

300mA 6.5V Low-Noise Low-I_Q High PSRR LDO

Features

- Input Voltage Range: 2.5V to 6.5V
- Output Voltage Range:
 - Fixed Operation: 1.2V, 1.8V, 3.3V and 5V
- Maximum output current: 300mA
- Low Dropout Voltage: 152mV at 300mA
- Fast Load and Line Transient Responses
- Low Noise When Using External Bypass Cap
- Output Voltage Accuracy: 2%
- Thermal Shutdown and Over-Current Protection
- Stable with 1 μ F or larger ceramic capacitors
- Operating Junction Temperature: -40°C to +125°C
- Available package: SOT23-5

Applications

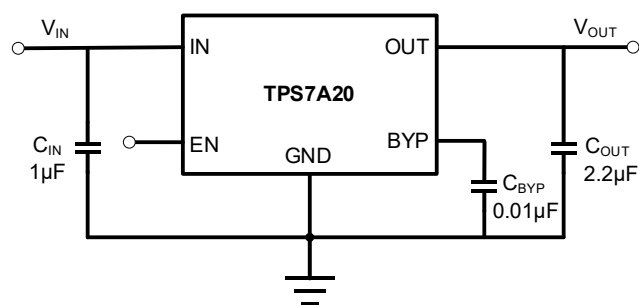
- Cellular Phones
- Laptop computers
- Portable Equipment
- Battery-Powered Systems
- High-Efficiency Linear Power Supplies

Description

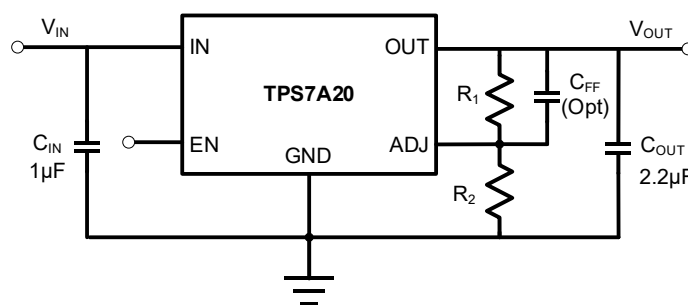
TPS7A20 is a low power and low dropout voltage linear regulator capable of sourcing 300mA current. The output voltage can be adjusted from 1.2V to 5.5V by using external resistor dividers for the adjustable version. The fixed version output voltages are 1.2V, 1.8V, 3.3V to 5V.

The TPS7A20 also features over current limit and thermal shutdown protection, as well as automatic discharge function to quickly discharge V_{OUT} in the disabled states.

Typical Application Circuits

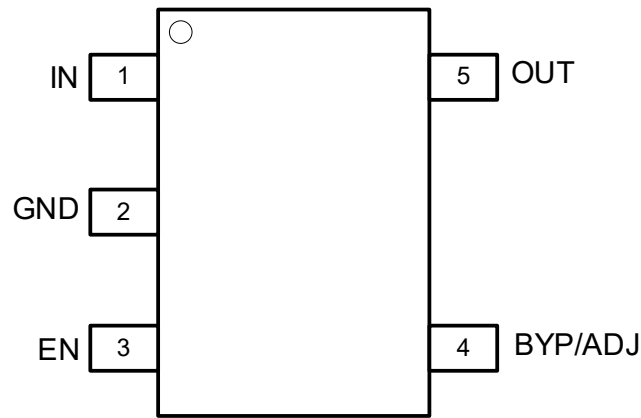


Fixed Output Voltage



Adjustable Output Voltage

Pin Configuration and Functions



5-Pin SOT-23 (Top View)

Pin Descriptions

PIN Number	PIN Name	I/O	Function
1	IN	I	Input supply voltage pin. It is recommended to use a 1uF or larger ceramic capacitor from IN pin to ground to get a good power supply decoupling.
2	GND	-	Ground.
3	EN	I	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator.
4	BYP/ADJ	-	For fixed voltage versions, connect this pin to an external bypass capacitor to reduce the output noise to very low levels. For adjustable voltage version, this pin is the input to the control loop error amplifier and sets the output voltage of the device.
5	OUT	O	Regulator output voltage pin. A 2.2μF or larger ceramic capacitor from OUT to ground is required to ensure regulator stability. The capacitor should be placed as close to the output as possible. Minimize the impedance from the OUT pin to the load.

Package/Ordering Information

DEVICE	PACKAGE TYPE	OUTPUT VOLTAGE	PACKING OPTION
TPS7A2012PDBVR	SOT23-5	1.2V	Tape and Reel, 3000
TPS7A2018PDBVR	SOT23-5	1.8V	Tape and Reel, 3000
TPS7A2033PDBVR	SOT23-5	3.3V	Tape and Reel, 3000
TPS7A2050PDBVR	SOT23-5	5.0V	Tape and Reel, 3000

Electrical Specifications

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
IN, OUT and EN Pins	IN, OUT and EN	-0.3 to +7	V
ADJ/BP Pin	ADJ/BP	-0.3 to +6	V
Storage temperature range	T _{STG}	-65 to +150	°C
Output current	I _{OUT}	300	mA

Notes:

1. Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied.

ESD Ratings

		Value	Unit
V _{ESD}	Electrostatic Discharge	HBM (Human Body Model)	3000
		CDM (Charge Device Model)	1000

Recommended Operation Conditions

Over operating temperature range unless otherwise noted

Parameter	Symbol	Min	Max	Unit
Input Supply Voltage	V _{IN}	2.5	6.5	V
Enable Input Voltage	EN	0	V _{IN}	V
Output Voltage	V _{OUT}	1.2	6	V
Adjustable Pin Voltage	ADJ/BP	0	5	V
Output Capacitance	C _{OUT}	1	47	μF
Output Current	I _{OUT}	0	300	mA
Operating Junction Temperature	T _J	-40	125	°C

Thermal Information

Package	R _{θJA}	Unit
SOT23-5	195	°C/W

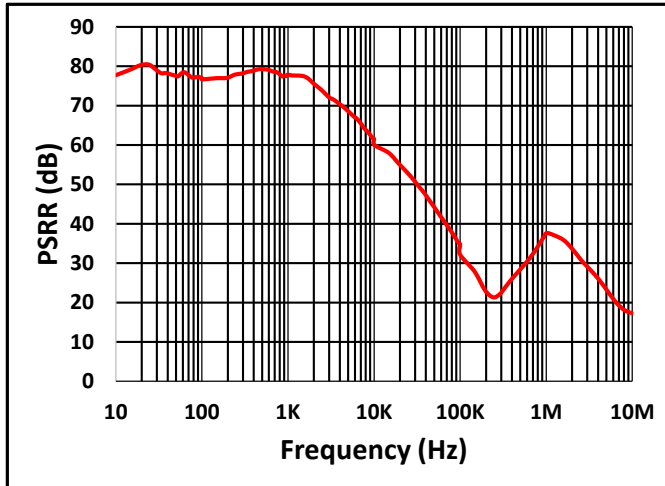
Electrical Characteristics

$V_{IN} = 2.5V$ or $V_{IN} = V_{OUT} + 1V$ (whichever is greater), $I_{OUT} = 1mA$, $C_{OUT} = 2.2\mu F$, typical values are at $T_A = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}		2.5	-	6.5	V
Reference Voltage	V_{REF}			1.2		V
Output Voltage Accuracy		$0.1mA \leq I_{OUT} \leq 300mA$	-2.0	0	2.0	%
GND Pin Current	I_{GND}	$V_{IN} = 2.5V$, No Load		69		μA
		$V_{IN} = 2.5V$, $I_{OUT} = 300mA$		128		μA
Shutdown Current	I_{SHDN}	$V_{IN} = 2.5V$, $V_{EN} = 0V$		2.3		μA
Dropout Voltage	V_{DO}	$V_{OUT} = 3.3V$, $I_{OUT} = 300mA$		230		mV
Output Current Limit	I_{LIM}			720		mA
Line Regulation	$\Delta V_{OUT(LINE)}$	$V_{IN} = V_{OUT} + 1V$ to 6.5V		0.15		mV/V
Load Regulation	$\frac{\Delta V_{OUT}}{(V_{OUT} \Delta I_{OUT})}$	$V_{IN} = 6V$, $I_{OUT} = 1mA$ to 300mA		0.8		%/A
EN pin low-level input voltage (device disabled)	$V_{IL(EN)}$				0.5	V
EN pin high-level input voltage (device enabled)	$V_{IH(EN)}$		1.6			V
EN PIN Leakage Current	I_{EN}	$V_{EN} = 6.5V$		0.8		μA
Power Supply Ripple Rejection	PSRR	$f = 1kHz$, $V_{OUT} = 5V$, $I_{OUT} = 300mA$		64		dB
Output Noise Voltage	V_N	$BW = 10Hz$ to $100kHz$, $I_{OUT} = 300mA$, $V_{IN} = 6.5$, $V_{OUT} = 1.8V$, $C_{BP} = 10nF$		50		μV_{RMS}
Thermal Shutdown Temperature	TSD			160		$^\circ C$
Thermal Shutdown Hysteresis	T_{HYS}			20		$^\circ C$

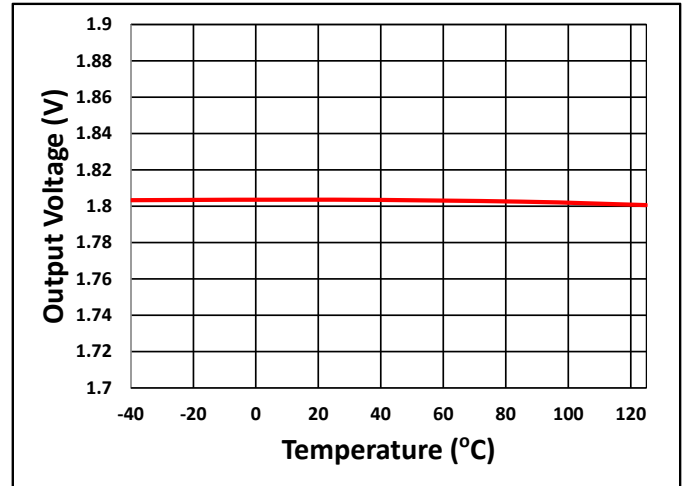
Typical Characteristics

$C_{IN} = 1\mu F$, $C_{OUT} = 2.2\mu F$, $I_{OUT} = 300mA$, $T_A = 25^\circ C$ unless otherwise noted



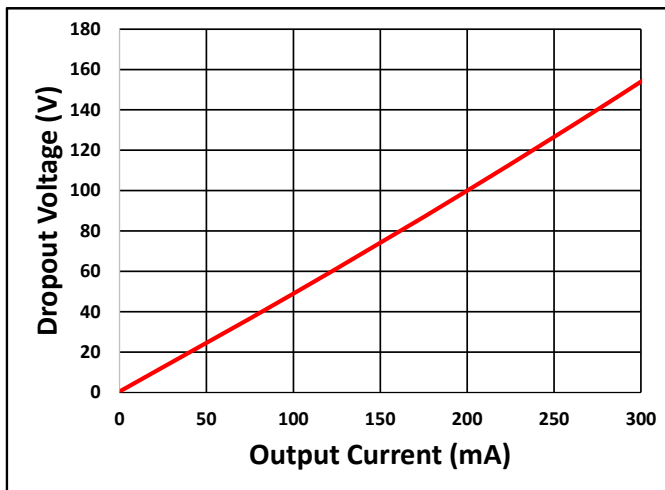
$V_{IN} = 6V$, $V_{OUT} = 5V$, $I_{OUT} = 300mA$, $C_{OUT} = 2.2\mu F$

Fig. 1 PSRR



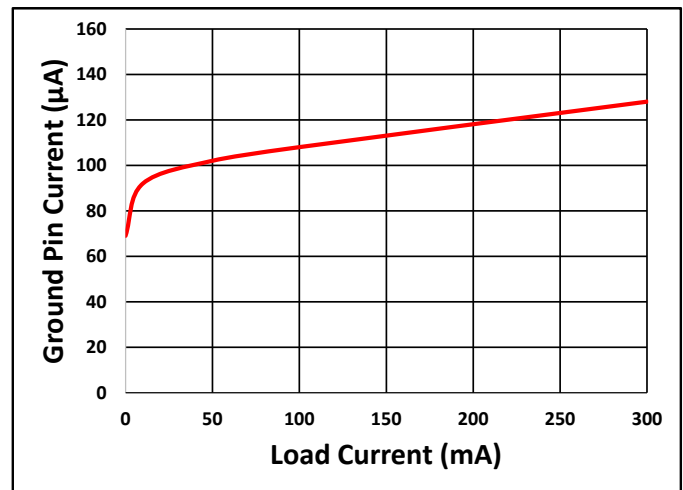
$V_{IN} = 2.5V$, $V_{OUT} = 1.8V$, $C_{OUT} = 2.2\mu F$

Fig. 2 Output Voltage vs Temperature



$V_{IN} = 6V$

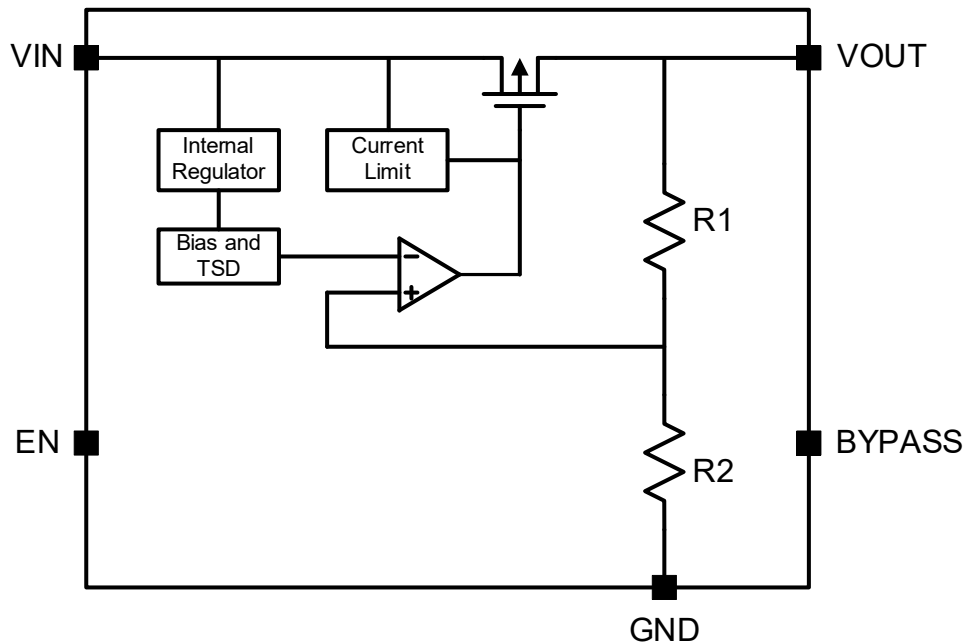
Fig. 3 Dropout Voltage



$V_{IN} = 2.5V$

Fig. 4 Ground Current vs Load Current

Functional Block Diagram



Block Diagram of Fixed Output Voltage

Feature Description

Enable

The enable pin for TPS7A20 is active high. The device is enabled when the enable pin voltage is greater than $V_{IH(EN)}$ and disabled with the enable pin voltage less than $V_{IL(EN)}$. If independent control of chip enable is not needed, then connect the enable pin to the input. The TPS7A20 has an internal pulldown MOSFET that connects a discharge resistor from VOUT to ground when the device is disabled to actively discharge the output voltage.

Output Current Limit

When overload events happen, the output current is internally limited.

Undervoltage Lockout (UVLO)

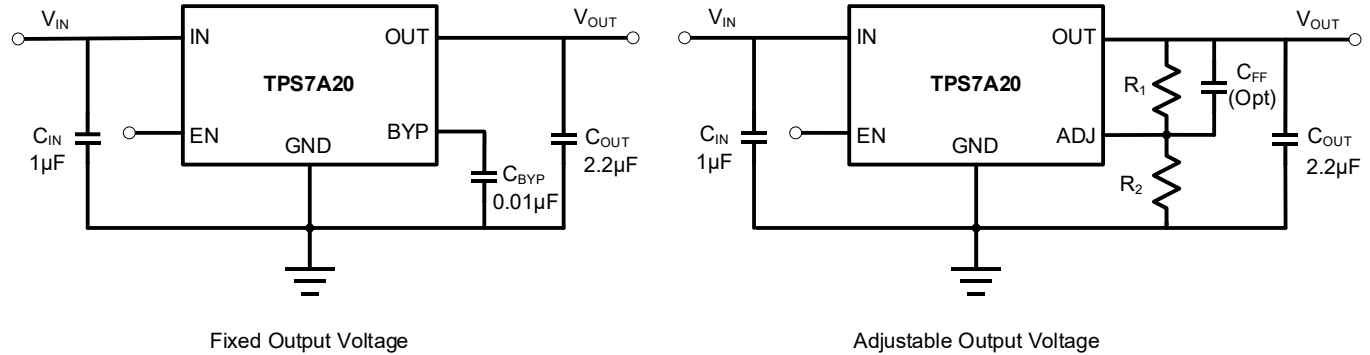
TPS7A20 uses an undervoltage lockout circuit to keep the output shut off until the internal circuitry is operating properly.

Thermal Protection

TPS7A20 contains a thermal shutdown protection circuit to turn off the output current when excessive heat is dissipated in the LDO.

Application Information

Typical Application for Fixed and Adjustable Output Voltage



Input Capacitor and Output Capacitor

The TPS7A20 is designed and characterized for operation with ceramic capacitors of 1µF or greater at the input and 1µF or greater at the output. Locate the input and output capacitors as near as practical to the input and output pins to minimize the trace inductance from the capacitor to the device.

Adjustable Output Voltage

The output voltage of the TPS7A20 can be adjusted from 1.2V to 5V according to the following equation.

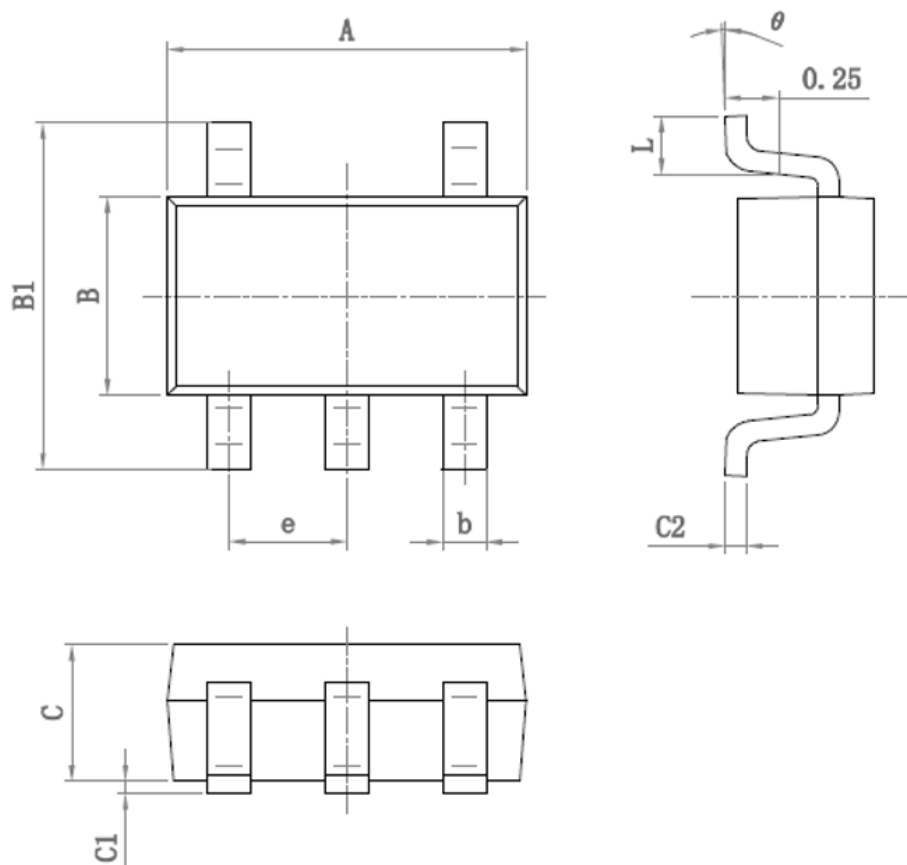
$$V_{OUT} = 1.2V \times \left(1 + \frac{R1}{R2}\right)$$

Feed Forward Capacitor

A Feed-Forward Capacitor (C_{FF}) in parallel with the $R1$ resistor can be used to improve the output noise and PSRR performance. This C_{FF} is user optional for performance improvements not for LDO stability.

PACKAGE OUTLINE DIMENSIONS

SOT23-5



Symbol	Dimensions (mm)		Symbol	Dimensions (mm)	
	Min	Max		Min	Max
A	2.82	3.02	C	1.05	1.15
e	0.95 (BSC)		C1	0.03	0.15
b	0.28	0.45	C2	0.12	0.23
B	1.50	1.70	L	0.35	0.55
B1	2.60	3.00	θ	0°	8°