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

T30LMPSR165

The T30LMPSR165 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 (0.8 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 T30LMPSR165 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: 100 µA to 300 mA in 0.1 µs
  - Voltage Undershoot: 30 mV
  - Settling Time: 0.8 µs
- ±1% Accuracy Over Load/Temperature
- Very Low Dropout: 26 mV for 2.85 V @ 300 mA
- High PSRR: Typ. 50 dB at 20 mA, f = 100 kHz
- Operating Input Voltage Range: 1.4 V to 3.6 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

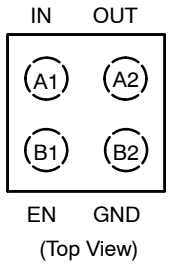
- Battery-powered Equipment
- Wireless LAN Devices
- Smartphone, Tablets
- Cameras, DVRs, STB and Camcorders

WLCSP4
CASE 567VS

MARKING DIAGRAM

X = Specific Device Code
M = Date Code

PIN CONNECTIONS



(Top View)

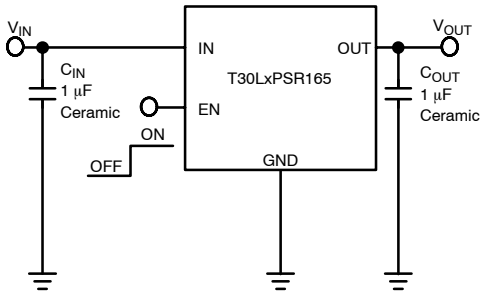


Figure 1. Typical Application Schematic

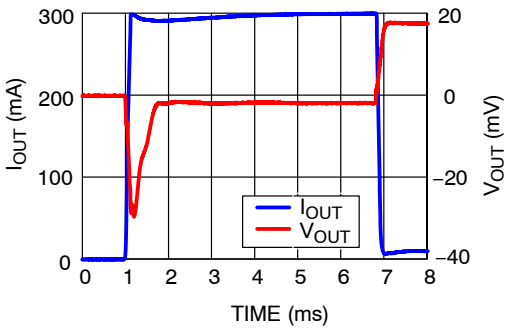


Figure 2. Load Transient Response for C_{OUT} 1 µF and Load Step 100 µA to 300 mA with Rise Time 0.1 µs

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 13 of this data sheet.

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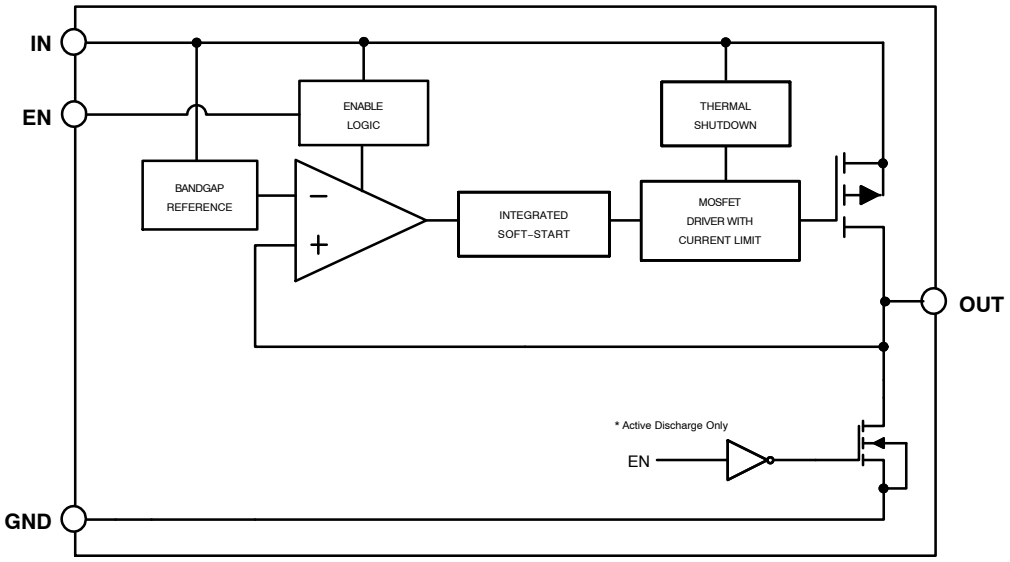

Figure 3. Simplified Schematic Block Diagram

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} < 0.285 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 (Note 1)	V_{IN}	−0.3 to 4	V
Output Voltage	V_{OUT}	−0.3 to (V_{IN} + 0.3) ≤ 4, whichever is lower	V
Enable Voltage	V_{EN}	−0.3 to 4	V
Maximum Junction Temperature	$T_{J(max)}$	150	°C
Storage Temperature Range	T_{STG}	−65 to 150	°C
ESD Capability, Human Body Model (Note 2)	ESD_{HBM}	2	kV
ESD Capability, Charged Device Model (Note 2)	ESD_{CDM}	1	kV

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, RECOMMENDED OPERATING RANGES 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-A114
   ESD Charged Device Model tested per JS-002-2018
   Latchup Current Maximum Rating: ≤150 mA per JEDEC standard: JESD78

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP4 (Note 3), Thermal Resistance, Junction-to-Air	$R_{\theta JA}$	101	°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^2 copper area.

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RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Unit
Input Voltage (Note 4)	V_{IN}	1.4	3.6	V
Enable Voltage	V_{EN}	0	3.6	V
Input Capacitance (Note 5)	C_{IN}	1		μF
Output Capacitance (Note 5)	C_{OUT}	1	47	μF
Junction Temperature	T_J	−40	125	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

4. Minimum V_{IN} = 1.4 V or (V_{OUT} + V_{DO}), whichever is higher.
5. The specified value refers to the effective capacitance, accounting for all relevant derating factors, including DC bias, temperature, and capacitor tolerance.

ELECTRICAL CHARACTERISTICS

(−40 °C ≤ T_J ≤ 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 6))

Parameter	Test Conditions		Symbol	Min	Typ	Max	Unit
Operating Input Voltage			V_{IN}	1.4		3.6	V
Output Voltage Accuracy	I_{OUT} = 1 mA to 300 mA	$V_{OUT(NOM)}$ ≤ 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} ≤ 3.6 V, (V_{IN} ≥ 1.4 V)		LineReg		0.02		%/V
Load Regulation	I_{OUT} = 1 mA to 300 mA		LoadReg		0.001		%/mA
Dropout Voltage (Note 7)	$V_{OUT(NOM)}$ = 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} ≤ 0.285 V	T_J ≤ 85 °C	I_{SHUT}		0.01	1	μA
		T_J ≤ 125 °C				3.5	
EN Pin Threshold Voltage	EN Input Voltage “H”		V_{ENH}	0.77			V
	EN Input Voltage “L”	T_J ≤ 85 °C	V_{ENL}			0.325	
		T_J ≤ 125 °C				0.285	
EN Pull Down Current	V_{EN} = 3.6 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

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.

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T30LMPSR165CFCT120T2G 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 6)

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		

T30LMPSR165CFCT200T2G 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 6)

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		

T30LMPSR165CFCT285T2G 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 6)

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.

6. 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.
7. Dropout voltage is characterized when V_{OUT} falls about 3% below $V_{OUT(NOM)}$.

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

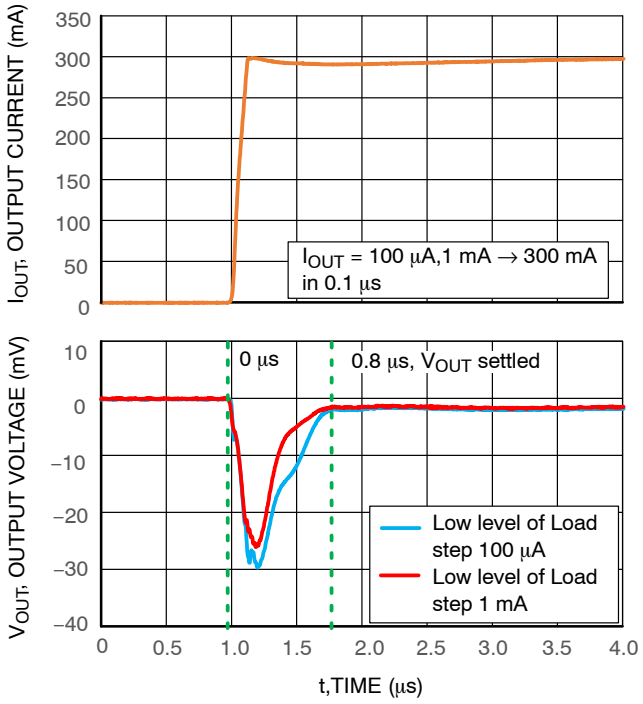

Figure 4. Load Transient Response for 0.1 μs Edge and Different Low Level of Load Step

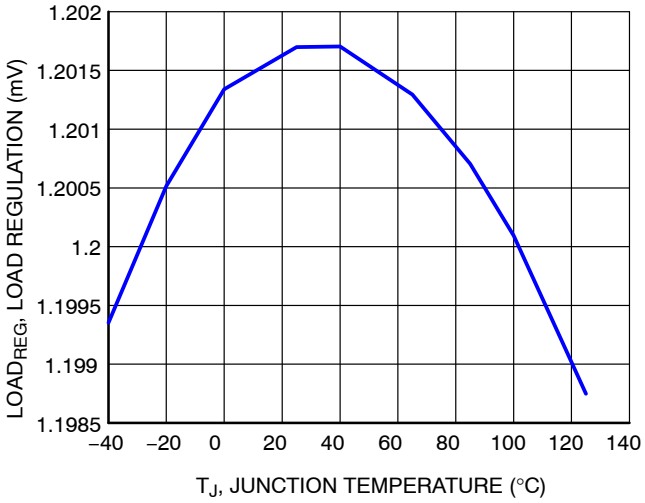

Figure 5. Output Voltage vs. Temperature – $V_{OUT(NOM)}$ = 1.2 V

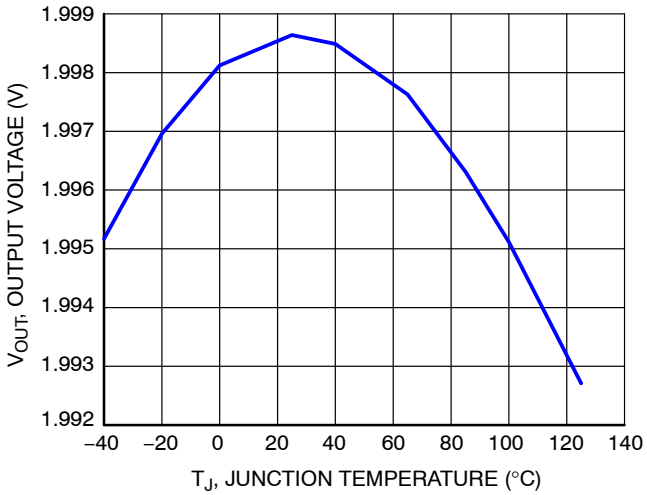

Figure 6. Output Voltage vs. Temperature – $V_{OUT(NOM)}$ = 2.0 V

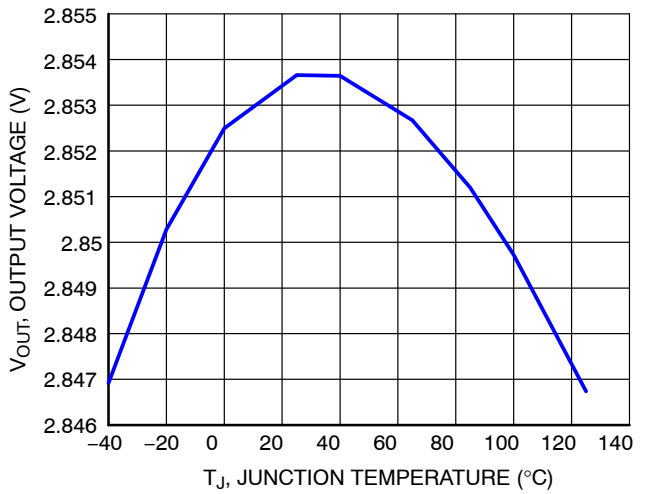

Figure 7. Output Voltage vs. Temperature – $V_{OUT(NOM)}$ = 2.85 V

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

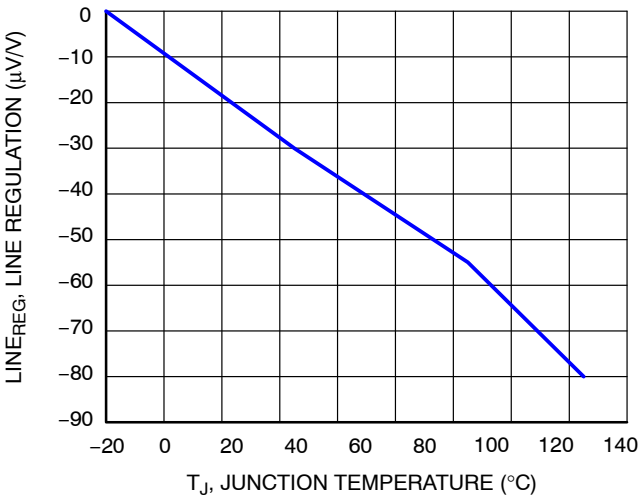

Figure 8. Line Regulation vs. Temperature

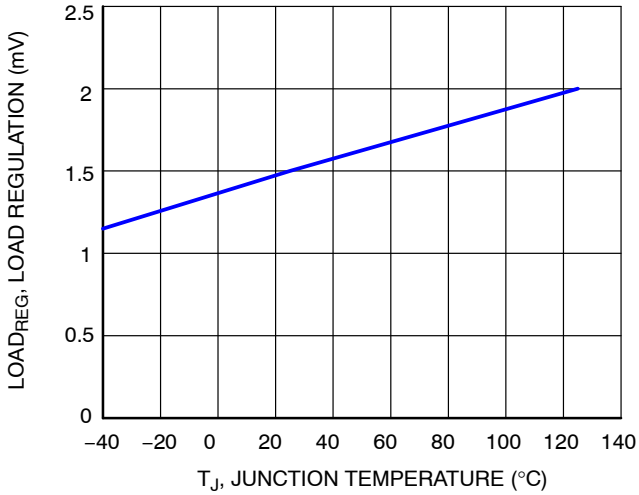

Figure 9. Load Regulation vs. Temperature

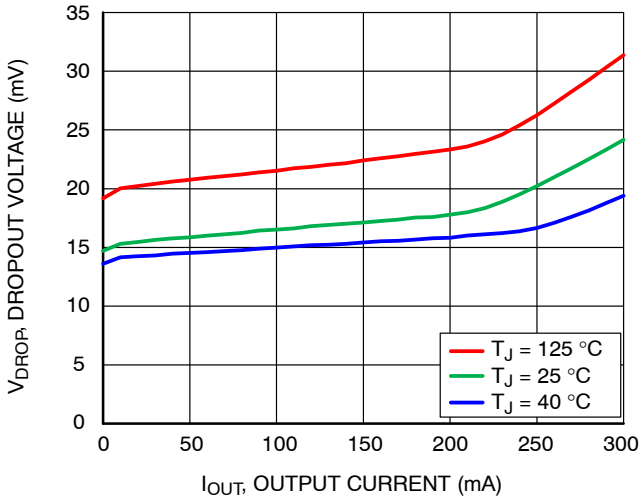

Figure 10. Dropout Voltage vs. Output Current – $V_{OUT(NOM)}$ = 2.0 V

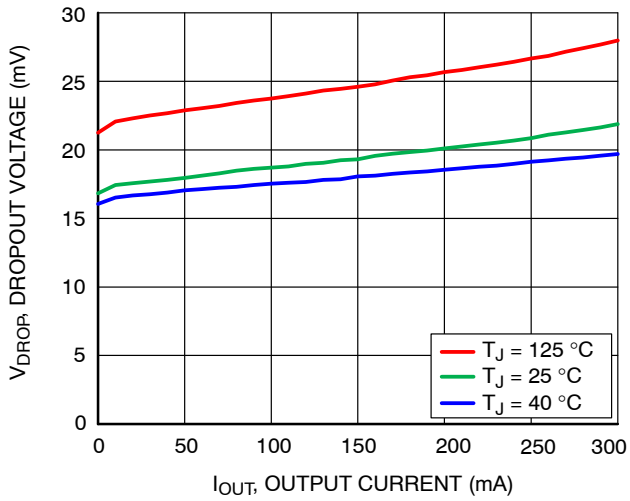

Figure 11. Dropout Voltage vs. Output Current – $V_{OUT(NOM)}$ = 2.85 V

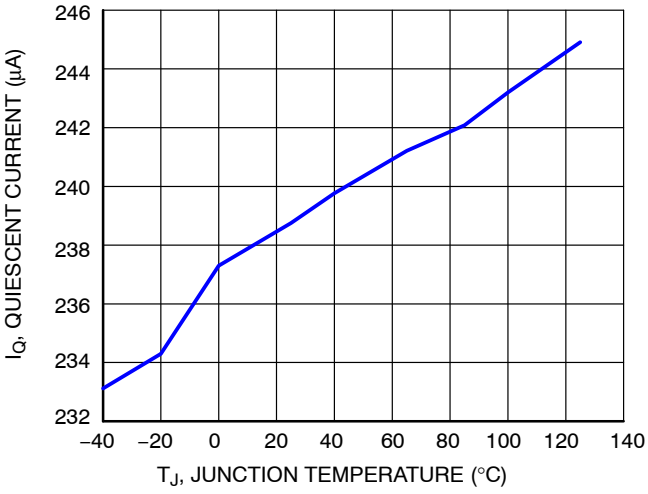

Figure 12. Quiescent Current vs. Temperature

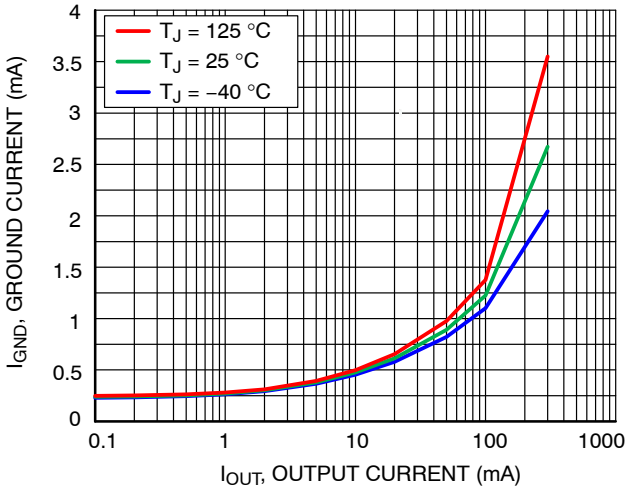

Figure 13. Current Limit and Short-Circuit Current vs. Temperature

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

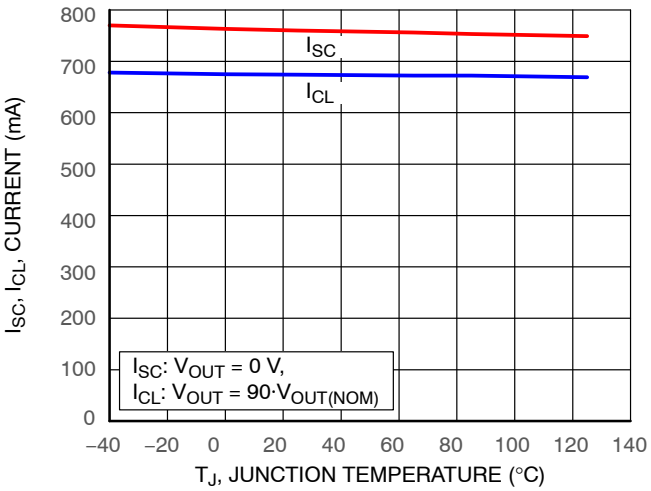

Figure 14. Limit Current and Short-Circuit Current vs. Temperature

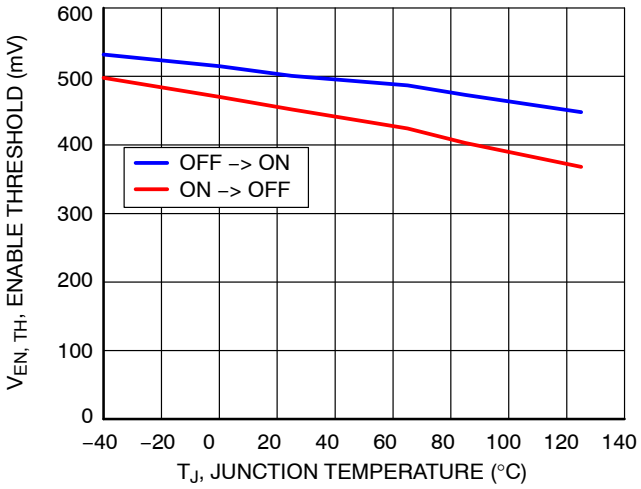

Figure 15. Enable Threshold vs. Temperature

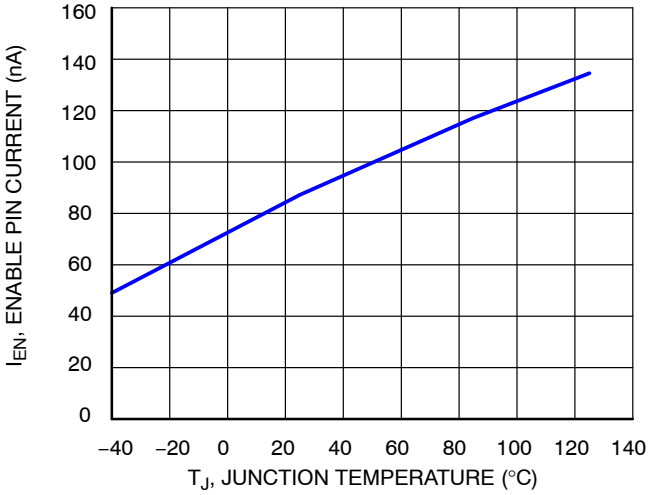

Figure 16. Enable Pin current vs. Temperature

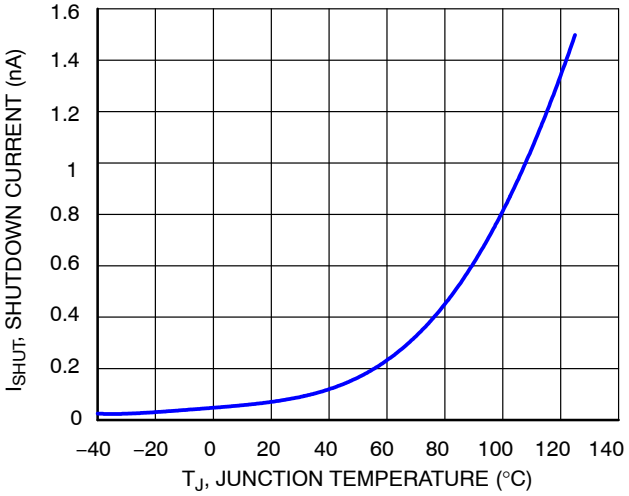

Figure 17. Shutdown Current vs. Temperature

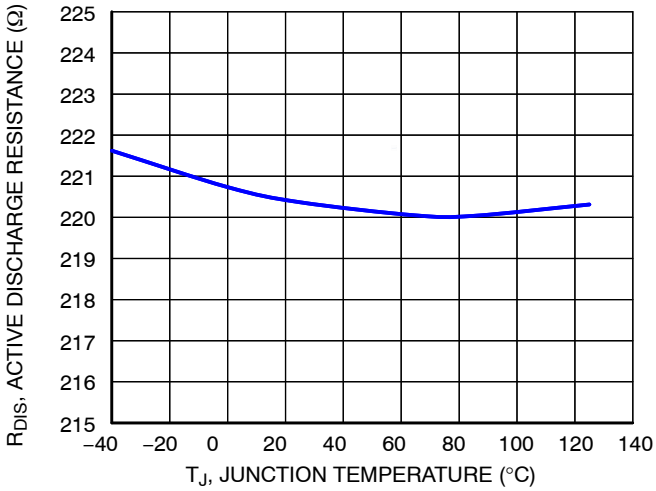

Figure 18. Active Discharge Resistance vs. Temperature

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

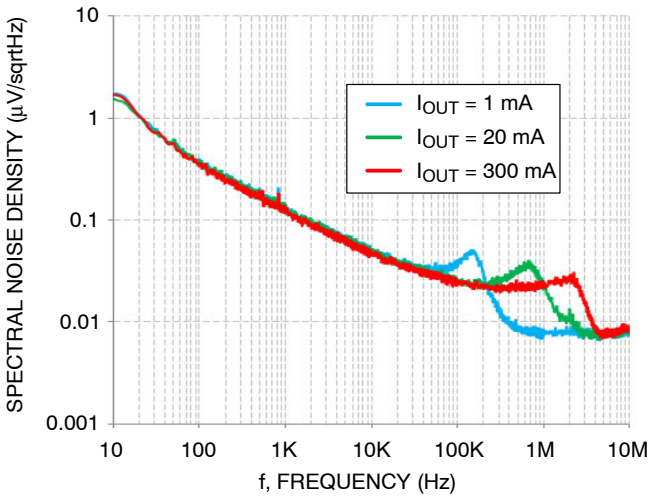

Figure 19. Spectral Noise Density vs. Frequency for Different I_{OUT}

I_{OUT} (mA)	Output Noise (μV_{RMS})	
	10 Hz – 100 kHz	100 Hz – 100 kHz
1	15.6	14.0
20	14.5	13.0
300	14.1	12.6

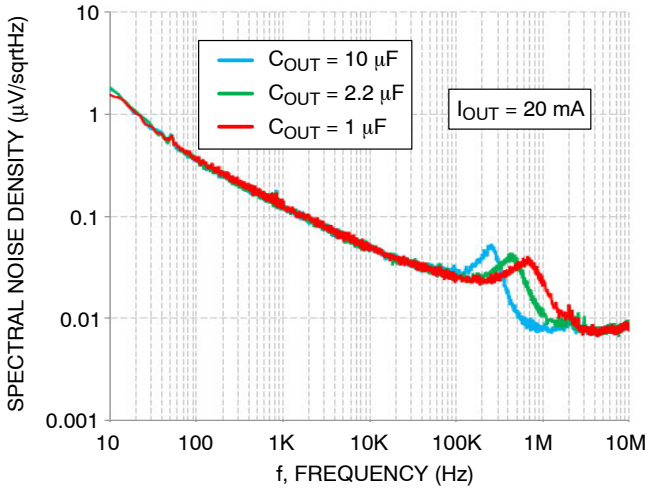

Figure 20. Spectral Noise Density vs. Frequency for Different C_{OUT}

C_{OUT} (μF)	RMS Output Noise (μV)	
	10 Hz – 100 kHz	100 Hz – 100 kHz
1	14.5	13.0
2.2	14.5	13.0
10	14.6	13.0

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

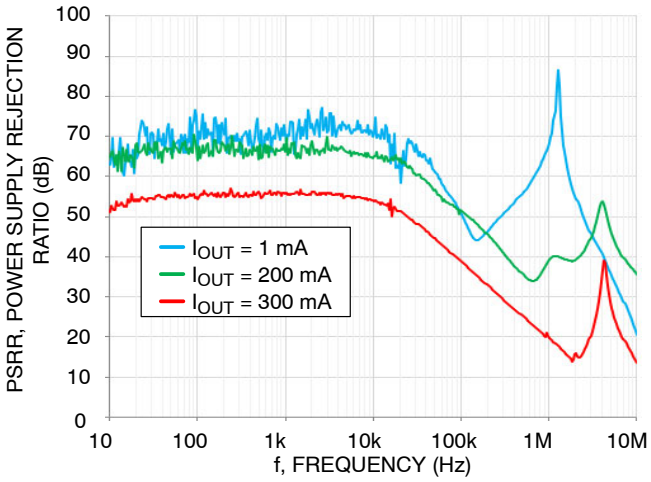

Figure 21. PSRR vs. Frequency for Different I_{OUT}

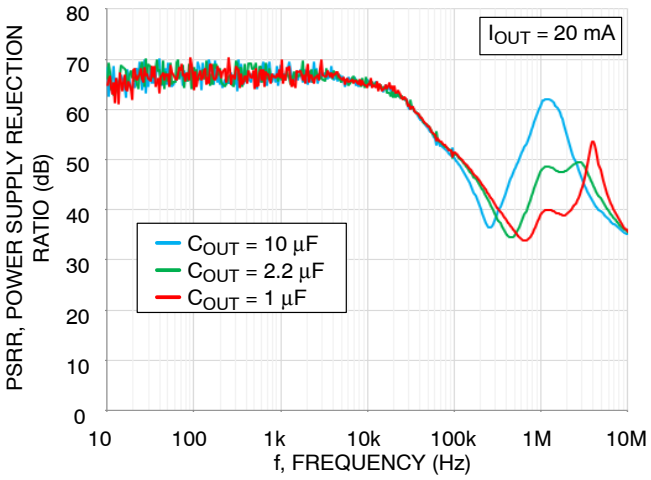

Figure 22. PSRR vs. Frequency for Different C_{OUT}

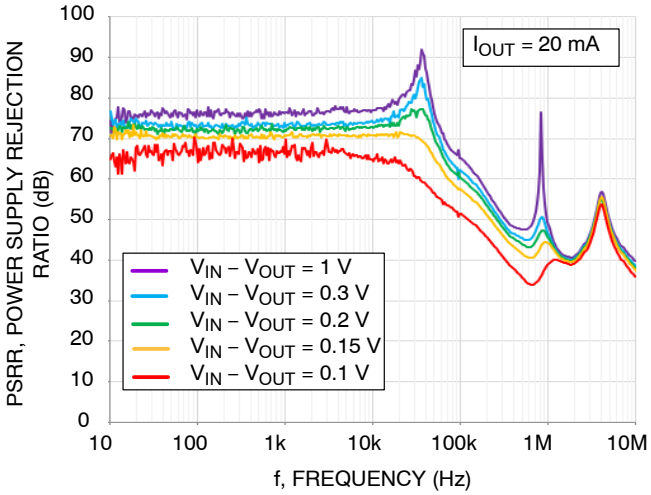

Figure 23. PSRR vs. Frequency – $V_{OUT(NOM)}$ = 2.85 V

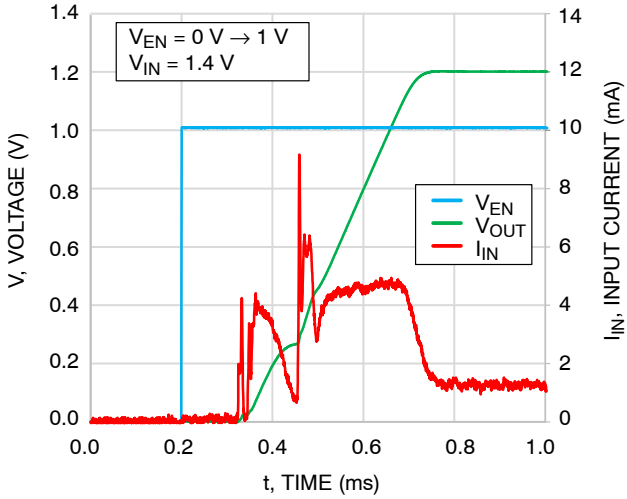

Figure 24. Enable Transient Response – $V_{OUT(NOM)}$ = 1.2 V

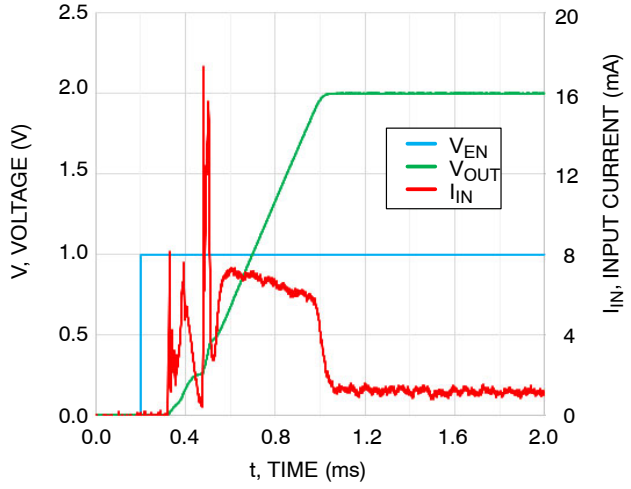

Figure 25. Enable Transient Response – $V_{OUT(NOM)}$ = 2.0 V

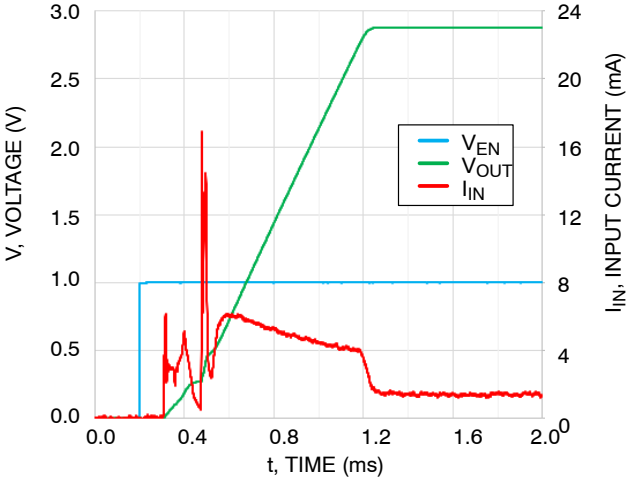

Figure 26. Enable Transient Response – $V_{OUT(NOM)}$ = 2.85 V

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

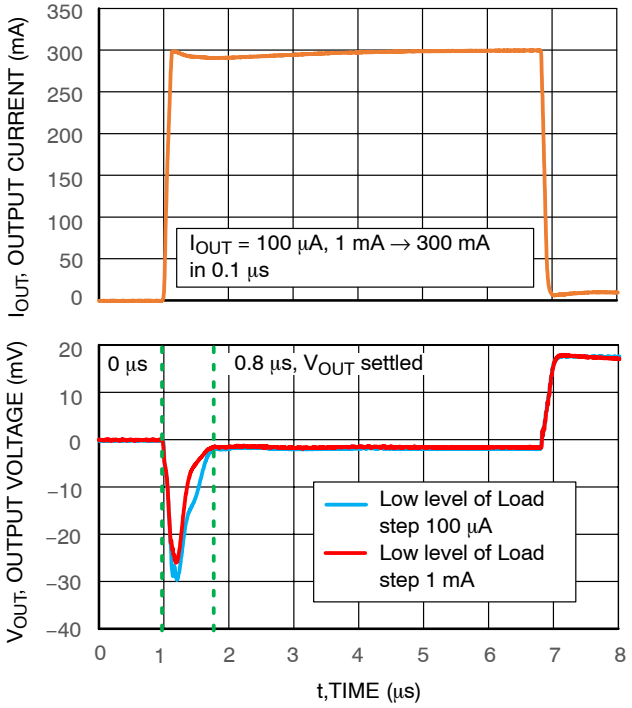

Figure 27. Load Transient Response for 0.1 μs Edge and Different Low Level of Load Step

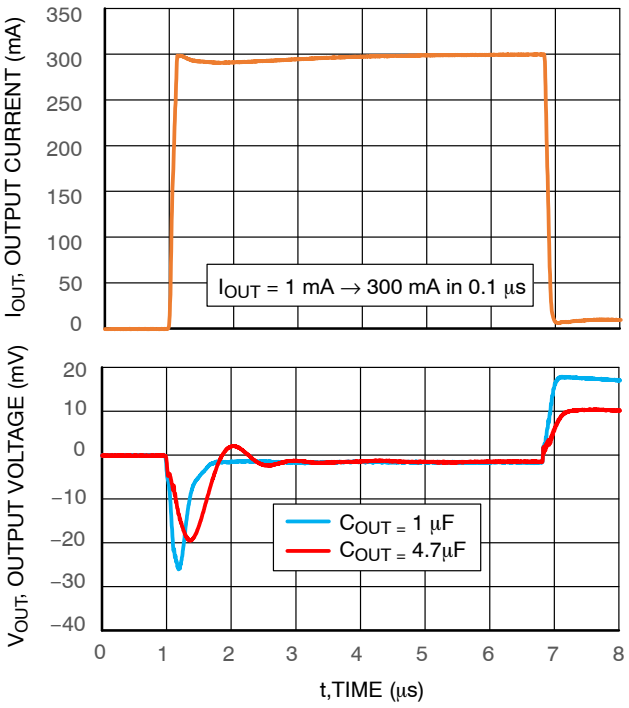

Figure 28. Load Transient Response for 0.1 μs Edge and Different C_{OUT}

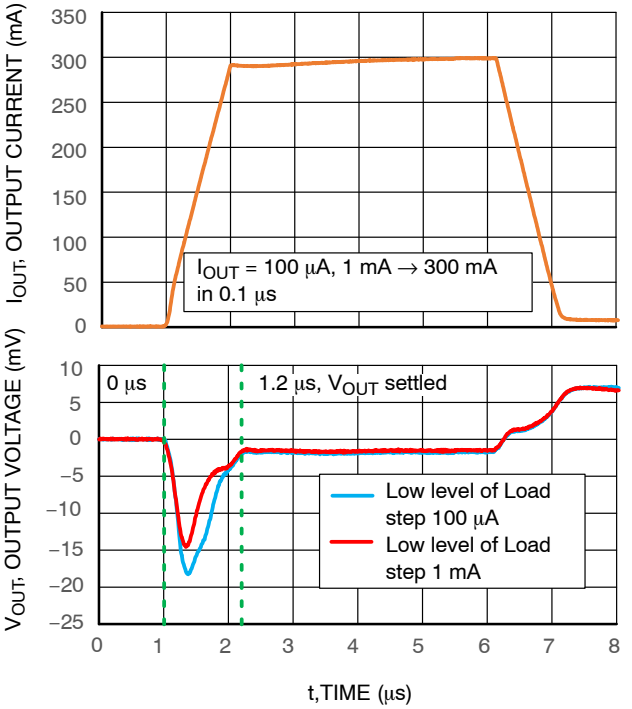

Figure 29. Load Transient Response for 1 μs Edge and Different Low Level of Load Step

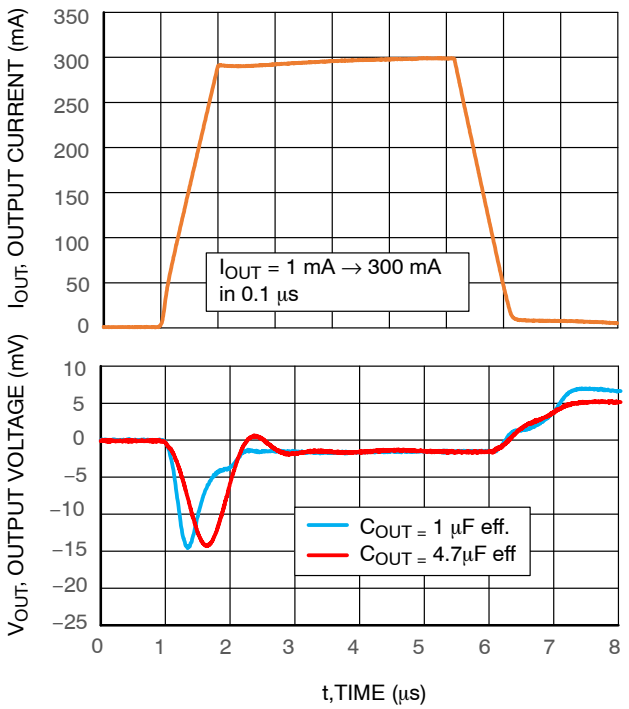

Figure 30. Line Transient Response for 1 μs Edge and Different C_{OUT}

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TYPICAL CHARACTERISTICS

T_J = 25 °C; V_{IN} = $V_{OUT(NOM)}$ + 0.1 V, whichever is greater, I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF eff., unless otherwise noted. V_{EN} = 1.0 V

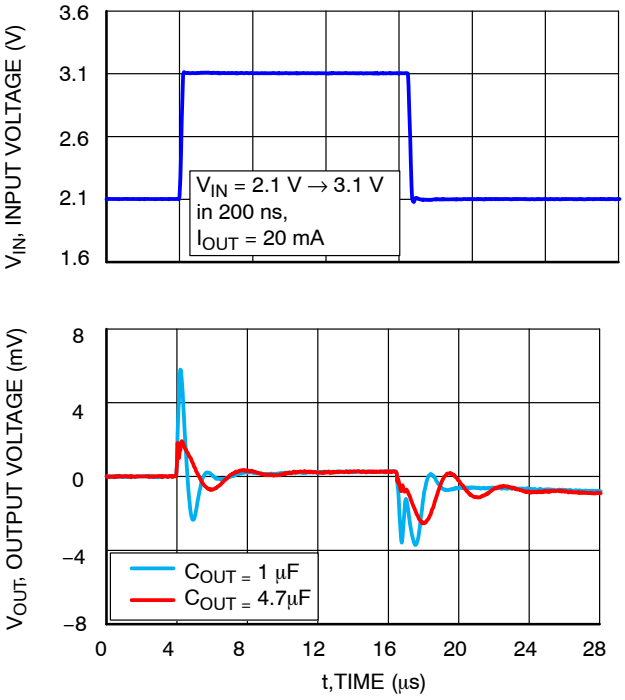

Figure 31. Line Transient Response for 0.2 μs Edge and Different C_{OUT}

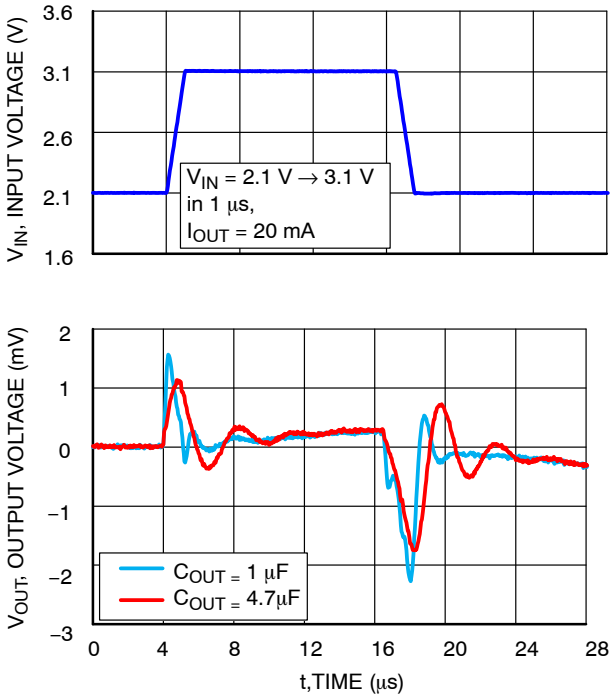

Figure 32. Line Transient Response for 1 μs Edge and Different C_{OUT}

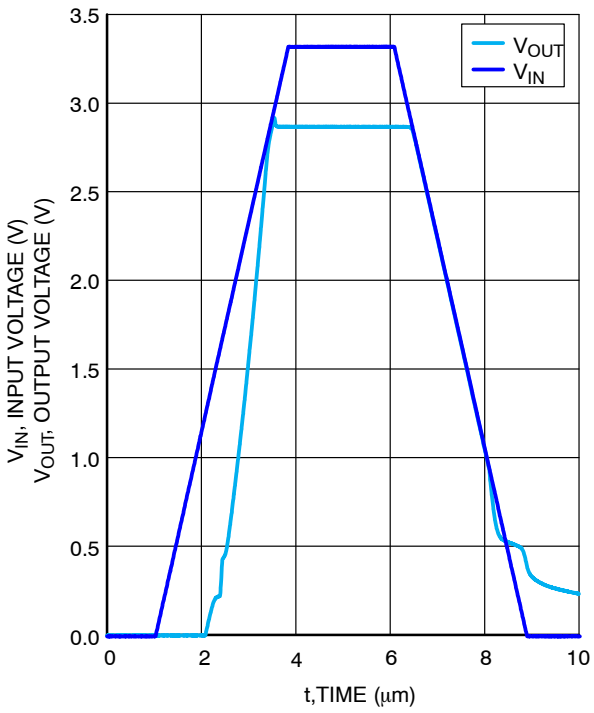

Figure 33. Turn On/Off – Slow Rising – $V_{OUT(NOM)}$ = 2.85 V

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APPLICATIONS INFORMATION

General

The T30LMPSR165 is an ultra-fast transient 300 mA low dropout regulator designed to meet the requirements of low voltage RF applications and high performance analog circuits. The T30LMPSR165 device provides excellent dynamic response, very high PSRR and low noise. In connection with low quiescent current this device is well suitable for battery powered application such as cell phones, tablets and other. The T30LMPSR165 is fully protected in case of current overload, output short circuit and overheating.

Input Capacitor Selection (C_{IN})

Input capacitor connected as close as possible is necessary for ensure device stability. The X7R or X5R capacitor should be used for reliable performance over temperature range. The value of the input capacitor should be 0.75 μF or greater to ensure the best dynamic performance. This capacitor will provide a low impedance path for unwanted AC signals or noise modulated onto constant input voltage. There is no requirement for the ESR of the input capacitor but it is recommended to use ceramic capacitors for their low ESR and ESL. A good input capacitor will limit the influence of input trace inductance and source resistance during sudden load current changes.

Output Capacitor Selection (C_{OUT})

The T30LMPSR165 requires an output capacitor connected as close as possible to the output pin of the regulator. The recommended capacitor value is 1 μF and X7R or X5R dielectric due to its low capacitance variations over the specified temperature range. The T30LMPSR165 is designed to remain stable with minimum effective capacitance of 0.6 μF to account for changes with temperature, DC bias and package size. Especially for small package size capacitors such as 0201 the effective capacitance drops rapidly with the applied DC bias. Please refer to Figure 34.

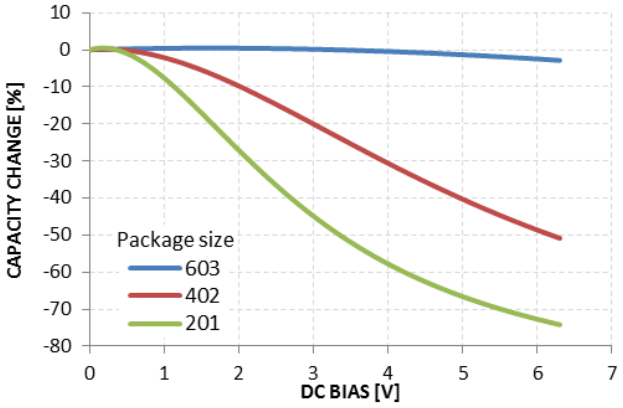

Figure 34. Capacity vs DC Bias Voltage

There is no requirement for the minimum value of Equivalent Series Resistance (ESR) for the C_{OUT}. Larger output capacitors and lower ESR could improve the load transient response or high frequency PSRR. It is not recommended to use tantalum capacitors on the output due to their large ESR. The equivalent series resistance of tantalum capacitors is also strongly dependent on the temperature, increasing at low temperature.

Enable Operation

The T30LMPSR165 uses the EN pin to enable/disable its device and to deactivate/activate the active discharge function. If the EN pin voltage is < 0.325 V the device is guaranteed to be disabled. The pass transistor is turned-off so that there is virtually no current flow between the IN and OUT. The active discharge transistor is active so that the output voltage V_{OUT} is pulled to GND through a 280 Ω resistor. In the disable state the device consumes as low as typ. 0.01 μA from the V_{IN}. If the EN pin voltage is > 0.825 V the device is guaranteed to be enabled. The T30LMPSR165 regulates the output voltage and the active discharge transistor is turned-off. The EN pin has internal pull-down current source with typ. value of 0.1 μA which assures that the device is turned-off when the EN pin is not connected. In the case where the EN function isn't required the EN should be tied directly to IN.

Output Current Limit

Output Current is internally limited within the IC to a typical 570 mA. The T30LMPSR165 will source this amount of current measured with a voltage drops on the 90% of the nominal V_{OUT}. The current limit and short circuit protection will work properly over whole temperature range and also input voltage range. There is no limitation for the short circuit duration.

Thermal Shutdown

When the die temperature exceeds the Thermal Shutdown threshold (TSD – 160 °C typical), Thermal Shutdown event is detected and the device is disabled. The IC will remain in this state until the die temperature decreases below the Thermal Shutdown Reset threshold (T_{SDL} – 140 °C typical). Once the IC temperature falls below the 140 °C the LDO is enabled again. The thermal shutdown feature provides the protection from a catastrophic device failure due to accidental overheating. This protection is not intended to be used as a substitute for proper heat sinking.

Power Dissipation

As power dissipated in the T30LMPSR165 increases, it might become necessary to provide some thermal relief. The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material, and the ambient temperature affect the rate of junction temperature

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rise for the part. The maximum power dissipation the T30LMPSR165 can handle is given by:

$$P_{D(MAX)} = \frac{[125\ ^{\circ}C - T_A]}{\theta_{JA}} \quad \text{(eq. 1)}$$

The power dissipated by the T30LMPSR165 for given application conditions can be calculated from the following equations:

$$P_D \approx V_{IN} \cdot I_{GND} + I_{OUT}(V_{IN} - V_{OUT}) \quad \text{(eq. 2)}$$

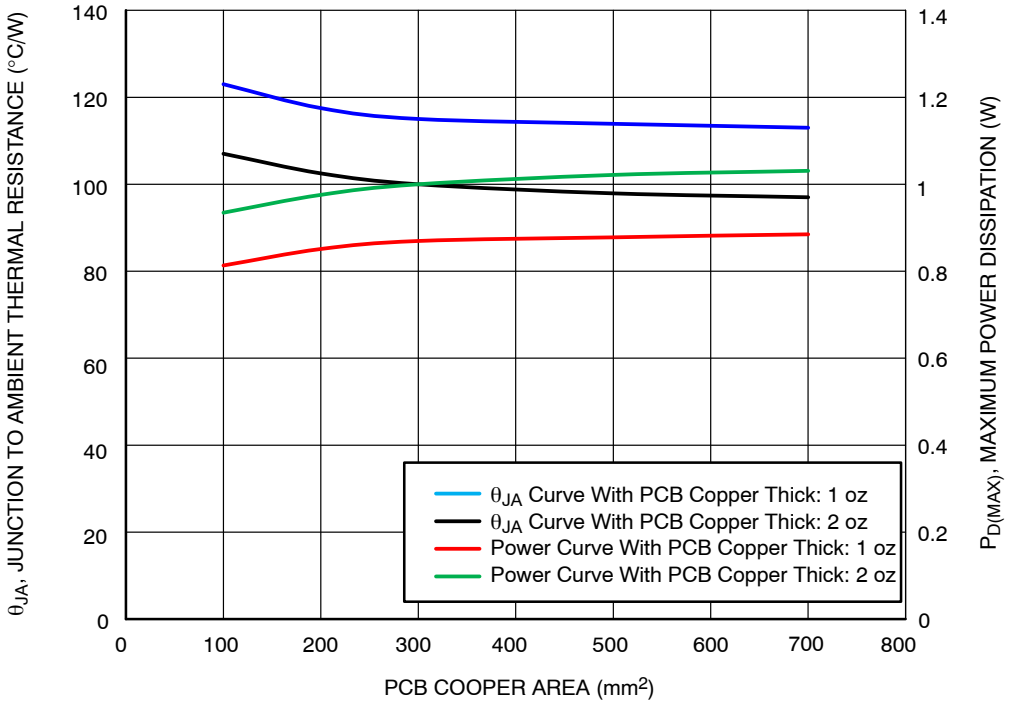

Figure 35. θ_{JA} and $P_{D(MAX)}$ vs. PCB Copper Area (CSP4)

ORDERING INFORMATION

Device	Nominal Output Voltage	Marking	Rotation	Description	Package	Shipping†
T30LMPSR165CFCT100T2G	1.00 V	3	90°	300 mA LDO, with Active Discharge Feature	WLCSP4 CASE 567VS (Pb-Free) UBM: 200 μm Bump type: Sn Plate	10000 / Tape & Reel
T30LMPSR165CFCT105T2G	1.05 V	4	90°			
T30LMPSR165CFCT110T2G	1.10 V	K	0°			
T30LMPSR165CFCT120T2G	1.20 V	U	0°			
T30LMPSR165CFCT125T2G	1.25 V	5	90°			
T30LMPSR165CFCT180T2G	1.80 V	3	0°			
T30LMPSR165CFCT200T2G	2.00 V	L	0°			
T30LMPSR165CFCT280T2G	2.80 V	V	0°			
T30LMPSR165CFCT285T2G	2.85 V	Y	0°			

† 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.

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REVISION HISTORY

Revision	Description of Changes	Date
0	Initial document release.	4/10/2026
1	Operating Input Voltage Range update, Absolute Maximum Ratings table update, Ordering Information table update, Note 3 of Thermal Characteristics table update, Recommended Operating Conditions table added.	4/21/2026
2	Update of the first Features bullet (p.1), update of the EN pin description in Pin Function Description table (p.2) and update of Note 2 below Absolute Maximum Ratings table (p.2), T30LxPSR165CFCT120/200/285T2G changed to T30LMPSR165CFCT120/200/285T2G (p.4).	9/10/2026

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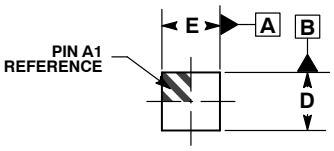
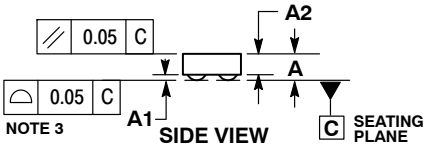
WLCSP4, 0.64x0.64x0.33
CASE 567VS
ISSUE O

DATE 25 JAN 2018

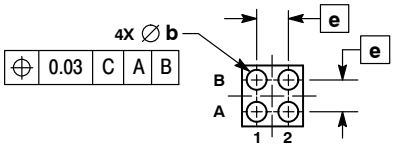
SCALE 4:1



TOP VIEW



SIDE VIEW



BOTTOM VIEW

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

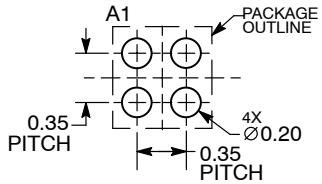
	MILLIMETERS		
DIM	MIN	NOM	MAX
A	---	---	0.33
A1	0.04	0.06	0.08
A2		0.23 REF	
b	0.180	0.200	0.220
D	0.610	0.640	0.670
E	0.610	0.640	0.670
e		0.35 BSC	

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.

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.

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

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