

## **600mA High Output Current LDO Regulator**

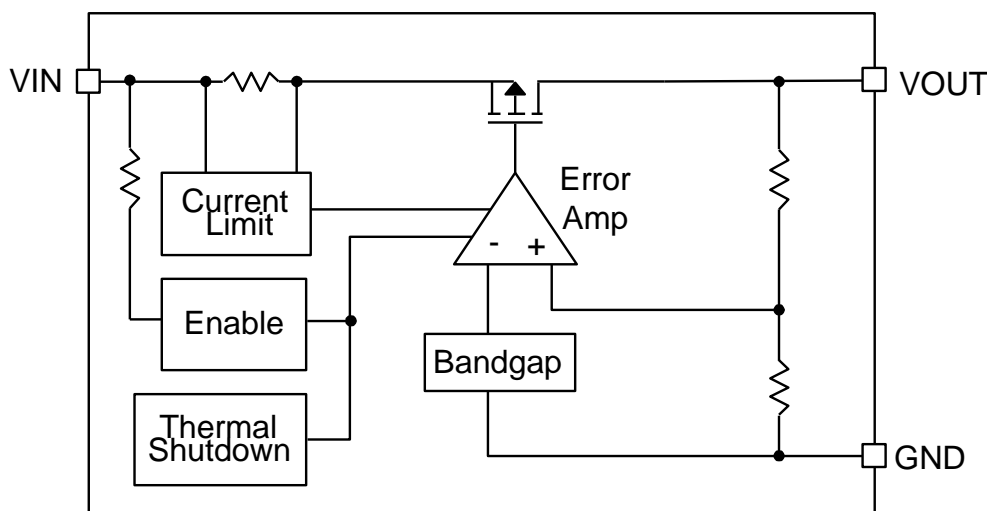
### ❖ GENERAL DESCRIPTION

The AX6634/A is a low noise, low quiescent current, low dropout and high output accuracy linear regulator. The Device includes pass element, error amplifier, band-gap, current-limit and thermal shutdown circuitry. The output current is up to 600mA. The characteristics of low dropout voltage and less quiescent current make it good for some critical current application, for example, some battery powered devices. Due to internal flexible design, result in extensively fixed output voltage versions form 1.2V to 5V per 0.1V steps. Built-in current-limit, Short current protection and thermal-shutdown functions prevent any fault condition from IC damage.

### ❖ FEATURES

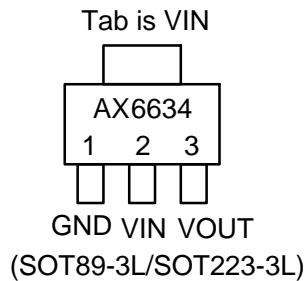
- Input voltage range : 2.6V~5.5V
- Dropout voltage is 220mV at 600mA output current
- Guaranteed 600mA output current
- Fixed Output voltage is form 1.2 V to 5V by 0.1V steps.
- Fast transient response
- Current limit and thermal shutdown protection
- Short circuit current fold-back
- Available in the 3-Pin Pb-Free SOT-89 and SOT223 packages

### ❖ BLOCK DIAGRAM

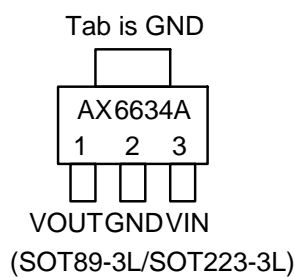


## ❖ PIN ASSIGNMENT

The packages of AX6634/A are SOT89-3L and SOT223-3L; the pin assignment is given by:



Name	Description
VIN	Voltage input
GND	Ground
VOUT	Output Voltage



## ❖ ORDER/MARKING INFORMATION

Order Information	
<p><b>AX6634 X - XXX X X</b></p> <div> <div>Pin Define</div> <div>Output voltage</div> <div>Package</div> <div>Packing</div> </div> <p>Refer 120 : 1.2V F : SOT89-3L Blank: Bag Pin Assignment 130 : 1.3V E : SOT223-3L A : Taping 500 : 5.0V</p>	
Top Marking (SOT89-3L)	Top Marking (SOT223-3L)
<p>6 6 3 4 X → Functional code Blank: AX6634 A: AX6634A L Y W X → ID code: internal WW: 01~26(A~Z) 27~52(a~z) Year: A=2010 1=2011</p> <p>Output Type</p> <p>A:1.2V J:2.0V S:2.8V a:3.6V n:4.4V B:1.3V K:2.1V T:2.9V b:3.7V O:4.5V C:1.4V L:2.2V U:3.0V d:3.8V q:4.6V D:1.5V M:2.3V V:3.1V e:3.9V r:4.7V E:1.6V N:2.4V W:3.2V f:4.0V t:4.8V F:1.7V P:2.5V X:3.3V g:4.1V u:4.9V G:1.8V Q:2.6V Y:3.4V h:4.2V y:5.0V H:1.9V R:2.7V Z:3.5V m:4.3V</p>	<p>AX 6 6 3 4 A - V V Y W W X → ID code: internal WW: 01~52 Year: A= 2010 1= 2011</p> <p>Blank: AX6634 A: AX6634A</p> <p>Output Voltage AX6634-120: 1.2V AX6634-130: 1.3V AX6634-500: 5.0V</p>

### ❖ ABSOLUTE MAXIMUM RATINGS (at $T_A=25\text{ }^{\circ}\text{C}$ )

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
Power Dissipation (1 in <sup>2</sup> heatsink)	PD	600	mW
Storage Temperature Range	$T_{ST}$	-40 to +150	$^{\circ}\text{C}$
Operating Temperature Range	$T_{OP}$	-40 to +85	$^{\circ}\text{C}$
Operating Junction Temperature	$T_J$	-40 to +125	$^{\circ}\text{C}$
Thermal Resistance from Junction to case	$\theta_{JC}$	SOT89-3L=100	$^{\circ}\text{C/W}$
		SOT223-3L=15	
Thermal Resistance from Junction to ambient	$\theta_{JA}$	SOT89-3L=160	$^{\circ}\text{C/W}$
		SOT223-3L=75	

Note:  $\theta_{JA}$  is measured with the PCB copper area of approximately 1 in<sup>2</sup>(Multi-layer). That need connect to tap pin.

### ❖ ELECTRICAL CHARACTERISTICS $T_A=25\text{ }^{\circ}\text{C}$ (unless otherwise noted)

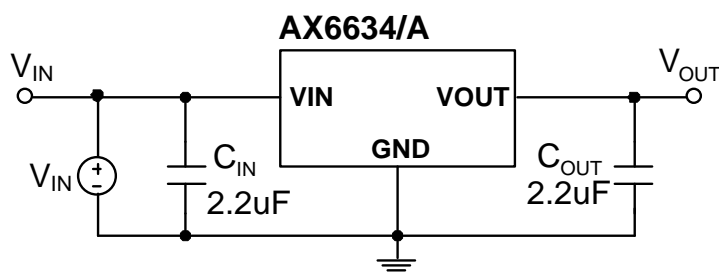
Characteristics	Symbol	Conditions		Min	Typ	Max	Units
Input Voltage	V <sub>IN</sub>	(Note1)		2.6	-	5.5	V
Output Voltage Accuracy (Note1)	ΔV <sub>OUT</sub>	I <sub>OUT</sub> =1mA		-1.5	-	+1.5	%
V <sub>OUT</sub> Temperature Coefficient	TC			-	30	-	ppm/°C
Quiescent Current	I <sub>Q</sub>	I <sub>OUT</sub> =0mA, V <sub>IN</sub> =5V		-	45	-	μA
Ground Current	I <sub>GND</sub>	I <sub>OUT</sub> =1mA to 600mA		-	45	-	μA
Dropout Voltage	V <sub>DROP</sub>	I <sub>OUT</sub> =600mA	V <sub>OUT</sub> =1.50V	-	1.10	1.30	V
			V <sub>OUT</sub> =1.80V	-	0.70	0.90	
			V <sub>OUT</sub> =2.50V	-	0.35	0.50	
			V <sub>OUT</sub> =3.30V	-	0.22	0.35	
Current Limit (Note 2)	I <sub>LIMIT</sub>			0.8	-	-	A
Short Circuit Current	I <sub>short</sub>	Output Voltage < 0.25*V <sub>OUT</sub>		-	300	-	mA
Line Regulation	ΔV <sub>Line</sub>	I <sub>OUT</sub> =0mA, V <sub>IN</sub> = V <sub>OUT</sub> +1V to V <sub>OUT</sub> +2V	V <sub>OUT</sub> ≤ 2.0V	-	-	0.15	%
			V <sub>OUT</sub> >2.0V	-	0.02	0.1	%
Load Regulation (Note 3)	ΔV <sub>LOAD</sub>	I <sub>OUT</sub> =1m~600mA		-	0.2	1	%
Ripple Rejection	PSRR	C <sub>IN</sub> =2.2μF, C <sub>O</sub> =2.2uF, I <sub>OUT</sub> =100mA	F=1KHz	-	55	-	dB
			F=10KHz	-	30	-	
			F=100KHz	-	30	-	
Temperature Shutdown	T <sub>S</sub>			-	140	-	°C
Temperature Shutdown Hysteresis	T <sub>SH</sub>			-	30	-	°C

Note1: Minimum  $V_{IN}$  voltage is defined by output adds a dropout voltage.

Note2: Current limit is measured at constant junction temperature by using pulsed testing with a low ON time.

Note3: Regulation is measured at constant junction temperature by using pulsed testing with a low ON time.

## ❖ APPLICATION CIRCUIT



## ❖ FUNCTION DESCRIPTIONS

A minimum of 2.2μF capacitor must be connected from V<sub>OUT</sub> to ground to insure stability. Typically a large storage capacitor is connected from V<sub>IN</sub> 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<sub>OUT</sub> in order for the device to regulate properly.

## ❖ APPLICATION INFORMATION

Like any low-dropout regulator, the AX6634/A 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 (see Capacitor Characteristics Section). 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 2.2μF capacitor on the input and a 2.2μF capacitor on the output of the AX6634/A. Larger input capacitor values and lower ESR (X5R, X7R) provide better supply-noise rejection and transient response. A higher- value output capacitor (4.7μF) 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<sub>DS (ON)</sub>, multiplied by the load current:

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

## Current Limit and Short-Circuit Protection

The AX6634/A used a current sense-resistor to monitor the output current. A portion of the PMOS output transistor's current is mirrored to a resistor such that the voltage across this resistor is proportional to the output current. Once the output current exceeds limit threshold, AX6634/A would be protected with a limited output current. Further more, when the output is short to ground, the output current would be folded-back to a less limit.

## Thermal Considerations

The AX6634/A 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:

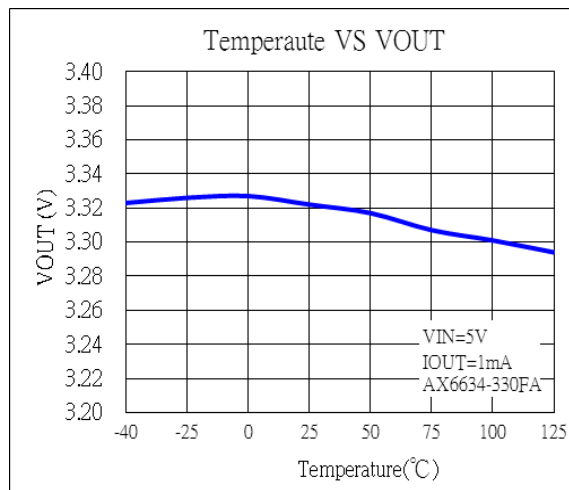
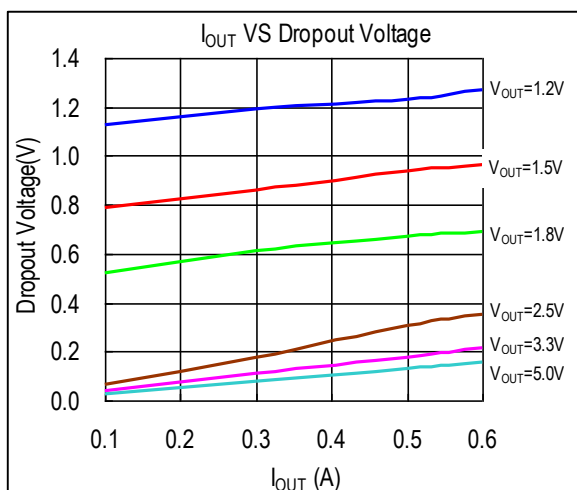
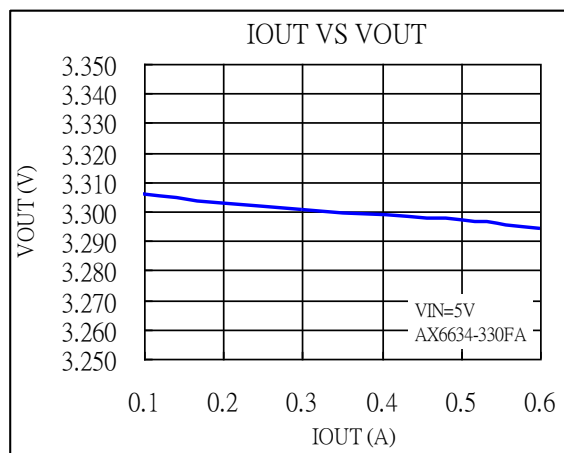
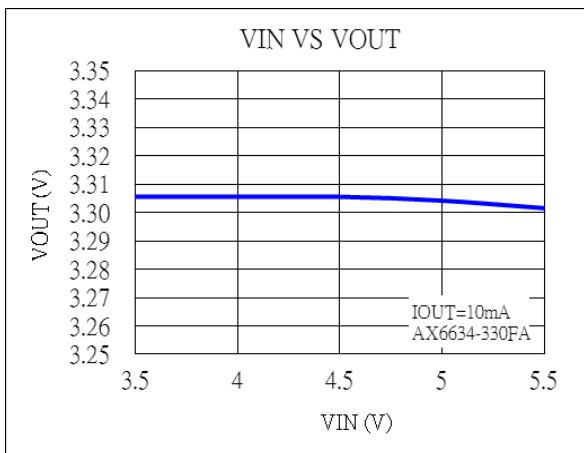
$$PD (MAX) = (T_{J (MAX)} - T_A) / \theta_{JA}$$

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 ( $\theta_{JA}$ ) for SOT89-3L package at recommended minimum footprint is 160°C/W (please refer Maximum rating table). Visit our website in which "Recommended Footprints for Soldering Surface Mount Packages" for detail.

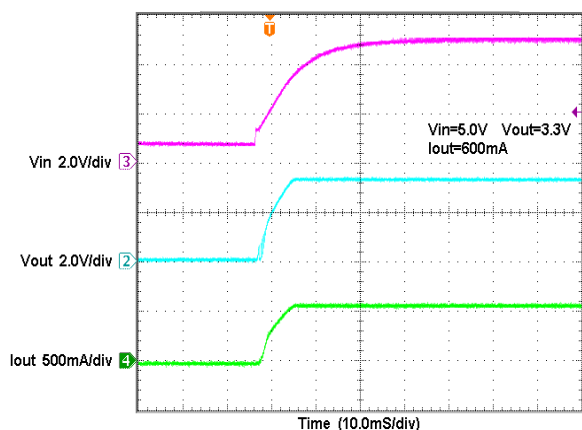
## PCB Layout

An input capacitance of  $\cong 2.2\mu F$  is required between the AX6634/A input pin and ground (the amount of the capacitance may be increased without limit), this capacitor must be located a distance of not more than 1cm from the input and return to a clean analog ground. Input capacitor can filter out the input voltage spike caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire. Otherwise, the actual voltage at the VIN pin may exceed the absolute maximum rating. The output capacitor also must be located a distance of not more than 1cm from output to a clean analog ground. Because it can filter out the output spike caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire.

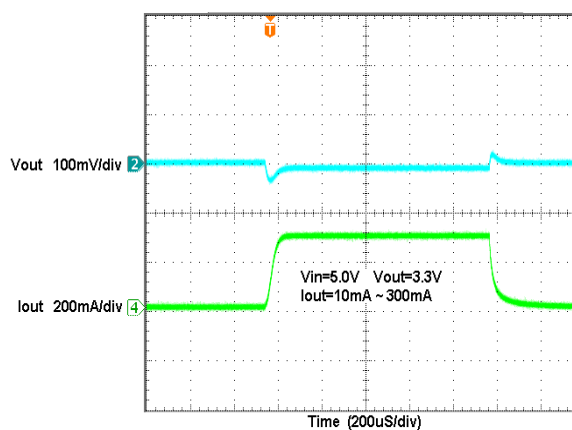
# ❖ TYPICAL CHARACTERISTICS



Power ON

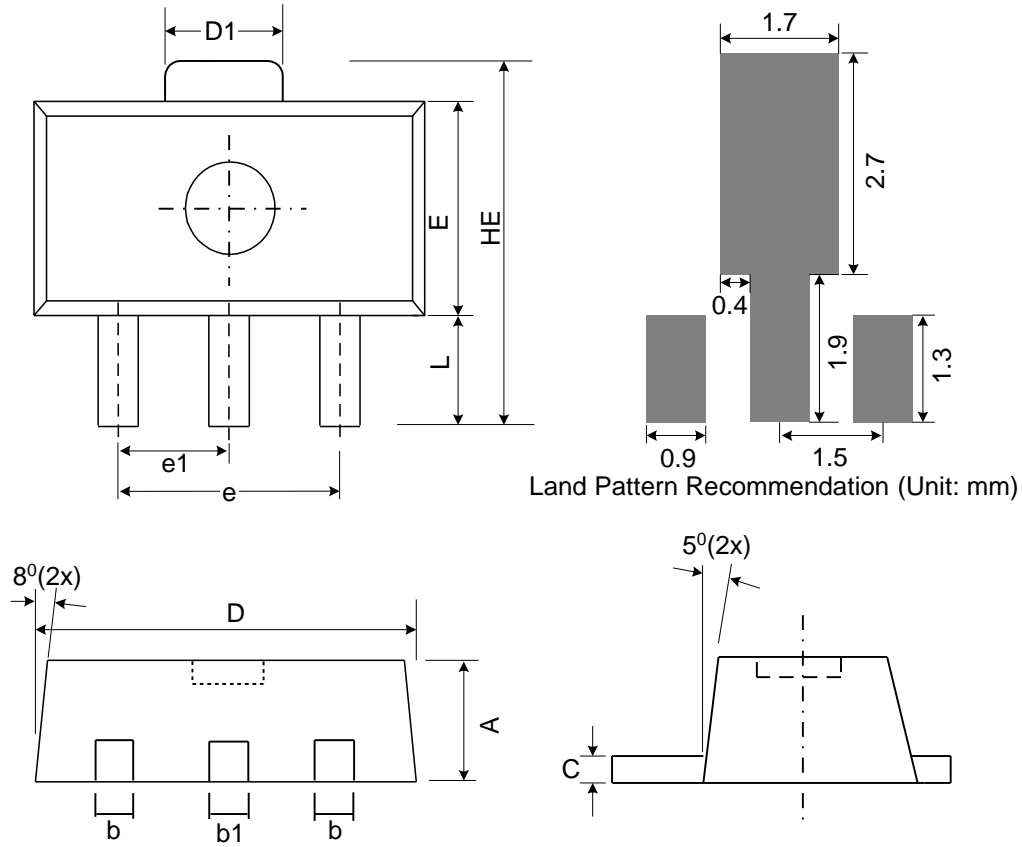


Load Transient



❖ **PACKAGE OUTLINES**

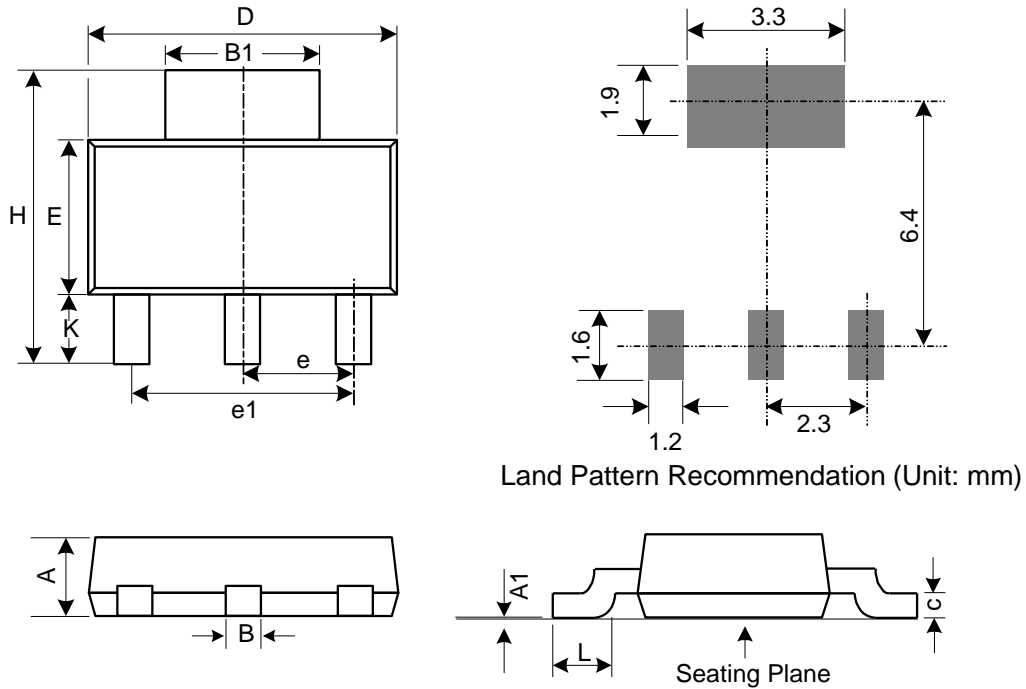
**(1) SOT89-3L**



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.40	1.50	1.60	0.055	0.059	0.063
b	0.36	0.42	0.48	0.014	0.017	0.019
b1	0.44	0.50	0.56	0.017	0.02	0.022
C	0.35	0.40	0.44	0.014	0.016	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.35	1.59	1.83	0.053	0.063	0.072
e	3.0 BSC			0.118 BSC		
e1	1.5 BSC			0.059 BSC		
E	2.29	2.45	2.60	0.09	0.097	0.102
HE	3.94	4.10	4.25	0.155	0.161	0.167
L	0.80	1.00	1.20	0.031	0.04	0.047

JEDEC outline: TO-243 AB

(2) SOT223-3L



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.8	-	-	0.071
A1	0.02	0.06	0.1	0.001	0.002	0.004
B	0.66	0.75	0.84	0.026	0.03	0.033
B1	2.9	3	3.1	0.114	0.118	0.122
C	0.23	0.315	0.35	0.009	0.012	0.014
D	6.3	6.5	6.7	0.248	0.256	0.264
E	3.3	3.5	3.7	0.13	0.138	0.146
H	6.7	7	7.3	0.264	0.278	0.287
L	0.75	-	-	0.03	-	-
K	1.5	1.75	2	0.059	0.069	0.079
e	2.3 Basic			0.091 Basic		
e1	4.6 Basic			0.181 Basic		

JEDEC outline: TO-261 AB