

# LDO Regulator - 400 mA, Best-in-Class Dropout, with Bias Rail

## Product Preview

### T30LMPSR132, T30LAPSR132

The T30LxPSR132 is an ultra-fast, 400 mA bias rail LDO with market-leading dropout voltage (**20 mV @ full load**). Due to its advanced CMOS process, the T30LxPSR132 offers ultra-fast dynamic response and provides very stable output voltage with 1% accuracy over full temperature range. The device also features high PSRR across frequency range and ultra-low noise optimized for noise sensitive applications. The T30LxPSR132 very low bias current makes the device suitable for battery powered applications. The minimum recommended output capacitance (1 x 2.2  $\mu$ F) and the low profile, WLCSP6 0.99 mm x 0.65 mm, 0.35P Chip Scale package is ideal for space-constrained applications.

#### Features

- Best-in-Class Dropout: 20 mV (typ.) at 400 mA
- $\pm 1\%$  Accuracy over  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  Temp. Range
- High PSRR across Frequency Range
  - ◆ 75 dB at 1 kHz
  - ◆ 38 dB at 100 kHz
- Very Low Bias Input Current of Typ. 85  $\mu$ A
- Ultra Low Noise, 7.5  $\mu\text{V}_{\text{RMS}}$  Typ.
- Excellent Load Transient Performance
- Input Voltage Range: up to 2.2 V
- Bias Voltage Range: up to 3.3 V
- Output Voltage Range: 0.5 V to 1.8 V (Fixed), Resolution 25 mV
- 1.2 V Logic Level Enable Input Compatibility

#### Typical Applications

- Battery-powered Equipment
- Smartphones, Tablets
- Cameras, DVRs, STB and Camcorders

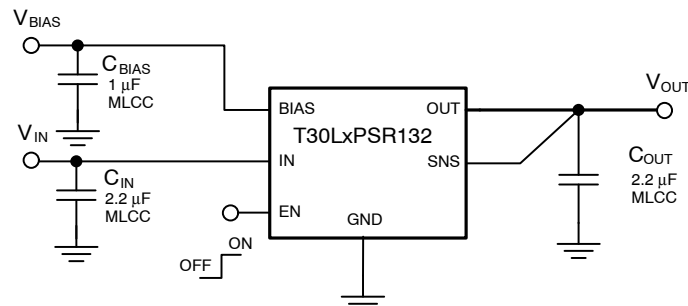


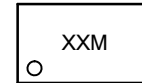
Figure 1. Typical Application Schematics

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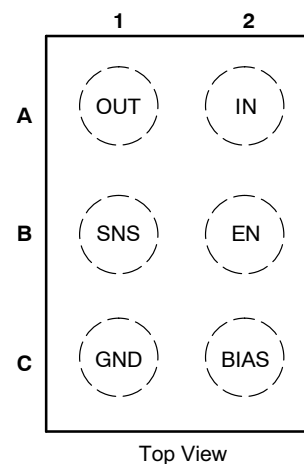
WLCSP6 0.99x0.65x0.29  
CASE 567ZT

#### MARKING DIAGRAM



XX = Specific Device Code  
M = Month Code

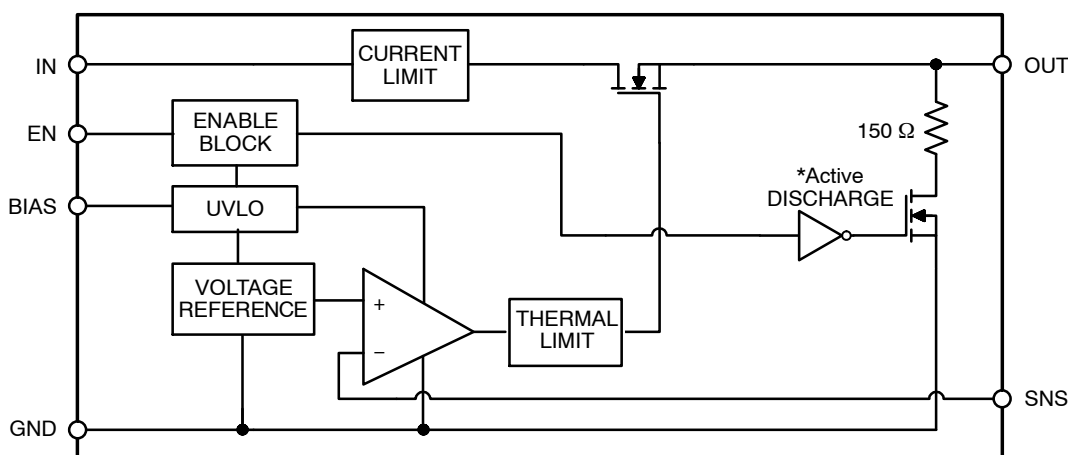
#### PIN CONNECTIONS



#### ORDERING INFORMATION

See detailed ordering and shipping information on page 4 of this data sheet.

## T30LMPSR132, T30LAPSR132



\*Active output discharge function is present only in "A" and "C" option devices.

**Figure 2. Simplified Schematic Block Diagram – Fixed Version**

### PIN FUNCTION DESCRIPTION

Pin No. WLCSP6	Pin Name	Description
A1	OUT	Regulated Output Voltage pin
A2	IN	Input Voltage Supply pin
B1	SNS	Output voltage Sensing Input. Connect to Output on the PCB to output the voltage corresponding to the part version.
B2	EN	Enable pin. Driving this pin high enables the regulator. Driving this pin low puts the regulator into shutdown mode.
C1	GND	Ground pin
C2	BIAS	Bias voltage supply for internal control circuits.

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Note 1)	$V_{IN}$	-0.3 to 2.5	V
Output Voltage	$V_{OUT}$	-0.3 to $(V_{IN}+0.3) \leq 2.5$	V
Chip Enable, Bias and SNS Input	$V_{EN}, V_{BIAS}, V_{SNS}$	-0.3 to 3.6	V
Output Short Circuit Duration	$t_{SC}$	unlimited	s
Maximum Junction Temperature	$T_J$	150	°C
Storage Temperature	$T_{STG}$	-55 to 150	°C
ESD Capability, Human Body Model (Note 2)	$ESD_{HBM}$	2000	V
ESD Capability, Charged Device Model (Note 2)	$ESD_{CDM}$	750	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. This device series incorporates ESD protection (except OUT pin) and is tested by the following methods:  
ESD Human Body Model tested per EIA/JESD22-A114.  
ESD Charged Device Model tested per JS-002-2018.  
Latchup Current Maximum Rating tested per JEDEC standard: JESD78.

### THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP6 1.145 mm x 0.75 mm Thermal Resistance, Junction-to-Air (Note 3)	$R_{\theta JA}$	69	°C/W

3. This junction-to-ambient thermal resistance under natural convection was derived by thermal simulations based on the JEDEC JESD51 series standards methodology. Only a single device mounted at the center of a high\_K (2s2p) 80 mm x 80 mm multilayer board with 1-ounce internal planes and 2-ounce copper on top and bottom. Top copper layer has a dedicated 1.6 mm<sup>2</sup> copper area.

## T30LMPSR132, T30LAPSR132

**ELECTRICAL CHARACTERISTICS**  $-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ ;  $V_{\text{BIAS}} = 2.7\text{ V}$  or  $(V_{\text{OUT}} + 1.6\text{ V})$ , whichever is greater,  $V_{\text{IN}} = V_{\text{OUT(NOM)}} + 0.1\text{ V}$ ,  $I_{\text{OUT}} = 1\text{ mA}$ ,  $V_{\text{EN}} = 1\text{ V}$ ,  $C_{\text{IN}} = 2.2\text{ }\mu\text{F}$ ,  $C_{\text{OUT}} = 2.2\text{ }\mu\text{F}$ ,  $C_{\text{BIAS}} = 1\text{ }\mu\text{F}$ , unless otherwise noted. Typical values are at  $T_J = +25^{\circ}\text{C}$ . Min/Max values are for  $-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$  unless otherwise noted. (Note 4)

Parameter	Test Conditions		Symbol	Min	Typ	Max	Unit
Operating Input Voltage Range			$V_{\text{IN}}$	$V_{\text{OUT}} + V_{\text{DO}}$		2.2	V
Operating Bias Voltage Range			$V_{\text{BIAS}}$	$(V_{\text{OUT}} + 1.50) \geq 2.5$		3.3	V
Undervoltage Lock-out	$V_{\text{BIAS}}$ Rising Hysteresis		$\text{UVLO}_{(\text{BIAS})}$		2.1 0.1		V
	$V_{\text{IN}}$ Rising Hysteresis		$\text{UVLO}_{(\text{IN})}$		$0.8 \times V_{\text{OUT}}$ 0.1		
Output Voltage Accuracy	$-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$ , $V_{\text{OUT(NOM)}} + 0.1\text{ V} \leq V_{\text{IN}} \leq V_{\text{OUT(NOM)}} + 1.0\text{ V}$ , $2.7\text{ V}$ or $(V_{\text{OUT(NOM)}} + 1.6\text{ V})$ , whichever is greater < $V_{\text{BIAS}} < 3.3\text{ V}$ , $1\text{ mA} < I_{\text{OUT}} < 400\text{ mA}$		$V_{\text{OUT}}$	-0.8		+0.8	%
Output Voltage Accuracy	$-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ , $V_{\text{OUT(NOM)}} + 0.1\text{ V} \leq V_{\text{IN}} \leq V_{\text{OUT(NOM)}} + 1.0\text{ V}$ , $2.7\text{ V}$ or $(V_{\text{OUT(NOM)}} + 1.6\text{ V})$ , whichever is greater < $V_{\text{BIAS}} < 3.3\text{ V}$ , $1\text{ mA} < I_{\text{OUT}} < 400\text{ mA}$		$V_{\text{OUT}}$	-1		+1	%
$V_{\text{IN}}$ Line Regulation	$V_{\text{OUT(NOM)}} + 0.1\text{ V} \leq V_{\text{IN}} \leq 2.2\text{ V}$		$\text{LineReg}$		0.01		%/V
$V_{\text{BIAS}}$ Line Regulation	$2.7\text{ V}$ or $(V_{\text{OUT(NOM)}} + 1.6\text{ V})$ , whichever is greater < $V_{\text{BIAS}} < 3.3\text{ V}$		$\text{LineReg}$		0.01		%/V
Load Regulation	$I_{\text{OUT}} = 1\text{ mA}$ to $400\text{ mA}$		$\text{LoadReg}$		1		mV
$V_{\text{IN}}$ Dropout Voltage	$I_{\text{OUT}} = 400\text{ mA}$ (Note 5)		$V_{\text{DO}}$		20	50	mV
$V_{\text{BIAS}}$ Dropout Voltage	$I_{\text{OUT}} = 400\text{ mA}$ , $V_{\text{IN}} = V_{\text{BIAS}}$ (Notes 5, 6)		$V_{\text{DO}}$		1.1	1.5	V
Output Current Limit	$V_{\text{OUT}} = 90\% V_{\text{OUT(NOM)}}$		$I_{\text{CL}}$	530	660	800	mA
SNS Pin Operating Current			$I_{\text{SNS}}$		0.1	0.5	$\mu\text{A}$
Bias Pin Quiescent Current	$V_{\text{BIAS}} = 3.3\text{ V}$ , $I_{\text{OUT}} = 0\text{ mA}$		$I_{\text{BIASQ}}$		85	130	$\mu\text{A}$
Bias Pin Disable Current	$V_{\text{EN}} \leq 0.325\text{ V}$		$I_{\text{BIAS(DIS)}}$		0.5	TBD	$\mu\text{A}$
Input Pin Disable Current			$I_{\text{VIN(DIS)}}$		0.5	TBD	$\mu\text{A}$
EN Pin Threshold Voltage	EN Input Voltage "H"		$V_{\text{EN(H)}}$	0.77			V
	EN Input Voltage "L"		$V_{\text{EN(L)}}$			0.325	
EN Pull Down Current	$V_{\text{EN}} = 3.3\text{ V}$		$I_{\text{EN}}$		0.3	TBD	$\mu\text{A}$
Power Supply Rejection Ratio	$V_{\text{IN}}$ to $V_{\text{OUT}}$ , $V_{\text{IN}} = V_{\text{OUT}} + 0.1\text{ V}$ , $I_{\text{OUT}} = 150\text{ mA}$ , $C_{\text{OUT}} = 2.2\text{ }\mu\text{F}$ , 0201	$f = 100\text{ Hz}$	$\text{PSRR}(V_{\text{IN}})$		75		dB
		$f = 1\text{ kHz}$			80		
		$f = 10\text{ kHz}$			60		
		$f = 100\text{ kHz}$			40		
	$V_{\text{BIAS}}$ to $V_{\text{OUT}}$ , $V_{\text{IN}} = V_{\text{OUT}} + 0.1\text{ V}$	$f = 1\text{ kHz}$	$\text{PSRR}(V_{\text{BIAS}})$		80		dB
Output Noise Voltage	$V_{\text{IN}} = V_{\text{OUT}} + 0.1\text{ V}$ , $f = 10\text{ Hz}$ to $100\text{ kHz}$	$I_{\text{OUT}} = 10\text{ mA}$	$V_{\text{N}}$		9		$\mu\text{V}_{\text{RMS}}$
		$I_{\text{OUT}} = 400\text{ mA}$			7.5		
Thermal Shutdown Threshold	Temperature increasing				160		$^{\circ}\text{C}$
	Temperature decreasing				140		
Output Discharge Pull-Down	$V_{\text{EN}} \leq 0.325\text{ V}$ , $V_{\text{OUT}} = 0.5\text{ V}$ , Active Discharge Version Only		$R_{\text{DISCH}}$		150		$\Omega$

4. Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at  $T_A = 25^{\circ}\text{C}$ . Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
5. Dropout voltage is characterized when  $V_{\text{OUT}}$  falls 3% below  $V_{\text{OUT(NOM)}}$ .
6. For fixed output voltages below  $1.5\text{ V}$ ,  $V_{\text{BIAS}}$  dropout does not apply due to a minimum Bias operating voltage of  $2.5\text{ V}$ .

## T30LMPSR132, T30LAPSR132

**ELECTRICAL CHARACTERISTICS**  $-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ ;  $V_{\text{BIAS}} = 2.7\text{ V}$  or  $(V_{\text{OUT}} + 1.6\text{ V})$ , whichever is greater,  $V_{\text{IN}} = V_{\text{OUT(NOM)}} + 0.1\text{ V}$ ,  $I_{\text{OUT}} = 1\text{ mA}$ ,  $V_{\text{EN}} = 1\text{ V}$ ,  $C_{\text{IN}} = 2.2\text{ }\mu\text{F}$ ,  $C_{\text{OUT}} = 2.2\text{ }\mu\text{F}$ ,  $C_{\text{BIAS}} = 1\text{ }\mu\text{F}$ , unless otherwise noted. Typical values are at  $T_J = +25^{\circ}\text{C}$ . Min/Max values are for  $-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$  unless otherwise noted. (Note 4)

Parameter	Test Conditions		Symbol	Min	Typ	Max	Unit
Delay time	From assertion of V <sub>EN</sub> to output voltage increase	'A' option	t <sub>DELAY</sub>		120		μs
		'C' option			120		
Rise time	V <sub>OUT</sub> rise from 10% to 90% V <sub>OUT(NOM)</sub>	'A' option	t <sub>RISE</sub>		21		
		'C' option			100		
Turn-On Time	From assertion of V <sub>EN</sub> to V <sub>OUT</sub> = 98% V <sub>OUT(NOM)</sub>	'A' option	t <sub>ON</sub>		140		
		'C' option			220		

- Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at  $T_A = 25^{\circ}\text{C}$ . Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
- Dropout voltage is characterized when  $V_{\text{OUT}}$  falls 3% below  $V_{\text{OUT(NOM)}}$ .
- For fixed output voltages below 1.5 V,  $V_{\text{BIAS}}$  dropout does not apply due to a minimum Bias operating voltage of 2.5 V.

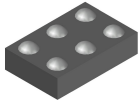
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### ORDERING INFORMATION

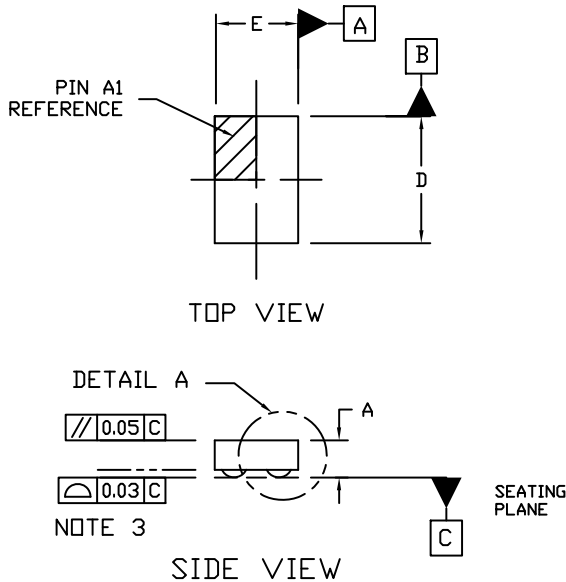
Device	Output Voltage	Marking	Option	Package	Shipping <sup>†</sup>
T30LxPSR132CFCT080T2G (Consult onsemi sales)	0.80 V	TBD	Output Active Discharge, Slow Turn-On Slew Rate	WLCSP6 Case 567ZT (Pb-Free) UBM: 210 $\mu\text{m}$ Bump Type: (98.2% Sn/1.8% Ag) Plate	10,000 / Tape & Reel
T30LxPSR132CFCT120T2G (Consult onsemi sales)	1.20 V	TBD	Output Active Discharge, Slow Turn-On Slew Rate		

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

- To order other package and voltage variants, please contact your **onsemi** sales representative.

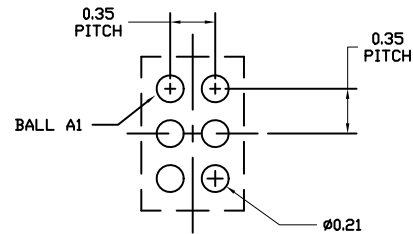
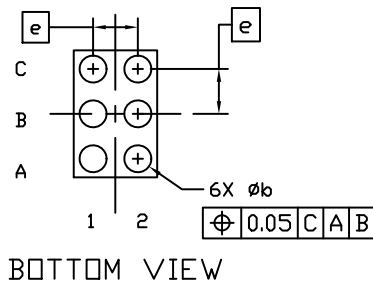
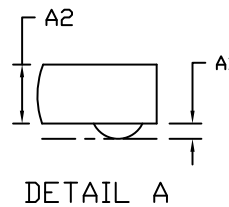

**WLCSP6 0.99x0.65x0.29**  
**CASE 567ZT**  
**ISSUE B**

DATE 21 JAN 2022

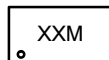

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
4. COPLANARITY APPLIES TO THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. DIMENSION *b* IS MEASURED AT THE MAXIMUM BALL DIAMETER, PARALLEL TO DATUM C.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.250	0.290	0.330
A1	0.040	0.060	0.080
A2	0.23 REF		
b	0.180	0.210	0.240
D	0.940	0.990	1.040
E	0.600	0.650	0.700
e	0.35 BSC		


**RECOMMENDED**  
**MOUNTING FOOTPRINT\***

- \* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC**  
**MARKING DIAGRAM\***


XX = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

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