600mA LDO Linear Regulator

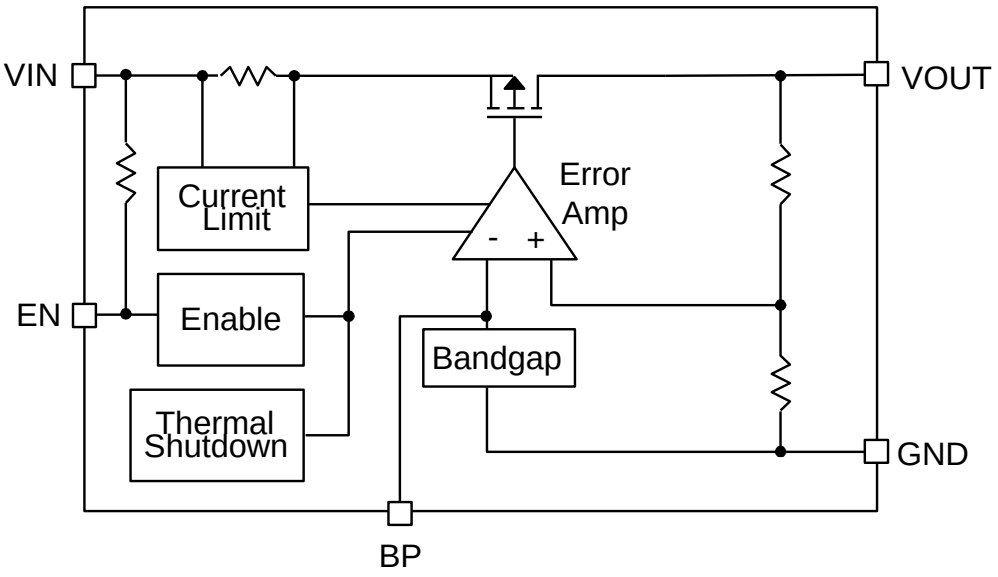
❖ GENERAL DESCRIPTION

The AX6606 is a low dropout, positive linear regulator with very low quiescent. It can supply up to 600mA output current. The BP pin with a 10nF bypass capacitor can help reduce the output noise level. The characteristics of low dropout voltage and less quiescent current make it good for some critical current application, for example, some battery powered devices. The typical quiescent current is approximately 50μA. In the shutdown mode, the maximum supply current is less than 1uA. The AX6606 regulator is able to operate with output capacitors as small as 2.2uF for stability. The AX6606 series are offering several fixed output voltage types including 1.0V, 1.1V, 1.2V, 1.3V and 1.4V. Built-in current-limit and thermal-shutdown functions prevent any fault condition from IC damage.

❖ FEATURES

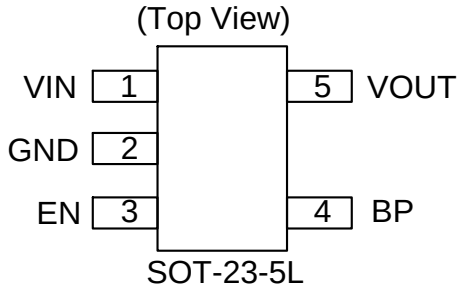
- Input voltage range : 2.6V~5.5V
- 1.0V/1.1V/1.2V/1.3V/1.4V fixed output voltages
- Guaranteed 600mA output current
- Very Low quiescent current at 50μA (typ.)
- Maximum supply current in shutdown mode <1uA
- Current limit and thermal shutdown protection
- Short circuit current fold-back
- Available in the SOT-23-5L and TDFN-6L Pb-Free Packages

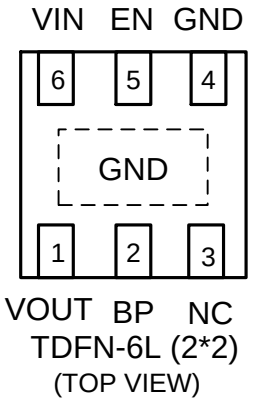
❖ BLOCK DIAGRAM



❖ PIN ASSIGNMENT

The packages of AX6606 are SOT-23-5L and TDFN-6L; the pin assignment is given by:





Name	Description
VIN	Voltage input. The input capacitor in the range of 2.2uF to 10uF is sufficient.
GND	Ground
EN	Enable pin (Active High)
VOUT	Output Voltage, The AX6606 is stable with an output capacitor 2.2uF for greater.
BP	Reference Noise Bypass (The Bypass capacitor ≧1nF
NC	No Connect Pin

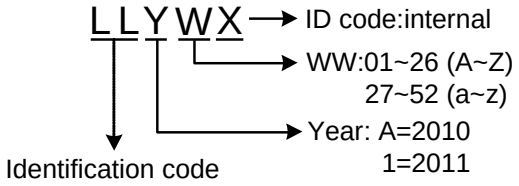
❖ ORDER/MARKING INFORMATION

Order Information

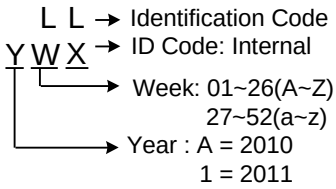
AX6606 - XX XX X

- Output voltage: 10 : 1.0V; 11 : 1.1V; 12 : 1.2V; 13 : 1.3V; 14 : 1.4V
- Package: B : SOT-23-5L; Z6 : TDFN-6L (2*2)
- Packing: Blank:Tube; A : Taping

Top Marking (SOT-23-5L)



Top Marking (TDFN-6L)



Appendix

Part Number	Identification Code
AX6606-1.0V	Fb
AX6606-1.1V	Fc
AX6606-1.2V	Fd
AX6606-1.3V	Fe
AX6606-1.4V	Ff

❖ ABSOLUTE MAXIMUM RATINGS (at T_A=25 °C)

Characteristics		Symbol	Rating	Unit
V_{IN} Pin Voltage		V_{IN}	GND - 0.3 to GND + 6	V
Output Voltage		V_{OUT}	GND - 0.3 to V_{IN} + 0.3	V
Enable Voltage		V_{EN}	GND - 0.3 to GND + 6	V
BP Pin Voltage		V_{BP}	GND - 0.3 to GND + 6	V
Power Dissipation	SOT-23-5L	PD	400	mW
	TDFN-6L		830	
Storage Temperature Range		T_{ST}	-40 to +150	°C
Operating Temperature Range		T_{OP}	-40 to +85	°C
Junction Temperature		T_J	-40 to +125	°C
Thermal Resistance from Junction to case	SOT-23-5L	θ_{JC}	180	°C/W
	TDFN-6L		25	
Thermal Resistance from Junction to ambient	SOT-23-5L	θ_{JA}	250	°C/W
	TDFN-6L		120	

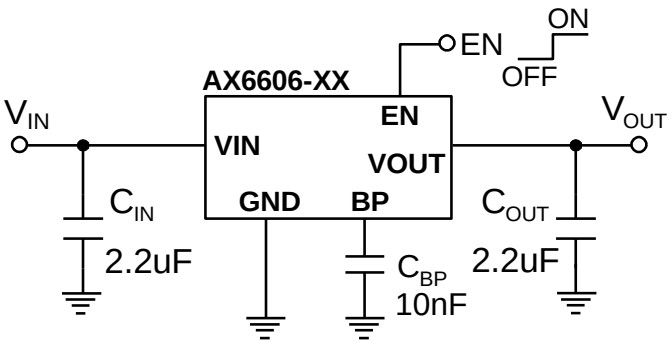
Note: θ_{JA} is measured with the PCB copper area of approximately 1 in^2(Multi-layer).

❖ ELECTRICAL CHARACTERISTICS (V_{IN}=5V, T_A=25 °C, unless otherwise noted)

Characteristics	Symbol	Conditions		Min	Typ	Max	Units
Input Voltage	V_{IN}	I_{OUT} =30mA **(Note1)**		2.6	-	5.5	V
Quiescent Current	I_Q	I_{OUT} =0mA		-	50	-	μA
Shutdown Current	I_{SD}	V_{EN}=0V		-	-	1	μA
Output Voltage Accuracy	ΔV_{OUT}	V_{IN}=2.6V to 5.5V, I_{OUT}=1mA		-3	-	+3	%
Dropout Voltage **(Note2)**	V_{DROP}	I_{OUT}=600mA		-	-	1700	mV
Current Limit	I_{LIMIT}			700	-	-	mA
Short Circuit Current	I_{Short}	Output Voltage < 0.375*V_{OUT}		-	300	-	mA
Load Regulation **(Note 3)**	ΔV_{LOAD}	I_{OUT} =10m~0.6A		-	10	30	mV
Ripple Rejection	PSRR	C_{IN}=2.2uF, C_{OUT}=2.2uF, I_{OUT} =10mA	F=120Hz	-	65	-	dB
			F=1KHz	-	55	-	
Enable Input Threshold	V_{ENH}			1.5	-	-	V
	V_{ENL}			-	-	0.4	
Enable Pin Current	I_{ENH}	V_{EN}=V_{IN}		-	0.003	0.1	μA
	I_{ENL}	V_{EN}=0V		-	0.35	1	
Temperature Shutdown	T_S			-	140	-	°C
Temperature Shutdown Hysterisis	T_{SH}			-	30	-	°C

Note1. Minimum V_{IN} voltage is defined by output adds a dropout voltage.
Note2. The dropout voltage is defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} drop about 100mV.
Note3. Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

❖ APPLICATION CIRCUIT



❖ FUNCTION DESCRIPTIONS

A minimum of 2.2uF capacitor must be connected from V_{OUT} to ground to insure stability. Typically a large storage capacitor is connected from V_{IN} to ground to ensure that the input voltage does not sag below the minimum dropout voltage during the load transient response. This pin must always be dropout voltage higher than V_{OUT} in order for the device to regulate properly.

❖ APPLICATION INFORMATION

Like any low-dropout regulator, the AX6606 requires input and output decoupling capacitors. The device is specifically designed for portable applications requiring minimum board space and smallest components. These capacitors must be correctly selected for good performance. Please note that linear regulators with a low dropout voltage have high internal loop gains which require care in guarding against oscillation caused by insufficient decoupling capacitance.

Capacitor Selection

Normally, use a 2.2uF capacitor on the input and a 2.2uF capacitor on the output of the AX6606. Larger input capacitor values and lower ESR (X5R, X7R) provide better supply-noise rejection and transient response. A higher- value output capacitor (4.7uF) may be necessary if large, fast transients are anticipated and the device is located several inches from the power source.

Input-Output (Dropout) Voltage

A regulator's minimum input-to-output voltage differential (dropout voltage) determines the lowest usable supply voltage. In battery-powered systems, this determines the useful end-of-life battery voltage. Because the device uses a PMOS, its dropout voltage is a function of drain-to source on-resistance, $R_{DS\ (ON)}$, multiplied by the load current:

$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS\ (ON)} \times I_{OUT}$$

Current Limit and Thermal Shutdown Protection

In order to prevent overloading or thermal condition from damaging the device, AX6606 regulator has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

Thermal Considerations

The AX6606 series can deliver a current of up to 600mA over the full operating junction temperature range. However, the maximum output current must be dated at higher ambient temperature to ensure the junction temperature does not exceed 125°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

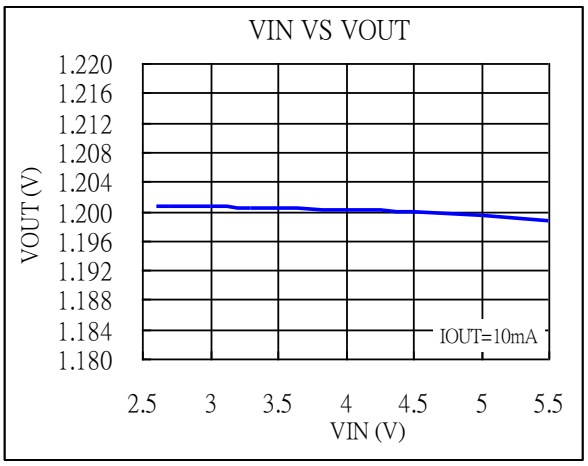
$$PD = (V_{IN} - V_{OUT}) I_{OUT}$$

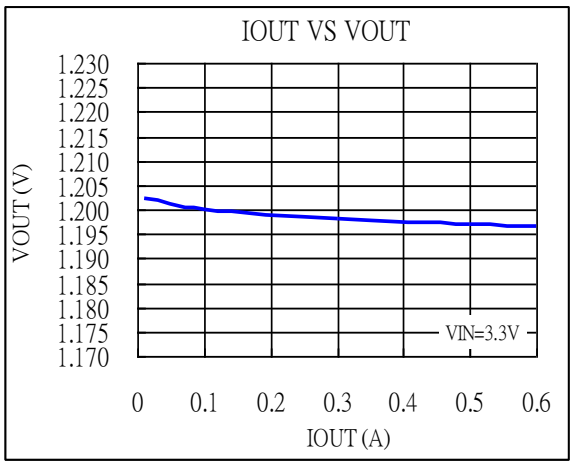
The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

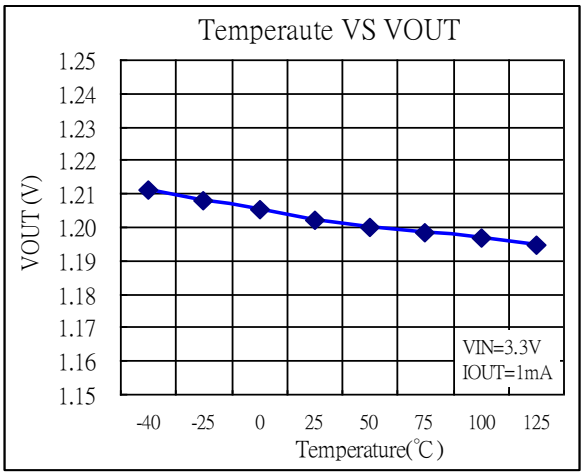
$$PD\ (MAX) = (T_{J\ (MAX)} - T_A) / \theta_{JA}$$

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}) for SOT-23-5L package at recommended minimum footprint is 250°C/W.

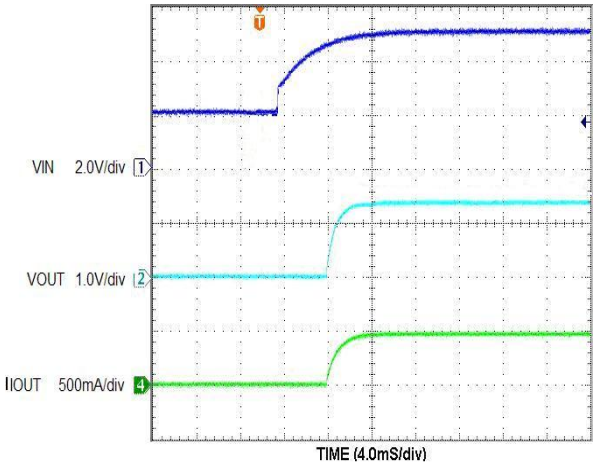
❖ TYPICAL CHARACTERISTICS



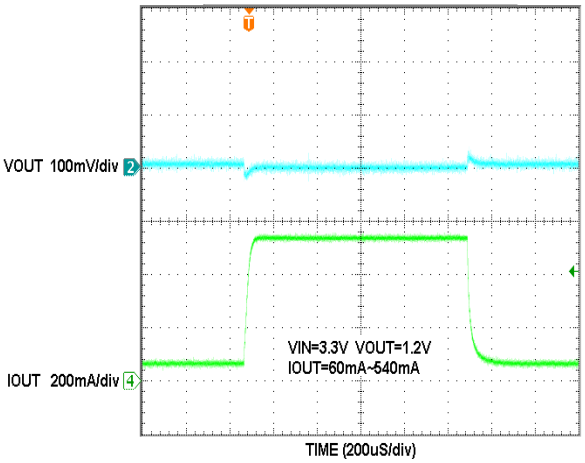




Power ON

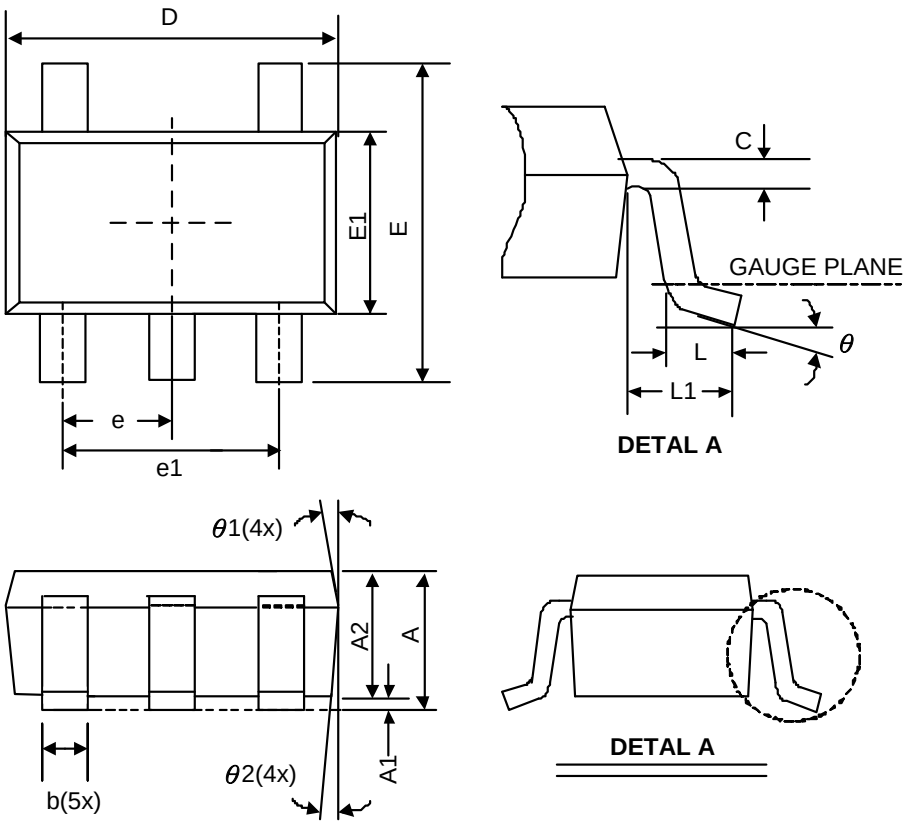


Load Transient



❖ PACKAGE OUTLINES

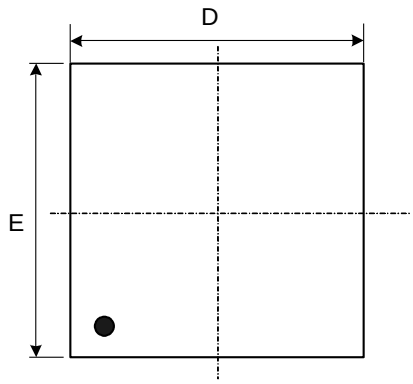
(1) SOT-23-5L



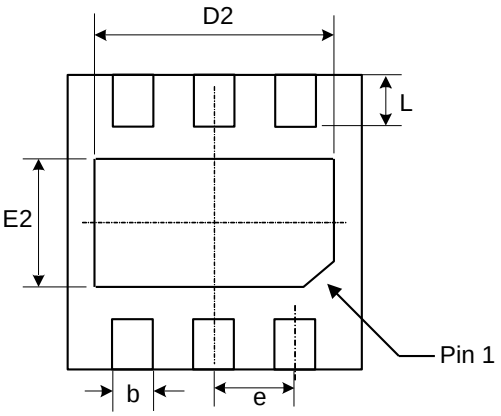
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.45	-	-	0.057
A1	0	0.08	0.15	0	0.003	0.006
A2	0.9	1.1	1.3	0.035	0.043	0.051
b	0.3	0.4	0.5	0.012	0.016	0.02
C	0.08	0.15	0.22	0.003	0.006	0.009
D	2.7	2.9	3.1	0.106	0.114	0.122
E1	1.4	1.6	1.8	0.055	0.063	0.071
E	2.6	2.8	3	0.102	0.11	0.118
L	0.3	0.45	0.6	0.012	0.018	0.024
L1	0.5	0.6	0.7	0.02	0.024	0.028
e1	1.9 BSC			0.075 BSC		
e	0.95 BSC			0.037 BSC		
θ	0°	4°	8°	0°	4°	8°
θ 1	5°	10°	15°	5°	10°	15°
θ 2	5°	10°	15°	5°	10°	15°

JEDEC outline: MO-178 AA

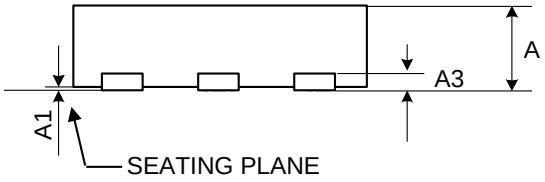
(2) TDFN-6L (2*2 0.75mm)



(Top View)



(Bottom View)



(SIDE View)

Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.203 REF.			0.008 REF.		
b	0.20	0.28	0.35	0.009	0.011	0.013
D	1.95	2.00	2.05	0.077	0.079	0.081
D2	1.35	1.50	1.65	0.055	0.059	0.063
E	1.95	2.00	2.05	0.077	0.079	0.081
E2	0.75	0.90	1.05	0.031	0.035	0.039
e	0.65 BSC.			0.026 BSC.		
L	0.20	0.30	0.40	0.008	0.012	0.016