BL9195

300mA 3-Pin, Ultra Fast, Ultra Low Dropout High PSRR CMOS LDO Regulator

FEATURES

- Ultra-Fast Response in Line/Load Transient
- Low Dropout:210mV@300mA
- Wide Operating Voltage Range:2V to 6V
- Wide Output Voltage Range:1.2V to 5V
- Low Temperature Coefficient
- Current Limiting Protection
- Thermal Shutdown Protection
- Only 1μF Output Capacitor Required for Stability
- High Power Supply Rejection Ratio
- Custom Voltage Available
- Available in 3-Lead SOT23, SOT89 and SOT223 Package

APPLICATIONS

- Cellular and Smart Phones
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Hand-Held Instrument
- PCMCIA Cards
- MP3/MP4/MP5 Players
- Portable Information Appliances

DESCRIPTION

The BL9195 is designed for portable RF and wireless applications with demanding performance and space requirements. The BL9195 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 BL9195 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The other features include ultra low dropout voltage, high output accuracy, current limiting protection, and high ripple rejection ratio. Available in 3-lead SOT23, SOT89 and SOT223 packages.

ORDERING INFORMATION

BL9195 XX X X XXX

Package:
RT: SOT23-3
SRT: SOT89-3
TRT: SOT223-3

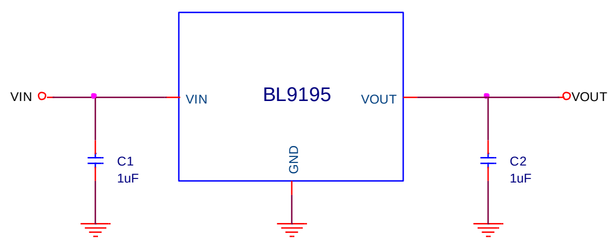
Features:
P: Standard (default, lead free)
C: Customized
G: Green

Output Voltage Accuracy:
A: ±1%
B: ±2%

Output Voltage:
12: 1.2V 13:1.3V 15: 1.5V 18:1.8V
25:2.5V 27:2.7V 28:2.8V 285: 2.85V
30: 3.0V 32:3.2V 33:3.3V 50:5.0V
CT: custom fixed output (50mV step)

TYPICAL APPLICATION

BL9195 SOT23-3/SOT89-3/SOT223-3



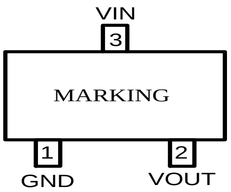
Application hints:

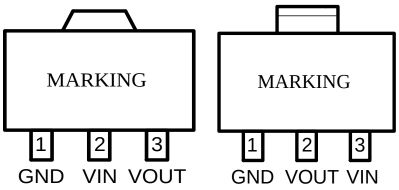
Output capacitor (C2⩾2.2uF) is recommended in BL9195-1.2V, BL9195-1.3V, BL9195-1.5V and BL9195-1.8V application to assure circuit stability.

Absolute Maximum Rating (Note 1)

Input Supply Voltage (V_{IN})	-0.3V to +6.5V
Output Voltage	-0.3V to V_{IN}+0.3V
Output Current	300mA
Maximum Junction Temperature	125°C
Operating Temperature Range (Note2)	-40°C to 85°C
Storage Temperature Range	-65°C to 125°C
Lead Temperature (Soldering, 10s)	300°C

Package Information





Part Number	Top Mark	Top Mark	Temp Range
BL9195-1.2V	G A Y W (Note3)	BL9195 (Note4) YWSS A	-40°C to +85°C
BL9195-1.3V	G B Y W	BL9195 YWSS B	-40°C to +85°C
BL9195-1.5V	G C Y W	BL9195 YWSS C	-40°C to +85°C
BL9195-1.8V	G D Y W	BL9195 YWSS D	-40°C to +85°C
BL9195-2.5V	G E Y W	BL9195 YWSS E	-40°C to +85°C
BL9195-2.7V	G F Y W	BL9195 YWSS F	-40°C to +85°C
BL9195-2.8V	G G Y W	BL9195 YWSS G	-40°C to +85°C
BL9195-2.85V	G H Y W	BL9195 YWSS H	-40°C to +85°C
BL9195-3.0V	G I Y W	BL9195 YWSS I	-40°C to +85°C
BL9195-3.2V	G J Y W	BL9195 YWSS J	-40°C to +85°C
BL9195-3.3V	G K Y W	BL9195 YWSS K	-40°C to +85°C
BL9195-5.0V	G L Y W	BL9195 YWSS L	-40°C to +85°C

Thermal Resistance (Note 5):

Package	Θ_{JA}	Θ_{JC}
SOT23-3	250°C/W	130°C/W
SOT89-3	160°C/W	45°C/W
SOT223-3	60°C/W	20°C/W

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

Note 2: The BL9195 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.

NOTE3: Y: Year of wafer manufacturing W: Week of wafer manufacturing.

Y	0	1	2	3	4	…
Year	2010	2011	2012	2013	2014	……

W	01	2	…	26	27	28	…	52

Week	A	B	…	Z	a	b	…	z

Note 4: Y: Year of assembly manufacturing W: Week of assembly manufacturing
SS: Lot ID (the 7th and 8th number of Lot numbers)

Y	0	1	2	3	4	…
Year	2010	2011	2012	2013	2014	……

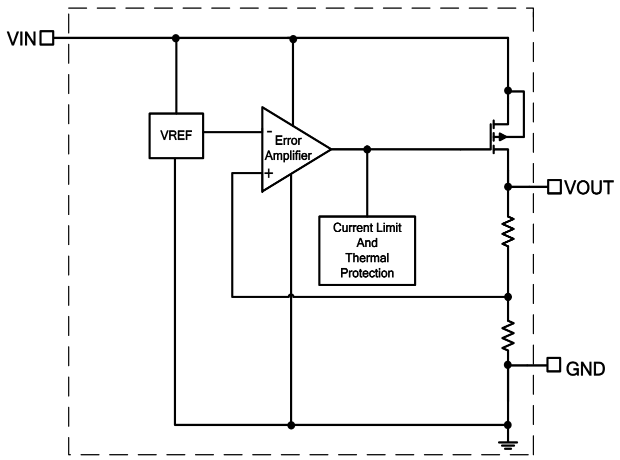
W	01	2	…	26	27	28	…	52
Week	A	B	…	Z	$\overline{A}$	$\overline{B}$	…	$\overline{Z}$

Note 5: Thermal Resistance is specified with approximately 1 square of 1 oz copper.

Pin Description

PIN-NUMBER			NAME	FUNCTION
SOT23-3	SOT223-3	SOT89-3		
1		1	GND	Ground
3		2	VIN	Power Input Voltage
2		3	VOUT	Output Voltage

Block Diagram



Electrical Characteristics (Note 6)

(V_{IN}=3.6V, C_{IN}=C_{OUT}=1μF, T_A=25°C, unless otherwise noted.)

Parameter		Symbol	Conditions	MIN	TYP	MAX	unit
Input Voltage		V_{IN}		2		6	V
Output Voltage Accuracy (Note 7)		ΔV_{OUT}	V_{IN}=3.6V, I_{OUT}=1mA	-1		+1	%
				-2		+2	
Current Limit		I_{LIM}	R_{LOAD}=1Ω	400	430		mA
Quiescent Current		I_Q	I_{OUT}=0mA		90	130	μA
Dropout Voltage		V_{DROP}	I_{OUT}=200mA, V_{OUT}=2.8V		130	180	mV
			I_{OUT}=300mA, V_{OUT}=2.8V		210	300	
Line Regulation (Note 8)		ΔV_{LINE}	V_{IN}=3.6V to 5.5V I_{OUT}=1mA		0.05	0.17	%/V
Load Regulation (Note 9)		ΔV_{LOAD}	1mA<I_{OUT}<300mA			2	%/A
Output Voltage (Note 10) Temperature Coefficient		TC_{VOUT}	I_{OUT}=1mA		±60		ppm/°C
Output Noise Voltage		e_{NO}	10Hz to100KHz, I_{OUT}=200mA		100		μV_{RMS}
Power Supply Rejection Ratio	f=217Hz	PSRR	I_{OUT}=100mA		-78		dB
	f=1KHz				-72		
	f=10KHz				-52		
Thermal Shutdown Temperature		T_{SD}	Shutdown, Temp increasing		165		°C
Thermal Shutdown Hysteresis		T_{SDHY}			30		°C

Note 6: 100% production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

Note 7: This IC includes two kinds of output voltage accuracy versions. A: ±1%, B: ±2%.

Note 8: Line regulation is calculated by $\Delta V_{LINE} = \left(\frac{V_{OUT1} - V_{OUT2}}{\Delta V_{IN} \times V_{OUT(normal)}}\right) \times 100$

Where V_{OUT1} is the output voltage when V_{IN}=5.5V, and V_{OUT2} is the output voltage when V_{IN}=3.6V, $\triangle V_{IN}$=1.9V . V_{OUT} (normal) =2.8V.

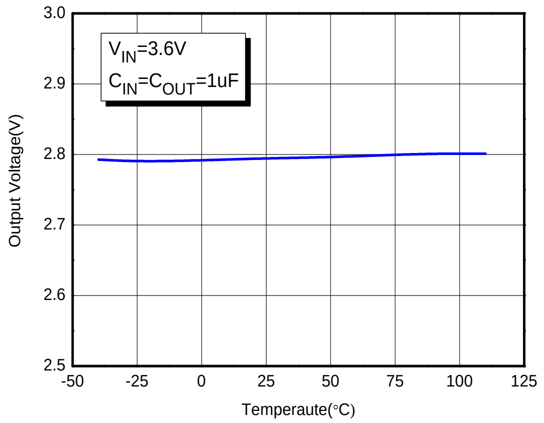
Note 9: Load regulation is calculated by $\Delta V_{LOAD} = \left(\frac{V_{OUT1} - V_{OUT2}}{\Delta I_{OUT} \times V_{OUT(normal)}}\right) \times 100$

Where V_{OUT1} is the output voltage when I_{OUT}=1mA, and V_{OUT2} is the output voltage when I_{OUT}=300mA. $\triangle I_{OUT}$=0.299A, V_{OUT}(normal)=2.8V.

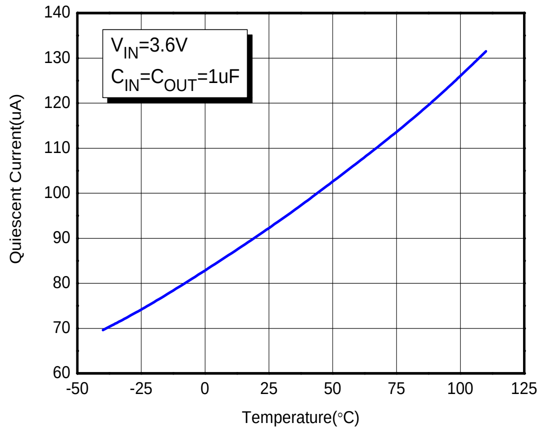
Note 10: The temperature coefficient is calculated by $TC_{V_{OUT}} = \frac{\Delta V_{OUT}}{\Delta T \times V_{OUT}}$

Typical Performance Characteristics

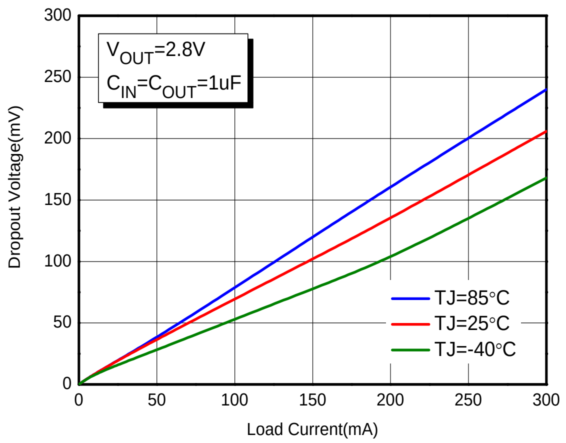
Output Voltage Vs. Temperature



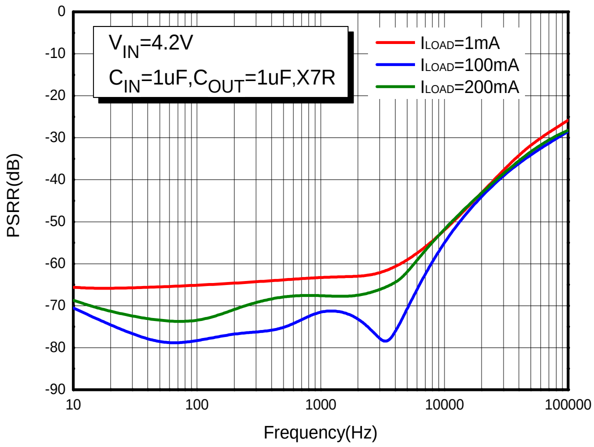
Quiescent Current Vs. Temperature



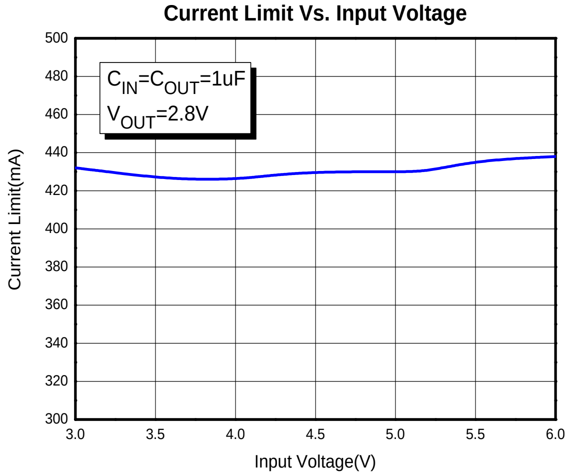
Dropout Voltage Vs. Load Current



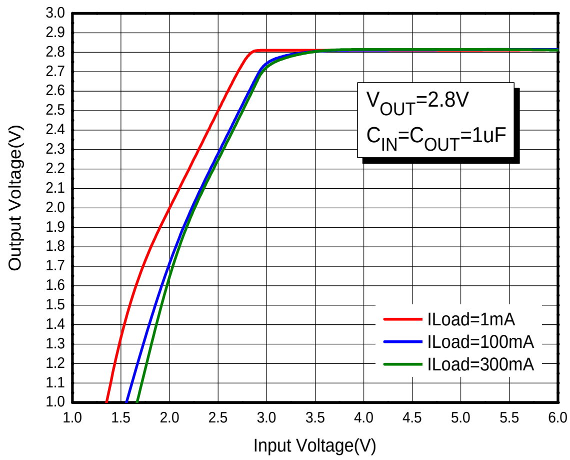
PSRR



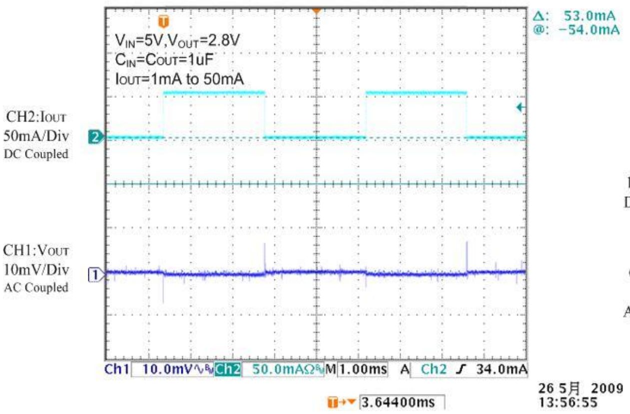
Current Limit Vs. Input Voltage



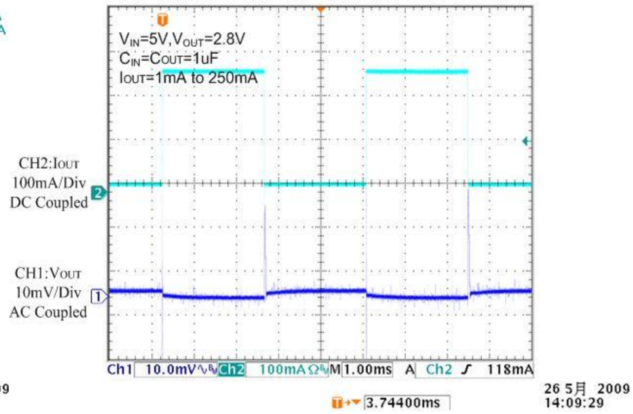
VOUT Vs.VIN



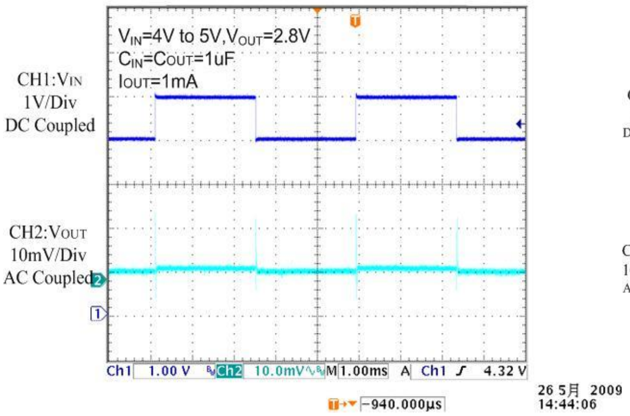
Load Transient Response



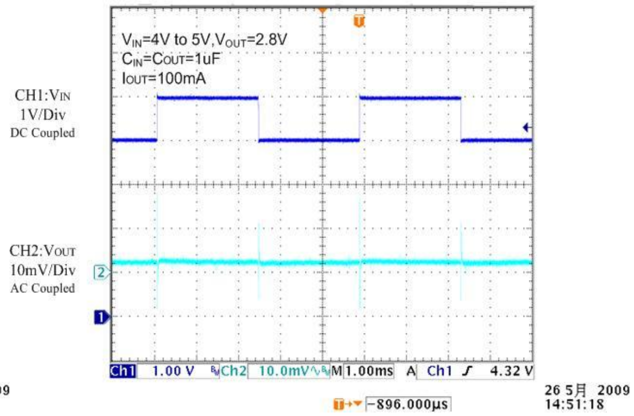
Load Transient Response



Line Transient Response



Line Transient Response



Applications Information

Like any low-dropout regulator, the external capacitors used with the BL9195 must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the BL9195 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 PSRR and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The BL9195 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF with ESR is > 25mΩ on the BL9195 output ensures stability. The BL9195 still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability, and PSRR. The output capacitor should be located not more than 0.5 inch from the V_{OUT} pin of the BL9195 and returned to a clean analog ground.

Thermal Considerations

Thermal protection limits power dissipation in BL9195. When the operation junction temperature exceeds 165°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 30°C.
For continue operation, do not exceed absolute maximum operation junction temperature 125°C. The power dissipation definition in device is:

$$P_D = (V_{IN}-V_{OUT}) \times I_{OUT} + V_{IN} \times I_Q$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula：

$$P_D(MAX) = (T_J(MAX) - T_A) / \theta_{JA}$$

Where $T_J(MAX)$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of BL9195, 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-23-3 package is 250°C/W, SOT89-3 package is 160°C/W, SOT-223-3 package is 60°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:

$P_D(MAX) = (125°C-25°C)/160 = 667mW$ (SOT89-3)

$P_D(MAX) = (125°C-25°C)/250 = 400mW$ (SOT23-3)

$P_D(MAX) = (125°C-25°C)/60 = 1666mW$ (SOT223-3)

The maximum power dissipation depends on operating ambient temperature for fixed T_J(MAX) and thermal resistance θ_{JA}. It is also useful to calculate the junction of temperature of the BL9195 under a set of specific conditions. In this example let the Input voltage V_{IN}=3.3V, the output current Io=300mA and the case temperature T_A=40°C measured by a thermal couple during operation. The power dissipation for the V_{OUT}=2.8V version of the BL9195 can be calculated as:

P_D = (3.3V−2.8V) ×300mA+3.6V×100uA
=150mW

And the junction temperature, T_J, can be calculated as follows:

T_J=T_A+P_D×θ_{JA}=40°C+0.15W×250°C/W
=40°C+37.5°C=77.5°C<T_J(MAX) =125°C

For this operating condition, T_J is lower than the absolute maximum operating junction temperature,125°C, so it is safe to use the BL9195 in this configuration.

Layout considerations

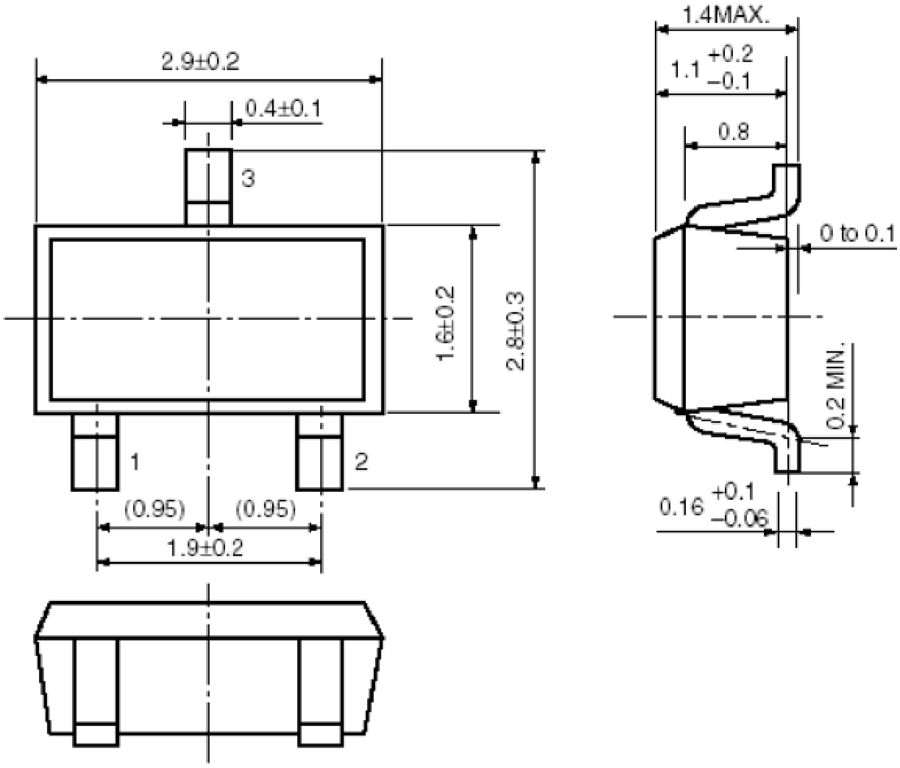
To improve ac performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for V_{IN} and V_{OUT}, with each ground plane connected only at the GND pin of the device.

Package Description

1. SOT23-3

Package	SOT-23-3	Devices per reel	3000	Unit	mm

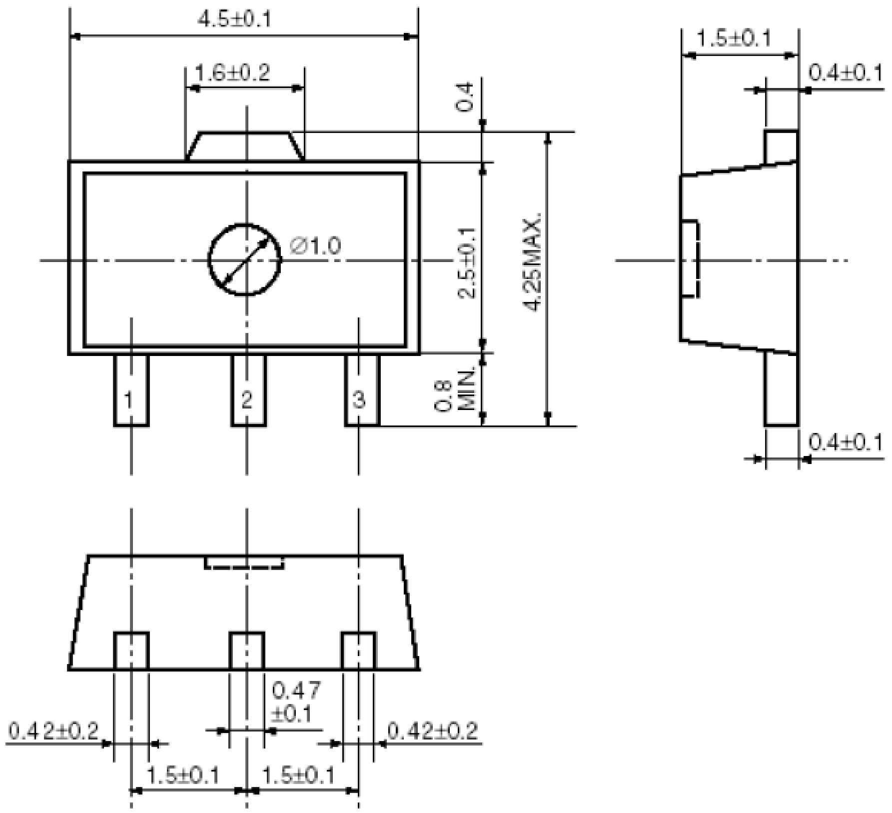
Package dimension:



2. SOT89-3

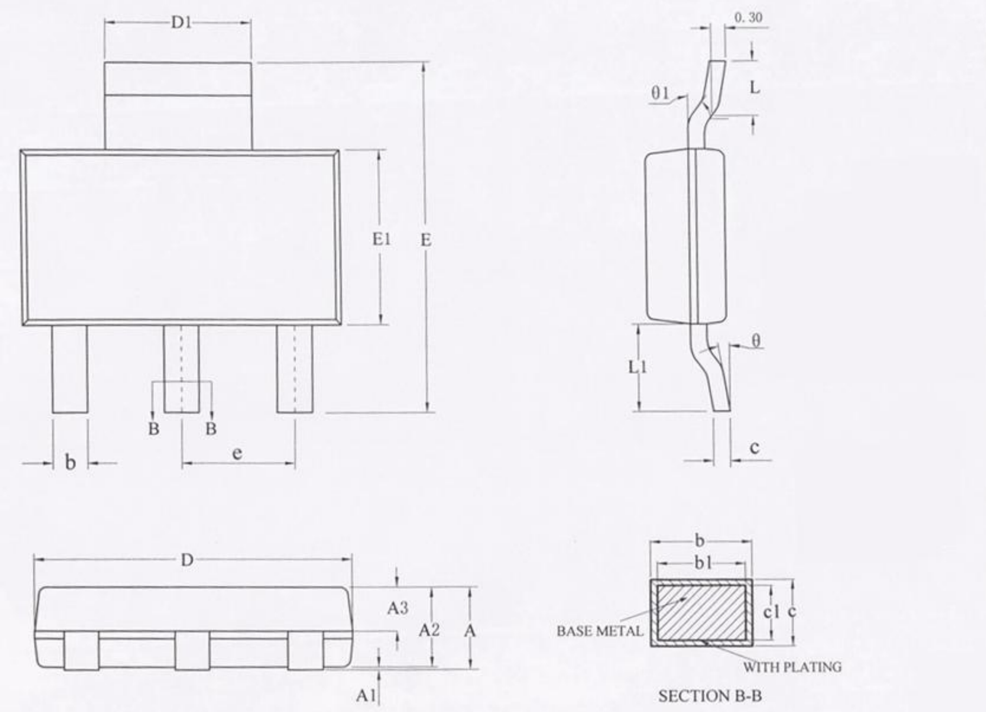
Package	SOT-89-3	Devices per reel	1000	Unit	mm

Package dimension:



3. SOT223-3

Package	SOT223-3	Device per reel	2500	Unit	mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.50	1.65	1.80
A1	0.03	0.06	0.09
A2	1.45	1.60	1.75
A3	0.80	0.90	1.00
b	0.69	—	0.78
b1	0.68	0.71	0.74
c	0.30	—	0.35
c1	0.29	0.30	0.31
D	6.30	6.50	6.70
D1	3.00REF		
E	6.80	7.00	7.20
E1	3.40	3.50	3.60
e	2.30BSC		
L	0.90	—	—
L1	1.75BSC		
θ	0	—	7°
θ1	37.5 REF		