FEATURES

- Low dropout voltage 350mV at 600mA (Typ.)
- Output voltage accuracy ：±2%
- Small output capacitor
- Output short circuit protection
- Thermal overload shutdown protection
- SOT-89 Package
- RoHS Compliant and 100% Lead (Pb)-Free

APPLICATIONS

- CD-ROM Drivers
- DVD-ROM Drivers
- Portable Consumer Equipment
- Radio Control Systems
- Wireless Communication Systems

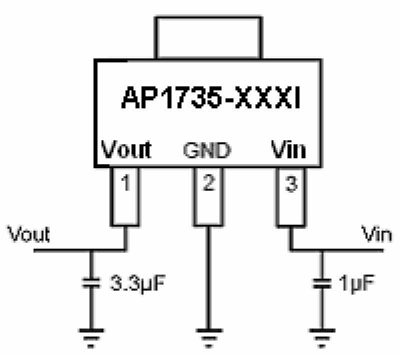
GENERAL DESCRIPTION

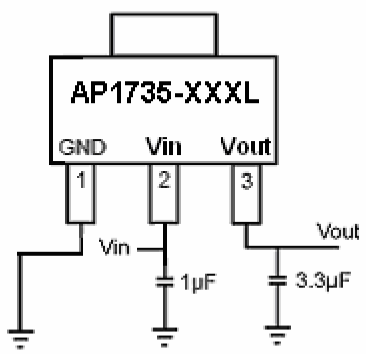
The AP1735 is a low-dropout linear regulator that operations in the input voltage range from +2.5V to +7.0V and delivers 600mA output current.

The output voltage is preset at an internally trimmed voltage 1.8V. 2.5V or 3.3V. Other output voltages can be mask-optioned from 1.4V to 4.4V with 100mV increment.

The AP1735 consists of a 1.25V bandgap reference, an error amplifier, and a P-channel pass transistor. Other features include short-circuit protection and thermal shutdown protection. The AP1735 devices are available in SOT-89 packages.

TYPICAL APPLICATION CIRCUITS





ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Ratings	Units
Input voltage VIN to GND		Vin	7.0	V
Output current limit, $I_{(LIMIT)}$		Iout	1.3	A
Junction Temperature		T_J	+155	℃
Power Dissipation	SOT-89	Pd	550	mW
Operating Ambient Temperature		Topr	-40 ~ +125	°C
Storage Temperature		Tstg	-55 ~ +150	°C
Lead temperature (soldering, 10sec)			+250	°C
Thermal Resistance	SOT-89	θ_{JA}	180	°C/W

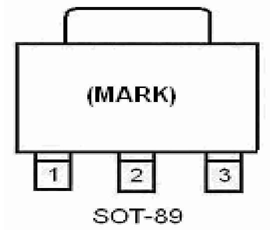
* The power dissipation values are based on the condition that junction temperature T_J and ambient temperature T_A difference is 100°C.
* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum -rated conditions for extended periods may affect device reliability.

ELECTRICAL CHARATERISTICS

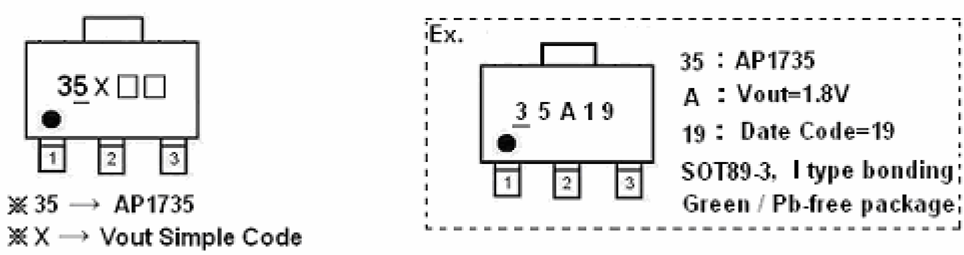
(T_A=25℃, unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage		2.5		7.0	V
V_{OUT}	Output Voltage	$V_{IN}=V_{OUT}+0.48V$, I_{OUT}=1mA, $V_{out}\leq 1.8V$	V_{OUT} -2%	V_{OUT}	V_{OUT} +2%	V
		$V_{IN}=V_{OUT}+0.48V$, I_{OUT}=1mA, $V_{OUT}>1.8V$	V_{OUT} -2%	V_{OUT}	V_{OUT} +2%	V
I_{MAX}	Maximum Load Current			600		mA
I_Q	Ground Pin Current	I_{LOAD}=0mA to 600mA, $V_{IN}=V_{OUT}+0.8V$		100	120	μA
I_{SC}	Short-Circuit Current	$V_{OUT}=0$, $V_{IN}>V_{OUT}+1.0V$		650	760	mA
V_{DROP}	Dropout Voltage	I_{OUT}=100mA		60	100	mV
		I_{OUT}=600mA		350	600	mV
ΔV_{LINE}	Line Regulation	$V_{OUT}+0.8V<V_{IN}<9V$, I_{LOAD}=1mA		0.2	0.3	%/V
ΔV_{LOAD}	Load Regulation	I_{OUT}=0mA to 600mA		0.01	0.02	%/mA
e_N	Output Noise	F=10KHz, C_{OUT}=3.3μF		80		μV_{RMS}
PSRR	Ripple Rejection	F=1KHz, C_{OUT}=3.3μF		55		dB
T_{SD}	Thermal Shutdown Temperature			155		°C
T_{HYS}	Thermal Shutdown Hysteresis			20		°C

PIN ASSIGNMENT & PIN CONFIGURATION

	Pin 1	Pin 2	Pin 3	(Front View)
AP1735-XXXI	VOUT	GND	V_{IN}	
AP1735-XXXL	GND	V_{IN}	VOUT	

PACKAGE MARKING INFORMATION



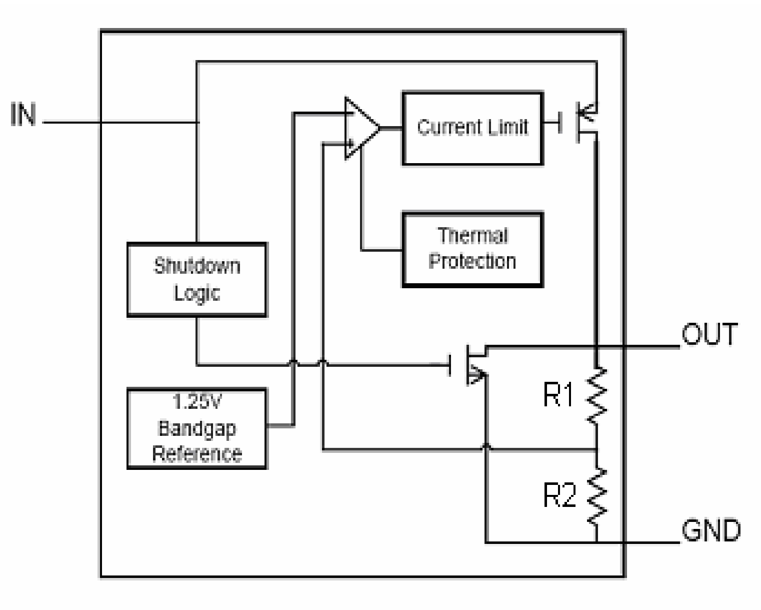
※ 35 → AP1735
※ X → Vout Simple Code
※ There is a under-line under 1st digit for "I" (I type of SOT-89) on the mark.
There is a under-line under 2st digit for "L" (L type of SOT-89) on the mark.
There is a under-line under 1ast digit for Non-Green/Pb package on the mark.

ORDERING INFORMATION

AP1735 – □□ – □ □	Vout Code：
Package Code Lead Free Code V_{OUT}	**For Examples：18=1.8V、28=2.8V、33=3.3V …** **Lead Free Code**： **P**：Commercial Standard, Lead (Pb) Free and Phosphorous (P) Free Package **Package Code**：(Note*) **I**：SOT-89 **L**：SOT-89

*Note：The difference between SOT-89/I and SOT-89/L, please refer "PIN ASSIGNMENT & PIN CONFIGURATION".

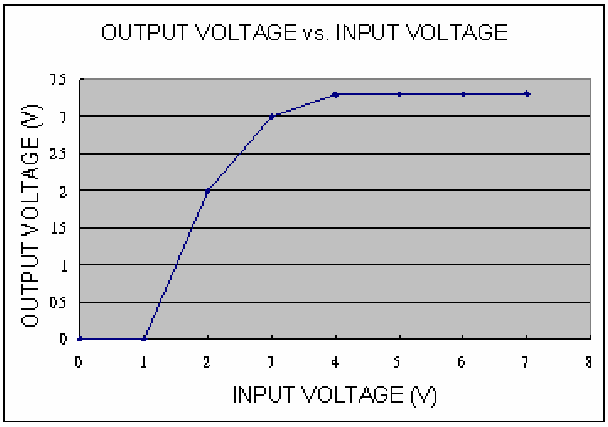
FUNCTIONAL BLOCK DIAGRAM



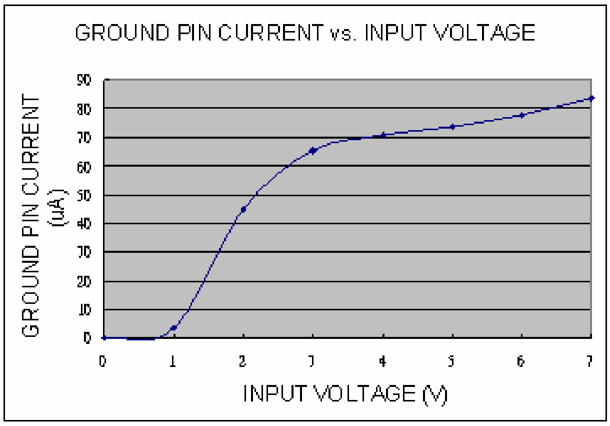
TYPICAL OPERATING CHARACTERISTICS

(AP1735-33PI,C_{IN}=1μF , C_{OUT}=3.3μF, T_A=+25℃, unless otherwise noted.)

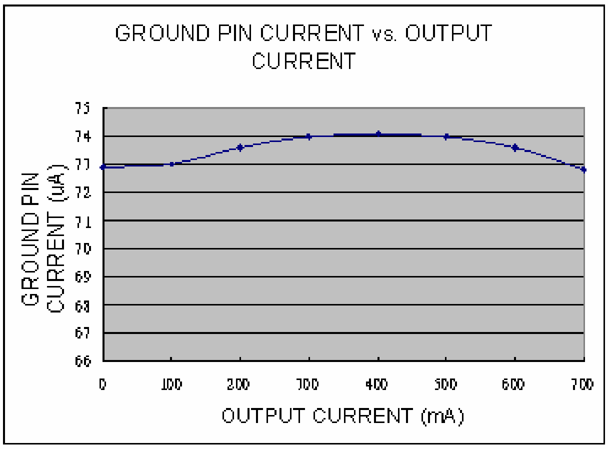
I_{OUT}=1mA

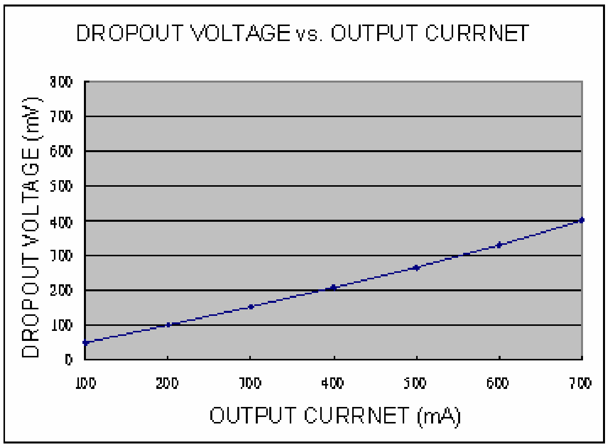


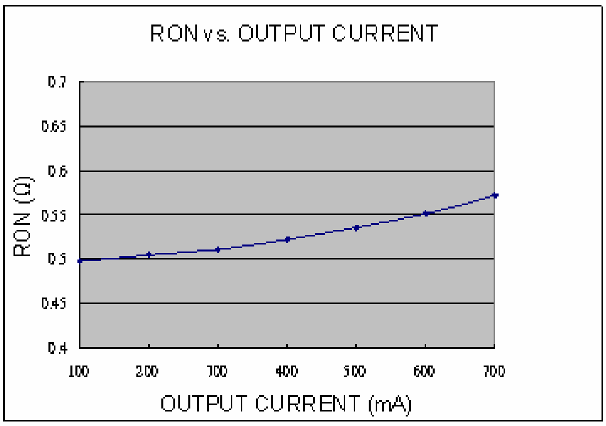
I_{OUT}=0mA



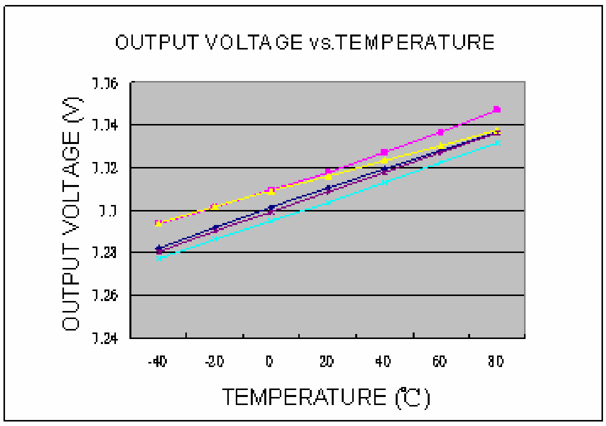
V_{IN}=5V







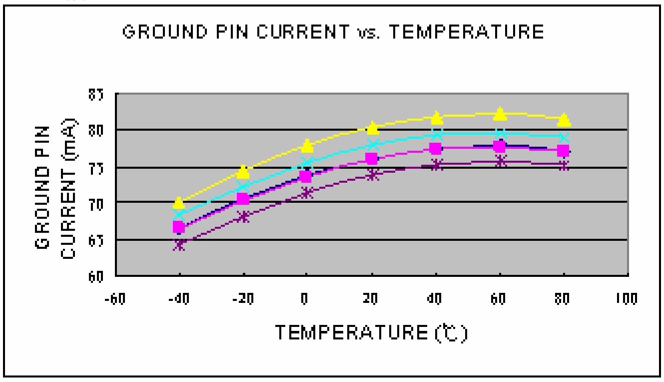
V_{IN}=5V, I_{OUT}=1mA



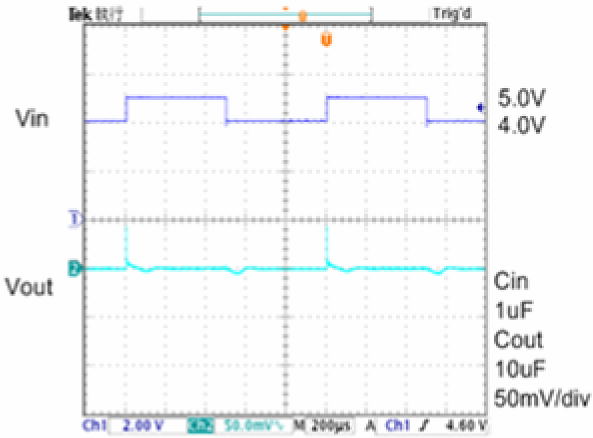
TYPICAL OPERATING CHARACTERISTICS (CONTINUED)

(AP1735-33PI, C_{IN}=1μF , C_{OUT}=3.3μF, T_A=+25℃, unless otherwise noted.)

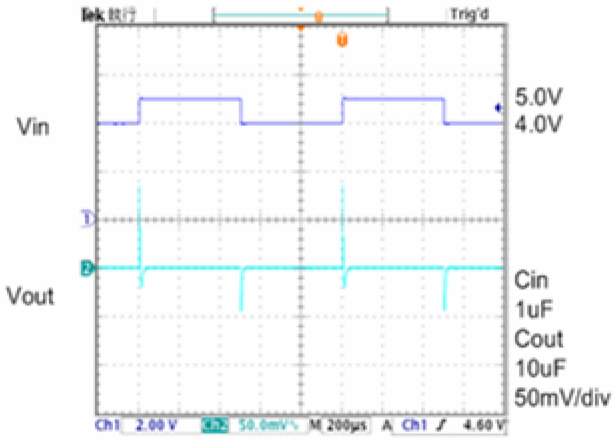
V_{IN}=5V



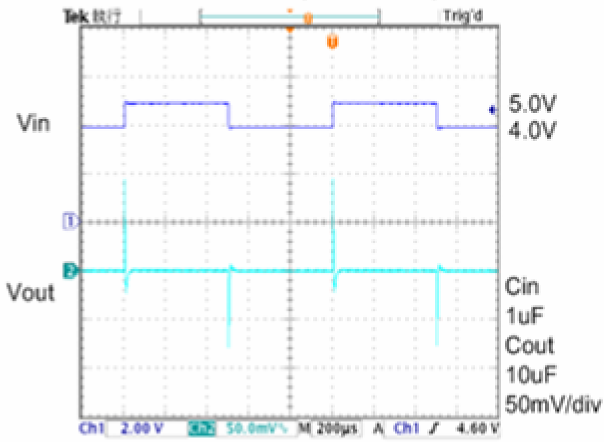
Line Transient (Iout=1mA)



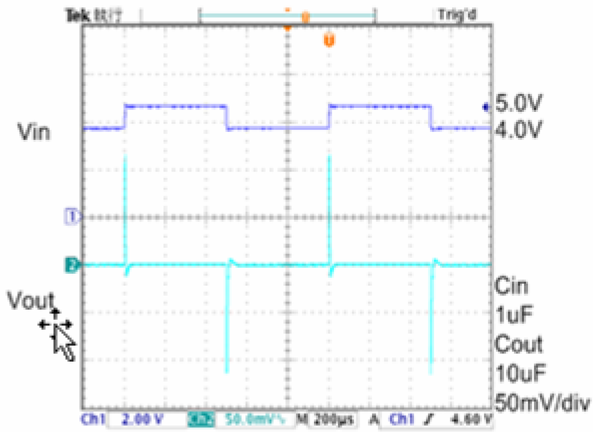
Line Transient (Iout=50mA)

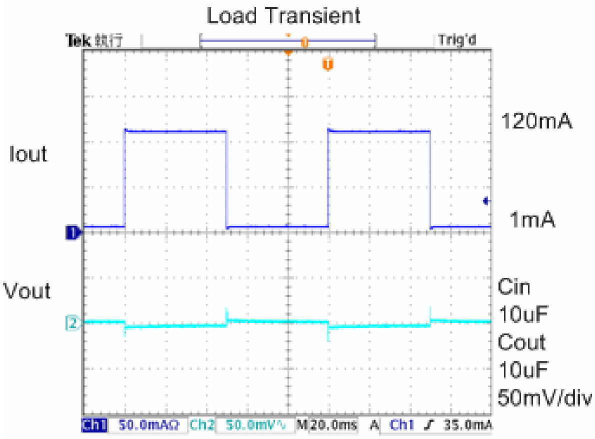


Line Transient (Iout=100mA)

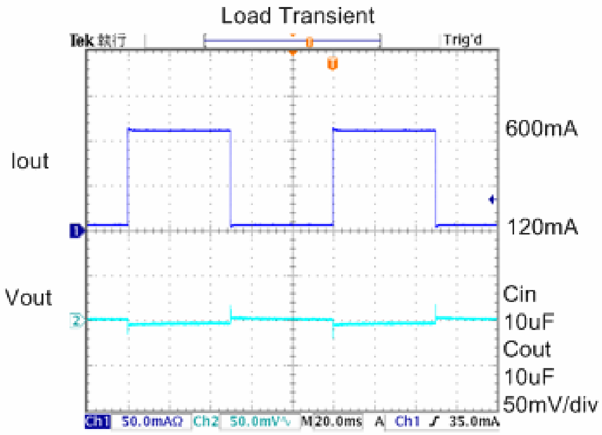


Line Transient (Iout=500mA)

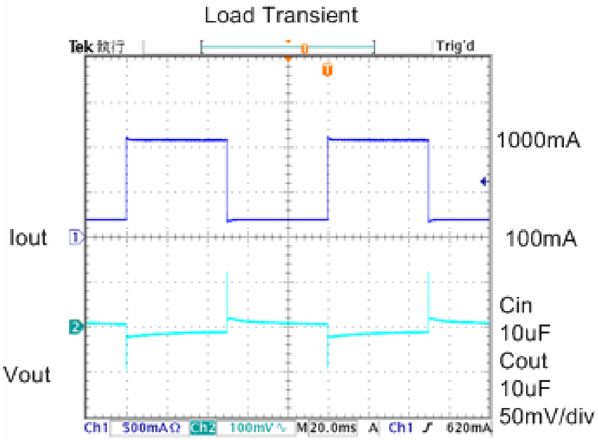




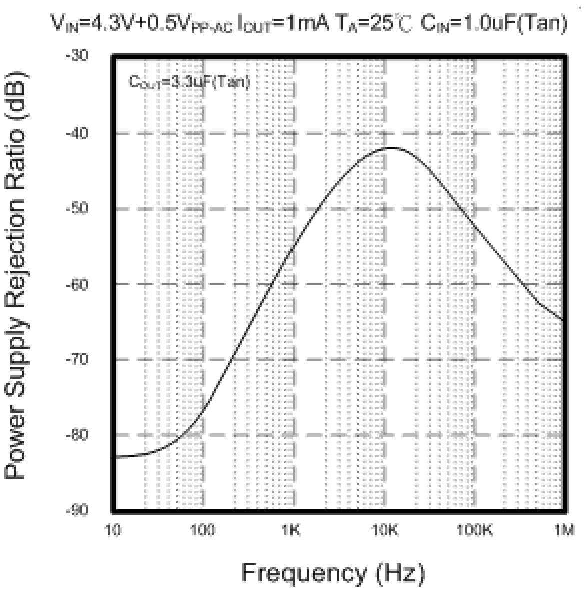
Load Transient
Iout
Vout
120mA
1mA
Cin
10uF
Cout
10uF
50mV/div



Load Transient
Iout
Vout
600mA
120mA
Cin
10uF
Cout
10uF
50mV/div



Load Transient
Iout
Vout
1000mA
100mA
Cin
10uF
Cout
10uF
50mV/div



V_{IN}=4.3V+0.5$V_{PP\text{-}AC}$ I_{OUT}=1mA T_A=25℃ C_{IN}=1.0uF(Tan)
C_{OUT}=3.3uF(Tan)
Power Supply Rejection Ratio (dB)
-30
-40
-50
-60
-70
-80
-90
10
100
1K
10K
100K
1M
Frequency (Hz)

Detail Description

The AP1735 is a low-dropout linear regulator. The device provides preset 1.8V 2.5V and 3.3V output voltages for output current up to 600mA. Other mask options for special output voltages from 1.4V to 4.4V with 100mV increment are also available.

The 1.25V bandgap reference is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass-transistor gate is pulled up to decrease the output voltage.

The output voltage is feedback through an internal resistive divider connected to OUT pin. Additional blocks include an output current limiter, thermal sensor, and shutdown logic.

Internal P-channel Pass Transistor

The AP1735 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive, which reduces ground pin current. PNP-based regulators also waste considerable current in dropout when the pass transistor saturates, and use high base-drive currents under large loads. The AP1735 does not suffer from these problems and consumes only 100μA (Typ.) of ground pin current under heavy loads as well as in dropout conditions.

Thermal Overload Protection

Thermal overload protection limits total power dissipation in the AP1735. When the junction temperature exceeds TJ = +155°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the junction temperature cools down by 20°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the AP1735 in the event of fault conditions. For continuous operation, the maximum operating junction temperature rating of T_J = +155°C should not be exceeded.

Operating Region and Power Dissipation

Maximum power dissipation of the AP1735 depends on the thermal resistance of the case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The power dissipation across the devices is $P = I_{OUT} \times (V_{IN} - V_{OUT})$. The resulting maximum power dissipation is:

$$P_{MAX} = \frac{(T_J - T_A)}{\theta_{JC} + \theta_{CA}} = \frac{(T_J - T_A)}{\theta_{JA}}$$

Where $(T_J - T_A)$ is the temperature difference between the AP1735 die junction and the surrounding air, θ_{JC} is the thermal resistance of the package chosen, and θ_{CA} is the thermal resistance through the printed circuit board, copper traces and other materials to the surrounding air. For better heat-sinking, the copper area should be equally shared between the IN, OUT, and GND pins.

If the AP1735 uses a SOT-89 package and this package is mounted on a double sided printed circuit board with two square inches of copper allocated for "heat spreading", the resulting θ_{JA} is 180°C/W.

Based on a maximum operating junction temperature 155°C with an ambient temperature of 25°C, the maximum power dissipation will be:

$$P_{MAX} = \frac{(T_J - T_A)}{\theta_{JC} + \theta_{CA}} = \frac{(155 - 25)}{180} = 0.722W$$

Thermal characteristics were measured using a double sided board with 10Z square inches of copper area connected to the GND pin for "heat spreading".

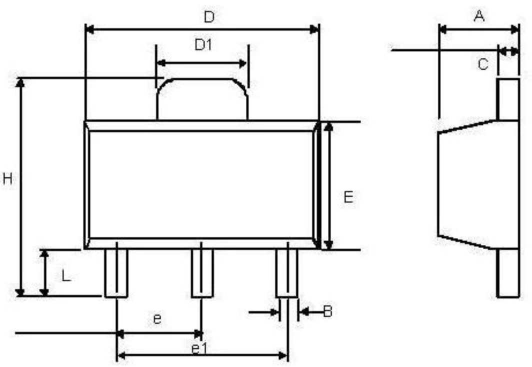
Dropout Voltage

A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The AP1735 uses a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance ($R_{DS(ON)}$) multiplied by the load current.

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

PACKAGE OUTLINE

A) SOT-89 (unit：mm)



SYMBOL	MIN	MAX
A	1.40	1.60
B	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.62	1.83
E	2.29	2.60
e	1.50 (TYP.)	
e1	3.00 (TYP.)	
H	3.94	4.25
L	0.89	1.20