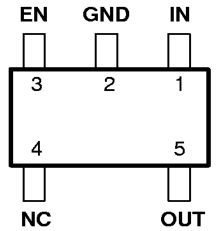
- **100-mA Low-Dropout Regulator**
- **Fixed Output Voltage Options: 5 V, 3.8 V, 3.3 V, 3.2 V, and 3 V**
- **Dropout Typically 170 mV at 100-mA**
- **Thermal Protection**
- **Less Than 1 μA Quiescent Current in Shutdown**
- **–40°C to 125°C Operating Junction Temperature Range**
- **5-Pin SOT-23 (DBV) Package**
- **ESD Protection Verified to 1.5 KV Human Body Model (HBM) per MIL-STD-883C**

DBV PACKAGE
(TOP VIEW)



NC – No internal connection

description

The TPS761xx is a 100 mA, low dropout (LDO) voltage regulator designed specifically for battery-powered applications. A proprietary BiCMOS fabrication process allows the TPS761xx to provide outstanding performance in all specifications critical to battery-powered operation.

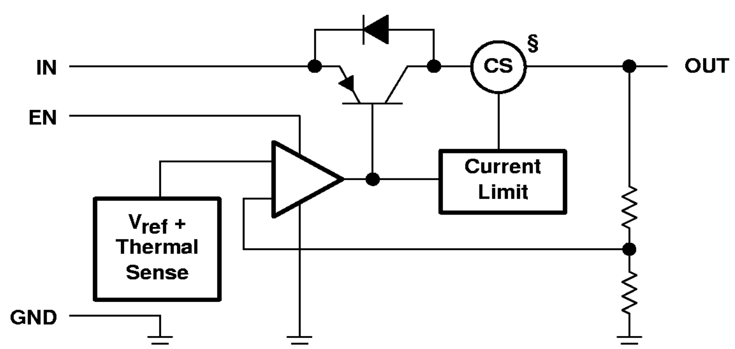
The TPS761xx is available in a space-saving SOT-23 (DBV) package and operates over a junction temperature range of –40°C to 125°C.

AVAILABLE OPTIONS

T_J	VOLTAGE	PACKAGE	PART NUMBER		SYMBOL
–40°C to 125°C	3 V	SOT-23 (DBV)	TPS76130DBVR†	TPS76130DBVT‡	PAEI
	3.2 V		TPS76132DBVR†	TPS76132DBVT‡	PAFI
	3.3 V		TPS76133DBVR†	TPS76133DBVT‡	PAII
	3.8 V		TPS76138DBVR†	TPS76138DBVT‡	PAKI
	5 V		TPS76150DBVR†	TPS76150DBVT‡	PALI

† The DBVR passive indicates tape and reel of 3000 parts.
‡ The DBVT passive indicates tape and reel of 250 parts.

functional block diagram



§ Current sense

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
EN	3	I	Enable input
GND	2		Ground
IN	1	I	Input voltage
NC	4		No connection
OUT	5	O	Regulated output voltage

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Input voltage range, V_I (see Note 1) . . . . –0.3 V to 16 V
Voltage range at EN . . . . –0.3 V to V_I + 0.3 V
Peak output current . . . . internally limited
Continuous total dissipation . . . . See Dissipation Rating Table
Operating junction temperature range, T_J . . . . –40°C to 125°C
Storage temperature range, T_{stg} . . . . –65°C to 150°C
ESD rating, HBM . . . . 1.5 kV

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltages are with respect to device GND pin.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25°C$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING	$T_A = 85°C$ POWER RATING
DBV	150 mW	1.2 mW/°C	96 mW	78 mW

recommended operating conditions

		MIN	NOM	MAX	UNIT
Input voltage, V_I	TPS76130	3.35		16	V
	TPS76132	3.58		16	
	TPS76133	3.68		16	
	TPS76138	4.18		16	
	TPS76150	5.38		16	
Continuous output current, I_O		0		100	mA
Operating junction temperature, T_J		–40		125	°C

electrical characteristics over recommended operating free-air temperature range, $V_I = V_{O(typ)} + 1$ V, $I_O = 1$ mA, EN = V_I, $C_o = 4.7$ µF (unless otherwise noted)

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_O	Output voltage	TPS76130	$T_J = 25°C$		2.96	3	3.04	V
			$T_J = 25°C$,	1 mA < I_O < 100 mA	2.9		3.04	
			1 mA < I_O < 100 mA		2.89		3.07	
		TPS76132	$T_J = 25°C$		3.16	3.2	3.24	V
			$T_J = 25°C$,	1 mA < I_O < 100 mA	3.11		3.24	
			1 mA < I_O < 100 mA		3.08		3.3	
		TPS76133	$T_J = 25°C$		3.26	3.3	3.34	V
			$T_J = 25°C$,	1 mA < I_O < 100 mA	3.21		3.34	
			1 mA < I_O < 100 mA		3.18		3.4	
		TPS76138	$T_J = 25°C$		3.76	3.8	3.84	V
			$T_J = 25°C$,	1 mA < I_O < 100 mA	3.71		3.84	
			1 mA < I_O < 100 mA		3.68		3.9	
		TPS76150	$T_J = 25°C$		4.95	5	5.05	V
			$T_J = 25°C$,	1 mA < I_O < 100 mA	4.88		5.05	
			1 mA < I_O < 100 mA		4.86		5.1	
$I_{I(standby)}$	Standby current		EN = 0 V				1	µA
	Quiescent current (GND current)		$I_O = 0$ mA,	$T_J = 25°C$		90	115	µA
			$I_O = 0$ mA				130	
			$I_O = 1$ mA,	$T_J = 25°C$		100	130	
			$I_O = 1$ mA				170	
			$I_O = 10$ mA,	$T_J = 25°C$		190	220	
			$I_O = 10$ mA				260	
			$I_O = 50$ mA,	$T_J = 25°C$		850	1000	
			$I_O = 50$ mA				1200	
			$I_O = 100$ mA,	$T_J = 25°C$		2600	3600	
			$I_O = 100$ mA				4000	
	Input Regulation	TPS76130	4 V < V_I < 16,	$I_O = 1$ mA		3	10	mV
		TPS76132	4.2 V < V_I < 16,	$I_O = 1$ mA		3	10	
		TPS76133	4.3 V < V_I < 16,	$I_O = 1$ mA		3	10	
		TPS76138	4.8 V < V_I < 16,	$I_O = 1$ mA		3	10	
		TPS76150	6 V < V_I < 16	$I_O = 1$ mA		3	10	
V_n	Output Noise Voltage		BW = 300 Hz to 50 kHz	$C_o = 10$ µF, $T_J = 25°C$		190		µVrms
	Ripple rejection		f = 1 kHz, $C_o = 10$ µF,	$T_J = 25°C$		63		dB

electrical characteristics over recommended operating free-air temperature range, $V_I = V_{O(typ)} + 1$ V, $I_O = 1$ mA, EN = V_I, $C_o = 4.7\ \mu F$ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
	Dropout voltage	I_O = 0 mA,	T_J = 25°C		1	3	mV
		I_O = 0 mA				5	
		I_O = 1 mA,	T_J = 25°C		7	10	
		I_O = 1 mA				15	
		I_O = 10 mA,	T_J = 25°C		40	60	
		I_O = 10 mA				90	
		I_O = 50 mA,	T_J = 25°C		120	150	
		I_O = 50 mA				180	
		I_O = 100 mA,	T_J = 25°C		170	240	
		I_O = 100 mA				280	
	Peak output current/current limit	T_J = 25°C		100	150		mA
	High level enable input			2			V
	Low level enable input					0.8	V
I_I	Input current (EN)	EN = 0 V		–1	0	1	μA
		EN = V_I			2.5	5	

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_O	Output voltage	vs Output current	1, 2, 3
		vs Free-air temperature	4, 5, 6
	Ground current	vs Free-air temperature	7, 8, 9
	Output noise	vs Frequency	10
Z_o	Output impedance	vs Frequency	11
V_{DO}	Dropout voltage	vs Free-air temperature	12
	Line transient response	vs Time	13, 15
	Load transient response	vs Time	14, 16

TYPICAL CHARACTERISTICS

TPS76130
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

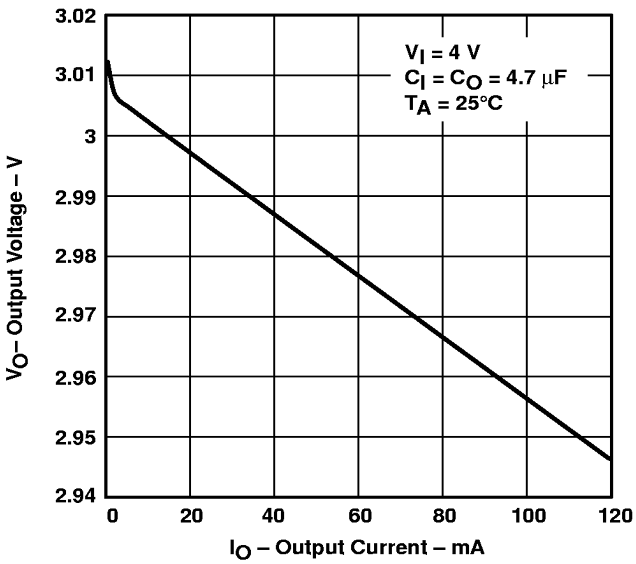


Figure 1

TPS76133
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

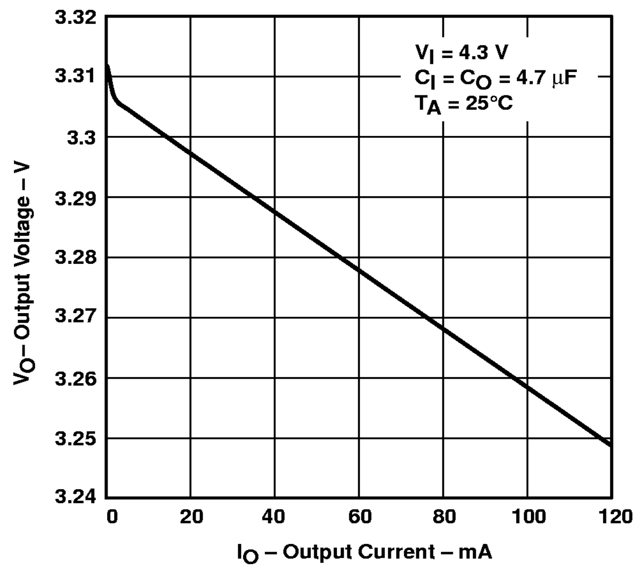


Figure 2

TPS76150
OUTPUT VOLTAGE
vs
OUTPUT CURRENT

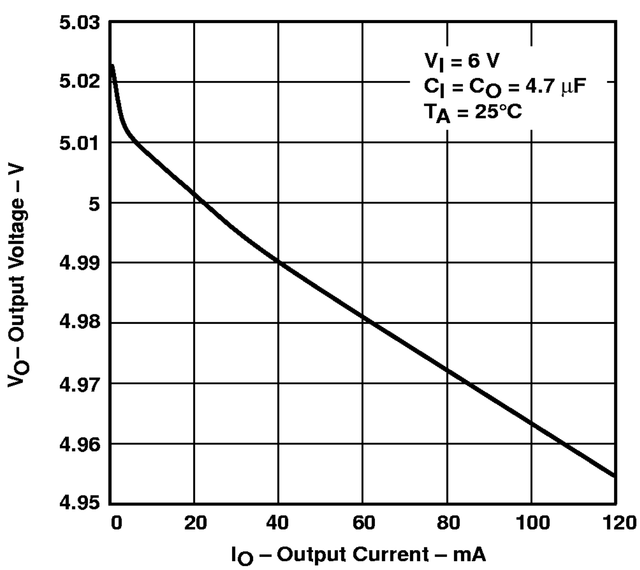


Figure 3

TPS76130
OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

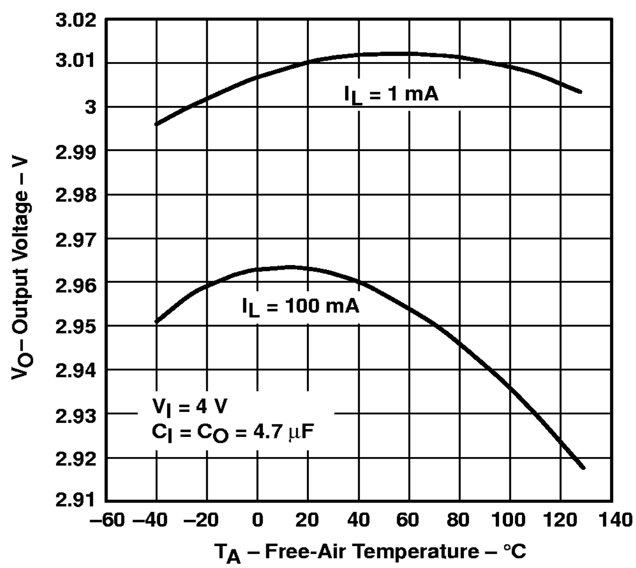


Figure 4

TYPICAL CHARACTERISTICS

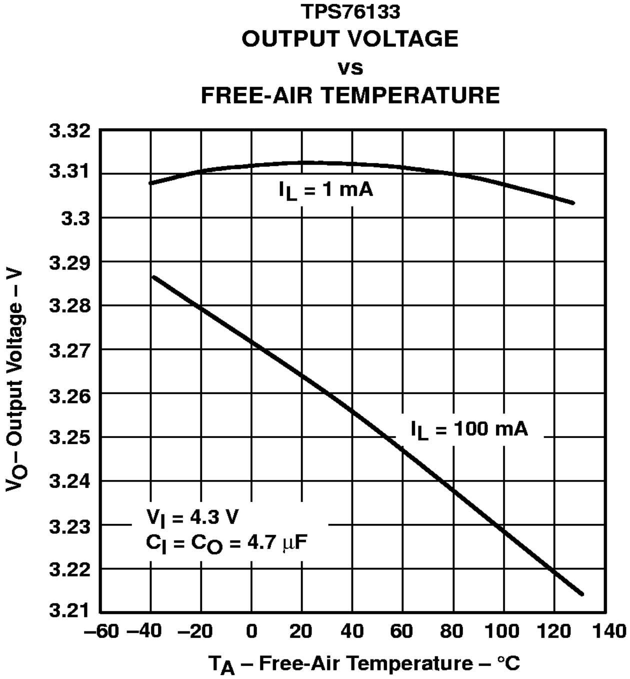


Figure 5

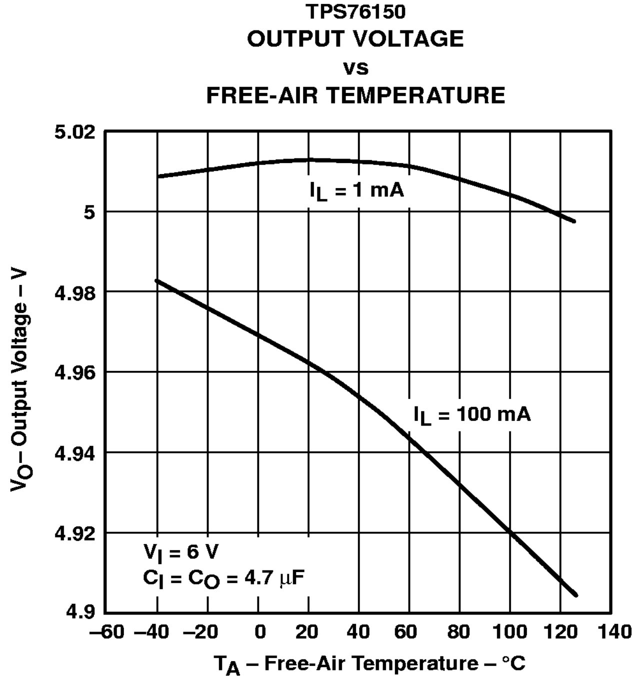


Figure 6

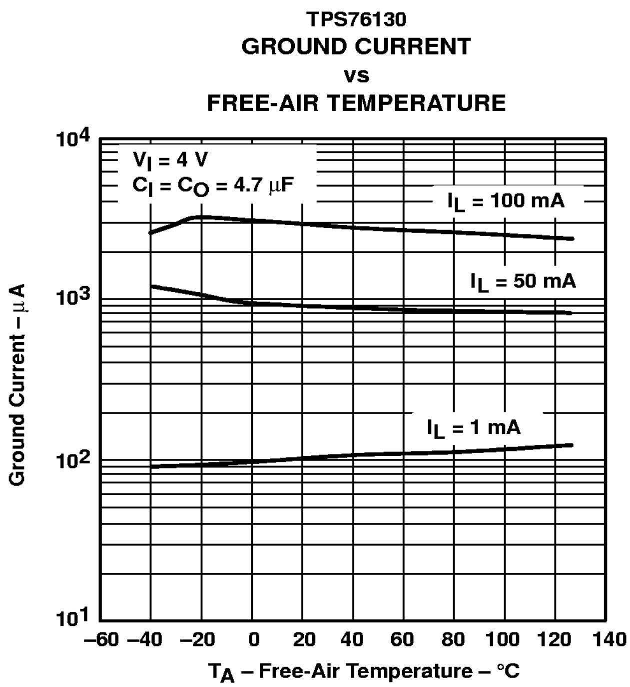


Figure 7

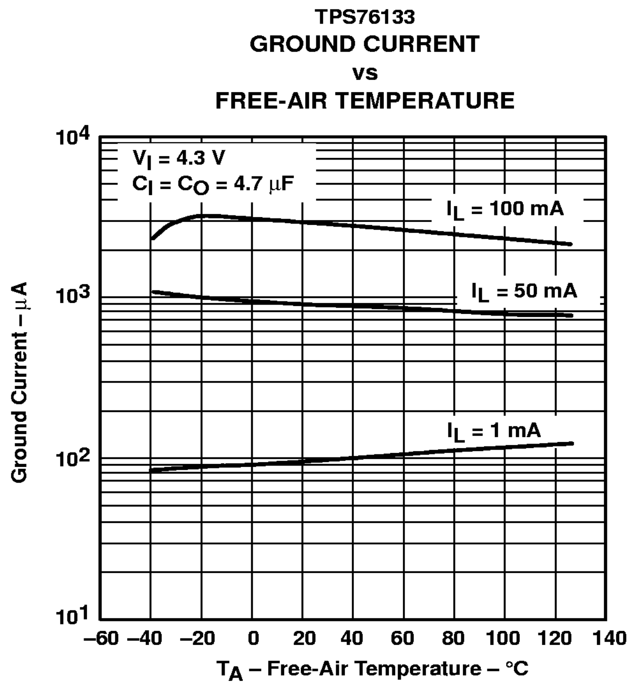


Figure 8

TYPICAL CHARACTERISTICS

TPS76150
GROUND CURRENT
vs
FREE-AIR TEMPERATURE

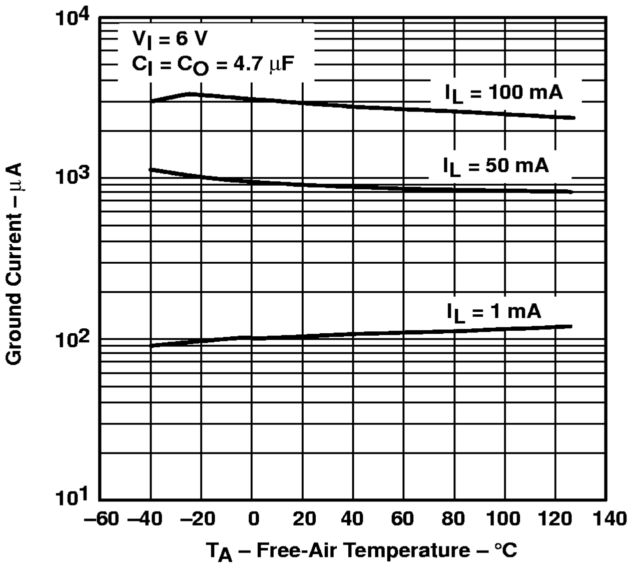


Figure 9

OUTPUT NOISE
vs
FREQUENCY

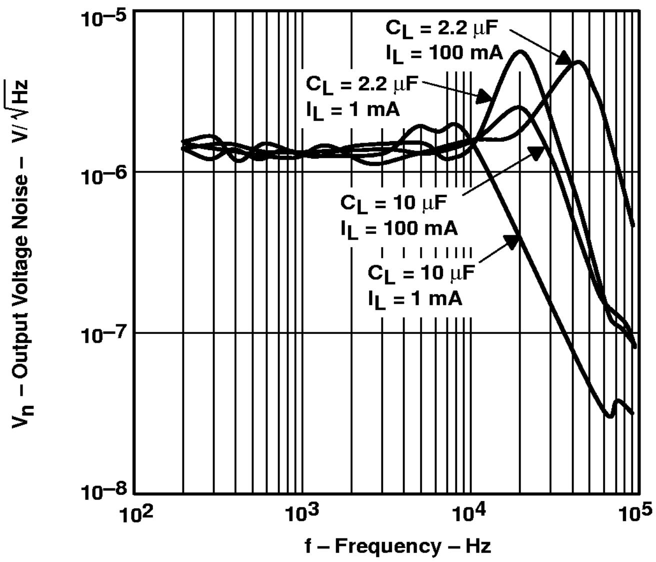


Figure 10

OUTPUT IMPEDANCE
vs
FREQUENCY

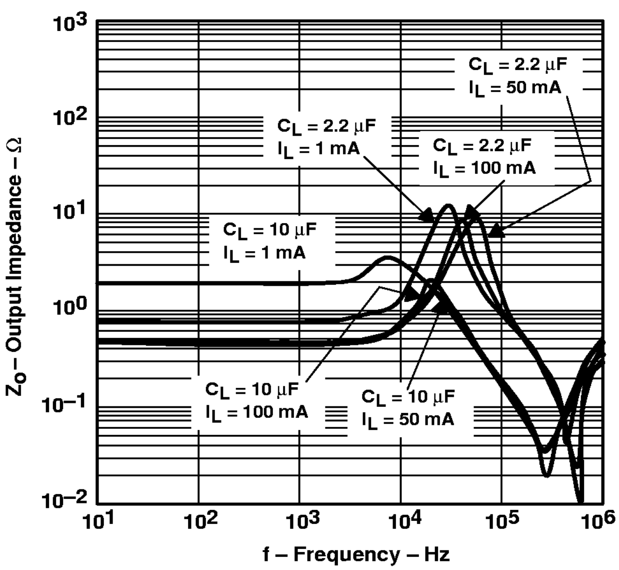


Figure 11

TPS76130
DROPOUT VOLTAGE
vs
FREE-AIR TEMPERATURE

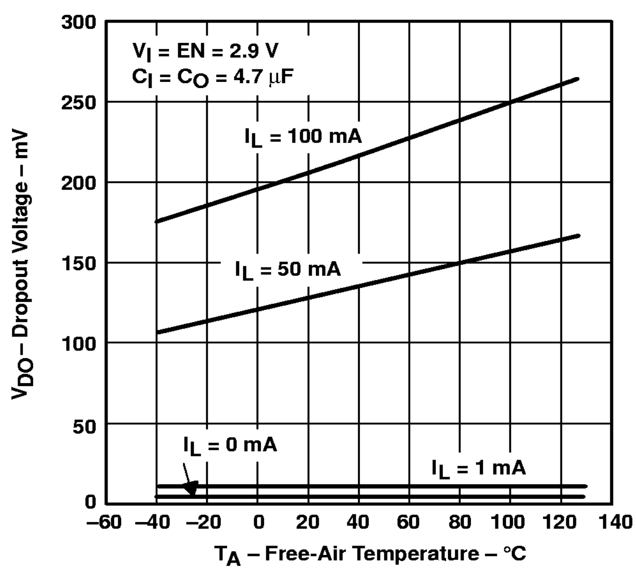


Figure 12

TYPICAL CHARACTERISTICS

TPS76130
LINE TRANSIENT RESPONSE

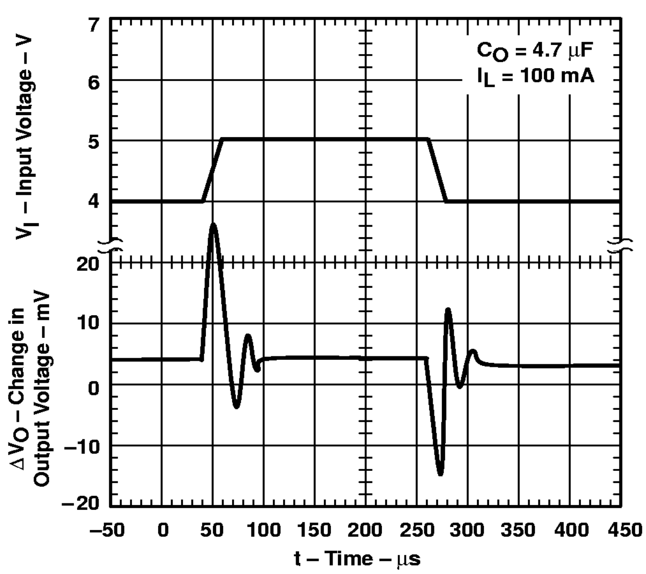


Figure 13

TPS76130
LOAD TRANSIENT RESPONSE

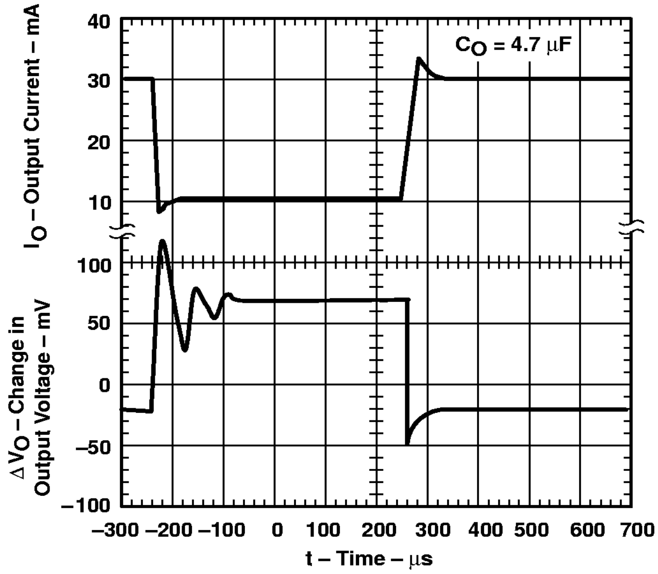


Figure 14

TPS76150
LINE TRANSIENT RESPONSE

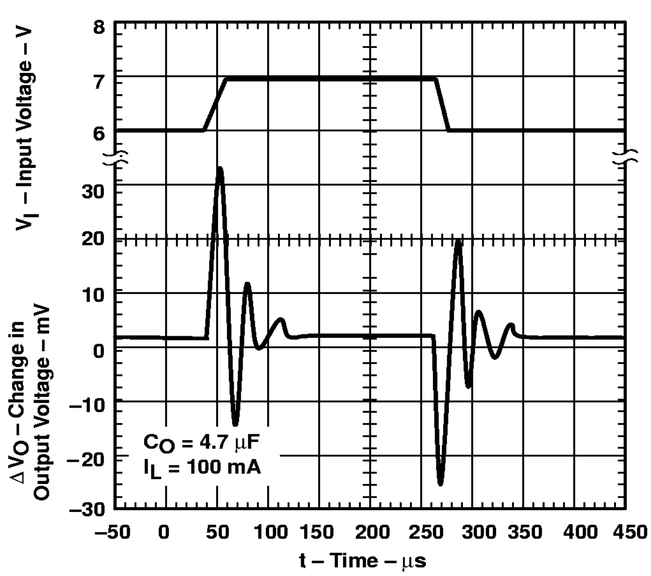


Figure 15

TPS76150
LOAD TRANSIENT RESPONSE

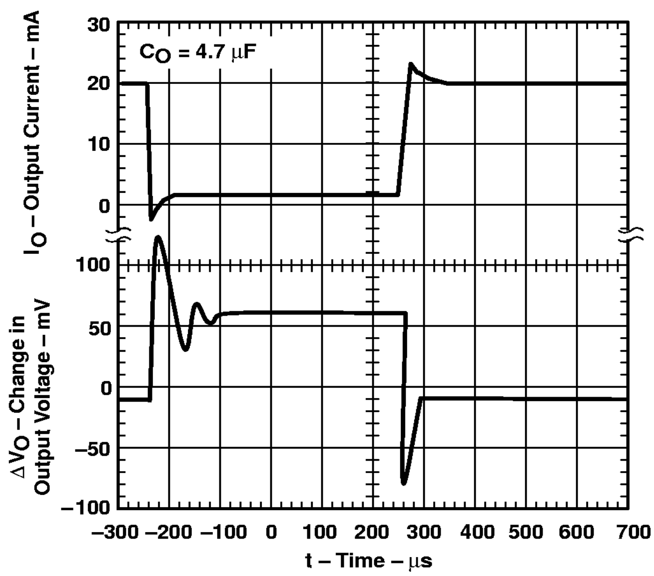


Figure 16

APPLICATION INFORMATION

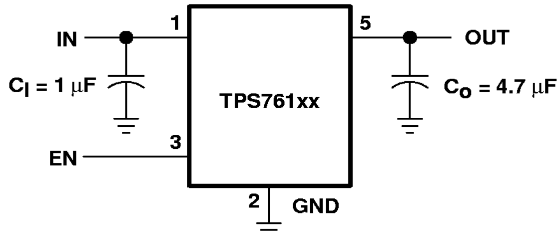


Figure 17. TPS761xx Typical Application

over current protection

The over current protection circuit forces the TPS761xx into a constant current output mode when the load is excessive or the output is shorted to ground. Normal operation resumes when the fault condition is removed.

NOTE:

An overload or short circuit may also activate the over temperature protection if the fault condition persists.

over temperature protection

The thermal protection system shuts the TPS761xx down when the junction temperature exceeds 160°C. The device recovers and operates normally when the temperature drops below 150°C.

input capacitor

A 1-µF or larger ceramic decoupling capacitor with short leads connected between IN and GND is recommended. The decoupling capacitor may be omitted if there is a 1 µF or larger electrolytic capacitor connected between IN and GND and located reasonably close to the TPS761xx. However, the small ceramic device is desirable even when the larger capacitor is present if there is a lot of high frequency noise present in the system.

output capacitor

Like all low dropout regulators, the TPS761xx requires an output capacitor connected between OUT and GND to stabilize the internal control loop. The minimum recommended capacitance value is 4.7 µF and the ESR (equivalent series resistance) must be between 0.1 Ω and 10 Ω. Solid tantalum electrolytic, aluminum electrolytic, and multilayer ceramic capacitors are all suitable, provided they meet the requirements described above. Most of the commercially available 4.7-µF surface-mount solid-tantalum capacitors, including devices from Sprague, Kemet, and Nichicon, meet the ESR requirements stated above. Multilayer ceramic capacitors should have minimum values of 4.7 µF over the full operating temperature range of the equipment.

enable (EN)

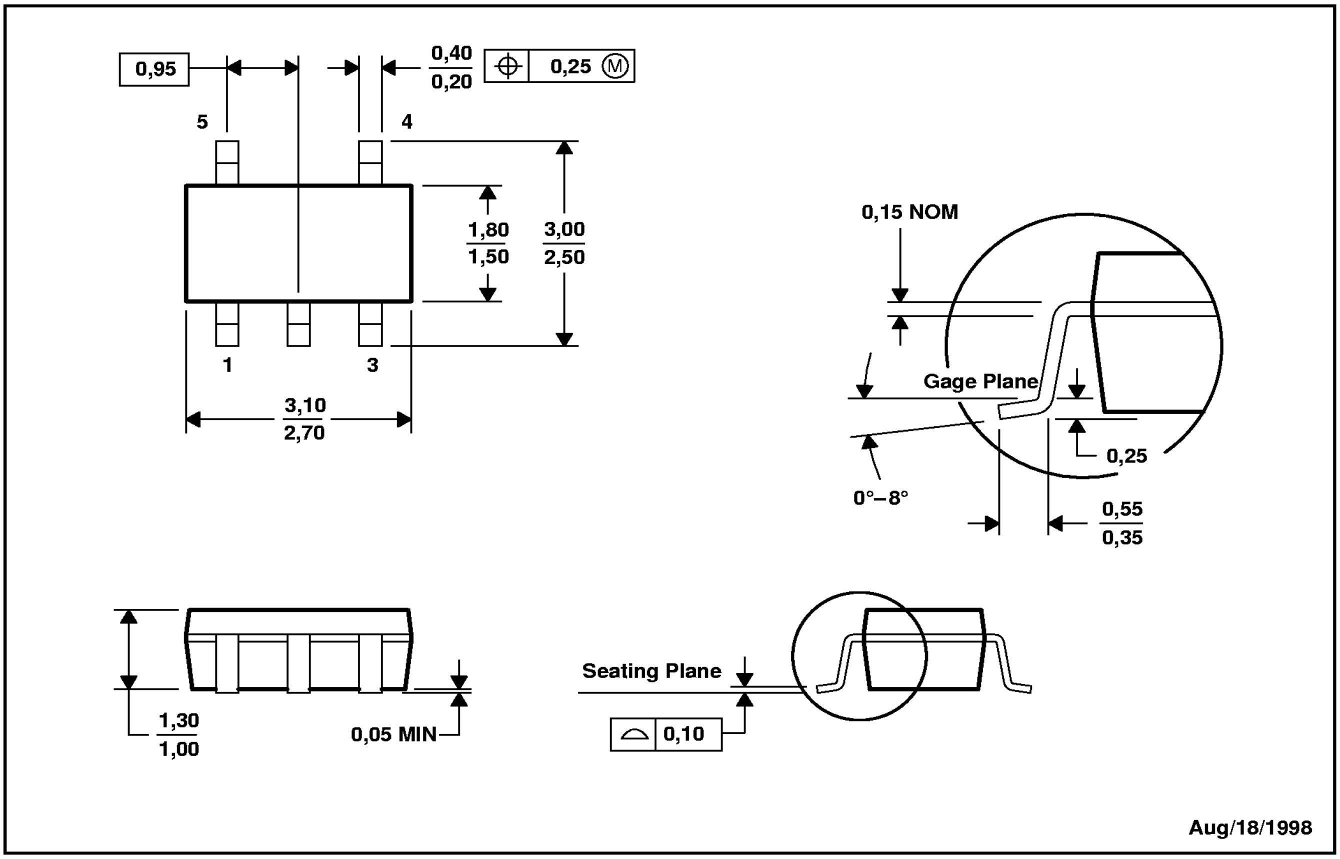
A logic zero on the enable input shuts the TPS761xx off and reduces the supply current to less than 1 µA. Pulling the enable input high causes normal operation to resume. If the enable feature is not used, EN should be connected to IN to keep the regulator on all of the time. The EN input must not be left floating.

reverse current path

The power transistor used in the TPS761xx has an inherent diode connected between IN and OUT as shown in the functional block diagram. This diode conducts current from the OUT terminal to the IN terminal whenever IN is lower than OUT by a diode drop. This condition does not damage the TPS761xx provided the current is limited to 150 mA.

MECHANICAL DATA

DBV (R-PDSO-G5) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.