PAM3110

1.5A Low Dropout Voltage CMOS Regulator

Features

- High Output Current Up to 1.5A
- Output Voltage Available in 0.9V,1.2V,1.5V, 1.8V, 2.5V, 2.8V, 3.0V, 3.3V and 5.0V
- Stable with a Ceramic Output Capacitor
- Dropout Voltage: 400mV@1.5A
- Low Quiescent Current
- Over Temperature Shutdown
- Short Circuit Protection
- Low Temperature Coefficient
- Standard SOT-223 and TO-252 Packages
- Pb-Free Package

Applications

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

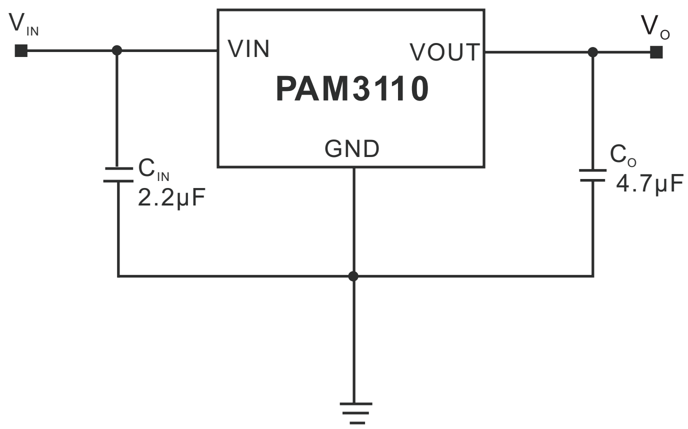
General Description

The PAM3110 is a 1.5A CMOS LDO regulator that features a low quiescent current and low dropout voltages, as well as over temperature shutdown. The fixed output voltage of the PAM3110 is set at the factory and trimmed to ±1.5%. The PAM3110 is stable with a ceramic output capacitor of 4.7μF or higher.

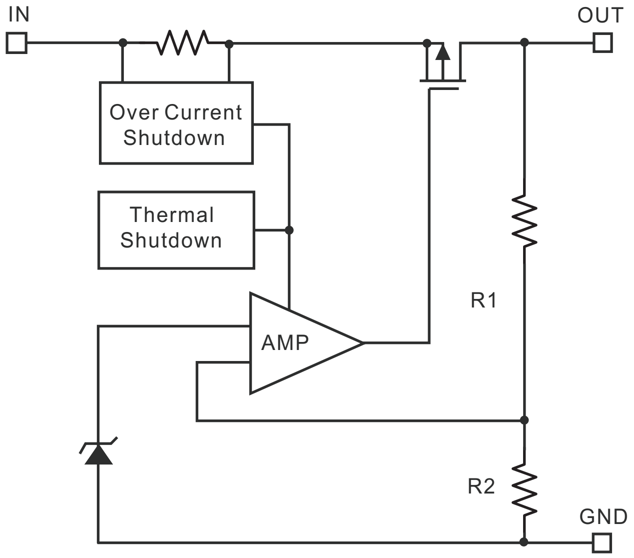
This family of regulators can provide either a stand-alone power supply solution or act as a post regulator for switch mode power supplies. They are particularly suitable for applications requiring low input and output voltages.

PAM3110 is available in SOT-223 and TO-252 package.

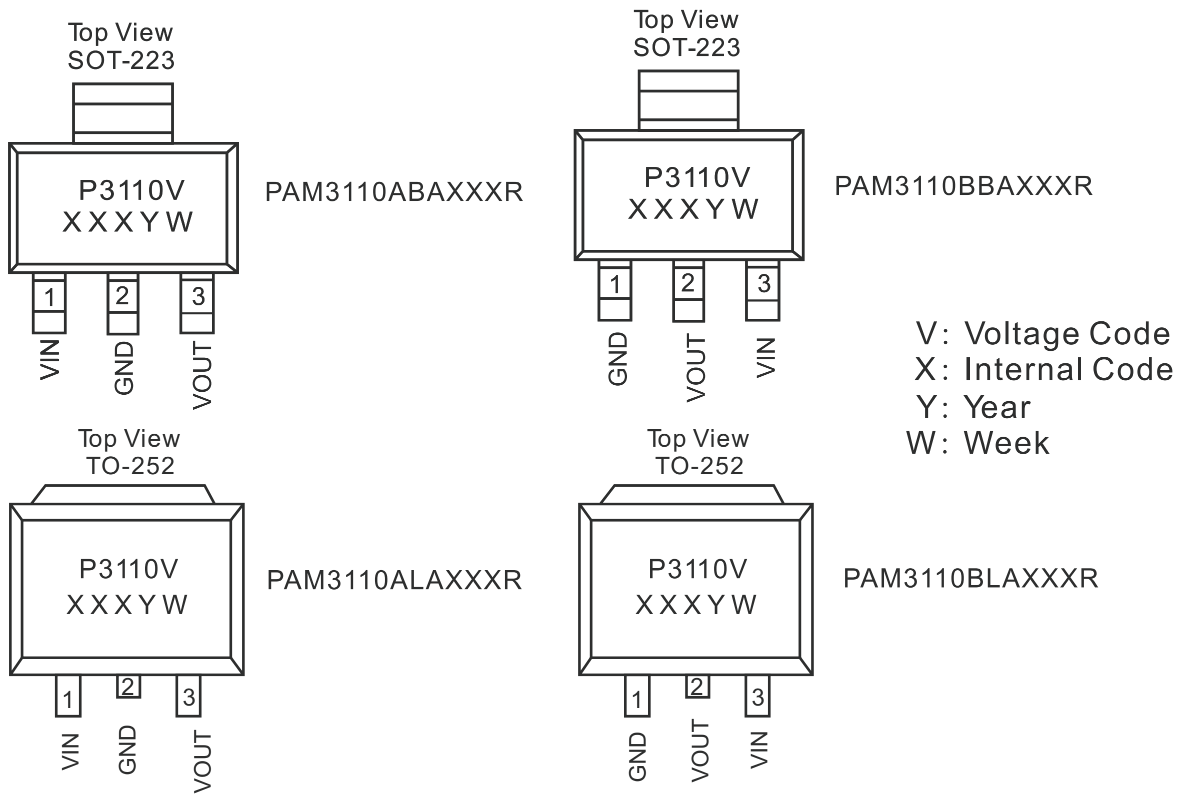
Typical Application Circuit



Block Diagram



Pin Configuration & Marking Information



Pin Number (SOT-223/TO-252)	Pin Number (SOT-223/TO-252)	Name	Function
3	1	VIN	Input
1	2	GND	Ground
2	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...6.0V
Output Pin Voltage ....-0.3V to V_{IN}+0.3V
Maximum Output Current......................$P_D/(V_{IN}-V_O)$

Storage Temperature....................-65°C to 150°C
Maximum Junction Temperature..................150°C
Lead Soldering Temperature (5sec)........... 300°C

Recommended Operating Conditions

Maximum Supply Voltage.............................5.5V

Junction Temperature Range........-40°C to 125°C
Ambient Temperature Range...........-40°C to 85°C

Thermal Information

Parameter	Symbol	Package	Maximum	Unit
Thermal Resistance (Junction to Case)	θ_{JC}	SOT-223	7	°C/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}=2.2μF, C_O=4.7μF, unless otherwise noted.

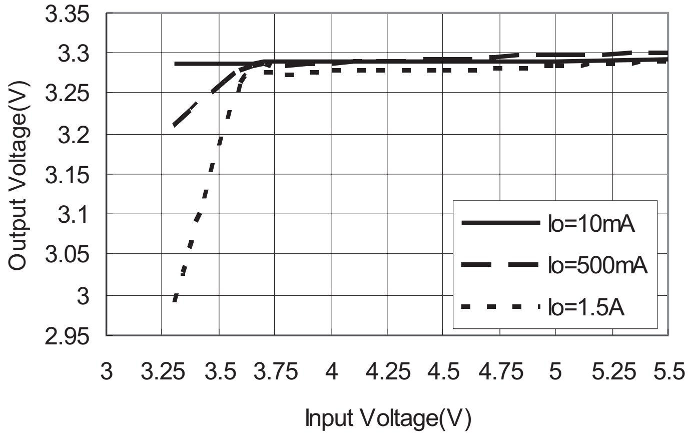
Parameters	Symbol	Test Conditions		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}			2.5		5.5	V
Output Voltage Accuracy	V_O	I_O=100mA		-1.5		1.5	%
Dropout Voltage	V_{DROP}	I_O=500mA	2.5V>Vo≥1.5V		250		mV
			Vo≥2.5		200		
		I_O=1.5A	2.5V>Vo≥1.5V		550		
			Vo≥2.5V		400		
Short Circuit Current	I_{SC}	Vo<0.3V			500		mA
Quiescent Current	I_Q	I_O=0mA				300	μA
Ground Pin Current	I_{GND}	I_O=1mA to 1.0A				300	μA
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} =Vo+0.5V to Vo+1.5V					
Load Regulation	LDR	I_O=1mA to 1.0A			0.5	2	%/A
Over Temperature Shutdown	OTS				150		°C
Over Temperature Hysteresis	OTH				30		°C
Temperature Coefficient	TC				40		ppm/°C
Power Supply Ripple Rejection	PSRR	I_O =100mA, V_O=1.5V	f=100Hz		55		dB
			f=1kHz		50		
			f=10kHz		35		
Output Noise	Vn	f=10Hz to 100kHz			40		μVrms

Typical Performance Characteristics

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

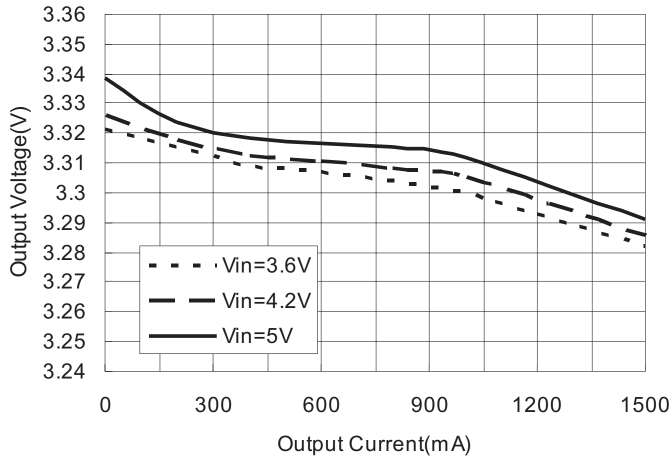
1. Output Voltage vs Input Voltage

Vo=3.3V

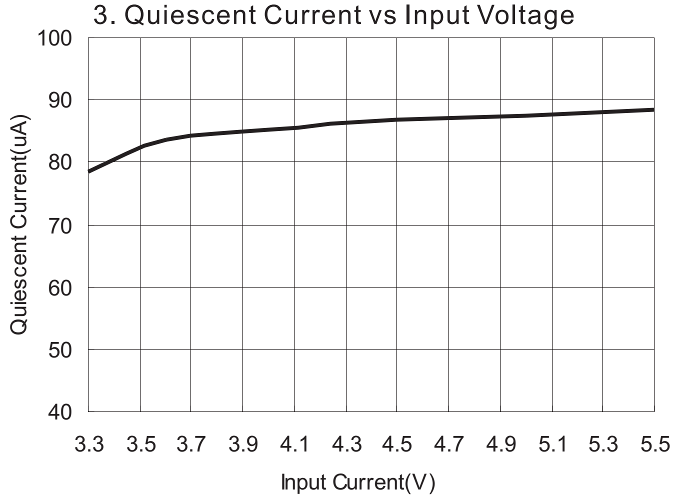


2. Output Voltage vs Output Current

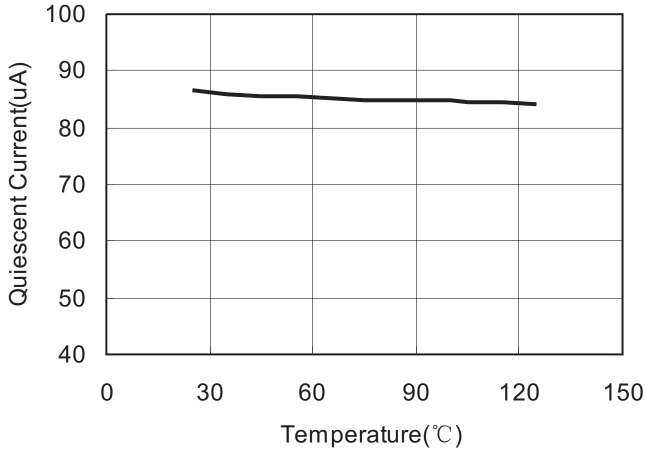
Vo=3.3V



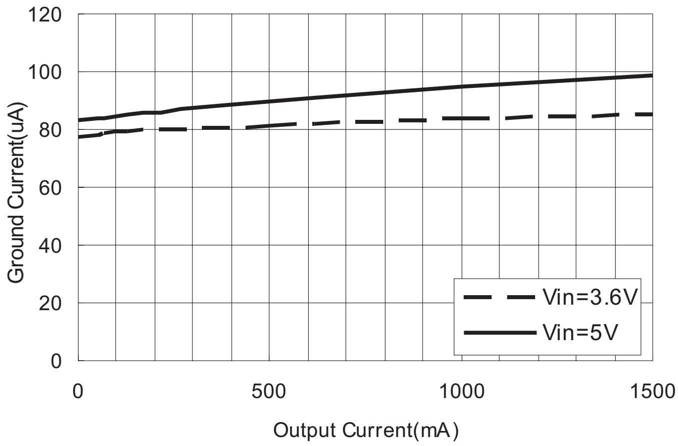
3. Quiescent Current vs Input Voltage



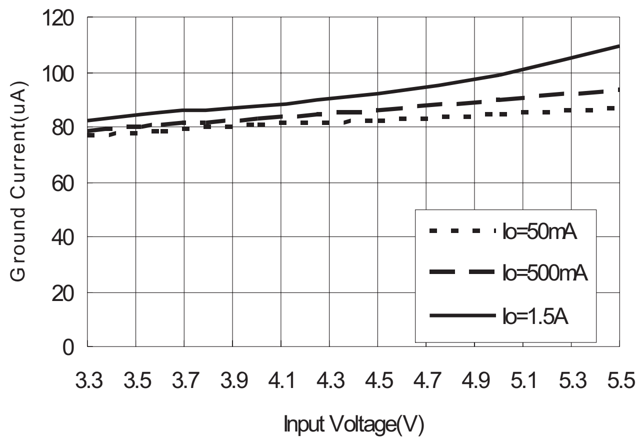
4. Quiescent Current vs Temperature



5. Ground Current vs Output Current



6. Ground Current vs Input Voltage

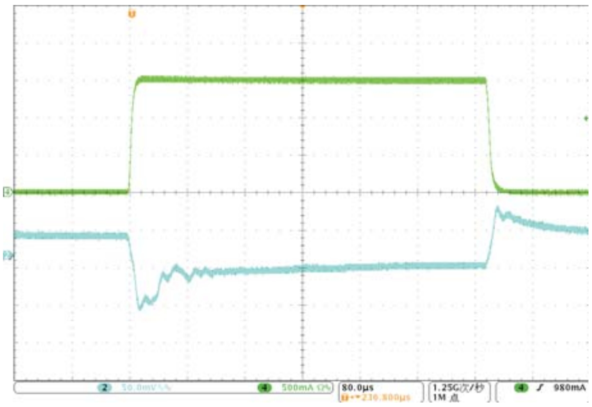


Typical Performance Characteristics (continued)

7. Load Transient Response

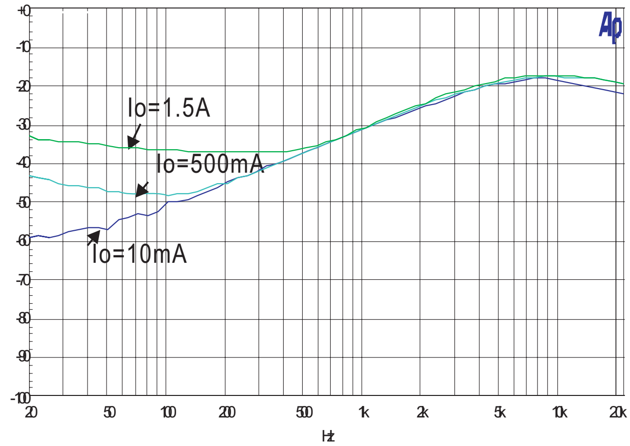
Vo
AC
Coupling

Io
DC
Coupling



Vo=3.3V ,V_{IN}=5V, Io=0mA to 1.5A

8. Ripple Rejection vs Frequency

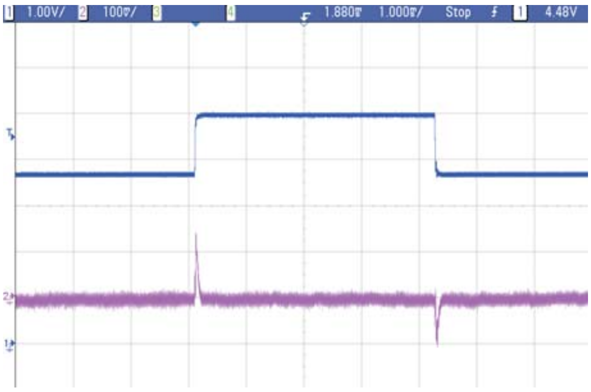


Vo=3.3V,V_{IN}=4.2V,Vpp=1V

9. Line Transient Response

V_{IN}
DC
Coupling

Vo
AC
Coupling



Vo=3.3V, V_{IN}=3.3V to 5V, Io=10mA

Application Information

The PAM3110 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 and low dropout voltage (typically 300mV 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 PAM3110 family suitable for powering many microprocessors and FPGA supplies. The PAM3110 family also has low output noise (typically 40μVRMS with 4.7μF 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 PAM3110, is required for stability. A 4.7μF 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 2.5 V is used.

Regulator Protection

The PAM3110 features internal current limiting, thermal protection and short circuit protection. During normal operation, the PAM3110 limits output current to about 2A. 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 30°C below the high temp trip point, regulator operation resumes. The short circuit current of the PAM3110 is about 0.5A 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:

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

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 $V_{I(avg)} \times I_{(Q)}$ 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

PAM3110X X X xxx X

- X (5th) — Shipping Package
- xxx — Output Voltage
- X (3rd) — Number of Pins
- X (2nd) — Package Type
- X (1st) — Pin Configuration

Pin Configuration	Package Type	Number of Pins	Output Voltage
A Type 1. VIN 2. GND 3. VOUT B Type 1. GND 2. VOUT 3. VIN	B: SOT-223 L: TO-252	A: 3	090: 0.9V 120: 1.2V 150: 1.5V 180: 1.8V 250: 2.5V 280: 2.8V 300: 3.0V 330: 3.3V

Part Number	Output Voltage	Marking	Package Type	MOQ & Shipping Package
PAM3110ABA090R	0.9V	P3110C XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA090R	0.9V	P3110C XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA090R	0.9V	P3110C XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA090R	0.9V	P3110C XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA120R	1.2V	P3110E XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA120R	1.2V	P3110E XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA120R	1.2V	P3110E XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ALA120R	1.2V	P3110E XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA150R	1.5V	P3110G XXXYW	SOT-223	3,000 Units/Tape & Reel

(To be cont'd)

Ordering Information

(Cont'd)

Part Number	Output Voltage	Marking	Package Type	MOQ & Shipping Package
PAM3110BBA150R	1.5V	P3110G XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA150R	1.5V	P3110G XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA150R	1.5V	P3110G XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA180R	1.8V	P3110E XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA180R	1.8V	P3110E XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA180R	1.8V	P3110E XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA18R	1.8V	P3110E XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA250R	2.5V	P3110G XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA250R	2.5V	P3110G XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA250R	2.5V	P3110G XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA250R	2.5V	P3110G XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA280R	2.8V	P3110H XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA280R	2.8V	P3110H XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA280R	2.8V	P3110H XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA280R	2.8V	P3110H XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA300R	3.0V	P3110J XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA300R	3.0V	P3110J XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA300R	3.0V	P3110J XXXYW	TO-252	2,500 Units/Tape & Reel

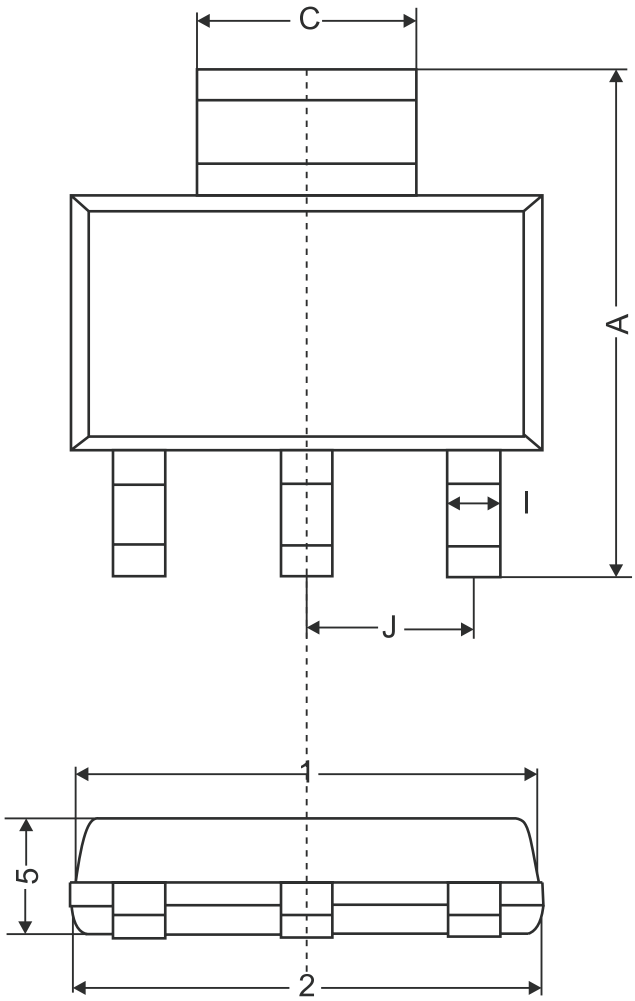
Ordering Information

(Cont'd)

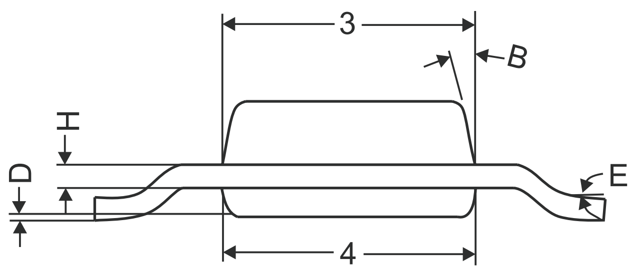
Part Number	Output Voltage	Marking	Package Type	MOQ & Shipping Package
PAM3110BLA300R	3.0V	P3110J XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA330R	3.3V	P3110K XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA330R	3.3V	P3110K XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA330R	3.3V	P3110K XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA330R	3.3V	P3110K XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110ABA500R	5.0V	P3110V XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110BBA500R	5.0V	P3110V XXXYW	SOT-223	3,000 Units/Tape & Reel
PAM3110ALA500R	5.0V	P3110V XXXYW	TO-252	2,500 Units/Tape & Reel
PAM3110BLA500R	5.0V	P3110V XXXYW	TO-252	2,500 Units/Tape & Reel

Outline Dimension

SOT-223

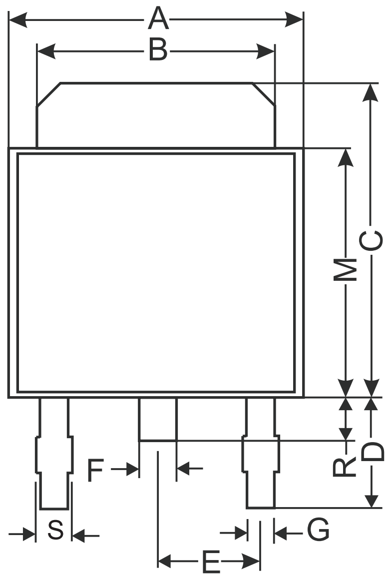


Dimensions (Millimeter)			
Symbol	MIN	NOM	MAX
A	6. 70	7. 00	7. 30
C	2. 90	3. 00	3. 10
D	0. 02	0. 06	0. 10
E	0°	5°	10°
I	0. 60	0. 70	0. 80
H	0. 25	0. 30	0. 35
B	13° TYP		
J	2.30REF		
1	6. 30	6. 50	6. 70
2	6. 30	6. 50	6. 70
3	3. 30	3. 50	3. 70
4	3. 30	3. 50	3. 70
5	1. 40	1. 60	1. 80



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	2.30REF		
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