3A ADJUSTABLE LOW VOLTAGE LOW DROPOUT CMOS REGULATOR

Description

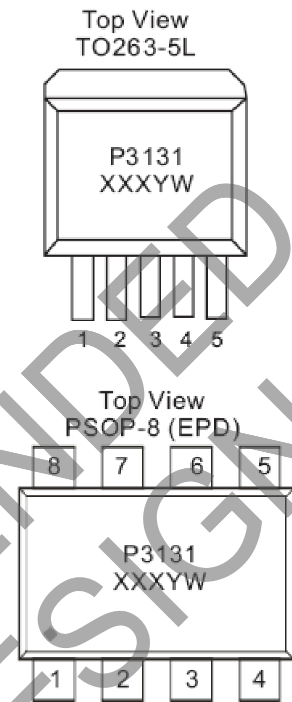
The PAM3131 is a 3A CMOS adjustable LDO regulator that features a low quiescent current, ultra low input, output, and dropout voltages, as well as over temperature protection. It is available in TO-263 and PSOP-8 (Exposed Pad) packages. The output voltage is adjustable from 0.9V to 3.3V. The PAM3131 is stable with a ceramic output capacitor of 1.0μF 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.

Features

- Low-Dropout Regulator Supports Input Voltages Down to 1.4V
- Low Dropout Voltage: 300mV@ 3A
- Output Voltage Adjustable from 0.9V-3.3V
- Stable with a Ceramic Output Capacitor of 1.0μF or Higher
- Low Quiescent Current
- Current Limit
- Over Temperature Shutdown
- Short Circuit Current Protection
- Low Temperature Coefficient
- Standard TO-263 and PSOP-8 (Exposed Pad) Packages
- Pb-Free Package

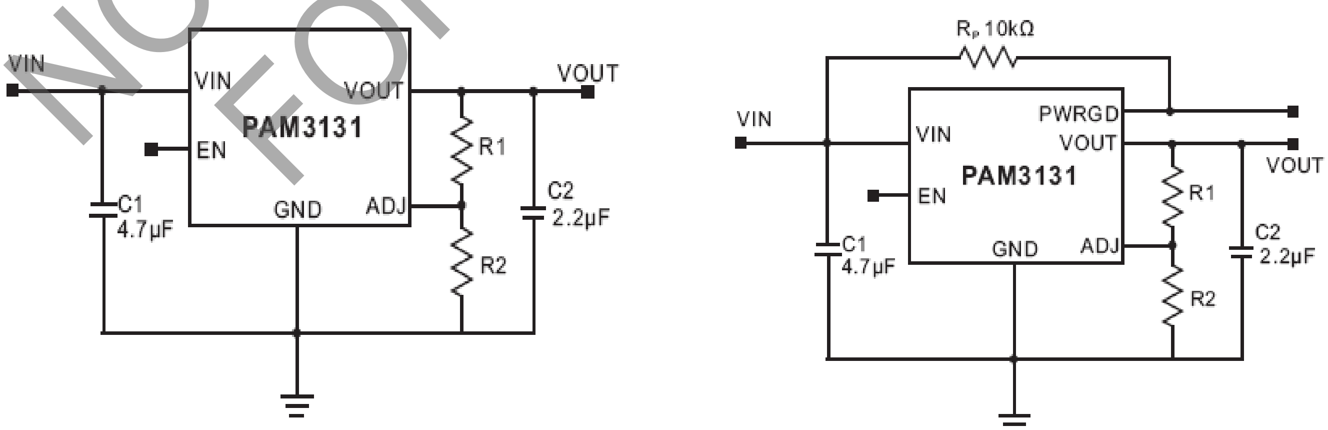
Pin Assignments



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

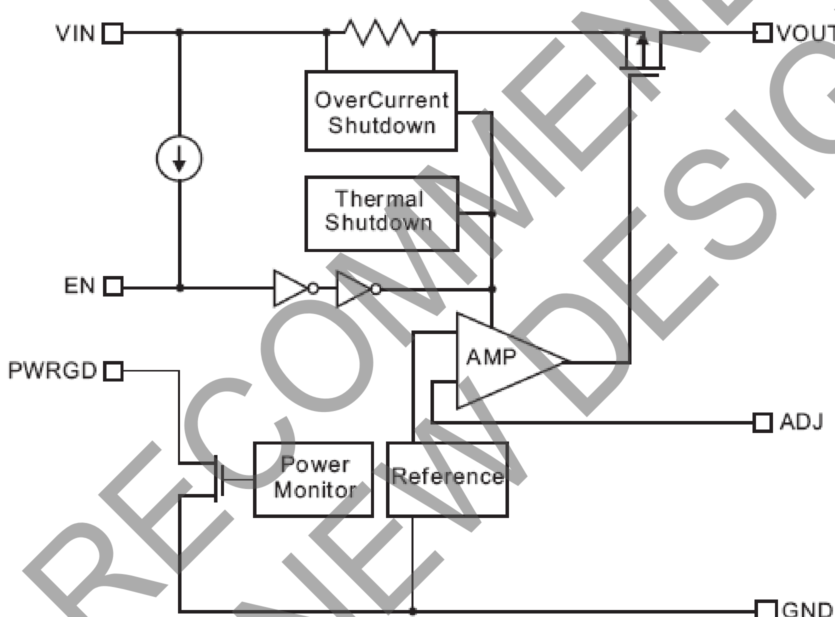
Typical Applications Circuit



Pin Description

Pin Name	Pin Number		Function
	TO263-5L	PSOP-8(EPD)	
VIN	1	2	Input
EN	2	3	Enable Pin
ADJ	4	6	Adjustable Pin
VOUT	5	7	Output
GND	3	1, 4, 8	Ground
PWRGD	—	5	Power Good

Functional Block Diagram



Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

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.

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

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Parameter	Rating	Unit
Supply Voltage Range	1.4 to 3.6	V
Operation Temperature Range	-40 to +85	°C
Junction Temperataure Range	-40 to +125	

Thermal Information

Parameter	Symbol	Package	Max	Unit
Thermal Resistance (Junction to Case)	θ_{JC}	TO-263	7	
		PSOP-8	10	°C/W
Thermal Resistance (Junction to Ambient)	θ_{JA}	TO-263	35	
		PSOP-8	50	
Internal Power Dissipation (T_A = 25°C)	P_D	TO-263	2800	mW
		PSOP-8	2000	

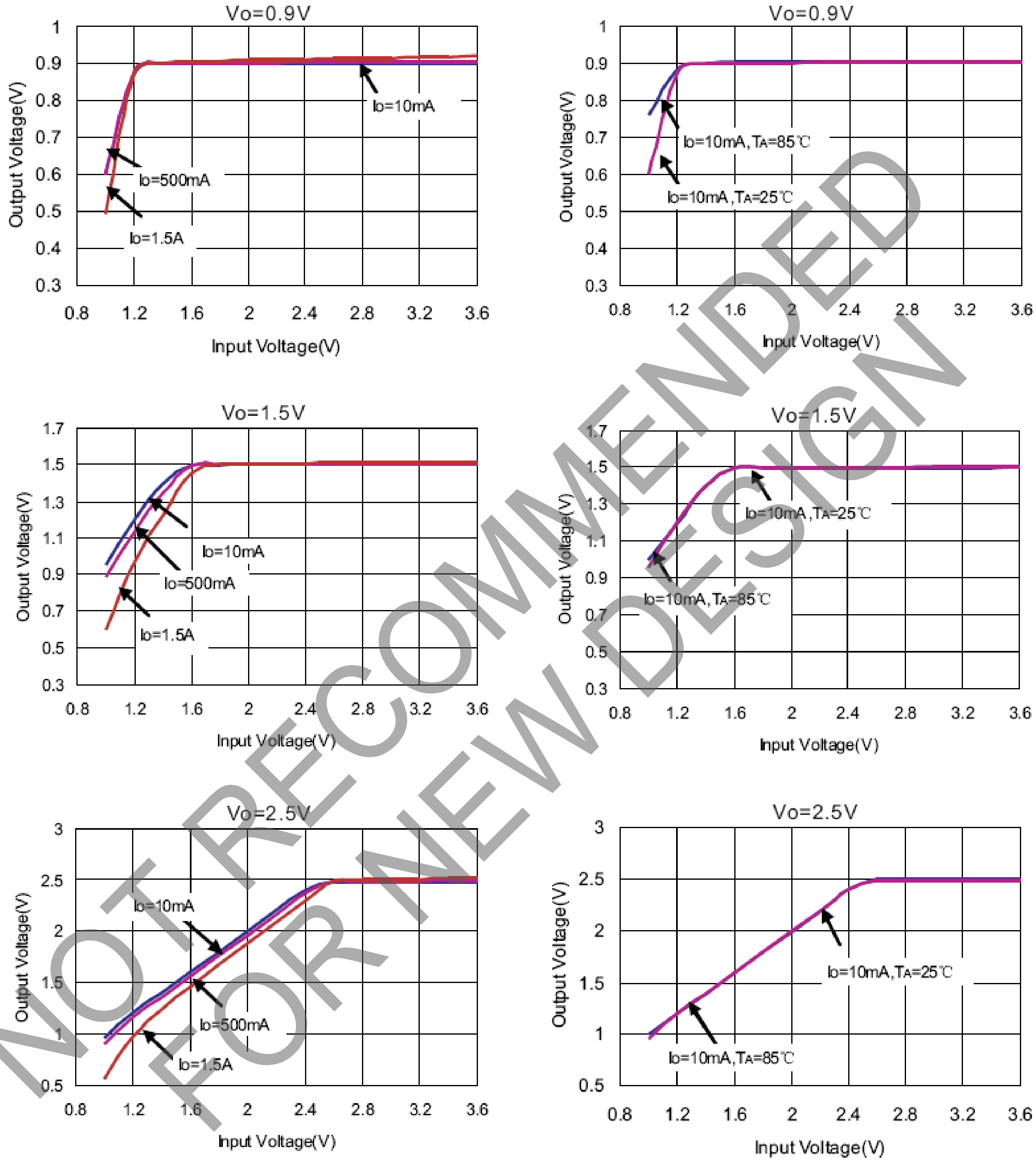
Electrical Characteristics (@T_A = +25°C, V_{IN} = V_O +1V, C_{IN} = 4.7µF, C_O = 4.7µF, unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
Input Voltage Range	V_{IN}			Note 1		3.6	V
ADJ Reference Voltage	V_{REF}	I_O = 100mA		0.882	0.900	0.918	V
Dropout Voltage	V_{DROP}	I_O = 500mA	V_O = 0.9V		330	500	mV
			V_O = 1.0V		220	400	
			2.5V > V_O ≥ 1.2V		50	200	
			V_O ≥ 2.5V		40	150	
		I_O = 3.0A	V_O = 0.9V		500		
			V_O = 1.0V		400		
			2.5V > V_O ≥ 1.2V		350		
			V_O ≥ 2.5V		300		
Short Circuit Current	I_{SC}	V_O < 0.3V			1.0		A
Output Current	I_O			3.0		Note 2	A
Quiescent Current	I_Q	I_O = 0mA			90	150	µA
Ground Pin Current	I_{GND}	V_O > 0.8V				1.0	mA
Line Regulation	LNR	V_O ≤ 2.5V, I_O = 10mA V_{IN} = V_O +0.5V to V_O +1.5V			0.2	1.0	%/V
		V_O > 2.5V, I_O = 10mA V_{IN} = 3.3V to 3.6V					
Load Regulation	LDR	I_O = 1mA to 3.0A, V_{IN} = V_O +0.5A			0.5	2	%/A
Over Temperature Shutdown	OTS				150		°C
Over Temperature Hysteresis	OTH				50		°C
Temperature Coefficient	T_C				40		ppm/°C
Power Supply Ripple Rejection	PSRR	I_O = 100mA, V_O = 1.5V	f = 100Hz		64		dB
			f = 1kHz		58		
Output Noise	Vn	f = 10Hz to 100kHz			40		$µV_{RMS}$

Notes:
1. The minimum input voltage ( ) of the PAM3131 is determined by output voltage and dropout voltage. The minimum input voltage is defined as:
2. Output current is limited by P_D, maximum $I_O = P_D/(V_{IN(MAX)} - V_O)$.

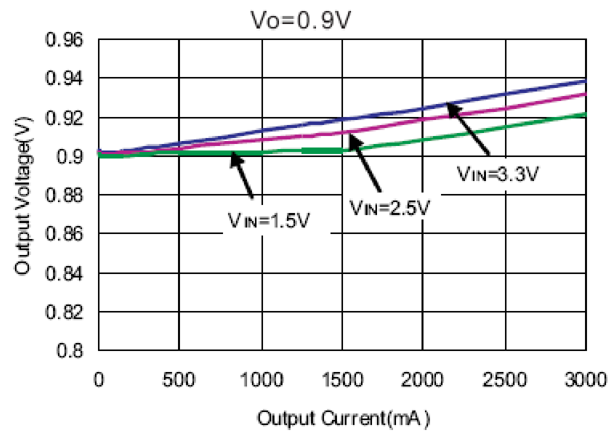
Typical Performance Characteristics (@T_A = +25°C, C_{IN} =4.7µF, C_O = 2.2µF, unless otherwise specified.)

1. Output Voltage vs Input Voltage

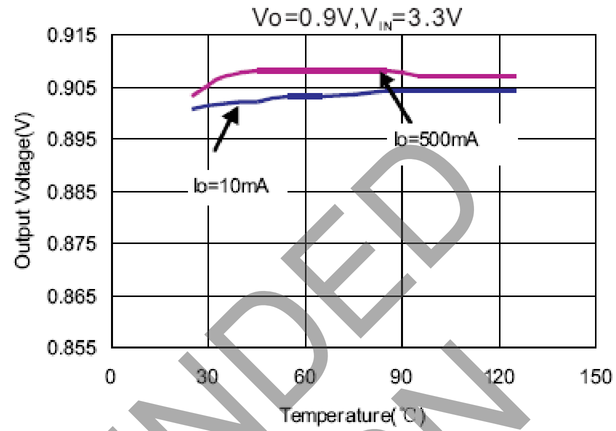


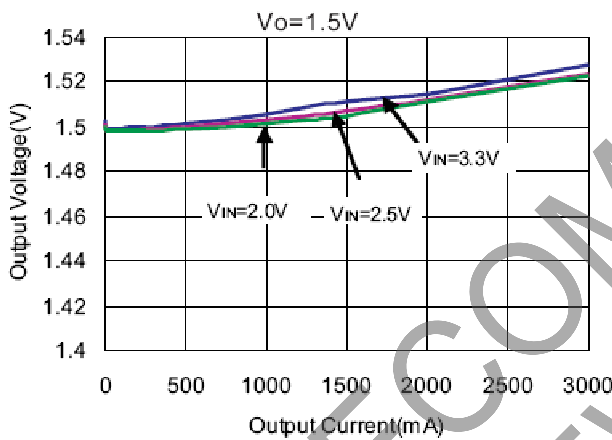
Typical Performance Characteristics (cont.) (@T_A = +25°C, C_{IN} =4.7µF, C_O = 2.2µF, unless otherwise specified.)

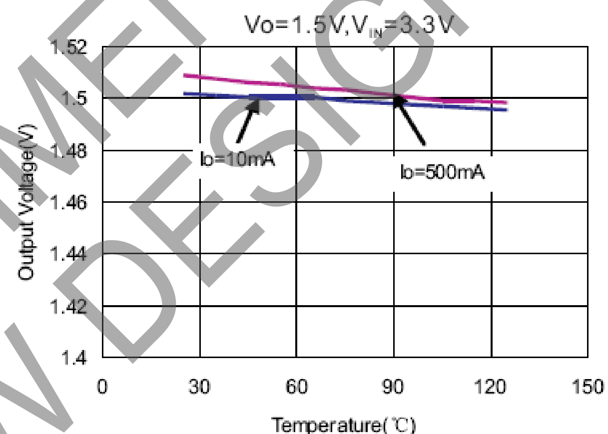
2. Output Voltage vs Output Current

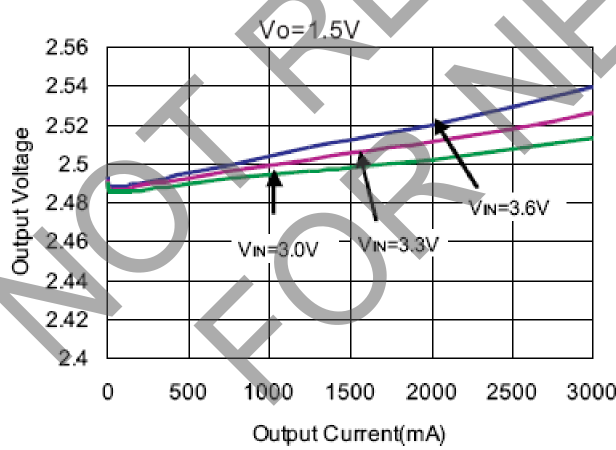


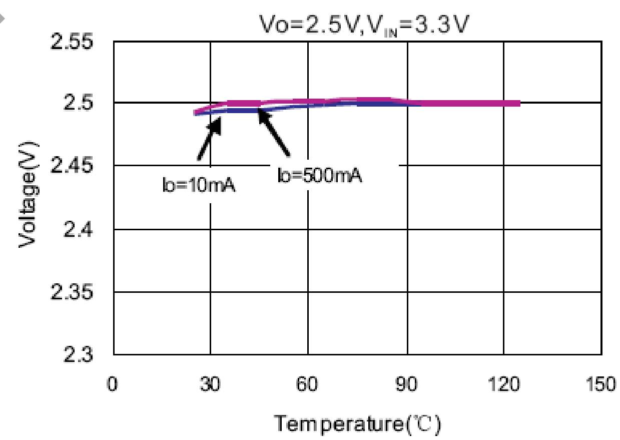
3. Output Voltage vs Temperature





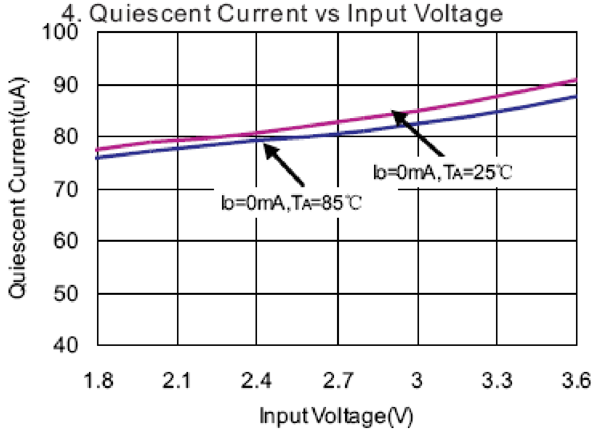




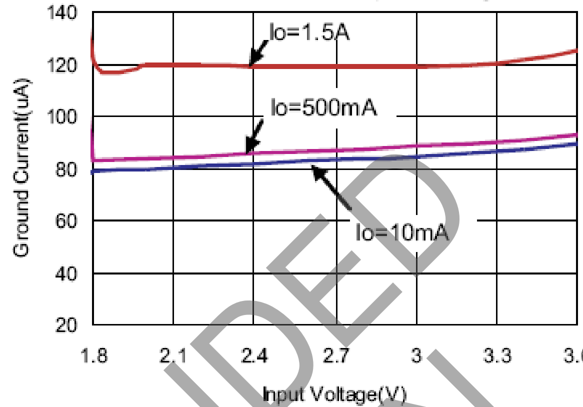


Typical Performance Characteristics (cont.) (@T_A = +25°C, C_{IN} =4.7µF, C_O = 2.2µF, unless otherwise specified.)

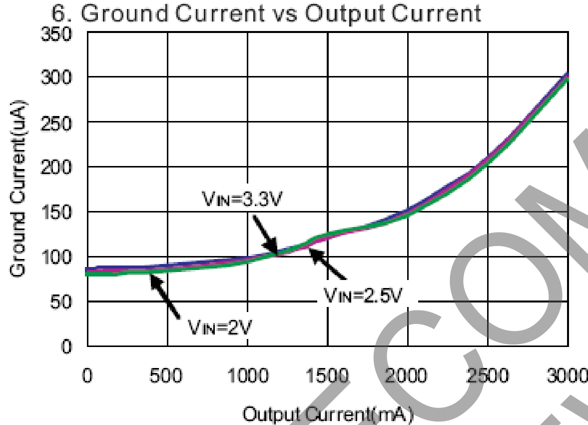
4. Quiescent Current vs Input Voltage



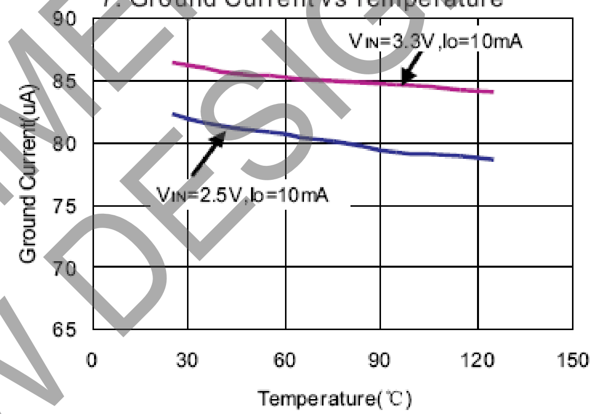
5. Ground Current vs Input Voltage



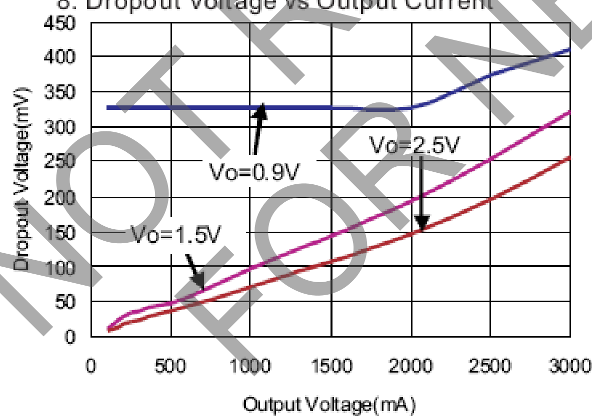
6. Ground Current vs Output Current



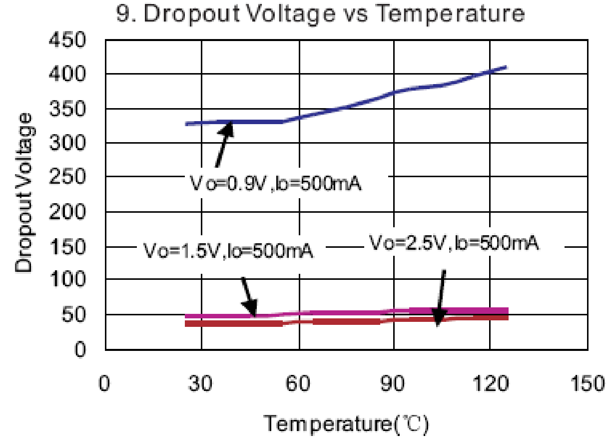
7. Ground Current vs Temperature



8. Dropout Voltage vs Output Current

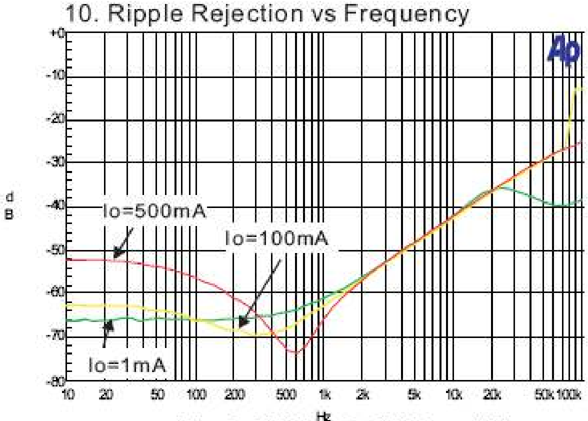


9. Dropout Voltage vs Temperature



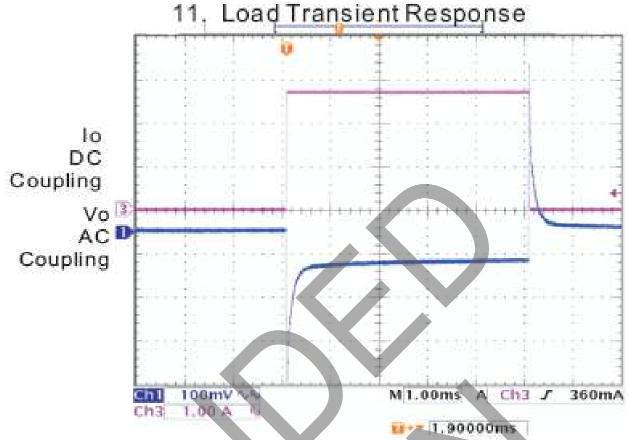
Typical Performance Characteristics (cont.) (@T_A = +25°C, C_{IN} =4.7µF, C_O = 2.2µF, unless otherwise specified.)

10. Ripple Rejection vs Frequency

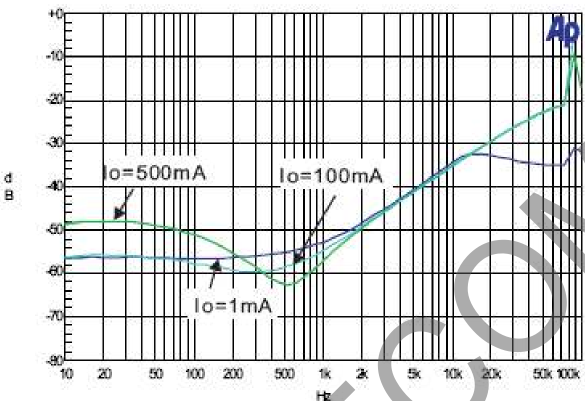


Vo=0.9V,V_{IN}=2.5V,Vpp=1V

11. Load Transient Response

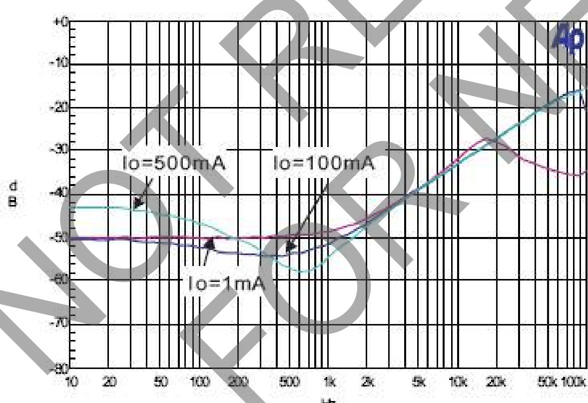


Vo=1.5V,V_{IN}=3.3V, Io=1mA to 3.0A

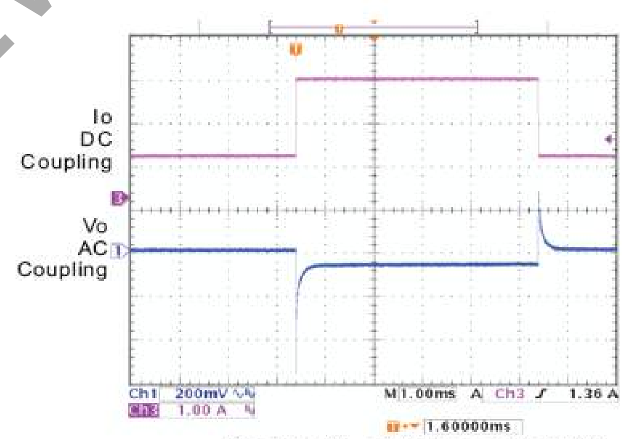


Vo=1.5V,V_{IN}=2.5V,Vpp=1V

Vo=1.5V,V_{IN}=3.3V, Io=1mA to 1.0A



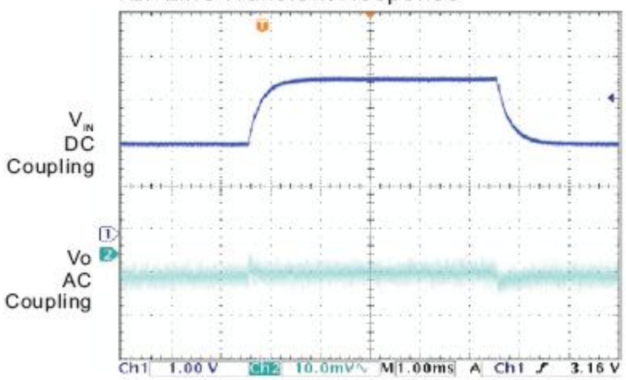
Vo=2.5V,V_{IN}=3.3V,Vpp=0.3V



Vo=1.5V,V_{IN}=3.3V, Io=1A to 3.0A

Typical Performance Characteristics (cont.) (@T_A = +25°C, C_{IN} =4.7µF, C_O = 2.2µF, unless otherwise specified.)

12. Line Transient Response



Vo=1.5V,Io=100mA, V_{IN}=2.0V to 3.3V

Application Information

The PAM3116 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 PAM3116 family suitable for powering many microprocessors and FPGA suppl ies. The PAM3116 family also has low output noise (typically 50µVRMS with 4.7µF output capacitor), making it ideal for use in telecom equipment.

External Capacitor Requirements

A 4.7µF or larger ceramic input bypass capacitor, connected between V_{IN} and GND and located close to the PAM3116, 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 1 0µF 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 2.5V is used.

Regulator Protection

The PAM3116 features internal current limiting, thermal protection and short circuit protection. During normal operation, the PAM3116 limits output current to about 2.5A. 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 +40°C below the high temp trip point, regulator operation resumes. The short circuit current of the PAM3116 is about 0.7A 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 heat sinks. The purpose of thi s 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:

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 $V_{I(AVG)}$ xI_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 lowers.

Ordering Information

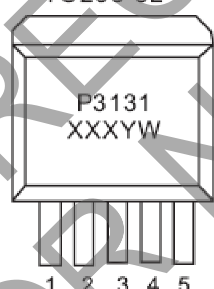
PAM3131 X X X X

Pin Configuration	Package Type	Number of Pins	Packaging
A Type: 1. VIN 2. EN 3. GND 4. ADJ 5. VOUT B Type: 1. GND 2. VIN 3. EN 4. GND 5. PWRGD 6. ADJ 7. VOUT 8. GND	M: TO-263 E: PSOP-8	B: 5 C: 8	R: Tape & Reel

Part Number	Package Type	Standard Package
PAM3131AMBR	TO236-5L	800 Units/Tape&Reel
PAM3131BECR	PSOP-8	2500 Units/Tape&Reel

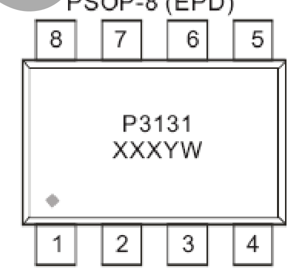
Marking Information

Top View
TO263-5L



P3131: PAM3131
X: Internal Code
Y: Year
W: Week

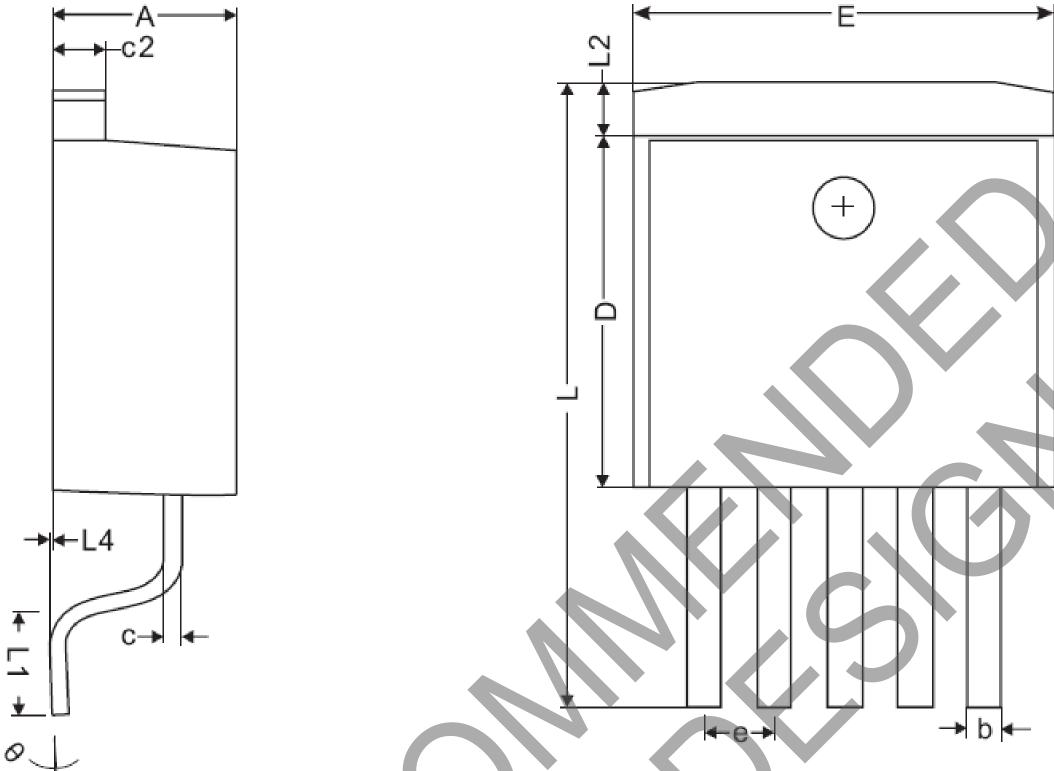
Top View
PSOP-8 (EPD)



P3131: PAM3131
X: Internal Code
Y: Year
W: Week

Package Outline Dimensions (All dimensions in mm.)

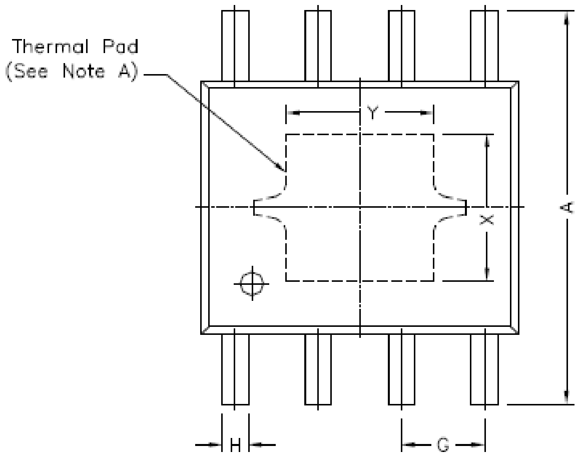
TO263-5L



Dimensions(Millimeter)			
Symbol	MIN	NOM	MAX
A	4.40	4.60	4.80
b	0.66	0.78	0.91
L4	0.00	0.15	0.30
c	0.36	0.43	0.50
L3	1.50 REF.		
L1	2.29	2.54	2.79
E	9.80	10.1	10.4
c2	1.25	1.35	1.45
L2	1.27 REF.		
D	8.6	8.8	9.0
e	1.70 REF.		
L	14.6	15.2	15.8
θ	0°	4°	8°

Package Outline Dimensions (cont.) (All dimensions in mm.)

PSOP-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	

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