

# PS22922

## 12V, 1A Fast Transient Response Linear Regulator

### Preliminary

Data Sheet 292204 issue 1 Mar-13

#### Features

- $V_{IN}$  Range 1.7 – 12V
- Fixed and adjustable output voltage
- 1A maximum output current
- 350mV typical dropout voltage
- Bypass output for low PSRR and output noise
- Power Good pin with 500 $\mu$ s delay
- Low self noise
- Shutdown mode for longer battery life
- High PSRR typically 60dB at 100Hz
- Stable with a wide range of Ceramic, Tantalum or Electrolytic capacitors
- Current limit protection
- Thermal Shutdown
- -40°C to 125°C temperature range
- Available in SOT223

#### Applications

- Set Top Boxes
- Digital Audio systems
- DSP
- POL regulators
- SMPS post regulator

#### Description

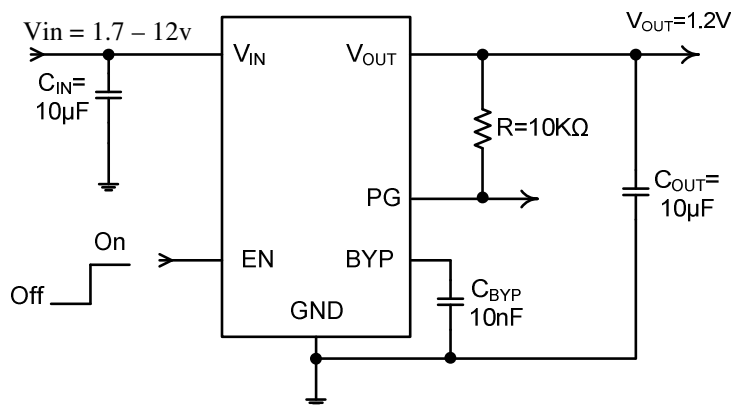
The PS22922 is a high performance, precision linear regulator with very low dropout voltage and excellent transient response. It is designed to operate with wide input voltage range of 1.7 – 12 Volts making it ideal for two step conversion. The device is capable of supplying 1A of output current with a typical dropout voltage of 350mV. The output Voltage is available in either fixed or adjustable options. For fixed option, the internal resistor network can be set in 100mV increment ranging from 0.5 to 5.0 volts.

The product includes an Enable pin for electrical on/off of the regulator. Forcing the Enable pin to logic low shuts down the LDO and reduces the supply current below 1 $\mu$ A. The PS22922 features fast transient response and low self output noise. Connecting a capacitor from ByPass to GND further enhances the PSRR and the output noise.

An open collector power good flag with 500 $\mu$ s delay is available for systems requiring supply monitoring and sequencing of other supplies. The regulator features the full suite of protection with a combination of current limit and thermal overload protection.

The PS22922 is available in SOT223 and it is rated for a -40°C to +125°C junction temperature range.

#### Typical Application

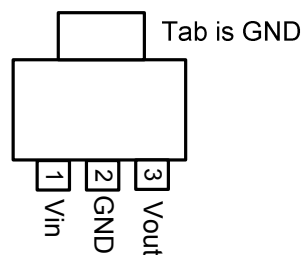


## Pin Description

Symbol	Pin # SOT223	Description
EN	N/A	Enable pin. It controls the electrical on/off of the device. When connected to logic low, the device shuts off and consumes less than 1µA of current. Logic high will resume normal operation.
ByPass	N/A	Bypass pin. Connect an external capacitor from BYP to ground to bypass the noise generated by the internal bandgap. This improves power supply rejection ratio and output noise. A minimum capacitor of 220pF is recommended.
V <sub>IN</sub>	1	Input supply pin. Connect a 10µF capacitor between this pin and ground.
NC	N/A	No connect.
FB	N/A	Feedback Voltage. A resistor network of two resistors is used to set-up the output voltage connected between V <sub>out</sub> and GND. The center tap of the two resistors is connected to FB pin. For fixed voltage options, the resistors are internally connected to V <sub>OUT</sub> .
V <sub>OUT</sub>	3	Regulated output Voltage. Connect a 10µF capacitor from this pin to ground.
PG	N/A	Power good. It is an open collector, active high output that indicates the status of the output voltage. When output voltage (V <sub>OUT</sub> ) exceeds the PG trip threshold, the PG pin goes in to a high impedance state. When the device is out of regulation or shutdown, the PG pin is pulled low. A 10KΩ to 1MΩ resistor should be connected from PG to V <sub>OUT</sub> .
GND	2	Ground connection.
	Tab	Expose pad. Connected to PCB ground plane for good thermal dissipation.

NB: N/A = Not available in the shown package type

## Pin Configuration



SOT223 (Top View)

**Absolute Maximum Ratings<sup>(1)</sup>**

Maximum Input Supply Voltage.....	-0.8 to 15V
Enable Voltage.....	-0.8 to 15V
Power Good.....	-0.8 to 15V
Feedback Voltage.....	-0.8 to 5V
ByPass Voltage.....	-0.8 to 5V

Enable input Voltage.....	0V to $V_{IN}$
Junction Operating Temperature.....	-40°C to 125°C

**Recommended Operating Conditions**

Input Voltage.....	1.7 to 12V
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**Thermal Information<sup>(2)</sup>**

SOT223 <sup>1</sup> $\theta_{JA}$ .....	60 °C/W
Storage Temperature Range.....	-65 to 150°C
Lead Temperature.....	260°C
Junction Temperature.....	-40 to 125°C

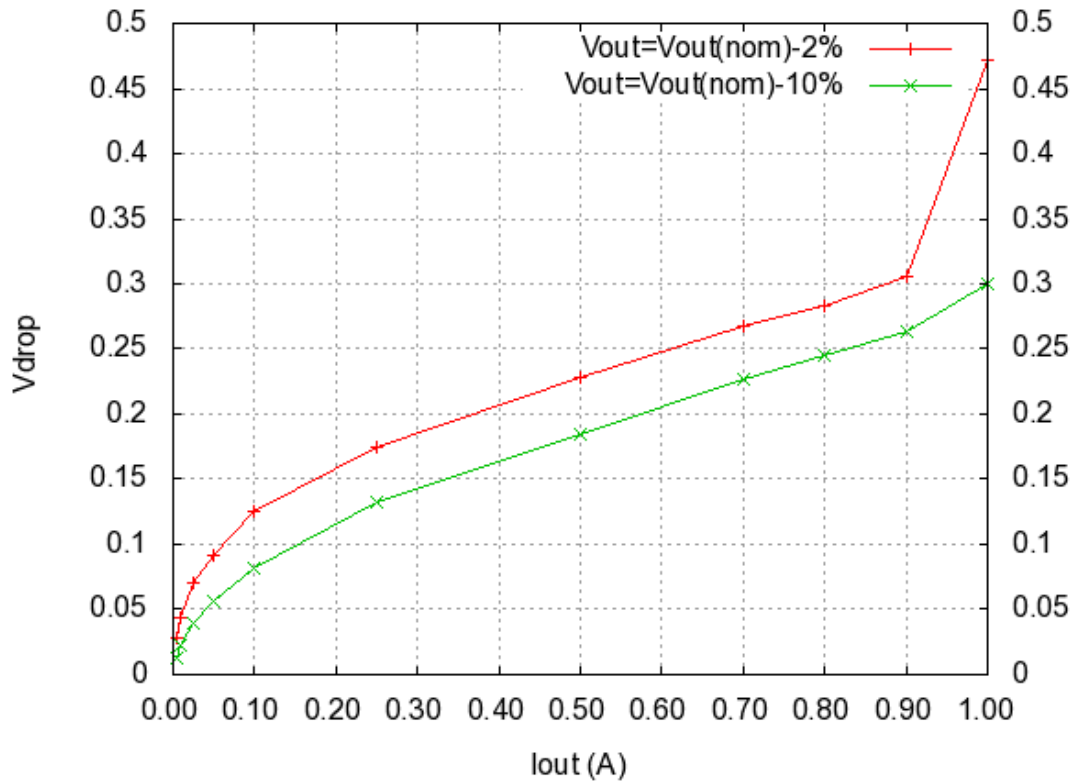
**ELECTRICAL CHARACTERISTICS**

Unless otherwise noted:  $V_{IN}=5.0V$ ;  $V_O=3.3V$ ;  $C_{IN}=C_{OUT}=22\mu F$ ; Typical values are  $T_A=25^\circ C$

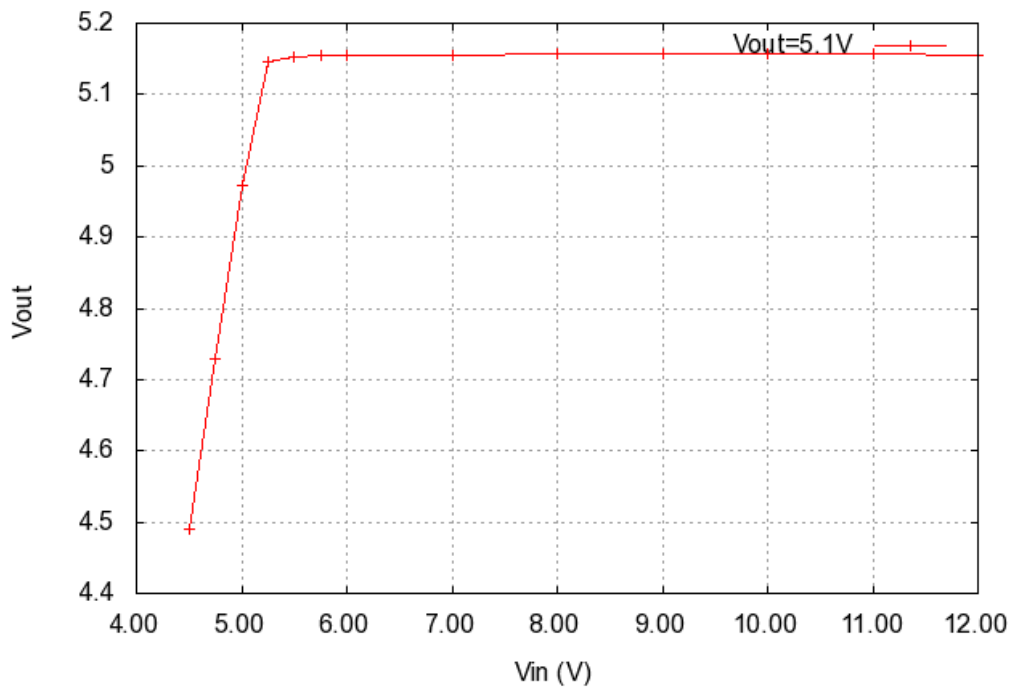
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Output Voltage Range	$V_O$	Fixed option; 100mV increment	0.5		5.0	V
		Adjustable	0.5		$V_O+V_{DO}$	
Output Voltage Tolerance				TBD		
Feedback Voltage	$V_{FB}$		0.494	0.50	0.506	V
Maximum Output Current	$I_O$		1.0			A
Shutdown current	$I_{SHD}$	$V_{EN}=GND$		0.01	1.0	$\mu A$
Current Limit	$I_{LIM}$		1.1		2.0	A
Supply Current	$I_Q$	$I_{OUT}=1A$			TBD	mA
Load Regulation <sup>3</sup>		$I_{OUT}=0.1mA - 150mA$	-1.0		1.0	%
Line Regulation		$V_{IN}=V_O+1V$ to 12V; $I_{OUT}=10mA$	-0.5		0.5	%
Dropout Voltage	$V_{DO}$	$I_{OUT}=500mA$		300	TBD	mV
		$I_{OUT}=750mA$			TBD	
		$I_{OUT}=1A$			TBD	
Enable Threshold Low	$V_{EN(L)}$				0.8	V
Enable Threshold High	$V_{EN(H)}$		1.4			V
Input Enable Low Current	$I_{EN(L)}$	$V_{EN}=0V$		0.01	2.0	$\mu A$
Input Enable High Current	$I_{EN(H)}$	$V_{EN}=2V$		5.0	8.0	$\mu A$
Ripple Rejection Ratio	PSRR	$I_O=50mA$	Freq=100Hz		62	dB
			Freq=10KHz		60	
Output Noise	$e_n$	BW; 10Hz – 100KHz $I_O=100mA$ $C_{OUT}=10\mu F$	$C_{BYP}=Open$		TBD	nV/ $\sqrt{Hz}$
			$C_{BYP}=100nF$		TBD	
Power good low threshold	$V_{OL\_PG}$	$I_{PG}=200\mu A$			400	mV
Power good delay	$V_{PG\_delay}$			500		$\mu s$
Thermal Shutdown	$T_{SD}$			140		°C
Thermal Shutdown Hys.	$T_{SD\_HYS}$			15		°C

**Notes:**

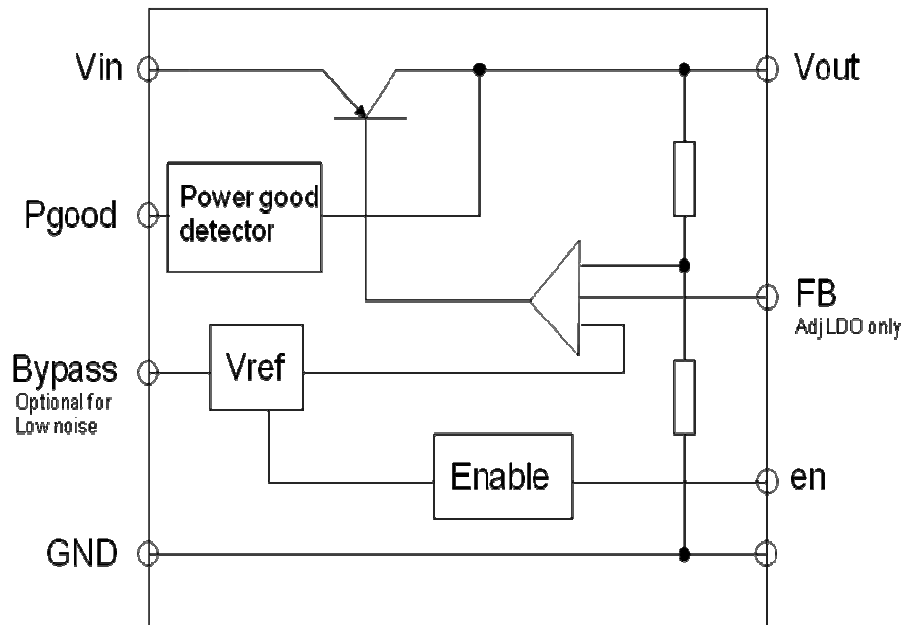
1. Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Measured on approximately 1" square of 1oz copper.
2. The PS22922 is guaranteed to meet performance specifications over the -40°C to +125°C operating junction temperature range and is assured by design, characterization, and correlation with statistical process control.
3. Load regulation is measured using pulse techniques with duty cycle <5%.



Typical Vdrop vs Iout (A)



Typical Line regulation vs Vin (V)

**FUNCTIONAL BLOCK DIAGRAM**

**APPLICATION HINT**
**Input Capacitor ( $C_{IN}$ )**

Input capacitor may be required when the device is not near the source power supply or when supplied by a battery. This capacitor will reduce the circuit's sensitivity when powered from complex source impedance and significantly enhance the output transient response. The input bypass should be mounted with the short possible track directly across the regulator's input and ground terminals. A 10 $\mu$ F ceramic capacitor should be adequate for most applications.

**Output Capacitor ( $C_{OUT}$ )**

The output capacitor provides not only stability to the regulator, but also, enhances the load transient response. A minimum capacitance of 10 $\mu$ F is required. When selecting a ceramic capacitor, only X5R and X7R dielectric types should be used. Other types such as Z5U and Y5F have such severe loss of capacitance due to effects of temperature variation and applied voltage, they may provide as little as 20% of rated capacitance in many typical applications.

Always consult capacitor manufacturer's data curves before selecting a capacitor. High-quality ceramic capacitors can

be obtained from Taiyo-Yuden, AVX, and Murata. Higher values of the output capacitance can be used to enhance loop stability and transient response.

The adjustable output voltage option allows the user to select an output voltage by using an external resistor divider. PS22922 uses a 0.5V reference voltage at the positive terminal of the error amplifier. To set the output voltage a programming resistor from the feedback pin (FB) to ground must be selected. A 10k $\Omega$  resistor is a good selection for a programming resistor R2. A higher value may result in an excessively sensitive feedback node while a lower value will draw more current and degrade the light load efficiency. The equation for selecting the voltage specific resistor is:

$$V_o = \left(1 + \frac{R1}{R2}\right) * V_{FB}$$

For the fixed output devices, R1 and R2 are included within the device.

### ByPass Capacitor

Connecting a capacitor between the BYP pin and ground can significantly reduce output noise. Values can range from 0pF to 100nF, depending on the sensitivity to output noise in the application. The start up speed of the PS22291 is inversely proportional to the size of the bypass capacitor. Applications requiring a slow ramp-up of output voltage should consider larger values of bypass capacitance. Likewise, if rapid turn on is necessary, consider omitting  $C_{BYP}$ .

### Enable/Shutdown

The enable (EN) pin is active high and is compatible with standard digital signalling levels. When  $V_{EN}$  below 0.8V, it turns the regulator off while  $V_{EN}$  above 1.4V turns the regulator on. If not used, EN can be connected to the input Voltage. If EN is connected to  $V_{IN}$ , it should be connected as close as possible to the largest capacitance on the input to prevent voltage droops on that line from triggering the enable circuit.

### Thermal consideration

The PS22292 is designed to provide 1A of continuous current in a very small package. Maximum power dissipation can be calculated based on the output current and the voltage drop across the part. To determine the maximum power dissipation of the package, use the junction-to-ambient thermal resistance of the device and the following basic equation:

$$P_{D(max)} = \left( \frac{T_{J(max)} - T_A}{\theta_{JA}} \right)$$

Where  $T_{J(max)}$  is the maximum junction temperature of the die,  $T_A$  is the ambient operating temperature, and  $\theta_{JA}$  is layout dependent. The actual power dissipation of the regulator circuit can be determined using the equation:

$$P_D = (V_{IN} - V_{OUT}) * I_{OUT} + V_{IN} * I_{SUP}$$

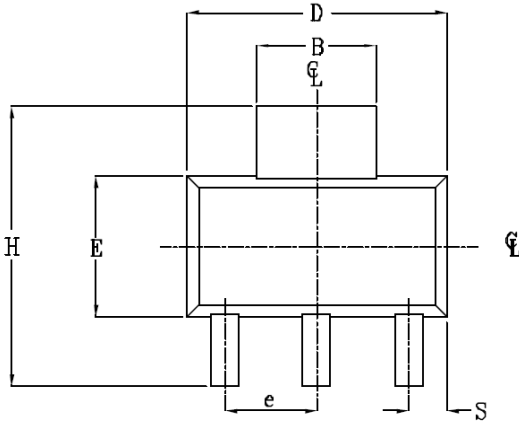
Substituting  $P_D(max)$  for  $P_D$  and solving for the operating conditions that are critical to the application will give the maximum operating conditions for the regulator.

**Ordering Information**

Device	Operating junction Temp.	Package	Comments
PS22922T8T2A5	-40°C to +125°C	SOT223	V <sub>o</sub> = 1.2v
PS22922TET2A5	-40°C to +125°C	SOT223	V <sub>o</sub> = 1.8v
PS22922TUT2A5	-40°C to +125°C	SOT223	V <sub>o</sub> = 3.3v

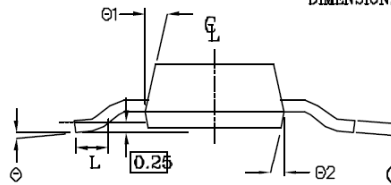
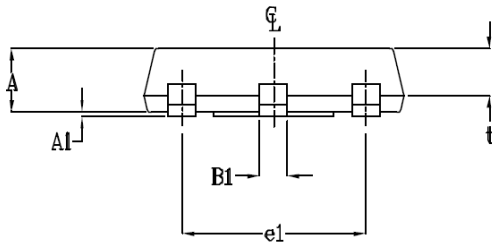
**N.B For other values of output voltage please contact your local Plessey Semiconductors sales representative**

**Outline Drawing and Landing Pattern (SOT223)**



POS	MILLIMETERS		INCHES	
	MAX	MIN	MAX	MIN
I				
A	1.70	1.50	.067	.060
A1	0.10	0.02	.004	.0008
B	3.15	2.95	.124	.116
B1	0.85	0.65	.033	.026
C	0.35	0.25	.014	.010
D	6.70	6.30	.264	.248
e	2.30 NOM		.0905 NOM	
e1	4.60 NOM		.181 NOM	
E	3.70	3.30	.146	.130
H	7.30	6.70	.287	.264
S	1.05	0.85	.041	.033
t	1.30	1.10	.051	.043
θ	10° MAX		10° MAX	
θ1	16°	10°	16°	10°
θ2	16°	10°	16°	10°
L	0.75 MIN		0.0295 MIN	

NOTE:  
 1. PACKAGE OUTLINE EXCLUSIVE OF ANY MOLD FLASHES DIMENSION.  
 2. PACKAGE OUTLINE EXCLUSIVE OF BURR DIMENSION.



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