FEATURES

- Low Ground Pin Current
- Ultra Low Dropout Voltage
- Excellent Line and Load Regulation
- Guaranteed Output Current of 1.0A
- Fixed Output Voltage: 1.0V, 1.2V, 1.5V 1.8V, 2.5V, 2.8V, and 3.3V
- Over Current Protection
- Over Temperature Protection
- Available in SOT-223 Package

APPLICATIONS

- Battery Powered Equipment
- Motherboards and Graphic Cards
- Microprocessor Power Supplies
- Peripheral Cards
- High Efficiency Linear Regulators
- Battery Chargers

DESCRIPTION

The TPS1117LVxx series of high performance ultra low dropout linear regulators operates from 2.7V to 5.5V input supply and provides ultra low dropout voltage, high output current with low ground current. Wide range of preset output voltage options are available. These ultra low dropout linear regulators respond fast to step changes in load which makes them suitable for low voltage micro-processor applications. The TPS1117LVxx is developed on a CMOS process technology which allows low quiescent current operation independent of output load current. This CMOS process also allows the TPS1117LVxx to operate under extremely low dropout conditions.

SOT-223-3

ORDERING INFORMATION

Device	Package
TPS1117LVxxS	SOT-223-3L

xx: Output Voltage

ABSOLUTE MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
Input Supply Voltage (Survival)	V_{IN}	−0.3	6.5	V
Output Voltage (Survival)	V_{OUT}	−0.3	V_{IN} + 0.3	V
Maximum Output Current	I_{MAX}	-	1.0	A
ESD Rating, HBM		2	-	kV
Operating Junction Temperature Range	T_{JOPR}	−40	125	°C
Storage Temperature Range	T_{STG}	−65	150	°C

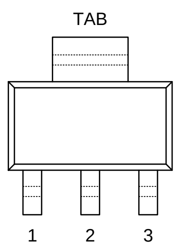
RECOMMENDED OPERATING RATINGS (Note 2)

CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
Input Supply Voltage	V_{IN}	2.7	5.5	V

ORDERING INFORMATION

VOUT	Package	Order No.	Supplied As	Status
1.0V	SOT-223-3L	TPS1117LV10S	Tape & Reel	Contact Us
1.2V	SOT-223-3L	TPS1117LV12S	Tape & Reel	Active
1.5V	SOT-223-3L	TPS1117LV15S	Tape & Reel	Contact Us
1.8V	SOT-223-3L	TPS1117LV18S	Tape & Reel	Contact Us
2.5V	SOT-223-3L	TPS1117LV25S	Tape & Reel	Contact Us
2.8V	SOT-223-3L	TPS1117LV28S	Tape & Reel	Contact Us
3.3V	SOT-223-3L	TPS1117LV33S	Tape & Reel	Contact Us

PIN CONFIGURATION

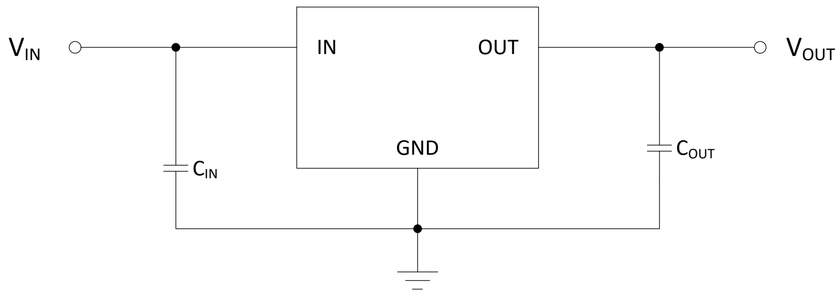


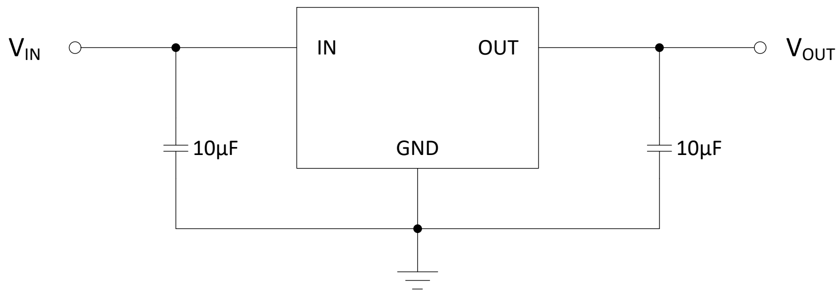
SOT-223-3L

PIN DESCRIPTION

Pin No.	Pin Name	Pin Function
1	GND	Ground
2	OUT	Output Voltage
3	IN	Input Supply
TAB	TAB	Connect to OUT

TYPICAL APPLICATION CIRCUIT





* See Application Information for the details over external capacitor.

** TPS1117LVxx can deliver a continuous current of 1.0A over the full operating temperature. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 1.0A may be still undeliverable.

ELECTRICAL CHARACTERISTICS

Limits in standard typeface are for T_J = 25ºC, and limits in **boldface type** apply over the **full operating temperature range**.
V_{IN} = $V_{OUT(NOM)}$ + 1.0 V or V_{IN} = 2.7 V, whichever is greater; I_L = 10 mA, C_{IN} = C_{OUT} = 10 µF, unless otherwise specified.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage Tolerance (Note 3)	V_{OUT}	V_{OUT} + 1.0 V ≤ V_{IN} ≤ 5.5 V 10 mA ≤ I_L ≤ 800 mA	−2 **−3**	-	2 **3**	%
Output Current (Note 3)	I_{OUT}		-	-	1.0	A
Line Regulation (Note 3, 4)	ΔV_{OUT} / ΔV_{IN}	V_{OUT} + 1.0 V ≤ V_{IN} ≤ 5.5 V	-	0.25	-	%/V
Load Regulation (Note 3, 4, 5)	ΔV_{OUT} / ΔI_{OUT}	10 mA ≤ I_{OUT} ≤ 800 mA	-	1.5	-	%
Dropout Voltage (Note 6)	V_{DROP}	I_{OUT} = 100 mA	-	40	50 **60**	mV
		I_{OUT} = 400 mA	-	200	250 **300**	mV
		I_{OUT} = 800 mA	-	400	500 **600**	mV
Ground Current (Note 7)	I_{GND}	I_{OUT} = 100 mA	-	130	200 **260**	µA
		I_{OUT} = 800 mA	-	200	300 **400**	µA
Power Supply Ripple Rejection	PSRR	f = 1.0 kHz	-	45	-	dB
Output Current Limit	I_{CL}		-	1.6	-	A
Thermal Shutdown Temperature	T_{SD}		-	165	-	°C
Thermal Shutdown Hysteresis	ΔT_{SD}		-	20	-	°C

Note 1. Stresses listed as the absolute maximum ratings may cause permanent damage to the device. These are for stress ratings. Functional operating of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibly to affect device reliability.

Note 2. The device is not guaranteed to function outside its operating ratings. The minimum operating value for input voltage is equal to either ($V_{OUT.NOM}$ + V_{DROP}) or 2.7 V, whichever is greater.

Note 3. Operating conditions are limited by maximum junction temperature. The output voltage specification does not apply to all possible combinations of input voltage and output current. When operating at maximum input voltage condition, the output current range must be limited. When operating at maximum output current condition, the input voltage range must be limited. For more information, refer to the Maximum Output Current Capability section of this data sheet.

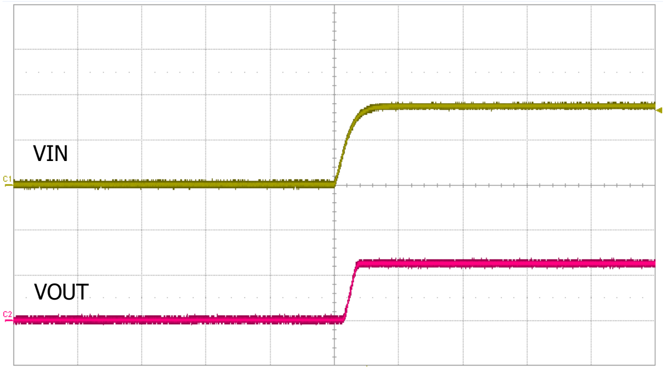
Note 4. Output voltage line regulation is defined as the change in output voltage from the nominal value due to change in the input line voltage. Output voltage load regulation is defined as the change in output voltage from the nominal value due to change in load current.

Note 5. Regulation is measured at constant junction temperature by using a 10ms current pulse. Devices are tested for load regulation in the load range from 10 mA to 800 mA.

Note 6. Dropout voltage is defined as the minimum input to output differential voltage at which the output drops 2% below the nominal value. Dropout voltage specification applies only to output voltages of 2.5 V and above. For output voltages below 2.5 V, the dropout voltage is nothing but the input to output differential, since the minimum input voltage is 2.7 V.

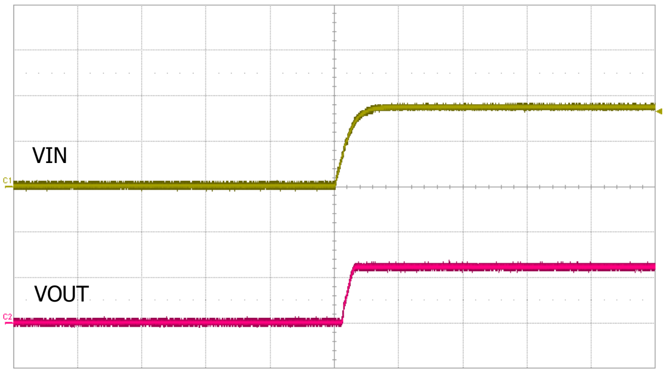
Note 7. Ground current, or quiescent current, is the difference between input and output currents. It's defined by I_{GND} = I_{IN} - I_{OUT} under the given loading condition. The total current drawn from the supply is the sum of the load current plus the ground pin current.

TYPICAL OPERATING CHARACTERISTICS



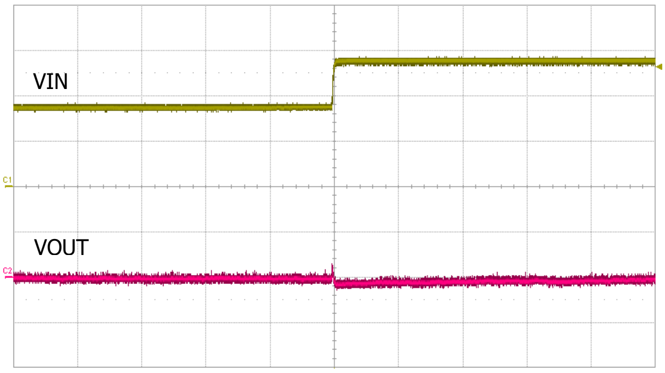
VIN: 2.0V/div, VOUT: 2.0V/div, Time: 1ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=0A

Start Up Transient Response



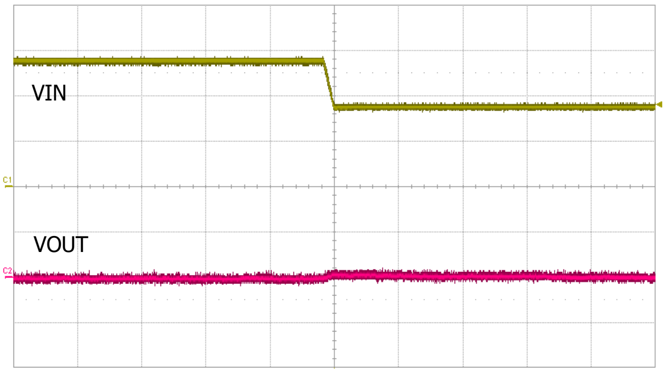
VIN: 2.0V/div, VOUT: 2.0V/div, Time: 1ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=1.0A

Start Up Transient Response



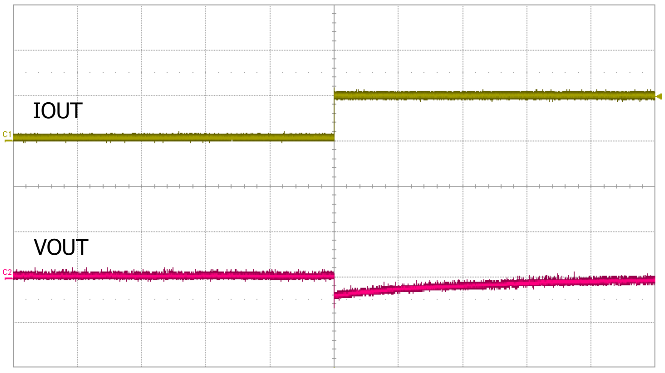
VIN: 2.0V/div, VOUT: 20mV/div, Time: 10ms/div
VIN=3.5V to 5.5V, VOUT=2.5V @ IOUT=10mA

Line Transient Response



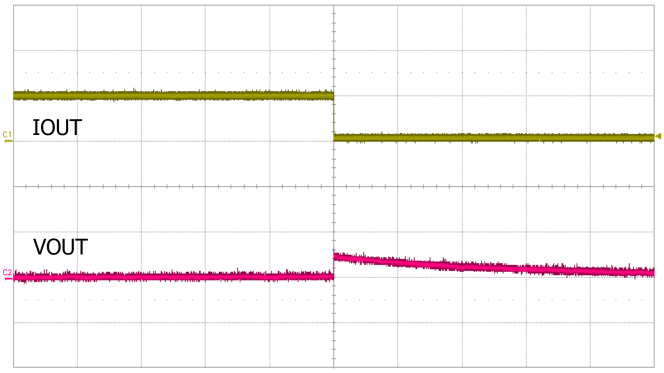
VIN: 2.0V/div, VOUT: 20mV/div, Time: 10ms/div
VIN=5.5V to 3.5V, VOUT=2.5V @ IOUT=10mA

Line Transient Response



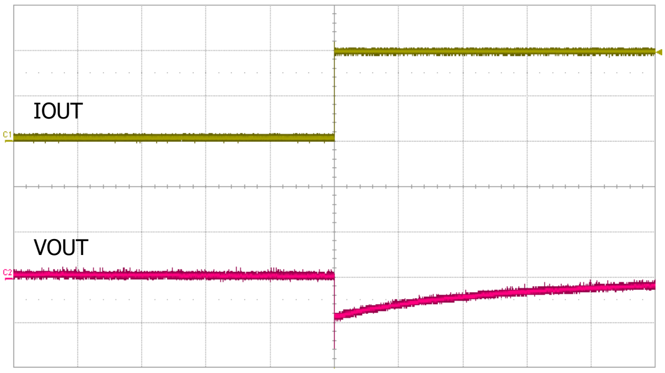
IOUT: 500mA/div, VOUT: 50mV/div, Time: 10ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=10mA to 0.5A

Load Transient Response



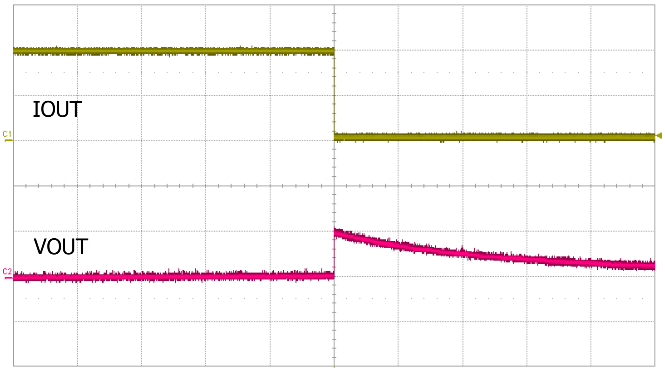
IOUT: 500mA/div, VOUT: 50mV/div, Time: 10ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=0.5A to 10mA

Load Transient Response



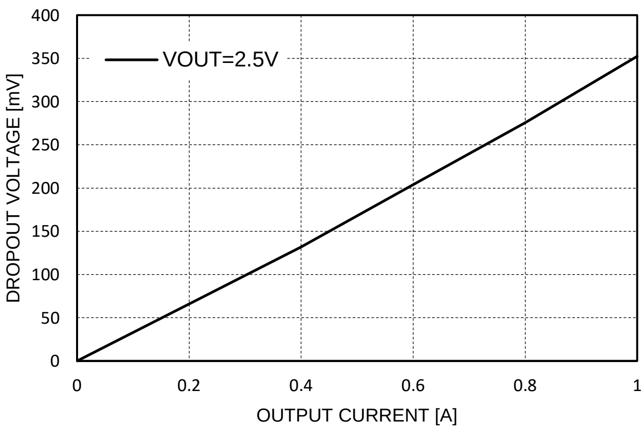
IOUT: 500mA/div, VOUT: 50mV/div, Time: 10ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=10mA to 1.0A

Load Transient Response



IOUT: 500mA/div, VOUT: 50mV/div, Time: 10ms/div
VIN=3.5V, VOUT=2.5V @ IOUT=1.0A to 10mA

Load Transient Response



Dropout Voltage

APPLICATION INFORMATION

The TPS1117LVxx is intended for applications where high current capability and very low dropout voltage are required. It provides a simple, low cost solution that occupies very little PCB area.

INPUT CAPACITOR

A large bulk capacitance over than 6.8 μF should be closely placed to the input supply pin of the TPS1117LVxx to ensure that the input supply voltage does not sag. Also a minimum of 6.8 μF ceramic capacitor is recommended to be placed directly next to the VIN Pin. It allows for the device being some distance from any bulk capacitor on the rail. Additionally, input droop due to load transients is reduced, improving load transient response.

OUTPUT CAPACITOR

A minimum ceramic capacitor over than 6.8 μF should be very closely placed to the output voltage pin of the TPS1117LVxx. Increasing capacitance will improve the overall transient response and stability.

MAXIMUM OUPUT CURRENT CAPABILITY

The TPS1117LVxx can deliver a continuous current of 1.0 A over the full operating junction temperature range. However, the output current is limited by the restriction of power dissipation which differs from packages. A heat sink may be required depending on the maximum power dissipation and maximum ambient temperature of application. With respect to the applied package, the maximum output current of 1.0 A may be still undeliverable due to the restriction of the power dissipation of TPS1117LVxx. Under all possible conditions, the junction temperature must be within the range specified under operating conditions.

The temperatures over the device are given by:

$$T_C = T_A + P_D \times \theta_{CA}$$
$$T_J = T_C + P_D \times \theta_{JC}$$
$$T_J = T_A + P_D \times \theta_{JA}$$

where T_J is the junction temperature, T_C is the case temperature, T_A is the ambient temperature, P_D is the total power dissipation of the device, θ_{CA} is the thermal resistance of case-to-ambient, θ_{JC} is the thermal resistance of junction-to-case, and θ_{JA} is the thermal resistance of junction to ambient.

The total power dissipation of the device is given by:

$$P_D = P_{IN} - P_{OUT} = (V_{IN} \times I_{IN}) - (V_{OUT} \times I_{OUT})$$
$$= (V_{IN} \times (I_{OUT} + I_{GND})) - (V_{OUT} \times I_{OUT}) = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND}$$

where I_{GND} is the operating ground current of the device which is specified at the Electrical Characteristics. The maximum allowable temperature rise (T_{Rmax}) depends on the maximum ambient temperature (T_{Amax}) of the application, and the maximum allowable junction temperature (T_{Jmax}):

$$T_{Rmax} = T_{Jmax} - T_{Amax}$$

The maximum allowable value for junction-to-ambient thermal resistance, θ_{JA}, can be calculated using the formula:

$$\theta_{JA} = T_{Rmax} / P_D$$

TPS1117LVxx is available in SOT-223 package. The thermal resistance depends on amount of copper area or heat sink, and on air flow. If the maximum allowable value of θ_{JA} calculated above is as described in Table 1, no heat sink is needed since the package can dissipate enough heat to satisfy these requirements. If the value for allowable θ_{JA} falls near or below these limits, a heat sink or proper area of copper plane is required

Table 1. Absolute Maximum Ratings of Thermal Resistance

Characteristic	Symbol	Rating	Unit
Thermal Resistance Junction-To-Ambient	θ_{JA}	140	°C/W

(No heat sink / No air flow / No adjacent heat source, TA = 25°C)

In case that there is no cooling solution and no heat sink / minimum copper plane area for heat sink, the maximum allowable power dissipation of each package is as follow;

Characteristic	Symbol	Rating	Unit
Maximum Allowable Power Dissipation at T_A=25°C	P_{DMax}	0.714	W

Please note that above maximum allowable power dissipation is based on the minimum copper plane area which does not exceed the proper footprint of the package. And the ambient temperature is 25°C.

If proper cooling solution such as copper plane area or air flow is applied, the maximum allowable power dissipation could be increased. However, if the ambient temperature is increased, the allowable power dissipation would be decreased.

REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.