

Linear Regulator - 300 mA, Market Leading Transient Response Time and Ultra-Low Dropout

Product Preview

T30LMPSR165, T30LAPSR165

The T30LxPSR165 is an ultra-fast linear regulator capable of supplying 300 mA output current from 1.4 V input voltage. The device provides a best-in-class transient response time (1 μ s, typ.) suitable for applications with fast sampling rate. The device features an ultra-low dropout voltage (26 mV at 300 mA) enabling higher efficiency while offering wide output voltage range (1.0 V up to 3.2 V), very low noise and high PSRR for noise sensitive applications. Due to its low quiescent current, the T30LxPSR165 is suitable for battery powered devices such as smartphones and tablets. The device is designed to work with a 1 μ F input and 1 μ F output ceramic capacitor. It is available in ultra-small 0.35P, 0.64 mm x 0.64 mm Chip Scale Package (CSP).

Features

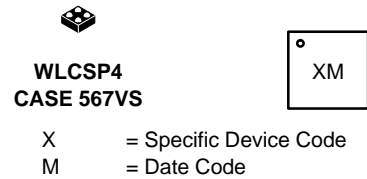
- Market Leading Load Transient Response: 0 to 300 mA in 100 ns
 - ◆ Voltage Undershoot: 37 mV
 - ◆ Settling Time: 1 μ s
- $\pm 1\%$ Accuracy Over Load/Temperature
- Very Low Dropout: 26 mV for 2.85 V @ 300 mA
- High PSRR: Typ. 45 dB at 20 mA, f = 100 kHz
- Operating Input Voltage Range: 1.4 V to 3.3 V
- Available in Fixed Voltage Option: 1.0 V to 3.2 V
- Ultra Low Noise: 16 μ V_{RMS}
- Stable with a 1 μ F eff. Output Capacitance
- Available in WLCSP4 0.64 mm x 0.64 mm x 0.33 mm Package
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

Typical Applications

- Battery-powered Equipment
- Wireless LAN Devices
- Smartphone, Tablets
- Cameras, DVRs, STB and Camcorders

This document contains information on a product under development. onsemi reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



PIN CONNECTIONS

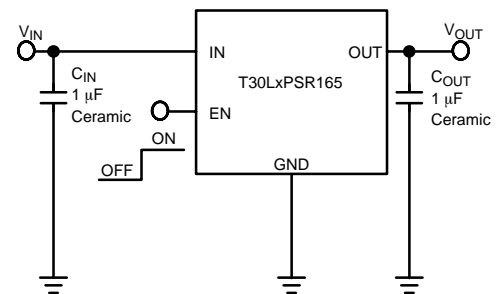
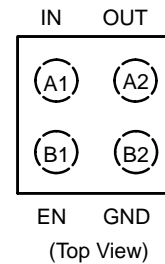


Figure 1. Typical Application Schematic

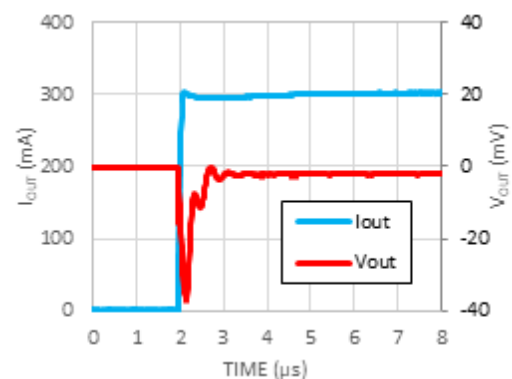


Figure 2. Load Transient Response for Load Step 0 to 300 mA with Rise Time 100 ns

ORDERING INFORMATION

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

T30LMPSR165, T30LAPSR165

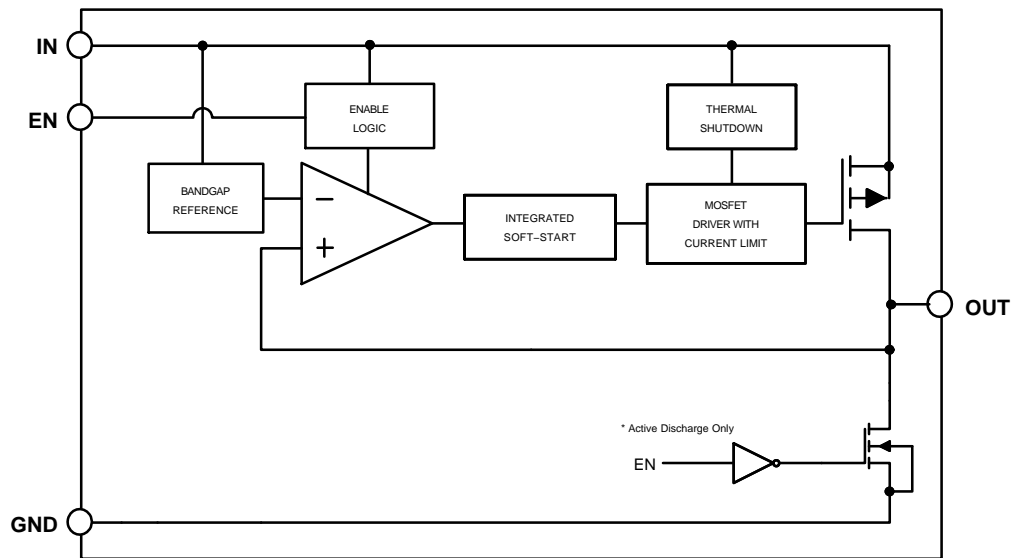


Figure 3. Simplified Schematic Block Diagram

PIN FUNCTION DESCRIPTION

Pin No. WLCSP4	Pin Name	Description
A1	IN	Input voltage supply pin
A2	OUT	Regulated output voltage. The output should be bypassed with small 1 μ F ceramic capacitor.
B1	EN	Chip enable: Applying $V_{EN} < 0.3$ V disables the regulator, Pulling $V_{EN} > 0.825$ V enables the LDO.
B2	GND	Common ground connection

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Notes 1, 3)	V_{IN}	-0.3 to 3.6	V
Output Voltage	V_{OUT}	-0.3 to $V_{IN} + 0.3$, max. 3.6	V
Enable Voltage (Notes 1, 3)	V_{CE}	-0.3 to 3.6	V
Output Short Circuit Duration	t_{SC}	unlimited	s
Maximum Junction Temperature	T_J	150	$^{\circ}$ C
Storage Temperature Range	T_{STG}	-55 to 150	$^{\circ}$ C
ESD Capability, Human Body Model (Note 2)	ESD _{HBM}	2000	V
ESD Capability, Charged Device Model (Note 2)	ESD _{CDM}	1000	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.

- Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
- This device series incorporates ESD protection and is tested by the following methods:
 ESD Human Body Model tested per EIA/JESD22-A114ESD
 Charged Device Model tested per JS-002-2018
 Latchup Current Maximum Rating tested per JEDEC standard: JESD78
- The common grey zones (Device working in grey zone is functional but parameters from ELECTRICAL CHARACTERISTICS table are not guaranteed):
 The range between max operating temperature and max thermal shutdown trigger temperature,
 The range between min operating supply and min POR level,
 The range between max operating supply and abs_max.

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP4 (Note 4), Thermal Resistance, Junction-to-Air	$R_{\theta JA}$	101	$^{\circ}$ C/W

- Measured according to JEDEC board specification. Detailed description of the board can be found in JESD51-7

T30LMPSR165, T30LAPSR165

ELECTRICAL CHARACTERISTICS

($-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$; $V_{IN} = V_{OUT(NOM)} + 0.1\text{ V}$ or **1.4 V**, whichever is greater; $I_{OUT} = 1\text{ mA}$; $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ eff., unless otherwise noted. $V_{EN} = 1\text{ V}$. Typical values are at $T_J = +25^{\circ}\text{C}$ (Note 5))

Parameter	Test Conditions		Symbol	Min	Typ	Max	Unit
Operating Input Voltage			V_{IN}	1.4	–	3.3	V
Output Voltage Accuracy	$I_{OUT} = 1\text{ mA to }300\text{ mA}$	$V_{OUT(NOM)} \leq 1.4\text{ V}$	V_{OUT}	–15	–	+15	mV
		$V_{OUT(NOM)} > 1.4\text{ V}$		–1	–	+1	%
Line Regulation	$V_{OUT(NOM)} + 0.5\text{ V} \leq V_{IN} \leq 3.3\text{ V}, (V_{IN} \geq 1.4\text{ V})$		LineReg	–	0.02	–	%/V
Load Regulation	$I_{OUT} = 1\text{ mA to }300\text{ mA}$		LoadReg	–	0.001	–	%/mA
Dropout Voltage (Note 6)	$V_{OUT(NOM)} = 2.85\text{ V}$	$I_{OUT} = 300\text{ mA}$	V_{DO}	–	26	70	mV
Current Limit	$V_{OUT} = 90\% \times V_{OUT(NOM)}$		I_{CL}	325	570	–	mA
Quiescent Current	$I_{OUT} = 0\text{ mA}$		I_Q	–	240	300	μA
Shutdown Current	$V_{EN} \leq 0.3\text{ V}$	$T_J \leq 85^{\circ}\text{C}$	I_{SHUT}	–	0.01	1	μA
		$T_J \leq 125^{\circ}\text{C}$		–	–	3.5	
EN Pin Threshold Voltage	EN Input Voltage "H"		V_{ENH}	0.825	–	–	V
	EN Input Voltage "L"		V_{ENL}	–	–	0.3	
EN Pull Down Current	$V_{EN} = 3.3\text{ V}$		I_{EN}	–	0.1	0.5	μA
Power Supply Rejection Ratio	$I_{OUT} = 20\text{ mA}$	$f = 100\text{ Hz}$	PSRR	–	75	–	dB
		$f = 1\text{ kHz}$		–	75	–	
		$f = 10\text{ kHz}$		–	60	–	
		$f = 100\text{ kHz}$		–	45	–	
Output Voltage Noise	$f = 10\text{ Hz to }100\text{ kHz}$		V_N	–	16	–	μV_{RMS}
Thermal Shutdown Threshold	Temperature rising		T_{SDH}	–	160	–	$^{\circ}\text{C}$
	Temperature falling		T_{SDL}	–	140	–	$^{\circ}\text{C}$
Active Output Discharge Resistance	$V_{EN} < 0.3\text{ V}$		R_{DIS}	–	280	–	Ω

T30LMPSR165, T30LAPSR165

T30LxPSR165CFCT120T2G CHARACTERISTICS

$-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$; $V_{IN} = 1.4\text{ V}$, $V_{OUT(NOM)} = 1.2\text{ V}$, whichever is greater; $I_{OUT} = 1\text{ mA}$; $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ eff., unless otherwise noted. $V_{EN} = 1\text{ V}$. Typical values are at $T_J = +25^{\circ}\text{C}$ (Note 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Delay Time	From assertion of V_{EN} to output voltage increase	t_{DELAY}	–	120	–	μs
Rise Time	V_{OUT} rise from 5% to 95% $V_{OUT(NOM)}$	t_{RISE}	–	340	–	
Turn-on Time	From assertion of V_{EN} to $V_{OUT} = 95\%$ $V_{OUT(NOM)}$	t_{ON}	–	500	–	

T30LxPSR165CFCT200T2G CHARACTERISTICS

$-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$; $V_{IN} = 2.1\text{ V}$, $V_{OUT(NOM)} = 2.0\text{ V}$, whichever is greater; $I_{OUT} = 1\text{ mA}$; $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ eff., unless otherwise noted. $V_{EN} = 1\text{ V}$. Typical values are at $T_J = +25^{\circ}\text{C}$ (Note 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Delay Time	From assertion of V_{EN} to output voltage increase	t_{DELAY}	–	120	–	μs
Rise Time	V_{OUT} rise from 5% to 95% $V_{OUT(NOM)}$	t_{RISE}	–	610	–	
Turn-on Time	From assertion of V_{EN} to $V_{OUT} = 95\%$ $V_{OUT(NOM)}$	t_{ON}	–	790	–	

T30LxPSR165CFCT285T2G CHARACTERISTICS

$-40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$; $V_{IN} = 2.95\text{ V}$, $V_{OUT(NOM)} = 2.85\text{ V}$, whichever is greater; $I_{OUT} = 1\text{ mA}$; $C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ eff., unless otherwise noted. $V_{EN} = 1\text{ V}$. Typical values are at $T_J = +25^{\circ}\text{C}$ (Note 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Delay Time	From assertion of V_{EN} to output voltage increase	t_{DELAY}	–	120	–	μs
Rise Time	V_{OUT} rise from 5% to 95% $V_{OUT(NOM)}$	t_{RISE}	–	820	–	
Turn-on Time	From assertion of V_{EN} to $V_{OUT} = 95\%$ $V_{OUT(NOM)}$	t_{ON}	–	1000	–	

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.

- 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_{OUT} falls about 3% below $V_{OUT(NOM)}$.

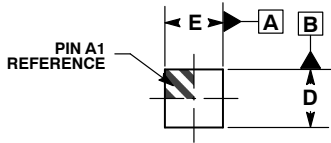
ORDERING INFORMATION

Device	Nominal Output Voltage	Marking	Rotation	Description	Package	Shipping [†]
T30LxPSR165CFCT120T2G (Consult onsemi sales)	1.20 V	TBD	TBD	300 mA, Active Discharge	WLCSP4 CASE 567VS (Pb-Free)	5000 or 10000 / Tape & Reel
T30LxPSR165CFCT200T2G (Consult onsemi sales)	2.00 V	TBD	TBD			
T30LxPSR165CFCT285T2G (Consult onsemi sales)	2.85 V	TBD	TBD			

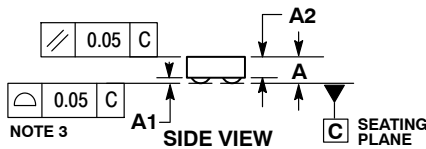
SCALE 4:1

WLCSP4, 0.64x0.64x0.33
CASE 567VS
ISSUE O

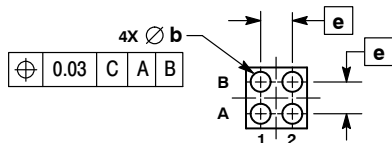
DATE 25 JAN 2018



TOP VIEW

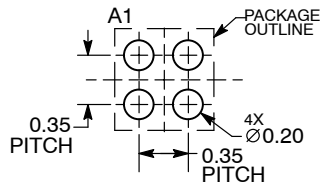


SIDE VIEW



BOTTOM VIEW

RECOMMENDED
SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	---	---	0.33
A1	0.04	0.06	0.08
A2	0.23 REF		
b	0.180	0.200	0.220
D	0.610	0.640	0.670
E	0.610	0.640	0.670
e	0.35 BSC		

GENERIC
MARKING DIAGRAM*



X = Specific Device Code
M = Month

*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.

DOCUMENT NUMBER:	98AON82946G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	WLCSP4, 0.64X0.64X0.33	PAGE 1 OF 1

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales