

# 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  $\mu$ 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  $\mu$ F input and 1  $\mu$ 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  $\mu$ 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  $\mu$ V<sub>RMS</sub>
- Stable with a 1  $\mu$ 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



WLCSP4  
CASE 567VS



X = Specific Device Code  
M = Date Code

#### PIN CONNECTIONS

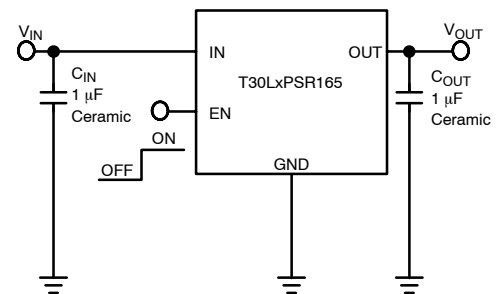
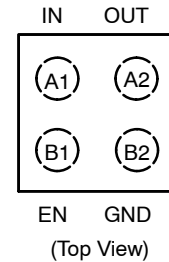


Figure 1. Typical Application Schematic

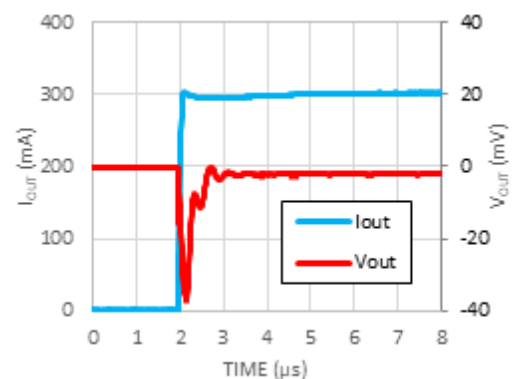


Figure 2. Load Transient Response for  
C<sub>OUT</sub> 1  $\mu$ F and Load Step 0 to 300 mA with  
Rise Time 100 ns

#### ORDERING INFORMATION

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

## T30LMPSR165, T30LAPSR165

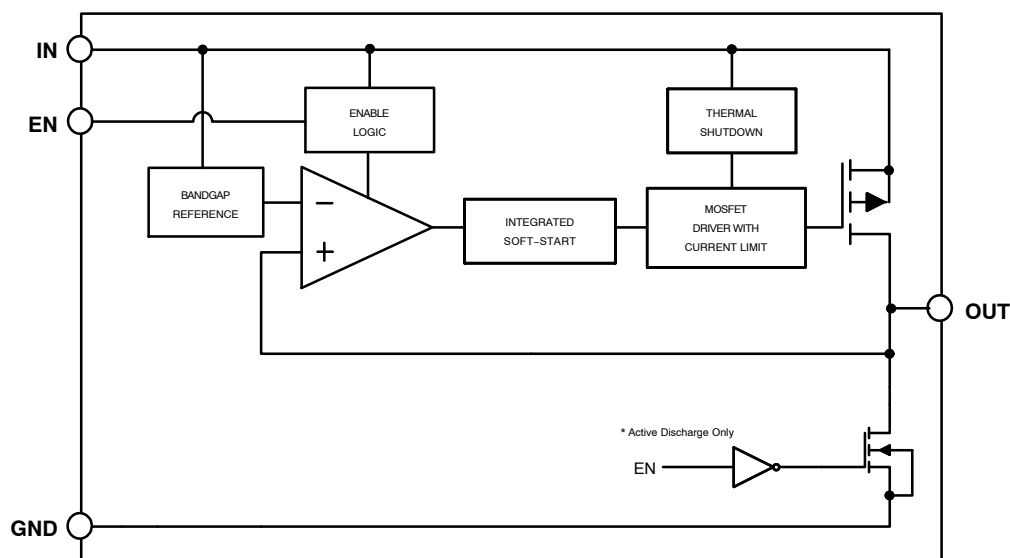


Figure 3. Simplified Schematic Block Diagram

### 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 $\mu$ 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 <sub>HBM</sub>	2000	V
ESD Capability, Charged Device Model (Note 2)	ESD <sub>CDM</sub>	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	$\mu\text{A}$
Shutdown Current	$V_{EN} \leq 0.3\text{ V}$	$T_J \leq 85^{\circ}\text{C}$	$I_{SHUT}$	–	0.01	1	$\mu\text{A}$
		$T_J \leq 125^{\circ}\text{C}$		–	–	3.5	
EN Pin Threshold Voltage	EN Input Voltage “H”		$V_{ENH}$	0.77	–	–	V
	EN Input Voltage “L”	$T_J \leq 85^{\circ}\text{C}$	$V_{ENL}$	–	–	0.325	
		$T_J \leq 125^{\circ}\text{C}$		–	–	0.285	
EN Pull Down Current	$V_{EN} = 3.3\text{ V}$		$I_{EN}$	–	0.1	0.5	$\mu\text{A}$
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	–	$\mu\text{V}_{RMS}$
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	–	$\Omega$

## 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	–	$\mu\text{s}$
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	–	$\mu\text{s}$
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	–	$\mu\text{s}$
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

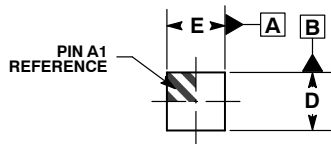
Device	Nominal Output Voltage	Marking	Rotation	Description	Package	Shipping <sup>†</sup>
T30LMPSR165CFCT120T2G (Consult <b>onsemi</b> sales)	1.20 V	TBD	TBD	300 mA, Active Discharge	WLCSP4 CASE 567VS (Pb-Free)	5000 or 10000 / Tape & Reel
T30LMPSR165CFCT200T2G (Consult <b>onsemi</b> sales)	2.00 V	TBD	TBD			
T30LMPSR165CFCT285T2G (Consult <b>onsemi</b> sales)	2.85 V	TBD	TBD			



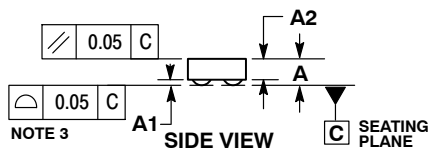
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WLCSP4, 0.64x0.64x0.33  
CASE 567VS  
ISSUE O

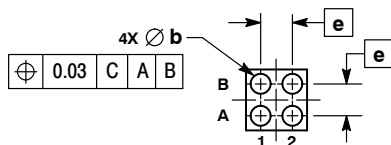
DATE 25 JAN 2018



TOP VIEW

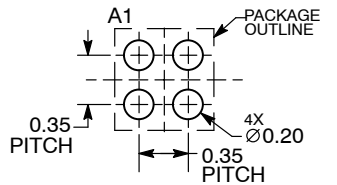


SIDE VIEW



BOTTOM VIEW

RECOMMENDED  
SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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.

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

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DESCRIPTION:	WLCSP4, 0.64X0.64X0.33	PAGE 1 OF 1

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