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

Preliminary Document

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 μs, typ.) suitable for applications with fast sampling rate. The devices 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 μF input and 1 μF 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 μs
- ±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 μV_{RMS}
- Stable with a 1 μF 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

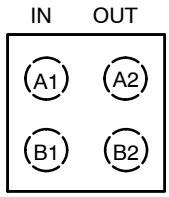
This Preliminary document is for informational purposes only. **onsemi** may update or withdraw it without notice. Content and referenced products are under development and subject to change.

MARKING DIAGRAM

WLCSP4
CASE 567VS

X = Specific Device Code
M = Date Code

PIN CONNECTIONS



(Top View)

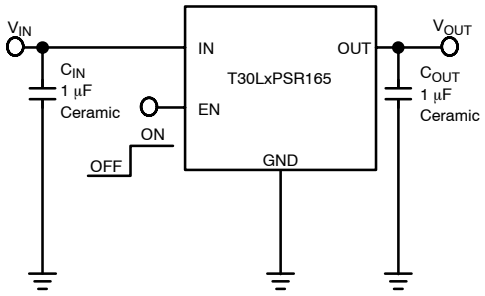


Figure 1. Typical Application Schematic

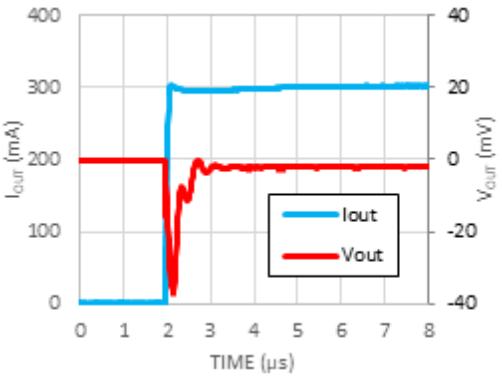


Figure 2. Load Transient Response for C_{OUT} 1 μF and Load Step 0 to 300 mA with Rise Time 100 ns

ORDERING INFORMATION

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

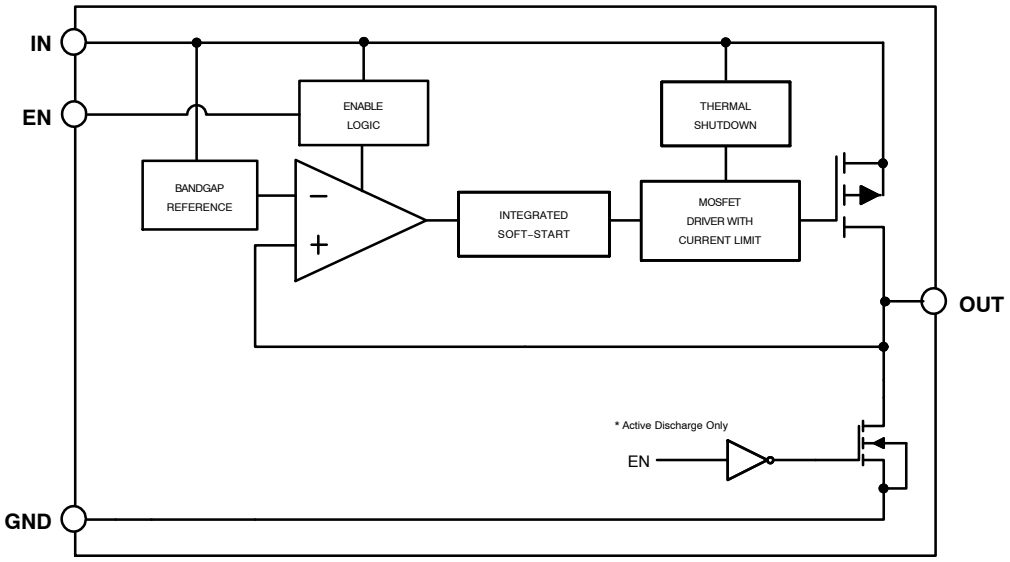


Figure 3. Simplified Schematic Block Diagram

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 μF 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	°C
Storage Temperature Range	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}	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.

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. 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
3. 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	°C/W

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

ELECTRICAL CHARACTERISTICS

($-40°C \le T_J \le 125°C$; $V_{IN} = V_{OUT(NOM)}$ + 0.1 V or **1.4 V**, whichever is greater; I_{OUT} = 1 mA; $C_{IN} = C_{OUT}$ = 1 μF eff., unless otherwise noted. V_{EN} = 1 V. Typical values are at T_J = +25°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 mA to 300 mA	$V_{OUT(NOM)} \le 1.4$ V	V_{OUT}	−15	–	+15	mV
		$V_{OUT(NOM)} > 1.4$ V		−1	–	+1	%
Line Regulation	$V_{OUT(NOM)}$ + 0.5 V ≤ V_{IN} ≤ 3.3 V, ($V_{IN} \ge 1.4$ V)		LineReg	–	0.02	–	%/V
Load Regulation	I_{OUT} = 1 mA to 300 mA		LoadReg	–	0.001	–	%/mA
Dropout Voltage (Note 6)	$V_{OUT(NOM)}$ = 2.85 V	I_{OUT} = 300 mA	V_{DO}	–	26	70	mV
Current Limit	V_{OUT} = 90% x $V_{OUT(NOM)}$		I_{CL}	325	570	–	mA
Quiescent Current	I_{OUT} = 0 mA		I_Q	–	240	300	μA
Shutdown Current	$V_{EN} \le 0.285$ V	$T_J \le 85°C$	I_{SHUT}	–	0.01	1	μA
		$T_J \le 125°C$		–	–	3.5	
EN Pin Threshold Voltage	EN Input Voltage “H”		V_{ENH}	0.77	–	–	V
	EN Input Voltage “L”	$T_J \le 85°C$	V_{ENL}	–	–	0.325	
		$T_J \le 125°C$		–	–	0.285	
EN Pull Down Current	V_{EN} = 3.3 V		I_{EN}	–	0.1	0.5	μA
Power Supply Rejection Ratio	I_{OUT} = 20 mA	f = 100 Hz	PSRR	–	70	–	dB
		f = 1 kHz		–	70	–	
		f = 10 kHz		–	65	–	
		f = 100 kHz		–	50	–	
Output Voltage Noise	f = 10 Hz to 100 kHz		V_N	–	16	–	μV_{RMS}
Thermal Shutdown Threshold	Temperature rising		T_{SDH}	–	160	–	°C
	Temperature falling		T_{SDL}	–	140	–	°C
Active Output Discharge Resistance	$V_{EN} < 0.285$ V		R_{DIS}	–	280	–	Ω

T30LxPSR165CFCT120T2G CHARACTERISTICS

$-40°C \le T_J \le 125°C$; V_{IN} = 1.4 V, $V_{OUT(NOM)}$ = 1.2 V, whichever is greater; I_{OUT} = 1 mA; $C_{IN} = C_{OUT}$ = 1 μF eff., unless otherwise noted. V_{EN} = 1 V. Typical values are at T_J = +25°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

$-40°C \le T_J \le 125°C$; V_{IN} = 2.1 V, $V_{OUT(NOM)}$ = 2.0 V, whichever is greater; I_{OUT} = 1 mA; $C_{IN} = C_{OUT}$ = 1 μF eff., unless otherwise noted. V_{EN} = 1 V. Typical values are at T_J = +25°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

$-40°C \le T_J \le 125°C$; V_{IN} = 2.95 V, $V_{OUT(NOM)}$ = 2.85 V, whichever is greater; I_{OUT} = 1 mA; $C_{IN} = C_{OUT}$ = 1 μF eff., unless otherwise noted. V_{EN} = 1 V. Typical values are at T_J = +25°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.

5. Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at T_A = 25°C. Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
6. Dropout voltage is characterized when V_{OUT} falls about 3% below $V_{OUT(NOM)}$.

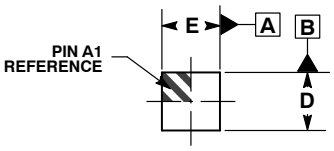
ORDERING INFORMATION

Device	Nominal Output Voltage	Marking	Rotation	Description	Package	Shipping†
T30LMPSR165CFCT110T2G (Consult **onsemi** sales)	1.10 V	TBD	TBD	300 mA LDO, with Active Discharge Feature	WLCSP4 CASE 567VS (Pb-Free) UBM: 200 μm Bump type: Sn Plate	10000 / Tape & Reel
T30LMPSR165CFCT120T2G (Consult **onsemi** sales)	1.20 V	U	0°			
T30LMPSR165CFCT180T2G (Consult **onsemi** sales)	1.80 V	TBD	TBD			
T30LMPSR165CFCT200T2G (Consult **onsemi** sales)	2.00 V	L	0°			
T30LMPSR165CFCT280T2G (Consult **onsemi** sales)	2.80 V	TBD	TBD			
T30LMPSR165CFCT285T2G (Consult **onsemi** sales)	2.85 V	Y	0°			

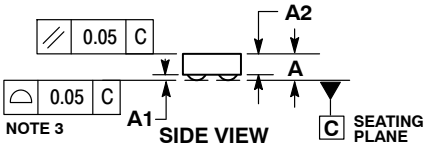
WLCSP4, 0.64x0.64x0.33
CASE 567VS
ISSUE O

DATE 25 JAN 2018

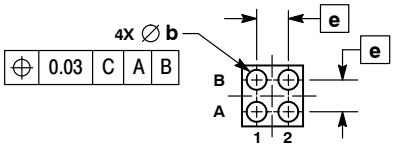
SCALE 4:1



TOP VIEW

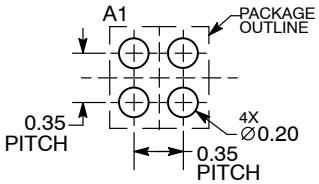


SIDE VIEW



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.

	MILLIMETERS		
DIM	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.

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

ADDITIONAL INFORMATION

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