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in “Absolute Maximum Ratings” section.

Shutdown Operation

The AIC1701B is shutdown by pulling the EN input low, and turned on by driving the EN high. If EN pin floating, the AIC1701B will shut down because EN pin has built-in a pull low resistor (refer to Block Diagram).

PHYSICAL DIMENSIONS

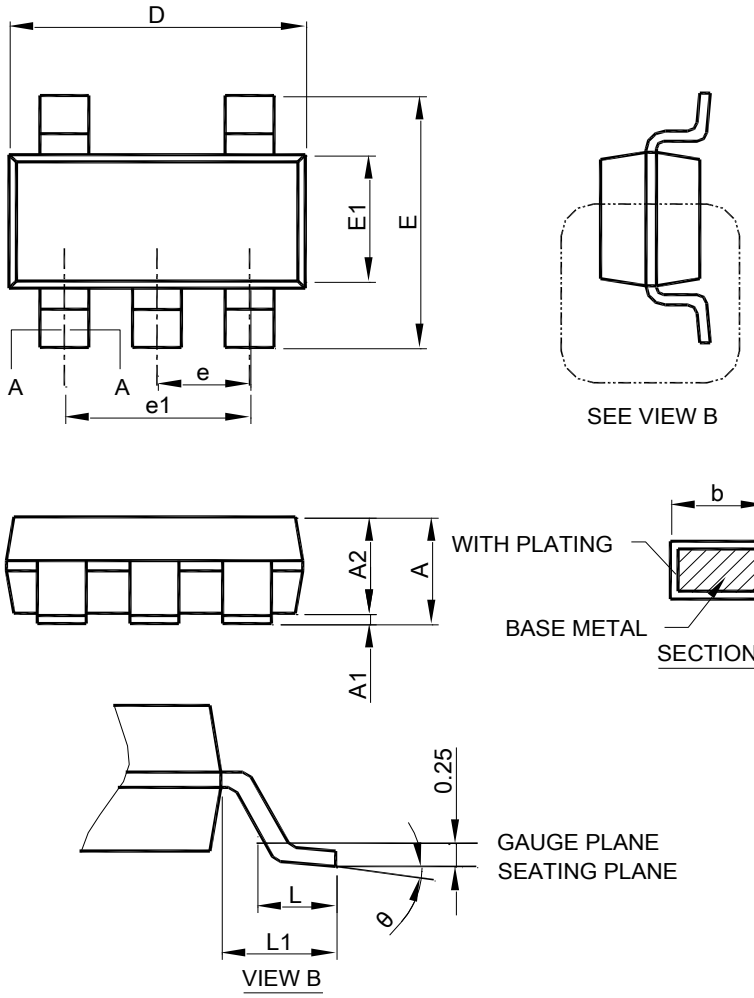
- **DFN-4 (1x1x0.55-0.625mm)**



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	0.500	0.600
A1	0.00	0.050
A3	0.152REF.	
D	0.950	1.050
E	0.950	1.050
D1	0.450	0.550
E1	0.450	0.550
k	0.211REF	
b	0.180	0.280
e	0.625TYP	
L	0.200	0.300

Note: Followed From JEDEC 664-1.

- **SOT23-5**



SYMBOL	SOT23-5	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

Note : 1. Refer to JEDEC MO-178AA.
2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.
3. Dimension "E1" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.