PAM3115

1.5A Low Voltage-Low Dropout CMOS Regulator

Key Features

- Low-Dropout Regulator Supports Input Voltages Down to 1.4V
- Output Voltage Available in 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V,2.8V,2.85V,3.0V, 3.3V
- Stable with a Ceramic Output Capacitor of 1.0uF or Higher
- Low Dropout Voltage:150mV @1.5A
- Low Quiescent Current
- Over Temperature Shutdown
- Short Circuit Protection
- Low Temperature Coefficient
- Standard SOT-223,TO-252 and SOP-8 (Exposed Pad) Packages
- Pb-Free Package

Applications

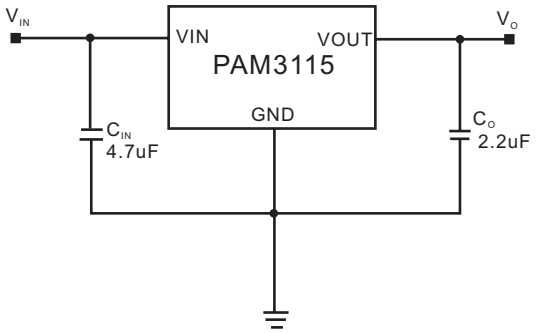
- DSP, FPGA, and Microprocessor Power Supplies
- 1.2V Core Voltage for DSPs
- SATA Power Supply
- LCD TV/ Monitors
- Wireless Devices
- Communication Devices
- Portable Electronics
- Post Regulator for SMPS

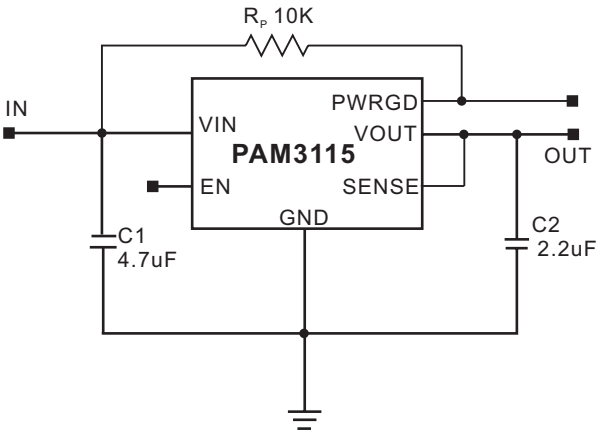
General Description

The PAM3115 is a 1.5A CMOS LDO regulator that features a low quiescent current, ultra low input, output and dropout voltages, as well as over temperature shutdown. It is available in SOT-223 , TO-252 and SOP-8(exposed pad) packages. The fixed output voltage of the PAM3115 is set at the factory and trimmed to ±2%. The PAM3115 is stable with a ceramic output capacitor of 1.0uF or higher.

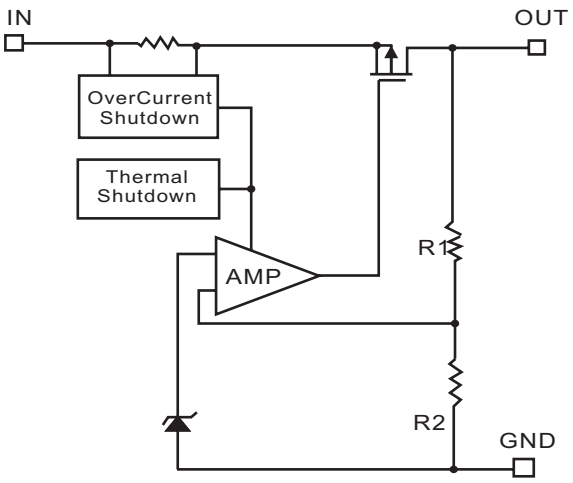
This family of regulators can provide either a stand-alone power supply solution or act as a post regulator for switch mode power supplies. They are particularly well suited for applications requiring low input and output voltages.

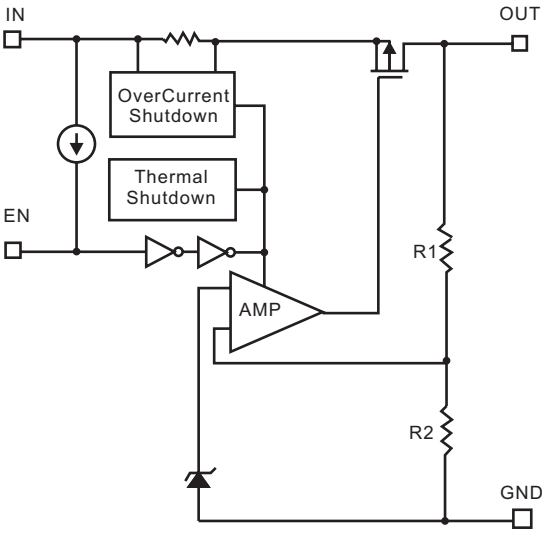
Typical Application





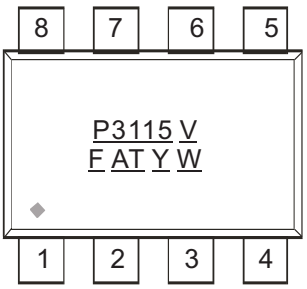
Block Diagram





Pin Configuration & Marking Information

Top View
SOP-8(EPD)

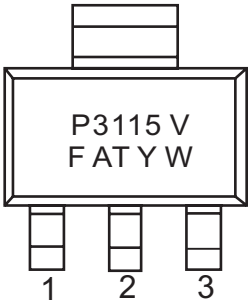


V: Voltage Code
F: Internal Code
A: Assembly Code
T: Testing Code
Y: Year
W: Weekly

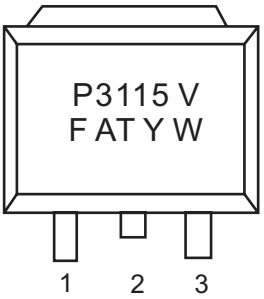
Pin Number	Name	Function
1	GND	Ground
2	VIN	Input
3	EN	Enable Pin
4	GND	Ground
5	PWRGD	Power Good
6	SENSE	Sense
7	VOUT	Output
8	GND	Ground

Pin Configuration & Marking Information(continued)

Top View
SOT-223



Top View
TO-252



V: Voltage Code
F: Internal Code
A: Assembly Code
T: Testing Code
Y: Year
W: Weekly

Pin Number	Name	Function
1	VIN	Input
2	GND	Ground
3	VOUT	Output

Absolute Maximum Ratings

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Input Voltage.....4.0V
Output Pin Voltage.....-0.3V to V_{IN}+0.3V
Operation Temperature Range.....-40℃ to 85℃
Operation Junction Temperature.....-40℃ to 125℃
Maximum Output Current.....$P_D/(V_{IN}-V_O)$
Storage Temperature..... -65℃ to 150℃
Maximum Junction Temperature.....150℃
Soldering Temperature.....300℃, 5sec

Recommended Operating Conditions

Supply Voltage Range.....1.4V to 3.6V
Operation Temperature Range.....-40℃ to 85℃
Junction Temperature Range..... -40℃ to 125℃

Thermal Information

Parameter	Symbol	Package	Maximum	Unit
Thermal Resistance (Junction to Case)	θ_{JC}	SOT-223	7	℃/W
		TO-252	7	
Thermal Resistance (Junction to Ambient)	θ_{JA}	SOT-223	160	
		TO-252	90	
Internal Power Dissipation	P_D	SOT-223	625	mW
		TO-252	1200	

Electrical Characteristic

V_{IN}= V_O+0.5V, T_A=25°C, C_{IN} =4.7uF, C_O=2.2uF, unless otherwise noted.

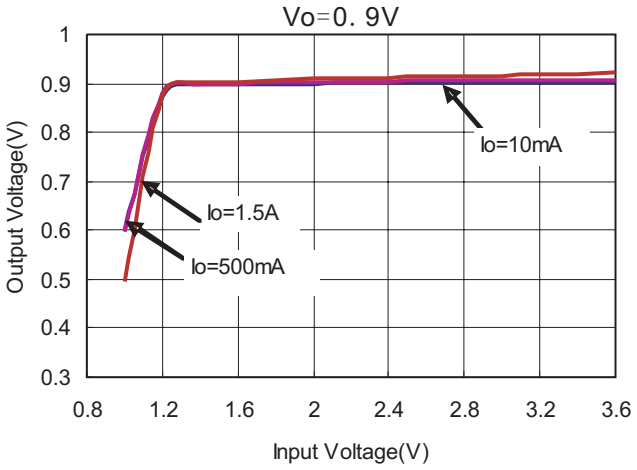
Parameters	Symbol	Test Conditions		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}			Note 1		3.6	V
Output Voltage Accuracy	V_O	I_O=100mA		-2		2	%
Dropout Voltage	V_{DROP}	I_O=500mA	Vo=0.9V		330	500	mV
			Vo=1.0V		220	400	
			2.5V>Vo≥1.2V		50	200	
			Vo≥2.5V		40	150	
		I_O=1.5A	Vo=0.9V		330	500	
			Vo=1.0V		220	400	
			2.5V>Vo≥1.2V		150	350	
			Vo≥2.5V		120	300	
Short Circuit Current	I_{SC}	Vo < 0.3V			1.0		A
Quiescent Current	I_Q	Io=0mA			90	150	uA
Ground Pin Current	I_{GND}	Io=1mA to 1.5A				600	uA
Line Regulation	LNR	V_O≤2.5V,Io=10mA V_{IN} =Vo+0.5V to Vo+1.5V			0.5	1	%/V
		V_O>2.5V,I_O=10mA V_{IN} =3.3V to 3.6V					
Load Regulation	LDR	I_O=1mA to 1.5A			0.5	2	%/A
Over Temperature Shutdown	OTS				150		℃
Over Temperature Hysteresis	OTH				50		℃
Temperature Coefficient	TC				40		ppm/℃
Power Supply Ripple Rejection	PSRR	I_O =100mA, V_O=1.5V	f=100Hz		55		dB
			f=1KHz		55		
			f=10KHz		35		
Output Noise	Vn	f=10Hz to 100kHz			40		uVrms

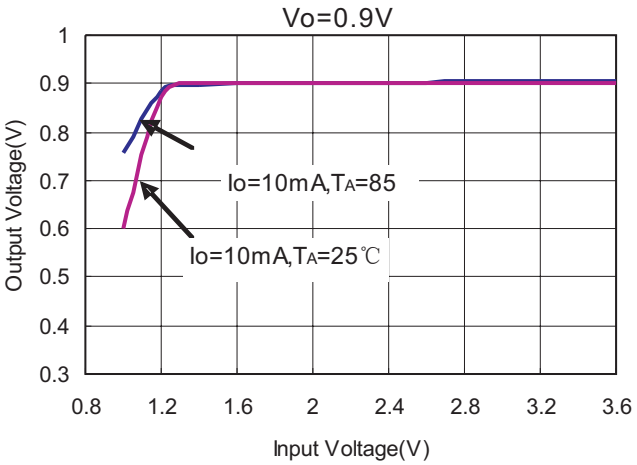
Note1: The minimum input voltage ($V_{IN(MIN)}$) of the PAM3115 is determined by output voltage and dropout voltage. The minimum input voltage is defined as:
$V_{IN(MIN)}$=V_O+V_{drop}

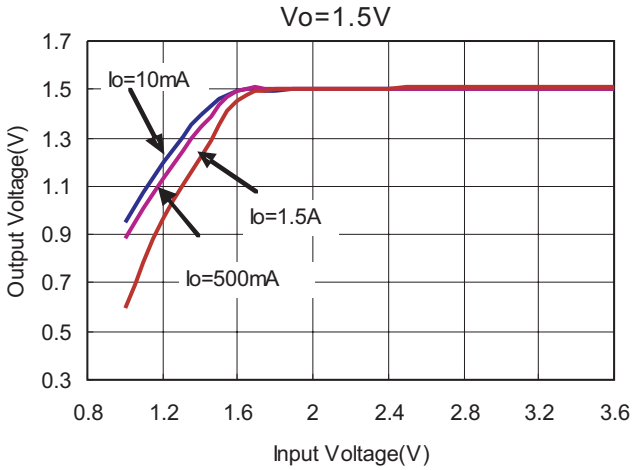
Typical Performance Characteristics

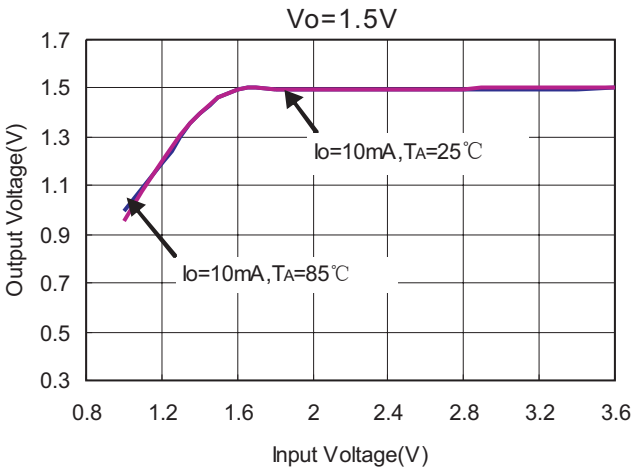
T_A=25°C,C_{IN}=4.7uA,Co=2.2uF,unless otherwise noted.

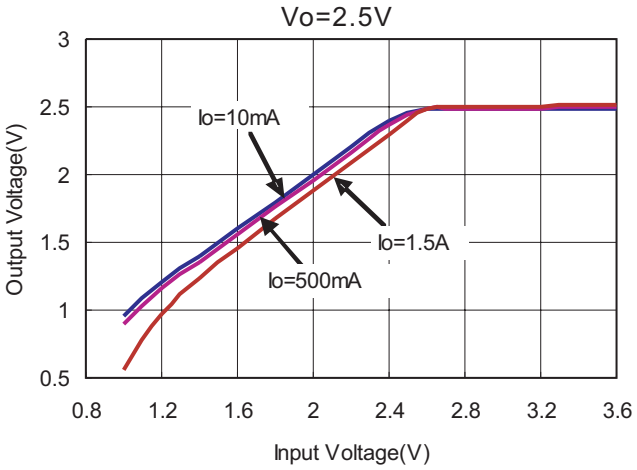
1. Output Voltage vs Input Voltage

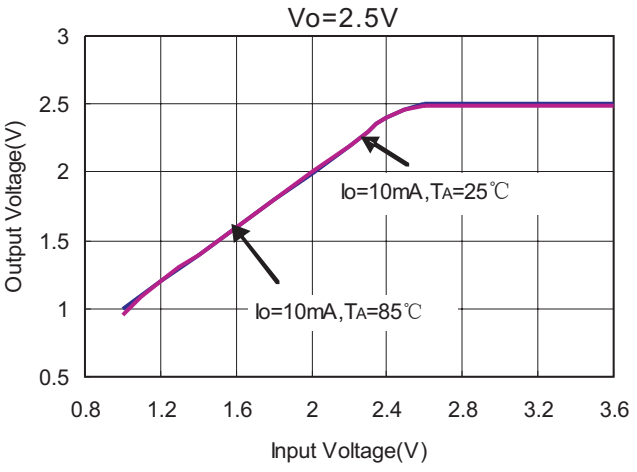






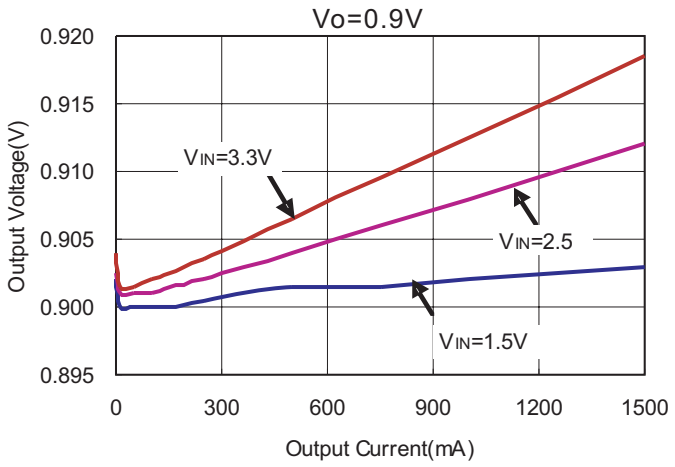




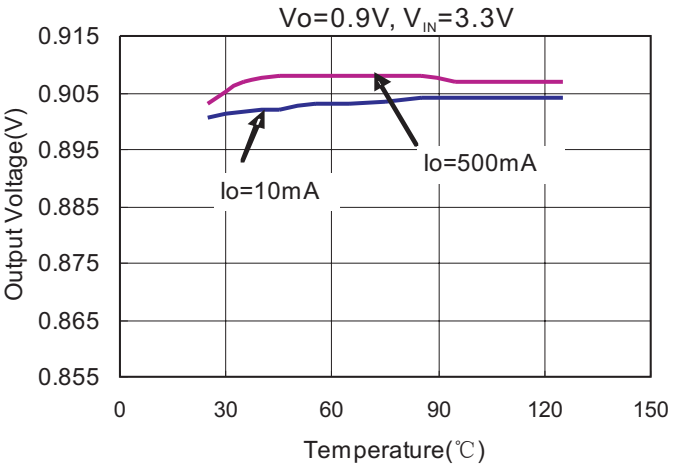


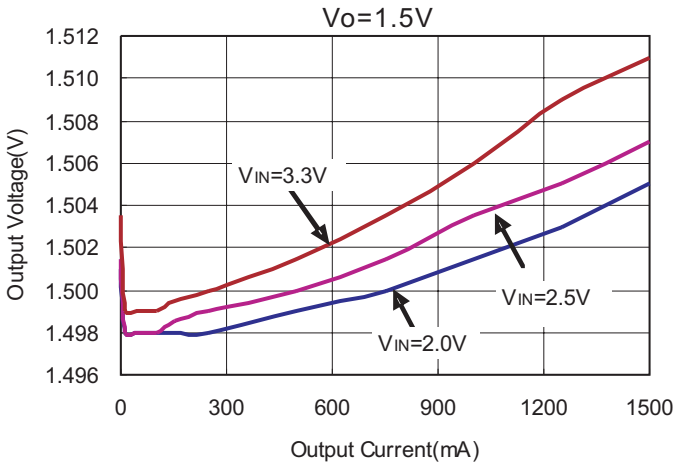
Typical Performance Characteristics(continued)

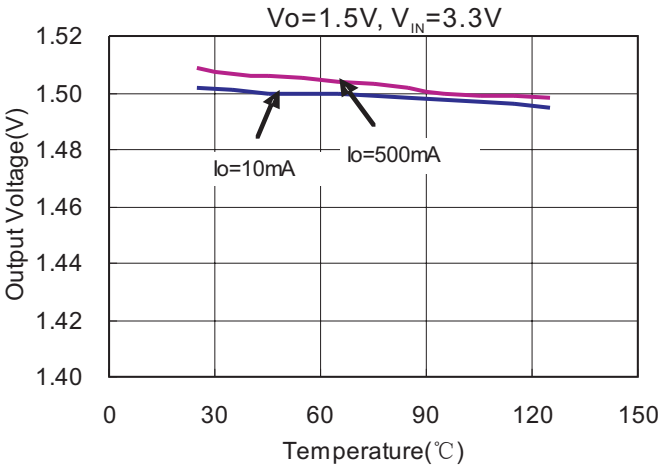
2. Output Voltage vs Output Current

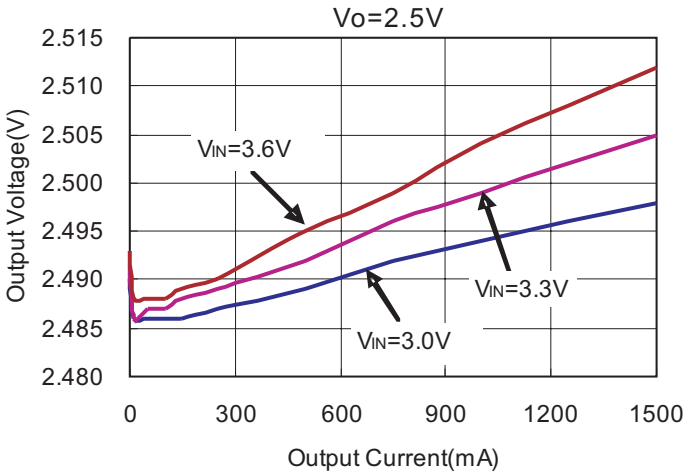


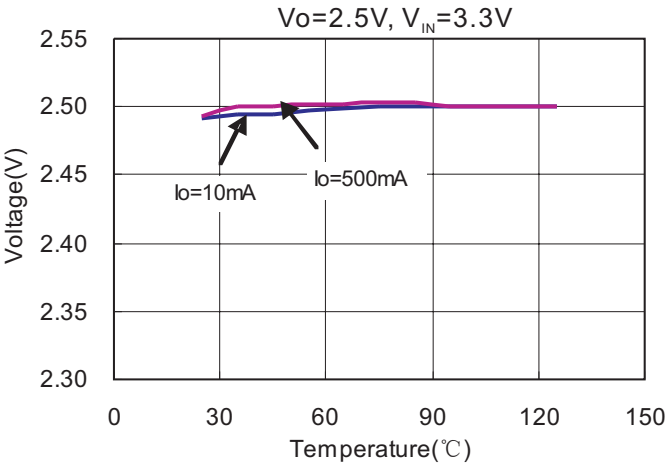
3. Output Voltage vs Temperature





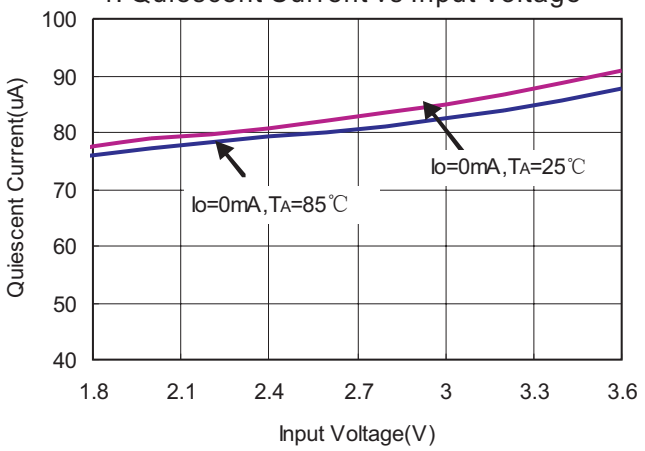




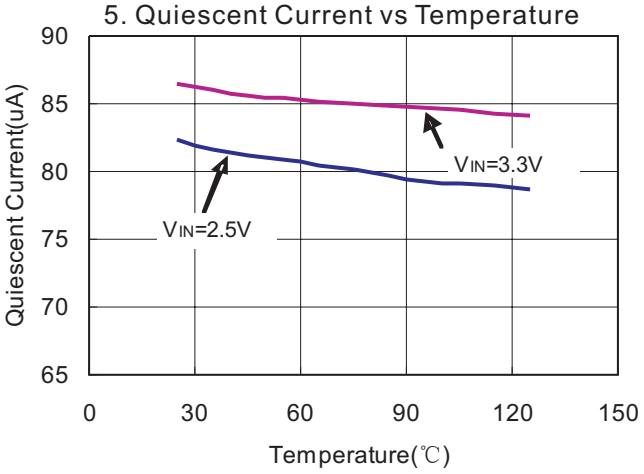


Typical Performance Characteristics(continued)

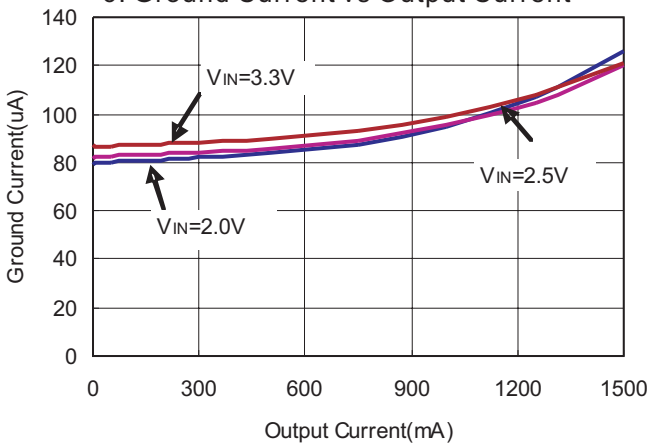
4. Quiescent Current vs Input Voltage



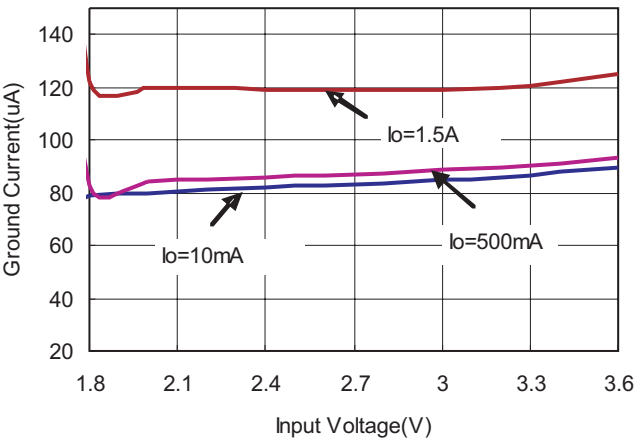
5. Quiescent Current vs Temperature



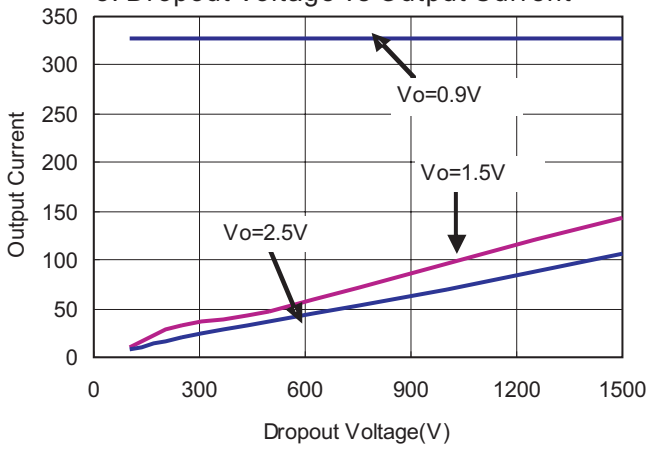
6. Ground Current vs Output Current



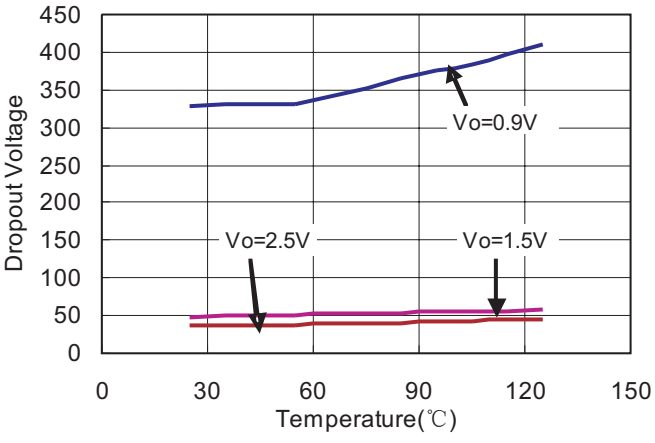
7. Ground Current vs Input Voltage



8. Dropout Voltage vs Output Current

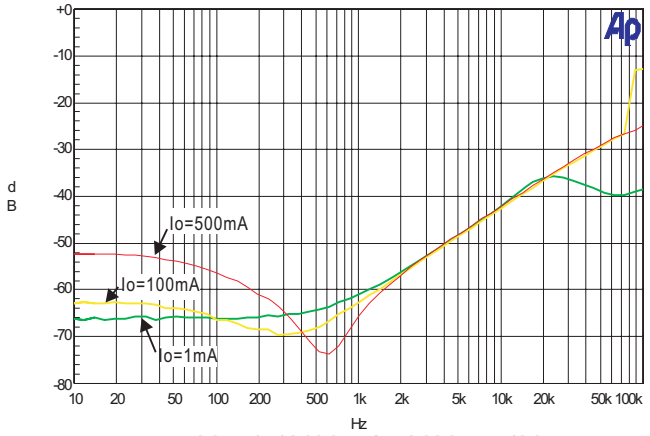


9. Dropout Voltage vs Temperature

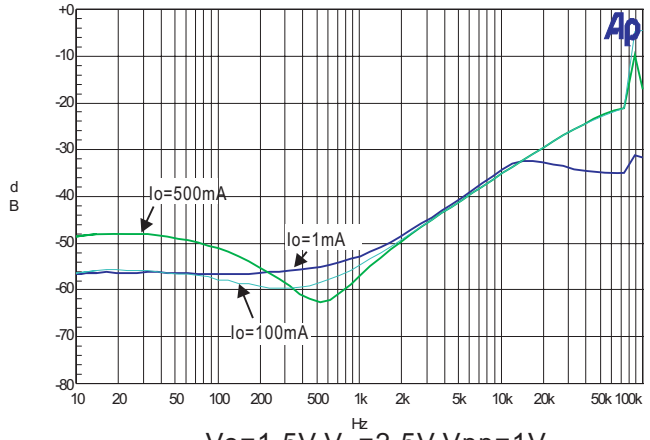


Typical Performance Characteristics(continued)

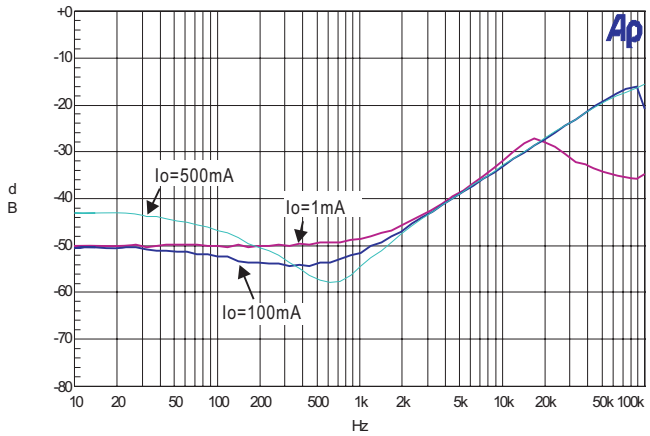
10. Ripple Rejection vs Frequency



Vo=0.9V,V_{IN}=2.5V,Vpp=1V

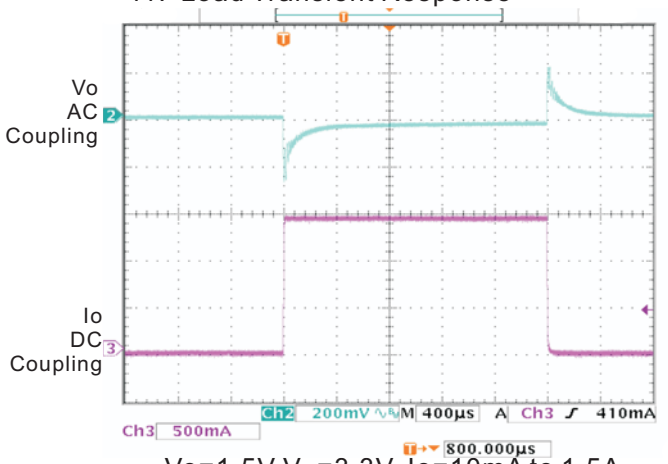


Vo=1.5V,V_{IN}=2.5V,Vpp=1V

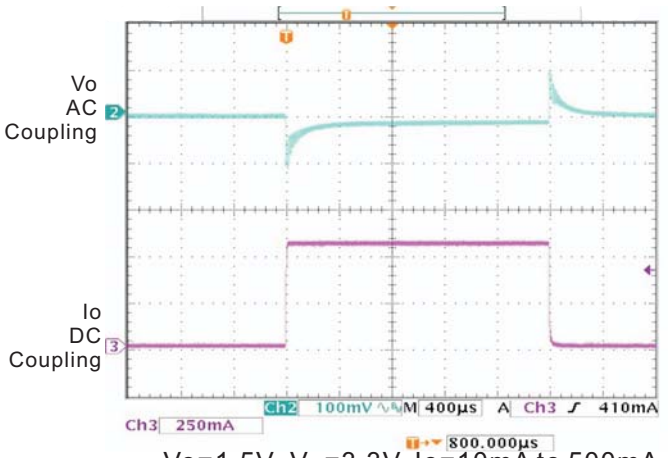


Vo=2.5V,V_{IN}=3.3V,Vpp=0.3V

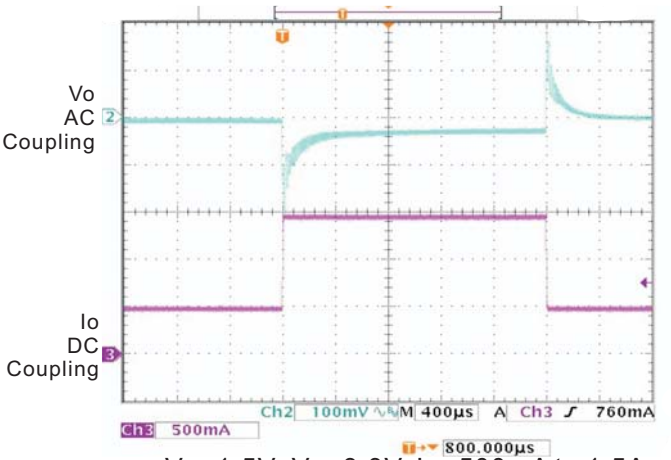
11. Load Transient Response



Vo=1.5V,V_{IN}=3.3V, Io=10mA to 1.5A



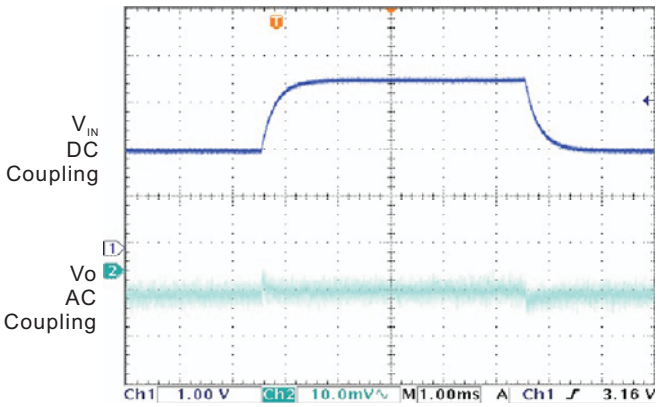
Vo=1.5V ,V_{IN}=3.3V, Io=10mA to 500mA



Vo=1.5V ,V_{IN}=3.3V, Io=500mA to 1.5A

Typical Performance Characteristics(continued)

12. Line Transient Response



Vo=1.5V, V_{IN}=2V to 3.3V, Io=1mA

Application Information

The PAM3115 family of low-dropout (LDO) regulators have several features that allow them to apply to a wide range of applications. The family operates with very low input voltage (1.4V) and low dropout voltage (typically 150mV at full load), making it an efficient stand-alone power supply or post regulator for battery or switch mode power supplies. The 1.5A output current make the PAM3115 family suitable for powering many microprocessors and FPGA supplies. The PAM3115 family also has low output noise (typically 40μVRMS with 2.2μF output capacitor), making it ideal for use in telecom equipment.

External Capacitor Requirements

A 2.2μF or larger ceramic input bypass capacitor, connected between V_{IN} and GND and located close to the PAM3115, is required for stability. A 1.0uF minimum value capacitor from V_O to GND is also required. To improve transient response, noise rejection, and ripple rejection, an additional 10μF or larger, low ESR capacitor is recommended at the output. A higher-value, low ESR output capacitor may be necessary if large, fast-rise-time load transients are anticipated and the device is located several inches from the power source, especially if the minimum input voltage of 1.4 V is used.

Regulator Protection

The PAM3115 features internal current limiting, thermal protection and short circuit protection. During normal operation, the PAM3115 limits output current to about 3A. When current limiting engages, the output voltage scales back linearly until the over current condition ends. While current limiting is designed to prevent gross device failure, care should be taken not to exceed the power dissipation ratings of the package. If the temperature of the device exceeds 150°C, thermal-protection circuitry will shut down. Once the device has cooled down to approximately 50°C below the high temp trip point, regulator operation resumes. The short circuit current of the PAM3115 is about 1A when its output pin is shorted to ground.

Thermal Information

The amount of heat that an LDO linear regulator generates is:

$P_D=(V_{IN}-V_O)I_O$.

All integrated circuits have a maximum allowable junction temperature (T_J max) above which normal operation is not assured. A system designer must design the operating environment so that the operating junction temperature (T_J) does not exceed the maximum junction temperature (T_J max). The two main environmental variables that a designer can use to improve thermal performance are air flow and external heatsinks. The purpose of this information is to aid the designer in determining the proper operating environment for a linear regulator that is operating at a specific power level.
In general, the maximum expected power (P_D(max)) consumed by a linear regulator is computed as:

$$P_{DMAX}=(V_{I(avg)}-V_{O(avg)})\times I_{O(avg)}+V_{I(avg)}\times I_{(Q)} \quad (1)$$

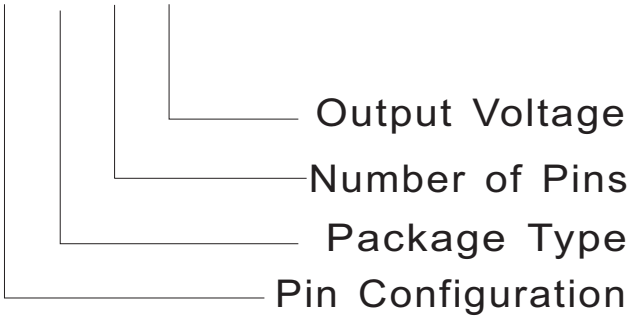
Where:

- $V_{I(avg)}$ is the average input voltage.
- $V_{O(avg)}$ is the average output voltage.
- $I_{O(avg)}$ is the average output current.
- $I_{(Q)}$ is the quiescent current.

For most LDO regulators, the quiescent current is insignificant compared to the average output current; therefore, the term $V_{I(avg)}$ x$I_{(Q)}$ can be neglected. The operating junction temperature is computed by adding the ambient temperature (T_A) and the increase in temperature due to the regulator' s power dissipation. The temperature rise is computed by multiplying the maximum expected power dissipation by the sum of the thermal resistances between the junction and the case ($R_{\theta JC}$), the case to heatsink ($R_{\theta CS}$), and the heatsink to ambient ($R_{\theta SA}$). Thermal resistances are measures of how effectively an object dissipates heat. Typically, the larger the device, the more surface area available for power dissipation so that the object 's thermal resistance will be lower.

Ordering Information

PAM3115 X X X X



Pin Configuration	Package Type	Number of Pins	Output Voltage
A Type 1. VIN 2. GND 3. VOUT B Type 1. GND 2. VIN 3. EN 4. GND 5. PWRGD 6. SENSE 7. VOUT 8.GND	B: SOT-223 L: TO-252 E: SOP-8	A: 3 C: 8	090: 0.9V 100: 1.0V 120: 1.2V 150: 1.5V 180: 1.8V 250: 2.5V 280: 2.8V 285: 2.85V 300: 3.0V 330: 3.3V

Please consult PAM sales office or authorized Rep. /Distributor for output voltage and package type availability.

Ordering Information

Part Number	Output Voltage	Marking	Package Type	Standard Package
PAM3115ABA090	0.9V	P3115Z FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA090	0.9V	P3115Z FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC090	0.9V	P3115Z FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA100	1.0V	P3115Y FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA100	1.0V	P3115Y FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC100	1.0V	P3115Y FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA120	1.2V	P3115B FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA120	1.2V	P3115B FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC120	1.2V	P3115B FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA150	1.5V	P3115C FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA150	1.5V	P3115C FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC150	1.5V	P3115C FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA180	1.8V	P3115E FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA180	1.8V	P3115E FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC180	1.8V	P3115E FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA250	2.5V	P3115G FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA250	2.5V	P3115G FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC250	2.5V	P3115G FATYW	SOP-8	2,500Units/Tape&Reel

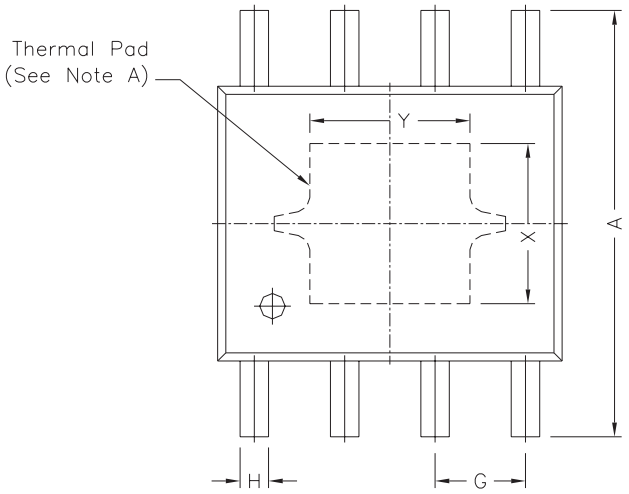
Ordering Information(continued)

Part Number	Output Voltage	Marking	Package Type	Standard Package
PAM3115ABA280	2.8V	P3115H FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA280	2.8V	P3115H FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC280	2.8V	P3115H FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA285	2.85V	P3115I FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA285	2.85V	P3115I FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC285	2.85V	P3115I FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA300	3.0V	P3115J FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA300	3.0V	P3115J FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC300	3.0V	P3115J FATYW	SOP-8	2,500Units/Tape&Reel
PAM3115ABA330	3.3V	P3115K FATYW	SOT-223	3,000Units/Tape&Reel
PAM3115ALA330	3.3V	P3115K FATYW	TO-252	2,500Units/Tape&Reel
PAM3115BEC330	3.3V	P3115K FATYW	SOP-8	2,500Units/Tape&Reel

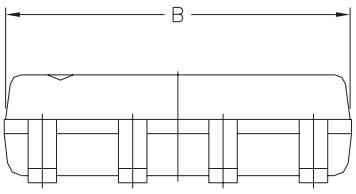
Please consult PAM sales office or authorized Rep. /Distributor for output voltage and package type availability.

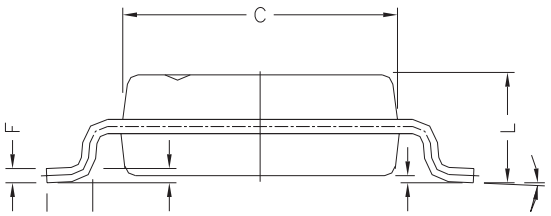
Outline Dimension

SOP-8



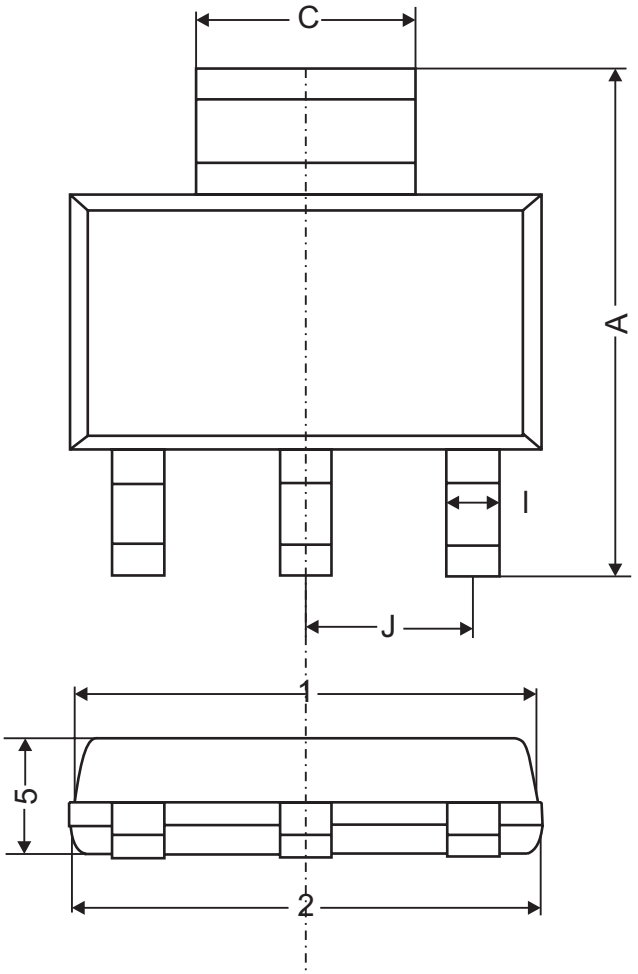
REF.		DIMENSIONS Millimeters Min.	Max.
A		5.80	6.20
B		4.80	5.00
C		3.80	4.00
D		0°	8°
E		0.40	0.90
F		0.19	0.25
M		0	0.15
H		0.35	0.49
L		1.35	1.75
G		1.27 TYP.	
Option1	X	2.28	
	Y	2.28	
Option2	X	2.41	
	Y	3.30	



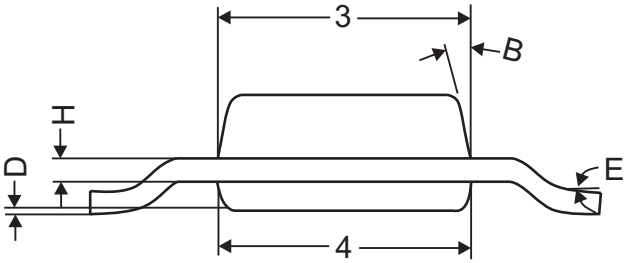


Outline Dimension

SOT-223

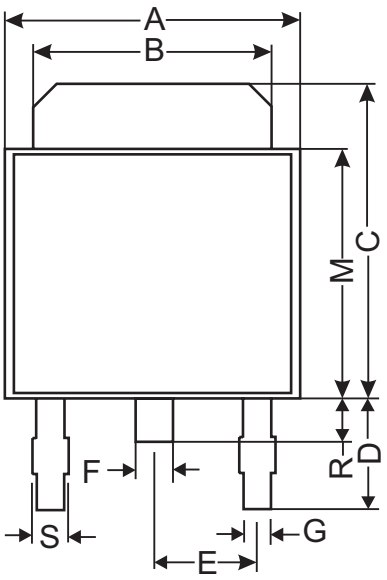


Dimensions(Millimeter)			
Symbol	MIN	NOM	MAX
A	6.70	7.00	7.30
C	2.90	3.00	3.10
D	0.02	0.06	0.10
E	0º	5º	10º
I	0.60	0.70	0.80
H	0.25	0.30	0.35
B	13º TYP		
J	2.30 REF.		
1	6.30	6.50	6.70
2	6.30	6.50	6.70
3	3.30	3.50	3.70
4	3.30	3.50	3.70
5	1.40	1.60	1.80



Outline Dimension

To-252



Dimensions(Millimeter)			
Symbol	MIN	NOM	MAX
A	6.40	6.60	6.80
B	5.20	5.35	5.50
C	6.80	7.00	7.20
D	2.20	2.50	2.80
E	2.30 REF.		
F	0.70	0.80	0.90
S	0.60	0.75	0.90
G	0.50	0.60	0.70
H	2.20	2.30	2.40
J	0.45	0.50	0.55
K	0	0.07	0.15
L	0.90	1.20	1.50
M	5.40	5.60	5.80
R	0.80	1.00	1.20

