AT5205

150mA Low-Noise LDO Regulator

Immense Advance Tech.

FEATURES

- Low –Noise Output
- High Output Voltage Accuracy
- Guaranteed 150mA Output
- Low GND Current
- Low Dropout Voltage
- Extremely Tight Load and Line Regulation
- Very Low Temperature Coefficient
- Current and Thermal Limiting
- Reverse-Battery Protection

APPLICATION

- Cellular Telephones
- Laptop, Notebook, and Palmtop Computers
- Battery-Powered Equipment
- PCMCIA V_{CC} and V_{PP} Regulation / Switching
- Consumer / Personal Electronics
- SMPS Post-Regulator / DC-to-DC Modules
- High-Efficiency Linear Power Supplies

DESCRIPTION

The AT5205 series voltage regulators are specifically designed for use as a power source for video instruments, handheld communication equipment, and battery powered equipment. The AT5205 series voltage regulator ICs feature a high accuracy output voltage and low GND current. Each device contains a voltage reference unit, and error amplifier, a driver transistor, and resistors for setting output voltage, and a current limit circuit. These devices are allow construction of an efficient, constant voltage power supply circuit. The AT5205 is available in fixed and adjustable output voltage versions in a small SOT-25 surface mount package. The fixed version also available in SOT-89 surface mount packages.

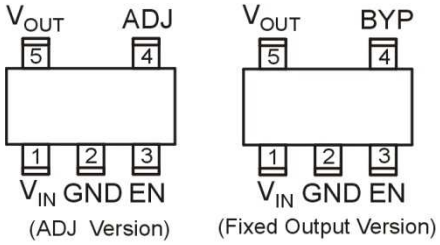
ORDER INFORMATION

AT 5205- X.X KE R

- IAT
- Circuit Type
- Output Voltage: A= ADJ, 2.5= 2.5V, 3.0= 3.0V, 3.3= 3.3V, 5.0= 5.0V
- KE: SOT-25
- KG: SOT-89 (KG type is only available in Fixed Output Version)
- Shipping: R: Tape & Reel, T: Tube

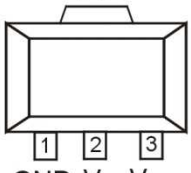
PIN CONFIGURATIONS (TOP VIEW)

SOT-25



SOT-89

TAB

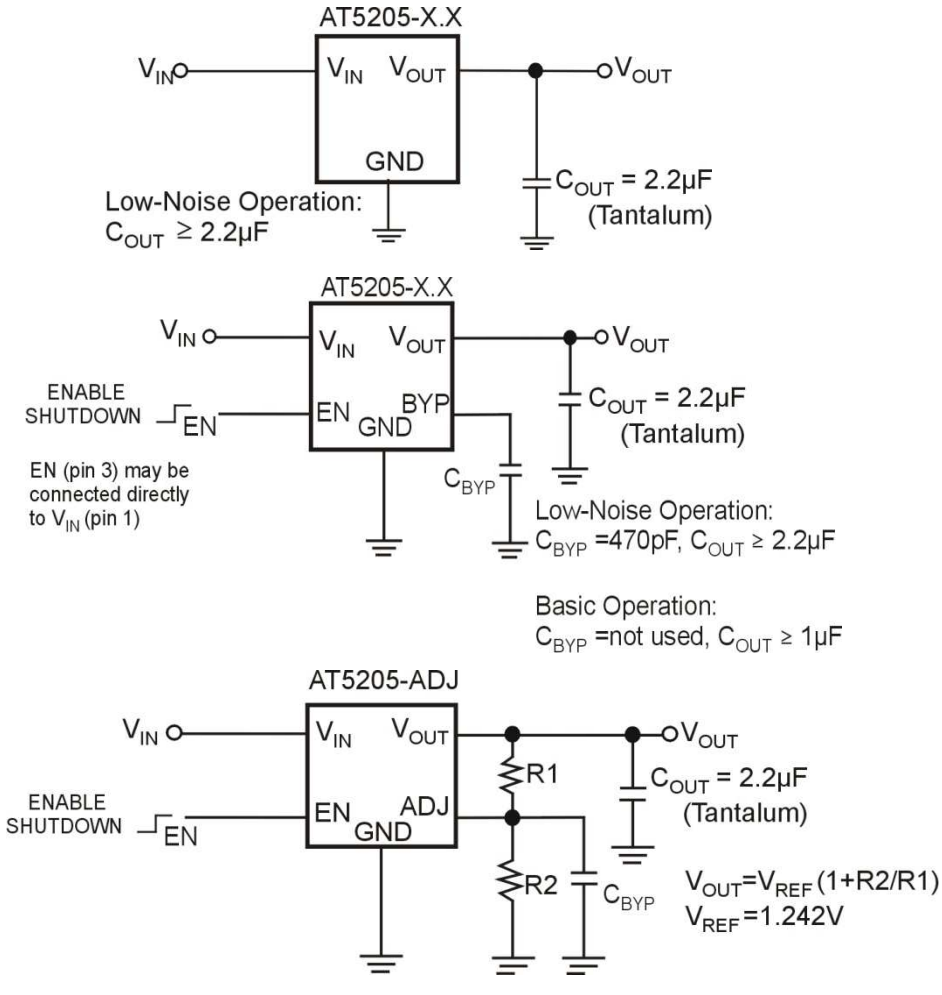


(TAB is connected to Pin2)
Fixed Output Version

PIN DESCRIPTIONS

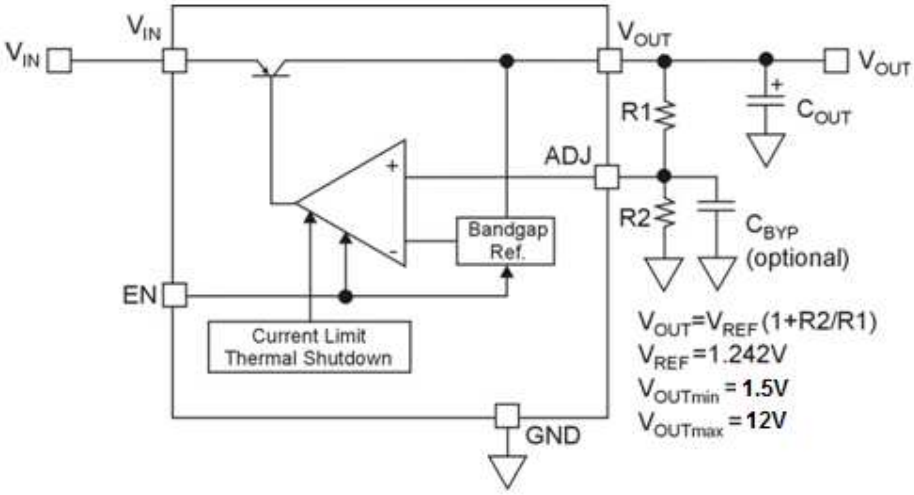
Pin Name	Pin Description
GND	Ground. For SOT-25 package type, GND pin connect to a large copper pad or plane to channel heat from IC.
V_{IN}	Regulator Input supply voltage can range 2.5V to 16V. For SOT-89 package, type V_{IN} pin connects to a large copper pad or plane to channel heat form the IC.
V_{OUT}	Regulator Output.
BYP	Reference Bypass: Connect external 470pF capacitor to GND to reduce output noise. May be left open.
ADJ	Feedback for setting the output voltage, connect external resistors network for adjustable output. $V_{OUT} = \frac{1.242(R1+R2)}{R1}$ Volts
EN	Enable/Shutdown (Input): CMOS compatible input. Logic high = enable; logic low or open = shutdown.

TYPICAL APPLICATION CIRCUITS

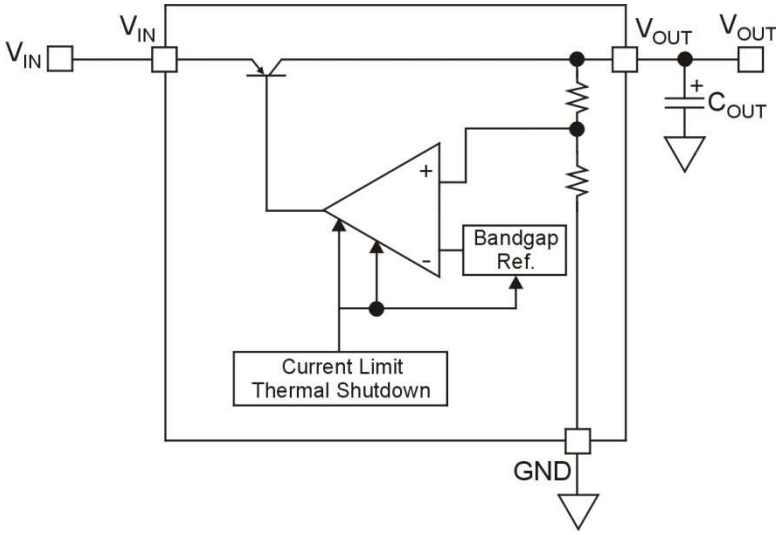


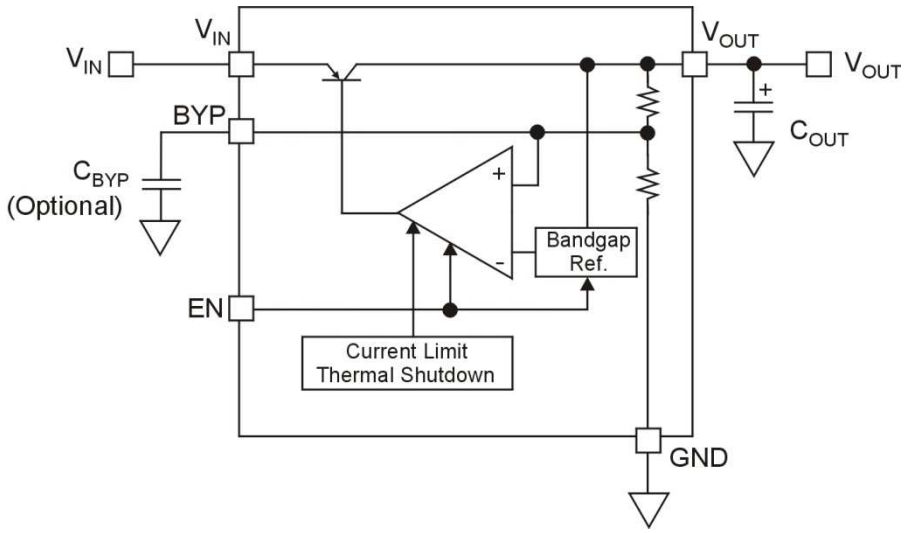
BLOCK DIAGRAM

(Adjustable Voltage)



(Fixed Voltage)





ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter		Symbol	Max Value	Unit
Supply Input Voltage		V_{IN}	-20 to +20	V
Enable Input Voltage		EN	-20 to +20	W
Maximum Junction Temperature		T_J	125	℃
Storage Temperature Range		T_{STG}	-60 to +150	℃
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	℃
Power Dissipation P_D @ T_A=25℃	SOT-25	P_D	300	mW
	SOT-89		640	
Thermal Resistance Junction to Ambient (Note 2)	SOT-25	θ_{JA}	333	℃ / W
	SOT-89		156	
Thermal Resistance Junction to Case	SOT-25	θ_{JC}	106.6	℃ / W
	SOT-89		100	

RECOMMENDED OPERATING CONDITIONS (Note 3)

Parameter	Symbol	Operation Conditions	Unit
Supply Input Voltage	V_{IN}	2.5 to 16	V
Enable Input Voltage	EN	0 to V_{IN}	V
Operating Junction Temperature Range	T_J	-40 to +125	℃
Operating Ambient Temperature Range	T_{OPA}	-40 to +85	℃

Note 1: Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25℃.

Note 3: The device is not guaranteed to function outside its operating conditions.

ELECTRICAL CHARACTERISTICS

V_{IN} = V_{OUT} +1V; I_L = 100μA; C_L =1.0μF; T_A= 25℃ , **boldface type** apply over full operating temperature range, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage Accuracy	V_{OUT}	$V_{ariation\ from\ specified}$ V_{OUT}	-1 **-2**		-1 **+2**	%
Feedback Voltage (For Adjustable Voltage)	V_{REF}	(Note 4)	1.223	1.242	1.260	V
Output Voltage Temperature Coefficient	$\triangle V_{OUT}/\triangle T$	(Note 5)		**40**		ppm / ℃
Line Regulation	REG_{LINE}	V_{IN} = V_{OUT} + 1V to 16V		0.004	0.012 **0.050**	% / V
Load Regulation	REG_{LOAD}	I_L = 0.1mA to 150mA, (Note 6)		0.02	0.2 **0.5**	%
Dropout Voltage (Note 7)	V_D	I_L = 100μA I_L = 50mA I_L = 100mA I_L = 150mA		10 110 140 165	50 **70** 150 **230** 250 **300** 275 **350**	mV
Ground Pin Current (Note 8)	I_{GND}	I_L = 100μA I_L = 50mA I_L = 100mA I_L = 150mA		120 350 600 1300	160 **180** 600 **800** 1000 **1500** 1900 **2500**	μA
Ripple Rejection	RSRR	f = 100Hz, I_L =0.1Ma		65		dB
Current Limit	I_{LIMIT}	V_{OUT} = 0V		320	600	mA
Thermal Regulation	$\triangle V_{OUT}/\triangle P_D$	(Note 9)		0.05		% / V
Output Noise	e_{no}	I_L = 50mA, C_L = 2.2μF, 470pF from BYP to GND		260		nV/$\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS (CONTINUED)

VIN = VOUT +1V; IL = 100μA; CL =1.0μF; TA= 25℃, boldface type apply over full operatin g temperature range, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Enable						
Ground Pin Quiescent Current	I_Q	V_{EN} ≤ 0.4V (Shutdown) V_{EN} ≤ 0.18V (Shutdown)		0.01	1 **5**	μA
Enable Input Logic-Low Voltage	V_{IL}	Regulator Shutdown			0.40 **0.18**	V
Enable Input Logic-High Voltage	V_{IH}	Regulator Enabled	**2.0**			V
Enable Input Current	I_{IL}	V_{IL}≤0.4V V_{IL}≤0.18V		0.01	-1 **-2**	μA
	I_{IH}	V_{IH}≥2.0V	2	5	35 **40**	μA

Note 4: The AT5205-ADJ maintains a fixed 1.242 (typ) reference between the V_{OUT} pin and ADJ pin for the ADJ version. Moreover, the output voltage of ADJ version must be set between 1.5V to 12V.

Note 5: Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.

Note 6: Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 150mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

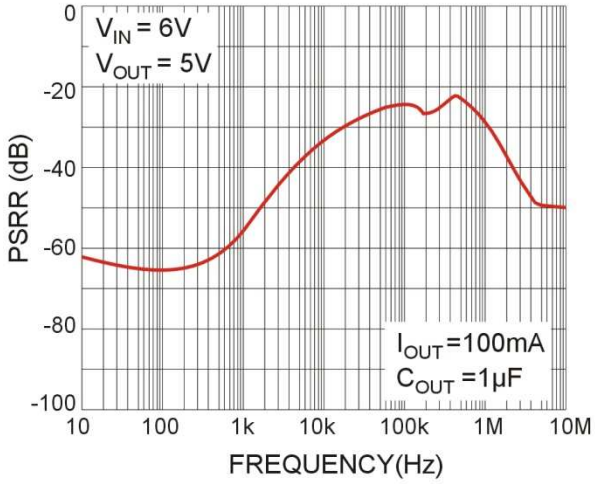
Note 7: Dropout Voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at 1V differential.

Note 8: Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

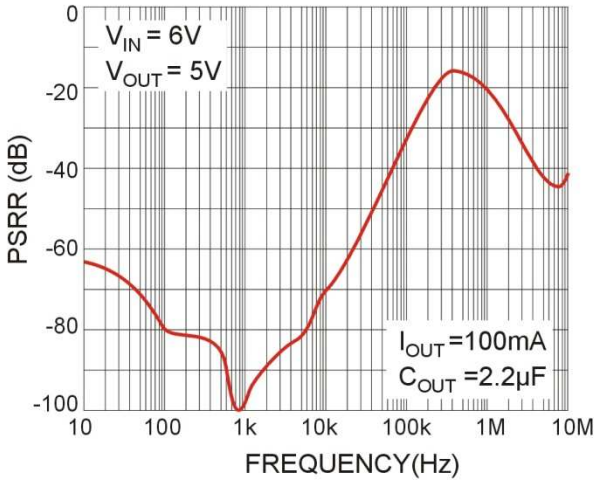
Note 9: Thermal regulation is defined as the change in output voltage at a time “t” after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 150mA load pulse at V_{IN} = 16V for t = 10ms.

TYPICAL CHARACTERISTICS

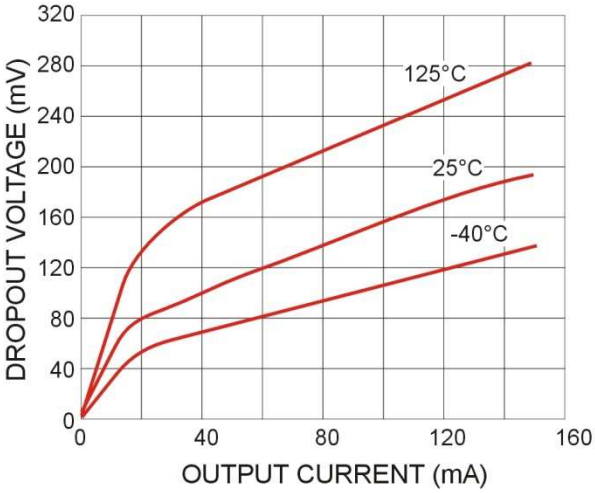
(1) Power Supply Rejection Ratio



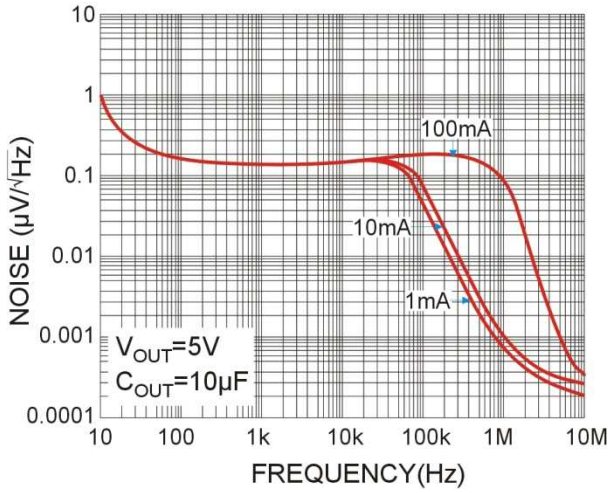
(2) Power Supply Rejection Ratio



(3) Dropout Voltage vs. Output Current



(4) Noise Performance



APPLICATION INFORMATION

Enable / Shutdown

Forcing EN (enable/shutdown) high (>2) enables the regulator. EN is compatible with CMOS logic gates. If the enable/shutdown feature is not required, connect EN (pin 3) to V_{IN} (supply input, pin1).

Input Capacitor

A 1μF capacitor should be placed from V_{IN} to GND if there is more than 10 inches of wire between the input and the acfilter capacitor or if a battery is used as the input.

Reference Bypass Capacitor

BYP (reference bypass) is connected to the internal voltage reference. A 470pF capacitor (C_{BYP}) connected from BYP to GND quiets this reference, providing a significant reduction in output noise. C_{BYP} reduces the regulator phase margin; when using C_{BYP}, output capacitors of 2.2μF or greater are generally required to maintain stability.

The start-up speed of the AT5205 is inversely proportional to the size of the reference bypass capacitor. Applications requiring a slow ramp-up of output voltage should consider larger values of C_{BYP}. Likewise, if raped turn-on is necessary, consider omitting C_{BYP}.

If output noise is not a major concern, omit C_{BYP} and leave BYP open.

Output Capacitor

An output capacitor required between V_{OUT} and GND to prevent oscillation. 2.2μF minimum is recommended. Larger values improve the regulator's transient response; the output capacitor value may be increased without limit.

The output capacitor should have an ESR (effective series resistance) of about 5W or less and a resonant frequency above 1MHz. Ultra-low-ESR capacitors can cause a low amplitude oscillation on the output and/ or under damped transient response. Most tantalum or aluminum electrolytic capacitors are adequate; film types will work, but more expensive. Since many aluminum electrolytics have electrolytes that freeze at about -30℃, solid tantalums ate recommended for operation below -25℃.

At lower values for output current, less output capacitance is required for output stability. The capacitor can be reduced to 0.47μF for current below 10mA or 0.33μF for current below 1mA.

No-Load Stability

AT5205 will remain stable and in regulation with no load (other than the internal voltage divider) unlike many other voltage regulators. This is especially important in CMOS RAM keep-alive applications.

Thermal Considerations

AT5205 is designed to provide 150mA of continuous current in a small SOT-89 package. Maximum power dissipation can be calculated based on the output current and the voltage drop across the part. To determine the maximum power dissipation of the package, use the junction-to-ambient thermal resistance of the device and the following basic equation:

$$P_{D(MAX)} = \frac{(T_{J(MAX)} - T_A)}{R_{\theta JA}})$$

$T_{J(MAX)}$ is the maximum junction temperature of the die, 125℃, and T_A is the ambient operating temperature. $R_{\theta JA}$ is layout dependent.

APPLICATION INFORMATION (CONTINUED)

Figure 1 is a typical circuit application. Figure 2 is a current boost circuit which can deliver more than 600mA. The circuit has no current limiting and the external transistor must be rated for the expected power dissipation.

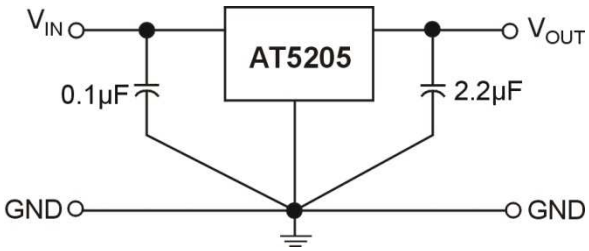


Figure 1. Typical Application

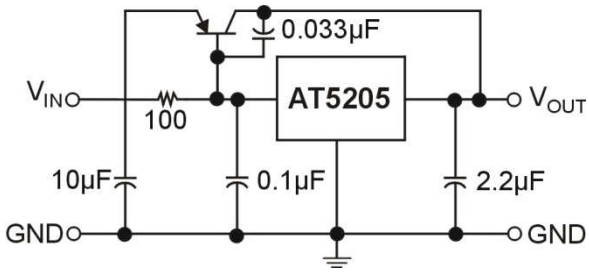
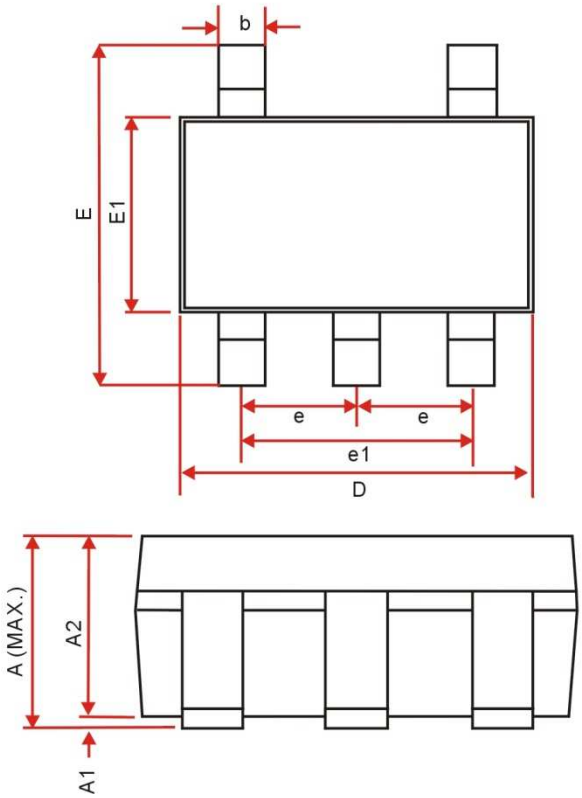
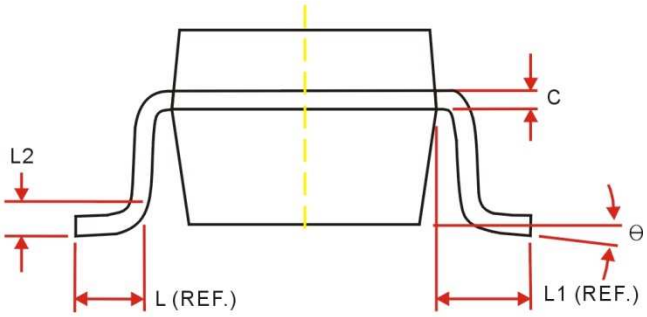


Figure 2. Current Boost circuit

PACKAGE OUTLINE DIMENSIONS

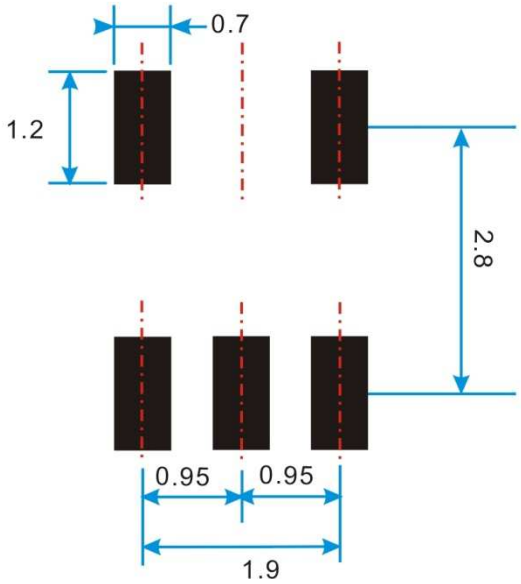
SOT-25 PACKAGE OUTLINE DIMENSIONS





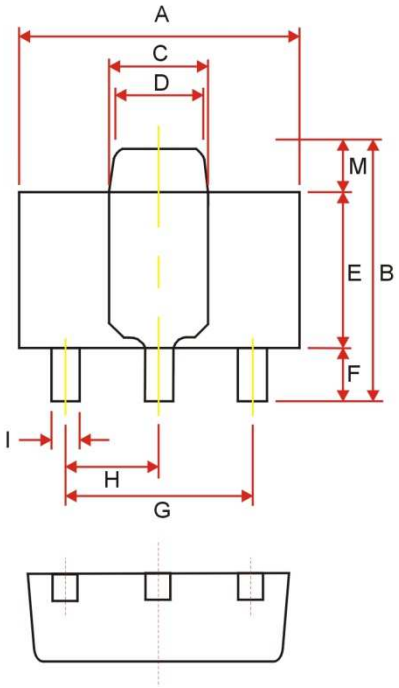
Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.45 MAX.	
A1	0	0.15
A2	0.90	1.30
C	0.08	0.22
D	2.90 BSC.	
E	2.80 BSC.	
E1	1.60 BSC.	
L	0.30	0.60
L1	0.60BSC.	
L2	0.25BSC.	
Θ	0°	10°
b	0.30	0.50
e	0.95BSC.	
e1	1.90BSC.	

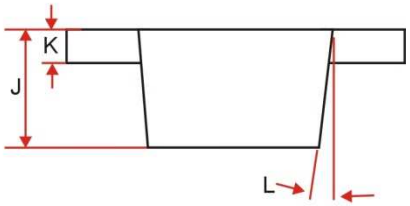
SOT-25 PACKAGE FOOTPRINT (mm)



PACKAGE OUTLINE DIMENSIONS

SOT-89 PACKAGE OUTLINE DIMENSIONS





REF.	Dimensions In Millimeters	
	Min.	Max.
A	4.40	4.60
B	3.94	4.25
C	1.50	1.70
D	1.30	1.50
E	2.29	2.60
F	0.89	1.20
G	3.00 REF.	
H	1.50 REF.	
I	0.40	0.56
J	1.40	1.60
K	0.35	0.44
L	5°TYP.	
M	0.70 REF.	