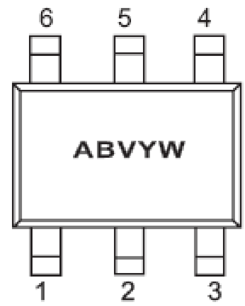
PAM3102

DUAL 150mA HIGH PSRR LOW-DROPOUT CMOS REGULATOR

Description

The dual LDO PAM3102 series of positive voltage linear regulators feature high output voltage accuracy, low quiescent current and low dropout voltage, making them ideal for battery powered applications. The line transient response and load transient response are excellent. Their high PSRR make them useful in applications where AC noise on the input power supply must be suppressed. Space-saving TSOT26 package for 2-ch LDOs is attractive for portable and handheld applications. They have both thermal shutdown and a current limit feature to prevent device failure under extreme operating conditions. They are stable with an output capacitance of 2.2µF or greater.

Pin Assignments



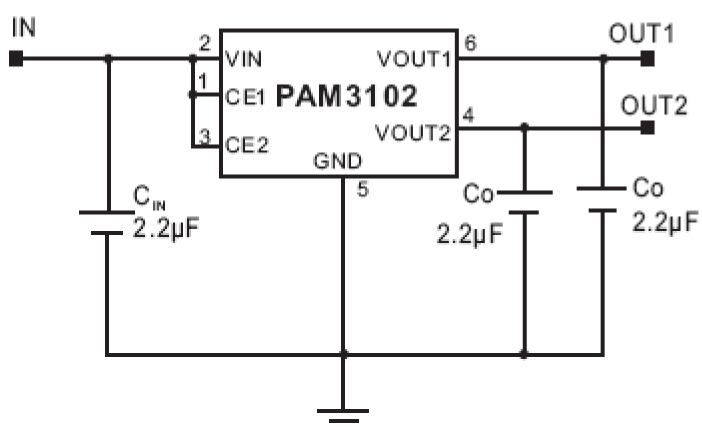
Features

- Output Accuracy: ±2%
- Low Dropout Voltage: 180mV@150mA
- High PSRR: 70dB@100Hz
- Low Noise Output
- Current Limiting
- Short Circuit Protection
- Thermal Shutdown
- Space Saving Package TSOT26
- Pb-Free Package

Applications

- Cellular Phone
- Portable Electronics, PDA
- Wireless Devices, Wireless LAN
- Computer Peripherals
- Camera Module
- GPS Receiver

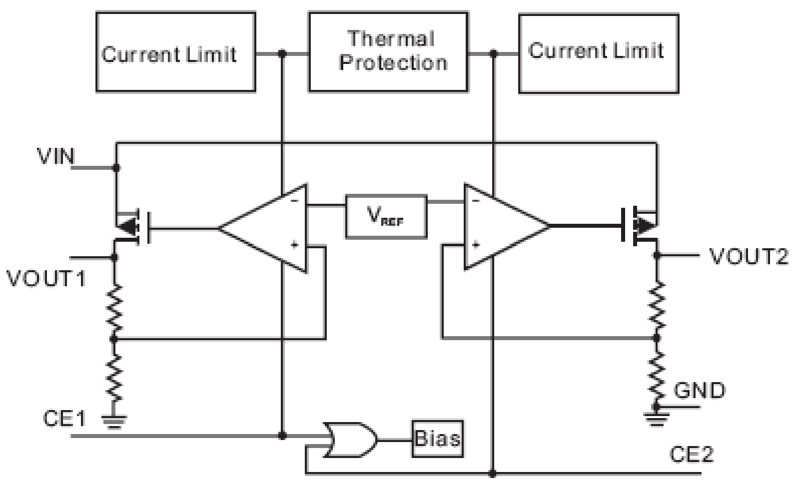
Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	CE1	Output 1 Enable
2	VIN	Input
3	CE2	Output 2 Enable
4	VOUT2	Output 2
5	GND	Ground
6	VOUT1	Output 1

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	6.0	V
Output Current	150/150	mA
Output Pin Voltage	GND -0.3 to V_{IN} +0.3V	V
Storage Temperature	-40 to +125	°C
ESD Rating (HBM)	2	kV
Lead Soldering Temperature	300, (5sec)	°C

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

Parameter	Rating	Unit
Supply Voltage Range	5.5	V
Enable Input Resistance	0 to V_{IN}	V
Junction Temperature	-40 to +125	°C
Operation Temperature	-40 to +85	

Thermal Information

Parameter	Symbol	Package	Max	Unit
Thermal Resistance Junction to Case)	θ_{JC}	TSOT26	130	°C/W
Thermal Resistance (Junction to Ambient)	θ_{JA}	TSOT26	250	
Internal Power Dissipation	P_D	TSOT26	400	mW

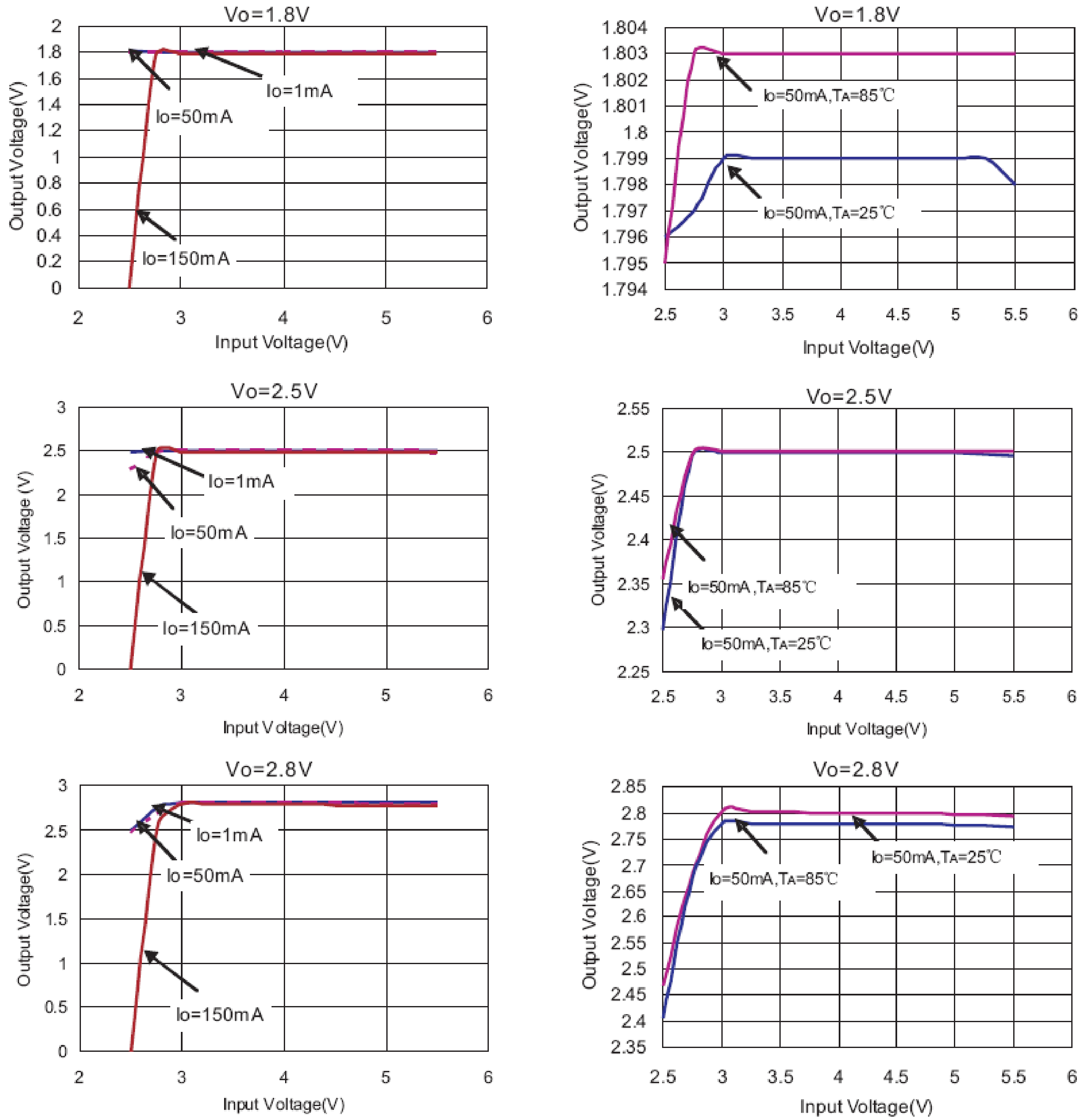
Electrical Characteristics (@T_A = +25°C, V_{CE1} = V_{CE2} = V_{IN} = V_O +1V, C_{IN} = 2.2µF, C_O = 2.2µF, unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
Input Voltage	V_{IN}			Note 1		5.5	V
Output Voltage	V_O	I_O = 1mA		-2.0		+2.0	%
Dropout Voltage	V_{DROP}	V_O = 1.8V, I_O = 150mA			950		mV
		V_O = 2.5V, I_O = 150mA			350		
		V_O = 2.8V, I_O = 150mA			180		
Output Current	I_O			150		Note 2	mA
Current Limit	I_{LIM}	V_O ≥ 1.2V			200		mA
Quiescent Current	I_Q	I_O = 0mA			175	250	µA
Ground Pin Current	I_{GND}	I_O = 1mA to 150mA			200	250	µA
Shutdown Current	I_{SD}	V_{CE1} = V_{CE2} = 0V			0.1	1	µA
Short Circuit Current	I_{SC}	V_O = 0V			150		mA
Line Regulation	LNR	I_O = 50mA, V_{IN} = 3V to 4V	V_O = 1.8V	-0.15	0.1	0.15	%/V
		I_O = 50mA, V_{IN} = 3.5V to 4.5V	V_O = 2.5V				
		I_O = 50mA, V_{IN} = 3.8V to 4.8V	V_O = 2.8V				
Load Regulation	LDR	V_{IN} = 3.3V, I_O = 1mA to 150mA		-2	1.0	2	%
Power Supply Ripple Rejection	PSRR	I_O = 50mA, V_O = 1.8V	f = 100Hz		70		dB
			f = 1kHz		63		dB
			f = 10kHz		45		dB
Output Noise	V_N	f = 10Hz to 100kHz			35		μV_{RMS}
CE Input High Threshold	V_{TH}			1.5			V
CE Input Low Threshold	V_{TL}					0.3	V
CE Pull-Up Resistance	R_{CE}			1.7	5	15	MΩ
Temperature Coefficient	TC				40		ppm/°C
Over Temperature Shutdown	OTS	I_O = 1mA			155		°C
Over Temperature Hysteresis	OTH	I_O = 1mA			40		°C

Notes: 1. The minimym inout voltage ($V_{IN(MIN)}$) of the PAM3102 is determined by output voltage and dropout voltage. The minimum input voltage is defined as: $V_{IN(MIN)} = V_O + V_{DROP}$
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} = 2.2µF, C_O = 2.2µF, unless otherwise specified.)

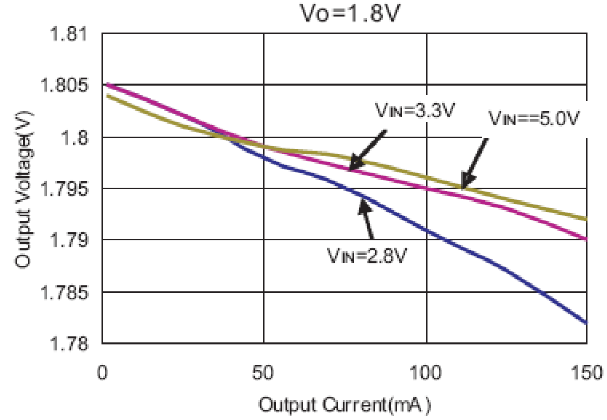
1. Output Voltage vs Input Voltage



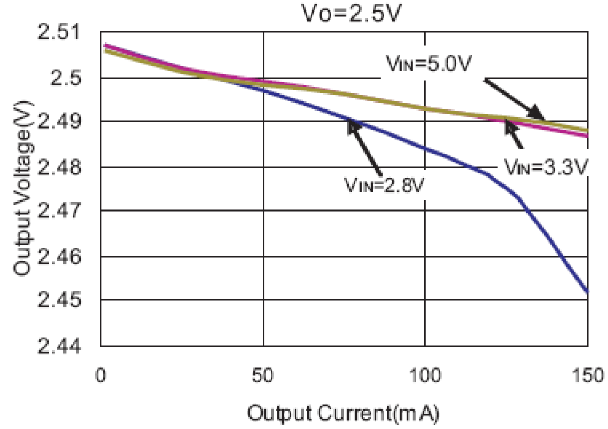
Typical Performance Characteristics (cont.)

2. Output Voltage vs Output Current

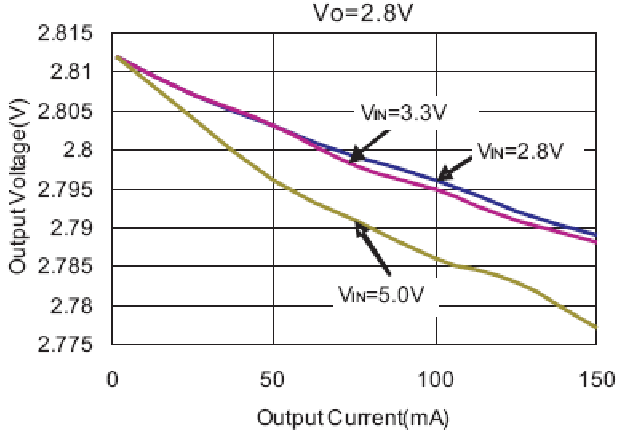
Vo=1.8V



Vo=2.5V

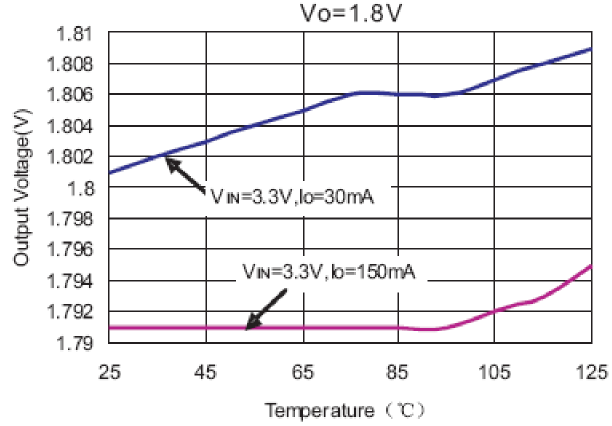


Vo=2.8V

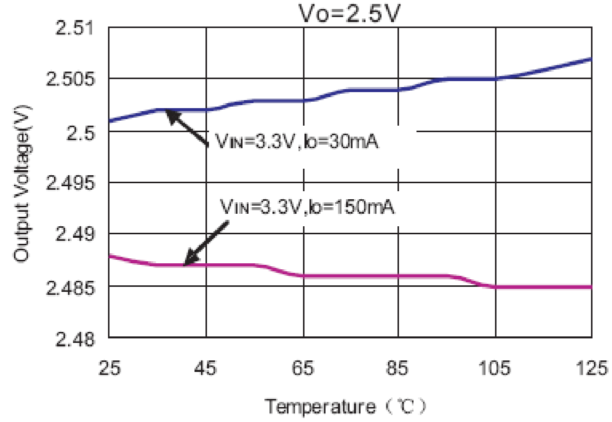


3. Output Voltage vs Temperature

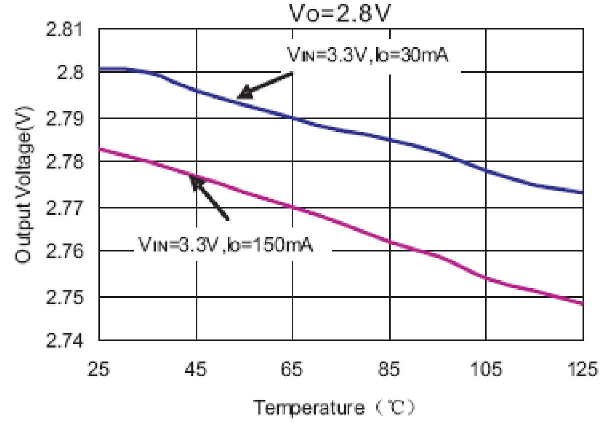
Vo=1.8V



Vo=2.5V

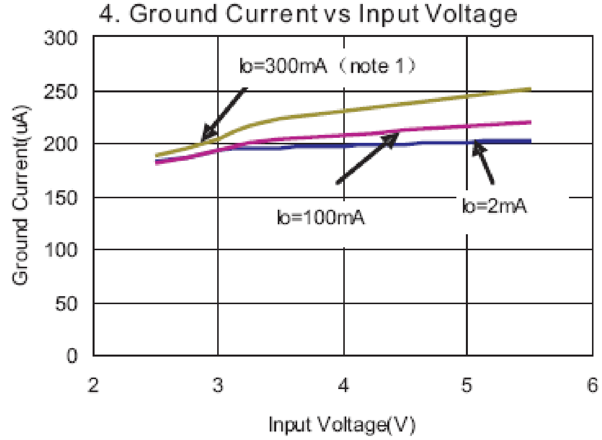


Vo=2.8V

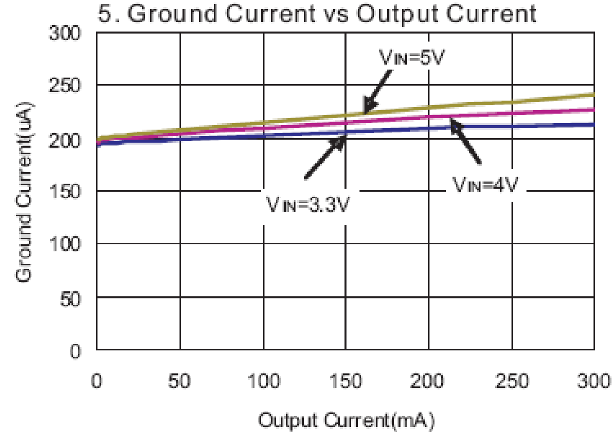


Typical Performance Characteristics (cont.)

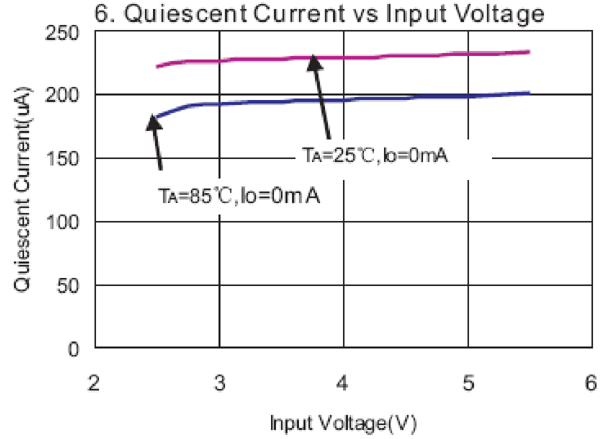
4. Ground Current vs Input Voltage



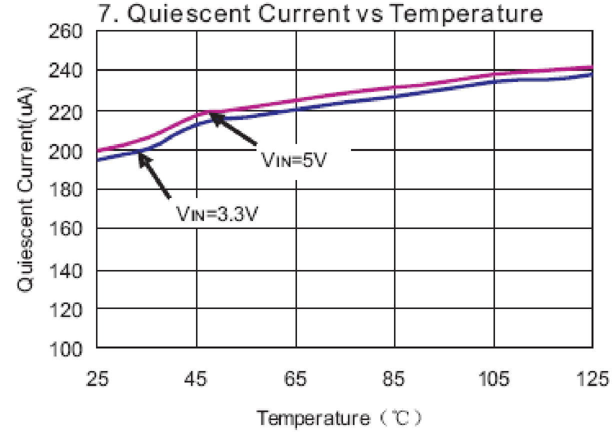
5. Ground Current vs Output Current



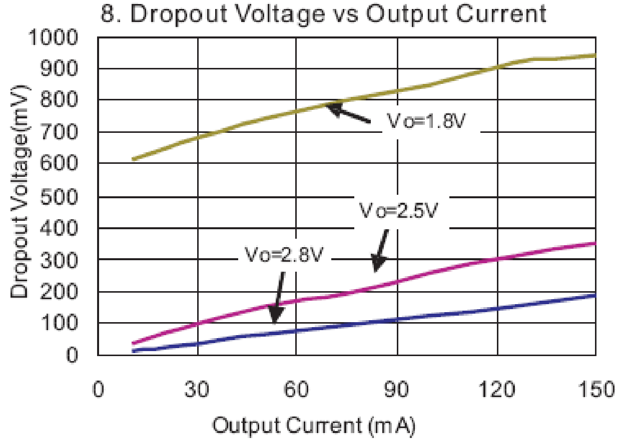
6. Quiescent Current vs Input Voltage



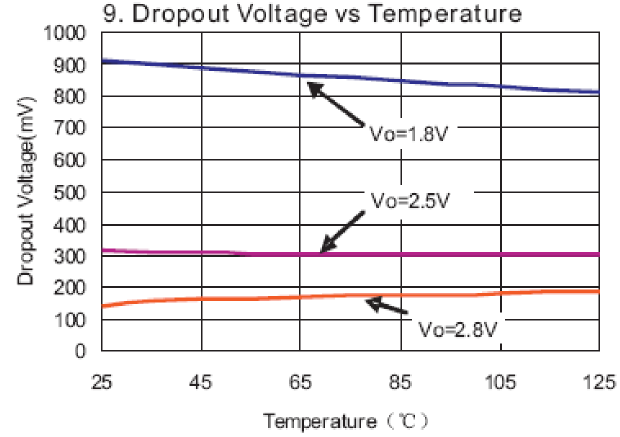
7. Quiescent Current vs Temperature



8. Dropout Voltage vs Output Current



9. Dropout Voltage vs Temperature

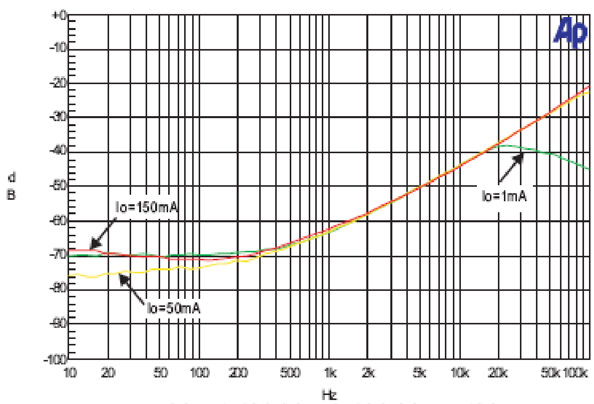


note 1: 2 channels total output current

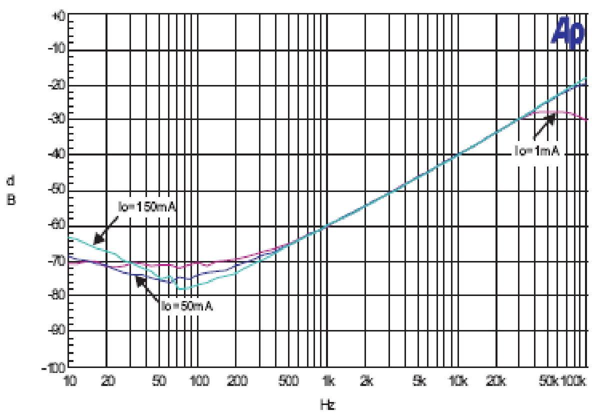
Io=150mA

Typical Performance Characteristics (cont.)

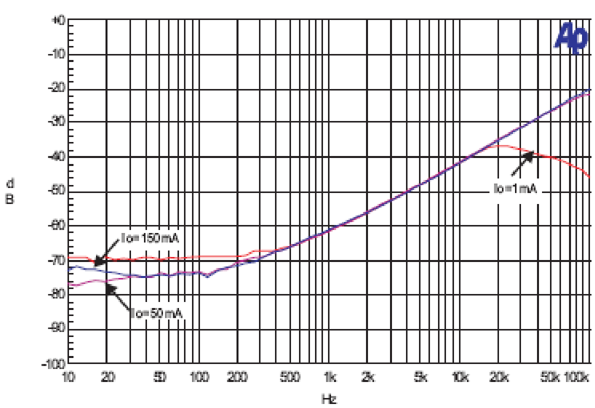
10. Power Supply Ripple Rejection



V_O=1.8V, V_{IN}=3.3V, Vpp=1V

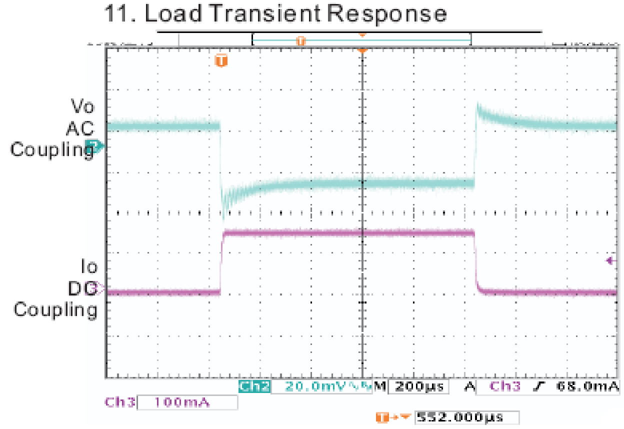


V_O=2.5V, V_{IN}=3.3V, Vpp=1V

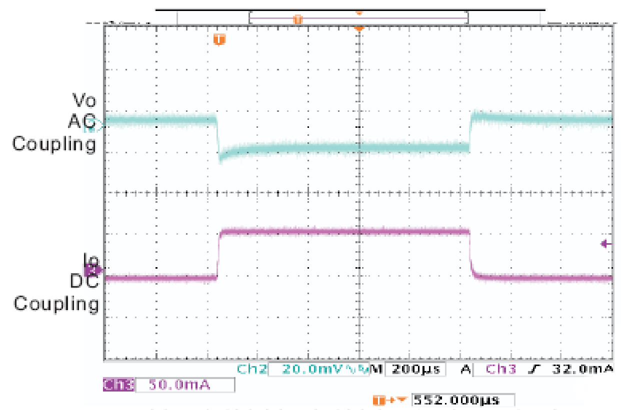


V_O=2.8V, V_{IN}=3.3V, Vpp=1V

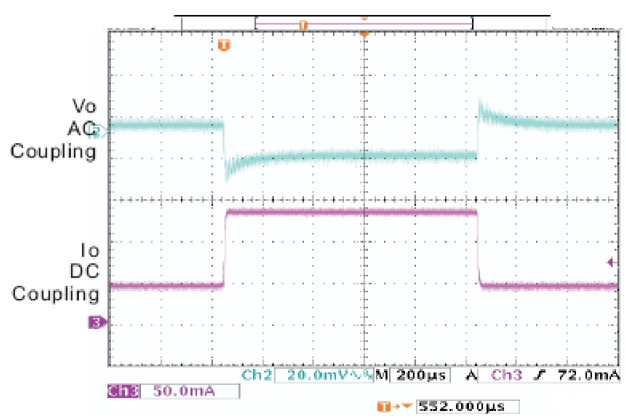
11. Load Transient Response



V_{IN}=4.0V, V_O=2.8V, I_O=1mA to 150mA



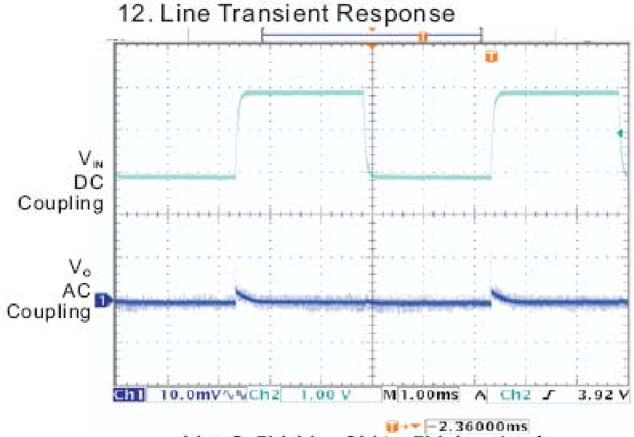
V_{IN}=4.0V, V_O=2.8V, I_O=1mA to 50mA



V_{IN}=4.0V, V_O=2.8V, I_O=50mA to 150mA

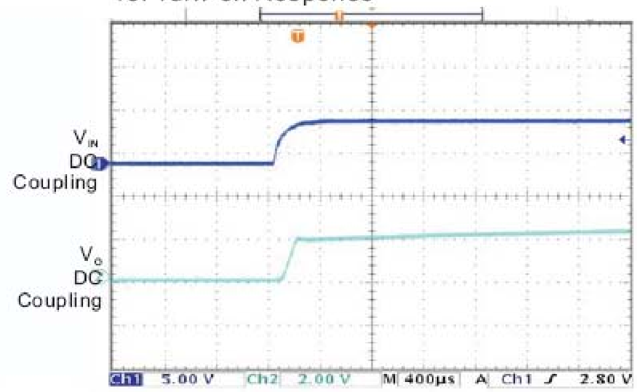
Typical Performance Characteristics (cont.)

12. Line Transient Response



Vo=2.5V, V_{IN}=3V to 5V, Io=1mA

13. Turn-on Response



V_{IN}=0 to 5V

Application Information

Capacitor Selection and Regulator Stability

Similar to any low dropout regulator, the external capacitors used with the PAM3102 must be carefully selected for regulator stability and performance.

A capacitor C_{IN} of more than 1µF can be employed in the input pin, while there is no upper limit for the capacitance of C_{IN}. Please note that the distance between C_{IN} and the input pin of the PAM3102 should not exceed 0.5 inch. Ceramic capacitors are suitable for the PAM3102. Capacitors with larger values and lower ESR (equivalent series resistance) provide better PSRR and line-transient response.

The PAM3102 is designed specifically to work with low ESR ceramic output capacitors in order to save space and improve performance. Using an output ceramic capacitor whose value is >2.2µF with ESR>5mΩ ensures stablilty.

Shutdown Input Operation

The PAM3102 is shutdown by pulling the CE input low, and turned on by tying the CE input to V_{IN} or leaving the CE input floating.

Input-Output (Dropout) Voltage

A regulator's minimum input-output voltage differential (or dropout voltage) determines the lowest usable supply voltage. The PAM3102 has a typical 180mV dropout voltage. In batterypowered systems, this will determine the useful end-of-life battery voltage.

Current Limit and Short Circuit Protection

The PAM3102 features a current limit, which monitors and controls the gate voltage of the pass transistor. The output current can be limited to 300mA by regulating the gate voltage. The PAM3102 also has a built-in short circuit current limit.

Thermal Considerations

Thermal protection limits power dissipation in the PAM3102. When the junction temperature exceeds 150°C, the OTP (Over Temperature Protection) starts the thermal shutdown and turns the pass transistor off. The pass transistor resumes operation after the junction temperature drops below 120°C.

For continuous operation, the junction temperature should be maintained below 125°C. The power dissipation is defined as:

$$P_D = (V_{IN} - V_O) * I_O + V_{IN} * I_{GND}$$

The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surrounding airflow and temperature difference between junction and ambient. The maximum power dissipation can be calculated by the following formula:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum allowable junction temperature +125°C , T_A is the ambient temperature and θ_{JA} is the thermal resistance from the junction to the ambient.

For example, as is 250°C/W for the SOT-23 package based on the standard JEDEC 51-3 for a single-layer thermal test board, the maximum power dissipation at T_A =25°C can be calculated by following formula:

$$P_{D(MAX)} = (125°C - 25°C) / 250 = 0.4W \text{ SOT-23}$$

It is also useful to calculate the junction temperature of the PAM3102 under a set of specific conditions. Suppose the input voltage V_{IN} = 3.3V, the output current I_O = 300mA and the case temperature T_A = +40°C measured by a thermal couple during operation, the power dissipation is defined as:

$$P_D = (3.3V - 2.8V) * 150mA + (3.3V - 1.8V) * 150mA + 3.3V * 200\mu A \cong 300mW$$

And the junction temperature T_J can be calculated as follows:

$$T_J = T_A + P_D * \theta_{JA}$$

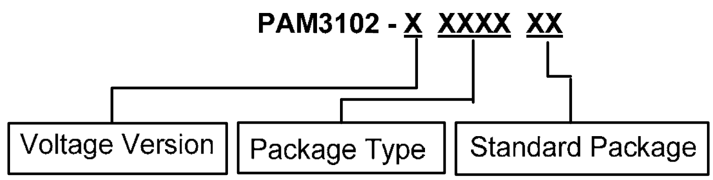
$$T_J = 40°C + 0.3W * 250°C/W$$

$$= 40°C + 75°C$$

$$= 115°C < T_{J(MAX)} = +125°C$$

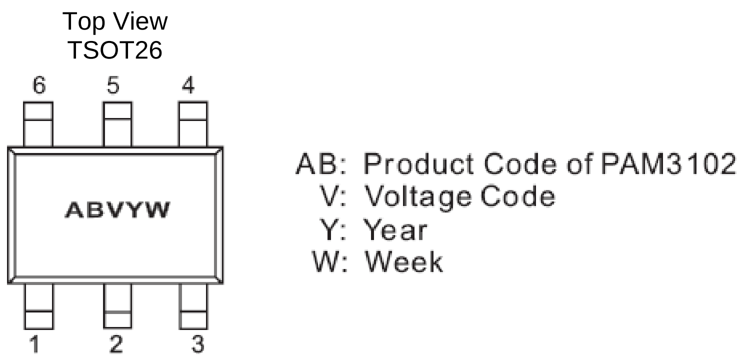
For this application, T_J is lower than the absolute maximum operating junction temperature,+125°C, so it is safe to use the PAM3102 in this configuration.

Ordering Information

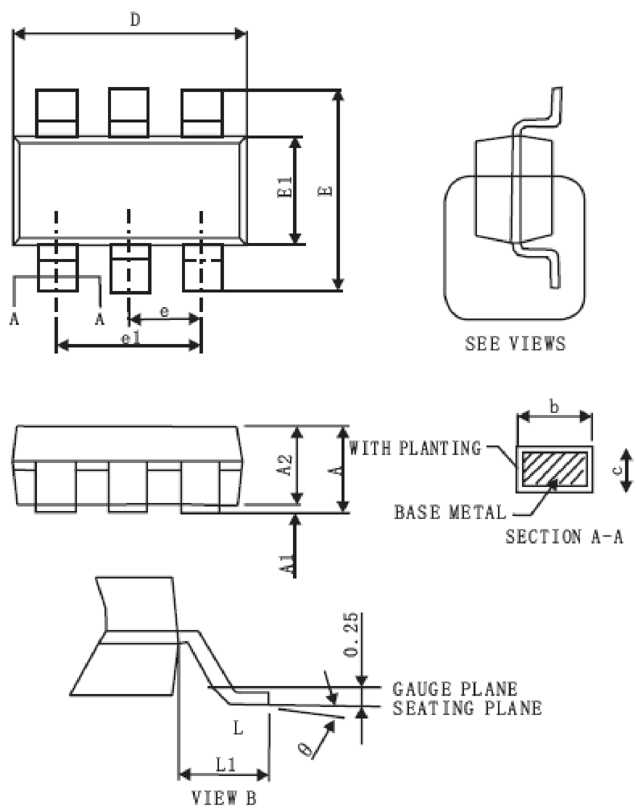


Part Number	Output Voltage	Part Marking	Package Type	Standard Package
PAM3102-AST26R1	VOUT1 1.8V VOUT2 2.8V	ABAYW	TSOT26	3000Units/Tape&Reel
PAM3102-BST26R1	VOUT1 1.8V VOUT2 2.5V	ABBYW	TSOT26	3000Units/Tape&Reel

Marking Information



Package Outline Dimensions (All dimensions in mm.)



Symbol	A	A1	A2	b	c	D	E
Spec	1.20±0.25	0.10±0.05	1.10±0.2	0.40±0.1	0.15±0.07	2.90±0.1	2.80±0.2
Symbol	E1	e	e 1	L	L1	θ	
Spec	1.60±0.1	0.95BSC	1.90BSC	0.55±0.25	0.60REF	4°±4°	

Unit: Millimeter