AP139

300mA LOW-NOISE CMOS LDO

Features

- Very Low Dropout Voltage
- Low Current Consumption: Typ. 45µA, max. 60uA
- Output Voltage: 1.5V, 1.8V, 2.0V, 2.5V, 2.8V, 3.0V 3.3V, and 3.5V
- Guaranteed 300mA Output
- Input Range from 2.7 up to 5.5V
- Thermal Shutdown
- Current Limiting
- Stability with Low ESR Capacitors
- Low Temperature Coefficient
- Lead Free Package: SOT25
- SOT25: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/RoHS Compliant (Note 1)

General Description

The AP139 is a positive voltage linear regulator utilizing CMOS technology. The features that include low quiescent current (45µA typ.), low dropout voltage, and high output voltage accuracy, make it ideal for battery applications. EN input connected to the device will produce a low bias current.
The space-saving SOT25 package is attractive for "pocket" and "hand held" applications.

This rugged device has both thermal shutdown, and current limit protections to prevent device failure under the "worst" operating conditions.
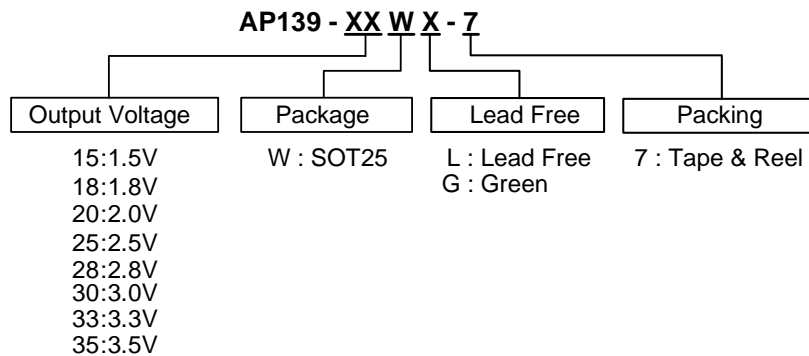
In a low noise, regulated supply application, a 10nF capacitor is necessary to be placed in between Bypass and Ground.

The AP139 is stable with a low ESR output capacitor of 1.0µF or greater.

Applications

- Personal Communication Devices
- Home Electric/Electronic Appliances
- PC Peripherals
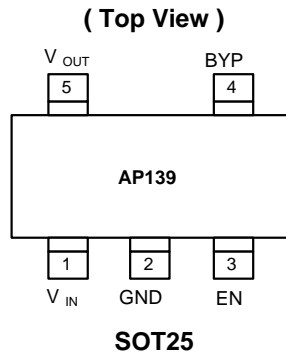- Battery-Powered Devices

Ordering Information

AP139 - XX W X - 7

Output Voltage	Package	Lead Free	Packing
15:1.5V 18:1.8V 20:2.0V 25:2.5V 28:2.8V 30:3.0V 33:3.3V 35:3.5V	W : SOT25	L : Lead Free G : Green	7 : Tape & Reel

Device	Package Code	Packaging (Note 2)	7" Tape and Reel	
			Quantity	Part Number Suffix
AP139-XXWL-7	W	SOT25	3000/Tape & Reel	-7
AP139-XXWG-7	W	SOT25	3000/Tape & Reel	-7

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at http://www.diodes.com/products/lead_free.html.
2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

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Pin Assignments

(Top View)

V OUT 5		BYP 4
	AP139	
1	2	3
V IN	GND	EN

SOT25

Pin Descriptions

Pin Name	Pin No.	Description
V_{IN}	1	Power Supply
GND	2	Ground
EN	3	Enable Pin
BYP	4	Bypass Signal Pin
V_{OUT}	5	Output

Block Diagram
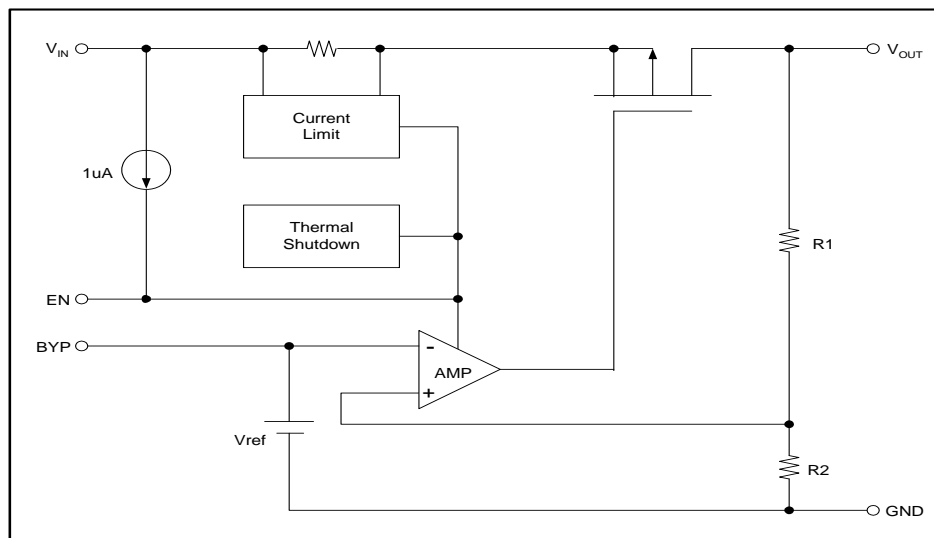
Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	+6	V
I_{OUT}	Output Current	$P_D/(V_{IN}-V_O)$	mA
V_{OUT}	Output Voltage	GND - 0.3 to V_{IN}+ 0.3	V
	ESD Classification	B	
T_{OP}	Operating Junction Temperature Range	-40 to +125	ºC
T_{MJ}	Maximum Junction Temperature	150	ºC
P_D	Internal Power Dissipation	250	mW

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input voltage	2.7	5.5	V
I_{OUT}	Output Current	0	300	mA
T_A	Operating Ambient Temperature	-40	85	°C

Electrical Characteristics $(T_A = +25ºC, \text{ unless otherwise noted})$

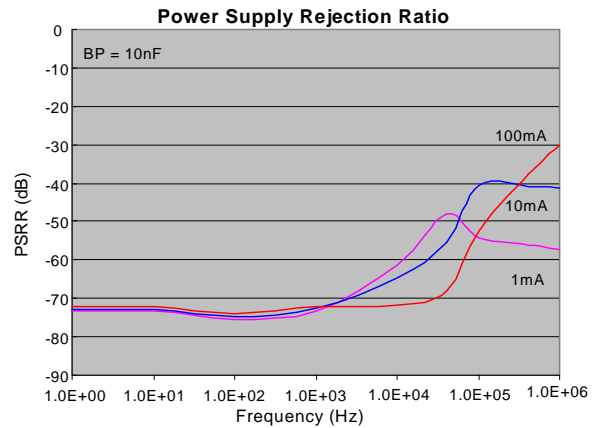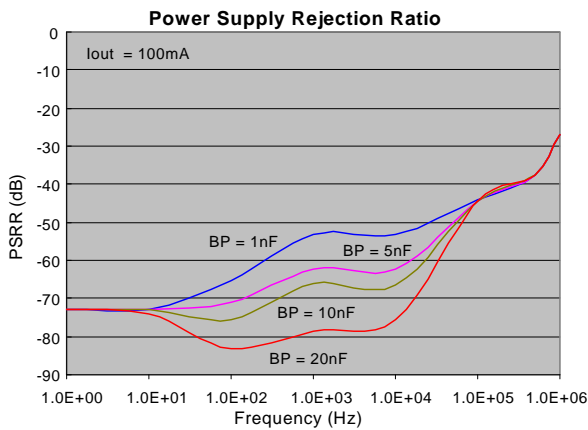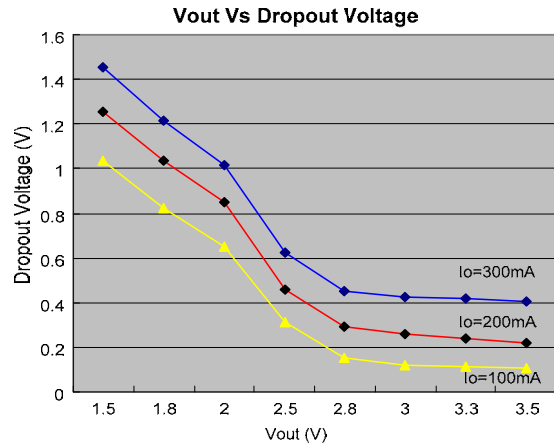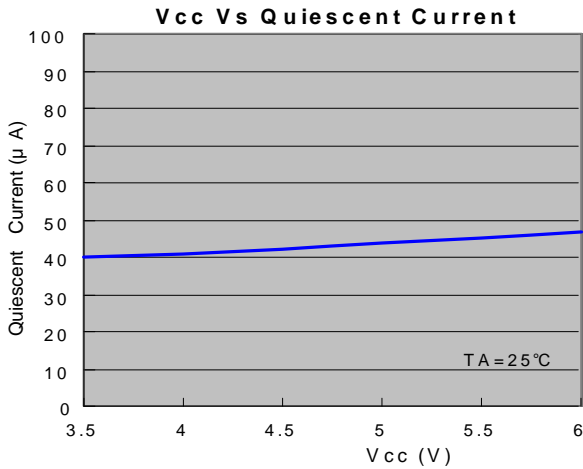| Symbol	Parameter	Test Conditions		Min	Typ.	Max	Unit
V_{IN}	Input Voltage			Note 3	-	5.5	V
I_Q	Quiescent Current	$I_O = 0mA$		-	45	60	µA
I_{STB}	Standby Current	$V_{IN} = 5.0V, V_{OUT} = 0V, V_{EN} < V_{EL}$		-	2.0	3.0	µA
V_{OUT}	Output Voltage Accuracy	$I_O = 1mA, V_{IN} = 5V$		-2	-	2	%
	V_{OUT} Temperature Coefficient			-	50	-	ppm/°C
$V_{DROPOUT}$	Dropout Voltage	$I_O = 1mA$ to 300mA, $V_{OUT} = V_{O(NOM)} - 1.5\%$	$V_O \geq 2.8V$	-	-	0.45	V
I_{OUT}	Output Current			300	-	-	mA
I_{LIMIT}	Current Limit	$V_{OUT} > 1.05V$		300	450	-	mA
I_{short}	Short Circuit Current	$V_{cc} = 5V, V_{out} < 1.05V$		-	150	300	mA
$\triangle V_{LINE}$	Line Regulation	$I_{OUT} = 1mA, V_{IN} = (V_{OUT} +1V)$ to 5.5V		-	0.1	0.3	%
$\triangle V_{LOAD}$	Load Regulation	$I_O = 1mA$ to 300mA, $V_{IN} = 5V$		-	0.3	1	%
PSRR	Power Supply Rejection	$I_O = 100mA$, $C_O = 2.2µF$ ceramic	f = 1KHz	-	60	-	dB
			f = 10KHz	-	50	-	
			f = 100KHz	-	40	-	
PSRR	Power Supply Rejection	$I_O = 100mA$, $C_O = 2.2µF$ ceramic, $C_{BYP} = 20nF$	f = 1KHz	-	75	-	dB
			f = 10KHz	-	55	-	
			f = 100KHz	-	30	-	
V_{EH}	EN Input Threshold	Output ON		1.7	-	-	V
V_{EL}		Output OFF		-	-	0.8	V
I_{EN}	Enable Pin Current			-	-	<0.1	µA
OTS	Over Temperature Shutdown			-	130	-	°C
OTH	Over Temperature Hysteresis			-	20	-	°C
θ_{JA}	Thermal Resistance	SOT25 (Note 4)			226		ºC/W
θ_{JC}	Thermal Resistance	SOT25 (Note 4)			34		ºC/W

Notes: 3. $V_{IN(MIN)} = V_{OUT} + V_{DROPOUT}$.
4. Test conditions for SOT25: Devices mounted on FR-4 PC board, MRP, 1 oz. copper, single sided, calibrate at T_J=85 ºC, measure at T_A=25 ºC, no heat Sink, no air flow.

Typical Application

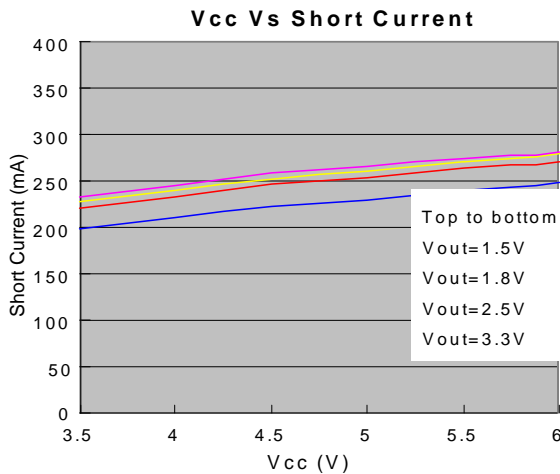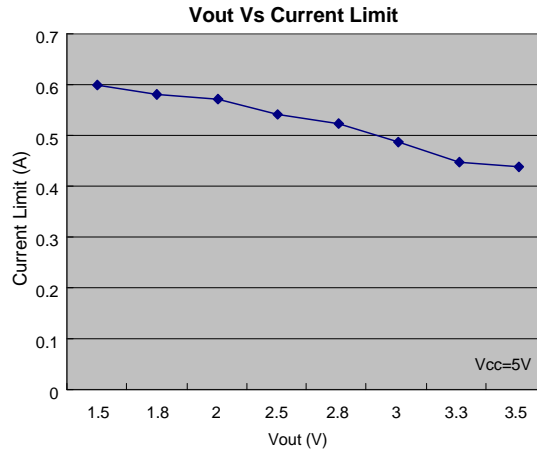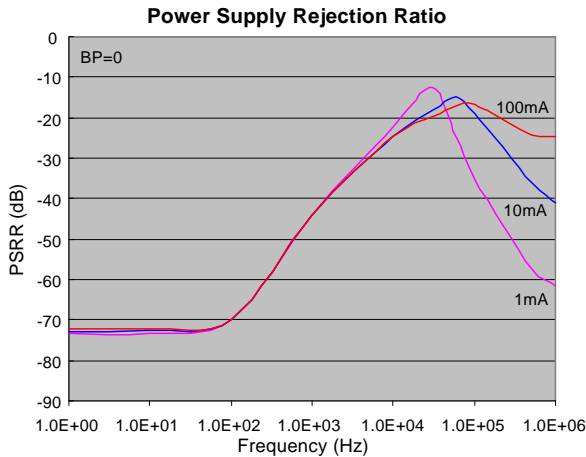IN ○————————

V$_{IN}$ V$_{OUT}$ OUT

AP139

BYP GND EN

C1 1uF C2 10nF C3 1uF

Typical Performance Characteristics

Vcc Vs Quiescent Current

Quiescent Current (µA)

TA = 25℃

Vcc (V)

Vout Vs Dropout Voltage

Dropout Voltage (V)

Io=300mA
Io=200mA
Io=100mA

Vout (V)

Power Supply Rejection Ratio

PSRR (dB)

Iout = 100mA

BP = 1nF BP = 5nF
BP = 10nF
BP = 20nF

Frequency (Hz)

Power Supply Rejection Ratio

PSRR (dB)

BP = 10nF

100mA
10mA
1mA

Frequency (Hz)
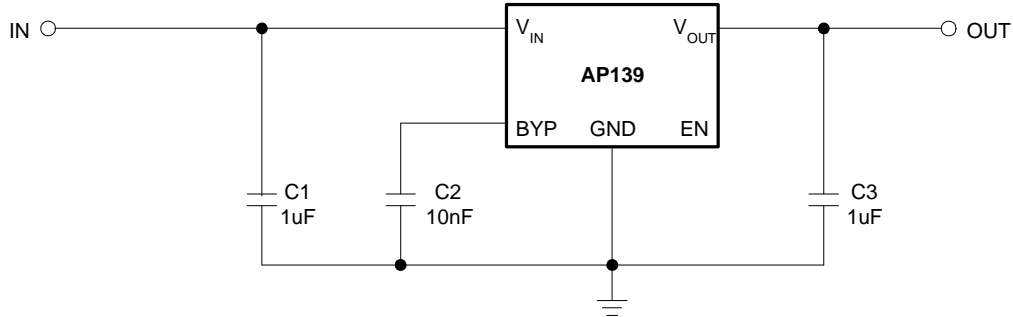
Typical Performance Characteristics   (Continued)

Power Supply Rejection Ratio

Vout Vs Current Limit

Vcc Vs Short Current

Top to bottom
Vout=1.5V
Vout=1.8V
Vout=2.5V
Vout=3.3V

Functional Description

The AP139 of CMOS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, thermal shutdown.

The P-channel pass transistor receives data from the error amplifier, over-current protection, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. The over-current and thermal shutdown circuits become active when the junction temperature exceeds 130°C, or the current exceeds 300mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 110°C.

The AP139 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress.

Enable
The enable pin normally floats high. When actively, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 2μA. This pin behaves much like an electronic switch.

External Capacitor
The AP139 is stable with a low ESR output capacitor to ground of 1.0μF or greater. It can keep stable even with higher ESR capacitors. A second capacitor is recommended between the input and ground to stabilize V_{IN}. The input capacitor should be larger than 0.1μF to have a beneficial effect. All capacitors should be placed in close proximity to the pins. A "quiet" ground termination is desirable.

Marking Information

(1) SOT25

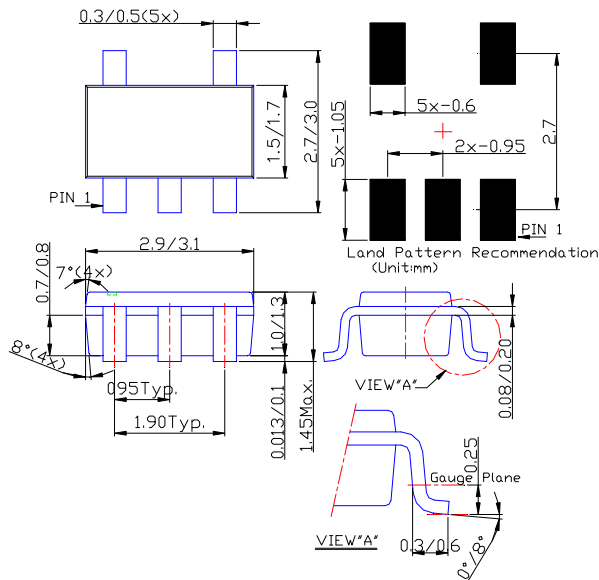(Top View)

```
5          4
   XX Y W X
1    2    3
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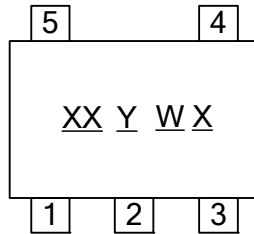
XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
    a~z : 27~52 week; z represents
    52 and 53 week
X : a~z : Lead Free
    A~Z : Green

Part Number	Package	Identification Code
AP139-15W	SOT25	N0
AP139-18W	SOT25	N1
AP139-20W	SOT25	N2
AP139-25W	SOT25	N3
AP139-28W	SOT25	N4
AP139-30W	SOT25	N5
AP139-33W	SOT25	N6
AP139-35W	SOT25	N7

Package Information   (All Dimensions in mm)

0.3/0.5(5x)
1.5/1.7
2.7/3.0
5x-1.05
PIN 1

5x-0.6
2x-0.95
2.7
PIN 1
Land Pattern Recommendation
(Unit:mm)

2.9/3.1
0.7/0.8
7°(4x)
8°(4x)
0.95Typ.
1.90Typ.
1.0/1.3
0.013/0.1
1.45Max.
VIEW"A"
0.08/0.20
0.25
Gauge Plane
VIEW"A" 0.3/0.6 0°~8°

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